DOE/SF/10499-T139
(STMPO-594)

# RECEIVER STEAM GENERATION (CONTROLS)
# PREOPERATIONAL TEST
# PROCEDURE 1030
# REVISION 0
# SECTIONS 1 THROUGH 9

UNITED STATES DEPARTMENT OF ENERGY/
SOUTHERN CALIFORNIA EDISON COMPANY

10 MWe SOLAR PILOT PLANT
DAGGETT, CALIFORNIA

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HUNTINGTON BEACH, CALIFORNIA

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RECEIVER STEAM GENERATION (CONTROLS)

PREOPERATIONAL TEST PROCEDURE 1030

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INSERT

## RECEIVER STEAM GENERATION TEST (1030) SAFETY POLICIES

(December 23, 1981)

### INTRODUCTION

This outlines the Safety Policies that will be followed during the Receiver Steam Generation Test (1030) period. In addition to these Safety Policies, all personnel involved in the program are encouraged to read and understand the SCE Accident Prevention Manual (APM). Questions regarding these rules should be directed to your immediate supervisor.

ONLY AUTHORIZED PERSONNEL will be allowed in the Collector Field, Receiver Tower, Core Area or Control Room during actual test periods. AUTHORIZED PERSONNEL are those individuals who have obtained approval from the Operating Foreman and/or who have previously demonstrated familiarity with the solar facilities design and the safety procedures.

### GENERAL

1. SCE Accident Prevention Rules and Solar One Generating Station Operating Procedures shall be followed when working on all process and electrical distribution systems. Particular emphasis will be placed on SCE Clearance Procedures as defined in the APM.

2. In the event of an accident, SCE and DOE shall be notified and SCE will conduct an inquiry to identify the cause of the accident and take measures necessary to prevent its recurrence.

3. All personnel involved in testing and operations shall be cognizant and understand these Safety Policies. It will be the responsibility of ALL supervisors to insure these Safety Policies are followed.

4. SCE Control Operators shall have prior knowledge of ALL personnel working in a hazardous area, and will maintain communication with these personnel by use of pagers.

5. ALL personnel shall obtain approval from the Operating Foreman BEFORE entering designated hazardous areas or working on any equipment. Personnel shall be notified by the Control Operator of any designated hazardous areas related to the requested approval.

6. ALL control systems related to Receiver Steam Generation (1030) Testing shall be in good working condition.

7. A warning system shall be devised to indicate; test start, wire walk, stray heliostat, emergency stow, and test end. This warning system could be a sequence of whistle soundings, a public address message or flashing lights.

8. Identification badges will be issued to all personnel and shall be worn in a conspicuous location by everyone.

9. Hard hats shall be worn by all personnel within the plant area.

10. The Operating Foreman shall be notified immediately of any abnormal or hazardous situations observed.

GUESTS

1. Guests shall be accompanied by a qualified person when entering Collector Field, Receiver Tower, Core Area or Control Room during non operating periods. Guests will not normally be allowed in these areas during operating periods.

2. Guests on an exception basis may be allowed in the Collector Field, Receiver Tower, Core Area or Control Room during operating periods with the approval of the Operating Foreman and accompanied by AUTHORIZED PERSONNEL at all times.

3. Use of cameras shall be allowed only with the appropriate approvals. The Security Officer should be contacted regarding approval authority.

4. Temporary identification badges shall be issued by plant security and worn in a conspicuous location.

COLLECTOR FIELD

1. ONLY AUTHORIZED PERSONNEL shall be allowed in the Collector Field during its operation and only with the approval of the Operating Foreman. This limitation applies to the access roads leading to and from the Core Area.

2. AUTHORIZED PERSONNEL working in the Collector Field shall carry and wear, if required, safety approved dark glasses and maintain communication with the Control Operator by use of pagers.

3. Personnel working in the Collector Field with motorized vehicles shall not leave vehicles unattended unless the Control Operator has cleared that area specifically for that purpose.

4. The Weather Station Towers are "OFF LIMITS" to all personnel during (1030) testing.

5. In the event of loss of electrical power, the Collector Field shall be cleared.

6. All heliostats involved in testing shall normally be placed in "standby" before sunrise. These heliostats shall normally not be moved to face down stow until after sunset, except in emergency conditions or in accordance with test requirements, and after an appropriate warning signal.

7. Wire walks involving the southeast quadrant should be initiated only from the ALT-1 stow position.

8. If more than two heliostats in one quadrant are required to wire walk, a wire walk notification shall be given.

9. Areas designated "Location of Bottom of Wire Walk" shall be marked in a conspicuous matter and will immediately be evacuated when the "wire walk" alarm is sounded.

10. Established "wire walks" will be used when moving heliostats between stow and "standby".

11. Sun images on heliostats should not be viewed intentionally with the naked eye or through any type of lensed mechanism.

RECEIVER TOWER

1. ONLY AUTHORIZED PERSONNEL will be allowed on the Receiver Tower during (1030) testing.

2. Receiver Tower access shall normally be made by the elevator and limited to times when heliostats are in "standby" or "track" and only with the approval of the Operating Foreman. Movement up and down the Receiver Tower during wire walk periods shall be limited to emergency situations and requires the approval of the Operating Foreman.

3. Receiver panels should not be viewed directly by the naked eye or through any type of lensed mechanism.

4. Hazardous areas shall be posted and local danger spots safety striped. These areas are to be avoided during wire walks.

5. Personnel shall be restricted from the fifteenth level (directly above the BCS targets) during Receiver operation or with any portion of the Collector Field in track except for special situations left up to the discretion of the Operating Foreman. Dark glasses shall be used as protection from Receiver brightness.

## INTRODUCTION

The purposes of this 1000 series preoperational test are to:

(1) Verify the "process" operation of solar specific portions of the plant.

(2) Develop the control functions and/or field tune the individual plant controllers.

(3) Verify selected portions of the Plant Operating Procedures (Ref. RADL 2-36, Plant Operating/Training Manual)

As a result in addition to satisfying the stated Acceptance Criteria (Section 2.0), portions of this procedure are designed to gather data required to develop and refine the basic control functions. Also, the actual procedures themselves (step-by-step activities) will be evaluated against currently published operating procedures. In the event selected steps of the procedure do not produce the desired condition or better ways of achieving the desired conditions are identified, the operating and test procedures will be revised (red lined in the field) to support subsequent testing.

In the event stated test objectives or acceptance criteria are not fully satisfied due to technical, cost, or schedule considerations, a field decision will be made by the members of the Test Working Group to move forward through the test procedure or to retest (with possible equipment modification) until satisfactory results are achieved. From a program cost and schedule standpoint, it is intended to move forward through the procedure unless issues of equipment or personnel safety are involved. Problem areas will be so noted and serve as detailed test objectives for subsequent "in depth" test activities to be carried out as part of the Operational Test Program.

Preoperational Test 1030 involves a series of "hot flow" tests in which heliostats are applying redirected power to the receiver. The major activities of Test 1030 are:

1) Hot water flow to the flash tank

2) Steam flow to the flash tank

3) Steam flow to the downcomer

Major process elements to be investigated during this test are shown in Figure 1.

The overall flow of the 1030 test procedure is shown in Figure 2. A detailed functional flow of all test objectives is shown in Figure 3 with references to paragraphs which describe the test objectives. The generic test types consist of panel cure tests and control tests. The panel cure tests are designed to cure the pyromark and gather heat flux distribution data. Control tests are designed to gather design data required to tune controllers (open loop tests) and also to directly tune simple loops. Controls tests are designed to confirm control system operation, stability, and transient response at the maximum and minimum design conditions for temperature, pressure flow, and disturbance conditions.

The scope of this test procedure includes items that should be tested to ensure proper receiver and related system operation. During the course of the test, specific test areas may be deleted or expanded upon on the basis of test data and problem areas identified at that point. All such deviations, expansions, or deletions will be made with the consent of the Test Working Group.

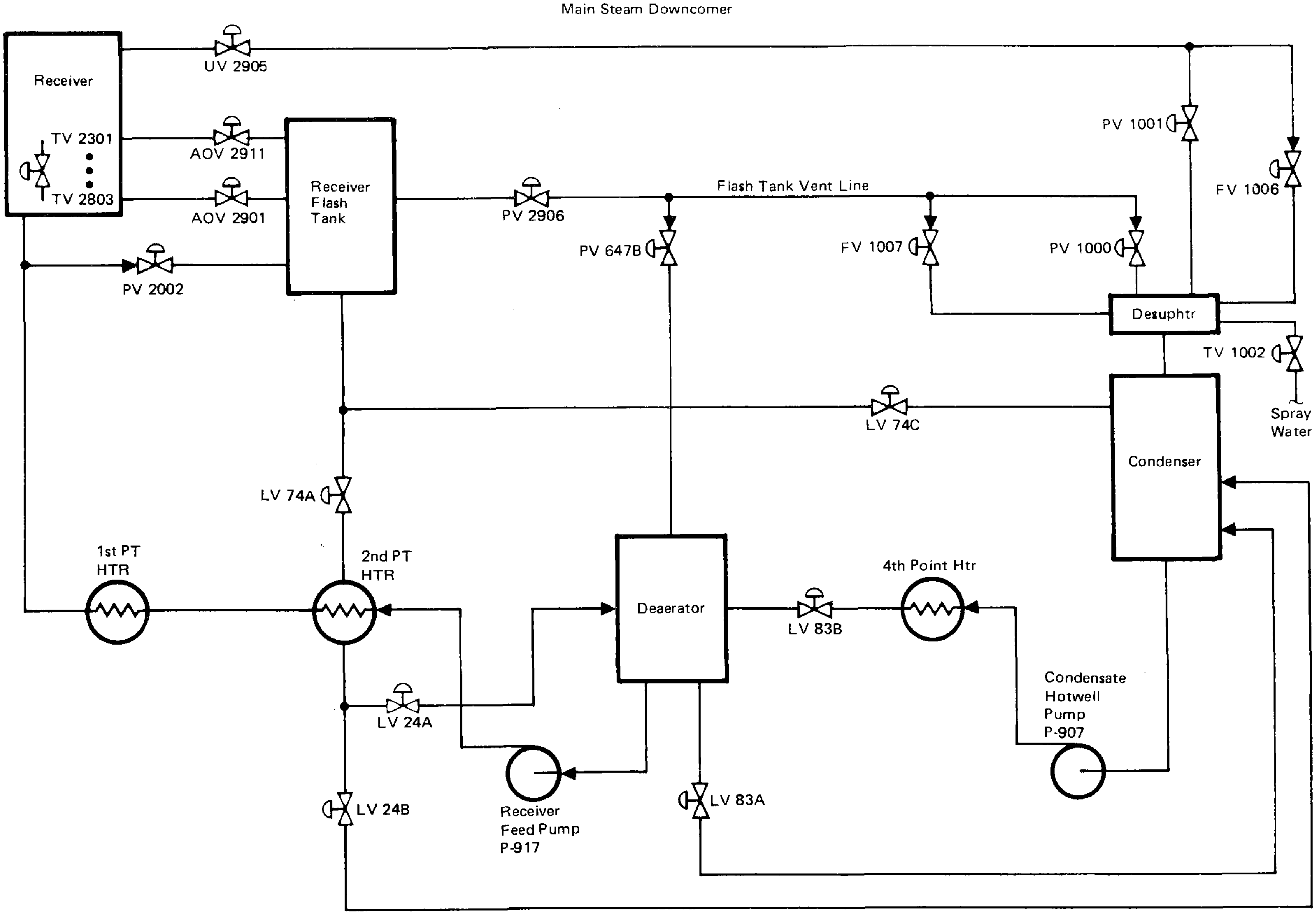


Figure 1. Test 1030 Principal Flow Paths

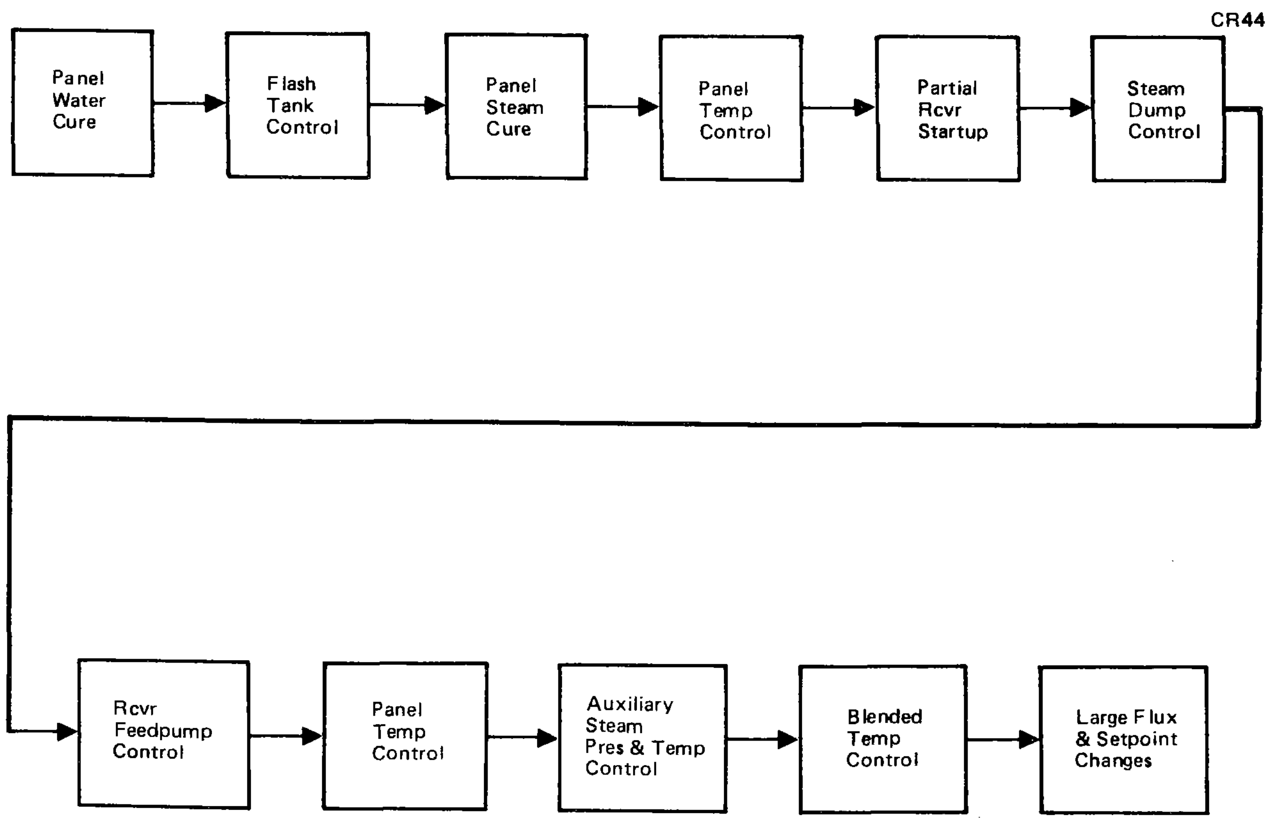


Figure 2. Test Procedure 1030-Overall Schematic Diagram


Note: This Figure Is A Road Map To The Test Procedure – As Follows – For Example:

A. Test Objective 1.2.1 Is Defined In Paragraph 1.2.1, Etc.....

B. Initial Conditions for 1.2.1 Are Defined In 7.2.1, Etc.....

C. Test Procedures For 1.2.1 Are Round The Paragraph 8.2.1, Etc.....

Figure 3. Functional Flow – Test Procedure 1030 Test Objective

1.0 OBJECTIVES

1.1 "Hot Water" Receiver Operation - Flow to Flash Tank

1.1.1 Demonstrate that heat flux is properly applied to the receiver.

1.1.2 Carryout low temperature cure of the Pyromark point ($T \leq 460°F$) in prescribed temperature steps by controlling individual panel flows to produce the desired panel metal temperatures.

1.1.3 Obtain panel incident flux versus absorbed power data for each panel.

1.1.4 Verify proper thermal expansion of receiver panels.

1.1.5 Verify dynamic operation of inter panel light seals.

1.2 "Steaming" Receiver Operation - Flow to Flash Tank

1.2.1 Panel Steam Cure - panels 209, 210, 211, 212.

1.2.1.1 Demonstrate that heat flux is properly applied to the receiver panels.

1.2.1.2 Carryout high temperature cure of the Pyromark paint on panels 209, 210, 211, 212 ($T \leq 850°F$) in prescribed temperature steps by controlling individual panel flows to produce the desired panel metal temperatures (appropriate to all boiler panels).

1.2.1.3 Obtain open loop process control responses to small signal flux and flow changes.

1.2.2 Flash Tank Control Tuning - Steam Loops

1.2.2.1 Demonstrate satisfactory closed loop operation of the flash tank vent valve pressure controllers (PC-2906, PC-1000, and PC-647B) and the desuperheater spray water temperature controller TC-1002.

1.2.3 Control Tests - panels 210, 212, Steam Loop Operation

1.2.3.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 210 and 212. Obtain both step and frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances.

1.2.3.2 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 210 and 212. Obtain both step and frequency response to valve disturbance at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances.

1.2.3.3 Obtain closed loop response data on panel temperature controllers TC-2501, TC-2503 to temperature set point and flux changes at a nominal temperature of 660°F. Tune control loops as required.

1.2.3.4 Obtain closed loop response data in panel temperature controllers TC-2501 and TC-2503. Determine response to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops as required.

1.2.3.5 Obtain closed loop response data on receiver feedpump controller PC-1105 in the valve control mode. Determine response to setpoint and valve disturbances with receiver panels under flow control. Tune control loop as required.

1.2.4 Panel Steam Cure - panels 213, 214, 215, 216

1.2.4.1 Demonstrate that heat flux is properly applied to the receiver panels.

1.2.4.2 Carry out high temperature cure of the Pyromark paint on panels 213, 214, 215, 216 ($T \leq 850$°F) in prescribed temperature steps by controlling individual panel flows to produce the desired panel metal temperatures (appropriate to all boiler panels.

1.2.4.3 Obtain loop process control response data to small signal flux and flow changes.

1.2.5 Control Tests - panels 214 and 216 - Steam Loop Operation

1.2.5.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 214 and 216. Obtain both step and frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances.

1.2.5.2 Obtain process control open loop data response for tuning of receiver temperature control loops on panels 214 and 216. Obtain both step and frequency response data to valve disturbances at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances.

1.2.5.3 Obtain closed loop response data on panel temperature controllers TC-2601 and TC-2701 to temperature set point and flux changes at a nominal temperature 660°F. Tune control loops as required.

1.2.5.4 Obtain closed loop response data in panel temperature controllers TC-2602 and TC-2701. Determine response to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops as required.

1.2.6 Panel Steam Cure - panels 204, 205, 206, 207, 208

1.2.6.1 Demonstrate that heat flux is properly applied to the receiver panels.

1.2.6.2 Carry out high temperature cure of the Pyromark paint on panels 204, 205, 206, 207, 208, 209 (T $\leq$ 850°F) in prescribed temperature steps by by controlling individual panel flows to produce the desired panel metal temperatures (appropriate to all boiler panels).

1.2.6.3 Obtain open loop process control responses to small signal flux and flow changes.

1.2.7 Control Tests - panels 204 and 206, Steam Loop Operation

1.2.7.1 Obtain process control open loop data required for tuning of the receiver temperature control loops on panels 204 and 206. Obtain both step and frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances.

1.2.7.2 Obtain process control open loop data required for tuning of the receiver temperature control loops on panels 204 and 206. Obtain both step and frequency response data to valve disturbances at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances.

1.2.7.3 Obtain closed loop response data on panel temperature controllers TC-2301 and TC-2303 to temperature set point and flux changes at a nominal temperature of 660°F. Tune control loops as required.

1.2.7.4 Obtain closed loop response data on panel temperature controllers TC-2301 and TC-2303. Determine response to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops as required.

1.2.8 Panel Steam Cure - panels 217, 218, 219, 220, 221

1.2.8.1 Demonstrate that heat flux is properly applied to the receiver panels.

1.2.8.2 Carry out high temperature cure of Pyromark paint on panels 217, 218, 219, 220, 221 ($T \leq 850°F$) in prescribed temperature steps by controlling individual panel flows to produce the desired panel metal temperatures (appropriate to all boiler panels).

1.2.8.3 Obtain open loop process control responses to small signal flux and flow changes.

1.2.9 Control Tests - panels 217, 219, 221 - Steam Loop Operation

1.2.9.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 217, 219 and 221. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances.

1.2.9.2 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 217, 219 and 221. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances.

1.2.9.3 Obtain closed loop response data on panel temperature controllers TC-2801, TC2803 and TC-2702, to temperature set point and flux change at a nominal temperature of 660°F. Tune control loops as required.

1.2.9.4 Obtain closed loop response data in panel temperature controllers TC-2701, TC-2801 and TC-2803. Determine response to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops as required.

1.2.10 Control Tests - Low Flow - panels 204, 208, 217, 221

1.2.10.1 Obtain process control open loop data sequences for tuning of receiver temperature control loops on panels 204, 208, 217, 221. Obtain both step and frequency response both to valve disturbance at nominal temperature of 660°F and start-up flow conditions. Obtain step/ramp response to small signal flux disturbances.

1.2.10.2 Obtain closed loop response data on panel temperature controllers TC-2301, TC-2402, TC-2702, TC-2803 to temperature set point and flux changes at a nominal temperature of 660°F and equivalent start-up flow conditions. Tune control loops as required.

1.2.11 Partial Receiver Start - panels 209 thru 214

1.2.11.1 Demonstrate that heat flux is properly applied of the receiver panels for the start-up heliostat field configuration.

1.2.11.2 Verify start up procedures and sequencing for receiver panels 209 thru 214.

1.2.11.3 Obtain closed loop response data on panel temperature controllers TC-2403 thru TC-2602 to temperature set point and flux changes at nominal temperature of 660°F and 485 psia under start-up flux/field configuration conditions. Tune control loops as required.

1.2.12 Partial Receiver Start - panels 204 thru 208

1.2.12.1 Demonstrate that heat flux is properly applied to the receiver panels for the start-up heliostat configuration.

1.2.12.2 Verify start up procedures and sequencing for receiver panels 204 thru 208.

1.2.12.3 Obtain closed loop response data on panel temperature controllers TC-2301 thru TC-2402 to temperature set point and flux changes at nominal temperature of 660°F and 485 psia under start-up flux/field configuration conditions. Tune control loops as required.

1.2.13 Partial Receiver Start - panels 215 thru 221

1.2.13.1 Demonstrate that heat flux is properly applied to the receiver panels for the start-up heliostat field configuration.

1.2.13.2 Verify start-up procedures and sequencing for receiver panels 215 thru 221.

1.2.13.3 Obtain closed loop response data on panel temperature controllers TC-2603 thru TC-2803 to temperature set point and flux changes at a nominal temperature of 660°F and 485 psig under start-up flux/field configuration conditions. Tune control loops as required.

1.2.14 Integrated Receiver Start (Flow to Flash Tank)

1.2.14.1 Demonstrate that heat flux is properly applied to all receiver panels for the start-up heliostat field configuration.

1.2.14.2 Verify start-up procedures and sequencing for receiver panels 201 thru 224.

1.2.14.3 Obtain closed loop response data on panel temperature controllers TC-2301 thru TC-2803 to temperature set point and flux changes at a nominal temperature of 660°F and 485 psig under start-up flux/field configuration conditions. Tune control loops as required.

1.2.14.4 Verify satisfactory operation of PC-1105 in valve control mode. Tune controller as required.

1.2.15 Verification of Proper Thermal Expansion of Receiver Panels

1.2.15.1 Verify that receiver panel thermal expansions are in reasonable agreement with predicted values.

1.2.15.2 Verify that there is no evidence of panel binding or distortion.

1.2.16 Verification of Dynamic Operation of Water Panel Light Seals

1.2.16.1 Verify that there are no light leaks observed between panels during visual light tigheness cracks.

1.3 "Steaming" Receiver Operation - flow to downcomer

1.3.1 Condition Downcomer and Steam Dump System

1.3.1.1 Verify that the downcomer can be properly conditioned.

1.3.2 Control Tests - Steam Dump System

1.3.2.1 Demonstrate satisfactory closed loop operation of PC-1001 and TC-1002 at nominal flash tank pressure conditions. Obtain closed loop response data on PC-1001 and TC-1002 to set point and flow disturbances conditions. Tune control loops as required.

1.3.2.2 Verify that the transition from receiver flash tank pressure control to SDS pressure control is satisfactory.

1.3.2.3 Demonstrate satisfactory closed loop operation of PC-1001 and TC-1002 at rated reciever pressure conditions. Verify receiver panel controls, feedpump control and SDS control operation is satisfactory during pressure ramps from flash tank limits rated pressure conditions. Obtain closed loop response data on PC-1001 & TC-1002 to set point and flow disturbances. Tune loops as required.

1.3.3 Control Tests - Receiver Feedpump - rated pressure

1.3.3.1 Obtain process control open loop response data for receiver feedpump speed changes at rated pressure conditions.

1.3.3.2 Demonstrate satisfactory closed loop control of the receiver feedpump (PC-1105) in both the pressure and valve control modes. Obtain closed loop responses to set point changes.

1.3.3.3 Verify that the automatic pressure run-back capability on the combined steam dump/receiver feedpump system is satisfactory.

1.3.4 Control Tests - panels 214, 217, 219, 221 - low flow

1.3.4.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC-2602, TC-2702, TC-2801, TC-2803) at rated pressure, derated temperature and low flow. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 660°F. Obtain step/ramp response to flux disturbances.

1.3.4.2 Demonstrate satisfactory closed loop control of receiver panel temperatures for TC-2602, TC-2702, TC-2801, TC-2803 at rated pressure, derated temperature and low flow. Obtain response to temperature set point and flux changes. Tune control loops as required.

1.3.4.3 Obtain process control open loop data for tuning of receiver temperature controllers (TC-2602, TC-2702, TC-2801, TC-2803) at rated pressure, moderate temperature and low flow. Obtain both step and frequency response data disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

1.3.4.4 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 at rated pressure, moderate temperature and low flow. Obtain response to temperature set point and flux changes. Tune control loops as required.

1.3.5 Control Tests - panels 214, 217, 219, 221 - Moderate flow

1.3.5.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC-2602, TC-2702, TC-2801, TC-2803) at rated pressure, moderate temperature and moderate flow. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

1.3.5.2 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 at rated pressure, moderate temperature and moderate flow. Obtain response to temperature set point and flux changes. Tune control loops as required.

1.3.6 Control Test - Steam Dump System - High Flow

1.3.6.1 Demonstrate satisfactory closed loop control of the Steam Dump System for PC-1001, TC-1002 at rated pressure, moderate temperature and high flow. Obtain response to pressure set point and flow changes. Tune control loops as required.

1.3.7 Control Tests - panels 214, 217, 219, 221 - High Flow

1.3.7.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC-2602, TC-2702, TC-2801, TC-2803) at rated pressure, moderate temperature and high flow. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

1.3.7.2 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 at rated pressure, moderate temperature and high flow. Obtain response to temperature set point and flux changes. Tune control loops as required.

1.3.7.3 Obtain process control open loop data for tuning of receiver temperature controllers (TC-2602, TC-2702, TC-2801, TC-2803) at rated pressure, rated temperature and high flow. Obtain both step and frequency response data to valve disturbances at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances.

1.3.7.4 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 at rated pressure, rated temperature and high flow. Obtain response to temperature setpoint and flux changes. Tune control loops as required.

1.3.7.5 Demonstrate satisfactory closed loop control of all receiver panel temperatures for TC-2301 thru TC-2803 in panel temperature control mode at rated pressure, rated temperature and high flow. Obtain response to temperature set point and flux charges. Tune control loops as required.

1.3.8 Control Tests - Auxiliary Steam - Loop Tuning

1.3.8.1 Demonstrate satisfactory closed loop control of auxiliary steam pressure controller PC-1003 and temperature controller TC-1004. Obtain response to set point and flow changes. Tune control loops.

1.3.9 Control Tests - all panels - Blended temperature control

1.3.9.1 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 using blended temperature control at rated pressure, rated temperature and high flow. Obtain response to temperature set point and flux changes. Tune control loops as required.

1.3.9.2 Demonstrate satisfactory closed loop control of receiver temperature for TC-2301 thru TC-2803 in the blended temperature control mode. For temperature set point and flux changes at rated pressure, rated temperature and high flow conditions. Tune control loops as required.

1.3.9.3 Demonstrate satisfactory closed loop control of receiver temperature for TC-2301 thru TC-2803 in the blended temperature control mode. Obtain response to temperature set point and flux changes at rated pressure, rated temperature and moderate flow conditions. Tune control loops as required.

1.3.9.4 Demonstrate satisfactory closed loop control of receiver temperatures for TC-2301 thru TC-2803 in the blended temperature control mode. Obtain response to temperature set point and flux changes at rated pressure, rated temperature and low flow conditions. Tune control loops as required.

1.3.10 Control Tests - Large Signal Flux/Setpoint response tests - Rated Steam conditions - Blended temperature control

1.3.10.1 Induce maximum flux gradients on the receiver panels via heliostat field configuration and verify satisfactory control response and operating conditions are within design limits.

1.3.10.2 Verify satisfactory control system response on all panels to a maximum induced decreasing flux condition (100% to 10%) and a maximum increasing flux condition (10% to 100%).

1.3.10.3 Verify satisfactory control system response to a maximum temperature set point ramp rate from rated to derated steam conditions and from derated to rated steam conditions.

1.3.11 Control Tests - Derated Steam Conditions - Blended Temperature Control

1.3.11.1 Demonstrate satisfactory closed loop control of receiver temperature for TC-2301 thru TC-2803 in the blended temperature control mode. Obtain response to temperature set point and flux changes at rated pressure, derated temperature and high flow conditions. Tune control as required.

1.3.11.2 Demonstrate satisfactory closed loop control of receiver panel temperature for TC-2602, TC-2702, TC-2801, TC-2803 using blended temperature control at rated pressure, derated temperature and low flow. Obtain response to temperature set point and flux changes. Tune control loops as required. Determine control system stability margins at low flow.

1.3.11.3 Determine the low flow controllability limit on temperature control for the receiver panels.

1.3.11.4 Verify satisfactory control system response on all panels to a maximum induced decreasing flux condition (100% to 10%) and a maximum increasing flux condition (10% to 100%) at derated temperature conditions.

1.3.12 Moisture Separators and Accumulator

1.3.12.1 Verify proper operation of the receiver panel moisture separators and accumulator level control functions.

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.0 | ACCEPTANCE CRITERIA | | |
| 2.1 | "Hot Water" Receiver Operation - Flow to Flash Tank | | |
| 2.1.1 | Measured heat flux is in reasonable agreement with calculated values and uncooled surfaces are not exposed to excessive incident power (as determined through visual inspection and structural temperature probes). | 8.1.7-9<br>8.1.14<br>8.1.17-19<br>8.1.24<br>8.1.27-29<br>8.1.34<br>8.1.37-39<br>8.1.44 | 1.1.1 |
| 2.1.2 | Receiver panel paint has been cured for the specified time periods at 300, 360, 410, and 460°F (±35°F) by controlling hot water flow to the individual panels. | 8.1.10-13<br>8.1.20-23<br>8.1.30-33<br>8.1.40-43 | 1.1.2 |
| 2.1.3 | Acceptable data has been produced and recorded which allows the correlation between incident power (as measured by individual flux sensors) and absorbed power (as measured by water enthalpy rise) to be made. | 8.1.14<br>8.1.24<br>8.1.34<br>8.1.44 | 1.1.3 |
| 2.1.4 | Measured receiver panel thermal expansions are in reasonable agreement with predicted values based on panel metal temperature data. No evidence of panel binding or distortion is evident upon post test inspection. | 8.1.14<br>8.1.24<br>8.1.34<br>8.1.44 | 1.1.4 |
| 2.1.5 | No light leaks are observed during visual light tightness checks conducted during non operating periods. | 8.1.45 | 1.1.5 |

| | | Initial | Date |
|---|---|---|---|
| 2.2 | Steaming Receiver Operation - Flow to Flash Tank | | |
| 2.2.1 | Panel Steam Cure - Panels 209, 210, 211 & 212 | | |
| 2.2.1.2 | Receiver panel paint has been cured for the specified time periods at 520, 585, 660, 720, 780, and 850°F (±35°F) by controlling feedwater flow to individual panels. | 8.2.1.10-<br>8.2.1.15 | 1.2.1.2 |
| 2.2.1.3 | Open loop process control response data has been gathered and recorded for small changes in incident flux and flow. | 8.2.1.7-<br>8.2.1.15 | 1.2.1.3 |
| 2.2.2 | Flash Tank Control Tuning - Steam Loops | | |
| 2.2.2.1 | Closed loop test acceptance criteria applied to PC2906, PC1000, PC647B, and TC1002.---<br><br>• Closed loop response is stable and well behaved in the presence of set point changes and process disturbances<br><br>• Mode switching transients do not significantly degrade plant operation or cause conditions to exceed design requirements.<br><br>• All alarms and limits are acceptable for safe, controlled operation. | 8.2.2.4<br>8.2.2.7<br>8.2.2.10<br>8.2.2.11<br>8.2.2.13 | 1.2.2.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| | • Control Logic for initialization, mode transfers, and shutdown is satisfactory. | | |
| | • Monitored, displayed, and recorded data is satisfactory for evaluating the closed loop test performance. | | |
| 2.2.3 | Control Tests - Panels 210, 212, Steam Operation Loop | | |
| 2.2.3.1 | Open loop test acceptance criteria applied to control loops on panels 210 & 212: Monitored and recorded data are valid and meed the evaluation requirements (parameters, scan rate, calibration, measurable output) over the specified range of test conditions. | 8.2.3.1 | 1.2.3.1 |
| 2.2.3.2 | Same as 2.2.3.1 | 8.2.3.2 | 1.2.3.2 |
| 2.2.3.3 | Closed loop test acceptance criteria applied to controllers TC2501 & TC2503 while operating under temperature control (Same as criteria listed in Section 2.2.2.1). | 8.2.3.3 | 1.2.2.3 |
| 2.2.3.4 | Same as 2.2.3.3 | 8.2.3.4 | 1.2.3.4 |
| 2.2.3.5 | Closed loop test acceptance criteria applied to controller PC1105 while operating under valve control (Same as criteria listed in Section 2.2.2.1). | 8.2.3.5 | 1.2.3.5 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.4 | Panel Steam Cure - Panels 213, 214, 215, & 216 | | |
| 2.2.4.1 | Measured heat flux is in reasonable agreement with predicted values. | 8.2.4.10-<br>8.2.4.15 | 1.2.4.1 |
| 2.2.4.2 | Receiver panel paint has been cured for the specified time periods at 520, 585, 660, 720, & 850°F (±35°F) by controlling feedwater flow to individual panels. | 8.2.4.10-<br>8.2.4.15 | 1.2.4.2 |
| 2.2.4.3 | Open loop process control response data has been gathered and recorded for small changes in incident flux and flow. | 8.2.4.7-<br>8.2.4.15 | 1.2.4.3 |
| 2.2.5 | Control Tests - Panels 214 & 216 - Steam Loop Operation | | |
| 2.2.5.1 | Open loop test acceptance criteria applied to control loops on panels 214 & 216. (Same as criteria in Section 2.2.3.1). | 8.2.5.1 | 1.2.5.1 |
| 2.2.5.2 | Same as 2.2.5.1 | 8.2.5.2 | 1.2.5.2 |
| 2.2.5.3 | Closed loop test acceptance criteria applied to controllers TC2602 & TC2701 (Same as criteria listed in Section 2.2.2.1). | 8.2.5.3 | 1.2.5.3 |
| 2.2.5.4 | Same as 2.2.5.3 | 8.2.5.4 | 1.2.5.4 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.6 | Panel Steam Cure - Panels 204, 205, 206, 207, & 208 | | |
| 2.2.6.1 | Measured heat flux is in reasonable agreement with predicted values. | 8.2.6.10-8.2.6.15 | 1.2.6.1 |
| 2.2.6.2 | Receiver panel paint has been cured for the specified time periods at 520, 585, 660, 720, & 850°F (±35°F) by controlling feedwater flow to individual panels. | 8.2.6.10-8.2.6.15 | 1.2.6.2 |
| 2.2.6.3 | Open loop process control response data has been gathered and recorded for small changes in incident flux and flow. | 8.2.6.7-8.2.6.15 | 1.2.6.3 |
| 2.2.7 | Control Tests - Panels 204 & 206, Steam Loop Operation | | |
| 2.2.7.1 | Open loop test acceptance criteria applied to control loops on panels 204 & 206: Monitored and recorded data are valid and meet the evaluation requirements (parameters, scan rate, calibration, measurable output) over the specified range of test conditions. | 8.2.7.1 | 1.2.7.1 |
| 2.2.7.2 | Same as 2.2.7.1 | 8.2.7.2 | 1.2.7.2 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.7.3 | Closed loop test acceptance criteria applied to controllers TC2301 & TC2303 while operating under temperature control (Same as criteria listed in Section 2.2.2.1). | 8.2.7.3 | 1.2.7.3 |
| 2.2.7.4 | Same as 2.2.7.3 | 8.2.7.4 | 1.2.7.4 |
| 2.2.8 | Panel Steam Cure - Panels 217, 218, 219, 220, & 221 | | |
| 2.2.8.1 | Measured heat flux is in reasonable agreement with predicted values. | 8.2.8.10-<br>8.2.8.15 | 1.2.8.1 |
| 2.2.8.2 | Receiver panel paint has been cured for the specified time periods at 520 585, 660, 720, 780, & 850°F (±35°F) by controlling feedwater flow to individual panels. | 8.2.8.10-<br>8.2.8.15 | 1.2.8.2 |
| 2.2.8.3 | Open loop process control response data has been gathered and recorded for small changes in incident flux and flow. | 8.2.8.7-<br>8.2.8.15 | 1.8.8.3 |
| 2.2.9 | Control Tests - Panels 217, 219, 221 - Steam Loop Operation | | |
| 2.2.9.1 | Open loop test acceptance criteria applied to control loops on panels 217, 219, & 221 (Same as criteria listed in Sections 2.2.3.1). | 8.2.9.1 | 1.2.9.1 |
| 2.2.9.2 | Same as 2.2.9.1 | 8.2.9.2 | 1.2.9.2 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.9.3 | Closed loop test acceptance criteria applied to controllers TC2702, TC2801, & TC2803 while operating under temperature control (Same as criteria listed in Section 2.2.2.1). | 8.2.9.3 | 1.2.9.3 |
| 2.2.9.4 | Same as 2.2.9.3 | 8.2.9.4 | 1.2.9.4 |
| 2.2.10 | Control Tests - Low Flow - Panels 204, 208, 217, & 221 | | |
| 2.2.10.1 | Open loop test acceptance criteria applied to control loops on panels 204, 208, 271, & 221. (Same as criteria listed in Section 2.2.3.1). | 8.2.10.1 | 1.2.10.1 |
| 2.2.10.2 | Closed loop test acceptance criteria applied to controllers TC2301, TC2402, TC2702, & TC2803 while operating under temperature control (Same as criteria listed in Section 2.2.2.1). | 8.2.10.2 | 1.2.10.2 |
| 2.2.11 | Partial Receiver Startup - Panels 209 & 214 | | |
| 2.2.11.1 | A satisfactory procedure has been carried out for the establishment of panel steaming operation. | 8.2.11.2- | 1.2.11.1 |
| 2.2.11.2 | Closed loop test acceptance criteria applied to controllers TC2403 & TC2602. (Same as criteria listed in Section 2.2.2.1). | 8.2.11.11- | 1.2.11.2 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.12 | Partial Receiver Startup - Panels 204 & 208 | | |
| 2.2.12.1 | A satisfactory procedure has been carried out for the establishment of panel steaming operation. | 8.2.12.2-8.2.12.9 | 1.2.12.1 |
| 2.2.12.2 | Closed loop test acceptance criteria applied to controllers TC2301 & TC2402. (Same as criteria listed in Section 2.2.2.1). | 8.2.12.11-8.2.12.20 | 1.2.12.2 |
| 2.2.13 | Partial Receiver Startup - Panels 215 & 221 | | |
| 2.2.13.1 | A satisfactory procedure has been carried out for the establishment of panel steam operation. | 8.2.12.2-8.2.12.9 | 1.2.13.1 |
| 2.2.13.2 | Closed loop test acceptance criteria applied to controllers TC2403 & TC2402. (Same as criteria listed in Section 2.2.2.1). | 8.2.13.11-8.2.13.22 | 1.2.13.2 |
| 2.2.14 | Integrated Receiver Startup (Flow to Flash Tank) | | |
| 2.2.14.1 | A satisfactory procedure has been carried out for the establishment of receiver steam operation. | 8.2.14.2-8.2.14.12 | 1.2.14.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.2.14.2 | Closed loop test acceptance criteria applied to all receiver boiler panels when operating in temperature control. (Same as criteria listed in Section 2.2.2.1). | 8.2.14.13-<br>8.2.14.16 | 1.2.14.2 |
| 2.2.14.3 | Field pump controller operates in a stable and satisfactory manner when reacting to changes in receiver control valve position. | 8.2.14.13-<br>8.2.14.16 | 1.2.14.3 |
| 2.2.15 | Receiver Panel Thermal Expansion | | |
| 2.2.15.1 | Measured receiver panel thermal expansions are in reasonable agreement with predicted values based on panel metal temperature data. No evidence of panel binding or distortion is evident upon post test inspection. | 8.2.1.9<br>8.2.4.9<br>8.2.6.9<br>8.2.8.9 | 1.2.15 |
| 2.2.16 | Receiver Panel Light Tightness | | |
| 2.2.16 | No light leaks are observed during visual light tightness checks conducted during non operating periods. | 8.2.16 | 1.2.16 |
| 2.3 | "Steaming" Receiver Operation - Flow to Flash Tank | | |
| 2.3.1 | Condition Downcomer and Steam Dump System | | |
| 2.3.1.1 | A proper procedure is carried out to thermally condition the downcomer piping and remove condensed moisture through the automatic low point drains. | 8.3.1.1-<br>8.3.1.8 | 1.3.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.2 | Control Tests - Steam Dump System | | |
| 2.3.2.1 | Closed loop test acceptance criteria applied to controllers PC1001 and TC1002. (Same as criteria listed in Section 2.2.2.1). | 8.3.2.5<br>8.3.2.8 | 1.3.2.1 |
| 2.3.2.2 | Steam pressure control can be transferred from flash tank vent system to the steam dump system in a relatively bumpless fashion without creating an upset in the process conditions. | 8.3.2.9 | 1.3.2.2 |
| 2.3.2.3 | Closed loop test acceptance criteria applied to controllers PC1001 and TC1002 during pressure ramping sequence (Same as criteria listed in Section 2.2.2.1). | 8.3.2.13<br>8.3.2.15 | 1.3.2.3 |
| 2.3.3 | Control Tests - Receiver Feed Pump - Rated Pressure | | |
| 2.3.3.1 | Open loop test acceptance criteria applied to feed pump controller PC1105 (See criteria listed in Section 2.2.3.1). | 8.3.3.1 (all subsections) | 1.3.3.1 |
| 2.3.3.2 | Closed loop test acceptance criteria applied to PC1105 while operating in pressure and valve control modes at high discharge pressure (Same as criteria listed in Section 2.2.2.1). | 8.3.3.2 (all subsections) | 1.3.3.2 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.3.3 | The control system is capable of automatically running back the set point pressure from rated pressure to 500 psig in 3 minutes. | 8.3.3.3.5-8.3.3.3.10 | 1.3.3.3 |
| 2.3.4 | Control Tests - Panels 214, 217, 219, 221-Low Flow | | |
| 2.3.4.1 | Open loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, derated temperature, and low flow (See open loop criteria listed in Section 2.2.3.1). | 8.3.4.1 (all subsections) | 1.3.4.1 |
| 2.3.4.2 | Closed loop test acceptance criteria applied to controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, derated temperature, and low flow (Same as criteria listed in Section 2.2.2.1). | 8.3.4.2 (all subsections) | 1.3.4.2 |
| 2.3.4.3 | Open loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and low flow (See open loop criteria listed in Section 2.2.3.1). | 8.3.4.3 (all subsections) | 1.3.4.3 |
| 2.3.4.4 | Closed loop test acceptance criteria applied to controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and low flow (Same as criteria listed in Section 2.2.2.1). | 8.3.4.4 | 1.3.4.4 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.5 | Control Tests - Panels 214, 217, 219, 221 - Moderate Flow | | |
| 2.3.5.1 | Open loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and moderate flow (See open loop criteria listed in Section 2.2.3.1). | 8.3.5.1 (all subsections) | 1.3.5.1 |
| 2.3.5.2 | Closed loop test acceptance criteria applied to controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and moderate flow (Same as criteria listed in Section 2.2.2.1). | 8.3.5.2 (all subsections) | 1.3.5.2 |
| 2.3.6 | Control Test - Steam Dump System - High Flow | | |
| 2.3.6.1 | Closed loop test acceptance criteria applied to controllers PC1001 and TC1002 while operating at rated pressure, moderate temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.6.1 (all subsections) | 1.3.6.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.7 | Control Tests - Panels 214, 217, 219, 221 - High Flow | | |
| 2.3.7.1 | Open loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and high flow (See open loop criteria listed in Section 2.2.3.1). | 8.3.7.1 (all sub-sections) | 1.3.7.1 |
| 2.3.7.2 | Closed loop test acceptance criteria applied to controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, moderate temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.7.2 (all sub-sections) | 1.3.7.2 |
| 2.3.7.3 | Open loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, rated temperature, and high flow (See open loop criteria listed in Section 2.2.3.1). | 8.3.7.3 (all sub-sections) | 1.3.7.3 |
| 2.3.7.4 | Closed loop test acceptance criteria applied to controllers TC2602, TC2702, TC2801, and TC2803 operating at rated pressure, rated temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.7.4 (all sub-sections) | 1.3.7.4 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.7.5 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in temperature control mode at rated pressure, rated temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.7.5 (all subsections) | 1.3.7.5 |
| 2.3.8 | Control Tests - Auxiliary Steam - Loop Tuning | | |
| 2.3.8.1 | Closed loop test acceptance criteria applied to auxiliary steam pressure and temperature controllers (PC1003 and TC1004) (Same as criteria listed in Section 2.2.2.1). | 8.3.8.1-8.3.8.6 | 1.3.8.1 |
| 2.3.9 | Control Tests - All Panels - Blended Temperature Control | | |
| 2.3.9.1 | Closed loop test acceptance criteria applied to receiver panel controllers TC2602, TC2702, TC2801, TC2803 while controlling to blended steam and panel metal temperature at rated pressure, rated temperature, and high flow. (Same as criteria listed in Section 2.2.2.1.). | 8.3.9.1 (all subsections) | 1.3.9.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.9.2 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in a blended steam and metal temperature control mode at rated pressure, rated temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.9.2 (all subsections) | 1.3.9.2 |
| 2.3.9.3 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in a blended steam and metal temperature control mode at rated pressure, rated temperature, and moderate flow (Same as criteria listed in Section 2.2.2.1). | 8.3.9.3 (all subsections) | 1.3.9.3 |
| 2.3.9.4 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in a blended steam and metal temperature control mode at rated pressure, rated temperature, and low flow (Same as criteria listed in Section 2.2.2.1). | 8.3.9.4 (all subsections) | 1.3.9.4 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.10 | Control Tests - Large Signal Flux/Setpoint Response Tests - Rated Steam Conditions - Blended Temperature Control | | |
| 2.3.10.1 | Satisfactory panel flow distribution occurs within individual panels to maintain panel metal temperature gradients to <200°F when the panels are exposed to the maximum design heat flux gradients. | 8.3.10.1 (all sub-sections) | 1.3.10.1 |
| 2.3.10.2 | Satisfactory panel control system response occurs when the receiver is exposed to flux transients from 100% to 10% and 10% to 100% while operating at rated temperature and pressure. | 8.3.10.2 (all sub-sections) | 1.3.10.2 |
| 2.3.10.3 | Satisfactory control system response occurs when ramping the receiver temperature set point from rated to derated and back to rated conditions. | 8.3.10.3 (all sub-sections) | 1.3.10.3 |
| 2.3.11 | Control Tests - Derated Steam Conditions - Blended Temperature Control | | |
| 2.3.11.1 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in a blended steam and metal temperature control mode at rated pressure, derated temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.11.1 (all sub-sections) | 1.3.11.1 |

