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

RCRA/HSWA
Permit Renewal Application

Volume 8

October 1, 2020
VOLUME 8

CONTENTS IN THIS VOLUME:

SECTION FT2
SECTION FT3 (OUT OF SERVICE)
SECTION T-6
SECTION UT1 (OUT OF SERVICE)
SECTION FT2
ASSESSMENT

Of

EVAPORATOR FLASH TANK NO. 2
(FT 2)

Located At The
LONE MOUNTAIN HAZARDOUS WASTE
FACILITY
WAYNOKA, OKLAHOMA

PREPARED FOR

safety-kleen®

July 2002
# ASSESSMENT

Of
EVAPORATOR FLASH TANK NO. 2 (FT 2)
Located At The
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
WAYNOKA, OKLAHOMA
Prepared For
SAFETY-KLEEN, INC.

## TABLE OF CONTENTS

1. TANK SYSTEM DESCRIPTION ......................................................... 1.

2. PRIMARY TANK VESSEL .............................................................. 1.
   2.1 General Description ............................................................. 1.
   2.2 Design Standards .................................................................. 1.
   2.3 Hazardous Characteristics of Waste Stored ............................... 1.
   2.4 Welding Specifications and Inspection ....................................... 2.
   2.5 Corrosion Protection .............................................................. 2.
   2.6 Documented Age of Tank ....................................................... 2.
   2.7 Results of Leak Tests ............................................................. 2.
   2.8 Existing Data Obtained ........................................................... 2.
   2.9 Calculation of Existing Foundation Loading ............................... 2.
   2.10 Required Structural Calculation ............................................. 3.
   2.11 Comparison of Actual to Theoretical Structural Values ............... 3.
   2.12 Ancillary Equipment ............................................................. 3.

3. SECONDARY CONTAINMENT SYSTEM ............................................. 4.
   3.1 General Description of Secondary Containment ........................... 4.
   3.2 Corrosion Protection .............................................................. 4.
   3.3 Documented Age of the Containment Area ................................. 4.
   3.4 Results of Leak Tests ............................................................. 4.
   3.5 Calculation of Capacity Available (CCA) .................................... 4.
   3.6 Required Volume ................................................................. 4.
   3.7 Comparison of Available Volume to Required Volume .................. 4.

4. CONCLUSIONS ............................................................................. 5.

5. RECOMMENDATIONS ................................................................. 5.

6. CERTIFICATION .......................................................................... 5.

## LIST OF APPENDICES:

- APPENDIX A: MANUFACTURER'S CERTIFICATION
- APPENDIX B: WELDING PROCEDURES AND INSPECTIONS
- APPENDIX C: HYDROSTATIC LEAK TESTS
- APPENDIX D: CALCULATIONS
- APPENDIX E: METALLURGICAL INFORMATION
- APPENDIX F: SUPPORT STRUCTURE CALCULATIONS
- APPENDIX G: FOUNDATION ANALYSIS
- APPENDIX H: CONCRETE COATING INFORMATION FOR SECONDARY CONTAINMENT
- APPENDIX I: SECONDARY CONTAINMENT
ASSESSMENT
Of
EVAPORATOR FLASH TANK NO. 2 (FT 2)
Located At The
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
WAYNOKA, OKLAHOMA
Prepared For
SAFETY-KLEEN, INC.

1. TANK SYSTEM DESCRIPTION

Evaporator Flash Tank No. 2 (FT 2) 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. 2 (FT 2) 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. 2 (FT 2), 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. 2 (FT 2) 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. 2 (FT 2) 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:**
  - pH-value: 6 < pH < 13
  - Oxidation/Reduction (O/R) Potential: 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.**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank Diameter</td>
<td>6-ft. 4-in.</td>
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<tr>
<td>Nominal Height of Tank</td>
<td>31-ft.</td>
</tr>
<tr>
<td>Maximum Capacity</td>
<td>3,765-gal.*</td>
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<tr>
<td>Overflow Liquid Level</td>
<td>9-ft. 1-in.</td>
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<tr>
<td>Overflow Volume</td>
<td>1,137-gal.</td>
</tr>
<tr>
<td>Design Specific Gravity</td>
<td>1.5</td>
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<tr>
<td>Maximum Bottom Pressure</td>
<td>10.8-psi</td>
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<tr>
<td>Maximum Operating Temperature</td>
<td>300° F</td>
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</table>

**Construction Material:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
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</thead>
<tbody>
<tr>
<td>Flue</td>
<td>ASTM A36</td>
</tr>
<tr>
<td>Shell</td>
<td>ASTM 316L</td>
</tr>
<tr>
<td>Bottom</td>
<td>ASTM 316L</td>
</tr>
<tr>
<td>Skirt</td>
<td>ASTM A36</td>
</tr>
<tr>
<td>Flanges, Blinds, Coupler and Plugs</td>
<td>ASTM 316L</td>
</tr>
<tr>
<td>Bolts</td>
<td>SA 193-87/SA 194-2H</td>
</tr>
</tbody>
</table>

Well 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 0.250-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. 2 (FT 2) 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 2 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 withstandng 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).

<table>
<thead>
<tr>
<th>Area</th>
<th>2,739-sf</th>
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<tbody>
<tr>
<td>Curb Height</td>
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<tr>
<td>Material</td>
<td>Concrete</td>
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<tr>
<td>Gross Volume</td>
<td>685-cf</td>
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</tbody>
</table>

Note: See Appendix I for secondary containment.

3.6 Required Volume.

(a) Containment Capacity Required (CCR):

\[ CCR = \text{Volume of Largest Tank (Overflow Volume) in the Secondary Containment} \]

Volume of Largest Tank = (FT1) ........................................... 506-cf

3.7 Comparison of Available Volume to Required Volume.

(a) Containment Capacity Available (CCA):

<table>
<thead>
<tr>
<th>Containment Capacity Required (CCR)</th>
<th>506-cf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Containment Volume Available</td>
<td>685-cf</td>
</tr>
<tr>
<td>Excess Containment Volume</td>
<td>179-cf</td>
</tr>
</tbody>
</table>

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. 2 (FT1) system have been previously analyzed, reviewed, and deemed to be adequately designed.

The Evaporator Flash Tank No. 2 (FT 2) 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. 2 (FT 2) 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. 2 (FT 2) 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. 2 (FT 2) 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. 2 (FT 2), 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 knowingly violating.

Rob L. Stallings, P.E.
Envirotech Engineering & Consulting, Inc.

CA. 1960 - Expiration Date 06/30/03
APPENDIX A.

MANUFACTURER'S CERTIFICATION
A. TANK SYSTEM DESCRIPTION

The Rotary Drum Filter System is a dewatering unit located in the pre-treatment building of the Lone Mountain Hazardous Waste Facility. The system consists of a skid mounted pre-engineered unit supplied by Alar Engineering, Inc. of Mokena, IL and other additional tanks, pumps, and piping. The Rotary Drum Filter and its ancillary equipment are located together on two levels and within a concrete curbed containment area. The purpose of this system is to dewater sludge and compress it into filter cakes.

The tank system actually consists of three tanks or vessels which hold hazardous waste:

- Filter Pan
- Receiver Tank
- Recycled Water Tank

The function, design and construction of each of the three tanks will be described individually.

In addition to the three tanks mentioned, two other tanks (Seal Flush Tank and Recycled Water Tank) are part of the system; however, these tanks do not hold hazardous waste.

Filter Pan - RF-1

This is a horizontal, cylindrical tank with an open top and flat ends. The filter pan is part of the Alar system and is located on the upper level. The dimensions are 7-ft in length and 4.2-ft in width and 2-ft in depth at the deepest point. It houses the rotary drum filter. There are several pipe inlets located in this tank.

During start-up operations, a diatomaceous earth and water mixture is piped into the filter pan and the rotary drum filtration process is started. A vacuum is used to draw the diatomaceous earth mixture onto the polypropylene cloth-coated rotary drum. After a sufficient pre-coating is generated on the drum, a valve controlling the flow of the mixture is closed. Another valve is opened and hazardous waste is pumped into the filter pan. The waste is filtered through the drum in the same manner described for the diatomaceous earth and water mix. As the hazardous waste solids are built up on the drum, a knife blade is advanced and the semi-dry solids are removed and collected in a container for disposal.
MANUFACTURER'S CERTIFICATION FOR
A TANK BUILT TO API STANDARD 650

To Safety-Kleen Corp. (Lone Mountain Facility)  
Route 2 Box 170  
Waynoka, OK 73860

We hereby certify that the tank constructed for you at Lide Industries, Inc.
Route 2, Box 159R  
Mexia, TX 76667

and described as follows: Two 6'-4" O.D. x 20'-6" Tall Stainless Steel
(small or contract number, diameter, height, capacity, floating or fixed roof)
Flash Tanks Serial #'s 1733 and 1734

meets all applicable requirements of API Standard 650, 10th Edition, Revision, Appendix
JM&S, dated __________________, including the requirements for design, materials, fabrication, and erection.

The tank is further described on the attached as-built data sheet dated 05/21/02

Lide Industries, Inc.
Manufacturer

Billy Lide
Authorized Representative

05/23/02
Date

Figure 8-2—Manufacturer's Certification Letter
APPENDIX B.

WELDING PROCEDURES AND INSPECTIONS
### Radiographic Examination Report

#### Customer/Contact: Lide Industries
#### Location/Address: Mexia, TX
#### Unit/System: J-203
#### Material: 5/8 A, B, C, D, E
#### Thickness: 250
#### Diameter: 6 A, B, C, D, E
#### Reinforcement Thickness: 1/4 A, B, C, D, E
#### SPD: 19 A, B, C, D, E
#### Exposure Time: 3 min
#### IQI Size/Material: 5 P MP
#### IQI Location: 5 A
#### Shim Thickness Material: 1/4 A, B, C, D, E
#### # of Exposures: 1 A, B, C, D, E
#### Markers: No. or Spacing: 1 A, B, C, D, E
#### Source: X-Ray
#### Filming: Single / Double
#### Film Process: Auto
#### NOE Procedure: KTV-1 Rev 4
#### Acceptance Standard: API LSC
#### Surface Condition: As Welded
#### Stage of Manufacture: Intermediate
#### Weld:

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</table>

#### Remarks:

- Additional Pages: Yes
- Comments:

### Summary

- Film Size: 4.5x10
- Report No.: 1
- Unit No.: 198
- Total No. of Welds: 2
- Hours Worked: 12:30 AM to 1:30 PM
- Total Hours: 9

---

Signature of Customer's Representative: [Image]

Name, Signature, and Level of Longview Inspection Examiner: [Image]

SEE BACK FOR DISCLAIMER
**QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)**

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

<table>
<thead>
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<tbody>
<tr>
<td>By</td>
<td>EVAN LEMON</td>
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<td>RB15L</td>
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<td>Date</td>
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<td>Revision No.</td>
<td>0</td>
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**Joints (QW-402)**

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<td>F6 (No) F5</td>
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<tr>
<td>Backing Material (Type)</td>
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<tr>
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<td>□</td>
</tr>
<tr>
<td>Nonfusing Metal</td>
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</tr>
<tr>
<td>Nonmetallic</td>
<td>□</td>
</tr>
<tr>
<td>Other</td>
<td>□</td>
</tr>
</tbody>
</table>

RETAINERS NOT USED

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 Mfr., 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. 8    Group No. 1  to P-No. 8    Group No. 1

OR

Specification type and grade, SA-240-316L

to Specification type and grade, SA-240-316L

OR

Chem. Analysis and Mech. Prop. --
to Chem. Analysis and Mech. Prop. --

Thickness Range:

<table>
<thead>
<tr>
<th>Base Metal</th>
<th>Groove</th>
<th>.1875 - .4818 *</th>
<th>Filler</th>
<th>ALL</th>
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<tbody>
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<td>ALL</td>
<td>Filler</td>
<td>ALL</td>
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</tbody>
</table>

**Filler Metals (QW-404)**

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**FILLER METALS WILL BE USED. FILLER METAL IS FLUX CORED**

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

**FCAW - NO POWDERED OR SUPPLEMENTAL**

(12/89)

This form (E00000) may be obtained from the Order Dept., ASME, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300.
POSSESSIONS (QW-405)
Positional of Groove... ALL
Positional of Fillers... ALL
Welding Progression... Up... XX... Down
POSTWELD HEAT TREATMENT (QW-407)
Temperature Range... NA
Time Range... ---

GAS (QW-408)
Percent Composition
Gas(es) (Mixture) Flow Rate
Shielding... ARG/CO2... 75/25... 20-35 CFM
Trailing... ---... ---... ---
Backin... ---... ---... ---

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC... DC
Amps (Range)... SEE BELOW
Volts (Range)... SEE BELOW
(Pure Tungsten, 2% Thoriated, etc.)
Tungsten Electrode Size and Type... ---
Mode of Metal Transfer for GMAW... SHORT CIRCUIT ARC
(Spray arc, short circuiting arc, etc.)
Electrode Wire Feed speed range... ---

TECHNIQUE (QW-410)
String or Weave Bead... SMAW = STRING, FCW = WEAVE
Orifice or Gas Cup Size... 3/8" - 1/2"
Initial and Interpass Cleaning (Brushing, Grinding, etc.)... BRUSH, GRIND, OR CHIP AS NEEDED
Method of Back Gouging... AIR ARC OR GRIND AS NEEDED
Oscillation... NONE
Contact Tube to Work Distance... .750"
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

<table>
<thead>
<tr>
<th>Weld Layer(s)</th>
<th>Process</th>
<th>Filler Metal</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class</td>
<td>Type</td>
</tr>
<tr>
<td>1 &amp; 2</td>
<td>SMAW</td>
<td>EXXX X</td>
<td>REV</td>
</tr>
<tr>
<td>REM</td>
<td>FCW</td>
<td>EXXXXT1</td>
<td>(\frac{1}{32}^\text{&quot;})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\frac{1}{8}^\text{&quot;})</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.035</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.045</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
**QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORDS (PQR)**

(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)

Record Actual Conditions Used to Weld Test Coupon.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>I.d.e. Tank Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure Qualification Record No.</td>
<td>BR15L</td>
</tr>
<tr>
<td>WPS No.</td>
<td>BR15L</td>
</tr>
<tr>
<td>Welding Process</td>
<td>SMAW/FCAW</td>
</tr>
</tbody>
</table>

**JOINTS (QW-402)**

![Groove Design of Test Coupon](image)

- Groove Design of Test Coupon

**BASE METALS (QW-403)**

<table>
<thead>
<tr>
<th>Material Spec.</th>
<th>SA-240</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type or Grade</td>
<td>316L</td>
</tr>
<tr>
<td>P-No.</td>
<td>8</td>
</tr>
<tr>
<td>Thickness of Test Coupon</td>
<td>.438</td>
</tr>
<tr>
<td>Diameter of Test Coupon</td>
<td>3-1/2&quot; OD</td>
</tr>
<tr>
<td>Other.</td>
<td>---</td>
</tr>
</tbody>
</table>

**FILLER METALS (QW-404)**

<table>
<thead>
<tr>
<th>SPA Specification</th>
<th>5.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS Classification</td>
<td>E308L-16, E308LT-1</td>
</tr>
<tr>
<td>Filler Metal F-No.</td>
<td>5</td>
</tr>
<tr>
<td>Weld Metal Analysis A-No.</td>
<td>8</td>
</tr>
<tr>
<td>Size of Filler Metal</td>
<td>3/32&quot;</td>
</tr>
<tr>
<td>Other.</td>
<td>---</td>
</tr>
<tr>
<td>Weld Metal Thickness</td>
<td>.250</td>
</tr>
</tbody>
</table>

**POSTWELD HEAT TREATMENT (QW-407)**

| Temperature | NA |
| Time | --- |
| Other. | --- |

**GAS (QW-408)**

| Gas(es) | Argon, CO2 |
| Percent Composition | 75/25 |
| Flow Rate | 25 CFH |

**ELECTRICAL CHARACTERISTICS (QW-409)**

| Current | DC |
| Polarity | REV |
| Amps. | F5-110, F6-130 |
| Voltage | F5-21, F5-24 |
| Tungsten Electrode Size | NA |
| Other. | FCW-SHORT CIRCUIT ARC |

**POSITION (QW-405)**

| Position of Groove | 6G |
| Weld Progression (Uphill, Downhill) | UPHILL |
| Other. | --- |

**PREHEAT (QW-406)**

| Preheat Temp. | 70 DEGREES F |
| Interpass Temp. | 300 DEGREES F |
| Other. | --- |

**TECHNIQUE (QW-410)**

| Travel Speed | 8 FPM |
| String or Weave Bond | SMAW-STRING, FCW-WEAVE |
| Oscillation | NONE |
| Multipass or Single Pass (per side) | MULTIPLE |
| Single or Multiple Electrodes | SINGLE |
| Other. | FCW-NO POWDERED OR SUPPLEMENTAL |

| FILLER METALS WERE USED | FILLER METAL IS FLUX CORE |

---

This form (E00007) may be obtained from the Order Dept., ASME, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2.
### Tensile Test (QW-150)

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Width</th>
<th>Thickness</th>
<th>Area</th>
<th>Ultimate Total Load</th>
<th>Ultimate Unit Stress</th>
<th>Type of Failure &amp; Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-1</td>
<td>.752</td>
<td>.468</td>
<td>.352</td>
<td>28750</td>
<td>81675</td>
<td>EM DUCT</td>
</tr>
<tr>
<td>T-2</td>
<td>.749</td>
<td>.465</td>
<td>.348</td>
<td>28250</td>
<td>81178</td>
<td>EM DUCT</td>
</tr>
</tbody>
</table>

### Guided-Bend Tests (QW-150)

<table>
<thead>
<tr>
<th>Type and Figure No.</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOT BEND QW-462.3 (a)</td>
<td>ACCEPTABLE</td>
</tr>
<tr>
<td>ROOT BEND QW-462.3 (a)</td>
<td>ACCEPTABLE</td>
</tr>
<tr>
<td>FACE BEND QW-462.3 (a)</td>
<td>ACCEPTABLE</td>
</tr>
<tr>
<td>FACE BEND QW-462.3 (a)</td>
<td>ACCEPTABLE</td>
</tr>
</tbody>
</table>

### Toughness Tests (QW-170)

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Notch Location</th>
<th>Specimen Size</th>
<th>Test Temp.</th>
<th>Impact Values</th>
<th>Drop Weight Break (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ft. lbs.</td>
<td>% Shear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

### 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** ROBERTO CONTRERAZ

**Clock No.** 460-47-7944

**Tests conducted by:** LONGVIEW INSPECTION, INC.

**Laboratory Test No.** 127-89

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** LITE TANK COMPANY

**Date** 4/24/89

(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.)
APPENDIX C.

HYDROSTATIC LEAK TESTS
TEST INSPECTION REPORT

DATE: 05/22/02

CUSTOMER: Safety-Kleen

PURCHASE ORDER: 103034

ITEM NO.: 1

EQUIPMENT: Flash Tank

CODE: API 650

X-RAY: Spot

METHOD OF TEST: Filled with water and held for 24 hours

INSPECTED BY: Lide Industries, Inc.

RESULTS: Satisfactory (no leaks)
HYDROSTATIC TEST RECORD

Customer: Safety-Kleen - Lone Mountain Facility

Project: Evaporator Flash Tank No. 2

Location: Waynoka, Oklahoma

Test Start Date: 07/18/02  Test Start Time: 4:00 p.m.

Test Finish Date: 07/19/02  Test Finish Time: 5:00 p.m.

Test Procedure: Fill evaporator flash tank to the overflow nozzle with water.

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

July 19, 2002

(Witness)
Shell

\[ V = \frac{\pi D^2 h}{4} + \frac{1}{6} \pi h (3a^2 + h^2) \]

- \( L = 15.5' \)
- \( h = 11' \)
- \( D = 6.25' \)
- \( a = \frac{6.25}{2} = 3.125' \)

Max Vol

\[ V = \frac{\pi \times 6.25^2}{4} \times 15.5 + \frac{1}{6} \pi \times 11 \times [3(3.125^2) + 11^2] \]

\[ V = 488 + 18 \]

\[ V = 506 \text{ ft}^3 = 2785 \text{ gals (Max Vol)}^{*} \]

* includes plus
**Overflow Vol.**

Shell:

\[ V = \frac{\pi D^2L}{4} + \frac{1}{6} \pi h \left( 3a^2 + h^2 \right) \]

- \( D = 6.25' \)
- \( h = 7.1' \)
- \( L = 4.25' \)
- \( a^2 = 5.167 \)

\[ V = \frac{\pi (6.25^2)(4.25)}{4} + \frac{1}{6} \pi (7.167) \left[ 3(5.167^2) + 7.1^2 \right] \]

\[ V = 134 + 18 = 152 \text{ ft}^3 = 1137 \text{ gal} \]

**Water Weights (tank contents only)**

**Max Vol**

\[ W = (3785 \text{ gal})(6.342 \text{ lb/gal})(1.5) = 47.256 \text{ #} \]

**Overflow Vol**

\[ W = (1137 \text{ gal})(6.342 \text{ lb/gal})(1.5) = 14.226 \text{ #} \]

**Weight of Tank**

- 7300 # weight of new tank shell + skirt (as per MFY Data)
- 1500 # weight of flue
- 250 # insulation (estimated)
- 3000 # accessories (estimated)

**Total Weight Tank**

12,050 #
## Weight of Tank & Contents

### Max Volume

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt Tank</td>
<td>12,050 #</td>
</tr>
<tr>
<td>Wt Contents</td>
<td>47,356 #</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>59,406 #</td>
</tr>
</tbody>
</table>

### Overflow Vol

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt Tank</td>
<td>12,050 #</td>
</tr>
<tr>
<td>Wt Contents</td>
<td>14,226 #</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>26,276 #</td>
</tr>
</tbody>
</table>
Max Bottom Operating Pressure

Assume tank pressure at atmospheric

C Max Vol

\[ H = 15.5' + 1' = 16.5' \]
\[ P = \frac{16.5'(1.5)}{2.31} = 10.8 \text{ psi} \]

C Overflow Vol

\[ H = 4.25' + 1' = 5.25' \]
\[ P = \frac{5.25'(1.5)}{2.31} = 3.47 \text{ psi} \]
Overturning Moment (W/Nm)

\[ OTM = [(1.25)(10.25) + (14)(22.5) + (27.25)(22.5)] \text{ (ft)} \]

\[ OTM = 40,691 \text{ ft-lb} \]

**Calc:**

**Bottom:**

\[ W_b = \left( \frac{\pi D^3}{4} \right) (0.25) (4.94) = 527 \text{ ft-lb} \]

\[ D = 6.75 \text{ ft-lb} \]

\[ r_1 = 3.165 \text{ ft-lb} \]

\[ r_2 = 1.5 \text{ ft-lb} \]

\[ h = 3 \text{ ft-lb} \]

\[ D' = 3 \text{ ft-lb} \]

\[ L' = 7.5 \text{ ft-lb} \]

**Shell**

\[ W_s = \pi D L (0.25) (4.94) = 4,238 \text{ ft-lb} \]

\[ W_s = \left( \pi D L' + \pi (r_1 + r_2) \right) \left( r_1 - r_2 \right) \left( 0.25 \right) (4.94) \]

\[ = (90.7 + 50.3)(0.25)(4.94) = 12,588 \text{ ft-lb} \]
\[ C_g = \frac{[(32 \times 5) + (42.7) \times (40 \times 30) + (1258) \times 215]}{5}\frac{1}{22} \]

\[ C_g = 12.81' \]
Wind Loads on Vessel

API CD 3.11

Wind Load = 18 PSF on projected frontal area

(See Sheet A for OTM Colors)

OTM = 40,491 ft-lbf

Tank Weight (empty) = 12,050 #

\[
\frac{(2)(W_D)}{2} = \frac{W}{D} = \text{Empty Tank Weight}\]

\[
\frac{3}{2} \left( \frac{12,000 \times (4.59)}{2} \right) = 25,425
\]

40,491 > 25,425 : Anchors are required

Anchors

\[
x_a = \frac{1}{2} m + \frac{W}{N}
\]

\[
N = 8 \quad x_a = \text{tension load/anchor (#)}
\]

\[
x_a = \frac{W(40,491)}{(6.5)(8)} = \frac{12,050}{8} = 1523 #
\]
Assume 3½" A-36 Anchor Bolt

Root Area = 0.309 in²

Allowable Tension = 15,000 PSI (See API 650 F-7)

Allow 0.25" CA on the diameter.

\[ \sqrt{\frac{(0.309)(4)}{\pi}} - 0.25 = 0.772 \text{ in} \]

\[ A = \text{Root Area} = \left(0.772\right)^2 \frac{\pi}{4} = 0.112 \text{ in}² \]

\[ \frac{\text{Allowable Tensile Strength}}{\text{Bolt}} = \left(0.112 \text{ in}²\right)\left(15,000 \text{ PSI}\right) = 1680# \]

\[ \frac{\text{Allowable Tensile Strength}}{\text{Anchor}} > \frac{\text{Tension Load/Anchor}} {1680 > 1623} \]

\[ \therefore 8 - 3\frac{1}{4}" A-36 Bolt OK! \]
Seismic Loads Per APT 6-D Appendix E

Zone 1 \( z = 0.1875 \)  
\( I = 1.0 \)
\( C_1 = 0.29 \)

Calc \( C_e \)

\[ W_t = \text{total wt of content (MAX VOL)} = 4725 \text{ lb} \]

\[ D = 6.39' \]
\[ H = 9.0' \]

\[ \frac{D}{H} = \frac{6.39}{9.0} = 0.71 \]

\[ \frac{W_1}{W_t} = 0.87 \]
\[ \frac{W_2}{W_t} = 0.15 \]  \( \text{(See Fig E-2)} \)

\[ \frac{X_1}{H} = 0.42 \]
\[ \frac{X_2}{H} = 0.78 \]  \( \text{(See Fig E-2)} \)

\( K' = 0.57 \)  \( \text{(See Fig E-4)} \)

\( T = K' \frac{D}{4} \)

\[ = (0.57)\sqrt{6.39} = 1.434 \]

\( \alpha = 1.5 \)  \( \text{(S/k Amp Factor Unknown - See Table E-2)} \)

\[ C_e = \frac{0.25}{T} = \frac{(0.25)(1.5)}{1.434} = 0.314 \]
\[ W_1 = W_t (0.87) = (47356) (0.87) = 41,200 \text{ #} \]
\[ W_2 = W_t (0.15) = (47356) (0.15) = 7,103 \text{ #} \]
\[ X_1 = (0.42)(9.0) = 3.78' \]
\[ X_2 = (0.78)(9.0) = 7.02' \]

\[ M = 26 \left( C_i + \frac{W_s C_i}{W_t} + C_{w_t} R_s + C_{w_e} R_e \right) \]
\[ X_s = (\text{Base to shell CG}) = 12' \text{ approx} \]
\[ W_s = \text{ wt Shell (\#)} = 12050 \]
\[ W_r = \text{ N/A (included in shell)} \]
\[ H_t = \text{ N/A} \]

\[ M = (0.1875)(1)(0.24)(12)(12050) + (0.24)(41200)(3.78) + (3.14)(2103)^2 \]
\[ M = 13544 \text{ FT-#} \]
\[ \text{Seismic} \]
\[ M_y = 40491 \text{ FT-#} \]

Wind

Wind Dictates

Anchor Bolt Caps are OK!
Max Long Comp (Andland Tank)

\[
b = \frac{Wt + 12.92m}{D^2}
\]

\[
b = \frac{12050 + (1.273)(40.4917)}{\pi (6.33)^2}
\]

\[
b = 1898 \# / ft. CIRC
\]

\[
\frac{b}{12t} = \frac{1284}{(12)(25)} = 402 \text{ Psi}
\]

\[
\frac{117}{D^2(Wt+40)} = \frac{11069}{(4.5^2)(12050+25032)} = 0.56
\]

\[
\frac{GHD^2}{r^2} = \frac{(1.5)(9.0)(6.5)^2}{(125)^2} = 9124
\]

\[
F_a = \frac{10^4 t}{2.5D} + 400 \sqrt{6H}
\]

\[
= \frac{(10^4)(0.25)}{(2.5)(6.5)(12)} + 400 \sqrt{(1.5)(9)(12)}
\]

\[
F_a = 8918 \text{ PSF}
\]

\[
\frac{b}{12t} \ll F_a \quad \text{OK!}
\]

\[
F_a \leq 5 F_a \quad \text{OK}
\]
**Shell Thickness Calc**

**Thermal Red. Factor**

\[ RF = \frac{C}{200°F} = 0.81 \]

**Min. Thickness** as per 3.6.5.2

\[ t_{d} = \frac{2.6D(H-1)G}{E \cdot S_{d} \cdot RF + CA} \]  

- Design Shell Thickness Method

\[ S_{d} = 48 \text{ ksi} \]
\[ S_{t} = 81 \text{ ksi} \]

**316L Stainless Steel**

\[ \frac{3}{8} S_{d} = 28 \text{ ksi} \]
\[ \frac{3}{8} S_{t} = 54 \text{ ksi} \]

\[ E = 0.7 \]  
Assume \( H = 20.5 \) (Conservative)

\[ t_{d} = \frac{(2.6)(4.2)(20.5-1)(1.5)}{(0.7)(28000)(0.125)} + 0.125 \]

\[ t_{d} = 0.154'' \]

**Hydraulic Test Shell Thickness Method**

\[ S_{d} = \frac{2.6D(H-1)}{S_{t}} \]

\[ \frac{3}{4} S_{d} = 31,500 \]
\[ \frac{3}{4} S_{t} = 231/2 \]  
\[ S_{d} = 231/2 \]
\[ t_t = \frac{(2.0)(4.98)}{(3015 - 1)} \]
\[ t_t = 0.0129 \]

If \( t_d > t_t \):
\[ t = t_d = 0.156" \]

Minimum Shell Thickness (Calc)
\[ t = 0.156" \]

Note: 1/4" plate OK!
Tank Bottom Calculations

\[ G_c = \frac{PR}{t} \Rightarrow t = \frac{PR}{G_c} + CA \]

- \( G_c = \) Circumferential Stress
- \( SF = \) Safety Factor
- \( P = \) tank pressure (11,425 psi - see Calc sheet)
- \( R = \) tank radius (3.145"
- \( t = \) req. thickened

\[ G_c = \frac{64}{2.5} = \frac{42,000}{2.5} \text{ PSI (316 stainless)} \]

\[ t = \frac{(11,425 \text{ PSI}) (0.165 ft) (0.75)}{14,500 \text{ PSI}} + 0.125 \text{ in} \]

\[ t = 0.151 \text{ in} \quad \text{Min Bottom Thickness (Calc)} \]

Note: "1/4" plate OK!
APPENDIX E.

METALLURGICAL INFORMATION
AvestaPolarit, Inc.
Plate Products

Certificate of Analysis and Tests

ORDER 221463 - 15

HEAT & PIECE 814488-3A

SOLD TO: METAL SERVICES, INC.
PO BOX 550639
DALLAS TX 75355

SHIP TO: METAL SERVICES, INC.
10770 SANDHILL ROAD
1-214-340-7140
DALLAS TX 75238
649001-0004

--- YOUR ORDER & DATE ---
N 0115429 0/00/00

--- ITEM DESCRIPTION ---

HEAT & PIECE 814488 - 3A
WEIGHT 2143
GRADE 316L
UNS-S31603
DIMENSIONS 250 X 96.000 X 288.000 EXACT

--- SPECIFICATIONS ---

*** MFG IN NEW CASTLE, IN, USA
ASTM A240-00 ASME SA240 98ED
ASTM A167-93, ASME SA167-92
ASTM A262-98 PRAC B
NACE MR0175-2000

FROM SLABS IMPORTED FROM BRITAIN
(2) 75\% OD X 1476
316L Std

PLATES & TEST PCS SOLUTION ANNEALED @ 1950 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
REE OF MERCURY CONTAMINATION
ROLL, ANNEALED & PICKLED (HRAP)

--- MECHANICAL & OTHER TESTS ---

HARDNESS RB 87
GRAIN SIZE 6
YIELD STRENGTH (PSI) 54278
TENSILE STRENGTH (PSI) 89291
BEND OK
INTERGRANULAR CORROSION OK
ELONGATION % IN 2" 50.0
REDUCTION OF AREA % 71.1

--- CHEMICAL COMPOSITION ---

CARBON (C) .044
MANGANESE (MN) 1.63
PHOSPHORUS (P) .027
SULFUR (S) .001
SILICON (SI) .39
CHROMIUM (CR) 16.35
NICKEL (NI) 10.07
COBALT (CO) .16
COPPER (CU) .34
MOLY (MO) 2.15
NITROGEN .04
COLUMBIUM (CB) .008
TITANIUM (TT) .001
ALUMINUM (AL) .007
TIN (SN) .012

P.O. 0115429
ITEM 75\% OD X 1476

--- MILL TEST REPORTS FURNISHED ---
CUSTOMER BAKER TAPPERT
DATE 3-21-01
ITEM NO. 0115429
OUR INV NO. 0115429

KNOWINGLY & WILLFULLY FALSIFYING OR CONCEALING A MATERIAL FACT ON THIS FORM,
OR MAKING FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR REPRESENTATIONS
HEREIN COULD CONSTITUTE A FELONY PUNISHABLE UNDER FEDERAL STATUTES.

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER
**NOTICE OF SHIPMENT / PACKING LIST**

**Curt. Order No. & Date**: 816779 | 01/11/02

**Curt. Code**: 836385

**Accepting Mill**: MASSILLON, OH

**Shipper No.**: 418872

**Product Code**: 31020101600000

**Mill Order Number**: 52-012-052

**Date Shipped**: 01/15/02

**Invoice**:

**SOLD TO**:

| SOUTHWEST STAINLESS |
| 2805 MARKET STREET |
| SUITE #150 |
| GARLAND, TX 75041 |

**GRADE AND SPECIFICATIONS**

CARRIER - MAVERICK TRANSPO., INC. (8-9:30AM)


**ITEM PCS DIMENSIONS W/G/L** |

<table>
<thead>
<tr>
<th>HEAT # COIL #</th>
<th>TEST #</th>
<th>GROSS TARE NET</th>
<th>THEO TAG H/CD SKID</th>
</tr>
</thead>
<tbody>
<tr>
<td>010A 1 48/.250/566</td>
<td>895658B 092610N010</td>
<td>9604427</td>
<td>23480</td>
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**COILS**

- 2 COILS

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**NR = DATA NOT REQUIRED**

**PAGE 01 - FINAL PAGE.**

**SHIPPING CONTROL COPY**

**01/14/02 14:08:47**

**CERTIFICATE OF...**

**CARRIAGE = MAVERICK TRANSPO., INC. (8-9:30AM)**

**ALLEGHENY STAINLESS STEEL TYPE 316-L PLATE-HOT ROLLED COILS ANNEALED PICKLED 3 EDGE (ASTM-A-480/A-480M-01)**


**ITEM PCS DIMENSIONS W/G/L**

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NOTICE OF SHIPMENT

Allegheny Ludlum
An Allegheny Technologies Company

SHIPS TO
SOUTHWEST STAINLESS
2903 MARKET STREET
SUITE N-155
DALLAS, TX

SHIPPED TO
SOUTHWEST STAINLESS
2903 MARKET STREET
SUITE N-155
DALLAS, TX

GRADE AND SPECIFICATIONS
ALLEGHENY STAINLESS STEEL TYPE 316 PLATE-HEAT ROLLED COILS ANNEALED PICKLED 3' COIL (ASTM-A-880/SA-409)-00

CERTIFICATE OF TEST

ITEM POS DIMENSIONS W/S/L
HEAT # LGI TEST II CROSS TAPE NET THEIN TAG #/CD SKIN #

006 1.00 x 1.875 x 511.5F B-2 R-6 722123 006215001A 9604067 12380 12380

007 1.00 x 2.000 x 357 B-1 R-6 722110 006215005B 9604097 20680 20680

33240 33260

TYPE HEAT TEST
HEAT 72211F

YIELD TENSILE % ALONG
TEST NO 760-4562

007 9604097

0.95 1.06 0.625 0.0004 60 74 91 HRB HR HR

1 45300 82000 14% 70 16.3

1 49500 94500 93 70 14% HR

* Y.S. BY 0.2% OFFSET METHOD

NR = DATA NOT REQUIRED

PICK 01 - FINAL PAGE
NOTICE OF SHIPMENT/ PACKING LIST

816779  01/11/02  836385  MASSILLON, OH  418800  31020101060000  52-012-052  01/14/02

PRIME SEC.

