



Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

December 23, 1997

Mr. Mark C. King, C.F.E.
Office of the Property Appraiser
Suite 270
231 East Forsythe Street
Jacksonville, Florida 32202

Re: Pollution Control Equipment - BP Oil Company

Dear Mr. King:

The Department of Environmental Protection has reviewed the material attached to your letter of December 12, 1997. The material submitted is adequate to establish that the leak collection, detection, and retention systems listed by BP Oil Company are eligible for assessment as pollution control equipment pursuant to Section 193.621, Florida Statutes.

If you have any questions concerning this matter, I may be reached at Suncom 277-0472 or at (850) 487-0472.

Sincerely,

Hamilton S. Owen
Hamilton S. Owen, P.E.



**OFFICE OF THE PROPERTY APPRAISER
DUVAL COUNTY, FLORIDA**

DEPARTMENT OF
ENVIRONMENTAL PROTECTION
386 161 37
TALLAHASSEE, FLORIDA

**ERNIE MASTROIANNI
PROPERTY APPRAISER**

SUITE 270
231 E. FORSYTH STREET
JACKSONVILLE, FLORIDA 32202

December 12, 1997

Mr. Hamilton S. Oven, P.E.
Dept. Of Enviromental Protection
2600 Blain Stone Rd
Tallahassee, Florida 32399-2400

Re: Assessment of Pollution Equipment-BP Oil Company

Dear Mr. Oven

We have recieved a packet of information from BP Oil Company requesting that certain assets be assessed as pollution control equipment.

Attached you will find the orginal packet of information that was supplied to our office with a copy being made for our files. Please advise our office as to the validity of their request to Section 193,621, Florida Statutes.

If you have any questions, please call me at (904) 630-1964

Sincerely

Mark C. King
Mark C. King, C.F.E.
Market Analyst

5

Memo



DAMES & MOORE

A DAMES & MOORE GROUP COMPANY

6400 Congress Avenue
Suite 2500
Boca Raton, FL. 33487-2833
561-994-6500 Tel
561-994-6524 Fax

FROM: ROBERT G. COOPER / TIMOTHY L. HARMAN
TO: MADELINE MANELSKI
DATE: DECEMBER 4, 1997
SUBJECT: JACKSONVILLE POLLUTION CONTROL EXEMPTION

RECEIVED
DEC 10 1997

ERNIE MASTROIANNI
PROPERTY APPRAISER

Dames & Moore has reviewed the information provided in the attached package and documentation from BP Oil related to completion of the work to install pollution control devices on tanks at the Jacksonville facility.

The Pollution Control Equipment and Services filed for under this exemption were all integral to installing appropriate pollution control devices to contain and detect a leak in the primary steel floor of above ground storage tanks at the Jacksonville facility. The equipment was installed from 1989 through 1996.

The double floor in each tank was installed by cutting a horizontal slot around the entire circumference of an above ground storage tank at a distance of 4 to 16 inches above the existing floor. A new steel floor was installed in the area of the slot and a high density polyester liner was installed in the "cup" formed by the old floor and the 4 inches of the old tank shell. A zinc ribbon was installed between the new and old bottom to serve as cathodic protection for the new floor.

After the new floor was completed, the liner acts as an impervious sump for any leaks in the new floor and, PVC detection ports located at 6 locations around the circumference are serving to detect leaks should they occur. As a part of this work, related valves and monitoring equipment were installed and the tanks were repainted to protect the steel.

A handwritten signature in blue ink, appearing to read 'M. Manelski'.

CERTIFIED FLORIDA PROFESSIONAL ENGINEER

12/4/97

DATE

STATE OF FLORIDA
DUVAL COUNTY
APPLICATION FOR POLLUTION CONTROL EXEMPTION
PERSONAL PROPERTY
SECTION § 193.621 FLORIDA STATUTE

THE BP EXPLORATION & OIL, INC. HEREBY MAKES AN APPLICATION FOR POLLUTION CONTROL EXEMPTION OF CERTAIN PERSONAL PROPERTY LOCATED AT THE BP OIL TERMINAL, 2101 HECKSCHER DR, DUVAL COUNTY, PERSONAL ACCT#: 806805-0000 AND HEREBY SUBMITS THE FOLLOWING DOCUMENTS AND INFORMATION:

1. THE FUNCTION OF THE EQUIPMENT AS IT RELATES TO POLLUTION CONTROL.
2. A COPY OF THE PLANS AND SPECIFICATIONS AND RELATED DOCUMENTS DESCRIBING THE EQUIPMENT USED FOR POLLUTION CONTROL.
3. A LIST OF THE POLLUTION CONTROL DEVICES BEING UTILIZED BY THE FACILITY ALONG WITH THE COST OF THESE DEVICES.

THE TOTAL COST ESTIMATE IS \$3,834,280. THE COST SOUGHT TO BE EXECPT IS \$3,834,280.

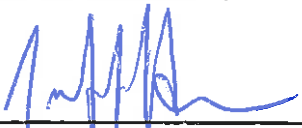
PERSON TO CONTACT REGARDING ADDITIONAL DETAILS:

MS. MADELINE MANELSKI
BP EXPLORATION & OIL COMPANY
C/O ARTHUR ANDERSEN LLP
Property Tax Department
15990 N. Barkers Landing
Houston, Texas 77079
(281) 529-6011

APPLICANT SIGNATURE:

 12/5/97

KEITH CHARITY, TERMINAL MANAGER DATE

 12/4/97

CERTIFIED FLORIDA PROFESSIONAL ENGINEER DATE



BP OIL

Keith M. Charity
Jacksonville Terminal

BP Oil Company
P.O. Box 26038
2101 Heckscher Drive
Jacksonville, Florida 32226-6038

Phone: 904-757-4650
Fax: 904-751-3310

November 17, 1997

Dames & Moore Group Company
6400 Congress Avenue
Suite 2500
Boca Radon, Fl. 33487-2833

Attn: Mr. Robert G. Cooper

Dear Mr. Cooper:

This letter is in reference to information on the Jacksonville Pollution Control Exemption.

As I stated in my telephone conversation, all work at the BP Oil Terminal In Jacksonville, Florida is complete. The equipment has been installed as proposed and is currently in place and functional. The devices that are listed on the cost tables are allowable service or equipment related to the eligible pollution control devices.

Please advise if this information addresses correctly your memo of October 30, 1997.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Keith M. Charity', written over the typed name and title.

Keith M. Charity
Terminal Manager

AFE 92-1453 Tank 117

PTR ENGINEERING PROJECTS
TAX EXEMPTION

10524 Jacksonville

P.O. No.	Vendor	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
			Expended	Date	Expended	Date					
001	Alternate	Waste disposal	2,565.00	1/7/91	2,565.00	12/14/90			2,565.00		2,565.00
KMC001	Alternate	Waste disposal	2,559.27	1/15/91	2,559.27	12/12/90			2,559.27		2,559.27
KMC002	Alternate	Waste disposal	2,565.00	1/15/91	2,565.00	12/12/90			2,565.00		2,565.00
KMC003	Alternate	Waste disposal	2,565.00	1/15/91	2,565.00	1/15/91			2,565.00		2,565.00
NO PO	Alternate	Sample testing	50.00	2/1/91	50.00	1/3/91			50.00		50.00
96837085	Energy Pro	Valves	8,053.00	11/30/90	8,053.00	10/29/90			8,053.00		8,053.00
96837085	Energy Pro	Freight	233.79	11/30/90	233.79	11/6/90			233.79		233.79
J3593	Global Env	Clean tank 117	11,200.00	12/91	11,200.00	12/12/90			11,200.00		11,200.00
96837022	Matrix	Leak detection	145,754.00	9/13/91	145,754.00	7/3/91	20,000.00	15,000.00	110,754.00		145,754.00
002	Southeast	Piping work	2,364.32	4/10/91	2,364.32	3/28/91			2,364.32		2,364.32
J3628	Southeast	Piping work	2,290.55	1/15/91	2,290.55	12/24/90			2,290.55		2,290.55
96837274	Wilkins	Valves	1,289.34	12/21/90	1,289.34	12/11/90			1,289.34		1,289.34
							20,000.00	15,000.00	146,489.27	0.00	181,489.27

AFE 92-1454 Tank 101

PTR ENGINEERING PROJECTS
TAX EXEMPTION

10524 Jacksonville

P.O. No.	Vendor	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
			Expended	Date	Expended	Date					
00002	A&M Piping	Sandblast interior	8,275.00	4/1/91	8,275.00	3/12/91			8,275.00		8,275.00
KMC004	Alternate	Waste disposal	1,296.00	1/15/91	1,296.00	12/12/90			1,296.00		1,296.00
NO PO	Alternate	Waste disposal	864.00	2/1/91	864.00	3/12/91			864.00		864.00
96837086	Genl Valve	Valves	2,654.06	12/7/90	2,654.06	11/9/90			2,654.06		2,654.06
J3593	Global Env	Clean tank 101	5,900.00	1/7/91	5,900.00	12/20/90			5,900.00		5,900.00
96837021	Matrix	Bottom, liner, & cath	24,396.00	10/16/90	24,396.00	9/21/90	5,000.00	4,000.00	15,396.00		24,396.00
96837021	Matrix	Annular plate	10,623.00	4/5/91	10,623.00	2/28/91			10,623.00		10,623.00
96837021	Matrix	Roof legs/seals	9,237.00	6/20/91	9,237.00	3/22/91				9,237.00	9,237.00
J4296	Matrix	Bottom, liner, & cath	5,721.10	12/1/91	5,721.10	10/31/91			5,721.10		5,721.10
J3624	Southeast	Drain/piping work	1,433.84	1/15/91	1,433.84	12/21/90			1,433.84		1,433.84
							5,000.00	4,000.00	52,163.00	9,237.00	70,400.00
						TOTAL					

AFE 92-1455 Tank 116

PTR ENGINEERING PROJECTS
TAX EXEMPTION

10524 Jacksonville

P.O. No.	Vendor	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
ENGCGFP	ENGTIME	-	Expended	Date	Expended	Date					
ENGLLD	ENGTIME	-	480.00	4/15/95	-	-	50.00	30.00	400.00		480.00
00002	A&M Piping	Blas/paint bottom	72.00	1/15/92	-	-	8.00	4.00	60.00		72.00
0001KMC	Alternate	Waste disposal	1,200.00	4/1/91	1,200.00	3/12/91			1,200.00		1,200.00
0002KMC	Alternate	Waste disposal	2,511.00	10/1/90	2,511.00	10/9/90			2,511.00		2,511.00
0003KMC	Alternate	Waste disposal	2,511.00	10/1/90	2,511.00	9/14/90			2,511.00		2,511.00
0004KMC	Alternate	Waste disposal	810.00	10/1/90	810.00	9/14/90			810.00		810.00
0001	Envir Reco	Sample analysis	2,511.00	10/1/90	2,511.00	9/7/90			2,511.00		2,511.00
0005KMC	Griffith	Clean tank	3,143.00	12/5/90	3,143.00	11/21/90			3,143.00		3,143.00
96837017	Matrix	Bottom, liner, & cath	11,014.00	10/1/90	11,014.00	8/20/90			11,014.00		11,014.00
96837017	Matrix	Bottom, liner, & cath	96,504.00	10/17/90	96,504.00	9/21/90	15,000.00	10,000.00	71,504.00		96,504.00
96837017	Matrix	-	70,356.00	1/2/91	70,356.00	12/1/90			70,356.00		70,356.00
96837153	Matrix	-	5,360.00	12/17/90	-	-			5,360.00		5,360.00
J3590	Southeast	Valve work	2,511.00	11/1/90	-	-			2,511.00		2,511.00
J3626	Southeast	Close tank	1,968.18	12/21/90	1,968.18	12/11/90			1,968.18		1,968.18
J3629	Southeast	Drain, clean & close	2,125.14	1/15/91	2,125.14	12/21/90			2,125.14		2,125.14
J3630	Southeast	Prepare and test tank	4,155.43	1/7/91	4,155.43	12/27/90			4,155.43		4,155.43
			4,597.84	1/15/91	4,597.84	12/27/90			4,597.84		4,597.84
			211,829.59			TOTAL	15,058.00	10,034.00	186,737.59	0.00	211,829.59

AFE 92-1456 Tank 102

PTR ENGINEERING PROJECTS
TAX EXEMPTION

10524 Jacksonville

P.O. No.	Vendor	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
			Expended	Date	Expended	Date					
0002KMC	Alternate	Waste disposal	1,123.00	10/1/90	1,123.00	8/20/90			1,123.00		1,123.00
0001KMC	Griffith	Clean tank	5,932.00	10/1/90	5,932.00	8/20/90			5,932.00		5,932.00
96837155	Griffith	Clean tank	1,782.00	11/1/90	1,782.00	8/20/90			1,782.00		1,782.00
96837020	Matrix	Bottom, liner & cath	23,730.00	10/16/90	23,730.00	9/21/90	8,000.00	4,000.00	11,730.00		23,730.00
96837020	Matrix	Bottom, liner & cath	37,630.00	12/19/90	37,630.00	12/10/90			37,630.00		37,630.00
J3589	Southeast	Steps/gauge platform	3,605.00	12/21/90	3,605.00	12/7/90				3,605.00	3,605.00
J3625	Southeast	Welding & testing	4,028.34	2/12/91	4,028.34	12/21/90			4,028.34		4,028.34
J3627	Southeast	Prep tank for test	4,668.83	2/12/91	4,668.83	12/20/90			4,668.83		4,668.83
						TOTAL	8,000.00	4,000.00	66,894.17	3,605.00	82,499.17

P.O. No.	Vendor	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System.	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
			Expended	Date	Expended	Date					
ENGLD	ENGTIME	-	120.00	4/15/92	-	-	20.00	10.00	90.00		120.00
96837416	A&M Piping	Bottom, liner & cath	29,240.00	4/19/91	29,240.00	4/12/91			29,240.00		29,240.00
96837416	A&M Piping	Blast repair shell roof	26,730.00	6/13/91	26,730.00	5/14/91				26,730.00	26,730.00
		Seals, legs, manways, seams, stairs, misc.	60,720.00	7/10/91	60,720.00	6/20/91				60,720.00	60,720.00
96837416	A&M Piping	Bottom, liner & cath	38,986.66	7/9/91	38,986.66	7/1/91			38,986.66		38,986.66
96837416	A&M Piping	Bottom, liner & cath	113,925.38	10/1/91	113,925.38	9/20/91	20,000.00	15,000.00	78,925.38		113,925.38
96857920	A&M Piping	Blast & seal roof	14,000.00	11/8/91	14,000.00	11/4/91				14,000.00	14,000.00
98008422	A&M Piping	Blast & paint btm ring	1,500.00	2/1/92	1,500.00	12/16/91			1,500.00		1,500.00
J4101	A&M Piping	Blast seams	4,125.00	2/1/92	4,125.00	12/16/91				4,125.00	4,125.00
004	Fisher	Waste disposal	6,175.00	4/15/91	6,175.00	3/12/91			6,175.00		6,175.00
004	Fisher	Waste disposal	6,080.00	4/16/91	6,080.00	3/12/91			6,080.00		6,080.00
70520066	Harco	Cath prot materials	592.16	5/1/91	592.16	4/17/91		592.16			592.16
70520066	Harco	Cath prot freight	788.21	6/1/91	788.21	4/16/91		788.21			788.21
96857823	Horizon	Painting	1,742.00	11/18/91	1,742.00	10/2/91				1,742.00	1,742.00
31882	SE Chem	Soil analysis	2,100.00	4/1/91	2,100.00	3/19/91			2,100.00		2,100.00
00001	South Mar	Certify welding	600.00	3/18/91	600.00	2/28/91			600.00		600.00
2674	South Petro	Open & lower legs	296.51	6/1/91	296.51	4/3/91			296.51		296.51
J4400	Southeast	Drain, clean raise legs	8,147.22	2/1/92	8,147.22	1/7/92			8,147.22		8,147.22
			315,868.14			TOTAL	20,020.00	16,390.37	172,140.77	107,317.00	315,868.14

