MAR 2 3 1998
Sta. 16 : 58

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 609609

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	SST Engineering	None
5. Proj./Prog./Dept./Div.:	6. Design Authority/ Design Agent/Cog. Engr.:	7. Purchase Order No.:
W-320	JW Bailey/John Huber	None
8. Originator Remarks:		9. Equip./Component No.:
USQ TF-96-0678 Rev. 1		NA
		10. System/Bldg./Facility:
		241-AY
11. Receiver Remarks: 11A. Design Baseline Document? [ ] Yes [X] No		12. Major Assm. Dwg. No.:
		H-2-824485
		13. Permit/Permit Application No.:
		NA
		14. Required Response Date:
		ASAP

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-sition	(I) Receiv-er Dispo-sition
1	HNF-2312	All	0	Acceptance Test Report for the AY-102 Enraf Densitometer	Q	1		

16. KEY

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

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

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	Design Authority JW Bailey	JW Bailey	3/2/98		4	4	DA King	DA King	3/2/98	52-48
NA		Design Agent N/A									
1	1	Cog.Eng. JH Huber	JH Huber	2-26-98	T4-07						
1	1	Cog. Mgr. RE Larson	RE Larson	3/2/98	T4-07						
1	1	QA WL Adams	WL Adams	3/10/98	S5-12						
		Safety									
		Env.									

18. John Huber — Signature of EDT Originator — 2-26-98 Date

19. RE Larson — Authorized Representative for Receiving Organization — 3/12/98 Date

20. JW Bailey — Design Authority/ Cognizant Manager — 3/2/98 Date

21. DOE APPROVAL (if required) Ctrl. No.
[ ] Approved
[ ] Approved w/comments
[ ] Disapproved w/comments

S

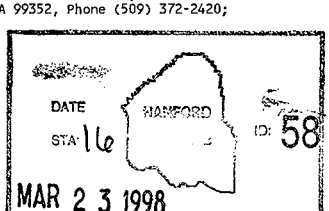
Acceptance Test Report for the AY-102 Enraf Densitometer

John Huber
Lockheed Martin Hanford Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 609609 UC: 512 and 2030
Org Code: 74800 Charge Code: D2M41
B&R Code: EW3120071 Total Pages: ~~45~~ 49 KMH 3/23/98

Key Words: Enraf, Densitometer, Gauge, Gage, ATG, 854, Level, LIT, Level Indicating Transmitter, Density Indicating Transmitter, Logger, LOGv18

Abstract: This Acceptance Test Report documents the Enraf Series 854 AY-102 Acceptance Test Procedure. This report formalizes acceptance of the gauge for use as a densitometer on AY-102.



Release Approval — Date — Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number HNF-2312	Page 1

(2) Title
Acceptance Test Report for the AY-102 Enraf Densitometer

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
RS 0	(7) EDT 609609	JH Huber	RE Larson Released 3/12/98

Table of Contents

1.0 Introduction

On February 11, 1998, the AY-102, Riser 15E Enraf Densitometer was acceptance tested per HNF-SD-WM-ATP-077. The test was performed at the Department of Energy's Hanford Site, 200 East Area, building MO-407. The test validated the functionality of the Densitometer for use by project W-320, C-106 Retrieval.

2.0 Description of Test

The purpose of the test procedure was to verify the functionality of the Enraf Series 854 ATG densitometer. Typically, all Enraf Series 854 ATGs are acceptance tested before transport to the field. The ATP, as performed for level gauges, sets default program values within the gauge and verifies the gauge's force transducer calibration. Additional testing was performed to verify functionality of the 854 as a densitometer.

2.1 Criteria

In order for the gauge to pass the Acceptance Test, it must meet the following criteria. It is recognized that acceptance criteria are not listed in HNF-SD-WM-ATP-077. This is an oversight on the part of the author and will be remedied at its next revision.

2.1.1 Gauge accepts all commands.

All standard Enraf ATG command protocols must be accepted by the gauge. Only standard protocols are provided in the procedure, so all commands issued per the ATP must be accepted. If issuance of any command returns an error code, the error code must be cleared without physical reparation or modification to the gauge.

2.1.2 Force transducer is calibrateable.

The force transducer within the gauge is the primary component important to gauge operability. Should the force transducer be out of calibration, the gauge will not weigh the displacer properly, causing the gauge to report erroneous levels if at all. In the case of a Level Gauge ATP, the force transducer must report a displacer weight within 3 grams of the actual weight inscribed or marked on the displacer. For densitometers, the same criteria applies, however, a formal force transducer calibration is required regardless.

2.1.3 All error codes must be clearable.

All operations or activities performed by the gauge must be carried out as expected or described in the test or vendor documentation. If any operation returns an error code, recovery must be possible within a reasonable amount of time and effort.

3.0 Test Method and Test Equipment

The Enraf gauge was installed on a test bench with approximately 75 cm of travel between the gauge and the floor. The gauge was connected to a Portable Enraf Terminal (PET) via proprietary connections, and the PET was connected to the computer workstation via RS232 cabling provided by Enraf Inc. A custom manufactured density displacer was used (Enraf Part No. 0815.907). At one point during the test, a plastic-lined, water filled, office waste container was used in order to perform a density measurement.

4.0 Test Results

4.1 Discussion of Test Results

A reproduction of the master control copy of the test procedure follows (Attachment 2). The data sheets containing all data taken are included as a part of Attachment 2.

Initially, difficulties were encountered when establishing communication between the workstation (running LOGv18[1] software), the PET and the gauge. All connections appeared to be correct, but PET was returning a "No Gauge Answer" message. Further examination revealed that an Infrared Connection had been established between the PET and gauge which was incorrect. The PET / gauge connection was to be a Bi-Phase Mark connection to the "T-T" terminals in the gauge housing. This was corrected, but communication between the workstation and the gauge still could not be effected. The gauge had been shipped with a gauge address (TA) equal to 33. The gauge address was changed to 00 and communication was finally established. None of these difficulties had any bearing on the functionality of the gauge.

[1] LOGv18 is a trademark of Delft Instruments.

The gauge accepted all commands. All error codes, when encountered, were cleared successfully, and the force transducer reported a displacer weight to within 3 grams after calibration.

There was some suspicion on the part of the cognizant engineer as to the actual volume of the displacer. As a part of this report, calculations are provided that determine the actual displacer volume based on data recorded by the engineer during the test. The calculations may be found in Attachment 1.

4.2 Discussion of Test Exceptions

4.2.1 Exception 1

At step 2.6.6 it was required to verify that the analog display appeared as shown in the vendor documentation. However, for this to occur, an analog "MPU" card must be installed in the gauge. The design for this densitometer did not call for analog output, and therefore the gauge was not configured with an MPU card. The resulting display on the gauge was indicative of this configuration "Analog out / No MPU". This exception was deemed acceptable by the Cognizant Engineer and the test was resumed.

