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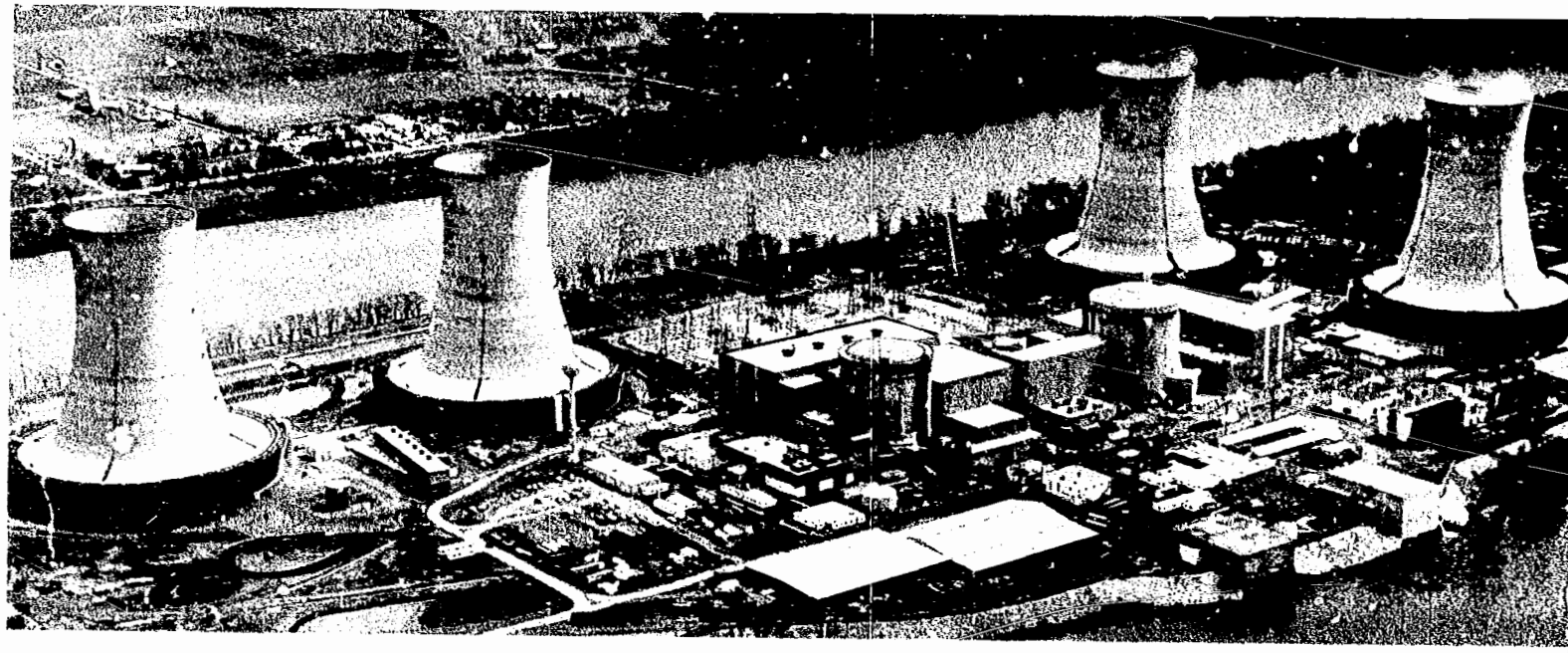

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FIELD MEASUREMENTS AND INTERPRETATION OF TMI-2 INSTRUMENTATION: IC-10-dPT

J. E. Jones
J. T. Smith
M. V. Mathis

U.S. Department of Energy
Three Mile Island Operations Office
Under DOE Contract No. DE-AC07-76IDO1570

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Volume VI

FIELD MEASUREMENTS AND INTERPRETATION OF TMI-2 INSTRUMENTATION: IC-10-dPT

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Section 1

INTRODUCTION

During and following the TMI-2 accident, a number of instruments failed or were suspected of providing erroneous readings. Because of this problem, industry concerns were focused upon the behavior of instrumentation under adverse conditions. To better understand failure mechanisms, the Technical Integration Office (TIO) contracted Technology for Energy Corporation (TEC) to perform field measurements on a set of selected TMI-2 instruments to determine in-situ operating characteristics. For some instruments, these measurements were to be performed prior to removal (and replacement with new instruments) in order to have a cross reference with post removal observations. For other instruments, an indication of the condition of the instrument (i. e., fully operational or failed) was desired.

This report describes the measurements and results of the Control Rod Drive Bypass Flow IC-10-dPT. This instrument consists of a Bailey Type BY Process Computer Transmitter connected to a readout module by approximately 500 feet of cable through a penetration junction and an instrument mounting junction. The status of this instrument is uncertain, but it was producing a reasonable output reading of zero flow which could indicate it had not failed. As a result, measurements on this instrument were designed to determine if it were properly functioning.

Section 2

INSTRUMENT LOCATION, CABLING, AND TERMINATIONS

A review of appropriate drawings from Bailey Meter Company and Burns & Roe (itemized in the Appendix in the measurement procedure, pages A-5 and A-6) resulted in the composite electrical diagram shown in Figure 2-1. From this information, Table 2-1 gives a list of the appropriate termination points for performing measurements in Control Cabinet 157. Also noted in Figure 2-1 are the cable lengths pulled during instrument installation and lengths after trimming between each termination and/or junction point.

The flow sensing assembly is a Bailey Type BY which consists of a differential pressure LVDT, temperature compensation, and calibration adjustment for conversion of pressure difference to flow. This instrument has a normal range of 0-200 GPM, producing an output of -10 to +10 volts. The functional diagram of the unit is shown in Figure 2-2.

Since measurements were being made in Control Cabinet 157, the effect of the readout meter (attached to the signal line) was present on the observed instrument response. However, since this readout was located outside containment, it did not experience severe operating environments, and thus was not considered to have failed.