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P.O. No.	Vendor	Tank	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
ENGLD	ENGTIME	-	-	8,592.00	10/15/92	-	-	1,718.40	859.20	5,584.80	429.60	8,592.00
EXPLD	EXPENSE	-	-	1,595.76	7/1/92	-	-	319.15	159.58	1,037.24	79.79	1,595.76
98008950	A&M Piping	105	Install diffuser	839.75	7/1/92	839.75	6/11/92		83.98	713.79	41.99	839.75
98008976	A&M Piping	104/105/109	Gauge tube ext	1,306.91	7/2/92	1,306.91	6/22/92		130.69	1,110.87	65.35	1,306.91
7053007301	A&M Piping	-	-	2,635.18	7/1/92	-	-		263.52	2,239.90	131.76	2,635.18
105240001	A&M Piping	-	-	6,250.00	4/2/92	-	-		625.00	5,312.50	312.50	6,250.00
96857843	A&M Piping	-	-	14,570.59	10/1/91	-	-		1,457.06	12,385.00	728.53	14,570.59
9685741603	A&M Piping	-	-	15,933.07	2/3/92	-	-		1,593.31	13,543.11	796.65	15,933.07
96857921	A&M Piping	-	-	16,756.57	5/4/92	-	-		1,675.66	14,243.08	837.83	16,756.57
96857843	A&M Piping	-	-	17,807.07	11/8/91	-	-		1,780.71	15,136.01	890.35	17,807.07
96857843	A&M Piping	-	-	18,213.61	9/9/91	-	-		1,821.36	15,481.57	910.68	18,213.61
96857843	A&M Piping	-	-	18,213.61	9/23/91	-	-		1,821.36	15,481.57	910.68	18,213.61
96857921	A&M Piping	-	-	19,156.04	7/1/92	-	-		1,915.60	16,282.53	957.80	19,156.04
98008427	A&M Piping	109	Blast, prime & finish	19,300.00	4/6/92	19,300.00	4/2/92		1,930.00	16,405.00	965.00	19,300.00
96857921	A&M Piping	-	-	22,048.26	12/10/91	-	-		2,204.83	18,741.02	1,102.41	22,048.26
96857921	A&M Piping	-	-	22,048.26	12/1/91	-	-		2,204.83	18,741.02	1,102.41	22,048.26
96857923	A&M Piping	-	-	29,798.52	5/4/92	-	-		2,979.85	25,328.74	1,489.93	29,798.52
96857923	A&M Piping	-	-	36,968.81	7/1/92	-	-		3,696.88	31,423.49	1,848.44	36,968.81
96857921	A&M Piping	-	-	39,686.38	4/1/92	-	-		3,968.64	33,733.42	1,984.32	39,686.38
96857923	A&M Piping	-	-	47,696.07	12/10/91	-	-		4,769.61	40,541.66	2,384.80	47,696.07
96857923	A&M Piping	-	-	47,696.07	12/1/91	-	-		4,769.61	40,541.66	2,384.80	47,696.07
96857923	A&M Piping	-	-	53,600.50	4/1/92	-	-		5,360.05	45,560.43	2,680.03	53,600.50
524001	Ameri Asso	-	-	3,420.96	11/18/91	-	-			3,420.96		3,420.96
0002	Carroll	-	-	1,935.00	7/1/91	-	-			1,935.00		1,935.00
96858212	Energy Pro	-	Valve freight	54.35	12/19/91	54.35	12/16/91			54.35		54.35
9685735	Energy Pro	-	-	266.17	11/1/91	-	-			266.17		266.17
96858212	Energy Pro	-	Valve	1,976.00	12/20/91	1,976.00	12/10/91			1,976.00		1,976.00
9685735	Energy Pro	-	-	12,870.00	10/1/91	-	-			12,870.00		12,870.00
96857919	Fisher	-	-	1,140.00	9/1/91	-	-			1,140.00		1,140.00
0005	Griffith	-	-	5,429.00	8/6/91	-	-			5,429.00		5,429.00
96858379	Harco	113	Cath prot freight	17.96	1/3/92	17.96	12/13/91		17.96			17.96
NO PO 2	Harco	113	Cath prot material	90.87	12/19/91	90.87	12/16/91		90.87			90.87
NO PO 1	Harco	105	Cath prot material	126.06	12/20/91	126.06	12/16/91		126.06			126.06
96857892	Harco	-	-	141.90	8/13/91	-	-		141.90			141.90
96857973	Harco	-	-	291.29	9/9/91	-	-		291.29			291.29
96858378	Harco	105/113	Cath prot freight	817.91	1/3/92	817.91	12/10/91		817.91			817.91

P.O. No.	Vendor	Tank	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
98008964	KBG	-	Photos	16.25	6/23/92	16.25	6/22/92				16.25	16.25
J4296	Matrix	-	Prep for water	443.90	12/1/91	443.90	11/12/91			443.90		443.90
96837022	Matrix	-	-	30,065.00	9/13/91	-	-			30,065.00		30,065.00
96857840	Matrix	-	-	43,618.00	12/2/91	-	-			43,618.00		43,618.00
96858349	MPC	-	Liner freight	1,248.75	4/1/92	1,248.75	2/18/92	1,248.75				1,248.75
96858349	MPC	106	Liner	8,661.04	3/2/92	8,661.04	2/18/92	8,661.04				8,661.04
96858349	MPC	110	Liner	20,108.42	3/1/92	20,108.42	2/18/92	20,108.42				20,108.42
96858349	MPC	108	Liner	33,096.21	3/5/92	33,096.21	2/18/92	33,096.21				33,096.21
96858349	MPC	114	Liner	33,096.21	3/6/92	33,096.21	2/18/92	33,096.21				33,096.21
96858349	MPC	111	Liner	52,236.30	3/3/92	52,236.30	2/18/92	52,236.30				52,236.30
96858349	MPC	112	Liner	52,236.30	3/4/92	52,236.30	2/18/92	52,236.30				52,236.30
96858324	MQS	104	Leak test	1,668.00	1/4/92	1,668.00	12/26/91			1,668.00		1,668.00
96858324	MQS	109	Leak test	1,894.00	1/3/92	1,894.00	12/26/91			1,894.00		1,894.00
98008974	MQS	113	Leak test	1,894.00	7/1/92	1,894.00	6/17/92			1,894.00		1,894.00
0001	SEPM	-	-	584.80	6/20/91	-	-			584.80		584.80
96857886	South Marine	-	-	435.00	8/9/91	-	-			435.00		435.00
J0001	Southeast	117	Manway gaskets	534.00	7/12/91	534.00	4/12/91			534.00		534.00
J0002	Southeast	117	Piping	749.38	7/12/91	749.38	4/12/91			749.38		749.38
J0003	Southeast	117	Test, drain and clean	797.60	7/12/91	797.60	4/12/91			797.60		797.60
98009136	Southeast	113	Pull blinds & clean	989.08	8/12/92	989.08	6/25/92			989.08		989.08
98009160	Southeast	114	Pull blinds & clean	1,132.43	8/20/92	1,132.43	8/7/92			1,132.43		1,132.43
98008973	Southeast	105	Pull blinds & clean	1,657.34	7/1/92	1,657.34	6/9/92			1,657.34		1,657.34
J3903	Southeast	117	Water wash tank	1,679.55	7/12/91	1,679.55	4/12/91			1,679.55		1,679.55
J3907	Southeast	117	Pump water out	1,827.50	6/20/91	1,827.50	4/12/91			1,827.50		1,827.50
J3905	Southeast	117	Test	1,890.41	7/12/91	1,890.41	4/12/91			1,890.41		1,890.41
J3904	Southeast	117	Clean tank	1,949.32	7/12/91	1,949.32	4/12/91			1,949.32		1,949.32
J3906	Southeast	117	Grind/weld pitting	1,977.75	7/12/91	1,977.75	4/12/91			1,977.75		1,977.75
J3902	Southeast	117	Piping	1,999.90	7/12/91	1,999.90	4/12/91			1,999.90		1,999.90
J3696	Southeast	116	Piping	3,428.80	6/10/91	3,428.80	1/24/91			3,428.80		3,428.80
J4689	Southeast	113	Clean tank	4,640.02	7/2/92	4,640.02	6/22/92			4,640.02		4,640.02
96858208	Temcor	-	Grating on tanks	7,652.00	4/3/92	7,652.00	2/28/92				7,652.00	7,652.00
96858207	Temcor	-	-	9,600.00	12/1/91	-	-				9,600.00	9,600.00
96858208	Temcor	-	4 walkways for alum domes	13,304.17	4/2/92	13,304.17	1/26/92				13,304.17	13,304.17
96857971	Temcor	-	-	24,600.00	12/1/91	-	-				24,600.00	24,600.00

P.O. No.	Vendor	Tank	Description	PTR Control Report		Photodisc File Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
96858208	Temcor	-	4 walkways for alum domes	66,520.83	4/1/92	66,520.83	12/31/91				66,520.83	66,520.83
TAX	UNKNOWN	-	-	562.97	3/2/92	-	-	112.59	56.30	365.93	28.15	562.97
TAX	UNKNOWN	-	-	836.55	10/1/91	-	-	167.31	83.66	543.76	41.83	836.55
TAX	UNKNOWN	-	-	1,307.05	3/1/92	-	-	261.41	130.71	849.58	65.35	1,307.05
TAX	UNKNOWN	-	-	2,151.25	3/5/92	-	-	430.25	215.13	1,398.31	107.56	2,151.25
TAX	UNKNOWN	-	-	2,151.25	3/6/92	-	-	430.25	215.13	1,398.31	107.56	2,151.25
TAX	UNKNOWN	-	-	3,395.36	3/3/92	-	-	679.07	339.54	2,206.98	169.77	3,395.36
TAX	UNKNOWN	-	-	3,395.36	3/4/92	-	-	679.07	339.54	2,206.98	169.77	3,395.36
				921,134.79			TOTAL	203,443.19	47,918.50	524,863.60	144,909.50	921,134.79

P.O. No.	Vendor	Tank	Description	PTR Control Report		File Hard Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
ENGJLV	ENGTIME	-	-	1,296.00	1/15/92	-	-	388.80	129.60	712.80	64.80	1,296.00
ENGLLD	ENGTIME	-	-	7,848.00	10/15/92	-	-	2,354.40	784.80	4,316.40	392.40	7,848.00
EXPLJAC	EXPENSE	-	-	454.16	1/1/93	-	-	136.25	45.42	249.79	22.71	454.16
EXPLLD	EXPENSE	-	-	1,783.71	1/1/92	-	-	535.11	178.37	981.04	89.19	1,783.71
98009118	A&M Piping	114	Waste disposal	295.32	12/8/92	295.32	9/28/92			295.32		295.32
NO PO 6	A&M Piping	110	Stripping valve	503.74	2/8/93	503.74	2/1/93			503.74		503.74
NO PO 5	A&M Piping	113	Sample valves	793.58	2/8/93	793.58	1/15/93			793.58		793.58
98009269	A&M Piping	110	Fab diffuser	936.27	1/26/93	936.27	12/31/92					
LLD005	A&M Piping	114	Sample valves	1,060.40	2/1/93	1,060.40	1/15/93				936.27	936.27
NO PO 7	A&M Piping	114	Roof piping stairs	1,192.27	2/8/93	1,192.27	2/1/93				1,060.40	1,060.40
KCX01	A&M Piping	114	Leak detection	1,734.00	1/1/93	1,734.00	12/12/92			1,734.00		1,734.00
JAX002	A&M Piping	105	Paint logo	2,750.00	4/8/93	2,750.00	3/31/93					2,750.00
98009269	A&M Piping	110	Leak detection	6,446.11	2/25/93	6,446.11	2/1/93					6,446.11
A&M02	A&M Piping	?	?	6,473.09	5/1/92	6,473.09	4/14/92					6,473.09
A&M03	A&M Piping	?	?	6,663.75	5/1/92	6,663.75	4/14/92					6,663.75
JAX004	A&M Piping	105	Blast & coat	8,100.00	4/8/93	8,100.00	3/31/93					8,100.00
A&M01	A&M Piping	?	?	8,620.00	5/1/92	8,620.00	4/14/92					8,620.00
JAX003	A&M Piping	110	Blast & coat	9,280.00	4/8/93	9,280.00	3/31/93					9,280.00
J4863	A&M Piping	105	Blast & coat bottom	9,800.00	1/1/92	9,800.00	10/1/92					9,800.00
98009118	A&M Piping	114	Leak detection	10,281.12	2/25/93	10,281.12	2/1/93			10,281.12		10,281.12
JX2	A&M Piping	113	Blast, coat, roof & walkway	15,470.00	12/15/92	15,470.00	12/10/92				15,470.00	15,470.00
05240001	A&M Piping	114	Blast, coat, roof & walkway	16,400.00	8/9/93	16,400.00	7/18/93				16,400.00	16,400.00
98009269	A&M Piping	110	Leak detection	19,338.38	1/5/93	19,338.38	12/15/92	5,801.51	1,933.84	10,836.11	966.92	19,338.38
98009269	A&M Piping	110	Leak detection	24,750.09	11/3/92	24,750.09	10/12/92	7,425.03	2,475.01	13,612.55	1,237.50	24,750.09
98009118	A&M Piping	114	Leak detection	26,789.27	12/8/92	26,789.27	11/10/92	8,036.78	2,678.93	14,734.10	1,339.46	26,789.27
98009118	A&M Piping	114	Leak detection	30,843.36	1/5/93	30,843.36	12/15/92	9,253.01	3,084.34	16,963.85	1,542.17	30,843.36
98009269	A&M Piping	110	Leak detection	37,125.14	10/12/92	37,125.14	9/1/92	11,137.54	3,712.51	20,418.83	1,856.26	37,125.14
98009269	A&M Piping	110	Leak detection	41,262.73	12/8/92	41,262.73	11/10/92	12,378.82	4,126.27	22,694.50	2,063.14	41,262.73
98009118	A&M Piping	114	Leak detection	58,136.92	9/2/92	58,136.92	9/1/92	17,441.08	5,813.69	31,975.31	2,906.85	58,136.92
98009118	A&M Piping	114	Leak detection	79,571.68	11/3/92	79,571.68	10/12/92	23,871.50	7,957.17	43,764.42	3,978.58	79,571.68
98008336	Allentech	-	Overflow vents	678.40	5/8/92	678.40	5/5/92				678.40	678.40
98008729	Allentech	-	Diffusers	1,929.53	4/20/92	1,929.53	4/14/92				1,929.53	1,929.53
NO PO 4	Allentech	-	Diffusers	1,661.50	1/12/92	1,661.50	11/4/92				1,661.50	1,661.50
JAX005	Carroll	114	Lighting	1,448.00	4/8/93	1,448.00	4/2/93				1,448.00	1,448.00