4.2.2 Exception 2

The intent of Section 2.7 was to verify that the Enraf ATG, with the density EPROM installed, would perform as a densitometer. Such in-shop functionality had been previously performed for densitometers installed at AN-107. These previous tests were performed using water-filled containers. Subsequent discussions with the manufacturer revealed that such efforts would not be required and that the gauge was capable of performing a density measurement in air. Thus, the procedure was written to do just that. However, it was found that the procedure recommended by the manufacturer would not work. The gauge behaved as if it needed to start at a tank product interface level in order to start a density measurement.

An office waste container was emptied and lined with plastic. The displacer was sent to I1 (interface 1). Density start level (item DK) and stop level (item DN) were each set equal to 25.4 cm (10-inches) below the water level in the waste container (setting DK=DN results in a single measurement rather than 10 divided equally between the two values). Command [I1] was sent to the gauge which lowered the displacer to the water surface. Command [IP] was then issued, which caused the displacer to descend 25.4 inches into the water and hold while it obtained ten density measurements at that level. When the displacer returned to the water surface,

command [SC] and [R0] were issued to verify they contained reasonable values (other than the default "99999"). Item R0 contains the first density measurement and item SC contains the average of the 10. Both items contained values near 1000 Kg/m^3 (~65 lbm/ft^3).

4.2.3 Exception 3

Editorial changes were made to steps 2.8.30 and 2.8.31 with regard to where certain displacer parameters would be obtained. The manufacturer is not always consistent in locating certain pieces of information. Step 2.8.33 was redlined to generalize entry of item S1, based on the free weight of the displacer. Step 2.8.35 was redlined to enter a value for item RM equivalent to S1. Step 2.8.37 was deleted since the next section provides instructions for gauge transport which require removal of the displacer; step 2.8.37 requires attachment of the displacer.

5.0 Conclusions and Recommendations

The results of the Acceptance Test Procedure shows that the gauge functions as designed and shipped by the manufacturer. The gauge is acceptable for use as the AY-102, Riser 15E densitometer.

6.0 References

(1) Instruction Manual Series 854 ATG Level Gauge, Enraf Inc., Part No. 4416.220, Version 2.2 (See CV-31560, vendor information file).

(2) Instruction Manual 854 ATG Density Software Package, Enraf Inc., Part No. 0000.564.4416.221-40, Version 1.0 (See CV-31560, vendor information file).

(3) System Requirements for Enraf Control Panel Software, Lockheed Martin Hanford Corporation, HNF-1569, dated February 25, 1998.

Attachment 1

Displacer Volume Calculations

Figure 2. Typical Checklist for Checking of Analysis/Calculations.

Document Checked - Number: _____ Revision: 0

Title: Displacer Volume Calculation by J Huber of 2 Mar 98

Yes	[illegible]	[illegible]	N/A	
[X]		[ ]	[ ]	Problem completely defined.
[X]		[ ]	[ ]	Appropriate analytical method used.
[ ]		[X]	[ ]	Necessary assumptions are appropriate, explicitly stated, and supported. Should list assumption that wire tension on ENRAF is accurate/calibrated
[ ]		[ ]	[X]	Computer codes and data files documented.
[X]		[ ]	[ ]	Data used in calculations explicitly stated in document.
[X]		[ ]	[ ]	Sources of non-standard formulae/data are referenced and the correctness of the reference verified. Yes, but value for water density slightly off at STP.
[X]		[ ]	[ ]	Data checked for consistency with original source information as applicable.
[X]		[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]		[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[X]		[ ]	[ ]	Hand calculations checked for errors.
[ ]		[ ]	[X]	Code run streams correct and consistent with analysis documentation.
[ ]		[ ]	[X]	Code output consistent with input and with results reported in analysis documentation.
[ ]		[ ]	[X]	Acceptability limits on analytical results applicable and supported. Limits checked against sources. - none stated
[ ]		[ ]	[X]	Safety margins consistent with good engineering practices.
[X]		[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]		[ ]	[ ]	Results and conclusions address all points required in the problem statement.

I have checked the analysis/calculation and it is complete and accurate to the best of my knowledge.

Ronald W Reed 9 Mar 98
engineer/Checker date

Note: Any hand calculations, notes, or summaries generated as part of this check should be signed, dated, and attached to this checklist. Material should be labeled and recorded so that it is intelligible to a technically qualified third party.

Drawing N/A HNF- 1992 Rev. 0 Page 1 of 3

Building 241-AY-102 Rev. 0 Job No. —

Subject Displacer Volume Calculation

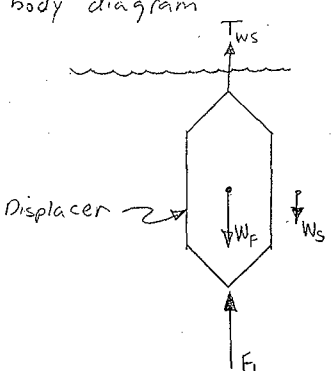
Originator John Huber JHuber Date: 3-2-98

Checker-Engineer RW Reed RWReed Date: 10 Mar '98

Problem: The actual volume of a particular density displacer is not known. However this displacer was used by an Enraf 854 ATG Densitometer to measure the density of room-temperature water. The density of water was measured to be approximately 65 lb/ft^3. The default displacer volume used by the gauge to calculate this density was 135 cc. The weight of this displacer was measured to be 238.6 grams. Can the actual volume of the displacer be determined from the given data, and if so, what is it? [Ref. 1]

Solution:

Free body diagram



W_S = Weight submerged
W_F = Free weight of displacer
F_b = Buoyant Force on displacer

$$W_S = W_F - F_b$$

$$F_b = W_F - W_S$$

T_{WS} = Wire tension, submerged

$$T_{WS} = W_S$$

The gauge calculates the product density by the following equation.

$$\text{Density} = \frac{W_F - W_S}{DV} \quad ; \quad DV = \text{Displacer Volume (Ref. 3)}$$

Careful consideration of this equation, coupled with the operation of the gauge, reveals that W_F & W_S are the keys to determining the volume of any displacer given a known product density. It is also assumed that the gauge force transducer is accurate / calibrated.

W_F is already known. $W_F - W_S$ can be determined using the measured density of 65 lb/ft^3 and the default DV of 135cc.

Determine $W_F - W_S = F_b$

$$F_b = \rho_{H_2O} \cdot DV$$

$$F_b = \underbrace{65 \frac{lb}{ft^3} \cdot \frac{16.018 \, kg/m^3}{1 \, lb/ft^3} \cdot \frac{1000g}{1kg} \cdot \frac{1m^3}{10^6 cc}}_{\rho_{H_2O}\,(\text{measured})} \cdot \underbrace{135cc}_{DV} = 140.56\,g \quad (\text{Ref. 4})$$

Actual Displacer Volume:

$$V_a = \frac{F_b}{\rho_{real}} \quad ; \quad \rho_{real} = .9982\,g/cc \quad (\text{at standard temp \& pressure})$$

$$V_a = \frac{140.56\,g}{.9982\,g/cc} = \underline{\underline{140.81\,cc}}$$

{ continued }

Conclusion:

The actual volume of the displacer is 140.81 cc. Since there are no extenuating circumstances that would indicate the water used was not at standard temperature and pressure, this volume should be used in future operations of the densitometer with this displacer

References:

1) HNF-SD-WM-ATP-077 Rev. 6 "Enraf Series 854 Advanced Technology Gauge (ATG) Acceptance Test Procedure," master control test copy, dated 2-12-98.

