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DEC 21 1994

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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1	WHC-SD-WM-TC-005 <i>2KE 12/14/94</i>	a11	0	Test Procedure for Use of the Shear Vane in Tanks 103-SY, 103-AN, and 103-AW [Record Copy]	<i>NIA</i> <i>12-2094</i>	2					
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20. <i>GD Bazinet</i> Cognizant Manager Date 12/20/94											
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YE 12/21/94
Document Number: ~~WHC~~ SD-WM-TC-005, REV.0

Document Title: Test Procedure for Use of the Shear Vane in Tanks
103-SY, 103-AN, and 103-AW [Record Copy]

Release Date: December 20, 1994

This document was reviewed following the
procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

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December 20, 1994

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Name: *ED Waters*
MD LeClair/ED Waters 12/20/94

Signature

Organization/Charge Code 71240

D2AB1

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7. Abstract

This is a record copy of a test procedure for application of the full-scale shear vane to underground waste tanks at Hanford. The introduction of the report provides background information on the development and proof-testing of the shear vane, as well as information about its current location. The document was originally prepared in 1988, and the work was shelved temporarily for lack of funds. Activities to utilize the shear vane will be expedited by use of this information.

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PREFACE

This document is assembled and released in this form in December 1994 by E. D. Waters to provide a controlled record copy of some important work which was performed in and before 1989. The document consists of the following items:

- An Internal Memo (13316-89-039) prepared in 1989 by Michelle LeClair which summarized work and status of the In Situ Shear Vane, a full-scale apparatus to measure shear strength of sludges in waste tanks.

Note that the five references listed in the Memo were attached to that Memo. Since they are all released documents, they are not attached to this current document, WHC-SD-WM-TC-005 Rev. 0, as might be indicated by reading the Memo.

- The Test Procedure document which was prepared by MD LeClair and was reviewed by several people. It consisted of 140 pages and is the main body of this document.
- Pages 142 through 146: Review Comment Records for the original Test Procedure Document.
- Pages 147 through 148: Test Load Surveillance Reports for the shear vane apparatus.
- Pages 149 through 151: Warehouse Storage Request Sheets for the apparatus.
- Pages 152 through 154: Equipment Loan Order - Lab Equip Central Pool, which lists the instruments associated with the shear vane as tested.
- Page 155 - Intentionally left Blank to protect the previous pages.

NOTE: The drawings of the apparatus, as discussed in the Memo, are in the possession of R. L. Hand, DST Retrieval, 373-3053, MO-414, 200-E, MSIN S4-53.

Date:

10/20/93

Here is the letter report which statuses the shear vane @ the time I concluded my work on it and placed it into storage @ 2101 M. To my knowledge none else has conducted any further work w/ this equipment.

Michelle LeClair
2-1246

Page ii

From: Tank Waste Characterization Section
Phone: 3-1003 2752E/A110/200E R2-12
Date: June 7, 1989
Subject: STATUS OF THE IN SITU SHEAR VANE

13316-89-039

To: A. J. DiLiberto R2-12

cc: M. D. LeClair H4-50
R. S. McBeath R2-87
K. W. Owens R1-19 w/o attachments
R. E. Russell H5-05 w/o attachments
C. C. Simmons H5-05 w/o attachments
L. C. Stegen R2-07 w/o attachments
L. M. Sasaki *LMS* R2-12
J. C. Womack R2-18 w/o attachments
MDL File/LB

NOTES
12/19/94
EDW

- References:
- (1) Supporting Document, M. D. LeClair, "Shear Vane 'Cold' [was
Test Report," SD-WM-TRP-032, Rev. 0., dated ATTACHMENT
November 1, 1988. IV].
 - (2) Supporting Document, M. D. LeClair, "Shear Vane 'Cold' [was
Test Procedure," SD-WM-TC-004, Rev. 0., dated ATTACHMENT
March 10, 1988. III].
 - (3) Prototype Control Prints, WHC, "Shear Vane Installation,"
H-2-91691, Rev. 0., dated September 24, 1987.
 - (4) Supporting Document, C. C. Simmons, "Prototype Planning [was
Document Double Shell Tank Characterization System (Shear ATTACH-
Vane)," SD-WM-PTD-031, Rev. 0., dated September 3, 1987. MENT
I].
 - (5) Supporting Document, R. S. McBeath, "Shear Vane Test Plan
Using Simulated Waste," SD-WM-TP-040, Rev. 0., [was ATTACH-
dated June 30, 1987. MENT
II].

The in situ shear vane is an instrument designed to measure the in situ shear strength of double-shell tank waste sludges. This prototype equipment is identified by prototype number CCS-092478-01 and the official Shear Vane Assembly Drawing number H-2-91691 (Reference 3).

Work has been discontinued on the in situ shear vane due to loss of funding, as well as questions regarding the validity of the data obtained with this equipment. This letter summarizes the shear vane work completed, provides the current status of the equipment, and also recommends actions to be taken should the in situ shear vane be revived as a method to characterize tank waste sludges.

ATTACHMENT V was: SD-WM-TC-005 "Test Procedure for Use of the
Shear Vane in TANKS: 103-S4, 103-AN, 103-AW."
M.D. Le Clair, Rev. 0 May 1988 (140 pp).
EDW
12/19/94

A. J. DiLiberto
Page 2
June 7, 1989

A planning document (Reference 4) was written by the design engineer in September 1987, and the equipment was designed and fabricated in FY 87-88. A test plan (Reference 5) authorized a series of non-radioactive "cold" tests performed with the in situ shear vane. The tests were conducted during January 25-29, 1988 using the procedure (Reference 2) established for this work. (The planning document, test plan and test procedure are Attachments I, II, and III, respectively.)

All results of the "cold" test were documented in the test report (Reference 1). (A copy of this document can be found in Attachment IV.) Two concerns resulted from the "cold" testing. They are as follows:

1. Shear strength values obtained with the prototype vane are lower than the values obtained with the laboratory vane. The difference is approximately a factor of two. (Haake) EDW
2. During testing only 16 in. of shaft was submerged in the simulants. For the purpose of the test evaluation, shaft friction can be considered negligible. However, as much as 34 ft. of shaft may be submerged in sludge when testing in double-shell tanks. In this situation, the shaft friction may no longer be negligible. 15 EDW.

After "cold" testing was completed, work was started on a "hot" test procedure to be followed when obtaining shear strength measurements of waste in Tanks 103-SY, 103-AN, and 103-AW. Work was then discontinued on the shear vane, and consequently, the "hot" test procedure was never released. A draft of this procedure with the review Engineering Data Transmittal and the Review Comment Records can be found in Attachment V of this letter.

During design and testing of the shear vane, several red-line changes were made to the official Shear Vane Assembly Drawings (Reference 3). These red-lined drawings were approved in a Formal Safety Design Review meeting. Copies of the Formal Safety Design Review documentation can be found in Appendix III of the "Shear Vane 'Cold' Test Report" (Reference 1). Since the release of the Safety Design Review meeting minutes, the shear vane assembly has been painted and the hoist assembly has been certified. (See Attachment VI of this letter for a copy of the hoist assembly certification.) The drawings have yet to be as-built and remain in the possession of the design engineer, (C. C. Simmons (6-0769)).

See Preface page

12/19/94 EDW.

KE 12/21/94

WHG-SD-WM-TC-005 Rev. 0

A. J. DiLiberto

Page 4

June 7, 1989

If work on the Shear Vane apparatus is revived, the following actions are recommended:

1. Before in-tank testing can begin, further tests are required to resolve the issue of the significant disparity between measurements obtained with the laboratory apparatus and those obtained with the prototype. In particular, the tip speed scale-up criterion has never been adequately verified and should be investigated.
2. To more adequately determine the contribution of shaft friction to the total friction value, it is recommended that a significant length (10-30 ft.) of vaneless shaft be lowered into as much as 30 ft. of cured simulant. The shaft could be rotated and a torque measurement would be obtained for shaft friction in the entire depth of simulant.
3. As-build the official Shear Vane Assembly Drawings (Reference 3).
4. Revise and issue the "hot" test procedure (Attachment V). *[Now the main body of this report]*
5. Recalibrate all equipment and leak test the spray wash assembly just prior to in-tank use. *Ed Weston 12/19/94*

If there are any questions regarding the above information, please contact the undersigned on 3-1003.

M. D. LeClair

M. D. LeClair, Engineer

Concurrence:

A. J. DiLiberto

A. J. DiLiberto, Manager
Tank Waste Characterization

Attachments (8)

Page vi

(17)	(18)	(19)	(20) DCE APPROVAL (If required)
<u>Michelle L. Cain</u> 4/2/88 Signature of EDT Date Originator	<u>[Signature]</u> 4/2/88 Authorized Representative Date for/Receiving Organization	<u>[Signature]</u> 4/2/88 Cognizant/Project Engineer's Date Manager	LTR No. _____ ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

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1.0 TEST SUBJECT IDENTIFICATION

The equipment to be tested is the In Situ Shear Vane as designed by the Mechanical Engineering Technology Section. This prototype equipment is identified by prototype number CCS-092478-01 and the Shear Vane Assembly Drawing Number H-2-91691 [1987]. Support equipment (clamp assembly, spray wash assembly, wiper assembly, electronics, etc.) will also be used in the shear vane test. Figure 1.0 shows a profile of the In Situ Shear Vane Assembly.

FIGURE 1 PROFILE OF THE IN SITU SHEAR VANE ASSEMBLY

2.0 GENERAL DESCRIPTION

2.1 Test Objectives

This test is designed to obtain in situ shear strength measurements of the waste in double-shell tanks 103-SY, 103-AN, and 103-AW. By rotating the shaft and vane at various depths in each of these tanks, torque reading will be obtained. The torque readings are used to calculate shear strengths of the waste. After testing is completed in these three tanks, the data and information gathered will be used to determine if the shear vane is a valid means of obtaining shear strength measurements of double-shell waste sludges.

If the shear vane is found to be a valid means of obtaining these measurements, the shear strength information will be used to formulate a simulated sludge having the same rheological properties as the actual waste sludge. The simulated sludge will then be used in scale model testing to finalize waste retrieval equipment parameters.

2.2 Test Method

Incremental lengths of shaft are inserted through a four inch riser in each of tanks 103-SY, 103-AN, and 103-AW. (Tank 103-SY will be tested first.) A 3-1/2 inch diameter four-blade vane is attached to the bottom of this shaft. When the shaft is rotated in tank wastes, a force is sensed by the load cell. The signal conditioner converts the load cell output and transmits it to the chart recorder. The chart recorder, in turn, plots out the force data so it can be read by testing personnel.

The double-shell tank waste is not homogenous, and therefore, it is necessary to obtain force measurements at various levels within each tank. Using the control shaft it is possible to lower the vane in 7" to 11" increments and take measurements at each of the successive sites. Approximately 50 force measurements will be taken in each of the three tanks which results in 150 possible force measurements. (Only as many as six measurements will be taken in the supernatant. The remaining measurements will be taken in the sludge.)

3.0 TEST CONDITION LIMITS

Some environmental conditions will restrict the use of the electronic equipment used with the shear vane. If there is precipitation (snow, rain, hail, etc.) or temperatures below 40°F, the electronic equipment will not operate properly and the test must be postponed until the weather is more favorable. High winds will interfere with the crane used for installation and removal of the shear vane equipment and may cause delays in testing. Whole body exposure exceeding 5 rads/hour would be an environmental condition that would abort the test.

The accepted operational range of the equipment would be exceeded only if the force applied to the vane is in excess of 50 lbf. (The equipment has a force range of 0-100 lbf.) If the readout from the recorder indicates this force has been exceeded, it will be necessary to postpone the test until cause of the excessive force is determined. However, the shear strength data obtained from core samples of these tank wastes indicate it is highly unlikely such high forces will be encountered.

Tanks 103-SY, 103-AN, and 103-AW are all equipped with exhaustor systems which must remain in operation for the duration of testing in each tank. If a tank exhaustor system were to fail while the shear vane was installed on the tank, the test would be aborted.

Other pre-test requirements include obtaining sludge level readings for Tanks 103-AN, and 103-AW no more than five days before testing in the respective tank. Liquid level measurements for Tanks 103-SY, 103-AN, and 103-AW must be obtained for the six hour period preceding the start of testing in each respective tank.

4.0 INSTRUMENTS AND CALIBRATION

Several key electronic instruments are used in conjunction with the shear vane to obtain force measurements of the sludge. Table 4.1 lists these instruments along with their serial numbers, required ranges and sensitivity, as well as the calibration requirements for each. The accuracy of the system is ± 0.25 ft-lbf as determined from the system calibration.

TABLE 4.1

INSTRUMENTS USED TO CONDUCT THE IN SITU SHEAR VANE TESTS

<u>Equipment</u>	<u>Sensitivity</u>	<u>Range</u>	<u>Serial Number</u>	<u>Calibration Requirements</u>
Recorder	N/A	0-10 Volt	748-02209	Performed by WHC Std. Lab 01-19-88
Signal Conditioner	0.295 V/lbf	30 Volt	FU-66	Performed by WHC Std. Lab 01-19-88
Load Cell	N/A	1-100 lbf	B16668	Performed by WHC Std. Lab 01-19-88
Digital Voltmeter	$\pm 0.02\%$	0-10 Volt	3636	Performed by WHC Std. Lab 02-01-88

5.0 FACILITIES, EQUIPMENT, AND MATERIALS

This test will be conducted in Tank Farms 241-SY, 241-AN, and 241-AW. It is anticipated that each set of shaft sections and each vane can be used for testing in only one tank, therefore, two additional shaft sets and two additional vanes have been fabricated for these tests.

The equipment and materials required are as follows:

- o Fabricated shear vanes, shaft sections, table assembly and drive system.
- o Support electronics (power supply, signal conditioner, recorder, load cell, voltmeter, and motor controller).
- o Clamp, wiper and spray wash assemblies.
- o 120 VAC convenience outlet.
- o Stop watch.
- o Portable space heater.

6.0 SAFETY

Responses to abnormal releases of radioactivity are covered in Emergency Procedures. The procedure shall be performed in accordance with the Master Safety Rules, Accident Prevention Standards, and Tank Farm Safety Rules. The provisions of General Regulations and Practices for Radiation Work (GEN-0) and specified Radiation Work Permits (RWP's) apply to this procedure.

Protective clothing is required by the applicable RWP and Radiation Protection (RP) will prescribe additional protective clothing as necessary.

7.0 MAINTENANCE AND FAILURES

Breakdowns and malfunctions are not expected. If equipment failure occurs, necessary repairs will be made, and the test will be restarted at the authority of the Waste Disposal Technology personnel.

8.0 TEST DATA

Some liquid level and sludge level readings will be obtained to assist in testing. All other data obtained in this test will be force measurements and respective tank depths. The force data will automatically be plotted on chart paper by a chart recorder device. The output from this device is read by the testing personnel and then recorded on prepared data sheets (see Section 14.0 for data sheet format). This data will later be analyzed using the "VANE-2" calculator program [Heath, 1987].

9.0 PERSONNEL REQUIREMENTS

A variety of functions are required to conduct the shear vane test. Personnel requirements are as follows:

- o An engineer from Waste Disposal Technology will direct all testing efforts.
- o An engineer from Pacific Northwest Laboratory will provide technical support as needed.
- o The design engineer representing Mechanical Engineering Technology Section will be assisting in the initial setup of the shear vane system. This person will also be responsible for repairs of the shear vane apparatus if a malfunction occurs.
- o Operations personnel will be present for the duration of the test and will assist in operating the shear vane apparatus.
- o Maintenance and field services personnel will assist in the installation and removal of the shear vane apparatus from each of the tanks tested. They will also provide support in the event of equipment malfunction.
- o Radiation Protection Department personnel will provide the necessary radiation protection technologist (RPT) support.
- o A representative from Quality Assurance (QA) will provide support as needed for the duration of the test.