P.O. No.	Vendor	Tank	Description	PTR Control Report		File Hard Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
98008459	Energy Pro	-	Valves	1,614.00	4/21/92	1,614.00	4/3/92			1,614.00		1,614.00
98008462	Energy Pro	-	Valves	1,614.00	4/20/92	1,614.00	4/3/92			1,614.00		1,614.00
98008459	Energy Pro	-	Valves	2,373.00	4/20/92	2,373.00	4/6/92			2,373.00		2,373.00
98008462	Energy Pro	-	Valves	2,373.00	4/21/92	2,373.00	4/6/92			2,373.00		2,373.00
98008460	Energy Pro	-	Valves	3,078.00	4/20/92	3,078.00	4/6/92			3,078.00		3,078.00
98008459	Energy Pro	-	Valves	5,998.00	5/1/92	5,998.00	4/10/92			5,998.00		5,998.00
J4421	Energy Pro	-	Valves	-	-	8,639.00	4/3/92			8,639.00		8,639.00
NO PO 1	Fisher	-	Waste disposal	3,610.00	2/1/92	3,610.00	1/20/92			3,610.00		3,610.00
G742524	Fisher	-	Waste disposal	20,505.00	2/5/92	20,505.00	1/21/92			20,505.00		20,505.00
J4402	Genl Valve	-	Valves	6,834.88	12/14/92	6,834.88	12/2/92			6,834.88		6,834.88
J4403	Griffith	105	Clean & dispose	5,852.50	2/1/92	5,852.50	1/15/92			5,852.50		5,852.50
KMC01	Griffith	113	Clean & dispose	10,111.50	2/1/92	10,111.50	1/15/92			10,111.50		10,111.50
98009356	Griffith	114	Clean & dispose	16,776.50	9/1/92	16,776.50	8/13/92			16,776.50		16,776.50
98009290	Harco	110	Clean & dispose	18,665.00	11/20/92	18,665.00	9/21/92			18,665.00		18,665.00
98009291	Harco	117	Cath prot	147.27	10/1/92	147.27	9/28/92		147.27			147.27
98009357	Harco	-	Cath prot freight	684.60	10/1/92	684.60	9/28/92		684.60			684.60
98009078	KBG	-	Photo	1,196.08	11/3/92	1,196.08	9/28/92		1,196.08			1,196.08
98009364	KBG	-	Photo	13.45	8/1/92	13.45	7/28/92				13.45	13.45
NO PO 3	MidValley	-	Valve	30.35	11/9/92	28.50	10/21/92				30.35	30.35
98009388	MPC	-	Valve	1,170.00	11/12/92	1,170.00	11/4/92			1,170.00		1,170.00
J4976	MPC	114	Liner assistance	921.24	11/9/92	921.24	10/26/92	921.24				921.24
CREDIT	MQS	110	Liner assistance	1,126.73	12/15/92	1,126.73	11/18/92	1,126.73				1,126.73
J524114	MQS	-	-	-3,745.18	2/16/93	-3,745.18	2/16/93			-3,745.18		-3,745.18
J5067	MQS	114	Test	924.00	3/17/93	924.00	3/9/93			924.00		924.00
98009403	Orbit	110	Test	1,068.00	3/9/93	1,068.00	2/22/93			1,068.00		1,068.00
98009359	Orbit	-	Valves	5,393.16	12/8/92	5,393.16	11/17/92			5,393.16		5,393.16
98009403	Orbit	-	Valve	7,481.63	1/5/93	7,481.63	11/20/92			7,481.63		7,481.63
98009403	Orbit	-	Valves	8,409.24	1/5/93	8,409.24	12/4/92			8,409.24		8,409.24
98009403	Orbit	-	Valves	10,652.13	12/7/92	10,652.13	11/12/92			10,652.13		10,652.13
98009256	Orbit	-	Valves	22,444.88	1/12/93	22,444.88	12/21/92			22,444.88		22,444.88
98009256	South Mar	110	Inspect	625.00	9/21/92	625.00	10/6/92			625.00		625.00
98009356	South Mar	114	Inspect	625.00	11/3/92	625.00	8/26/92			625.00		625.00
NO PO 2	Southeast	111/114	Piping	930.78	2/1/92	930.78	1/7/92			930.78		930.78
98009276	Southeast	110	Lower legs	1,433.50	9/25/92	1,433.50	9/9/92			1,433.50		1,433.50
98009277	Southeast	110	Pump down tank	1,950.40	9/25/92	1,950.40	9/17/92			1,950.40		1,950.40
J5110	Southeast	110	Leg work	2,213.28	3/1/93	2,213.28	3/1/93			2,213.28		2,213.28

P.O. No.	Vendor	Tank	Description	PTR Control Report		File Hard Copy		Under Tank Liner System	Cathodic Protection	Leak Detection Bottom System	Misc. Costs	TOTAL
				Expended	Date	Expended	Date					
J4396	Southeast	104	Clean & fill	2,577.93	2/1/92	2,577.93	17/92			2,577.93		2,577.93
J4545	Southeast	113	Clean	2,602.01	4/1/92	2,602.01	3/10/92			2,602.01		2,602.01
J5243242	Southeast	110	Jumper on line	2,862.60	3/17/93	2,862.60	3/1/93			2,862.60		2,862.60
J4398	Southeast	111/113	Piping	3,205.78	2/1/92	3,205.78	17/92			3,205.78		3,205.78
J4399	Southeast	109/113	Piping	3,942.03	2/1/92	3,942.03	17/92			3,942.03		3,942.03
KMC001	Southeast	105	Fill, drain, wash	4,263.82	6/5/92	4,263.82	5/26/92			4,263.82		4,263.82
J4397	Southeast	110/113	Piping	4,781.57	2/1/92	4,781.57	17/92			4,781.57		4,781.57
J4982	Southeast	110	Piping	4,888.13	1/11/93	4,888.13	12/18/92			4,888.13		4,888.13
JAX006	Southeast	114	Drain tank	4,980.39	4/8/93	4,980.39	3/31/93			4,980.39		4,980.39
J5112	Southeast	114	Fill tank	5,653.94	3/1/93	5,653.94	2/22/93			5,653.94		5,653.94
J5111	Southeast	110	Fill for test	7,855.78	3/1/93	7,855.78	3/1/93			7,855.78		7,855.78
KCJ02	Southeast	117	Piping	8,434.32	5/11/92	8,434.32	5/4/92			8,434.32		8,434.32
98008733	Ultraflo	113	Seal	12,300.00	5/15/92	12,300.00	4/28/92	484.31	161.44		12,300.00	12,300.00
TAX	UNKNOWN	-	-	1,614.35	11/12/92	-	-			887.89	80.72	1,614.35
								101,292.11	35,109.33	440,806.79	108,210.86	685,419.09

Tank 106

P.O. Number	Invoice Number	Total Invoice Amount	Vendor	Description	PTI Control Report Expiration Date	Under Tank Leak Systems	Cathodic Protection	Leak Detection Bottom Systems	Miscellaneous Cost	Totals
1	4,925.00 A & M Piping & Petro			Sandblast & Coat Interior for Jet Service	12/07/93				4,925.00	4,925.00
87459	935.45 Cathodic protection Services			Freight, Cadwelder w/ignite, Charges, Rubber Tape, Vinyl Tape, 3M Scotchfill	03/18/94					311.82
609780	654.53 Harco Technologies Corp.			Freight	03/10/94					654.53
609760	141.91 Harco Technologies Corp.			Tax Bill for Material	03/03/93					141.91
MA2083	475,840.00 Matrix Services			Diaphragm hand pump for food handling	05/10/93					173,325.13
3062296	64.83 McMaster - Carr			Living & Travel Expenses	04/15/94					21.61
10098	1,300.40 MPC Containment Systems			Liner Cement	09/30/93					1,300.40
10347	684.20 MPC Containment Systems				01/07/94					231.40
22-220966	1,931.00 MCS Inspection			Crew Hours, Miles traveled, Can 14AM, Gallons Leak Detectors	04/21/94					643.67
29978	500.00 PCA Engineering, Inc.			Internal Floor Coating Inspection	12/22/93					500.00
107838	1,013.10 Piping Equipment			FL Swing Checks and Flanged Gate	12/22/93					940.25
						0.00	311.82	0.00	181,743.65	182,995.72

Tank 108

P.O. Number	Invoice Number	Total Invoice Amount	Vendor	Description	PTI Control Report Expiration Date	Under Tank Leak Systems	Cathodic Protection	Leak Detection Bottom Systems	Miscellaneous Cost	Totals
1	19,805.00 A & M Piping & Petro			Sandblast & Coat Interior for Jet Service	12/07/93				19,805.00	19,805.00
87459	935.45 Cathodic protection Services			Freight, Cadwelder w/ignite, Charges, Rubber Tape, Vinyl Tape, 3M Scotchfill	03/18/94					311.82
6093864	2,173.89 Harco Technologies Corp.			Freight charge for materials	03/17/93					2,173.89
6093761	592.17 Harco Technologies Corp.			Tax Bill for Material	03/03/93					592.17
4-02271	145.37 MainServ - Allentech, Inc.			Freight Cost	09/15/93					145.37
MA2083	475,840.00 Matrix Services			Supply (1) long inlet diffuser	09/27/93					1,557.03
3062296	64.83 McMaster - Carr			Diaphragm hand pump for food handling	05/10/93					173,325.13
9789	1,298.77 MPC Containment Systems			Field Assistance & Travel & Living Expenses	04/15/94					21.61
10347	684.20 MPC Containment Systems			Liner Cement	01/07/94					1,298.77
22-220841	1,133.00 MCS			Crew Hours and Miles Traveled	10/04/93					231.40
22-220966	1,931.00 MCS Inspection			Crew Hours, Miles traveled, Can 14AM, Gallons Leak Detectors	04/21/94					643.67
107838	1,013.10 Piping Equipment			FL Swing Checks and Flanged Gate	12/22/93					940.25
						0.00	311.82	0.00	201,827.29	202,176.11

Tank 111

P.O. Number	Invoice Number	Total Invoice Amount	Vendor	Description	PTI Control Report Expiration Date	Under Tank Leak Systems	Cathodic Protection	Leak Detection Bottom Systems	Miscellaneous Cost	Totals
5101	1,800.00 A & M Piping & Petro			Blast clean & coating stairs platform	09/21/94					1,800.00
5102	18,300.00 A & M Piping & Petro			Fiberglass Interior	09/23/94					18,300.00
1401	3,310.50 C & N Piping Corporation			Furnish labor, equipment and strip down tank	04/12/94					3,310.50
87459	935.45 Cathodic protection Services			Freight, Cadwelder w/ignite, Charges, Rubber Tape, Vinyl Tape, 3M Scotchfill	03/18/94					311.82
6093762	1,008.62 Harco Technologies Corp.			Tax Bill for Material	03/03/93					1,008.62
4-241A	600.00 Incheape Testing Services			To Calibrate Shors	04/25/94					600.00
MA2083	475,840.00 Matrix Services			Diaphragm hand pump for food handling	05/10/93					173,325.13
3062296	64.83 McMaster - Carr			Field Technical Assistance and Expenses	01/17/94					21.61
10960	1,420.61 MPC Containment Systems			Liner Cement	01/07/94					1,420.61
10347	684.20 MPC Containment Systems									231.40
22-220966	1,931.00 MCS Inspection			Crew Hours, Miles traveled, Can 14AM, Gallons Leak Detectors	04/21/94					643.67
107838	1,013.10 Piping Equipment			FL Swing Checks and Flanged Gate	12/22/93					940.25
3833	2,103.55 Southeastern Petroleum Maintenance			Labor, Material and Equipment to lower legs on tank	06/16/93					2,103.55
						0.00	311.82	0.00	203,705.34	204,017.16

Total For all Tanks

589,191.99

AFE NUMBER: 92-2071

4774 Jacksonville

Fluid Bed Reactors

P O Number	Invoice Number	Total Invoice Amount	Vendor	Description	PTR Control Report		Under Tank Liner Systems	Cathodic Protection	Leak Detection Bottom Systems	Miscellaneous Cost	Totals
					Expended	Date					
	717	34,263.00	Eckel & Associates	Fluid Bed Reactors	2,000.00	10/21/93				2,000.00	2,000.00
G568821	000094	89,000.00	Envirex	Model 30 Gac-Fluid Bed Skid	89,000.00	12/16/92				89,000.00	89,000.00
				Totals	91,000.00		0.00	0.00	0.00	91,000.00	91,000.00

Tank 112

Invoice #	Invoice Date	Customer	Description	Quantity	Unit Price	Total	Unit	Material	Category	Subcategory	Notes
1819	3/4/94	C & N Piping Corporation	Supplied Labor, Equipment Materials to slip tank for new bottom	3,433.50	04/20/94	3,433.50					
1864	5/6/94	C & N Piping Corporation	Labor, equipment pipe drain, ship water and install skillets	5,659.28	12/14/94	5,659.28					
1472	1/9/94	C & N Piping Corporation	Supplied labor, equipment materials to relocate the VRU line	1,081.00	07/21/94	1,081.00					
1385	1/19/94	C & N Piping Corporation	Labor, equipment, mail lower roof support legs	1,819.50	03/23/94	1,819.50					
1424	2/6/94	C & N Piping Corporation	Supplied Labor, Equipment Materials to isolate lines	2,675.75	05/06/94	2,675.75					
1425	2/6/94	C & N Piping Corporation	Supplied Labor, Equipment Materials ship & remove VRU underground piping	2,687.00	05/12/94	2,687.00					
93261	8/7/94	Cathodic Protection Services	Freight	87.76	09/29/94	87.76					
92339	4/5/94	Cathodic Protection Services	Freight	450.50	08/25/96	450.50					
90529	2/4/94	Cathodic Protection Services	Freight	245.00	07/06/94	245.00					
90080	1/5/94	Cathodic Protection Services	Freight	165.25	08/21/94	165.25					
413218-01	12/6/94	General Valve	Tank Bottom	12,069.69	07/28/95	12,069.69					
394364	2/15/94	General Valve	Valve Assy., Twin Seal Valve, Carbon Steel Body & plug, Viton slip seal and viton o-rings, R.F.F.E., Gear operated, DTR Systems	2,157.69	06/16/94	2,157.69					
413218	12/6/94	General Valve	Valve Assy., Twin Seal Valve, Carbon Steel Body & plug, Viton slip seal and viton o-rings, R.F.F.E., Gear operated, DTR Systems	12,069.69	05/04/95	12,069.69					
FE2429	7/8/94	Matrix Services, Inc.		7,808.00	02/09/95	7,808.00					
FE2427	251,670.00	Matrix Services, Inc.		251,670.00	02/09/95	251,670.00					
10346	694.20	MPC Containment Systems	Liner Cement (tube)	694.20	01/07/94	694.20					
22-221203	961.50	MQS Inspection	Man Hours, Gallon Leak Tech, Miles Travel/Above Ground Storage Tank	961.50	11/30/94	961.50					
21847	817.00	Pipe Products	4 Powell 1503FE 150# C/S TL Gate	817.00	08/11/94	817.00					
505-993379-X	61.65	Roadway Express	Freight	61.65	06/15/94	61.65					
7708	20,700.00	Saraken Corporation	Truckload Gas Tanks Bottoms	20,700.00	06/17/94	20,700.00					
7707	6,200.00	Saraken Corporation	Tanker Clean-Out	6,200.00	06/17/94	6,200.00					
7706	3,850.00	Saraken Corporation	Tanker Clean Services	3,850.00	06/17/94	3,850.00					

AFE NUMBER: 92-2293

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Tank 116

P O Number	Invoice Number	Total Invoice Amount	Vendor	Description	PTR Confircl Report		Under Tank Liner Systems	Cathodic Protection	Leak Detection Bottom Systems	Miscellaneous Cost	Totals
					Expanded	Date					
	1464	6,280.00	C & N Piping Corporation	Labor Material and Equipment	6,280.00	07/22/94				6,280.00	6,280.00
	5962	503.20	LTS Sales Inc.	RBM Computer Book N/C TMW 3-2.5 Temp Probs & Well	503.20	11/04/94				503.20	503.20
	0009837IN	2,017.00	WSY Construction	Labor Material and Equipment	2,017.00	05/11/95				2,017.00	2,017.00
				Totals	8,800.20		0.00	0.00	0.00	8,800.20	8,800.20

