MAR 11 1996

ENGINEERING DATA TRANSMITTAL

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Distribution	Safety Basis Engineering/74E41	N/A
5. Proj./Prog./Dept./Div.: ENGR/74E41	6. Cog. Engr.: L. R. Kiewert	7. Purchase Order No.: N/A
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		10. System/Bldg./Facility: 200E/200W
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15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-TP-433	ALL	0	Single Shell Tank Riser Resistance to Ground Test Plan	SQ	I&4		

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. L. Kiewert	L.R. Kiewert	3-5-96	52-02	VICTOR P. OCAMPO	Victor P. Ocampo	3/6/96	G3-17	1	1
1	1	Cog. Mgr. J. Propson	J. Propson	3-7-96	R2-36						
1	1	QA M. S. Bhangoo	M.S. Bhangoo	3/7/96	51-57						
1	1	Safety	M. D. Johnson	3/5/96	R3-08						
1	1	W. Oper. P. Kison	P.M. Kison	3/5/96	74-07						
1	1	E. Oper. J. Wells	J E Wells	3/5-96	55-05						
1	1	Safety Anal. W. Conley									

18.	19.	20.	21. DOE APPROVAL (if required) Ctrl. No.
L.R. Kiewert 3-7-96 Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	J. Propson 3-7-96 Cognizant Manager Date	[] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (04/94) GEF097

BD-7400-172-1

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Per WHC-IP-0842)

USQ Tracking Number: TF-96-0039 Rev. No. 0

Does this change require a revision to the authorization basis? [ ] Yes [X] No

AREA: [200] East [200] West

Facility: [ ] 242-A [ ] DST [X] SST [ ] LERF
[ ] Aging Waste [ ] Other

EQUIPMENT DESCRIPTION: All SINGLE SHELL TANKS

REFERENCE DOCUMENT(S):

Single Shell Tank Riser Resistance to Ground Test Plan - WHC-SD-WM-TP-433

Engr. Task Plan - WHC-SD-WM-ETP-186

Hydrogen Ignition Capability of Tank Farm Instrumentation and Electrical Equipment - WHC-SD-WM-ES-176

Hanford Tank Farm Facilities Interim Safety Basis - WHC-SD-WM-ISB-001 Rev 0, Volume 1

Single Shell Tank Interim Operational Safety Requirements - WHC-SD-WM-OSR-005 Rev 0

TITLE: SINGLE SHELL TANKS RISER RESISTANCE MEASUREMENTS

Background Information
Resistance to earth measurements for Single Shell Tanks are conducted as part of an effort to gather data on the electrical connection of the tank risers to the earth ground for the tank farm and determine the adequacy of the structural attachment of risers to the reinforcing steel within the tank concrete structure. The data will be used to help close out lightning as a hazard for the single shell tanks. Resistance measurements are taken by using a battery powered instrument to circulate AC current of 10 ma maximum (50VOC) between a designated riser, through the structure of the tank and then through the earth to a pin in the ground several hundred feet away. Measurements are conducted on watchlist tanks as well as non-watchlist tanks.

1. Does the PROPOSED CHANGE, test, experiment or DISCOVERY increase the probability of occurrence of an accident previously evaluated in the AUTHORIZATION BASIS documentation?

   [X] No [ ] Yes [ ] Maybe*

   Basis: Numerous studies and reports have been written on tank farm flammable gas hazards. WHC-SD-WM-ES-176 "Hydrogen Ignition Capability of Tank Farm Instrumentation & Electrical Equipment" presents curves of voltage versus current axis' (from UL913) which indicate the minimum ignition points of voltage and current. The voltage and current generated by the instrument used for making the ground measurements is insuffient to cause ignition of the most flammable gas - Hydrogen - this is in compliance with WHC-SD-WM-ISB-001 Rev 0, Volume 1 Section 6 which references the requirement source WHC-SD-WM-OSR-005 Rev 0 section 5.29 C3 which states that until the vapor space is established to be non-flammable, work controls shall be in place to minimize ignition sources that might cause a gas event.