SOLD TO
SOUTHWEST STAINLESS
2805 MARKET STREET
SUITE #150
GARLAND
TX 75041

GRADE AND SPECIFICATIONS
ALLEGHENY STAINLESS STEEL TYPE 316-L PLATE-HOT ROLLED COILS ANNEALED PICKLED 3 EDGE (ASTM-A-480/A-480M-01)

ITEM PCS DIMENSIONS W/G/L

HEAT # COIL # TEST # GROSS TARE NET THEO TAG N/CD SKID N

012 1 72.7/.250/362. 69421FC 05641H116A 9603901 23100 23100

TYPE HEAT/TEST

COIL 1

YIELD TENSILE % ELONG

ITEM TEST NO

PSI* PSI IN 2" % R/A HARDNESS BEND A 262 PR E SIZE HARDENABILITY

012 9603901
T 40100. 81500. 61. 73. 149.HB NR NR NR
T 38700. 81500. 60. 73. 149.HB

NR = DATA NOT REQUIRED

PAGE 01 - FINAL PAGE.

SHIPPING CONTROL COPY

01/14/02  08:41:27

The above is a true copy of this on file. The material and test results confirm the above content and specification(s) as set forth in Allegheny Ludlum's Order Acknowledgment.

C.W. Norgard - Manager, Commodity Services

*Y.S. BY 0.2% OFFSET METHOD
### NOTICE OF SHIPMENT/PACKING LIST

**CUST. ORDER NO. & DATE:** 816779 01/11/02

**CUST. CODE:** 836385

**ADAPTING MILL:** MASSILLON, OH 418800

**SHIPPER NO.:** 31020101060000

**PRODUCT CODE:** 52-012-052

**ILLUM. MILL ORDER NUMBER:** 01/14/02

**DATE SHIPPED:**

**SOLD TO: 1**

**SOLD TO:** SOUTH WEST STAINLESS

**2505 MARKET STREET**

**SUITE #150**

**GARLAND, TX 75041**

**SHIPPED TO:** SOUTH WEST STAINLESS

**504 504**

**C/D TSA PROCESSING**

**1625 W SAM HOUSTON PKWY N**

**HOUSTON, TX 77043**

### GRADE AND SPECIFICATIONS

**CARRIER:** JONES MOTOR CO., INC. (NOON-1:30)


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**YIELD**

**TENSILE**

**% ELONG**

**CORROSION GRAIN**

**ITEM TEST NO**

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**NR = DATA NOT REQUIRED**

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*The above is a true copy of data on file. The materials and test results are in the actual control of the specification(s) as set forth in Allegheny Ludlum's Quality Announcement.*

**Cust. Rep. - Shipment:** Thomas Smith
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GRADE AND SPECIFICATIONS


ITEM PCS DIMENSIONS W/G/L

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THIS CERTIFICATE OF TEST SHALL NOT BE REPRODUCED EXCEPT IN FULL.

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**Notes:**
- **Material:** ASTM A182 F316/F316L
- **Dimensions:** As listed above.
- **Heat Treatment:** Performed as indicated.
- **Surface Treatment:** Performed as indicated.

**Quality Control Department:**
- **Inspector:** NFF
- **Approval:**
- **Manufacturer's Certification:**

**Manufacture Date:**
- **Received:** 28/04/2002
- **Calculated:** 07/04/2002

**Inspection Authority:**
- **Date:** 28/04/2002
- **Signature:**

**Material Identification:**
- **Series:** 06108, 06099, 06110, 06121, 06112, 06113
- **Date:** 28/04/2002
- **Signature:**

**Certification:**
- **Date:** 28/04/2002
- **Signature:**

**Document Number:**
- **Serial:** 101134
- **Date:** 28/04/2002
- **Signature:**

**Manufacturer's Information:**
- **Address:**
- **Phone:**
- **Fax:**

**Additional Information:**
- **Location:**
- **Environment:**
- **Other Details:**
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**HEAT TREATMENT**

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**NOTE**

MUTTI CREMENZO
# MILL TEST REPORT

**DATE:** Jan 4/2002

**PURCHASER:** SOUTHWEST STAINLESS, INC.

**PURCHASE ORDER NO.:** 016148

**ENLIN S/C NO.:** B234SW

## PRODUCT:
STAINLESS STEEL FORGED FLANGE

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<td>GCJ8</td>
<td>50</td>
<td>316L/316</td>
<td>150# SLIP ON RF</td>
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### CHEMICAL ANALYSIS OF MATERIAL

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<th>P</th>
<th>S</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
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### MECHANICAL CHARACTERISTICS

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<th>TS.—PSI</th>
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<th>%—RA</th>
<th>HEAT—TREAT</th>
<th>DIMENSION</th>
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MATERIAL RESISTANT TO INTERCRYSTALLINE CORROSION ACCORDING TO ASTM A352 PRACTICE E.
FREE FROM MERCURY CONTAMINATION.
MATERIAL IN ACCORDANCE WITH NACE MR0175-94.

**FACTORY INSPECTOR:**

[Signature]

**QUALITY ASSURANCE DEPARTMENT**

[Signature]
# MILL TEST & INSPECTION CERTIFICATE

**CUSTOMER SELLER: INDUSTRIES, INC.**

**ORDER NO:** 97059

**CERT NO:** 12052

**INDEX NO:** 801100690

**L/C NO:** 518202119

**DATE:** 01/12/04

**PAGE:** 10

### CHEMICAL COMPOSITION (%)

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### MECHANICAL TEST

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<th>Yield Strength (kg/mm²)</th>
<th>Elongation (%)</th>
<th>R of A</th>
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**Remark:**

- **SOLUTION TREATED:** 1040°C, W.Q.
- **CONFORMS TO HACG M90-085**
- **STEEL ROLLING PROCESS:** ELECTRIC FURNACE

**WE CERTIFY THE ABOVE MENTIONED FITTINGS HAVE BEEN MANUFACTURED AND TESTED IN ACCORDANCE WITH THE SPECIFICATIONS SHOWN.**

**S. C. Loon, C. H. King**

**Q. C. MANAGER, INSPECTOR**
SOUTHWEST STAINLESS
TO: 2805 MARKET STREET
SUITE #150
GARLAND, TX 75041

CUST NO: 63806080
JOB NO: 9094C
PO NO: 813639
DATE: 04/05/00

HEAT NO. ITEM DESCRIPTION
927264 2" WELDED PIPE SCH 40S TP316L/TP316 ASTM A212-95A/ASME SA312
-90, P93 ADD, WELDED

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<td>R865</td>
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Reverse Bend: Flange Flare Flattening Current Hydro

Annealed at 1900 deg F.
And water quenched to below 800 deg F.

Heat No. Less than 3 min.

Radiographic Examination

Heat No.: Yeb

Hardness in accordance with NACE MR0175.
BRISTOL METALS DOES NOT ADD MERCURY DURING ANY MANUFACTURING PROCESS.
WE CERTIFY THIS REPORT TO BE TRUE AND ACCURATE, ACCORDING TO OUR RECORDS ON FILE.

BRISTOL METALS L.P.
David Singleton
REPRESENTATIVE
# Test Certificate

**Aichi Steel Corporation**

**Kariya Plant: Kariya-City, Aichi-Pref., Japan**

**Date:** Aug. 05, 2000

**Material:** AISI316/316L

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<td>23208</td>
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**Chemical Composition (%)**

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<th>Cr</th>
<th>Mo</th>
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**Mechanical Properties**

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<th>Hardness Test</th>
<th>Bend Test</th>
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<td>Tempering</td>
<td>Yield Strength</td>
<td>Tensile Strength</td>
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<td>MIN</td>
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**Grain Size Test**

- 6.3: GOOD

**Micro Structure**

- 60: Flat Bar (Stainless steel)
- 61: Equal Leg Angle Bar (Stainless steel)
- 62: Unequal Leg Angle Bar (Stainless steel)
- 63: Channel Bar
- 64: Sheet Bar (Stainless steel)
- 51: Flat Bar (Square edge)
- 52: Flat Bar (Parabolic type)
- 54: Flat Bar (Round edge)
- 56: Wire Rod

**Condition**

- A: Annealed
- B: Low Temperature Annealed
- C: Cold Drawn
- D: Solution Heat Treated
- E: Pickled
- F: Quenched
- G: Normalized
- H: Tempered
- I: Bar Turned

**Remarks**

- ASTM A276-98A, A484, A479/479M-97/97C+S2.1: ASME SA479/479M-98ED+S2.1
- SAE AMS QQ S 763: INTER GRANULAR CORROSION TESTED ASTM A262
- A.C.E+DK.1/LOT.1: 1976°F X 2 MINUTES WATER QUENCH

**Signature**

Chief, Inspection Department

Aichi Steel Corporation
APPENDIX F.

SUPPORT STRUCTURE CALCULATIONS
Structural Support Calculations
### Column Loads

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<td>E-2</td>
<td>34.1</td>
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<td>A-3</td>
<td>8.4</td>
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<td>B-3</td>
<td>27.9</td>
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<tr>
<td>C9-3</td>
<td>28.8</td>
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<td>D-1-3</td>
<td>19.9</td>
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<td>E-3</td>
<td>14.4</td>
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<td>A-5</td>
<td>9.8</td>
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<td>B-5</td>
<td>17.6</td>
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<td>A-7</td>
<td>4.8</td>
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<td>B-7</td>
<td>8.5</td>
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<td>C-7</td>
<td>11.5</td>
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<td>F-7</td>
<td>12.1</td>
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<td>C-6</td>
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<td>F-6</td>
<td>24.2</td>
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<td>C-4</td>
<td>28.1</td>
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<tr>
<td>F-4</td>
<td>24.2</td>
</tr>
<tr>
<td>F-31</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Except at grid F, all columns will be 14.31 in. with K1 = 130 allowable. Column is 93.9 k. This satisfies all conditions.
Horz. Forces & Grid. Fp

\[ \frac{3.76}{4} \times 8150 = 9.77 \text{ kips} \]

\[ 9.77 \times 11.5 \times 1000 \div 1400 = 512 \text{ kips/in} \text{ moment} \]

\[ 8150 \times 11.5 = 27.5 > 6.2 \text{ columns OK} \]
Horiz. Forces & Diag. Bracing:

7.26 kips. C-1 to F-1
12.23 kips. E-2 to E-3
14.64 kips. D-1 to E-1

Col. Uplift:
21.65 kips
Neglecting Dead Load:

Diag. Braces:
W/4, 3/4. Epoxy Anchors

Column Uplift:
21.65 kips
W/4, 3/4. Epoxy Anchors

Pullout Test on 3/4 Epoxy Anchors, W/60 lbf Induced Dent is 26.13 kips with 1.5 safety factor on 1.5 kips per anchor.
26 kips x 4 = 24 > 21.65 kips, O.K.
DESIGN LOADS (1990 BOCA NATIONAL FIRE CODE)

Live Load: 100 psf (light manufacturing - page 246)
Dead Load: 20 psf
Total: 120 psf

Tanks F1, F2, & F3: 47,300 lbs each (filled)
Tank E4: 25,300 lbs (filled)

LATERAL FORCES FOR EARTHQUAKE LOADS

\[ V = 2.5 A_n \times I \times K \times C \times S \times W \]

\[ A_n = 0.1 \times (2 \omega \omega_1) \] (Page 273)
\[ I = 1.0 \] (Table 1113.1, Page 275)
\[ K = 1.0 \] (Table 1113.4.3, Page 278)
\[ C = 1.2 \] (Page 279)
\[ S = 1.5 \] (Table 1113.4.1, Page 281)
\[ W = \text{Weight} \]

\[ V = 2.5 \times 0.1 \times 1.0 \times 1.0 \times 1.2 \times 1.5 \times W \]
\[ V = 0.645 \, W \]
Beam Grid: A.1 to B.1

\[ h = 2.4 \quad d = 2.4 \]

\[ 3.08 \quad 3.08 \quad 3.08 \]

\[ 2 \]

\[ H_0 = 0.4 \times 3.08 = 1.24 \]

\[ H_0 = 0.4 \times 3.08 = 1.24 \]

\[ 2.4 \]

\[ 3.08 \quad 1.42 \quad 1.42 \quad 1.11 \quad 2.37 \]

\[ 1 \]

\[ H_0 = 3.3 \times 3.08 = 10.2\]

\[ H_0 = 3.3 \times 4.86 = 16.14 \]

\[ H_0 = 4.3 \times 2.31 = 10.0 \]

\[ 2.4 \]

\[ 3.08 \quad 1.11 \quad 2.37 \]

\[ 1 \]

\[ H_0 = 4.3 \times 1.11 = 4.73 \]

\[ H_0 = 4.3 \times 2.31 = 10.0 \]

\[ H_0 = 4.3 \times 1.11 = 4.73 \]

\[ H_0 = 4.3 \times 2.31 = 10.0 \]

\[ 3.3 \]

\[ 3.08 \]

\[ 1.11 \]

\[ 2.37 \]

\[ H_0 = 2.4 \times 3.08 = 7.4\]

\[ H_0 = 2.4 \times 3.08 = 7.4\]

From A.5 to B.1: H = 27.3 V = 11.9
BEAM a GRID B-N TO D-N

\[ M_0 = 1 \times 2.91 = 46.4 \]
\[ M_0 = 2 \times 5.13 \times 2.91 = 58.3 \]
\[ M_0 = 3 \times 2.91 = 58.3 \]

FROM ASD 2.173 ALLOWABLE \( M = 66.3 \geq 60.1 \)

(2/11)

BEAM b GRID D-N TO E-N

\[ M_0 = 1 \times 2.91 = 46.4 \]
\[ M_0 = 2 \times 5.13 \times 2.91 = 60.1 \]
\[ M_0 = 3 \times 2.91 = 60.1 \]

(2/11)

(2/11)
Beam & Grid D1-1 to E1-1 & D1-3 to E3 (11/12/91)

\[ N = 15.4 \times 0.7 = 10.3 \]
\[ N = 15.4 \times 3.59 = 56.4 \]
\[ N = 11.0 \times 0.51 = 5.63 \]
From ASD, 2.7, allowable G. N. = 66.5 > 10.3

Beam & Grid B-1 to C-1 (11/12/91)

\[ N = 64 \times 2.01 = 128 \]
\[ N = 64 \times 5.13 = 328 \]
\[ N = 3 \times 12.3 = 37 \]
From ASD, 2.7, allowable G. N. = 485 > 128
BEAM GRID A-3 TO B-3

\[ \begin{align*}
4,1 & \quad -10.75 \\
3.00 & \quad 2.37 & \quad 2.37 \\
4.4 & \quad 7.5
\end{align*} \]

\[ 19 \times 4.4 \times 7.5 = 729 \]

FROM ASD 2.174, ALLOWABLE 14 x 77.3 >

BEAM GRID A-5 TO A-7

\[ \begin{align*}
3.35 & \quad 3.82 & \quad 3.82 & \quad 3.35 & \quad 2.89 \\
G1 & \quad m & \quad m & \quad 3.1 & \quad 2.7
\end{align*} \]

\[ M = 0 \quad 6.1 \times 3.35 \quad = 20.4 \]

\[ I = \frac{G1 \times (G1 + 3.82)}{12} \quad = 31.9 \]

\[ T = 3 \quad 6.1 \times 6.14 \times 2.7 \times 3.35 \quad = 29.2 \]

\[ T = 4 \quad 6.1 \times 2.89 \quad = 17.9 \]

FROM ASD 2.172, ALLOWABLE 14 x 76.2 > 31.9
BEAM GRID A-3 TO A-5

UNBRACED LOAD 40

\[ M_{u1} = 4.2 \times 3.31 \approx 13.9 \]
\[ M_{u2} = 4.2 \times 6.2 - 1.5 \times 3.31 \approx 22.0 \]
\[ M_{u3} = 4.0 \times 7.96 - 7.2 \times 3.98 \approx 33.4 \]
\[ M_{u4} = 4.0 \times 3.98 \approx 15.9 \]

FROM ASD 2.17 ALLOWABLE M = 76.7 > 23.4

BEAM GRID B-3 TO B-5

UNBRACED LOAD 40

\[ M_{u1} = 7.6 \times 3.31 \approx 25.1 \]
\[ M_{u2} = 7.6 \times 6.2 - 3.31 \times 3.31 \approx 39.3 \]
\[ M_{u3} = 7.1 \times 7.96 - 3.9 \times 3.98 \approx 41.2 \]
\[ M_{u4} = 7.1 \times 3.98 \approx 28.4 \]

FROM ASD 2-172 ALLOWABLE M = 76.7 > 41.2
Bean & Grid B.5 To B.7

\[ \begin{align*}
\text{UNBROKEN LENGTH 36Ft} \\
10 & \quad 80 & \quad 65 & \quad 75 & \quad 75 \\
\end{align*} \]

\[
\begin{align*}
3.35 & \quad 3.67 & \quad 3.81 & \quad 3.35 & \quad 2.89 \\
0 & \quad 0 & \quad 0 & \quad 0 & \quad 0 \\
\end{align*} \]

\[
\begin{align*}
N \oplus 0 &= 6.9 \times 3.35 = 23.1 \\
M \oplus 0 &= 6.9 \times 7.17 - 3.5 \times 3.35 = 36.1 \\
N \oplus 3 &= 7.0 \times 6.24 - 3.1 \times 3.35 = 33.8 \\
M \oplus 3 &= 7.0 \times 2.89 = 20.2 \\
\end{align*} \]

From ASD 2.172 Allowable N = 7kips > 33.8

Cross Beam Under FT 10.43 (Spaced 5'10 span) (4.8 ft)

\[
\begin{align*}
1.45 & \quad 1.50 & \quad 1.45 \\
\end{align*} \]

\[
\begin{align*}
N \oplus 0 &= 7.0 \times 1.45 = 9.9 \\
I \oplus 0 &= 7.0 \times 2.92 - 6.7 \times 1.50 = 10.4 \\
I \oplus 0 &= 7.0 \times 1.45 = 9.9 \\
\end{align*} \]

From ASD 2.174 Allowable N = 30.7 > 10.4
Bean Grid C-3 to C-4

(W.12:38)

1. 1.87
2. 1.45
3. 2.52
4. 1.77
5. 2.01
6. 9.8
7. 3.00
8. 3.7
9. 1.1

H = 13.7 x 1.87...
= 25.5
H = 13.7 x 3.35 - 1.6 + 1.48...
= 43.5
H = 13.7 x 5.27 - 1.6 x 40 - 84 + 7.52...
= 52.9
H = 11.1 x 6.19 - 3.3 x 3.15 - 1.7 x 0.81...
= 54.4
H = 11.1 x 3.78 - 3.3 x 0.94...
= 40.9
H = 11.1 x 3.86...
= 33.3

From ASD... R = 172. Allowable: M = 91.2... > 54.4

Bean Grid F-31 to F-4, F-4 to F-6

(W.12:49)

H = 9.2 x 3.35 = 30.8
H = 9.2 x 3.35 = 30.2

From ASD n = 172 Allowable M... > 30.8
BEAM & GRID C-G TO G-C

\[ W_{1/2} \text{ in} = 3.44 \]

\[ H = \frac{3.87 - 3.35}{9.0} = 0.52 \]
\[ H = \frac{7.17 - 8.4}{3.35} = 0.97 \]
\[ H = \frac{9.4 - 3.35}{9.4} = 0.7 \]

FROM ASD, 2.173 ALLOWABLE M = 35.3

BEAM & GRID C-G TO C-G

\[ W_{1/2} \text{ in} = 3.44 \]

\[ H = \frac{3.35}{10.2} = 0.33 \]
\[ H = \frac{6.25 - 9.8}{10.2} = 0.25 \]
\[ H = \frac{3.35}{10.8} = 0.31 \]
\[ H = \frac{1.5}{10.8} = 0.14 \]

FROM ASD, 2.173 ALLOWABLE M = 35.3
BEAM UNDER 2" 4" (DIA: C4) (1 1/2" C4)

UNRESTRICTED LENGTH 5'-19/32"

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<tr>
<td>1.75</td>
<td>1.62</td>
<td>1.39</td>
<td>1.09</td>
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<tr>
<td>1/8</td>
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</table>

M = 0.17 x 8.1 x 355 = 29.5

M = 0.17 x 8.1 x 4.43 - 49.1 x 0.2 = 32.0

FROM ADS 2-173, ALLOWABLE M = 64.5 > 32.0

BANK GRIP B:3 TO G:7:3

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<tr>
<td>12.9</td>
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M = 0.17 x 12.8 x 0.81 = 28.3

M = 0.17 x 12.8 x 5.13 - 12.8 x 2.92 = 28.0

M = 0.17 x 26.5 x 1.46 - 13.7 x 1.9 = 26.4

M = 0.17 x 25.5 x 67 = 17.1

FROM ADS 2-172, ALLOWABLE M = 91.2 > 28.3
CROSS BOW UQDR. BF4 (2 PAGES) 50.5 SPAN (18x18)  

UNBRACED LETH. LC  

M = 4,3 x 1.43  
N = 4.3 x 2.92 - 4.0 x 1.56  = 60  
H = 4.3 x 1.43  

FROM A50 P.174 ALLOWABLE M - 303 > 60

BEND UQDR. FLUSH TANKS (2 PAGES)  

M = 10.9 x 3.55  = 45.3  
H = 12.9 x 4.63 - 7.0 x 9.53  = 52.2  

FROM A50 P.174 ALLOWABLE M - 26.8 > 52.2
BEAN = GRID E-7 TO E-3

\[ M = \frac{1.8 \times 12.33}{8} = 2.8 \text{ k} \]

UNBRACED LETH 12.4

FROM ASD 2-174 ALLOWABLE M = 38.3 > 2.8

BEAN = GRID B-12 TO B-3

\[ M = \frac{3.6 \times 17.33}{8} = 6.5 \text{ k} \]

UNBRACED LETH 10.4

FROM ASD 2-174 ALLOWABLE M = 38.3 > 6.5

BEAN = GRID B-1 TO B-2

\[ M = \frac{4.2 \times 12.33}{8} = 6.5 \text{ k} \]

UNBRACED LETH 10.4

FROM ASD 2-174 ALLOWABLE M = 38.3 > 6.5

BEAN = GRID A-1 TO A-2

\[ M = \frac{3.4 \times 12.33}{8} = 3.7 \text{ k} \]

UNBRACED LETH 10.4

FROM ASD 2-174 ALLOWABLE M = 38.2 > 3.7

BEAN = GRID A-5 TO B-5

\[ M = \frac{3.4 \times 9.85}{8} = 3.9 \]

UNBRACED LETH 9.3

FROM ASD 2-174 ALLOWABLE M = 38.13 > 3.9
BEAM 7 1/8 SOUTH OF GRID B:7 TO C:7

\[ M = \frac{3.2 \times 7.25}{8} = 2.9 \, k\text{f} \]

From ASD, page 2-175, allowable \( M = 11.5 > 2.9 \).

UNREACED LATH 7 1/3

BEAM C1 3/8 NORTH OF GRID B:5 TO C:5

\[ M = \frac{3.2 \times 7.25}{8} = 2.9 \, k\text{f} \]

From ASD, page 2-175, allowable \( M = 11.5 > 2.9 \).

UNREACED LATH 7 1/3

BEAM 2 1/8 NORTH OF GRID B:5 TO C:5

\[ M = \frac{2.8 \times 7.25}{8} = 2.5 \, k\text{f} \]

From ASD, page 2-175, allowable \( M = 11.5 > 2.5 \).

BEAM 3 1/3 3/4 SOUTH OF GRID B:5 TO C:5

\[ M = \frac{3.0 \times 7.25}{8} = 2.7 \, k\text{f} \]

From ASD, page 2-175, allowable \( M = 11.5 > 2.7 \).

BEAM C1 7/16 SOUTH OF GRID B:5 TO C:5

\[ M = \frac{3.2 \times 7.25}{8} = 2.9 \, k\text{f} \]

From ASD, page 2-175, allowable \( M = 11.5 > 2.9 \).
BEAM 71° 36' NORTH ON GRID A-5 TO B-5  

\[ M = \frac{3.4 \times 9.25}{8} - 3.9 \text{ k} \]

From above 2.175, allowable 11.5 > 3.9

BEAM 61° 3 NORTH ON GRID A-5 TO B-5  

\[ M = \frac{4.0 \times 9.25}{8} - 4.6 \text{ k} \]

From above 2.175, allowable 11.5 > 4.6

BEAM 71° 38' SOUTH ON GRID A-7 TO B-7  

\[ M = \frac{4.2 \times 9.25}{8} - 4.9 \text{ k} \]

From above 2.175, allowable 11.5 > 4.9

BEAM 31° 44' SOUTH ON GRID A-7 TO B-7  

\[ M = \frac{4.0 \times 9.25}{8} - 4.6 \text{ k} \]

From above 2.175, allowable 11.5 > 4.6

BEAM 31° 44' SOUTH ON GRID B-5 TO C-5  

\[ M = \frac{3.0 \times 7.05}{8} - 2.9 \text{ k} \]

From above 2.175, allowable 11.5 > 2.9
BEAM 0-GRID D-2 TO D-3  (WIN14)

UNBRACED LENGTH 11'-6"

\[ M = \frac{3.0 \times 14.83}{2} = 47.3 \text{ kips}\cdot\text{ft} \]

From ASD 2.175, Allowable M = 70.17 > 47.3

BEAM 0-GRID B-1 TO D-7  (WIN19)

UNBRACED LENGTH 10'-6"

\[ N = \frac{32.125}{2} = 5.0 \text{ kips} \]

From ASD 2.175, Allowable N = 17.0 > 5.0

BEAM 3'-11\frac{3}{4}" SOUTH OF GRID A-3 TO B-3  (WIN20)

UNBRACED LENGTH 9'-3"

\[ N = \frac{4.4 \times 9.25}{2} = 51.1 \text{ kips} \]

From ASD 2.175, Allowable N = 15.0 > 51.1

BEAM 0, 7TH SOUTH OF GRID A-5 TO B-5  (WIN20)

UNBRACED LENGTH 9'-3"

\[ N = \frac{4.0 \times 9.25}{2} = 41.26 \text{ kips} \]

From ASD 2.175, Allowable N = 9.0 > 41.26

BEAM 3'-3\frac{3}{4}" SOUTH OF GRID A-5 TO B-5  (WIN20)

UNBRACED LENGTH 9'-3"

\[ M = \frac{3.6 \times 9.25}{2} = 47.3 \text{ kips}\cdot\text{ft} \]

From ASD 2.175, Allowable M = 9.0 > 47.3
BEAM 3-1, 20' WEST OF Grid B-1 TO B-2 (2 Places)  
(1.415) Unbraced Lath 13.5 

M = \frac{2.813 \times 13.5}{2}  

From ASD 0.175, Allowable M = 171 \text{ in} > 7.8

BEAM 2-20, 20' WEST OF Grid B-1 TO B-3  
(1.8415)  
Unbraced Lath 13.5

M = \frac{3.213 \times 13.5}{8}  

From ASD 0.175, Allowable M = 121 > 6.7

BEAM UNDER TANKS 2-8 PLACES  
(1.8110)  
Unbraced Lath 12.5

M = \frac{1.62 \times 12.5}{2}  

From ASD 0.175, Allowable M = 15.6 > 1.2

BEAM UNDER TANKS 3x5.8 SPAN 2-8 PLACES  
(1.810)  
Unbraced Lath 3x5.8

M = \frac{12 \times 3.55}{8}  

From ASD 0.175, Allowable M = 15.6 > 5
BEAM A GRID A-7 TO B-7

\[ M = \frac{1.2 \times 9.85 \times 2.1}{8} \]

From A515 2-174 allowable \( M = 38.3 > 2.1 \)

BEAM A GRID B-7 TO C-7

\[ M = \frac{1.4 \times 7.75 \times 1.3}{8} \]

From A515 2-174 allowable \( M = 38.3 > 1.3 \)

BEAM A GRID B-5 TO C-5

\[ M = \frac{2.6 \times 7.25 \times 2.4}{8} \]

From A515 2-174 allowable \( M = 38.3 > 2.4 \)

BEAM A GRID C-7 TO F-7

\[ M = \frac{3.6 \times 18.04 \times 2.1}{8} \]

\[ M = \text{cant. end} = \frac{120 \times 5.45^2}{2} = 3.0 \text{ kN} \]

From A515 2-174 allowable \( M = 31.4 > 3.0 \)
BEAM @ GRID C-G TO F-G & C-4 TO E-4 (WRONG)

\[ M = \frac{7.2 \times 13.04}{12} = 16.2 \text{ kN} \]

\[ N = \frac{140 \times 5.45^2}{4} = 5.9 \text{ kN} \]

From ASD 2.174, Allowable N = 31.4 > 16.2

BEAM @ GRID C-3.1 TO F-3.1 (WRONG)

\[ M = \frac{6.6 \times 18.04}{12} = 14.9 \text{ kN} \]

\[ N = \frac{20 \times 5.45^2}{2} = 3.0 \text{ kN} \]

From ASD 2.174, Allowable N = 31.4 > 14.9

BEAM @ FILLED PRESSURE GRID C TO F (GUEST) (WRONG)

\[ M = \frac{3 \times 18.04 \times 8.1}{2} = 8.1 \text{ kN} \]

\[ N = \frac{40 \times 5.45^2}{2} = 6.8 \text{ kN} \]

From ASD 2.174, Allowable N = 31.4 > 6.8
BEAM # 31/2" 3/4" NORTHERN GRID A-3 TO C-3

$M = \frac{32 \times 7.25 \times 3.1}{6}$

From ASD, 2.175 allowable $M = 11.5 > 3.1$

BEAM @ GRID E-1 TO E-2

$M = \frac{1.8 \times 11.33}{6}$

From ASD, 2.175 allowable $M = 5.0 > 2.175$

BEAM @ GRIO A-1 TO A-2

$M = \frac{1.8 \times 13}{6}$

From ASD, 2.175 allowable $M = 4.8 > 2.9$
NEZZ BEAM = GRID B-1 TO C9-1

UNREACED LENGTH 4.0

\[ \theta \]

\[ 2.8 \]

\[ 3.12 \]

\[ 4.00 \]

\[ 1.58 \]

\[ 2.1 \]

\[ \theta \]

\[ 2.8 \]

\[ N \rightarrow \theta \times 2.1 \times 3.12 = 6.6 \]

\[ N \rightarrow \theta \times 2.8 \times 1.58 = 4.4 \]

FROM ASD 2.175 ALLOWING N = 23.6 > 6.6

WEZZ BEAM = GRID B-2 TO D-2

UNREACED LENGTH 7.0

\[ \theta \]

\[ 2.1 \]

\[ 2.8 \]

\[ 1.54 \]

\[ 1.58 \]

\[ 2.00 \]

\[ 2.00 \]

\[ 1.58 \]

\[ 1.54 \]

\[ \theta \]

\[ 2.8 \]

\[ N \rightarrow \theta \times 5.2 \times 1.54 = 8.0 \]

\[ N \rightarrow \theta \times 5.2 \times 3.12 = 16.0 \times 1.58 = 13.3 \]

\[ N \rightarrow \theta \times 5.2 \times 5.10 = 26.0 \times 3.58 = 20.0 \times 14.4 \]

\[ N \rightarrow 4. \times 6.7 \times 3.12 = 1.4 \times 4.4 \times 1.58 = 13.9 \]

\[ N \rightarrow \theta \times 6.7 \times 1.54 = 10.3 \]

FROM ASD 2.174 ALLOWING N = 29.3 > 14.4
NEZZ BEAK  B. 51 TO C.9-3 $ D.1-3 TO E.3  
$ E.1 TO D.1-1  
UNDERống LENGTH 4.7

\[ M = 0 \quad 1.9 \times 1.54 = 2.9 \text{ kip} \]
\[ N = 0 \quad 0.7 \times 3.52 = 2.5 \text{ kip} \]

FROM ASD 7-175 ALLOWABLE M = 23.6 7.39

NEZZ BEAK  & GRID  D.2 TO E.2  
UNDER่ง LENGTH 3.7

\[ K = 0 \quad 5.6 \times 1.54 = 8.6 \]
\[ M = 0 \quad 5.6 \times 5.12 = 5.2 \times 3.58 = 10.1 \]
\[ T = 0 \quad 4.7 \times 1.64 = 7.8 \]

FROM ASD 7-174 ALLOWABLE M = 27.6 > 10.1
Mezz Beam <9.1 to <9.2 (W815) (Unrecessed Leth 10")
N = 3.16 x 126 = 51.7 k
8

From ads 2,15 allowing M = 14.0 > 5.7

Mezz Beam D1.1 to D1.2 (W815) (Unrecessed Leth 7")
N = 5.7 x 132.7 = 78.2 k
8

From ads 2,15 allowing N = 21.0 > 8.2

Mezz Beam 1.7 U34 on Cattle Car 2 (W815) (Unrecessed Leth 8")
N = 4.2 x 13 = 56.8 k
8

From ads 2,15 allowing N = 21.25 > 6.8

Mezz Beam 3.1m East of B1 to B2 (W815) (4" G Unrecessed Leth)
N = 5.2 x 13 = 9.1
8

From ads 2,15 allowing N = 21.25 > 9.1

Mezz Beam High East of B2 to B3 (W815) (Unrecessed Leth 7")
N = 4.2 x 13 = 60.5
8

From ads 2,15 allowing N = 21.0 > 60.5
MEZZ B EAM & G R ID E-1 TO E-2 (W8.10)
B 2 TO B 3 & E 7 TO E 3
M = \frac{1.2 \times 13}{2} = 1.95 \, k \quad \text{(Unbraced, Lath 13/8)}

From A05 0.115 Allowable M = 4.0 > 1.95

MEZZ BEAM & GRID B 1 TO B 7 (W8.10)
M = \frac{26 \times 13}{2} = 41.2 \, k \quad \text{(Unbraced, Lath 13/8)}

From A05 PAG 0.175 Allowable M = 12.2 >

MEZZ BEAM & GRID C 4 TO C 7, E 2 & D 1 TO D 1-2 (W8.15) Unbraced Lath 13/8
M = \frac{52 \times 13}{2} = 81.5 \, k

From A05 0.175 Allowable M = 8.5 > 8.5

MEZZ BEAM 1 Ch U G E E 1 TO E 7 & E 2 TO E 3 (W8.15)
M = \frac{4 \times 13}{2} = 26.5 \, k

From A05 0.175 Allowable M = 21.2 > 26.5
MEZ 2 BEAM 2.11 SPAN, DEPLANT. W. 8.4 k

\[ M = \frac{2.11 \times 8.4 \times 10}{2} \]

From ACI 21.7.5 Allowable M = 16.0 > 4

MEZ 2 BEAM 2 TANK OPENING (C RING) (W 8.0)

\[ M = \frac{8.0 \times 7.16}{4} \]

From ACI 21.7.5 Allowable M = 16.0 > 1.0
COLUMNS ON 12" SLABS

Max. Load is at B, 5 = 17.6 kip.

12" Slab, 4,000 psi Conc / 4# 13 BW & CIR.

Allowable M per ton slab:
\[ M = \frac{f_d \times A_t \times f_s}{32} \]
\[ M = \frac{0.20 \times 9,000 \times 85 \times 3}{32} = 17.7 \text{kft} \text{ lbs} \]

Critical Section Moment

Check of 2-way (Punching) Shear:
\[ A_{shear} = 4 \times 16" \times 6" \times 11.5 \times 1000 = 26.1 \text{ kip} > 17.6 \text{ kip} \text{ O.K.} \]

Required Moment per ft. of slab:
\[ \frac{P \times L}{B} = \frac{918 \times 175}{18} = 12,740 \text{ lbs} \text{ O.K.} \]

From ASD Page P5-32B Beam Design #29.
<table>
<thead>
<tr>
<th>Load</th>
<th>kips</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.76</td>
<td>8155</td>
</tr>
</tbody>
</table>

**Moment Calculation**

\[
\frac{8155 \times 11.5}{1400} = 712 \text{ k} \cdot \text{ft}
\]

Column check: \(712 < 578\), OK.

**Combined Loads**

\[
\frac{5.7}{27.5} + \frac{24.2}{149} = 0.3515 < 1 \text{ (OK)}
\]

From 608-3.31
Horizontal Force @ Meris: Max. 1989 P.S. 7.1 k
     D.L. 12.3 k
     E.N. 5.9 k

Horizontal Force @ Grid 2: (7.1 + 12.3 + 5.9) x .645 = 11.4 k
     D.L. 3.8 k Horiz. Force Per Con.

Max. Axial Con. = .38 x 12.25 = 4.66 k

Recoil Sq. = 4.26 x 12 = 50.7 < 5.63 5 X

Combined Loading

2.59 + 12.3 + 4.26 x 13 = 59 < 1

5.63 9.5

Cols. OK.
MOMENT, CONNECTOR COL. CAP PLATE: COLS. F.31, F.4, F.5, F.7

Force = Frc. \( \frac{9.37 \times 12}{8.435} \) = 14.86 k

Welded on brackets: 70 x 4 x 8. 20 ft. > 14.86 ok.

Nail thru bolts: 9.37 x 12 \( \div 6.75 \) = 9.96 k

16.96 \( \div 3.2 \text{ per bolt} \) < 9.3 ok.
APPENDIX G.

