



FORT ST. VRAIN NUCLEAR GENERATING STATION  
PUBLIC SERVICE COMPANY OF COLORADO

SR-TE-9-X  
Issue 1  
Page 1 of 28

TITLE: <u>INSERTED ROD POSITION VERIFICATION</u>			
DEPARTMENT: <u>Technical Services</u>			
ISSUANCE AUTHORIZED BY	<u>[Signature]</u>		
PORC REVIEW	<u>PORC 629 JUL 12 1985</u>	EFFECTIVE DATE	<u>7-17-85</u>

Do not start test before \_\_\_\_\_ Week # \_\_\_\_\_  
and must be completed by \_\_\_\_\_ Sch. Clerk

This procedure cannot be run in its entirety for the following reasons:

- \_\_\_\_\_ 1. This system is not operating.
- \_\_\_\_\_ 2. This system is not required to be operating and has a frequency of one month or less (reference Technical Specification, paragraph 2.18).
- \_\_\_\_\_ 3. Reactor is in "scrammed" condition.
- \_\_\_\_\_ 4. Loop I is in "Loop Shutdown" condition.
- \_\_\_\_\_ 5. Loop II is in "Loop Shutdown" condition.
- \_\_\_\_\_ 6. 1A Helium circulator is in "tripped condition".
- \_\_\_\_\_ 7. 1B Helium circulator is in "tripped condition".
- \_\_\_\_\_ 8. 1C Helium circulator is in "tripped condition".
- \_\_\_\_\_ 9. 1D Helium circulator is in "tripped condition".
- \_\_\_\_\_ 10. Other \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_ 11. Reschedule test for \_\_\_\_\_

\_\_\_\_\_  
Department Supervisor

8508200525 850731  
PDR ADOCK 05000267  
P PDR

## 1.0 PURPOSE

\*\*\*See Commitment 11.1\*\*\* Establish "in" rod position for control rod pairs with inoperable position indication per FSV Technical Specifications.

## 2.0 PRECAUTIONS, LIMITATIONS, AND SPECIAL ASSISTANCE

### Precautions:

- 2.1 If either "in" limit light does not actuate upon full insertion and/or analog/digital position indication is not present, extreme care must be used to avoid over-driving the rod in the "in" direction, thereby causing equipment damage.

Station Manager notification needed for the last phase due to potential equipment damage.

- 2.2 Communications between the control room and the person performing the test must be maintained to follow the test instructions.

- 2.3 Wattage instrumentation installed and tested is intended for use. Other instrumentation must be used only with extreme caution.

### Limitations:

- 2.4 The test provides most conclusive results under shutdown, cooled down, depressurized conditions.

It is not intended that this test be run at power, although it is technically possible.

- 2.5 The wattmeter/recorder used requires a precision of 1 watt to be successfully used to perform this test. Precision is determined by repeating the measurement and determining the data range over which the same measurement falls. If recording paper is used, an engineering rule may be used to establish precision.

- 2.6 The wattmeter must have a response time able to discriminate the initial starting transient (approximately one second or less).

These equipment characteristics should be verified on a known inserted rod if any question on equipment capability occurs.

Refer to the equipment list for equipment meeting these requirements (Att. D.)



Special Assistance:

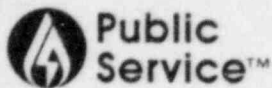
- 2.7 TA's or other proficient (demonstrated) individuals are required to perform the test.
- 2.8 RO's are required to perform indicated rod shims.
- 2.9 If equipment other than permanent wattmeter transducers/recorders installed in the Fuel Handling Machine Control room is used, an electrician will be required to implement a TCR which will install the watt recorder.

3.0 PREREQUISITES

3.1 Test Equipment

Name	Identification No.	Last Calibration Date
Wattmeter		
(Transducer/Recorder):		
RXMCC #1 (or equivalent)		
RXMCC #2 (or equivalent)		
Stop Watch		

- 3.2 References P-85032 - PSC response to NRC on "14 Man Audit" items; attachment: Wattmeter Testing - TSP-30 (Proposed) and the accompanying engineering justification.



4.0 AUTHORIZATIONS

4.1 Departmental Approval

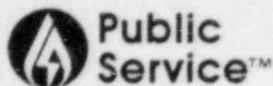
Dept. Supervisor \_\_\_\_\_ Date \_\_\_\_\_

4.2 Mech/Elec Clearance Issued, if required: Number \_\_\_\_\_

4.3 Radiation Work Permit Issued, if required: Number \_\_\_\_\_

4.4 Permission to initiate test

Shift Supervisor \_\_\_\_\_ Date \_\_\_\_\_



5.0 PROCEDURE

5.1 TEST PROCEDURE - INITIAL CONDITIONS

5.1.1 Recording wattmeter is connected to the CRDMCC with the Region(s) to be tested.

5.1.2 If the wattmeter is not connected to the desired CRDMCC obtain a TCR through the Results Department and request an electrician to connect as required.