2) Engineers Notes, John Huber, dated 2-12-98. (for measured water density).

3) "Instruction Manual Series 854 ATG Level Gauge," version 2.3, dated March 1996, Part No. 4416.220, Enraf Inc.

4) "Mechanical Engineering Reference Manual," 8th Edition, Michael R. Lindeburg, PE., dated 1990, Professional Publications. (for unit conversions).

Attachment 2

Acceptance Test Procedure
HNF-SD-WM-ATP-077
Master Control Copy

ENGINEERING CHANGE NOTICE

1. ECN 638783

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	John Huber, 77860, T4-07, 373-5549	[X] Yes [] No USQ TF-96-0678 Rev 1	12/15/97
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Enraf Acceptance Test/D2M41	N/A	Q
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
	WHC-SD-WM-ATP-077 Rev 5	None	N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change 5 WCB 1/7/98 13b. Design Baseline Document? [] Yes [X] No

ETN-94-0036 - Replace Rev 4 of WHC-SD-WM-ATP-077 with Rev 6 (attached).

14a. Justification (mark one)

Criteria Change	[]	Design Improvement	[X]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

ATP revised to correct minor error with Densitometer acceptance.

15. Distribution (include name, MSIN, and no. of copies)

JG Chandler	S5-08
JH Huber	T4-07 (1 Adv)
FM Jones	H6-11
JM Hay	T4-01
RS Rodriquez	S0-09
RW Jones	S5-06 (1 advance)

RELEASE STAMP

DATE: JAN 08 199

STA: 4

HANFORD RELEASE

4 A2-2

HNF-2312 Rev. 0

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 638783

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[ ] Yes	Additional [ ] $	Additional [ ] $	Improvement [ ]
[X] No	Savings [ ] $ N/A	Savings [ ] $ N/A	Delay [ ] N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[ ]	Seismic/Stress Analysis	[ ]	Tank Calibration Manual	[ ]
Functional Design Criteria	[ ]	Stress/Design Report	[ ]	Health Physics Procedure	[ ]
Operating Specification	[ ]	Interface Control Drawing	[ ]	Spares Multiple Unit Listing	[ ]
Criticality Specification	[ ]	Calibration Procedure	[ ]	Test Procedures/Specification	[ ]
Conceptual Design Report	[ ]	Installation Procedure	[ ]	Component Index	[ ]
Equipment Spec.	[ ]	Maintenance Procedure	[ ]	ASME Coded Item	[ ]
Const. Spec.	[ ]	Engineering Procedure	[ ]	Human Factor Consideration	[ ]
Procurement Spec.	[ ]	Operating Instruction	[ ]	Computer Software	[ ]
Vendor Information	[ ]	Operating Procedure	[ ]	Electric Circuit Schedule	[ ]
OM Manual	[ ]	Operational Safety Requirement	[ ]	ICRS Procedure	[ ]
FSAR/SAR	[ ]	IEFD Drawing	[ ]	Process Control Manual/Plan	[ ]
Safety Equipment List	[ ]	Cell Arrangement Drawing	[ ]	Process Flow Chart	[ ]
Radiation Work Permit	[ ]	Essential Material Specification	[ ]	Purchase Requisition	[ ]
Environmental Impact Statement	[ ]	Fac. Proc. Samp. Schedule	[ ]	Tickler File	[ ]
Environmental Report	[ ]	Inspection Plan	[ ]		[ ]
Environmental Permit	[ ]	Inventory Adjustment Request	[ ]		[ ]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
N/A		

21. Approvals

Signature	Date	Signature	Date
Design Authority PF Kison	12/17/97	Design Agent	
Cog. Eng. JH Huber	12-17-97	PE	
Cog. Mgr. JL Homan	12/31/97	QA	
QA T-I Volkman	12/18/97	Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

ix A2-3

Enraf Series 854 Advanced Technology Gauge (ATG) Acceptance Test Procedure

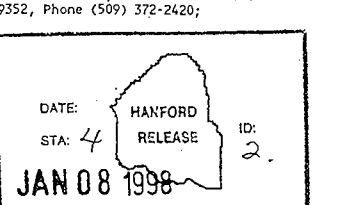
John H. Huber , LMHC
PO BOX 1500, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

638783
EDT/ECN: ECN ~~631297~~ UC: 512 and 2030
Org Code: 74800 Charge Code: D2M41
B&R Code: EW3120071 Total Pages: ~~37~~ 34 1/7/98

Key Words: Enraf, Densitometer, Gauge, Gage, ATG, 854, Level, LIT, Level Indicating Transmitter, Density Indicating Transmitter, Logger

Abstract: This Acceptance Test Procedure was written to test the Enraf Series 854 ATG prior to installatoin in the Tank Farms. The procedure sets various parameters and verifies that the gauge is functional.

Release Approval 1/7/98
Date



Release Stamp

Approved for Public Release

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG) ACCEPTANCE TEST PROCEDURE

RECORD OF REVISION	(1) Document Number HNF 1-6-96 ~~WHC~~-SD-WM-ATP-077	Page 2

(2) Title
ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG) ACCEPTANCE TEST PROCEDURE

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) EDT 141624, 2/18/94	GA Barnes	TL Moore
0-A	Add Record of Revision page i Replaces pages 2 of 14 and 14 of 14. ECN 602579, 4/15/94		
0-B	Replaces Record of Revision page i Replaces pages 10 of 14 and 14 of 14 ECN 602580, 5/3/94		
0-C	Replace Record of Revision page i Replaces pages 4, 6, 9, 12, and 14 Add Appendix A ECN 608122, 5/24/94		
1	Replace Rev 0-C with Rev 1 *ECN 608123, ECN 613180, 7/20/94		
2	Replace Rev 1 with Rev 2 Rev 2 is a complete rewrite ECN 613319, 1/24/95		
3	Replace Rev 2 with Rev 3 Rev 3 is a complete rewrite ECN 620620, 5/5/95		
4	Replace Rev 3 with Rev 4 Rev 4 is an update ECN 631224, 3/27/96		
5	Replace Rev 4 with Rev 5 1.Rev 5 incorporates testing requirements for Enraf Densitometers. ECN 631297		
RS 6	Clarified recording of DV in step 2.8.31. Added additional steps in section 2.7 ECN 638783	JH Huber 12-17-97	JL Homan for JLH 12/31/97

ECN-617152, ECN-613204
12 1/8/98

HNF-SD-WM-ATP-077
REV 6

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG) ACCEPTANCE TEST PROCEDURE

J. H. Huber
Single-Shell Tank Engineering

January 6, 1998

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ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG) ACCEPTANCE TEST PROCEDURE

1.0 INSTRUCTIONS

1.1 PURPOSE

This procedure checks the Enraf gauge received at Hanford is completely functional and has received no shipping damage. This procedure does not certify the gauge operation; that is done by the manufacturer.