P O Number	Invoice Number	Invoice Amount	Vendor	Description	PRR Control Report		Under Tank Liner Systems	Cathodic Protection	Leak Detection Bottom System	Miscellaneous	
					Expensed	Date				Cost	Totals
	3090	74,950.00	Ballard	Install Fiberglass Tank Bottom	74,950.00	02/23/95				74,950.00	74,950.00
	404802	11,859.84	Flow Technologies	Valve Assy.	11,859.84	02/01/95				11,859.84	11,859.84
	19435	292.81	Gauging Systems	Float 13" Guide, Hollow Shell	292.81	01/26/95				292.81	292.81
	JA2415	26,507.00	Matrix Service	Tank Bottom Replacement	26,507.00	01/20/95				26,507.00	26,507.00
	JA2423	26,507.00	Matrix Service	Tank Bottom Replacement	26,507.00	01/31/95				26,507.00	26,507.00
	MR2472	2,626.63	Matrix Service	Time and Material	2,626.63	03/21/95				2,626.63	2,626.63
	27378	588.08	Pipe Products	6 Powell 1503FE 150# C/STL Gate	588.08	01/27/95				588.08	588.08
	8046	17,445.00	Sarakem Corporation	Gallons Diesel Tank Bottom Shipped, Tank Clean, Load Transportation, Labor, drum, Drum Solids Disposal	17,445.00	11/16/94				17,445.00	17,445.00
	0009699IN	2,200.00	WBY Construction	Labor, Material and Equipment	2,200.00	03/10/95				2,200.00	2,200.00
	2-0995	11,950.00	MainServ	Install column base plates with 2 angle clips	11,950.00	05/01/95				11,950.00	11,950.00
	08360	25,907.95	Sarakem Corporation	Gallons Diesel Tank Bottom Shipped, Tank Clean, Load Transportation, Labor, drum, Drum Solids Disposal	25,907.95	04/28/95				25,907.95	25,907.95
	2-0969	1,243.50	MainServ	Non-Working Firewatch, cold cut 4" hole in bottom	1,243.50	04/19/95				1,243.50	1,243.50
	0728	162.45	Universal	Furnish Labor and Equipment	162.45	04/20/95				162.45	162.45
	3110	48,900.00	Ballard	Furnish Labor, Equipment and Supervision to Install Film Epoxy Tank Lining System	48,900.00	05/16/95				48,900.00	48,900.00
										0.00	0.00
					2,1140.26			0.00	0.00	251,140.26	251,140.26

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BP OIL

**NEW LEAK DETECTION
BOTTOM SYSTEMS
IN
EXISTING ABOVEGROUND
STORAGE TANKS**

SPECIFICATION NO.:	6-2
EDITION NO.:	5
PUBLISHED DATE:	4-20-95

PTR ENGINEERING

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SECTION 1 - SCOPE

1.1 OVERVIEW

- 1.1.1 This specification, together with any design drawings and other referenced materials (codes, specifications, and standards), covers the material, design, fabrication, installation, testing, inspection, and documentation requirements for the installation of new leak detection bottom systems in existing aboveground storage tanks.
- 1.1.2 The new leak detection bottom system shall be designed and installed as a 2%-sloped, "cone-down" center-sump bottom with an annular ring, a sub-floor liner, leak detection piping, and cathodic protection. See Figure 1 for a general cross-section of the leak detection bottom system.
- 1.1.3 Except for equipment and materials specifically mentioned as supplied by Owner, the Contractor shall provide all material, equipment, labor, testing, and supervision to complete the work in accordance with this specification and all applicable standards.
- 1.1.4 The Contractor must receive formal acceptance from the Owner for any alternate materials or installation techniques proposed by the Contractor before they are used.

1.2 REFERENCES

- 1.2.1 The following standards, codes, specifications, regulations, and recommended practices are useful references related to the installation of new leak detection bottom systems in existing aboveground storage tanks. The most recent edition shall be used unless otherwise specified.
 - 1.2.1.1 BP Oil Specifications:

Specification No. 1-1	General Conditions
Specification No. 2-1	Product Piping
Specification No. 5-1	Painting - Tanks, Lines and Structural Steel
 - 1.2.1.2 API Standards, Publications, and Recommended Practices:

Standard 650	Welded Steel Tanks for Oil Storage
Recommended Practice 651	Cathodic Protection of Aboveground Petroleum Storage Tanks
Standard 653	Tank Inspection, Repair, Alteration, and Reconstruction
Publication 2009	Safe Welding and Cutting Practices in Refineries, Gas Plants and Petroleum Plants
Standard 2015	Safe Entry and Cleaning of Petroleum Storage Tanks
Publication 2202	Dismantling and Disposing of Steel From Aboveground Leaded Gasoline Storage Tanks
Publication 2207	Preparing Tank Bottoms for Hot Work
Publication 2217	Guidelines for Confined Space Work in the Petroleum Industry
 - 1.2.1.3 OSHA Standards:

29 CFR Section 1910.146	Permit-Required Confined Spaces for General Industry; Final Rule
29 CFR Section 1926.62	Lead Exposure in the Construction Industry
 - 1.2.1.4 ASME Boiler and Pressure Vessel Codes:

Section IX	Welding Qualifications
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 - 1.2.1.5 American Society for Testing and Materials (ASTM):

ASTM D-751	Standard Methods of Testing Coated Fabrics
ASTM F-739	Resistance of Protective Clothing Materials to Permeation by Liquids or gases under Conditions of Continuous Contact

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SECTION 2 - SAFETY

2.1 GENERAL

- 2.1.1 The terminal facility handles highly flammable liquids. All work shall be executed by experienced personnel in accordance with the Owner's safety rules and regulations. The Owner's "Safety Rules and Regulations for Contractors and their Employees" booklet will be made available to the Contractor personnel and should be reviewed in detail with all employees. Any Contractor employee (including subcontractors) who performs work on site must receive, review, and sign-off the last page of the booklet before commencing any work.
- 2.1.2 Each Contractor employee shall view the following BP Oil Safety Video's and successfully complete the associated tests before starting work.

"Safety Rules and Regulations"

"Hot Work Procedures"

"Confined Space Entry"

- 2.1.3 All accidents which arise out of, or in connection with, the performance of work, which causes personal injury or any property damage shall be reported immediately to the Owner. This report shall be provided verbally at once. A subsequent detailed written report must be submitted to the Owner within one working day.
- 2.1.4 No smoking is permitted in the terminal facility.

2.2 CONFINED SPACE

- 2.2.1 The environment inside a storage tank is considered a confined space. The Owner will prepare the tank for "hot work" by cleaning and gas freeing the tank. Before Contractor entry, the atmosphere inside the tank will be tested to verify that the levels of oxygen, hydrocarbon, benzene, lead, hydrogen sulfide, and any other potential contaminants are acceptable for entry and "hot work" inside the tank. The Owner will document these tests using a third party marine chemist or industrial hygienist.
- 2.2.2 The Owner will issue a "Confined Space Entry Permit" to the Contractor. Entry inside the tank or onto the floating roof is strictly prohibited until the Contractor receives the written permit. All work and activities inside the confined space of the tank shall be in strict accordance with the OSHA Standard 29 CFR 1910.146 regarding confined spaces.
- 2.2.3 While working inside the tank, the Contractor shall comply with API 2015, specifically Section 9, Appendix C, and Appendix E.
- 2.2.4 The Contractor may change the conditions as a result of the work being performed and shall incorporate necessary provisions, e.g. air movers, respiratory protection, etc., as appropriate. The Contractor shall furnish and maintain continuous oxygen and hydrocarbon level monitoring to detect any change in the atmospheric environment inside the tank.

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- 2.4.7 When laboratory analysis is performed, samples of the paint shall be collected by a designated, competent individual, trained in the hazards of lead and sampling protocol. Samples should be done in each homogeneous area so that the analysis is representative of the complete surface and sub-layers to be abated. The samples shall be analyzed by methods that will provide reliable results down to 0.1% or less of lead concentration by weight. A sample shall be considered to be lead-free if the analysis indicates that the lead content is below 0.1%.
- 2.4.8 Personal protective equipment, including respiratory protection when required, shall be used during any task that may create an exposure to lead. Respiratory protection shall be used when exposure to lead exceeds the action limit, during initial exposure assessment for determination of potential exposure levels to lead, or when an employee requests a respirator. Personal protective clothing shall include full-body disposable coveralls, disposable shoe coverlets, gloves, and any other clothing that is deemed necessary. The outer most layer of protective clothing worn in lead work areas shall be left at the work site for proper decontamination or disposal.
- 2.4.9 Exposure assessment (air monitoring) and medical surveillance (biological monitoring) shall be performed as required by the OSHA Lead Standard. Upon completion of work, the Contractor shall make available to the Owner copies of all air and biological monitoring results and data.

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SECTION 3 - MATERIALS AND DESIGN

3.1 TANK LINER SYSTEM

3.1.1 General

- 3.1.1.1 The tank liner system shall be designed to be installed in conjunction with the new 2% sloped "cone-down" steel tank bottom. The liner shall be installed underneath the new steel tank bottom; shall be anchored to the tank shell; and shall serve as a leak detection system for the tank.
- 3.1.1.2 The design of the tank liner system shall include provisions for the necessary hardware to accommodate the leak detection piping and cathodic protection system.

3.1.2 Liner Material

- 3.1.2.1 The liner shall be a urethane coated fabric and shall have the following characteristics:

<u>Characteristic</u>	<u>Test Method</u>	<u>Value</u>
Base Fabric Weight	ASTM D-751	> 12 oz./yd. ²
Overall Weight	ASTM D-751	> 32 oz./yd. ²
Thickness	ASTM D-751	= 40 mils +/- 2
Coating Adhesion	ASTM D-751	> 15 lbs./in.
Permeability	ASTM F-739, Gasoline	< 0.25 oz./ft ² /day
Tensile Strength, Grab	ASTM D-751	> 1000 lbs.
Tensile Strength, Strip	ASTM D-751	> 700 lbs.
Puncture Resistance, Ball	ASTM D-751	> 1200 lbs.
Tearing Strength, Tongue	ASTM D-751	> 50 lbs.

- 3.1.2.2 The liner and all of the liner system hardware and accessories shall be chemically inert and compatible for the storage of gasoline, diesel fuel, kerosene, jet fuel, blended fuels, oxygenated fuels, neat MTBE, neat ethanol, and methanol.
- 3.1.2.3 The liner shall be of sufficient size to accommodate the slope of the tank bottom, the "turn-up" at the "dead" shell, and minor variations in the tank diameter. The liner material shall have a minimum diameter 3 feet larger than the nominal tank diameter.
- 3.1.2.4 The tank liner shall be factory fabricated into one or more sections, dependent upon the tank diameter and as recommended by the manufacturer, for ease of handling and installation under jacked fixed roof columns and/or floating roof legs. Tank liners fabricated in two or more sections shall, unless otherwise approved, include zipper enclosures, welded to the tank liner, enabling the seams to be sealed in the field by the installation Contractor.
- 3.1.2.5 The liner system shall include an adequate number of protection pads to be placed under fixed roof columns and floating roof legs during construction to protect the tank liner.
- 3.1.2.6 The tank liner shall be manufactured with parallel factory seams. Factory seams shall be lap welded with a minimum overlap of 2", and shall have minimum shear and tensile strengths which exceed 95% of the parent material or the specifications noted in Section 3.1.2.1.

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3.2 LEAK DETECTION PIPING

3.2.1 PVC Pipe and Fitting Specifications

- 3.2.1.1 PVC pipe and fittings shall be made of PVC compound of cell classification 12454-B as described in ASTM D-1784. Fittings shall meet or exceed the requirements for pressure fittings covered in ASTM D-2464, for Sch. 80 threaded fittings, and ASTM D-2467, for Sch. 80 socket-type fittings.
- 3.2.1.2 All socket-type connections shall be made with PVC cement. Only isopropyl alcohol shall be used when cleaning the pipes and fittings. Do not use solvents.
- 3.2.1.3 Slotted PVC pipe shall have 0.010" wide x .75" long slots at 180° on its circumference, spaced at 0.25" along its length. The slots shall prevent the migration of sand particles, while permitting fluid flow.

3.2.2 Leak Detection Piping/Cathodic Protection Shell Ports

- 3.2.2.1 Shell ports shall be provided for the radial monitor lines, the two (2) secondary liner drain lines, and the cathodic protection test station. The shell ports shall be located in the "dead" shell and shall provide means for the leak detection piping to penetrate the liner, pass through the tank shell, and be monitored from the exterior of the tank.
- 3.2.2.2 **Radial Monitor Shell Port:** Each radial monitor shell port shall consist of a 1½" 3000# forged steel full coupling, a 1½" rubber washer, a 1½" Sch. 80 PVC male adapter, a 1½" x 1" Sch. 80 PVC socket bushing, and a 1½" 3000# steel square head threaded plug. See Section 3.2.5.2 for the required number of radial monitors.
- 3.2.2.3 **Secondary Liner Drain Shell Port:** Each secondary liner drain shell port shall consist of a 1½" 3000# forged steel full coupling, a 1½" rubber washer, a 1½" Sch. 80 PVC male adapter, a 1½" x 1" steel bushing, a 1" steel close nipple, a 1" 800# steel threaded ball valve, and a 1" 3000# steel square head threaded plug.
- 3.2.2.4 **Cathodic Protection Shell Port:** The cathodic protection shell port shall consist of a 1½" 3000# forged steel full coupling, a 1½" rubber washer, and a 1½" Sch. 80 PVC male adapter.
- 3.2.2.5 See Figure 7 (page 28) for shell port details and Figure 6 (page 27) for quantities and orientation.

3.2.3 Primary Liner Drain/Observation Well

- 3.2.3.1 The primary liner drain/observation well assembly shall be used to monitor the tank liner for liquid and provide means to drain the liner.
- 3.2.3.2 The observation well size shall be 6". It shall consist of a 6" diameter Sch. 80 PVC pipe with a 6" PVC cap, 6" 150# PVC flange, 6" 150# PVC blind flange, 6"x6"x6" PVC tee, 6"x2" PVC socket bushing, and any other required fittings. The 6" blind flange shall have two (2) plugged openings; one - ¾" and one - 2". The PVC blind flange shall be supplied with the two plugs and they shall be drilled for Owner's security system. The observation well shall be pre-assembled by the liner manufacturer before shipping to the job site.

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3.2.5.3 Each radial monitor pipe shall be located on the top side of the liner and shall extend from its respective shell port to within 5 feet of the tank center line. At the North-South location, the radial monitor line shall extend continuously across the tank.

3.2.5.4 Each radial monitor line shall consist of 1" diameter slotted Sch. 80 PVC pipe and the required Sch. 80 PVC couplings and caps.

3.2.5.5 See Figures 6 and 7 for the radial monitor line details, quantities, and orientation.

3.3 CATHODIC PROTECTION SYSTEM

3.3.1 General

3.3.1.1 The cathodic protection system shall consist of zinc ribbon sacrificial anode, zinc hull anodes, reference cells, a test station junction box, and all necessary accessories including wire, splice connection equipment/material, conduit, and hardware.

