WANL-TME-1740

April 1968

Westinghouse Astronuclear Laboratory

WANL CHECKOUT PROCEDURES, WANL SUPPLIED
EQUIPMENT, TSCS/ECS - ETS-1

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

WANL-TME-1740

TITLE: WANL Checkout Procedures, WANL
Supplied Equipment, TSCS/ECS - ETS-1

DATE: April 1968

AUTHORS: J. Brinda and C. C. Merchant
Control Systems Design and Analysis
Instrumentation and
Control Systems Engineering

APPROVED: L. C. Mackey
L. C. Mackey, Supervisor
Control Systems Design and Analysis
Instrumentation and
Control Systems Engineering

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

G. L. Hohmann
G. L. Hohmann, Manager
Instrumentation and
Control Systems Engineering

G. R. Thomas
G. R. Thomas, Manager
Nuclear Systems Engineering

INFORMATION CATEGORY

Unclassified
G. L. Hohmann 4/30/68
Authorized Classifier Date

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
2. ETS - NUCLEAR INSTRUMENTATION	4
2.1 STARTUP NUCLEAR INSTRUMENTATION	4
2.2 LINEAR NUCLEAR INSTRUMENTATION	9
2.3 LOG NUCLEAR INSTRUMENTATION, TEST STAND AND ENGINE	15
3. DRUM CONTROL SUBSYSTEM	20
3.1 FORWARD CONTROL CHECKOUT	20
4. REACTOR SAFETY SYSTEM	22
4.1 CONTROL POINT CHECKOUT (LRE 06, CTE 08) (REACTOR SAFETY SYSTEM IN <u>OPERATE</u>)	22
4.2 TEST CELL BUILDING CHECKOUT (RACK 63)	27
5. TEMPERATURE AVERAGER AND REJECT	29
5.1 TEST STAND AVERAGE SUBSYSTEM (RACK 63, CHASSIS A2)	29
6. ETS-1 FREQUENCY ANALYZER AND PRINTER	33
6.1 FREQUENCY ANALYSIS PRINTOUT	33
6.2 LOG POWER PRINTOUT	35
6.3 POWER INCREASE TIME PRINTOUT	36

TABLE OF CONTENTS
(Continued)

	Page
7. REACTOR CONTROL	37
7.1 POSITION CONTROL	37
7.2. POWER CONTROL	39
7.3 TEMPERATURE CONTROL	40
7.4 POWER OVERRIDE CONTROL	42
7.5 TEMPERATURE OVERRIDE CONTROL	43
7.6 DRUM OVERRIDE CONTROL	43
7.7 INHIBITS	44
7.8 DRY TEMPERATURE AUTOSTART	45

LIST OF FIGURES

<u>FIGURE NO.</u>		<u>PAGE</u>
1	PRINTOUT FORMAT	34-A

I. INTRODUCTION

The purpose of the procedures contained in this report is to checkout the nuclear subsystem controls at the system level. The nuclear subsystem controls have been checked out previously at the chassis level. In some instances, interfacing equipment such as the simulator, mode selection controls on the CTE Console, and other setup type controls are used in the performance of these checkout procedures; however, it is not the intent nor the purpose of these procedures to checkout this interfacing equipment.

The nuclear subsystem controls equipment for which checkout procedures are included in this report are listed below:

- I. NUCLEAR INSTRUMENTATION
 - a) Start Up Nuclear Instrumentation
 - b) Linear Nuclear Instrumentation
 - c) Log Nuclear Instrumentation, Test Stand and Engine
- II. DRUM CONTROL SUBSYSTEM
 - a) Forward Control
- III. REACTOR SAFETY SYSTEM
 - a) Fixed Power Scram
 - b) Floating Power Scram
 - c) Period Scram

- d) Maximum Drum Position Scram
- e) Programmed Power Scram
- f) Drum Roll In Scram
- g) 24 Volt Power Supply Scram
- h) Nuclear Instrumentation A-C Power Supply Scram
- i) Drum Actuator Low Pressure Scram

IV. TEMPERATURE AVERAGER AND REJECT

V. ETS-1 FREQUENCY ANALYZER AND PRINTER

- a) Frequency Analysis Printer
 - 1. Drum Position
 - 2. Power Control
 - 3. Temperature Control
 - 4. Pressure Control
 - 5. TPCV Position
- b) Log Power Printout
- c) Power Increase Timer

VI. REACTOR CONTROL

- a) Ganged Drum Control
- b) Power Control
- c) Temperature Control
 - 1. Normal Temperature Control

- 2. State Programmed Temperature Control
- 3. On-Off Temperature Control
- d) Power Override Control
- e) Temperature Override Control
- f) Drum Override Control
- g) Inhibits
- h) Dry Temperature Autostart

2. ETS - NUCLEAR INSTRUMENTATION

2.1 START UP NUCLEAR INSTRUMENTATION

This portion of the procedure provides checkout of:

- a) Pulse Amplifiers, Rack 46, Chassis A2, A3, A4
- b) Log Count Rate Drivers, Rack 03, Chassis A2, A3, A4
- c) Scalars, Meters, Indicators and Controls of the LRE Console 06,
Panels A2, A3
- d) Log Count Rate Meter of the ATE Console 07, Panel A1.

This checkout is conducted using the Pulse Calibrator, Rack 44 Chassis A5, to supply test signals to the inputs of the pulse amplifiers.

2.1.1 Checkout from TCB with Readout at CP

2.1.1.1 Place Nuclear Start Up Instrumentation in LOCAL CALIBRATE
(Rack 44, Chassis A5).

2.1.1.2 Set PULSE CALIBRATOR (Rack 44, Chassis A5) for 1.0 counts per second, maximum output.

2.1.1.3 With SCALERS (LRE CONSOLE 06) set for Power ON, AUTO,
and 300 Second time, read (momentarily depress SUR Reset, LRE 06):

LOG COUNT RATE (1,2,3) - $1.0 \begin{smallmatrix} +.35 \\ -.30 \end{smallmatrix}$ counts/sec

TOTAL COUNTS (1,2,3) - 300 ± 10 counts

2.1.1.4 Set PULSE CALIBRATOR (Rack 44, Chassis A⁵) for 10.0 counts per second, maximum output.

2.1.1.5 Read (LRE 06):

LOG COUNT RATE - $10.0^{+3.5}_{-3.0}$ counts/sec

TOTAL COUNTS - 3000 ± 100 counts

(Indication holds for 3 sec, then resets)

2.1.1.6 Set PULSE CALIBRATOR (R44, A⁵) for 100.0 cps.

2.1.1.7 Read (LRE 06):

LOG COUNT RATE - $10^2^{+35}_{-30}$ counts/sec

TOTAL COUNTS - $30,000 \pm 1000$ counts

2.1.1.8 Set PULSE CALIBRATOR (R44, A⁵) for 1000.0 cps.

2.1.1.9 Read (LRE 06):

LOG COUNT RATE - $10^3^{+350}_{-300}$ counts/sec

TOTAL COUNTS - $300,000 \pm 10000$ counts

2.1.1.10 Set TIME INTERVAL SELECT (1,2,3) (LRE-06) for 60 seconds.

Momentarily depress SUR RESET (LRE 06).