5.1.3 Insure the wattmeter is operational. (Turn power "on", check to see pen is correctly set and inking, and adequate chart paper is installed, or perform other checks as appropriate for the instrument.). Zero the instrument or otherwise identify "zero" level, once the wattrecorder is on. All following references to wattage are with respect to this "zero" level, if the wattrecorder is not exactly zeroed.

5.1.4 Verify the wattmeter calibration date and record.

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Test Conductor Signature

\_\_\_\_\_  
Date



5.1.5 Obtain a calibrated stopwatch and record calibration date if available; a calibrated stopwatch is preferred but not required as time sequences have no bearing on the conclusion and are for equipment protection.

5.1.6 Attach a voltmeter (multimeter) in the voltage measurement mode across the individual phase-phase terminals for phases AB, BC, and AC. Record voltages (see Att. A) N/A if voltage recording device installed.

AB BC AC

5.2.7 Periodically monitor voltage across one phase to ground. N/A if voltage recording device installed.

## 5.2 PRELIMINARY CHECKS

5.2.1 Perform a check-out of the wattmeter recorder using a problem-free (test) rod to verify basic function of the instrument and check channels (RXMCC #1 and RXMCC #2).

Acceptance Criteria: Discernable starting peak with decay to a lower value over a 5 to 10 second interval.

Test Conductor Signature

Date



5.3 TEST PROCEDURE - PROCUREMENT OF DATA

5.3.1 WARNINGS:

- a) Testing will normally only be done while shutdown.
- b) The requirements of SOP 12-02 must be met:

Not more than 2 CRDOA absorber pairs at positions other than fully inserted, including those of any CRDOA removed from the reactor (i.e., if any CRDOA is removed, its absorber pairs must be considered fully withdrawn).

- 5.3.2 Request Shift Supervisor's permission to perform shim motor wattage test. Identify Region involved and reason.

Region \_\_\_\_\_

Purpose \_\_\_\_\_

- 5.3.3 Review Attachment B to become familiar with watt recorder interpretation.

- 5.3.4 Request Reactor Operator to notify Shift Supervisor and then exercise or shim the desired control rod pair.

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Test Conductor Signature

\_\_\_\_\_  
Date



5.4 TEST PROCEDURE - IN POSITION DETERMINATION - LEVEL 1

5.4.1 Perform the following while  
obtaining watt recordings:

Sequence a

a) Scram the rod pair (pull  
the fuse, scram the  
Reactor, etc., as  
appropriate).

b) Shim "out" for 15  
seconds. (This will not  
have a significant  
effect on core  
reactivity since the  
total rod travel will be  
about 16 inches.)

Record time of "out" shim:

                                      
a                  b                  c

c) Shim "in" for the exact  
time recorded above.  
The rod pair should  
again be at the fully  
inserted position.

Sequence b

d) Repeat steps 5.4.1 a) -  
5.4.1 c) above.

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



Sequence c

- e) Repeat steps 5.4.1 a) -  
5.4.1 c) above.

- f) Scram the rod pair.

5.4.2 Evaluate as follows:

NOTE: For an inserted rod pair, the cable drum must wrap to raise the rod pair. As this occurs motor load will increase. For the "out" shims above, a wattage trace which shows an increasing 'steady' value after the starting peak decay will be observed, if rods are actually inserted.

- a) Record the minimum  
wattage for each "out"  
shim:

1a

1b

1c

- b) Record final wattage for  
each "out" shim:

2a

2b

2c

NOTE: For the "in" shims, an increase in the 'steady' wattage at the end of the shim, as the drum unwraps, will be observed.

\_\_\_\_\_  
Test Conductor Signature

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- c) Record the steady wattage after the starting peak for each "in" shim:

3a      3b      3c

- d) Record the final wattage for each "in" shim:

4a      4b      4c

- e) Calculate and record for items 1 and 2, cases a through c,

$$5 = \frac{2 - 1}{2} \times 100\% \text{ and}$$

for items 3 and 4, cases a through c

$$6 = \frac{4 - 3}{4} \times 100\%$$

Record:

5a      5b      5c      (> 5%)

6a      6b      6c      (> 5%)

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



#### 5.4.3 Acceptance Criteria

##### Out Shims:

The difference between the final steady wattage and the initial wattage dip must exceed 5%.