3.3.1.2 The theoretical design life for the cathodic protection system shall be 20 years minimum.

3.3.2 Sacrificial Anode Ribbon, Leads, and Splice Connections

3.3.2.1 The sacrificial anode material shall be zinc ribbon meeting the chemical requirements of ASTM B418-80 Type II and shall have a minimum galvanic efficiency rating of 90%. The zinc ribbon anode shall have a weight of 1.2 lbs./ft. and it shall have the cross sectional dimensions of 5/8" x 7/8". The wire core shall have a diameter of 0.135". Platt Brothers & Company, Inc. Model *Plattline II "Plus"* or equal shall be used for the zinc ribbon anode.

3.3.2.2 The lineal feet of anode ribbon required for a tank is a function of the diameter of the tank. The equation to be used is: $\text{Lineal Feet} = .262(D^2) + 2.6(D)$, where D is the diameter of the tank, in feet.

3.3.2.3 There shall be two (2) anode ribbon lead wires which shall terminate at the test station junction box. These lead wires shall be constructed of No. 8 AWG stranded copper with HMW/PE insulation and shall conform to ASTM D1248, Type 1, Class C, Grade 5. A minimum of four (4) spliced connections, for each (of the two) anode ribbon lead wire, shall be made between the anode ribbon and the lead wire. The approximate length of each anode ribbon lead wire is equal to $1.57D + 10$, where D is the diameter of the tank, in feet.

3.3.2.4 All splice connections, which include both the anode ribbon-to-anode ribbon splices and the anode ribbon-to-anode ribbon lead wire splices, shall be made with exothermic welds. The proper size weld molds, weld metal, and other accessories shall be used.

3.3.2.5 All splice connections shall be sealed (encapsulated) against water penetration with acceptable splice sealing kits.

3.3.2.6 See Figure 8 (page 29) for the zinc ribbon anode layout.

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3.3.5 Hull (Tank Bottom) Anodes (OPTIONAL)

- 3.3.5.1 Zinc hull anodes shall be used to cathodically protect the center portion of the top side of the new steel tank bottom. Only to be used when specified by the Owner's Engineer.
- 3.3.5.2 Each zinc hull anode shall have a weight of 22 lbs. and have a current rating of 1 Amp-yrs. The dimensions of the anode shall be 6" wide x 12" long x 1 1/4" tall. Each hull anode shall have two (2) galvanized steel mounting straps to provide means for welding the anode to the tank bottom. Harco Model M-24 zinc hull anodes, or CPS hull anodes (part number AZH22H2B), or equal shall be used.
- 3.3.5.3 The number and placement of hull anodes shall be determined on a per tank basis by the Owner's Engineer. The surface area that one hull anode can effectively protect is described as a 3' radius around the hull anode.

3.4 SAND SPECIFICATIONS

- 3.4.1 The fill material between the tank liner and the new steel tank bottom shall be clean, dry Silica sand.
- 3.4.2 The Silica sand shall be at least 98% Silicon Dioxide (SiO₂) and it shall have the following characteristics:

<u>Characteristic</u>	<u>Test Method</u>	<u>Value</u>
Resistivity	ASTM G-57	> 50,000 ohm-cm
pH	EPA 9045	6 - 8
Soluble Chloride	EPA 9252	< 50 ppm
Total Sulfide	EPA 376.2	< 50 ppm

3.5 STEEL MATERIAL REQUIREMENTS

- 3.5.1 As a minimum, materials selected for shell insert plates, bottom plates, annular ring plates, back-up bars, reinforcing plates, thickened insert plates, shell nozzles and flanges, and manhole necks shall be chosen according to API 650, latest edition and this specification. In addition, no Group I (API 650 Table 2-3) steels shall be permitted to be used as any part of the tank.
- 3.5.2 Material used for shell insert plates, reinforcing plates, thickened insert plates, and annular ring plates must meet the requirements as defined by Figure 2-1 in API 650 with respect to the metal design temperature and the steel thickness.
- 3.5.3 The bottom plates, column base plates, floating roof base plates, gauging strike plates, etc. shall be a minimum of 1/4" inch thick ASTM-A36 modified steel. Decoil steel is not acceptable. All ASTM-A36 modified steel must meet the requirements of Group II per API 650 Table 2-3 and must be killed or semi-killed. Manganese content shall be 0.80 - 1.20 percent by heat analysis for all thicknesses. Maximum carbon content must not exceed 0.20 percent.
- 3.5.4 Mill test reports (MTR's) are required for all new steel supplied and installed by the Contractor.

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3.7.3 All bottom plate joints in the finished tank bottom shall be "shingled" to provide drainage toward the center sump. The bottom plates shall be lap welded over the lip of the sump to avoid ponding of water around the sump.

3.7.4 No supports, attachments, etc. shall be welded directly to the new bottom plates - always use seal welded pads for pipe supports, ladder supports, columns, etc.

3.8 ANNULAR RING DESIGN

3.8.1 All tanks shall be fitted with full penetration butt welded annular ring plates. The annular ring plate thickness shall be 3/8" inch unless API 650 requires a greater thickness.

3.8.2 Annular ring plates shall have a radial width that provides at least 34 inches between the inside of the shell and any lap welded joint in the bottom and at least a $3 \pm \frac{1}{2}$ inches outside the shell.

3.8.3 The annular ring plates shall be installed with a minimum of a 2% slope away from the tank shell toward the center sump.

3.8.4 See Figure 10 (page 31) for annular ring details.

3.9 SHELL OPENINGS (NOZZLES AND MANWAYS) DESIGN

3.9.1 The location, type, and number of required nozzles for the tank will be specified by the Owner's Engineer.

3.9.2 All shell manways shall be 24" size and equally spaced around the tank. Unless otherwise specified by the Owner's Engineer, the minimum number of shell manways shall be per the following: One (1) - for tank diameters less than or equal to 25 feet, Two (2) - for tank diameters greater than 25 and less than 100 feet, and Three (3) - for tank diameters greater than or equal to 100 feet.

3.9.3 All shell manways shall be flush with the inside of the tank shell. Shell manways for floating roof tanks shall be provided with filler pieces flush with the inside of the tank shell and attached to the manhole cover.

3.9.4 The product suction and fill nozzles shall extend into the tank per the "J" dimension given in Table 3-8 of API 650 and the internal end of these nozzles shall be supplied with a flanged connection.

3.9.5 The height of an API Regular Type nozzle or manway shall not be less than the " H_N " value given in Table 3-8 of API 650. The height of an API Low Type nozzle or manway shall not be less than the "C" value given in Table 3-8 of API 650.

3.9.6 Reinforcement of shell openings shall be as defined in API 650 and API 653. Reinforcement may be obtained by using a fillet welded reinforcing plate when API 653 allows, or by using a thickened insert plate.

3.9.7 Fillet welded nozzle/manway reinforcing plates or each segment if they are not made in one piece shall be provided with a NPT $\frac{1}{4}$ inch diameter telltale hole and shall be located substantially on the horizontal centerline and shall be open to the atmosphere. These telltale holes shall be tested in accordance with API 650 and this specification.

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SECTION 4 - PRE-CONSTRUCTION SUBMITTALS

4.1 GENERAL

- 4.1.1 The pre-construction submittals shall include tank bottom design drawings; welding procedure and qualification testing documentation, mill test reports on the new steel, safety program and training certification documentation, and a bar chart project schedule.
- 4.1.2 All pre-construction submittals are to be received and approved by the Owner before any construction may begin.

4.2 DESIGN DRAWINGS

- 4.2.1 A design drawing package for the new bottom system installation and shell/nozzle work shall be submitted and approved, in writing, by the Owner before construction may begin.
- 4.2.2 The drawing package shall include, as a minimum, the following items:
- a) Bottom and annular ring plate layout drawing including all critical dimensions of weld seams to each other as well as to existing shell vertical seams and to new shell insert plate vertical seams. Bottom plate weld sequence (which will eliminate bottom ripples) shall be indicated on this drawing.
 - b) All weld joint cross section detail drawings with the applicable welding procedures. This includes the shell-to-annular ring plate fillet welds, the annular ring plate butt welds, the bottom plate lap welds, the nozzle neck full penetration welds, and the full penetration shell welds.
 - c) Shell rollout drawing illustrating all nozzle/manway modifications including proposed doorsheets. This drawing shall include all dimensions (size and location) of all shell inserts, thickened inserts, nozzle/manway reinforcing plates, nozzles, and manways.
 - d) Detailed drawings for each nozzle and manway with its respective reinforcing plate or thickened insert plate. These drawings to include the applicable welding procedures.
 - e) Detailed drawing of a steel cone roof walkway meeting OSHA requirements for center gauging access (if applicable).

4.3 WELDING DOCUMENTATION

- 4.3.1 Submittal information for welding shall include all welding procedure specifications (WPS), procedure qualification records (PQR), and welder qualification tests (WPO) for each procedure and welder to be used on the project. Welding procedures and the qualification of welders and welding operators shall be in accordance with ASME Code Section IX. The transfer of welder qualification tests from one employer to another is not acceptable. All welding procedures and welders must be approved by the Owner's Engineer before work begins.

4.4 MILL TEST REPORTS

- 4.4.1 Mill Test Reports (MTR) shall be submitted for all new steel supplied and installed by the Contractor including all shell plates, nozzle/manway reinforcing plates, thickened insert plates, bottom plates, annular ring plates, plates used for manholes, nozzle necks, and plate ring flanges.

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SECTION 5 - CONSTRUCTION PROCEDURES

5.1 INITIAL SITE WORK

- 5.1.1 Contractor shall verify that all tank dimensions as shown on Owner's drawings and bid specifications are correct. This includes confirming that the drawings and bid specification are complete and meet the requirements of API 650, API 653, and the specifications herein. Other items discovered that require additional work to comply with API 650, API 653, or this specification will be considered extra work under the terms of the contract. The Owner maintains the right to authorize any additional work before it is begun. Any change to the contract must be approved in writing before it is begun.
- 5.1.2 A shell settlement survey shall be performed and evaluated for acceptance according to API 653 B2.2. If the tank does not meet the API 653 criteria the Contractor shall jack and level the tank as required. The tank must be level before any attempt is made to proceed beyond this point. ODOT 304 or crusher-run base (or other approved material) shall be used as a fill material for leveling the tank. Unless specified in the scope of work, tank jacking will be considered additional work under the terms of the contract. The jacking procedure must be approved by Owner's Engineering. The Contractor shall furnish all necessary documentation verifying that the tank is level to within API 653 guidelines.
- 5.1.3 The tank bottom shall be surveyed to determine the difference in elevation between the bottom at the center and the bottom at the shell. The Contractor shall also determine and document the degree of edge settlement present in the tank. Although edge settlement in the "dead" shell and original tank bottom is not a structural concern, this information will be used to determine the location for the shell slot for the new bottom and the proper portion of the original bottom that must be removed for the new "cone-down" bottom.

5.2 SHELL SLOTTING, OLD BOTTOM REMOVAL, AND EXCAVATION

- 5.2.1 The bottom of the shell slot shall be between 4 and 6 inches above the existing tank bottom. The exact location depends on the layout of the existing bottom ("cone-up" or "cone-down"), the degree of edge settlement in the original bottom, the presence of any lower shell corrosion, and/or the location of any shell nozzles, manways, doorsheets, etc. that are to remain (maintaining proper weld spacing). The location of the new bottom must provide a minimum of 2½ inches of clearance between any section of the old bottom and the new bottom. See Section 5.6. If a shell slot height greater than 6 inches is required in order to maintain adequate clearance between the two bottoms, due to the conditions mentioned above, additional means to support the "dead" shell and keep it stable may be required. The Owner's Engineer must approve of the location of the shell slot prior to beginning.
- 5.2.2 Adequate support lugs shall be installed completely around the circumference of the tank shell, using E7018 electrodes, before the shell is slotted. Maximum spacing of the support lugs is 5 feet. Alignment of the shell above and below the slot shall be maintained before and after the new annular ring plates are installed. See Figure 3 for shell slot and shell alignment details.
- 5.2.3 A secured, track-guided torch shall be used to make the shell slot cut for installation of the new bottom. Air carbon arc-gouging is not permitted for this operation. A horizontal slot ½ inch wider than the thickness of the new annular ring plate shall be torch-cut in the shell in accordance with Figure 3. The edges of the slot shall be straight and level to within 1/8 inch in a 3 foot arc measured on the shell. A jagged, rough, wavy cut is unacceptable.

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5.3 PRIMARY LINER DRAIN / OBSERVATION WELL INSTALLATION

- 5.3.1 The Contractor shall excavate for the center liner sump, for the 2 inch PVC primary liner drain, and for the 6 inch PVC observation well. The primary liner drain shall be sloped ($\frac{1}{4}$ " per foot) toward the observation well.
- 5.3.2 The Contractor shall provide good support/backfill for the supplied Sonotube for the liner sump to eliminate stress on the bulkhead fitting where the 2" PVC pipe penetrates the liner sump.
- 5.3.3 The PVC primary liner drain/observation well assembly and piping shall be installed and hydrostatically tested as recommended by the liner system manufacturer. The test shall use a minimum hydrostatic pressure of 25 psi for 60 minutes. The system shall be pumped out and blown dry after test.
- 5.3.4 See Figure 5 (page 26) for the primary liner drain/observation well details.

5.4 TANK LINER INSTALLATION

- 5.4.1 Stud bolts ($\frac{1}{2}$ inch diameter on 12 inch centers) shall be welded to the "dead" shell for attachment of the carbon steel compression members for the tank liner anchoring. See Section 3.1.3 and Figure 4 for the liner anchoring detail.
- 5.4.2 1 $\frac{1}{2}$ inch, 3000# steel couplings shall be welded in the "dead" shell for the cathodic protection shell port, the radial monitor shell ports, and the two (2) Secondary Liner Drain shell ports. The steel couplings shall be full-fillet welded, from the outside, flush with the interior of the tank shell. See Figure 7 (page 28) for details.
- 5.4.3 The liner shall be protected against the exposed edge of the remaining original bottom. The Contractor shall either tack weld round bar and attach sliced air compressor hose to the edge of the original bottom around the entire tank circumference.
- 5.4.4 The liner shall be unrolled and placed directly on the excavated surface and it shall be fitted over the stud bolts that shall anchor the liner to the shell. The liner shall be carefully fitted at the bottom corner of the tank to eliminate any voids and allow proper seating of the liner material upon compression of the sand pad. Only minimal folds or wrinkles shall remain in the liner after installation.
- 5.4.5 The gasket material, supplied by the liner manufacturer, shall be fitted over the stud bolts between the liner and the carbon steel compression members. The compression members shall securely fastened with heavy hex nuts.
- 5.4.6 Openings shall be cut in the liner for the cathodic protection shell port, the radial monitor shell ports, and the two (2) Secondary Liner Drain shell ports. For each shell port, the washer and PVC adaptor shall be securely fastened to the 1 $\frac{1}{2}$ inch steel couplings making a tight seal to the liner material.
- 5.4.7 The Contractor shall apply urethane sealant between the liner and the "dead" shell and around all liner penetrations (including the $\frac{1}{2}$ inch stud bolts, the primary liner drain bulkhead fitting, the cathodic protection shell port, the radial monitor shell ports, and the two secondary liner drain shell ports) ensuring that all gaps are filled and that the entire liner system is water tight.
- 5.4.8 Coated fabric liners shall be joined using the details and procedures complying with the tank liner manufacturer's recommendations. All field (zipper) seams shall be vacuum box tested.