2.1.1.11 Read (LRE 06):

LOG COUNT RATE - $10^3^{+350}_{-300}$ counts/sec

TOTAL COUNTS - $60,000 \pm 2000$ counts

2.1.1.12 Set TIME INTERVAL SELECT (LRE-06) for 10 seconds.

Momentarily depress SUR RESET (LRE 06).

2.1.1.13 Read (LRE 06):

$$\text{LOG COUNT RATE} - 10^3 \begin{matrix} +350 \\ -300 \end{matrix} \text{ counts/sec}$$

$$\text{TOTAL COUNTS} - 10,000 \pm 300 \text{ counts.}$$

2.1.1.14 Set SCALERS (1,2,3) (LRE 06) for HOLD

2.1.1.15 Read (LRE 06):

$$\text{LOG COUNT RATE} - 10^3 \begin{matrix} +350 \\ -300 \end{matrix} \text{ counts/sec}$$

$$\text{TOTAL COUNT} - 10,000 \pm 300 \text{ counts (continuous)}$$

2.1.1.16 Set SCALERS (1,2,3) (LRE 06) for AUTO. Momentarily depress
SUR RESET (LRE 06).

2.1.1.17 Read (LRE 06):

$$\text{LOG COUNT RATE} - 10^3 \begin{matrix} +350 \\ -300 \end{matrix} \text{ counts/sec.}$$

$$\text{TOTAL COUNTS} - 10,000 \pm 300 \text{ counts}$$

2.1.1.18 Set PULSE CALIBRATOR (R44, A⁵) for 10.0 KC.

2.1.1.19 Read (LRE 06):

$$\text{LOG COUNT RATE} - 10^4 \begin{matrix} +3500 \\ -3000 \end{matrix} \text{ counts/sec.}$$

$$\text{TOTAL COUNTS} - 100,000 \pm 3500 \text{ counts}$$

2.1.1.20 Set PULSE CALIBRATOR (R44, A⁵) for 100.0 KC.

2.1.1.21 Set SCALERS (1,2,3) (LRE 06) for .3 seconds.

2.1.1.22 Read (LRE 06):

$$\text{LOG COUNT RATE} - 10^5 \begin{matrix} +(*\text{See note 1}) \\ -30,000 \end{matrix} \text{ counts/sec}$$

$$\text{TOTAL COUNTS} - 30,000 \pm 2000 \text{ counts}$$

2.1.1.23 Place Nuclear Start Up Instrumentation in REMOTE CALIBRATE(Rack 44, A⁵).2.1.2 Checkout from CP2.1.2.1 Place AUTO/HOLD (1,2,3) (LRE 06) in AUTO, TIME INTERVAL(1,2,3) - .3 second, SCALER POWER - ON.

2.1.2.2 Depress CHAN 1 ATE switch (LRE 06).

2.1.2.3 Depress and hold NUCLEAR INSTRUMENT CALIBRATION

(LRE 06) and read:

$$\text{(LRE 06) LOG COUNT RATE} - 10^5 \text{ }^{+(*\text{See note 1})}_{-30,000 \text{ counts/sec}}$$
$$\text{(LRE 06) TOTAL COUNTS} - 30,000 \pm 2000 \text{ counts}$$

(Indication holds for 3 sec,
then resets)

$$\text{(ATE 07) LOG COUNT RATE} - 10^5 \pm 3 \times 10^4 \text{ counts/sec}$$
2.1.2.4 Depress CHAN 2 ATE switch (LRE 06).

2.1.2.5 Depress and hold NUCLEAR INSTRUMENT CALIBRATION

(LRE 06) and read:

$$\text{(ATE 07) LOG COUNT RATE} - 10^5 \pm 3 \times 10^4 \text{ counts/sec}$$

2.1.2.6 Depress CHAN 3 ATE switch (LRE 06).

2.1.2.7 Depress and hold NUCLEAR INSTRUMENT CALIBRATION

(LRE 06) and read:

$$\text{(ATE 07) LOG COUNT RATE} - 10^5 \pm 3 \times 10^4 \text{ counts/sec}$$

*Note 1 - If meters peg, set pulse frequency until meters read 10^5 counts/sec.

2.1.2.8 Depress BF3 POWER switch (LRE 06) for POWER ON.

2.1.2.9 Read (Rack 44, Chassis A6, A7 and A8):

500 to 3000 volts D. C. (dependant upon voltage control setting)

2.1.2.10 Depress BF3 POWER switch for POWER OFF, SCALERS for POWER OFF and AUTO.

2.2 LINEAR NUCLEAR INSTRUMENTATION

This portion of the procedure provides checkout of:

- a) Linear Picoammeter, Rack 45, Chassis A1, A2, A3
- b) Meters, indicators and controls of the LRE console 06, Panel A2
- c) Linear Power Meter and Range Indicator on CTE console 08.

This procedure is conducted using the Range Calibrator, Rack 45, Chassis A5, to provide inputs to the linear picoammeter.

2.2.1 Checkout from TCB with Readout at CP

2.2.1.1 Place Linear Nuclear Instrumentation in POWER ON, LOCAL CAL, 10^{-12} and X1 (Rack 46, Chassis A5).

2.2.1.2 Read (LRE 06):

LINEAR POWER (1,2,3) - .55 ± .02

RANGE INDICATOR (1,2,3) - 0

2.2.1.3 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-11} .

2.2.1.4 Read (LRE 06):

LINEAR POWER (1,2,3) - .55 ± .02

RANGE INDICATOR (1,2,3) - 1

2.2.1.5 Depress CHAN 1 CTE switch (LRE 06).

2.2.1.6 Read (CTE 08):

LINEAR POWER - .55 ± .02

RANGE INDICATOR - 1

2.2.1.7 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-10} .

2.2.1.8 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - 2

(LRE 06) LINEAR POWER - $.55 \pm .02$

(LRE 06) RANGE INDICATOR - 2

2.2.1.9 Depress CHAN 2 CTE switch (LRE 06).

2.2.1.10 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - 2

2.2.1.11 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-9} .