5a, 5b, 5c (> 5% each)

##### In Shims:

The difference between the final wattage peak and the initial steady wattage must exceed 5%.

6a, 6b, 6c (> 5% each)

- 5.4.4 Repeat exactly the above sequences, 5.4.1a)-f) and 5.4.2a)-c) as many times as desired, using attached repetition sheet. (Attachment C) Any sequence for which the acceptance criteria is met may be used to conclude that the rod pair is "in".

Test Conductor Signature

Date



## 5.5 IN POSITION DETERMINATION - LEVEL 2

NOTE: Both the peak wattage and decay time for an outward shim starting at the fully inserted position varies from those of a shim starting with the drum sheave wrapped. This is due to the decreased power to establish motion, in conjunction with a quicker decay to the final steady value due to the more rapid acceleration when the rods are not immediately required to rise upon shim initiation.

CAUTION: Any RWP or incomplete shim will require repeating the test sequence.

CAUTION: This test does have a significant reactivity effect since total rod travel will be approximately 50 inches.

### 5.5.1 Perform the following:

#### Sequence a

a) Scram control rod pair if not already scrammed; reset the scram breaker. Start the wattrecorder when ready.

b) Shim outward for 15 seconds; wait 10 seconds.

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



c) Perform 5.5.1 b) again,  
exactly.

d) Perform 5.5.1 b) again,  
exactly.

e) Shim inward for 15  
seconds; wait 10  
seconds.

f) Perform 5.5.1 e) again,  
exactly.

g) Perform 5.5.1 e) again  
exactly.

Sequence b

h) Repeat steps 5.5.1 a) -  
5.5.1 g) above.

Sequence c

i) Repeat steps 5.5.1 a) -  
5.5.1 g) above.

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



j) Scram the rod pair.

5.5.2 Evaluate as follows:

NOTE: The wattage record will indicate three sequences, each a series of 3 "out" shims and 3 "in" shims, of exactly the same duration.

a) Record the wattage peaks of each shim, consecutively, below:

Sequence a

"out" shims

shim 1 1a      shim 2 2a      shim 3 3a

"in" shims

shim 4 4a      shim 5 5a      shim 6 6a

Sequence b

"out" shims

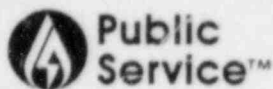
shim 1 1b      shim 2 2b      shim 3 3b

"in" shims

shim 4 4b      shim 5 5b      shim 6 6b

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



Sequence c

"out" shims

shim 1 \_\_\_\_\_ shim 2 \_\_\_\_\_ shim 3 \_\_\_\_\_  
1c 2c 3c

"in" shims

shim 4 \_\_\_\_\_ shim 5 \_\_\_\_\_ shim 6 \_\_\_\_\_  
4c 5c 6c

TEST DEFINITION: Decay Time:

Time to reach a minimum or stable value (within 5% of estimated final steady value), or time of the shim, whichever is smaller.

Final Estimated Value	Range	Minimum/Maximum Values to Determine Decay Time
X	0.05X	$X - 0.05X = 0.95X$ $X + 0.05X = 1.05X$

EXAMPLES:

20	1	19/21
40	2	38/42
100	95	95/105

- b) Record the decay time of each shim, consecutively.

Sequence a

"out" shims

shim 1 \_\_\_\_\_ shim 2 \_\_\_\_\_ shim 3 \_\_\_\_\_  
1'a 2'a 3'a

"in" shims

shim 4 \_\_\_\_\_ shim 5 \_\_\_\_\_ shim 6 \_\_\_\_\_  
4'a 5'a 6'a

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date

Sequence b

"out" shims

 shim 1  $\frac{\quad}{1'b}$     shim 2  $\frac{\quad}{2'b}$     shim 3  $\frac{\quad}{3'b}$ 

"in" shims

 shim 4  $\frac{\quad}{4'b}$     shim 5  $\frac{\quad}{5'b}$     shim 6  $\frac{\quad}{6'b}$ 
Sequence c

"out" shims

 shim 1  $\frac{\quad}{1'c}$     shim 2  $\frac{\quad}{2'c}$     shim 3  $\frac{\quad}{3'c}$ 

"in" shims

 shim 4  $\frac{\quad}{4'c}$     shim 5  $\frac{\quad}{5'c}$     shim 6  $\frac{\quad}{6'c}$ 

$$c) \quad \text{Average items 2-3} \quad \frac{2 + 3}{2} = 7$$

$$\text{and average items 2'-6'} \quad \frac{2' + 3' + 4' + 5' + 6'}{5} = 8'$$

for each sequence.