1.2 SCOPE

This procedure provides acceptance testing for Enraf Series 854 level gauges used to monitor levels and/or waste densities in Hanford Waste Storage Tanks. The test will verify that the gauge functions according to the manufacturer's instructions and specifications and is properly setup prior to being delivered to the tank farm area. This ATP does not set up the gauge for any specific tank, but is generalized to permit testing the gauge prior to installation package preparation.

This procedure assumes that in the case of Densitometer acceptance, the density EPROM has been installed by Hanford Instrument Technicians in the gauge per Manufacturer's instructions.

1.3 REFERENCES

- Instruction Manual Series 854 ATG Level Gauge, Enraf Inc., Part No. 4416.220, Version 2.2 (See CV-31560, vendor information file).

- Instruction Manual 854 ATG Density Software Package, Enraf Inc., Part No. 0000.564.4416.221-40, Version 1.0 (See CV-31560, vendor information file).

1.4 RESPONSIBILITIES

1.4.1 The Person In Charge (PIC) is responsible for coordinating the level gauge testing.

1.4.2 Maintenance (Instrument Craft) is responsible for performing the testing and recording the test results.

1.4.3 Quality Control is responsible for witnessing the tests, signing the data sheets when testing is completed and placing a "green tag" on the gauge after successful completion of the test.

1.5 DESCRIPTION OF THE SYSTEM

Enraf-Nonius Series 854 level gauges are certified by Factory Mutual (FM) for National Fire Protectional Association (NFPA 70) hazardous Class I, Division 1, Groups B, C, and D Locations. Its level measuring principle is based on the detection of variations in the weight of a displacer suspended in the process fluid. The displacer is connected to a wire wound on a precision measuring drum. A level change causes a change in the weight of the displacer which will be detected by the force transducer. Electronics within the gauge cause a servo motor to adjust the position of the displacer and compute the tank level based on the new position of the displacer drum. The gauge displays the level in decimal inches. An analog output signal transmits the level data for remote data processing. In densitometer mode, the principle of operation is similar. The gauge measures the weight of the displacer at various levels within the product and compares the measured weight with the known clean weight. The electronics then use this weight difference along with the known displacer volume and area to calculate product density. It should be noted that the only difference between the level measurement gauge and density measurement gauge is the installation of an EPROM (Eraseable, Programable, Read Only Memory) chip installed in the latter.

1.6 TEST CONDITIONS AND EQUIPMENT REQUIRED

The equipment listed below is required to perform this procedure.

- Portable Enraf Terminal (PET) Model No. 847
- Enraf Test Weights (Enraf PN 1854-061)
- Reamer (Enraf PN 4563.030) or #31 drill
- Enraf Extraction Tool (optional)

2.0 TEST EXECUTION SECTION

NOTE:

The commands typed on the PET or computer are shown in square brackets "[]" (The square brackets are NOT to be typed as part of the command). Included is any additional information the command requires. After typing the text within the square brackets, press the ENTER key. If an error is made during the typing of the command, use the backspace (BS) key to delete the error.

After entering a command, the PET or computer will give one of two responses: The first response will show the entered command with an "&" character at the end (i.e. "TG&"). This response tells the user that the gauge accepted the command. The second response will show the two digit command (i.e. TG) followed by a "!" and a three digit error code (i.e. "TG!053"). This command tells the user that the gauge did not accept the command. For a list of error codes, see the Enraf 854 ATG Level Gauge Instruction Manual, section 12.4.

PROCEDURE NOTE

In the following steps, if values are requested, the values shall be recorded in the Test Execution Data Sheet (located at the end of this procedure) for the appropriate step number in the Value column. If verification is requested, write accept in the accept/reject column in the Test Execution Data Sheet for the appropriate step number.

If an error occurs in any step, an exception will be entered in the Exceptions Data Sheet listing the step where the error occurred, and a general description of the error. Corrective actions shall be in accordance with section 3.0. A force transducer calibration may be performed at any time at the Test Conductor's discretion.

2.1 INITIALIZING THE GAUGE

INFORMATION
This section prepares the gauge for testing. It connects power and unlocks the servo motor.

2.1.1 Mount the gauge per the 854 ATG Level gauge Instruction Manual. Provide electrical connections to the gauge per the 854 ATG Level Gauge Instruction Manual, the National Fire Protection Association (NFPA 70) National Electrical Code.

2.1.2 Install the drum and displacer per the Enraf Series 854 ATG Level Gauge Instruction Manual, Section 8.4.

2.1.3 Unlock the servo motor prior to connecting power per the 854 ATG Level Gauge Instruction Manual, Section 8.5.

2.1.4 Connect the PET to the optical port located on the side of the gauge housing.

2.1.5 Connect the gauge to a 120 Vac (+/- 5 Vac) power source, per the 854 ATG Level Gauge Instruction Manual, Section 4.3.1. The display screen on the gauge will show one dark line. After approximately 20 seconds, the display will show the gauge initializing.

2.1.6 Configure the gauge per Appendix A.

2.1.7 In the Logger program, select SEND ITEMS and Ensure F5 equals 1B/2B; IF NOT, THEN <F5>, <ENTER>, <ENTER>.

2.2 CHECKING FOR ERROR CODES

INFORMATION

Record any errors on the data sheet. Correct the errors, or enter it as an exception. For a list of error codes, see the Enraf 854 ATG Level Gauge Instruction Manual.

2.2.1 Enter Command [EP] = "XPU error code". Verify that EP000 is displayed. Record verification in the data sheet.

2.2.2 Enter Command [ES] = "SPU error code". Verify that ES0000 is displayed. Record verification in the data sheet.

2.3 TESTING THE LEVEL GAUGE OPERABILITY

INFORMATION

This section enters data into the memory of the level gauge. These values tailor the gauge for the specific tank.

2.3.1 Enter Command [UN]. This command unlocks the gauge and allows the displacer to move downward to the floor or other hard surface.

NOTE:

If the displacer does not move downward, check to make sure that the drum moves freely on the bearings. If the drum does not move freely, perform the drum bearing removal/reconditioning procedure in Appendix B. If the drum does move freely, re-calibrate the force transducer using the procedure in Appendix C. After drum bearing reconditioning or force transducer re-calibration, perform step 2.3.1 again. Document the drum bearing reconditioning or force transducer re-calibration as an exception.