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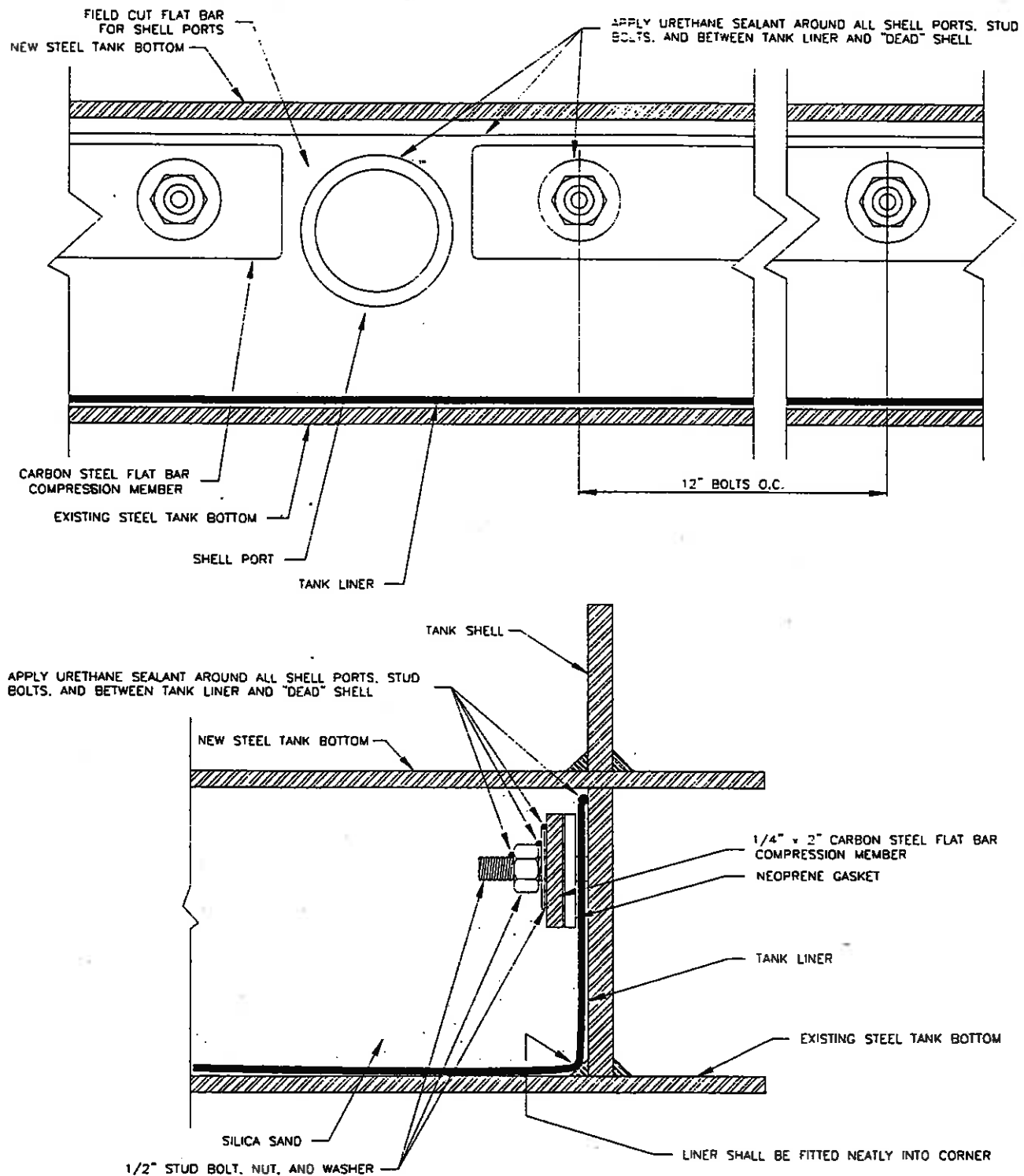
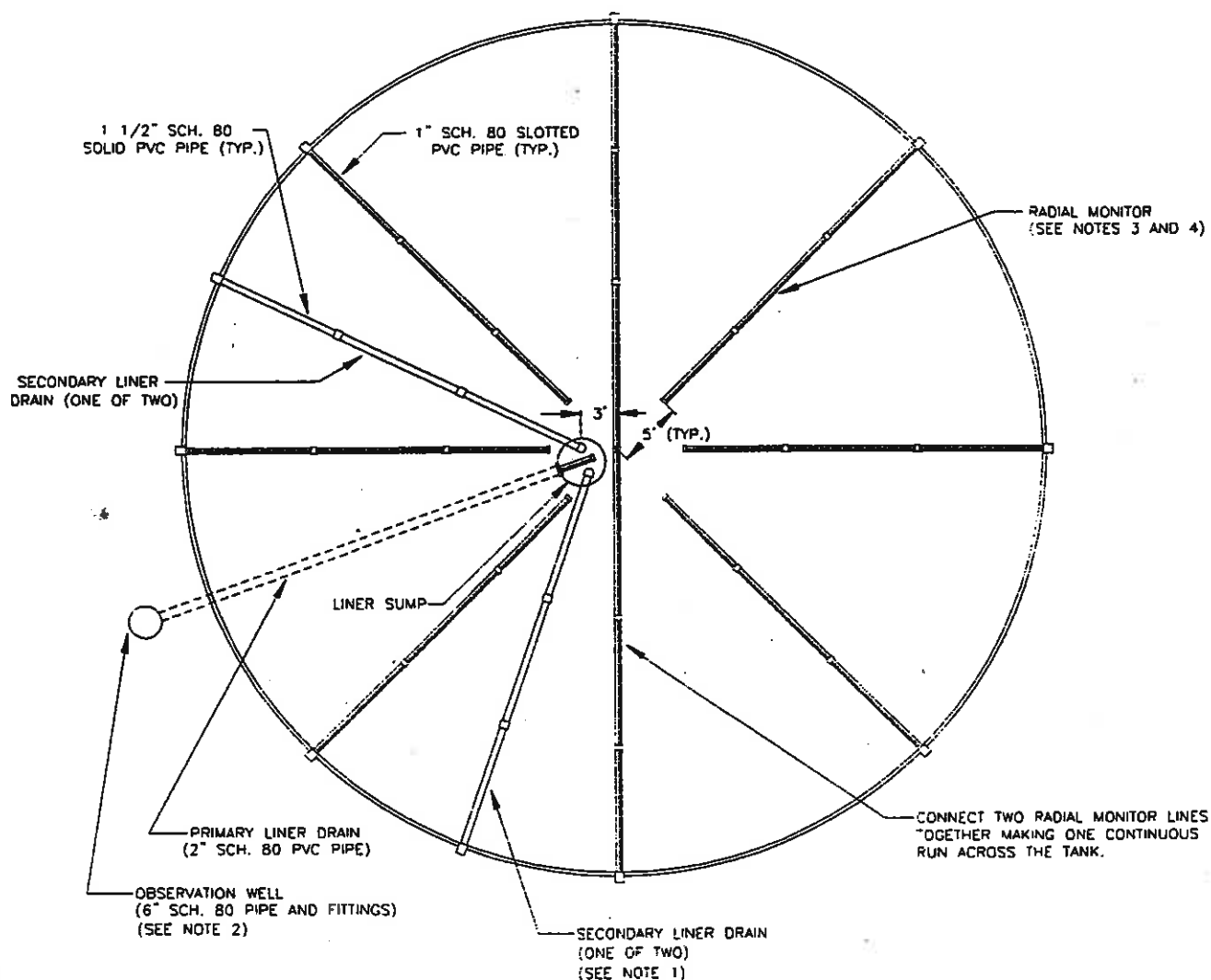


FIGURE 4 - LINER ANCHORING DETAIL

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NOTES:

- 1.) SPACE THE TWO SECONDARY LINER DRAINS 90 DEGREES APART FROM EACH OTHER.
- 2.) FIELD LOCATE THE PRIMARY LINER DRAIN/OBSERVATION WELL TO PROVIDE EASY ACCESS.
- 3.) SPACE THE RADIAL MONITORS EVENLY AROUND THE CIRCUMFERENCE OF THE TANK. WRAP ALL SLOTTED PVC RADIAL MONITOR PIPING WITH GEOTEXTILE FABRIC. CONNECT NORTH AND SOUTH RADIAL MONITORS MAKING ONE CONTINUOUS RUN ACROSS TANK.
- 4.) NUMBER OF RADIAL MONITORS DEPENDENT UPON TANK DIAMETER (SEE CHART BELOW).

TANK DIAMETER RANGE (FEET)	MINIMUM NUMBER OF RADIAL MONITORS
Up to 38	4
39 - 57	6
58 - 76	8
77 - 95	10
96 - 114	12
115 - 133	14
134 - 152	16
153 - 171	18
172 - 191	20
192 - 210	22

FIGURE 6 - LEAK DETECTION PIPING LAYOUT

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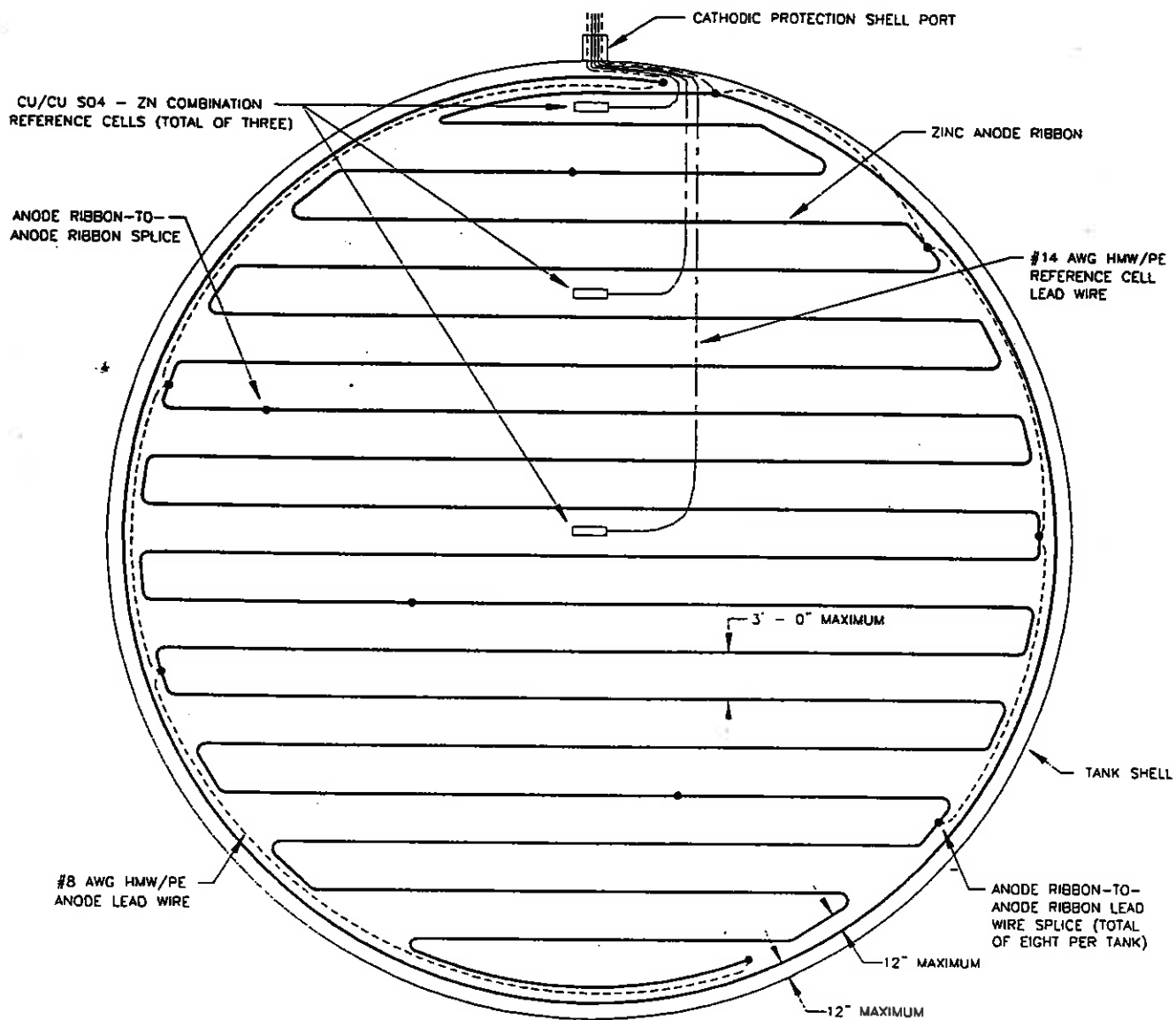


FIGURE 8 - CATHODIC PROTECTION LAYOUT

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5.7 SAND PAD INSTALLATION

- 5.7.1 After the cathodic protection and leak detection piping systems are in place, a layer of clean dry silica sand, of adequate thickness (between 4 and 6 inches) shall be installed over the zinc anode ribbon, reference cells, lead wires, and PVC leak detection piping.
- 5.7.2 This layer of sand shall be of adequate thickness to insure that absolutely no contact exists between the new steel bottom and the zinc anode ribbon. Additional sand shall be installed under the steel cone roof column(s), due to the concentrated loads, as required to maintain the proper slope of the bottom.
- 5.7.3 The sand used must have a minimum resistivity of 50,000 ohm-cm and meet the other specifications stated in Section 3.4. Documentation shall be submitted verifying that these specifications are met before the sand is brought to the site.
- 5.7.4 The Contractor shall take any necessary means to keep the sand dry during installation and during construction.

5.8 BOTTOM AND ANNULAR RING INSTALLATION

- 5.8.1 The new steel bottom plates shall be thoroughly cleaned of mud, clay and other foreign matter before being placed on the graded sand pad. Clumps of clay, welding rod stubs, rocks, etc. shall be removed from the sand pad before the bottom plates are laid in place.
- 5.8.2 The new steel bottom shall be installed as a "cone-down", center sump bottom. The new bottom requires a minimum slope of 2.4" inches in 10 feet (2%) toward the sump in the center of the tank. To prevent trapping water at the lapped joints, bottom plates shall be lapped to allow drainage of water to the sump. The bottom plates shall be lap welded over the lip of the sump to avoid ponding of water around the sump.
- 5.8.3 After the bottom plates are laid out and tacked, they shall be joined by welding the joints in a sequence that results in the least distortion from shrinkage and thus to provide, as nearly as possible, a perfect 2% slope to the sump.
- 5.8.4 During the installation of the annular ring the Contractor shall ensure that both sections of shell (above and below the new bottom) remain aligned. Care shall be taken to insure that the proper slope of the annular ring is maintained after installation is completed.