FOUNDATION ANALYSIS
Foundation Design Analysis
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
Project Manager

Our Mission:
Provide the highest quality waste and by-product management services that consistently meet or exceed customer needs and regulatory requirements of competitive cost while enhancing shareholder value.
<table>
<thead>
<tr>
<th>Specimen</th>
<th>Diameter, In.</th>
<th>Drilled Length, In.</th>
<th>Capped Length, In.</th>
<th>Crushing Load, Lb.</th>
<th>L/D Correction Factor</th>
<th>Compressive Strength, Lb/In²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHI-1</td>
<td>3.75</td>
<td>5.5</td>
<td>5.7</td>
<td>32,400</td>
<td>0.96</td>
<td>2,810</td>
</tr>
<tr>
<td>PHI-2</td>
<td>3.75</td>
<td>5.5</td>
<td>4.9</td>
<td>47,200</td>
<td>0.93</td>
<td>3,880</td>
</tr>
<tr>
<td>PHI-3</td>
<td>3.75</td>
<td>6.5</td>
<td>4.8</td>
<td>41,400</td>
<td>0.93</td>
<td>3,490</td>
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<tr>
<td>PHI-4</td>
<td>3.75</td>
<td>7.5</td>
<td>4.6</td>
<td>60,700</td>
<td>0.93</td>
<td>5,110</td>
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<tr>
<td>PHI-5</td>
<td>3.75</td>
<td>7.0</td>
<td>7.1</td>
<td>43,000</td>
<td>0.99</td>
<td>3,860</td>
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<tr>
<td>PHI-6</td>
<td>3.75</td>
<td>6.5</td>
<td>4.1</td>
<td>57,100</td>
<td>0.88</td>
<td>4,950</td>
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<tr>
<td>PHI-7</td>
<td>3.75</td>
<td>7.0</td>
<td>5.0</td>
<td>43,800</td>
<td>0.96</td>
<td>3,810</td>
</tr>
<tr>
<td>PHI-8</td>
<td>3.75</td>
<td>6.0</td>
<td>7.0</td>
<td>74,800</td>
<td>0.96</td>
<td>6,480</td>
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<tr>
<td>PHI-9</td>
<td>3.75</td>
<td>5.0</td>
<td>5.5</td>
<td>33,500</td>
<td>0.96</td>
<td>2,950</td>
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<td>PHI-10</td>
<td>3.75</td>
<td>6.0</td>
<td>4.7</td>
<td>72,500</td>
<td>0.93</td>
<td>6,100</td>
</tr>
<tr>
<td>PHI-11</td>
<td>3.75</td>
<td>6.0</td>
<td>5.6</td>
<td>55,700</td>
<td>0.96</td>
<td>4,840</td>
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<tr>
<td>PHI-12</td>
<td>3.75</td>
<td>6.0</td>
<td>6.6</td>
<td>65,600</td>
<td>0.98</td>
<td>5,800</td>
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<tr>
<td>PHI-13</td>
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<td>5.0</td>
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<td>80,200</td>
<td>0.95</td>
<td>5,900</td>
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<td>PHI-14</td>
<td>3.75</td>
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<td>60,200</td>
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<tr>
<td>PHI-15</td>
<td>3.75</td>
<td>6.0</td>
<td>4.7</td>
<td>53,800</td>
<td>0.93</td>
<td>4,530</td>
</tr>
<tr>
<td>PHI-16</td>
<td>3.75</td>
<td>13.0</td>
<td>6.0</td>
<td>50,800</td>
<td>0.97</td>
<td>4,460</td>
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<tr>
<td>PHI-17</td>
<td>3.75</td>
<td>22.0</td>
<td>7.0</td>
<td>30,740</td>
<td>0.99</td>
<td>2,760</td>
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<tr>
<td>PHI-18</td>
<td>3.75</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHI-19</td>
<td>3.75</td>
<td>6.0</td>
<td>7.0</td>
<td>61,600</td>
<td>0.99</td>
<td>7,320</td>
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<td>PHI-20</td>
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<td>0.96</td>
<td>7,100</td>
</tr>
<tr>
<td>PHI-21</td>
<td>3.75</td>
<td>19.0</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>PHI-22</td>
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<td>14.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHI-23</td>
<td>3.75</td>
<td>7.0</td>
<td>7.0</td>
<td>53,200</td>
<td>0.99</td>
<td>4,770</td>
</tr>
</tbody>
</table>

PHI = Pre-Water Treatment
FHI = Final Water Treatment

* Samples which we were not able to pull out of the hole.
CORE HOLE TO BE FILLED WITH SKESTONE #10 WITH SAND BINDER

FILL PLUG TO 1/4" BELOW FINISH GRADE, LEAVE SURFACE ROUGH

PROTECTIVE COATING TO MATCH EXISTING.

EXIST. CONCRETE (VARIABLE THICK.)

REMOVE DIRT AROUND FULL CIRCUMFERENCE 1.5" WIDE MIN.

FILL TO 1.5" BELOW CONC. W/BENTONITE PELLETS

CORE PLUG DETAIL

CORE PLUG DETAIL FOR
USPGI, LONE MOUNTAIN FACILITY
WAYNOCA, OKLAHOMA

REV. NO. 1.23.92 CHANGE FILL IN SOL. TO BENTONITE SEAL PER GENE WALKER REQUEST

Myers
ENGINEERING CORPORATION
Oklahoma City, Oklahoma

JOB NO.

SCALE

DRAWN

DATE

1 SHEET OF 1
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.

<table>
<thead>
<tr>
<th>COLUMN</th>
<th>LOAD, KIPS</th>
<th>FOUNDATION CONDITION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>3.6</td>
<td>'17&quot; floor slab</td>
<td>OK (see page #2)</td>
</tr>
<tr>
<td>A-2</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-3</td>
<td>8.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-5</td>
<td>9.8</td>
<td>6&quot; floor slab</td>
<td>OK (see page #1)</td>
</tr>
<tr>
<td>A-7</td>
<td>4.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-1</td>
<td>14.3</td>
<td>17&quot; floor slab</td>
<td>OK (see page #2)</td>
</tr>
<tr>
<td>B-2</td>
<td>36.3</td>
<td></td>
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</tr>
<tr>
<td>B-3</td>
<td>27.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-5</td>
<td>17.6</td>
<td>6&quot; floor slab</td>
<td>OK (see page #1)</td>
</tr>
<tr>
<td>B-7</td>
<td>8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-4</td>
<td>28.1</td>
<td>24&quot; x 36&quot; cont.fltg.</td>
<td>OK (see page #3)</td>
</tr>
<tr>
<td>Code</td>
<td>Number</td>
<td>Description</td>
<td>Status</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>----------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>C-6</td>
<td>24.8</td>
<td>24&quot; x 36&quot; cont. ftg.</td>
<td>Ok (see page #3)</td>
</tr>
<tr>
<td>C-7</td>
<td>11.5</td>
<td>6&quot; floor slab</td>
<td>Ok (see page #1)</td>
</tr>
<tr>
<td>C.9-1</td>
<td>14.1</td>
<td>17&quot; floor slab</td>
<td>Ok (see page #2)</td>
</tr>
<tr>
<td>C.9-2</td>
<td>28.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-2</td>
<td>62.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.1-1</td>
<td>19.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.1-3</td>
<td>19.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>14.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-2</td>
<td>34.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-3</td>
<td>14.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-3.1</td>
<td>12.0</td>
<td>6&quot; floor slab</td>
<td>Ok (see page #1)</td>
</tr>
<tr>
<td>F-4</td>
<td>24.2</td>
<td>24&quot; x 36&quot; cont. ftg.</td>
<td>Ok (see page #3)</td>
</tr>
<tr>
<td>F-6</td>
<td>24.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-7</td>
<td>12.1</td>
<td>6&quot; floor slab</td>
<td>Ok (see page #1)</td>
</tr>
</tbody>
</table>
**Columns on 2" Slabs**

Max. Cal. Load is at B-S = 17.6 Kips.

2" Slabs, 4,000 psi Conc. w/ #4@12 EW @ CTR.

Allowable M for 2" Slabs
\[ M_{allow} = 120 \times 4,000 \times 0.85 \times 3 \times 17.6 \times \frac{1}{12} \text{ Lbs-ft} \]

Check of 2 Way (Punching) Shear
\[ 4 \times 12 \times 12 \times 1.1 = 4,000 = 26.7 \text{ K.} > 17.6 \text{ K. OK} \]

Required Moment per ft of Slab
\[ \frac{2500 \times 11.5}{12} \times \frac{x}{11.5} = 0.885 \text{ Lbs} \leq 12.240 \text{ Lbs. OK.} \]
COLUMN: SN. 17" SLABS W/ G. 12" E.B. T & B

Max. Col. Load Is At Grid D-12 = 62.9 Kips

Allowable Moment in Slab
\[ 0.44 \times 24000 \times 12 = 172,720 \text{ lb} = 10.56 \text{ k} \]

Allowable Soil Bulk = 2500 \times \text{Square 180} = 2320

\[ \frac{62.9}{2.32} = 27.11 \text{ Kip} \]

2-way (Punching) Shear
\[ 4 \times 7.2 \times 17 \times 1.1 \times 7400 = 127.7 \text{ k} \geq 62.9 \text{ k} \quad \text{Ok} \]

Re: Allowable Moment In Girder Beam

\[ 29.5 \times 2.32 = 1.31 \text{ k} \leq 10.56 \text{ k} \quad \text{Ok} \]
COLUMNS ON 24' 3" GRADE BEAM

Max. Col. Load is at Col. C-4 = 28.1 Tons.

Grade Beam has 24" Top, CTR & BOTT (According to Lawson Fenton)

Allowable Moment in Grade Beam (Figuring Top Reinf.)
As ft-lb = \( \frac{28.1 \times 24000 \times 30 \times 637,200 \text{ Lb. ft.}}{52,800} \)

Allowable Soil Bxe 2500 - GB Weight 360 5 2140
\( \frac{28.1 \times 24 \times 637.2 \text{ ft-lb}}{2140} = \)

Read Moment in Grade Beam:
\( \frac{28.1 \times 24 \times 637.2 \times 18.2 \text{ k} < 52.8 \text{ k}}{2} \)
APPENDIX H.

CONCRETE COATING INFORMATION FOR SECONDARY CONTAINMENT
Primer 67/67C

100 % SOLIDS, MOISTURE-TOLERANT
EPOXY PRIMER FOR STEEL AND
CONCRETE (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
NFFA #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

<table>
<thead>
<tr>
<th></th>
<th>CONCRETE</th>
<th>STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primer 67</td>
<td>150-200</td>
<td>250-300</td>
</tr>
<tr>
<td>Primer 67C</td>
<td>100-150</td>
<td>100-150</td>
</tr>
</tbody>
</table>

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:

Primer 67
Component A 1 gal.
Component B 1 gal.

Primer 67C
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**

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>POT LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°F</td>
<td>90 min.</td>
</tr>
<tr>
<td>75°F</td>
<td>60 min.</td>
</tr>
<tr>
<td>90°F</td>
<td>30 min.</td>
</tr>
</tbody>
</table>

At 75°F the pot life and thin film cure of Primer 67 can be decreased by the addition of Accelerator #1 as follows:

<table>
<thead>
<tr>
<th>Oceans/Accelerator #1 per mixed gal. Primer 67</th>
<th>Pot Life</th>
<th>Thin Film Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4</td>
<td>35 min.</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>6-7</td>
<td>15 min.</td>
<td>2 hrs.</td>
</tr>
</tbody>
</table>

Using 7 ounces of accelerator #1 per mixed gallon of Primer 67, the thin film cure @ 40°F is reduced to 8 hours.

---

Dudick Incorporated
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:**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Minimum Reccoat Time</th>
<th>Maximum Reccoat Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>12 hrs.</td>
<td>6 Days</td>
</tr>
<tr>
<td>75°F</td>
<td>6-8 hrs.</td>
<td>5 Days</td>
</tr>
<tr>
<td>90°F</td>
<td>4-5 hrs.</td>
<td>3 Days</td>
</tr>
</tbody>
</table>

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 105°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.
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

<table>
<thead>
<tr>
<th>Protecto-Coat 200</th>
<th>40 Mil Basecoat</th>
<th>20 Mil Topcoat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (PSI) ASTM C307</td>
<td>2,400-2,600</td>
<td>2,200-2,500</td>
</tr>
<tr>
<td>Elongation</td>
<td>225% to 275%</td>
<td>50 to 60%</td>
</tr>
<tr>
<td>Shore D Hardness</td>
<td>40-45</td>
<td>65-70</td>
</tr>
<tr>
<td>Abrasion Resistance CS 17 wheels/1000 cycles x 1000 gms load</td>
<td>10 mg weight loss</td>
<td>32 mg weight loss</td>
</tr>
<tr>
<td>Solids by Volume</td>
<td>80%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*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 07 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

<table>
<thead>
<tr>
<th>SQUARE FEET PER GALLON</th>
<th>CONCRETE</th>
<th>STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primer 67</td>
<td>150-200</td>
<td>250-300</td>
</tr>
<tr>
<td>Protecto-Coat 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Base Coats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>35-40 mil DFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>16-20 mil DFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-10 Solvent</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

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 mil 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 abraded-blasted or etched with muratic 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. oz.

*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.

**TOPOCOAT**
Add appropriate amount of hardener for each gallon of Protec-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 Protec-Coat 200**

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>RECOAT TIME</th>
<th>CURE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°</td>
<td>48 Hrs.</td>
<td>96 Hrs.</td>
</tr>
<tr>
<td>70°</td>
<td>24 Hrs.</td>
<td>48 Hrs.</td>
</tr>
<tr>
<td>90°</td>
<td>16 Hrs.</td>
<td>36 Hrs.</td>
</tr>
</tbody>
</table>

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. 207646 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 Protec-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:

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>POT LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°F</td>
<td>120 Min.</td>
</tr>
<tr>
<td>75°F</td>
<td>60 Min.</td>
</tr>
<tr>
<td>90°F</td>
<td>45 Min.</td>
</tr>
</tbody>
</table>

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Where immersion testing is required, spark test the coating with a 5,000 to 7,000 volt AC spark tester. Mark and repair all pinholes. Use Protec-Coat liquid mixed with the appropriate amount of hardener. Retest only the repairs.

**CLEANING**
Use S-10 Solvent to clean tools and equipment.

**SHIPPING**
Protec-Coat 200 Topcoat A and B and Protec-Coat 200 Basecoat A are classified as plastic liquids and are non-regulated.

Protec-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, Protec-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. Protec-Coat Systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protec-Coat systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

---

Protecto-Coat 2*®
Elastomeric, Spray Applied, Environmentally Safe, Urethane Coating.
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 lacquer 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 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 MERCHANTABILITY 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.
APPENDIX I.

SECONDARY CONTAINMENT
SAFETY KLEEN
LONE MOUNTAIN FACILITY
FT 1 & 2 TANK ASSESSMENT
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' = 712.25 ft³

C. ENROACHMENTS
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 ½'' 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. ENROCachment VOLUME CALCULATIONS
1. 16 x 0.83 ft x 0.83 ft x 0.25 ft = 2.75 ft³
2. 9 x 1 ft x 0.83 ft x 0.25 ft = 1.87 ft³
3. 1 x 1.17 ft x 1.25 ft x 0.25 ft = 0.37 ft³
4. 1 x 2 ft x 0.67 ft x 0.25 ft = 0.34 ft³
5. 2 x 1 ft x 1 ft x 0.25 ft = 0.5 ft³
6. 2 x 2.67 ft x 1 ft x 0.25 ft = 1.34 ft³
7. 1 x 2 ft x 2 ft x 0.25 ft = 1.0 ft³
8. 4 x 1.17 ft x 2.5 ft x 0.25 ft = 2.93 ft³
9. 1 x 1.33 ft x 2.67 ft x 0.25 ft = 0.89 ft³
10. 2 x 2 ft x 4.25 ft x 0.25 ft = 4.25 ft³
11. 4 x 5 ft x 1.67 ft x 0.25 ft = 8.35 ft³
12. 4 x 3 ft x 1 ft x 0.25 ft = 3 ft³

TOTAL ENROCachment VOLUME 27.59 FT³

AVAILABLE CONTAINMENT VOLUME 685 FT³

LARGEST TANK VOLUME (FT 1) 506 FT³

EXCESS CONTAINMENT 179 FT³
SECTION FT3

(OUT OF SERVICE)
ASSESSMENT OF EVAPORATOR FLASH TANK NO.3 (FT3)
LONE MOUNTAIN HAZARDOUS WASTE FACILITY
U.S.P.C.I./LAIDLAW
WAYNOKA, OKLAHOMA

A TANK SYSTEM DESCRIPTION

Evaporator Flash Tank No.3 (FT3) is a new welded above-ground waste-water treatment and storage tank to be installed as a part of the final waste-water treatment plant at the Lone Mountain Facility. The top of the tank is completely open to the atmosphere for evaporation purposes. Evaporator Flash Tank #3 (FT3) is located within the Waste-water Final Treatment building on the first mezzanine level of the support structure. The tank system consists of Evaporator Flash Tank #3 (FT3), Circulating Pump (P5), Heat Exchanger (EU3), Pump (P83), Filter press (FP3), and associated piping and instruments.

B PRIMARY TANK VESSEL

1. General Description

   Evaporator Flash Tank No.3 (FT3) is a circular steel tank with an outside diameter of 6'4" and a height of 31'0". The tank proper has a skirt that is anchored to the support structure. The bottom of the tank is dished and welded to the shell. A self-supporting flue is attached to the top of the tank. Flash 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 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
   \[ 7 < \text{pH} < 12 \]
   \[ 2 < \text{N} < 7 \]

(Flash Tank FT3)
(09/18/96)
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 Plasite 7156 Hi-Resistant Heavy Build Protective coating. Each layer is applied at a dry film thickness of not less than 5.0 mils. The corrosion protection system was installed according to the application instructions in Appendix F of this assessment. 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.

5. Documented Age of Tank

This tank was manufactured by Scott Manufacturing, Inc. of Lubbock, Texas in August 1995 and installed in October 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 defects:

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.

(Flash Tank FT3)
(09/18/96)
7. Existing Data Obtained

a. Diameter of Tank 6'4"
b. Nominal Height of Tank 31'0"
c. Maximum Capacity 2981 gal.
d. Overflow Liquid Level 9'1"
e. Overflow Volume 2234 gal.
f. Design Specific Gravity 1.5
g. Maximum Bottom Pressure 4.7 psi
h. Maximum Operating Temperature 300°F

i. Material of Construction
  i) Shell ASTM A36
  ii) Bottom ASTM A516 F&D Head
  iii) Roof ASTM A36
  iv) Steel Pipe ASTM A53, Grade B
  v) Bolts ASTM A307, Grade B

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 48,162 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 Flash Tank No. 3 (FT3) system includes the following:

- **a)** Circulating Pump (P5) - a centrifugal pump designed to pump 800 GPM at 150 feet of discharge head with a suction head of 11 feet.

- **b)** Heat exchanger (EU3) -- 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.

- **c)** Pump (P83) - 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 (FP3) - a gasketed unit employing glass filled polypropylene plates designed to operate at a temperature/pressure limit of 100 psi at 212°F. Manufacturer information and special operating instructions are included in Appendix B of this assessment.

- **e)** Associated piping, valves and instruments - all piping is Schedule 40 carbon steel fitted with 150 psi flanges except the Low pressure blow
down line from Pump P5 to EB-2 shall be heater hose rated at -40°F to 350°F and 175 to 250 psi respectively. 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 was 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 is 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 3 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 was installed in June 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 included 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. Pipe Support System

A visual inspection of the pipe support system was conducted. This inspection included a look at such things as materials of construction, welds, and construction methods. From this inspection a determination was made that the pipe support system is adequate.

(Flash Tank FT3)
(09/18/96)
D  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. 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 compressive 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)

<table>
<thead>
<tr>
<th>Area</th>
<th>2739 s.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curb Height</td>
<td>0.25 ft.</td>
</tr>
</tbody>
</table>

(Flash Tank FT3)
(09/18/96)
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**

<table>
<thead>
<tr>
<th>Containment Capacity Required</th>
<th>401 c.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Containment Volume Available</td>
<td>685 c.f.</td>
</tr>
<tr>
<td>Excess Containment Volume</td>
<td>284 c.f.</td>
</tr>
</tbody>
</table>

E CONCLUSIONS

1. The foundation, structural support, seams, connections, and controls for the Evaporator Flash Tank No. 3 (FT3) System have been adequately designed.

2. The Evaporator Flash Tank No. 3 (FT3) 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 Flash Tank No. 3 (FT3) system was inspected after installation for weld breaks, punctures, scrapes of protective coating, cracks, leaks, corrosion, and other structural damage or inadequacies of construction/installation.

4. The Evaporator Flash Tank No. 3 (FT3) was tightness tested after installation and it was found that the tank tested positive for tightness.

5. The Secondary Containment for the Evaporator Flash Tank No. 3 (FT3) 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 Flash Tank No. 3 (FT3) system is properly supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

(Flash Tank FT3)
(09/18/96)
7. The Evaporator Flash Tank No. 3 (FT3) system associated ancillary equipment was
tightness tested after equipment installation in accordance with ASME/ANSI B31
and it was found that the ancillary equipment tested positive for tightness.

8. All instruments and heat exchanger plates shall be installed, calibrated, and tested
before operating personnel starts FT-3 process cycle.

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 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.

[Signature]

(Flash Tank FT3)
(09/18/96)
Primary Tank Volume Calculations
3' φ (OD.) OVERFLOW VOLUME = 2234 GALL.
MAX. VOLUME = 2981 GALL.

6' 4" φ (OD.)
7/6" OD. FLANGED & DISHED BOTTOM (VOLUME ~ 110 GAL.)

MAX. WATER HT. = \( \frac{(2981 - 110)}{7.46052 \frac{gal}{ft^2}} \left( \frac{1}{\pi \left(0.33\right)^2} \right) = 12.2' \)

OVERFLOW WATER HT. = 9.1'
MAX. WATER WT. = 2981 gal. \((8.3454)(1.5) = 37317 \frac{ft}{lbf} \)
OVERFLOW WATER WT. = 2234 \((8.3454)(1.5) = 27916 \frac{ft}{lbf} \)
- Wind Load on Tank - Per API 650, 3.11

Wind Load = 18 psf

\[
O.T.M. = 18 \text{psf} \left( 3'(10.5') \left( \frac{10.5'}{2} + 20.5' \right) + 0.33' \left( \frac{20.5'}{2} \right)^2 \right)
\]

\[
O.T.M. = 38542 \text{ ft-lb}
\]

- Determine Shell WT.

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flue</td>
<td>1010 #</td>
</tr>
<tr>
<td>Insulation</td>
<td>192 #</td>
</tr>
<tr>
<td>Roof R</td>
<td>402 #</td>
</tr>
<tr>
<td>3/8'' Shell R</td>
<td>3241 #</td>
</tr>
<tr>
<td>Accessories</td>
<td>10,845 #</td>
</tr>
<tr>
<td>Total Tank WT</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{Contents} = 2981 \text{ gal}
\]

\[
\text{Total Tank + Contents} = 48,162 \#
\]

\[
C = \frac{2M}{D(P)} = \frac{2 \times 38542}{0.33' \times (0.9 \times 10845)}
\]

\[
C = 1.25 > 0.66
\]

\[\therefore\] Anchor bolts are req'd.
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' = 712.25 ft³

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 @ 12" 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 ft³
2. 9 x 1 ft x 0.83 ft x 0.25 ft = 1.87 ft³
3. 1 x 1.17 ft x 1.25 ft x 0.25 ft = 0.37 ft³
4. 1 x 2 ft x 0.67 ft x 0.25 ft = 0.34 ft³
5. 2 x 1 ft x 1 ft x 0.25 ft = 0.5 ft³
6. 2 x 2.67 ft x 1 ft x 0.25 ft = 1.34 ft³
7. 1 x 2 ft x 2 ft x 0.25 ft = 1.0 ft³
8. 4 x 1.17 ft x 2.5 ft x 0.25 ft = 2.93 ft³
9. 1 x 1.33 ft x 2.67 ft x 0.25 ft = 0.89 ft³
10. 2 x 2 ft x 4.25 ft x 0.25 ft = 4.25 ft³
11. 4 x 5 ft x 1.67 ft x 0.25 ft = 8.25 ft³
12. 4 x 3 ft x 1 ft x 0.25 ft = 3 ft³

TOTAL ENCROACHMENT VOLUME

AVAILABLE CONTAINMENT VOLUME

LARGEST TANK VOLUME (FT³)

EXCESS CONTAINMENT

27.59 ft³
684.66 ft³
401 ft³
283.66 ft³
Manufacturers Design Information
Primary Tank
MANUFACTURER'S CERTIFICATION FOR
TANK BUILT TO API STANDARD 650

TO USPCI/LAIDLAW (Name and address of purchaser)

ROUTE 2, BOX 170

WAYNOKA, OKLAHOMA 73860-9622

We hereby certify that the tank constructed for you at

USPCI - LONE MOUNTAIN FACILITY (Location)

WAYNOKA, OKLAHOMA

and described as follows: (1) SMI 499-3, 6'-4" O.D., 31'H
(Serial or contract number, diameter, height, capacity, floating or fixed roof)

2981 GAL, WITH FIXED FLUE OPEN TOP ROOF

meets all applicable requirements of API Standard 650, NINTH
Edition, JULY 1993 Revision, Appendix A, J, & M
dated NOVEMBER 30, 1994, including design, materials,
fabrication, and testing.
The tank is further described on the attached as-built data sheet dated

8-1-95 (LAST REVISION DATE)

SCOTT MANUFACTURING, INC.
Manufacturer

WILLIAM A. BRENNER MGR/HC
Authorized Representative

8-24-95
Date
**DESIGN DATA**

- **Operating Pressure**
  - Atmosphere
  - 300°F

- **Design Temperature**
  - 1

- **Seismic Zone**
  - 1

- **Wind Velocity**
  - 100 MPH

- **Corrosion Allowance**
  - 1/8"

- **Min. Plate Thickness**
  - 3/8"

- **Specific Gravity**
  - 1.5

**Design Standard**

- API 650 with Appendix A, J, Q, M

*The design of this tank is "based" on API 650, although API 650 is meant to cover only tanks whose entire bottom is uniformly supported on the ground. The bottom for this tank is not uniformly supported. However, the design will comply wherever possible to API 650.*
TRY USING (8) - 3/4'' A325 ANCHOR BOLTS

Root Area = 0.309 in²

Allow. Tensile Stress = 15,000 psi

Design Anchor Bolts per API (650, F.7)

Provide 1/4'' Corrosion Allowance on the Diameter

\[ \text{Equiv. Diameter} = \sqrt{\frac{0.309 \times 4}{\pi} - 0.25''} = 0.3712 \text{ in.} \]

Adjusted Root Area = \[ \frac{\pi \times (0.3712^2)}{4} \]

\[ = 0.112 \text{ in.}^2 \]

Allow. Bolt Tension = \[ 0.112 \text{ in.}^2 \times (15000 \times \frac{4}{3}) \]

Allow. Bolt Tension = 2235.4 #

Bolt Circle = 6'' + 2(1 1/2'') = 6'' - 7''

Bolt Circle; \( d = 6.583 \text{ ft.} \)

Number of Anchor Bolts = \[ \frac{4 \times (38542)}{0.583 \times 2235.4} - \frac{0.9 \times (10845\#)}{2235.4\#} \]

Resid. Number of A.B. = 4.11 Bolts < 8 \( \checkmark \) OK

USE (8) - 3/4'' A325 ANCHOR BOLTS
CHECK SEISMIC LOADS PER API (650, APPENDIX E).

ZONE 1 - Z = 0.1875 (TABLE E-1)

I = 1.0
C = 0.24

W_{FLUE} = 1202 \# 
W_{SHPELL} = 9241 \# 
W_{R} = 402 \# 
W_{T} = 37317 \#

\frac{D}{H} = \frac{6.33'}{12.66'} = .5

\frac{W_{1}}{W_{T}} = .91 \quad W_{1} = .91(37317\#) = 33959\#
\frac{W_{2}}{W_{T}} = .13 \quad W_{2} = .13(37317\#) = 4852\#

\frac{X_{1}}{H} = .45 \quad X_{1} = .45(12.66')+5' = 10.7'
\frac{X_{2}}{H} = .833 \quad X_{2} = .833(12.66')+5' = 15.6'

k = .57 \quad T = .57(4.33)\frac{1}{2} = 1.434 \quad \phi = 1.5

C_{2} = \frac{0.30(1.5)}{1.434} = .314
Seismic Cont.

\[ C_1 W_{Flue} X_{Flue} = 0.24(1202\text{#})(25.75') = 7428.4 \]
\[ C_1 W_s X_s = 0.24(924\text{#})(10.25') = 22732.9 \]
\[ C_1 W_r H_r = 0.24(402\text{#})(20.5') = 1977.8 \]
\[ C_1 W_1 X_1 = 0.24(3395\text{#})(10.7') = 87206.7 \]
\[ C_2 W_2 X_2 = 0.314(4852\text{#})(15.6') = 23767.0 \]
\[ \text{Seismic O.T.M.} = 0.1875(1.0)(143,112.8) \]

\[ \text{Seismic O.T.M.} = 24834 \text{ FT-#} \quad < \quad \text{Wind O.T.M.} = 38542 \text{ FT-#} \]

\[ \therefore \text{Wind O.T.M. governs design of anchor bolts} \]

Per API 650: E.5.2

\[ b = W_t + 1.273 M \]
\[ b = \frac{10842\text{#}}{7\pi(6.33')^2} + \frac{1.273(38542)}{(6.33')^2} = 1770 \text{#/ft} \]
\[ b = \frac{1770\text{#}}{12(375')} = 393.3 \text{ psi} \]

\[ GHD^2 = \frac{1.5(13')(6.33')^2}{0.375''} = 2083.6 \text{ psi} < 10^6 \]

\[ F_a = \frac{10^6(375)}{2.5(6.33')(12)} + 600\sqrt{1.5(13')(12)} = 11,153 \text{ psi} \]

\[ F_a = 11,153 \text{ psi} > \frac{b}{12t} = 393 \text{ psi} \quad \checkmark \text{OK} \]
DESIGN SELF-SUPPORTED FLUE

\[ F_L = \frac{CLD_0g_{cr}}{2\beta} \]

\[ C_L = 0.2 \quad D_0 = 3' \quad \beta = 1\% = 0.01 \]

\[ f_t = 3.52 \cdot \frac{D}{4\pi H_1^2} \left[ \frac{E \cdot \frac{q}{K}}{2\cdot K_0} \right]^{\frac{1}{2}} \]

\[ f_t = 3.52 \left( \frac{36''}{12''} \right) \left[ \frac{2930000 \cdot (384)}{2 \cdot (0.283 \cdot 10^6 \text{ psi})} \right]^{\frac{1}{2}} \]

\[ f_t = 88.2 \text{ cps} \]

\[ V_{cr1} = 3.41 \cdot D_0 \cdot f_t \]

\[ V_{cr1} = 3.41 \cdot (3') \cdot (88.2 \text{ cps}) \]

\[ V_{cr1} = 901.6 \text{ mph} = 1322.6 \text{ fps} \]

\[ V_{cr2} = \frac{f_t \cdot D_0}{s} \quad s = \frac{88.2 \cdot (5')}{0.2} \]

\[ V_{cr2} = 1322.6 \text{ fps} \]

\[ q_{cr} = 0.00119 \cdot V_{cr}^2 \]

\[ q_{cr} = 0.00119 \cdot (1322.6)^2 \]

\[ q_{cr} = 2082 \text{ psf} > 18 \text{ psf} \]

Dynamic wind is not critical.
\[ f_o = \frac{678.5 \cdot t}{D_o^2} \]
\[ = \frac{678.5 \cdot (1.25)}{(3')^2} \]
\[ f_o = 18.85 \]
\[ V_o = \frac{f_o \cdot D_o}{25} \]
\[ = \frac{18.85 \cdot (3')}{2.1'} \]
\[ V_o = 14.14 \text{ ft/sec} = 94.4 \text{ mph} \]
\[ \frac{P}{250} = \frac{36''}{250} = 0.144'' \]
\[ \therefore \text{ OVALING VIBRATIONS ARE NOT CRITICAL} \]
\[ \frac{t}{R_o} = \frac{0.25}{18''} = 0.01389 \]
\[ F_{cr} = F_Y \left[ 0.8 + \frac{5t}{D_o} \right] \]
\[ = 36,000 \text{ psi} \left[ 0.8 + \frac{5(1.25)}{18} \right] \]
\[ F_{cr} = 31,300 \text{ psi} \]
\[ C'_{o} = \sqrt{\frac{2 \pi^2 E}{F_{cr}}} \]
\[ = \sqrt{\frac{2 \pi^2 \cdot (28,300,000)}{31,300}} \]
\[ C'_{o} = 133.6 \]
\[
\frac{KL}{r} = 2.0 \quad L = 10.5' \\
\gamma = \frac{36''}{4} + \frac{35.5''}{4} = 12.64 \text{ in}^3 \\
\gamma = 12.64 \text{ in}^3 \\
\frac{KL}{r} = 2.0 \left( 10.5' \times 12 \right) = 19.94 < C_c = 133.6 \\
K\phi = 1 - 0.5 \left[ \frac{KL}{r} \right]^2 \\
= 1 - 0.5 \left( \frac{19.94}{133.6} \right) \\
K\phi = 0.989 \\
F_c = \frac{K\phi F_{cr}}{F_S} = 2.0 \\
F_S = 2.0 \\
F_c = 15,476 \text{ psi} \\
\sigma = \frac{KL (36'')^2}{32 (36'')} = 249.22 \text{ ksi} \\
\text{Wind QTM} = 18 \text{ psi} \left( 10.5'' \right) \left( \frac{10.5''}{2} \right) = 2977 \text{ ft-lb} \\
\sigma_c = \frac{3 \times F_{cr} (12)}{249.22} = 0.144 \text{ ksi} < F_c = 15.4 \text{ ksi} \text{ OK}
Tank Wall Thickness
- **Calculate Shell Thickness per API 650, M.3**

  From Table M-1:
  
  For 300°F, Reduction Factor (RF.) = 0.88

  \[ t_{\text{req'd.}} = \frac{2.6 \cdot D \cdot (H-1) \cdot G}{E(21000)(RF.)} + C.A. \]

  \[ D = 6.33' \quad H = 12.2' \quad (\text{say 13'}) \quad G = 1.5 \]

  Use \( E = 0.70 \quad C.A. = \frac{1}{8}'' (0.125) \quad RF. = 0.88 \)

  \[ t_{\text{req'd.}} = \frac{2.6(6.33')(13'-1)(1.5)}{0.70(21000)(0.88)} + 0.125 \]

  \[ t_{\text{req'd.}} = 0.148'' \times 2 = 0.296'' \]

  Use Min. 3/8'' Steel Plate for Shell

- **Reinforcement Plates around Shell Openings**

  Are not required because \( t = \frac{3}{8}'' > 0.296'' \)
- Design Shell Manway & Bottom Manway - 30" Ø

\[ P = 13^1 (62.4 \text{ ft}^3)(1.5) = 1216.8 \text{ psf} = 8.45 \text{ psi} \]

\[ S = \frac{P \cdot r^2}{t^2} \quad S = 21,000 \text{ psi} \]

\[ t_{\text{req'd}} = \sqrt{\frac{P \cdot r^2}{S}} = \sqrt{\frac{8.45 (15')^2}{21,000}} \quad \text{C.A.} \]

\[ t_{\text{req'd}} = 0.30'' + 0.125'\prime = 0.425'\prime \]

Use \( \frac{1}{2}'' \) R
DESIGN FLANGED & DISHEO BOTTOM

\[ t_{\text{req'd}} = 0.00075 \times 272 \times PR + C.A. \]

\[ t_{\text{req'd}} = 0.00075 \times 722 \times (0.45 \times 15) \times \left( \frac{0.33' \times 12'}{2} \right) + 0.125'' \]

\[ t_{\text{req'd}} = 15 \text{ in.} \]

USE 3/8'' THICK R.
Heat Exchanger
**BACKGROUND**
Given are standard ASME/ASTM materials of construction.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Quantity</th>
<th>Material</th>
<th>Notes</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Frame Plate</td>
<td>1</td>
<td>SA516-70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Pressure Plate</td>
<td>1</td>
<td>SA516-70</td>
<td>1</td>
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<tr>
<td>3a.</td>
<td>Carrying Bar</td>
<td>1</td>
<td>Aluminum</td>
<td></td>
<td>900 mm</td>
</tr>
<tr>
<td>3b.</td>
<td>T-Profile Cladding</td>
<td>2</td>
<td>SA240,304SS</td>
<td></td>
<td>900 mm</td>
</tr>
<tr>
<td>4.</td>
<td>Guide Bar</td>
<td>1</td>
<td>SA479,304SS</td>
<td></td>
<td>750 mm</td>
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<tr>
<td>5.</td>
<td>Tightening Bolt</td>
<td>8</td>
<td>SA193,57</td>
<td></td>
<td>2&quot; - 4 1/2 UNC</td>
</tr>
<tr>
<td>6.</td>
<td>Tightening Nut</td>
<td>8</td>
<td>SA194,2H2</td>
<td></td>
<td>2&quot; - 4 1/2 UNC</td>
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<tr>
<td>7.</td>
<td>Support Column</td>
<td>1</td>
<td>Aluminum</td>
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<td>Support Foot</td>
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<td>9.</td>
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<tr>
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<tr>
<td>11.</td>
<td>Connection Liner</td>
<td>4</td>
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<td>12.</td>
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<td>13.</td>
<td>Channel Plate Gasket</td>
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<td>14.</td>
<td>Channel Plate</td>
<td>39</td>
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</tbody>
</table>

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

*Drawing is not an accurate depiction, see certified print.*
ALFA - LAVAL THERMAL

PLATE HEAT EXCHANGER
Specification Sheet

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

Quantity: 2
Serial#: 30101-96638 thru 96639

PHE Model Type: M15-FPG

HOT SIDE COLD SIDE
-1- =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 thickness: AISI 316

Gasket material: EPDM Clip-on

Design pressure: 150 PSI
Design temperature: 300 F

Liquid volumes US gallon 13 2300 lb

CERTIFIED
APPROVED FOR FABRICATION
BY DATE
<p>| | | | | | | | | | | | | | |</p>
<table>
<thead>
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<td>U</td>
<td>U</td>
<td>O</td>
<td>O</td>
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<td>32</td>
<td>Chan Plt 03A</td>
<td>L</td>
<td></td>
<td>U&lt;&lt;&lt;&lt;&lt;U</td>
<td>o</td>
<td>0</td>
<td>o</td>
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<tr>
<td>31</td>
<td>Chan Plt 03B</td>
<td>L</td>
<td></td>
<td>o</td>
<td>0</td>
<td>O</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>30</td>
<td>End Plt2 83B</td>
<td>H</td>
<td></td>
<td>o</td>
<td>0</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
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</table>

0.6mm

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

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

Model Type: M15-TFG
Quantity: 2
Serial#: 30101-96638 thru 96639
Supplier: Alfa Laval Thermal Inc.
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
thickness
Gasket material
A - Dimension (See Drawing)
Total number of plates
Total unit dry weight
Extra/Inspection port location

---SAMPLE FLOW DIAGRAMS---

Sample SINGLEPASS Flow Diagram

---MULTIPASS Flow Diagram

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

1lep......Plate heat exchanger with connections on frame plate
         (stationary cover) only.
1ip......Plate heat exchanger with both frame plate and pressure
         plate (movable cover) connections.
S2,S3,S4...Frame plate connection designations.
P2,T3,T4...Pressure plate connection designations.
       (See drawing for locations of T and S ports.)