2.2.1.12 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - 3

(LRE 06) LINEAR POWER - $.55 \pm .02$

(LRE 06) RANGE INDICATOR - 3

2.2.1.13 Depress CHAN 3 CTE switch (LRE 06).

2.2.1.14 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

RANGE INDICATOR - 3

2.2.1.15 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-8} .

2.2.1.16 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - $\underline{\quad}$

(LRE 06) LINEAR POWER - $.55 \pm .02$

(LRE 06) RANGE INDICATOR - $\underline{\quad}$

2.2.1.17 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-7} .

2.2.1.18 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - $\underline{\quad}$

(LRE 06) LINEAR POWER - $.55 \pm .02$

(LRE 06) RANGE INDICATOR - $\underline{\quad}$

2.2.1.19 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-6} .

2.2.1.20 Read:

(CTE 08) LINEAR POWER - $.55 \pm .02$

(CTE 08) RANGE INDICATOR - $\underline{\quad}$

(LRE 06) LINEAR POWER - $.55 \pm .02$

(LRE 06) RANGE INDICATOR - $\underline{\quad}$

2.2.1.21 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-5} .

2.2.1.22 Read:

(CTE 08) LINEAR POWER - .55 + .02

(CTE 08) RANGE INDICATOR - 7

(LRE 06) LINEAR POWER - .55 + .02

(LRE 06) RANGE INDICATOR - 7

2.2.1.23 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-4} .

2.2.1.24 Read:

(CTE 08) LINEAR POWER - .55 + .02

(CTE 08) RANGE INDICATOR - 8

(LRE 06) LINEAR POWER - .55 + .02

(LRE 06) RANGE INDICATOR - 8

2.2.1.25 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-3} .

2.2.1.26 Read:

(CTE 08) LINEAR POWER - .55 + .02

(CTE 08) RANGE INDICATOR - 9

(LRE 06) LINEAR POWER - .55 + .02

(LRE 06) RANGE INDICATOR - 9

2.2.1.27 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-2} and X. 3.

2.2.1.28 Read:

(CTE 08) LINEAR POWER - 1.65 + .10

(CTE 08) RANGE INDICATOR - 0

(LRE 06) LINEAR POWER - 1.65 + .10

(LRE 06) RANGE INDICATOR - 0

2.2.1.29 Set RANGE CALIBRATOR (Rack 46, A5) for X1.

2.2.1.30 Read:

(CTE 08) LINEAR POWER - .55 + .02

(CTE 08) RANGE INDICATOR - 0

(LRE 06) LINEAR POWER - .55 + .02

(LRE 06) RANGE INDICATOR - 0

2.2.1.31 Set RANGE CALIBRATOR (Rack 46, A5) for LRE CALIB, X1.

2.2.1.32 Read:

(LRE 06) LINEAR POWER - 0

(LRE 06) RANGE INDICATOR - 0

2.2.2 Checkout from CP

2.2.2.1 Depress and hold NUCLEAR INST CALIB switch (LRE 06).

2.2.2.2 Read:

(LRE 06) LINEAR POWER - 1.1 + .10

(LRE 06) RANGE INDICATOR - 8

(CTE 08) LINEAR POWER - 1.1 + .10

(CTE 08) RANGE INDICATOR - 8

2.3 LOG NUCLEAR INSTRUMENTATION, TEST STAND and ENGINE

This section of the procedure provides a checkout of:

- a) Test Stand Log Microammeters, Rack 46, Chassis A1, A2, A3
- b) Test Stand Average and Reject, Rack 46, Chassis A4
- c) Engine Log Microammeters, Rack 47, Chassis A2, A3, A4
- d) Engine Average and Reject, Rack 47, Chassis A5
- e) Meters, Indicators, and Controls of the LRE console 06, Panel A1.

This checkout is conducted using the Range Calibrator, Rack 46, Chassis A5 to supply test signals to the inputs of the Log Microammeters.

2.3.1 Checkout from TCB with Readout at CP

2.3.1.1 Set RANGE CALIBRATOR (Rack 46, Chassis A5) for POWER ON, LOCAL CAL, 10^{-10} and X1.

2.3.1.2 Read 55 ± 20 W on (LRE 06):

TEST STAND LOG POWER (1,2,3)

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER (1,2,3)

2.3.1.3 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $0.0 \pm .1$ VDC on digital display for each position.

2.3.1.4 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-9} .

2.3.1.5 Read 550.0 ± 50 W on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.6 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $1.25 \pm .1$ VDC on digital display.

2.3.1.7 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-8} .

2.3.1.8 Read $5.5 \pm .5$ KW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.9 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $2.50 \pm .04$ VDC on digital display for each position.

2.3.1.10 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-7} .

2.3.1.11 Read 55.0 ± 5 KW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.12 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $3.75 \pm .04$ VDC on digital display for each position.

2.3.1.13 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-6} .

2.3.1.14 Read 550.0 ± 50 KW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.15 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $5.00 \pm .04$ VDC on digital display for every position.

2.3.1.16 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-5} .

2.3.1.17 Read $5.5 \pm .5$ MW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.18 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $6.25 \pm .04$ VDC on digital display for every position.

2.3.1.19 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-4} .

2.3.1.20 Read 55.0 ± 5 MW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.21 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $7.5 \pm .04$ VDC on digital display for every position.

2.3.1.22 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-3} .

2.3.1.23 Read 550.0 ± 50 MW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.24 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $8.75 \pm .04$ VDC on digital display for every position.

2.3.1.25 Set RANGE CALIBRATOR (Rack 46, A5) for 10^{-2} .

2.3.1.26 Read 5500 ± 500 MW on (LRE 06):

TEST STAND LOG POWER

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER

ENGINE AVERAGE LOG POWER

2.3.1.27 Place NUCLEAR POWER SIGNAL Selector switch (LRE 06) in each of its positions and read $10 \pm .14$ VDC on digital display for every position.

2.3.1.28 Set RANGE CALIBRATOR (Rack 46, A5) for LRE CAL, X1.

2.3.2 Checkout from CP

2.3.2.1 Depress and hold NUCLEAR INST CALIB switch (LRE 06).

2.3.2.2 Read 1100 MW $\pm$ 200 MW on (LRE 06):

TEST STAND LOG POWER (1,2,3)

TEST STAND AVERAGE LOG POWER

ENGINE LOG POWER (1,2,3)

ENGINE AVERAGE LOG POWER

3. DRUM CONTROL SUBSYSTEM

This portion of the procedure provides checkout of:

- a) Actuator Amplifiers, Rack 48, Chassis A3, A4, A5
- b) Forward Drum Control, Rack 48, Chassis A2
- c) Drums Panel, ATE Console 07 Panel A4

3.1 FORWARD CONTROL CHECKOUT

3.1.1 Place DRUM CONTROL SUBSYSTEM in TCB Control.

3.1.2 With INDIVIDUAL DRUM CONTROL (Rack 48, Chassis A2) set at 100, select Drum No. 1 with INDIVIDUAL DRUM SELECTOR.

3.1.3 Depress LOCK/UNLOCK push button switch (Rack 48, A2). Drum No. 1 should remain LOCKED.

3.1.4 Set INDIVIDUAL DRUM CONTROL at 0.0.

3.1.5 Depress LOCK/UNLOCK push button switch. Drum No. 1 should be UNLOCKED.

3.1.6 Check for complete control of drum position by setting INDIVIDUAL DRUM CONTROL over the complete range and observing the correspondence between the demanded and actual drum positions.