10.0 WITNESSES

A representative from QA will be the only witness required for these tests.

11.0 PROCEDURE

This test procedure is divided into nine subsections. Sections 11.1.1, 11.2.1, and 11.3.1 specify pre-test requirements that must be satisfied before commencing with testing in Tanks 103-SY, 103-AN, and 103-AW, respectively. Section 11.1.2, 11.2.2, and 11.3.2 outline the method for obtaining force measurements of the solid waste in Tanks 103-SY, 103-AN and 103-AW, respectively. Equipment removal (from the tank) is discussed in sections 11.1.3, 11.2.3, and 11.3.3 for these respective tanks.

The nine test sections will be conducted in order. Data sheets are provided for recording information obtained in all of the test sections and for making necessary calculations. There are also sheets provided to record observations and exceptions to anticipated results.

11.1.1 Pre-Test Requirements for Testing in Tank 103-SY

1. At least five days before testing begins in Tank 103-SY, inspect risers 14A and 22A of Tank 103-SY for any damage. The shear vane assembly will be installed on the riser found to be in better condition. If both risers are in good condition, either may be used. Record the number of the riser to be used on the Pre-Test Data Sheet.
2. Obtain daily liquid level readings for the two week period preceding the test. These readings must be studied to verify the liquid level in Tank 103-SY has remained fairly constant over this time period. Daily liquid level readings can be obtained from Computer Automated Surveillance System (CASS) located in 2750E Building, Room B-105 (3-2618). A computer printout of this set of readings will be maintained in the Laboratory Record Book. If liquid levels have been fluctuating drastically (more than 5 inches), testing in this tank may be postponed.
3. Verify that Operations installs the shear vane equipment in Tank 103-SY one day before testing begins in this tank. The spray wash, wiper, and clamp assemblies should all be bolted to the riser chosen in step 1 above. The solid shaft section with a tapered end should be inserted through these assemblies and the vane should be attached to the lower end of this shaft section.

The following Standard Operating Procedures (SOP's) apply to this installation procedure:

- TO-020-044 "Lock and Tag Control Procedure" [1987]
- TO-020-250 "In Farm Installation of New or Modified Large Equipment Items" [1984]
- TO-020-270 "Equipment Removal or Installation at Diversion Boxes and Pits" [1986]

4. The day of testing, verify that Operations connects all electrical

equipment to the motor and completes all electrical wiring before testing commences. The electrical equipment will be located on a table approximately 8' from the shear vane table.

5. Obtain hourly liquid level readings for Tank 103-SY for the 6 hour period preceding the start of the shear vane test. These readings can be obtained from Computer Automated Surveillance System (CASS) located in 2750E Building, Room B-105 (3-2618). Record this set of readings on the Pre-Test Data Sheet as indicated.

NOTE: Sludge levels will not be taken in Tank 103-SY. Core samples of this tank show that there is no distinct supernate/sludge interface, therefore, the liquid level reading will actually indicate the sludge level.

6. On the day testing begins, verify that QA checks the calibration of the torque measuring instruments of the shear vane. The table must be in place over the riser, and all electrical equipment must be connected before this calibration will be performed.

A known load, C, is applied to a bolt at the end of the motor arm (see Figure 11.1). This bolt is 12" from the center of the shaft drive tube (center of rotation). The force recorded on the chart recorder should be $2C \text{ lb}_f$. This is the force seen by the load cell. The load cell is centered between both the bolt at the end of the motor arm and the center of the shaft drive tube. Since the distance between the load cell and the shaft drive tube center line is 6", the torque seen at the center of the shaft is $1/2 (2C)$ or $C \text{ ft} \cdot \text{lb}_f$. If this torque is not approximately equal to C, the equipment must be repaired before continuing with the test. Record all values on the Load Cell Calibration Data Sheet as indicated.

11.1.2 Torque Measurements of Waste in Tank 103-SY

Before starting this test section, all pre-test requirements listed in Section 11.1.1 must be met.

Throughout this test section, the chart recorder will be used to record the forces measured by the load cell. When the chart recorder is first turned on it will have to be operated for approximately 20 minutes before any measurements are taken. It is important that each measurement recorded on the chart paper have the corresponding shaft rotational speed, shaft length, and motor voltage written on the chart paper next to it. Arrows should be drawn to indicate when the motor was turned on and off. The chart paper should also be signed and dated by the Waste Disposal Technology representative (see Figure 11.2).

NOTE: When in use, the chart recorder should be set at 0.5 on the minute scale. If this speed is changed, the change point should be indicated on the chart paper. When the chart recorder is not in use, the paper feed should be turned off.

FIGURE 11.1

SD-WM-TC-005 Rev. 0 14

TOP VIEW OF SHEAR VANE TABLE AND MOTOR ARM

EXAMPLE OF INFORMATION TO BE INCLUDED ON THE CHART RECORDER OUTPUT

It is very important to record all pertinent information on the data sheets. A running total of the combined shaft and vane length below the quick release pin, Q, will be maintained on the Torque Measurement Data Sheet (see column 6). Since the shaft will not be lowered the same amount each time, it is important to refer to the equation on the Torque Measurement Data Sheet to calculate Q. The value Q must never exceed M, the maximum allowable combined length of the shaft and vane below the quick release pin (see the following NOTE). Therefore, it is very important to calculate the resulting Q value for each successive step before the shaft is actually lowered.

NOTE: After completion of each force measurement there is a hold point which requires the initials of the operator, a QA stamp, and the date (in the blocks provided) to assure that all data has been properly entered and to assure the number in column 6 of the Torque Measurement Data Sheet does not exceed M inches. The value of M, is calculated and recorded on the Calculation Data Sheet as indicated.

NOTE: Each time the clamp is loosened or the swivel assembly is removed in the following procedure, there will be a hold point which requires initials of the operator, a QA stamp and the date (on the blanks provided) to assure that whenever a shaft holding device is removed, another will remain in place. This will prevent an oversight and keep the shaft from falling into the tank. The three holding devices of the shear vane apparatus are (1) the clamp assembly, (2) the hoist (swivel assembly) with slack taken up in the cable, and (3) a quick release pin inserted in the control shaft and resting in the notch of the shaft drive tube.

NOTE: The force recorded by the chart recorder should never exceed 50 lbf. Since there is no automatic shutoff on the motor of the shear vane, it is very important to watch the chart recorder closely to ensure this force is never exceeded. If the force (as recorded by the chart recorder) ever exceeds 50 lbf, the motor should be turned off immediately and the situation should be investigated.

NOTE: If the 50 lbf is exceeded or if the shaft fails to rotate, the motor should be turned off. To determine that the motor is functioning properly, attach the top of the shaft to the swivel assembly and lift the shaft until the quick release pin in the control shaft is no longer resting in the notch of the shaft drive tube. Turn the motor on and observe its function when the force of the shaft is removed from the shaft drive tube. If the motor is not rotating properly then necessary repair must be made to the equipment before the test can continue. If the motor is functioning properly, the test will be aborted and the situation will be further investigated.

NOTE: Never use excessive force to push the shaft down into the tank waste. If the shaft will not fall into the waste under the force of its own weight, test personnel may assist in lowering the shaft by holding the shaft and pushing down. Do not jiggle the shaft up and down or use any tools to force the shaft down into the waste.

PROCEDURE FOR SECURING SHAFT WHEN SHEAR VANE ASSEMBLY IS LEFT UNATTENDED

NOTE: In the event testing will not be completed in the one day, the following three HOLD's are a means of assuring that the shaft is secured when the equipment is left unattended. The shaft will be left in this orientation until testing resumes in the tank. In addition to these HOLD's, steps A and B must also be followed when the equipment is left unattended for extended periods.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- A. Turn the motor off and disconnect the equipment from the power source.
 - B. Remove the support equipment (signal conditioner, voltmeter, motor controller, and chart recorder) from the tank farm. The load cell remains in place.
 - C. Cover the remaining equipment to protect it from the weather.
-
-

The procedure for obtaining force measurements of the waste in Tank 103-SY is as follows:

1. Turn the chart recorder on and let it run for approximately 20 minutes.
2. Turn the motor on. Using the knob on the motor controller, adjust the voltmeter setting to 1.53 volts (approximately 0.033 rpm). Turn the motor off, and leave the motor controller knob untouched.
3. Turn the chart recorder paper drive on and zero the chart recorder on the green line to the far left of the chart paper.
4. Measure the vertical distance between the base of the shear vane table and the top of the riser flange. This distance is termed t . Use the value of t to calculate the value of M , the maximum combined length of the shaft and vane and record these values on the Calculation Data Sheet as indicated.
5. Using an average of the liquid level readings (for the previous 6 hours), D_A , determine the length of shaft to be lowered into the tank before taking the first force reading of the waste. See the Calculation Data Sheet for this calculation.

NOTE: One shaft section is already inserted through the clamp, wiper and washer assemblies, and the vane is attached to the lower end of this shaft section. The clamp is tightened around this shaft section.

NOTE: The following steps 6-36 outline the addition of up to eight solid shaft sections. As many as eight shaft sections may be added before the first force reading is taken. (See the Calculation Data Sheet for the exact number of shaft sections). If fewer shaft sections are added before taking the first reading, cross out the remaining steps and skip to the HOLD preceding step 37. Have representatives from Operations, QA, and Waste Disposal Technology initial by the crossed-out sections.

NOTE: When screwing together shaft sections do not cross-thread and hand tighten only. These considerations also apply when screwing shaft sections to the swivel assembly. When the motor is on, the rotation of the shaft will be in the direction that will further tighten the shaft connections.

SHAFT 1:

6. To add the first of X_N (see Calculation Data Sheet) solid 5' shaft sections to the existing shaft, screw the male end of one solid shaft section to the swivel assembly.

7. Using the hand crank, raise the base of this shaft section above the top of the shaft drive tube.
8. With the hand crank, lower the shaft section through the shaft drive tube until it is low enough to be connected to the top of the existing shaft.
9. Screw the two shaft sections together.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

10. Loosen the clamp from around the shaft.
 11. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
- NOTE: If the gasket of the wiper assembly grabs onto the shaft as it is lowered, lubricate the gasket with silicon spray. This may need to be repeated several times during the test.
12. Tighten the clamp around the shaft.

SHAFT 2:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

13. Remove the swivel assembly from the shaft and screw it to the male end of a second solid 5' shaft section of shaft.
14. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
15. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

16. Loosen the clamp from around the shaft.

17. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
18. Tighten the clamp around the shaft.

SHAFT 3:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

19. Remove the swivel assembly from the shaft and screw it to the male end of a third solid 5' section of shaft.

20. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

21. Repeat steps 16-18.

SHAFT 4:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

22. Remove the swivel assembly from the shaft and screw it to the male end of a fourth solid 5' section of shaft.

23. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

24. Repeat steps 16-18.

SHAFT 5:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

25. Remove the swivel assembly from the shaft and screw it to the male end of a fifth solid 5' section of shaft.

26. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

27. Repeat steps 16-18.

SHAFT 6:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

28. Remove the swivel assembly from the shaft and screw it to the male end of a sixth solid 5' section of shaft.

29. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

30. Repeat steps 16-18.

SHAFT 7:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

31. Remove the swivel assembly from the shaft and screw it to the male end of a seventh solid 5' section of shaft.

32. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

33. Repeat steps 16-18.

SHAFT 8:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

34. Remove the swivel assembly from the shaft and screw it to the male end of a eighth solid 5' section of shaft.

35. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

36. Repeat steps 16-18.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

37. Remove the swivel assembly from the top of the shaft.

NOTE: This procedure includes steps for the taking up to 40 force measurements in Tank 103-SY waste. A running total of the value of Q is maintained in column 6 of the Torque Measurement Data Sheet. If, M, the maximum combined length of the shaft and vane, will be exceeded by lowering the shaft an additional 7-11 inches, measurements will cease in this tank.

NOTE: In steps 38-75, H_i indicates the starting hole number as calculated on the Calculation Data Sheet. If the value of H_i is greater than one, all of the next several steps will not be followed. If this is the case, cross out the remaining steps and skip the NOTE preceding step 76. Have representatives from Operations, QA, and Waste Disposal Technology initial by the crossed-out sections.

PIN IN HOLE H_i :

38. Insert a quick release pin into starting hole H_i (as calculated on the Calculation Data Sheet) of a control shaft section (see Figure 11.3).

39. Screw the male end of this control shaft section to the swivel assembly.

FIGURE 11.3

CONTROL SHAFT WITH PIN LOCATIONS IDENTIFIED

40. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
41. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

42. Loosen the clamp from around the shaft.
43. **Very Slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

44. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

45. Remove the swivel assembly from the top of the control shaft.
46. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
47. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE (H_i+1):

48. Insert a quick release pin into hole (H_i+1).
49. Raise the shaft with the hand crank, and remove the pin from hole H_i of the control shaft.

50. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

51. Repeat steps 45-47.

PIN IN HOLE (H_i+2):

52. Insert a quick release pin into hole (H_i+2).

53. Raise the shaft with the hand crank, and remove the pin from hole (H_i+1) of the control shaft.

54. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

55. Repeat steps 45-47.

PIN HOLE (H_i+3):

56. Insert a quick release pin into hole (H_i+3).

57. Raise the shaft with the hand crank, and remove the pin from hole (H_i+2) of the control shaft.

58. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

59. Repeat steps 45-47.

PIN IN HOLE (H_i+4):

60. Insert a quick release pin into hole (H_i+4).

61. Raise the shaft with the hand crank, and remove the pin from hole (H_i+3) of the control shaft.

62. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

63. Repeat steps 45-47.

PIN IN HOLE (H_i+5):

64. Insert a quick release pin into hole (H_i+5).

65. Raise the shaft with the hand crank, and remove the pin from hole (H_i+4) of the control shaft.

66. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

67. Repeat steps 45-47.

PIN IN HOLE (H_i+6):

68. Insert a quick release pin into hole (H_i+6).

69. Raise the shaft with the hand crank, and remove the pin from hole (H_i+5) of the control shaft.

70. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

71. Repeat steps 45-47.

PIN IN HOLE (H_i+7):

72. Insert a quick release pin into hole (H_i+7).

73. Raise the shaft with the hand crank, and remove the pin from hole (H_i+6) of the control shaft.

74. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

75. Repeat steps 45-47.

NOTE: The following steps 76-275 outline the procedure for obtaining up to 32 additional force measurements in Tank 103-SY waste. The value of Q can not exceed the value of M (see the Calculation Data Sheet), therefore, it is possible fewer than 32 measurements will be taken. If fewer measurements are taken before testing is completed in Tank 103-SY, cross out the remaining steps and skip to step 276. Have representatives from Operations, QA, and Waste Disposal Technology initial by the crossed-out sections.

NOTE: For the remaining steps in this test section, it may be necessary to substitute a control shaft section for a solid shaft section. It is important to lower the nine solid shaft sections into the tank before substituting one of the control shaft sections. The three control shafts should remain on the top end of the shaft and should be the last three shaft sections added to the shaft. Where control shaft sections are added in place of solid shaft sections, the repetitive steps will be crossed out. These crossed-out sections must be initialed by Operations, QA, and Waste Disposal Technology personnel.

76. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

77. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

78. Unscrew the control shaft from the existing shaft.

79. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

80. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

81. Screw the male end of a solid shaft section to the swivel assembly.

82. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

83. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

84. Loosen the clamp from around the shaft.

85. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

86. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

87. Remove the swivel assembly from the shaft.

PIN IN HOLE 1:

88. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

89. Screw the male end of this control shaft section to the swivel assembly.

90. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

91. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

92. Loosen the clamp from around the shaft.

93. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin

does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

94. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

95. Remove the swivel assembly from the top of the control shaft.

96. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

97. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

98. Insert a quick release pin into hole 2.

99. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

100. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

101. Repeat steps 95-97.

PIN IN HOLE 3:

102. Insert a quick release pin into hole 3.

103. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

104. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

105. Repeat steps 95-97.

PIN IN HOLE 4:

106. Insert a quick release pin into hole 4.

107. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

108. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

109. Repeat steps 95-97.

PIN IN HOLE 5:

110. Insert a quick release pin into hole 5.

111. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

112. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

113. Repeat steps 95-97.

PIN IN HOLE 6:

114. Insert a quick release pin into hole 6.

115. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

116. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

117. Repeat steps 95-97.

PIN IN HOLE 7:

118. Insert a quick release pin into hole 7.

119. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

120. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

121. Repeat steps 95-97.

PIN IN HOLE 8:

122. Insert a quick release pin into hole 8.

123. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

124. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

125. Repeat steps 95-97.

PIN IN HOLE 1:

126. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

127. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

128. Unscrew the control shaft from the existing shaft.
129. Using the hand crank, lower the control shaft until the swivel assembly can be reached.
130. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.
131. Screw the male end of a solid shaft section to the swivel assembly.
132. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
133. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

134. Loosen the clamp from around the shaft.
135. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
136. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

137. Remove the swivel assembly from the shaft.
138. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).
139. Screw the male end of this control shaft section to the swivel assembly.
140. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

141. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

142. Loosen the clamp from around the shaft.

143. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

144. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

145. Remove the swivel assembly from the top of the control shaft.

146. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

147. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

148. Insert a quick release pin into hole 2.

149. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

150. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

151. Repeat steps 145-147.

PIN IN HOLE 3:

152. Insert a quick release pin into hole 3.

153. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

154. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

155. Repeat steps 145-147.

PIN IN HOLE 4:

156. Insert a quick release pin into hole 4.

157. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

158. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

159. Repeat steps 145-147.

PIN IN HOLE 5:

160. Insert a quick release pin into hole 5.

161. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

162. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

163. Repeat steps 145-147.

PIN IN HOLE 6:

164. Insert a quick release pin into hole 6.

165. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

166. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

167. Repeat steps 145-147.

PIN IN HOLE 7:

168. Insert a quick release pin into hole 7.

169. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

170. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

171. Repeat steps 145-147.

PIN IN HOLE 8:

172. Insert a quick release pin into hole 8.

173. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

174. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

175. Repeat steps 145-147.

PIN IN HOLE 1:

176. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

177. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

178. Unscrew the control shaft from the existing shaft.

179. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

180. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

181. Screw the male end of a solid shaft section to the swivel assembly.

182. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

183. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

184. Loosen the clamp from around the shaft.

185. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

186. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

187. Remove the swivel assembly from the shaft.

188. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

189. Screw the male end of this control shaft section to the swivel assembly.

190. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

191. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

192. Loosen the clamp from around the shaft.

193. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

194. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

195. Remove the swivel assembly from the top of the control shaft.

196. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

197. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

198. Insert a quick release pin into hole 2.

199. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

200. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

201. Repeat steps 195-197.

PIN IN HOLE 3:

202. Insert a quick release pin into hole 3.

203. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

204. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

205. Repeat steps 195-197.

PIN IN HOLE 4:

206. Insert a quick release pin into hole 4.

207. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

208. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

209. Repeat steps 195-197.

PIN IN HOLE 5:

210. Insert a quick release pin into hole 5.

211. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

212. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

213. Repeat steps 195-197.

PIN IN HOLE 6:

214. Insert a quick release pin into hole 6.

215. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

216. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

217. Repeat steps 195-197.

PIN IN HOLE 7:

218. Insert a quick release pin into hole 7.

219. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

220. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

221. Repeat steps 195-197.

PIN IN HOLE 8:

222. Insert a quick release pin into hole 8.

223. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

224. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

225. Repeat steps 195-197.

PIN IN HOLE 1:

226. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

227. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

228. Unscrew the control shaft from the existing shaft.

229. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

230. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

231. Screw the male end of a solid shaft section to the swivel assembly.

232. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

233. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

234. Loosen the clamp from around the shaft.

235. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

236. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

237. Remove the swivel assembly from the shaft.

238. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

239. Screw the male end of this control shaft section to the swivel assembly.

240. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

241. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

242. Loosen the clamp from around the shaft.

243. **Very** slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

244. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

245. Remove the swivel assembly from the top of the control shaft.
246. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
247. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

248. Insert a quick release pin into hole 2.
 249. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.
 250. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.
- HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.
- Operator's Initials: _____; QA Stamp: _____; Date: _____
251. Repeat steps 245-247.

PIN IN HOLE 3:

252. Insert a quick release pin into hole 3.
 253. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.
 254. Repeat step 250.
- HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.
- Operator's Initials: _____; QA Stamp: _____; Date: _____
255. Repeat steps 245-247.

PIN IN HOLE 4:

256. Insert a quick release pin into hole 4.
257. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.
258. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

259. Repeat steps 245-247.

PIN IN HOLE 5:

260. Insert a quick release pin into hole 5.

261. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

262. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

263. Repeat steps 245-247.

PIN IN HOLE 6:

264. Insert a quick release pin into hole 6.

265. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

266. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

267. Repeat steps 245-247.

PIN IN HOLE 7:

268. Insert a quick release pin into hole 7.

269. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

270. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

271. Repeat steps 245-247.

PIN IN HOLE 8:

272. Insert a quick release pin into hole 8.

273. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

274. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

275. Repeat steps 245-247.

276. After obtaining the last force measurement in this tank, tighten the clamp around the shaft.

The following three HOLD's are a means of assuring that the shaft is secured. The shaft will be left in this orientation until the shear vane assembly is removed from the tank farm.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

277. Turn the motor off and disconnect the equipment from the power source.

278. Remove the support equipment (load cell, signal conditioner, voltmeter, and chart recorder) from the tank farm.
279. Cover the remaining equipment to protect it from the weather.

11.1.3 Post-Test Requirements for Testing in Tank 103-SY

1. Verify that Operations removes the shear vane equipment from Tank 103-SY within one day after the completion of force testing in this tank.

The following SOP's apply to this removal procedure:

TO-020-044 "Lock and Tag Control Procedure" [1987]
TO-020-250 "In Farm Installation of New or Modified Large Equipment Items" [1984]
TO-020-270 "Equipment Removal or Installation at Diversion Boxes and Pits" [1986]
TO-040-540 "Raw Water Surveillance and Usage" [1988]
TO-100-030 "Radioactive Waste Packaging and Transport Requirements" [1987]

2. Obtain daily liquid level readings for Tank 103-SY for the duration of the shear vane test. These readings can be obtained from Computer Automated Surveillance System (CASS) located in 2750E Building, Room B-105 (3-2618). A computer printout of liquid levels for the testing period will be maintained in the Laboratory Record Book.

11.2.1 Pre-Test Requirements for Testing in Tank 103-AN

1. At least five days before testing begins in Tank 103-AN, inspect riser 21A of Tank 103-AN for any damage. The shear vane assembly will be installed on this riser if it is found to be in good condition. If the condition of riser 21A is not satisfactory, another riser must be chosen at this time. Record the number of the riser to be used on the Pre-Test Data Sheet.
2. Verify that Operations has obtained sludge level readings for Tank 103-AN at least five days before testing begins in this tank. SOP TO-040-560 "Tank Farm Sludge Level Readings" [1988] defines the method for obtaining these readings. Record the sludge level readings on the Pre-Test Data Sheet as indicated.
3. Obtain daily liquid level readings for the two week period preceding the test. These readings must be studied to verify the liquid level in Tank 103-AN has remained fairly constant over this time period. Daily liquid level readings can be obtained from Computer Automated Surveillance system (CASS) located in 2750E Building, Room B-105 (3-2618). A computer printout of this set of readings will be maintained in the Laboratory Record Book. If liquid levels have been fluctuating drastically (more than 5 inches), testing in this tank may be postponed.
4. Verify that Operations installs the shear vane equipment in Tank 103-AN one day before testing begins in this tank. The spray wash, wiper and clamp assemblies should all be bolted to the riser chosen in step 1 above. The solid shaft section with a tapered end should be inserted through these assemblies and the vane should be attached to the lower end of this shaft section.

The following SOP's apply to this installation procedure:

TO-020-044 "Lock and Tag Control Procedure" [1987]
TO-020-250 "In Farm Installation of New or Modified
Large Equipment Items" [1984]
TO-020-270 "Equipment Removal or Installation at
Diversion Boxes and Pits" [1986]

5. The day of testing, verify that Operations has connects all electrical equipment to the motor and completes all electrical wiring before testing commences. The electrical equipment will be located on a table approximately 8' from the shear vane table.
6. Obtain hourly liquid level readings for Tank 103-AN for the 6 hour period preceding the start of the shear vane test. These readings can be obtained from CASS located in 2750E Building, Room B-105 (3-2618). Record this set of readings on the Pre-Test Data Sheet as indicated.
7. On the day testing begins, verify that Quality Assurance (QA)

checks the calibration of the torque measuring instruments of the shear vane. The table must be in place over the riser, and all electrical equipment must be connected before this calibration will be performed.

A known load, C, is applied to a bolt at the end of the motor arm (see Figure 11.1). This bolt is 12" from the center of the shaft drive tube (center of rotation). The force recorded on the chart recorder should be $2C \text{ lbf}$. This is the force seen by the load cell. The load cell is centered between both the bolt at the end of the motor arm and the center of the shaft drive tube. Since the distance between the load cell and the shaft drive tube center line is 6", the torque seen at the center of the shaft is $1/2 (2C)$ or $C \text{ ft}\cdot\text{lbf}$. If this torque is not approximately equal to C, the equipment must be repaired before continuing with the test. Record all values on the Load Cell Calibration Data Sheet as indicated.

11.2.2 Torque Measurements of Waste in Tank 103-AN

Before starting this test section, all pre-test requirements listed in section 11.2.1 must be met.

Throughout this test section, the chart recorder will be used to record the forces measured by the load cell. When the chart recorder is first turned on it will have to be operated for approximately 20 minutes before any measurements are taken. It is important that each measurement recorded on the chart paper have the corresponding shaft rotational speed, shaft length, and motor voltage written on the chart paper next to it. Arrows should be drawn to indicate when the motor was turned on and off. The chart paper should also be signed and dated by the Waste Disposal Technology representative (see Figure 11.2).

NOTE: When in use, the chart recorder should be set at 0.5 on the minute scale. If this speed is changed, the change point should be indicated on the chart paper. When the chart recorder is not in use, the paper feed should be turned off.

It is very important to record all pertinent information on the data sheets. A running total of the combined shaft and vane length below the quick release pin, Q, will be maintained on the Torque Measurement Data Sheet (see column 6). Since the shaft will not be lowered the same amount each time, it is important to refer to the equation on the Torque Measurement Data Sheet to calculate Q. The value Q must never exceed M, the maximum allowable combined length of the shaft and vane below the quick release pin (see the following **NOTE**). Therefore, it is very important to calculate the resulting Q value for each successive step before the shaft is actually lowered.

NOTE: After completion of each force measurement there is a hold point which requires the initials of the operator, a QA stamp, and the date (in the blocks provided) to assure that all data has been

properly entered and to assure the number in column 6 of the Torque Measurement Data Sheet does not exceed M inches. The value of M, is calculated and recorded on the Calculation Data Sheet as indicated.

NOTE: Each time the clamp is loosened or the swivel assembly is removed in the following procedure, there will be a hold point which requires initials of the operator, a QA stamp and the date (on the blanks provided) to assure that whenever a shaft holding device is removed, another will remain in place. This will prevent an oversight and keep the shaft from falling into the tank. The three holding devices of the shear vane apparatus are (1) the clamp assembly, (2) the hoist (swivel assembly) with slack taken up in the cable, and (3) a quick release pin inserted in the control shaft and resting in the notch of the shaft drive tube.

NOTE: The force recorded by the chart recorder should never exceed 50 lbf. Since there is no automatic shutoff on the motor of the shear vane, it is very important to watch the chart recorder closely to ensure this force is never exceeded. If the force (as recorded by the chart recorder) ever exceeds 50 lbf, the motor should be turned off immediately and the situation should be investigated.

NOTE: If the 50 lbf is exceeded or if the shaft fails to rotate, the motor should be turned off. To determine that the motor is functioning properly, attach the top of the shaft to the swivel assembly and lift the shaft until the quick release pin in the control shaft is no longer resting in the notch of the shaft drive tube. Turn the motor on and observe its function when the force of the shaft is removed from the shaft drive tube. If the motor is not rotating properly then necessary repair must be made to the equipment before the test can continue. If the motor is functioning properly, the test will be aborted and the situation will be further investigated.

NOTE: Never use excessive force to push the shaft down into the tank waste. If the shaft will not fall into the waste under the force of its own weight, test personnel may assist in lowering the shaft by holding the shaft and pushing down. Do not jiggle the shaft up and down or use any tools to force the shaft down into the waste.

PROCEDURE FOR SECURING SHAFT WHEN SHEAR VANE ASSEMBLY IS LEFT UNATTENDED

NOTE: In the event testing will not be completed in the one day, the following three HOLD's are a means of assuring that the shaft is secured when the equipment is left unattended. The shaft will be left in this orientation until testing resumes in the tank. In addition to these HOLD's, steps A and B must also be followed when the equipment is left unattended for extended periods.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- A. Turn the motor off and disconnect the equipment from the power source.
 - B. Remove the support equipment (signal conditioner, voltmeter, motor controller, and chart recorder) from the tank farm. The load cell remains in place.
 - C. Cover the remaining equipment to protect it from the weather.
-
-

The procedure for obtaining force measurements of the waste in Tank 103-AN is as follows:

1. Turn the chart recorder on and let it run for approximately 20 minutes.
2. Turn the motor on. Using the knob on the motor controller, adjust the voltmeter setting to 1.53 volts (approximately 0.033 rpm). Turn the motor off, and leave the motor controller knob untouched.
3. Turn the chart recorder paper drive on and zero the chart recorder on the green line to the far left of the chart paper.
4. Measure the vertical distance between the base of the shear vane table and the top of the riser flange. This distance is termed t . Use the value of t to calculate the value of M , the maximum combined length of the shaft and vane and record these values on the Calculation Data Sheet as indicated.
5. Using an average of the liquid level readings (for the previous 6 hours), D_A , determine the length of shaft to be lowered into the tank before taking the first force reading of the waste. See the Calculation Data Sheet for this calculation.

NOTE: One shaft section is already inserted through the clamp, wiper and washer assemblies, and the vane is attached to the lower end of this shaft section. The clamp is tightened around this shaft section.

NOTE: The following steps 6-33 outline the addition of up to seven solid shaft sections. As many as seven shaft sections may be added before the first force reading is taken. (See the Calculation Data Sheet for the exact number of shaft sections). If fewer shaft sections are added before taking the first reading, cross out the remaining steps and skip to the HOLD preceding step 34. Have representatives from Operations, QA and Waste Disposal Technology initial by the crossed-out sections.

NOTE: When screwing together shaft sections do not cross-thread and hand tighten only. These considerations also apply when screwing shaft sections to the swivel assembly. When the motor is on, the rotation of the shaft will be in the direction that will further tighten the shaft connections.

SHAFT 1:

6. To add the first of X_N (see Calculation Data Sheet) solid 5' shaft sections to the existing shaft, screw the male end of one solid shaft section to the swivel assembly.