PLATE DESCRIPTIONS

1121...Plate position starting from frame plate.
1n Plt...Channel Plate. Standard 4-port channel plate. Gasketed so
         that flow from two ports opens to the channel plate center.
1 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.
1 Plt1...End Plate 1. Channel plate adjacent to pressure plate
         on single pass unit.
1n Plt...Turning Plate. Redirects flow with port locations which are
         not punched (no U or O) on multipass units.
1 Plt...Transition Plate. Channel plate adjacent to both pressure
         plate and partition plates on multipass unit.
1 Plt...Partition Plate. Thicker steel plate required on some
         multipass units.
1n Plt...Twin plate. Channel plate type used on welded units only.
1,03,83...Plate hole punching description. A-L internal use only.

PORT PUNCHING

.......Port surrounded by ring gasket. Fluid in this port
........Flow opening port. Fluid flows into this channel.
0 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

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

\begin{align}
\text{:Plate } & \Rightarrow \begin{bmatrix}
  U & 0 \\
  \downarrow & \uparrow \end{bmatrix} \\
\end{align}

\text{(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.)
<table>
<thead>
<tr>
<th>Plates:</th>
<th>M15-F CH AISI_316 0.5mm EPDM_Clip-on</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Channel Plt: 0.03 i. Channel plate</td>
</tr>
<tr>
<td></td>
<td>0.6mm End Plt1 16B H End plate 1</td>
</tr>
<tr>
<td></td>
<td>2 1 End Plt2 83B H End plate 2</td>
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<tr>
<th>Gaskets:</th>
<th>EPDM Clip-on</th>
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<tr>
<td>Channel plate gasket</td>
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<tr>
<td>Channel plate gasket</td>
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</tr>
<tr>
<td>End plate gasket II consists of:</td>
<td></td>
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<tr>
<td>2 Channel plate gaskets</td>
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<td>74 37</td>
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<tr>
<td>2 1</td>
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<tr>
<td>2 1</td>
<td></td>
</tr>
<tr>
<td>4 2</td>
<td></td>
</tr>
</tbody>
</table>
Structural Support Calculations
COLUMN LOADS

A-1 - 3.6 K
B-1 - 14.3 K
C-1 - 14.1 K
D-1 - 19.2 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-3 - 28.8 K
D-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 - 25.5 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 - 24.9 K
F-3.1 - 12.0 K

EXCEPT @ GRID: F, ALL COLUMNS WILL BE 14.8±24.
WITH KL 1740 ALLOWABLE
COL LOAD IS 93.0 K.
THIS SATISFIES ALL CONDITIONS.
Horiz. Forces & Grid F

\[ \frac{3,726}{4} \times 11.5 \times 9.37 \text{ kips} \]

\[ \frac{9.37 \times 12,1000}{11,400} \approx 5.12 \text{ kips} \]

\[ W = 3.11 \times 27.5 = 5.2 \text{ kips} \]

Columns A
HORZ. FORCES & DIAG. BRACING:

7.26 kips C-7 to F-7
12.23 kips E-2 to E-3
6.16 kips A-1 to A-2
14.64 kips D-1.1 to E-1

COL. UPLIFT:
21.65 kips

NEGLECTING DEAD LOAD:

DIAG. BRACE: 4.35 ft 1.5 psi 26.13 kips ≈ 17.4 psi kpsi < 2x 1.5, Brace OK.

COLUMN UPLIFT: 21.65 kips 4 + 3.44 Epoxy Anchors

Pullout Test on 3.44 Epoxy Anchors, w/ G/L u Incrobement is 24 kips, with a safety factor of 4 to 1
2 kips per anchor
6 kips 4 x 24 N/A OK.
**Design Loads** (1990 BOCA National Building Code)

- **Live Load**...100 psf (Light Manufacturing...Page 246)
- **Dead Load**...20 psf
- **Total**...120 psf

- **Tanks FT1, FT2, & FT3** 47,300 lbs. Each (Filled)
- **Tank FT4** 25,000 lbs (Filled)

**Lateral Forces for Earthquake Loads**

\[ V = 2.5 A V I K C S W \]  
\[ A_v = 0.1 (20\% \text{ of}) \]  
\[ I = 1.0 (\text{Table 113.1, Page 275}) \]  
\[ K = 1.0 (\text{Table 113.4.3, Page 278}) \]  
\[ C = 0.12 (\text{Page 279}) \]  
\[ S = 1.5 (\text{Table 113.4.6, Page 281}) \]  
\[ W = \text{Weight} \]

\[ V = 2.5 \times 0.1 \times 1.0 \times 0.0 \times 1.0 \times 1.5 \times W \]
\[ V = 0.045W \]
Bean Grid A-1 to B-4

Unperforated Length 3.1

\[ 2.4 \times 2.4 = 4.96 \]

FROM 250 2.174 Minimum M > 27.3 > 11.9
E1.  BEAM & GRID: B-2 TO D-2

\[ \begin{align*}
N &= 1 \quad 24.8 \times 2.92 \\
H &= 2 \quad 24.8 \times 2.92 \\
H &= 3 \quad 24.8 \times 2.92
\end{align*} \]

\[ \text{From ASD, 2.173, Allowable } M = 60.3 \text{ > 60.1} \]

E1.  BEAM & GRID: D-2 TO E-2

\[ \begin{align*}
N &= 1 \quad 25.4 \times 2.92 \\
H &= 2 \quad 25.4 \times 2.92 \\
H &= 3 \quad 25.4 \times 2.92
\end{align*} \]

\[ \text{From ASD, 2.173, Allowable } M = 60.3 \text{ > 60.1} \]
BEAN a GRID D1-1 TO E1-1 & D1-3 TO E3 (11/29/95)

(BEANEAD 1ST TH 11/11)

<table>
<thead>
<tr>
<th>6</th>
<th>9</th>
</tr>
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<tbody>
<tr>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
</tr>
</tbody>
</table>

N = 0 15.4 x 6.1 = 10.3
N = 0 15.4 x 3.59 = 6.9 x 2 = 17.6
N = 0 11.0 x 7.01 = 79.3

FROM ASD. 2.173. ALLOWABLE. N = 66.5 > 79.3

BEAN a GRID B-1. TO C9-1 (11/29/95)

(BEANEAD 1ST TH 11/11)

<table>
<thead>
<tr>
<th>7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>7.5</td>
</tr>
</tbody>
</table>

N = 0 64 x 2.01 = 14.1
N = 0 64 x 5.13 - 7.5 x 2.5 = 10.9
N = 0 9.2 x 6.7 = 60.2

FROM ASD. 2.174 ALLOWABLE. N = 42.5 > 14.1
**BEAM - GRID A-3 TO A-3**

Unbraced Leth 3' 0

\[ M = 3.00 \times 2.37 = 7.11 \]

\[ H = 3.14 \times 5.14 = 16.17 \]

\[ H = 2.89 \times 2.89 = 8.36 \]

From ASD 2.172 allowable M = 76.5 > 21.9

---

**BEAM - GRID A-5 TO A-7**

Unbraced Leth 3' 10

\[ M = 3.35 \times 2.89 = 9.84 \]

\[ H = 3.35 \times 3.82 = 12.85 \]

\[ H = 3.82 \times 3.35 = 12.85 \]

\[ H = 2.89 \times 2.89 = 8.28 \]

From ASD 2.172 allowable M = 76.5 > 21.9
BEAM 0 GRID A-3 TO A-5

\[ M_{0O} = 42 \times 3.31 \]
\[ M_{0O} = 4.2 \times 622 - 1.8 \times 3.31 \times 220 \]
\[ M_{0O} = 4.0 \times 7.96 - 2.2 \times 3.98 \times 23.4 \]
\[ N_{0O} = 4.0 \times 3.98 \times 15.7 \]

FROM ASBD 2.17C ALLOWABLE M = 76.7 ≥ 41.2

BEAM 0 GRID B-3 TO B-5

\[ M_{0O} = 7.6 \times 3.31 \]
\[ M_{0O} = 7.6 \times 622 - 3.3 \times 3.31 \times 39.3 \]
\[ M_{0O} = 7.1 \times 7.96 - 3.9 \times 3.98 \times 41.2 \]
\[ N_{0O} = 7.1 \times 3.98 \times 7.8 \]

FROM ASBD 2.17C ALLOWABLE M = 76.7 ≥ 41.2
BEAN \_3 GRID 3.5 TO 3.7

\[ \begin{align*}
[0] & \quad 10 \text{ M} \\
[2] & \quad 8 \text{ M} \\
[4] & \quad 3.35 \text{ M} \\
[6] & \quad 3.35 \text{ M} \\
\end{align*} \]

\[ \begin{align*}
N_{x1} &= 6.9 \times 3.35 = 23.1 \\
N_{x2} &= 6.9 \times 7.17 - 3.5 \times 3.35 = 36.1 \\
N_{x3} &= 7.0 \times 6.74 - 3.1 \times 3.35 = 33.3 \\
N_{x4} &= 7.0 \times 2.89 = 20.4 \\
\end{align*} \]

FROM ASD 2.174 ALLOWABLE N = 76.2 > 33.3

CROSS BEAM UNDER FT 1.913 (CROSSED 5.0 SPAN) \(N\text{E 16}\)

\[ \begin{align*}
9 & \quad 1.50 \\
19 & \quad 1.50 \\
\end{align*} \]

\[ \begin{align*}
N_{x5} &= 7.0 \times 1.42 \times 9.9 \\
N_{x6} &= 7.0 \times 2.92 - 6.7 \times 1.50 = 10.4 \\
N_{x7} &= 7.0 \times 1.42 = 9.9 \\
\end{align*} \]

FROM ASD 2.174 ALLOWABLE N = 76.2 > 10.4
BEAN GRID C-3 TO C-4

\[
\begin{align*}
N_0 & > 13.7 \times 1.87 = 25.5 \\
N_0 & < 13.7 \times 3.35 - 1.61 \times 1.48 = 43.5 \\
M_0 & > 13.7 \times 5.21 - 1.61 \times 4.0 - 24.5 \times 2.52 = 52.9 \\
M_0 & < 11.1 \times 6.19 - 3.35 \times 1.7 \times 2.5 = 54.4 \\
M_0 & > 11.1 \times 3.78 - 3.35 \times 1.78 = 40.9 \\
M_0 & < 11.1 \times 3.88 \\
\text{From A50} \quad \sigma = 172 \quad \text{Allowable} M_0 > 91.2 \quad > 54.4
\end{align*}
\]

BEAN GRID F-31 TO F-4, F-4 TO FG

\[
\begin{align*}
N_0 & > 9.2 \times 3.35 = 30.8 \\
N_0 & < 9.2 \times 3.35 = 30.8 \\
\text{Allowable} M_0 > 62.8 > 30.8
\end{align*}
\]
BEAM & GRID C-5 TO C-7

\[ \begin{align*}
\frac{3.35}{4.0} & = 0.82 \\
\frac{3.35}{3.85} & = 0.89 \\
\frac{3.35}{4.7} & = 0.71 \\
\frac{3.35}{9.4} & = 0.35 \\
\end{align*} \]

N o 1 = 9.0 x 3.35 = 30.2
N o 2 = 9.0 x 7.17 - 8.4 x 3.82 = 37.4
N o 3 = 9.4 x 3.35 = 31.5

From ASD 2.173 allowable M = 64.8 > 35.3

BEAM O GRID C-4 TO C-6

\[ \begin{align*}
\frac{3.35}{2.90} & = 1.21 \\
\frac{3.35}{1.39} & = 2.43 \\
\frac{3.35}{1.95} & = 1.70 \\
\end{align*} \]

N o 1 = 10.2 x 3.35 = 34.7
N o 2 = 10.2 x 6.76 - 9.8 x 2.90 = 35.3
N o 3 = 10.3 x 3.35 - 1.5 x 1.42 = 34.0
N o 4 = 10.8 x 1.5 = 16.2

From ASD 2.173 allowable M = 64.8 > 35.3
Bean Under G4 (n places)

Unreashed Lenth 5403

M = 1 \times 8.1 \times 3.55 = 28.8

N = 8.1 \times 4.63 - 49.1 \times 3.55 = 32.0

From ADS 2-73 Allowable M = 66.5 > 28.8

Beam G Grid B-3 To G7-3

From ADS 2-73 Allowable M = 91.2 > 28.8
CROSS BEAM UNDER FF4 (2 Places) UNLESS IMM. (18 x 18)

UNRECOGNIZABLE TEXT

M = 4.3 x 1.92 = 6.6
N = 4.3 x 2.92 = 12.5
M = 4.3 x 1.42 = 6.1

From ASD 2.174 Allowable M = 303 > 6.6

BEAM UNDER FLASH TANKS (2 Places) UNRECOGNIZABLE LTH. 51.04

M = 10.4 x 3.55 = 45.8
N = 12.9 x 4.33 = 55.0

From ASD 2.173 Allowable M = 26.5 > 55.0
Bean = Grid E-2 to E-3
Unbraced Leth 12.4
M = \frac{1.8 \times 12.33 \times 2.8}{8} = 28.8 k\text{f}
From ASD 2-174 Allowable M = 38.3 > 28.8

Bean = Grip B-2 to B-3
Unbraced Leth 10.4
M = \frac{3.6 \times 10.23 \times 6.5}{8} = 55.5 k\text{f}
From ASD 2-174 Allowable M = 38.3 > 55.5

Bean = Grid B-1 to B-2
Unbraced Leth 10.4
M = \frac{4.2 \times 12.33 \times 6.5}{8} = 60.5 k\text{f}
From ASD 2-174 Allowable M = 38.3 > 60.5

Bean = Grid A-1 to A-2
Unbraced Leth 12.4
M = \frac{2.4 \times 12.33 \times 3.7}{8} = 37 k\text{f}
From ASD 2-174 Allowable M = 38.2 > 37

Bean = Grid A-5 to B-5
Unbraced Leth 9.3
M = \frac{34.9 \times 9.25}{8} = 39 k\text{f}
From ASD 2-174 Allowable M = 38.3 > 39
BEAM 7¼8 SOUTH OF GRID B-7 TO C-7

UNBROACHED

LATH 1:3

N = 3.2 x 7.25 = 2.9 k

8

From ASD page 2-175 Allowable N = 11.5 > 2.9

BEAM G-3 NORTH OF GRID B-5 TO C-5

UNBROACHED

LATH 1:3

M = 3.2 x 7.25 = 2.9 k

8

From ASD 2-175 Allowable M = 11.5 > 2.9

BEAM 2½3 SOUTH OF GRID B-5 TO C-5

UNBROACHED

LATH 1:3

M = 2.8 x 7.25 = 2.5 k

8

From ASD 2-175 Allowable M = 11.5 > 2.5

BEAM 3½3 SOUTH OF GRID B-5 TO C-5

UNBROACHED

LATH 1:3

M = 3.0 x 7.25 = 2.7 k

8

From ASD 2-175 Allowable M = 11.5 > 2.7

BEAM G-17 SOUTH OF GRID B-5 TO C-5

UNBROACHED

LATH 1:3

M = 3.2 x 7.25 = 2.9 k

8

From ASD 2-175 Allowable M = 11.5 > 2.9
Beam 2'4" N of Grid A-5 to B-5 

\[ N = \frac{3.419.25}{2} = 3.9.0 \]

From AOS 2'175 Allowable \( N = 9.0 > 3.9 \)

Beam 6'3" N of Grid A-5 to B-5 

\[ N = \frac{4.9.95}{2} = 4.6 \]

From AOS 2'175 Allowable \( N = 9.0 > 4.6 \)

Beam 7'2" E of Grid A-7 to B-7 

\[ N = \frac{4.9.95}{2} = 4.9 \]

From AOS 2'175 Allowable \( N = 9.0 > 4.9 \)

Beam 3'44" South of Grid A-7 to B-7 

\[ N = \frac{4.6}{2} = 4.6 \]

From AOS 2'175 Allowable \( N = 9.0 > 4.6 \)

Beam 3'44" South of Grid B-5 to C-5 

\[ N = \frac{3.0.7.05}{2} = 12.9.0 \]

From AOS 2'175 Allowable \( N = 11.5 > 2.9 \)
BEAM 3'11" X 1'11" NORTHSIDE GRID A-3 TO B-3. (Uneq)
\[ M = 4.4 \times 9.25 = 51.1 \text{ kN} \]
\[ N = 4.9 \times 9.25 = 51.1 \text{ kN} \]
\[ E \]
FROM ASD 2.175. ALLOWABLE M = 9.0 > 51.1

BEAM (2'11") SOUTH ON GRID A-5 TO B-5. (Uneq)
\[ M = 4.6 \times 9.25 = 42.6 \text{ kN} \]
\[ E \]
\[ \]
FROM ASD 2.175. ALLOWABLE M = 9.0 > 42.6

BEAM 3'11" SOUTH ON GRID A-5 TO B-5. (Uneq)
\[ M = 3.6 \times 9.25 = 42.6 \text{ kN} \]
\[ E \]
\[ \]
FROM ASD 2.175. ALLOWABLE M = 9.0 > 42.6
BEAM 31 ft. 6 in. WEST of GRID B-1 to B-2. (N.PlaCCs)

K = \frac{480.12}{8} = 6.018 \text{ kI}.

From ASD @ 7.8: Allowable M = 17.4 > 7.8.

BEAM @480.12 ft. 8 in. from B-1 to B-2. (N.PlaCCs)

M = \frac{3.8 \times 13}{8} = 5.2 \text{ kI}.

From ASD @ 7.8: Allowable M = 12.1 > 5.2.

BEAM UNDER TANKS... (8 PLACES) (N.PlaCCs)

M = \frac{156 \times 5.9}{8} = 112 \text{ kI}.

From ASD @ 7.8: Allowable M = 15.6 > 112.

BEAM @ TANKS 31 ft. 5 in. SPAN (8 PLACES) (N.PlaCCs)

M = \frac{12 \times 3.55}{8} = 5.5 \text{ kI}.

From ASD @ 7.8: Allowable M = 15.6 > 5.5.
BEAM @ GRID A-7 TO B-7

\[ M_e = 1.8 \times 9.25 = 21.1 \text{ kN.m} \]

From ASD 2.174 Allowable Mz = 38.3 > 2.1

BEAM @ GRID B-7 TO C-7

\[ M_e = \frac{1.4 \times 7.75}{2} = 13 \text{ kN.m} \]

From ASD 2.174 Allowable Mz = 38.3 > 1.3

BEAM @ GRID B-5 TO C-5

\[ M_e = \frac{3.6 \times 7.75}{2} = 24.1 \text{ kN.m} \]

From ASD 2.174 Allowable Mz = 38.3 > 2.4

BEAM @ GRID C-7 TO F-7

\[ M_e = \frac{3.6 \times 18.54}{8} = 8.1 \text{ kN.m} \]

H = Cont. Exp = \( \frac{12 \times 5.45^2}{2} = 30 \text{ kN} \)

From ASD 2.174 Allowable Mz = 31.4 > 8.1
BEAM & GRID C: G10 F: G & C: 4 To F: A. (WRIGR).

\[ N = \frac{7,2 \times 18.54}{2} = 16.2 \, k \]

\[ N = \text{cont.} = 7.0 \times 5.45^2 = 5.9 \, k \]

FROM ASD 2.174 ALLOWS N = 31.4 > 16.2.

BEAM & GRID C: 3.1 To F: 3.1 (WRIGR).

\[ M = 6.6 \times 18.54 = 14.9 \, k \]

\[ N = \text{cont.} = 2.0 \times 5.45^2 = 3.0 \, k \]

FROM ASD 2.174 ALLOWS N = 31.4 > 14.9.

BEAM - FILTER PRESS GIRD C: TO F (GRUESE) (WRIGR).

\[ M = \frac{3.6 \times 18.54}{2} = .8 \, k \]

\[ N = \text{cont.} = \frac{4.0 \times 5.45^2}{2} = 6.8 \, k \]

FROM ADS 2.174 ALLOWS N = 31.4 > 6.8.
BEAM 41/2 x 34 1/4 in. North of Grid. B: 3, I.D.: C-3. (W8.15)

UNDERSIZED LETH 7 1/2

M = 34 x 7.25 = 3.1 k"  

FROM ASD. 2.175 ALLOWABLE M = 11.5 > 3.1

BEAM 0 GRID E-1 TO E-2. (W8.16)

UNDERSIZED LETH 12 1/4

M = 1 1/2 x 11.22 = 2.5

FROM ASD. 2.175 ALLOWABLE M = 5.0 > 2.5

BEAN 41/2 x 34 1/4 in. South of A: 2 and A: 3. (W8.16)

UNDERSIZED LETH 13 1/4

M = 1 1/2 x 13 = 21.9 k"  

FROM ASD. 2.175 ALLOWABLE M = 4.8 > 2.19
MEZZ BEAM - GRID B-1 TO C-1

UNBROKEN LMT. 4.0

From ASID 2.175: Allowable M = 23.4 > 6.6

MEZZ BEAM - GRID B-1 TO D-1

UNBROKEN LMT. NO.

From ASID 2.175: Allowable N = 29.5 > 14.4
NEZZ BEND  B-3 TO C-7 -3  D-1 TO E-3  (WE15)

M0  1.4 1.54 = 2.9 k
M0  0.7 3.58 = 2.5 k

FROM ASD  0.175  ALLOWABLE M  28.6 > 2.9

NEZZ BEAN & GRIP D-2 TO E-2  (W20)

M0  0.7 3.58 = 5.2 1.54 = 8.9
M0  0.7 5.12 - 5.2 3.58 = 10.1
M0  0.7 4.7 1.54 = 7.8

FROM ASD  0.114  ALLOWABLE M  27.6 > 10.1
MEZZ BEAM... C9.1 TO C9.8
(M.W.15)
(UNREACED. LATH 10")
N = 3,600,1267 = 5.7 k
8
FROM ADS R.175 ALLOWING N = 4.0 > 5.7

MEZZ BEAM D1.1 TO D1.2
(M.W.15)
(UNREACED. LATH 7")
N = 5,760,1267 = 8.2 k
8
FROM ADS R.175 ALLOWING N = 21.0 > 8.2

MEZZ BEAM B1.14 ON C1.1 TO C1.2
(M.W.15)
(UNREACED LATH 4")
N = 4.2, 13 = 6.8 k
8
FROM ADS R.175 ALLOWING N = 21.25 > 6.8

MEZZ BEAM 3114 EAST OF B1 TO B-1
(M.W.15)
(41/6 UNREACED LATH)
N = 5.6, 13 = 9.1
8
FROM ADS R.175 ALLOWING N = 21.25 > 9.1

MEZZ BEAM 1147 EAST ON B2 TO B3
(M.W.15)
(UNREACED LATH 7")
N = 4.9, 13 = 6.5
8
FROM ADS R.175 ALLOWING N = 21.0 > 6.5
MEZZ. BEAM & GRID. E-1 TO E-2.
R2 TO R3 & E2 TO E3

M = 1.2 x 13 = 15.6 k

UNBROKEN LETH. 15 k

FROM ADS 2.175 ALLOWABLE M = 21.2 k > 15.6

MEZZ. BEAM & GRID. C-9-3 TO C-9-2 & D-1-3 TO D-1-2

M = 5.2 x 13 = 67.6 k

UNBROKEN LETH. 71 k

FROM ADS 2.175 ALLOWABLE M = 21.2 k > 67.6

MEZZ. BEAM & GRID. E1 TO E4 & E2 TO E3

M = 4.0 x 13 = 52.0 k

UNBROKEN LETH. 65 k

FROM ADS 2.175 ALLOWABLE M = 21.2 k > 52.0
**Mezz. Beam 2'-11" span, 6'P.L.O.S. M.R.O.**

\[ N = \frac{6.5 \times 2.5}{2} = 4.25 \]

From A.D.S. 2.175 Allowable M. 16.0 > 4.25

**Mezz. Beam - Tank Opening (G. P.) (W.P.1) Unbraced L. O.T. 2'-11"**

\[ N = \frac{6.5 \times 7.14}{4} = 11.1 \]

From A.D.S. 2.175 Allowable M. 16.0 > 11.1
COLUMNS ON 9" SLABS

Max. Load is at 3.5 - 17.6 kips.

9" slab 4000 psi Conc. w/ #4 1/2 in. dia. bars.

Allowable N. for F. t. slab:

As f.t.d. = 20 x 24000 x .85 x 3 x 10,000 = 114,400 lbs.

5 ft (1.52 m)

Critical section

MOMENT

Check of 2-way (Punching) shear:

4 x 120 x .6 x 11 = 8900 = 76.1 k > 17.6 k, O.K.

Required moment req. ft of slab:

12000 x 11.5 x 1.5 = 91,800 lbs < 12,240 lbs, O.K.

From ASD Page 2-302, Beam diag.
Horiz. Forces & Bldg. E

3.76 x 3.25 = 12.15 kips per col.

3.76 x 4 = 15.04 kips per col.

Moment:

\[ \frac{9.37 \times 12.15 \times 1000}{91400} = 5.7 \text{ kips ft} \]

\[ 12.15 \times 27.6 = 339.7 \text{ kips-ft, columns OK} \]

Combined Loads:

\[ \frac{5.2}{27.6} + \frac{124.2}{149} = 0.3515 < 1 \text{ Cons. O.K.} \]

\[ \text{PSW A.S.S.} 3.31 \]
Horiz. Force = 7.1 k

Horiz. Force = (1.14 + 12.85) * 0.645 = 11.4 k

N. Horiz. Acc. = 38.12 k

Resd. 5k = 4k + 12.85 = 25.9 N

Combined Loading

25.9 + 12.85 = 38.85 k

Cols. OK
MOMENT COINH @ CON CAP PLATE 20 x 6, F3, F4, F5

FROM PAGE 6: MOMENT 1k. 9.37 k

FORCES @ FLR: 9.37 x 12 \( \frac{28 + 1435}{28} \) = 14.86 k

WELD @ FLANGE: 70 x 4 x 8, 79.4 > 14.86 0k

Min. Thr @ BOLTS: 9.37 x 12 \( \frac{28}{28} \) = 16.66 k

16.66 x 2.38 PAR. BOLT < 9.3 0k
Foundation Design Analysis
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
Project Manager

Our Mission:
Provide the highest quality waste and by-product management services that consistently meet or exceed customer needs and regulatory requirements at competitive cost while enhancing shareholder value.
<table>
<thead>
<tr>
<th></th>
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PHI - Pre-Heater Treatment
FHI - Final Heater Treatment

* Samples which we were not able to pull out of the hole.
CORE HOLE TO BE FILLED WITH SEDSTONE 140 WITH SAND BINDER

FILL PLUG TO 1/4" BELOW FINISH GRADE, LEAVE SURFACE ROUGH

PROTECTIVE COATING TO MATCH EXISTING

EXIST. CONCRETE (VARIABLE THK)

REMOVE DIRT AROUND FULL CIRCUMFERENCE 1/2" WIDE MIN.

FILL TO 15" BELOW CONC. W/ BENTONITE PELLETS

CORE PLUG DETAIL
To: USPCI

Long Mountain Facility
Route 2, Box 100A
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.

<table>
<thead>
<tr>
<th>COLUMN</th>
<th>LOAD, KIPS</th>
<th>FOUNDATION CONDITION</th>
<th>REMARKS</th>
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<td>A-2</td>
<td>4.5</td>
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<td>8.4</td>
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<td>28.1</td>
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<td>24&quot; x 36&quot; cont. ftg.</td>
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<tr>
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<td>F-7</td>
<td>12.1</td>
<td>6&quot; floor slab</td>
<td>OK (see page #1)</td>
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</tbody>
</table>
COLUMNS ON 6" SLABS

Max. Cal. Load is at B.5 = 17.6 kips

6" Slab, 4,000 psi Conc. W/ 4' x 12 EW + CTR.

Allowable M per ft. of slabs

\[ M = \frac{F \times L^2}{8} \]

As for \( F = 120 \times 0.4 \times 0.85 \times 3 \times 17.2 \times 12 \text{ LBS} \)

Critical section

Check of 2 way (punching) shear

\[ 4 \times 10'' \times 6'' \times 7.1 \times 4000 = 28 \text{ kips} > 17.6 \text{ kips O.K.} \]

Required moment per ft. of slabs

\[ \frac{2500 \times 11.5 \times 11.5}{12} = 6.888 \text{ LBS} < 12.24 \text{ LBS O.K.} \]
COLUMN CON. 17" SLAB W/ G. REIN. T.D.B

MAX. COL. LOAD IS 1ST GRID D.12 = 62.9 KIPS

ALLOWABLE MOMENT IN SLAB

44 x 24,000 x 12 = 1,126,720 LB = 10.56 K'

ALLOWABLE SoIL FRC. = 2500 x 180 = 2320

12.7 27.81 SQFT REO. AREA = 5-1/2 SQUARES

2.54 (PUNCHING) SHEAR = 4 x 2.7 x 17 x 1.1 x 74,000

127.7 K < 62.9 K OK

READ MOMENT IN GRADE BEAN

1.15 x 2.72 x 1.51 K' = 10.56 K' OK.
COLUMNS ON 24"x36" GRADE BEAM

Max col load is at col C-4 = 28.1 kips.

Grade Beam HSC, 2.4" top, CTR 4.13777 ft (According to Lawson Ponton)

Allowable Moment in Grade Beam (Figuring 1/3 Rein):

At 4 ft = 18.3 x 24000 = 30163200 lb. ft = 52.8 k ft

Allowable soil BRC 2500 = GB Weight 360 t. 2140

23,160 = GB length of Grade Beam to support col.

2,140 ft

Read Moment in Grade Beam:

\[
\frac{21.8 k \times 24.7}{2} = 18.2 k < 52.8 k \text{ OK}
\]
Tank Leak Tests
HYDROSTATIC TEST RECORD

RECORD DATE: 8-8-95
VENDOR: SCOTT MANUFACTURING, INC.

CUSTOMER: USPCI-LONE MT. FACILITY
CUSTOMER: P.O. NO. 132

PROJECT: EVAPROATOR FLASH TANK NO. 3
W.O. NO.: 48709, 10, & 11

LOCATION: WAYNOKA, OK.
JOB NO.: 499

TESTING PROCEDURE: WELDED STEEL TANKS FOR OIL STORAGE, API STANDARD 650, NINTH EDITION, JULY 1993, SECTION 5 - ERECTION, PARAGRAPH 5.3.6 TESTING OF THE SHELL, METHOD a.(1).

RESULTS: PRIOR TO SANDBLASTING AND PAINTING, EVAPROATOR FLASH TANK NO. 3 WAS FILLED WITH WATER UP TO THE SHELL AND FLUE CONNECTION. THE TANK WAS INSPECTED FREQUENTLY DURING THE FILLING OPERATION. WATER WAS HELD IN THE TANK FOR A PERIOD OF TWENTY FOUR HOURS. AFTER CAREFUL VISUAL INSPECTION NO LEAKS WERE VISIBLE IN ANY WELDED SHELL OR PIPE JOINTS.

REPORT NO 1

_VENDOR INSPECTOR'S SIGNATURE_
Hydrostatic Test Record

Customer: USPCI - Lone Mt. Facility
Project: Evaporation Flash Tank No.3
Location: Weynoka, OK

Test Start Date: 8/13/96  Test Start Time: 4:55 p.m.
Test Finish Date: 8/14/96  Test Finish Time: 8:30 a.m.

Test Procedure:
Fill evaporator feed tank to the manway with water.

Results:
There was no change in water level inside the feed tank. Visual inspection of tank indicated no water leaks.

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

Date: 8/20/96
Piping Leak Tests
Piping Pressure Test

Customer: USPCI - Lone Mt. Facility
Location: Waynoka, OK

Test Start Date: 5/2/95  Test Start Time: 1:20 p.m.
Test Finish Date: 5/2/95  Test Finish Time: 3:20 p.m.

Test Procedure:
Fill piping section between filter press pump P83 discharge to inlet of filter press FP3. Apply water pressure to system up to 150 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:
Piping section was isolated from P83 by flange and FP3 by valve. System was pressured up to 150 psig and held this pressure for 2 hours. No change in pressure gauge reading was observed.

Witness: [Signature]
Date: 5/2/95
Hydrostatic Test Record

Customer: USPCI - Lone Mt. Facility
Project: Suction pipe from Evaporator Flash Tank No. 3 to Pump P-5.
Location: Waynoka, OK

Test Start Date: 8/13/96  Test Start Time: 4:55 p.m.
Test Finish Date: 8/14/96  Test Finish Time: 8:30 a.m.

Test Procedure:
Prior to hydrostatic test on FT3, open bottom valve and flood suction piping to Pump P-5.

Results:
There was no change in water level inside the flash tank. Visual inspection of the suction piping between FT3 and Pump P-5 indicated no water leaks.

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

Date: 8/20/96
Piping Pressure Test

Customer: USPCI - Lone Mt. Facility

Project: Discharge piping from Filter Press FP3 to suction side of Evaporation Feed Pump P-5.

Location: Waynoka, OK

Test Start Date: 8/13/96
Test Start Time: 11:15 a.m.

Test Finish Date: 8/13/96
Test Finish Time: 1:15 p.m.

Test Procedure:
Fill piping section between Filter Press FP3 discharge to suction side of Pump P-5. Apply water pressure to system up to 155 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:
Piping section was isolated from Filter Press FP3 by flange and P-5 by valve. System was pressured up to 155 psig and held this pressure for 2 hours. No change in pressure gauge reading was observed.

Signature: [Signature]
Geoffrey E. Bruegge, P.E.
Envirotech Services, Inc.

Date: 8/20/96
Piping Pressure Test

Customer: USFCI - Lone Mt. Facility

Project: Discharge piping from Evaporation Feed Pump P-5 to suction side of Evaporation Heat Exchanger EU3.

Location: Waynoka, OK

Test Start Date: 8/14/96  Test Start Time: 9:20 a.m.

Test Finish Date: 8/14/96  Test Finish Time: 11:20 a.m.