3.1.7 Demand drum to 90° . Perform frequency response using the EXTERNAL INPUT, TP20 (Rack 48, Chassis A2) as the demand input and the position feedback on the actuator amplifier (Rack 48, Chassis A3) as the measured feedback. The demand should be 1° peak-to-peak and measurements should be performed at 0.4, 0.63, 1.0, 1.6 and 2.5 HZ.

- 3.1.8 Repeat steps 3.1.3 through 3.1.7 for the remaining drums.
- 3.1.9 Restore DRUM CONTROL SUBSYSTEM to TCB control.
- 3.2 ATE CONTROL POINT CHECKOUT
 - 3.2.1 Place DRUM CONTROL SUBSYSTEM in CP, INDIVIDUAL DRUM CONTROL and SIMULATE.
 - 3.2.2 Select Drum No. 1 (ATE 07).
 - 3.2.3 With Drum No. 1 Position Control, check for complete control and correspondence between demanded and actual drum positions.
 - 3.2.4 Repeat steps 3.2.2 and 3.2.3 for the remaining drums.

4. REACTOR SAFETY SYSTEM

This portion of the procedure provides checkout of:

- a) Reactor Safety System, Rack 63, Chassis A3
- b) Scram Alarm and Bypass on Reactor Setup Panel of LRE Console 06,
Panel A4
- c) TSCS Scram and Bypass Panel, Rack 01L, Chassis A3
- d) Scram Alarm and Bypass on Drum Control Panel of ATE Console 07,
Panel A4.

4.1 CONTROL POINT CHECKOUT (LRE 06, CTE 08) (REACTOR SAFETY SYSTEM IN OPERATE).

The CTE switch should be in the SIMULATE mode.

4.1.1 Fixed Power Scram

4.1.1.1 Set FIXED Power Scram limit setting for 25% power (LRE 06).

4.1.1.2 Select and place FIXED Power Scram in ACTIVE, and all OVERRIDES in BYPASS.

4.1.1.3 Bring reactor to 1% power in AUTO START, POWER CONTROL (CTE 08).

4.1.1.4 Slowly increase power until reactor SCRAM is reached. Note highest Measured Power attained. Scram should occur at 275 MW.

4.1.1.5 Reset Engine Safety System, place FIXED Power Scram in BYPASS, and set FIXED Power Scram Limit setting for 100% power.

4.1.1.6 Repeat step 4.1.1.3.

4.1.1.7 Slowly increase power until FIXED power scram is indicated. Indicated scram should occur at 1100 MW. The system should not SCRAM.

4.1.1.8 Reset Engine Safety System, set FIXED POWER SCRAM limit setting for 150% power.

4.1.1.9 Slowly increase power until FIXED power scram is indicated. Indicated scram should occur at 1650 MW. The system should not SCRAM.

4.1.2 Floating Power Scram

4.1.2.1 Set FLOATING Power Scram limit setting for ratio of 2.0 (Measured Log Power to Demanded Log Power, LRE 06).

4.1.2.2 Place FLOATING Power Scram in ACTIVE and all Overrides in BYPASS.

4.1.2.3 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.1.2.4 Place follow-up power in OFF.

4.1.2.5 In POSITION CONTROL increase DRUM ANGLE DEMAND until reactor Scram is obtained. Note highest Measured Power attained. Scram should occur at 2 KW.

4.1.2.6 Place FLOATING Power Scram in BYPASS and all Overrides in BYPASS.

4.1.2.7 Repeat steps 4.1.2.3 and 4.1.2.4.

4.1.2.8 In POSITION CONTROL increase DRUM ANGLE DEMAND until FLOATING Power Scram is indicated. Indication should occur at 2 KW. The system should not SCRAM.

4.1.3 Period Scram

4.1.3.1 Set PERIOD TRIP for 50% (LRE 06), SAMPLE TIME for .50 Sec (LRE 06), and all Overrides in BYPASS (Rack 01-L).

4.1.3.2 Place PERIOD Scram in ACTIVE.

4.1.3.3 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.1.3.4 In POSITION Control, rapidly demand roll out of drums with Position Demand Control until reactor Scram is obtained. Note shortest period attained. Shortest period should be approximately 0.50 sec.

4.1.3.5 Reset Engine Safety System, Place PERIOD Scram in BYPASS.

4.1.3.6 Set PERIOD TRIP for 200%, SAMPLE TIME for 1.0 Sec.

4.1.3.7 Repeat step 4.1.3.3.

4.1.3.8 In POSITION Control, rapidly demand roll out of drums until Period Scram is indicated. Period at time of indicated scram should be approximately 1.0 sec.

4.1.3.9 Reset Engine Safety System.

4.1.3.10 Re-establish a power level of 1 KW.

4.1.3.11 Set PERIOD TRIP for 100% SAMPLE TIME for .25 sec.

4.1.3.12 In POSITION control rapidly demand roll out of drums until Period Scram is indicated. Period at time of indicated scram should be approximately 0.25 sec.

4.1.3.13 Reset Engine Safety System.

4.1.3.14 Re-establish a power level of 1 KW.

4.1.3.15 Set PERIOD TRIP for 25%, SAMPLE TIME for 0.10 sec.

4.1.3.16 In POSITION control rapidly demand roll out of drums until Period Scram is indicated. Period at time of indicated scram should be approximately 0.10 sec.

4.1.4 Maximum Drum Position Scram

4.1.4.1 Set all Overrides in BYPASS.

4.1.4.2 Set MAXIMUM DRUM Scram limit for 95 Degrees.

4.1.4.3 Place MAXIMUM DRUM Scram in ACTIVE.

4.1.4.4 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.1.4.5 In POSITION Control, slowly increase DRUM ANGLE DEMAND with Position Demand Control until reactor Scram is obtained. Note maximum Average Drum Angle attained. Scram should occur at a measured average drum angle of $95^{\circ} \pm 3^{\circ}$.