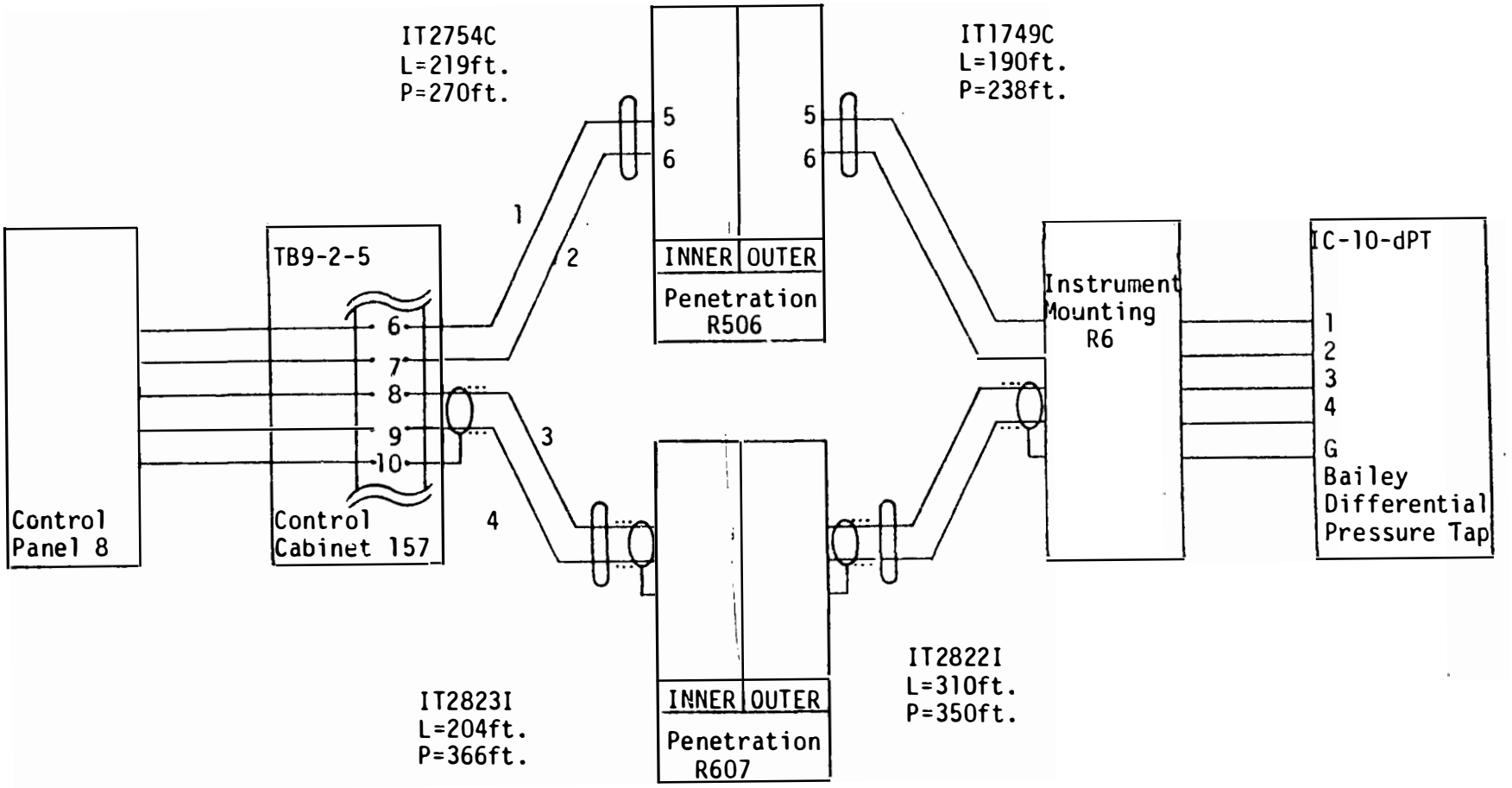


Figure 2-1. Composite Electrical Diagram for Control Rod Drive Bypass Flow IC-10-dPT

Table 2-1

TERMINATION POINTS FOR IC-10-dPT MEASUREMENTS

Signal	Cabinet 156 Identification*
+Signal	TB9-2-5/9
-Signal	TB9-2-5/8
Shield	TB9-2-5/10
118 VAC (H)	TB9-2-5/6
118 VAC (L)	TB9-2-5/7

*From cables IT2823I (signal lines) and IT2754C (118 VAC).

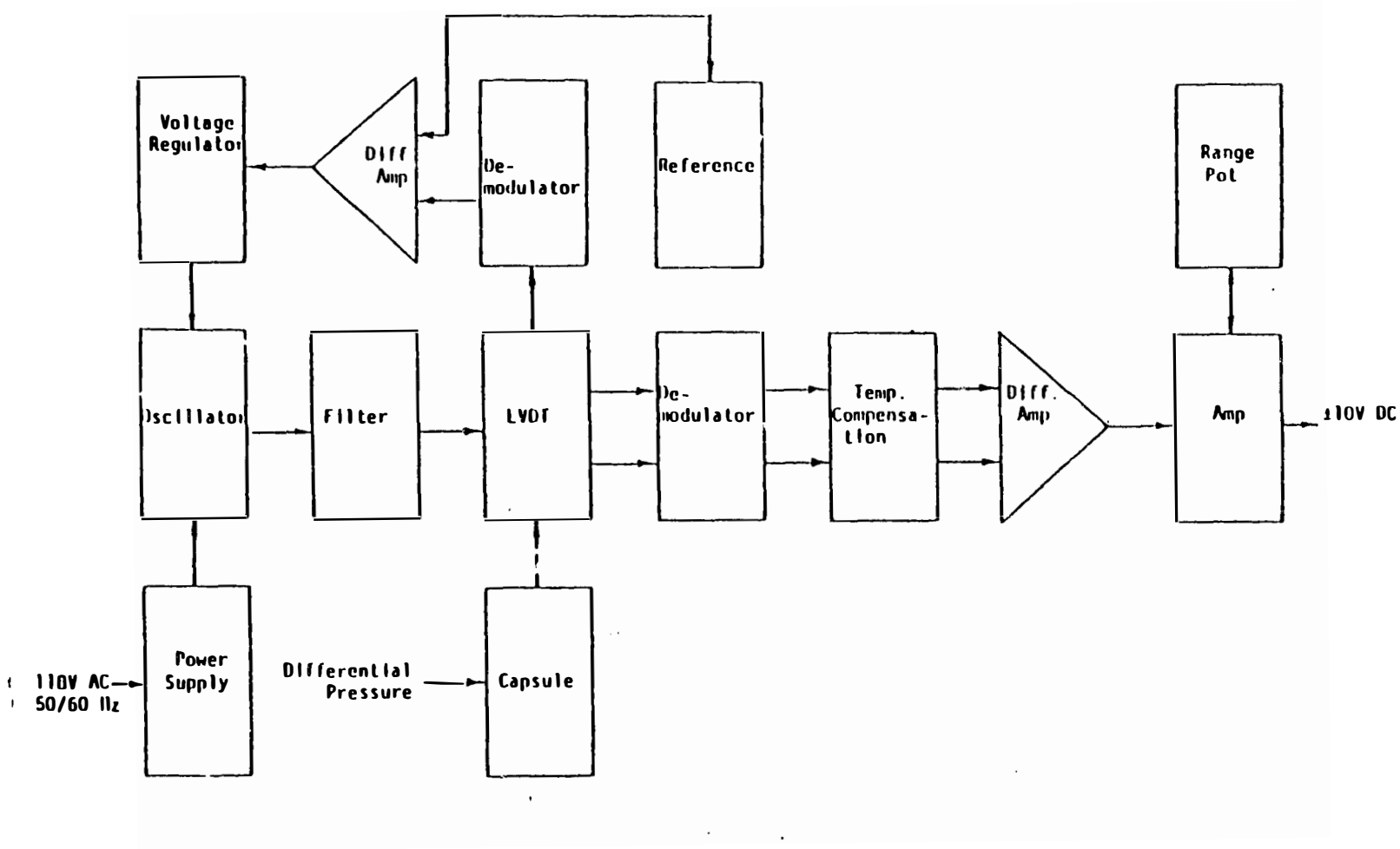


Figure 2-2. Functional Diagram of Bailey Type BY Differential Pressure Transmitter.