Test Procedure:

Fill piping section between Pump P-5 discharge to suction side of EU3. Apply water pressure to system up to 235 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:

Piping section was isolated from Pump P-5 by flange and EU3 by valve. System was pressured up to 235 psig and held this pressure for 2 hours. No change in pressure gauge reading was observed.

Signature: Geoffrey E. Bueggemann, P.E.

Envirotech Services, Inc.

Date: 8/20/96
Piping Pressure Test

Customer: USPCI - Lone Mt. Facility

Project: Discharge piping from Evaporator Heat Exchanger EU3 to suction side of Flash Tank FT3.

Location: Waynoka, OK

Test Start Date: 8/14/96  Test Start Time: 8:30 a.m.
Test Finish Date: 8/14/96  Test Finish Time: 10:30 a.m.

Test Procedure:

Fill piping section between EU3 discharge to suction side of FT3. Apply water pressure to system up to 225 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:

Piping section was isolated from EU3 by flange and FT3 by valve. System was pressured up to 225 psig and held this pressure for 2 hours. No change in pressure gauge reading was observed.

Signature:  
Geoffrey E. Bruggemann, P.E.
Envirotech Services, Inc.

Date: 8/20/96
Piping Pressure Test

Customer: USPCI - Lone Mt. Facility

Project: Suction piping of Evaporator Flash Tank FT3 to suction side of Filter Press Pump P83.

Location: Waynoka, OK

Test Start Date: 8/29/96 Test Start Time: 8:30 a.m.
Test Finish Date: 8/29/96 Test Finish Time: 10:30 a.m.

Test Procedure:

Fill piping section between discharge side of FT3 and Pump P83. Apply water pressure to system of 50 psig by hydro pump and hold this pressure for minimum 2 hours.

Results:

Piping section was isolated from FT3 by valve and P83 by flange. System was pressured up to 50 psig and held this pressure for 2 hours. Visual inspection of all piping indicated no leaks.

Signature: Geoffrey E. Brueggemann
Geoffrey B. Brueggemann, P.E., Envirotech Services, Inc.

Date: Aug 29, 1996
Tank Metallurgy
W/O #: 48710  DATE: 8-8-95  INSPECTED BY: M. JORDAN

CUSTOMER: USPCI  EVAPORATOR FLASH TANK NO.3
LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

INSPECTION CRITERIA PER:  CUSTOMER:  SMI:  

INSPECTION: TANK AND PERTINENT PARTS/TYPE INSPECTION: VISUAL, DIMENSIONAL, X-RAY
DRAWING #: 479-1  THRU 10  LOCATION: IN SHOP AND PAINT AREA

BRIEF DESCRIPTION OF INSPECTION: ALL WELDS, DIMENSIONS AND ORIANTIONS CHECKED. 8-8-95 TANK WAS RAISED UPRIGHT AND HYDRO TESTED. NO LEAKS FOUND, SEE X-RAY LOCATION MAP:
THREE SPOTS SHOT.

PAINT: 11 MILS (TOTAL) INSIDE
4 MILS (TOTAL) OUTSIDE
INSLATION, CLADDING, ASSEMBLY PER SPECIFICATIONS.
WASHERS WERE USED (BOTH SIDES) ON CONE BOLT UP.

MINOR PAINT TOUCH-UP WAS NEEDED (AFTER LOADED FOR SHIPPING)

INSPECTION RESULTS:

CONFORMING:  [ ]  NON CONFORMING:  

IF NON CONFORMING - CORRECTIONS IMPLEMENTED:

CORRECTIONS APPROVED  YES [ ]  NO [ ]

COPIES TO:  BILL BASOW  8-22-95

NAME  [Signature]  DATE: 8-22-95
<table>
<thead>
<tr>
<th>Sequence</th>
<th>By</th>
<th>Location</th>
<th>Plane Size</th>
<th>Visual Code</th>
<th>Defect/Discontinuity</th>
<th>Remarks</th>
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<tbody>
<tr>
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<td>0-1</td>
<td>60°</td>
<td>Yes</td>
<td>No</td>
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<tr>
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<td>0-1</td>
<td>60°</td>
<td>Yes</td>
<td>No</td>
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</tr>
<tr>
<td>3</td>
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<td>0-1</td>
<td>60°</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Number of Personnel: 2
Inspection: 49875
Testing: 47889
Part No.: 3
Per Dism.: No
Miles: 133
Travel Time: Site Time: 4
Total Time: 8
Job Location: WILDFORST
Start Day: 4-15-86
End Day: 4-19-86

Agreed and Accepted: [Signature]
Date: [Date]
WELDER AND WELDING OPERATOR QUALIFICATION TEST RECORD

Welder or welding operator's name: BILL FISHER
SS#457-82-6797
Welding process: Manual
Position: UPHILL
Material specification: A550 A 3.3
Diameter and wall thickness (if pipe) - otherwise, joint thickness: 2T = 1.012

FILLER METAL
Specification no.: SFA 5.20
Classification: AWS E 71T-1
Filler metal diameter and trade name: 0.045" ERNO 1 ABC
Flux for submerged arc or gas for gas metal arc or flux cored arc welding: CG - 100%

VISUAL INSPECTION (9.25.1)
Appearance: GOOD
Undercut: NONE
Piping porosity: NONE
Guided Beam Test Results: N/A - SEE, AWS D1.1-90 5.3.2

RADIOMATIC TEST RESULTS

#8 BILL FISHER
O-1 PASS 2-0 PASS
1-2 PASS PERMIAN N.D.T. #5945

Test witnessed by: RON HUMBERLEY
Test no.: 06990-7

We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of 5C or D of AWS D1.1, Structural Welding Code.

Manufacturer or contractor: SCOTT MFG. INC.
Authorized by: RICK SCOTT
Date: 6-9-90

Form E-4
ANSI/AWS D1.1-90
LUBBOCK LABS, INC.

SCOTT MANUFACTURING, INC.
P.O. BOX 10392
LUBBOCK, TX 79408

Customer: LUBBOCK, TX 79408

Date 10-16-93

Report of: WELDER AND WELDING OPERATOR QUALIFICATION TEST RECORD

Social Security no. 461-78-1423
Identification no. 275

Welder or welding operator’s name: WYNNE CADEL
Weelding process: AUTOMATIC
Position: 3G VERTICAL - ALSO QUALIFIES FOR 1G FLAT & 2G HORIZONTAL - DOWNWARD
Material specification: S.N.I. CORTEN

Diameter and wall thickness (if pipe) - otherwise, joint thickness: 0.375"
Thickness range this qualifies: 0.125" to 0.75" - ALSO QUALIFIES FILLER WELDS OF UNLIMITED

FILLER METAL

Specification no. AWS 5.29 Classification E 8781-Y F no.

Is backing strip used? YES

Filler metal diameter and trade name: 0.045" Flux for submerged arc or gas for gas metal arc or flux cored arc welding

VISUAL INSPECTION (9.25.1)
Appearance: GOOD Undercut: NONE Pitting, porosity: NONE

Guided Bend Test Results

Type | Result | Type | Result
--- | --- | --- | ---
FACE 1 | ACCEPTED |   |   
ROOT 1 | ACCEPTED |   |   

Test conducted by: ALFONSO RODRIGUEZ
Laboratory test no. 0101693-A
Test date: 10-16-93

Appearance: N/A
Fracture test root penetration: Marcocch
(Describe the location, nature, and size of any crack or tearing of the specimen.)
Laboratory test no. N/A
Test date: N/A

RADIOGRAPHIC TEST RESULTS

Film identification | Results | Remarks | Film identification | Results | Remarks
--- | --- | --- | --- | --- | ---

Test witnessed by: N/A
Test no. N/A

We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of S&C or D of AWS D1.1, 1992 Structural Welding Code.

Manufacturer or contractor: SCOTT MANUFACTURING, INC.
Authorized by: N/A
Date: 10-16-93
Customer: SCOTT MANUFACTURING, INC.
P.O. BOX 10232
LUBBOCK, TEXAS 79408

Report of: WELDING PROCEDURE QUALIFICATION TEST RECORD

Procedure Specifications
- Material specification: A53, Grade B, 6"Dia.
- Welding process: GMAW
- Manual or machine: Manual
- Position of welding: 6GR-T, K, Y CONNECTIONS
- Filler metal specification: SFA.5.20
- Filler metal: AWS E 71T-1
- Weld metal grade*: ASTM A 53, Grade B
- Shielding gas: CO2
- Flow rate: 35-40 CFH
- Single or multiple pass: Multiple
- Single or multiple arc: Single
- Welding current: DIRECT/REVERSE
- Welding progression: Uphill
- Preheat temperature: N/A
- Postheat treatment: N/A
- Welder's name: BILL FISHER

*Applicable when filler metal has no AWS classification.

Visual Inspection (9.25.1)
- Appearance: Good
- Undercut: None
- Piping porosity: None

Test date: 6-9-90
Witnessed by: [Signature]

Welding Procedure

<table>
<thead>
<tr>
<th>Pass no.</th>
<th>Electrode size</th>
<th>Welding current</th>
<th>Speed of travel</th>
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<tbody>
<tr>
<td>1-6</td>
<td>0.045&quot;</td>
<td>220</td>
<td>12-14</td>
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</table>

We, the undersigned, 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 SB of AWS D1.1, (1990) Structural Welding Code.

Procedure no.: SM-072
Manufacturer or contractor: SCOTT MFG. INC.
Revision no.: 6-09-50
Authorized by: RICK SCOTT
Date: 6-9-90

Laboratory test no.: 06990-7A

Welded joint configuration:
- Restriction ring
- 1/2 max
- 37-1/2" arc
- 1/2 min
- 1/8" gap
- 3/16 min
- 0-1/16" root gap
- 1/2 max
- 6 min
- 1/2 min
- 1/2 max

GROOVE WELD TEST RESULTS

<table>
<thead>
<tr>
<th>Side</th>
<th>Test</th>
<th>Result</th>
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<tbody>
<tr>
<td>Left</td>
<td>1</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Right</td>
<td>2</td>
<td>Satisfactory</td>
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Radiographic-ultrasonic examination

RT report no.: PASS-PEMNIAN N.D.T. 05945
UT report no.: N/A

FILLET WELD TEST RESULTS

<table>
<thead>
<tr>
<th>Minimum size multiple pass</th>
<th>Maximum size single pass</th>
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<tr>
<td>1.</td>
<td>3.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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</table>

All-weld-metal tension test

Tensile strength, psi
Yield point/strength, psi
Elongation in 2 in., %
Procedure Qualification Test Record (PQR)

Variables

- Base metal: ASTM 500 GR:B / ASTM 500 GR:B
- Metal thickness: 0.188 / 0.188
- Coating: NONE
- Joint preparation: GRIND
- Flanging: TOP - JOINT DETAIL
- Position of welding: FLAT AND HORZ. (1F & 2F)
- Welding process: FLUX-CORED (FMW)
- Manual, semiautomatic, or automatic: SEMIAUTOMATIC

*Filler metal spec.: AWS 5.20
*Filler metal class: SPA 5.20 (E71T-1)
*Weld metal grade: MILD STEEL (A-1)
Electrical characteristics: D.C.R.P
Made of transfer: SPRAY
Shielding gas/composition: 75% A + 25% Co2
Gas flow (CFH): 25 CFH
Welder's name: G. GOODRILL
Welder's ID no.: 275

Weld in butt Joint visual exam results
(see 3.4.1 or 8.4.1)
- Fusion: ACCEPT
- Penetration: ACCEPT
- Reinforcement: ACCEPT
- Porosity: ACCEPT
- Undercut: ACCEPT
- Cracks: ACCEPT

Filler weld visual exam results
(see 3.4.2 or 8.4.2)
- Fusion: ACCEPT
- Effective throat: ACCEPT
- Convexity: ACCEPT
- Porosity: ACCEPT
- Undercut: ACCEPT
- Cracks: ACCEPT

*See Definitions

Joining Procedure

<table>
<thead>
<tr>
<th>Filler Metal Size</th>
<th>Welding Power</th>
<th>Speed of Travel</th>
<th>Joint Detail</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
<td>Voltage Range: 244 IPM (WIRE)</td>
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<tr>
<td>FLUX-CORED .045</td>
<td>150 (I)</td>
<td>25 (V)</td>
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</table>

NOTES:
1) FLARE-VEE WELDS-ONE PASS
2) FLARE-BEVEL WELDS-THREE PASSES.

We, the undersigned, certify that the statements in this record are correct and that the test specimens were prepared, joined, and examined in accordance with the requirements of ANSI/AWS D10.1, Sheet Metal Welding Code.

PER MIL STD 1261-3

Manufacturer or Contractor: SCOTT MANUFACTURING INC.
Authorized by: [Signature]
Date: 7/20/1984
### QUALITY DEPARTMENT - WELDING INSPECTION RECORD (WIR)

**WIR NO.**

**PART NAME:** WELDER'S QUALIFICATION TEST SPECIMEN I.D. # 275

**WELDER:** C. Caddel

**work station:** W.O.*

**date:** 7-20-94

**welding code:** MIL-STD-1261C

## WELDING CHARACTERISTICS

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>ACCEPT</th>
<th>REJECT</th>
<th>DISCREPANCIES</th>
<th>NO OF WELDS INSPECT</th>
<th>NO ACCEPT/REJ'T</th>
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<tr>
<td>POROSITY</td>
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<td>OVERLAP</td>
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<tr>
<td>UNDERCUT</td>
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<td>UTOIN</td>
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<td></td>
</tr>
</tbody>
</table>

☑  ACCEPTED  ☐  REJECTED  ☐  HOLD  ☐  OTHER

**INSPECTED BY/DATE:**

**VISUAL INSPECTION CRITERIA**

FOR PRODUCTION WELDS: QAM 14.3.4

☑ reinspected  ☐ accepted  ☐ rejected

**COMMENTS/OBSERVATIONS**

FLAT & HORIZONTAL (1F & 2F)

**REINSPECTED BY:**

**DATE:**
<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
<th>PRICE PER U/M</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>2</td>
<td>7 5/8&quot; O.D. X 6&quot; STAINLESS STEEL FLEXMECH MIST ELIMINATOR</td>
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</table>

FREIGHT
TAX

INVOICE DATE: 6-26-95
Shipping: 7/26/95

SHIP TO:
F.M. 1585, 3/4 Mile East of Hwy 62/82
Wolfforth, TX 79382

MAIL TO:
P.O. Box 10232
Lubbock, TX 79408-3232

INSTRUCTIONS:
Send invoice & Bill of Lading to Scott Manufacturing, Inc.
P.O. Box 10232
Lubbock, TX 79408-3232

Date: 6-26-95

PAY & ADD
CCD
PAID
COLLECT

USPS

TAX EXEMPT YES NO
COST CODE: 586079
WORK ORDER #: T-487609
PURCHASE ORDER #: 37625

PROJECT: KOCH ENGINEERING CO. INC.
**PACKING LIST**

**Koch Engineering Company Inc.**

**DIVMET® Division**

**SHIP TO:**
Koch Manufacturing Inc.
P.O. Box 10232
Hobby TX 77408

**ACOUNTS PAYABLE**

**DATE:** 06/28/95

**SHIPPED TO:**
Scott Manufacturing Inc.
FM 1585, 3/4 Mile East
Hwy 62/82, Wolforth TX 79382

**CUSTOMER ORDER NO.:** 37625

**TERMS:** NET 30

**SHIP VIA:** CENTRAL

**REMARKS:**

**F.O.B.:** Houston

<table>
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<tr>
<th>Item</th>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
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<td><strong>YAMETER</strong></td>
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<td><strong>&amp; BOTTOM GRIDS</strong></td>
<td>TB-5</td>
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**WAIVER**

**JOB NO.:** 46794

**Rep:**

**P.O. Box 10232**

**9630 Clarewood • Suite C - 2 • Houston, Texas 77036 • 713/777-4114 • FAX 713/776-9541**
Scott Manufacturing, Inc.
Custom Metal Fabrication
P.O. Box 10232
Lubbock, Texas 79408-3232
(806) 747-3395
FAX (806) 866-4930

SHIP TO:
F.M. 1605, 3/4 Mile East of Hwy 02/02
Wellford, TX 79382

MAIL TO:
P.O. Box 10232
Lubbock, TX 79408-3232

INSTRUCTIONS:
Send Invoice & Bill of Lading to
Scott Manufacturing, Inc.
P.O. Box 10232
Lubbock, TX 79408-3232

Date 6-26-95

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<td>3/8&quot; X 75 1/4&quot; O.D. X A516 MATERIAL DISHED &amp; PLACHED HEAD W/ MITER'S</td>
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<tr>
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<td></td>
<td>F.R.T.</td>
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DELIVERY DATE 7/5/95 (SHIP OUT)

FOB DESTINATION SMJ

PREPAY & ADD □ COD □
PREPAID □ COLLECT □

TAX EXEMPT YES □ NO □
COST CODE 6520
WORK ORDER # T-48709
PURCHASE ORDER # 37626
FORT WORTH F&D HEAD COMPANY
P. O. BOX 18477 — FORT WORTH, TEXAS 76162-0477

MILL TEST REPORT

<table>
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<tr>
<th>CODE</th>
<th>QTY.</th>
<th>SIZE—OD</th>
<th>THK.</th>
<th>PLATE MFG.</th>
<th>HEAT NO.</th>
<th>SLAB NO.</th>
<th>MAT'L</th>
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<th>COLD FORMED</th>
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<tbody>
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<td>75 1/4&quot;OD x 3/8&quot;NOM. Flanged &amp; Dished Head 69 1/4&quot;DR, 3/4&quot;ICR, 2&quot;SF.</td>
<td>Geneva Steel</td>
<td>1A1009</td>
<td>.26-01</td>
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</table>

FORT WORTH F & D HEAD COMPANY CERTIFIES THAT HEADS MANUFACTURED FROM MATERIAL REPRESENTED BY THIS REPORT COMPLY WITH ASME CODE SECTION II & SECTION VIII, DIVISION 1. ALL HEADS COMPLY WITH UCS-79(d) & UG-81(a). NO SUBSEQUENT HEAT TREATMENT WAS PERFORMED.

WE CERTIFY THAT THIS IS A TRUE COPY OF THE ORIGINAL METALLURGICAL TEST CERTIFICATE NOW IN OUR FILES.

FORT WORTH F & D HEAD COMPANY
<table>
<thead>
<tr>
<th>QUANTITY</th>
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<tr>
<td>1</td>
<td>1/4 R</td>
<td>60 X 240</td>
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**TAX EXEMPT**: Yes ☑️ No ☐

**COST CODE**: 6094

**WORK ORDER**: JT 48709

**PURCHASE ORDER**: 37692
**Lot 1**

**Houston**

**Contract No.**

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<th>№ поз.</th>
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<th>Груп (как)</th>
<th>Марка стали</th>
<th>Диаметр, мм</th>
<th>Прочность</th>
<th>Ударная вязкость</th>
<th>Ударная вязкость после морозов</th>
<th>Холодная прокатка</th>
<th>Твердость</th>
<th>Масса, кг</th>
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<td>2412710</td>
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**Chemical Composition, %**

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<th>№ поз.</th>
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<th>Cr</th>
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<td>0.17</td>
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**Mechanical Properties**

- Tensile strength: 462 MPa
- Impact toughness: 15 J
- Yield strength: 220 MPa

**Hardness**

- Brinell hardness: 240 HB
**STEEL AUTHORITY OF INDIA LTD**  
**BHILAI STEEL PLANT**  
**BHILAI, INDIA**

**MILL TEST CERTIFICATE**

**CERTIFICATE NO. 3VII000269**  
**DATE:** 09-03-1973

1. **BUYER'S NAME AND ADDRESS:** PETRIS VIERNER AND BAHNHOFFSTRASSE 10  
   CH-4336 UBS, SWITZERLAND

2. **MATERIAL:** PRIME HOT ROLLED MILD STEEL PLATES

3. **PROCESS OF MANUFACTURE:** BASIC OXIDE CONVERTER CONTINUOUS CAST  
   KILLED STEEL

4. **QUALITY:**  
   - ASTM A-38

5. **TOLEUSANCES:**  
   - ASTM A-6 WITH S-11 SEMI-TEEL

6. **BILL OF LADING NUMBER:** 3VII000269  
   **DATE:** 09-03-1973

7. **NAME OF VESSEL:** H.W. STATE OF HINDAT

8. **LOADING PORT:** VISAMAPURAM/INDIA

9. **DISCHARGE PORT:** HOUSTON PIER/USA

**ITEM NUMBER:** 1

**THEORETICAL WEIGHT PER PIECE IN KG.** 1111  
**LOT NO:** 203  
**IN FACT REFERENCE NO:** 2.1223

**TEST RESULTS**

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"STEEL AUTHORITY OF INDIA LIMITED"
## TEST RESULTS

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**NUMBER OF PIECES:** 59

**TOTAL WEIGHT (METRIC TON):** 556.611

*Certified that the material is in accordance with ASTM A-36, 1997 edition and rolling tolerance on thickness, width, length and flatness according to ASTM A-6 material have sheared edges on all four sides.*

*For Chief Metallurgist*

*HILAL STEEL PLANT*

"STEEL AUTHORITY OF INDIA LIMITED"
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DELCIVERY DATE: 7-5-95

TAX EXEMPT: YES ☐ NO ☐
COST CODE: 6070
WORK ORDER #: JT 48710
PURCHASE ORDER #: 37693

Scott Manufacturing, Inc.
Custom Metal Fabrication
P.O. Box 10232
Lubbock, Texas 79408-3232
(806) 747-3395
FAX (806) 866-4930

SHIP TO:
F.M. 1065, 3/4 Mile East of Hwy 62/82
Wolfforth, TX 79382

MAIL TO:
P.O. Box 10232
Lubbock, TX 79408-3232

INSTRUCTIONS:
Send Invoice & Bill of Lading to
Scott Manufacturing, Inc.
P.O. Box 10232
Lubbock, TX 79408-3232

Date: 6-29-95

ONE CONTACT: Gordon
**ACEROS CORSA, S.A. DE C.V.**

**A P A R T A D O POSTAL 75-269 54180 M E X I C O, D. F. T E L S . : 5 8 6 - 1 6 - 0 0 y 5 8 6 - 8 7 - 2 2 T E L E X 0 1 7 7 6 5 5 0 C O S A M E F A X 5 8 6 - 8 1 - 3 8**

**S O L D T O : C O M M E R C I A L M E T A L S C O .**

**P.O.BOX 1046**

**D A L L A S , T X . 7 5 2 2 1 - 1 0 4 6**

**M I L L T E S T R E P O R T**

**T E S T E D A S T M A 6**

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<th>S</th>
<th>P</th>
<th>Tensile PSI</th>
<th>Yield PSI</th>
<th>Bourg. % (E)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>FB 2&quot;X3/8&quot;X20</td>
<td>15.754</td>
<td>8</td>
<td>85</td>
<td>686</td>
<td>9850</td>
<td>0.17</td>
<td>0.72</td>
<td>0.20</td>
<td>0.029</td>
<td>0.022</td>
<td>66,600</td>
<td>49,300</td>
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<tr>
<td>2</td>
<td>FB 2 1/2&quot;X3/8&quot;X20</td>
<td>16.653</td>
<td>8</td>
<td>72</td>
<td>576</td>
<td>9816</td>
<td>0.23</td>
<td>0.60</td>
<td>0.25</td>
<td>0.027</td>
<td>0.015</td>
<td>68,300</td>
<td>50,600</td>
<td>22.60</td>
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<tr>
<td>3</td>
<td>FB 3&quot;X3/8&quot;X20</td>
<td>29.197</td>
<td>14</td>
<td>60</td>
<td>640</td>
<td>9876</td>
<td>0.16</td>
<td>0.66</td>
<td>0.24</td>
<td>0.050</td>
<td>0.024</td>
<td>75,000</td>
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<td>4</td>
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<td>52</td>
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<td>9990</td>
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<td>0.74</td>
<td>0.20</td>
<td>0.031</td>
<td>0.020</td>
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<td>52,100</td>
<td>22.90</td>
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</table>

**M E L T E D A N D M A N U F A C T U R E D I N M E X I C O**

A - Equals Legs Angles
FB - Flat Bars
R - Rounds

**P.O. # 1-349**

**D a t e : 25/01/95**

**P.O. R.C. 604X 310789**

**S h i p p e d t o : A. MEJIA Y GOMEZ SANJURIO**

**Y/D ALFREDO RAMIREZ**

**A C E R O S C O R S A , S.A. DE C.V.**

**M e d i e n e d S i g n a t u r e s**
# Certified Test Report

The following tests conform to the requirements of the specifications listed.

<table>
<thead>
<tr>
<th>Heat No.</th>
<th>Section</th>
<th>Specification</th>
<th>T</th>
<th>Yield PSI</th>
<th>Tensile PSI</th>
<th>Elong %</th>
<th>R.A.</th>
<th>Bend Test</th>
<th>Diam</th>
<th>RFL</th>
<th>Rolled</th>
<th>Date</th>
<th>Lbs/Ft</th>
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<tbody>
<tr>
<td>19359</td>
<td>20</td>
<td>ASTM A36-93a</td>
<td>1</td>
<td>50300</td>
<td>74000</td>
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<td>8</td>
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<td></td>
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<td>010694</td>
<td>4.44</td>
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<tr>
<td>19359</td>
<td>40</td>
<td>ASTM A36-93a</td>
<td>1</td>
<td>50300</td>
<td>74000</td>
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<td></td>
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<td>010694</td>
<td>4.44</td>
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<table>
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<th>C</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Si</th>
<th>Cu</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>CS</th>
<th>V</th>
<th>Al</th>
<th>Ce</th>
<th>BHN</th>
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<tbody>
<tr>
<td>19359</td>
<td>0.19</td>
<td>0.70</td>
<td>0.007</td>
<td>0.037</td>
<td>0.22</td>
<td>0.59</td>
<td>0.10</td>
<td>0.17</td>
<td>0.050</td>
<td>0.000</td>
<td>0.020</td>
<td>0.003</td>
<td>0.00</td>
<td>1-42040</td>
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<tr>
<td>19359</td>
<td>0.19</td>
<td>0.70</td>
<td>0.007</td>
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<td>0.59</td>
<td>0.10</td>
<td>0.17</td>
<td>0.050</td>
<td>0.000</td>
<td>0.020</td>
<td>0.003</td>
<td>0.00</td>
<td>1-42040</td>
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<tr>
<td>19809</td>
<td>0.19</td>
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<td>0.16</td>
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<td>0.020</td>
<td>0.002</td>
<td>0.00</td>
<td>1-42040</td>
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### Remarks:

100% Melted and Manufactured in the USA and free from mercury contamination in the process.

For additional copies call accounting

(210) 372-6225.
<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>U/M</th>
<th>DESCRIPTION</th>
<th></th>
<th>PRICE PER U/M</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>2&quot; Std Pipe x 21' PL  A536EB</td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td></td>
<td>1/2&quot; Std Pipe x 21' PL  A536EB</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>8&quot; Sch 40 Pipe x 5'  A536EB</td>
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</tr>
<tr>
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<td></td>
<td>4&quot; Sch 80 Pipe x 2'  A536EB</td>
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<td></td>
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<tr>
<td>1</td>
<td></td>
<td>3&quot; Sch 80 Pipe x 6'  A536EB</td>
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<tr>
<td>1</td>
<td></td>
<td>2&quot; Sch 160 Pipe x 1 1/2'  A536EB</td>
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<td>1</td>
<td></td>
<td>10&quot; Sch 40 Pipe x 2 1/2'  A536EB</td>
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<td></td>
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**INSTRUCTIONS:**
Send Invoice & Bill of Lading to
Scott Manufacturing, Inc.
P.O. Box 10232
Lubbock, TX 79408-3232

**Date:** 7/5/95

**TAX EXEMPT:** YES □ NO □

**COST CODE:** 6070

**WORK ORDER #:** JT48710

**PURCHASE ORDER #:** 37748

### Material Code

<table>
<thead>
<tr>
<th>Product ID/Testing</th>
<th>Test Type/Condition</th>
<th>Test Cond.</th>
<th>Gauge Width</th>
<th>Tensile PSI</th>
<th>Ext %</th>
<th>Tensile PSI</th>
<th>YIT</th>
<th>ECO %</th>
<th>Hardness</th>
<th>WA HYDRO</th>
<th>Drill</th>
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<tbody>
<tr>
<td>L83346</td>
<td>STRIP/L/B</td>
<td>AR</td>
<td>0.750</td>
<td>49100</td>
<td>50</td>
<td>76500</td>
<td>0.65</td>
<td>39.0</td>
<td>99.0</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>NS9348</td>
<td>STRIP/L/B</td>
<td>AR</td>
<td>0.750</td>
<td>49100</td>
<td>50</td>
<td>76500</td>
<td>0.65</td>
<td>39.0</td>
<td>99.0</td>
<td>3000</td>
<td>3000</td>
</tr>
</tbody>
</table>

**END OF DATA THIS SHEET**

### Legend

- **L**: Longitudinal
- **T**: Transverse
- **U**: U-Notch
- **N**: Normalized
- **Q**: Quenched & Tempered
- **A**: As Rolled
- **M**: As Quenched

### Certificate

- **Certificate Number**: CLP/94/196096-01
- **Vehicle**: LT8220
- **Vendor**: USS Tubular Products
  - 1807 East 26th St.
  - Lorain, OH 44055

---

*Certification is based on the following equations:

\[ CE = \frac{(4.5\times C + 4.3\times Mn + 4.3\times Cr + 3.6\times Mo + 5.5\times V)}{100} \]

---

Jul 20, 1995
### INSPECTION CERTIFICATE

**Material:** AS ROLLED

**Identification:**

<table>
<thead>
<tr>
<th>PRODUCT IDENTIFICATION</th>
<th>FLAT</th>
<th>BEND</th>
<th>GRAIN SIZE</th>
<th>VIM</th>
<th>COLLAPSE</th>
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<tbody>
<tr>
<td>L5349A</td>
<td>OK</td>
<td>CK</td>
<td></td>
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<td>N89348</td>
<td>OK</td>
<td>CK</td>
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**END OF DATA THIS SHEET**

**LEGEND:**

- L: Longitudinal
- T: Transverse
- B: Body
- W: Weld
- HAZ: Heat Affected Zone

### TESTING / INSPECTION INFORMATION

**Test/Inspection** | **Results/Comments**
--- | ---
FULL LENGTH VISUAL | YES
FULL LENGTH EMI | 
FULL LENGTH MT | 
FULL LENGTH UT | 
END AREA INSPECTION (PLAIN END) | 
SPECIAL END AREA (SEA) INSPECTION | 
FULL LENGTH DRAF | 

### ADDITIONAL NOTES/COMMENTS

All melting and manufacturing took place in the USA. No repairs by welding. No mercury or mercury compounds are added to the steel and all mercury bearing equipment is protected by a double boundary of containment.

---

This is to certify that the product described herein was manufactured, sampled, tested and/or inspected in accordance with the specification and fulfills the requirements in such respects.

Prepared by the office of:

D. S. DABKOWSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

Date: 12/05/94
<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>MATERIAL DESCRIPTION</th>
<th>SPECIFICATION &amp; GRADE</th>
<th>Heat Lot No.</th>
<th>Tensile Test PSI</th>
<th>Percent Elongation</th>
<th>Gauge Width IN.</th>
<th>Flat Test Result</th>
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<tr>
<td>03</td>
<td>ASTM A53-90B/A106-91 GR. B</td>
<td>ASME SA53/SA106 S90 91ADD</td>
<td>N67242</td>
<td>2000</td>
<td>73500</td>
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<td>ASME SA53/SA106 S90 91ADD</td>
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<td>73200</td>
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** END OF DATA THIS SHEET **

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.

CE = .37
HRB=78.0
CE = .36
HRB=78.0
**TUVERIE DE SAINT SAULVE**

**MATERIAL TEST REPORT**

**PURCHASER : MARSON KEYSTONE CORP.**

**DATER NO. 60-3-06510 08.04.92**

**REMARKS STEEL PIPE, NOT FINISHED ULL STEEL IN MILL**

**Specification : GRADE IV, API 5 L 31 Electron, ASTM A 106B 31 A 106 B 31**

**Stencils/Marks: ON PIPE VALLIERES SV 004146-10 DATE OF MANUFACTURE 105/0/1006/05**

**Dimension 10.25 X HYDROSTATIC PRESSURE LENGTH IN FEET HEAT NUMBER**

**CUSTOMER'S REFERENCE**

**DIE STAMPING ON PIPE IN FRANCE**

**CUST. TAG : PHILADELPHIA CUSTOMER'S REFERENCE MADE IN FRANCE DURABLE**

**MACHINE:**

<table>
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<tr>
<th>ITEM</th>
<th>YR.</th>
<th>O.D.</th>
<th>L.T.</th>
<th>QUANTITY</th>
<th>TOTAL LENGTH</th>
<th>TOTAL WEIGHT</th>
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<tbody>
<tr>
<td>06</td>
<td>03</td>
<td>06.303</td>
<td>7.420</td>
<td>30</td>
<td>217.00 IN</td>
<td>11874 LBS</td>
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</table>

| 1/2 | 8.320 |

**REMARKS LENGTH OF 10.97 TO 12.00 METERS IN L. 34 / 44 FT)**

**LABORATORY ANALYSIS (CI)**

<table>
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<tr>
<th>PROCESS</th>
<th>HEAT</th>
<th>C</th>
<th>Si</th>
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<th>P</th>
<th>S</th>
<th>Cu</th>
<th>Ni</th>
<th>Cr</th>
<th>N</th>
<th>V</th>
<th>W</th>
<th>Mo</th>
<th>Fe</th>
<th>%</th>
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<tbody>
<tr>
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<td>0.485</td>
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</table>

3/5/92
**U.S. STEEL GROUP**  
A unit of USX Corporation

**USS TUBULAR PRODUCTS**

**MARMON KEYSTONE CORP**  
P O BOX 791  
BUTLER PA 16003-0791

**MARMON KEYSTONE CORP**  
P O BOX 791  
BUTLER PA 16003-0791

**DATE**  
06/03/94

---

**TECHNICAL REPORT**

**METALLURGICAL TEST REPORT**

**NHS**  10.00.13

**THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREBIN WAS**

MFG., SAMPLED, TESTED, AND/OR INSPECTION ACCORDING TO THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.

APPROVED BY OFFICE OF:
D.S. DASHER, MGR. MET. &
Q.A., USS TUBULAR PRODUCTS

---

**ITEMS**

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>REQ'D.</th>
<th>TESTED</th>
<th>SPECIFICATION &amp; SPACE</th>
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<td>C-4172</td>
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<td>0.34</td>
<td>API 5L ER. 2944 40TH ED. ADD 11/92. ASME A53-90B/106-91 OR. B. ASME BA53/AS506 ER. B 1992 EDITION 1992 ADDENDUM</td>
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**TEST RESULTS**

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<th>HEAT NO.</th>
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<th>Ni</th>
<th>Mo</th>
<th>V</th>
<th>Cu</th>
<th>Ti</th>
<th>Ba</th>
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<tr>
<td>02</td>
<td>186254</td>
<td>B</td>
<td>16</td>
<td>0.70</td>
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<tr>
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<td>0.01</td>
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</tr>
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---

**END OF DATA THIS SHEET.**

**ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.**

---

**N 80-84**

---

**GEN STEEL VISE INC.**

---

**C 4-170** TO **CORR STEEL STEEL**
**U.S. STEEL GROUP**

A unit of USI Corporation

**USS TUBULAR PRODUCTS**

MARQON KEYSTONE CORP

P.O. BOX 791

BUTLER PA 16003-0791

---

**METALLURGICAL TEST REPORT**

**DATE:** 07/11/94

---

**INVOICE NO:** 1000001

---

**ORDER NO:** 1000001

---

**MATERIALS:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<td>A106 GR. B</td>
<td>ASME B36.10M</td>
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**TEST RESULTS:**

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<th>Property</th>
<th>Value</th>
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<tbody>
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<td>55,000 PSI</td>
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<tr>
<td>Ultimate Strength</td>
<td>39.5</td>
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<tr>
<td>Elongation</td>
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---

**SPECS:**

- ASTM A53
- ASME B36.10M

---

**NOTES:**

- All testing and marking of tubing took place in the USA.