Sequence a

 Record 7 and 8:  $\frac{\quad}{7a}$      $\frac{\quad}{8'a}$ 
Sequence b

 Record 7 and 8:  $\frac{\quad}{7b}$      $\frac{\quad}{8'b}$ 
Sequence c

 Record 7 and 8:  $\frac{\quad}{7c}$      $\frac{\quad}{8'c}$ 

 \_\_\_\_\_  
 Test Conductor Signature

 \_\_\_\_\_  
 Date



## Decay Times:

The difference in the average decay times for all shims and that for an "out" shim from the inserted position must exceed 50%.

10a, 10b, 10c (> 50% each)

- 5.5.4 Repeat exactly the above sequences 5.5.1 a) - j) and 5.5.2 a) - d) as many times as desired, using attached repetition sheet (Att. C). Any sequence for which the acceptance criteria is met may be used to conclude that the rod pair is "in".

- 5.5.5 If the result is negative, notify the Shift Supervisor and Technical Services Supervisor, or Superintendent that "The control rod pair in Region (give Region) cannot be considered inserted".

---

Test Conductor Signature

---

Date



5.6 IN POSITION EVALUATION - LEVEL 3 - ABSOLUTE

CAUTION: This test should only be performed if both the analog/digital position pots are not correctly indicating and the "in" limit switches are not picking, or there is evidence that the multijaws coupling connecting these indicating devices is failed, causing readings inconsistent with the rod motion, or if there is an absolute need for independent verification of rod pair position (in this instance an electrician will be required to jumper-out the "in" limit switch if it has not failed).

Because this activity places a high risk on breaking the multijaws coupling, Station Manager approval is required to proceed.

(This is the most definitive wattage test for determining "in" position.)

Approval to proceed:

\_\_\_\_\_  
Station Manager

\_\_\_\_\_  
Date/Time

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date

## 5.6.1 Read the following theory:

A shim in which the motor raises the control rod pair, nominally referred to as outward shim, performed by shimming in the "out" direction, differs from an inward shim due to the differences in the peak and steady wattages, for the case where the cable drum is wound approximately 1/4 turn so that the moment arm is developed.

At the fully inserted position, the moment arm is zero, as the rod pair hangs free from the drum attached by the anchor ends. At this point, the transient peak for an "out" or "in" shim is the same, although under normal conditions only an "out" shim may be accomplished, as the picking of the "in" limit switches precludes shimming in the inward direction.

Note that if the "in" limit switches fail or are opened up, shimming in the inward direction is again possible, except that now the cable is wrapping around the drum sheave in the reverse direction. Hence the shim motor is essentially performing a raising transient, which requires more wattage than an inserting transient.

\_\_\_\_\_  
Test Conductor Signature\_\_\_\_\_  
Date



Thus the shim motor wattage transient will appear as if an "out" shim is being performed, even though the shim is in the "in" direction.

The crux of this test is to observe the change in the motor transient performance that will occur if the rods are at the fully inserted position.

5.6.2 Perform the following:

NOTE: Any RWP or incomplete shim will require repeating the test sequence.

CAUTION: The following sequence must be performed exactly to minimize risk of damaging the assembly.

Sequence a

a) Scram control rod pair if not already scrambled; reset the scram breaker. Start the wattrecorder when ready.

b) Shim "out" for 10 seconds; wait  $\geq 10$  seconds.

Shim time:

a      b      c

Test Conductor Signature

Date



- c) Shim "in" for 10  
seconds; wait  $\geq 10$   
seconds.

Shim time:

\_\_\_\_\_

a                  b                  c

- d) Shim "in" for 10  
seconds; wait  $\geq 10$   
seconds.

Shim time:

\_\_\_\_\_

a                  b                  c

- e) Shim "out" for 10  
seconds; wait  $\geq 30$   
seconds.

Shim time:

\_\_\_\_\_

a                  b                  c

Sequence b

- f) Repeat 5.6.2 a) through  
5.6.2 e), exactly.

Sequence c

- g) Repeat 5.6.2 a) through  
5.6.2 e), exactly.

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



h) Scram the rod pair.

5.6.3 Evaluate as follows:

a) Determine and record the  
final wattage for the  
shims in item 5.6.2 b).

1a 1b 1c

b) Determine and record the  
final wattage for the  
shims in item 5.6.2 c)

2a 2b 2c

c) Calculate and record for  
a) and b), items a  
through c above

$$3 = \frac{1 - 2}{1} \times 100\%$$

Record

3a 3b 3c (> + 25%)

d) Determine and record the  
final wattage for the  
shims in item 5.6.2 d).