Section 3

PREPARATION OF MEASUREMENT PROCEDURES

As a result of generating the composite electrical diagram and from a review of the Bailey Meter Product Instruction E21-17 Manual, the major types of measurements to be performed were identified as:

1. Determine as-found condition of flow indication and record signal output.

2. Perform passive measurements (i.e., passively monitor signals) on each electrical connection consisting of time domain waveforms, very-high frequency spectrum analysis (i.e., MHz region), and frequency spectra below 100 kHz.

3. Perform resistance, capacitance, impedance, and Time Domain Reflectometry (TDR) active measurements (i.e., actively introducing a test signal).

These measurements were designed to verify the operation of the Readout Module and the power supplies, but the focus of the measurement was on the flow measurement assembly, cabling, and terminations/connections to the assembly. The Appendix contains the detailed procedure which was followed during the measurement program, and a summary of measurements is presented in the next section.

Section 4

MEASUREMENTS

Since the output of IC-10-dPT was designed to cover the range of -10 to +10 volts, the signal could be directly measured without amplification. Before performing measurements, the readout of IC-10-dPT indicated no flow for the control rod drive. The flow indication signal was then recorded for approximately 10 minutes on an FM recorder and the voltage outputs measured (with a DVM). The output of the flow signal was -10.8 VDC, and the power supply was 117 VAC.

The next measurements consisted of photographing the output waveforms of the flow signal and line voltage from a storage oscilloscope. Figures 4-1 and 4-2 show the results of these time trace measurements. Along with the time traces, both high and low frequency spectra (frequency domain) were taken of the flow signal. Figure 4-3 shows the measured spectra over both a 6 MHz and 1 MHz bandwidth, while Figure 4-4 shows spectra over both a 100 kHz and 1 kHz range.

Following the frequency spectra measurements, electrical calibration data was requested from the TMI Instrumentation Shop; however, this data was not available. Power was then removed from IC-10-dPT. The test fixture was removed and all signal lines from cables IT2823I and IT2754C to cabinet 157 were disconnected.

A series of active measurements (i.e., actively introducing a test signal into the circuit) was then performed. Table 4-1 shows the