4.1.4.6 Place MAXIMUM DRUM Scram in BYPASS.

4.1.4.7 Repeat step 4.1.4.4.

4.1.4.8 In POSITION Control, slowly increase DRUM ANGLE DEMAND until Maximum Drum Position scram is indicated. The system should not scram.

4.1.5 Programmed Power Scram

4.1.5.1 Set FIXED POWER/PROGRAM POWER Scram select in PROGRAM.

4.1.5.2 Set FIXED Power Scram in ACTIVE.

4.1.5.3 Set all Overrides in BYPASS.

4.1.5.4 Set FIXED Power Scram limit at 200% power.

4.1.5.5 In Power and Pressure Control, establish Average Measured Chamber Pressure at 137 PSIA.

4.1.5.6 Select Power and Pressure Control. Increase Power Demand until reactor Scram is obtained. Note maximum Measured Log Power attained. Scram should occur at a power level of $1100 \text{ MW} \pm 80 \text{ MW}$.

4.1.5.7 Set FIXED Power Scram in BYPASS.

4.1.5.8 Establish a power level of 1 MW in POWER control.

4.1.5.9 Increase Power Demand until Power Scram is indicated. Indicated scram should occur at 11 MW. The system should not Scram.

4.1.5.10 Establish a chamber temperature of 4090°R and chamber pressure of 275 PSIA.

4.1.5.11 In POWER control increase power demand until a Power Scram is indicated. Indicated scram should occur at $2200 \text{ MW} \pm 200 \text{ MW}$. The system should not scram.

4.1.6 Drum Roll-In Scram

4.1.6.1 Set DRUM ROLL-IN Scram in ACTIVE.

4.1.6.2 Set all Overrides in BYPASS.

4.1.6.3 Establish 100% power.

4.1.6.4 Select POWER control.

4.1.6.5 Decrease Power Demand on a 2 sec period until Drum Roll-In Scram occurs. Scram should occur at approximately 11 MW power level.

4.1.6.6 Set DRUM ROLL-IN Scram in BYPASS.

4.1.6.7 Repeat 4.1.6.3 and 4.1.6.4.

4.1.6.8 Decrease Power Demand on a 2 sec period until Drum Roll-In Scram is indicated. System should not scram.

4.2 TEST CELL BUILDING CHECKOUT (RACK 63)

4.2.1 24 Volt Power Supply Scram

4.2.1.1 Set DRUM CONTR PWR Scram in ACTIVE.

4.2.1.2 Set all overrides in BYPASS.

4.2.1.3 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.2.1.4 Fail +24 VDC Actuator Power Supply by removing the two 117 VAC Chassis fuses (Rack 50, Chassis A4). Reactor should scram.

4.2.1.5 Reset Engine Safety System, replace fuses.

4.2.1.6 Repeat step 4.2.1.3.

4.2.1.7 Fail -24 VDC Actuator Power Supply by removing the two 117 VAC Chassis fuses (Rack 50, Chassis A5). System should scram.

4.2.1.8 Repeat step 4.2.1.5.

4.2.2 Nuclear Instrumentation A-C Power Supply Scram

4.2.2.1 Set NUCL INST POWER Scram in ACTIVE.

4.2.2.2 Set all Overrides in BYPASS.

4.2.2.3 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.2.2.4 Fail A-C Power Supply to Nuclear Instrumentation by opening the A-C line breaker for Rack 46. System should scram.

4.2.2.5 Reset Engine Safety System and restore A-C line breaker to closed position.

4.2.3 Drum Actuator Low Pressure Scram

4.2.3.1 Set DRUM ACTUATOR PRESSURE in ACTIVE.

4.2.3.2 Set all Overrides in BYPASS.

4.2.3.3 Bring reactor to 1 KW power in AUTO START, POWER CONTROL.

4.2.3.4 Remove Actuator Low Pressure Signal at Modulok in Rack 63. Apply +10 VDC to the Actuator Low Pressure Signal input Modulok. System should Scram

4.2.3.5 Replace Actuator Low Pressure Signal at Modulok.

5. TEMPERATURE AVERAGER AND REJECT

This portion of the procedure provides a checkout of:

- a) Temperature Averager, Rack 46 Chassis A9
- b) Temperature Averager, Rack 63 Chassis A2.

5.1 TEST STAND AVERAGE SUBSYSTEM (RACK 63, CHASSIS A2)

5.1.1 Bring reactor (Simulate Mode) to 1100°R Chamber Temperature.

5.1.2 Station No. 1 Checkout - Station .5 + 1.0

5.1.2.1 With Station No. 1 Lock Down Limit Control set for 3 rejections (Rack 63, Chassis A2), manually reject (by inserting manual reject pins on Test Point Panel of Chassis A2) three inputs, one at a time and noting for NO changes in the Meter reading (ATE-07) for Station .5 + 1.0.

5.1.2.2 Manually reject three additional inputs, one at a time noting that the meter reading (ATE-07) for Station .5 + 1.0 drops for each rejection, and LOCK DOWN indicator (Chassis A2) is lit.

5.1.2.3 Restore Station No. 1 to normal conditions.

5.1.3 Station No. 2 Checkout - EXIT GAS

5.1.3.1 With Station No. 2 Lock Down Limit Control set for 3 rejections, manually reject three inputs, one at a time and noting NO changes in the Meter reading (ATE-07) for EXIT GAS.

5.1.3.2 Manually reject three additional inputs, one at a time, noting that the Meter reading (ATE-07) for EXIT GAS drops for each rejection and LOCK DOWN indicator (Chassis A2) is lit.

5.1.3.3 Restore Station No. 2 to normal conditions.

5.1.4 Station No. 3 Checkout - Tie Rod Material

5.1.4.1 With Station No. 3 Lock Down Limit Control, set for 3 rejections, manually reject three inputs, one at a time and noting for NO changes in the Meter reading (ATE-07) for TIE ROD MATERIAL.

5.1.5 Manually reject three additional inputs, one at a time, noting that the Meter reading (ATE-07) for TIE ROD MATERIAL drops for each rejection and LOCK DOWN indicator (Chassis A2) is lit.

5.1.6 Restore Station No. 3 to its normal conditions.

5.1.7 Station No. 4 Checkout - Outer Reflector

5.1.7.1 With Station No. 4 Lock Down Limit Control, set for 2 rejections, manually reject two inputs, one at a time and noting for NO changes in the Meter reading (ATE-07) for OUTER REFLECTOR.

5.1.7.2 Manually reject two additional inputs, one at a time, noting that the Meter reading (ATE-07) for OUTER REFLECTOR drops for each rejection, and LOCK DOWN indicator (Chassis A2) is lit.