| | | Verification Paragraph | Objective |
|---|---|---|---|
| 2.3.11.2 | Closed loop test acceptance criteria applied to all receiver panel temperature controllers (TC2301 - TC2803) operating in temperature control mode at rated pressure, rated temperature, and high flow (Same as criteria listed in Section 2.2.2.1). | 8.3.11.2 (all subsections) | 1.3.11.2 |
| 2.3.11.3 | Sufficient data has been gathered to define the receiver low flow controllability limit. | 8.3.11.3 (all subsections) | 1.3.11.3 |
| 2.3.11.4 | Satisfactory panel control system response occurs when the receiver is exposed to flux transients from 100% to 10% and 10% to 100% while operating at rated temperature and pressure. | 8.3.11.4 (all subsections) | 1.3.11.4 |
| 2.3.12 | Moisture Separator and Accumulator | | |
| 2.3.12.1 | The receiver moisture separator and accumulator operates properly and maintains level within set point limits. | 8.3.12 | 1.3.12.1 |

## 3.0 REFERENCES

### 3.1 Pilot Plant System Documentation

3.1.1 Pilot Plant System Description, Dec. 1980

3.1.2 Pilot Plant Startup and Acceptance Test Plan, Dec. 1980

3.1.3 Plant Operating/Training Manual
Book 1 - Operating Instructions, July 1981

### 3.2 Logic Diagrams

3.2.1 Controller Logic Diagrams, Issued May 1981

### 3.3 Line Schedules

40P7002133104 Rev. 4 March 20, 1981

a) Condensate (CO)
b) Feedwater FW)
c) Nitrogen (N)
d) Instrument Air (NA)
e) Vents (VT)

### 3.4 Single Line Diagrams

a) 40E700 5133351, Main One Line Diagram
b) 40E700 5133353-1, 4160 Volt System
c) 40E700 5133354, 480 V. Switchgear "B01"
d) 40E700 5133106, 4160 Volt Feeders, Collector Subsystem
e) 40E700 5133192, 480 V. MCC B
f) 40E700 5133193, 480 V. MCC C
g) 40E300 5132029, Load Center "A" and Receiver F.W. Pump

### 3.5 Piping and Instrumentation Diagrams

a) P3-1201, Receiver Preheat Panel Feedwater
b) P3-1202, Receiver Boiler Panels RB-204 thru RB-206
c) P3-1203, Receiver Boiler Panels RB-207 thru RB-209

d) P3-1204, Receiver Boiler Panels RB-210 thru RB-212

e) P3-1205, Receiver Boiler Panels RB-213 thru RB-215

f) P3-1206, Receiver Boiler Panels RB-216 thru RB-218

g) P3-1207, Receiver Boiler Panels RB-219 thru RB-221

h) P3-1208, Main Steam Manifold, $GN_2$, and Drain System

i) P3-1901, Steam System

j) P3-1903, Feedwater and Condensate

3.6 Electrical Loop Diagrams

| | | | | |
|---|---|---|---|---|
| a) | 9033/4 | SK-EL1, | TV-2301 | Sheets 1-3 |
| b) | 9033/4 | SK-EL2, | TV-2302 | Sheets 1-3 |
| c) | 9033/4 | SK-EL3, | TV-2303 | Sheets 1-3 |
| d) | 9033/4 | SK-EL4, | TV-2401 | Sheets 1-3 |
| e) | 9033/4 | SK-EL5, | TV-2402 | Sheets 1-3 |
| f) | 9033/4 | SK-EL6, | TV-2403 | Sheets 1-3 |
| g) | 9033/4 | SK-EL7, | TV-2501 | Sheets 1-3 |
| h) | 9033/4 | SK-EL8, | TV-2502 | Sheets 1-3 |
| i) | 9033/4 | SK-EL9, | TV-2503 | Sheets 1-3 |
| j) | 9033/4 | SK-EL10, | TV-2601 | Sheets 1-3 |
| k) | 9033/4 | SK-EL11, | TV-2602 | Sheets 1-3 |
| l) | 9033/4 | SK-EL12, | TV-2603 | Sheets 1-3 |
| m) | 9033/4 | SK-EL13, | TV-2701 | Sheets 1-3 |
| n) | 9033/4 | SK-EL14, | TV-2702 | Sheets 1-3 |
| o) | 9033/4 | SK-EL15, | TV-2703 | Sheets 1-3 |
| p) | 9033/4 | SK-EL16, | TV-2801 | Sheets 1-3 |
| q) | 9033/4 | SK-EL17, | TV-2802 | Sheets 1-3 |
| r) | 9033/4 | SK-EL18, | TV-2803 | Sheets 1-3 |
| s) | 9033/4 | SK-EL19, | TV-2906 | Sheet 1 |
| t) | 9033/4 | SK-EL20, | TV-2002 | Sheet 1 |
| u) | 9033/4 | SK-EL21, | UV-2905 | Sheets 1-2 |
| v) | 9033/4 | SK-EL32, | PV-1000 | Sheet 1 |
| w) | 9033/4 | SK-EL33, | PV-1001 | Sheets 1-2 |
| x) | 9033/4 | SK-EL34, | TV-1002 | Sheet 1 |
| y) | 9033/4 | SK-EL35, | PV-1003 | Sheet 1 |
| z) | 9033/4 | SK-EL36, | TV-1004 | Sheet 1 |
| aa) | 9033/4 | SK-EL49, | PV-647B | Sheet 1 |

bb) 9033/4 SK-EL50, LV-74A Sheet 1

cc) 9033/4 SK-EL51, LV-74E Sheet 1

dd) 9033/4 SK-EL52, P-917 Sheets 1-4

ee) 9033/4 SK-EL55, TY-2009 Sheet 1

ff) 9033/4 SK-EL56, FY-2233 Sheets 1-2

gg) 9033/4 SK-EL57 HS-2913 Sheet 1

hh) 9033/4 SK-EL58, Flow Meter Power Sheet 1

ii) 9033/4 SK-EL59, RS SOV to ILS (RS #1) Sheet 1

jj) 9033/4 SK-EL60, RS POS SW to ILS & DARM (RS #1) Sheet 1

kk) 9033/4 SK-EL61, RS POS SW to MUX (RS #1) Sheet 1

ll) 9033/4 SK-EL62, RS PRESS SW to MUX (RS #1) Sheet 1

mm) 9033/4 SK-EL63, RS T/C to MUX (RS #1) Sheet 1

nn) 9033/4 SK-EL64, RS Heat Flux to MUX (RS #1) Sheets 1-2

oo) 9033/4 SK-EL65, RS XTMR & RTD to MUX (RS #1) Sheet 1

pp) 9033/4 SK-EL66, PSS Misc. SW to MUX (RS #1) Sheet 1

qq) 9033/4 SK-EL67, PSS TEMP SW to MUX (RS #1, 2, & 3) Sheet 1

rr) 9033/4 SK-EL76, PSS SOV to ILS (RS #2) Sheet 1

ss) 9033/4 SK-EL77, PSS POS SW to ILS (RS #2) Sheet 1

tt) 9033/4 SK-EL78, PSS Level SW to ILS (RS #2) Sheet 1

uu) 9033/4 SK-EL79, PSS POS SW to MUX (RS #2) Sheet 1

vv) 9033/4 SK-EL88, RS Deflection XTMR to DARM (RS #1) Sheets 1-2

ww) 9033/4 SK-EL89, RS RTD to DARM (RS #1) Sheets 1-2

xx) 9033/4 SK-EL90, RS PRESS XTMR to DARM (RS #1) Sheet 1

yy) 9033/4 SK-EL91, RS T/C to DARM (RS #1) Sheets 1-2

3.7 Instrument Index

3.7.1 Master Equipment List (MEL)

3.7.2 Measurements List

3.7.3 Measurement User File (MUF)

3.8 Material Requisition and/or Specification

N/A

3.9 Vendor Data

N/A

3.10 Standards

N/A

3.11 Startup Schedule

3.11.1 "Best Effort" Working Startup Schedule October 20, 1981

| | Initial | Date |
|---|---|---|

## 4.0 PREREQUISITES

| | Initial | Date |
|---|---|---|
| 4.1 Turnover of the system to SCE is complete and in accordance with Section 5.4 of the SCE Startup Manual. | | |
| 4.2 Referenced material has been reviewed and later revision (if any) will not affect this test. | | |
| 4.3 The Master Tracking System has been reviewed and outstanding items (if any) will not affect this test. A summary list of outstanding items is attached on Appendix 10A. | | |
| 4.4 The Abnormal Equipment and Circuitry Log has been reviewed, is current, and is satisfactory for this test. A summary list is attached on Appendix 10B. | | |
| 4.5 The system has been walked through and verified complete to the extent required to conduct this test. | | |
| 4.6 Related prerequisite and preoperational tests (Test numbers 000-980) have been completed to the extent required to demonstrate the operability of the plant systems required for this test. | | |
| 4.7 All test equipment as per section 6.0, is available, calibrated and in working order. | | |

| | Initial | Date |
|---|---|---|
| 4.8 Protective plant trip circuits listed in Appendix 10G have been electrically verified. | | |
| 4.9 A pretest coordination meeting has been held to familiarize test and operations personnel with the requirements of this test. | | |

## 5.0 LIMITS AND PRECAUTIONS

5.1 This test involves the use of redirected power on to the receiver. As a result, no personnel are permitted on or above the 15th tower level during these operating periods. Test personnel are permitted however in remote station #1 at the 13th and 14th level.

5.2 High temperature, high pressure steam and feedwater will be flowing throughout the plant except to the turbine and thermal storage equipment. Care should be exercised when working around any operating or flowing system. Avoid areas exposed to safety valve discharges.

5.3 Opening of the system for inspection, maintainance, or repair should be done only after internal temperatures and pressures have reached ambient conditions and proper clearances have been received.

5.4 The heliostat field should be kept clear of unattended vehicles. Personnel working in the collector field must be in communication with the control room and be working under the direction of the control room operator.

5.5 Visual inspections of hot areas should only be accomplished after cooldown and under extremely guarded conditions after proper clearances have been received.

5.6 Groups of 4 or more heliostats shall not perform simultaneous wire walks during operating hours without "alarming" personnel in the field and on the tower.

5.7 In case of a power failure or sustained dropout, tracking heliostats shall be directed to face up stow position.

5.8 Operating personnel should be familiar with emergency procedures involving defocus of the collector field during normal operation and following loss of primary field power.

5.9 Safety policies and procedures as contained in the Southern California Edison Accident Prevention Manual and the "solar specific" supplements shall be followed.

# 6.0 TEST EQUIPMENT

NOTE: Test equipment equivalent to that specified may be used. Equipment serial number will be recorded prior to start of test and calibration shall be verified for expected test time period.

## 6.1 Indicating Instruments

None required

## 6.2 Sensors and Transducers

None required

## 6.3 Recording Equipment

### 6.3.1 Strip Chart Recorders

Make: Gould
Model: Brush 260
Number Required: 2

## 6.4 Others

### 6.4.1 Control Test Unit

Serial Number: MDAC Supplied
Number Required: 2

### 6.4.2 Transfer Function Analyzer

Make: EMR
Number Required: 1

6.4.3 Function (Wave) Generator

Make: Hewlett Packard

Model: 3310A

Number Required: 1

| | Initial | Date |
|---|---|---|
| 7.0 INITIAL CONDITIONS<br><br>7.1 Environmental Conditions<br><br>7.1 Testing during subfreezing periods should be avoided. In the event of a freezing condition, the receiver should be drained per the procedure listed in the Plant Operating/Training Manual (RADL 2-36), Instruction T-19. | | |
| 7.1.2 Testing should be carried out during cloud free periods or during "hazy" periods when a uniform and constant insolation is available. Testing during partly cloudy periods should be avoided except for specific tests designed to monitor cloud induced transients. | | |
| 7.2 Temporary Installations<br><br>7.2.1 The Controls Test Units, Transfer Function Analyzer, Function Generator, and strip chart recorders are installed as required to support Section 8 testing. | | |
| 7.3 Support Systems/Plant Operating Status<br><br>7.3.1 This test requires the operation of all plant systems excluding:<br>• Thermal storage system<br>• Beam characterization system<br>• Operational control system (OCS)<br>and all related power, instrumentation, and control equipment. | | |

| | Initial | Date |
|---|---|---|
| 7.3.2 Auxiliary steam should be available to the deaerator and turbine seal steam regulator in sufficient quantities to properly deaerate the condensate and maintain a turbine/condenser vacuum. Condenser vacuum system shall be operational. | | |
| 7.3.3 Turbine shall be on turning gear with the lube oil system operational. | | |
| 7.3.4 All flow path to and from the turbine and the thermal storage system shall be isolated to prevent undesired feedwater or hot receiver flow (hot water or steam) from entering those portions of the plant. | | |
| 7.3.5 All aspects of the Data Acquisition System as it involves SDPC, DARMS, and SHIMMS information shall be operational including data transmission to and recording at MDAC Huntington Beach. In the event the data transmission link to Huntington Beach becomes inoperable, testing may continue at the discretion of the lead Startup Engineer. | | |

7.4 Process Conditions

The following process and SDPC controller conditions should exist for the respective portions of this test: (Note that in carrying out the indicated Section 8 steps, controllers and hand switches are manipulated in accordance with the procedure.

| Initial | Date |
|---|---|

"Initial condition" tabulations referenced in this section refer to those specific controllers or hand switches which must be reinitialized prior to proceeding to the next portion of Section 8. Those items that are unchanged from a previous initialization table or do not require further manipulation beyond its previous status are not listed in the initialization table).

7.4.1 Applies to Test Section 8.1

7.4.1.1 Feedwater flow shall be established through the individual receiver panels while panel controllers are operating in flow control regulating to preset (default) valves. Flash tank nitrogen pressure shall be set and controlled (by the operator) to prevent cavitation across the control valves.

7.4.1.2 The following heliostat groups should be in "Standby" and available to "Track" the receiver:

| Collector Field Segments | Panels Cured |
|---|---|
| 505,506,507 | 209-212 |
| 506,507,508 | 213-216 |
| 402,403,504,505 | 204-208 |
| 410,411,508, 509 | 217-221 |

7.4.1.3 Controllers and hand switches shall be in the status identified in Table 10C-1a.

| Initial | Date |
|---|---|

7.4.1.4 Process conditions should be established which approach those listed in Table 10C-1b.

7.4.2 Applies to Section 8.2.1 - 8.2.10

7.4.2.1 The following heliostat groups should be in "Standby" and available to "Track" the receiver:

| Collector Field Wedges | Panels Cured/ Controls Testing |
|---|---|
| 01,02,05,06,07 | 209-212 |
| 01,06,07,08,12 | 213-216 |
| 01,02,03,04,05,12 | 204-208 |
| 01,08,09,10,11,12 | 217-221 |

7.4.2.2 Process conditions should be established which approach those referenced in Figure 4 for the appropriate test objective and procedure. Refer to initial condition tables in Appendix 10C.

7.4.3 Process conditions should be established which approach those referenced in Figure 4 for the appropriate test objective and procedure. Refer to initial condition tables in Appendix 10C.

FIGURE 4. ROADMAP FOR TEST OBJECTIVES, PROCEDURES, INITIAL CONDITIONS.

| TEST OBJECTIVES | PROCEDURE | PROCESS/LOOP INITIAL CONDITIONS TABLE NO. |
|---|---|---|
| 1.1 | 8.1 | 10C-8.1A, 8.1B |
| 1.2.1 | 8.2.1 | 10C-8.2.1A,B |
| 1.2.2 | 8.2.2 | 10C-8.2.2A,B |
| 1.2.3 | 8.2.3 | 10C-8.2.3A,B |
| 1.2.4 | 8.2.4 | 10C-8.2.4A,B |
| 1.2.5.1 | 8.2.5.1 | 10C-8.2.5.1A |
| 1.2.5.4 | 8.2.5.4 | 10C-8.2.5.4B |
| 1.2.6 | 8.2.6 | 10C-8.2.6.A,B |
| 1.2.7 | 8.2.7.1 | 10C-8.2.7.1A |
| 1.2.7.1.4 | 8.2.7.1.4 | 10C-8.2.7.1.4B |
| 1.2.8 | 8.2.8 | 10C-8.2.8A,B |
| 1.2.9 | 8.2.9 | 10C-8.2.9A,B |
| 1.2.10 | 8.2.10 | 10C-8.2.10A,B |
| 1.2.11 | 8.2.11 | 10C-8.2.11A,B |
| 1.2.12 | 8.2.12 | 10C-8.2,12A,B |
| 1.2.13 | 8.2.13 | 10C-8.2.13A,B |
| 1.2.14 | 8.2.14 | 10C-8.2.14A,B |
| 1.3.1 | 8.3.1 | 10C-8.3.1A,B |
| 1.3.2 | 8.3.2 | 10C-8.3.2A,B |
| 1.3.3 | 8.3.3 | 10C-8.3.3A,B |
| 1.3.4 | 8.3.4 | 10C-8.3.4A,B |
| 1.3.5 | 8.3.5 | 10C-8.3.5A,B |
| 1.3.6 | 8.3.6 | 10C-8.3.6A,B |
| 1.3.7 | 8.3.7 | 10C-8.3.7A,B |
| 1.3.8 | 8.3.8 | 10C-8.3.8A,B |
| 1.3.9 | 8.3.9 | 10C-8.3.9A,B |
| 1.3.10 | 8.3.10 | 10C-8.3.10A,B |
| 1.3.11 | 8.3.11 | 10C-8.3.11A,B |

| | Initial | Date |
|---|---|---|
| 8.0 PROCEDURE AND DATA COLLECTION | | |
| 8.1 "HOT WATER" RECEIVER OPERATION - FLOW TO FLASH TANK | | |
| 8.1.1 Verify that the initial conditions have been established as required in Section 7.4.1. | | |

Steps 8.1.2 - 8.1.24 are required to carry-out the hot water cure of panels 209-216. Cure of panels 209-212 should be carried out during the morning to noon time period while the cure of panels 213-216 should be carried out during the noon to afternoon period. Initial flows assigned to individual panels assume a cool, windy ambient condition. If the cure is carried out on a hot, still day, some reduction in the heliostat track commands will be required. Under no circumstances shall the total feedwater flow to the receiver exceed 50,000 LB/HR.

When heat is first applied to the receiver, it shall be done through a series of steps that gradually increases the total incident power to the final desired value. During this period, uncooled surfaces shall be monitored for excessive temperature and heated panels shall be monitored for sufficient water flow to prevent excessive temperatures. As part of the cure holds point for each panel, the incident power (flux meter data), feedwater flow rate, and

| Initial | Date |
|---|---|

feedwater temperature increase through the panel shall be recorded to allow a correlation between incident (measured) power and absorbed power to be made. Individual panel lengths and wall temperatures shall be recorded (both in a heated and unheated state) for panel growth analysis.

Hot Water Cure of Panels 209-212
(Steps 8.1.2-8.1.14)

8.1.2 Call up the individual flow control loops FCM-2301, FCM-2302,...FCM-2803 and switch each of the controllers from "Cascade" to "Console" and input the appropriate set points listed below.

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301 | 0 |
| FCM-2302 - FCM-2303 | 500 |
| FCM-2401 | 1500 |
| FCM-2402 | 4000 |
| FCM-2403* - FCM-2503* | 6000 |
| FCM-2601 - FCM-2602 | 6000 |
| FCM-2603 | 4000 |
| FCM-2701 | 1500 |
| FCM-2702 - FCM-2703 | 500 |
| FCM-2801 - FCM-2803 | 0 |

*Panels to be cured

| | Initial | Date |
|---|---|---|
| 8.1.3 Verify that the valve control set point for the receiver feed pump is 80% and switch feed pump controller, PC-1105 to valve control. | | |
| 8.1.4 Verify that the flows set in step 8.1.2 are maintained at their set point values. | | |
| 8.1.5 Verify that the receiver flash tank vent set point is 485 psig (adjustment of PC-2906, PC-1000, and PC-647B). | | |
| 8.1.6 Verify that collector field segments 505, 506, and 507 are in "Standby" and ready to track the receiver. | | |
| 8.1.7 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperature <360°F and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are <200°F. Maximum metal temperature and gradient constraints shall be as monitored by (top) panel DAS sensors, TEX-2354B, C, & D - TEX-2856B, C, & D. (Sensors on substantially heated panels are TEX-2454B, C, & D - TEX-2754B, C & D).<br><br>Increase 15/S/505, 507<br>Increase 5/S/506 | | |

| Initial | Date |
|---|---|

NOTE: Receiver structural temperatures should not be allowed to exceed the following values. These temperature limit criteria apply to all subsequent sections of this procedure where uncooled structures and shields are exposed to incident flux.

| Tag No. | Location | Limit, F |
|---|---|---|
| TEX 2053A | Heat shield front, level 17 | 1200 |
| TEX 2053B | Beam near heat shield, level 17 | 700 |
| TEX 2053C | Back of shield, top of module 12 | 1200 |
| TEX 2053D | Top of aircraft beacon, north side | 200 |
| TEX 2053E | Air at base of aircraft beacon | 160 |
| TEX 2053G | Air near vent values | 160 |
| TEX 2053I | Slide R0012882-11, item 4, el. 347.8 ft. panel 12 | 700 |
| TEX 2053J | Transverse beam R0012846, item 1, el. 357.8 ft. panel 12 | 700 |
| TEX 2053K | T.B. base R0012876, item 1, el. 357.8 ft. panel 12 | 700 |
| TEX 2053L | T.B. bar R0012876, item 9, el. 347.8 ft. panel 12 | 700 |
| TEX 2053M | Support near manifold, R0012845, item 18, el. 382.4 ft. panel 12 | 700 |
| TEX 2053N | Slide R0012882-11, item 4, el. 371.9 ft. panel 12 | 700 |

| | Initial | Date |
|---|---|---|
| 8.1.8 If an excessive temperature condition is not experienced during step 8.1.7, issue the following heliostat "Increase" command and verify adequate flow to maintain panel metal temperatures 360°F and no excessive heating of uncooled structures (75% power check point). Verify that panel temperature gradients are <200°F. Verification carried out with temperature sensors listed in 8.1.7.<br><br>Increase 9/505/507<br>Increase 2/S/506 | | |
| 8.1.9 Repeat Step 8.1.8 for the full test incident power command unless excessive temperature conditions (≥360°F) or gradients (>200°F) were experienced or can be anticipated based on a 33% increase in incident power.<br><br>Increase 6/S/505, 507<br>Increase 2/S/506 | | |
| At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure.<br><br>8.1.10 Reduce the flow control set points for panel controllers FCM-2403-FCM-2503 (panels 209-212) to produce a panel metal temperature of ∿315°F as indicated by SDPC data points TI-2403A or B - TI-2503A or B. Verify that the DAS sensors (TEX-2456B, C, & D - | | |

| | Initial | Date |
|---|---|---|
| TEX-2556B, C, & D) are all indicating temperatures ≤360°F. (In the event the DAS sensors are indicating an excessive temperature (>360°F), increase appropriate panel flow until the DAS reading is reduced to 360°F). Increase flow through adjacent heated panels (205-208 and 213-218) as required to maintain the metal temperature at <360°F as measured by TEX-2355B, C, & D - TEX-2455B, C, & D and TEX-2654B, C, & D - TEX-2756B, C, & D. Maintain the cure condition on panels 209-212 for a 20 min hold period. Make any flow adjustments required due to changing sun position. Record on the cure log sheet (Appendix 10H) that this step of the cure has been completed for panels 209-212. (Carryout Step 8.1.14 during each hold period.) | | |
| 8.1.11 Reduce the flow control set points for panel controllers FCM-2403 - FCM-2503 (panels 209-202) to produce individual panel temperatures of 360 ± 35°F as indicated by TI-2403A or TI-2503A or B. Adjust flows as required to maintain adjacent heated panel temperatures at ≤360°F and gradients ≤200°F as measured by TEX-2355B, C, & D - TEX-2455B, C, & D and TEX-2654B, C, & D - TEX-2756B, C, & D. Maintain the cure condition on panels 209-212 for a 20 min hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 209-212. | | |

| | Initial | Date |
|---|---|---|
| 8.1.12 Repeat Step 8.1.11 to produce panel metal temperatures of 410 ± 35°F as measured by TI-2403A or B - TI-2503A or B (panels 209-212). | | |
| 8.1.13 Repeat Step 8.1.11 to produce panel metal temperatures of 460 + 10 - 35°F as measured by TI-2403A or B - TI-2503A or B (panels 209-212). Hold for 1 hr to accomplish cure step. | | |

8.1.14 During each of the cure hold periods (Steps 8.1.10 - 8.1.13), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses.

- Time and day
- Insolation
- Collector field-ring-track status
- Receiver panel incident flux measurements

  YI-2110A, B & C - YI-2112A, B, & C
  YI-2210A, B & C - YI-2212A, B, & C
  YI-2307A & B
  YTX-2307C
  YI-2308A, B & C - YI-2309A, B, & C
  YI-2407A & B
  YTX-2407C
  YI-2408A, B & C - YI-2409A, B, & C
  YI-2507A & B
  YTX-2507C
  YI-2508A, B & C - YI-2509A, B, & C
  YI-2607A & B

| Initial | Date |
|---|---|
| | |

YTX-2607C

YI-2608A, B & C - YI-2609A, B, & C

YI-2707A & B

YTX-2707C

YI-2708A, B & C - YI-2709A, B, & C

YI-2807A & B

YTX-2807C

YI-2808A, B & C - YI-2809A, B, & C

- Individual receiver panel flows
- Individual panel inlet and outlet temperatures
- Panel metal temperatures
- Panel strain gauges

Hot Water Cure of Panels 213-216 (Steps 8.1.15-8.1.24)

8.1.15 Call up the individual panel flow controllers (FCM-2301 - FCM-2803) and verify that they are in the console mode. Input the appropriate set points listed below.

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301 - FCM-2303 | 0 |
| FCM-2401 - FCM-2402 | 500 |
| FCM-2403 | 1500 |
| FCM-2501 | 4000 |
| FCM-2502 - FCM-2503 | 6000 |
| FCM-2601* - FCM-2701* | 6000 |
| FCM-2702 | 4000 |
| FCM-2703 | 1500 |
| FCM-2801 - FCM-2802 | 1000 |
| FCM-2803 | 0 |

*Panels to be cured

| | | Initial | Date |
|---|---|---|---|
| 8.1.16 | Verify that collector field segments 506, 507, and 508 are in "Standby" and ready to track the receiver. | | |
| 8.1.17 | Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures <360°F and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are <200°F. Maximum metal temperature gradient constraints shall be as monitored by (top) panel DAS sensors, TEX-2354B, C, & D - TEX-2856B, C, & D. (Sensors on substantially heated panels are TEX-2456B, C, & D - TEX-2756B, C, & D).<br><br>Increase 15/S/506, 508<br>Increase 5/S/507 | | |
| 8.1.18 | If an excessive temperature condition is not experienced during Step 8.1.17, issue the following heliostat "Increase" command and verify adequate flow to maintain panel metal temperatures <360°F and no excessive heating of uncooled structures (75% power check point). Verify that panel temperature gradients are <200°F. Verification carried out with temperature sensors listed in Step 8.1.17.<br><br>Increase 9/S/506, 508<br>Increase 2/S/507 | | |

| | Initial | Date |
|---|---|---|

8.1.19 Repeat Step 8.1.17 for full test incident power command unless excessive temperature conditions ($\geq$360°F) or gradients (>200°F) were experienced or can be anticipated based on a 33% increase in incident power.

Increase 6/S/505, 507
Increase 2/S/506

At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure.

8.1.20 Reduce the flow control set points for panel controllers FCM-2601 - FCM-2701 (panels 213-216) to produce a panel metal temperature of 315°F as indicated by SDPC data points TI-2601A or B - TI-2701A or B. Verify that the DAS sensors (TEX-2654B, C, & D - TEX-2754B, C, & D) are all indicating temperatures $\leq$360°F. (In the event the DAS sensors are indicating an excessive temperature (>360°F), increase appropriate panel flow until the DAS reading is reduced to 360°F). Increase flow through adjacent heated panels (207-212 and 217-220) as required to maintain the metal temperature at <360°F as measured by TEX-2454B, C, & D - TEX-2556B, C & D and TEX-2755B, C, & D - TEX-2855B, C, & D. Maintain the cure condition on panels 213-216 for a 20 min hold period. Make any flow adjustments required due to changing sun position.

| | Initial | Date |
|---|---|---|
| Record on the cure log sheet (Appendix 10H) that this step of the cure has been completed for panels 213-216. (Carryout Step 8.1.24 during each hold period). | | |
| 8.1.21 Reduce the flow control set points for panel controllers FCM-2601 - FCM-2701 (panels 213-216) to produce individual panel metal temperatures of 360 ± 35°F as indicated by TI-2601A or B - TI-2701A or B. Adjust flows as required to maintain adjacent heated panel temperatures at $\leq$360°F and gradients $\leq$200°F as measured by TEX-2454B, C, & D - TEX-2556B, C, & D and TEX-2755B, C, & D - TEX-2855B, C, & D. Maintain the cure condition on panels 213-216 for a 20 min hold period. Make any flow adjustment required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 213-216. | | |
| 8.1.22 Repeat Step 8.1.21 to produce panel metal temperatures of 410 ± 35°F as measured by TI-2601A or B - TI-2701A or B (panels 213-216). | | |
| 8.1.23 Repeat Step 8.1.21 to produce panel metal temperatures of 460 ± 10 - 35°F as measured by TI-2601A or B - TI-2701A or B (panels 213-216). Hold for 1 hr to accomplish cure step. | | |

| | Initial | Date |
|---|---|---|

8.1.24 During each of the cure hold periods (Steps 8.1.20 - 8.1.23), the following parameters should be recorded to support subsequent collector system "optical" performance analysis (ref Step 8.1.14)

- Time and day
- Insolation
- Collector field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows
- Individual panel inlet and outlet temperatures

Steps 8.1.25 - 8.1.44 are required to carry-out the hot water cure of receiver panels 204-208 and 217-221. Cure of panels 204-208 shall be carried out during the morning to noon time period while cure of panels 217-221 shall occur during the noon to afternoon period. Sufficient flow shall be distributed through the heated panels to prevent excessive temperature or temperature gradient conditions. The maximum allowable feedwater flow is 50,000 lb/hr.

During the individual cure hold points for each panel, incident flux, feedwater flow, and feedwater temperature rise, data shall be recorded for subsequent absorbed versus incident power correlation analysis. Individual panel lengths and wall temperatures shall be

| Initial | Date |
|---|---|

recorded (both in a heated and unheated state) for panel growth analysis.

Hot Water Cure of Panels 204-208
(Steps 8.1.25 - 8.1.34)

8.1.25 Verify that the individual receiver flow control loops FCM-2031 - FCM-2803 are in console mode and input the appropriate set points listed below:

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301* - FCM-2402* | 5500 |
| FCM-2403 | 5500 |
| FCM-2501 | 4000 |
| FCM-2502 - FCM-2503 | 3000 |
| FCM-2601 - FCM-2701 | 1000 |
| FCM-2702 - FCM-2803 | 0 |

*Panels to be cured

8.1.26 Verify that collector field segments 402, 403, 504, 505 are in "Standby" and ready to track the receiver.

8.1.27 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures <360°F and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are <200°F.

| Initial | Date |
|---|---|

Maximum metal temperature and gradient constraints shall be as monitored by (top) panel DAS sensors, TEX-2354B, C, & D - TEX-2856B, C & D. (Sensors on substantially heated panels are TEX-2354B, C, & D - TEX-2556B, C, & D).

Increase 10/S/402, 403, 505
Increase 7/S/504

8.1.28 If an excessive temperature condition is not experienced during Step 8.1.27, issue the following heliostat "Increase" command and verify adequate flow to maintain panel metal temperatures $<360°F$ and no excessive heating of uncooled temperature gradients are $<200°F$. Verification carried out with temperature sensors listed in Step 8.1.27.

Increase 5/S/402, 403, 505
Increase 3/S/504

8.1.29 Repeat Step 8.1.28 for the full test incident power command unless excessive temperature conditions ($\geq 360°F$) or gradients ($>200°F$) were experienced or can be anticipated based on a 33% increase in incident power.

Increase 5/S/402, 403, 505
Increase 4/S/504

| | Initial | Date |
|---|---|---|

At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure.