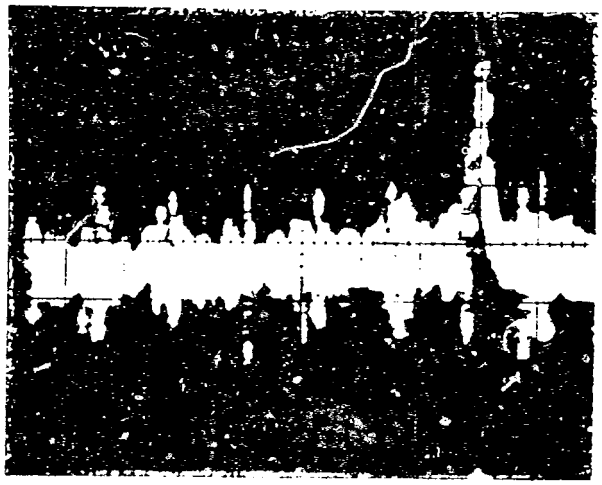


Photo 111-1

Time - 50μsec/div

Gain - 10 mV/div

Signal - SIGNAL

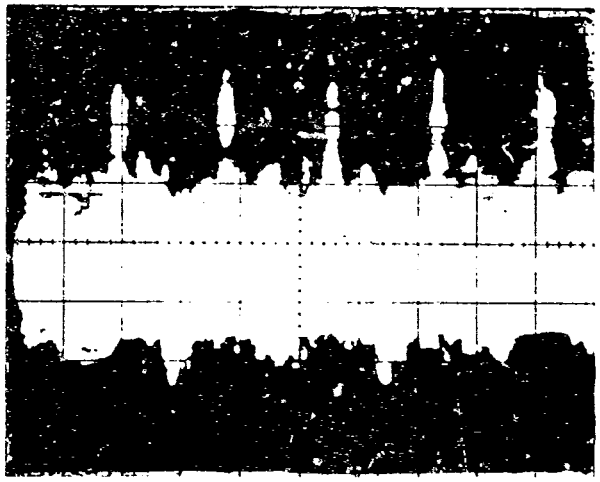


Photo 111-2

Time - 0.5msec/div

Gain - 10 mV/div

Signal - SIGNAL

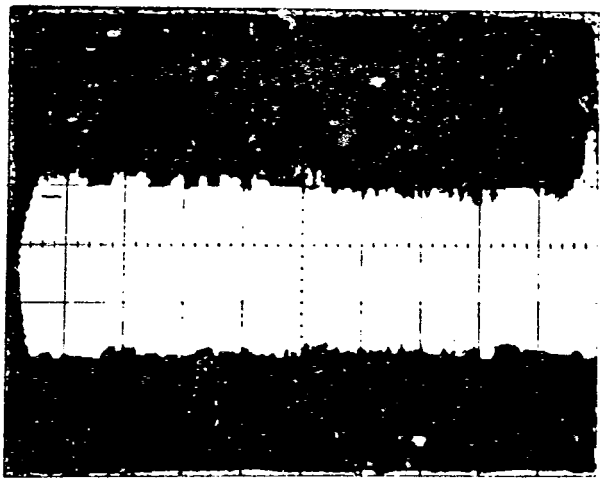


Photo 111-3

Time - 5msec/div

Gain - 10 mV/div

Signal - SIGNAL

Figure 4-1. Oscilloscope Traces of Flow Signal

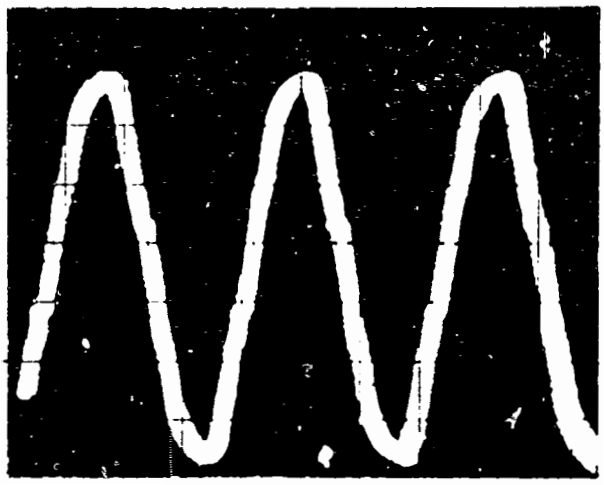


Photo 111-4

Time - 5msec/div

Gain - 5 V/div

X10 Probe

Signal - 118 VAC

Figure 4-2. Oscilloscope Trace of 118 VAC Supply

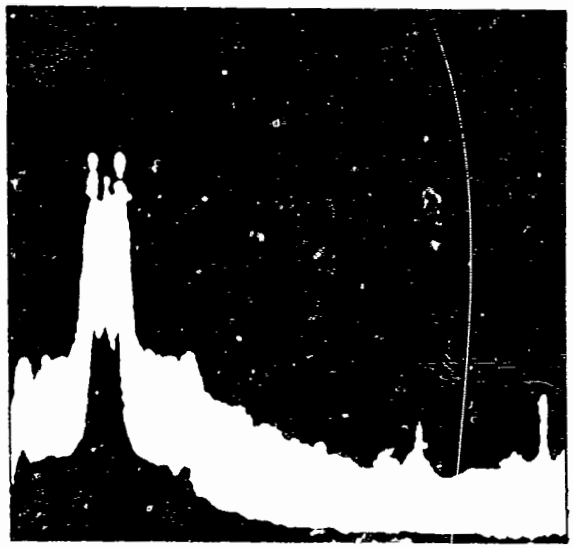


Photo 111-5

BW - 3 KHz

Scan width - 1 mHz/div

Scan time - 1 sec/div

Attn - 0

Log Ref - -20 db

SIGNAL

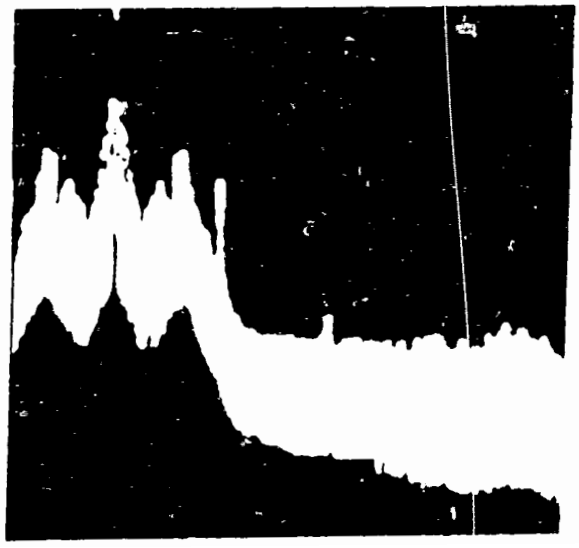


Photo 111-6

BW - 3 KHz

Scan width - 0.2 mHz/div

Scan time - 1 sec/div

Attn - 0

Log Ref - -20 db

SIGNAL

Figure 4-3. High Frequency Spectra of Flow Signal

0.00408 RMS

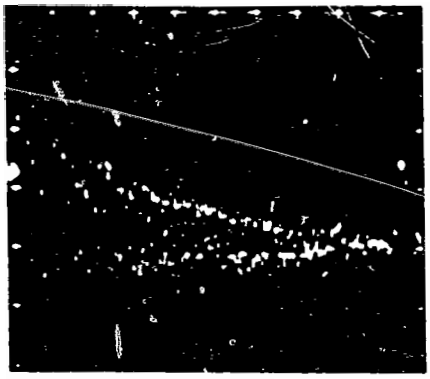


Photo 111-7

100 KHz Range

+20 db Reference

0.000543 RMS

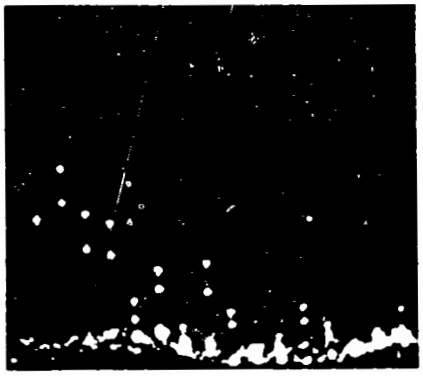


Photo 111-8

1 KHz Range

+20 db Reference

Figure 4-4. Low Frequency Spectra of Flow Signal

Table 4-1

CAPACITANCE, IMPEDANCE, AND RESISTANCE MEASUREMENTS

Signal	Capacitance (nF)*			Impedance (ohms)			Resistance (ohms)**
	100Hz	1kHz	100kHz	100Hz	1kHz	100kHz	
+Signal -Signal	22	20	15	4.3K	3.3K	104	6.7K (8.1K)
+Signal Shield	59	47	41	27K	3.3K	40	OF†
-Signal Shield	59	48	43	27K	3.2K	38	OF
118 VAC (H) 118 VAC (L)	-120	17	25	12K	9K	65	99 (99)
118 VAC (H) -Signal	0.9	0.6	-2.5	OF	OF	333	OF
118 VAC (H) Shield	0.9	0.6	-29	OF	OF	171	OF

*nF = Nanofarads.

**Values in parentheses are reverse polarity values.

†OF indicates overflow condition.

results of capacitance, impedance, and DC resistance measurements on some of the field cable lines (see Appendix page A-12 for a complete set). A set of TDR measurements were taken on the signal lines to determine possible cable defects. These TDR traces are shown in Figures 4-5 to 4-8.

STRIP CHART 111-i

IC-10-DPT

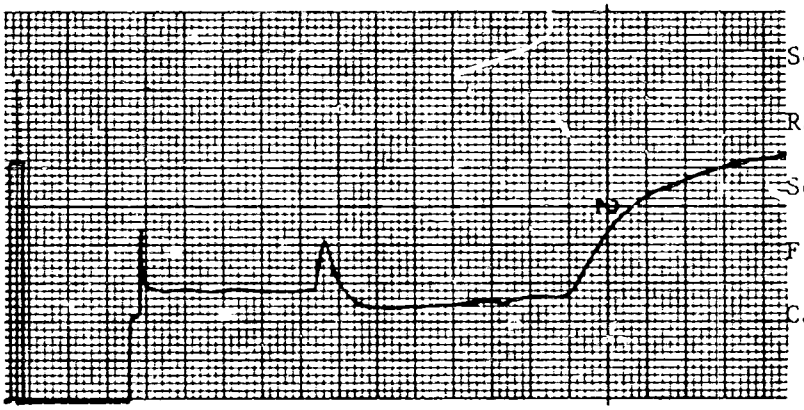
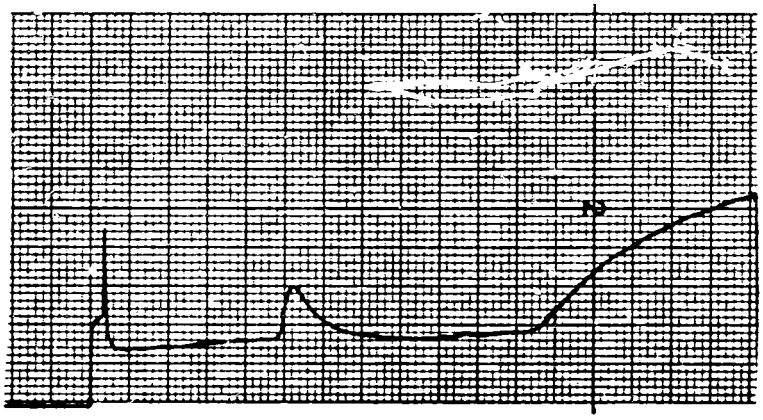