4a 4b 4c

Test Conductor Signature Date



- e) Determine and record the final wattage for the shims in item 5.6.2 e).

5a   5b   5c

- f) Calculate and record for a) and e) items a through c.

$$6 = \frac{4 - 5}{4} \times 100\%$$

Record:

6a   6b   6c   (> + 25%)

#### 5.6.4 Acceptance Criteria

The difference in wattage between a normal "out" shim and a normal "in" shim exceeds positive 25% AND the difference in wattage between a reversed "in" shim (actually an "out" shim) and a reversed "out" shim (actually an "in" shim) exceeds 25%.

3a, 3b, 3c   (> + 25%)

6a, 6b, 6c   (> + 25%)

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date



5.6.5 If the result is negative  
notify the Shift Supervisor  
and Technical Services  
Supervisor, or Superintendent  
that the "The control rod  
pair in Region (give Region)  
cannot be considered  
inserted".

5.7 NOTIFICATION

To insure no rod motion for shutdown  
margin purposes, instruct the  
Reactor Operator to pull the fuses  
on that Region and write a System  
Status Tag precluding rod motion for  
that rod pair.

\_\_\_\_\_  
Test Conductor Signature

\_\_\_\_\_  
Date

**6.0 TEST CONDUCTOR'S REPORT**

6.1 Were any procedure changes or deviations made to the test and DCCF/PDR initiated? (Attach copies if applicable)  
Yes\_\_\_\_ No\_\_\_\_

6.2 Were all steps successfully completed as stated in test?  
Yes\_\_\_\_ No\_\_\_\_

6.3 If the answer to 6.2 is NO, notify Department Supervisor and list conditions and/or SSR number(s):  
  
\_\_\_\_\_

6.4 Test completed except for items noted in 6.3  
  
\_\_\_\_\_

\_\_\_\_\_  
Test Conductor

\_\_\_\_\_  
Date

6.5 Test sheets and data sheets reviewed and approved except for items noted in 6.3  
  
\_\_\_\_\_

\_\_\_\_\_  
Department Representative

\_\_\_\_\_  
Date

**7.0 DEPARTMENT SUPERVISOR'S/TEST CONDUCTOR'S REVIEW**

(If the answer to 6.2 is YES, sections 7.0 and 8.0 are not applicable go to Section 9.0)

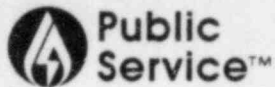
7.1 Does the failure described in 6.3 require any action or impose any limit to operation per the applicable LCO(s)?  
Yes\_\_\_\_ No\_\_\_\_ N/A\_\_\_\_

7.2 Applicable LCO(s)\_\_\_\_\_  
Action or Limit\_\_\_\_\_

7.3 Is the reason test is not being completed at this time due to plant or equipment status?  
Yes\_\_\_\_ No\_\_\_\_ N/A\_\_\_\_

7.4 If the answer to 7.3 is YES, list condition(s) and/or SSR number(s):  
  
\_\_\_\_\_

7.5 Is retest necessary for items listed in 6.3 and/or 7.4?  
Yes\_\_\_\_ No\_\_\_\_ N/A\_\_\_\_



7.6 If the answer to 7.5 is YES; list specific section(s) or step(s) to be retested.

\_\_\_\_\_  
Dept. Supervisor/Test Conductor

\_\_\_\_\_  
Date

8.0 RETEST SECTION

(If the answer to 7.5 is NO go to Section 9.0)