5.1.7.3 Restore Station No. 4 to its normal conditions.

5.1.8 Station No. 5 Checkout - Station No. 20 to Data

5.1.8.1 With Station No. 5 Lock Down Limit Control, set for 2 rejections, manually reject two inputs, one at a time and noting for NO changes in the test Meter (100 UAMP) applied to the Rack 63 output Modular terminals for this data channel.

5.1.8.2 Manually reject two additional inputs, one at a time, noting that the test Meter drops for each rejection, and LOCK DOWN indicator (Chassis A2) is lit.

5.1.8.3 Restore Station No. 5 to its normal conditions.

5.1.8.4 If end of checkout, shut down reactor.

5.2 ENGINE CONTROL SYSTEM AVERAGE SUBSYSTEM (RACK 46, CHASSIS A9)

5.2.1 Bring reactor (Simulate Mode) to 1100°R Chamber Temperature.

5.2.2 Station No. 1 Checkout - Station 26

5.2.2.1 With Station No. 1 Lock Down Limit Control, set for 6 rejections (Rack 46, Chassis A9), manually reject (by inserting manual reject pins on Test Point Panel of Chassis A9) six inputs, one at a time and noting for NO changes in the Meter reading (ATE-07) for IN-CORE 1.

5.2.2.2 Manually reject four additional inputs, one at a time, noting that the Meter reading (ATE-07) for IN-CORE 1 drops for each rejection. Number of rejects is displayed on Rack 38 and LOCK DOWN indicators (Rack 46, Chassis A9 and Rack 38) are lit.

5.2.2.3 Restore Station No. 1 to its normal conditions.

5.2.3 Station No. 2 Checkout - Station 32

5.2.3.1 With Station No. 2 Lock Down Limit Control, set for 6 rejections (Rack 46, Chassis A9), manually reject six inputs, one at a time and noting for NO changes in the Meter reading (ATE-07) for IN-CORE 2.

5.2.3.2 Manually reject four additional inputs, one at a time, noting that the Meter reading (ATE-07) for IN-CORE 2 drops for each rejection and LOCK DOWN indicator (Rack 46, Chassis A9) is lit.

5.2.3.3 Restore Station No. 2 to its normal conditions.

5.2.3.4 If end of checkout, shut down reactor.

6. ETS-1 FREQUENCY ANALYZER AND PRINTER

This portion of the procedure provides a checkout of:

- a) Programmer, Rack 01R, Chassis A1
- b) Transfer Function Analyzer, Rack 01R, Chassis A2
- c) Print-Out Switching, Rack 01R, Chassis A3
- d) Printer, Rack 01R, Chassis A4.

6.1 FREQUENCY ANALYSIS PRINTOUT

6.1.1 Prepare Frequency Analyzer System as follows:

6.1.1.1 At Rack 38 patch Average Measured Drum Angle, Average Measured Power, Average Measured In Core Temperature, Average Measured Chamber Pressure and Average Measured TPCV Angle to their respective Rack 01-R inputs.

6.1.1.2 Return Programmer (Rack 01-D, Chassis A1) to position 1 by depressing CLEAR switch until the POWER, CLEAR and START indicators are lit.

6.1.1.3 On Transfer Function Analyzer (Chassis A2)

6.1.1.3.1 Depress and Lock DISPLAY 0.

6.1.1.3.2 Correlator Range to 1-15V.

6.1.1.3.3 Integration to NORMAL.

6.1.1.3.4 DC Bias to OFF and rotate set Pot to ZERO.

6.1.1.3.5 Demod to OUT.

6.1.1.3.6 Mode to USE.

- 6.1.1.3.7 Three FREQUENCY SELECT to ZERO.
- 6.1.1.3.8 Multiplier to R.
- 6.1.1.3.9 Function to DC SINE WAVE.
- 6.1.1.3.10 Amplitude Output to 330.
- 6.1.1.3.11 Function Generator Phase to ZERO.
- 6.1.1.4 On Printout Switching Chassis (Chassis A3)
 - 6.1.1.4.1 Function to θ_d .
 - 6.1.1.4.2 Printout to FUNCTION ANALYSIS.
 - 6.1.1.4.3 Analysis No. 1 to 1.
 - 6.1.1.4.4 Print to RUN.
- 6.1.1.5 On Printer (Chassis A4)
 - 6.1.1.5.1 Power to ON.
 - 6.1.1.5.2 Record to ON.
 - 6.1.1.5.3 Space Selector to 1.
- 6.1.2 Start Reactor to 1% Power in AUTO START and Power Control Mode.
- 6.1.3 Start Engine to 80% Power in Program Control.
- 6.1.4 Switch to Drum Position Control (CTE 08).
- 6.1.5 Depress PROGRAM START switch on Rack 01-R, Chassis A3. Verify that Programmer advances to Position 2, then proceeds automatically through position 6 and finally returns to position 1. Five entries appear on printer tape to be interpreted in accordance with Printer Format, Figure 1. (Programmed perturbing frequencies are 0.16, 0.6, 1.6, 6.0 and 16.0 cycles per second).

FIGURE 1
PRINTOUT FORMAT

*Decimel Location 0, 1, 2, 3 Places to Left
⊗ Fixed Decimel

- 6.1.6 Switch to Power Control (CTE 08).
- 6.1.7 On Printout Switching Chassis (Rack 01-R, Chassis A3), set FUNCTION switch to $\frac{L}{n} N_d$.
- 6.1.8 Repeat step 6.1.5.
- 6.1.9 Switch to temperature control (CTE 08).
- 6.1.10 On Printout Switching Chassis (Rack 01-R, Chassis A3) set FUNCTION switch to $\frac{T}{d}$.
- 6.1.11 Repeat step 6.1.5.
- 6.1.12 Switch to Pressure Control (CTE 08).
- 6.1.13 On Printout Switching Chassis (Rack 01-R, Chassis A3) set FUNCTION switch to $\frac{P}{d}$.
- 6.1.14 Repeat step 6.1.5.
- 6.1.15 Switch to TPCV Control (CTE 08).
- 6.1.16 On Printout Switching Chassis (Rack 01-R, Chassis A3) set FUNCTION switch to $\frac{\alpha}{d}$.
- 6.1.17 Repeat step 6.1.5.
- 6.1.18 On Printout Switching Chassis (Rack 01-R, Chassis A3) set FUNCTION switch to OFF, PRINT to STOP, and PRINTOUT switch to LOG POWER.
- 6.2 LOG POWER PRINTOUT

6.2.1 On LRE 06 Console place NUCLEAR POWER SIGNAL Selector Switch in each of its eight Power monitoring positions. For each position, Log Power Monitor Driver programs Printer (Rack 01-R, Chassis A4) and produces printout. The eight entries on the printer tape to be interpreted in accordance with Printer Format, Figure 1.