2.3.2 Enter Command [W2=ENRAF2]. This command enters protection level 2.

2.3.3 Enter the following parameters into the gauge (Verify proper parameter entry and record the verification in the Data Sheet):

- [TT=+00900.00] ("TANK TOP" parameter)
- [UR=+00900.00] ("UPPER REFERENCE" parameter)
- [MH=+00890.00] ("MOTOR HIGH" parameter)
- [MZ=+00880.00] ("LOCK TEST LIMIT" parameter)
- [HH=+00870.00] ("HIGH HIGH ALARM" parameter)
- [HA=+00860.00] ("HIGH ALARM" parameter)
- [LA=+00006.00] ("LOW ALARM" parameter)
- [LL=+00003.00] ("LOW LOW ALARM" parameter)
- [ML=+00001.00] ("MOTOR LIMIT SWITCH LOW" parameter)
- [RL=+00850.00] ("REFERENCE LEVEL" parameter)

2.3.4 Enter command [AR]. This command directs the gauge to accept the current value for "RL".

2.3.5 Enter command [EX].

NOTE:

Prior to executing step 2.3.6, verify that the opening to the gauge flange is blocked so that the displacer cannot be raised up into the drum housing.

2.3.6 Enter Command [CA]. This command raises the displacer. Verify that the displacer raises up to the gauge flange and stops. Record the verification in the data sheet.

2.3.7 Enter Command [UN].

2.3.8 After the gauge stabilizes, verify that the level reading in the gauge LCD display is reading within 0.10 inches of the RL value programmed in step 2.3.3. Record the verification in the data sheet.

2.3.9 Enter command [TG]. This commands tests the gauge.

2.3.10 Verify that the displacer rises a couple of inches and then goes back down to the RL. Record the verification in the data sheet.

2.4 DRUM CIRCUMFERENCE VERIFICATION

2.4.1 Enter Command [DC]. This command displays the preprogrammed drum circumference.

2.4.2 Verify that the drum circumference value displayed (DC) is the same as the value for the Drum circumference found engraved on the wire drum. Record the value in the data sheet. If the Drum Circumference value engraved on the wire drum does not exactly match the preprogrammed Drum Circumference (DC) value, perform steps 2.4.3 through 2.4.5, otherwise go to step 2.5. Note that display on computer is in meters, and engraved value is in millimeters.

> NOTE:
>
> This value is displayed in scientific notation.
>
> The value will look like "DC=+.33000000E+00".

2.4.3 Enter Command [W2=ENRAF2].

2.4.4 Enter Command [DC=+.XXXXXXXXE+00]. The value for XXXXXXXX is the Drum Circumference value engraved on the wire drum. Record the value in the data sheet.

2.4.5 Enter command [EX].

2.5 DISPLACER WEIGHT VERIFICATION

2.5.1 Enter command [CA].

2.5.2 After the displacer rises a few inches, enter command [FR]. This command stops the displacer.

2.5.3 Enter command [MF]. This command measures the motor frequency.

2.5.4 After "FR" appears in the gauge's LCD display, PET display or computer display, enter command [WQ]. This command measures the weight of the displacer. Record the WQ value in the data sheet.

> NOTE:
>
> This value is displayed in scientific notation.
>
> The value will look like "WQ=+.22300000E+03".

2.5.5 Verify that the WQ value is within 3 grams of the weight engraved on the displacer. Record the verification in the data sheet.

2.5.6 If the value for WQ is not within 3 grams (.00300000E+03) of the weight engraved on the displacer, calibrate the force transducer per the force transducer calibration procedure found in Appendix C. Document this calibration as an exception. After force transducer calibration, perform steps 2.5.3-2.5.5 again.

> NOTE:
>
> The previous step is not required for densitometer testing. A force transducer calibration is routinely performed for densitometers in the following sections.

2.6 TESTING THE DISPLAY (Densitometers Only)

INFORMATION

This section tests for proper communications and the ability of the gauge to change from the Level Display to the Analog Display. The Analog Display will only be used for diagnostics during gauge operation. The Level Display will be used during normal operation.
All Densitomter Sections assume that the Density EPROM has been installed in the gauge

Enter these commands from the computer terminal.

2.6.1 Select item 2) SEND ITEMS from the LOGv18 menu.

2.6.2 Press F2, enter 00, and press ENTER to address the gauge (TA=00). The transmission address of the gauge is displayed in the second column at the bottom of the screen.

2.6.3 Enter command [W1=ENRAF1] to enter protection level 1.

2.6.4 Enter command [DF=J] to enter the analog display format J.

2.6.5 Enter command [EX] to exit protection level 1, store the changed data and initialize the 854 ATG.

2.6.6 RECORD VERIFICATION that the analog display (format J) screen is displayed on the gauge after initialization. See Figure 7.9 (page 29) in the 854 ATG Instruction Manual.

NOTE: The terminal display will not show the format change until the F2 key is pressed and then the ENTER key.

2.6.7 Enter command [W1=ENRAF1] to enter protection level 1.

2.6.8 Enter command [DF=B] to enter the display format B.

2.6.9 Enter command [EX] to exit protection level 1, store the changed data and initialize the 854 ATG.

2.6.10 RECORD VERIFICATION that the level display (format B) screen is displayed on the gauge after initialization (See Figure 7.3, page 26, in the 854 ATG Instruction manual).

2.7 DENSITY CALIBRATION SETUP (Densitometers Only)

INFORMATION

The drum circumference value, provided by the manufacturer, is used in calibrating the gauge for changes in level. The value insures the gauge reports level changes accurately.

2.7.1 Enter command [W2=ENRAF2] to enter protection level 2.

2.7.2 Enter command [SM] to enter the maintenance mode.

2.7.3 Enter command [GU] to raise the displacer and enter command [FR] to stop the displacer. Raise the displacer until it is in full view, and can be easily accessed. RECORD the level value.

CAUTION: When entering the [FR] command, be aware of the time delay between entering the command and the displacer stopping.

2.7.4 Enter command [SO] to exit the maintenance mode.

2.7.5 Enter command [MZ=+xxxxx.xx] to enter the level value recorded in 2.7.3 as the Lock Test motor limit

See exceptions 2-11-96

A2-19

setting. RECORD VERIFICATION of proper value entry. The gauge will automatically return to this level during a LT (lock test) command.

2.7.6 Enter command [DK=+xxxxx.xx] to enter the current level recorded in step 2.7.3 minus 6 inches as the Interface Density Profile Start Level.

2.7.7 Enter command [DZ=+xxxxx.xx] to enter the value recorded in 2.7.3 minus 18 inches (must be 18 inches if available travel below the displacer. If not repeat steps 2.7.3 to 2.7.7).

2.7.8 Enter command [SD=D] to set scan direction (down).

2.7.9 Enter command [IP] to start an interface profile scan.

See exceptions

NOTE - If the gauge does not perform the interface profile (IP), then it is possible the Density EPROM was not installed, or the ML value is set too high. Refer to the 854 Instruction Manual for further information.

2.7.10 When the profile scan is complete, enter command [SC] and record the value. RECORD VERIFICATION that SC is a non-default value (i.e. contains a lot of 9's or the default value as shown in the Enraf 854 Instruction Manual).

See exception 2-11-98

2.7.11 Enter command [WT=EDD] to disable the wire-rupture detection. RECORD VERIFICATION of proper value entry. The disabling allows for calibration.