Figure 4-5. TDR Trace of Flow Signal Lines

STRIP CHART 111-2

IC-10-DPT



Setting - 500μρ/div

Range - 52.6 ft/div

Sensitivity - 0.25

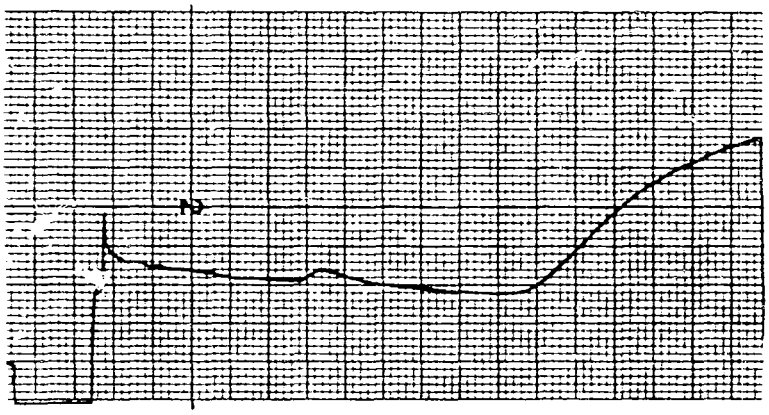
Filter - 15 Hz

Cable dielectric - poly

Figure 4-6. TDR Trace of (+) Signal to Shield

STRIP CHART 111-3

IC-10-DPT



Setting - 500μρ/div

Range - 52.6 ft/div

Sensitivity - 0.25

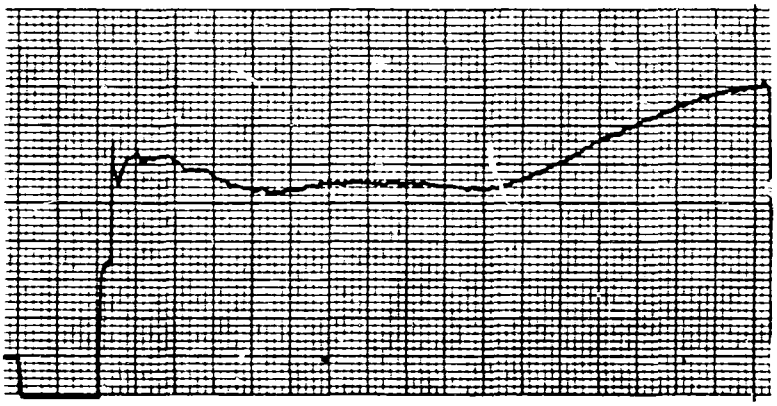
Filter - 15 Hz

Cable dielectric - other

Figure 4-7. TDR Trace of 118 VAC Lines

STRIP CHART 111-4

IC-10-DPT



Setting - 500μρ/div

Range - 52.6 ft/div

Sensitivity - 0.25

Filter - 15 Hz

Cable dielectric - other

Figure 4-8. TDR Trace of 118 VAC (H) to Shield

Section 5

INTERPRETATION OF MEASUREMENTS

This section presents a summary of the interpretation of the measurements taken on IC-10-dPT. This interpretation is intended to indicate the condition of the device based on observed data.

Since this device varies from -10 to +10 volts for a 0 to 200 GPM range, the observation of 0 flow readout indicates that the voltage should be -10 volts. The measured value of -10.8 volts is below this expected value, which could indicate a problem in the instrument or could be a slight offset problem at low flow rates (i.e., no flow). The 117 VAC value on the power supply line is also well within a normal operating range.

The time traces and frequency spectra do not indicate any serious contamination which would affect the DC readout. Table 5-1 lists the low level AC components present on the flow signal. Note that even though up to 50 mV P-P fluctuations are present, readout devices normally respond at low frequencies. As a result, the worst-case effect of these AC variations is likely to be less than the 0.5 mV RMS value given for the 60 Hz components.

One feature of the frequency spectrum of the flow signal gives an indication that the differential pressure LVDT (see Figure 2-2) is operating. Since the LVDT AC output is "demodulated" by a full-wave rectifier and Resistance-Capacitance (RC) smoothing, a low level ripple must be present at the frequency of the internal oscillator. The

Table 5-1

MAJOR AC COMPONENTS ON THE FLOW SIGNAL

Frequency	Amplitude
60 Hz and harmonics	0.5 mV RMS
1 kHz and harmonics	4 mV RMS
96 kHz	1 mV RMS
200 kHz (broadband)	<1 mV RMS
Total Spectrum	50 mV P-P

oscillator for this type device operates at approximately 1000 hertz and the component values of the RC smoothing circuit (R = 100k ohms, C = 0.68 μF) would produce a ripple factor (fraction of AC RMS fluctuations) of 0.001. This would indicate that the expected ripple would be in the millivolt range. From Table 5-1, this AC ripple value was measured to be 4 mV, which is reasonable.. Also, the reduction in amplitude of the higher harmonics (see Figure 4-4) is consistent with the expected attenuation of a rectified signal.

The capacitance, impedance, and resistance data given in Table 4-1 is difficult to quantitatively interpret, but qualitative results are possible. Most of the data indicates very low effective capacitance values, which would be expected from the amplifier section of the transmitter. However, the 118 VAC (H) to 118 VAC (L) measurement passes through the primary of a transformer. This creates an inductance which appears as negative capacitance at the 100 hertz measurement.

The presence of a 10,000 ohm resistor in the transmitter amplifier and the absence of other direct electrical paths indicates that a resistance measurement near this value should be obtained. The measured values for the flow signal were 6700 and 8100 ohms for two polarities. The variation would be caused by active electrical components, and the values are of the magnitudes expected. Since the expected responses are present, there is no obvious indication of instrumentation degradation from these measurements.

The results of TDR measurements performed on the cable (shown in Figures 4-5 to 4-7) are summarized in Table 5-2. Note that the lengths identified in the table are only approximate, since no calibration of the cable resistance and material composition was performed on the TDR instrument. Some junction points were not identified by these measurements, but no indication of cabling problems is present in this data.

Table 5-2

SUMMARY OF TDR MEASUREMENTS

Signal Lines	Distance* (ft)	Description**	Probable Cause
+Signal	232	Point R increase	Penetration R607
-Signal	489	Point R small decrease	Terminal block
	579	Large R increase	Electronics
+Signal	221	Point R increase	Penetration R607
Shield	479	Point R small increase	Terminal block
	574	Large R increase	Electronics
118 VAC (H)	274	Point R increase	Penetration R506
118 VAC (L)	579	Large R increase	Electronics

Note: Distances are not calibrated due to lack of prior information on the cable type which prevented calibration tests.

*TDR to terminal block test cable (15 ft) not included in distance.