6.3 POWER INCREASE TIME PRINTOUT

6.3.1 On Printout Switching Chassis (Rack 01-R, Chassis A3) set PRINTOUT switch to POWER INCREASE TIME.

6.3.2 Switch to Power Control.

6.3.3 On LRE 06 Console Select POWER INCREASE TIME CHANNEL 1, FOLDING TIME E/4, POWER ON and PRINTER STOP.

6.3.4 Run Power Demand down to 1% power.

6.3.5 With a preselected PERIOD, run Power Demand to 100% power. Power Increase Timer should sample Power increase and produce several printouts for every E/4 folding of power. The entries on the printer tape should be interpreted in accordance with Printer Format, Figure 1 and with readings on the POWER INCREASE TIME digital display and Period Meters.

7. REACTOR CONTROL

This portion of the procedure provides a checkout of:

- a) Log Power and Temperature Controller, Rack 48, Chassis A1
- b) Experimental Controller No. 2, Rack 48, Chassis A6.

The following tests are to be performed in the SIMULATE Mode.

For these tests, the following should be recorded on the control room recorders:

- 1. ganged drum demand
- 2. average measured drum position
- 3. log power demand
- 4. average log power measured
- 5. temperature demand
- 6. average measured chamber temperature
- 7. average measured station 26 temperature
- 8. average measured chamber pressure.

7.1 POSITION CONTROL

7.1.1 Ganged Control

- 7.1.1.1 Select GANGED DRUM POSITION control (CTE 08)
- 7.1.1.2 Press START REACTOR (CTE 08)
- 7.1.1.3 Slowly increase manual ganged drum demand until reactor is critical. Establish 1 KW power level in GANGED DRUM CONTROL.

7.1.1.4 On Frequency Analyzer (Rack 01-R, Chassis A2) set FUNCTION to DC SQUARE WAVE, FREQUENCY SELECT to .001 cps, AMPLITUDE OUTPUT to FULL OUTPUT, and MODE to USE.

7.1.1.5 On Printout Switching Chassis (Rack 01-R, Chassis A3), set FUNCTION to Θ_d and PRINTOUT switch to FUNCTION ANALYSIS. This will step the drums 2° .

7.1.1.6 Remove step by setting the FUNCTION switch on the printout switching chassis to OFF.

7.1.2 Individual Control

7.1.2.1 Establish to 50% power level. Switch to Ganged Drum Position Control.

7.1.2.2 At ATE 07 Console, select desired individual drum.

7.1.2.3 Null selected drums actual position against its manual position control (ATE 07).

7.1.2.4 Depress ACTIVATE push button switch (ATE 07).

7.1.2.5 Rotating the particular manual control will position the drum at any desired angle from 0 through 180 degrees.

7.1.2.6 To restore the drum to ganged control, rotate its position control for a NULL.

7.1.2.7 Depress the DEACTIVATE push button switch (ATE 07).

7.1.2.8 Continue to select, null and remove from ganged control, any desired drum or combination of drums including all twelve if desired.

7.1.2.9 Restore individual drums to ganged control.

7.2 POWER CONTROL

7.2.1 Select POWER CONTROL (CTE 08) and TEST STAND log power LRE (01).

7.2.2 Establish 1 KW power level in NUCLEAR AUTO START, POWER control.

7.2.3 On Frequency Analyzer (Rack 01R, Chassis A2) set FUNCTION to DC SQUARE WAVE, FREQUENCY SELECT to .001 cps, AMPLITUDE OUTPUT to FULL OUTPUT, and MODE to USE.

7.2.4 On Printout Switching Chassis (Rack 01-R, Chassis A3) set PRINTOUT switch to FUNCTION ANALYSIS and FUNCTION switch to $\ln N_d$. This will step to measured power 40 WATTS.

7.2.5 Remove step by setting the FUNCTION switch on the Printout Switching Chassis to OFF.

7.2.6 Select ENG log power feedback (LRE 06) Measured power feedback should not switch.

7.2.7 Select TEST STAND log power feedback (LRE 06).

7.2.8 Select DRUM POSITION control.

7.2.9 Select ENG log power feedback. Control power feedback should switch to ENG log power.

7.2.10 Select POWER control.

7.2.11 Repeat steps 7.2.3, 7.2.4 and 7.2.5.

7.2.12 Establish a chamber temperature of 2500°R in PROGRAM control.

7.2.13 Select TEST STAND log power. Control power feedback should switch to TEST STAND log power.

7.2.14 Maintain conditions for temperature control test.

7.3 TEMPERATURE CONTROL

7.3.1 Normal Temperature Control

7.3.1.1 System should be operating at a Chamber Temperature of 2500°R in PROGRAM control and the Temperature Feedback CHAMBER TEMPERATURE (ATE 07).

7.3.1.2 On Frequency Analyzer (Rack 01R, Chassis A2) set FUNCTION to DC SQUARE WAVE, FREQUENCY SELECT to .001 cps, AMPLITUDE OUTPUT to FULL OUTPUT and MODE to USE.

7.3.1.3 On Printout Switching Chassis (Rack 01R, Chassis A3) set PRINTOUT switch to FUNCTION ANALYSIS and FUNCTION to T_D. This will step measured temperature feedback 100°R.

7.3.1.4 Remove step by setting the FUNCTION switch on the Printout Switching Chassis to OFF.

7.3.1.5 Select IN-CORE Temperature Feedback (ATE 07). Feedback temperature should not switch.

7.3.1.6 Select CHAMBER Temperature Feedback (ATE 07).

7.3.1.7 Select POWER control.

7.3.1.8 Select IN-CORE Temperature Feedback (ATE 07). Feedback temperature should switch to in-core temperature.

7.3.1.9 Select TEMPERATURE control.

7.3.1.10 Repeat step 7.3.1.2, 7.3.1.3, and 7.3.1.4.

7.3.1.11 Select ganged DRUM POSITION control.

7.3.1.12 Select CHAMBER Temperature Feedback. Feedback temperature should switch to chamber temperature.

7.3.2 State Program Temperature Control

7.3.2.1 Establish a measured chamber temperature of 1100^oR in PROGRAM Control and STATE PROGRAM TEMPERATURE CONTROL. State Program Temperature Controller should indicate COMPENSATION 1.

7.3.2.2 Repeat step 7.3.1.2, 7.3.1.3, and 7.3.1.4.

7.3.2.3 Establish a measured chamber pressure of 160 PSIA in PROGRAM Control. State Program Temperature Controller should indicate COMPENSATION 2.