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

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Conducting riser resistance measurements does **not** increase the probability of an an accident previously evaluated in the existing Authorization Basis.

2.Does the PROPOSED CHANGE, test, experiment or DISCOVERY increase the consequences of an accident previously evaluated in the AUTHORIZATION BASIS documentation?

[X] No [] Yes [] Maybe*

Basis: The consequences of an accident resulting from flammable gas ignition are not increased by taking the resistance measurements.

3. Does the PROPOSED CHANGE, test, experiment or DISCOVERY increase the probability of occurrence of a malfunction of EQUIPMENT previously evaluated in the AUTHORIZATION BASIS documentation?

[X] No [] Yes [] Maybe*

Basis:All existing equipment will remain in place and in service. Existing equipment will continue to be operated in the same manner with no change in the probability of occurence of a malfunction previously evaluated in the ISB Volume I, Rev 0, Section 3. The administrative control requirements specified in OSDs 007, 013, 017 and 030 for the flammable gas program will be followed while the resistance measurements are being taken.

4. Does the PROPOSED CHANGE, test, experiment or DISCOVERY increase the consequences of a malfunction of ITS EQUIPMENT previously evaluated in the AUTHORIZATION BASIS documentation?

[X] No [] Yes [] Maybe*

Basis: ITS equipment is unaffected by this test.

5. Does the PROPOSED CHANGE, test, experiment or DISCOVERY create the possibility of an accident of a different type than any previously evaluated in the AUTHORIZATION BASIS documentation?

[X] No [] Yes [] Maybe*

Basis: No credible accidents are postulated.

6. Does the PROPOSED CHANGE, test, experiment or DISCOVERY create the possibility of a malfunction of EQUIPMENT of a different type than any previously evaluated in the AUTHORIZATION BASIS documentation?

[X] No [] Yes [] Maybe*

Basis: No credible accidents are postulated

7. Does the PROPOSED CHANGE, test, experiment or DISCOVERY reduce the margin of safety as defined in the basis for any Technical Specification/Operational Safety Requirement?

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

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[X] No [] Yes [] Maybe*

Basis: OSR-005 Rev 0 Section 5.29 C3 establishes the administrative controls for the flammable Watchlist tanks - Instrumentation used for resistance measurements required by the Test Plan are located outside the tanks and use low voltage and current to preclude the ignition of any flammable gases within the tank. The administrative controls specified in the OSDs will be followed when the test is conducted. The margin of safety is not reduced.

8. Does the PROPOSED CHANGE, test, experiment or DISCOVERY require a new or revised OSR, IOSR or a compensatory measure required by a Compliance Implementation Plan?

[X] No [] Yes [] Maybe*

Basis: The existing OSRs and IOSRs are unaffected by the resistance measurements.

USQE No. 1 Larry R. Kiewert (Print Name) — Signature: L. R. Kiewert — Date: 3/7/96

USQE No. 2 M. S. Tiffaney (Print Name) — Signature: M S Tiffaney — Date: 3/7/96

PRC REVIEW (If Required)

Meeting No.: _____ Date _____

PRC Chairman Concurrence:

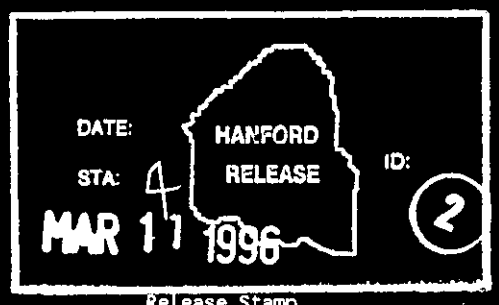
SINGLE-SHELL TANK RISER RESISTANCE TO GROUND TEST PLAN

L.R. Kiewert
WHC, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT: 613396 UC: 721
Org Code: 74E41 Charge Code: N2148
B&R Code: EW3120072 Total Pages: 13

Key Words: RISER RESISTANCE MEASUREMENTS

Abstract: This Test Procedure provides the general directions for conducting Single-Shell Tank Riser to Earth Measurements which will be used by engineering as a step towards providing closure for the Lightning Hazard Issue.