7. Using the hand crank, raise the base of this shaft section above the top of the shaft drive tube.
8. With the hand crank, lower the shaft section through the shaft drive tube until it is low enough to be connected to the top of the existing shaft.
9. Screw the two shaft sections together.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

10. Loosen the clamp from around the shaft.
 11. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
- NOTE: If the gasket of the wiper assembly grabs onto the shaft as it is lowered, lubricate the gasket with silicon spray. This may need to be repeated several times during the test.
12. Tighten the clamp around the shaft.

SHAFT 2:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

13. Remove the swivel assembly from the shaft and screw it to the male end of a second solid 5' shaft section of shaft.
 14. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
 15. Screw the two shaft sections together.
- NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.
- HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.
- Operator's Initials: _____; QA Stamp: _____; Date: _____
16. Loosen the clamp from around the shaft.

17. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
18. Tighten the clamp around the shaft.

SHAFT 3:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

19. Remove the swivel assembly from the shaft and screw it to the male end of a third solid 5' section of shaft.

20. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

21. Repeat steps 16-18.

SHAFT 4:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

22. Remove the swivel assembly from the shaft and screw it to the male end of a fourth solid 5' section of shaft.

23. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

24. Repeat steps 16-18.

SHAFT 5:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

25. Remove the swivel assembly from the shaft and screw it to the male end of a fifth solid 5' section of shaft.

26. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

27. Repeat steps 16-18.

SHAFT 6:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

28. Remove the swivel assembly from the shaft and screw it to the male end of a sixth solid 5' section of shaft.

29. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

30. Repeat steps 16-18.

SHAFT 7:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

31. Remove the swivel assembly from the shaft and screw it to the male end of a seventh solid 5' section of shaft.

32. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

33. Repeat steps 16-18.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

34. Remove the swivel assembly from the top of the shaft.

NOTE: Steps 35-52 outline the procedure for the taking 3 force measurements in the upper part of the supernate phase in Tank 103-AN waste.

PIN IN HOLE 1:

35. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

36. Screw the male end of this control shaft section to the swivel assembly.

37. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

38. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

39. Loosen the clamp from around the shaft.

40. **Very Slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

41. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

42. Remove the swivel assembly from the top of the control shaft.
43. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
44. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

45. Insert a quick release pin into hole 2.
46. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.
47. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

48. Repeat steps 42-44.

PIN IN HOLE 3:

49. Insert a quick release pin into hole 3.
50. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.
51. Repeat step 47.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

52. Repeat steps 42-44.
-
-

NOTE: The following steps 53-81 outline the procedure for obtaining up to three additional force measurements in the supernate phase of the waste in Tank 103-AN. As the shaft is lowered to obtain these three measurements, it may be possible that the vane will enter the top of the sludge layer.

53. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

54. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

55. Unscrew the control shaft from the existing shaft.

56. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

57. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

58. Screw the male end of a solid shaft section to the swivel assembly.

59. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

60. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

61. Loosen the clamp from around the shaft.

62. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

63. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

64. Remove the swivel assembly from the shaft.

PIN IN HOLE 6:

65. Insert a quick release pin into hole 6.
66. Screw the male end of this control shaft section to the swivel assembly.
67. Using the hand crank, raise the control shaft section until its female end is high enough to allow connection to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

68. Loosen the clamp from around the shaft.
69. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

70. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

71. Remove the swivel assembly from the top of the control shaft.
72. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
73. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 7:

74. Insert a quick release pin into hole 7.

75. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

76. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

77. Repeat steps 71-73.

PIN IN HOLE 8:

78. Insert a quick release pin into hole 8.

79. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

80. Repeat step 76.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

81. Repeat steps 71-73.

NOTE: Steps 82-281 are instructions for the taking up to 32 force measurements in Tank 103-AN waste. The number of measurements taken will depend on the value of Q, the combined length of the shaft and vane. A running total of the value of Q is maintained in column 6 of the Torque Measurement Data Sheet. If, M, the maximum combined length of the shaft and vane, will be exceeded by lowering the shaft an additional 7-11 inches, measurements will cease in this tank.

NOTE: For the remaining steps in this test section, it may be necessary to substitute a control shaft section for a solid shaft section. It is important to lower the nine solid shaft sections into the tank before substituting one of the control shaft sections. The three control shafts should remain on the top end of the shaft and should be the last three shaft sections added to the shaft. Where control shaft sections are added in place of solid shaft sections, the repetitive steps will be crossed out. These crossed-out sections must be initialed by Operations, QA, and

Waste Disposal Technology personnel.

82. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

83. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

84. Unscrew the control shaft from the existing shaft.

85. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

86. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

87. Screw the male end of a solid shaft section to the swivel assembly.

88. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

89. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

90. Loosen the clamp from around the shaft.

91. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

92. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

93. Remove the swivel assembly from the shaft.

NOTE: In steps 94-131, H_i indicates the starting hole number as calculated on the Calculation Data Sheet. If the value of H_i is greater than one, all of steps 94-131 will not be used. If this is the case, cross out the remaining steps and skip to the NOTE

preceding step 132. Have representatives from Operations, QA and Waste Disposal Technology initial by the crossed-out sections.

PIN IN HOLE H_i :

94. Insert a quick release pin into starting hole H_i (as calculated on the Calculation Data Sheet) of a control shaft section (see Figure 11.3).
95. Screw the male end of this control shaft section to the swivel assembly.
96. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
97. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

98. Loosen the clamp from around the shaft.
 99. **Very Slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.
- NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.
- NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

100. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

101. Remove the swivel assembly from the top of the control shaft.
102. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the

motor off.

103. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE (H_i+1):

104. Insert a quick release pin into hole (H_i+1).

105. Raise the shaft with the hand crank, and remove the pin from hole H_i of the control shaft.

106. With the hand crank, **very** slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

107. Repeat steps 101-103.

PIN IN HOLE (H_i+2):

108. Insert a quick release pin into hole (H_i+2).

109. Raise the shaft with the hand crank, and remove the pin from hole (H_i+1) of the control shaft.

110. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

111. Repeat steps 101-103.

PIN IN HOLE (H_i+3):

112. Insert a quick release pin into hole (H_i+3).

113. Raise the shaft with the hand crank, and remove the pin from hole (H_i+2) of the control shaft.

114. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

115. Repeat steps 101-103.

PIN IN HOLE (H_i+4):

116. Insert a quick release pin into hole (H_i+4).

117. Raise the shaft with the hand crank, and remove the pin from hole (H_i+3) of the control shaft.

118. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

119. Repeat steps 101-103.

PIN IN HOLE (H_i+5):

120. Insert a quick release pin into hole (H_i+5).

121. Raise the shaft with the hand crank, and remove the pin from hole (H_i+4) of the control shaft.

122. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

123. Repeat steps 101-103.

PIN IN HOLE (H_i+6):

124. Insert a quick release pin into hole (H_i+6).

125. Raise the shaft with the hand crank, and remove the pin from hole (H_i+5) of the control shaft.

126. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

127. Repeat steps 101-103.

PIN IN HOLE (H_i+7):

128. Insert a quick release pin into hole (H_i+7).

129. Raise the shaft with the hand crank, and remove the pin from hole (H_i+6) of the control shaft.

130. Repeat step 106.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

131. Repeat steps 101-103.

NOTE: The following steps 132-281 include instructions for obtaining up to 24 additional force measurements in Tank 103-AN solid waste. The value of Q can not exceed the value of M (see the Calculation Data Sheet), therefore, it is possible fewer than 24 additional measurements will be taken. If fewer measurements are taken before testing is completed in Tank 103-AN, cross out the remaining steps and skip to step 282. Have representatives from Operations, QA and Waste Disposal Technology initial by the crossed-out sections.

132. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

133. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

134. Unscrew the control shaft from the existing shaft.

135. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

136. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.
137. Screw the male end of a solid shaft section to the swivel assembly.
138. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
139. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

140. Loosen the clamp from around the shaft.
141. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
142. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

143. Remove the swivel assembly from the shaft.

PIN IN HOLE 1:

144. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).
145. Screw the male end of this control shaft section to the swivel assembly.
146. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
147. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

148. Loosen the clamp from around the shaft.
149. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

150. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

151. Remove the swivel assembly from the top of the control shaft.
152. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (no slope) is reached.
153. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

154. Insert a quick release pin into hole 2.
155. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.
156. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

157. Repeat steps 151-153.

PIN IN HOLE 3:

158. Insert a quick release pin into hole 3.

159. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

160. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

161. Repeat steps 151-153.

PIN IN HOLE 4:

162. Insert a quick release pin into hole 4.

163. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

164. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

165. Repeat steps 151-153.

PIN IN HOLE 5:

166. Insert a quick release pin into hole 5.

167. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

168. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

169. Repeat steps 151-153.

PIN IN HOLE 6:

170. Insert a quick release pin into hole 6.

171. Raise the shaft with the hand crank, and remove the pin from hole 5

. of the control shaft.

172. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

173. Repeat steps 151-153.

PIN IN HOLE 7:

174. Insert a quick release pin into hole 7.

175. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

176. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

177. Repeat steps 151-153.

PIN IN HOLE 8:

178. Insert a quick release pin into hole 8.

179. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

180. Repeat step 156.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

181. Repeat steps 151-153.

PIN IN HOLE 1:

182. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

183. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

184. Unscrew the control shaft from the existing shaft.
185. Using the hand crank, lower the control shaft until the swivel assembly can be reached.
186. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.
187. Screw the male end of a solid shaft section to the swivel assembly.
188. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
189. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

190. Loosen the clamp from around the shaft.
191. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
192. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

193. Remove the swivel assembly from the shaft.
194. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).
195. Screw the male end of this control shaft section to the swivel assembly.
196. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
197. Screw the bottom of the control shaft to the top of the existing

shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

198. Loosen the clamp from around the shaft.

199. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

200. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

201. Remove the swivel assembly from the top of the control shaft.

202. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

203. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

204. Insert a quick release pin into hole 2.

205. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

206. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

207. Repeat steps 201-203.

PIN IN HOLE 3:

208. Insert a quick release pin into hole 3.

209. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

210. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

211. Repeat steps 201-203.

PIN IN HOLE 4:

212. Insert a quick release pin into hole 4.

213. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

214. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

215. Repeat steps 201-203.

PIN IN HOLE 5:

216. Insert a quick release pin into hole 5.

217. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

218. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

219. Repeat steps 201-203.

PIN IN HOLE 6:

220. Insert a quick release pin into hole 6.

221. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

222. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

223. Repeat steps 201-203.

PIN IN HOLE 7:

224. Insert a quick release pin into hole 7.

225. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

226. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

227. Repeat steps 201-203.

PIN IN HOLE 8:

228. Insert a quick release pin into hole 8.

229. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

230. Repeat step 206.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

231. Repeat steps 201-203.

PIN IN HOLE 1:

232. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

233. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

234. Unscrew the control shaft from the existing shaft.

235. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

236. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

237. Screw the male end of a solid shaft section to the swivel assembly.

238. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

239. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

240. Loosen the clamp from around the shaft.

241. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

242. Tighten the clamp around the shaft.

253. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

254. Insert a quick release pin into hole 2.

255. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

256. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

257. Repeat steps 251-253.

PIN IN HOLE 3:

258. Insert a quick release pin into hole 3.

259. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

260. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

261. Repeat steps 251-253.

PIN IN HOLE 4:

262. Insert a quick release pin into hole 4.

263. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

264. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

265. Repeat steps 251-253.

PIN IN HOLE 5:

266. Insert a quick release pin into hole 5.

267. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

268. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

269. Repeat steps 251-253.

PIN IN HOLE 6:

270. Insert a quick release pin into hole 6.

271. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

272. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

273. Repeat steps 251-253.

PIN IN HOLE 7:

274. Insert a quick release pin into hole 7.

275. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

276. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

277. Repeat steps 251-253.

PIN IN HOLE 8:

278. Insert a quick release pin into hole 8.

279. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

280. Repeat step 256.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

281. Repeat steps 251-253.

282. After obtaining the last force measurement in this tank, tighten the clamp around the shaft.

The following three HOLD's are a means of assuring that the shaft is secured. The shaft will be left in this orientation until the shear vane assembly is removed from the tank farm.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

283. Turn the motor off and disconnect the equipment from the power source.

284. Remove the support equipment (load cell, signal conditioner, voltmeter, and chart recorder) from the tank farm.

285. Cover the remaining equipment to protect it from the weather.

11.2.3 Post-Test Requirements for Testing in Tank 103-AN

1. Verify that Operations removes the shear vane equipment from Tank 103-AN one day after the completion of force testing in this tank.

The following SOP's apply to this removal procedure:

- TO-020-044 "Lock and Tag Control Procedure" [1987]
- TO-020-250 "In Farm Installation of New or Modified Large Equipment Items" [1984]
- TO-020-270 "Equipment Removal or Installation at Diversion Boxes and Pits" [1986]
- TO-040-540 "Raw Water Surveillance and Usage" [1988]
- TO-100-030 "Radioactive Waste Packaging and Transport Requirements" [1987]

2. Obtain liquid level readings for Tank 103-AN for the duration of the shear vane test. These readings are taken on an hourly basis and can be obtained from CASS located in 2750E Building, Room B-105 (3-2618). A computer printout of liquid levels for the testing period will be maintained in the Laboratory Record Book.

11.3.1 Pre-Test Requirements for Testing in Tank 103-AW

1. At least five days before testing begins in Tank 103-AW, inspect riser 10A of Tank 103-AW for any damage. The shear vane assembly will be installed on this riser if it is found to be in good condition. If the condition of riser 10A is not satisfactory, another riser must be chosen at this time. Record the number of the riser to be used on the Pre-Test Data Sheet.
2. At least two weeks before testing commences in Tank 103-AW, obtain confirmation from Tank Farm Process Engineering that no transfers are scheduled to take place into or out of Tank 103-AW for the duration of testing in this tank.
3. Verify Operations performs a gamma scan in Tank 103-AW at least five days before testing begins in this tank. SOP TO-040-330 "Drywell Surveillance Van Operating Procedure" [1988] defines the method for obtaining solid level readings using this procedure. Record the sludge level readings on the Pre-Test Data Sheet as indicated.

NOTE: Waste has recently been added to Tank 103-AW and much of the fine particulate solids are expected to remain suspended in the upper layers of the waste. A gamma scan is expected to give a more accurate indication of the depth of solids in Tank 103-AW, than the "Tank Farm Sludge Level Readings" (SOP TO-040-560) method.

4. Verify that Operations installs the shear vane equipment in Tank 103-AW one day before testing begins in this tank. The spray wash, wiper and clamp assemblies should all be bolted to the riser chosen in step 1 above. The solid shaft section with a tapered end should be inserted through these assemblies and the vane should be attached to the lower end of this shaft section.

The following SOP's apply to this installation procedure:

TO-020-044 "Lock and Tag Control Procedure" [1987]
 TO-020-250 "In Farm Installation of New or Modified Large Equipment Items" [1984]
 TO-020-270 "Equipment Removal or Installation at Diversion Boxes and Pits" [1986]

5. The day of testing, verify that Operations connects all electrical equipment to the motor and completes all electrical wiring before testing commences. The electrical equipment will be located on a table approximately 8' from the shear vane table.
6. Obtain hourly liquid level readings for Tank 103-AW for the 6 hour period preceding the start of the shear vane test. These readings can be obtained from CASS located in 2750E Building, Room B-105 (3-2618). Record this set of readings on the Pre-Test Data Sheet as indicated.

7. On the day testing begins, verify that QA checks the calibration of the torque measuring instruments of the shear vane. The table must be in place over the riser, and all electrical equipment must be connected before this calibration will be performed.