2.7.12 Enter command [EX] to exit protection level 2, store all entered data and initialize the 854 ATG.

2.8 DENSITY CALIBRATION (Densitometers Only)

INFORMATION

Density calibration requires the gauge to be fully operational. When exchanging items hanging on the wire, make sure the gauge is de-energized to avoid damage to the force transducer. Be sure to maintain some tension on the wire while changing weights to prevent the wire from uncoiling from the drum.

No liquid is required for this calibration.

2.8.1 Replace the displacer with the 25g test weight on the measuring wire.

CAUTION: When exchanging items hanging on the wire, make sure the gauge is de-energized to avoid damage to the force transducer. Also be sure to maintain

tension on the wire to avoid unraveling the wire from the drum.

2.8.2 Enter command [UN] to release the test weight.

2.8.3 Enter command [BT] to begin a balance test. The ATG will now find the average frequency corresponding to the 25g weight. Wait until the test has been completed.

2.8.4 Enter command [BF] to request the measured average frequency after completion of the balance test. RECORD the frequency. Do not yet reprogram this value in the gauge. Reprogramming must be done after completion of all four calibration measurements.

2.8.5 Enter command [UN] to release the test weight.

2.8.6 Enter command [LT] to raise the test weight to the MZ level (2.7.5).

2.8.7 Add the 75g weight to the 25g weight.

2.8.8 Enter command [UN] to release the test weight.

2.8.9 Enter command [BT] to begin a balance test. The ATG will now find the average frequency corresponding to the 25g+75g weight combination. Wait until the test has been completed.

2.8.10 Enter command [BF] to request the measured average frequency after completion of the balance test. RECORD the frequency.

2.8.11 Enter command [UN] to release the test weight.

2.8.12 Enter command [LT] to raise the test weight again.

2.8.13 Replace the 75g weight with the 150g weight.

2.8.14 Enter command [UN] to release the test weight.

2.8.15 Enter command [BT] to begin a balance test. The ATG will now find the average frequency corresponding to the 25g+150g test-weight combination. Wait until the test has been completed

2.8.16 Enter command [BF] to request the measured average frequency after completion of the balance test. RECORD the frequency.

2.8.17 Enter command [UN] to release the test weight.

2.8.18 Enter command [LT] to raise the test weight again.

2.8.19 Replace the 150g weight with the 225g weight.

2.8.20 Enter command [UN] to release the test weight.

2.8.21 Enter command [BT] to begin a balance test. The ATG will now find the average frequency corresponding to the 25g+225g test-weight combination. Wait until the test has been completed.

2.8.22 Enter command [BF] to request the measured average frequency after completion of the balance test. RECORD the frequency.

2.8.23 Enter command [UN] to release the test weight.

2.8.24 Enter command [LT] to raise the test weight again.

2.8.25 Enter command [W2=ENRAF2] to enter protection level 2.

2.8.26 Enter command [F0=+.xxxxxxxxE+xx] to input the frequency value recorded in Step 2.8.4. RECORD VERIFICATION of proper value entry.

2.8.27 Enter command [F1=+.xxxxxxxxE+xx] to input the frequency value recorded in Step 2.8.10. RECORD VERIFICATION of proper value entry.

2.8.28 Enter command [F2=+.xxxxxxxxE+xx] to input the frequency value recorded in Step 2.8.16. RECORD VERIFICATION of proper value entry.

2.8.29 Enter command [F3=+.xxxxxxxxE+xx] to input the frequency value recorded in Step 2.8.22. RECORD VERIFICATION of proper value entry.

marked 2-11-98

2.8.30 Enter command [DW=+.xxxxxxxxE+xx] to assign the value for DW, which is ~~engraved~~ on the density displacer. RECORD VERIFICATION of proper value entry.

2.8.31 Enter command [DV=+.xxxxxxxxE+xx] to assign the value for DV, which is ~~engraved on the density displacer~~ RECORD DV on Data Sheet along with RECORD VERIFICATION of proper value entry.

2.8.32 Enter command [DA=+.16000000E+02] to assign the value for the displacer area. RECORD VERIFICATION of proper value entry.

2.8.33 Enter command [S1=+.~~24~~500000E+03] ~~to assign the value for the weight of the displacer with one-third submerged.~~ This value is used to determine when I1 has been reached. RECORD VERIFICATION of proper value entry.

2.8.34 Enter command [WT=EDE] to enable the wire rupture detection. RECORD VERIFICATION of proper value entry.

2.8.35 Enter command [RM=+.~~24~~500000E+03] ~~to assign the value for wire tension during execution of the AR command.~~ RECORD VERIFICATION of proper value entry.

2.8.36 Enter command [EX] to exit protection level 2.

2.8.37 Replace the test weights with the displacer on the measuring wire.

CAUTION: When exchanging items hanging on the wire, make sure the gauge is de-energized to avoid damage to the force transducer. Also be sure to maintain tension on the wire to avoid unraveling the wire from the drum.

HP required
7-11-98

2.9 TRANSPORTING THE LEVEL GAUGE

> CAUTION
>
> This section prepares the gauge for transport. The motor must be locked to prevent possible damage to the force transducer.

2.9.1 If the level gauge display is not in FORMAT B (see the 854 ATG Level Gauge Instruction Manual, Figure 7.3), enter command [W1=ENRAF1]. Once in Protection Level 1, enter command [DF=B] (this command switches the gauge to display format B). Enter command [EX].

2.9.2 If using a computer for the testing, log the gauge data onto the computer (see Appendix A).

2.9.3 Disconnect the gauge from the power source.

2.9.4 "Lock" the servo motor, per the 854 ATG Level Gauge Instruction Manual, Section 8.5, prior to transporting the gauge.

2.9.5 Remove the drum and displacer, per the 854 ATG Level Gauge Instruction Manual, Section 8.4, prior to transporting the gauge.

2.10 DATA

2.10.1 Mail a copy of the completed data sheets, vender information, and hardcopy of the logfile to J. H. Huber at T4-07.

3.0 EXCEPTIONS TO ACCEPTANCE TEST

Exceptions to the test are dispositioned and agreed to by all witnesses. Actions taken regarding disposition are noted on the "Exception to Acceptance Test" sheet. Typical dispositions are:

- Test approved with exception (i.e., rerun of the acceptance test unnecessary).
- Entire acceptance test to be repeated after the discrepancy has been corrected.
- ATP step(s) affected to be repeated after the discrepancy has been corrected.

4.0 TEST DATA MANAGEMENT

The test data shall be entered on the attached data sheets. Witness signatures at the bottom of the data sheet indicates that the witness agrees to the accuracy of the data recorded and comparisons made.

Upon successful completion of testing activities, the master copy of the DATA SHEETS will be signed by the Test Witnesses. An appropriate "Acceptance Test Report" shall be generated to publish the results of testing activities.

4.1 ACCEPTANCE TEST REPORT GUIDANCE

The data sheets which are completed during the testing activities will be included in the Acceptance Test Report. If additional gauges are tested using this procedure, a different data sheet will be used for each gauge and added to the ATR as a revision.