8.1.30 Reduce the flow control set points for panel controllers FCM-2301 - FCM-2402 (panels 203-208) to produce a panel metal temperature of ∿315°F as indicated by SDPC data points TI-2301A or B - TI-2402A or B. Verify that the DAS sensors (TEX-2354B, C, & D - TEX-2654B, C, & D) are all indicating temperatures $\leq$360°F. (In the event the DAS sensors are indicating on excessive temperature (>360°F), increase appropriate panel flow until the DAS reading is reduced to 360°F.) Increase flow through adjacent heated panels (209-214) as required to maintain the metal temperature at <360°F as measured by TEX-2456B, C, & D - TEX-2655B, C, & D. Maintain the cure condition on panels 203-208 for a 20 min hold period. Make any flow adjustments required due to changing sun position. Record on the cure log sheet (Appendix 10H) that this step of the cure has been completed for panels 203-208. (Carryout Step 8.1.34 during each hold period.)

8.1.31 Reduce the flow control set points for panel controllers FCM-2301 - FCM-2402 (panels 203-208) to produce individual panel metal temperatures of 360 ± 35°F as indicated by TI-2301A or B - TI-2402A or B. Adjust flows

| | Initial | Date |
|---|---|---|
| as required to maintain adjacent heated panel temperatures at $\leq$360°F and gradients $\leq$200°F as measured by TEX-2456B, C, & D - TEX-2655B, C, & D. Maintain the cure condition on panels 203-208 for a 20 min hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 203-208. | | |
| 8.1.32 Repeat Step 8.1.31 to produce panel metal temperatures of 410 ± 35°F as measured by TI-2301A or B - TI-2402A or B (panels 203-208). | | |
| 8.1.33 Repeat Step 8.1.31 to produce panel metal temperatures of 460 ± 10 - 35°F as measured by TI-2301A or B - TI-2402A or B (panels 203-208). Hold for 1 hr to accomplish cure step. | | |
| 8.1.34 During each of the cure hold periods (Steps 8.1.30 - 8.1.33), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses (ref Step 8.1.14)<br>• Time and day<br>• Insolation<br>• Collector field-ring-track status<br>• Collector field status<br>• Receiver panel incident flux measurements<br>• Individual receiver panel flows | | |

| Initial | Date |
|---|---|

- Individual panel inlet and outlet temperature
- Panel metal temperatures
- Panel strain gauges

Hot Water Cure of Panels 217-221 (Steps 8.1.35 - 8.1.44)

8.1.35 Call up the individual panel flow controllers (FCM-2301 - FCM-2803) and verify that they are in the console mode. Input the appropriate set points listed below.

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301 - FCM-2402 | 0 |
| FCM-2403 - FCM-2503 | 1000 |
| FCM-2601 - FCM-2602 | 3000 |
| FCM-2603 | 4000 |
| FCM-2701 | 5500 |
| FCM-2702* - FCM-2803* | 5500 |

*Panels to be cured

8.1.36 Verify that collector field segments 508, 509, 410, and 411 are in "Standby" and ready to track the receiver.

8.1.37 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures <360°F and no excessive heating of uncooled structures (half power check point). Verify that all heated

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| panel temperature gradients are <200°F. Maximum metal temperature and gradient constraints shall be as monitored by (top) panel DAS sensors, TEX-2354A, B, & C - TEX-2856A, B, & C. (Sensors on substantially heated panels are TEX-2654A, B, & C - TEX-2856A, B & C).<br><br>Increase 10/S/410, 411, 508<br>Increase 7/S/509 | | |
| 8.1.38 If an excessive temperature condition is not experienced during Step 8.1.37, issue the following heliostat "Increase" command and verify adequate flow to maintain panel metal temperatures <360°F and no excessive heating of uncooled structures (75% power check point). Verify that panel metal temperature gradients are <200°F. Verification carried out with temperature sensors listed in Step 8.1.28.<br><br>Increase 5/S/410, 411, 508<br>Increase 3/S/509 | | |
| 8.1.39 Repeat Step 8.1.38 for the full incident power command unless excessive temperature conditions (≥360°F) or gradients (>200°F) were experienced or can be anticipated based on a 33% increase in incident power.<br><br>Increase 5/S/410, 411, 508<br>Increase 4/S/509 | | |

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At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure.

8.1.40 Reduce the flow control set points for panel controllers FCM-2702 - FCM-2803 (panels 217-221) to produce a panel metal temperature of 300°F as indicated by SDPC data points TI-2702A or B - TI-2803A or B. Verify that the DAS sensors (TEX-2755B, C, & D - TEX-2856B, C, & D) are all indicating temperatures ≤360°F. (In the event the DAS sensors are indicating an excessive temperature (>360°F), increase appropriate panel flow until the DAS reading is reduced to 360°F). Increase flow through adjacent heated panels (211-216) as required to maintain the metal temperature at <360°F as measured by TEX-2555B, C, & D - TEX-2754B, C, & D. Maintain the cure condition on panels 217-221 for a 20 min hold period. Make any flow adjustments required due to changing sun position. Record on the cure log sheet (Appendix 10H) that this step of the cure has been completed for panels 217-221. (Carryout Step 8.1.44 during each hold period.)

8.1.41 Reduce the flow control set points for panel controllers FCM-2702 - FCM-2803 (panels 217-221) to produce individual panel metal temperatures of 360 ± 35°F as indicated by TI-2702A or B - TI-1803A or B. Adjust flows

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| as required to maintain adjacent heated panel temperatures at $\leq$360°F and gradients $\leq$200°F as measured by TEX-2555B, C, & D - TEX-2754B, C, & D. Maintain the cure condition on panels 217-221 for a 20 min hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 217-221. | | |
| 8.1.42 Repeat Step 8.1.41 to produce panel metal temperatures of 410 ± 35°F as measured by TI-2702A or B - TI-2803A or B (panels 217-221). | | |
| 8.1.43 Repeat Step 8.1.41 to produce panel metal temperatures of 460 ± 10 - 35°F as measured by TI-2702A or B - TI-2803A or B (panels 217-221). Hold for 1 hr to accomplish cure step. | | |

8.1.44 During each of the cure hold periods (Steps 8.1.40 - 8.1.43), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses (ref Step 8.1.14)

- Time and day
- Insolation
- Collector field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows

| | Initial | Date |
|---|---|---|
| • Individual panel inlet and outlet temperatures<br>• Panel metal temperatures<br>• Panel strain gauges | | |
| 8.1.45 Periodically inspect the inter panel light seals during non operating periods of the water cure procedure to verify the integrity of the light seal. As a minimum, inspections should be made upon completion of each of the major sections of the water cure procedure (panels 209-212, 213-216, 204-208, and 217-221). | | |
| 8.1.46 Periodically inspect the individual receiver panels during non operating periods for indications of binding caused by thermal expansion. As a minimum, inspections should be made upon completion of each of the major sections of the water cure procedure (panels 209-212, 213-216, 204-208, and 217-221). | | |

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8.2 "STEAMING" RECEIVER OPERATION - FLOW TO FLASH TANK

This portion of Section 8 involves the steam (high temperature) cure of the receiver boiler panels as well as open and closed loop controls testing of receiver related control systems. The final portion of this section (8.2) involves the routine startup of the receiver (per the published operating instructions) and the establishment of panel steaming operation while under temperature control. Since all receiver discharge flow will pass to the flash tank during this section of the procedure, total feedwater flow is limited to ≤50,000 lb/hr while the steam generation rate is limited to 40,000 lb/hr. The steam cure of the individual boiler panels is divided into 4 activities (panels 209-212, panels 213-216, panels 204-208, and panels 217-221). During each cure activity, power is also supplied to the receiver preheat panels to carryout a curing function for those panels and provide higher temperature feedwater to the boiler panels which approaches their normal inlet operating temperatures.

During the course of all testing carried out as part of section 8.2, the flash tank vent pressure setting shall be maintained at ∿485 psig to provide a more or less constant pressure test environment. Steam that is produced during these tests will be

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preferentially diverted to the deaerator to provide some feedwater heating. Excess steam will be diverted to the condenser. As a result, feedwater temperature supplied to the receiver may range from ∿220 to ∿350°F, depending on the quantity of steam produced by the receiver and the degree of heat recovery used during any particular test.

The receiver feed pump shall be operated in either a pressure or valve position control mode depending on the particular test. When operating in pressure control, set points will be selected which are compatible with the 485 psig flash tank vent controller setting. When operating in valve control, the pump discharge pressure will automatically adjust to the system demands as controlled by the flash tank pressure setting and receiver control valve action.

After each of these cure activities, control checkout testing is carried out for applicable receiver controllers. Testing of the flash tank vent controllers occurs after completion of the cure of panels 209-212, when significant steam is available.

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Curing of panel groupings 204-208 and 209-212 as well as carrying out related controls checkout testing should be accomplished during the morning to noon time period. Corresponding point cure and controls checkout testing for panel groups 213-216 and 217-221 should be accomplished during the noon to afternoon time period.

8.2.1 Steam Cure of Panels 209-212 Step 8.2.1.1 - 8.2.1.15)

8.2.1.1 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.1.2 Call up the individual panel flow controllers (FCM-2301 - FCM-2803) and verify that they are in the "console" mode. Input the appropriate set points listed below.

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301 - FCM-2303 | 500 |
| FCM-2401 | 1500 |
| FCM-2402 | 3500 |
| FCM-2403* | 4500 |
| FCM-2501* - FCM-2503* | 5000 |
| FCM-2601 | 5000 |
| FCM-2602 | 4500 |
| FCM-2603 | 3500 |
| FCM-2701 | 2000 |
| FCM-2702 | 1000 |
| FCM-2703 - FCM-2803 | 500 |

*Panels to be cured

| | Initial | Date |
|---|---|---|
| 8.2.1.3 Verify that the valve control set point for the receiver feed pump is 80% and switch feed pump controller, PC-1105 to valve control. | | |
| 8.2.1.4 Verify that the flows set in Step 8.2.1.2 are maintained at their set point values. | | |
| 8.2.1.5 Verify that the receiver flash tank vent set point is 485 psig (adjustment of PC-2906, PC-1000, and PC-647B). | | |
| 8.2.1.6 Verify that collector field wedges 01, 05, 06, 07, and 12 are in "Standby" and ready to track the receiver. | | |
| 8.2.1.7 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures <520°F as indicated by TI-2301A or B - TI-2803A or B and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are <200°F as indicated by panel (top) DAS sensors TEX-2354B, C, & D). "Track" command should be issued in a "rapid" fashion to produce a "step" change in input power to the receiver which simulates actual operating transients to be expected. Transient data to be recorded during the "step" change in power | | |

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|---|---|---|
| includes flow rate, metal temperatures, and inlet/outlet fluid temperatures for each panel as well as system pressures.<br><br>Increase 17/W/05, 07<br>Increase 8/W/01, 12<br>Increase 5/W/06 | | |
| 8.2.1.8 Repeat Step 8.2.1.7 using the following heliostat "Increase" command (75% power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.1.7.<br><br>Increase 9/W/05, 07<br>Increase 4/W/01, 12<br>Increase 2/W/06 | | |
| 8.2.1.9 Repeat Step 8.2.1.7 using the following heliostat "Increase command (10% test power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.1.7. Note: this step should be deleted or modified if excessive metal temperatures or temperature gradients were experienced during Step 8.2.1.8 or can be anticipated as a result of a 33% increase in incident receiver power.<br><br>Increase 9/W/05, 07<br>Increase 4/W/01, 12<br>Increase 2/W/06 | | |

| Initial | Date |
|---|---|

At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure. Whenever possible panel flow set point changes required to transition from one cure condition to the next should be done through step changes (reductions) in flow to permit the gathering of dynamic receiver data. In selecting the step changes in flow set points, conservation should be used to prevent a panel over temperature condition from occurring.

During each cure hold point (Step 8.2.1.10 - 8.2.1.15), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses.

- Time and day
- Insolation
- Collector field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows
- Individual panel inlet and outlet temperatures
- Panel metal temperatures
- Panel strain gauges

8.2.1.10 Reduce the flow control set points for panel controllers FCM-2403 - FCM-2503 (panels 209-212) to produce individual panel metal temperatures of 520 ± 35°F as indicated by TI-2403A

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|---|---|---|
| or B - TI-2503A or B. Adjust flows as required to maintain adjacent heated panel temperatures <520°F and gradients <200°F as measured by TEX-2354B, C, & D - TEX-2455B, C, & D and TEX-2654B, C, & D - TEX-2856B, C, & D. Maintain the cure condition on panels 209-212 for a 20 min hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 209-212. | | |
| 8.2.1.11 Repeat Step 8.2.1.10 to produce panel metal temperatures of 585 ± 35°F as indicated by TI-2403A or B - TI-2503A or B (panels 209-212). | | |
| 8.2.1.12 Repeat Step 8.2.1.10 to produce panel metal temperatures of 660 ± 35°F as indicated by TI-2403A or B - TI-2503A or B (panels 209-212). | | |
| 8.2.1.13 Repeat Step 8.2.1.10 to produce panel metal temperatures of 720 ± 35°F as indicated by TI-2403A or B - TI-2503A or B (panels 209-212). | | |
| 8.2.1.14 Repeat Step 8.2.1.10 to produce panel metal temperatures of 780 ± 35°F as indicated by TI-2403A or B - TI-2503A or B (panels 209-212). | | |

| | Initial | Date |
|---|---|---|
| 8.2.1.15 Repeat Step 8.2.1.10 to produce panel metal temperatures of 850 ± 35°F as indicated by TI-2403A or B - TI-2503A or B (panels 209-212). | | |

| | Initial | Date |
|---|---|---|

8.2.2 Demonstrate satisfactory closed loop operation of the flash tank vent valve pressure controllers (PC2906, PC1000, and PC647B) and the desuperheater spray water temperature controller TC1002. Refer to Figure 8.2.2-1 through 8.2.2-4.

8.2.2.1 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.2.2 Confirm that the flow to the flash tank and receiver operation is stable and well behaved.

8.2.2.3 Increase the energy flow to the flash tank to achieve steady state steam flow out of flash tank at the desired flash tank operating pressure. Confirm PC2906 is active and controlling flash tank pressure.

8.2.2.4 Tune PC2906 - flash tank pressure controller (Figure 8.2.2-1) by carrying out the following steps using loop tuning form.

A) Set receiever console to configure mode.

B) Decrease pressure set point of PC2906 by 10% and observe the response on the strip chart.

C) Increase PC2906 set point back to nominal value and observe the response on the strip chart.

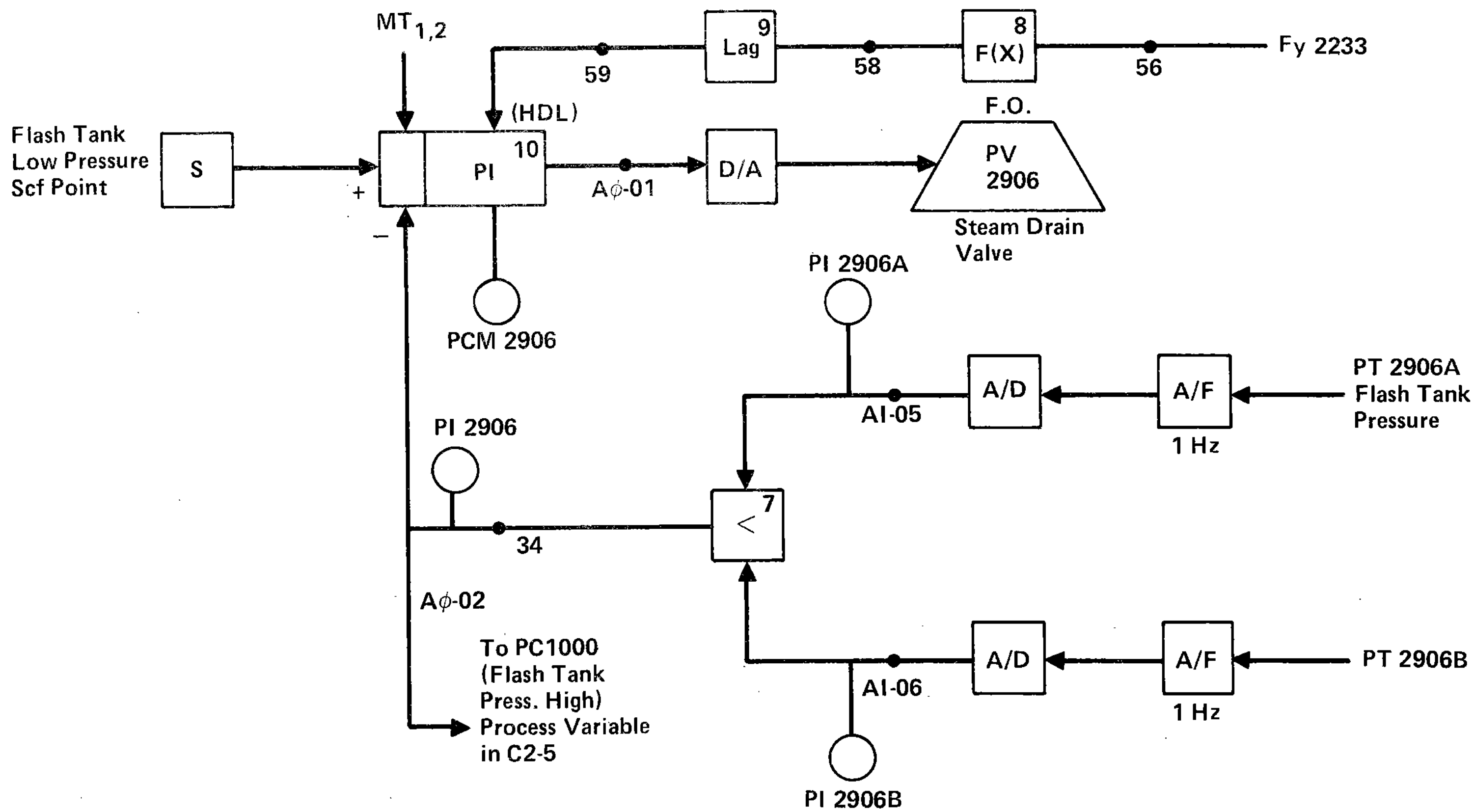


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Figure 8.2.2-1. Receiver Flash Tank Low Pressure Controller Functional Block Diagram – PC 2906

| | Initial | Date |
|---|---|---|
| D) Increase/decrease proportional gain, K1 (C1-11, AL-10).* | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease PC2906 set point 10% and observe response. | | |
| G) Increase PC2906 set point to nominal value and observe pressure response. | | |
| H) Increase/decrease reset gain, K2 (C1-11, AL-10) in the ± 30% increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary PC2906 controller gains and record. | | |
| K) Adjust set points, alarms, and limits if required. | | |
| 8.2.2.5 Increase flow to maximum flash tank flow limits and verify satisfactory operation of PC2906. Tune loops is required. | | |
| 8.2.2.6 Establish transition conditions such that PC647B is active and controlling deaerator pressure. (i.e. increase D.A. pressure to PC647B set point or decrease PC647B set point to D.A. operating conditions). | | |

| | Initial | Date |
|---|---|---|

8.2.2.7 Tune PC647B - D.A. pressure controller (Figure 8.2.2-2) by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease pressure set point of PC647B by 10% and observe the response on the strip chart.

C) Increase PC647B set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C4-4, AL-1).*

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease PC647B set point 10% and observe response.

G) Increase PC647B set point to nominal value and observe pressure response.

H) Increase/decrease reset gain, K2 (C4-4, AL-1) in the ± 30% increments.

I) Repeat steps F -- H as required until response is satisfactory.

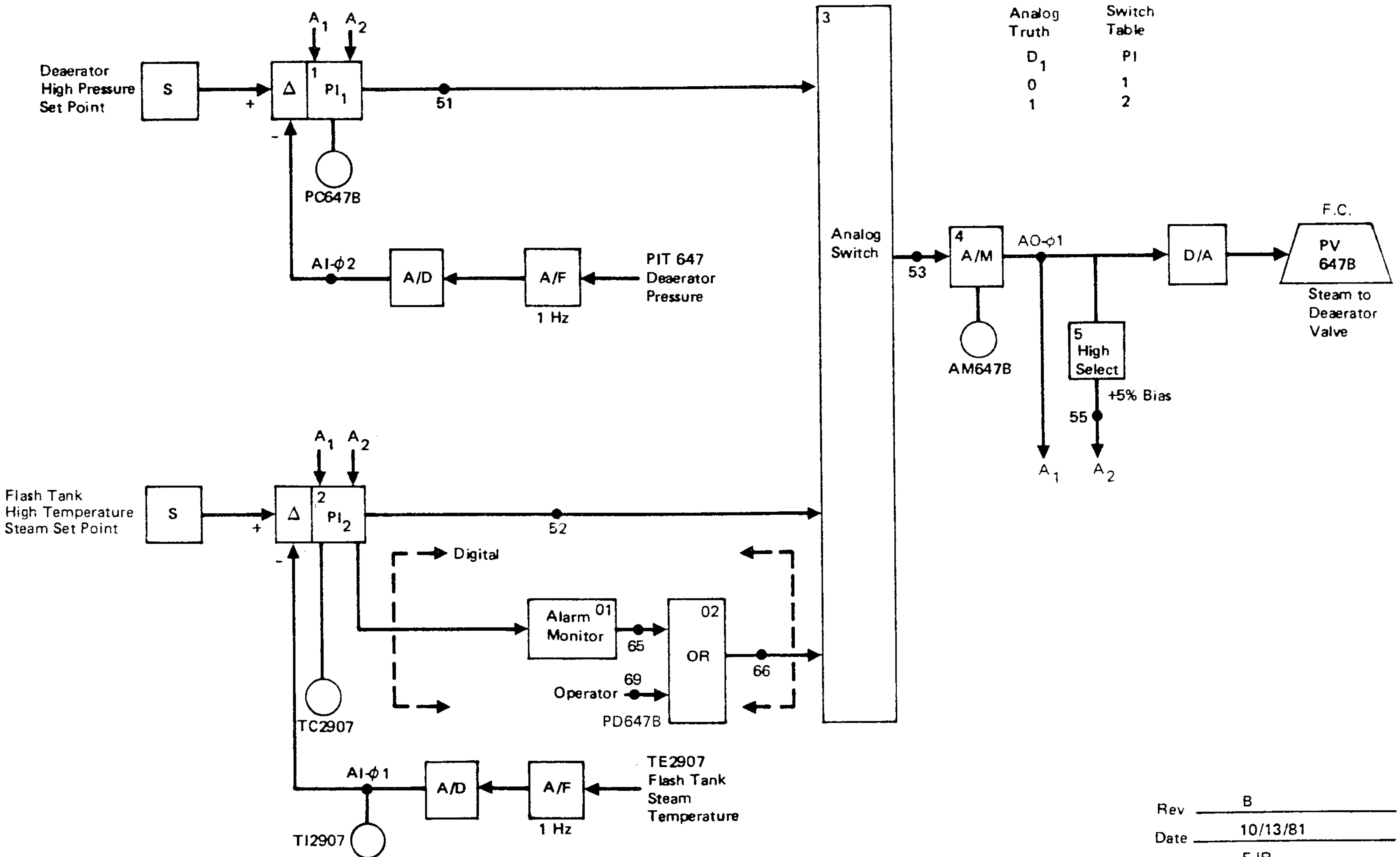


Figure 8.2.2-2. Receiver Flash Tank Steam Drain to Deaerator Controller (With High Temperature Override) Functional Block Diagram – PC647B

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| | Initial | Date |
|---|---|---|

J) Establish preliminary PC647B controller gains and record.

K) Adjust set point, alarms and limits if required.

8.2.2.8 Verify satisfactory operation of the high temperature override on PC647B.

8.2.2.8.1 Confirm that PC1000 is in auto mode with setpoint of 500 psig. Confirm TC1002 is in auto mode.

8.2.2.8.2 Select PD647B and switch from pressure control mode to temperature control mode. Confirm that control response diverts steam flow from the deaerator to the condenser thru PC1000 and the transition is well behaved. Tune TC2907 control parameters if required.

8.2.2.8.3 Select PD647B and switch back from temperature control override mode to pressure control.

8.2.2.8.4 Decrease temperature control setpoint and override alarm threshold (C4-4, AL-2, PV Alarm) such that the temperature override loop will automatically initiate. Confirm response is satisfactory for temperature override control. Tune TC2907 control parameters if required using loop tuning form.

| | | Initial | Date |
|---|---|---|---|
| 8.2.2.8.5 | Reset TC2907 setpoint and override alarm threshold back to nominal conditions. | | |
| 8.2.2.9 | Transition flash tank outlet flow from deaerator to condenser. | | |
| 8.2.2.9.1 | Verify PC1000 is in auto mode with a setpoint of 500 psig. Verify TC1002 is in auto mode. | | |
| 8.2.2.9.2 | Select AM647B, set to manual mode and adjust output to divert partial flow from deaerator to condenser. (Note - Flash tank pressure should increase resulting in PC2906 opening up and PC1000 assuming flash tank pressure control.) Verify that PC1000 and PC2906 are functioning properly. | | |
| 8.2.2.10 | Tune PC1000 - Flash tank high pressure controller (Figure 8.2.2-3) by carrying out the following steps using loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease pressure set point on PC1000 by 10% and observe the response on the strip chart.<br><br>C) Increase pressure set point back to nominal value and observe the response on the strip chart. | | |
| | D) Increase/decrease proportional gain, K1 (C2-5, AL-19).* | | |

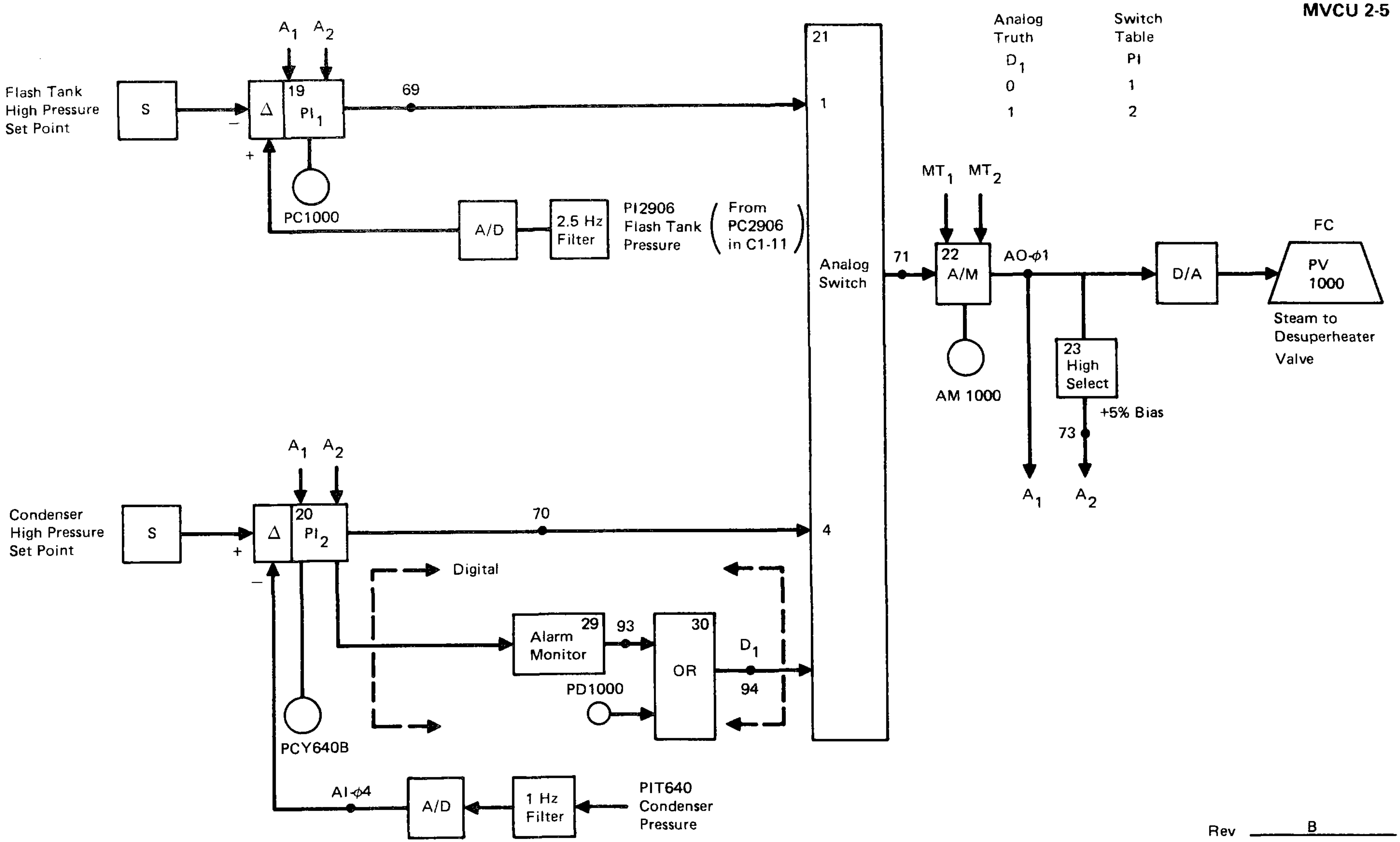


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**Figure 8.2.2-3. Receiver Flash Tank High Pressure Controller (With Condenser High Pressure Override) Functional Block Diagram – PC1000**

| Initial | Date |
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E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease PC1000 set point 10% and observe response.

G) Increase PC1000 set point to nominal value and observe pressure response.

H) Increase/decrease reset gain, K2 (C2-5, AL-19) in the ± 30% increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary PC1000 controller gains and record.

K) Adjust setpoint, alarms, limits as required.

8.2.2.11 Tune TC1002 - desuperheater temperature controller (Figure 8.2.2-4) by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TCM1002 by 10% and observe the response on the strip chart.

C) Increase TCM1002 set point back to nominal value and observe the response on the strip chart.

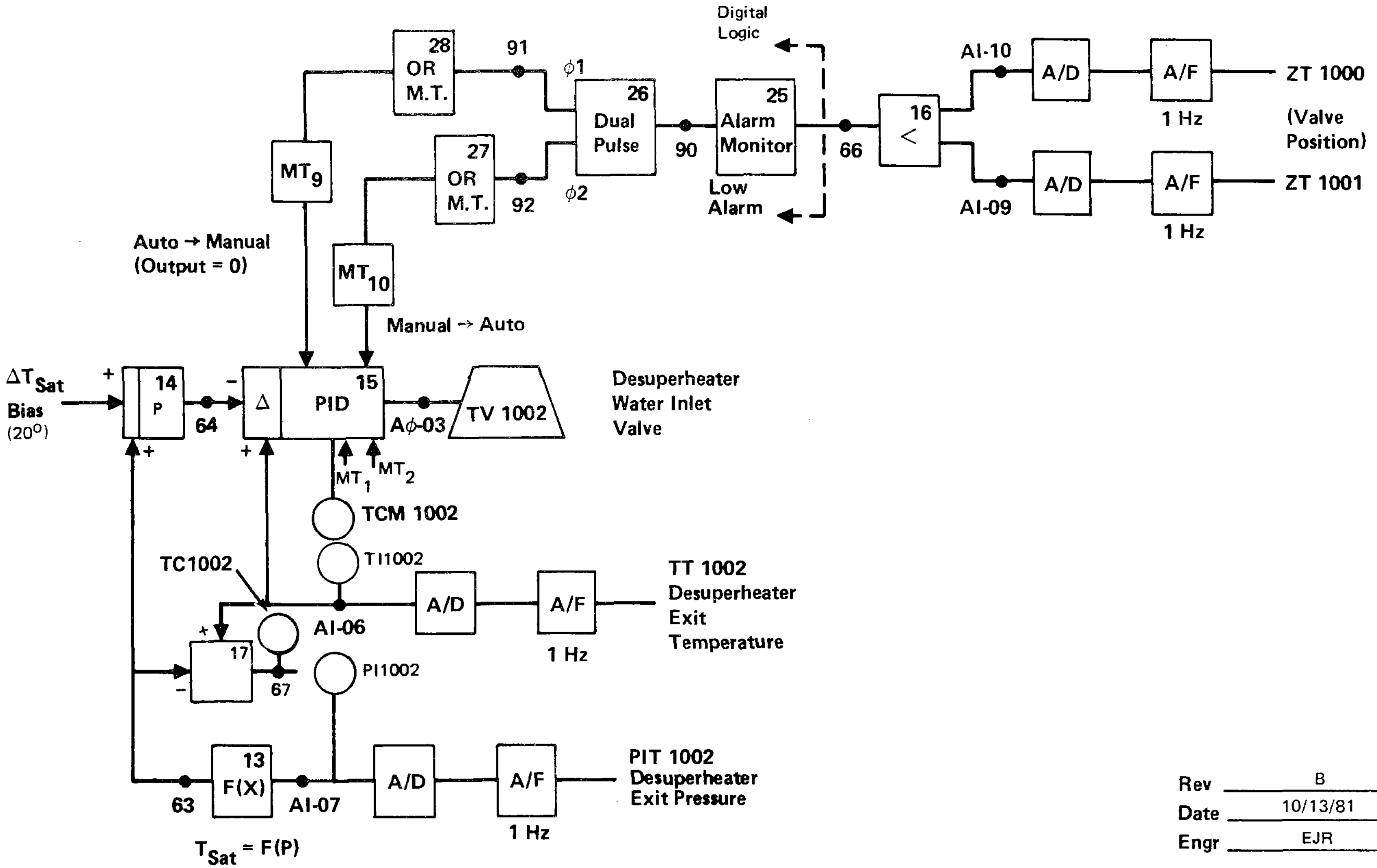


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Figure 8.2.2-4. Steam Dump Line Desuperheater Temperature Controller Functional Block Diagram – TC1002

| | Initial | Date |
|---|---|---|
| D) Increase/decrease proportional gain, K1 (C2-5, AL-15).* | | |
| E) Repeat steps B -- D as required until response is satisfactory.<br>F) Decrease TCM1002 set point 10% and observe response.<br>G) Increase TCM1002 set point to nominal value and observe temperature response.<br>H) Increase/decrease reset gain, K2 (C2-5, AL-15) in the ± 30% increments.<br>I) Repeat steps F -- H as required until response is satisfactory.<br>J) Establish preliminary TV1002 controller gains and record.<br>K) Adjust setpoints, alarms, limits as required. | | |
| 8.2.2.12 Verify satisfactory operation of PC1000 and TC1002 at high flow conditions.<br>8.2.2.12.1 Select AM647B and close valve PV647B diverting full flash tank outlet steam flow to condenser. | | |

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|---|---|---|

8.2.2.12.2 Confirm satisfactory operation of PC1000 and TC1002 under high flow conditions. Tune PC1000 and TC1002 if required.

8.2.2.13 Verify override logic on PC1000

8.2.2.13.1 Simulate condenser high pressure conditions by reducing pressure override alarm value (C2-5, AL-20, PV Alarm) and pressure set-point (PCY640B) to condenser pressure valve. Note - Caution: Flash tank pressure must be closely monitored during the test since there is no longer direct control over it.

8.2.2.13.2 Observe response and verify that PCY640B is active and controlling condenser pressure.

8.2.2.13.3 Tune PC1000 - condenser pressure mode controller PCY640B (Figure 8.2.2-3) by carrying out the following steps using tuning form.

A) Set receiver console to configure mode.

B) Decrease pressure set point of PCY640B by 10% and observe the response on the strip chart.

C) Increase PCY640B set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C2-5, AL-20).*

| | Initial | Date |
|---|---|---|
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease PCY640B set point 10% and observe response. | | |
| G) Increase PCY640B set point to nominal value and observe pressure response. | | |
| H) Increase/decrease reset gain, K2 (C2-5, AL-20) in the ± 30% increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary PCY640B controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |
| 8.2.2.13.4 Reset condenser pressure override alarm valve to its nominal condition. | | |
| 8.2.2.13.5 Select PD1000 and initiate condenser pressure override control operator command. Confirm satisfactory transition and control system response. | | |
| 8.2.2.13.6 Select PD1000 and reset back to flash tank pressure control. Reset PCY640B setpoint back to its nominal value. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.2.2.14 | Reset nominal operating flow path from flash tank. | | |
| 8.2.2.14.1 | Select AM647B and set to auto. Confirm that PC647B is active and nominal flow is established to the deaerator. | | |
| 8.2.2.14.2 | Confirm flash tank pressure control transitions from PC1000 to PC2906 and this transition is satisfactory. | | |
| 8.2.2.15 | Verify valve override logic on TC1002 is functional and operates satisfactorily. | | |
| 8.2.2.16 | Restore system back nominal operating conditions. | | |

| | Initial | Date |
|---|---|---|

8.2.3 CONTROL TESTS - PANELS 210, 212 - STEAM LOOP OPERATION

8.2.3.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 210 & 212 (refer to Figures 8.2.3-1 and 8.2.3-2). Obtain both step & frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances.

8.2.3.1.1 Verify that the prerequisites have been met as required in Section 4.2.3.

8.2.3.1.2 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.3.1.3 Re-establish the approximate heliostat configuration and flow conditions used for the 850° panel cure (see Section 8.2.1.15).

8.2.3.1.4 Adjust flowrate setpoints (FCM2501, FCM2503) to achieve 850°F outlet panel steam temperature on panels 210 & 212. Monitor T12504 & T12506.