A known load, C , is applied to a bolt at the end of the motor arm (see Figure 11.1). This bolt is 12" from the center of the shaft drive tube (center of rotation). The force recorded on the chart recorder should be $2C \text{ lbf}$. This is the force seen by the load cell. The load cell is centered between both the bolt at the end of the motor arm and the center of the shaft drive tube. Since the distance between the load cell and the shaft drive tube center line is 6", the torque seen at the center of the shaft is $1/2 (2C)$ or $C \text{ ft}\cdot\text{lbf}$. If this torque is not approximately equal to C , the equipment must be repaired before continuing with the test. Record all values on the Load Cell Calibration Data Sheet as indicated.

11.3.2 Torque Measurements of Waste in Tank 103-AW

Before starting this test section, all pre-test requirements listed in Section 11.3.1 must be met.

Throughout this test section, the chart recorder will be used to record the forces measured by the load cell. When the chart recorder is first turned on it will have to be operated for approximately 20 minutes before any measurements are taken. It is important that each measurement recorded on the chart paper have the corresponding shaft rotational speed, shaft length, and motor voltage written on the chart paper next to it. Arrows should be drawn to indicate when the motor was turned on and off. The chart paper should also be signed and dated by the testing personnel (see Figure 11.2).

NOTE: When in use, the chart recorder should be set at 0.5 on the minute scale. If this speed is changed, the change point should be indicated on the chart paper. When the chart recorder is not in use, the paper feed should be turned off.

It is very important to record all pertinent information on the data sheets. A running total of the combined shaft and vane length below the quick release pin, Q , will be maintained on the Torque Measurement Data Sheet (see column 6). Since the shaft will not be lowered the same amount each time, it is important to refer to the equation on the Torque Measurement Data Sheet to calculate Q . The value Q must never exceed M , the maximum allowable combined length of the shaft and vane below the quick release pin (see the following **NOTE**). Therefore, it is very important to calculate the resulting Q value for each successive step before the shaft is actually lowered.

NOTE: After completion of each force measurement there is a hold point which requires the initials of the operator, a QA stamp, and the date (in the blocks provided) to assure that all data has been

properly entered and to assure the number in column 6 of the Torque Measurement Data Sheet does not exceed M inches. The value of M, is calculated and recorded on the Calculation Data Sheet as indicated.

NOTE: Each time the clamp is loosened or the swivel assembly is removed in the following procedure, there will be a hold point which requires initials of the operator, a QA stamp and the date (on the blanks provided) to assure that whenever a shaft holding device is removed, another will remain in place. This will prevent an oversight and keep the shaft from falling into the tank. The three holding devices of the shear vane apparatus are (1) the clamp assembly, (2) the hoist (swivel assembly) with slack taken up in the cable, and (3) a quick release pin inserted in the control shaft and resting in the notch of the shaft drive tube.

NOTE: The force recorded by the chart recorder should never exceed 50 lbf. Since there is no automatic shutoff on the motor of the shear vane, it is very important to watch the chart recorder closely to ensure this force is never exceeded. If the force (as recorded by the chart recorder) ever exceeds 50 lbf, the motor should be turned off immediately and the situation should be investigated.

NOTE: If the 50 lbf is exceeded or if the shaft fails to rotate, the motor should be turned off. To determine that the motor is functioning properly, attach the top of the shaft to the swivel assembly and lift the shaft until the quick release pin in the control shaft is no longer resting in the notch of the shaft drive tube. Turn the motor on and observe its function when the force of the shaft is removed from the shaft drive tube. If the motor is not rotating properly then necessary repair must be made to the equipment before the test can continue. If the motor is functioning properly, the test will be aborted and the situation will be further investigated.

NOTE: Never use excessive force to push the shaft down into the tank waste. If the shaft will not fall into the waste under the force of its own weight, test personnel may assist in lowering the shaft by holding the shaft and pushing down. Do not jiggle the shaft up and down or use any tools to force the shaft down into the waste.

PROCEDURE FOR SECURING SHAFT WHEN SHEAR VANE ASSEMBLY IS LEFT UNATTENDED

NOTE: In the event testing will not be completed in the one day, the following three HOLD's are a means of assuring that the shaft is secured when the equipment is left unattended. The shaft will be left in this orientation until testing resumes in the tank. In addition to these HOLD's, steps A and B must also be followed when the equipment is left unattended for extended periods.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- A. Turn the motor off and disconnect the equipment from the power source.
 - B. Remove the support equipment (signal conditioner, voltmeter, motor controller, and chart recorder) from the tank farm. The load cell remains in place.
 - C. Cover the remaining equipment to protect it from the weather.
-
-

The procedure for obtaining force measurements of the waste in Tank 103-AW is as follows:

1. Turn the chart recorder on and let it run for approximately 20 minutes.
2. Turn the motor on. Using the knob on the motor controller, adjust the voltmeter setting to 1.53 volts (approximately 0.033 rpm). Turn the motor off, and leave the motor controller knob untouched.
3. Turn the chart recorder paper drive on and zero the chart recorder on the green line to the far left of the chart paper.
4. Measure the vertical distance between the base of the shear vane table and the top of the riser flange. This distance is termed t . Use the value of t to calculate the value of M , the maximum combined length of the shaft and vane and record these values on the Calculation Data Sheet as indicated.
5. Using an average of the liquid level readings (for the previous 6 hours), D_L , determine the length of shaft to be lowered into the tank before taking the first force reading of the waste. See the Calculation Data Sheet for this calculation.

NOTE: One shaft section is already inserted through the clamp, wiper and washer assemblies, and the vane is attached to the lower end of this shaft section. The clamp is tightened around this shaft section.

NOTE: The following steps 6-36 outline the addition of up to eight solid shaft sections. As many as eight shaft sections may be added before the first force reading is taken. (See the Calculation Data Sheet for the exact number of shaft sections). If fewer shaft sections are added before taking the first reading, cross out the remaining steps and skip to the HOLD point preceding step 37. Have representatives from Operations, QA and Waste Disposal Technology initial by the crossed-out sections.

NOTE: When screwing together shaft sections do not cross-thread and hand tighten only. These considerations also apply when screwing shaft sections to the swivel assembly. When the motor is on, the rotation of the shaft will be in the direction that will further tighten the shaft connections.

SHAFT 1:

6. To add the first of X_N (see Calculation Data Sheet) solid 5' shaft sections to the existing shaft, screw the male end of one solid shaft section to the swivel assembly.

7. Using the hand crank, raise the base of this shaft section above the top of the shaft drive tube.
8. With the hand crank, lower the shaft section through the shaft drive tube until it is low enough to be connected to the top of the existing shaft.
9. Screw the two shaft sections together.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

10. Loosen the clamp from around the shaft.
 11. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
- NOTE: If the gasket of the wiper assembly grabs onto the shaft as it is lowered, lubricate the gasket with silicon spray. This may need to be repeated several times during the test.
12. Tighten the clamp around the shaft.

SHAFT 2:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

13. Remove the swivel assembly from the shaft and screw it to the male end of a second solid 5' shaft section of shaft.
14. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
15. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

16. Loosen the clamp from around the shaft.

17. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
18. Tighten the clamp around the shaft.

SHAFT 3:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

19. Remove the swivel assembly from the shaft and screw it to the male end of a third solid 5' section of shaft.

20. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

21. Repeat steps 16-18.

SHAFT 4:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

22. Remove the swivel assembly from the shaft and screw it to the male end of a fourth solid 5' section of shaft.

23. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

24. Repeat steps 16-18.

SHAFT 5:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

25. Remove the swivel assembly from the shaft and screw it to the male end of a fifth solid 5' section of shaft.

26. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

27. Repeat steps 16-18.

SHAFT 6:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

28. Remove the swivel assembly from the shaft and screw it to the male end of a sixth solid 5' section of shaft.

29. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

30. Repeat steps 16-18.

SHAFT 7:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

31. Remove the swivel assembly from the shaft and screw it to the male end of a seventh solid 5' section of shaft.

32. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

33. Repeat steps 16-18.

SHAFT 8:

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

34. Remove the swivel assembly from the shaft and screw it to the male end of a eighth solid 5' section of shaft.

35. Repeat steps 14-15.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

36. Repeat steps 16-18.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

37. Remove the swivel assembly from the top of the shaft.

NOTE: Steps 38-375 outline the procedure for taking up to 56 force measurements in Tank 103-AW waste. The number of measurements taken will depend on the value of Q, the combined length of the shaft and vane. A running total of the value of Q is maintained in column 6 of the Torque Measurement Data Sheet. If, M, the maximum combined length of the shaft and vane, will be exceeded by lowering the shaft an additional 7-11 inches, measurements will cease in this tank.

NOTE: In steps 38-75, H_i indicates the starting hole number as calculated on the Calculation Data Sheet. If the value of H_i is greater than one, all of the next several steps will not be followed. If this is the case, cross out the remaining steps and skip to the NOTE preceding step 76. Have representatives from Operations, QA and Waste Disposal Technology initial by the crossed-out sections.

PIN IN HOLE H_i :

38. Insert a quick release pin into starting hole H_i (as calculated on the Calculation Data Sheet) of a control shaft section (see Figure 11.3).

39. Screw the male end of this control shaft section to the swivel assembly.
40. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
41. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

42. Loosen the clamp from around the shaft.
43. **Very Slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

44. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

45. Remove the swivel assembly from the top of the control shaft.
46. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
47. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE (H_i+1):

48. Insert a quick release pin into hole (H_i+1).
49. Raise the shaft with the hand crank, and remove the pin from hole

H_i of the control shaft.

50. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

51. Repeat steps 45-47.

PIN IN HOLE (H_i+2):

52. Insert a quick release pin into hole (H_i+2).

53. Raise the shaft with the hand crank, and remove the pin from hole (H_i+1) of the control shaft.

54. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

55. Repeat steps 45-47.

PIN IN HOLE (H_i+3):

56. Insert a quick release pin into hole (H_i+3).

57. Raise the shaft with the hand crank, and remove the pin from hole (H_i+2) of the control shaft.

58. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

59. Repeat steps 45-47.

PIN IN HOLE (H_i+4):

60. Insert a quick release pin into hole (H_i+4).

61. Raise the shaft with the hand crank, and remove the pin from hole

(H_i+3) of the control shaft..

62. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

63. Repeat steps 45-47.

PIN IN HOLE (H_i+5):

64. Insert a quick release pin into hole (H_i+5).

65. Raise the shaft with the hand crank, and remove the pin from hole (H_i+4) of the control shaft.

66. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

67. Repeat steps 45-47.

PIN IN HOLE (H_i+6):

68. Insert a quick release pin into hole (H_i+6).

69. Raise the shaft with the hand crank, and remove the pin from hole (H_i+5) of the control shaft.

70. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

71. Repeat steps 45-47.

PIN IN HOLE (H_i+7):

72. Insert a quick release pin into hole (H_i+7).

73. Raise the shaft with the hand crank, and remove the pin from hole (H_i+6) of the control shaft.

74. Repeat step 50.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

75. Repeat steps 45-47.

NOTE: The following steps 76-375 outline the procedure for obtaining up to 48 additional force measurements in Tank 103-AW waste. The value of Q can not exceed the value of M (see the Calculation Data Sheet), therefore, it is possible fewer than 32 measurements will be taken. If fewer measurements are taken before testing is completed in Tank 103-AW, cross out the remaining steps and skip to step . Representatives from Operations, QA, and Waste Disposal Technology must initial by the crossed-out sections.

NOTE: For the remaining steps in this test section, it may be necessary to substitute a control shaft section for a solid shaft section. It is important to lower the nine solid shaft sections into the tank before substituting one of the control shaft sections. The three control shafts should remain on the top end of the shaft and should be the last three shaft sections added to the shaft. Where control shaft sections are added in place of solid shaft sections, the repetitive steps will be crossed out. These crossed-out sections must be initialed by Operations, QA, and Waste Disposal Technology personnel.

76. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

77. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

78. Unscrew the control shaft from the existing shaft.

79. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

80. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

81. Screw the male end of a solid shaft section to the swivel assembly.

82. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

83. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

84. Loosen the clamp from around the shaft.

85. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

86. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

87. Remove the swivel assembly from the shaft.

PIN IN HOLE 1:

88. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

89. Screw the male end of this control shaft section to the swivel assembly.

90. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

91. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

92. Loosen the clamp from around the shaft.

93. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin

does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in an erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

94. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

95. Remove the swivel assembly from the top of the control shaft.

96. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

97. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

98. Insert a quick release pin into hole 2.

99. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

100. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

101. Repeat steps 95-97.

PIN IN HOLE 3:

102. Insert a quick release pin into hole 3.

103. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

104. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

105. Repeat steps 95-97.

PIN IN HOLE 4:

106. Insert a quick release pin into hole 4.

107. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

108. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

109. Repeat steps 95-97.

PIN IN HOLE 5:

110. Insert a quick release pin into hole 5.

111. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

112. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

113. Repeat steps 95-97.

PIN IN HOLE 6:

114. Insert a quick release pin into hole 6.

115. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

116. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

117. Repeat steps 95-97.

PIN IN HOLE 7:

118. Insert a quick release pin into hole 7.

119. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

120. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

121. Repeat steps 95-97.

PIN IN HOLE 8:

122. Insert a quick release pin into hole 8.

123. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

124. Repeat step 100.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

125. Repeat steps 95-97.

PIN IN HOLE 1:

126. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

127. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

128. Unscrew the control shaft from the existing shaft.

129. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

130. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

131. Screw the male end of a solid shaft section to the swivel assembly.

132. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

133. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

134. Loosen the clamp from around the shaft.

135. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

136. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

137. Remove the swivel assembly from the shaft.

138. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

139. Screw the male end of this control shaft section to the swivel assembly.

140. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

141. Screw the bottom of the control shaft to the top of the existing

shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

142. Loosen the clamp from around the shaft.

143. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

144. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

145. Remove the swivel assembly from the top of the control shaft.

146. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

147. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

148. Insert a quick release pin into hole 2.

149. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

150. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

151. Repeat steps 145-147.

PIN IN HOLE 3:

152. Insert a quick release pin into hole 3.

153. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

154. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

155. Repeat steps 145-147.

PIN IN HOLE 4:

156. Insert a quick release pin into hole 4.

157. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

158. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

159. Repeat steps 145-147.

PIN IN HOLE 5:

160. Insert a quick release pin into hole 5.

161. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

162. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

163. Repeat steps 145-147.

PIN IN HOLE 6:

164. Insert a quick release pin into hole 6.

165. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

166. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

167. Repeat steps 145-147.

PIN IN HOLE 7:

168. Insert a quick release pin into hole 7.

169. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

170. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

171. Repeat steps 145-147.

PIN IN HOLE 8:

172. Insert a quick release pin into hole 8.

173. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

174. Repeat step 150.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

175. Repeat steps 145-147.

PIN IN HOLE 1:

176. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

177. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

178. Unscrew the control shaft from the existing shaft.

179. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

180. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

181. Screw the male end of a solid shaft section to the swivel assembly.

182. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

183. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials; _____; QA Stamp: _____; Date: _____

184. Loosen the clamp from around the shaft.

185. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

186. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

187. Remove the swivel assembly from the shaft.

188. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

189. Screw the male end of this control shaft section to the swivel assembly.

190. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

191. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

192. Loosen the clamp from around the shaft.

193. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

194. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

195. Remove the swivel assembly from the top of the control shaft.

196. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

197. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

198. Insert a quick release pin into hole 2.

199. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

200. With the hand crank, **very slowly** lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

201. Repeat steps 195-197.

PIN IN HOLE 3:

202. Insert a quick release pin into hole 3.

203. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

204. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

205. Repeat steps 195-197.

PIN IN HOLE 4:

206. Insert a quick release pin into hole 4.

207. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

208. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

209. Repeat steps 195-197.

PIN IN HOLE 5:

210. Insert a quick release pin into hole 5.

211. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

212. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

213. Repeat steps 195-197.

PIN IN HOLE 6:

214. Insert a quick release pin into hole 6.

215. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

216. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

217. Repeat steps 195-197.

PIN IN HOLE 7:

218. Insert a quick release pin into hole 7.

219. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

220. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

221. Repeat steps 195-197.

PIN IN HOLE 8:

222. Insert a quick release pin into hole 8.

223. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

224. Repeat step 200.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

225. Repeat steps 195-197.

PIN IN HOLE 1:

226. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

227. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

228. Unscrew the control shaft from the existing shaft.

229. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

230. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

231. Screw the male end of a solid shaft section to the swivel assembly.

232. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

233. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

234. Loosen the clamp from around the shaft.

235. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

236. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

237. Remove the swivel assembly from the shaft.

238. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

239. Screw the male end of this control shaft section to the swivel assembly.

240. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

241. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

242. Loosen the clamp from around the shaft.

243. **Very slowly** lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

244. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 245. Remove the swivel assembly from the top of the control shaft.
- 246. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.
- 247. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

- 248. Insert a quick release pin into hole 2.
- 249. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.
- 250. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 251. Repeat steps 245-247.