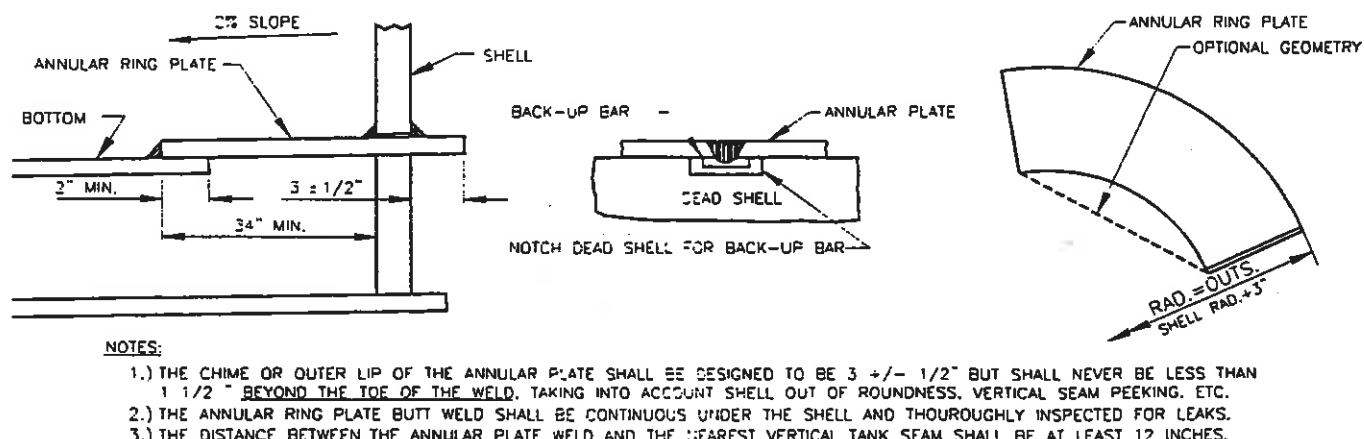


FIGURE 10 - ANNULAR RING DETAILS

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5.10.2 Items Applicable to Tanks with a Steel Cone Roof and without a Floating Roof

- 5.10.2.1 The Contractor shall provide and install a steel cone roof walkway, meeting OSHA requirements, to be used for center gauging access. The walkway shall be 36" wide using gripstrut or equivalent grating. The walkway design shall provide a minimum clearance of 6" under the walkway to allow access for painting. The walkway shall be designed to provide a smooth transition, with no tripping hazards, to existing rails and platforms.
- 5.10.2.2 Near the center of the steel cone roof, the Contractor shall provide and install a new 8" steel riser with an 8" Oceco gasketed gauge hatch assembly. Contractor shall also install a seal welded 24" diameter, ¼" thick steel striker plate on the new bottom directly below the 8" gauge hatch.
- 5.10.2.3 The cone roof columns shall be shortened or lengthened as needed due to the elevation and slope of the new tank bottom. Weep holes shall be installed in each roof column to prevent product from being trapped. All columns must be plumbed and supported by a new ¼" minimum thickness bearing plate that is seal welded to the new bottom. This bearing plate must extend 6 inches beyond the column or existing support configuration.
- 5.10.2.4 The Contractor shall install two (2) 4" 150# flanged nozzles on the steel cone roof, near the shell of the tank, to be used for future independent tank high level alarms. The nozzles shall be positioned so they can be easily accessed from the top of the steel cone roof platform. The two nozzles shall be installed such that the faces of the flanges are at the same elevation. Blind flanges shall be installed on the nozzles.

5.10.3 Items Applicable to Tanks with a Steel Cone Roof and a Floating Roof (Aluminum Pontoon, Steel Pan, etc.)

- 5.10.3.1 The Contractor shall provide and install a steel cone roof walkway, meeting OSHA requirements, to be used for center gauging access. The walkway shall be 36" wide using gripstrut or equivalent grating. The walkway design shall provide a minimum clearance of 6" under the walkway to allow access for painting. The walkway shall be designed to provide a smooth transition, with no tripping hazards, to existing rails and platforms.
- 5.10.3.2 Near the center of the steel cone roof, the Contractor shall provide and install a new 8" steel riser with an 8" Oceco gasketed gauge hatch assembly.
- 5.10.3.3 Near the center of the internal floating roof, the Contractor shall install a new 8" floating roof penetration and funnel assembly for center manual gauging. The funnel shall include slotted seal material to reduce emissions. Contractor shall also install a 24" diameter, ¼" thick steel striker plate on the new bottom directly below the 8" funnel. If the floating roof deck is submerged below the product level, as with a steel pan floating roof, a sleeve with a minimum length of 24" shall be used between the roof deck and the gauge funnel. Diesel test the penetration for leaks.
- 5.10.3.4 The cone roof columns shall be shortened or lengthened as needed due to the elevation and slope of the new tank bottom. Weep holes shall be installed in each roof column to prevent product from being trapped. All columns must be plumbed and supported by a new ¼" minimum thickness bearing plate that is seal welded to the new bottom. This bearing plate must extend 6 inches beyond the column or existing support configuration.

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SECTION 6 - TESTING AND INSPECTION

6.1 GENERAL

- 6.1.1 Testing and inspection shall be done in accordance with API 650 and the additional requirements of this specification. When conflicts occur, the stricter requirements shall govern.
- 6.1.1 Personnel performing Radiography, Magnetic Particle, Dye Penetrant, and Vacuum Box inspections shall be qualified per the requirements of API 650 and API 653.
- 6.1.1 Prior to final inspection and the hydrostatic test, the inside and outside of the tank shall be thoroughly cleaned and shall be free from all slag, scale, grit, weld spatter, pieces of metal, welding rod stubs, etc. All welds shall be free of slag, oil, grease, paint, and any other foreign substance which might prevent thorough inspection or proper interpretation of the required tests.

6.2 TANK LINER SEAMS

- 6.2.1 Inspection and testing of the tank liner shall conform to the manufacturer's guidelines. These tests shall include 100% vacuum box testing of all field seams using a soap solution at a minimum negative pressure of 2 psi and a minimum holding time of 10 seconds. The soap solution shall be applied in a manner that does not induce bubbles.
- 6.2.2 Penetrations must be demonstrated to be leak tight. The Contractor shall provide written confirmation of this test showing a seam layout of the liner, with names, signatures and qualifications of the vacuum box operators.

6.3 LEAK DETECTION PIPING

- 6.3.1 The 6" observation well assembly and associated 2" primary liner drain line PVC glue joints shall hydrostatically pressure tested for leaks in strict accordance with the liner manufacturer's instructions.

6.4 ANNULAR RING PLATE BUTT JOINTS

- 6.4.1 Each annular ring plate butt weld shall be magnetic particle inspected. The MT testing shall be done twice for each weld inspected; once after the completion of the root pass and again after the completion of the final cover pass.
- 6.4.2 Particular attention and testing shall be performed to detect leaks in the annular plate butt weld directly under the shell. It is recommended that when performing the diesel test for the shell-to-annular ring plate fillet (corner) weld that the outside bottom of the chime at the location of the annular plate butt welds be inspected for diesel, that might indicate a leak.

6.5 SHELL-TO-ANNULAR RING PLATE FILLET WELDED T-JOINTS

- 6.5.1 After completing one side (inside or outside) of the new shell-to-annular ring plate corner weld, it shall be inspected by applying a light penetrating oil to the opposite side. The penetrating oil shall be allowed to stand a minimum of four (4) hours and then the weld shall be inspected for leaks. The penetrating oil shall be removed before welding continues.

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6.12 HYDROSTATIC TESTING

- 6.12.1 When a hydrostatic test is required, The Contractor shall furnish a written notification that all construction is in accordance with this document, API 650, and 653, that inspection/testing is complete and the tank is prepared for the hydrotest.
- 6.12.2 The Contractor shall be responsible for preparing the tank for the hydrotest and the Owner shall be responsible for performing the hydrotest, monitoring the hydrotest, and discharging the water from the hydrotest.
- 6.12.3 The tank shall be filled with water to its maximum fill height and remain filled for a minimum of 24 hours. See the chart below for the recommended holding times according to the tank diameter. Any tank that shows signs of leakage during the hydrostatic test shall be emptied, as soon as possible, and the source of leakage determined and repaired before the hydrostatic test is continued.

Tank Diameter Range (Feet)	Minimum Holding Time for the Hydrotest
Up to 35	24 hours
36 - 60	2 days
61 - 90	3 days
91 - 120	4 days
121 - 150	5 days
151 and up	6 days

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SECTION 7 - POST-CONSTRUCTION SUBMITTALS

7.1 GENERAL

- 7.1.1 The post-construction submittals shall include the lead monitoring results, tank elevation readings and analysis, as-built drawings; welding procedure and qualification testing documentation, mill test reports, sand analysis results, and testing/inspection documentation.
- 7.1.2 The Contractor shall furnish written notification that all construction and testing/inspection is complete (prepared to be hydrostatically tested) and was performed in accordance with API 650, API 653, and this specification.

7.2 LEAD HAZARD SAFETY MONITORING DATA

- 7.2.1 The Contractor shall submit all lead-in-air monitor results for both personnel exposure and perimeter sampling.
- 7.2.2 The Contractor shall submit all biological (lead-in-blood) testing results for each employee, if applicable.

7.3 ELEVATION SURVEY

- 7.3.1 The Contractor shall submit the elevation readings of the tank that were obtained before construction began and analyzed for acceptability with respect to API 653. The location of the settlement measurement points shall be noted on this report.
- 7.3.2 The submitted documentation shall include the "settlement plot" (as illustrated in Figure B-3 of API 653) graphing the elevation readings vs. measurement location point on a (x,y) graph.

7.4 AS-BUILT DRAWINGS

- 7.4.1 An as-built drawing package for the new bottom system installation and shell/nozzle work shall be submitted to the Owner's Engineer at the end of the project.
- 7.4.2 The as-built drawing package shall include, as a minimum, the following items:
- Bottom and annular ring plate layout drawing including all critical dimensions of weld seams to each other as well as to existing shell vertical seams and to new shell insert plate vertical seams.
 - As-built detail drawings illustrating the layout and orientation of the tank liner system; including all tank liner seams, liner sump location, and the leak detection piping layout; as well as the cathodic protection system; including the zinc anode ribbon layout, wiring diagram, and the reference cell(s) location(s).
 - As-built shell rollout drawings illustrating all nozzle/manway modifications including doorsheets as well as existing shell appurtenances that were not changed. This drawing shall include all dimensions (size and location) of all shell inserts, thickened inserts, nozzle/manway reinforcing plates, nozzles, and manways.
 - As-built drawings for each nozzle and manway with its respective reinforcing plate or thickened insert plate. These drawings to include the applicable welding procedures.

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APPENDIX A - RIVETED TANK SPECIAL SPECIFICATIONS

A.1 SCOPE

A.1.1 This appendix provides the additional special specifications that only apply to riveted tanks.

A.2 GEOTEXTILE FILTER FABRIC

A.2.1 When installing a new leak detection bottom system in a tank with an existing riveted bottom geotextile fabric shall be placed over the portion of the remaining riveted bottom to protect the new liner material from the potentially rough or sharp surfaces of the rivets. See Section 3.1.5 of this Specification for the geotextile filter fabric specifications.

A.3 RIVETED SHELL SEAMS

A.3.1 All shell modifications on riveted tanks shall be made without cutting through or disturbing the existing horizontal or vertical riveted seams, except for the shell to bottom joint.

A.3.2 With respect to weld spacing requirements outlined in Section 3.10 of this Specification, the same weld spacing is applicable to the riveted seams. The centerline of the last row of rivets shall be considered to be the edge of the joint.

A.3.3 The edges of both the inside and outside "doubler" plates within 2" of the new bottom shall be ground providing a $\frac{1}{2}$ " radius before welding the corner weld. Back/seal weld the bottom row of rivets above the new bottom, on the inside and outside, using a 3/32" E7018 electrode (one pass). See Figure A11 for the corner weld detail at the riveted "doubler" plates.

A.4 WATER STOPS

A.4.1 Water stops shall be installed on all riveted tanks. Locate one water stop approximately 3' on each side of each "doubler" plate. A minimum dimension of 12" shall be maintained between the water stop and the edge of any "doubler" plate. A minimum dimension of 12" shall be maintained between the water stop and any annular plate butt weld or any shell butt weld. See Figure A12 for the water stop detail.

A.5 SEAM SEALING RIVETED JOINTS

A.5.1 *Areas to Seam Seal:* Internally, all riveted seams in the first shell course including the first horizontal riveted seam shall be seam sealed. Externally, all riveted seams within 36" of any welding operation during construction shall be seam sealed. This includes the bottom 36" of every "doubler" plate. The seam seal coverage area shall extend 3" beyond the edge of the "doubler" plate rivet heads or edge of the riveted shell plate. Riveted seams below the new chime shall not be seam sealed.

A.5.2 *Surface Preparation:* Surfaces to be seam sealed shall be near white metal blast cleaned (SSPC-SP 10). See Section 2 of this specification and BP Oil Specification No. 5-1 Painting - Tanks, Lines and Structural Steel for safety information, specifically on lead exposure.

A.5.3 *Seam Sealing:* Prepared surfaces shall be coated with Con-Lux Seam-O-Lon 2040 Sealant with a minimum W.F.T. of 40 mils. Follow manufacturers instruction for application. Other seam sealing products may be proposed, but must be approved by the Owner's Engineer.

A.5.4 See Appendix B for other painting touch-up and stenciling specifications.

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APPENDIX B - PAINTING TOUCH-UP/STENCILING SPECIFICATIONS

B.1 SCOPE

- B.1.1 This appendix, together with any specific scope of work, provides the specifications for the painting touch-up and stenciling requirements to be performed after the new leak detection bottom is installed.
- B.1.2 In general, the first course of the tank along with other areas on the tank or associated piping that has been affected by the tank work shall be painted. Other potential areas that shall be painted include items such as new overflow and/or air scoop vents, new or modified piping connected to the tank, new walkways on steel cone roof tanks, etc.
- B.1.3 Stenciling will be required to identify the new leak detection and cathodic protection equipment and to identify tank number, capacity, product storage, hydrotest information, etc.

B.2 SAFETY

- B.2.1 Usage of internal combustion equipment, sand blasting, and hand/power tool cleaning is considered hot work and will require a BP Oil issued Hot Work Permit.
- B.2.2 The Contractor shall assume that the subject tank has contained a leaded petroleum product at one time and that the existing paint system contains lead, unless otherwise confirmed by laboratory analysis or documentation from the Owner.
- B.2.3 Lead is a systemic, cumulative poison that can enter the body by inhalation of dust, fume or vapor, or by ingestion via eating, drinking, or smoking on the job. Significant lead exposure can occur by removing paint from surfaces previously coated with lead-based paint and the cutting or burning of lead contaminated metal alloys.
- B.2.4 The Contractor shall take all necessary safety precautions due to the presence and hazards of lead and is responsible for meeting the requirements mandated by OSHA Lead Standard 29 CFR 1926.62 pertaining to the removal of lead-based paints and coatings, and the burning, cutting, and welding of metal alloys containing lead. The Contractor is responsible for all associated costs pertaining to the adherence of this standard.
- B.2.5 The Contractor shall have in place a written Lead Exposure Control Program, which shall be made accessible to the Owner at any time.
- B.2.6 See Section 2 of this specification and BP Oil No. 5-1 Painting - Tanks, Lines and Structural Steel for more safety information, specifically on lead exposure.

B.3 PREPARATION

- B.3.1 All new steel; including shell insert plates, nozzles, reinforcing plates, piping, etc.; shall be commercial blast cleaned (SSPC-SP 6) removing all millscale.
- B.3.2 Areas around the new shell inserts, new reinforcing plates, the new chime, and new piping where new steel meets existing painted steel shall be hand or power tool cleaned (SSPC-SP 2 or 3).
- B.3.3 The topside of the new chime, the bottom side of the new chime, the "dead" shell, and the top side of the old chime shall be hand or power tool cleaned (SSPC-SP 2 or 3).