8.2.3.1.5 Verify that the control test unit is installed and operating on TV2501 & TV2503.

8.2.3.1.6 Verify receiver feedpump is in pressure control (PC1105).

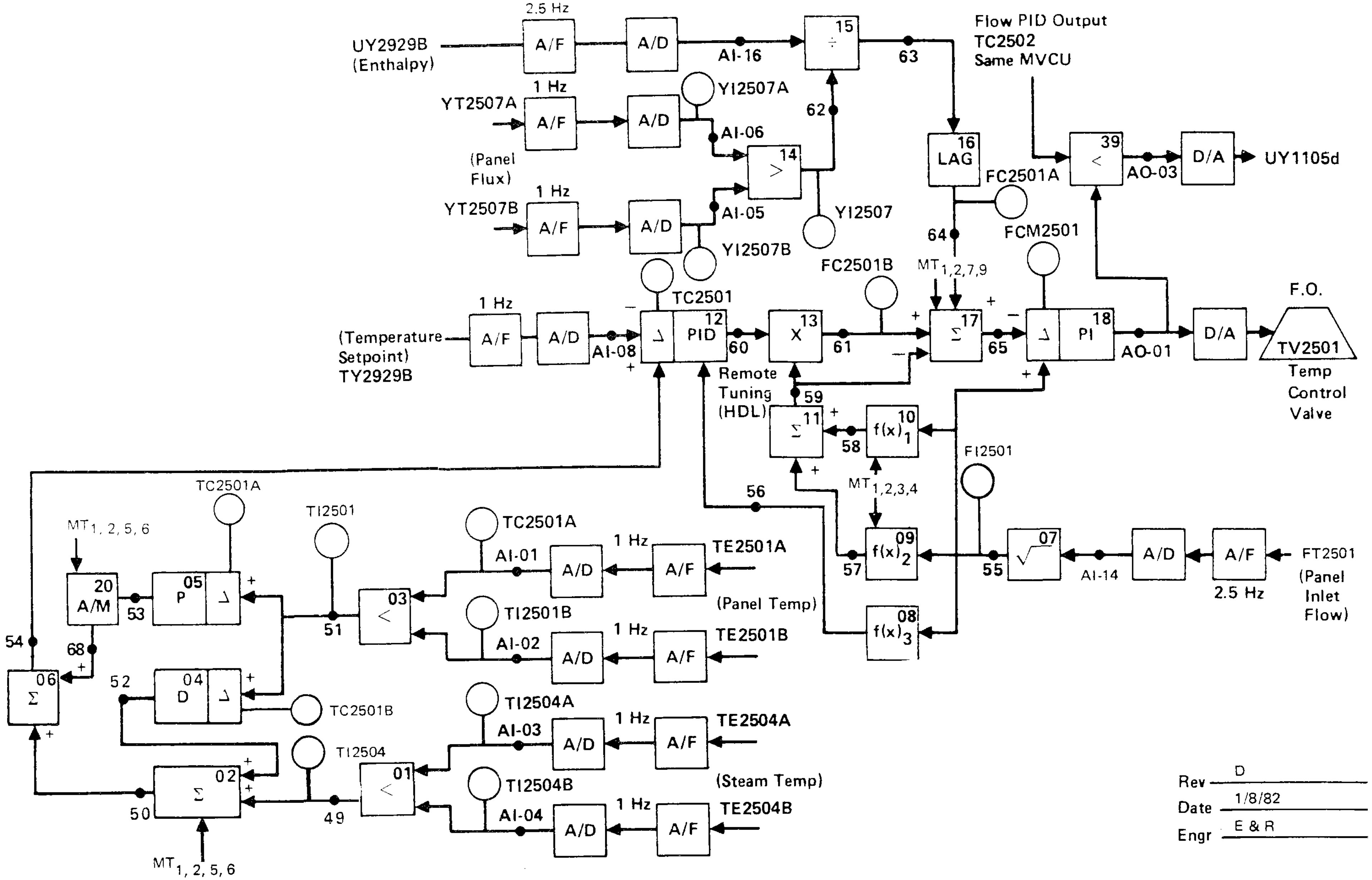


Figure 8.2.3-1. RS Steam Temperature Controller Functional Block Diagram TC-2501

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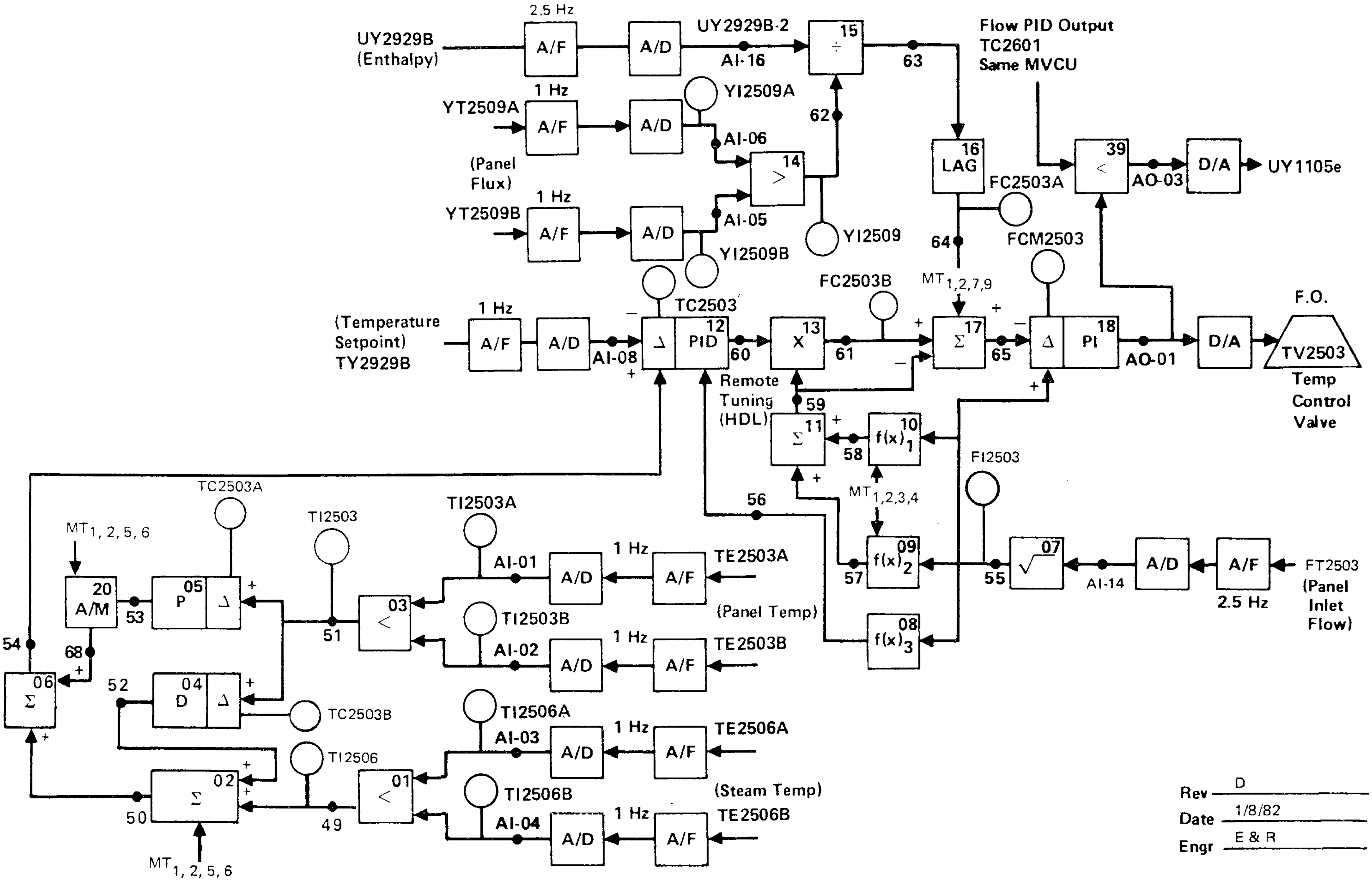


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Engr E & R

Figure 8.2.3-2. RS Steam Temperature Controller Functional Block Diagram TC-2503

| | Initial | Date |
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8.2.3.1.7 Obtain open loop step response data on panel 210 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2501 to manual mode.

C) Implement a step decrease in FCM2501 output by approximately 10% of nominal valve (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ±0.1 lb/sec and temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2501 (PV & CO), T12501, T12504, Y12504, P12902.

FCM2501 Output ____________%
Command Change

D) Implement a step increase (back to nominal) in FCM2501 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2501 back to auto.

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8.2.3.1.8 Obtain open loop step/ramp response to a flux disturbance on panel 210 & 212 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2501, FCM2503 to manual mode.

C) Implement a step/ramp decrease in the power level on panel 210 & 212 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2501 (PV & CO), TI2501, TI2504, YI2507A/B, FCM2503 (PV & CO), TI2503, TI2506, YI2509A/B, PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Set FCM2501, FCM2503 back to auto.

| | Initial | Date |
|---|---|---|

8.2.3.1.9 Perform frequency response tests on panel 210 (See TC2501, Figure 8.2.3-1) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2501. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.3.1.7 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2501 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2501.

6) Set FCM 2501 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on F12501.

| | Initial | Date |
|---|---|---|

8.2.3.1.9 7) Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ   Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room). ____

(2) If panel temperature drifts off the nominal test condition - adjust FCM2501 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU. ____

9) Set FCM2501 back to auto. ____

8.2.3.1.10 Obtain open loop step response data on panel 212 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady condition for approximately 5 minutes. ____

| | Initial | Date |
|---|---|---|

8.2.3.1.10 B) Set FCM2503 to manual mode.

C) Implement a step decrease in FCM2503 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2503 (PV & CO), T12503, T12506, YI2509, & PI2902.

FCM2503 Output ____________%
Command Change

D) Implement a step increase (back to nominal) in FCM2503 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2503 back to auto.

8.2.3.1.11 Perform frequency response tests on panel 212 (See TC2503, Figure 8.2.3-2) by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| 8.2.3.1.11 1) Verify that the controls test unit (CTU) is installed and operating on TC2503. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.3.1.10 C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2503 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2503. | | |
| 6) Set FCM2503 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2503.<br><br>Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles). | | |

| | Initial | Date |
|---|---|---|

8.2.3.1.11 7) Repeat 4) at a frequency of 0.05 HZ

Repeat 4) at a frequency of 0.07 HZ

Repeat 4) at a frequency of 0.1 HZ

Repeat 4) at a frequency of 0.2 HZ

Repeat 4) at a frequency of 0.5 HZ

Repeat 4) at a frequency of 0.7 HZ

Repeat 4) at a frequency of 1 HZ

Repeat 4) at a frequency of ____ HZ

Repeat 4) at a frequency of ____ HZ

Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room).

(2) If panel temperature drifts off the nominal test condition - adjust FCM2503 output from operator station to correct - if cannot successfully adjust - return to Step 5. ______ ______

8) Switch TFA input out of CTU. ______ ______

9) Set FCM2503 back to auto. ______ ______

| | Initial | Date |
|---|---|---|
| 8.2.3.2 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 210 & 212 (refer to Figures 8.2.3-1 and 8.2.3-2). Obtain both step & frequency response data to valve disturbances at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.3.2.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.3.2.2 Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.3.3.3 Re-establish the approximate heliostat configuration and flow conditions used for 660°F panel cure (See Section 8.2.1.12). | | |
| 8.2.3.2.4 Adjust flowrate setpoints (FCM2501 & FCM2503) to achieve 660°F outlet panel steam temperature on panels 210 & 212. Monitor TI2504 & TI2506. | | |
| 8.2.3.2.5 Verify that the control test unit is installed and operating on TV2501 & TV2503. | | |
| 8.2.3.2.6 Verify receiver feedpump is in pressure control (PC1105). | | |
| 8.2.3.2.7 Obtain open loop step response data on panel 210 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |

| | Initial | Date |
|---|---|---|

8.2.3.2.7 B) Set FCM2501 to manual mode.

C) Implement a step decrease in FCM2501 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2501 (PV & CO), TI2501, TI2504, YI2507, & PI2902.

FCM2501 Output ________%
Command Change

D) Implement a step increase (back to nominal) in FCM2501 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2501 back to auto.

8.2.3.2.8 Obtain open loop step/ramp response to a flux disturbance on panel 210 & 212 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

| | Initial | Date |
|---|---|---|

8.2.3.2.8 B) Set FCM2501, & FCM2503 to manual mode.

C) Implement a step/ramp decrease in the power level on panel 210 & 212 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2501 (PV & CO), TI2501, TI2504, YI2507A/B, FCM2503 (PV & CO), TI2503, TI2506, YI2509A/B & PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\leq$ 50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Set FCM2501 & FCM2503 back to auto.

8.2.3.2.9 Perform frequency response tests on panel 210 (See TC2501, Figure 8.2.3-1) by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| 8.2.3.2.9 1) Verify that the controls test unit (CTU) is installed and operating on TC2501. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.3.2.7 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2501 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2501. | | |
| 6) Set FCM2501 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2501. Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles). | | |

| | Initial | Date |
|---|---|---|

8.2.3.2.9 7) Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ    Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room).

(2) If panel temperature drifts off the nominal test condition - adjust FCM2501 output from operator station to correct - if cannot successfully adjust - return to Step 5. ____ ____

8) Switch TFA input out of CTU. ____ ____

9) Set FCM2501 back to auto. ____ ____

8.2.3.2.10 Obtain loop step response data on panel 212 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. ____ ____

| | | Initial | Date |
|---|---|---|---|
| 8.2.3.2.10 | B) Set FCM2503 to manual mode. | | |
| | C) Implement a step decrease in FCM2503 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach a steady state. | | |
| | Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2503 (PV & CO), TI2503, TI2506, YI2507, & PI2902. | | |
| | FCM2503 Output ________% Command Change | | |
| | D) Implement a step increase (back to nominal) in FCM2503 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| | E) Reset FCM2503 back to auto. | | |
| 8.2.3.2.11 | Perform frequency response tests on panel 212 (See TC2503, Figure 8.2.3-2) by carrying out the following steps. | | |
| | 1) Verify that the controls test unit (CTU) is installed and operating on TC2503. | | |

| | Initial | Date |
|---|---|---|

8.2.3.2.11 2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.3.2.10 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2503 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2503.

6) Set FCM2503 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2503.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ

| | Initial | Date |
|---|---|---|

8.2.3.2.11 7) Repeat 4) at a frequency of 0.5 HZ

Repeat 4) at a frequency of 0.7 HZ

Repeat 4) at a frequency of 1 HZ

Repeat 4) at a frequency of ____ HZ

Repeat 4) at a frequency of ____ HZ

Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2503 output from operator station to correct - if cannot successfully adjust - return to Step 5. ____ ____

8) Switch TFA input out of CTU. ____ ____

9) Set FCM2503 back to auto. ____ ____

| | Initial | Date |
|---|---|---|

8.2.3.3 Obtain closed loop response data on panel temperature controllers TC2501, & TC2503 to temperature setpoint and flux changes at a nominal temperature of 660°F. Tune control loops as required.

8.2.3.3.1 Verify that the receiver panel 210 is in a steady state condition at approximately 485 psig and 660°F. TC2501 in flow control. Adjust flow setpoint if required to achieve 660°F.

8.2.3.3.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2501, set to console mode and set temperature setpoint to current PV value.

8.2.3.3.3 Initiate panel metal temperature control on TC2501. Select TD2301B and initiate switch to on position. Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactory control metal temperature, Select TD2501A and switch back to flow control. Also Select TD2501B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.3.3.1).

8.2.3.3.4 Tune TC2501 - panel metal temperature controller (See Figure 8.2.3-1) by carrying out the following steps using the loop tuning form.

| | Initial | Date |
|---|---|---|
| 8.2.3.3.4 A) Set receiver console to configure mode. | | |
| B) Decrease temperature setpoint of TC2501 by 10% and observe the response on the strip chart. | | |
| C) Increase TC2501 setpoint back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain K1 (C1-4, AL-12)*. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC2501 setpoint 10% and observe response on strip chart. | | |
| G) Increase TC2501 setpoint to nominal value and observe temperature response on strip chart. | | |
| H) Increase/decrease reset gain, K2 (C1-4, AL-12) in the ± 30 increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary TC2501 controller gains in metal temperature control mode and record. | | |
| K) Adjust setpoints, alarms, and limits if required. | | |

| | Initial | Date |
|---|---|---|
| 8.2.3.3.5 Verify that the receiver panel 212 is in a steady state condition at approximately 485 psig and 660°F. TC2503 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.3.3.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2503, set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.3.3.7 Initiate panel metal temperature control on TC2503. Select TD2503B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactory control metal temperature, Select TD2503A and switch back to flow control. Also Select TD2503B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.3.3.5). | | |
| 8.2.3.3.8 Tune TC2503 - panel metal temperature controller (See Figure 8.2.3-2) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease temperature setpoint of TC2503 by 10% and observe the response on the strip chart. | | |

| | Initial | Date |
|---|---|---|

8.2.3.3.8 C) Increase TC2503 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-5, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2503 setpoint 10% and observe response on strip chart.

G) Increase TC2503 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-5, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2503 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

| | Initial | Date |
|---|---|---|
| 8.2.3.3.9 Obtain closed loop response on TC2501 & TC2503 to a flux disturbance on panels 210 and 212 by carrying out the following steps. | | |
| A) Confirm that receiver panels 210 & 212 are in a steady state condition for approximately 2 minutes. | | |
| B) Confirm TC2501 & TC2503 is in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panel 210 & 212 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2501 (PV & CO), TI2501, TI2504, YI2507A/B, FCM2503 (PV & CO), TI2503, TI2506, YI2509A/B & PI2501.<br><br>Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.2.3.3.9 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TI2501 & TC2503. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select C1-4, AL-16 and C1-5, AL-16 - using loop tuning form increase/ decrease gain and low time constant as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|
| 8.2.3.4 Obtain closed loop response data on panel temperature controllers TC2501 & TC2503 to temperature setpoint and flux changes at a nominal temperature of 850°F. Tune control loops as required. | | |
| 8.2.3.4.1 Verify that the receiver panel 210 is in a steady state condition at approximately 485 psig and 660°F. TC2501 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.3.4.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2501, set to console mode and set temperature setpoint to 850°F. | | |
| 8.2.3.4.3 Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactory control metal temperature, Select TC2501 and switch back to 600°F setpoints - consult test engineer for controller parameter adjustments and go back to Section 8.2.3.3.1). | | |
| 8.2.3.4.4 Tune TC2501 - panel metal temperature controller (See Figure 8.2.3-1) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode. | | |

| | Initial | Date |
|---|---|---|
| 8.2.3.4.4 B) Decrease temperature setpoint of TC2501 by 10% and observe the response on the strip chart. | | |
| C) Increase TC2501 setpoint back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain K1 (C1-4, AL-12)*. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC2501 setpoint 10% and observe response on strip chart. | | |
| G) Increase TC2501 setpoint to nominal value and observe temperature response on strip chart. | | |
| H) Increase/decrease reset gain, K2 (C1-4, AL-12) in the ± 30 increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary TC2501 controller gains in metal temperature control mode and record. | | |
| K) Adjust setpoints, alarms, and limits if required. | | |

| | Initial | Date |
|---|---|---|
| 8.2.3.4.5 Verify that the receiver panel 212 is in a steady state condition at approximately 485 psig and 660°F. TC2503 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.3.4.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2503, set to console mode and set temperature setpoint to 850°F. | | |

8.2.3.4.7 Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactory control metal temperature, Select TC2503 and switch back to 600°F setpoints - consult test engineer for controller parameter adjustments and go back to Section 8.2.3.4.1).

8.2.3.4.8 Tune TC2503 - panel metal temperature controller (See Figure 8.2.3-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2503 by 10% and observe the response on the strip chart.

C) Increase TC2503 setpoint back to nominal value and observe the response on the strip chart.

| | Initial | Date |
|---|---|---|

8.2.3.4.8 D) Increase/decrease proportional gain K1 (C1-5, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2503 setpoint 10% and observe response on strip chart.

G) Increase TC2503 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-5, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2503 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

| | Initial | Date |
|---|---|---|
| 8.2.3.4.9 Obtain closed loop response on TC2501 & TC2503 to a flux disturbance on panels 210 and 212 by carrying out the following steps. A) Confirm that receiver panels 210 & 212 are in a steady state condition for approximately 2 minutes. | | |
| B) Confirm TC2501 & TC2503 is in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panel 210 & 212 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2501 (PV& CO), TI2501, TI2504, YI2507A/B, FCM2503 (PV & CO), TI2503, TI2506, YI2509A/B & PI2501. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |
| | | |

| | Initial | Date |
|---|---|---|

8.2.3.4.9 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response TI2501 & TC2503. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select C1-4, AL-16 and C1-5, AL-16 - using loop tuning form increase/ decrease gain and low time constant as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain.

G) Set console back to monitor mode.

| | Initial | Date |
|---|---|---|

8.2.3.5 Obtain closed loop response data on receiver feedpump controller PC-1105 in the valve control mode. See Figure 8.2.3-3. Determine response to setpoint and valve disturbances with receiver panels under flow control. Tune control loop as required.

8.2.3.5.1 Demonstrate satisfactory closed loop control of the receiver feedpump while under valve control for flowrates ∿ 40,000 lb/hr.

Configure the system to the desired test conditions by carrying out the following steps:

1) Verify TC2301 -- TC2803 are operating on flow control.

2) Verify PC1105 is operating on pressure control.

8.2.3.5.2 Increase the setpoint on FCM2501 until the valve command of FCM2501 exceeds all other valve commands by 50%. Record value.

8.2.3.5.3 Set this maximum valve command setpoint on pump controller PC1105.

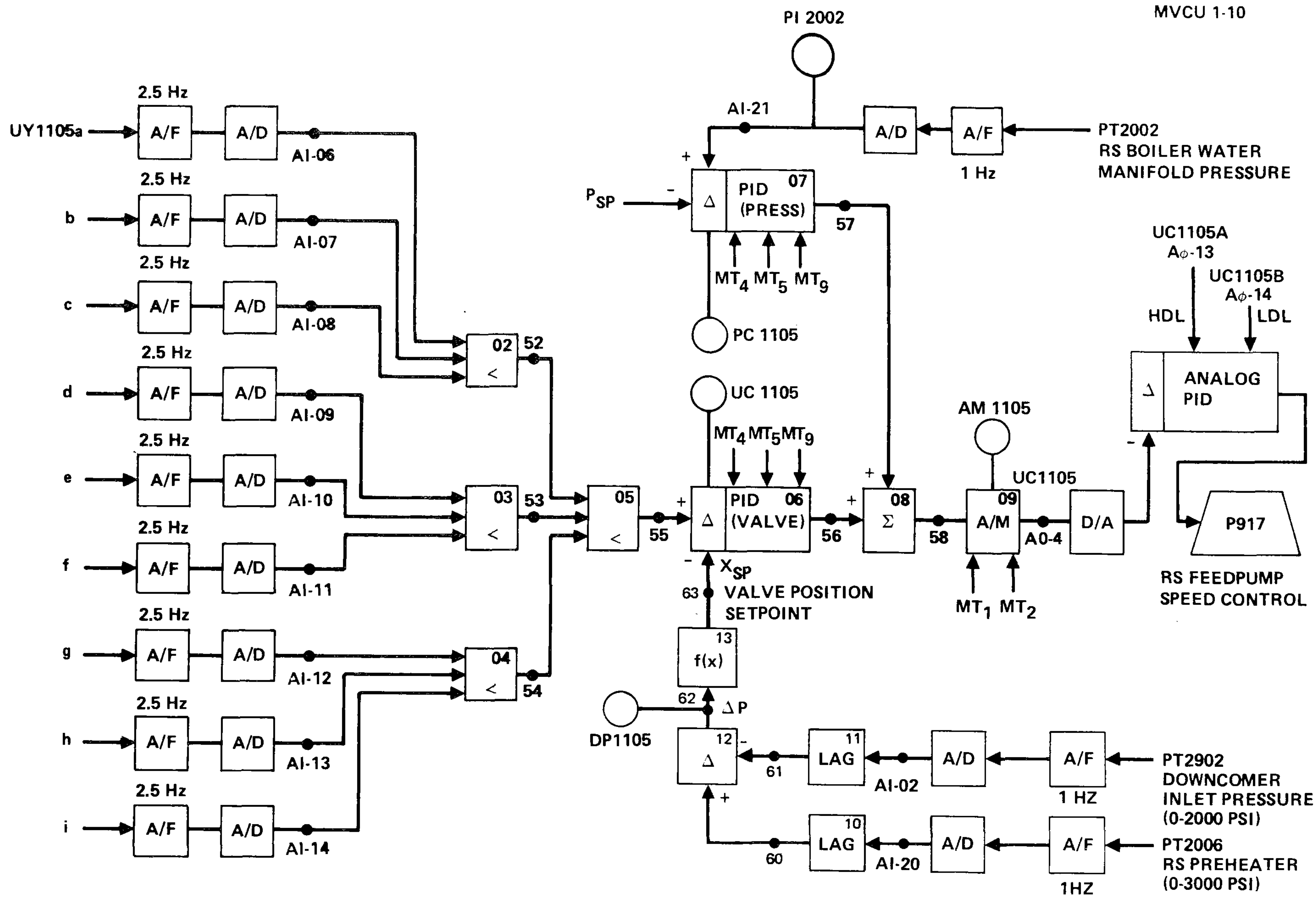


Figure 8.2.3-3. Feedwater Pump Controller Functional Block Diagram PC 1105

| | Initial | Date |
|---|---|---|
| 8.2.3.5.4 Switch PC1105 from pressure control to valve control mode. Observe response on DAS strip charts for FCM2501, UC1105, SI1105, PI2002, PI2006, FCM2503, and PDTX2230. Allow system to achieve steady state conditions. | | |
| 8.2.3.5.5 Increase FCM2501 setpoint by 20% above the nominal value established in 8.2.3.5.2. Observe the response and allow to reach steady state. | | |
| 8.2.3.5.6 Decrease FCM2501 setpoint back to nominal and allow to reach steady state. | | |
| 8.2.3.5.7 Decrease FCM2501 setpoint by 20% below the nominal value established in 8.2.3.5.2. Observe the response and allow to reach steady state. | | |
| 8.2.3.5.8 Increase FCM2501 setpoint back to nominal and tune controller PC1105 if required using loop tuning form. (C1-10, AL-6) | | |

Reconfigure the system to the desired test conditions by carrying out the following steps:

1) Reduce the setpoint on FCM2301 back to the original value as it existed in step 8.2.3.5.1.

2) Verify TC2301 --- TC2803 are operating on flow control.

| | Initial | Date |
|---|---|---|
| 8.2.3.5.8 3) Verify PC1105 is operating on pressure control. | | |

| | Initial | Date |
|---|---|---|

8.2.4 STEAM CURE OF PANELS 213-216 (STEP 8.2.4.1 - 8.2.4.15)

8.2.4.1 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.4.2 Call up the individual panel flow controllers (FCM2301 - FCM2803) and verify that they are in the "console" mode. Input the appropriate setpoints listed below.

| | Controller Setpoint (LB/HR) |
|---|---|
| FCM2301 - FCM2401 | 500 |
| FCM2402 | 1000 |
| FCM2403 | 2000 |
| FCM2501 | 3500 |
| FCM2502 | 4500 |
| FCM2503 | 5000 |
| FCM2601* - FCM2603* | 5000 |
| FCM2701* | 4500 |
| FCM2702 | 3500 |
| FCM2703 | 1500 |
| FCM2801 - FCM2803 | 500 |

* panels to be cured

8.2.4.3 Verify that the valve control setpoint for the receiver feedpump is 80% and switch feedpump controller, PC1105 to valve control.

8.2.4.4 Verify that the flows set in step 8.2.4.2 are maintained at their setpoint values.

| | Initial | Date |
|---|---|---|
| 8.2.4.5 Verify that the receiver flash tank vent setpoint is 485 psig (adjustment of PC2906, PC1000, and PC647B). | | |
| 8.2.4.6 Verify that collector field wedges 01, 06, 07, 08, and 12 are in "Standby" and ready to track the receiver. | | |
| 8.2.4.7 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures < 520°F as indicated by TI2301A or B - TI2803A or B and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are < 200°F as indicated by panel (top) DAS sensors TEX2354B, C, & D - TEX2856B, C, & D. (Sensors on substantially heated panels are TEX2456B, C, & D - TEX2756B, C, & D). "Track" command should be issued in a "rapid" fashion to produce a "step" change in input power to the receiver which simulated actual operating transients to be expected. Transient data to be recorded during the "step" change in power includes flow rate, metal temperatures, and inlet/outlet fluid temperatures for each panel as well as system pressures.<br><br>Increase 17/W/06, 08<br>Increase 8/W/01, 12<br>Increase 5/W/07 | | |

| | Initial | Date |
|---|---|---|
| 8.2.4.8 Repeat Step 8.2.4.7 using the following heliostat "Increase" command (75% power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.4.7.<br><br>Increase 9/W/06, 08<br>Increase 4/W/01, 12<br>Increase 2/W/07 | | |
| 8.2.4.9 Repeat Step 8.2.4.7 using the following heliostat "Increase" command (10% test power point). Carryout all temperature verification and data recording functions listed in Step 8.2.4.7.<br><br>Note: This step should be deleted or modified if excessived metal temperatures or temperature gradients were experienced during Step 8.2.4.8 or can be anticipated as a result of a 33% increase in incident receiver power.<br><br>Increase 9/W/06, 08<br>Increase 4/W/01, 12<br>Increase 2/W/07 | | |
| At this point in the procedure, flow control setpoints for individual panel can be made to produce the desired temperature for panel cure. Whenever possible panel flow setpoint changes required to transition from one cure condition to the next should be done through step change (reductions) in flow to permit the | | |

| Initial | Date |
|---|---|

gathering of dynamic receiver data. In selecting the step changes in flow setpoints, conservation should be used to prevent a panel over temperature condition from occurring.

During each cure hold point (Step 8.2.4.10 - 8.2.4.15), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses.

- Time and day
- Insolation
- Collector field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows
- Individual panel inlet and outlet temperatures
- Panel metal temperatures
- Panel strain gauges

8.2.4.10 Reduce the flow control setpoints for panel controllers FCM2601 - FCM2701 (panels 213-216) to produce individual panel metal temperatures of 520 ± 35°F as indicated by TI2601A or B - TI2701A or B. Adjust flows as required to maintain adjacent heated panel temperatures < 520°F and gradients < 200°F as measured by TEX2354B, C, & D - TEX2556B, C, & D and TEX2755B, C, & D - TEX2856B, C, & D. Maintain the cure condition on panels 213-216 for a 20 min hold period. Make any flow

| | | Initial | Date |
|---|---|---|---|
| | adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 213-216. | | |
| 8.2.4.11 | Repeat Step 8.2.4.10 to produce panel metal temperatures of 585 ± 35°F as indicated by TI2601A or B - TI2701A or B (panels 213-216). | | |
| 8.2.4.12 | Repeat Step 8.2.4.10 to produce panel metal temperatures of 660 ± 35°F as indicated by TI2601A or B - TI2701A or B (panels 213-216). | | |
| 8.2.4.13 | Repeat Step 8.2.4.10 to produce panel metal temperatures of 720 ± 35°F as indicated by TI2601A or B - TI2701A or B (panels 213-216). | | |
| 8.2.4.14 | Repeat Step 8.2.4.10 to produce panel metal temperatures of 780 ± 35°F as indicated by TI2601A or B - TI2701A or B (panels 213-216). | | |
| 8.2.4.15 | Repeat Step 8.2.4.10 to produce panel metal temperatures of 850 ± 35°F as indicated by TI2601A or B - TI2701A or B (panels 213-216). | | |

| | Initial | Date |
|---|---|---|
| 8.2.5 CONTROL TESTS - PANELS 214 & 216 - STEAM LOOP OPERATION | | |
| 8.2.5.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 214 & 216 (refer to Figures 8.2.5-1 thru 8.2.5-2). Obtain both step & frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.5.1.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.5.1.2 Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.5.1.3 Re-establish the approximate heliostat configuration and flow conditions used for 850°F panel cure (See Section 8.2.4.15). | | |
| 8.2.5.1.4 Adjust flowrate setpoint (FCM2602, FCM2701) to achieve 850°F outlet panel steam temperature on panels 214 & 216. Monitor T12605 & T12704. | | |
| 8.2.5.1.5 Verify that the control test unit is installed and operating on TV2602 & TV2701. | | |
| 8.2.5.1.6 Verify receiver feedpump is in pressure control (PC1105). | | |

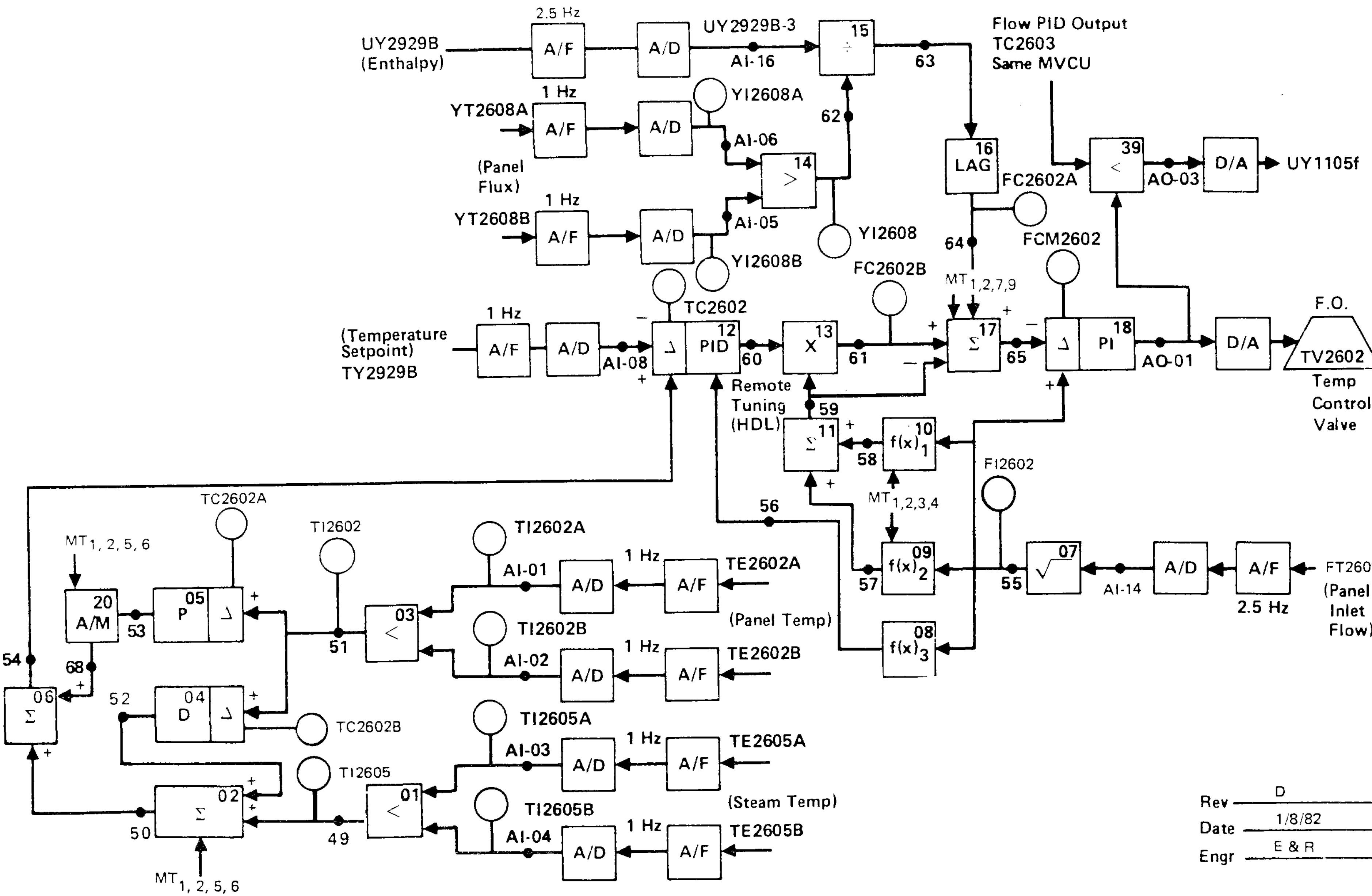


Figure 8.2.5-1. RS Steam Temperature Controller Functional Block Diagram TC-2602

Rev D
Date 1/8/82
Engr E & R

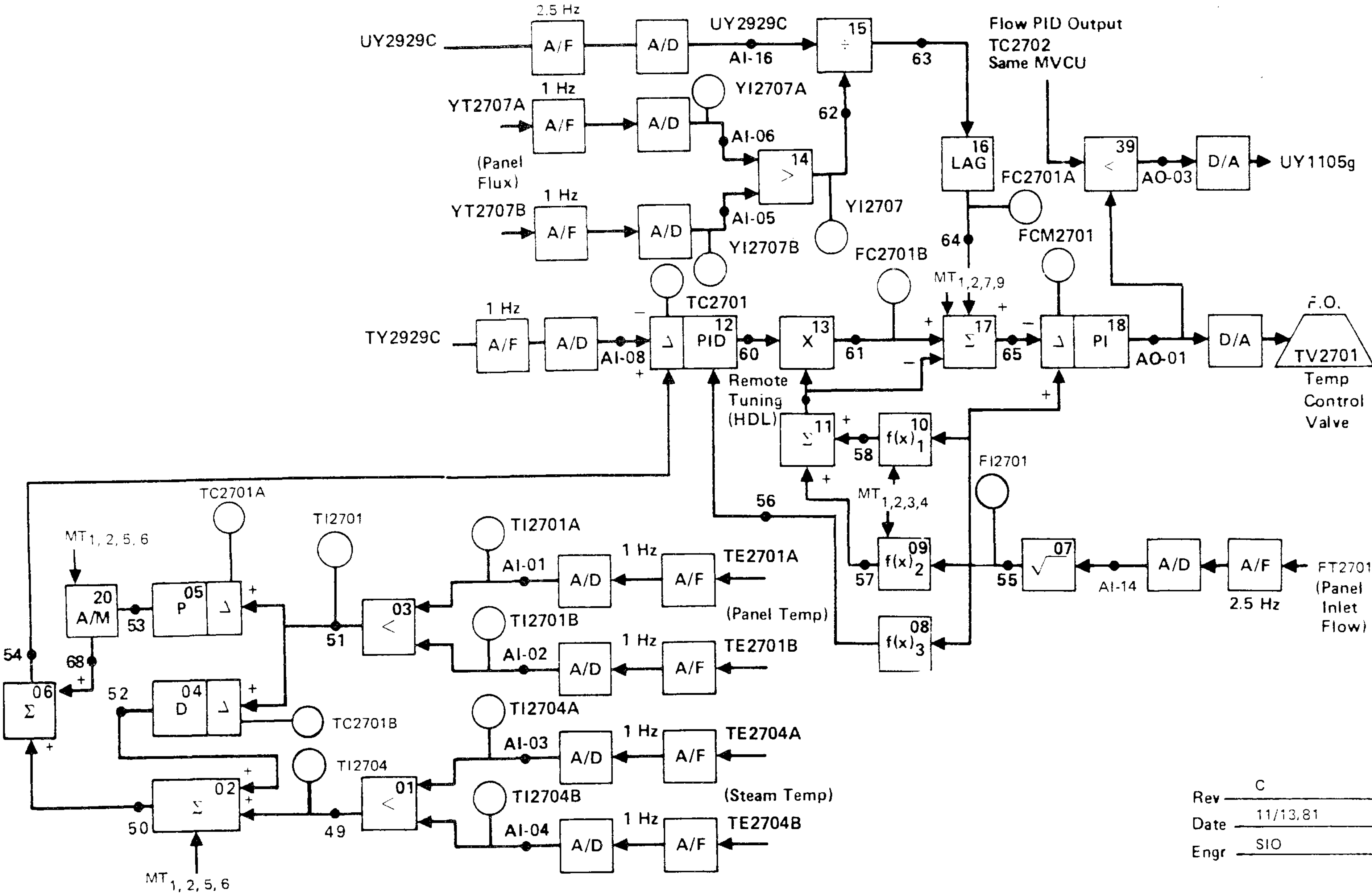


Figure 8.2.5-2. RS Steam Temperature Controller Functional Block Diagram TC-2701

Rev C
Date 11/13,81
Engr SIO

| | Initial | Date |
|---|---|---|

8.2.5.1.7 Obtain open loop step response data on panel 214 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. ______ ______

B. Set FCM2602 to manual mode. ______ ______

C. Implement a step decrease in FCM2602 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

NOTE: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), T12602, T12605, Y12608, & P12902. ______ ______

FCM2602 Output
Command Change __________%

D. Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. ______ ______

E. Reset FCM2602 back to auto. ______ ______

| | Initial | Date |
|---|---|---|

8.2.5.1.8 Obtain open loop step/ramp response to a flux disturbance on panel 214 & 216 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B. Set FCM2602 & FCM2701 to manual mode.

C. Implement a step/ramp decrease in the power level on panels 214 & 216 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2602 (PV & CO), T12602, T12605, Y12608A/B, FCM2701 (PV & CO), T12701, T12704, Y12707A/B & P12902.

NOTE: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ ___ $kw/m^2$ and temperature changes $\geq$ 50 to 100°F are desired.

D. Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E. Set FCM2602 & FCM2701 back to auto.

| | Initial | Date |
|---|---|---|
| 8.2.5.1.9 Perform frequency response test on panel 214 (See TC2501, Figure 8.2.5-1) by carrying out the following steps. | | |
| 1. Verify that the controls test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1). | | |
| 2. Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4. Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.5.1.7C.<br><br>NOTE: Verify that the TFA input to the CTU is switched out. | | |
| 5. Select FCM2602 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2602.<br><br>6. Set FCM2602 to manual mode.<br><br>7. Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on F12602. | | |

| | Initial | Date |
|---|---|---|

8.2.5.1.9 7. Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____HZ Determined
Repeat 4) at a frequency of ____HZ during test

NOTE: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test engineers) in RS-1 or DAS room.

NOTE: (2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8. Switch TFA input out of CTU.

9. Set FCM2602 back to auto.

8.2.5.1.10 Obtain open loop step response data on panel 216 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B. Set FCM2701 to manual mode.

| | Initial | Date |
|---|---|---|

8.2.5.1.10 C. Implement a step decrease in FCM2701 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

NOTE: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2701 (PV & CO), T12701, T12704, Y12707 & P12902.

FCM2701 Output
Command Change ________ %

D. Implement a step increase (back to nominal) in FCM2701 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E. Reset FCM2701 back to auto.

8.2.5.1.11 Perform frequency response tests on panel 216 (See TC2701, Figure 8.2.5-2) by carrying out the following steps.

1. Verify that the controls test unit (CTU) is installed and operating on TC2701. (Installation is in RS-1).

2. Verify that receiver feedpump is in pressure control mode (PC1105).

| | Initial | Date |
|---|---|---|

8.2.5.1.11 3. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4. Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.5.10C.

NOTE: Verify that the TFA input to the CTU is switched out.

5. Select FCM2701 and adjust setpoint to achieve a nominal 850°F steam outlet temperature TC2701.

6. Set FCM2701 to manual mode.

7. Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2701.

   Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

   Repeat 4) at a frequency of 0.05 HZ
   Repeat 4) at a frequency of 0.07 HZ
   Repeat 4) at a frequency of 0.1 HZ
   Repeat 4) at a frequency of 0.2 HZ
   Repeat 4) at a frequency of 0.5 HZ
   Repeat 4) at a frequency of 0.7 HZ
   Repeat 4) at a frequency of 1 HZ
   Repeat 4) at a frequency of ____ HZ Determined during
   Repeat 4) at a frequency of ____ HZ test

| | Initial | Date |
|---|---|---|

8.2.5.1.11 7. (Continued)

Note (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test engineers) in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2701 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8. Switch TFA input out of CTU.