**R is the abbreviation for resistance.

Section 6

CONCLUSIONS

Based on the measurements, data reduction, and circuit analysis of IC-10-dPT, there is no indication of degradation of the instrument. The only significant contamination present in the pressure signal that appeared to be abnormal was the 96 kHz component. However, the amplitude of this signal was relatively low and, from other measurements performed at TMI, this low-level 96 kHz component is probably due to a widespread 16 kHz (with harmonics) signal found in various circuits. In addition to the observation of no abnormal characteristics of the instrument, the low level oscillator ripple on the level signal indicates that the LVDT is working. Therefore, it appears that IC-10-dPT is operating correctly, but these measurements could not determine whether the instrument is calibrated.

APPENDIX

ORIGINAL FIELD PROCEDURES AND DATA SHEETS FOR IC-10-dPT

208-8

GENERATION CORRECTIVE MAINTENANCE SYSTEM
JOB TICKET FORM

Page A-1

REE MILE ISLAND UNIT 2

COMPONENT DESIGNATION SYS	COMP TYPE	COMP ID	LOOP	LOCATION/UNIT	JOB TYPE	REQUEST NUMBER	REQUEST DATE MO DAY YR	RECOMMENDED PRIORITY
IC	DPT	0010		0360	02CM	C5	092280	2

DESCRIBE MALFUNCTION OR MODIFICATION DESIRED

Perform attached procedure.

CAUSE OF MALFUNCTION (IF KNOWN)

ORIGINATOR'S EMP NO.	ORIGINATOR'S SIGNATURE	DATE	SUPERVISOR'S EMP NO.	SUPERVISOR'S SIGNATURE	DATE
06175	J Brunie	9/22/80	06175	J Brunner	9/22/80

DOE/EG&G Project

WORK ORDER NUMBER LOCATION	SERIAL	QC CODE	ACCOUNT NUMBER	PLANT CONDITION SU OP MD CO RF MS LR	PROD FAILURE YR MO DAY	START HR MIN
0360	018764		7E74015	/ / / / / / /		

CHANGE MOD REQ'D	EA	SAFETY	REG AGENCY CODE	CHG/MOD NUMBER	ENV CODE	OUTAGE CAUSE CODE	STATUS HOLD CODE
D	C	O	G		X		

QA APPROVAL TO COMMENCE WORK MO DAY YR	RESP LOCATION OR CONTRACTOR
	2036M

Location Cable Room elev 305', Control Building

Comply with [illegible]
set forth in [illegible]
Met Ed Safety Manual

Limits and Precautions:

a) Personnel

b) Equipment

c) Environment

d) Nuclear

Post Maintenance Testing required and Acceptance Criteria. ENSURE WORK AREA CLEANED UP AT COMPLETION OF JOB

[illegible] SUPERVISOR [illegible] SUPERVISOR OF MAINTENANCE — MAINTENANCE FOREMAN

COPY 1

JOB TICKET (WORK REQUEST)
REVIEW – CLASSIFI[illegible]IG CONTROL FORM

JOB TICKET NUMBER [illegible]

1. Does work represent a change or modification to an existing system or component? If yes, an approved change modification is required per AP 1021.
   C/M No. [illegible] Yes ____ No ✓

2a. Does work requires an RWP? Yes ____ No ✓

2b. Is an approved procedure required to minimize personnel exposure? Yes ____ No ✓

3a. Is work on a QC component as defined in GP 1008? Yes ____ No ✓

3b. If 3a is yes does work have an effect on Nuclear Safety? If 3b is yes, PORC reviewed Superintendent approved procedure must be used. Yes ____ No ✓

4. Agreement that a PORC reviewed, Superintendent approved procedure is not required for this work because it has no effect on nuclear safety. (Applies only if 3a is Yes and 3b is No).

N/A
UNIT SUPERINTENDENT ____ DATE

5a. Is the system on the Environmental Impact list in AP 1026? Yes ____ No ✓

5b. If 5a is YES, is an approved procedure required to limit environmental impact? Yes ____ No ✓

6. Agreement that 5b is No (Required only if 5a is Yes).

N/A
UNIT SUPT SUPV OF OPERATIONS ____ DATE

7. Plant status or prerequisite conditions required for work. (Operating and/or shutdown)

8. QC Dept. review, if required in item No. 3

N/A
QC SUPERVISOR ____ DATE

9. Does work require code inspector to be notified? Yes ____ No ✓

10. Supervisor of Maintenance approval to commence work.
    [signature] Date 9/22/80

11. Maintenance Foreman Assigned: ____

12. Code Inspector Notified. Name: ____ Date ____

13. Shift Foreman's approval to commence work: [signature] Date 9/23/80

____ Initial if Shift Foreman signature is not required.

Technology for Energy Corporation	TITLE IN-SITU MEASUREMENTS OF CABLES AND SIGNALS FROM DIFFERENTIAL PRESSURE ~~TRANSDUCER~~ TRANSMITTER IC-10-DPT (CONTROL ROD DRIVE HDR BYPASS FLOW)	NO. TP-111
	Page A-3	REV. 0
PROCEDURE	APPROVED M.V. Mathis, Director, Tech. Serv. Div.	DATE 9-15-80

PURPOSE: The purpose of these measurements is to gather baseline data and information in preparation for removal of the Differential Pressure Transducer IC-10-DPT from the Reactor Building TMI Unit 2. The tests specified in this procedure are designed to assess the condition of the in-containment instrumentation, associated cabling, and readout devices. This assessment will require the use of Time Domain Reflectometry (TDR), Impedance (Z), Spectral Analysis (frequency domain), and general oscilloscope observations (with recording) of waveforms from/to the unit under test (UUT).

PROCEDURE (ADMINISTRATIVE):

A. Limitations and Precautions

1. Nuclear Safety. The unit is not considered part of the engineered reactor safeguards system and thus is not nulcear safety-related.

2. Environmental Safety. ~~Source Range Detector Preamplifier NI-AMP-2~~ CONTROL ROD DRIVE HDR BYPASS FLOW TRANSMITTER IC-10-DP can be taken out-of and restored to services without producing a hazard to the environment.

3. Personnel Safety. The test described herein produces no additional personnel safety hazards other than normally associated with performing instrument testing.

4. Equipment Protection. In the performance of each test described herein, care will be taken to insure adequate equipment protection as follows:

   a. In all cases actual test hookups to the Unit-2 instrumentation shall be made and verifi d by Instrumentation Personnel.

   b. All passive measurements (Spectral Analysis and Oscilloscope observations) of waveforms and signals from powered instruments shall be performed using high input impedance probes or inputs ($Z = \geq 1$ Meg ohm) to prevent loading of signals.

   c. In all Time Domain Reflectometry and Impedance measurements, power will be removed from the unit under test and low level test signals prescribed in Table 4-1 shall be utilized to perform cable integretary measurements on the appropriate instrumentation cables by inserting test signals on appropriate co.ductors of Cables

WORK REQUEST PROCEDURE

ion

Maintenance Page A-4 t and Approval

Unit No. 2

This form outlines the format and acts as a cover sheet for a maintenance procedure. Due to the limited size of the form, additional pages may be attached as required. Work Request procedure AP 1016 Section 6 should be used as a guide in preparing the maintenance procedure.