TEST EXECUTION DATA SHEET				
Date: 2/11/98				Tank Number:
Gauge Serial Number: 854-20-422				Densitometer? (Yes) No
Test Performed By: P.J. Hutson				
Reference Sequence	Attribute	Value	Accept/Reject	Comment
2.2.1	EP	EP000	A	
2.2.2	ES	ES 00000	A	
2.3.3	PARAMETERS	———	A	ENTERED CORRECTLY
2.3.6	CA	———	A	STOPPED @ FLANGE
2.3.8	RL	849.99	A	
2.3.10	RL	849.99	A	
2.4.2	DC	T.33806400E+00	A	
2.4.4	DC	N/A	N/A	
2.5.4	WQ	+.24042898E+03	A	
2.5.5	WQ	+.24042898E+03	A	
2.6.6	J	ANALOUT/NO MPU	A	SEE EXCEPTIONS
2.6.10	B	+00849.99 in INN/---	IN A	
2.7.3	MZ	+00880.11	A	
2.7.5	MZ	+00880.11	A	
2.7.10	SC	+065.0774	A	
2.7.11	EDD	WT=EDD	A	

TEST EXECUTION DATA SHEET				
Date: 2/11/98				Tank Number:
Gauge Serial Number: 854-20-422				Densitometer? (Yes) No
Test Performed By: PJ Hurson				
Reference Sequence	Attribute	Value	Accept/Reject	Comment
2.8.4	F0	Post 02-11-98 ~~+.11563148E+05~~	A	
2.8.10	F1	+.12330815E+05	A	
2.8.16	F2	+.13055533E+05	A	
2.8.22	F3	+.13732716E+05	A	
2.8.26	F0	+.11559793E+05	A	
2.8.27	F1	+.12330815E+05	A	
2.8.28	F2	+.13055533E+05	A	
2.8.29	F3	+.13732711E+05	A	
2.8.30	DW	+.23660000E+03	A	
2.8.31	DV	+.13500000E+03	A	
2.8.32	DA	+.16000000E+02	A	
2.8.34	EDE	WT=EDE	A	
2.8.35	RM	+.22360000E+03	A	
2.9.4	MOTOR LOCK	MOTOR LOCKED	A	

Test Witnesses: CS Wiggins 2/11/98
PEG James D. Wiggins 02/11/98 Date

Quality Control M.S. Wingfield 2/11/98 Date

Maintenance PJ Hurson 02-11-98 Date

EXCEPTIONS DATA SHEET

Gauge Serial Number: 854-20-422

Paragraph No.	Description/Disposition
2.6.6	DISPLAY READS: ANAL.OUT / NOMPU. GAUGE IS NOT DESIGNED TO HAVE AN ANALOG CARD, NOMPU MESSAGE DOES NOT APPLY.
2.7 et al	TO get this to work, we had to place a bucket under the displacer. The IP scan must start at I1. ~~Also had to enter command~~ PK. We set PK & DN at approx 10-inches below I1 and one inch above "tank bottom". ~~The~~ When IP was invoked, the displacer went to correct level. When "IP" disappeared from display, we queried RQ & SC, which contained valid values. Gage/densitometer functions are queried in this manner.
2.8.30, 2.8.31, 2.8.33, 2.8.35, 2.8.37	Redlined per Cog Engineer. Acceptable.

TEST APPROVED - NO EXCEPTIONS:		TEST APPROVED - WITH EXCEPTIONS:	
			2/11/98
PIC	Date	James D. Uhliggins PIC	2/11/98 Date
		J. L. Lusby	2-12-98
Quality Assurance	Date	Quality Assurance	Date
			02-12-98
Maintenance	Date	Maintenance	Date
			2-11-98
Cog Engineer (Densitometers Only)	Date	Cog Engineer (Densitometers Only)	Date

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG) ACCEPTANCE TEST PROCEDURE

APPENDIX A

COMPUTER SETUP GUIDANCE:

1. Turn PET ON. ~~Connect the infrared connector from the PET to the ENRAF gauge.~~

2. Enter the TA command, note the gauge address displayed in the PET display, (i.e. TA05). TURN PET OFF.

3. Disconnect the infrared connector, and connect the computer and PET to the gauge per Figure A-1. Power up PET/gauge as required.

4. Place the PET in SETUP MODE by pressing keys control-esc at the same time.

5. Press the down arrow (!) on the PET keyboard until MODE is displayed at the top of the PET display.

6. Press the right arrow (-) until the cursor is underneath RS232.

7. Press the down arrow (!) until the display on the PET reads "RS-232 Baudrate".

8. Verify (and if necessary correct) the cursor is underneath 1200.

9. Press the down arrow until the PET display reads SETUP MODE, and then press, control-esc at the same time.

10. Turn on the computer, respond no to accessing network resources, push any key to continue.

11. At the c:\> prompt on the computer display, access the logger directory by typing, cd\logger

12. Start the logger program by typing, LOGV18

13. Use the computer arrow keys and highlight item #1, "Setup system", then press the enter key.

14. Highlight item #4, "Gauge address" and press enter.

15. Enter the gauge address noted from step #2 (note the flashing cursor), then press enter.

16. Verify that the other parameters shown in the "SETUP MENU" display match the parameters shown below. If the parameters don't match, change them using the procedure in steps 14 and 15.

```
SETUP MENU

 1 )  RS232C port & Baudrate                        (port 1 @ 1200 Baud.)
 2 ) Add header to every file                       (N)
 3 ) Ciu address                                    ()
*4 ) Gauge Address                                  (XX)
 5 ) Max. number of records in file LOGV17.CYC      (100)
 6 ) Name cyclusfile                                (LOGV17.CYC)
 7 ) Max. number of retries per CIU request         (3)
 8 ) Timeout CIU                                    (.9 sec.)
 9 ) Turn_around delay                              (0 sec.)
 A ) ITEM directory                                 (C:\LOGGER\ITEMS\)
 B ) CYC_file directory                             (C:\LOGGER\CYC\)
 C ) LOG_file directory                             (C:\LOGGER\LOG\)
 D ) file_to_Field_file directory                   (C:\LOGGER\FTF\)
 E ) Library_directory                              (C:\LOGGER\LIB\)
 F ) RAM disk                                       (\)
 G ) Return to main menu

*XX is obtained from gauge parameter [TA]
```

17. Highlight item #G, "Return to main menu", press enter key.

18. A prompt will ask, "Save new setup on disk (y,n)?, type, y for a yes response.

19. Highlight item #2, "Send items", press enter key.

20. Return to section 2.1.7.

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG)
ACCEPTANCE TEST PROCEDURE

1.CHANGING LEVEL DIMENSIONS:

2. <ESC> from LOGGER'S "MAIN MENU", enter the "SPECIAL MENU".