9. Set FCM2701 back to auto.

| | Initial | Date |
|---|---|---|

8.2.5.2 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 214 & 216 (refer to Figures 8.2.5-1 thru 8.2.5-2). Obtain both step & frequency response data to valve disturbances at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances.

8.2.5.2.1 Verify that the prerequisites have been met as required in Section 4.2.5. ________ ________

8.2.5.2.2 Verify that the initial conditions have been established as required in Section 7.3.5. ________ ________

8.2.5.2.3 Re-establish the approximate heliostat configuration and flow conditions used for the 660°F panel cure (See Section 8.2.4). ________ ________

8.2.5.2.4 Adjust flowrate setpoints (FCM2602 & FCM2701) to achieve 660°F outlet panel steam temperature on panels 214 & 216. Monitor T12605 & T12704. ________ ________

8.2.5.2.5 Verify that the control test unit is installed and operating on TV2602 & TC2704. ________ ________

8.2.5.2.6 Verify receiver feedpump is in pressure control (PC1105). ________ ________

8.2.5.2.7 Obtain open loop step response data on panel 214 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

| | Initial | Date |
|---|---|---|

8.2.5.2.7 B. Set FCM2602 to manual mode.

C. Implement a step decrease in FCM2602 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

NOTE: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), T12602, T12605, Y12608 & P12902.

FCM2602 Output
Command Change ________%

D. Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E. Reset FCM2602 back to auto.

8.2.5.2.8 Obtain open loop step/ramp response to a flux disturbance on panel 214 & 216 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

B. Set FCM2602 & FCM2701 to manual mode.

| | Initial | Date |
|---|---|---|
| 8.2.5.2.8 C. Implement a step/ramp decrease in the power level on panels 214 & 216 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608A/B, FCM2701 (PV & CO, TI12701, TI2704, YI2707A/B & PI2902.<br><br>NOTE: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% are temperature changes $\geq$ 50 to 100°F are desired. | | |
| D. Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E. Set FCM2602 & FCM2701 back to auto. | | |
| 8.2.5.2.9 Perform frequency response tests on panel 214 (See TC2602, Figure 8.2.5-1), by carrying out the following steps.<br><br>1. Verify that the controls test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1). | | |

| | Initial | Date |
|---|---|---|
| 8.2.5.2.9 2. Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4. Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.5.2.7C. | | |

NOTE: Verify that the TFA input to the CTU is switched out.

| | | |
|---|---|---|
| 5. Select FCM2602 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2602. | | |
| 6. Set FCM2602 to manual mode. | | |

7. Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ

| | Initial | Date |
|---|---|---|

8.2.5.2.9 7. Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ Determined
Repeat 4) at a frequency of ___ HZ during test

NOTE: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers) in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot sucessfully adjust - return to Step 5. ______ ______

8. Switch TFA input out of CTU. ______ ______

9. Set FCM2602 back to auto. ______ ______

8.2.5.2.10 Obtain open loop step response data on panel 216 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. ______ ______

B. Set FCM2701 to manual mode. ______ ______

C. Implement a step decrease in FCM2701 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

| | Initial | Date |
|---|---|---|

8.2.5.2.10. C. Continued

NOTE: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2701 (PV & CO), TI2701, TI2704, YI2707 & PI2902.

FCM2701 Output Command Change ________ %

D. Implement a step increase (back to nominal) in FCM2701 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E. Reset FCM2701 back to auto.

8.2.5.2.11 Perform frequency response tests on panel 216 (See TC2701, Figure 8.2.5-2) by carrying out the following steps.

1. Verify that the controls test unit (CTU) is installed and operating on TC2701. (Installation is in RS-1)

2. Verify the receiver feedpump is in pressure control mode (PC1105).

| | Initial | Date |
|---|---|---|

8.2.5.2.11 3. Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4. Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.5.2.10C. ______ ______

NOTE: Verify that the TFA input to the CTU is switched out.

5. Select FCM2701 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2701. ______ ______

6. Set FCM2701 to manual mode. ______ ______

7. Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2701.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ

| | Initial | Date |
|---|---|---|

8.2.5.2.11 7. Repeat 4) at a frequency of ___ HZ Determined
Repeat 4) at a frequency of ___ HZ during test

NOTE (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers) in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2701 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8. Switch TFA input out of CTU.

9. Set FCM2701 back to auto.

| | Initial | Date |
|---|---|---|
| 8.2.5.3 Obtain closed loop response data on panel temperature controllers TC2602 & TC2701 to temperature set point and flux changes at a nominal temperature of 660°F. Tune control loops as required. | | |
| 8.2.5.3.1 Verify that the receiver panel 214 is in a steady state condition at approximately 485 psig and 660°F. TC2602 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.5.3.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2602, set to console mode and set temperature setpoint to current PV valve. | | |
| 8.2.5.3.3 Initiate panel metal temperature control on TD2602. Select TD2602 and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>NOTE: If controller fails to satisfactory control metal temperature, select TD2602A and switch back to flow control. Also select TD2602B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.5.3.1). | | |

| Initial | Date |
|---|---|

8.2.5.3.4 Tune TC2602 - panel metal temperature controller (See Figure 8.2.5-1) by carrying out the following steps using the loop tuning form.

A. Set receiver console to configure mode.

B. Decrease temperature setpoint of TC2602 by 10% and observe the response on the strip chart.

C. Increase TC2602 setpoint back to nominal value and observe the response on the strip chart.

D. Increase/decrease proportional gain K1 (C1-6, AL-12)*.

E. Repeat steps B -- D as required until response is satisfactory.

F. Decrease TC2602 setpoint 10% and observe response on strip chart.

G. Increase TC2602 setpoint to nominal value and observe temperature response on strip chart.

H. Increase/decrease reset gain, K2 (C1-6, AL-12) in the ± 30 increments.

I. Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|
| 8.2.5.3.4 J. Establish preliminary TC2602 controller gains in metal temperature control mode and record.<br><br>K. Adjust setpoints, alarms, and limits if required. | | |
| 8.2.5.3.5 Verify that the receiver panel 216 is in a steady state condition at approximately 485 psig and 660°F. TC2701 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.5.3.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature setpoint to current PV valve. | | |
| 8.2.5.3.7 Initiate panel metal temperature control on TC2701. Select TD2701B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>NOTE: If controller fails to satisfactory control metal temperature, select TD2701A and switch back to flow control. Also select TD2701B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and to back to Section 8.2.5.3.5). | | |

| | Initial | Date |
|---|---|---|

8.2.5.3.8 Tune TC2701 - panel metal temperature controller (See Figure 8.2.5-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2701 by 10% and observe the response on the strip chart.

C) Increase TC2701 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-7, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2701 setpoint 10% and observe response on strip chart.

G) Increase TC2701 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-7, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|

8.2.5.3.8 J) Establish preliminary TC2701 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.5.3.9 Obtain closed loop response on TC2602 & TC2701 to a flux disturbance on panel 214 & 216 by carrying out the following steps.

A) Confirm that receiver panels 214 & 216 are in a steady state condition for approximately 2 minutes.

B) Confirm TC2602 & TC2701 are in a metal temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 214 & 216 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608A/B, FCM2701, (PV & CO), TI2701, TI2704, Y12707A/B & PI2902.

| | Initial | Date |
|---|---|---|
| 8.2.5.3.9 NOTE: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes > 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TI2602 & TI2701. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-6, AL-16 and C1-7, AL-16 - using loop tuning form increase/decrease gain and low time constant as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.2.5.4 Obtain closed loop response data on panel temperature controllers TC2602 & TC2701 to temperature setpoint and flux changes at a nominal temperature of 850°F. Tune control loops as required.

8.2.5.4.1 Verify that the receiver panel 214 is in a steady state condition at approximately 485 psig and 660°F. TC2602 in metal temperature control. Adjust setpoint if required to achieve 660°F.

8.2.5.4.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2602 set to console mode and set temperature setpoint to 850°F.

8.2.5.4.3 Allow panel to achieve steady state temperature.

NOTE: If controller fails to satisfactory control metal temperature, select TC2602 and switch back to 660°F setpoint - consult test engineer for controller parameter adjustments and go back to Section 8.2.5.4.1).

8.2.5.4.4 Tune TC2602 - panel metal temperature controller (See Figure 8.2.5-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

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| | |

8.2.5.4.4 B) Decrease temperature setpoint of TC2602 by 10% and observe the response on the strip chart.

C) Increase TC2602 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-6, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2602 setpoint 10% and observe response on strip chart.

G) Increase TC2602 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-6, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2602 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

| | Initial | Date |
|---|---|---|
| 8.2.5.4.5 Verify that the receiver panel 216 is in a steady state condition at approximately 485 psig and 660°F. TC2701 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.5.4.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2701, set to console mode and set temperature setpoint to 850°F. | | |
| 8.2.5.4.7 Allow panel to achieve steady state temperature.<br><br>NOTE: If controller fails to satisfactory control metal temperature, select TC2701 and switch back to 600°F setpoint - consult test engineer for controller parameter adjustments and go back to Section 8.2.5.4.5). | | |
| 8.2.5.4.8 Tune TC2701 - panel metal temperature controller (See Figure 8.2.5-2) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease temperature setpoint of TC2701 by 10% and observe the response on the strip chart.<br><br>C) Increase TC2701 setpoint back to nominal value and observe the response on the strip chart. | | |

| | Initial | Date |
|---|---|---|
| 8.2.5.4.8 D) Increase/decrease proportional gain, K1 (C1-7, AL-12)*.<br><br>E) Repeat steps B -- D as required until response is satisfactory.<br><br>F) Decrease TC2701 setpoint 10% and observe response on strip chart.<br><br>G) Increase TC2701 setpoint to nominal value and observe temperature response on strip chart.<br><br>H) Increase/decrease reset gain, K2 (C1-7, AL-12) in the ± 30 increments.<br><br>I) Repeat steps F -- H as required until response is satisfactory.<br><br>J) Establish preliminary TC2701 controller gains in metal temperature control mode and record.<br><br>K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.5.4.9 Obtain closed loop response on TC2602 & TC2701 to a flux disturbance on panel 210 by carrying out the following steps.<br><br>A) Confirm that receiver panels 214 & 216 are in a steady state condition for approximately 2 minutes. | | |

| | Initial | Date |
|---|---|---|
| 8.2.5.4.9 B) Confirm TC2602 & TC2701 are in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 214 & 216 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608A/B, FCM2701, (PV & CO), TI2701, TI2704, YI2707A/B & PI2902.<br><br>NOTE: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TI2602 & TC2701. If temperature excursions exceed $\pm$ 50°F - adjust flux loop gains via the following. | | |

| | Initial | Date |
|---|---|---|
| 8.2.5.4.9 E) 1) Set receiver console to configure mode. | | |
| 2) Select C1-6, AL-16 & C1-7, AL-16 - using loop tuning form increase/ decrease gain and low time constant as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| Initial | Date |
|---|---|

8.2.6 STEAM CURE OF PANELS 204-208 (STEP 8.2.6.1 - 8.2.6.15)

8.2.6.1 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.6.2 Call up the individual panel flow controllers (FCM2301 - FCM2803) and verify that they are in the "console" mode. Input the appropriate setpoints lists below.

| | Controller Setpoint (LB/HR) |
|---|---|
| FCM2301* | 4500 |
| FCM2302* - FCM-2402* | 5000 |
| FCM2403 | 6500 |
| FCM2501 | 6000 |
| FCM2502 | 4000 |
| FCM2503 | 1500 |
| FCM2601 - FCM2602 | 500 |
| FCM2603, FCM2701 - FCM2703, FCM2801 | 0 |
| FCM2802 - FCM2803 | 500 |

* panels to be cured

8.2.6.3 Verify that the valve control setpoint for the receiver feedpump is 80% and switch feedpump controller, PC1105 to valve control.

8.2.6.4 Verify that the flows set in step 8.2.6.2 are maintained at their setpoint values.

8.2.6.5 Verify that the receiver flash tank vent setpoint is 485 psig (adjustment of PC2906, PC1000, and PC647B).

| | Initial | Date |
|---|---|---|
| 8.2.6.6 Verify that collector field wedges 01, 02, 03, 04 and 05, are in "Standby" and ready to track the receiver. | | |

8.2.6.7 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures < 520°F as indicated by TI2301A or B - TI2803A or B and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are < 200°F as indicated by panel (top) DAS sensors TEX2354B, C, & D - TEX2856B, C, & D. (Sensors on substantially heated panels are TEX2354B, C, & D - TEX2556B, C, & D). "Track" command should be issued in a "rapid" fashion to produce a "step" change in input power to the receiver which simulates actual operating transients to be expected. Transient data to be recorded during the "step" change in power includes flow rate, metal temperatures, and inlet/outlet fluid temperatures for each panel as well as system pressures.

Increase 17/W/03
Increase 14/W/02
Increase 12/W/05
Increase 11/W/04
Increase 5/W/01

| | Initial | Date |
|---|---|---|

8.2.6.8 Repeat Step 8.2.6.7 using the following heliostat "Increase" command (75% power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.6.7.

Increase 9/W/03
Increase 7/W/02
Increase 6/W/05
Increase 5/W/04
Increase 3/W/01

8.2.6.9 Repeat Step 8.2.6.7 using the following heliostat "Increase" command (100% test power test check point). Carryout all temperature verification and data recording functions listed in Step 8.2.6.7.

NOTE: This step should be deleted or modified if excessive metal temperatures or temperature gradients were experienced during Step 8.2.6.8 or can be anticipated as a result of a 25% increase in incident receiver power.

Increase 8/W/03
Increase 6/W/02
Increase 6/W/05
Increase 5/W/04
Increase 2/W/01

| | Initial | Date |
|---|---|---|

8.2.6.9 At this point in the procedure, flow control setpoints for individual panels can be made to produce the desired temperature for panel cure. Whenever possible, panel flow setpoint changes required to transition from one cure condition to the next should be done through step change (reductions) in flow to permit the gathering of dynamic receiver data. In selecting the step changes in flow setpoints, conservation should be used to prevent a panel over temperature condition from occurring.

During each cure hold point (Steps 8.2.6.10 - 8.2.6.15), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses.

- Time and day
- Insolation
- Collector field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows
- Individual panel inlet and outlet temperatures
- Panel metal temperatures
- Panel strain gauges

8.2.6.10 Reduce the flow control setpoints for panel controllers FCM2301 - FCM2402 (panels 204-208) to produce individual panel metal temperatures of 520 ± 35°F as indicated by TI2301A or B - TI2402A or B. Adjust flows as required to

| | Initial | Date |
|---|---|---|
| 8.2.6.10 maintain adjacent heated panel temperature < 520°F and gradients < 200°F as measured by TEX2456B, C, & D - TEX2856B, C, & D. Maintain the cure condition on panels 204-208 for a 20 min hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 204-208. | | |
| 8.2.6.11 Repeat Step 8.2.6.10 to produce panel metal temperatures of 585 ± 35°F as indicated by TI2301A or B - TI2402A or B (panels 204-208). | | |
| 8.2.6.12 Repeat Step 8.2.6.10 to produce panel metal temperatures of 660 ± 35°F as indicated by TI2301A or B - TI2402A or B (panels 204-208). | | |
| 8.2.6.13 Repeat Step 8.2.5.10 to produce panel metal temperatures of 720 ± 35°F as indicated by TI2301A or B - TI2402A or B (panels 204-208). | | |
| 8.2.6.14 Repeat Step 8.2.6.10 to produce panel metal temperatures of 850 ± 35°F as indicated by TI2301A or B - TI2402A or B (panels 204-208). | | |
| 8.2.6.15 Repeat Step 8.2.6.10 to produce panel metal temperatures of 850 ± 35°F as indicated by TI2301A or B - TI2402A or B (panels 204-208). A preheater inlet temperature of 220°F should not be exceeded. | | |

| | Initial | Date |
|---|---|---|
| 8.2.7 CONTROL TESTS - PANELS 204 AND 206 - STEAM LOOP OPERATION | | |
| 8.2.7.1 Obtain process control loop data required for tuning of receiver temperature control loops on panels 204 and 206 (refer to Figures 8.2.7-1 thru 8.2.7-2). Obtain both step and frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.7.1.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.7.1.2 Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.7.1.3 Re-establish the approximate heliostat configuration and flow conditions used for the 850°F panel cure (See Section 8.2.6.15). | | |
| 8.2.7.1.4 Adjust flowrate setpoints (FCM2301, FCM2303) to achieve 850°F outlet panel steam temperature on panels 204 and 206. Monitor TI2304 and TI2306. | | |
| 8.2.7.1.5 Verify that the control test unit is installed and operating on TV2301 and TV2303. | | |
| 8.2.7.1.6 Verify receiver feedpump is in pressure control (PC1105). | | |

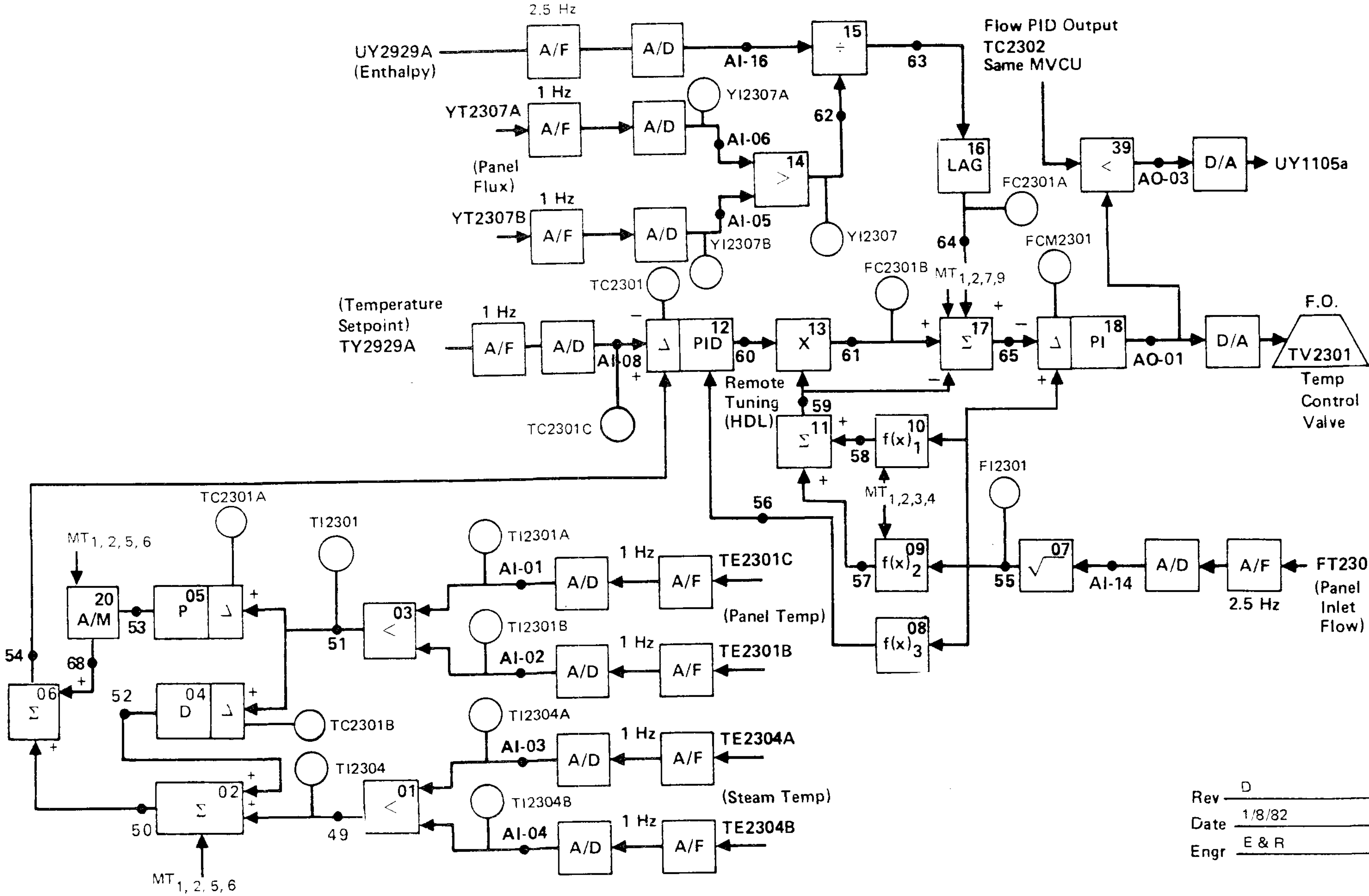
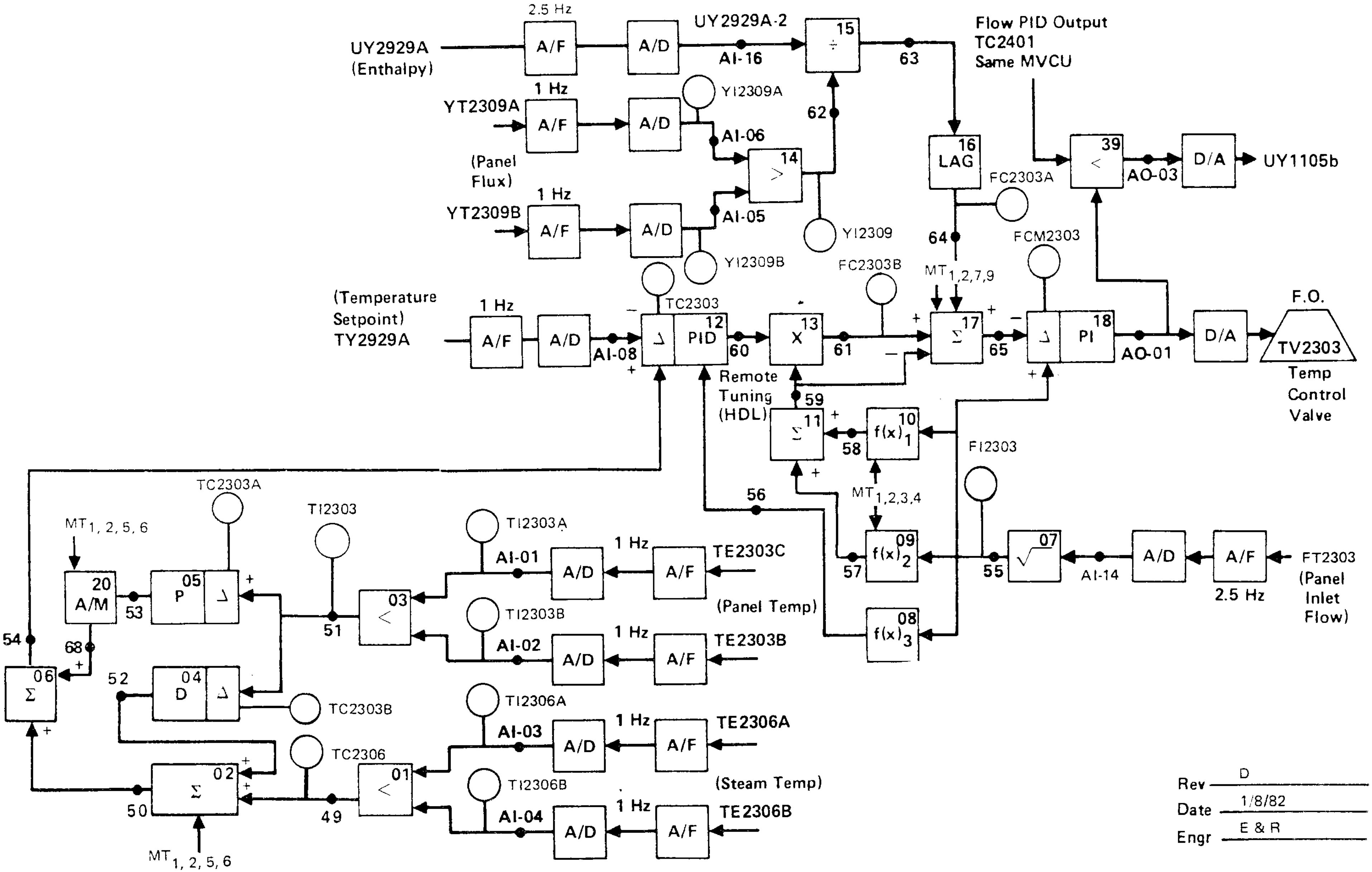



Figure 8.2.7-1. RS Steam Temperature Controller Functional Block Diagram TC-2301

Rev D

Date 1/8/82

Engr E & R




| | |
|---|---|
| Rev | D |
| Date | 1/8/82 |
| Engr | E & R |

Figure 8.2.7-2. RS Steam Temperature Controller Functional Block Diagram TC-2303

| Initial | Date |
|---|---|

8.2.7.1.7 Obtain open loop step response data on panel 204 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2301 to manual mode.

C) Implement a step decrease in FCM2301 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307, and PI2902.

FCM2301 Output _____%
Command Change

D) Implement a step increase (back to nominal) in FCM2301 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

| | Initial | Date |
|---|---|---|

8.2.7.1.7 E) Reset FCM2301 back to auto.

8.2.7.1.8 Obtain open loop step/ramp response to a flux disturbance on panels 204 and 206 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2301 and FCM2303 to manual mode.

C) Implement a step/ramp decrease in the power level on panels 204 and 206 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307A/B, FCM2303 (PV & CO), TI2303, TI2306, YI2309A/B and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.1.8 | D) condition. Monitor and adjust as in Section C. | | |
| | E) Set FCM2301 and FCM2303 back to auto. | | |
| 8.2.7.1.9 | Perform frequency response tests on panel 204 (See TC2301, Figure 8.2.7-1) by carrying out the following steps. | | |
| | 1) Verify that the controls test unit (CTU) is installed and operating on TC2301. (Installation is in RS-1). | | |
| | 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| | 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| | 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistant with the required output change determined in Section 8.2.7.1.7C. Note: Verify that the TFA input to the CTU is switched out. | | |
| | 5) Select FCM2301 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2301. | | |
| | 6) Set FCM2301 to manual mode. | | |

| | Initial | Date |
|---|---|---|

8.2.7.1.9 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2301.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Determined during test
Repeat 4) at a frequency of ____ HZ
Determined during test

(Note:(1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2301 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.1.9 | 8) Switch TFA input out of CTU. | | |
| | 9) Set FCM2301 back to auto. | | |
| 8.2.7.1.10 | Obtain open loop step response data on panel 206 by carrying out the following steps. | | |
| | A) Confirm that the receiver panels are in steady state condition for approximately 5 minutes. | | |
| | B) Set FCM2303 to manual mode. | | |
| | C) Implement a step decrease FCM2303 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.<br><br>Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change.<br><br>Monitor the following parameters on a strip chart to verify that data is recorded: FCM2303 (PV & CO), TI2303, TI2306, YI2309, and PI2902. | | |

| | Initial | Date |
|---|---|---|
| 8.2.7.1.10 D) Implement a step increase (back to nominal) in FCM2303 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2303 back to auto. | | |
| 8.2.7.1.11 Perform frequency response test on panel 206 (See TC2303, Figure 8.2.7-2) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2303. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistant with the required output change determined in Section 8.2.7.1.10 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2303 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2303. | | |

6) Set FCM2303 to manual mode.

| Initial | Date |
|---|---|

8.2.7.1.11 7) Using the transfer function analyzer (TFA) insert a 9.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2303.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Determined during test.
Repeat 4) at a frequency of ____ HZ
Determined during test.

(Note:(1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2303 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.1.11 | 8) Switch TFA input out of CTU. | | |
| | 9) Set FCM2303 back to auto. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.2 | Obtain process control open loop data required for tuning of receiver temperature control loops on panels 204 and 206 (refer to Figures 8.2.7-1 thru 8.2.7-2). Obtain both step and frequency response data to valve disturbances at nominal temperature 660°F. Obtain both step and frequency response data to valve disturbances at nominal temperature 660°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.7.2.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.7.2.2 | Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.7.2.3 | Re-establish the approximate heliostat configuration and flow conditions used for the 660°F panel cure (See Section 8.2.6.12). | | |
| 8.2.7.2.4 | Adjust flowrate setpoints (FCM2301 and FCM2303) to achieve 660°F outlet panel steam temperature on panels 204 and 206. Monitor TI2304 and TI2306. | | |
| 8.2.7.2.5 | Verify that the control test unit is installed and operating on TV2301 and TV2303. | | |
| 8.2.7.2.6 | Verify receiver feedpump is in pressure control (PC1105). | | |

| | Initial | Date |
|---|---|---|

8.2.7.2.7 Obtain open loop step response data on panel 204 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2301 to manual mode.

C) Implement a step decrease in FCM2301 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307, and PI2902.

FCM2301 Output _____%
Command Change

D) Implement a step increase (back to nominal) in FCM2301 output (closing valve) and allow temperatures, pressures and flowrate to reach steady state conditions.

E) Reset FCM2301 back to auto.

| | Initial | Date |
|---|---|---|

8.2.7.2.8 Obtain open loop step/ramp response to a flux disturbance on panel 214 and 206 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2301 and FCM2303 to manual mode.

C) Implement a step/ramp decrease in the power level on panels 204 and 206 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307A/B, FCM2303 (PV & CO), TI2303, TI2306, YI2309A/B and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Set FCM2301 and FCM2303 back to auto.

| | Initial | Date |
|---|---|---|
| 8.2.7.2.9 Perform frequency response tests on panel 204 (See TC2301, Figure 8.2.7-1) by carrying out the following steps. | | |
| 1) Verify that controls test unit (CTU) is installed and operating on TC2301. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistant with the required output change determined in Section 8.2.7.1.7C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2301 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2301. | | |
| 6) Set FCM2301 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2301. | | |

| | Initial | Date |
|---|---|---|

8.2.7.2.9 7) Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____HZ
Determined during test.
Repeat 4) at a frequency of ____HZ
Determined during test.

(Note[1] The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

[2] If panel temperature drifts off the nominal test condition - adjust FCM2301 output from operator station to correct - if cannot successfully adjust - return to Step 5. ____ ____

8) Switch TFA input out of CTU. ____ ____

9) Set FCM2301 back to auto. ____ ____

Initial | Date

8.2.7.2.10 Obtain open loop step response data on panel 206 by carrying out the following steps

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2303 to manual mode.

C) Implement a step decrease in FCM2303 output by approximately 10% nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2303 (PV & CO), TI2303, TI2306, YI2309 and PI2902.

FCM2303 Output _____%
Command Change

D. Implement a step increase (back to nominal) in FCM2303 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E. Reset FCM2303 back to auto.

| | Initial | Date |
|---|---|---|

8.2.7.2.11 Perform frequency response tests on panel 206 (See TC2303 Figure 8.2.7.2) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2303. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistant with the required output change determined in Section 8.2.7.1.10C. Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2303 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2303.

6) Set FCM2303 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2303.

| | Initial | Date |
|---|---|---|

8.2.7.2.11 7) Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____HZ
Determined during test
Repeat 4) at a frequency of ____HZ
Determined during test

(Note(1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2303 output from operator station to correct - if cannot successfully adjust - return to Step 5. ________ ________

8) Switch TFA input out of CTU. ________ ________

9) Set FCM2303 back to auto. ________ ________

| | Initial | Date |
|---|---|---|
| 8.2.7.3 Obtain closed loop response data on panel temperature controllers TC2301 and TC2303 to temperature set point and flux changes at a nominal temperature of 660°F. Tune control loops as required.<br><br>8.2.7.3.1 Verify that the receiver panel 204 is in a steady state condition at approximately 485 psig and 660°F. TC2301 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.7.3.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2301, set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.7.3.3 Initiate panel metal temperature control on TC2301. Select TD2301B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>(Note: If Controller fails to satisfactory control metal temperature, select TD2301A and switch back to flow control. Also select TD2301B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.7.3.1). | | |

| Initial | Date |
|---|---|

8.2.7.3.4 Tune TC2301 - panel metal temperature controller (See Figure 8.2.7-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2301 by 10% and observe the response on the strip chart.

C) Increase TC2301 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-1, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2301 setpoint 10% and observe response on strip chart.

G) Increase TC2301 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-1, AL-12) in the ±30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.3.4 | J) Establish preliminary TC2301 controller gains in metal temperature control mode and record.<br><br>K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.7.3.5 | Verify that the receiver panel 206 is in a steady state condition at approximately 485 psig and 660°F. TC2303 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.7.3.6 | Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2303, set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.7.3.7 | Initiate panel metal temperature control TC2303. Select TD2303B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>(Note: If controller fails to satisfactory control metal temperature, select TD2303A and switch back to flow control. Also select TD2303B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.7.3.5). | | |

| Initial | Date |
|---|---|

8.2.7.3.8 Tune TC2303 - panel metal temperature controller (See Figure 8.2.7-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2303 by 10% and observe the response on the strip chart.

C) Increase TC2303 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-2, AL-12)*

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2303 setpoint 10% and observe response on strip chart.

G) Increase TC2303 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-2, AL-12) in the ±30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|
| 8.2.7.3.8 J) Establish preliminary TC2303 controller gains in metal temperature control mode and record. K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.7.3.9 Obtain closed loop response on TC2301 and TC2303 to a flux disturbance on panels 204 and 206 by carrying out the following steps. A) Confirm that receiver panels 204 and 206 are in a steady state condition for approximately 2 minutes. | | |
| B) Confirm TC2301 and TC2303 are in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 204 and 206 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307A/B, FCM2303, (PV & CO), TI2303, TI2306 YI2309A/B and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|

8.2.7.3.9 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response TI2301 and TC2303 if temperature excursions exceed ±50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select Cl-1, AL-16 and Cl-2, AL-16 - using loop tuning form increase/decrease gain and low time constant as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux gain.

G) Set console back to monitor mode.

| | Initial | Date |
|---|---|---|
| 8.2.7.4 Obtain closed loop response data on panel temperature controllers TC2301 and TC2303 to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops as required. | | |
| 8.2.7.4.1 Verify that the receiver panel 204 is in a steady state condition at approximately 485 psig and 660°F. TC2301 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.7.4.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2301, set to console mode and set temperature setpoint to 850°F. | | |
| 8.2.7.4.3 Allow panel to achieve steady state temperature. (Note: If controller fails to satisfactory control metal temperature, Select TC2301 and switch back to 660°F setpoint. Consult test engineer for controller parameter adjustments and go back to Section 8.2.7.3.1). | | |

| Initial | Date |
|---|---|
| | |

8.2.7.4.4 Tune TC2301 - panel metal temperature controller (See Figure 8.2.7-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2301 by 10% and observe the response on the strip chart.

C) Increase TC2301 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-1, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2301 setpoint 10% and observe response on strip chart.

G) Increase TC2301 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-1, AL-12) in the ±30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | | Initial | Date |
|---|---|---|---|
| 8.2.7.4.4 | J) Establish preliminary TC2301 controller gains in metal temperature control mode and record.<br><br>K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.7.4.5 | Verify that the receiver panel 206 is in a steady state condition at approximately 485 psig and 660°F. TC2303 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.7.4.6 | Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC23C3, set to console mode and set temperature setpoint to 850°F. | | |
| 8.2.7.4.7 | Allow panel to achieve steady state temperature. | | |
| | (Note: If controller fails to satisfactory control metal temperature, Select TC2303 and switch back to 660°F setpoint. Consult test engineer for controller parameter adjustments and go back to Section 8.2.7.4.1). | | |

| | Initial | Date |
|---|---|---|

8.2.7.4.8 Tune TC2303 - panel metal temperature controller (See Figure 8.2.7-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2303 by 10% and observe the response on the strip chart.

C) Increase TC2303 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-2, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2303 setpoint 10% and observe response on strip chart.

G) Increase TC2303 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-2, AL-12) in the ±30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| Initial | Date |
|---|---|

8.2.7.4.8 J) Establish preliminary TC2303 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.7.4.9 Obtain closed loop response on TC2301 and TC2303 to a flux disturbance on panel 204 and 206 by carrying out the following steps.

A) Confirm 204 and 206 that receiver panels 204 and 206 are in a steady state condition for approximately 2 minutes.

B) Confirm TC2301 and TC2303 is in metal temperature control mode.

C) Implement a step/ramp decrease in the power level on panel 204 and 206 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307A/B, FCM2303 (PV & CO), TI2303, TI2306, YI2309A/B and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$1000 lb/hr are desired.

| | Initial | Date |
|---|---|---|
| 8.2.7.4.9 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TI2301 and TC2303. If temperature excursions exceed ±50°F - adjust flux loop gains via the following. | | |

1) Set receiver console to configure mode.

2) Select Cl-1, AL-16 and Cl-2, AL-16 - using loop tuning form increase/decrease gain and low time constant as required.

| | Initial | Date |
|---|---|---|
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.2.8 STEAM CURE OF PANELS 217-221
(STEPS 8.2.8.1 - 8.2.8.15)

8.2.8.1 Verify that the initial conditions have been established as required in Section 7.4.2.

8.2.8.2 Call up the individual panel flow controllers (FCM-2301 - FCM-2803) and verify that they are in the "console" mode. Input the appropriate set points listed below.

| | Controller Set Point (LB/HR) |
|---|---|
| FCM-2301 | 500 |
| FCM-2302 | 500 |
| FCM-2303, FCM-2401 - FCM-2403, FCM-2501 | 0 |
| FCM-2502 - FCM-2503 | 500 |
| FCM-2601 | 1500 |
| FCM-2602 | 4000 |
| FCM-2603 | 6000 |
| FCM-2701 | 6500 |
| FCM-2702* - FCM-2802* | 5000 |
| FCM-2803* | 4500 |

*panels to be cured

8.2.8.3 Verify that the valve control set point for the receiver feed pump is 80% and switch feed pump controller, PC-1105 to valve controller.

8.2.8.4 Verify that the flows set in step 8.2.8.2 are maintained at their set point values.

| | Initial | Date |
|---|---|---|
| 8.2.8.5 Verify that the receiver flash tank vent set point is 485 psig (adjustment of PC-2906, PC-1000, and PC-647B). | | |
| 8.2.8.6 Verify that collector field wedges 08, 09, 10, 11, and 12 are in "Standby" and ready to track the receiver. | | |
| 8.2.8.7 Issue the following heliostat "Increase" commands and verify adequate flow to maintain panel metal temperatures <520°F as indicated by TI-2301A or B - TI-2803A or B and no excessive heating of uncooled structures (half power check point). Verify that all heated panel temperature gradients are <200°F as indicated by panel (top) DAS sensors TEX-2354B, C, and D - TEX-2856B, C and D. (Sensors on substantially heated panels TEX-2654B, C, and D - TEX-2856B, C, and D). "Track" command should be issued in a "rapid" fashion to produce a "step" change in input power to the receiver which simulates actual operating transients to be expected. Transient data to be recorded during the "step" change in power includes flow rate, metal temperatures, and inlet/outlet fluid temperatures for each panel as well as system pressures.<br><br>Increase 17/W/10<br>Increase 14/W/11<br>Increase 12/W/08<br>Increase 11/W/09<br>Increase 5/W/12 | | |

| | Initial | Date |
|---|---|---|

8.2.8.8 Repeat Step 8.2.8.7 using the following heliostat "Increase" command (75% power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.9.7.

Increase 9/W/10
Increase 7/W/11
Increase 6/W/08
Increase 5/W/09
Increase 3/W/12

8.2.8.9 Repeat Step 8.2.8.7 using the following heliostat "Increase" command (100% test power check point). Carryout all temperature verification and data recording functions listed in Step 8.2.9.7. Note: this step should be deleted or modified if excessive metal temperatures or temperature gradients were experienced during Step 8.2.9.8 or can be anticipated as a result of a 25% increase in incident receiver power.

Increase 8/W/10
Increase 6/W/11
Increase 6/W/08
Increase 5/W/09
Increase 2/W/12

At this point in the procedure, flow control set points for individual panels can be made to produce the desired temperature for panel cure. Whenever possible, panel flow set point changes required to transition from one cure

| | Initial | Date |
|---|---|---|

8.2.8.9 condition to the next should be done through step changes (reductions) in flow to permit the gathering of dynamic receiver data. In selecting the step changes in flow set points, conservation should be used to prevent a panel over temperature condition from occuring.

During each cure hold point (Steps 8.2.8.10 - 8.2.8.15), the following parameters should be recorded to support subsequent collector system "optical" performance and panel thermal expansion analyses.