Release Approval — Date — Release Stamp

Approved for Public Release

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SINGLE-SHELL TANK RISER RESISTANCE TO EARTH GROUND TEST PLAN

1.0 PURPOSE

This procedure provides general directions for conducting soil resistivity measurements and resistance to earth measurements for the tank risers and various structures associated with the single shell tanks in accordance with Engineering Task Plan WHC-SD-WM-ETP-186, Lightning Hazard Closure. The express purpose of obtaining the resistance measurements is to provide data to assure that a lightning strike to a riser will be conducted to ground through the low resistance structure of the tank.

2.0 SCOPE/OBJECTIVES

Conduct measurements of single shell tank risers or other structures with a path to the tanks to determine the resistance to earth which is of interest in evaluating the path to ground of a direct lightning strike on a riser. Only those risers which are accessible will be measured.

2.1 SOIL RESISTIVITY

Measure the soil resistivity for each single shell tank farm location.... A, AX, B, BX, BY, C, S, SX, T, TX, TY, U.

2.2 RISER RESISTANCE TO EARTH

Measure the resistance to earth of risers and other selected structures associated with the single shell tanks. Each riser and the attached equipment will be measured. Additionally any metal structure above a tank which is attached directly or indirectly to a tank riser will be measured.

3.0 REFERENCES

IEEE STD 142-1991, "Grounding Of Industrial And Commercial Power Systems."

EEE STD 81-1983, "Guide For Measuring Earth Resistivity, Ground Impedance, And Earth Surface Potentials Of A Ground System."

WHC-SD-RE-TI-053, "Riser Configuration Document For Single-Shell Waste Tanks."

4.0 RESPONSIBILITIES

4.1 TEST COORDINATOR

The Test Coordinator (WHC Engineer) is responsible for the coordination, performance, and documentation of the Resistance to Earth Measurements Procedure and Report. The duties of the Test Coordinator include:

- Scheduling of the test as required.
- Recording Data, exceptions, and other notes as required by the procedure.
- Obtaining final approval signatures when all items are complete.

4.2 MEASUREMENTS PARTY

The Measurements party (listed below) shall provide the experienced personnel, tools, and equipment required for operability testing.

WHC Engineer
Electrician

4.3 WITNESSES

No witnesses are required for the resistance measurements.

5.0 DOCUMENTATION

5.1 TEST RECORD

All personnel involved in the collection of resistance data including test coordinator shall fill out a line in Section 9.0 Records. All measurements shall be recorded by the coordinator. Each tank to be measured will have an individual data sheet prepared that includes the particulars of the tank. An example of the data sheet is appendix A-1. Problems or unacceptable conditions are to be noted on the Exception Sheet - Section 8.0.

5.2 EXCEPTIONS

Exceptions and other notes are to be recorded under Section 8.0. This section must be dispositioned by Engr. performing measurements and signed off prior to issuing the final test report.

5.3 TEST EXECUTION RECORD

The final acceptance of the test results shall be indicated by signatures listed under section 10.0.

6.0 PREREQUISITES

6.1 DATA SHEETS

Risers/Structures to be measured for each tank are to be clearly mapped out and indicated on the Data sheet (Appendix A-1) for the specific tank.

6.2 EQUIPMENT REQUIRED

Earth Resistance Tester (Calibration Sticker Affixed).

Ground Probes
Test leads

6.3 JOB CONTROL

Ground resistance measurements of the single shell tank risers and structures will be administratively controlled through the tank farms Job Control System.

7.0 DATA COLLECTION METHODS

7.1 SOIL RESISTIVITY MEASUREMENTS

Soil resistivity will be measured for each general tank farm area where ground resistance measurements are to taken in order to account for any significant differences in the resistance to earth data from tank farm to tank farm. The Wenner Four Electrode Method (ASTM Standard G57-78-86)is used to measure resistivity at various depths at tank farm locations. This procedure involves the use of four electrodes which are driven in the soil along a straight line at equal spacing. The spacing determines the depth at which the soil is evaluated. Electrical current is circulated through the two outside electrodes while the resultant voltage drop is measured across the two inside electrodes. Using Ohms Law, the resistance is calculated by dividing the measured voltage drop by the applied current to yield resistance. Appendix A-2 illustrates this procedure. Once the resistance of the soil at a particular depth is determined, it is converted to resistivity by multiplying the value by a constant (191.5) and the electrode spacing(depth) in feet.