8.1 Verify satisfactory retest of section(s) or step(s) listed in 7.6

\_\_\_\_\_  
Retest Conductor

\_\_\_\_\_  
Date

8.2 Retest reviewed.

\_\_\_\_\_  
Department Representative

\_\_\_\_\_  
Date

9.0 APPROVALS

9.1 Test results approved. Satisfactory results confirm compliance with applicable LCO(s).

\_\_\_\_\_  
Department Supervisor

\_\_\_\_\_  
Date

9.2 Notification of satisfactory test results and test conclusion:

\_\_\_\_\_  
Shift Supervisor

\_\_\_\_\_  
Date

9.3 Requires Station Manager evaluation:

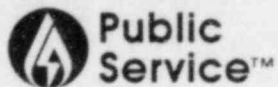
\_\_\_\_\_  
Department Supervisor

\_\_\_\_\_  
Date

9.4

\_\_\_\_\_  
Station Manager

\_\_\_\_\_  
Date



10.0 DATA SHEETS RECEIVED, VERIFIED SECTION 9.0 COMPLETE, AND  
SURVEILLANCE TEST RECORDS UPDATED.

\_\_\_\_\_  
Scheduling Technician

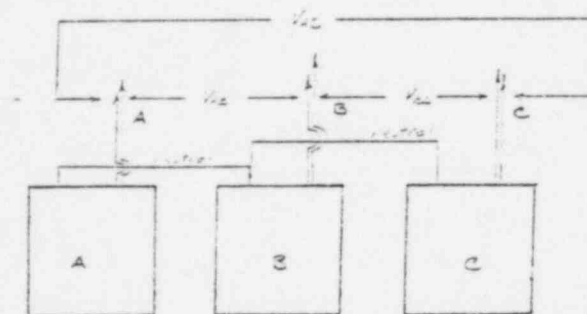
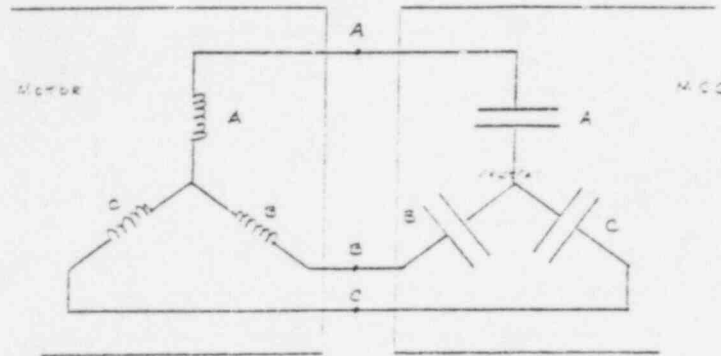
\_\_\_\_\_  
Date

11.0 COMMITMENTS

The step(s) and section(s) listed below may not be deleted without issuance of comparable controls. The procedure itself, if initiated as a result of commitment corrective action, may not be deleted without issuance of comparable controls.

- 11.1 This procedure is a result of commitments made to the NRC in P-85302.

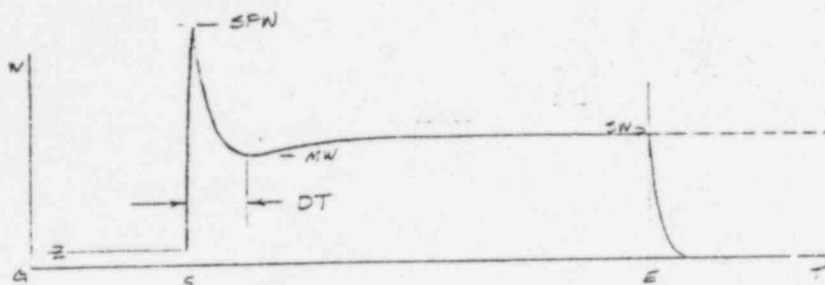
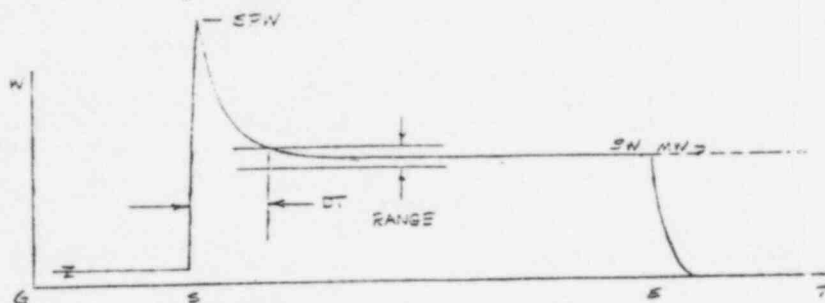
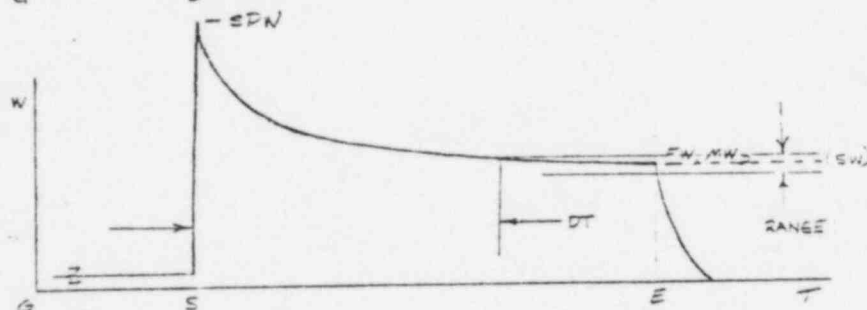
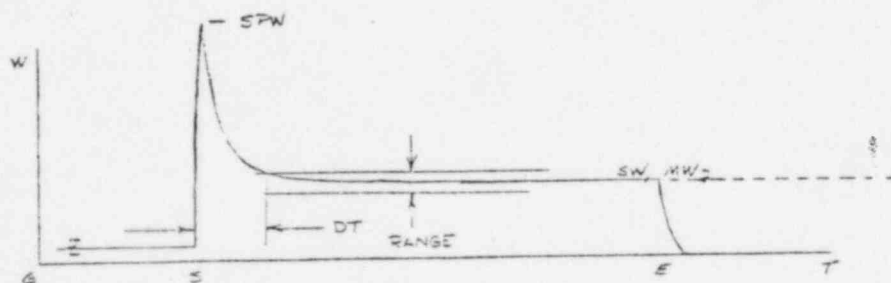
ATTACHMENT A  
ELECTRICAL SCHEMATIC