- Time and day
- Insolation
- Collection field-ring-track status
- Collector field status
- Receiver panel incident flux measurements
- Individual receiver panel flows
- Individual panel inlet and outlet temperatures
- Panel metal temperatures
- Panel strain gauges

8.2.8.10 Reduce the flow control set points for panel controllers FCM-2702 - FCM-2803 (panels 217-221) to produce individual panel metal temperatures of 520 ± 35°F as indicated by TI-2702A or B - TI-2803A or B. Adjust flows as required to maintain adjacent heated panel temperatures <520°F and gradients <200°F as measured by TEX-2354B, C, and D - TEX-2754B, C, and D.

| | | Initial | Date |
|---|---|---|---|
| 8.2.8.10 | Maintain the cure condition on panels 217-221 for a 20 minute hold period. Make any flow adjustments required due to changing sun positions. Record on the cure log sheet that this step of the cure has been completed for panels 217-221. | | |
| 8.2.8.11 | Repeat Step 8.2.8.10 to produce metal temperature of 585 ± 35°F as indicated by TI-2702A or B - TI-2803A or B (panels 217-221). | | |
| 8.2.8.12 | Repeat Step 8.2.8.10 to produce panel metal temperature of 660 ± 35°F as indicated by TI-2702A or B - TI-2803A or B (panels 217-221). | | |
| 8.2.8.13 | Repeat Step 8.2.8.10 to produce panel metal temperature of 720 ± 35°F as indicated by TI-2702A or B - TI-2803A or B (panels 217-221). | | |
| 8.2.8.14 | Repeat Step 8.2.8.10 to produce metal temperatures of 780 ± 35°F as indicated by TI-2702A or B - TI-2803A or B (panels 217-221). | | |
| 8.2.8.15 | Repeat Step 8.2.8.10 to produce panel metal temperatures of 850 ± 35°F as indicated by TI-2702A or B - TI-2803A or B (panels 217-221). A preheater inlet temperature of 220°F should not be exceeded. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9 CONTROL TESTS - PANELS 217, 219, 221 - STEAM LOOP OPERATION | | |
| 8.2.9.1 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 217, 219 and 221 (refer to figures 8-2.9-1 thru 8.2.9-3). Obtain both step and frequency response data to valve disturbances at nominal temperature of 850°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.9.1.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.9.1.2 Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.9.1.3 Re-establish the approximate heliostat configuration and flow conditions used for the 850° panel cure (see Section 8.2.8.15). | | |
| 8.2.9.1.4 Adjust flowrate setpoints (FCM2702, FCM2801, FCM2803) to achieve 850°F outlet panel steam temperature on panels 217, 219, and 212. Monitor TI27021, TI2804 and TI2806. | | |
| 8.2.9.1.5 Verify that the control test unit is installed and operating on TV2702, TV2801 and TV2803. | | |
| 8.2.9.1.6 Verify receiver feedpump is in pressure control (PC1105). | | |

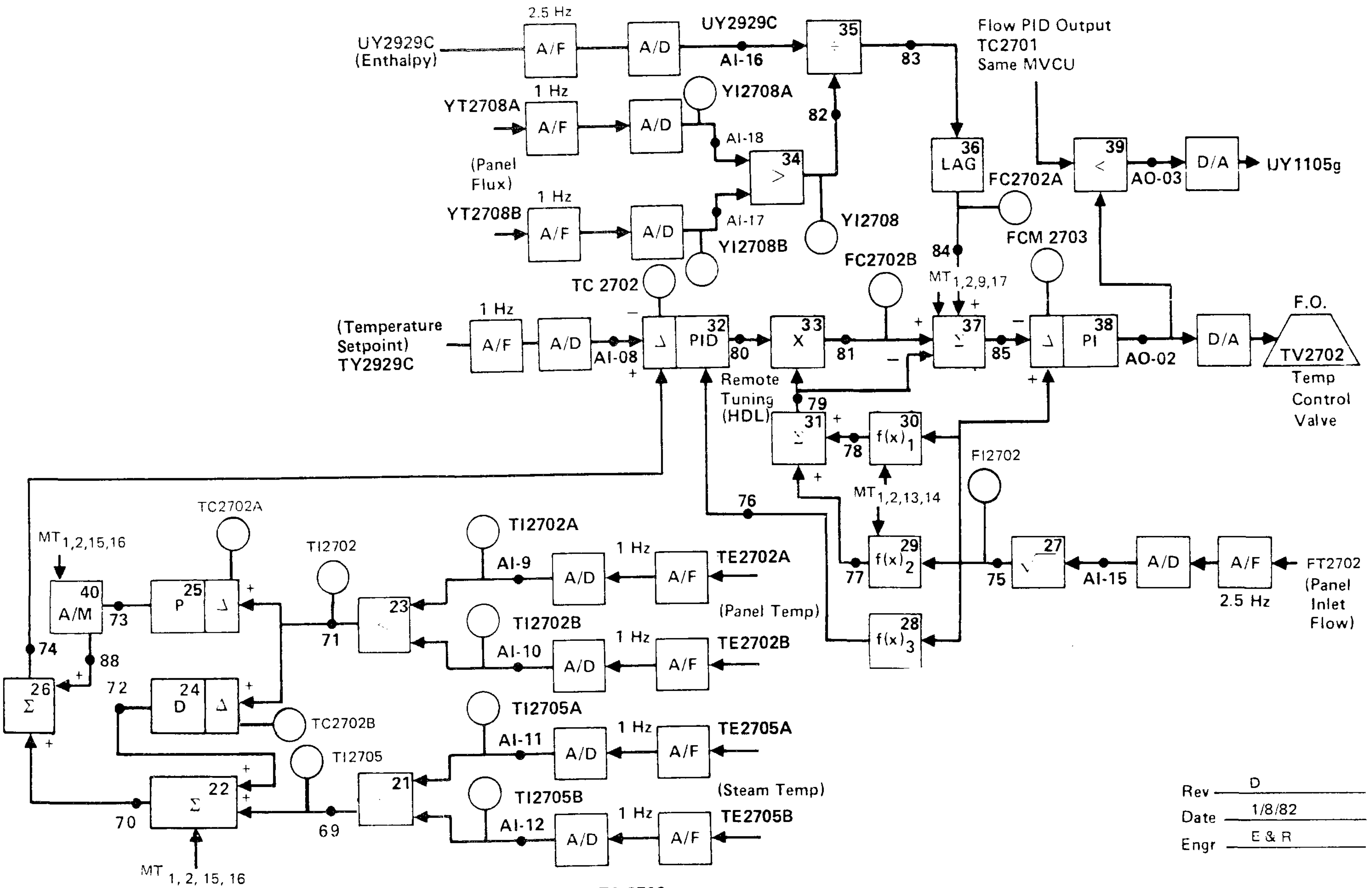



Figure 8.2.9-1. RS Steam Temperature Controller Functional Block Diagram TC-2702

Rev D
Date 1/8/82
Engr E & R

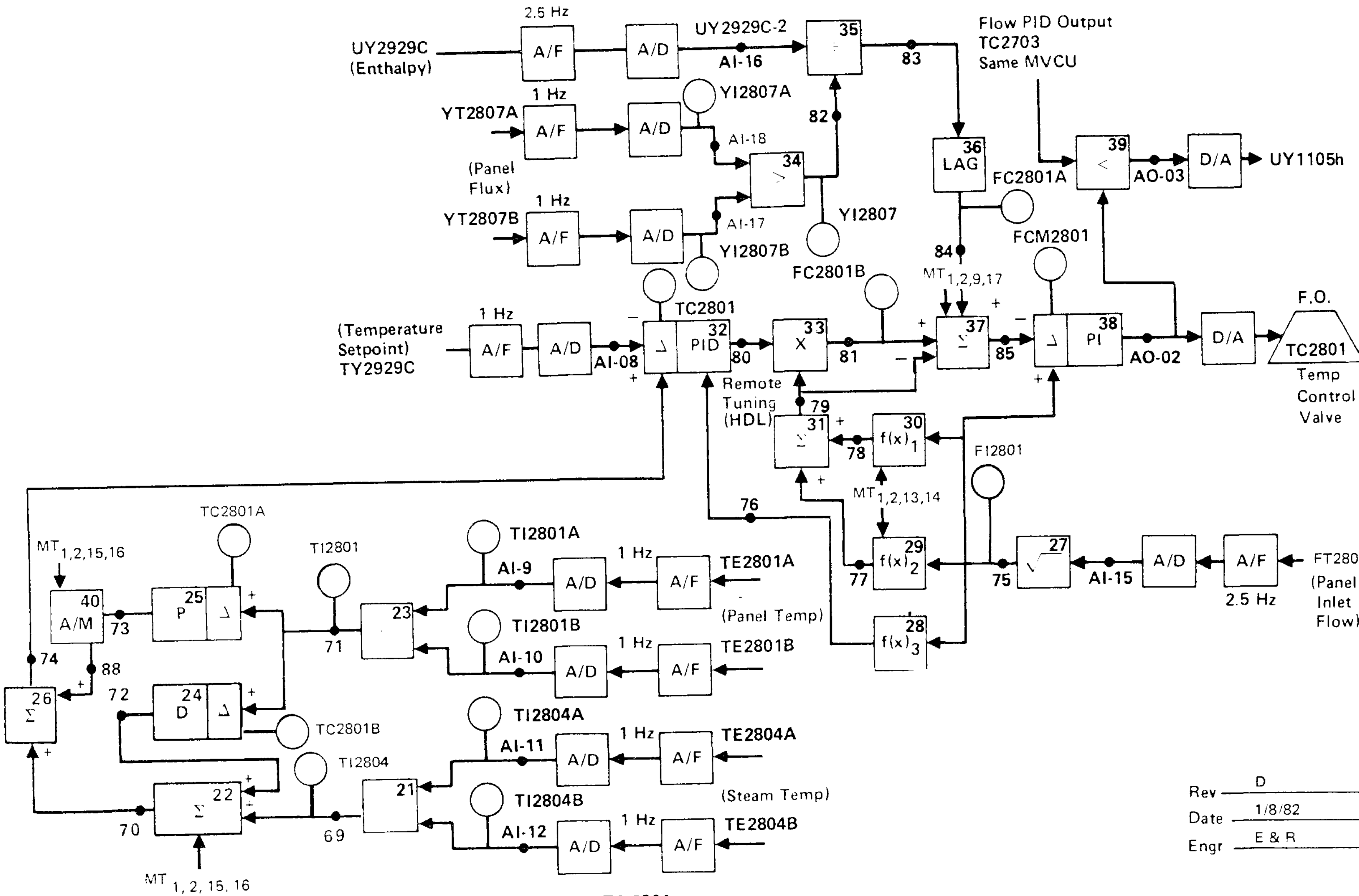



Figure 8.2.9-2. RS Steam Temperature Controller Functional Block Diagram TC-2801

Rev D
Date 1/8/82
Engr E & R

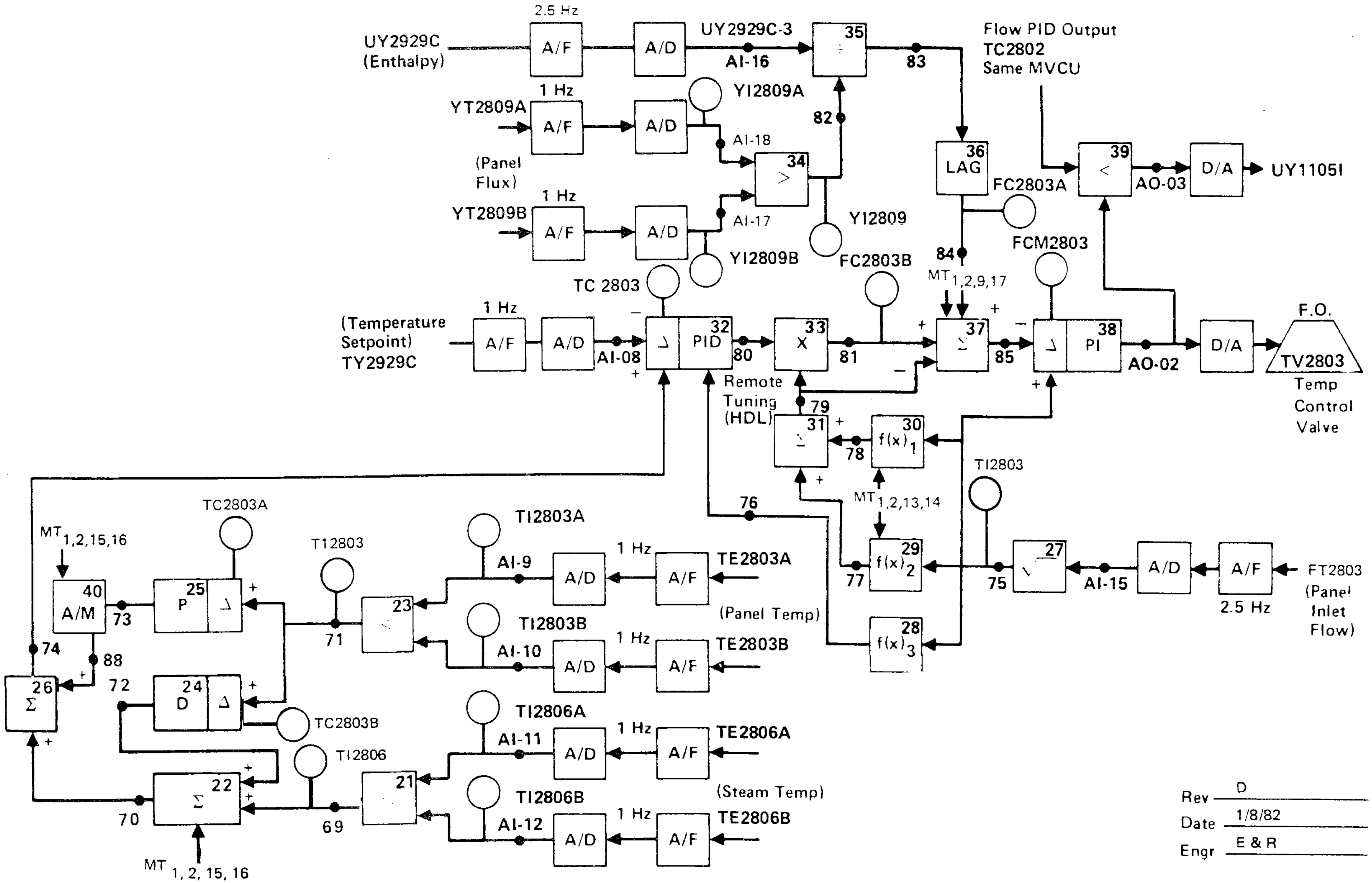



**Figure 8.2.9-3. RS Steam Temperature Controller Functional Block Diagram TC-2803**

Rev D
Date 1/8/82
Engr E & R

| | Initial | Date |
|---|---|---|
| 8.2.9.1.7 Obtain open loop step response data on panel 217 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2702 to manual mode. | | |
| C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.<br><br>Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902. | | |
| D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2702 back to auto. | | |

| | Initial | Date |
|---|---|---|

8.2.9.1.8 Obtain open loop step/ramp response to a flux disturbance on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2702 50 manual mode.

C) Implement a step/ramp decrease in the power level on panels 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2302 (PV & CO), TI2702, TI2705, YI2708A/B, FCM2801 (PV & CO), TI2801, TI2804, YI2807A/B, FCM2832, (VU & CO) TI2803, TI2806, YI2809A/B and PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired.

| | Initial | Date |
|---|---|---|
| 8.2.9.1.8 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2702, FCM2801, FCM2803 back to auto. | | |
| 8.2.9.1.9 Perform frequency response tests on panel 217 (see TC2702, Figure 8.2.9-1) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1) | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.1.7C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.1.9 5) Select FCM2702 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2702. | | |
| 6) Set FCM 2702 to manual mode. | | |

7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles.

Repeat 4) at a frequency of 0.05 Hz
Repeat 4) at a frequency of 0.07 Hz
Repeat 4) at a frequency of 0.1 Hz
Repeat 4) at a frequency of 0.2 Hz
Repeat 4) at a frequency of 0.5 Hz
Repeat 4) at a frequency of 0.7 Hz
Repeat 4) at a frequency of 1 Hz
Repeat 4) at a frequency of ___ Hz (Determined
Repeat 4) at a frequency of ___ Hz during test)

Note: (1) The TFA output amplitude max need to be adjusted during the the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

| | Initial | Date |
|---|---|---|
| 8.2.9.1.9 7) Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2102 output from operator station to correct if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2702 back to auto. | | |
| 8.2.9.1.10 Obtain open loop step response data on panel 219 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2801 to manual mode. | | |
| C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. | | |

| | Initial | Date |
|---|---|---|

8.2.9.1.10 C) Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902.

FCM2801 Output ________%
Command Change

D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2801 back to auto.

8.2.9.1.11 Perform frequency response tests on panel 219 (See TC2801, Figure 8.2.9-2) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1)

2) Verify the receiver feedback is in pressure control mode (PC1105).

| | Initial | Date |
|---|---|---|
| 8.2.9.1.11 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.1.7C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2801 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2803. | | |
| 6) Set FCM 2801 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2501. Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles. Repeat 4) at a frequency of 0.05 Hz Repeat 4) at a frequency of 0.07 Hz Repeat 4) at a frequency of 0.1 Hz Repeat 4) at a frequency of 0.2 Hz Repeat 4) at a frequency of 0.5 Hz Repeat 4) at a frequency of 0.7 Hz Repeat 4) at a frequency of 1 Hz | | |

| | Initial | Date |
|---|---|---|

8.2.9.1.11 7) Repeat 4) at a frequency of ___ Hz } Determined during test
Repeat 4) at a frequency of ___ Hz

Note: (1) The TFA output amplitude max need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA output out of CTU.

9) Set FCM2801 back to auto.

8.2.9.1.12 Obtain open loop step response data on panel 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2803 to manual mode.

C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperature to reach steady state.

| | Initial | Date |
|---|---|---|
| 8.2.9.1.12 C) Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100 F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902. | | |
| FCM2803 Output ________% Command Change | | |
| D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2803 back to auto. | | |
| 8.2.9.1.13 Perform frequency response tests on panel 221 (See TC2803, Figure 8.2.9-3) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.1.13 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.1.7C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2803 and adjust setpoint to achieve a nominal 850°F steam outlet temperature on TC2803. | | |
| 6) Set FCM 2803 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.<br><br>Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles.<br><br>Repeat 4) at a frequency of 0.05 Hz<br>Repeat 4) at a frequency of 0.07 Hz<br>Repeat 4) at a frequency of 0.1 Hz<br>Repeat 4) at a frequency of 0.2 Hz<br>Repeat 4) at a frequency of 0.5 Hz<br>Repeat 4) at a frequency of 0.7 Hz<br>Repeat 4) at a frequency of 1 Hz | | |

| | Initial | Date |
|---|---|---|

8.2.9.1.13 7) Repeat 4) at a frequency of ___ Hz
Repeat 4) at a frequency of ___ Hz
$\left.\right\}$ Deter-mined during test

Note: (1) The TFA output amplitude max need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM 2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM 2803 back to auto.

| | Initial | Date |
|---|---|---|
| 8.2.9.2 Obtain process control open loop data required for tuning of receiver temperature control loops on panels 217, 219 & 221 (refer to figures 8.2.9-1 thru 8.2.9-3). Obtain both step & frequency response data to valve disturbances at nominal temperature of 660°F. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.9.2.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.9.2.2 Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.9.2.3 Re-establish the approximate heliostat configuration and flow conditions used for the 660 panel cure (see Section 8.2.8.12). | | |
| 8.2.9.2.4 Adjust flowrate setpoints (FCM 2702, FCM 2801, FCM 2803) to achieve 660°F outlet panel steam temperature on panels 217, 219 & 221. Monitor TI2702, TI2804 & TI2806. | | |
| 8.2.9.2.5 Verify that the control test unit is installed and operating on TV2702, TV2801 & TV2803. | | |
| 8.2.9.2.6 Verify receiver feedpump is in pressure control (PC1105). | | |

| | Initial | Date |
|---|---|---|

8.2.9.2.7 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2702 to manual mode.

C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2702 back to auto.

| | Initial | Date |
|---|---|---|

8.2.9.2.8 Obtain open loop step/ramp response to a flux disturbance on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2702 to manual mode.

C) Implement a step/ramp decrease in the power level on panels 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2302 (PV & CO), TI2702, TI2705, YI2708A/B, FCM2801 (PV & CO), TI2801, TI2804, YI2807A/B, FCM2803 (PV & CO), TI2803, TI2806, YI2800A/B, and PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux change $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired.

| | Initial | Date |
|---|---|---|
| 8.2.9.2.8 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2702, FCM2801, FCM2803 back to auto. | | |
| 8.2.9.2.9 Perform frequency response tests on panel 217 (See TC2702, Figure 8.2.9-1) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyer output to be consistent with the required output change determined in Section 8.2.9.2.7C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2702 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2702. | | |

| Initial | Date |
|---|---|
| | |

8.2.9.2.9 6) Set FCM2702 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a +400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles.

Repeat 4) at a frequency of 0.05 Hz
Repeat 4) at a frequency of 0.07 Hz
Repeat 4) at a frequency of 0.1 Hz
Repeat 4) at a frequency of 0.2 Hz
Repeat 4) at a frequency of 0.5 Hz
Repeat 4) at a frequency of 0.7 Hz
Repeat 4) at a frequency of 1 Hz
Repeat 4) at a frequency of ___ Hz
Repeat 4) at a frequency of ___ Hz
} Determined during test

Note: (1) The TFA output amplitude max need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2102 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.2.9.2.9 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2702 back to auto. | | |

8.2.9.2.10 Obtain open loop step response data on panel 219 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. ______ ______

B) Set FCM2801 to manual mode. ______ ______

C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjust in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100 F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902. ______ ______

FCM2801 Output ____________%
Command Change

| | Initial | Date |
|---|---|---|
| 8.2.9.2.10 D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2801 back to auto. | | |
| 8.2.9.2.11 Perform frequency response tests on panel 219 (See TC2801, Figure 8.2.9-2) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.2.7C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |

| | Initial | Date |
|---|---|---|

8.2.9.2.11 5) Select FCM2801 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2803.

6) Set FCM 2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2501.

Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 Hz
Repeat 4) at a frequency of 0.07 Hz
Repeat 4) at a frequency of 0.1 Hz
Repeat 4) at a frequency of 0.2 Hz
Repeat 4) at a frequency of 0.5 Hz
Repeat 4) at a frequency of 0.7 Hz
Repeat 4) at a frequency of 1 Hz
Repeat 4) at a frequency of ___ Hz
Repeat 4) at a frequency of ___ Hz } Determined during test

Note: (1) The TFA output amplitude max need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

| | Initial | Date |
|---|---|---|
| 8.2.9.2.11 7) Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2801 back to auto. | | |
| 8.2.9.2.12 Obtain open loop step response data on panel 221 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2803 to manual mode. | | |
| C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.2.12 C) Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902. | | |
| FCM2803 Output __________% Command Change | | |
| D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2803 back to auto. | | |
| 8.2.9.2.13 Perform frequency response tests on panel 221 (See TC2803, Figure 8.2.9-3) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.2.13 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.2.7C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2803 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2803.<br><br>6) Set FCM2803 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.<br><br>Set the TFA to 0.02 Hz allow the system to reach steady state (3-4) cycles.<br><br>Repeat 4) at a frequency of 0.05 Hz<br>Repeat 4) at a frequency of 0.07 Hz<br>Repeat 4) at a frequency of 0.1 Hz<br>Repeat 4) at a frequency of 0.2 Hz<br>Repeat 4) at a frequency of 0.5 Hz<br>Repeat 4) at a frequency of 0.7 Hz<br>Repeat 4) at a frequency of 1 Hz | | |

| | | Initial | Date |
|---|---|---|---|
| 8.2.9.2.13 7) | Repeat 4) at a frequency of ___ Hz<br>Repeat 4) at a frequency of ___ Hz Determined during test | | |
| | Note: (1) The TFA output amplitude max need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.<br><br>(2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5. | ______ | ______ |
| 8) | Switch TFA input out of CTU. | ______ | ______ |
| 9) | Set FCM2803 back to auto. | ______ | ______ |

| | Initial | Date |
|---|---|---|

8.2.9.3 Obtain closed loop response data on panel temperature controllers (TC2702, TC2801 & TC2803 to temperature set point and flux changes at a nominal temperature of 660°F. Tune control loops as required.

8.2.9.3.1 Verify that the receiver panel 217 is in a steady state condition at approximately 485 psig and 660°F. TC2702 in flow control. Adjust flow setpoint if required to achieve 660°F.

8.2.9.3.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2702, set to console mode and set temperature setpoint to current PV value.

8.2.9.3.3 Initiate panel metal temperature control on TC2702. Select TD2702 and initiate switch to on position. Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactorily control metal temperature, select TD2702A and switch back to flow control. Also select TD2702B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.3.1).

| | Initial | Date |
|---|---|---|

8.2.9.3.4 Tune TC2702 - panel metal temperature controller (See Figure 8.2.9-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2702 by 10% and observe the response on the strip chart.

C) Increase TC2702 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-7, AL-32)*.

E) Repeat step B -- D as required until response is satisfactory.

F) Decrease TC2702 setpoint 10% and observe response on strip chart.

G) Increase TC2702 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-7, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|

8.2.9.3.4 J) Establish preliminary TC2702 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.9.3.5 Verify that the receiver panel 219 is in a steady state condition at approximately 485 psig and 660°F. TC2801 in flow control. Adjust flow setpoint if required to achieve 660°F.

8.2.9.3.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2801, set to console mode and set temperature setpoint to current PV value.

8.2.9.3.7 Initiate panel metal temperature control on TC2801. Select TD2801B and initiate switch to on position. Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactorily control metal temperature, select TD2801A and switch back to flow control. Also select TD2801B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.3.5).

| Initial | Date |
|---|---|

8.2.9.3.8 Tune TC2801 - panel metal temperature controller (See Figure 8.2.9-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2801 by 10% and observe the response on the strip chart.

C) Increase TC2801 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-8, AL-32)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2801 setpoint 10% and observe response on strip chart.

G) Increase TC2801 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-8, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|

8.2.9.3.8 J) Establish preliminary TC2803 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.9.3.9 Verify that the receiver panel 221 is in a steady state condition at approximately 485 psig and 660°F. TC2803 in flow control. Adjust flow setpoint if required to achieve 660°F.

8.2.9.3.10 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2803, set to console mode and set temperature setpoint to current PV value.

8.2.9.3.11 Initiate panel metal temperature control on TC2803. Select TD2803B and initiate switch to on position. Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactory control metal temperature, select TD2803A and switch back to flow control. Also select TD2803B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.3.9).

| | Initial | Date |
|---|---|---|

8.2.9.3.12 Tune TC2803 - panel metal temperature controller (See Figure 8.2.9-3) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2803 by 10% and observe the response on the strip chart.

C) Increase TC2803 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-9, AL-32)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2803 setpoint 10% and observe response on strip chart.

G) Increase TC2803 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-9, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|
| 8.2.9.3.12 J) Establish preliminary TC2803 controller gains in metal temperature control mode and record. | | |
| K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.9.3.13 Obtain closed loop response on TC2702, TC2801, & TC2803 to a flux disturbance on panels 217, 219 & 221 by carrying out the following steps. | | |
| A) Confirm that receiver panels 217, 219 & 221 are in a steady state condition for approximately 2 minutes. | | |
| B) Confirm TC2702, TC2801 & TC2803 are in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panel 217, 219, & 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2702, TI2702, TI2705, YI2708A/B, FCM2801, TI2801, TI2804, YI2807A/B, FCM2803, TI2803, TI2806, YI2809A/B, PI2902. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.3.13 C) Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TC2702, TI2801 & TC2803. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select Cl-7, AL-36, Cl-8, AL-36, Cl-9, AL-36 - using loop tuning form increase/decrease gain and low time constant as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.2.9.4 Obtain closed loop response data on panel temperature controllers TC2702, TC2801, & TC2803 to temperature set point and flux changes at a nominal temperature of 850°F. Tune control loops are required.

8.2.9.4.1 Verify that the receiver panel 217 is in a steady state condition at approximately 485 psig and 660°F. TC2702 in metal temperature control. Adjust setpoint if required to achieve 660°F.

8.2.9.4.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2702, set to console mode and set temperature setpoint to 850°F.

8.2.9.4.3 Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactorily control metal temperature, select TC2702 and switch back to 660°F setpoint - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.4.1).

8.2.9.4.4 Tune TC2702 - panel metal temperature controller (See Figure 8.2.9-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

| | Initial | Date |
|---|---|---|
| 8.2.9.4.4 B) Decrease temperature setpoint to TC2702 by 10% and observe the response on the strip chart. | | |
| C) Increase TC2702 setpoint back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain K1 (C1-7, AL-32)*. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC2702 setpoint 10% and observe response on strip chart. | | |
| G) Increase TC2702 setpoint to nominal value and observe temperature response on strip chart. | | |
| H) Increase/decrease reset gain, K2 (C1-7, AL-32) in the ± 30 increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary TC2702 controller gains in metal temperature control mode and record. | | |
| K) Adjust setpoints, alarms, and limits if required. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.4.5 Verify that the receiver panel 219 is in a steady state condition at approximately 485 psig and 660°F. TC2801 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |
| 8.2.9.4.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2801, set to console mode and set temperature setpoint to 850°F. | | |
| 8.2.9.4.7 Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactorily control metal temprature, select TC2801 and switch back to 660°F setpoint - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.4.1). | | |
| 8.2.9.4.8 Tune TC2801 - panel metal temperature controller (See Figure 8.2.9-2) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease temperature setpoint of TC2801 by 10% and observe the response on the strip chart.<br><br>C) Increase TC2801 setpoint back to nominal value and observe the response on the strip chart. | | |

| | Initial | Date |
|---|---|---|
| 8.2.9.4.8 D) Increase/decrease proportional gain K1 (C1-8, AL-32)*. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC2801 setpoint 10% and observe response on strip chart. | | |
| G) Increase TC2801 setpoint to nominal value and observe temperature response on strip chart. | | |
| H) Increase/decrease reset gain, K2 (C1-8, AL-32) in the ± 30 increments. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish preliminary TC2801 controller gains in metal temperature control mode and record. | | |
| K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.9.4.9 Verify that the receiver panel 221 is in a steady state condition at approximately 485 psig and 660°F. TC2803 in metal temperature control. Adjust setpoint if required to achieve 660°F. | | |

| | Initial | Date |
|---|---|---|

8.2.9.4.10 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2803, set to console mode and set temperature setpoint to 850°F.

8.2.9.4.11 Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactory control metal temperature, select TC2803 and switch back to 660°F setpoint - consult test engineer for controller parameter adjustments and go back to Section 8.2.9.4.9).

8.2.9.4.12 Tune TC2803 - panel metal temprature controller (See Figure 8.2.9-3) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2803 by 10% and observe the response of the strip chart.

C) Increase TC2803 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-9, AL-32)*.

E) Repeat steps B -- D as required until response is satisfactory.

| | Initial | Date |
|---|---|---|

8.2.9.4.12 F) Decrease TC2803 setpoint 10% and observe response on strip chart.

G) Increase TC2803 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-9, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2803 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.9.4.13 Obtain closed loop response on TC2702, TC2801, & TC2803 to a flux disturbance on panels 217, 219 & 221 by carrying out the following steps.

A) Confirm that receiver panels 217, 219 & 221 are in a steady state condition for approximately 2 minutes.

B) Confirm TC2702, TC2801 & TC2803 are in metal temperature control mode.

| | Initial | Date |
|---|---|---|

8.2.9.4.13 C) Implement a step/ramp decrease in the power level on panel 217, 219, & 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2702, TI2702, TI2705, YI2708A/B, FCM2801, TI2801, TI2804, YI2807A/B, FCM2803, TI2803, TI2806, YI2809A/B, PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ ____ kw/$m^2$ and flow changes $\geq$ 1000 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressure, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response TC2702, TI2801 & TC2803. If temperature excursions exceed $\pm$ 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

| | Initial | Date |
|---|---|---|
| 8.2.9.4.13 E) 2) Select Cl-7, AL-36, Cl-8, AL-36, Cl-4, AL-36 - using loop tuning form increase/decrease gain and low time constant as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. | | |
| G) Set console back to monitor mode. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.2.10 | CONTROL TESTS - LOW FLOW - PANELS 204, 208, 217, 221 | | |
| 8.2.10.1 | Obtain process control open loop data sequences for tuning of receiver temperature control loops on panels 204, 208, 217, 221. Obtain both step and frequency response both to valve disturbance at nominal temperature of 660°F and start-up flow conditions. Obtain step/ramp response to small signal flux disturbances. | | |
| 8.2.10.1.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.2.10.1.2 | Verify that the initial conditions have been established as required in Section 7.4.2. | | |
| 8.2.10.1.3 | Establish the plant startup heliostat configuration for panels 204, 208, 217, 221 Ref. Plant Operating/Training Manual, RADL 2-36, Appendix A. | | |
| 8.2.10.1.4 | Adjust flowrate setpoints (FCM2301, FCM2402, FCM2702, FCM2803) to achieve 660°F outlet panel steam temperature on panels 204, 208, 217, 221. Monitor TI2301, TI2402, TI2702, TI2803. | | |
| 8.2.10.1.5 | Verify that the control test unit is installed and operating on TV2301, TV2402, TV2702, TV2803. | | |

| | Initial | Date |
|---|---|---|
| 8.2.10.1.6 Verify receiver feedpump is in pressure control (PC1105). | | |
| 8.2.10.1.7 Obtain open loop step response data on panel 204 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a ready state condition for approximately 5 minutes. | | |
| B) Set FCM2301 to manual mode. | | |
| C) Implement a step decrease in FCM2301 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that the following parameters on a strip chart to verify that data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307, PI2902. | | |

FCM2301 Output ____________%
Command Change

| | Initial | Date |
|---|---|---|
| D) Implement a step increase (back to nominal) in FCM2301 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2301 back to auto. | | |

8.2.10.1.8 Obtain loop step/ramp response to a flux disturbance on panel 204 and 208 by carrying out the following steps.

| | | |
|---|---|---|
| A) Confirm that the receiver panels are in a ready state condition for approximately 5 min. | | |
| B) Set FCM2301 and FCM2402 to manual mode. | | |

C) Implement a step/ramp decrease in the power level on panels 204 and 208 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301 (PV & CO), TI2301, TI2304, YI2307A/B, FCM2402, TI2402, TI2405, YI2408A/B, PI2902.

| Initial | Date |
|---|---|

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor as in Section C.

E) Set FCM2301 and FCM2402 back to auto.

8.2.10.1.9 Perform frequency response tests on panel 204 (see TC2301, Figure 8.2.7-1) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2301. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady-state condition for approximately 2 minutes.

| | Initial | Date |
|---|---|---|

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.7.1.7 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2301 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2301.

6) Set FCM2301 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU) and adjust the TFA output such that a +400 lb/hr peak-to-peak response is achieved on FI2301.

Set the TFA to 0.02 Hz allow the system to reach steady state (3-4 cycles.

Repeat 4) at a frequency of 0.05 Hz
Repeat 4) at a frequency of 0.07 Hz
Repeat 4) at a frequency of 0.1 Hz
Repeat 4) at a frequency of 0.2 Hz
Repeat 4) at a frequency of 0.5 Hz
Repeat 4) at a frequency of 1 Hz
Repeat 4) at a frequency of ___ Hz Determined
Repeat 4) at a frequency of ___ Hz during test

| | Initial | Date |
|---|---|---|
| Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.<br><br>(2) If panel temperature drifts off the nominal test condition - adjust FCM2301 output from operator station to correct if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2301 back to auto | | |
| 8.2.10.1.10 Obtain open loop step response data on panel 208 by carrying out the following steps.<br><br>A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2402 to manual mode. | | |
| C) Implement a step decrease in FCM2402 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. | | |

| | Initial | Date |
|---|---|---|
| Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2402 (PV & CO), TI2402, TI2405, YI2408, PI2902. | | |
| FCM2402 Output ____________% Command Change | | |
| D) Implement a step increase (back to nominal) in FCM2402 output (closing valve) and allow temperatures, pressures and flowrate to reach steady state conditions. | | |
| E) Reset FCM2402 back to auto. | | |
| 8.2.10.1.11 Perform frequency response tests on panel 208 (see TC2402, Figure 8.2.7-2) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2402. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |

| | Initial | Date |
|---|---|---|
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.10.1.10 C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2402 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2402.<br><br>6) Set FCM2402 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 Hz sin wave into the CTU) and adjust the TFA output such that +400 lb/hr peak-to-peak response is achieved on FI2402.<br><br>Set the TFA to 0.2 Hz allow the system to reach steady state (3-4) cycles).<br><br>Repeat 4) at a frequency of 0.05 Hz<br>Repeat 4) at a frequency of 0.07 Hz<br>Repeat 4) at a frequency of 0.1 Hz<br>Repeat 4) at a frequency of 0.2 Hz<br>Repeat 4) at a frequency of 0.5 Hz | | |

| | Initial | Date |
|---|---|---|

Repeat 4) at a frequency of 0.7 Hz

Repeat 4) at a frequency of 1 Hz

Repeat 4) at a frequency of __ Hz Determined during test

Repeat 4) at a frequency of __ Hz

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2402 output from operator station to correct - if cannot successfully adjust - return to Step 5. ______ ______

8) Switch TFA input out of CTU. ______ ______

9) Set FCM2402 back to auto. ______ ______

8.2.10.1.12 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition of approximately 5 minutes. ______ ______

B) Set FCM2702 to manual mode. ______ ______

| Initial | Date |
|---|---|

C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

FCM2702 Output ____________%
Command Change

D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2702 back to auto.

8.2.10.1.13 Obtain open loop step/ramp response to a flux disturbance on panel 217 by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2702 to manual mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 217 and 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2302 (PV & CO), TI2702, TI2705, YI2708A/B, FCM2803 (PV & CO), TI2803, TI2806, YI2809A/B<br><br>Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$50 to 100°F are desired. | | |
| D) Implement a step/ramp increase in power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2702 and FCM2803 back to auto. | | |

| | Initial | Date |
|---|---|---|
| 8.2.10.1.14 Perform frequency response tests on panel 217 (See TC2702, Figure 8.2.9-1) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.10.1.7 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2702 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2702. | | |
| 6) Set FCM2702 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2702. | | |

| | Initial | Date |
|---|---|---|

8.2.10.1.14 7) Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ   Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2702 output from operator station to correct - if cannot successfully adjust - return to Step 5. ______ ______

8) Switch TFA input out of CTU. ______ ______

9) Set FCM2702 back to auto. ______ ______

| Initial | Date |
|---|---|

8.2.10.1.15 Obtain open loop step response data on panel 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2803 to manual mode.

C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: RCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902.

FCM2803 Output __________%
Command Change

D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

| | Initial | Date |
|---|---|---|

8.2.10.1.15 E) Reset FCM2803 back to auto.

8.2.10.1.16 Perform frequency response tests on panel 221 (See TC2803, Figure 8.2.9-3) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.2.9.1.7 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2803 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2803.

6) Set FCM2803 to manual mode.

| | Initial | Date |
|---|---|---|

8.2.10.1.16 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ   Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.2.10.1.16 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2803 back to auto. | | |

| | Initial | Date |
|---|---|---|

8.2.10.2 Obtain closed loop response data on panel temperature controllers TC2301, TC2402, TC2702, TC2803 to temperature setpoint and flux changes at a nominal temperature of 660°F and equivalent start-up flow conditions. Tune control loops as required.

8.2.10.2.1 Verify that the receiver panel 204 is in a steady state condition at approximately 485 psig and 660°F. Verify that the heliostat field is in the plant start-up configuration. TC2301 in flow control. Adjust flow setpoint if required to achieve 660°F.

8.2.10.2.2 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2301, set to console mode and set temperature setpoint to current PV value.

8.2.10.2.3 Initiate panel metal temperature control on TC2301. Select TD2301B and initiate switch to on position. Allow panel to achieve steady state temperature.

Note: If controller fails to satisfactory control metal temperature, Select TD2301A and switch back to flow control. Also Select TD2301B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.10.2.1).

| Initial | Date |
|---|---|

8.2.10.2.4 Tune TC2301 - panel metal temperature controller (See Figure 8.2.7.3-1) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2301 by 10% and observe the response on the strip chart.

C) Increase TC2301 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-1, AL-12)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2301 setpoint 10% and observe response on strip chart.