RHO (ohm-cm) = R x d x 191.5

R = measured resistance, d = distance between electrodes in feet.
191.5 = constant derived from 2 x 3.14 x 12 in./ft. x 2.54 cm./in.

The calculated value is the resistivity in ohm-centimeters. The soil pins are pushed into the earth by hand extending below the surface approximately 6 inches. The recommended spacing between the pins is 10'. Four pins are used and they are connected to the resistance meter using insulated test leads. The actual resistance is read off the digital display and converted to resistivity in ohm-cm.

7.2 RESISTANCE TO EARTH MEASUREMENTS

The measurement of riser to ground resistances will be conducted with a low voltage test instrument which is attached by test leads to steel pins which are driven into the ground approximately 12" so that the safety of underground structures beneath the pins is insured. Test current of 10ma maximum is circulated from the riser through the tank structure, through the ground to the current electrode. The connection at the riser or other structure to be measured is made with an alligator clip or other tension clip to assure a good connection. The preferred method of measuring riser to ground resistance is using the "Fall of Potential Method" however it may be necessary to use a different method if difficulties are encountered. There are a number of procedures which can be used to measure ground resistance. These procedures include (1) the direct method or two-point method, (2) a ratio method, (3) a three-point method and (4) the fall of potential method. This procedure is also called the three-electrode or three-pin method, which differs from the three-point method.

The fall of potential method uses a current electrode and a potential electrode arranged in a straight line away from the structure under test as indicated in Appendix A-3. Using this arrangement, current is introduced into the earth using the current electrode and the resulting change in potential between the structure and the potential electrode is measured. Resistance is plotted as a function of the distance between the structure and the potential electrode which is moved away from the structure being measured until the resistance levels out.

In practice the test is conducted in the same manner as the soil resistivity test using the same meter to supply a low voltage alternating current between the structure under test and the two pins that are driven in the ground some distance away. Typically the current pin will be located 500-1000' from the structure, while the potential pin is located approximately 62% of the distance to the current pin. In all cases sufficient data will gathered by moving the potential pin in a straight line towards the current pin until the resistance remains constant.

When difficulties are encountered to obtain measurements for a specific tank it may be necessary to use a reference ground or dead earth to obtain measurements. A typical reference ground could be buried piping. Although it is possible to perform these tests using direct currents, it is preferable to use a low voltage alternating current. When direct currents are used, errors and distortions are more likely as a result of of stray D.C. currents and the polarizing effect on metallic electrodes. A typical instrument to perform the testing is the Biddle Earth Tester manufactured by AVO International of Blue Bell Pennsylvania. This instrument provides the user with a direct digital readout of the resistance from electrode under test to ground.

7.3 ACCEPTANCE CRITERIA

Resistance Data will be gathered from a representative sample of tanks from each single shell tank farm and the test results evaluated before an acceptable value of resistance to earth is assigned to a riser. This criteria will appear in the test report.

7.4 INSTRUMENTATION REQUIRED

The Biddle Earth Tester will be used for all testing. This unit is a 4 terminal direct digital readout ohmmeter. The tester generates a low voltage (50VAC) 135 Hz current (0-10ma) between the current posts. The input to the detector section of the Tester is filtered and not affected by stray A.C. or D.C. currents and converts the voltage measurements directly into resistance.