Monitor voltages AB, BC, or AC  
Do not monitor voltages to neutral

Monitor voltages AB, BC, or AC  
Do not monitor voltages to neutral

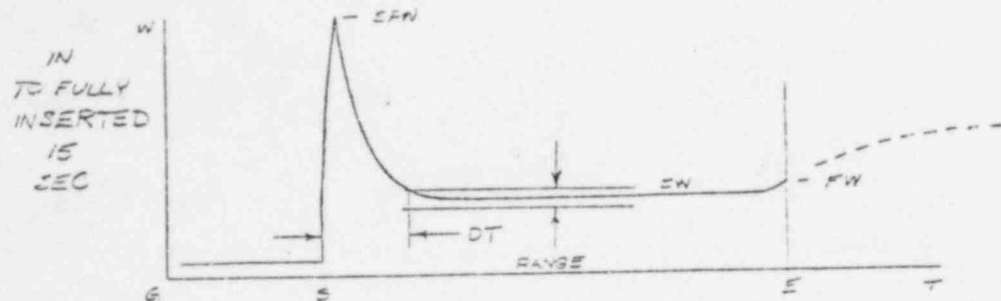
## ATTACHMENT B

 OUT  
FROM  
INSERTED  
15  
SEC

 OUT  
(TYPICAL)  
15  
SEC

 OUT  
(LONG DECAY)  
15  
SEC

 IN  
(TYPICAL)  
15  
SEC


G - GRID  
 Z - ZERO REFERENCE  
 SPW - STARTING PEAK WATTAGE  
 SN - STEADY WATTAGE  
 FW - FINAL WATTAGE  
 MW - MINIMUM WATTAGE

W - WATTAGE AXIS  
 T - TIME AXIS  
 DT - DECAY TIME  
 S - START OF SHIM  
 E - END OF SHIM  
 --- - WATTAGE TRACE IF SHIM CONTINUED

ATTACHMENT B (CONTINUED)



$$\text{RANGE} = (0.05 \times \text{SW}) \times 2$$

EX:  $\text{SW} = 80 \text{ W}$

$$\text{RANGE} = (0.05 \times 80 \text{ W}) \times 2 = 4 \text{ W} \times 2 = 8 \text{ W}$$

OR SW RANGE IS  $76 - 84 \text{ W}$

(I.E.,  $80 \text{ W} \pm 4 \text{ W}$ )



ATTACHMENT C

5.3 TEST PROCEDURE - PROCUREMENT OF DATA

5.3.1 Warnings

5.3.2 Region \_\_\_\_\_

Purpose \_\_\_\_\_

5.3.3 Review Att. B

5.3.4 Notify

5.4 TEST PROCEDURE - IN POSITION DETERMINATION -- LEVEL 1

5.4.1 Perform:

Sequence a

a) \_\_\_\_\_

b)                 
      a      b      c

c) \_\_\_\_\_

Sequence b

d) \_\_\_\_\_

Sequence c

e) \_\_\_\_\_

f) \_\_\_\_\_

## 5.4.2 Evaluate:

a) Minimum wattage, "out" shim

<u>1a</u>	<u>1b</u>	<u>1c</u>
-----------	-----------	-----------

---

b) Final wattage, "out" shim

<u>2a</u>	<u>2b</u>	<u>2c</u>
-----------	-----------	-----------

---

c) Steady wattage, "in" shim

<u>3a</u>	<u>3b</u>	<u>3c</u>
-----------	-----------	-----------

---

d) Final wattage, "in" shim

<u>4a</u>	<u>4b</u>	<u>4c</u>
-----------	-----------	-----------

---

$$5 = \frac{2 - 1}{2} \times 100\%$$

$$6 = \frac{4 - 3}{4} \times 100\%$$

e) 