G) Increase TC2301 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-1, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|
| 8.2.10.2.4 J) Establish preliminary TC2301 controller gains in metal temperature control mode and record.<br><br>K) Adjust setpoints, alarms, and limits if required. | | |
| 8.2.10.2.5 Verify that the receiver panel 208 is in a steady state condition at approximately 485 psig and 660°F. TC2402 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.10.2.6 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2402, set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.10.2.7 Initiate panel metal temperature control on TC2402. Select TD2402B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactory control metal temperature, Select TD2402A and switch back to flow control. Also Select TD2402B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.10.2.5. | | |

| | Initial | Date |
|---|---|---|

8.2.10.2.8 Tune TC2402 - panel metal temperature controller (See Figure 8.2.7-2) by carrying out the following steps using the loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint of TC2402 by 10% and observe the response on the strip chart.

C) Increase TC2402 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-3, AL-12)*.

E) Repeat steps B -- D as required until reponse is satisfactory.

F) Decrease TC2402 setpoint 10% and observe response on strip chart.

G) Increase TC2402 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-3, AL-12) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

| | Initial | Date |
|---|---|---|

8.2.10.2.8 J) Establish preliminary TC2402 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

8.2.10.2.9 Obtain closed loop response on TC2301 & TC2402 to a flux disturbance on panel 204 & 208 by carrying out the following steps.

A) Confirm that receiver panels 204 & 208 are in a steady state condition for approximately 2 minutes.

B) Confirm TC2301 & TC2402 is in metal temperature control mode.

C) Implement a step/ramp decrease in the power level on panel 204 & 208 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2301, (PV & CO), TI2301, TI2304, YI2307A/B, FCM2402, (PV & CO), TI2402, TI2405, YI2408A/B, PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and

| | Initial | Date |
|---|---|---|

8.2.10.2.9 temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response TI2301 & TI2402. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select C1-1, AL-16 and C1-3, AL-16 - using loop tuning form increase/ decrease gain and low time constant as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain.

G) Set console back to monitor mode.

8.2.10.2.10 Obtain closed loop response data on panel temperature controllers TC2702 & TC2803 to temperature setpoint and flux changes at a nominal temperature of 660°F. Tune control loops as required.

| | Initial | Date |
|---|---|---|
| 8.2.10.2.11 Verify that the heliostat field is in plant start-up configuration for panels 217, 221. Verify that the receiver panel 217 is in a steady state condition at approximately 485 psig and 660°F. TC2702 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.10.2.12 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2702 set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.10.2.13 Initiate panel metal temperature control on TC2702. Select TD2702B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactory control metal temperature, Select TD2702A and switch back to flow control. Also Select TD2702B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.10.2.1. | | |
| 8.2.10.2.14 Tune TC2702 - panel metal temperature controller (See Figure 8.2.9-1) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode. | | |

| | Initial | Date |
|---|---|---|

8.2.10.2.14 B) Decrease temperature setpoint of TC2702 by 10% and observe the response on the strip chart.

C) Increase TC2702 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-7, AL-32)*.

E) Repeat steps B -- D as required until response is satsifactory.

F) Decrease TC2702 setpoint 10% and observe response on strip chart.

G) Increase TC2702 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-7, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2702 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

| | Initial | Date |
|---|---|---|
| 8.2.10.2.15 Verify that the receiver panel 221 is in a steady state condition at approximately 485 psig and 660°F. TC2803 in flow control. Adjust flow setpoint if required to achieve 660°F. | | |
| 8.2.10.2.16 Confirm that the test data base is configured to initiate and maintain panel metal temperature control. Select TC2803, set to console mode and set temperature setpoint to current PV value. | | |
| 8.2.10.2.17 Initiate panel metal temperature control on TC2803. Select TD2803B and initiate switch to on position. Allow panel to achieve steady state temperature.<br><br>Note: If controller fails to satisfactory control metal temperature, Select TD2803A and switch back to flow control. Also Select TD2803B and switch out metal temperature loop - consult test engineer for controller parameter adjustments and go back to Section 8.2.10.2.15. | | |
| 8.2.10.2.18 Tune TC2803 - panel metal temperature controller (See Figure 8.2.9-1) by carrying out the following steps using the loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease temperature setpoint of TC2803 by 10% and observe the response on the strip chart. | | |

| | Initial | Date |
|---|---|---|

8.2.10.2.18 C) Increase TC2803 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain K1 (C1-9, AL-32)*.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2803 setpoint 10% and observe response on strip chart.

G) Increase TC2803 setpoint to nominal value and observe temperature response on strip chart.

H) Increase/decrease reset gain, K2 (C1-9, AL-32) in the ± 30 increments.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish preliminary TC2803 controller gains in metal temperature control mode and record.

K) Adjust setpoints, alarms, and limits if required.

| | Initial | Date |
|---|---|---|

8.2.10.2.19 Obtain closed loop response on TC2702 & TC2803 to a flux disturbance on panels 217 & 221 by carrying out the following steps.

A) Confirm that receiver panels 217 & 221 are in a steady state condition for approximately 2 minutes.

B) Confirm TC2801 & TC2803 are in metal temperature control mode.

C) Implement a step/ramp decrease in the power level on panel 217 & 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: FCM2702, TI2702, TI2705, YI2708A/B, FCM2803, TI2803, TI2806, YI2809A/B, PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 1000 lb/hr are desired.

| | Initial | Date |
|---|---|---|

8.2.10.2.19 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response TI2702, IT2803. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select Cl-7, AL-36, Cl-9, AL-36 - using loop tuning form increase/ decrease gain and low time constant as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain.

G) Set console back to monitor mode.

| | Initial | Date |
|---|---|---|

## 8.2.11 RECEIVER STARTUP SEQUENCE (PANELS 209-214)

This section of the procedure is designed to simulate the startup of the receiver using a portion of the 18 boiler panels and to allow final closed loop tuning of individual boiler panels prior to the startup and operational verification of the entire receiver (Section 8.2.14). The operational sequence verified in this section of the procedure is derived from published operating instructions (Ref: Plant Operating/Training Manual - RADL 2-36, Instruction(T-2) - Receiver Startup).

8.2.11.1 Verify that the initial conditions have been established as shown in Section 7.4.2.

8.2.11.2 Set the receiver temperature control set point (TSP-2929) to 585°F.

8.2.11.3 Verify the receiver flash tank pressure control set point is 485 psig.

8.2.11.4 Verify that the pump controller is operating in a valve control mode with an 80% valve position set point.

8.2.11.5 Place panel controllers FCM-2301 - FCM-2402 and FCM-2603 - FCM-2803 in manual and establish the following set points:

| | Initial | Date |
|---|---|---|

| | Set Point (lb/hr) |
|---|---|
| FCM-2301 - FCM-2302 | 1000 |
| FCM-2303 | 2000 |
| FCM-2401 - FCM-2402 | 3000 |
| FCM-2603 - FCM-2701 | 3000 |
| FCM-2702 | 2000 |
| FCM-2703 - FCM-2802 | 1000 |
| FCM-2803 | 500 |

Verify that the remain boiler panel controllers (TC-2403 - TC-2602) are in the flow control mode and controlling to default flow values.

| | Default Value (lb/hr) |
|---|---|
| TC-2403 | 1000 |
| TC-2501 | 1100 |
| TC-2502 - 2602 | 1200 |

8.2.11.6 Issue appropriate heliostate track commands for collector field wedges 4-8 <u>only</u> as determined from Tables A-6 and A-7 and Figures A-8 and A-9 (Ref: Plant Operating/Training Manual - RADL 2-36) which are enclosed in this procedure.

8.2.11.7 Monitor panels 209-214 and observe the transition to steam generation operation. Verify that controllers TC-2403 - TC-2602 switch from flow control to temperature control at the 585°F transition set point and subsequently modulates flow to maintain the control temperature.

TABLE A-6. COLLECTOR FIELD/RECEIVER STARTUP CONFIGURATION
(Number of Heliostats Per Wedge in "Track")
Valid Dates: Jan 5 through Feb 4
Nov 11 through Dec 6

| Time | Wedge | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Before 9:50 a.m. | 9 | 6 | 11 | 10 | 11 | 13 | 14 | 13 | 12 | 20 | 18 | 14 |
| Between 9:50 a.m. and 3:45 p.m. | 7 | 8 | 15 | 10 | 9 | 11 | 11 | 9 | 11 | 14 | 8 | 11 |

TABLE A-7. COLLECTOR FIELD/RECEIVER STARTUP CONFIGURATION
(Number of Heliostats Per Wedge in "Track")
Valid Dates: Dec 7 through Jan 4

| Time | Wedge | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Before 9:35 a.m. | 9 | 7 | 11 | 11 | 11 | 15 | 14 | 16 | 11 | 26 | 20 | 15 |
| Between 9:35 a.m. and 12:45 p.m. | 6 | 4 | 6 | 7 | 6 | 10 | 8 | 9 | 7 | 16 | 11 | 9 |
| Between 12:45 p.m. and 4:00 p.m. | 13 | 12 | 15 | 7 | 9 | 8 | 10 | 6 | 7 | 7 | 5 | 4 |

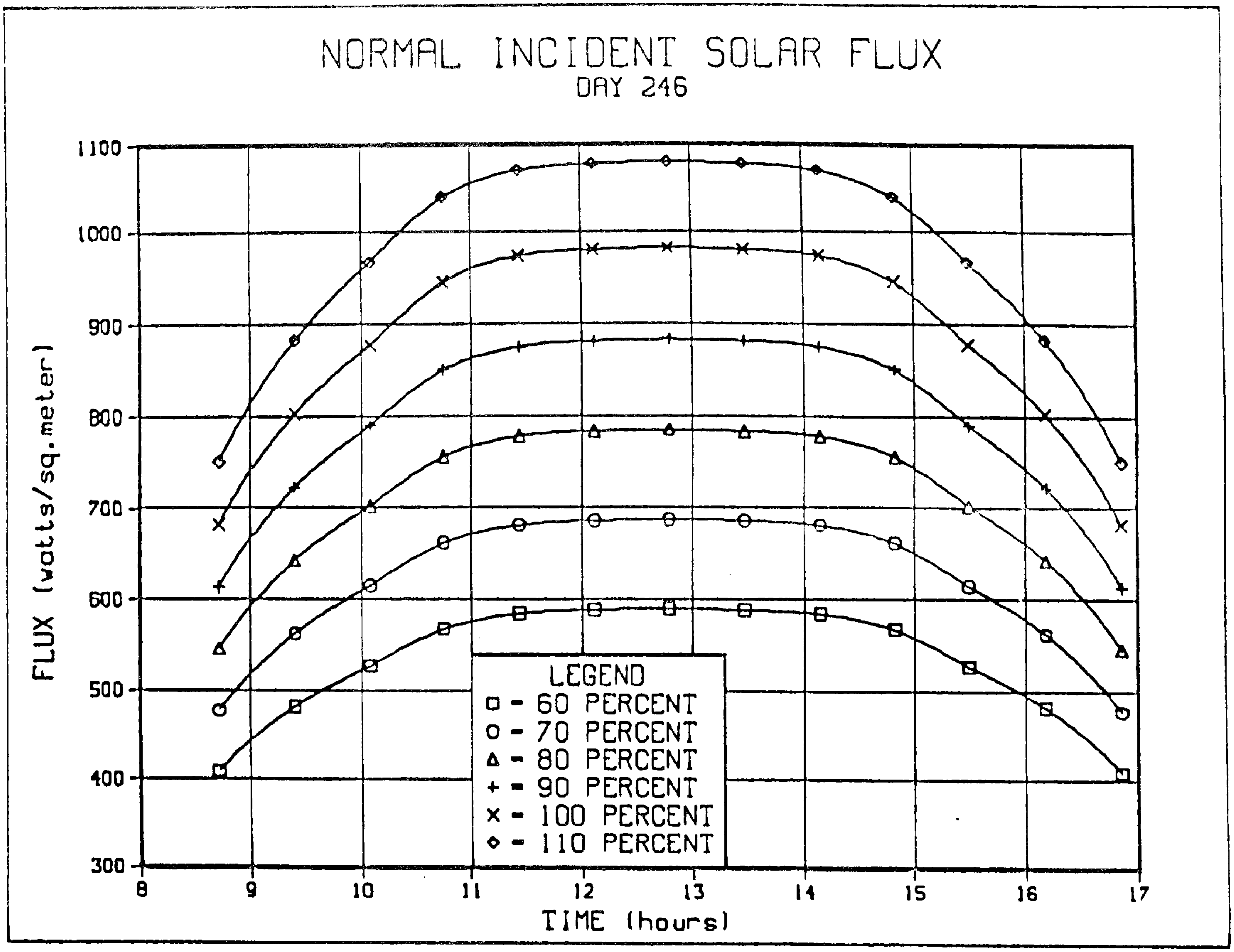



Figure A-8. Insolation Correction Data for Table A-6

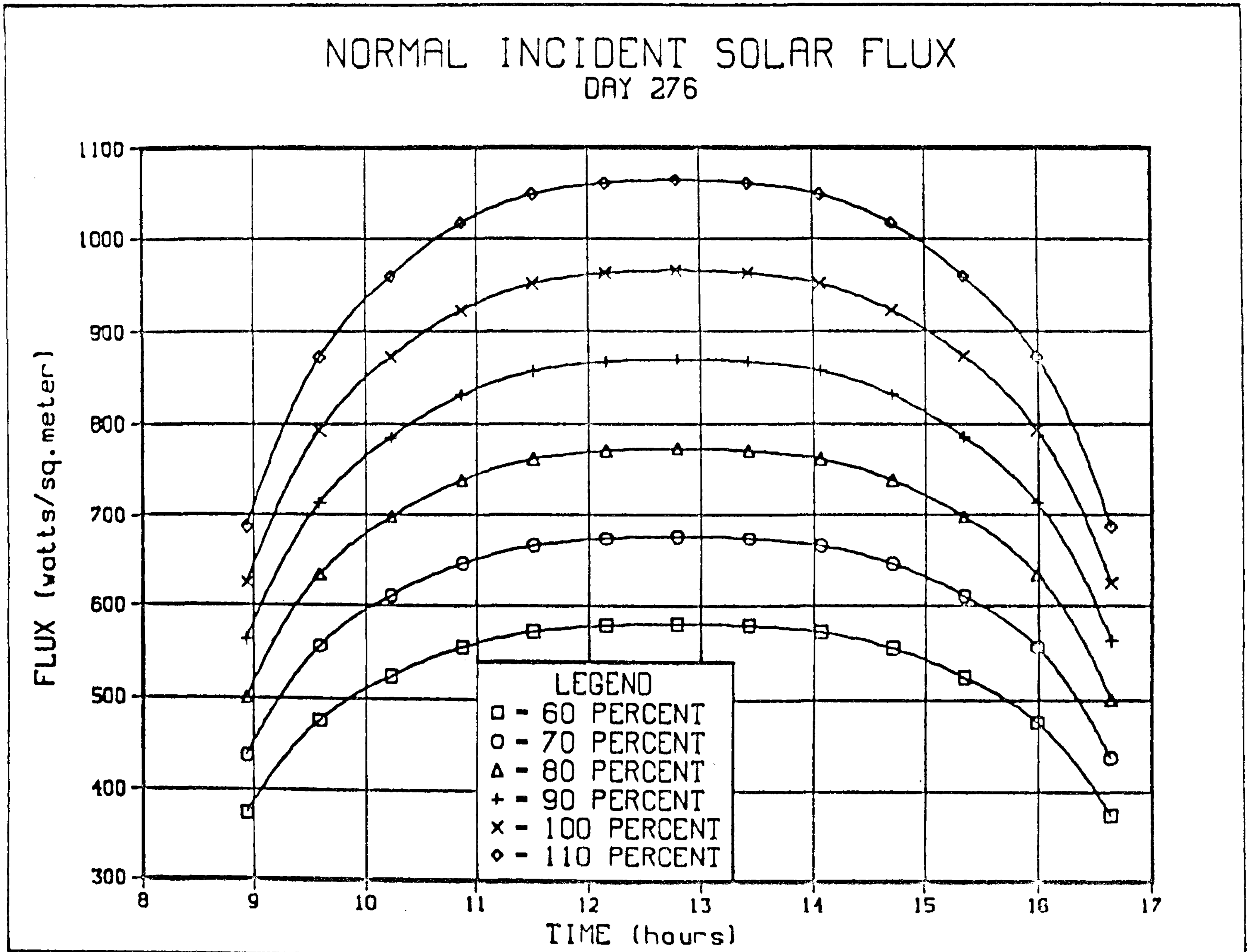



Figure A-9. Insolation Correction Data for Table A-7

| | Initial | Date |
|---|---|---|
| 8.2.11.8 Monitor receiver panels 204-208 and 215-221 and verify that discharge temperatures are 550°F (as indicated by TI-2301 - TI-2402 and TI-2603 - TI-2803). Verify temperature gradients are 200°F as indicated by TEX-2354B, C, & D - TEX-2455B, C, & D and TEX-2656B, C, & D - TEX-2856B, C, & D. Increase flow set points as required in these panels to satisfy the temperature limits. Total receiver flow shall not exceed 40,000 lb/hr. | | |
| 8.2.11.9 Monitor panel control valve positions and pump speed and verify that the pump speed modulates to keep the most wide open receiver panel control valve at 80% stroke (80% open). In the event the 80% valve corresponds to a fixed panel (204-208 and 215-221), reduce the flow set point for that controller in order to cause another valve to become the limiting 80% open valve. Verify that the feed pump speed modulates automatically to maintain the new limiting (80% open) valve at the 80% position. | | |
| The following steps are carried out to tune controllers TC-2403 - TC-2602 at a 660°F temperature set point and at the nominal flash tank operating pressure (485 psig). | | |
| 8.2.11.10 Adjust the receiver temperature control set point (TSP-2929) to 660°F and observe the panel temperature increase (TI-2403 - TI-2602) and control to the new set point value. | | |

| | Initial | Date |
|---|---|---|

8.2.11.11 Perform closed loop test of TC-2403. (See Figure 8.2.11-1) Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2403 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2403 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-3, AL-32)* as required.

E) Repeat steps B -- D as required until Response is satisfactory.

F) Decrease TC-2403 set point 10% (600°F) and observe response.

G) Increase TC-2403 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-3, AL-32) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

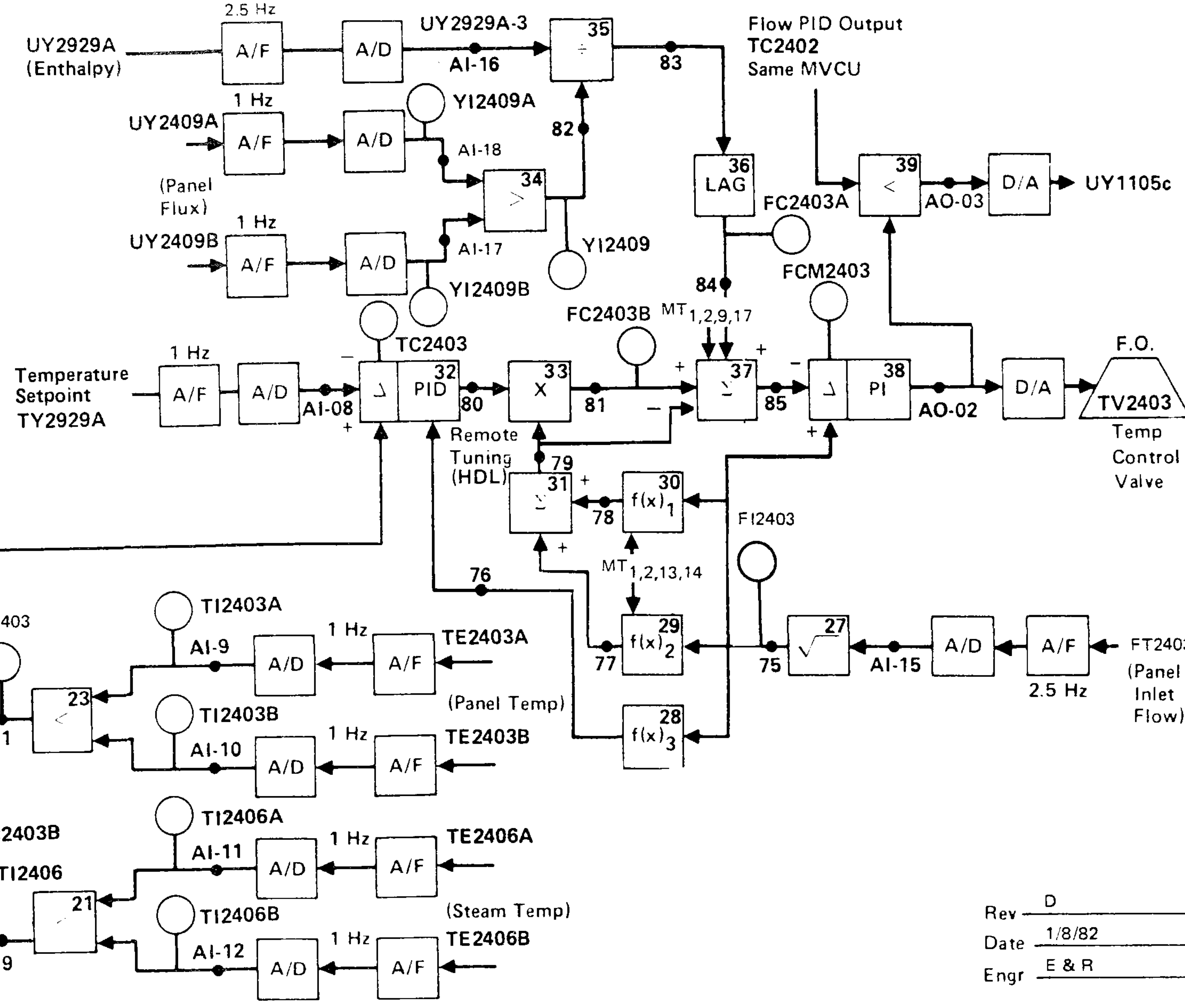



Figure 8.2.11-1. RS Steam Temperature Controller Functional Block Diagram TC-2403

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| Initial | Date |
|---|---|

J) Establish TC-2403 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.11.12 Perform closed loop tests of TC2501 (See Figure 8.2.3-1). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2501 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC2501 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-4, AL-12)* as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2501 set point 10% (600°F) and observe response.

G) Increase TC2501 set point to nominal value and observe temperature response.

| Initial | Date |
|---|---|

H) Increase/decrease reset gain, K2 (C1-4, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC2501 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.11.13 Perform closed loop tests of TC2502 (See Figure 8.2.11-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2502 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC2502 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-4, AL-32)* as required.

E) Repeat steps B -- D as required until response is satisfactory.

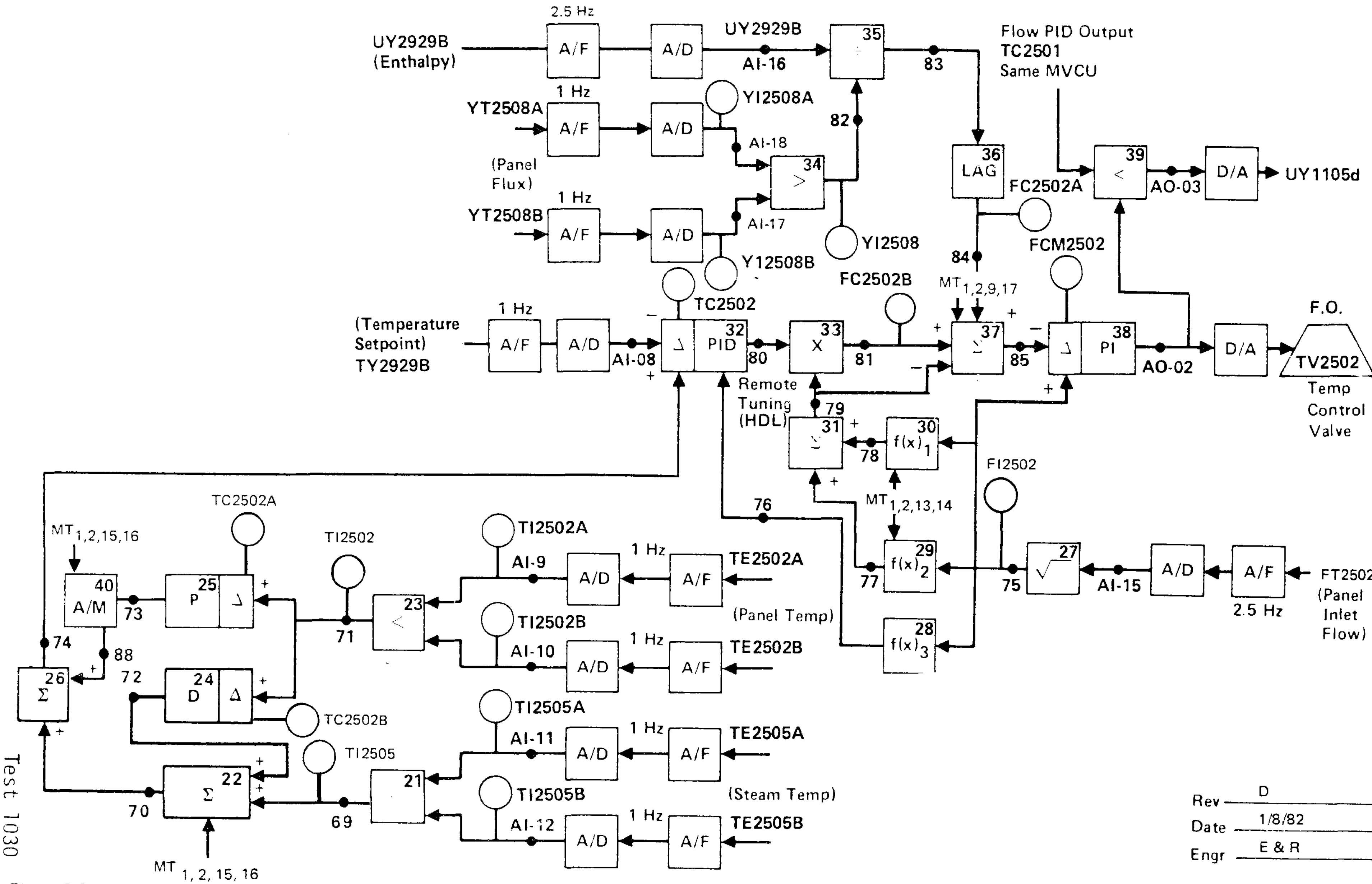


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Figure 8.2.11-2. RS Steam Temperature Controller Functional Block Diagram TC-2502

| | Initial | Date |
|---|---|---|

F) Decrease TC2502 set point 10% (600°F) and observe response.

G) Increase TC2502 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-4, AL-32) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC2502 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.11.14 Perform closed tests of TC2503 (See Figure 8.2.3-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2503 by 20% (600°F) and observe the response on the strip chart.

C) Increase TC2503 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-5, AL-12)* as required.

| | Initial | Date |
|---|---|---|

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2503 set point 10% (600°F) and observe response.

G) Increase TC2503 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-5, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC2503 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.11.15 Perform closed loop test of TC2601 (See Figure 8.2.11-3). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2601 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC2601 set point back to nominal value and observe the response on the strip chart.

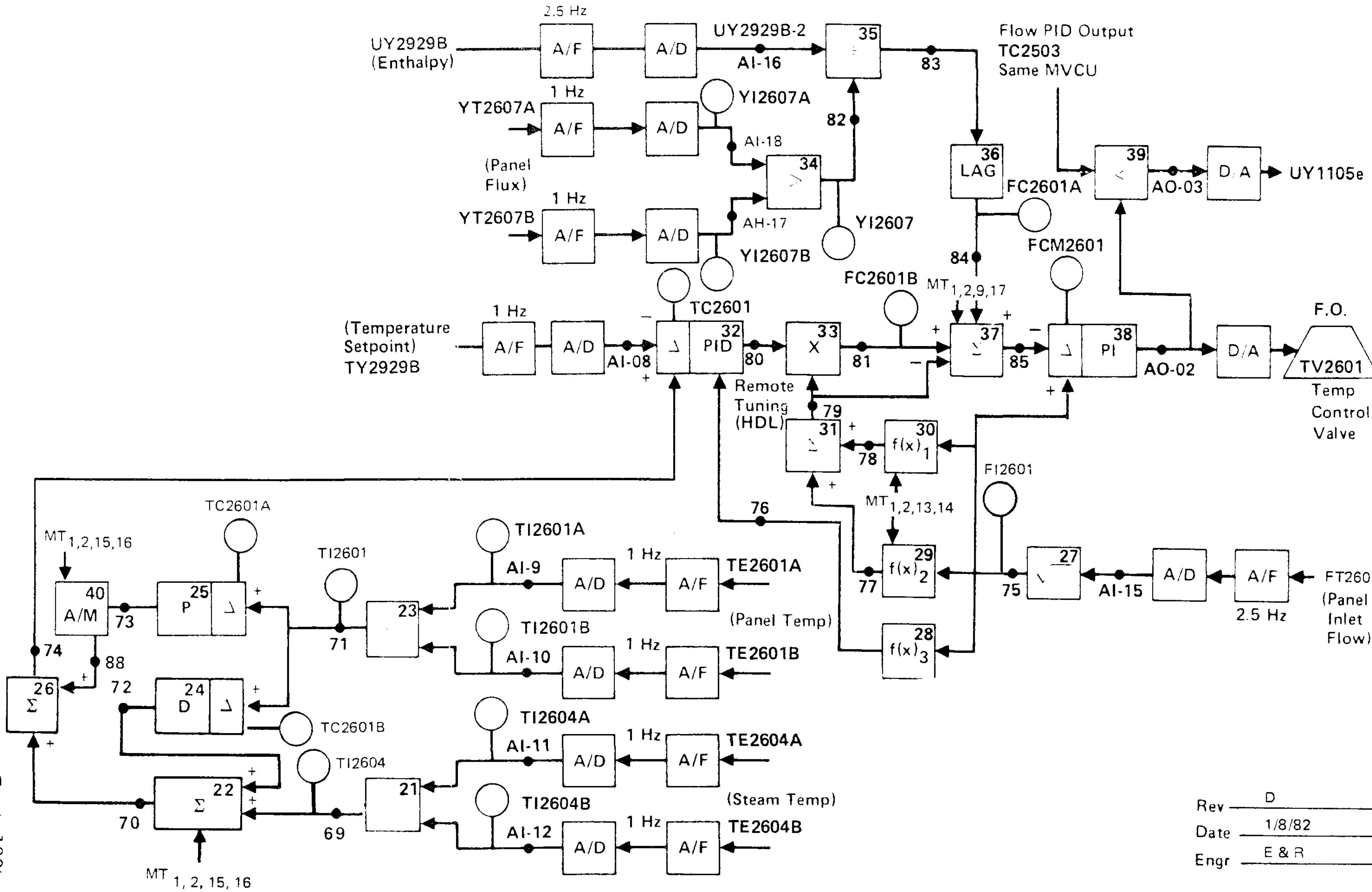


Figure 8.2.11-3. RS Steam Temperature Controller Functional Block Diagram TC-2601

| | |
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|---|---|

D) Increase/decrease proportional gain, K1 (C1-5, AL-32)* as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC2601 set point 10% (600°F) and observe response.

G) Increase TC2601 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain K2 (C1-5, AL-32) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC2601 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.11.16 Perform closed loop test of TC2602 (See Figure 8.2.5-1). Tune control loop if required by carrying out the following steps using loop tuning form.

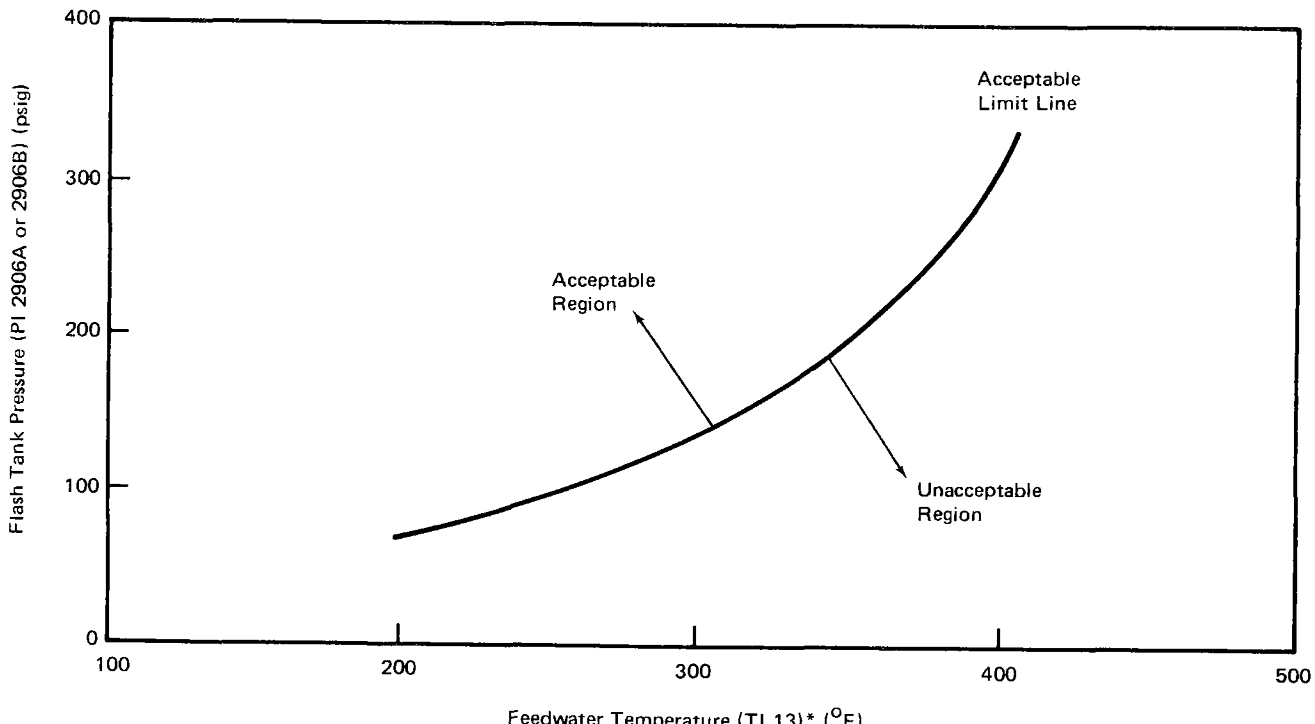
A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2602 by 10% (600°F) and the response on the strip chart.

| | Initial | Date |
|---|---|---|
| C) Increase TC2602 set point back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain, K1 (C1-6, AL-12)* as required. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC2602 set point 10% (600°F) and observe response. | | |
| G) Increase TC2602 set point to nominal value and observe temperature response. | | |
| H) Increase/decrease reset gain, K2, (C1-6, AL-12) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TX2602 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |
| 8.2.11.17 Verify that controllers TC 2403 - TC 2602 have been returned to the cascade control mode. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.2.11.18 | Ramp Temperature set point for panels 209-214 simultaneously from 660°F to 800°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.11.19 | Ramp temperature set point for panels 209-214 simultaneously from 800°F to 660°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.11.20 | Introduce a "step" change in input power to the receiver by issuing "DECREASE" commands of 20% to the wedges tracking the receiver. Observe panel temperatures and control valve responses for panels 209-214 during the transition period. | | |
| 8.2.11.21 | Return the heliostat configuration/panel power level back to the original value of the previous step by issuing the appropriate "INCREASE" command. Observe panel temperatures and control valve responses for panels 209-214 during the transition period. | | |
| 8.2.11.22 | Command "Tracking"heliostats to "Standby" and switch controllers TC 2403 - TC 2602 to flow control mode through CRT switch functions and allow all panels and flash tank to flood. Continue to shutdown the receiver or proceed to Section 8.2.12, proper flash tank pressure | | |

| | Initial | Date |
|---|---|---|
| should be established by opening SOV 2019A (HS 2019) and allowing $GN_2$ to pressurize the flash tank. Proper tank pressure is determined from Figure 8.2.11-4. | | |




*Last Remote Indication Upstream of Feedwater Recirculation Line to the Condenser

**Figure 8.2.11-4. Flash Tank Nitrogen Pressurization Curve**

| | Initial | Date |
|---|---|---|

8.2.12 RECEIVER STARTUP SEQUENCE (PANELS 204-208)

This Section assumes a continuation of activities carried out in Section 8.2.11, i.e., water flowing through the receiver panels and required heliostats tracking the "Standby". For this section of the procedure, heliostats from wedges 1-5 are required. If a receiver shutdown occurred prior to this section, initial feedwater circulation and cleanup per Plant Operating/Training Manual - RADL 2-36, Instruction T-1 is required prior to carrying out this section.

In carrying out this section of the procedure, selected modifications were made to the operating instructions to permit panels 204-208 to follow the flow control/temperature control sequence while the balance of the panels remain in a manual (flow control) condition.

| | | Initial | Date |
|---|---|---|---|
| 8.2.12.1 | Verify that the initial conditions have been established as shown in Section 7.4.2. | | |
| 8.2.12.2 | Verify the receiver temperature control set point (TSP 2929) is set to 585°F. | | |
| 8.2.12.3 | Verify the receiver flash tank pressure control set point is 485 psig. | | |
| 8.2.12.4 | Verify that the pump controller is operating in a valve control mode with an 80% valve position set point. | | |

| Initial | Date |
|---|---|

8.2.12.5 Place controllers FCM2403 - FCM2803 in manual and establish the following set points:

| | Set Point (lb/hr) |
|---|---|
| FCM 2403 - FCM 2501 | 3000 |
| FCM 2502 | 2000 |
| FCM 2503 - FCM 2602 | 1000 |
| FCM 2603 - FCM 2803 | 0 |

8.2.12.5 Verify that the remaining boiler panel controllers (TC2301 - TC2402) are in the flow control mode and controlling to default flow values.

| | Default Values (lb/hr) |
|---|---|
| TC 2301 | 556 |
| TC 2302 | 600 |
| TC 2302 | 700 |
| TC 2401 | 800 |
| TC 2402 | 900 |

8.2.12.6 Issue appropriate heliostat track commands for collector field wedges 1-5 only as determined from Tables A-6 and A-7 and Figures A-8 and A-9 (Ref: Plant Operating/Training Manual - RADL 2-36) which are enclosed in this procedure (Section 8.2.11).

8.2.12.7 Monitor panels 204-208 and observe the transition to steam generation operation. Verify that controllers TC2301 - TC2402 switch from flow control to temperature control at the 585°F transition set point and subsequently

| | Initial | Date |
|---|---|---|
| modulate flows to maintain the control temperature. | | |
| 8.2.12.8 Monitor receiver panels 209-214 and verify that discharge temperatures are 550°F (as indicated by TI2403 - TI2602). Verify temperature gradients are 200°F as indicated by TEX2456B, C, & D - TEX2655B, C, & D. Increase flow set points as required in these panels to satisfy the temperature limits. Total receiver flow shall not exceed 40,000 lb/hr. | | |
| 8.2.12.9 Monitor panel control valve position and pump speed and verify that the pump speed modulates to keep the most wide open receiver panel control valve at 80% stroke (80% open). In the event the 80% valve corresponds to a fixed flow panel (209-204), reduce the flow set point for that controller in order to cause another valve to become the limiting 80% open valve. Verify that the feed pump speed modulates automatically to maintain the new limiting (80% open) valve at the 80% position. | | |
| The following steps are carried out to tune controllers TC-2301 - TC-2402 at a 660°F temperature set point and at a nominal flash tank operating pressure (485 psig). | | |

| | Initial | Date |
|---|---|---|
| 8.2.12.10 Adjust the receiver temperature control set point (TSP-2929) to 660°F and observe the panel temperature increase (TI-2301 - TI-2402) and control to the new set point value. | | |

8.2.12.11 Perform closed loop test of TC-2301. (See Figure 8.2.7-1) Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2301 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2301 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-1, AL-12) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2301 set point 10% (600°F) and observe response.

G) Increase TC-2301 set point to nominal value and observe temperature response.

| | Initial | Date |
|---|---|---|
| H) Increase/decrease reset gain, K2 (C1-1, AL-12) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2301 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |

8.2.12.12 Perform closed loop tests of TC-2302 (See Figure 8.2.12-1). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2302 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC2302 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-1, AL-32) as required.

E) Repeat steps B -- D as required until response is satisfactory.