8.0 EXCEPTIONS

ITEM	TANK	DATE	DESCRIPTION/REASON	DISPOSITION/REASON

9.0 RECORDS

Test Participants

NAME PRINT	NAME SIGN	INITIALS	POSITION	DATE

10.0 TEST EXECUTION RECORD

10.1 COMPLETION OF TESTING

TANK FARM	TESTING COMPLETE	DATE	REMARKS

TEST ENGINEERS

_____
Cognizant Engineer

_____
Test Coordinator

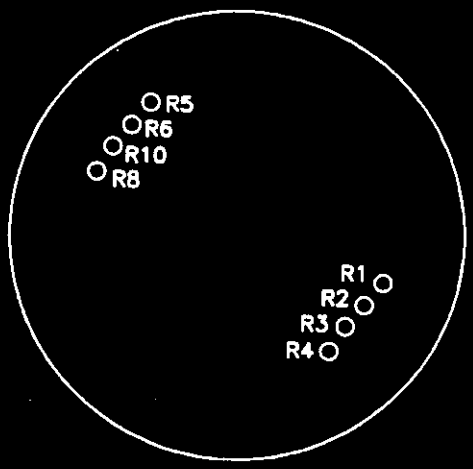
10.2 FINAL ACCEPTANCE

Resistance Measurements of the Single-Shell Tank Risers is completed in accordance with this procedure.