1. Procedure Title & No.:

Sensor/Cable measurements for Control Rod Drive Bypass Flow

2. Purpose: To determine signal characteristics of sensor/cable.

3. Description of system or component to be worked on.

IC-10-dPT

4. References:

See attached

5. Special Tools, and Materials required.

See attached

6. Detailed Procedure (attach additional pages as required)

See attached

Supervisor of Maintenance recommends approval [signature] Date 9/22/80

Engineering Review [signature] Date 9/22/80

* PORC RECOMMENDS APPROVAL

Unit No. 1 Chairman _____ Date _____ Unit No. 2 Chairman _____ Date _____

* UNIT SUPERINTENDENT APPROVAL

Unit No. 1 _____ Date _____ Unit No. 2 _____ Date _____

* Standing Procedure _____ _____

Supervisor of QC Date

*Note These approvals required only on Nuclear Safety Related/Radiation work permit jobs.

IT2754C and IT2825I (terminations shall be removed and replaced on TB 9-2-5 of Cabinet 157).

Table 4-1 Active Measurements

Active Signal Parameter	Time Domain Reflectometry	Impedance
Voltage	225 mV nominal (into 50 ohm base)	$\leq$ 5V rms
Frequency	---	100Hz, 1kHz, 10kHz, 100kHz
Current	$\leq$ 10mA	$\leq$ 100mA
Other	225mV, 110 picosecond pulses	---

B. Prerequisites

1. The Shift Supervisor/Shift Foreman shall be notified for concurrence prior to the performance of those measurements.

2. Instrumentation personnel shall be assigned to assist in the performance of these measurements.

3. All measurements and test instrumentation shall be in current calibration (traceable to NBS).

4. The Shift Supervisor/Shift Foreman shall be notified prior to starting and upon completion of the measurements.

C. Procedure for Performing Measurements

References:

1. Instruction Manual for Bailey Differential Pressure Transducer, BY8230X-A.

2. Burns & Roe Dwg. 3045, Sh. 346.

3. Burns & Roe Dwg. 3305, Sh. 7.
4. Burns & Roe Dwg. 3024, Sh. 54.
5. Burns & Roe Dwg. 3045, Sh. 26F.
6. Burns & Roe Dwg. 3045, Sh. 36h.
7. Instruction Manual, Tektronix Model 1502 Time Domain Reflectometer.
8. Instruction Manual, Hewlett Packard Model 4274 Multifrequency LCR Meter.
9. Instruction Manual, Hewlett Packard Spectrum Analyzer (Model 141T, 85538, 8552B Modules).
10. Instruction Manual, Nicolet Model 444A-26 Spectrum Analyzer.
11. Instruction Manual, Tektronix Model 335 Oscilloscope.
12. Instruction Manual, Lockheed Store-4 Recorder.
13. Instruction Manual, Tektronix SC502 Oscilloscope.
14. TEC Composite Electrical Connection Diagram, IC-10-DPT (see attachment).

SIGNAL	CABLE	CABINET 157
118 VAC (H)	IT2754C	TB 9-2-5/6
118 VAC (L)	IT2754C	TB 9-2-5/7
- Signal	IT2826I	TB 9-2-5/8
+ Signal	IT2825I	TB 9-2-5/9
Shield	IT2827I	TB 9-2-5/10

1. Notify Shift Supervisor/Shift Foreman of start of test on IC-10-DPT.
2. Verify power is applied to IC-10-DPT.
3. Record present reading from IC-10-DPT.

Signature/Date

SIGNAL	READING IN ~~INCHES~~
IC-10-DPT Readout	Ø FLOW

SYSTEM SHUT DOWN

4. Connect Isolation Amplifier (TEC Model 901) to TB 9-2-5/8&9 (Signal) in Cabinet 157 and record signal for 30 minutes. Remove recorder and amplifier when complete.

5. Using a Keithley Model 177 DMM (or equivalent, Range 0-2000 V, Precision ± 1%) measure the Voltage or current at the following test points.

SIGNAL	CABINET 157	TEST LEAD	READING
a.	TB 9-2-5/9 TB 9-2-5/8	(+) (-)	Signal −10.86 (VDC)
*b.	TB 9-2-5/6 TB 9-2-5/7	(+) (-)	118 VAC 116.6 VAC

*CAUTION: 118 VDC

Signature/Date

6. Using a Tektronix Model SC502 (or equivalent) oscilloscope observe the waveform at the following test point:

SIGNAL	CABINET 157	PARAMETER			
a.	TB 9-2-5/9 TB 9-2-5/8	SIGNAL	Photo III-1 Time Base 50mS Vert Gain 10mV	Photo III-2 Time Base 5mS Vert Gain 10mV	Photo III-3 Time Base 5mS Vert Gain 10mV
*b.	TB 9-2-5/6 TB 9-2-5/7	118 VAC	Photo III-4 Time Base 5mS Vert Gain 5V	Photo _____ Time Base ____ Vert Gain ____	Photo _____ Time Base ____ Vert Gain ____

*CAUTION 118 VAC at TB 9-2-5/6 & 7; use X10 probe.

Sync the oscilloscope and photograph the waveform using up to three time base and vertical gain settings. Mark the back of the photographs with the instrument tag number and parameter measured.

T S 9/23/80
Signature/Date

7. Using a Hewlett-Packard Spectrum Analyzer (Models 141T, 8553B and 8552 or equivalent) perform an analysis of the following signal for spectral content:

SIGNAL	CABINET 157	PARAMETER	PHOTO #
*a.	TB 9-2-5/9 TB 9-2-5/8	SIGNAL	III-5 III-6

*CAUTION 118 VAC at TB 9-2-5/6&7.

Before photographing each scope display, adjust analyzer for best spectral resolution. Record critical analyzer parameters e.g., RF bandwidth, RF bandwidth and sweep speed on rear of photograph as well as parameter analyzed.

SPECTRUM IDENT	FREQUENCY	AMPLITUDE	REMARKS

BANDWIDTH	SCAN WIDTH	INPUT ATTEN	SCAN TIME	LOG REF 10 db LOG	SENS	PHOTO
3 KHz	1 MEG Hz/DIV	0	1 SEC	-20 db	0	III-5
"	0-2 MEG Hz/DIV	"	"	"	"	III-6

Signature/Date 9/23/80

8. Using the Nicolet Model 444 FFT Analyzer (or equivalent) perform FFT annalysis of signals for the following test point:

SIGNAL	CABINET 157	PARAMETER	PHOTO #
*a.	TB 9-2-5/9 TB 9-2-5/8	SIGNAL	III-7 III-8

LOOK RANGE

*CAUTION 118 VAC at TB 9-2-5/6&7.