---

** signature:**

32.94
Piping Metallurgy
<table>
<thead>
<tr>
<th>Quantity</th>
<th>OD.</th>
<th>ID.</th>
<th>Wt.</th>
<th>Avg</th>
<th>Heat No.</th>
<th>C</th>
<th>P</th>
<th>Si</th>
<th>Mn</th>
<th>Cr</th>
<th>Mo</th>
<th>Cu</th>
<th>Fe</th>
<th>Reliability</th>
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<td>0.19</td>
<td>0.73</td>
<td>0.006</td>
<td>0.011</td>
<td>0.23</td>
<td>0.10</td>
<td>0.06</td>
<td>0.02</td>
<td>0.23</td>
</tr>
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</table>

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

**CUSTOMER PO #**
# Certified Test Report

**Item** | **Quantity** | **Description** | **Specification** | **Heat Code**
---|---|---|---|---
36 | 6 | 8x6 STC Conc | A234-92A/SA234 WP8 | XHP

- **A106B 48 / .88766**
- **4x2 STD ECC**

37 | 2 | 4x2 STD ECC | A234-92A/SA234 WP8 | XLP

- **A106B 09 / .X83447**

38 | 3 | 6x4 STD ECC | A234-92A/SA234 WP8 | XLK

- **A106B 00 / .X83188**

39 | 6 | 2 STD LR 45 | A234-92A/SA234 WP8 | LYH1

- **A106B 09 / .NA66242**

**Stress Relieved at 1200°F**

**Chemical Analysis**

| Code | C | Mn | P | S | Si | Mo | Cr | Ni | V | Cu | Nb | C.E.
|------|---|---|---|---|---|----|---|---|---|----|---|---
| XHP  | .19 | .75 | .010 | .006 | .34 | .07 | .02 | .15 | .08 | .00 | .00 | .35
| XLR  | .18 | .80 | .012 | .006 | .24 | .03 | .01 | .04 | .01 | .00 | .00 | .33
| XLK  | .18 | .78 | .012 | .012 | .23 | .02 | .01 | .04 | .01 | .00 | .00 | .32
| LYH1 | .17 | .81 | .008 | .007 | .24 | .04 | .01 | .04 | .01 | .00 | .00 | .32

**Physical Properties**

<table>
<thead>
<tr>
<th>Heat Code</th>
<th>Tensile *</th>
<th>Yield KSI</th>
<th>% Elong</th>
<th>Hardness HB</th>
<th>Size MM</th>
<th>Temp</th>
<th>Foot Pounds</th>
<th>Lateral Expansion</th>
<th>% Shear</th>
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<tbody>
<tr>
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* 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 B16.10, B16.29, and NACE MR01-75.
- **Flanges:** ASTM A105 and ANSI B16.5, ASME SA105, ANSI B16.5, and NACE MR01-75.
- **All welded fittings are tested by certified welders in accordance with the requirements of Paragraph UG-11, Section V of the ASME Boiler and Pressure Vessel Code Requirements, Paragraph UG-75d. We certify that all welds in the above figures are correct as contained in the records of the Company's Quality Assurance Program, and are per NACE MR01-75.
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**SEAMLESS**
ASTM/ASME A/SA 106 B 90
HF CARBON PIPE
10/31/94

**PLAIN ENDS - U.V.G. COAT**
ACCEPTABLE PER NACE MR0 175 TABLE 3
A.I.M. FOR 20′ J.N. LENGTHS

**MILL TEST REPORTS FURNISHED BY**
TEXAS PIPE & SUPPLY CO. INC.
CUSTOMER NUMBER FOR:

---

**HEAT NO.**

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I CERTIFY THAT THE MATERIAL HEREFOR DISCLOSED HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE ORDERED SPECIFICATION AND THAT THE TEST INFORMATION IS CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.

TECHNICAL ANALYST

SIGNED UNDER SHERMAN BEHIND

DATE: OCTOBER
CERTIFIED TEST REPORT

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<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
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<th>% Hardness</th>
<th>Size MM</th>
<th>Temp</th>
<th>FOOT POUNDS</th>
<th>LATERAL EXPANSION</th>
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*L = LONGITUDINAL, T = TRANSVERSE, R = ROUND, S = STRIP

HACKNEY is a domestic manufacturer, and these items conform to the following specifications as they apply:


Flanges: ASTM A105 AND AS16-70, ASME SA16-70, and ASME B16.34, per ASME MR01-75.

All welds were heat treated as required by the applicable specification. All welds were examined per Article 2, ASME Section V. All were internally examined per ASME Section VIII, Division 1, Section VIII, Division 1, Article 1 of the ASME Code. Heat-cany weld caps meet ASME Division 1, Section VIII, Pressure Vessel Code Requirements, Paragraph UG-11. We certify that all welds were examined per the requirements of Paragraph UG-11, Section VIII, Division 1, Article 1 of the ASME Code. The above figures are correct as contained in the records of the Company.
**CERTIFIED TEST REPORT**

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<thead>
<tr>
<th>EM</th>
<th>QUANTITY</th>
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**MECHANICAL PROPERTIES AND PHYSICAL PROPERTIES:**

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- 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 A534 WPB, ASME SA336 WPB, ANSI B16.9, B16.22, B16.36 and NACE MR01-75.

**FLANGES:** ASTM A105 AND A516-70, ASME SA105, AS516-70, B16.5, B16.47, and NACE MR01-75.

Welded fittings are welded according to the requirements of ASME Section V, and all welds are subject to radiographic examination per Article 2, ASME Section V. All are in conformance with the requirements of Paragraph UG-11. All welded fittings are welded to ASME Section XI, Division 2, ASME Code Section VIII-(B) and meet ASME Code Section VIII-(D) and the requirements of Paragraph UG-11. We certify that the welds and fillers are of a quality passing a hydrostatic test compatible with their rating, and that the above figures are correct as contained in the records of the Company's Hardness testing and strength tests per ASME MR01-75.
# Certified Test Report

**Item** | **Quantity** | **Description/Specification** | **Heat Code**
---|---|---|---
12 | 6 | 4 150 RF SD A105-93B/SA105 | 0794BH
| | | A105 26 / 494-1178 AS FORGED | 0594DX
| | | 2 150 RF THRD A105-93B/SA105 | 1192DE
| | | A105 26 / 494-3254 AS FORGED | 0994BH
| 15 | 12 | 1 150 RF SH STD A105-90A/SA105 | 1192DE
| | | A105 LS 25545 AS FORGED | 0994BH
| 19 | 8 | 2 300 RF BLIND A105-93B/SA105 | 0994BH
| | | A105 26 / 494-3205 AS FORGED | 0994BH

## Chemical Analysis

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## Physical Properties

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<th>Yield Strength (ksi)</th>
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<th>Size MI x 10 mm</th>
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**L** = Longitudinal; **T** = Transverse; **R** = Round; **S** = Strip

 HACKNEY is a domestic manufacturer, and all items conform to the following specifications as they apply:

- **Fittings:** ASME A234 WPB, ASME SA234 WPB, ANSI B16.20, B16.34, and NACE MR01-75.
- **Flanges:** ASME A105 and ASME B16.70, ASME SA105, ANSI B16.5, and NACE MR01-75.
- All welds were tested as required by the applicable specifications. The welds conform to the requirements of Parts 192 and 195, Title 49, Code of Federal Regulations, Paragraph UG-11, Section VII, Division I of the ASME Code. All test weld caps meet ASME Division 1, Section VIII Pressure Vessel Requirements, Paragraph UG-11. We certify these flanges and flanged accessories, as well as the above figures, are correct as contained in the records of the Company. The hardness testing and Charpy V-notch test are in accordance with NACE MR01-75.
<table>
<thead>
<tr>
<th>ITEM</th>
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<th>HEAT CODE</th>
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<td>2</td>
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<td>A106B NSS FX0054</td>
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**CHEMICAL COMPOSITION**

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<tr>
<th>HEAT CODE</th>
<th>C</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Si</th>
<th>Cr</th>
<th>Mo</th>
<th>Cu</th>
<th>Ni</th>
<th>V</th>
<th>N</th>
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**MECHANICAL TEST RESULTS**

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<th>HEAT CODE</th>
<th>TENSILE KSI</th>
<th>YIELD KSI</th>
<th>%elong</th>
<th>0.2% ELONG</th>
<th>HARD. (HRC)</th>
<th>DIA 10 MM Min.</th>
<th>TEMP</th>
<th>FOOT POUNDS</th>
<th>LATERAL EXPANSION</th>
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<tr>
<td>AZAZ</td>
<td>85.0 T</td>
<td>58.8 S</td>
<td>33.0</td>
<td>197</td>
<td>58.4 HAXY</td>
<td>25.4 x 10 mm</td>
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<tr>
<td>KWS1</td>
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<td>LAO1</td>
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</table>

* L = LONGITUDINAL, T = TRANSVERSE

AZAZ, KWS1, LAT1, LAO1, CONFORMS TO THE REQUIREMENTS OF NACE MR0175-92

"items were heat treated in accordance with the requirements of NACE MR0175-92 and were manufactured.
We hereby certify that the above figures are correct as contained in the record of Hackney, Inc., and were manufactured.
"
# CERTIFIED TEST REPORT

<table>
<thead>
<tr>
<th>TEM</th>
<th>QUANTITY</th>
<th>DESCRIPTION/SPECIFICATION</th>
<th>HEAT CODE</th>
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<td>12</td>
<td>8 STD WC A516-70 TUSCL: 5872530</td>
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<td>3X2 STD CONC A234-92A/SA234 WPB</td>
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<td>11</td>
<td>6</td>
<td>A106B 09 / L60626 STRESS RELIEVED AT 1200 F</td>
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<tr>
<td>13</td>
<td>12</td>
<td>3 STD LR 90 A234-92A/SA234 WPB</td>
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<thead>
<tr>
<th>CODE</th>
<th>C</th>
<th>Mn</th>
<th>P</th>
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<th>Mo</th>
<th>Cu</th>
<th>Ni</th>
<th>V</th>
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## RESULTS

<table>
<thead>
<tr>
<th>HEAT CODE</th>
<th>TENSILE *</th>
<th>Hardness</th>
<th>Ductility %</th>
<th>Temp. (°F)</th>
<th>Foot Pounds</th>
<th>Lateral Expansion %</th>
<th>Shear</th>
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<tbody>
<tr>
<td>AZDF</td>
<td>197</td>
<td>123</td>
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<td>LKE1</td>
<td>118</td>
<td>123</td>
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<td>C59D</td>
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</tr>
</tbody>
</table>

*L = LONGITUDINAL, T = TRANSVERSE

LKE1, C59D, LKE1 CONFORM TO THE REQUIREMENTS OF NACE MR0175-92

*The items in this report tested in accordance with the requirements of NACE MR0175-92, as well as the standard test methods of the ASTM and ASME specifications, as noted for each item.
Secondary Containment Corrosion Protection
Tank Corrosion Protection
INTERIOR COATING SYSTEM

SURFACE PREPARATION

SSPC-SP 5 "WHITE METAL BLAST CLEANING," 2.0-3.0 MILS SURFACE PROFILE.

PRIME COAT

APPLY BY SPRAY TO ALL INTERIOR SURFACES, ONE COAT OF PLASITE 7156 HI-RESTANT HEAVY BUILD PROTECTIVE COATING, IVORY, AT A DRY FILM THICKNESS OF NOT LESS THAN 5.0 MILS. A MINIMUM DRYING TIME OF 12 HOURS AT 70° SHALL BE ALLOWED BEFORE APPLICATION OF THE FINISH COAT.

WELD AND SEAM STRIPE COAT

APPLY BY HIGH QUALITY BRUSH, ONE COAT OF PLASITE 7156 HI-RESISTANT HEAVY BUILD PROTECTIVE COATING, IVORY, TO ALL WELDS AND SEAMS.

FINISH COAT

APPLY BY SPRAY, TO ALL INTERIOR SURFACES, ONE FINISH COAT OF PLASITE 7156 HI-RESISTANT HEAVY BUILD PROTECTIVE COATING, LIGHT GRAY, AT A DRY FILM THICKNESS OF NOT LESS THAN 5.0 MILS. A MINIMUM DRYING TIME OF 7 DAYS AT 70° F SHALL ELAPSE AFTER COMPLETION OF THE INTERIOR PAINT SYSTEM BEFORE THE TANK CAN BE PLACED IN SERVICE.

TOTAL DRY FILM THICKNESS

THE TOTAL DRY FILM THICKNESS SHALL NOT BE LESS THAN 10.0 MILS. PER SSPC DRY FILM THICKNESS MEASURING STANDARD. ADDITIONAL FINISH COATS WILL BE APPLIED IN AREAS OF DEFICIENT THICKNESS.

EXTERIOR COATING SYSTEM

SURFACE PREPARATION

SSPC-SP10 "NEAR WHITE METAL BLAST CLEANING," 2.0-3.0 MILS SURFACE PROFILE.

PRIME COAT

APPLY BY SPRAY TO ALL EXTERIOR SURFACES, ONE COAT OF GLID-GUARD CORROSION RESISTANT HS EPOXY NO. 5466 SERIES, GRAY, AT A DRY FILM THICKNESS OF NOT LESS THAN 3.0 MILS.
PLASITE 7156 HI-RESISTANT HEAVY BUILD PROTECTIVE COATING

TYPE: A water-resistant epoxy coating polymerized with an amine adduct-type curing agent.
INTENDED USE: Primarily as a tank lining for water, including low conductivity deionized or distilled water at elevated temperatures, as well as use with brines and petroleum processes. Designed and laboratory confirmed for immersion in demineralized water at 250°F.

FOR INDUSTRIAL USE ONLY!

GOVERNMENT AGENCY ACCEPTANCE: Meets the requirements of the U.S. Food and Drug Administration, 21 CFR 175.300.

Accepted by the U.S. Department of Agriculture for surfaces which contact potable water and for incidental food contact.

Accepted by the U.S. Environmental Protection Agency for surfaces which contact potable water.

NSF REQUIREMENT GUIDE: PLASITE 7156 is certified by the National Sanitation Foundation (NSF) to Standard 61 for potable water up to 180°F when the following requirements are met. PLASITE 71 Thinner, up to a maximum of 15%, must be used for thinning purposes. Prior to placing the lining in service it must be force cured at 200°F metal temperature for four hours.

CHEMICAL RESISTANCE: Excellent resistance to waters and brines at elevated temperatures. Refer to CHEMICAL RESISTANCE on Page 2.

TEMPERATURE RESISTANCE: Dry film basis is 400°F for short periods. Continuous immersion temperatures depend on particular reagent and temperatures.

SURFACE PREPARATION: Steel surfaces shall be prepared by blasting to white metal since this coating is intended for use in immersion service. Refer to Page 3 for details on SURFACE PREPARATION.

APPLICATION: PLASITE 7156 is formulated for use as a spray applied coating. Refer to SPRAY EQUIPMENT on Page 4.

COLORS: Ivory; Light gray. Special colors are available but may not be suitable for food service. Consult PLASITE Technical Service Department.

FILM THICKNESS PER COAT: A 5 to 6 mil film is produced in one multi-pass spray coat. A total film thickness of 10 to 12 mils is required for immersion service.

COVERAGE: 850 mill lb/gallon ± 2% (theoretical). For estimating purposes, 57 lb/gallon will produce a 10 to 12 mil DFT film (20% loss included). Two multi-pass spray coats will produce the 10 to 12 mil DFT film recommended for immersion service.

DRYING TIME: Surface will normally be tack free in 2 hours at 70°F.

CURING TIME: 7 days at 70°F to 90°F; 20 days at 30°F to 50°F. Consult laboratory for possible difference in resistance of coating when curing at the lower temperatures. Refer to Page 2 for force curing.

PHYSICAL SPECIFICATIONS

PIGMENTS: Titanium dioxide, inerts and tinting colors.

SOLIDS: 74% ± 2% by weight; 53% ± 2% by volume.

POT LIFE: Approximately 8 to 10 hours at 70°F.

SHELF LIFE: 24 months at 70°F. Material in stock should be turned upside down every 3 months.

SPRAY VISCOSITY: At 70°F, 17 ± 5 seconds Ford Cup #4.

SHIPPING WT: Approximately 13.5 lb/gallon.

*ABRASIVE RESISTANCE: 75.3 milligrams loss average, 1000 cycles, Taber CS-17 Wheel, 1000 Gr. Wt. Ivory Color.

*SURFACE HARDNESS: König Pendulum Hardness of 113 seconds; (Glass Standard = 250 seconds) ASTM Method D4366-84.

THERMALSHOCK: Unaffected in 5 cycles, minus 70°F to plus 212°F.

GLOSS: 7.0 at 60°

NOTE: Above tests were conducted on film cured at 150°F.

VOLATILE ORGANIC COMPOUNDS CONTENT

THINNED 10% BY VOLUME

WITH PLASITE 71 THINNER

<table>
<thead>
<tr>
<th>COLOR</th>
<th>Lbs./Gal</th>
<th>Grams/Liter</th>
<th>Lbs./Gal</th>
<th>Grams/Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivory</td>
<td>3.05 ± 2%</td>
<td>368 ± 2%</td>
<td>3.39 ± 2%</td>
<td>406 ± 2%</td>
</tr>
<tr>
<td>Lt. Gray</td>
<td>3.12 ± 2%</td>
<td>374 ± 2%</td>
<td>3.45 ± 2%</td>
<td>413 ± 2%</td>
</tr>
</tbody>
</table>

*Determined theoretically by using ASTM Method test results.
ZONE OF USAGE

A ZONE: This would include immersion service for process and storage vessels. A film thickness of 10 to 12 mils required.

CHEMICAL RESISTANCE

The following list of laboratory tests is an indication of the range of chemical resistance. These tests consist of 1" x 5" mild steel test panels coated to a film thickness of 12 mils. The panels are one-half immersed in the solution at noted temperatures for a period of six months with no effect on the coating.

<table>
<thead>
<tr>
<th>WATERS</th>
<th>ALKALIES</th>
<th>MISCELANEOUS</th>
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<tbody>
<tr>
<td>Demineralized</td>
<td>260°F</td>
<td>50% Sodium Chlorate</td>
</tr>
<tr>
<td>Sea Water</td>
<td>212°F</td>
<td>Crude Oil</td>
</tr>
<tr>
<td></td>
<td>50% Sodium Hydroxide</td>
<td>100°F</td>
</tr>
<tr>
<td></td>
<td>50% Magnesium Hydroxide</td>
<td>150°F</td>
</tr>
<tr>
<td></td>
<td>25% Sodium Hydroxide</td>
<td>150°F</td>
</tr>
<tr>
<td></td>
<td>10% Calcium Hydroxide</td>
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NOTE: Although the chemical tests indicated show that PLASITE 7156 is unaffected by immersion as listed, it is not meant to imply an express guarantee in actual service. The service is dependent upon proper application and actual operating conditions and it is recommended that users confirm adaptability of the product for a specific use by their own tests. PLASITE 7156 is not suitable for service in corrosive acids or oxidizing service for continuous immersion.

THINNERS

The following thinners are recommended:

PLASITE 71 Thinner — a medium-fast thinner to be used under most conditions (above 50°F).

PLASITE 20 Thinner — a fast thinner to be used when applying at lower temperatures (below 50°F).

The amounts of thinner required will vary depending on air and surface temperatures and application equipment. Normal application temperatures and conditions will require addition of approximately 10% by volume with approximately 5% additional thinner added for each 5° of increased temperature. Airless spray equipment and above normal temperatures require additional thinning.

It is recommended that the amount of thinner included on each order amount to approximately 20% of the coating order.

PRIMERS

PLASITE 7104 inhibitive primer is available for use in special applications such as pre-priming of blasted steel surfaces prior to final fabrication or erection and prior to application of final topcoats. The propriety of such a system should be determined by consulting plant laboratory or by prior experience or testing.

PLASITE 7104 Primer is applied at a spreading rate of 205 ft²/gallon for a 3 mil DFT (20% loss included). The PLASITE 7156 Coating, for ZONE A Service, is normally intended for use as a self-priming system with a separate primer not required.

PLASITE 7104 Primer is NOT recommended for potable water service.

CURING

1. For immersion service, complete curing will normally take place in 7 days at 70°F, 14 days at 50°F, or 20 days at 30°F to 50°F. As ventilation and other factors affect the time/cure of coatings, additional time allowance is recommended at any temperature if cure time is questioned. When exposure is severe, force curing is recommended to obtain maximum resistance.

2. With adequate ventilation, when applying at temperatures between 30°F and 50°F, coating surfaces will normally be tack free in 16 to 24 hours; between 50°F and 70°F, 2 to 16 hours.

3. Force curing at elevated temperature is desirable for certain exposures. Where coating is to be subjected to immersion in taste sensitive solutions, it is recommended that the curing temperature be at 200°F for 4 hours. In order to ensure the complete removal of solvent and odor, force curing is recommended when coating is to be used in potable water and food material service.

4. Listed below are a few force curing schedules that may be used for time and work planning. When applying at temperatures of 30°F to 60°F, allow 16 to 24 hours air dry time prior to raising the metal temperature to the force curing temperature. When applying at temperatures above 60°F to 70°F, allow 2 to 5 hours air dry time. After the appropriate air dry period, raise metal temperature approximately 30°F each 30 minutes until the desired force curing metal temperature is reached.

7156-2
Final cure may be checked by exposing coated surface to ethyl alcohol for ten minutes. If no dissolving and only minor softening of film occurs, the curing can be considered complete. The film will reharden after exposure if cured.

**SURFACE PREPARATION**

**STEEL**

Immersion Service (Zone A as described under ZONE OF USAGE).

1. All sharp edges shall be ground to produce a radius and all imperfections, such as, skip welds, delaminations, scabs, slivers and slag, shall be corrected prior to abrasive blasting. Skip welds shall be welded solid.

2. Degrease surface prior to sandblasting. Organic solvents, alkaline solutions, steam, hot water with detergents or other systems that will completely remove dirt, oil, grease, etc. may be used. Used tanks may require additional decontamination.

3. The surface shall be blasted to an SSPC-SP5 or NACE No. 1 white metal surface using a Venturi blast nozzle supplied with 80 to 100 psi. An anchor pattern or "tooth" in the metal shall correspond to approximately 20 to 25% of the total film thickness of the coating.

4. Contaminated grit shall not be used for the finish work.

5. The blasting media used shall be a natural abrasive, or steel grit, or slag grit (similar or equal to BLACK BEAUTY®). These abrasives shall be sharp with a hard-cutting surface, properly graded, dry, and of best quality. The media shall be of proper size to obtain the specified anchor pattern and shall be free of objectionable contaminants.

6. The anchor pattern shall be sharp and no evidence of a polished surface is allowed.

7. Remove all traces of grit and dust with a vacuum cleaner or by brushing. Care must be taken to avoid contaminating the surface with fingerprints or from detrimental material on the workers' clothes. The surface temperature shall be maintained at a minimum of 5° above the dew point to prevent oxidation of the surface. The coating shall be applied within the same day that the surface has been prepared.

8. Utilized, inhibitive primer should be applied as soon as possible after surface preparation.

**NOTE:** The above specification numbers are from Steel Structure Painting Council Surface Preparation Specifications, 4516 Henry Street, Suite 301, Pittsburgh, PA 15213-3728 and National Association of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218.

**CONCRETE**

Immersion Service (Zone A as described under ZONE OF USAGE).

All concrete surfaces require whip blasting with No. 50 grit for immersion service. Fully cured concrete must be blasted to provide a hard, firm, clean and neutral surface for coating. All concrete surfaces must be filled and sealed with PLASITE 9028M1 or PLASITE 9028M2, applied in accordance with appropriate PLASITE bulletin. All surface imperfections, "bug holes," etc. must be completely repaired before application of PLASITE 7156. PLASITE 9028M1 or PLASITE 9028M2 are not recommended for food or potable water service. Ref. Force Curing recommendation for taste sensitive solutions.

**ALUMINUM**

Surface shall be clean and grease free with a blast produced anchor pattern or "tooth" as described earlier under "STEEL." In addition, the blasted surface shall be given a chemical treatment such as:

- ALODINE® 1200S available from Parker & Anchem
- IRIDITE® 14-2 produced by Allied-Kellite Division of Witco Corporation
- OAKITE® CRYSOCOAT-747LT5 Plus
- OAKITE® CRYSOCOAT-ULTRASEAL
- OAKITE® CRYSOCOAT-747LT5 Plus
- OAKITE® CRYSOCOAT-ULTRASEAL
- Producing by Oakite Products
- 50 Valley Road
- Berkeley Heights, NJ 07922
- (908) 464-6900
- Canada: (416) 791-1628

7155-3
SPRAY APPLICATION
1. All spray equipment should be thoroughly cleaned and the hose, in particular, should be free of old paint film and other contaminants.
2. Use standard production type spray guns:
   - GUN: JeVibiss JGA-503
   - FLUID: AIR
   - PRESSURE: 1500 to 1800 psi with tip size from .015" to .021". Thinning requirements are more than for conventional spray.

BRUSH APPLICATION
A high quality brush should be used.

SAFETY AND MISCELLANEOUS EQUIPMENT
1. For tank lining work, it is recommended that the operator provide himself with clean coveralls and rubber soled shoes and observe good personal hygiene. Certain personnel may be sensitive to various types of resins which may cause dermatitis.

2. THE SOLVENT IN THIS COATING IS FLAMMABLE AND CARE AS DEMANDED BY GOOD PRACTICE OSHA, STATE AND LOCAL SAFETY CODES, ETC. MUST BE FOLLOWED CLOSELY. Keep away from heat, sparks and open flame and use necessary safety equipment, such as air mask, explosion-proof electrical equipment, non-sparking tools and ladders, etc. Avoid contact with skin and breathing of vapor or spray mist. When working in tanks, rooms and other enclosed spaces, adequate ventilation must be provided. Refer to PLASITE Bulletin PA-3. Keep out of the reach of children.

3. CAUTION - Read and follow all caution statements on this product technical bulletin, material safety data sheet and container label for this product.

MIXING
The catalyst is in a separate container and measured for the coating unit supplied. Thoroughly mix the pigments. After the pigment and liquid is thoroughly mixed, add the measured liquid catalyst slowly and mix completely with the coating. The coating should stand approximately 30 minutes after the catalyst has been thoroughly mixed.

APPLICATION PROCEDURE
6. By repeating Step No. 4 a homogeneous film of 10 to 12 mils is obtained.
7. Equipment must be thoroughly cleaned immediately after use with PLASITE thinner to prevent the setting of the coating.

NOTE: All welds, pits and rough metal areas should be coated by brush prior to spray application.

BRUSH APPLICATION
(Recommended for small areas and repairs only)
1. Apply a very light crisscross brush coat.
2. Allow to dry for approximately 5 minutes.
3. Apply a heavy coat using crisscross brush pattern. "Flow" the coating on rather than try to "brush out.
4. Allow to dry tack-free.
5. Repeat Steps 3 and 4 until sufficient film thickness is obtained. Normally a film thickness of 2½ to 3 mils can be obtained per coat by this method.

INSPECTION
Degree of surface preparation shall conform to appropriate specifications as outlined in SURFACE PREPARATION section. Film thickness of each coat and total dry film thickness of coating system shall be determined with a non-destructive magnetic gauge properly calibrated.

Refer to PLASITE Bulletin PA-3, Section 3, for inspection requirements.

This bulletin provides standard information on the coating and application procedure. Since varying conditions may not be covered, consult your local sales representative or PLASITE Technical Service Department for further information.

METRIC COMPARISONS
1 mil = .001" = 25.4 microns
1 U.S. gallon = 3.785 liters
1 sq. ft. × 0.0929 = sq. meters
°C = 5(°F - 32) / 9

71554
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

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 and resistance to moisture and many chemicals.

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 Grey 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 B.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 termite damaged 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 g/liter (13.5 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 g/liter (15.75 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. — 5467/5468
- Generic Type — Polyamide epoxy
- Color — White
- Gloss — Approximately 30% at 60°
- Percent Solids by Weight — 71% ± 1%
- Percent Solids by Volume — 54% ± 1%
- Theoretical Coverage per 1.0 dry mll (1.9 mls wet) — 565 sq.ft./gal
- **Recommended Film Build/Coverage (theoretical, un reduced)
  - Minimum — 3.0 mls dry (5.5 mls wet)
  - Maximum — 5.0 mls dry (15.5 mls wet)

When computing working coverage, allow for application losses, surface irregularities, nip-var unstirred, 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 g/ml) un reduced
  - 3.48 lbs/gallon (417 g/ml) reduced
  - 3.56 lbs/gallon (427 g/ml) reduced
- Drying Time (70°F., 60% Relative Humidity)
  - Touch — 1-2 hours
  - Hand Dry — 7 hours
  - Recheck — 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.

*Compositions of other products in this series may differ slightly.
**As measured over the peaks of any surface projections or blister 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. 5468 (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 mill 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-SP-6-B2 and SSCP-SP-COM) is recommended. For splash and spillage, Near-White Blast Cleaning (SSPC-SP-10-B2 and SSPC-SP-COM) is satisfactory.

TYPE C — CORROSIVE
This exposure is less aggressive 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 mill 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-SP-10-B2 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-6-B2 and SSPC-SP-COM) is recommended. Where exposure is normal weathering only, Brush-Off Blast Cleaning (SSPC-SP-7-B2 and SSPC-SP-COM), Power Tool Cleaning (SSPC-SP-3-B2 and SSPC-SP-COM), or Hand Tool Cleaning (SSPC-SP-2-B2 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-SP-7-B2 and SSPC-SP-COM), Power Tool Cleaning (SSPC-SP-3-B2 and SSPC-SP-COM), or Hand Tool Cleaning (SSPC-SP-2-B2 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. Dust 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 and/or 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. 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 8.0 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: 31E-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 634, or equivalent
Fluid Nozzle: Binks Model 630 or equivalent
Air Cap: Binks Model 633 or equivalent

COVERAGE
Typical coverage (calculated, unredused) is 1.73 sq. ft./gallon at 5.0 mils dry (8.5 mils wet). Minimum film thickness is 3.0 mils dry (5.5 mils wet). Maximum is 8.0 mils dry (15.0 mils wet). 106 sq. ft./gallon. All wet mill 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 DURA-MASTER™ High Solids Epoxy No. 5295/5299 series
GLID-GUARD METALITE™ High Build Epoxy No. 5475/5476
GLID-GUARD Cold Cure Epoxy No. 5281/5285
GLID-GUARD Coal Tar Epoxy No. 5270/5271
GLID-GUARD Hi-Build Coal Tar Epoxy No. 5273/5274
GLID-GUARD GLID-TILE™ Epoxy 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 Hi Acrylic No. 6440 series
Piping Corrosion Protection
**Kem Kromik Universal Metal Primer—B50Z Series**

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 &quot;universal&quot; primer under high performance topcoats as is also suitable as a &quot;barrier&quot; coat over conventional coatings which would normally be attacked by strong solvents in high performance coatings.</td>
</tr>
</tbody>
</table>

**Characteristics**

**Color:** Brown, Off White, and Bull

**Coverage: Recommended:** 204-273 sq. ft./gal. 6.9 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)
- @ 60 mils wet, 50% R. H. and:
  - @ 40°F @ 77°F @ 110°F
- To Touch: 2 hours 30 minutes 15 minutes
- Tack Free: 2 1/2 hours 1 hour 20 minutes
- To Recoat with:
  - alkyd: 2 1/2 hours 1 hour 45 minutes
  - epoxy: 36 hours 16 hours 16 hours
  - urethane: 36 hours 16 hours 16 hours

**Finish:** 0-10 units @ 65°F

**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

**Performance Specifications**

**Substrate:**
- Steel: SSPC SP2/SP-14
- Surface Preparation: (See pages 2 through 6)

**Suggested Topcoats:**
- A-100 Exterior Latex Finishes: 24-26
- Coralthane II Satin Polyurethane: 32
- DTM Acrylic Coatings: 34
- Heavy Duty Epoxy: 40
- Hi-Bid Aliphatic Polyurethane: 40
- Hi-Solid Polyurethane: 50
- Industrial Enamel: 54
- Industrial Enamel HS: 55
- Metalac Semi-Gloss Coating: 64
- Portar 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

**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 a phenolic core.

**Airless spray:**
- Pressure: 1800-3000 psi
- Tip: .015" - .019"
- Hose: 1/4" I.D.
- Filter: 60 mesh
- Reduction: Normally no reduction required

**Convensional spray:**
- Pressure: 1800-3000 psi
- Tip: .015" -.019"
- Hose: 1/4" I.D.
- Filter: 60 mesh
- Reduction: Normally no reduction required

**Physical Properties:**

- Abrasion Resistance (ASTM D4060, 1000 cycles): 250 mg
- Direct Impact (ASTM G114): 70 inch lbs.
- Dry Heat Resistance (ASTM D2441): 20°F
- Elcometer Adhesion (ASTM D4541): 250 psi
- Exterior Durability [with chalk]: Good
- Flexibility (ASTM D224, 180° bend): 1/4" mandrel
- Pencil Hardness (ASTM D3363): H
- Salt Fog Resistance (ASTM B117): 503 hours
- Thermal Shock (ASTM D256): 5 cycles
- Resistance Guide:
  - (Resistance to liming, salt and scaling, etc.): Poor
- Acid Salt Solutions: Moderate
- Aliphatic Hydrocarbons: Moderate
- Alkalis: 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: Light
- Oxygenated Solvents: Not recommended

**The Sherwin-Williams Company**

Cleveland, OH 44115
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 MERCHANTABILITY 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 LOSS OF 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.
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, < 25,000 ohms
ASTM F-150

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 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

<table>
<thead>
<tr>
<th>SQUARE FEET PER GALLON</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE</td>
</tr>
<tr>
<td>Primer 67</td>
</tr>
<tr>
<td>Primer 67C</td>
</tr>
</tbody>
</table>

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 C-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:

| Primer 67  | Component A | 1 gal. |
| Primer 67C | Component A | 1 gal. |
| Primer 67C | 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:

<table>
<thead>
<tr>
<th>TEMPERATURE (°F)</th>
<th>POT LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°</td>
<td>30 min.</td>
</tr>
<tr>
<td>75°</td>
<td>60 min.</td>
</tr>
<tr>
<td>90°</td>
<td>30 min.</td>
</tr>
</tbody>
</table>

At 75°F the pot life and thin film cure of Primer 67 can be decreased by the addition of Accelerator #1 as follows:

<table>
<thead>
<tr>
<th>OZS./ACCELERATOR #1</th>
<th>POT LIFE</th>
<th>THIN FILM CURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>per mixed gal. Primer 67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>35 min.</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>6-7</td>
<td>15 min.</td>
<td>2 hrs.</td>
</tr>
</tbody>
</table>

Using 7 ounces of accelerator #1 per mixed gallon of Primer 67, the thin film cure @ 40°F is reduced to 6 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:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Minimum Recoat Time</th>
<th>Maximum Recoat Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>12 hrs.</td>
<td>8 Days</td>
</tr>
<tr>
<td>75°F</td>
<td>6-8 hrs.</td>
<td>5 Days</td>
</tr>
<tr>
<td>90°F</td>
<td>4-5 hrs.</td>
<td>3 Days</td>
</tr>
</tbody>
</table>

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 (Setalash) 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.
Dudick Inc.
Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Sicklerville, Ohio 44241
216-542-1970
FAX No. 216-542-7638

Protecto-Coat 200
ELASTOMERIC, SPRAY APPLIED, ENVIRONMENTALLY SAFE, URETHANE COATING. 40-60 MILS (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 alkalis. Also resistant to aliphatic solvents.

PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Protecto-Coat 200</th>
<th>40 Mil Basecoat</th>
<th>20 Mil Topcoat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (PSI) ASTM C-307</td>
<td>2,400-2,800</td>
<td>2,800-3,500</td>
</tr>
<tr>
<td>Elongation*</td>
<td>225% to 250%</td>
<td>50 to 60%</td>
</tr>
<tr>
<td>Shore D Hardness</td>
<td>45-45</td>
<td>65-70</td>
</tr>
<tr>
<td>Abrasion Resistance CS 17 wheel/1000 cycles</td>
<td>10 mg</td>
<td>32 mg</td>
</tr>
<tr>
<td>x 1000 gms</td>
<td>weight loss</td>
<td>weight loss</td>
</tr>
<tr>
<td>Solids by Volume</td>
<td>80%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*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 07 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

<table>
<thead>
<tr>
<th>SQUARE FEET PER GALLON</th>
<th>CONCRETE</th>
<th>STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primer 67</td>
<td>150-200</td>
<td>250-300</td>
</tr>
<tr>
<td>2 Base Coats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>35-40 mil DFT</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Top Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>16-20 mil DFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-10 Solvent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 blast-blasted or etched with muriatic acid (solution of 1 part 20% 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 D4544.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance is 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. oz.

*Premeasured units by weight

Protecto-Coat 200 Topcoat
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 Proteco-Cote Liquid and mix thoroughly until a uniform color is achieved. Apply a 20-mil-thick topcoat using spray, brush or roller.

**Cure Cycle for Proteco-Cote 200**

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>RECOAT TIME</th>
<th>CURE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>48 Hrs.</td>
<td>96 Hrs.</td>
</tr>
<tr>
<td>70°F</td>
<td>24 Hrs.</td>
<td>48 Hrs.</td>
</tr>
<tr>
<td>90°F</td>
<td>16 Hrs.</td>
<td>36 Hrs.</td>
</tr>
</tbody>
</table>

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 46 to 1 spray pump or equivalent. Use Graco Golden Mastic Gun or Graco No. 207445 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 Proteco-Cote 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:

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>POT LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>120 Min.</td>
</tr>
<tr>
<td>75°F</td>
<td>60 Min.</td>
</tr>
<tr>
<td>90°F</td>
<td>45 Min.</td>
</tr>
</tbody>
</table>

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 Proteco-Cote liquid mixed with the appropriate amount of hardener. Retest only the repairs.