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B.5 STENCILING

- B.5.1 All stencils shall be supplied by the Contractor.
- B.5.2 Paint used for stenciling shall be compatible with the finish coat of the tank surface.
- B.5.3 Verify all stenciling with the Owner's Representative at the site before proceeding.
- B.5.4 The Contractor shall stencil the following information in 2" high black letters and numbers with ½" stroke:
 - B.5.4.1 "SECONDARY LINER DRAIN" above each of the two (2) secondary liner drains.
 - B.5.4.2 "PRIMARY LINER DRAIN / OBSERVATION WELL" above the PVC primary liner drain/observation well.
 - B.5.4.3 "CATHODIC PROTECTION TEST STATION" above the Cathodic Protection Test Station.
 - B.5.4.4 "FULL HYDROTEST" and date of hydrotest, see Owner's Engineer for this information.
 - B.5.4.5 "LAST CLEANED" and date of cleaning, see Owner's Engineer for this information.
 - B.5.4.6 "SAFE FILL HEIGHT" and actual height, see Owner's Engineer for this information.
 - B.5.4.7 "SAFE FILL VOLUME" and actual volume, see Owner's Engineer for this information.
- B.5.5 The Contractor shall stencil the following information in 4" high black letters and numbers with 1" stroke:
 - B.5.5.1 "INLET" and "OUTLET" located two (2) feet above the Product Inlet and Outlet nozzles.
 - B.5.5.2 "VRU SUPPLY" and "VRU RETURN" located two (2) feet above the respective nozzles, if applicable.
 - B.5.5.3 "WATER DRAW VALVES" located two (2) feet above the respective nozzles.
- B.5.6 The Contractor shall stencil the following information in 4" high red letters with 1" stroke:
 - B.5.6.1 "NO SMOKING" at four locations, 90° apart, located six (6) feet above the new chime.
- B.5.7 The Contractor shall stencil the following information in 6" high black letters and numbers with 2" stroke:
 - B.5.7.1 Tank Number and Product Name at a location designated by the Owner.
- B.5.8 See Figure B13 for an example of the stenciling requirements.

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APPENDIX C - TANK GROUNDING SPECIFICATIONS

C.1 SCOPE

C.1.1 This appendix provides the specifications for the grounding of aboveground storage tanks.

C.1.2 All tanks shall be grounded from the live tank shell to the ground using #2 AWG bare stranded copper conductors, copper clad steel ground rods, and grounding clips.

C.2 GENERAL

C.2.1 The number and position of grounding rods is dependent on the tank diameter and is as follows:

<u>Tank Diameter</u>	<u>Number of Ground Rods</u>	<u>Position</u>
less than 30 feet	one (1)	180° from fill nozzle
30 feet to 50 feet	two (2)	120° and 240° from fill nozzle
larger than 50 feet	three (3)	90°, 180°, and 270° from fill nozzle

C.2.2 Ground rods shall be $\frac{3}{4}$ " x 10' long copper clad steel ground rod.

C.2.3 Tanks shall be bonded to the ground rods using #2 AWG bare stranded copper conductors.

C.2.4 See Figure C14 for ground clip and installation details.

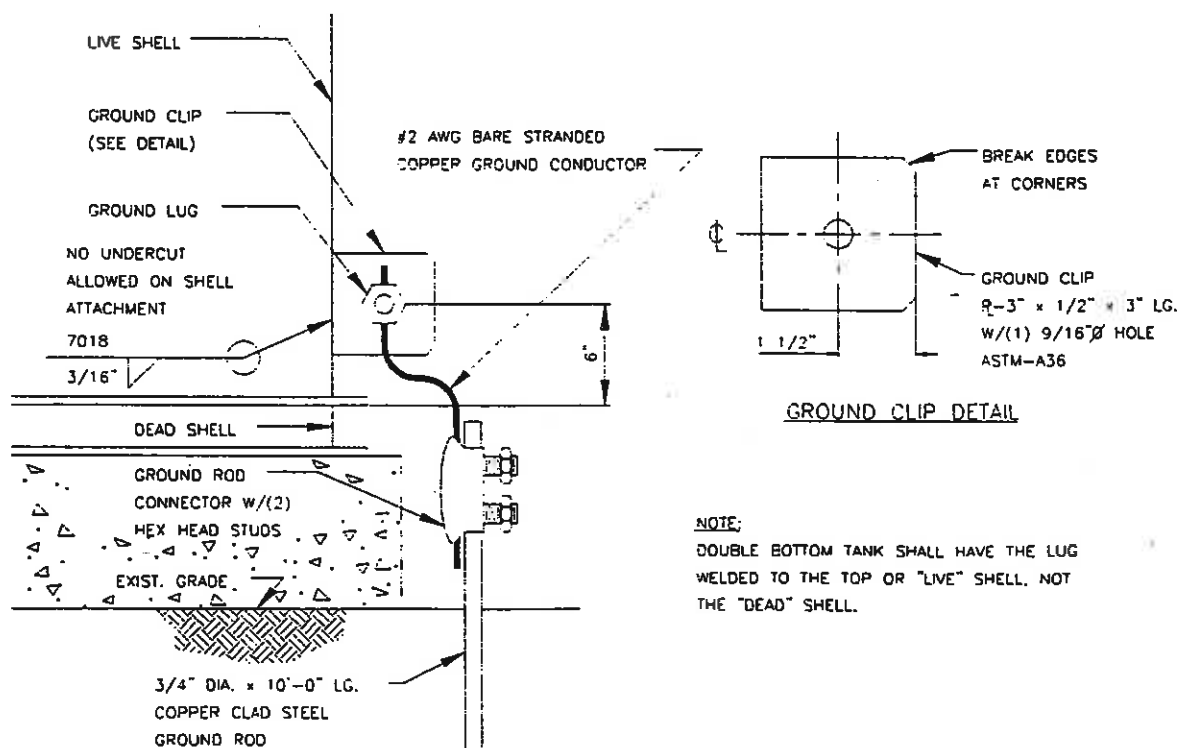


FIGURE C14 - TANK GROUNDING DETAIL

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APPENDIX D - WATER DRAW OFF VALVE/PIPING SPECIFICATIONS

D.1 SCOPE

- D.1.1 This appendix provides the specifications for the water draw off valves and piping.
- D.1.2 Each new tank bottom shall be equipped with two (2) new water draw off valves and piping extending to the center sump.

D.2 MATERIAL

- D.2.1 Contractor shall supply two (2) new water draw valves. The first valve shall be an Oceco 3" V-144 - flanged body (4" 150# RF flange). The second valve shall be an Oceco 2" V-144 - flanged body (3" 150# RF flange).
- D.2.2 Valves to be constructed of cast steel bodies, stainless steel stems, stainless steel seat rings, stainless steel valves, and teflon seats.

D.3 INSTALLATION

- D.3.1 The 3" V-144 valve shall be installed in a 4" 150# RF flanged nozzle with 3" Schedule 80 carbon steel pipe extending to the center sump. The clearance between the end of the 3" pipe and the bottom of the sump shall be 4".
- D.3.2 The 2" V-144 valve shall be installed in a 3" 150# RF flanged nozzle with 1½" Schedule 80 carbon steel pipe extending to the center sump. The clearance between the end of the 1½" pipe and the bottom of the sump shall be 2".
- D.3.3 Adequate pipe supports shall be installed to the tank bottom. Water draw piping shall be anchored to the supports using U-bolts and shall allow minor flexing and movement.
- D.3.4 Support angles shall not be welding directly to the new bottom but instead to ¼" x 6" diameter corrosion plates that shall be seal welded to the bottom.
- D.3.5 See Figure D15 for installation details.

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APPENDIX E - PRESSURE RELIEF SPECIFICATIONS

E.1 SCOPE

- E.1.1 This appendix provides the specifications for pressure relief valves and piping system.
- E.1.2 Each product line attached to the tank shall be equipped with a pressure relief system around the tank valve. The pressure relief system shall be designed to include test ports.

E.2 MATERIAL

- E.2.1 Pressure relief valves shall be Consolidated 1990C, 1"-MNPT x 1"-FNPT. Set pressures will be site specific and determined by the Owner's Engineer.
- E.2.2 All pressure relief system gate valves shall be 2" 150# RF Flanged Vogt 353, or equal.
- E.2.3 All pressure relief system ball valves (at test locations) shall be ½" Apollo #73-103 series, or equal, carbon steel threaded ball valves.
- E.2.4 All 2" and 1" pipe and nipples shall be schedule 80 carbon steel pipe.
- E.2.5 All fittings; i.e. elbows, unions, tees, couplings, sockolets, inserts, plugs; shall be 3000# forged steel with socket weld connections.

E.3 INSTALLATION

- E.3.1 All pressure relief piping and fittings shall be socket welded, except for the pressure relief valve connection.
- E.3.2 A 2" 150# nozzle shall be installed in the tank shell adjacent to the product nozzle and a 2" sockolet shall be installed on product line on the "pipeline" side of the tank valve.
- E.3.3 The pressure relief piping shall be hydrostatcally tested to 1.5 times the relief valve set pressure. The piping shall be drained and blown dry after the test.
- E.3.4 See Figure E16 for installation and design details.

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APPENDIX F - AUTOMATIC WATER GAUGING SYSTEM SPECIFICATIONS

F.1 SCOPE

- F.1.1 This appendix provides the specifications for the automatic water gauging system.
- F.1.2 Automatic water gauging systems shall be used on center sump tanks with open-top floating roofs or weather cover tanks with external floating roofs in lieu of roof walkways with center gauging.
- F.1.3 These automatic water gauging systems shall gauge water exclusively and shall operate as stand alone units displaying water level in .0625" increments. Gauging of product shall continue from the existing side gauge.
- F.1.4 New strapping charts shall be sighted with respect to the side gauging location, but shall include a separate center bottom table to be used to gauge water volume.

F.2 MATERIAL

- F.2.1 Automatic gauge shall be an L&J Model MCG 1020 BSW Gage.
- F.2.2 Each gage unit shall include two (2) separate sensor modules (each 2'-4" long), with each having an independent float.
- F.2.3 Floats shall be L&J 1 1/2" pipe Nitro floats (part number 575187D) with a designed specific gravity to float on water but submerge in gasoline and diesel product. Two (2) floats will be installed for each unit.
- F.2.4 Wiring to the sensor modules shall be Beldon 4 conductor - 22 gage teflon jacketed cable (Beldon number 88723).
- F.2.5 Power supply to gauge unit to be either 48 VDC or 110 AC, specify when ordering unit.
- F.2.6 All pipe and fittings shall be carbon steel, except for the water float pipe, it shall be 304SS.

F.3 INSTALLATION

- F.3.1 Automatic water gauging system shall be installed with 1 1/2" carbon steel and SS304 pipe and fittings extending to the center sump.
- F.3.2 All carbon steel pipe shall be schedule 80 and SS304 pipe shall be schedule 40. Flanges shall be 150# RF. All fittings; i.e. elbows, tees, couplings, caps; shall be 3000# socket weld type.
- F.3.3 Gauge piping shall penetrate the tank shell using a 1 1/2" 3000# socket weld coupling.
- F.3.4 Upon completion of the piping, the system shall be pressure tested soaping all joints for leaks. Testing and repairs shall take place prior to wiring installation.
- F.3.5 Follow manufactures instructions for wiring.
- F.3.6 See Figure F17 for installation details.

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CHECKLIST A - PRE-CONSTRUCTION SUBMITTALS

Category	Item	Date Sent
Design Drawings:	Bottom and Annular Ring Layout	
	Weld Joint Details	
	Shell Rollout	
	Nozzle/Manway Insert/Repad Details	
	Other	
Welding Documentation:		
	Welding Procedure Specifications (WPS)	
	Procedure Qualification Records (PQR)	
	Welder Qualification Tests (WPQ)	
Mill Test Reports:		
	MTR's for all New Steel	
Safety Documentation:		
	Lead Exposure Control Program	
	Training Documentation	
Schedule:	Bar Chart Schedule with Milestones	

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CHECKLIST B - CONSTRUCTION MILESTONES

Description	Date	Witnessed
Tank surveyed and checked for levelness per API 653		
Verified tank dimensions and nozzle/manway locations		
Verified that tank is safe for hot work		
Determined shell slot and verified by Owner's Engineer		
Shell slotted level and ground smooth		
Existing bottom tested prior to removing by hot work		
Excavation of existing soil to allow for new 2%-sloped bottom		
Installation of liner guard on edge of existing bottom		
Primary liner drain line installed sloping to observation well and tested		
Shell ports installed in "dead" shell		
Liner installed flat, tucked tightly into corners, and fastened to shell		
Shell port and stud bolt penetration through liner caulked		
Liner zipper seams caulked and vac box tested		
Liner sump installed and vac box tested		
Zinc anode ribbon installed at 3' O.C. and tested for continuity		
Silica sand installed and graded for 2%-slope for new bottom		
Radial monitor lines installed and wrapped with geotextile fabric		
Secondary liner drain lines installed		
Install new bottom plates shingled to center sump		
Annular ring installed sloping away from the shell		
Bottom welded with two passes E6010 root/E7024 cover		
Annular ring butt welds made with E6010 root/E7018 cover passes		
Corner weld made using two passes E7018 (inside and outside)		
Nozzle/manways installed with proper weld spacing and electrodes		
Lengthen/shorten roof legs and/or columns per elevation of new bottom		
Installation of water draw nozzles/piping		
Installation of steel cone roof walkways (if applicable)		
Installation of gauging penetrations/funnel (if applicable)		
Adjust floating roof low-leg position (if applicable)		
Inspect all welds and make necessary repairs/pick-ups		
Remove scrap and debris and return site to original condition		
Verify that tank is ready for hydrotest		

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CHECKLIST C - TESTING AND INSPECTION

Description	Date	Witnessed
Hydrostatic pressure test of primary liner drain/observation well		
Vacuum box test of all liner field (zipper) seams		
Liner sump vacuum box test		
Continuity test on cathodic protection system		
Laboratory tests performed on silica sand per the specs. in Sec. 3.4.2		
Magnetic particle test on annular plate butt weld root pass		
Magnetic particle test on annular plate butt weld cover pass		
Diesel test corner weld (after one side is completed)		
Vacuum box test on all bottom plate welds		
Vacuum*box test on all annular ring plate welds		
Vacuum box test on inside corner welds		
Magnetic particle or dye penetrant test nozzle/manway neck welds		
100% Radiograph test all shell butt welds		
Pressure test all nozzle/manway reinforcing plates		
Visual Inspection of all welds		
Inspection of pick-ups, all gouges overlaid and ground flush		
Pressure test of water draw piping		
Pressure test of floating roof drain assembly (if applicable)		
Diesel test any penetration made through floating roof (if applicable)		
Inspection for obstructions that will interfere with the roof in low-leg		
Inspect the tank for cleanliness at end of construction		
Verification that tank is ready for hydrotest		

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CHECKLIST D - POST-CONSTRUCTION SUBMITTALS

Category	Item	Date Sent
Lead Monitoring Data:	Lead-in-Air Monitoring Results	
Elevation Survey:	Plot of Shell Elevation Readings with Analysis	
As-built Drawings:	Bottom and Annular Ring Layout	
	Weld Joint Details	
	Shell Rollout	
	Nozzle/Manway Insert/Repad Details	
	Other	
Welding Documentation:	Welding Procedure Specifications (WPS)	
	Procedure Qualification Records (PQR)	
	Welder Qualification Tests (WPO)	
Mill Test Reports:	MTR's for all New Steel	
Sand Analysis Results:	Sand Analysis for Resistivity, pH, Chlorides, Sulphides	
Testing/Inspection Documentation:	Tank Liner Zipper Seam Vacuum Box Test	
	Primary Liner Drain/Observation Well Pressure Test.	
	Annular Ring Plate Butt Weld MT (root and cover)	
	Corner Weld Leak (Diesel) Test	
	Bottom Plate Vacuum Box Test	
	Shell Butt Weld Radiography Tests	
	Shell Penetration MT/PT Tests	
	Nozzle/Manway Reinforcing Plate Pressure Tests	
	Water Draw Piping Pressure Tests	
	Floating Roof Drain Pressure Test (if applicable)	