_____
West Tank Farms Engineering/Date

_____
East Tank Farms Engineering/Date

RISER RESISTANCE DATA SHEET

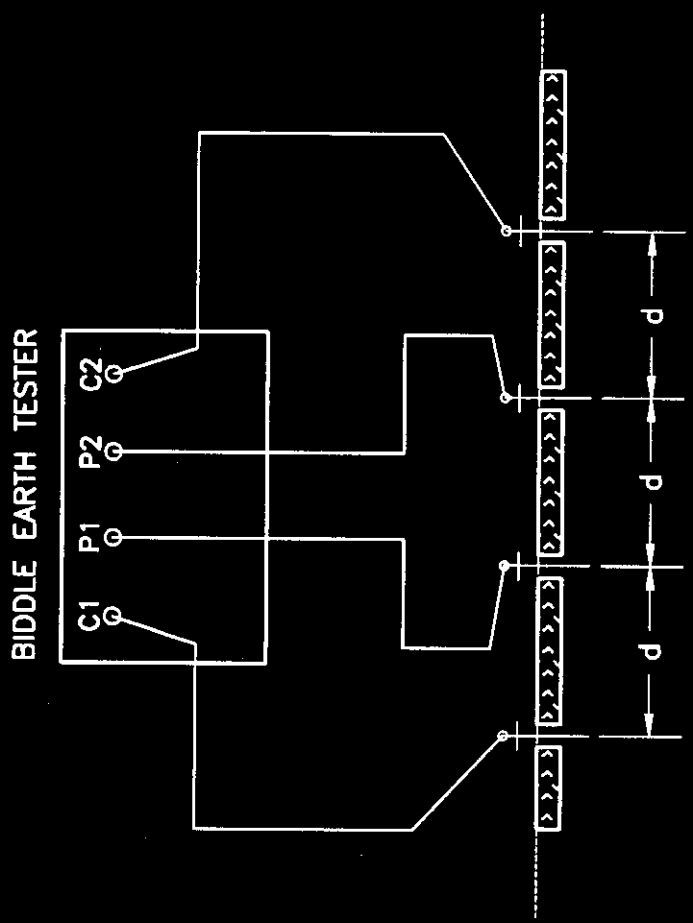


TANK B107

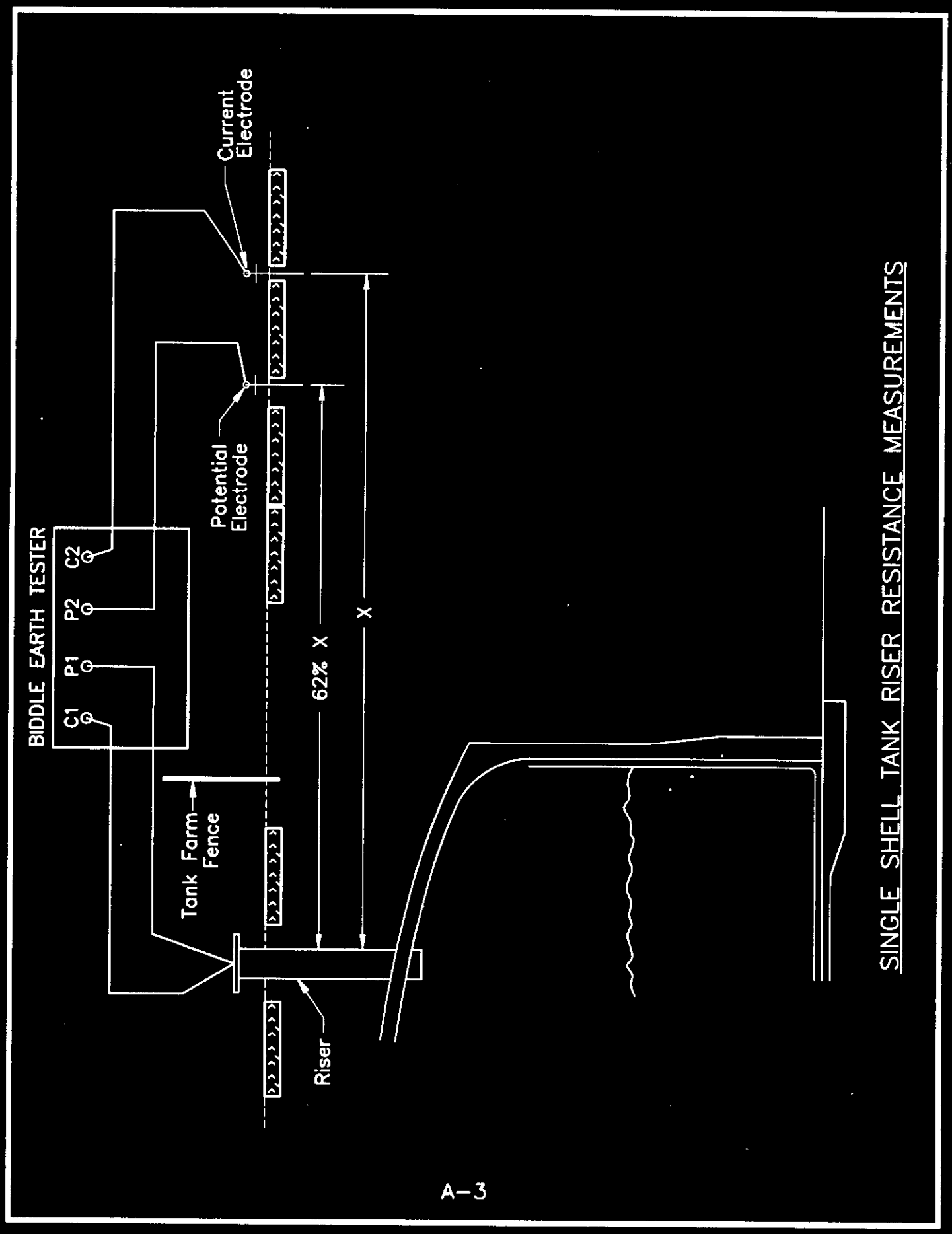
RISER	DESCRIPTION	ELEV	RESISTANCE		COMMENTS

TEST EQUIP #_____

CALIB DUE DATE _____



WENNER FOUR ELECTRODE METHOD
(SOIL RESISTIVITY)


BIDDLE EARTH TESTER
C1
P1
P2
C2
Current Electrode
Potential Electrode
62% X
X
Tank Farm Fence
Riser
SINGLE SHELL TANK RISER RESISTANCE MEASUREMENTS

TANK FARM SOIL RESISTIVITY DATA SHEET

TEST EQUIP #_____

CALIB DUE DATE _____

TANK FARM	DATE	LOCATION	RESISTIVITY

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Plant Controls 74E41	Date 3/7/96
Project Title/Work Order		EDT No. 613396
TWRS		ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
W. L. Cowley	A3-37	X			
P. F. Kison	T4-07	X			
V. P. Ocampo	G3-17	X			
J. G. Propson	R2-36	X			
D. M. Stenkamp	S2-02	X			
J. Weber	S2-02	X			
J. E. Wells	S5-05	X			
J. J. Zach	S7-14	X			