**CLEANING**

Use S-10 Solvent to clean tools and equipment.

**SHIPPING**

Proteco-Cote 200 Topcoat A and B and Proteco-Cote 200 Basecoat A are classified as plastic liquids and are non-regulated.

Proteco-Cote 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, Proteco-Cote 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. Proteco-Cote Systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Proteco-Cote systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.
If Proteco-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. Proteco-Coat liquid may be washed off with S-10 Cleaning Solvent, MEK liquid, or lacquer 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 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.
Waste Analysis
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 (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 270.1)
* 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, Ph.D.
Chemist

Submission #: 9408000203 lims

NOTE: Submitted material will be retained for 60 days unless notified or consumed in analysis. Material determined to be hazardous will be returned or a $20 disposal fee will be assessed. Our letters and reports are for the exclusive use of the client to whom they are addressed. Use of our name and reports must receive our prior written approval. Our letters and reports apply to the sample tested and/or inspected, and are not necessarily indicative of the qualities of apparently identical or similar materials.
**Client Name:** USPCI  
**Submission #:** 9408000203  
**Project Name:** HEAT EXCHANGERS  
**Report Date:** 08/28/94  

**Sample #:** TREATED EXHAUST BLOWOFF  
**Laboratory ID #:** 35372  
**Sample Container:** 5-gallon Plastic  
**Sampling Location:** Not listed on the chain of custody.  
**Sampling Date:** Not listed on the chain of custody.  
**Temperature (Celsius):** 21

### ALKALINITY, TOTAL (EPA 310.1)

**Analyte:** Total Alkalinity  
**Result (mg/l):** 7800  
**Det Limit:** 1

### ANION/CATION RATIO (CALCULATION)

**Analyte:** Anion/Cation Ratio  
**Result (%):** 1.00  
**Det Limit:** 0

### CALCIUM/Ca (EPA 216.1)

**Analyte:** Calcium  
**Result (mg/l):** 30.2  
**Det Limit:** 0.01

### CHLORIDE (EPA 300.6)

**Analyte:** Chloride  
**Result (mg/l):** 145000  
**Det Limit:** 0.1

### CYANIDE, TOTAL (EPA 335.2)

**Analyte:** Total Cyanide  
**Result (mg/l):** 23.9  
**Det Limit:** 0.20

### NIESSE TOTAL (BASED ON AAS/ICP)

**Analyte:** Hardness, Calculated  
**Result (mg/l):** 1500  
**Det Limit:**

### ICP SCAN (EPA 200.7)

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result (mg/l)</th>
<th>Det Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>&lt;0.0120</td>
<td>0.0120</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.072</td>
<td>0.0014</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.112</td>
<td>0.0148</td>
</tr>
<tr>
<td>Copper</td>
<td>0.286</td>
<td>0.0046</td>
</tr>
<tr>
<td>Cobalt</td>
<td>1.38</td>
<td>0.0028</td>
</tr>
<tr>
<td>Lead</td>
<td>0.362</td>
<td>0.042</td>
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<tr>
<td>Manganese</td>
<td>0.034</td>
<td>0.0004</td>
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<tr>
<td>Nickel</td>
<td>&lt;0.0046</td>
<td>0.0246</td>
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<tr>
<td>Antimony</td>
<td>0.286</td>
<td>0.056</td>
</tr>
<tr>
<td>Thallium</td>
<td>0.031</td>
<td>0.0031</td>
</tr>
<tr>
<td>Zinc</td>
<td>32.6</td>
<td>0.044</td>
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<tr>
<td>Arsenic</td>
<td>2.61</td>
<td>0.026</td>
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<tr>
<td>Selenium</td>
<td>2.98</td>
<td>0.107</td>
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<tr>
<td>Aluminum</td>
<td>0.152</td>
<td>0.045</td>
</tr>
<tr>
<td>Barium</td>
<td>&lt;0.0011</td>
<td>0.0011</td>
</tr>
<tr>
<td>Beryllium</td>
<td>31.2</td>
<td>0.069</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>&lt;0.023</td>
<td>0.023</td>
</tr>
<tr>
<td>Tin</td>
<td>&lt;0.017</td>
<td>0.017</td>
</tr>
<tr>
<td>Titanium</td>
<td>0.139</td>
<td>0.0037</td>
</tr>
<tr>
<td>Vanadium</td>
<td>4.08</td>
<td>0.015</td>
</tr>
<tr>
<td>Silicon</td>
<td>1.33</td>
<td>0.0013</td>
</tr>
<tr>
<td>Strontium</td>
<td>12</td>
<td>0.001</td>
</tr>
</tbody>
</table>

### IRON/Fe (EPA 236.1)

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result (mg/l)</th>
<th>Det Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>5.09</td>
<td>0.03</td>
</tr>
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</table>

### MAGNESIUM/Mg (EPA 242.1)

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result (mg/l)</th>
<th>Det Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium</td>
<td>31.7</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Client Name: USPCI  
Submission #: 9408000203  
Project Name: HEAT EXCHANGERS  
Report Date: 08/28/94

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (meq/l)</th>
<th>Det Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH (EPA 150.1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH For Liquid</td>
<td>7.3</td>
<td>0</td>
</tr>
<tr>
<td><strong>POTASSIUM/K (EPA 200.7)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>12300</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>SILICA (EPA 370.1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon Dioxide/Silica</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td><strong>SODIUM/Na (EPA 273.1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>105000</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>SPECIFIC CONDUCTANCE (EPA 120.1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Conductance</td>
<td>78900</td>
<td>1</td>
</tr>
<tr>
<td><strong>SULFATE (EPA 376.4)</strong></td>
<td></td>
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<tr>
<td>Sulfate</td>
<td>30200</td>
<td>1</td>
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<tr>
<td><strong>TDS-TOTAL DISSOLVED SOLIDS (EPA 160.1)</strong></td>
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<tr>
<td>Total Dissolved Solids</td>
<td>299000</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL SUSPENDED SOLIDS (EPA 160.2)</strong></td>
<td></td>
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<tr>
<td>Total Suspended Solids</td>
<td>1440</td>
<td>1</td>
</tr>
</tbody>
</table>
QUALITY CONTROL DATA

<table>
<thead>
<tr>
<th>ANALYTE</th>
<th>DATE ANALYZED</th>
<th>SPIKE VOL</th>
<th>STAND. DEV.</th>
<th>COEFF. OF VAR %</th>
<th>REC1/2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness, Calc.</td>
<td>8/19/94</td>
<td>----</td>
<td>0</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>8/19/94</td>
<td>----</td>
<td>5.7</td>
<td>0.7</td>
<td>100</td>
</tr>
<tr>
<td>Silica</td>
<td>8/25/94</td>
<td>----</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Sulfate</td>
<td>8/19/94</td>
<td>----</td>
<td>0.31</td>
<td>1.2</td>
<td>100</td>
</tr>
<tr>
<td>Chloride</td>
<td>8/25/94</td>
<td>----</td>
<td>178</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>T.S.S.</td>
<td>8/18/94</td>
<td>----</td>
<td>181</td>
<td>10</td>
<td>99</td>
</tr>
<tr>
<td>Total Cyanide</td>
<td>8/25/94</td>
<td>----</td>
<td>0</td>
<td>0</td>
<td>109</td>
</tr>
</tbody>
</table>

Standard Deviation = \((x_1 - x_2)/1.414\)
Coefficient of Variability % = ((S.D./Avg.) \times 100
Recovery % = \(((\text{spiked} - \text{unspiked})/\text{expected}) \times 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.
QUALITY CONTROL DATA

<table>
<thead>
<tr>
<th>ANALYTE</th>
<th>DATE ANALYZED</th>
<th>SPIKE VOL</th>
<th>STAND. DEV.</th>
<th>COEFF. OF VAR %</th>
<th>REC1/%</th>
<th>REC2/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>7/20/94</td>
<td>---</td>
<td>0.141</td>
<td>2.0</td>
<td>102</td>
<td>99</td>
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<tr>
<td>Total Alkalinity</td>
<td>7/26/94</td>
<td>---</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>---</td>
</tr>
<tr>
<td>T.D.S.</td>
<td>7/28/94</td>
<td>995</td>
<td>304</td>
<td>0.1</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Silicon Dioxide/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silica</td>
<td>8/1/94</td>
<td>---</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>---</td>
</tr>
<tr>
<td>Sulfate</td>
<td>8/1/84</td>
<td>---</td>
<td>5</td>
<td>2.4</td>
<td>99</td>
<td>---</td>
</tr>
<tr>
<td>Chloride</td>
<td>7/20/94</td>
<td>500</td>
<td>2.1</td>
<td>1.1</td>
<td>100</td>
<td>99</td>
</tr>
<tr>
<td>Hardness, Calcium</td>
<td>8/1/94</td>
<td>---</td>
<td>±4.2</td>
<td>1.1</td>
<td>110</td>
<td>100</td>
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<tr>
<td>T.S.S.</td>
<td>7/21/94</td>
<td>298</td>
<td>0.7</td>
<td>0</td>
<td>98</td>
<td>95</td>
</tr>
</tbody>
</table>

Standard Deviation = \((x_1-x_2)/1.414\)
Coefficient of Variability % = (S.D./Avg.) X 100

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.
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>2.4</td>
<td>-</td>
</tr>
<tr>
<td>Adenium</td>
<td>0.185</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>0.514</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>1.76</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td>97.6</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>12600</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>0.242</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>1.254</td>
<td></td>
</tr>
<tr>
<td>Tungsten</td>
<td>136000</td>
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</tr>
<tr>
<td>Nickel</td>
<td>35.4</td>
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</tr>
<tr>
<td>Arsenic</td>
<td>0.336</td>
<td></td>
</tr>
<tr>
<td>Antimony</td>
<td>0.198</td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>224</td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>67.2</td>
<td></td>
</tr>
<tr>
<td>Rubidium</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Molybdenum</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Strontium</td>
<td>224</td>
<td></td>
</tr>
<tr>
<td>Lithium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MERCURY DIGESTION (EPA 7470)**
Date of Mercury Digestion: 07/20/94

**MERCURY/Hg BY COLD VAPOR (EPA 246.1)**
Analyte: Mercury

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>0.002</td>
<td></td>
</tr>
</tbody>
</table>

**ALKALINITY, TOTAL (EPA 310.1)**
Analyte: Total Alkalinity

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity, Total</td>
<td>18900</td>
<td>1</td>
</tr>
</tbody>
</table>

**ANION/CATION RATIO (CALCULATION)**
Analyte: Anion/Cation Ratio

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anion/Cation Ratio</td>
<td>1.08</td>
<td>0</td>
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</tbody>
</table>

**BICARBONATE ALKALINITY (EPA 310.1)**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicarbonate Alkalinity</td>
<td>23100</td>
<td>1</td>
</tr>
</tbody>
</table>

**CALCIUM/Ca (EPA 200.7)**
Analyte: Calcium

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>735</td>
<td>0.001</td>
</tr>
</tbody>
</table>
**Name:** USPCI  
**Issue Date:** 08/04/94  
**Name:** HEAT EXCHANGERS  

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Results (mg/l)</th>
<th>Det. Limit</th>
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</thead>
<tbody>
<tr>
<td>ALKALINITY (EPA 110.1)</td>
<td>&lt;1</td>
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<tr>
<td>LORIDE (EPA 300.6)</td>
<td>116000</td>
<td>0.1</td>
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<tr>
<td>ANIDE, TOTAL (EPA 335.2)</td>
<td>&lt;0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>OIL (EPA 200.7)</td>
<td>112</td>
<td>0.013</td>
</tr>
<tr>
<td>Mg (EPA 200.7)</td>
<td>222</td>
<td>0.030</td>
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<tr>
<td>I (EPA 150.1)</td>
<td>13</td>
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<tr>
<td>SS (EPA 370.1)</td>
<td>17400</td>
<td>0.010</td>
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<tr>
<td>Oxide/Silica</td>
<td>400</td>
<td>2</td>
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<tr>
<td>ODIUM/Na (EPA 200.7)</td>
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<tr>
<td>SPECIFIC CONDUCTANCE (EPA 120.1)</td>
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<tr>
<td>SPECIFIC GRAVITY (USP 841)</td>
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<tr>
<td>SULFATE (EPA 375.4)</td>
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<tr>
<td>TDS-TOTAL DISSOLVED SOLIDS (EPA 160.1)</td>
<td>417000</td>
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</tr>
<tr>
<td>TSS-TOTAL SUSPENDED SOLIDS (EPA 160.2)</td>
<td>6780</td>
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</table>
# QUALITY CONTROL DATA

<table>
<thead>
<tr>
<th>ANALYTE</th>
<th>DATE ANALYZED</th>
<th>SPIKE VOL</th>
<th>STAND. DEV.</th>
<th>COEFF. OF VAR %</th>
<th>REC1/%</th>
<th>REC2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>7/20/94</td>
<td>...</td>
<td>0.141</td>
<td>2.0</td>
<td>102</td>
<td>99</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>7/26/94</td>
<td>...</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>...</td>
</tr>
<tr>
<td>T.D.S.</td>
<td>7/28/94</td>
<td>304</td>
<td>0.1</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon Dioxide/Silica</td>
<td>8/1/94</td>
<td>...</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>...</td>
</tr>
<tr>
<td>Sulfate</td>
<td>8/1/94</td>
<td>5</td>
<td>2.4</td>
<td>99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>7/26/94</td>
<td>2.1</td>
<td>1.1</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardness, Calcium</td>
<td>8/1/94</td>
<td>±4.2</td>
<td>1.1</td>
<td>110</td>
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<td></td>
</tr>
<tr>
<td>T.S.S.</td>
<td>7/23/94</td>
<td>0.7</td>
<td>0</td>
<td>98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard Deviation = (x1* x2)/1.414
Coefficient of Variability % = (S.D./Avg.) X 100

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.
Tank Drawings
<table>
<thead>
<tr>
<th>USE</th>
<th>NOMINAL DIAMETER D</th>
<th>T</th>
<th>ROLL RADIUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHELL MANHOLE</td>
<td>30&quot;</td>
<td>3/8</td>
<td>SHELL RADIUS</td>
</tr>
<tr>
<td>VIEWPORT</td>
<td>21 7/8 x 10 7/8</td>
<td>3/8</td>
<td>SHELL RADIUS</td>
</tr>
<tr>
<td>INFUENT</td>
<td>8&quot;</td>
<td>3/8</td>
<td>SHELL RADIUS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>R</th>
<th>A'</th>
<th>B'</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>62&quot;</td>
<td>31&quot;</td>
<td>13 1/2&quot;</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>46&quot;</td>
<td>36&quot;</td>
<td>104&quot;</td>
<td>5 7/8&quot;</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>19&quot;</td>
<td>8 3/4&quot;</td>
<td>4 3/8&quot;</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

ONE 1" TELLTALE HOLE IN REINFORCING PLATE, HOLE SHALL BE LOCATED ON HORIZONTAL CENTERLINE AND HAVE STD. PIPE THREADS.
Ancillary Equipment Drawings
Secondary Containment Drawings
SECTION T-6
ASSESSMENT OF WASTEWATER STORAGE TANK T-6
CLEAN HARBORS’ WAYNOKA FACILITY

For:

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.

Prepared by:

ENVIROTECH
ENGINEERING & CONSULTING, INC.

August 2018
18176.00
Contents

1. INTRODUCTION ............................................................................................................... 3
2. TANK SYSTEM DESCRIPTION .......................................................................................... 3
3. PRIMARY TANK VESSEL .................................................................................................. 3
   3.1 GENERAL DESCRIPTION OF WASTEWATER STORAGE TANK (T6) ........................................... 3
   3.2 DESIGN STANDARDS ......................................................................................................... 4
   3.3 HAZARDOUS CHARACTERISTICS OF WASTES STORED ................................................. 4
   3.4 EXISTING CORROSION PROTECTION ................................................................................. 5
   3.5 DOCUMENTED AGE OF TANK .......................................................................................... 5
   3.6 RESULT OF LEAK TESTS .................................................................................................. 5
   3.7 EXISTING DATA AVAILABLE .......................................................................................... 5
   3.8 STRUCTURAL CALCULATION .......................................................................................... 5
   3.9 COMPARISON TO ACTUAL STRUCTURE TO THEORETICAL VALUES .................................... 6
4. SECONDARY CONTAINMENT SYSTEM ............................................................................. 8
   4.1 GENERAL DESCRIPTION OF SECONDARY CONTAINMENT ............................................. 8
   4.2 DESIGN STANDARDS ......................................................................................................... 8
   4.3 HAZARDOUS CHARACTERISTICS OF WASTES STORED ................................................. 8
   4.4 EXISTING CORROSION PROTECTION ................................................................................. 8
   4.5 DOCUMENTED AGE OF THE CONTAINMENT AREA .......................................................... 9
   4.6 RESULT OF LEAK TESTS .................................................................................................. 9
   4.7 EXISTING AVAILABLE DATA .......................................................................................... 9
   4.8 STRUCTURAL CALCULATIONS .......................................................................................... 9
   4.9 COMPARISON OF ACTUAL STRUCTURE THEORETICAL VALUES ...................................... 10
   4.10 CALCULATION OF EXISTING CAPACITY ....................................................................... 10
5. FOUNDATION AND SHELL SETTLEMENT ANALYSIS .................................................... 10
6. ANCILLARY EQUIPMENT ................................................................................................... 11
   6.1 MANWAYS ......................................................................................................................... 11
   6.2 STAIRWAY AND PLATFORM ............................................................................................. 11
   6.3 NOZZLE FLANGES ............................................................................................................. 11
   6.4 LOAD LINES ....................................................................................................................... 11
   6.5 LEAK DETECTION SYSTEM .............................................................................................. 11
7. CONCLUSIONS .................................................................................................................. 12
   7.1 PRIMARY AND SECONDARY TANK USE ......................................................................... 12
   7.2 LIFE EXPECTANCY ............................................................................................................ 12
8. RECOMMENDATIONS ....................................................................................................... 12
   8.1 COMPATIBLE STORAGE .................................................................................................. 12
   8.2 CONTROL LIQUID HEIGHT .............................................................................................. 12
   8.3 DRAINAGE CONTROL ..................................................................................................... 12
   8.4 ROUTINE INSPECTIONS .................................................................................................. 12
   8.5 CORROSION PROTECTION ............................................................................................. 13
9. CERTIFICATION ................................................................................................................ 14
LIST OF FIGURES:

FIGURE 1. INTERIOR WALL SCHEMATIC
FIGURE 2. TANK THICKNESS MEASUREMENTS (WITH COATING)
FIGURE 2a. TANK THICKNESS MEASUREMENTS OF CORROSIVE FLOOR PITS
FIGURE 2b. TANK THICKNESS MEASUREMENTS OF STRIPPED FLOOR

LIST OF APPENDICES:

APPENDIX A. TANK SYSTEM VOLUME AND WEIGHT CALCULATIONS
APPENDIX B. PRIMARY & SECONDARY TANK THICKNESS CALCULATIONS
APPENDIX C. AS-BUILT PLANS
APPENDIX D. SECONDARY CONTAINMENT VOLUME CALCULATIONS
APPENDIX E. STRUCTURAL SUPPORT CALCULATIONS
APPENDIX F. TANK SYSTEM MEASUREMENT AND SETTLEMENT CALCULATIONS
1. INTRODUCTION

Envirotech Engineering and Consulting, Inc. performed professional engineering services for producing the following inspection and assessment of the T-6 Wastewater Storage Tank at the Lone Mountain Facility at Waynoka, Oklahoma and which is operated by Clean Harbors Environmental Services, Inc. Inspections were performed by Envirotech on May 21st, June 5th and August 23, 2018. The inspections and assessments were performed for the purpose of fulfilling the recommended update of the previous reported assessment by Envirotech in September of 2013.

The inspections included visual and sonic measurement of steel plate thicknesses of the walls and floors of the tank. Data and calculations from the previous assessment are included in this report and its appendices since Tank T-6 has demonstrated insignificant changes such that remains consistent with that data.

2. TANK SYSTEM DESCRIPTION

Wastewater Storage Tank (T6) is an on-ground wastewater storage tank installed in 1987. This tank has stored both raw leachate and treated wastewater (concentrate and sludge) in the past. The tank is vertical in position and cylindrical in shape. The tank is completely open to the atmosphere for evaporation purposes. Wastewater Storage Tank T6 is located in the central portion of the Lone Mountain Facility. A stairway, platform and walkway are located on the east side of the tank. The tank employs a tape float gage for liquid level measurement.

Wastewater Storage Tank (T6) is enveloped by a larger steel tank. The second steel tank is for the purpose of secondary containment. The annular tank space between the sides of the inner and outer tank is large enough for persons to enter and perform inspections. The distance between the bottoms of the inner and outer tank is only approximately 12-in. and is filled with pea gravel; therefore entry for direct inspection is impossible directly underneath the primary tank. Therefore, inspection of the secondary floor was evaluated under the gravel between the walls of the two tanks. This was considered adequate representation of the secondary floor.

3. PRIMARY TANK VESSEL

3.1 General Description of Wastewater Storage Tank (T6).

Wastewater Storage Tank (T6) consists of circular steel tank with an inside wall diameter of 100-ft. The tank has a maximum operating volume of 1,409,994.96-gal. (see Appendix A – Tank System Volume and Weight Calculations). The tank walls were initially constructed with three courses of steel plates. The first or bottom course was constructed of 5/16-in. A-36 steel. The second and third courses were constructed of ¼ in. A-36 steel. This is shown in Figure 1. The bottom the tank was
constructed of ¼-in. A-36 steel. A pea gravel base filter detection system is located directly under the tank.

Wastewater Storage Tank (T6) was assessed to determine if the unit remained adequately designed with sufficient structural strength and compatibility with the waste to be stored. To conduct the assessment, the contents of the tank were removed and the tank was thoroughly washed and cleaned.

The Tank T-6 was opened for inspection by Clean Harbors personnel who managed the confined entry requirements. The principal inspection was performed on May 21, 2018 by Envirotech personnel. Follow-up inspections were performed on June 5th and August 23rd, 2018 to obtain additional thickness information needed to complete this report.

The inspection included inspecting regular locations inside the lower wall levels between the tank walls. Inspection of the interior walls and floor as well as the exterior wall surfaces were also measured for metal thickness. Note that the secondary wall is constructed the same except the middle plate has a design thickness of 0.3125 inches. Envirotech performed a visual inspection and ultrasonic thickness measurement survey of the entire tank bottom as well as the first course and bottom section of the second course of the tank shell. The upper section of the tank was not tested because storage had not and would not occur at that height. The black tank coating was visually observed to be intact without noticeable damage to its surface. Steel thickness readings are shown on Figure 2 regarding the interior wall surface of the primary tank, the exterior wall of the secondary tank, and floor thickness measurements of the primary and secondary tank floors.

It will be mentioned at this time that the secondary walls and floor section were also inspected at the same time. The results of that inspection are reported in section 4 of this report. The wall section thickness of the outer wall is similar to the primary tank except the middle section is constructed with 0.3125-inch steel plate. The secondary tank floor thickness was measured at the area between the tank walls and results indicated adequate thickness of steel exists at those locations. No history or other information suggests the secondary floor has experienced measurable degradation.

3.2 Design Standards.

Original tank structure calculations located in Appendix B were performed to compare the existing tank to those sections that were applicable in the American Petroleum Institute Standard 650 – 1988 Edition API-650 – (New Tank Standards) and API 653-1992 (Tank Inspection, Repair, Alteration and Reconstruction) where applicable. Those calculations can be found in Appendix B of this report. The tank was earlier reported to have been constructed by Maloney Crawford of Tulsa, Oklahoma and the design drawings indicated that the tank was fabricated and erected in accordance with API Standard 650.

3.3 Hazardous Characteristics of Wastes Stored.

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

Wastewater, Wastewater Concentrate and Leachate
LEGEND INTERIOR & EXTERIOR TANKS

<table>
<thead>
<tr>
<th></th>
<th>INT 0.000</th>
<th>EXTERIOR &amp; EXTERIOR TANKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.000</td>
<td>Bottom of Middle Plate</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>Bottom of Lower Plate</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>Center of Lower Plate</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>Bottom of Middle Plate</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>Center of Lower Plate</td>
</tr>
</tbody>
</table>

NOTE: All thickness measurements are after coating.

Tank Thickness Measurements
Clean Harbors TankT-6 Inspection
Figure 2
013266-00
pH (4-13)
N > 6
Temperature = Ambient to 210° F

The hazardous characteristics of the waste treated in this tank were previously examined and 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 tank material type and thickness.

### 3.4 Existing Corrosion Protection.

Visual inspection of the primary tank revealed that the inside of the tank had been previously coated with coal tar epoxy coating. It was reported by Clean Harbors that the tank interior was recently sandblasted to prepare the surface for re-coating with a new layer of coal tar epoxy.

The exterior of the tank (between the outer secondary and inner primary wall) was inspected during the confined space entry. There is no coating on the interior surface, however the steel wall material appeared rust-coated but in good condition.

### 3.5 Documented Age of Tank.

This tank was erected and installed in 1987. The tank is 31-years old.

### 3.6 Result of Leak Tests.

A leak test has not been performed upon this vessel and is not required since the interior of the primary tank was inspected.

### 3.7 Existing Data Available.

<table>
<thead>
<tr>
<th>Diameter of Tank</th>
<th>100-ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>24-ft.</td>
</tr>
<tr>
<td>(Maximum Operating Level)</td>
<td>19-ft.</td>
</tr>
<tr>
<td>Material</td>
<td>A36 (Design)</td>
</tr>
<tr>
<td>Wall Thickness First Course</td>
<td>.3125-in.</td>
</tr>
<tr>
<td>Wall Thickness Second Course</td>
<td>.25-in.</td>
</tr>
<tr>
<td>Wall Thickness Third Course</td>
<td>.25-in.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.3</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Maximum Volume</td>
<td>188,502-c.f.</td>
</tr>
<tr>
<td>Seismic Zone</td>
<td>1</td>
</tr>
</tbody>
</table>

### 3.8 Structural Calculation.

The required thickness of the primary tank first course tank wall (as per API 653 – 1992) was calculated to be 0.3771-in., if the tank were filled to capacity (24-ft.) with material having a specific gravity of 1.3. This required thickness is greater than the original measured average thickness of 0.3154-in and
therefore would not over stress the tank. The table below presents allowable tank fluids heights for specific gravities ranging from 1.0 – 1.3. Appendix B (Primary Tank Wall Thickness Calculations) presents detailed calculations for the three courses of primary tank based on specific gravity of 1.3 and a 19-ft. maximum fluid level. Also see section 3.9 regarding maximum liquid level.

<table>
<thead>
<tr>
<th>ALLOWABLE FLUID HEIGHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp. Gr.</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td>1.1</td>
</tr>
<tr>
<td>1.2</td>
</tr>
<tr>
<td>1.3</td>
</tr>
</tbody>
</table>

### 3.9 Comparison to Actual Structure to Theoretical Values.

<table>
<thead>
<tr>
<th>WALL THICKNESS COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Minimum Thickness</td>
</tr>
<tr>
<td>1st Course</td>
</tr>
<tr>
<td>2nd Course</td>
</tr>
<tr>
<td>3rd Course</td>
</tr>
</tbody>
</table>

*Based on a specific gravity of 1.3 of a fluid height of 19-ft.

Notes:
1. Evaluated combined metal and coating.
2. 3rd course not measured since liquid level not planned to extend high enough to impact the surface as reported by Clean Harbors and visually observed by Envirotech.

<table>
<thead>
<tr>
<th>BOTTOM THICKNESS COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured Thickness</td>
</tr>
<tr>
<td>Bottom</td>
</tr>
</tbody>
</table>

During the initial tank inspection on May 21, 2018, Envirotech noted that significant corrosion had occurred primarily in the south end of the tank. During their second inspection on June 5, 2018, Envirotech observed several spot locations of corrosion which were ground to a flat surface to accommodate measurements that revealed the net remaining floor thickness was about 0.220 inches (see figure 2a). Since the cause and period of time could not be determined, it was recommended to replace the affected metal flooring. This was also based on APR 653 which states that minimum floor thickness is 0.010 inches for a tank without secondary containment. Even though this tank has such containment, use of the 0.010 inch criteria was considered an appropriate engineering factor of safety. Clean Harbors elected to continue with sandblasting the floor and the Envirotech engineer...
NOTE:
Roman Numerals denote calibration points
Floor thickness measurements are before coating
provided additional floor thickness data. It was demonstrated that the original floor is 0.250 inches thick (see Figure 2b). It was also demonstrated that corrosion was about 0.060 inches deep resulting in a floor thickness of about of 0.190 inches due to corrosion. Envirotech then reported to Clean Harbors that coating may progress since the tank bottom had adequate thickness. See photos below.
Area of Corrosion
4. SECONDARY CONTAINMENT SYSTEM

4.1 General Description of Secondary Containment

(The following information is provided by 1997 tank inspection report).

The secondary containment system consists of an outer tank shell 108-ft. in diameter. The outer shell height is 24-ft. The tank walls were constructed using three course of steel plates which were welded together. The first and second courses were constructed of 5/16-in. A-36 steel while the third course was constructed of ¼-in. A-36 steel. The tank bottom was constructed of ¼-in. A-36 steel.

Initially, the tank was built on a native soil pad with a crushed rock layer of approximately 6-in. The tank pad was elevated and surface drainage moved away from the tank. Over time, the area around the tank had filled in to the point that surface water stood around the tank after rainfall events. The impact is that standing water under the tank may enhance bottom corrosion. This has been minimized through ongoing maintenance to create drainage away from the base of the tank as visually observed by Envirotech in the current inspection. A 12-in. layer of pea gravel was installed between the secondary containment tank floor and the primary tank floor and acts as a leak detection and collection system. This is demonstrated in the as-built plans in Appendix C.

4.2 Design Standards.

The tank was earlier reported as constructed by Maloney Crawford of Tulsa, Oklahoma. The design drawings indicated that the tank was fabricated and erected in accordance with API Standard 650 at that time.

4.3 Hazardous Characteristics of Wastes Stored.

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

- Wastewater, Wastewater Concentrate and Leachate
  - pH (4-13)
  - N > 6
  - Temperature = Ambient to 210° F

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

4.4 Existing Corrosion Protection.

The interior of the tank was inspected during the confined space entry. There is no coating on the interior surface, however the material appeared in good condition. The exterior of the tank is painted with an epoxy paint as corrosion protection.
4.5 **Documented Age of the Containment Area.**

The secondary containment vessel was erected in 1987 thus making the containment system 31-years old.

4.6 **Result of Leak Tests.**

No leak tests have been performed.

4.7 **Existing Available Data.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of Tank</td>
<td>108-ft.</td>
</tr>
<tr>
<td>Height</td>
<td>24-ft.</td>
</tr>
<tr>
<td>(Maximum Operating Level)</td>
<td>19-ft.</td>
</tr>
<tr>
<td>Material</td>
<td>A36 (Design)</td>
</tr>
<tr>
<td>Wall Thickness First Course</td>
<td>.3125-in.</td>
</tr>
<tr>
<td>Wall Thickness Second Course</td>
<td>.3125-in.</td>
</tr>
<tr>
<td>Wall Thickness Third Course</td>
<td>.25-in.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.3</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Seismic Zone</td>
<td>1</td>
</tr>
</tbody>
</table>

4.8 **Structural Calculations.**

The required thickness of the secondary containment was previously determined to be a function of the specific gravity of the fluid and the corresponding fluid height in the primary vessel. Based on the Allowable Fluid Heights presented in Section 3-8, the maximum fluid heights that would be experienced in the secondary containment, range from 16-ft. to 20-ft. (see *Appendix D – Secondary Containment Volume Calculations*). The calculated minimum thicknesses associated with these fluid heights and specific gravities are presented below:

<table>
<thead>
<tr>
<th>Maximum Fluid Height (ft)</th>
<th>Specific Gravity of Fluid</th>
<th>Calculated Minimum Thickness – 1st Course (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0</td>
<td>1.3</td>
<td>0.2841</td>
</tr>
<tr>
<td>20.0</td>
<td>1.0</td>
<td>0.2784</td>
</tr>
</tbody>
</table>

*Appendix B (Secondary Tank wall Thickness Calculations)* presents detailed calculations based on a maximum fluid height of 16-ft. and a fluid specific gravity of 1.3. Note that under these conditions, fluid would never reach the third course of the secondary containment. *Appendix B* does however present a thickness calculation for the third course based on the 20-ft. maximum fluid height and specific gravity of 1.0.
A seismic design check was performed pursuant to API 650. Both the overturning moment and shell compression calculations indicate the tank being stable (see Exhibit E – Structural Support Calculations.)

A wind loading check was performed pursuant to API 650. These calculations indicate the tank is stable. (see Exhibit E – Structural Support Calculations).

### 4.9 Comparison of Actual Structure Theoretical Values.

<table>
<thead>
<tr>
<th>WALL THICKNESS COMPARISON</th>
<th>Calculated Minimum Thickness</th>
<th>Measured Thickness</th>
<th>Thickness Meets Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st &amp; 2nd Course</td>
<td>0.2841-in.</td>
<td>0.3300-in.</td>
<td>Yes</td>
</tr>
<tr>
<td>3rd Course</td>
<td>0.108-in.</td>
<td>0.2870-in.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BOTTOM THICKNESS COMPARISON</th>
<th>Measured Thickness</th>
<th>Minimum Thickness (per API 650)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>0.221</td>
<td>0.2500-in.</td>
</tr>
</tbody>
</table>

### 4.10 Calculation of Existing Capacity.

The secondary containment vessel envelopes the primary tank. If the primary tank leaks, the contents would flow into the secondary vessel and the hydraulic grade lines between the two tanks would equalize thus containing the contents of the primary tank.

### 5. FOUNDATION AND SHELL SETTLEMENT ANALYSIS

The total weight of tank systems was previously calculated to be 8,372-tons. (see Appendix A – Tank System Volume and Weight Calculations). The weight of the tank system is distributed equally over the entire area of the secondary containment tank bottom. This yields a foundation loading of 1827.79-psf. Although no foundation investigation was performed prior to the construction of the T6 tank system, other work and investigation on the Lone Mountain site have resulted in allowable soil loading in excess of 2500-psf.

The foundation loading attributable to resistance of an overturning moment as a result of seismic forces, was calculated to be 601.00-psf, again well below the 2500-psf limit (see Appendix E – Structural Support Calculations Shell Compression).
During the tank inspection, elevation measurements were taken at eight (8) points around the circumference of the tank to determine if settlement was occurring. The maximum out-of-plane settlement was computed pursuant to API 653 Appendix B and compared with the settlement found from the elevation measurements. The maximum allowable settlement was computed to be 0.42-ft. and the maximum measured settlement was found to be 0.23-ft (see Appendix F – Tank System Measurements and Settlement Calculations).

6. ANCILLARY EQUIPMENT

6.1 Manways.

Located in both the primary and secondary tanks are manways with a neck diameter of 24-in. The center of the manways are located approximately 30-in. from the bottom of the tanks. The manways are secured with flange plates 2-ft. 8-in. in diameter which are held in place with 8 7/8-in. dia. Bolts. Both manways were visually inspected by Envirotech Services, Inc. and found in good condition.

6.2 Stairway and Platform.

Affixed to the exterior of secondary containment tank is a metal access stairway that leads from the ground to a platform located at the top of the tank. The stairway and platform are bolted to brackets which are welded to the tank.

Located on the interior of the primary tank is a vertical steel ladder which connects to welded brackets on the side of the tank. The condition of the stairway, platform, ladder and attachment bracket all appear good.

6.3 Nozzle Flanges.

Six (6) nozzle flanges are located around the perimeter walls of both the primary and secondary tanks (see Diagrams T-6 In and T-6 Out in Appendix B). The sizes of the nozzles range from 2-in. to 8-in. in diameter. Nozzles designs are such that piping may be connected to the interior and exterior sections resulting in a piping linkage from the interior of the primary tank to the exterior of the secondary tank. Currently all nozzles are blanked off, and no piping connects the interior and exterior tanks. All of the nozzles were visually inspected by Envirotech Services, Inc. and found in good condition.

6.4 Load Lines.

Load lines were not in place during the inspection and therefore are not included in this assessment.

6.5 Leak Detection System.

Leak detection for the tank system is provided by a network of four (4) collection boxes located equidistant around the perimeter of the secondary containment tank. If a leak occurs in either the bottom or sides of the primary tank, the fluid should travel through the gravel pack and end up at one of the four (4) collection boxes. The fluid then passes under the lip of the gravel stop section of the collection box, found in the interior of the secondary containment tank, and enters the leak detection
piping which transports it to the exterior of the tank. The exterior piping is blanked with a gate valve and contains a sight glass for inspection purposes. The exterior piping, the gate valve and the sight glass are all contained within a secondary containment vault which is located on the exterior of the tank.