7.3.2.4 Repeat steps 7.3.1.2, 7.3.1.3, and 7.3.1.4.

7.3.2.5 Establish a measure chamber pressure of 285 PSIA in PROGRAM Control. State Program Temperature Controller should indicate COMPENSATION 3.

7.3.2.6 Repeat step 7.3.1.2, 7.3.1.3, and 7.3.1.4.

7.3.2.7 Establish a measure chamber temperature of 2500°R in PROGRAM Control.

7.3.2.8 Repeat steps 7.3.1.5 thru 7.3.1.13.

7.3.2.9 Select PROGRAM Control.

7.3.3 ON-OFF Temperature Control

7.3.3.1 Establish a measure chamber temperature of 2500°R in PROGRAM and ON-OFF TEMPERATURE Control.

7.3.3.2 Repeat step 7.3.1.2, 7.3.1.3, and 7.3.1.4.

7.3.3.3 Ramp to design condition on a ramp rate of 50°R/sec.

7.4 POWER OVERRIDE CONTROL

7.4.1 Set Power Override Control at 1000 (Rack 01-L).

7.4.2 Select Power Override ACTIVE (Rack 01-L).

7.4.3 Bring reactor to rated conditions in Power Control.

7.4.4 Slowly reduce setting of Power Override Control (Rack 01-L) until Power Override OPERATE indicator (Rack 01-L) lights.

7.4.5 Further reduction in the setting of the Power Override Control will force Measured Power downward in correspondence with the Override Control setting.

7.4.6 At the end of the checkout, slowly increase the Power Override Control setting to 1000. The Power Override OPERATE indicator should not be lighted. The reactor may then be shut down.

7.5 TEMPERATURE OVERRIDE CONTROL

7.5.1 Set Temperature Override Control at 1000 (Rack 01-L).

7.5.2 Select temperature override ACTIVE (Rack 01-L).

7.5.3 Bring reactor to rated conditions in Power Control.

7.5.4 Select Position control (CTE 06).

7.5.5 Slowly reduce setting of temperature override control (Rack 01-L) until temperature override OPERATE indicator (Rack 01-L) lights.

7.5.6 Further reduction in the setting of the temperature override control will force Measured Temperature downward in correspondence with the override control setting.

7.5.7 At the end of the checkout, slowly increase the temperature override control setting to 1000. The temperature override OPERATE indicator should not be lighted. The reactor may then be shut down.

7.6 DRUM OVERRIDE CONTROL

7.6.1 Press Drum Override Reset (CTE 08)

7.6.2 Start reactor to 400 watts in AUTO START, Power Control. Drum Override ACTIVE indicator is lit.

7.6.3 Establish T chamber at 1100°R and P chamber at 60 psia.

7.6.4 Select Experimental Temperature Control (CTE 08).

7.6.5 Select Reduce Gain Temperature Control (CTE 08).

7.6.6 Set DRUMS OVERRIDE THRESHOLD Set point for 1.0 degree (Rack 01-L).

7.6.7 On Frequency Analyzer (Rack 01-R, Chassis A2), set FUNCTION to DC SQUARE WAVE, FREQUENCY SELECT to .001 cps, AMPLITUDE OUTPUT to FULL OUTPUT and MODE to USE.

7.6.8 On Printout Switching Chassis (Rack 01-R, Chassis A3), set FUNCTION to θ_d and PRINTOUT switch to FUNCTION ANALYSIS. This will step Drum Demand 2° .

7.6.9 Drum Override OPERATE indicator should be lit.

7.6.10 On Printout Switching Chassis, set PRINTOUT switch to OFF.

7.6.11 Drum Error Meter (CTE 08) should read 0.0.

7.6.12 Verify DRUM OVERRIDE control by moving drums in Ganged Drum Position Demand potentiometer.

7.6.13 Press Drum Override Reset (CTE 08).

7.6.14 Drum Override OPERATE indicator should be OFF.

7.6.15 Drum Override NORMAL indicator should be ON.

7.6.16 Scram reactor.

7.6.17 Drum Override ACTIVE indicator should be OFF.

7.6.18 Drum Override BYPASS indicator should be OFF.

7.6.19 Place Drum Override in BYPASS (Rack 01-L).

7.7 INHIBITS

7.7.1 Establish a power level of 1 KW.

- 7.7.2 Select DRUM POSITION control.
- 7.7.3 Select FOLLOWUP POWER to OFF.
- 7.7.4 In DRUM POSITION control establish 10 KW power level.
- 7.7.5 Select POWER control. System should remain in DRUM POSITION Control.
- 7.7.6 Adjust POWER DEMAND to zero the power error.
- 7.7.7 Select POWER control. System should switch to POWER control.
- 7.7.8 Select FOLLOWUP POWER to ON.
- 7.7.9 Establish a chamber temperature of 1100°R in PROGRAM control.
- 7.7.10 Select FOLLOWUP POWER to OFF.
- 7.7.11 Increase chamber temperature and pressure in PROGRAM control such that the power increases one decade.
- 7.7.12 Select POWER control. System should remain in TEMPERATURE control.
- 7.7.13 Select DRUM POSITION control.
- 7.7.14 In DRUM POSITION control increase chamber temperature by 500°R.
- 7.7.15 Select POWER control. System should remain in DRUM control.
- 7.7.16 Select TEMPERATURE control. System should remain in DRUM control.
- 7.7.17 Increase POWER DEMAND to zero power error.
- 7.7.18 Select TEMPERATURE control. System should switch to POWER control.
- 7.8 DRY TEMPERATURE AUTOSTART

NOTE: This procedure for checkout of the Dry Temperature Autostart System is written to be run in the SIMULATE mode. The TSS must be modified to be able to run this checkout.

- 7.8.1 Select EXPERIMENTAL Autostart, DRY Temperature Autostart, EXPERIMENTAL Temperature Control Mode, STATE PROGRAM Temperature control, PROGRAM control.
- 7.8.2 Set EXPONENTIAL setting for 93° and RAMP RATE setting for 0.1°/sec.
- 7.8.3 Select REACTOR START and ENGINE START. The control drums should move out on an exponential followed by a ramp. The measured power and in-core temperature will increase. As soon as in-core temperature reaches 700°R, the T₂₆ LOOP CLOSURE indication should light.
- 7.8.4 When T₂₆ LOOP CLOSURE occurs, open PSV. The reactor will begin to chilldown. When reflector inlet temperature reaches 100°R, bootstrap will be initiated. When measured chamber pressure increases to 60 PSIA, the pressure loop and chamber temperature loop will close, the chamber temperature brought to 1100°R and the normal program started. The system will then ramp to design conditions.