PIN IN HOLE 3:

- 252. Insert a quick release pin into hole 3.
- 253. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.
- 254. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 255. Repeat steps 245-247.

PIN IN HOLE 4:

- 256. Insert a quick release pin into hole 4.
- 257. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.
- 258. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

259. Repeat steps 245-247.

PIN IN HOLE 5:

260. Insert a quick release pin into hole 5.

261. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

262. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

263. Repeat steps 245-247.

PIN IN HOLE 6:

264. Insert a quick release pin into hole 6.

265. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

266. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

267. Repeat steps 245-247.

PIN IN HOLE 7:

268. Insert a quick release pin into hole 7.

269. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

270. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

271. Repeat steps 245-247.

PIN IN HOLE 8:

272. Insert a quick release pin into hole 8.

273. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

274. Repeat step 250.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

275. Repeat steps 245-247.

PIN IN HOLE 1:

276. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.

277. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

278. Unscrew the control shaft from the existing shaft.

279. Using the hand crank, lower the control shaft until the swivel assembly can be reached.

280. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

281. Screw the male end of a solid shaft section to the swivel assembly.

282. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.

283. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

284. Loosen the clamp from around the shaft.

285. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.

286. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

287. Remove the swivel assembly from the shaft.

288. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).

289. Screw the male end of this control shaft section to the swivel assembly.

290. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.

291. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

292. Loosen the clamp from around the shaft.

293. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

294. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

295. Remove the swivel assembly from the top of the control shaft.

296. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

297. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

298. Insert a quick release pin into hole 2.

299. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

300. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

301. Repeat steps 295-297.

PIN IN HOLE 3:

302. Insert a quick release pin into hole 3.

303. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

304. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

305. Repeat steps 295-297.

PIN IN HOLE 4:

306. Insert a quick release pin into hole 4.

307. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

308. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

309. Repeat steps 295-297.

PIN IN HOLE 5:

310. Insert a quick release pin into hole 5.

311. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

312. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

313. Repeat steps 295-297.

PIN IN HOLE 6:

314. Insert a quick release pin into hole 6.

315. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

316. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

317. Repeat steps 295-297.

PIN IN HOLE 7:

- 318. Insert a quick release pin into hole 7.
- 319. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.
- 320. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 321. Repeat steps 295-297.

PIN IN HOLE 8:

- 322. Insert a quick release pin into hole 8.
- 323. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.
- 324. Repeat step 300.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 325. Repeat steps 295-297.

PIN IN HOLE 1:

- 326. Using the hand crank, raise the shaft until the base of the control shaft section is above the shaft drive tube.
- 327. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

- 328. Unscrew the control shaft from the existing shaft.
- 329. Using the hand crank, lower the control shaft until the swivel assembly can be reached.
- 330. Unscrew the swivel assembly from the top of the control shaft, and place the control shaft to the side.

331. Screw the male end of a solid shaft section to the swivel assembly.
332. Using the hand crank, raise this shaft section high enough to allow connection to the top of the existing shaft.
333. Screw the two shaft sections together.

NOTE: Verify twisting of the cable and cable thimble does not occur when screwing together shaft sections.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

334. Loosen the clamp from around the shaft.
335. Lower the resulting shaft until the swivel assembly is just above the shaft drive tube. The size of the swivel assembly will prevent it from being lowered through the shaft drive tube.
336. Tighten the clamp around the shaft.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

337. Remove the swivel assembly from the shaft.
338. Insert a quick release pin into hole 1 of a control shaft section (see Figure 11.3).
339. Screw the male end of this control shaft section to the swivel assembly.
340. Using the hand crank, raise the control shaft until its female end is high enough to allow connection to the top of the existing shaft.
341. Screw the bottom of the control shaft to the top of the existing shaft.

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

342. Loosen the clamp from around the shaft.
343. Very slowly lower the resulting shaft until the quick release pin comes to rest in the notch of the shaft drive tube. If the pin does not align with the notch, it may be necessary to turn the

motor on and rotate the shaft drive tube to align the notch with the pin.

NOTE: Never rotate the shaft by hand to align the pin with the notch of the shaft drive tube. This will disturb the waste sludge and result in a erroneous force measurement.

NOTE: Verify the ring of the quick release pin is not resting against the cover of the motor housing.

344. Verify the chart recorder drive is running. It should be set at 0.5 on the minute scale.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

345. Remove the swivel assembly from the top of the control shaft.

346. Turn the motor on and obtain a force reading. Leave the motor running until an equilibrium (zero slope) is reached. Turn the motor off.

347. Screw the swivel assembly to the top of the control shaft.

PIN IN HOLE 2:

348. Insert a quick release pin into hole 2.

349. Raise the shaft with the hand crank, and remove the pin from hole 1 of the control shaft.

350. With the hand crank, very slowly lower the shaft until the new pin comes to rest in the notch of the shaft drive tube.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

351. Repeat steps 345-347.

PIN IN HOLE 3:

352. Insert a quick release pin into hole 3.

353. Raise the shaft with the hand crank, and remove the pin from hole 2 of the control shaft.

354. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

355. Repeat steps 345-347.

PIN IN HOLE 4:

356. Insert a quick release pin into hole 4.

357. Raise the shaft with the hand crank, and remove the pin from hole 3 of the control shaft.

358. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

359. Repeat steps 345-347.

PIN IN HOLE 5:

360. Insert a quick release pin into hole 5.

361. Raise the shaft with the hand crank, and remove the pin from hole 4 of the control shaft.

362. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

363. Repeat steps 345-347.

PIN IN HOLE 6:

364. Insert a quick release pin into hole 6.

365. Raise the shaft with the hand crank, and remove the pin from hole 5 of the control shaft.

366. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

367. Repeat steps 345-347.

PIN IN HOLE 7:

368. Insert a quick release pin into hole 7.

369. Raise the shaft with the hand crank, and remove the pin from hole 6 of the control shaft.

370. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

371. Repeat steps 345-347.

PIN IN HOLE 8:

372. Insert a quick release pin into hole 8.

373. Raise the shaft with the hand crank, and remove the pin from hole 7 of the control shaft.

374. Repeat step 350.

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

375. Repeat steps 345-347.

376. After obtaining the last force measurement in this tank, tighten the clamp around the shaft.

The following three HOLD's are a means of assuring that the shaft is secured. The shaft will be left in this orientation until the shear vane assembly is removed from the tank farm.

HOLD: The clamp is securely tightened around the shaft.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The quick release pin is securely locked into the control shaft and is resting in the notch of the shaft drive tube.

Operator's Initials: _____; QA Stamp: _____; Date: _____

HOLD: The shaft is securely fastened to the swivel assembly, and all slack in the hoist cable has been taken up.

Operator's Initials: _____; QA Stamp: _____; Date: _____

377. Turn the motor off and disconnect the equipment from the power source.

378. Remove the support equipment (load cell, signal conditioner, voltmeter, and chart recorder) from the tank farm.

379. Cover the remaining equipment to protect it from the weather.

11.3.3 Post -Test Requirements for Testing in Tank 103-AW

1. Verify that Operations removes the shear vane equipment from Tank 103-AW one day after the completion of shear vane testing in this tank.

The following SOP's apply to this removal procedure:

- TO-020-044 "Lock and Tag Control Procedure" [1987]
- TO-020-250 "In Farm Installation of New or Modified Large Equipment Items" [1984]
- TO-020-270 "Equipment Removal or Installation at Diversion Boxes and Pits" [1986]
- TO-040-540 "Raw Water Surveillance and Usage" [1988]
- TO-100-030 "Radioactive Waste Packaging and Transport Requirements" [1987]

2. Obtain liquid level readings for Tank 103-AW for the duration of the shear vane test. These readings are taken on an hourly basis and can be obtained from CASS located in 2750E Building, Room B-105 (3-2618). A computer printout of liquid levels for the testing period will be maintained in the Laboratory Record Book.

12.0 DISPOSITION OF TEST SUBJECT

If the shear vane apparatus is determined to be a valid means of obtaining torque measurements of waste sludge in tanks, it will become a controlled item and will be retained by Operations. However, if the shear vane apparatus is inadequate for obtaining torque measurements, contaminated parts will be disposed of in a burial site. The non-contaminated parts will be stored in regulated overground storage.

13.0 REFERENCES

1. 87/09/24, "Shear Vane Installation," Drawing CCS-092478-01, Rev. 0, (Prototype Control Prints).
2. Heath, W. O., 87/02/00, "Procedure for Using Calculator Program 'VANE-2' for Reducing Shear Vane Sludge and Slurry Data," Procedure WHO-86-3, Rev. 1 (Draft).
3. 87/05/21, "Lock and Tag Control Procedure," SOP TO-020-044.
4. 84/08/21, "In Farm Installation of New or Modified Large Equipment Items," SOP TO-020-250.
5. 86/06/05, "Equipment Removal or Installation at Diversion Boxes or Pits," SOP TO-020-270.
6. 88/01/06, "Raw Water Surveillance and Usage", SOP TO-040-540.
7. 87/11/11, "Radioactive Waste Packaging and Transport Requirements," SOP TO-100-030.
8. 88/02/17, "Tank Farm Sludge Level Readings," SOP TO-040-560.
9. 88/06/01, "Raw Water Surveillance and Usage," SOP TO-040-540.
10. Bordelon, M. V. and Hanson, G. N., 86/12/08, "Double-Shell Underground Waste Storage Tanks - Riser Survey," Document SD-RE-TI-093, Rev. 1.
11. LeClair, M. D., 88/03/10, "Shear Vane 'Cold' Test Procedure," Document SD-WM-TC-004, Rev. 0.
12. McBeath, R. S., 87/06/30, "Shear Vane Test Plan Using Simulated Waste," Document SD-WM-TP-040, Rev. 0.
13. Simmons, C. C., 87/09/03, "Prototype Planning Document Double Shell Tank Characterization System (Shear Vane)," Document SD-WM-PTD-031, Rev. 0.

14.0 NOMENCLATURE

	<u>Units</u>
b_{3AN} = Base elevation of Tank 103-AN.	(ft)
b_{3AW} = Base elevation of Tank 103-AW.	(ft)
b_{3SY} = Base elevation of Tank 103-SY.	(ft)
C = Length of control shaft below quick release pin.	(inches)
D = Length of shaft added before obtaining the first force measurement in the sludge phase.	(inches)
D_A = Average liquid level reading for the previous six hrs.	(inches)
D_L = Liquid level reading.	(inches)
D_S = Measured height of the liquid/sludge interface.	(inches)
E = Applied load.	(lbf)
F = Measured force.	(lbf)
H = Pin hole number.	(dimensionless)
H_1, H_i = Hole number through which quick release pin is inserted for first measurement in sludge.	(dimensionless)
L = Length of shaft below sludge level.	(inches)
M = Maximum allowable combined length of shaft and vane below the quick release pin.	(inches)
N = Approximate shaft rotational speed.	(rpm)
Q = Combined length of shaft and vane below quick release pin.	(inches)
r = Riser elevation as measured from the top of the riser flange.	(ft)
T_0 = Total peak torque.	(ft·lbf)
t = Vertical distance between top of riser flange bottom of the shear vane table top.	(inches)
X_1, X_i = Number of 5' solid shaft sections required below quick release pin for first measurement in sludge.	(dimensionless)

NOMENCLATURE (CONTINUED)Units

X_L	=	Length of solid shaft below the quick release pin.	(inches)
X_N	=	Number of 5' solid shaft sections below the quick release pin.	(dimensionless)

15.0 DATA SHEETS

SHEAR VANE "HOT" TEST

Pre-Test Data Sheet - Tank 103-SY

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Procedure 11.1.1: Pre-Test Requirements for Testing
in Tank 103-SY.The Shear Vane Assembly will be installed
on riser number _____.

Liquid Level Readings: Tank 103-SY

Reading #	Liquid Level D _L , (inches)	Date (mo/day/yr)	Time (hr: min)
1			
2			
3			
4			
5			
6			

Load Cell Calibration Data Sheet - Tank 103-SY

Procedure 11.1.1: Pre-Test Requirements for Testing
in Tank 103-SY

[illegible]

SHEAR VANE "HOT" TEST

Calculation Data Sheet - Tank 103-SY

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
 Procedure 11.1.1: Pre-Test Requirements for Testing in Tank 103-SY

Calculation of D_A the average liquid level in Tank 103-SY:

$$D_A = \frac{D_{L1} + D_{L2} + D_{L3} + D_{L4} + D_{L5} + D_{L6}}{6}$$

$$D_A = \frac{\quad + \quad + \quad + \quad + \quad +}{6} = \quad \text{in.}$$

Note: Values D_{L1} through D_{L6} are shown on the Pre-Test Data Sheet for Tank 103-SY. All values are in inches. For Tank 103-SY, the liquid level also represents the sludge level.

The vertical distance between the bottom side of the shear vane table and the top of the riser flange (on which the shear vane is installed) is t . $t = \quad$ inches.

Calculation of D , the amount of shaft to be added before taking the first force measurement in Tank 103-SY waste:

$$D = r(12) + t + 9.8 - [b_{3SY}(12) + D_A] + 3.5 - 4.8$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{14A} = 671.4$ ft. and $r_{22A} = 672.42$ ft., and b_{3SY} is the base elevation of Tank 103-SY, $b_{3SY} = 617.24$ ft. [Bordelon, et. al., 1986])

$$D = r(12) + t + 8.5 - [(b_{3SY})(12) + D_A]$$

$$D = \quad + \quad + 8.5 - (\quad + \quad) = \quad \text{in.}$$

Note: In the above equation, 9.8" is the vertical distance between the center line of the quick release pin and the bottom side of the shear vane table top. The height of the vane is 4.8", and the first measurement must be taken 3.5" below the surface of the waste.

Calculation of X_1 or X_i , the number of solid shaft sections added before taking the first force measurement in the waste sludge of Tank 103-SY:

$$X_1 = X_i = \frac{D}{(12)5} = \frac{D}{60} = \frac{\quad}{\text{truncate}} \text{ solid 5' shaft sections}$$

SHEAR VANE "HOT" TEST

Continuation of Calculation Data Sheet - Tank 103-SY

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Procedure 11.1.1: Pre-Test Requirements for Testing in Tank 103-SY

Calculation of H_1 or H_i , the hole number into which the quick release pin will be inserted for the first force measurement in Tank 103-SY. (Use the truncated value of X_1):

$$H_1 = H_i = \frac{D - X_1(12)(5)}{7} = \underline{\hspace{2cm}}$$

Calculation of M, the maximum combined length of the shaft and vane that can be lowered below the quick release pin:

$$M = r(12) + t + 9.8 - [b_{3SY}(12) + 2]$$

(2 in. is the minimum distance between the base of the tank and the bottom of the vane.)

$$M = r(12) + t + 7.8 - b_{3SY}(12)$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{14A} = 671.4$ ft. and $r_{22A} = 672.42$ ft., and b is the base elevation of Tank 103-SY, $b_{3SY} = 617.24$ ft. [Bordelon, et. al., 1986])

$$M = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + 6.8 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ inches}$$

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SHEAR VANE "HOT" TEST

Page ____ of ____

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
 Test Procedure 11.1.2: Torque Measurements of Waste in Tank 103-SY

OBSERVATIONS & EXCEPTIONS TO ANTICIPATED RESULTS

DATE	COMMENTS	SIGNATURE

SHEAR VANE "HOT" TEST

Pre-Test Data Sheet - Tank 103-AN

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Procedure 11.2.1: Pre-Test Requirements for Testing
in Tank 103-AN.