3. Enter the "CHANGE DIMENSIONS" menu.

4. Enter the gauge's "TRANSMISSION ADDRESS" (TA).

5. Enter "1) LEVEL DIMENSION (XXXXXX)"

6. Enter "TO INCHES"

7. Return to the "MAIN MENU"

8. Return to "SEND ITEMS"

LOGGING GAUGE DATA ONTO COMPUTER:

1. From LOGGER'S "MAIN MENU", enter the "SPECIAL MENU".

2. Enter "1) GAUGE LOGGING TO DISK".

3. Enter the gauge's "TRANSMISSION ADDRESS" (TA).

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG)
ACCEPTANCE TEST PROCEDURE

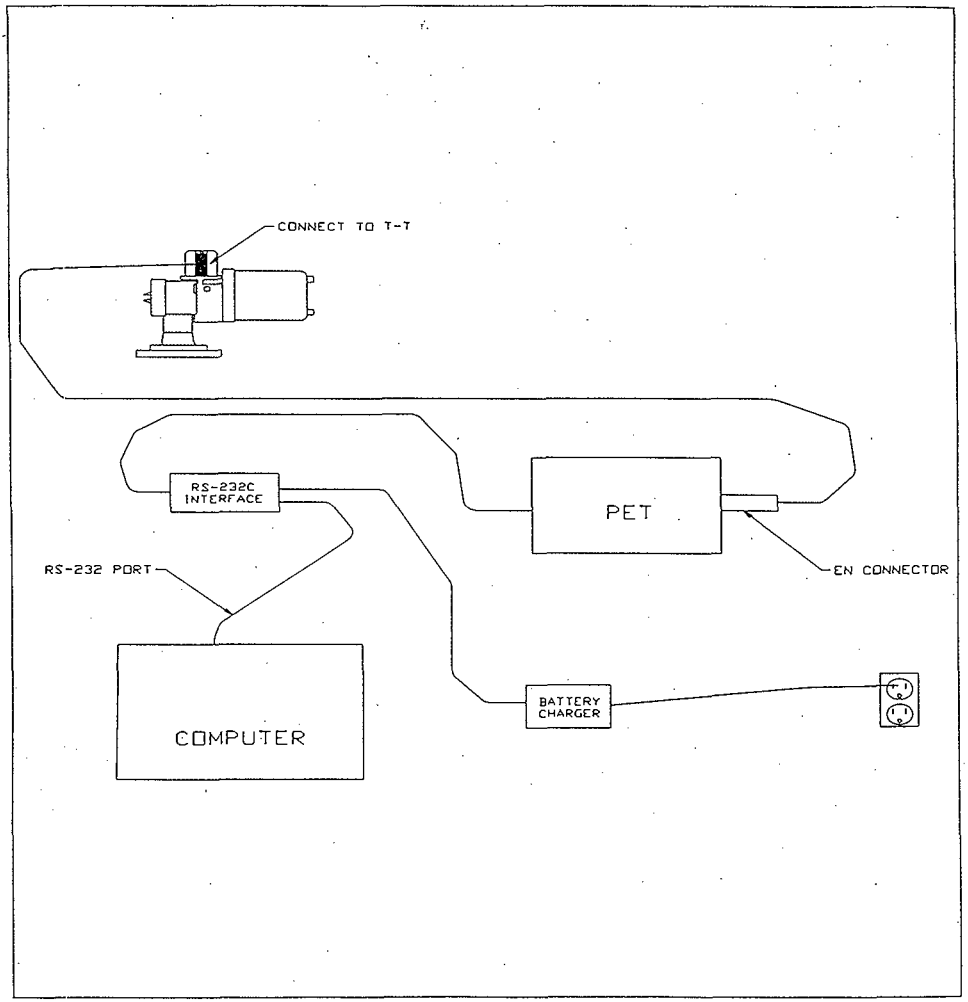

Figure A-1

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG)
ACCEPTANCE TEST PROCEDURE

APPENDIX B

DRUM BEARING REMOVAL/RECONDITIONING

1. Disconnect the gauge from the power source. Use a PLD to lock out power.

2. "Lock" the servo motor, per the 854 ATG Level Gauge Instruction Manual, Section 8.5.

3. Remove the drum and displacer per the 854 ATG Level Gauge Instruction Manual, Section 8.4.

4. Remove the drum shaft bushing from the gauge per the 854 ATG Level Gauge Instruction Manual, Figure 9.3.

5. Remove the bearings (2 black disks on each end of the bushing) from the drum shaft bushing per the 854 ATG Level Gauge Instruction Manual, Figure 9.3.

6. Use the reamer or the #31 drill to ream out both bearings.

7. Reinstall the reconditioned drum bearings into the drum shaft bushing.

8. Reinstall the drum shaft busing into the gauge.

9. Reinstall the drum and displacer, per the 854 ATG Level Gauge Instruction Manual, Section 8.4.

10. "Unlock" the servo motor, per the 854 ATG Level Gauge Instruction Manual, Section 8.5.

11. Connect the gauge to the power source.

ENRAF SERIES 854 ADVANCED TECHNOLOGY GAUGE (ATG)
ACCEPTANCE TEST PROCEDURE

APPENDIX C

FORCE TRANSDUCER CALIBRATION

1. Raise the displacer to approximately 6" below the gauge flange by entering command [CA]. To stop the displacer, enter command [FR].

2. Enter command [W2=ENRAF2].

3. Enter command [WT=DDD]. This command disables the "wire-rupture" protection.

4. Remove the displacer from the measuring wire.

5. Attached the 25 gram weight to the measuring wire loop. The 25 gram weight is the smallest of weights in the set and has two hooks.

6. Enter command [BT]. This command activates a BALANCE TEST. The BALANCE TEST will take approximately five minutes to complete.

7. After "FR" appears in the gauge's LCD display, PET display or computer display, enter command [BF]. This command will display the frequency measured during the BALANCE TEST. Record this frequency (F0) below:

F0=_____

8. Attach the 75 gram weight to the 25 gram weight. The 75 gram weight is the third smallest in the set. Note: If there is insufficient room for the test weights to move downward (approximately 12"), perform step 1 to raise the test weights.

9. Repeat steps 6 and 7. Record the frequency (F1) below:

F1=_____

10. Remove the 75 gram weight and attach the 150 gram weight to the 25 gram weight. The 150 gram weight is the second largest weight in the set. Note: If there is insufficient room for the test weights to move downward (approximately 12"), perform step 1 to raise the test weights.

11. Repeat steps 6 and 7. Record the frequency (F2) below:

    F2=_____

12. Remove the 150 gram weight and attach the 225 gram weight to the 25 gram weight. The 225 gram weight is the largest weight in the set. Note: If there is insufficient room for the test weights to move downward (approximately 12"), perform step 1 to raise the test weights.

13. Repeat steps 6 and 7. Record the frequency (F3) below:

    F3=_____

14. Enter command [W2=ENRAF2].

15. Enter command [F0=+.XXXXXXXXE+XX]. This command re-programs frequency 0. The value of F0 is the value obtained in step 7.

16. Repeat step 15 for frequencies F1, F2 and F3. The values for F1, F2 and F3 are the values obtained in steps 9, 11 and 13 respectively.

17. Enter command [WT=EDE]. This command enables the "wire-rupture" protection.

18. Enter command [EX].

19. Remove weights and install displacer.

20. Return to section 2.5.