Signature/Date 9/23/80

9. Inside Cabinet 157 perform usual electronic calibrations using applicable instrument shop procedures. Attach instrument shop calibration data sheet and record any significant adjustments or problems in the space below.

Procedure Step	Remarks
See attached instrument shop procedure data sheet.	

Instrument Shop Procedure No. _____

_____
Signature/Date

10. Remove all power from IC-10-DPT.

[signature] 9/23/80
Signature/Date

11. Open links for field wires from Cables IT2754C* and IT2825I at TB 9-2-5/6, 7, 8, 9, and 10 (Cabinet 157).

*CAUTION: 118 VAC Power Supply Cable (TB 9-2-5/6&7).

TERMINAL	SIGNAL IDENT.
TB 9-2-5/6	118 VAC (H)
TB 9-2-5/7	118 VAC (L)
TB 9-2-5/8	- Signal
TB 9-2-5/9	+ Signal
TB 9-2-5/10	Shield

Signature/Date

12. Using the Hewlett-Packard Model 4274 (or equivalent) Impedance Bridge, measure the capacitance and impedance at the following test points:

TEST POINT	FROM	TO
a.	TB 9-2-5/9 (+ Signal)	TB 9-2-5/8 (- Signal)
b.	TB 9-2-5/9 (+ Signal)	TB 9-2-5/10 (Shield)
c.	TB 9-2-5/8 (- Signal)	TB 9-2-5/10 (Shield)
d.	TB 9-2-5/6 (118 VAC H)	TB 9-2-5/7 (118 VAC L)
e.	TB 9-2-5/6 (118 VAC H)	TB 9-2-5/9 (+ Signal)
f.	TB 9-2-5/6 (118 VAC H)	TB 9-2-5/8 (- Signal)
g.	TB 9-2-5/6 (118 VAC H)	TB 9-2-5/10 (Shield)

Record the data required below:

Test Point	Capacitance			Impedance		
Frequency	100 Hz	1 kHz	100 kHz	100 Hz	1 kHz	100 kHz
a. TB 9-2-5/9:8	22.3nf	19.8nf	14.9 nf	4.3K/-34°	3.3K/-21°	104Ω/-78°
b. TB 9-2-5/9:10	59 nf	47nf	40.8 nf	27K/-86°	3.3K/-75°	40Ω/-76°
c. TB 9-2-5/8:10	59 nf	48nf	43 nf	27K/-86°	3 2K/-76°	37.7Ω/-75°
d. TB 9-2-5/6:7	10 nf 130nf	17nf	25 nf	12K/-55°	9K/-80°	65Ω/-79°
e. TB 9-2-5/6:9	0.9 nf	.59nf	-2.4nf	OF	OF	359Ω/147°
f. TB 9-2-5/6:8	0.9nf	.59nf	-2.5nf	OF	OF	353Ω/148°
g. TB 9-2-5/6:10	0.9 nf	.63ns	-29 nf	OF	OF	171Ω/161°

Put 15ft of coaxial cable RG/58 to series for above measurement

Signature/Date

13. Using the Tektronix Model 1502 (or equivalent) TDR unit peform TDR measurements on three test points.

Record data below:

Test Point	Instrument Settings Ampl Range Mult	Strip Chart Number
a. TB 9-2-5/9:8 (± Signal)		111-1
b. TB 9-2-5/9:10 (+ Signal: SHLD)		111-2
c. TB 9-2-5/6:7 (118 VAC)		111-3
d. TB 9-2-5/6:10 (118 VAC: SHLD)		111-4

T S [illegible] 9/23/80
Signature/Date

14. Using the Keithley Model 144 (or equivalent DMM) perform resistance measurements on the test points specified and record values in the space provided.

TEST POINT	FROM LINK	TP LINK	POLARITY From = -; To = - RESISTANCE	POLARITY From = -; To = + RESISTANCE
a.	TB 9-2-5/9	TB 9-2-5/8	6.7KΩ	8.1KΩ
b.	TB 9-2-5/9	TB 9-2-5/10	OPEN	OPEN
c.	TB 9-2-5/8	TB 9-2-5/10	OPEN	OPEN
d.	TB 9-2-5/6	TB 9-2-5/7	98.9Ω	98.9Ω
e.	TB 9-2-5/6	TB 9-2-5/9	OPEN	OPEN
f.	TB 9-2-5/6	TB 9-2-5/8	OPEN	OPEN
g.	TB 9-2-5/6	TB 9-2-5/10	OPEN	OPEN

20K RANGE

T S [illegible] 9/23/80
Signature/Date

15. Connect field wires from Cables IT2754C* and IT2825I at TB 9-2-5/6, 7, 8, 9, and 10 (Cabinet 157) and restore power to IC-10-DPT.

16. Notify the Shift Supervisor/Shift Foreman of the conclusion of testing ~~XT-AMP-2.~~ IC-10-dPT.

I hereby certify that this Test Procedure has been completed as written and that all data has been correctly entered and filed as requested.

TEC Representative _____ 9/23/80
Signature/Date

Instrumentation _____ 9/23/80
Signature/Date

GENERATION CORRECTIVE MAINTENANCE SYSTEM

CM STATUS ACTIVITY FORM

COMPONENT DESIGNATOR				LOCATION UNIT	JOB TYPE	WORK AUTHORIZATION NUMBER	REQUEST DATE		
SYS	COMP TYPE	COMP ID.	LOOP				MO	DAY	YR
5	8	12	16	17 22	23 24	28 32	33		38
T C	P T	0 0 1 D		0 3 6 0 0 2	C M	C S 7 1 2	0 9	2 0	8 0

TXN CD	ACT
1	4
8 0 4	A

ECM NUMBER
47 51

TXN CD	ACT
1	4
8 0 5	A

PRTY	RESP LOCATION OR CONTRACTOR	PRTY	ASSISTING CONTRACTOR	PRTY	ASSISTING CONTRACTOR
66	67 71				
C	0 3 6 N				

TXN CD	ACT
1	4
8 0 7	A

PURCHASE REQUISITION NUMBER	PURCHASE ORDER NUMBER
59 66	67 73

TXN	ACT
1	4
8 1 0	A

STATUS HOLD CODE	STATUS HOLD START DATE	STATUS HOLD RELEASE DATE	% COMPL	S/M APPROVAL TO COMMENCE WORK MO DAY YR	FIELD WORK COMPLETION DATE MO DAY YR	
39 40	41 45	47 52	53 55	56 61	62 67	
0 1						OUTAGE HOLD
0 2						PART HOLD
0 3						QUALITY CONTROL PART HOLD
0 4						QUALITY CONTROL PROCEDURE HOLD
0 5						OPERATIONS HOLD
0 6						CHANGE MODIFICATION HOLD
0 7						ENGINEERING HOLD
0 8						PLANNING HOLD
5 0						MANPOWER NOT AVAILABLE
5 1						AT PORC
5 2						AT QUALITY CONTROL
5 3						AT UNIT SUPERINTENDENT
5 4						AT READING
5 5						POST MAINTENANCE TEST HOLD
5 6						AT ALARA