The Shear Vane Assembly will be installed
on riser number _____

Liquid Level Readings: Tank 103-AN

Reading #	Liquid Level D.L. (inches)	Date (mo/day/yr)	Time (hr:min)
1			
2			
3			
4			
5			
6			

Load Cell Calibration Data Sheet - Tank 103-AN

Procedure 11.2.1: Pre-Test Requirements for Testing
in Tank 103-AN

[illegible]

SHEAR VANE "HOT" TEST

Calculation Data Sheet - Tank 103-AN

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
 Procedure 11.2.1: Pre-Test Requirements for Testing in Tank 103-AN

Calculation of D_A the average liquid/sludge level in Tank 103-AN:

$$D_A = \frac{D_{L1} + D_{L2} + D_{L3} + D_{L4} + D_{L5} + D_{L6}}{6}$$

$$D_A = \frac{\quad + \quad + \quad + \quad + \quad +}{6} = \quad \text{in.}$$

Note: Values D_{L1} through D_{L6} are shown on the Pre-Test Data Sheet for Tank 103-AN. All values are in inches.

The height of the liquid/sludge interface in Tank 103-AN is D_S , where
 $D_S = \quad$ inches.

The vertical distance between the bottom side of the shear vane table and the top of the riser flange (on which the shear vane is installed) is t , where $t = \quad$ inches.

Calculation of D , the amount of shaft to be added before taking the first force measurement in the sludge phase of Tank 103-AN:

$$D = r(12) + t + 9.8 - [b_{3AN}(12) + D_S] + 3.5 - 4.8$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{21A} = 668.75$ ft., and b_{3AN} is the base elevation of Tank 103-AN, $b_{3AN} = 613.07$ ft. [Bordelon, et. al., 1986])

$$D = r(12) + t + 8.5 - [(b_{3AN})(12) + D_S]$$

$$D = \quad + \quad + 8.5 - (\quad + \quad) = \quad \text{in.}$$

Note: In the above equation, 9.8" is the vertical distance between the center line of the quick release pin and the bottom side of the shear vane table top. The height of the vane is 4.8", and the first measurement must be taken 3.5" below the surface of the waste.

SHEAR VANE 'HOT' TEST PROCEDURE

Continuation of Calculation Data Sheet - Tank 103-AN

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
 Procedure 11.2.1: Pre-Test Requirements for Testing in Tank 103-AN

Calculation of X_1 or X_i , the number of solid shaft sections added before taking the first force measurement in the waste sludge of Tank 103-AW:

$$X_1 = X_i = \frac{D}{(12)5} = \frac{D}{60} = \frac{\quad}{\text{truncate}} \text{ solid 5' shaft sections}$$

Calculation of H_1 or H_i , the hole number into which the quick release pin will be inserted for the first force measurement in the sludge phase of Tank 103-AN. (Use the truncated value of X_1):

$$H_1 = H_i = \frac{D - X_1(12)(5)}{7} = \underline{\quad}$$

Calculation of M , the maximum combined length of the shaft and vane that can be lowered below the quick release pin:

$$M = r(12) + t + 9.8 - [b_{3AW}(12) + 2]$$

(2 in. is the minimum distance between the base of the tank and the bottom of the vane.)

$$M = r(12) + t + 7.8 - b_{3AN}(12)$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{21A} = 668.75$ ft., and b_{3AN} is the base elevation of Tank 103-AN, $b_{3AN} = 613.07$ ft. [Bordelon, et. al., 1986])

$$M = \underline{\quad} + \underline{\quad} + 6.8 - \underline{\quad} = \underline{\quad} \text{ inches}$$

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SHEAR VANE "HOT" TEST

Page ____ of ____

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Test Procedure 11.2.2: Torque Measurements of Waste in Tank 103-AN

OBSERVATIONS & EXCEPTIONS TO ANTICIPATED RESULTS

DATE	COMMENTS	SIGNATURE

SD-MM-TC-005 Rev. 0 134

SHEAR VANE "HOT" TEST

Pre-Test Data Sheet - Tank 103-AW

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Procedure 11.3.1: Pre-Test Requirements for Testing
in Tank 103-AW.The Shear Vane Assembly will be installed
on riser number _____

Liquid Level Readings: Tank 103-AW

Reading #	Liquid Level DL (inches)	Date (mo/day/yr)	Time (hr:min)
1			
2			
3			
4			
5			
6			

Load Cell Calibration Data Sheet - Tank 103-AW

Procedure 11.3.1: Pre-Test Requirements for Testing
in Tank 103-AW

[illegible]

SHEAR VANE "HOT" TEST

Calculation Data Sheet - Tank 103-AW

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
 Procedure 11.3.1: Pre-Test Requirements for Testing in Tank 103-AW

Calculation of D_A the average liquid level in Tank 103-AW:

$$D_A = \frac{D_{L1} + D_{L2} + D_{L3} + D_{L4} + D_{L5} + D_{L6}}{6}$$

$$D_A = \frac{\quad + \quad + \quad + \quad + \quad + \quad}{6} = \quad \text{in.}$$

Note: Values D_{L1} through D_{L6} are shown on the Pre-Test Data Sheet for Tank 103-AW. All values are in inches.

The approximate height of the liquid/sludge in Tank 103-AW is D_S , where $D_S = \quad$ inches.

(Note: There are expected to be fine particulate solids which will not be detected when the sludge level reading is taken.)

The vertical distance between the bottom side of the shear vane table and the top of the riser flange (on which the shear vane is installed) is t , where $t = \quad$ inches.

Calculation of D , the amount of shaft to be added before taking the first force measurement in the waste of Tank 103-AW:

$$D = r(12) + t + 9.8 - [b_{3AW}(12) + D_A] + 3.5 - 4.8$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{10A} = 686.33$ ft., and b_{3AW} is the base elevation of Tank 103-AW, $b_{3AW} = 632.24$ ft. [Bordelon, et. al., 1986])

$$D = r(12) + t + 8.5 - [(b_{3AW})(12) + D_A]$$

$$D = \quad + \quad + 8.5 - (\quad + \quad) = \quad \text{in.}$$

Note: In the above equation, 9.8" is the vertical distance between the center line of the quick release pin and the bottom side of the shear vane table top. The height of the vane is 4.8", and the first measurement must be taken 3.5" below the surface of the waste.

SHEAR VANE "HOT" TEST

Continuation of Calculation Data Sheet - Tank 103-AW

Equipment: In Situ Shear Vane (Prototype CCS-092478-01)

Procedure 11.3.1: Pre-Test Requirements for Testing in Tank 103-AW

Calculation of X_1 or X_i , the number of solid shaft sections added before taking the first force measurement in the waste sludge of Tank 103-AW:

$$X_1 = X_i = \frac{D}{(12)5} = \frac{D}{60} = \frac{\quad}{\text{truncate}} \text{ solid 5' shaft sections}$$

Calculation of H_1 or H_i , the hole number into which the quick release pin will be inserted for the first force measurement in Tank 103-AW. (Use the truncated value of X_1):

$$H_1 = H_i = \frac{D - X_1(12)(5)}{7} = \underline{\hspace{2cm}}$$

Calculation of M , the maximum combined length of the shaft and vane that can be lowered below the quick release pin:

$$M = r(12) + t + 9.8 - [b_{3AW}(12) + 2]$$

(2 in. is the minimum distance between the base of the tank and the bottom of the vane.)

$$M = r(12) + t + 7.8 - b_{3AW}(12)$$

(where r is the elevation of the riser on which the shear vane is installed, $r_{10A} = 686.33$ ft., and b_{3AW} is the base elevation of Tank 103-AW, $b_{3AW} = 632.24$ ft. [Bordelon, et. al., 1986])

$$M = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + 6.8 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ inches}$$

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Equipment: In Situ Shear Vane (Prototype CCS-092478-01)
Test Procedure 11.3.2: Torque Measurements of Waste in Tank 103-AW

OBSERVATIONS & EXCEPTIONS TO ANTICIPATED RESULTS

DATE	COMMENTS	SIGNATURE

The following pages are not a part of the test procedure, but rather are background and supporting information regarding the test procedure and the actual hardware.

Pages 142 through 146: Review Comment Records for the Test Procedure

Pages 147 through 148: Test Load Surveillance Report

Pages 149 through 151: Warehouse Storage Request Sheets

Pages 152 through 154: Equipment Loan Order - Lab Equip Central Pool

Page 155 - Intentionally left Blank

REVIEW COMMENT RECORD (RCR)

1. Date 4-21-88		2. Review No. TF-15-8	
3. Project No.		4. Page 1 of 3	
7. Reviewer L.E. THOMAS		9. Location/Phone R3-09/3-3658	
8. Organization/Group DEFENSE WASTE SAFETY			
11. CLOSED		16. Status	
10. Agreement with indicated comment disposition(s) L.E. Thomas Reviewer 3-28-89 Date M.D. DeCham Project Cognizant Engineer		15. Disposition (provide justification if NOT accepted)	
14. Hold Point		Accepted	
13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).		Not accepted	
1. General: Prior to work start, a pre-job safety meeting shall be held for all principals involved - this is covered in AFStandards as you have described - just a reminder that everyone needs to hear the same message.		Accepted	
2. General: The lengths of shafts indicated appear to hit the bottom of the tank before all the readings are taken. i.e., in tank 103-SY before the first readings are taken 45 feet of shaft has been installed and during the test another 20 feet is added, in tank 103-AW a total of 75 feet of shaft is used.		Not Accepted	
3. General: Suggest a note be placed after the force reading is recorded that the chart paper is marked.		Accepted	
4. Page 2, Figure 1: The shear vane needs guides to preclude catching the tank during removal. Suggest using 551 weld rod.		Not Accepted	
5. Page 4, para 1: Whole body exposure is not an environmental condition. Specify where the measurement is to be taken.		Accepted	
5. Document Number(s)/Title(s) SD-WM-TC-005 SHEAR VANE TEST PROCEDURE			
17. Comment Submittal Approval Reviewer			

Reviewer L.E. THOMAS		REVIEW COMMENT RECORD (RCR) CONTINUATION		Review No. TF-15-8	Page 2 of 3
Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status	
6	Page 4, 3.0 <u>Test Condition Limits</u> : Add that no pumping in or out of the test tank will be allowed while the shear vane is in the tank.		Accepted		
7	Page 10, 9.0 <u>Personnel Requirements</u> : Add who is responsible for recording data.		accepted		
8	Page 12, 11.1.1 <u>Pre-Test Requirements Tank 103-SY</u> : a. The procedure needs to address the installation of the washer by operations with more detail. This is to assure that it is installed safely without any operating procedure violations. b. Specify the RWP procedures that the shear vane is going to operate under.		a. accepted b. Accepted		
9	Page 13, 11.1.1 <u>Pre-Test Requirements</u> : Need a step prior to start of the test that an RPT survey the area for potential hot spots or shine to minimize exposure.		accepted		
10	Page 18, <u>Note</u> : a. Define what "one day" represents; one shift or three shifts. b. Define what extended periods mean or who determines what this time is.		a. accepted b. accepted		
11	Page 19: Step 1, add "with the paper drive off" after "turn the chart recorder on". Step 3, Add the chart speed. Step 4, The location of the data sheets need to be indicated. Step 5, The length of shaft to be used needs to be verified by operations and those lengths of shafts need to be set off to the side so nobody can make a mistake as to the length of shaft left. Note 3, Suggest using liquid lead on thread joint to seal out any potential contamination hold area.		Accepted Accepted Accepted Accepted Accepted as a suggestion.		

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Reviewer L.E. THOMAS		REVIEW COMMENT RECORD (RCR) CONTINUATION		Review No. Tf-15-8	Page 3 of 3
Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status	
12	Page 46, 11.1.3 Post - Test Requirements Tank 103-SY: The procedure needs to address the removal of the shaft and shear vane plus disposal of same.		Accepted		
13	Page 47, 11.2.1 Pre - Test Requirements Tank 103-AN: See comments above on 11.1.1.		Accepted		
14	Page 50, Note: Same comments as above regarding Page 18 Note.		Accepted		
15	Page 51: Same comments as above regarding Page 19.		Accepted		
16	Page 66, Step 152: Add "Turn the motor off".		Accepted		
17	Page 78, 11.2.3 Post Test Requirements Tank 103-AN: Same comments as above regarding Page 46 11.1.3.		Accepted		
18	Page 79, 11.3.1 Pre - Test Requirements Tank 103-AW: See comments above regarding 11.1.1.		Accepted		
19	Page 82: Same comment as above regarding Page 18 Note.		Accepted		
20	Page 83: Same comments as above regarding Page 19.		Accepted		
21	Page 91 Note 1: The statement is made to "skip to step" but does not say what step.		Accepted		
22	Page 117, 11.3.3 Post - Test Requirements Tank 103-AW: Same comments as above regarding Page 46, 11.1.3.		Accepted		

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REVIEW COMMENT RECORD (RCR)				1. Date 5/16/88	2. Review No.
				3. Project No.	4. Page 1 of 2
5. Document Number(s)/Title(s) SD-WM-TC-005 REV. 0 TEST PROCEDURE FOR USE OF THE SHEAR VANE IN TANKS 103-SY, 103-AN AND 103-AW		6. Program/Project/Building Number	7. Reviewer J. L. Foster J. P. Mollusky	8. Organization/Group TFPE/13331	9. Location/Phone A-100/2750-E 3-1829
17. Comment Submittal Approval <i>[Signature]</i> 5/16/88 Reviewer		10. Agreement with indicated comment disposition(s) <i>[Signature]</i> Reviewer 2-14-89 Date <i>M. D. DeClain</i> 2/14/89 Project/Cognizant Engineer		11. CLOSED <i>[Signature]</i> Reviewer Date Project/Cognizant Engineer	
12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	14. Hold Point	15. Disposition (provide justification if NOT accepted).		16. Status
1.	Section 9.0, p 10: Add the following bullet. "THE COGNIZANT ENGINEER OF THE TANK FARM BEING TESTED SHALL BE NOTIFIED PRIOR TO THE INSTALLATION & TESTING OF THE SHEAR VANE."		Accepted		
2.	Section 11.1.1, p 12: DEFINE ACCEPTABLE RISER CONDITIONS IN STEP 1.		Accepted		
3.	Section 11.1.1, p 12: STEP 3 - THE ACTUAL INSTALLATION OF THE SHEAR VANE ASSEMBLY REQUIRES MORE DETAILED INSTRUCTIONS.		Accepted		
4.	Section 11.1.1, p 12: STEP 4 - MAINTENANCE CONNECTS ALL ELECTRICAL EQUIPMENT.		Accepted		
5.	Section 11.1.1, p 13; STEP 5 - 2 ND SENTENCE: INCLUDE STATION NUMBER IN CASE PERSONNEL ARE UNABLE TO BE REACHED BY PHONE.		Accepted - include station number for the radio.		
6.	Section 11.1.1, p 13, STEP 6 - DELETE "NOT APPROXIMATELY EQUAL TO C" & ADD A PHRASE TO DEFINE THE TOLERANCES.		Accepted		