<u>5a</u>	<u>5b</u>	<u>5c</u>	( > 5%)
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<u>6a</u>	<u>6b</u>	<u>6c</u>	( > 5%)
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---

## 5.4.3 Acceptance Criteria:

5a, 5b, 5c &gt; 5% each

6a, 6b, 6c &gt; 5% each

IN POSITION DETERMINATION - LEVEL 2

## 5.5.1 Perform:

	<u>Sequence a</u>	<u>Sequence b</u>	<u>Sequence c</u>
a)	_____	_____	_____
b)	_____	_____	_____
c)	_____	_____	_____
d)	_____	_____	_____
e)	_____	_____	_____
f)	_____	_____	_____
g)	_____	_____	_____

Sequence b

h) Repeat 5.5.1 a) through 5.5.1 g) above

Sequence c

i) Repeat 5.5.1 a) through 5.5.1 g) above

j) Scram rod pair

## 5.5.2 Evaluate

a) Record wattage peaks:

Sequence a1a      2a      3a4a      5a      6aSequence b1b      2b      3b4b      5b      6bSequence c1c      2c      3c4c      5c      6c

b) Record decay time

Sequence a1'a      2'a      3'a4'a      5'a      6'aSequence b1'b      2'b      3'b4'b      5'b      6'b

Sequence c
 $\overline{1^1c} \quad \overline{2^1c} \quad \overline{3^1c}$ 
 $\overline{4^1c} \quad \overline{5^1c} \quad \overline{6^1c}$ 

c) Average  $2 - 3$        $\frac{2 + 3}{2} = 7$

and average  $2^1 - 6^1$        $\frac{2^1 + 3^1 + 4^1 + 5^1 + 6^1}{5} = 8^1$

Sequence a
 $\overline{7a} \quad \overline{8^1a}$ 
Sequence b
 $\overline{7b} \quad \overline{8^1b}$ 
Sequence c
 $\overline{7c} \quad \overline{8^1c}$ 

d) Calculate:       $9 = \frac{7 - 1}{7} \times 100\%$

10 =  $\frac{8^1 - 1^1}{8^1} \times 100\%$

Sequence a
 $\overline{9a} (> 5\%) \quad \overline{10a} (> 50\%)$ 
Sequence b
 $\overline{9b} (> 5\%) \quad \overline{10b} (> 50\%)$

Sequence c

$$\frac{\quad}{9c} (> 5\%) \frac{\quad}{10c} (> 50\%)$$

## 5.5.3 Acceptance Criteria

9a, 9b, 9c > 5% each  
10a, 10b, 10c > 50% each

5.6 IN POSITION EVALUATION - LEVEL 3

## 5.6.1 Re-read as necessary

## 5.6.2 Perform:

Sequence a

a) Scram

---

b) Shim "out"; wait

Shim time:

---

a      b      c

---

c) Shim "in"; wait

Shim time:

---

a      b      c

---

d) Shim "in"; wait

---

a      b      c

---

e) Shim "out"; wait

---

a      b      c

---

Sequence b

f) Repeat 5.6.2 a) through 5.6.2 e)

---



Sequence c

g) Repeat 5.6.2 a) through 5.6.2 e)

h) Scram



5.6.3 Evaluate:

- a) Record final wattage; 5.6.2 b)

1a   1b   1c

\_\_\_\_\_

- b) Record final wattage; 5.6.2 c)

2a   2b   2c

\_\_\_\_\_

- c) Calculate/record:

$$3 = \frac{1 - 2}{1} \times 100\%$$

3a   3b   3c   (> + 25%)

\_\_\_\_\_

- d) Record final wattage 5.6.2 d)

4a   4b   4c

\_\_\_\_\_

- e) Record final wattage 5.6.2 e)

5a   5b   5c

\_\_\_\_\_

- f) Calculate/record:

$$6 = \frac{4 - 5}{4} \times 100\%$$

6a   6b   6c   (> + 25%)

\_\_\_\_\_



#### 5.6.4 Acceptance Criteria

3a, 3b, 3c > + 25%  
6a, 6b, 6c > + 25%

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ATTACHMENT D

Acceptable Equipment for Wattmeter Testing

Esterline Angus Model A 601C Graphic Wattmeters  
100 Volt, 1000 Watt, 3 Phase, 3 Wire 60 Hz