7. CONCLUSIONS

7.1 Primary and Secondary Tank Use.

The primary and secondary tanks were assessed in this document pursuant to API 650-88 and API 653-2009 where applicable. The tank vessels, at the time of the inspection, were determined appropriate for use with the present waste stream at given densities, chemical, and physical characteristics as verified by Clean Harbors Environmental Services, Inc. It was noted that the primary tanks operating height should be restricted based on the apparent and reported maximum height as visually observed and regarding specific gravity of the fluid and its associated height restriction in Section-3.8.

7.2 Life Expectancy.

Based on the information presented and fluid height restriction noted, the useful life of the tanks is estimated to be an additional 15-yrs. However, corrosion of the interior tank shall be carefully observed to preempt internal steel lining failure due to corrosion. Repair of the floor plates may be required if corrosion continues as noted in this report.

8. RECOMMENDATIONS

8.1 Compatible Storage.

Clean Harbors should continually insure compatibility with the waste and densities stored in the tank.

8.2 Control Liquid Height.

Maintain a management system or alarm to ensure that the fluid height does not exceed that specified in Section-3.8 of the report.

8.3 Drainage Control.

Maintain site work around the perimeter of the tank to direct storm water away from the tank.

8.4 Routine Inspections.

Monthly visual inspections of the tank exterior should be conducted. This inspection should include each of the four (4) sight glasses associated with the leak detection system. If routine and preventative measures results in the tank being empty, consideration should be given to making periodic interior inspection.
8.5 Corrosion protection.

Continue routine painting of the tank exterior.
9. 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 the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including possibility of fine and imprisonment for known violations.

Ron Erdman, P.E.
License No. OK12502

Date

6-28-2018

CA1960
6-30-2020
Appendix A
T6, Wastewater Storage Tank

TANK SYSTEM VOLUME AND WEIGHT CALCULATIONS

DIMENSIONS:
Geometry: Cylindrical
Diameter (Primary Tank): 100.00 Feet
Diameter (Secondary Tank): 108.00 Feet
Height: 24.00 Feet
Operating Height: 19.00 Feet
Bottom: Flat

PRIMARY TANK VOLUME
Maximum Volume = 188,502.00 C.F.
Operating Volume = 149,230.75 C.F.

Total Primary Tank Volume = 188,602.00 C.F.
 = 1,409,994.66 Gal.

TANK SYSTEM WEIGHTS

| CONTENTS S.G. | 1.30 |
| DENSITY      | 81.12 LB/C.F. |

WEIGHT OF PRIMARY TANK CONTENTS: 7,845.64 TONS

TANK WEIGHT - PRIMARY TANK

SURFACE AREA CALCULATIONS

Tank Bottom = 7,854.25 S.F.
Tank Wall = Cir*h = 7,540.08 S.F.
Total Surface Area: 15,394.33 S.F.

TANK WEIGHT CALCULATIONS

Steel Thickness:
Bottom = 0.2500 inches
Tank Wall (1st. course) = 0.3125 inches
Tank Wall (2nd. & 3rd. Courses) = 0.2500 inches

Volume of Steel:
Bottom = 163.63 C.F.
Tank Wall = 170.16 C.F.
Density of Steel = 490.00 LB/C.F.

TOTAL PRIMARY TANK WEIGHT: 81.78 TONS
T6, Wastewater Storage Tank
TANK SYSTEM VOLUME AND WEIGHT CALCULATIONS

TANK WEIGHT - SECONDARY TANK

SURFACE AREA CALCULATION:

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank Bottom</td>
<td>9,161.20</td>
<td>S.F.</td>
</tr>
<tr>
<td>Tank Wall</td>
<td>8,144.29</td>
<td>S.F.</td>
</tr>
<tr>
<td><strong>Total Surface Area</strong></td>
<td>17,305.48</td>
<td>S.F.</td>
</tr>
</tbody>
</table>

TANK WEIGHT CALCULATION:

Steel Thickness:

<table>
<thead>
<tr>
<th>Description</th>
<th>Thickness</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>0.2500</td>
<td>inches</td>
</tr>
<tr>
<td>Tank Wall (1st &amp; 2nd Courses)</td>
<td>0.3125</td>
<td>inches</td>
</tr>
<tr>
<td>Tank Wall (3rd. Course)</td>
<td>0.2500</td>
<td>inches</td>
</tr>
</tbody>
</table>

Volume of Steel:

<table>
<thead>
<tr>
<th>Description</th>
<th>Volume</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>190.86</td>
<td>C.F.</td>
</tr>
<tr>
<td>Tank Wall</td>
<td>197.97</td>
<td>C.F.</td>
</tr>
</tbody>
</table>

Density of Steel = 490.00 LB/C.F.

**TOTAL SECONDARY TANK WEIGHT**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>65.26</td>
<td>TONS</td>
</tr>
</tbody>
</table>

Volume of pea gravel bed

<table>
<thead>
<tr>
<th>Volume</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,161.20</td>
<td>C.F.</td>
</tr>
</tbody>
</table>

Density of pea gravel = 120.00 LB/C.F.

**TOTAL PEA GRAVEL WEIGHT**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>549.67</td>
<td>TONS</td>
</tr>
</tbody>
</table>

**TOTAL TANK SYSTEM WEIGHT**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,372.35</td>
<td>TONS</td>
</tr>
</tbody>
</table>

Foundation Loading = 1827.79 psf
Appendix B
T6, Wastewater Storage Tank
PRIMARY TANK WALL THICKNESS

**DIMENSIONS:**
Geometry: Cylindrical
Diameter: 100.00 feet
Height: 19.00 feet
Specific Gravity: 1.3
Normal Operating temperature: Ambient

**FIRST COURSE**
Thickness \( t \) = \( (2.5^*H-1^*D^*S.G.)/(s^*E) \)

- \( s = \text{Allowable Design Stress} = 24,708 \text{ psi} \)
- \( E = \text{Joint Efficiency} = 100\% \)
- Calculated Thickness \( t = 0.2462 \text{ inches} \)
- Corrosion Allowance = 0.0625 inches

**Calculated Required Wall Thickness 1st Course** 0.3087 inches

- Measured Thickness (ultrasonic) 0.3154 inches
- Safety Factor 1.02

**SECOND AND THIRD COURSES**
Thickness \( t \) = \( (2.6^*H^*D^*S.G.)/(s^*E) \)

- Height (second course) 11.00 feet
- \( s = \text{Allowable Design Stress} = 24,708 \text{ psi} \)
- \( E = \text{Joint Efficiency} = 100\% \)
- Thickness \( t = 0.1505 \text{ inches} \)
- Corrosion Allowance = 0.0625 inches

**Calculated Required Wall Thickness 2nd Course** 0.2130 inches

- Measured Thickness (ultrasonic) 0.2490 inches
- Safety Factor 1.14
### T6, Wastewater Storage Tank
### SECONDARY TANK WALL THICKNESS CALCULATIONS

<table>
<thead>
<tr>
<th>Geometry</th>
<th>Cylindrical</th>
<th>Diameter:</th>
<th>108.00 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height:</td>
<td>feet</td>
<td></td>
<td>16.00 feet</td>
</tr>
<tr>
<td>Specific Gravity:</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Operating temperature:</td>
<td>Ambient</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### FIRST AND SECOND COURSE

\[ \text{Thickness} \ (t) = (2.6 \times H - 1.0 \times D \times S.G.)/(s \times E) \]

- \( s = \text{Allowable Design Stress} = 24,708 \text{ psi} \)
- \( E = \text{Joint Efficiency} = 100\% \)
- \( \text{Calculated Thickness} \ (t) = 0.2216 \text{ inches} \)
- \( \text{Corrosion Allowance} = 0.0625 \text{ inches} \)
- \( \text{Calculated Required Wall Thickness 1st Course} = 0.2841 \text{ inches} \)
- \( \text{Measured Thickness (ultrasonic)} = 0.3154 \text{ inches} \)
- \( \text{Safety Factor} = 1.11 \)

#### THIRD COURSE

\[ \text{Thickness} \ (t) = (2.6 \times H \times D \times S.G.)/(s \times E) \]

- Height (third course) \( = 4.00 \text{ feet} \)
- \( s = \text{Allowable Design Stress} = 24,708 \text{ psi} \)
- \( E = \text{Joint Efficiency} = 100\% \)
- \( \text{Thickness} \ (t) = 0.0455 \text{ inches} \)
- \( \text{Corrosion Allowance} = 0.0625 \text{ inches} \)
- \( \text{Calculated Required Wall Thickness 3rd. Course} = 0.1080 \text{ inches} \)
- \( \text{Measured Thickness (ultrasonic)} = 0.2490 \text{ inches} \)
- \( \text{Safety Factor} = 1.57 \)
Appendix C
Appendix D
Volume of Secondary Containment

Scenario #1 - Primary Tank Height = 24-ft
\[ V_p = V_{Primary\ Tank} = (100^2)\left(\frac{\pi}{4}\right)(24) = 188,502\ ft^3 \]

Scenario #2 - Primary Tank Height = 19-ft
\[ V_s = V_{Secondary\ Containment} = (109^2 - 100^2)\left(\frac{\pi}{4}\right)(24) = 35,457\ ft^3 \]

In the event of a Primary Tank failure, fluid will equal at the following height (H):

\[ (109^2\left(\frac{\pi}{4}\right)) H = V_p \]

\[ H = \frac{V_p}{(109^2\left(\frac{\pi}{4}\right))} = \frac{188,502}{(109^2\left(\frac{\pi}{4}\right))} = 20.2\ ft. \]
Appendix E
T6 Wastewater Storage Tank

STRUCTURAL SUPPORT CALCULATIONS

**DIMENSIONS**

- Tank Diameter = 100.00 ft.
- Total Height = 24.00 ft.
- Weight of Tank (Steel) = lbs
- Tank First Coarse Thickness = 0.3125 in.
- Tank Bottom Thickness = 0.25 in.

**SEISMIC DESIGN CHECK**

**OVERTURNING MOMENT**

- Zone Coefficient (Z): 0.1875
- Essential Facilities Factor (I): 1.0
- Lateral Earthquake Force Coeff. (C1): 0.24
- D/H: 4.17
- k Factor: 0.68
- Site Amplification Factor (S): 1.2
- Natural Period of First Sloshing (T): 6.8
- Lateral Earthquake Force Coeff. (C2): 0.035
- Weight of Tank Shell (Ws): 83,386.00 lbs.
- Total Weight of Tank Contents (Wt): 15,291,282.24 lbs.
- W1/Wt: 0.285
- W2/Wt: 0.67
- Weight of Effective Mass of Contents That Moves in Unison with the Tank Shell (W1): 4,358,015 lbs.
- Weight of Effective Mass in First Sloshing (W2): 10,245,159.10 lbs.
- Ht from Btm of Shell to Centroid of Shell (xs): 12 ft.
- X1/H: 0.375
- Ht. from Btm to the Centroid of Lateral Seismic Force (X1): 9 ft.
- X2/H: 0.54
- Ht. from Btm to the Centroid of Lateral Seismic Force (X2): 12.96 ft.
Overturning Moment \((M)\) = \((Z \times l \times (C1 \times W_s \times X_s + C1 \times W_1 \times X_1 + C2 \times W_2 \times X_2))\)

Overturning Moment \((M)\) = 2,637,208.48 lbs

Weight of tank to resist overturning moment: \(W_L\)

\[ W_L = 7.94 \times lb \times (F_{by} \times G.S. \times I) \times 0.5 \]

Thickness of bottom plate (lb) = 0.25 inches

Minimum specified yield of bottom plate (\(F_{by}\)) = 36,000 psi

Design specific gravity (S.G.) = 1.3

\[ W_L = 2093.13 \text{ lb/ft. circum} \]

\[ 1.25 \times S.G. \times H \times D = 3900.00 \]

\[ W_L < 1.25 \times S.G. \times H \times D \quad \text{OK!} \]

\[ M / D^2 (W_T + W_L) \]

\[ W_T = W_s / (3.1417 \times D) = 265.42 \]

\[ M / D^2 (W_T + W_L) = 0.112 \]

\[ M / D^2 (W_T + W_L) = 0.112 < 0.786 \quad \text{therefore the tank is stable.} \]

**SHELL COMPRESSION**

Maximum longitudinal compressive force (\(b\)):

\[ b = W_t + (1.273 \times M / D^2) \]

\[ 601.13 \text{ lb/ft. circum} \]

Maximum longitudinal compressive stress (\(b/12t\)) = 160.30 psi

\[ S.G. \times H \times D^2 / t^2 = 3,194,880.00 \]

\[ S.G. \times H \times D^2 / t^2 > 10^6 \quad \text{therefore} \]

Maximum allowable compressive stress (\(F_a\)):

\[ F_a = 10^6 \times t / D \]

\[ 3125 \text{ psi} \]

\[ b/12t < F_a \quad \text{therefore shell compression is OK.} \]
WIND LOADING CHECK

$M_{\text{max}}$ must be less than or equal to $0.66 \times (WD)/2$

where

$W = \text{Shell weight available to resist uplift (lbs)}$ \hspace{1cm} 83,386.00 \hspace{1cm} \text{lbs}$

$D = \text{Tank diameter (ft)}$ \hspace{1cm} 100 \hspace{1cm} \text{ft}$

$M = \text{Overturning moment} = PW \times \text{Area (projected)} \times H1$

$H1 = \text{Height from the ground to the centroid of the tank shell}$ \hspace{1cm} 12 \hspace{1cm} \text{ft}$

$Pw = \text{Wind Pressure (8 psf for up to 100 MPH winds on cylinder)}$

\[ M_{\text{max}} = 2,780,923 \text{ ft - lbs.} \]

\[ M = 518,400 \text{ ft - lbs.} \]

$M < M_{\text{max}}$, therefore the tank is stable.
Appendix F
ELEVATION MEASUREMENT

Pt. 1
Pt. 2
Pt. 3
Pt. 4
Pt. 5
Pt. 6
Pt. 7
Pt. 8
BM

Permissible Out of Plane Deflexion

\[ S < \left( \frac{L^2 \times Y \times 11}{(2 \times (E \times H))} \right) \]

\[ S = \text{Permissible Deflexion (ft.)} \]
\[ L = \text{Arc length between points (ft.)} \]
\[ Y = \text{Yield Strength (psi)} \]
\[ E = \text{Young's modulus (psi)} \]
\[ H = \text{tank height (ft.)} \]

\[ L^2 \times Y \times 11 / (2 \times (E \times H)) = 0.49 \text{ ft.} \]

From the graph \[ S = 0.23 \text{ ft.} \]

\[ S < 0.49 \text{ therefore settlement is acceptable} \]
T6 WASTEWATER STORAGE TANK

POINT NUMBER  ELEVATION
1            1394.45
2            1394.22
3            1394.25
4            1394.38
5            1394.38
6            1394.25
7            1394.35
8            1394.40

FIELD WORK 10-28-2013
SECTION UT1

(OUT OF SERVICE)
A. TANK VESSEL DESCRIPTION

Unloading Tank No.1 is an existing small steel aboveground unloading tank located in the pretreatment Truckwash Building of the Lone Mountain Hazardous Waste Facility. Unloading Tank No.1 and a portion of the ancillary equipment are located together in a concrete containment area.

B. PRIMARY TANK VESSEL

1. General Description

Unloading Tank No.1 is being assessed to determine if the unit is adequately designed with sufficient structural strength, and compatibility with the waste to be stored or treated. Unloading Tank No.1 is an aboveground tank used for the unloading and transfer of caustic liquids. The tank is horizontal in position. The tank is supported by four C5x9 steel columns on concrete foundations. The tank is vented through hatch on top of the tank. The temperature of the tank varies with the temperature of the truck unloading (approximately ambient).

Effluent piping is located from the pretreatment building to the caustic tanks.

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). Appendix A of API 650 was utilized for the design standard due to the small diameter of this vessel. These calculations can be found in the Appendix A of this assessment. The tank was originally built to AWWA D-100-84 standards with ATSM-A-36 Steel.

3. Hazardous Characteristics of Wastes Stored

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

Untreated wastes pH (4 - 13)
N > 1
Temperature = Ambient

The hazardous characteristics of the waste stored 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 tank has been coated with Anchor Paints TAR GARD BLACK. This is a coal tar epoxy paint. The specifications for this paint can be found in Appendix H of this report. This paint has been rated excellent for chemical resistance to Alkalis. The inside and out are coated with this material. It should be noted that when thickness calculations were compared a 1/16" corrosion allowance was used.

5. Documented Age of Tank

This tank was installed in June of 1991. The tank was manufactured just prior to installation therefore the tank age is 1 year.

6. Result of Leak Tests

The tank was hydrostatically tested prior to being put into service and no leaks were found. In addition the tank has been monitored during use and no leaks have been discovered.

7. Existing Data Obtained

<table>
<thead>
<tr>
<th>Tank Dimensions</th>
<th>See Appendix G of this Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>A36 steel</td>
</tr>
<tr>
<td>* Wall Thickness</td>
<td>0.188</td>
</tr>
<tr>
<td>Volume</td>
<td>159 cf.</td>
</tr>
<tr>
<td>Specific gravity of waste</td>
<td>1.5 (Provided by USPCI)</td>
</tr>
<tr>
<td>Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Seismic Zone</td>
<td>1</td>
</tr>
</tbody>
</table>

* 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 Existing Foundation Loading

Total Weight of Tank and Contents = 7.21 tons

Detailed calculations reflecting the volume and weight of the tank are found in Appendix A of this assessment. 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 0.2371 inches. This thickness includes 0.0625 inches 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 A of this assessment for detailed calculations or required wall thickness and structural analysis of the tank support system.) As mention previously this tank is supported by four C5x9 steel column supports. Detailed structural calculations of these supports are shown in Appendix A of this assessment. The support legs were found to be adequate given the present loading conditions.
10. Comparison of Actual Structure to Theoretical Values

Wall Thickness Comparison

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Required Wall Thickness</td>
<td>0.2371&quot;</td>
</tr>
<tr>
<td>Minimum Required Wall Thickness By API-650-88</td>
<td>0.1875&quot;</td>
</tr>
<tr>
<td>Measured Wall Thickness</td>
<td>0.188&quot;</td>
</tr>
</tbody>
</table>

As mentioned previously the calculated required thickness includes a 0.0625" corrosion allowance, however a corrosion allowance of 0.0125" is all that is provided due to the measured wall thickness of only 0.188".

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. This tank is located within a containment area inside the Truckwash building and consists of a reinforced concrete base floor area with vertical concrete sidewalls. All associated piping is aboveground. The area is inspected on a daily basis. There is a large sump located in the East end of this area.

At the time of inspection the concrete area was withstanding daily operations, and routine climatic conditions. The foundation walls and base are mass poured in place. No cracks from compression or uplift were visually apparent.

The containment area and tanks are 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.

2. Design Standards.

Design drawings for this area were obtained and used as a reference. It should be noted that these are design drawings and not as built drawings. 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 Stored

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

Untreated waste pH (4 - 13)
N > 1
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 concrete containment area and sump pump have been coated with Dudick Protecto-coat 800/900. This impermeable coating is compatible with the present waste stream for this tank vessel. The coating was installed in 1991 by Mid-America Painters of Woodward, OK. 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 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 on daily basis checking for leaks from the primary tank.

7. Existing Data Obtained

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See Appendix G of this assessment for a detailed layout and cross sections of the secondary containment. Also included in Appendix D of this assessment are detailed calculations of the gross volumes 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 the Appendix D of this assessment for detailed calculations of the available containment volume. The containment capacity available = 1209.21 c.f.

9. Required Volume

Containment Capacity Required (CCR)

CCR = Volume of Largest Tank in the secondary containment

Volume of Largest Tank = 159 c.f.(UT1)

10. Comparison of Available Volume to Required Volume

Containment Capacity Comparison

Containment Capacity Required = 159 c.f.
Secondary Containment Volume Available = 1209 c.f.
Excess Containment Volume = 1050 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. The useful life of the steel tank would be estimated at 18 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 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

   The secondary containment should be checked periodically for any deterioration and structural integrity. USPCI should continually insure compatibility with the waste and densities stored.

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
Date: 1/20/93

Engineer
Title

P.E. 4126

Page 113 - 6
APPENDIX A

The following appendices have been combined into one appendix:

Appendix A
Appendix B
Appendix C
Appendix E

These appendices were combined due to the fact that the original design calculations were prepared by Gauger Engineering. The calculations included in this appendix are those that were prepared by Gauger Engineering.
USPCI - CAUSTIC UNLOADING # 1

WEIGHT & CAPACITY OF TANK

HORIZONTAL DIAMETER OF END SECTION = 4.958'

Area of Half Circle = \( \pi \frac{D^2}{4} \div 2 = \frac{\pi}{2} (4.958)^2 \)

= 9.65594'

Area of Center Section = 4.958 x 4 = 19.832'

Total Inside Plan Area = 2 x 9.655 + 19.833 = 39.147'

Height of Tank Base Ring to Top = 12 + 3' 8" = 15'

Volume = 8.667 x 39.141 = 143.552 cu. ft.

Volume of End Conv = H x A x \( \frac{1}{2} \)

= .479 x 9.655 x \( \frac{1}{2} \) = 1.542 cu. ft.

Volume of Center Base Section = H x A x \( \frac{1}{2} \)

= .479 x 4 x 4.958 x \( \frac{1}{2} \) = 4.15 cu. ft.

Total Volume to Top Ring (overflow)

143.552 + 2 x 1.542 x 4.75 = 151.369 cu. ft

= 1132.24 gal.

(Use for Load Design)

Total Volume of Base Slope

1.542 x 2 + 4.15 = 7.834 cu. ft.

= 560.6 gal.

Volume of Unit Depth = 7.48 x 39.142

= 292.782 gal./ft.

Working (net) Volume = 1034.64 gal.

(Reserve of 4" Freeboard)

Section 113 - Appendix A - Page 1
Total Inside Vol. = 1182.24 + 58.4

= 1190.64 Gal.

Specific Gravity of Contents = 1.20
Max. Wt. for Tank Design = 1192.24 x 8.63 x 1.20

= 12265.4 #

**Estimate of Dead Wt.**

- 5/16" Plate: 629 #
- 3/16" Shell: 440 #
- 3/16" Top Foot: 393 #
- 1" Rod: 71 #
- 1/2" Rod: 7 #
- 5" Channel: 556 #
- 2 x 2 x 3/16 L: 116 #
- BR: 21 #
- Carbon: 20 #
- Misc. Weld: .97 #

**Total: 21580 #**

Max. Load = 14,415 # ±

Leg. Load = 3604 # Each.

Bearing Pressure = 100 psi
END SHELL ANALYSIS

Hoop Tension

\[ T = \frac{24.19 \times 60}{2} = 74.3 \text{ ksi} \]

Max. Hydro. Press. @ Bottom

\[ 5.61 \times 81.12 / 12 = 24.79 \text{ psi} \]

CAULIFLOWER SUPPORT FORCES

WEIGHTS

Contents @ 21.12pcf

Half Cycl. \( A = \frac{\pi (4.96)^2}{2 \times 4} = 9.65 \text{ ft}^2 \)

\( W_c = 9.65 \times 3.67 \times 81.12 = 2873 \text{* cylinder} \)

\( W_b = 9.65 \times 5 \times 3.55 \times 81.12 = 130 \text{*} \)

Contents 3003*

Tank Wt., \( \frac{1}{4} \text{ in} = 10.2 \text{*} \text{ft} \)

Top or Bottom...

9.65 x 10.2 = 99*

Shells...

5\( \pi \times 3.67 \times 10.2 = 29 \text{*} \)

Corner Angles...

5\( \pi \times 2.64 = 39 \text{*} \)

Total Wt. = 3534* L+D

Section 113 - Appendix A - Page 3
**Combined Forces on End Shells**

\[ \text{SHEAR} = \frac{3584}{2 \times 44} = 40.7 \text{ kips} \]

**Required Shell Thickness**

\[ T = \frac{673}{15000} = 0.04' + \frac{1}{8} = 0.11' \]

Use min. \( \frac{3}{16} \)"

**Clam Shell Bottom (Divide)**

\[ \alpha = \tan^{-1} \frac{2.5}{5'} = 78.69^\circ \]

Area = \( \pi \times 5\frac{3}{4} = 19.63 \text{ ft}^2 \)

**Total Load on Base Circle**

\[ F = 19.63 \times \left[ 2 \times 0.07 + \frac{1}{8} (1.5) \right] \times 1.3 \times 62.4 = 0.106 \text{ kips} \]

**Shear @ Corner Weld**

\[ \text{Shear} = \frac{610.6}{27 \times 12} = 32.4 \text{ kips} \]

**Radial Force @ Corner**

\[ \text{Radial Force} = \frac{32.4}{\tan \alpha} = 159 \text{ kips} \]

**Principal Tangential (Ray)**

\[ \text{Principal Tangential} = \sqrt{32.4^2 + 159^2} = 163 \text{ kips} \]
CORNER REINF. ANGLE

\[ C = 359 \times 20 = 4770 \text{ lb compression} \]

AREA OF ANGLES REQUIRED

\[ A = \frac{4770}{15000} = 0.32 \]

2x2x3/16 L = 0.440" OK

MAX. WELD FORCE 159#/k

FILLET WELDS @ 0.4 x 0.107 x 30000

\[ = 10180 \text{ lb/" WELD LEG} \]

\[ L = \frac{159}{10180} = 0.02 \text{ use } 5/16" \]
CENTRAL TANK SHELL

CONTINUITY ANALYSIS OF PLATES

HYDROSTATIC FORCES

\[ \sigma_g = 1.3 \]

\[ P = 62.4 \times 1.3 \times 3.067 \]

\[ = 297.5 \text{ PSF} = 24.79 \% \]

\[ \frac{1}{4}'' \text{ PL A} = 3.0'' \]

\[ I = \frac{12 \times 0.5^3}{12} = 0.0156 \]

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GAUGER ENGINEERING CO.
1306 E. 13TH STREET
TULSA, OKLAHOMA

CAUSTIC UNLOADING TANK SHEET CONTINUITY ANALYSIS
USPCI LONE MOUNTAIN FACILITY

ICRSAFE --- STRUCTURAL ANALYSIS BY FINITE ELEMENTS

2E OF THE STRUCTURE

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Section 113 - Appendix A - Page 9
SOLUTION SUMMARY

Number of degrees of freedom: 39 (39 in RAM and 0 on disk)

Number of loadcases: 1

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CENTRAL TANK SHELL

SIDE PLATE

Pressure:
3.667 x 1.3 x 62.4
= 298.8\text{ psi}
q = 2.07

REFER TO TIMOSHENKO, WOINOWSKY-KRIEGERTHEORY OF PLATES & SHELLS

Ratio of sides: \( \frac{b}{a} = 1.0 \)

From table:
\( P = 0.0244 \quad P_1 = 0.0245 \)
\( W = 0.9, a^2 \quad W_1 = 0.9, a^2 \)
\( = 0.0244 \times 2.07 \times 44^2 \quad = 0.0245 \times 2.07 \times 44^2 \)
\( = 105.8 \text{ in}^2 \quad = 98.18 \text{ in}^2 \)

Section modulus: \( S = \frac{bK^2}{6} \)
\( S = 0.167 K^2 = \frac{K^2}{6} = \frac{105.8}{15000} = 0.0071 \)
\( t = \sqrt{\frac{0.0071}{1.167}} = 0.2055 \text{ in per span} \)

\[ \frac{105.8}{105.8 + 8.18} \times 62.7 \]

Section 113 - Appendix A - Page 12
**Bottom Plate**

**Simple Supported Case**

\[ q = 4.0 \times 1.3 \times 62.4 \]
\[ = 324.5 \text{ psf} \]
\[ = 2.25 \text{ psi} \]

**Ratio of Sides**

\[ \frac{b}{2} = \frac{4.4}{30} = 0.1467 \approx 1.5 \]

**From Taylor's E & R**

\[ \beta = 0.0812 \]
\[ \beta_1 = 0.0498 \]

\[ M_x = \beta q a^2 \]
\[ = 0.0812 \times 2.25 \times 30^2 \]
\[ = 144.4 \text{ in}^3/\text{lb} \]

\[ M_y = \beta_1 q a^2 \]
\[ = 0.0498 \times 2.25 \times 30^2 \]
\[ = 100.8 \text{ in}^3/\text{lb} \]

**Bolted Supports Case**

**@ 4 Plate**

\[ M_x = 0.0368 \times 2.25 \times 30^2 \]
\[ = 74.52 \text{ in}^3/\text{lb} \]
\[ = 41.11 \text{ in}^3/\text{lb} \]

**@ 4 Edge**

\[ M_x = -0.0757 \times 2.25 \times 30^2 \]
\[ = -153.3 \text{ in}^3/\text{lb} \]
\[ = -115.43 \text{ in}^3/\text{lb} \]
CENTRAL TANK SHEAR

\[ \frac{110^\circ}{1} \]

\[ \text{SYN.} \]

\[ \begin{align*} 
118^\circ & = 125^\circ \text{*} \\
153^\circ & = \text{EST. 1600} \text{**} \\
322^\circ & = \text{**} \\
794^\circ & = \text{**} \\
170^\circ & = \text{**} \\
170^\circ & = \text{**} \\
433^\circ & = \text{**} \\
42^\circ & = \text{**} \\
40^\circ & = \text{**} \\
40^\circ & = \text{**} \\
207^\circ & = \text{**} \\
77^\circ & = \text{**} \\
44^\circ & = \text{**} \\
277^\circ & = \text{**} \\
31^\circ & = \text{**} \\
134^\circ & = \text{**} \\
134^\circ & = \text{**} \\
\end{align*} \]

MOMENT

\[ \text{DIAPHRAGM} \]

\[ B + \frac{2004 + 1704}{2} = 3098 \text{ in}^{3} \]

\[ = 253.17 \text{ kips} \]

Load ratio for this direction = 52%

\[ \mu = 0.52 \times 258.17 = 134.24 \text{ in}^{3} > 105.6 \text{ ok} \]

\[ \mu_5 = 0.52 \times 2804 / 12 = 121.5 \text{ in}^{3} / \text{kips} \]

\[ S = \frac{M}{E} = \frac{134.24}{60} = \frac{121.5}{15000} \]

\[ = 1.22 \text{ in} + \frac{1}{16} = 0.233 < \frac{5}{10} \text{ use } \frac{5}{16} \text{ in} \]

Section 113 - Appendix A - Page 14
For frame design assume all loads carried on frame pipes totally supported by frame.

\[
\frac{L}{2} = \frac{74.4}{10^2} = 120 \\
1 \frac{1}{2}'' \phi \text{ pipe} \\
A = 0.799 \\
\frac{L}{2} = \frac{60}{15} = 120 \\
\frac{E}{A} = 1.00 \\
A = 0.785 \pi'' \\
F_c = 10.26 \\
0.735 \times 10.2 = 7.67 \text{ in.} \\
\text{OK}
\]

\[
\frac{S_{yz}}{15000} = 0.045 \text{ OK} \\
\frac{S_{xy}}{15000} = 0.134 \text{ OK}
\]

Section 113 - Appendix A - Page 15
GAUGER ENGINEERING CO.
1306 E. 13TH STREET
TULSA, OKLAHOMA

ANALYSIS OF CAUSTIC UNLOADING TANK SUPPORT FRAME
USFCI LONE MOUNTAIN FACILITY

C R O S A F E --- STRUCTURAL ANALYSIS BY FINITE ELEMENTS
Version: SAFE2STA (2-D) Rel. 3.0 5/06/1991 2134131

E OF THE STRUCTURE

ber of nodes : 11
ber of materials : 1
ber of beams : 14
ber of beam end releases : 0
ber of plates : 0
ber of fasteners : 0
ber of primary loadcases : 1
ber of superposition loadcases : 0
ber of restrained degrees of freedom : 4

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Section 113 - Appendix A - Page 17
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**FX, FY, MZ**

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**LUTION SUMMARY**

number of degrees of freedom: 33 (33 in RAM and 0 on disk)

width: 30

number of loadcases: 1

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**SULTS FOR LOADCASE 1: TOTAL LD**

---

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### INTERNAL FORCES AND REACTIONS

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Section 113 - Appendix A - Page 20
June 3, 1991

Mr. Gene Walker
Environmental Engineer
USPCI Inc. Lone Mountain Facility
Route 2, Box 180 A
Waynoka, Oklahoma 73860

Caustic Unloading Tank #1
Pretreatment Washdown Area

Dear Mr. Walker,

The several items which were incomplete on my visit of May 30, 1991 have been satisfactorily completed at this time. Those items were concerned with touchup repainting, and completion of the ancillary piping to the pump location.

The leak test of the system was performed today and upon careful inspection, no leaks were detected.

This letter is to certify that the Caustic Unloading Tank #1 was installed in a manner that no structurally adverse conditions were produced in accordance with 40 CFR 264.192(b).

If there are questions please call at your convenience.

Sincerely,

Fred N. Gauger  H.S.C.E.
Registered Professional Engineer
Oklahoma #5823
GORE-TEX® JOINT SEALANT INSTALLATION INSTRUCTIONS

Can the flanges be coated with a gasket instead of the Joint Sealant. Use a release agent such as Teflon to prevent the gasket from sticking to the flanges. Apply the Joint Sealant to the gasket and the flange surface. Allow the Joint Sealant to cure before applying the gasket. Torque the bolts to the recommended value. Check the gasket for alignment and seating. The Joint Sealant will seal the gasket and prevent leaks. Use a torque wrench to ensure proper torque is applied to the bolts.

4. Complete the seal by crossing the ends near a bolt hole. Cross one end over the other about 1" and cut.

For the few critical applications where the extra bulk at the crossover could cause trouble, lap the ends as shown:

5. Assemble the flanged joint and torque the bolts as follows:
   a. Run up all nuts finger tight.
   b. Develop the required bolt stress in a minimum of three equal steps, following a tightening sequence as shown. Joint Sealant is highly compressible, but has little resilience, so gradual tightening is necessary to form a gasket of uniform thickness. Use a torque wrench if it is available.

Torquing Sequences

W. L. GORE & ASSOCIATES, INC.
100 AIRPORT RD. • P.O. BOX 1010 • ELKTON, MD 21921 • PHONE: 301/392-3200

Section 113 - Appendix A - Page 22
Section 113 - Appendix D

UT1, Unloading Tank No.1

SECONDARY CONTAINMENT VOLUME CALCULATIONS

Area No. 1 West End

Length = 64.50 feet
Width = 8.50 feet
Height = \((0.24+(0.54-0.24)/2)\) 
Surface Area = 293.25 S.F.
Volume = 114.37

Area No. 2 East End

Length = 61.50 feet
Width = 34.50 feet
Height = \((0.2+(0.54-0.2)/2)\) 
Surface Area = 2121.75 S.F.
Volume = 785.05

Sump South End

Length = 29.33
Width = 3.75
Height = \((0.5+(3.66-0.5)/2)\) 
Surface Area = 110.00
Volume = 228.80

Sump North End

Length = 6.58
Width = 3.75
Height = \((3+(3.66-3)/2)\) 
Surface Area = 24.68
Volume = 82.17

Gross Area = 
Gross Volume = 

Area 1 - Area 2 = 2549.67 S.F.
Area \times \text{Height} = 1210.36 C.F.

Volumes of items of Displacement **

1. Pipe Supports (9) 
   Total volume to deduct for items in containment area = 1.00 C.F.
2. Steel Pump Base
   0.17 C.F.

Subtraction for volume of rainfall

The entire area is covered and will not recieve any rain

TOTAL AVAILABLE VOLUME = Gross Volume - Subtractions = 1210.38 C.F.
Items of displacement -1.17 C.F.
Volume of rainfall 0.00 C.F.

TOTAL AVAILABLE VOLUME 1209.21 C.F.
or 9044.92 Gal.
# REPORT OF UT THICKNESS INSPECTION

**Tested For:** USPCI
**Location:** UT-1

**Date:** 7-13-92

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**UT UNIT**
- A-Scan
- Direct Readout
- A-Scan and Direct Readout

**Manufacturer:** KBA
**Model:** OME
**Serial No.:** 103162

**CALIBRATION BLOCK**
- ID Number: 01
- Size: 100 - 500 STEP
- Material Type: STEEL

**SEARCH UNIT**
- Single Element
- Dual Element
- Size: 0.625
- Frequency: 5 MHz
- Serial No.: E08931

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**Remarks:**
- NOTE: THESE READINGS TAKEN WITH PAINT REMOVED.

**Technician:** R. SHARLE Level: **

**Technician:** J. BRODER Level: II
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Section 113 - Appendix F - Page 3
APPENDIX G

Drawings