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Reviewer J. L. Foster J.P. Mollusky	REVIEW COMMENT RECORD (RCR) CONTINUATION	Review No.	Page 2 of 2
Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Disposition (provide justification if NOT accepted).	Status
7.	Calculation Data Sheet, p 126: Last Equation should be $M = \text{---} + \text{---} + 7.8 - \text{---} = \text{---}$ inches. SAME COMMENT ON p 132 + 138.	Accepted	
8.	p 132, 3RD Equation: Typo. - should be b3AN.	Accepted	
9.	GENERAL COMMENT: To avoid duplication, AN OTP should only be written for 241-SV-103 (OR 1st tank to be tested) AND A GENERIC OPERATING PROCEDURE FOR USE OF THE SHEAR VANE AT ANY OTHER TANK FARM (AFTER VERIFICATION OF OTP).	Accepted	
10.	GENERAL COMMENT: Operation of Washdown Assembly should be included in the procedure.	Accepted	

SD-WM-TC-005 REV 0 ^{1.4/5}

Rockwell Hanford Operations		SURVEILLANCE REPORT		Page <u>1</u> of <u>2</u>	
To: Name <u>C. C. Simmons</u> Title <u>Project Engineer</u> Company <u>WHC</u> Location <u>X3-25</u>		From: Name <u>II HUSTON</u> Title <u>CPQA</u> Company <u>WHC</u> Location <u>SI-54</u>		Surveillance Report Number <u>88-P-373</u> Reference Documents <u>RHO-PO-MA-4 June 1984, Rev. 1</u>	
☒ Satisfactory Status ☐ Unsatisfactory E1100 ☐ Unsatisfactory corrected immediately		<u>DISTRIBUTION</u> ORM Project Files <u>RI-28</u> Constr. Files <u>SI-54</u>		Project Number <u>Shear Vane</u> Area <u>1000</u> Location <u>1000</u> Prototype	
Item No.	Requirement: ACTIVITIES OBSERVED <u>RHO-PO-MA-4 Rev. 1, Page 7-16, Para 7.7.4 states in part:</u> <ol style="list-style-type: none"> 1) Test loads shall be at 125% of the rated load (design load 200 lbs). 2) The hoist shall hold the load for 10 min., or the time required to check all load-bearing part while under strain <ol style="list-style-type: none"> a) slippage b) damage c) permanent deformation of any part of the equipment. Observation: <ol style="list-style-type: none"> 1) Satisfactory: A Dillon Dynamometer, Code #815-29-06-004, calibration due date 6-4-88, expiration 6-4-88, load applied 250 lbs. 2) Satisfactory: The hoist was held at 250 lbs. for 10 min., during that time, the hoist was examined for slippage, 				
Initiator <u>II HUSTON</u>		Date <u>3-14-88</u> ACTION TAKEN/PLANNED		Date <u>3-14-88</u>	
Commitment Date		Action Party		Date	
RESPONSE EVALUATION Initials _____ ☐ Adequate Date _____ ☐ Inadequate		FOLLOW-UP EVALUATION ☐ Adequate ☐ Inadequate		ROCKWELL NCR No. _____ CAR No. _____	
Response Verification and/or Closure				Date	

Rockwell Hanford Operations

SURVEILLANCE REPORT
(Continuation Sheet)

Report No. 88-P-5

Page 2 of 2

damage, and any permanent deformation of any part of the equipment.

Witness:

J. J. Huston	Construction QA
C. C. Simmons	Design Engineer
M. D. LeClair	Project Engineer
D. G. Shepard	Engineering Tech.
R. W. Eggers	Rigger

11.22.000000 4/11/88

A.J. DiLiberto Shear Vane Equipment

SD-WM-TC-005
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WAREHOUSE STORAGE REQUEST CONTINUATION SHEET

Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions	Impact Level
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Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours
--------------	--------------	--------------	--------	-------------------	---------------	----------------

Name (from approved Nomenclature List) Shear Vane Table/Drive Assem. Stock No. 9900-3367-9001 Storage Location
Description (Type, Composition, Size, Rating, Other) Grey 3-legged metal table w/ enclosed drive assembly

Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions	Impact Level
----------	----------	---------------	------------	-----------	--------------------	--------------

Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours
--------------	--------------	--------------	--------	-------------------	---------------	----------------

Name (from approved Nomenclature List) Shear Vane hoist beam/winch Stock No. 9900-3367-9002 Storage Location
Description (Type, Composition, Size, Rating, Other)

10 ft hoist beam with winch (Can be inserted in one leg of the Shear Vane table.)

Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions	Impact Level
----------	----------	---------------	------------	-----------	--------------------	--------------

Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours
--------------	--------------	--------------	--------	-------------------	---------------	----------------

Name (from approved Nomenclature List) Chart Recorder Stock No. 9900-3367-9003 Storage Location
Description (Type, Composition, Size, Rating, Other)

Hewlett Packard 2-Channel recorder; S/N 748-02209; model 17501A; W607249

Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions	Impact Level
----------	----------	---------------	------------	-----------	--------------------	--------------

Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours
--------------	--------------	--------------	--------	-------------------	---------------	----------------

Name (from approved Nomenclature List) Signal Conditioner/Adapter Stock No. 9900-3367-9004 Storage Location

Description (Type, Composition, Size, Rating, Other) 4 Edeuco pulse Signal Conditioners (all have model #44-70.000)
Signal conditioners are mounted in an Edeuco Adapter; model 4942

Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions	Impact Level
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Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours
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Name (from approved Nomenclature List) Spray Wash/Wiper/Clamp Ass. Stock No. 9900-3367-9005 Storage Location

Description (Type, Composition, Size, Rating, Other) Washer assembly, neoprene wiper assembly + clamp assembly bolted together as one unit

A.J. DiLiberto

SD-WM-TC-005

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REV 0

SHEAR VANE EQUIPMENT

Westinghouse Hanford Company			WAREHOUSE STORAGE REQUEST CONTINUATION SHEET				
Item No. 6	Quantity 24	Unit of Issue EA.	Unit Price	PO/LI No.	Storage Dimensions	Impact Level 4	
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Drive Shaft			Stock No. 9900-3367-9006		Storage Location		
Description (Type, Composition, Size, Rating, Other) 5' long 1" diameter solid drive shaft sections with threaded ends stainless steel							
Item No. 7	Quantity 9	Unit of Issue EA.	Unit Price	PO/LI No.	Storage Dimensions	Impact Level 4	
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Drive Shaft			Stock No. 9900-3367-9007		Storage Location		
Description (Type, Composition, Size, Rating, Other) 5' long 1" diameter control drive shaft sections with threaded ends and holes along length of shaft, stainless steel							
Item No. 8	Quantity 3	Unit of Issue EA.	Unit Price	PO/LI No.	Storage Dimensions	Impact Level 4	
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Drive Shaft			Stock No. 9900-3367-9008		Storage Location		
Description (Type, Composition, Size, Rating, Other) 5' long 1" diameter solid drive shaft sections with threaded ends stainless steel							
Item No. 9	Quantity 1	Unit of Issue EA.	Unit Price	PO/LI No.	Storage Dimensions	Impact Level 4	
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Load Cell			Stock No. 9900-3367-9009		Storage Location		
Description (Type, Composition, Size, Rating, Other) Interface load cell, serial number B16668							
Item No. 10	Quantity 1	Unit of Issue EA.	Unit Price	PO/LI No.	Storage Dimensions	Impact Level 4	
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Voltmeter			Stock No. 9900-3367-9010		Storage Location		
Description (Type, Composition, Size, Rating, Other) Fluke digital voltmeter with power cord, Model 248, serial number 3636							

A.J. DiLiberto
SHEAR VANE EQUIPMENT

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Westinghouse Hanford Company			WAREHOUSE STORAGE REQUEST CONTINUATION SHEET				
Item No.	Quantity	Unit of Issue	Unit Price	PO/LI No.	Storage Dimensions		Impact Level
11	1	EA					4
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Controller			Stock No. 9900-3367- 9011 9011		Storage Location		
Description (Type, Composition, Size, Rating, Other) Motor controller, serial number 937 NC038							
12	2	EA					4
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) power cord			Stock No. 9900-3367-9012		Storage Location		
Description (Type, Composition, Size, Rating, Other)							
13	3	EA					4
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Shear vane			Stock No. 9900-3367-9013		Storage Location		
Description (Type, Composition, Size, Rating, Other) 3" diameter x 3" tall stainless steel vanes with four blades							
14	1	EA					4
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List) Hardware			Stock No. 9900-3367-9014		Storage Location		
Description (Type, Composition, Size, Rating, Other) cardboard box with miscellaneous hardware including bolts, leveling foot for shear vane table, pins, swivel assembly.							
15							4
Job Ref. No.	Property No.	Heat/Lot No.	CQ No.	PM/SL Review Date	PM Craft Code	PM Craft Hours	
Name (from approved Nomenclature List)			Stock No.		Storage Location		
Description (Type, Composition, Size, Rating, Other)							

Customer		Account Class		Work Order		Service Code		This Section Not To Be Used By Customer	
								Work Assigned To	
Bldg.		Area		Contractor		Code		Name	
2750E		200E		RHO				A. Diliberto	
Loan Period: 12 Months				Date		☒ 1830 ☐ 1831		SERVICES PERFORMED Description Process Code Units	
Sub-Custodian Authorization				Date		☐ Subject to Recall		Count A	
Item Recorder				W/L				Calibration B	
Loaned in as-is condition				607249				Repair - Fab C	
Mfg. & Model H-P 7100B				Serial Number		Value		Material D	
2 Channel				743-02209		\$1309-		Fixed Price E	
To Be Used By 64736				Phone 3-2910		Location		Loan Return Date	
R McBreath				Room 1243				Date Work Completed Total Cost	
Material Received By				Date		Loan Pool Authorization		Loan Input Date Return Input Date	
				5-17-87		B.L. [Signature]			

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower. Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

80-1006-069 (9-78)

Battelle Pacific Northwest Laboratories		LABORATORY EQUIPMENT CENTRAL POOL 3718A BUILDING - 300 AREA EQUIPMENT LOAN ORDER				Date		Control No.	
						5-17-87		11273	
Customer		Account Class		Work Order		Service Code		This Section Not To Be Used By Customer	
								Work Assigned To	
Bldg.		Area		Contractor		Code		Name	
2750E		200E		RHO				A. Diliberto	
Loan Period: 12 Months				Date		☒ 1830 ☐ 1831		SERVICES PERFORMED Description Process Code Units	
Sub-Custodian Authorization				Date		☐ Subject to Recall		Count A	
Item Adapter				W/L				Calibration B	
Loaned in as-is condition				541064				Repair - Fab C	
Mfg. & Model EPR-4442				Serial Number		Value		Material D	
Rock				FA 36		\$525-		Fixed Price E	
To Be Used By 64736				Phone 3-2910		Location		Loan Return Date	
R McBreath				Room 1243				Date Work Completed Total Cost	
Material Received By				Date		Loan Pool Authorization		Loan Input Date Return Input Date	
				5-17-87		B.L. [Signature]			

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower. Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

80-1006-069 (9-78)

SD-WM-TC-005 153

3718A BUILDING - 300 AREA
EQUIPMENT LOAN ORDER

REV 0

Customer		Account Class	Work Order	Service Code	This Section Not To Be Used By Customer	
					Work Assigned To	
					SERVICES PERFORMED	
Bldg.	Area	Contractor	Code	Name	Description	Process Code Units
12345	6789	1011	12	131415	Count	A
Loan Period: 12 Months					☒ 1830	☐ 1831
Sub-Custodian Authorization				Date	☐ Subject to Recall	
Item				W/L		
Loaned in as-is condition				3456		
Mfg. & Model			Serial Number		Value	
Endevco 4470.000			1-1167		\$ 579	
To Be Used By			Phone	Location	Loan Return Date	
12345			3-2410			
			Room			
			11243			
Material Received By			Date	Loan Pool Authorization		
R M C Euth			5-19-87	BU 7		
					Date Work Completed	Total Cost
					Loan Input Date	Return Input Date

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower. Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

8D-1006-069 (9-78)

LABORATORY EQUIPMENT CENTRAL POOL
3718A BUILDING - 300 AREA
EQUIPMENT LOAN ORDER

REV 0

11872

Customer		Account Class	Work Order	Service Code	This Section Not To Be Used By Customer	
					Work Assigned To	
					SERVICES PERFORMED	
Bldg.	Area	Contractor	Code	Name	Description	Process Code Units
12345	6789	1011	12	131415	Count	A
Loan Period: 12 Months					☒ 1830	☐ 1831
Sub-Custodian Authorization				Date	☐ Subject to Recall	
Item				W/L		
Loaned in as-is condition				3456		
Mfg. & Model			Serial Number		Value	
Endevco 4470.000			1-1167		\$ 579	
To Be Used By			Phone	Location	Loan Return Date	
12345			3-2410			
			Room			
			11243			
Material Received By			Date	Loan Pool Authorization		
R M C Euth			5-19-87	BU 7		
					Date Work Completed	Total Cost
					Loan Input Date	Return Input Date

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower. Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

8D-1006-069 (9-78)

SD-WM-TC-005 REV 0 154

Pacific Northwest Laboratories		LABORATORY EQUIPMENT CENTRAL POOL 3718A BUILDING - 300 AREA EQUIPMENT LOAN ORDER			Date 5-19-87	Control No. 11262
Customer	Account Class	Work Order	Service Code	This Section Not To Be Used By Customer		
				Work Assigned To		
				SERVICES PERFORMED		
Bldg. B16516110	Area 250E2000	Contractor R HU	Code	Name A D. Liberto	Description	Process Code
Loan Period: 12 Months		☒ 1830 ☐ 1831		Units		
Sub-Custodian Authorization		Date		☐ Subject to Recall		
Item Signal Conditioner		W/L		Count		
Loaned in as-is condition		5-16-86		Calibration		
Mfg. & Model Enduro 4470.000		Serial Number RT-09		Repair - Fab		
Pulse		Value \$ 579 -		Material		
To Be Used By R McBeath		Phone 3-2910		Location		Fixed Price
Material Received By		Room 7243		Loan Return Date		
		Date 5-19-87		Loan Pool Authorization		
				Date Work Completed		Total Cost
				Loan Input Date		Return Input Date

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower.
Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

SD-1006-069 (9-78)

Pacific Northwest Laboratories		LABORATORY EQUIPMENT CENTRAL POOL 3718A BUILDING - 300 AREA EQUIPMENT LOAN ORDER			Date 5-19-87	Control No. 11270
Customer	Account Class	Work Order	Service Code	This Section Not To Be Used By Customer		
				Work Assigned To		
				SERVICES PERFORMED		
Bldg. B16516110	Area 250E2000	Contractor R HU	Code	Name A D. Liberto	Description	Process Code
Loan Period: 12 Months		☒ 1830 ☐ 1831		Units		
Sub-Custodian Authorization		Date		☐ Subject to Recall		
Item Signal Conditioner		W/L		Count		
Loaned in as-is condition		5-16-86		Calibration		
Mfg. & Model Enduro 4470.000		Serial Number 1-4115		Repair - Fab		
Pulse		Value \$ 579 -		Material		
To Be Used By R McBeath		Phone 3-2910		Location		Fixed Price
Material Received By		Room 7243		Loan Return Date		
		Date 5-19-87		Loan Pool Authorization		
				Date Work Completed		Total Cost
				Loan Input Date		Return Input Date

NOTE: If loaned item cannot be returned, it will be permanently transferred to the borrower.
Costs incurred for modification, testing, calibration or repair of loans returned will be charged to the user cost code.

DISTRIBUTION:
White, Blue, Green, Canary: Accounting
Pink: Receiver Goldenrod: Releaser

SD-1006-069 (9-78)

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