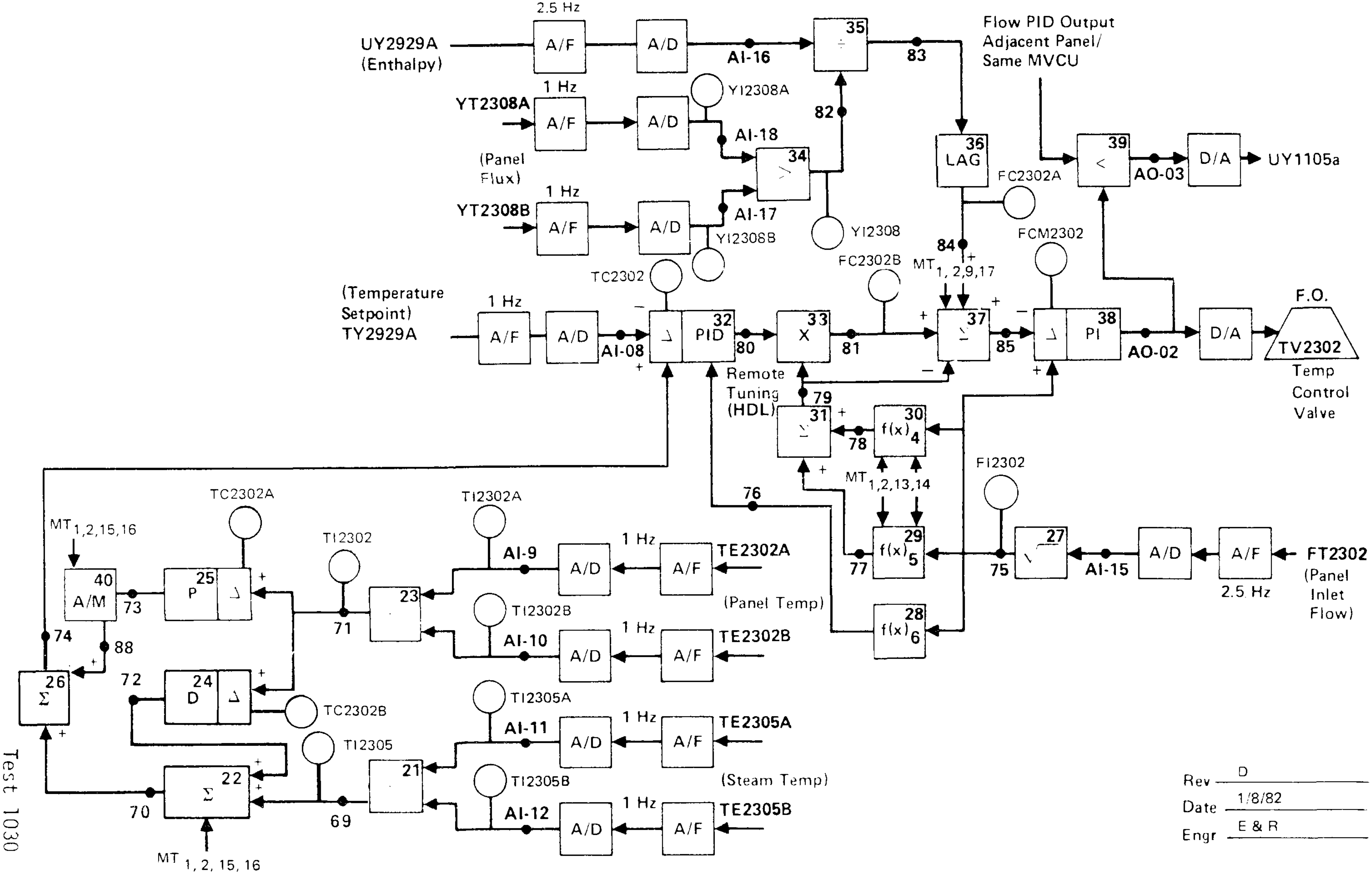



Figure 8.2.12-1. RS Steam Temperature Controller Functional Block Diagram TC-2302

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| | Initial | Date |
|---|---|---|
| F) Decrease TC-2302 set point 10% (600°F) and observe response. | | |
| G) Increase TC-2302 set point to nominal value and observe temperature response. | | |
| H) Increase/decrease reset gain, K2 (C1-1, AL-32) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2302 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |

8.2.12.13 Perform closed loop tests of TC-2303 (See Figure 8.7.2-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2303 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2303 set point back to nominal value and observe the response on the strip chart.

| Initial | Date |
|---|---|

D) Increase/decrease proportional gain, K1 (C1-2, AL-12) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2303 set point 10% (600°F) and observe response.

G) Increase TC-2303 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-2, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC-2303 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.12.14 Perform closed tests of TC-2401 (See Figure 8.2.12-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2401 by 10% (600°F) and observe the response on the strip chart.

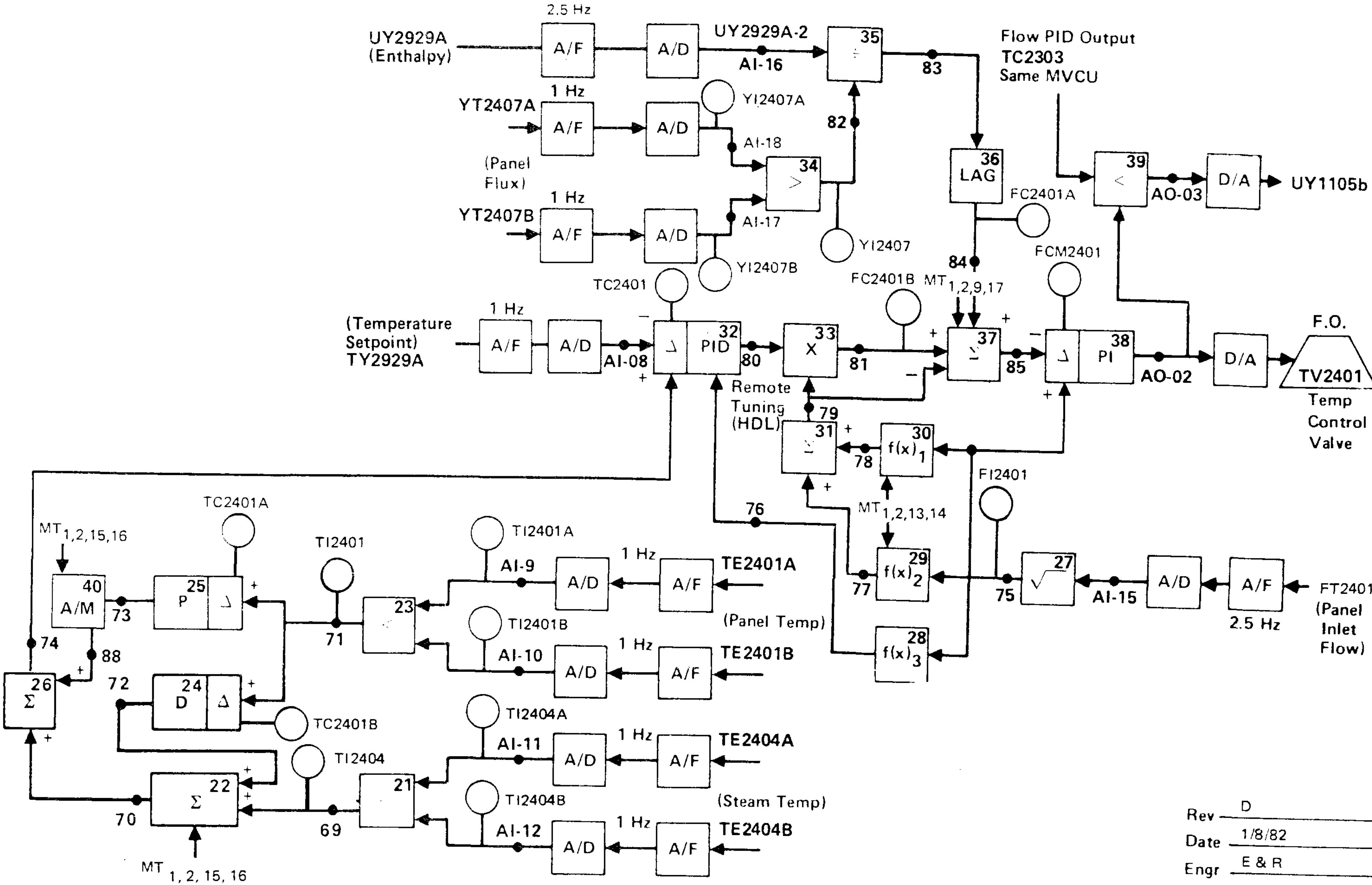


Figure 8.2.12-2. RS Steam Temperature Controller Functional Block Diagram TC-2401

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| | Initial | Date |
|---|---|---|
| C) Increase TC-2401 set point back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain, K1 (C1-2, AL-32) as required. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC-2401 set point 10% (600°F) and observe response. | | |
| G) Increase TC-2401 set point to nominal value and observe temperature response. | | |
| H) Increase/decrease reset gain, K2 (C1-2, AL-32) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2401 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |
| 8.2.12.15 Perform closed loop test of TC-2402 (See Figure 8.2.7-2). Tune control loop if required by carrying out the following steps using loop tuning form. | | |

| | Initial | Date |
|---|---|---|
| A) Set receiver console to configure mode. | | |
| B) Decrease temperature set point on TC-2402 by 10% (600°F) and observe the response on the strip chart. | | |
| C) Increase TC-2402 set point back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain, K1 (C1-3, AL-12) as required. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC-2402 set point 10% (600°F) and observe response. | | |
| G) Increase TC-2402 set point to nominal value and observe temperature response. | | |
| H) Increase/decrease reset gain K2 (C1-3, AL-12) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2402 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |

| | Initial | Date |
|---|---|---|
| 8.2.12.16 Verify that controllers TC-2301 - TC-2402 have been returned to the cascade control mode. | | |
| 8.2.12.17 Ramp temperature set point for panels 204-208 simultaneously from 660°F to 800°F using TSP-2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.12.18 Ramp temperature set point for panels 104-108 simultaneously from 800°F to 660°F using TSP-2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.12.19 Introduce a "step" change in input power to the receiver by issuing "DECREASE" commands of 20% to the wedges tracking the receiver. Observe panel temperatures and control valve responses for panels 204-208 during the transition period. | | |
| 8.2.12.20 Return the heliostat configuration/panel power level back to the original value of the previous step by issuing the appropriate "INCREASE" command. Observe panel temperatures and control valve responses for panels 204-208 during the transition period. | | |
| 8.2.12.21 Command "Tracking" heliostats to "Standby" and switch controllers TC-2301 - TC-2402 to flow control mode through CRT switch | | |

| Initial | Date |
|---|---|
| | |

functions and allow all panels and flash tank to flood. Continue to shutdown the receiver or proceed to Section 8.2.12.13. Proper flash tank pressure should be established by opening SOV-2019A (HS-2019) and allowing $GN_2$ to pressurize the flash tank. Proper tank pressure is determined from Figure 8.2.11-4.

| | | Initial | Date |
|---|---|---|---|
| 8.2.13 | RECEIVER STARTUP SEQUENCE (PANELS 215-221)<br><br>This Section assumes a continuation of activities carried out in Section 8.2.12 i.e., water flowing through the receiver panels and required heliostats tracking the "Standby". For this section of the procedure, heliostats from wedges 7-12 are required. If a receiver shutdown occurred prior to this section, initial feedwater circulation and cleanup per Plant Operating/Training Manual - RADL 2-36, Instruction T-1 is required prior to carrying out this section.<br><br>In carrying out this section of the procedure, selected modifications were made to the operating instruction to permit panels 215-221 to follow the flow control/temperature control sequence while the balance of the panels remain in a manual (flow control) condition. | | |
| 8.2.13.1 | Verify that the initial conditions have been established as shown in Section 7.4.2. | | |
| 8.2.13.2 | Verify the receiver temperature control set point (TSP 2929) is set to 585°F. | | |
| 8.2.13.3 | Verify the receiver flash tank pressure control set point is 485 psig. | | |
| 8.2.13.4 | Verify that the pump controller is operating in a valve control mode with an 80% valve position set point. | | |

| | Initial | Date |
|---|---|---|

8.2.13.5 Place panel controllers FCM-2402 - FCM-2602 and FCM-2301 in manual and establish the following set points:

| | Set Point (lb/hr) |
|---|---|
| FCM-2301, FCM-2402-FCM-2502 | 1000 |
| FCM-2503 | 2000 |
| FCM-2601 - FCM-2602 | 3000 |
| FCM-2302 - FCM-2401 | 0 |

Verify that the remaining boiler panel controllers (TC-2603 - TC-2803) are in the flow control mode and controlling to default flow values.

| | Default Values (lb/hr) |
|---|---|
| TC-2603 | 1100 |
| TC-2701 | 1000 |
| TC-2702 | 900 |
| TC-2703 | 800 |
| TC-2801 | 700 |
| TC-2802 | 600 |
| TC-2803 | 556 |

8.2.13.6 Issue appropriate heliostat track commands for collector field wedges 7-12 only as determined from Tables A-6 and A-7 and Figures A-8 and A-9 (Ref: Plant Operating/Training Manual - RADL - 2-36) which are enclosed in this procedure (Section 8.2.11).

| | Initial | Date |
|---|---|---|
| 8.2.13.7 Monitor panels 215-221 and observe the transition to steam generation operation. Verify that controllers TC-2603 - TC-2803 switch from flow control to temperature control at the 585°F transition set point and subsequently modulates flow to maintain the control temperature. | | |
| 8.2.13.8 Monitor receiver panels 203, 208-214 and verify that discharge temperatures are 550°F (as indicated by TI-2301, TI-2404-TI-2602). Verify temperature gradients are 200°F as indicated by TEX-2354B, C, & D, TEX-2455B, C, & D - TEX-2655B, C, & D. Increase flow set points as required in these panels to satisfy the temperature limits. Total receiver, flow shall not exceed 40,000 lb/hr. | | |
| 8.2.13.9 Monitor panel control valve positions and pump speed and verify that the pump speed modulates to keep the most wide open receiver panel control valve at 80% stroke (80% open). In the event the 80% valve corresponds to a fixed flow panel (204, 209-214), reduce the flow set point for that controller in order to cause another valve to become the limiting 80% open valve. Verify that the feed pump speed modulates automatically to maintain the new limiting (80% open) valve at the 80% position. | | |

The following steps are carried out to tune controllers TC-2603 - TC-2803 at a

| | Initial | Date |
|---|---|---|

660°F temperature set point and at the nominal flash tank operating pressure (485 psig).

8.2.13.10 Adjust the receiver temperature control set point (TSP-2929) to 660°F and observe the panel temperature increase (TI-2603 - TI-2803) and control to the new set point value.

8.2.13.11 Perform closed loop test of TC-2603 (See Figure 8.2.13-1). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2603 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2603 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-6, AL-32) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2603 set point 10% (600°F) and observe response.

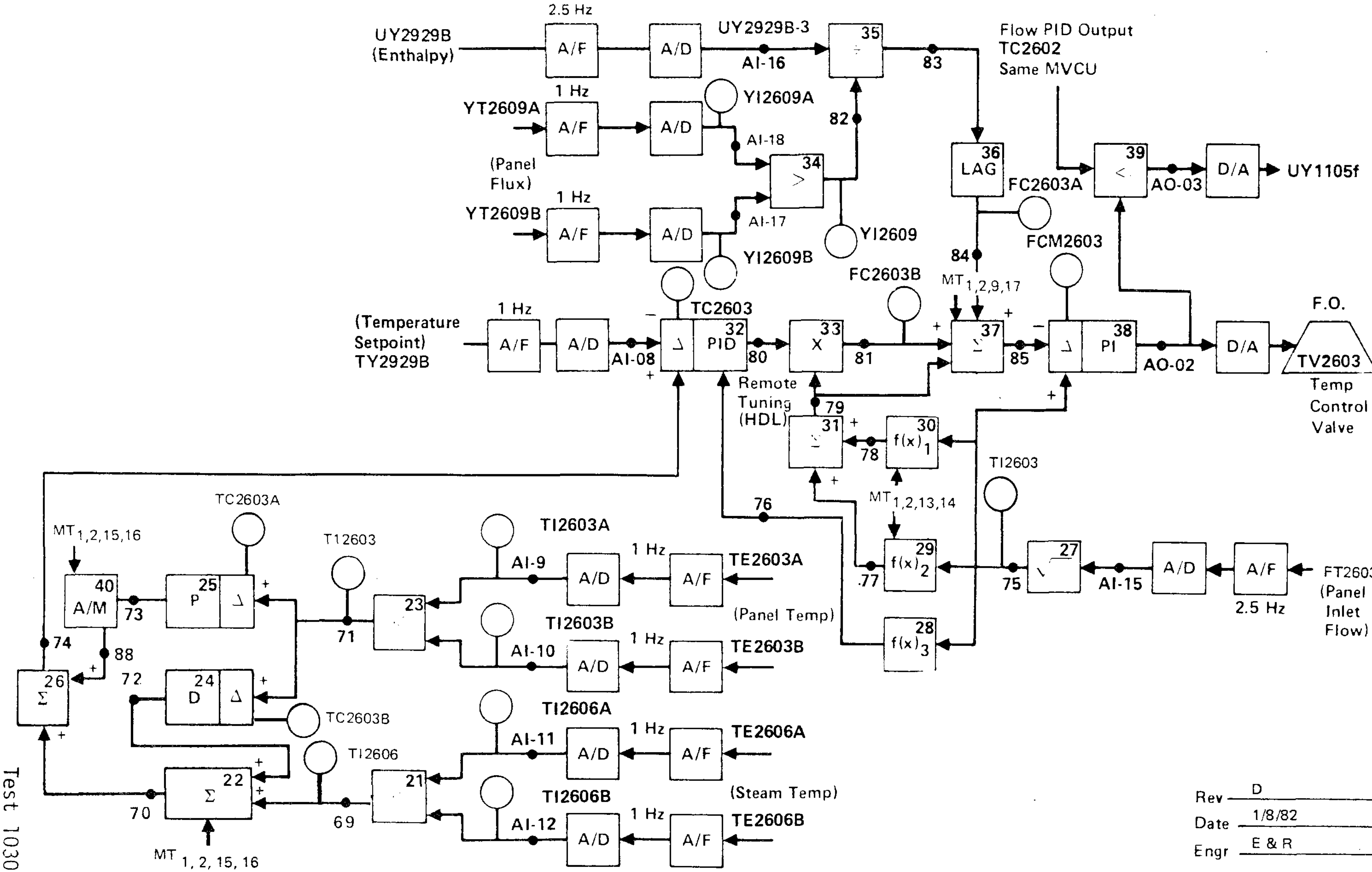


Figure 8.2.13-1. RS Steam Temperature Controller Functional Block Diagram TC-2603

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| | Initial | Date |
|---|---|---|

G) Increase TC-2603 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-6, AL-32) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC-2603 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.13.12 Perform closed loop tests of TC-2701 (See Figure 8.2.5-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point TC-2701 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2701 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C-17, AL-12) as required.

| Initial | Date |
|---|---|
| | |

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2701 set point 10% (600°F) and observe response.

G) Increase TC-2701 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-7, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC-2701 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.13.13 Perform closed loop tests of TC-2702 (See Figure 8.2.9-1). Tune Control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2702 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2702 set point back to nominal value and observe the response on the strip chart.

| Initial | Date |
|---|---|

D) Increase/decrease proportional gain, K1 (C1-7, AL-32) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2702 set point 10% (600°F) and observe response.

G) Increase TC-2702 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-7, AL-32) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TX-2702 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.13.14 Perform closed tests of TC-2703 (See Figure 8.2.13-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2703 by 10% (600°F) and observe the response on the strip chart.

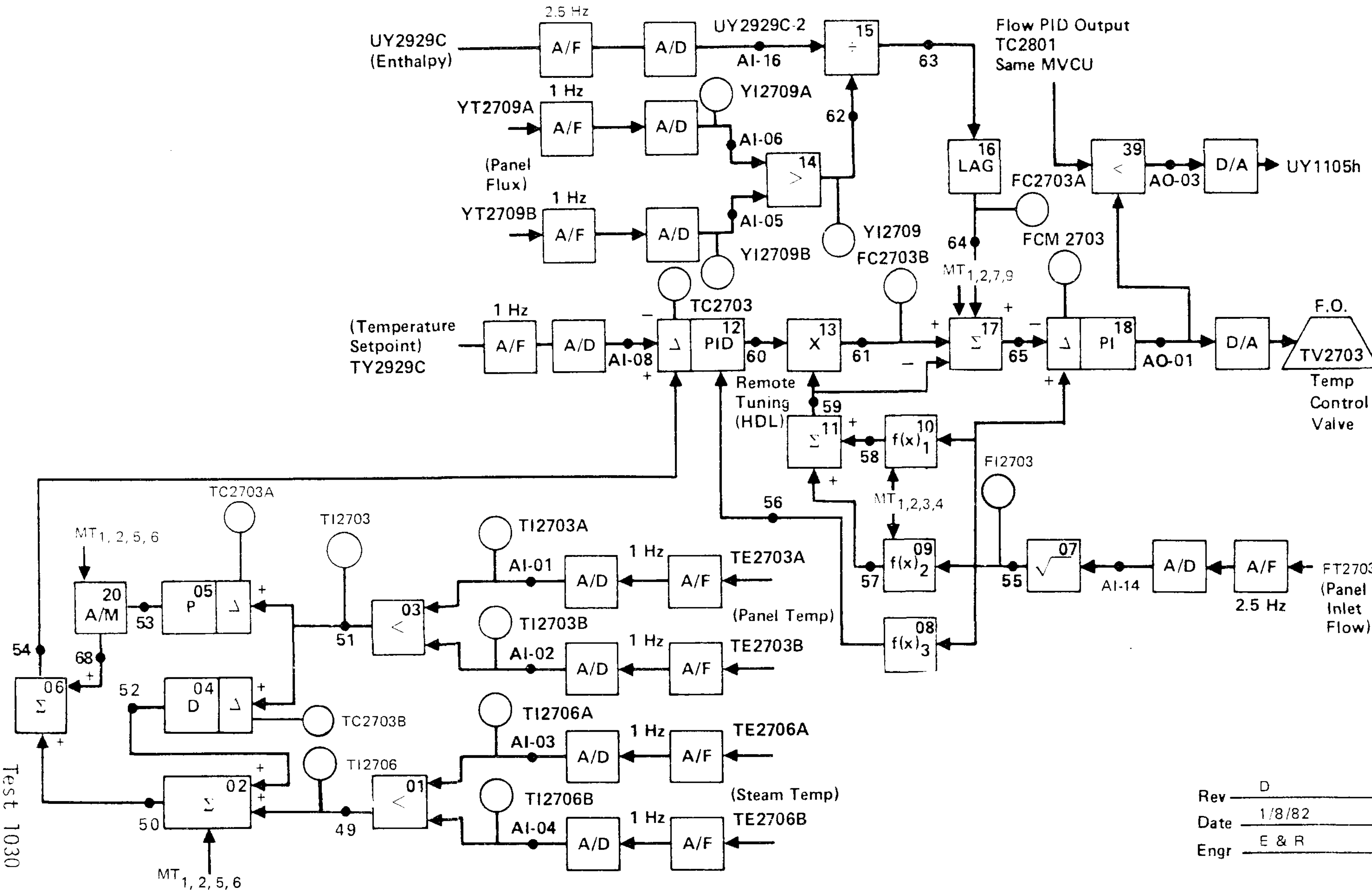


Figure 8.2.13-2. RS Steam Temperature Controller Functional Block Diagram TC-2703

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| | Initial | Date |
|---|---|---|

C) Increase TC-2703 set point back to nominal value and observe response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-8, AL-12) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2703 set point 10% (600°F) and observe response.

G) Increase TC-2703 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C1-8, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

J) Establish TC-2703 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.13.15 Perform closed loop test of TC-2801 (See Figure 8.2.9-2). Tune control loop if required by carrying out the following steps using loop tuning form.

| | Initial | Date |
|---|---|---|
| A) Set receiver console to configure mode. | | |
| B) Decrease temperature set point on TC-2801 by 10% (600°F) and observe the response on the strip chart. | | |
| C) Increase TC-2801 set point back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain, K1 (C1-8, AL-32) as required. | | |
| E) Repeat steps B -- D as required until response is satisfactory. | | |
| F) Decrease TC-2801 set point 10% (600°F) and observe response. | | |
| G) Increase TC-2801 set point back to nominal value and observe temperature response. | | |
| H) Increase/decrease reset gain K2 (C1-8, AL-32) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2801 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |

| | Initial | Date |
|---|---|---|

8.2.13.16 Perform closed loop test of TC-2802 (See Figure 8.2.13-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2802 by 10% (600°F) and the response on the strip chart.

C) Increase TC-2802 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-9, AL-12) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2802 set point 10% (600°F) and observe response.

G) Increase TC-2802 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2, (C1-9, AL-12) in the ±10% increments as required.

I) Repeat steps F -- H as required until response is satisfactory.

| Initial | Date |
|---|---|
| | |

J) Establish TC-2802 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

8.2.13.17 Perform closed loop tests of TC-2803 (See Figure 8.2.9-3). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC-2803 by 10% (600°F) and observe the response on the strip chart.

C) Increase TC-2803 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-9, AL-32) as required.

E) Repeat steps B -- D as required until response is satisfactory.

F) Decrease TC-2803 set point 10% (600°F) and observe response.

G) Increase TC-2803 set point to nominal value and observe temperature response.

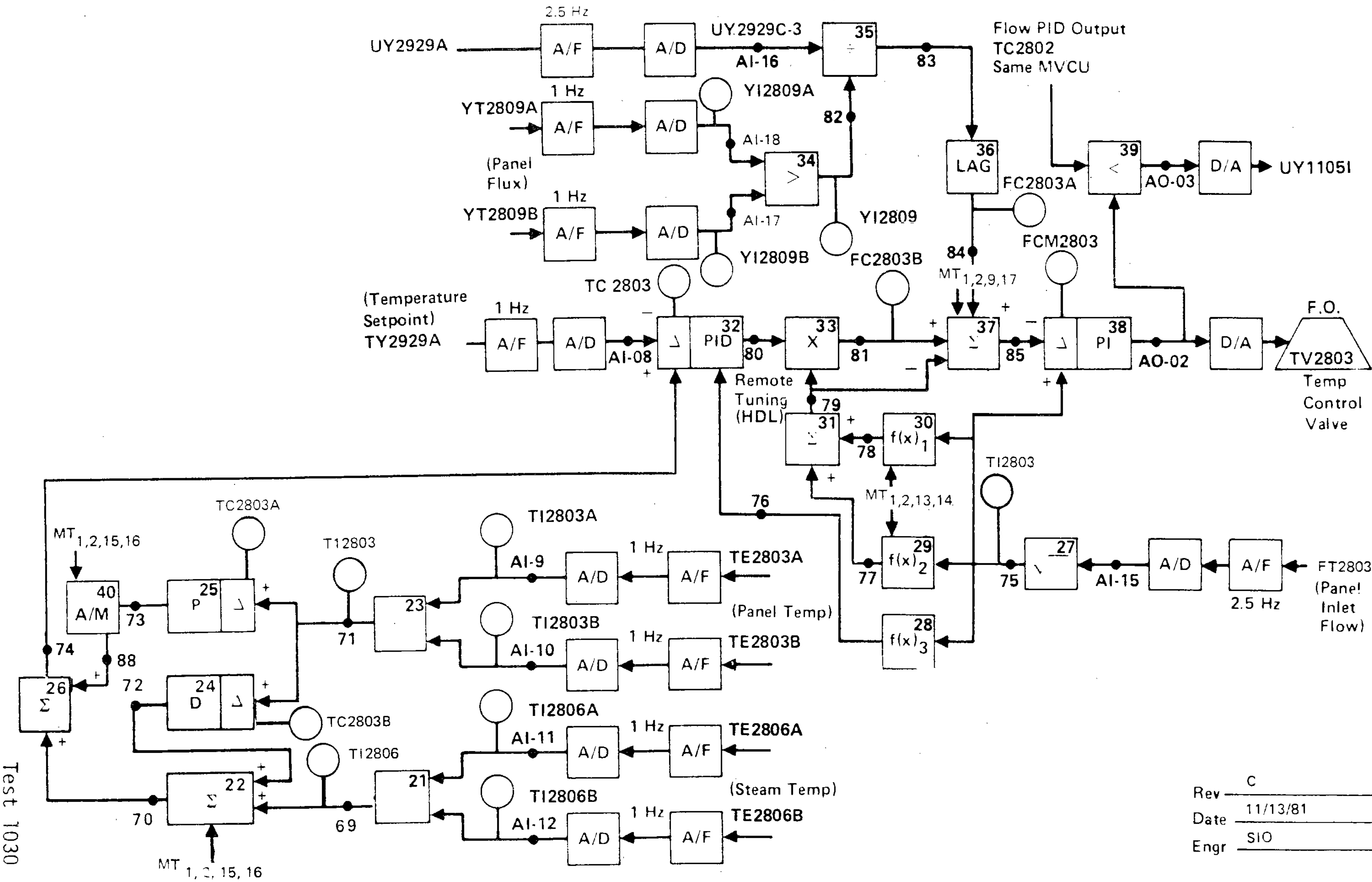


Figure 8.2.13-3. RS Steam Temperature Controller Functional Block Diagram TC-2803

| | Initial | Date |
|---|---|---|
| H) Increase/decrease reset gain, K2 (C1-9, AL-32) in the ±10% increments as required. | | |
| I) Repeat steps F -- H as required until response is satisfactory. | | |
| J) Establish TC-2803 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |
| 8.2.13.18 Verify that controllers TC-2603 - TC-2803 have been returned to the cascade control mode. | | |
| 8.2.13.19 Ramp temperature set point for panels 215-221 simultaneously from 660°F to 800°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.13.20 Ramp temperature set point for panels 215-221 simultaneously from 800°F to 660°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. | | |
| 8.2.13.21 Introduce a "step" change in input power to the receiver by issuing "DECREASE" commands | | |

| | Initial | Date |
|---|---|---|
| of 20% to the wedges tracking the receiver. Observe panel temperatures and control valve responses for panels 215-221 during the transition period. | | |
| 8.2.13.22 Return the heliostat configuration/panel power level back to the original value of the previous step by issuing the appropriate "INCREASE" command. Observe panel temperatures and control valve responses for panels 215-221 during the transition period. | | |
| 8.2.13.23 Command "Tracking" heliostats to "Standby" and switch controllers TC-2603 - TC-2803 to flow control mode through CRT switch functions and allow all panels and flash tank to flood. Continue to shutdown the receiver or proceed to Section 8.2.14, proper flash tank pressure should be established by opening SOV 2019A (HS 2019) and allowing $GN_2$ to pressurize the flash tank. Proper tank pressure is determined from Figure 8.2.11-4. | | |

| Initial | Date |
|---|---|

8.2.14 INTEGRATED RECEIVER STARTUP (FLOW TO FLASH TANK)

The intent of this section of the procedure is to duplicate the normal startup sequence for the receiver and to verify proper plant operation under these conditions. The initial conditions listed in Section 7 are designed to create a condition that would exist in the receiver (and system) immediately after filling of the receiver and the initiation of circulation through the panels.

8.2.14.1 Verify that the initial conditions have been established as shown in Section 7.4.2.

8.2.14.2 Verify the temperature set point for the 18 panel controllers is 585°F as set by TSP 2929.

8.2.14.3 Verify the receiver flash tank pressure control set point is 485 psig.

8.2.14.4 Verify that all panel controllers are in the flow control mode and controlling to the following default values:

| Controllers | Flow Tag ID | Measured Flow (lb/hr) |
|---|---|---|
| TC2301/TC2803 | FI2301/FI2803 | 556 |
| TC2302/TC2802 | FI2302/FI2802 | 600 |
| TC2303/TC2801 | FI2303/FI2801 | 700 |
| TC2401/TC2703 | FI2401/FI2703 | 800 |
| TC2402/TC2702 | FI2402/FI2702 | 900 |

| Initial | Date |
|---|---|

| Controllers | Flow Tag ID | Measured Flow (lb/hr) |
|---|---|---|
| TC2403/TC2701 | FI2403/FI2701 | 1000 |
| TC2501/TC2603 | FI2501/FI2603 | 1100 |
| TC2502/TC2602 | FI2502/FI2602 | 1200 |

If proper flow does not exist, verify the data base for the proper value and investigate for a possible plugged filter. Do not proceed until the proper flow is established.

8.2.14.5 Issue the appropriate heliostate track commands for the collector field wedges as determined from Tables A-6 and A-7 and Figures A-8 and A-9 (Ref: Plant Operating/ Training Manual - RADL 2-36) which are contained in Section 8.2.11 of this procedure.

8.2.14.6 Monitor all receiver boiler panels (204-221) and observe the transition to steam generation operation. Verify that controllers TC-2301 - TC-2803 switch from flow control to temperature control at the 585°F transition set point and subsequently modulate flows to maintain the control temperature.

8.2.14.7 Monitor receiver panel control valve position (AI-2301 - AI-2803) and switch controller PC-1105 to automatic (valve control) when the greatest open valve reaches 80% of full stroke. Verify that pump speed modulates to maintain the controlling valve at 80% stroke.

| | Initial | Date |
|---|---|---|
| 8.2.14.8 Observe flash tank pressure build during the initial receiver heatup process. Verify that the flash tank vent system controls the pressure to the 485 psig set point valve. When initial venting occurs, monitor deaerator and condenser pressure and observe the effect of the $GN_2$ slug that will vent from the flash tank. Monitor the system for possible over pressure conditions that could result in a plant trip. Operate remote deaerator vent valve as required to aid in the release of $GN_2$. | | |
| 8.2.14.9 Monitor the flows (process conditions and valve position) of PV 1000 and FV 1007 which divert flash tank steam to the condenser. Verify that an oscillatory condition does not exist between the two valves, particularly at low flows. | | |
| 8.2.14.10 Monitor the individual receiver panels for satisfactory control. Continue operation until all panels have transitioned to temperature control and are controlling to the 585°F set point condition. | | |
| 8.2.14.11 Enable the moisture accumulator drain function through the dedicated hand switch. Verify proper operation of the level control function by monitoring LI 2901 and the cleaning of LAHL 2901. | | |

| | Initial | Date |
|---|---|---|
| 8.2.14.12 Ramp receiver control temperature set point to 660°F (TSP 2929). Verify the ramp is carried out in a stable fashion and the receiver comes to equilibrium at the 660°F set point by monitoring TI-2301A or B - TI-2803A or B. Verify that the feed pump speed has been modulated to maintain the widest open receiver control valve at 80% stroke. | | |
| 8.2.14.13 Ramp temperature set point for all panels simultaneously from 660°F to 800°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transition period. Observe feed pump controller and tune as required. | | |
| 8.2.14.14 Ramp temperature set point for all panels simultaneously from 800°F to 660°F using TSP 2929 and allow to reach steady state. Observe panel temperatures and control valve responses during the transtion period. Observe feed pump controller and tune as required. | | |
| 8.2.14.15 Introduce a "step" change in input power to the receiver by issuing "DECREASE" commands of 20% to the wedges tracking the receiver. Observe panel temperatures and control valve responses for all panels during the transition period. Observe feed pump controller and tune as required. | | |

| | Initial | Date |
|---|---|---|
| 8.2.14.16 Return the heliostat configuration/panel power level back to the original value of the previous step by issuing the appropriate "INCREASE" command. Observe panel temperatures and control valve responses for all panels during the transition period. Observe feed pump controller and tune as required. | | |
| 8.2.14.17 Command "Tracking" heliostats to "Standby" and switch all controllers to flow control mode through CRT switch functions and allow all panels and flash tank to flood. Continue to shutdown the receiver or proceed to Section 8.3. Proper flash tank pressure should be established by opening SOV 2019A (HS 2019) and allowing $GN_2$ to pressurize the flash tank. Proper tank pressure is determined from Figure 8.2.11-4. | | |
| 8.2.15 Periodically inspect the individual receiver panels during non-operating periods for indications of binding caused by thermal expansion. As a minimum, inspections should be made upon completion of each of the major sections of the steam cure procedure (panels 209-212, 213-216, 204-208, and 217-221). | | |
| 8.2.16 Periodically inspect the inter panel light seals during non-operating periods of the steam cure procedure to verify the light integrity of the seals. As a minimum, inspections should be made upon completion of each of the major sections of the steam cure (panels 209-212, 213-216, 204-208, and 217-221). | | |

| | Initial | Date |
|---|---|---|

8.3 "STEAMING" RECEIVER OPERATION - FLOW TO STEAM DUMP

Tests contained in Section 8.3 of this procedure involve the flow of steam down the downcomer and the subsequent checkouts involving the steam dump and related systems as well as receiver operation at high pressure. Unless required otherwise by a particular test, the receiver feed pump will operate in a valve control mode in which the pump reacts to the receiver valve positions. Resulting feedwater pressures will be those that naturally occur as a result of steam dump system pressure control and the receiver panel control valves.

Feedwater temperatures will be those that naturally occur when auxiliary steam is introduced to the deaerator to provide for the normal deaerator function. No attempt will be made to otherwise "artificially" control the feedwater temperature. If excessive feedwater temperatures occur resulting in high receiver preheater temperatures, incident power delivered to the preheat panels should be reduced. This operation would duplicate the normal corrective action required during routine operation.

| | Initial | Date |
|---|---|---|

Receiver temperature control tests to be carried out in Section 8.3 involve two types of tests:

(i) panel metal temperature control

(ii) blended metal and steam temperature control.

Receiver panel temperature control tests through Section 8.3.8 involve control of panel metal temperature exclusively. Starting with Section 8.3.9, the steam temperature portion of the control loop will be closed resulting in controlling the panel in a "blended" (steam and metal) mode of operation.

8.3.1 Condition Downcomer and Steam Dump System

8.3.1.1 Verify that the initial conditions have been established as required in Section 7.4.2.

| | Initial | Date |
|---|---|---|

8.3.1.2 Verify that the turbine main steam stop valve, the turbine inlet steam motor operated valve (MOV 1031), and the thermal storage inlet steam motor operated valve (MOV 1030) are closed.

8.3.1.3 Place controller PC 1003 in manual and command the valve to the closed position. Verify the valve is closed by position feedback ZI 1003.

8.3.1.4 Command open the following low point drain valves and verify that they are in the open position.

| Valve | Handswitch | Feedback |
|---|---|---|
| LV1011 | HS 1011 | ZI 1011 |
| LV 1012 | HS 1012 | ZI 1012 |
| LV 1013 | HS 1013 | ZI 1013 |
| LV 1015 | HS 1015 | ZI 1015 |
| LV 1016 | HS 1016 | HS 1016 |

8.3.1.5 Command the steam dump valve to a 5% open position and verify position through feedback ZI 2905.

| Initial | Date |
|---|---|

8.3.1.6 Open the manual bypass valve around FV 1006 and allow warming steam to flow through the atomizing steam line into the steam dump system.

8.3.1.7 Monitor pipe temperature rise through TI 1001 and TEX 2950. Continue warmup until pipe temperature TI 1001 exceed 350°F. Pipe heatup rate should not exceed 60°F/min. Adjust downcomer valve position through TC 2905 to accelerate or retard the warmup cycle.

8.3.1.8 Input "closed" commands to the low point drain level valves and monitor valve position feedback.

| Valve | Handswitch | Feedback |
|---|---|---|
| LV 1011 | HS 1011 | ZI 1011 |
| LV 1012 | HS 1012 | ZI 1012 |
| LV 1013 | HS 1013 | ZI 1013 |
| LV 1015 | HS 1015 | ZI 1015 |
| LV 1016 | HS 1016 | ZI 1016 |

Continue warmup until the level valves are no longer held continuously in an open position due to high condensate level.

Continue on to the Steam Dump System Tests, Section 8.3.2.

| | | Initial | Date |
|---|---|---|---|
| 8.3.2 | Control Tests on the Steam Dump System | | |
| 8.3.2.1 | Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.2.2 | Open the steam downcomer valve by commanding controller UC 2905 to the 100% valve position. Verify that flash tank temperature conditioning valves AOV 2914 and AOV 2915 are open (ZI 2914 and ZI 2915). | | |
| 8.3.2.3 | Verify that steam dump desuperheater temperature controller TC 1002 is ready for automatic operation with a set point of 20°F (degrees of superheat). | | |
| 8.3.2.4 | Place steam dump controller PC 1001 in manual (AM 1001) and command the value to a 10% open position. Allow steam to stabilize. Verify that the atomizing steam valve FV 1006 and spray water temperature valve TV 1002 open and control the steam temperature to 20°F superheat. Adjust position of steam dump valve as required to permit proper operation (opening) of TV 1002. | | |
| 8.3.2.5 | Perform closed loop tests of TC 1002 (see Figure 8.3.2-1). Tune control loop if required by carrying out the following steps using loop tuning form.<br><br>A) Set receiver console to configure mode. | | |

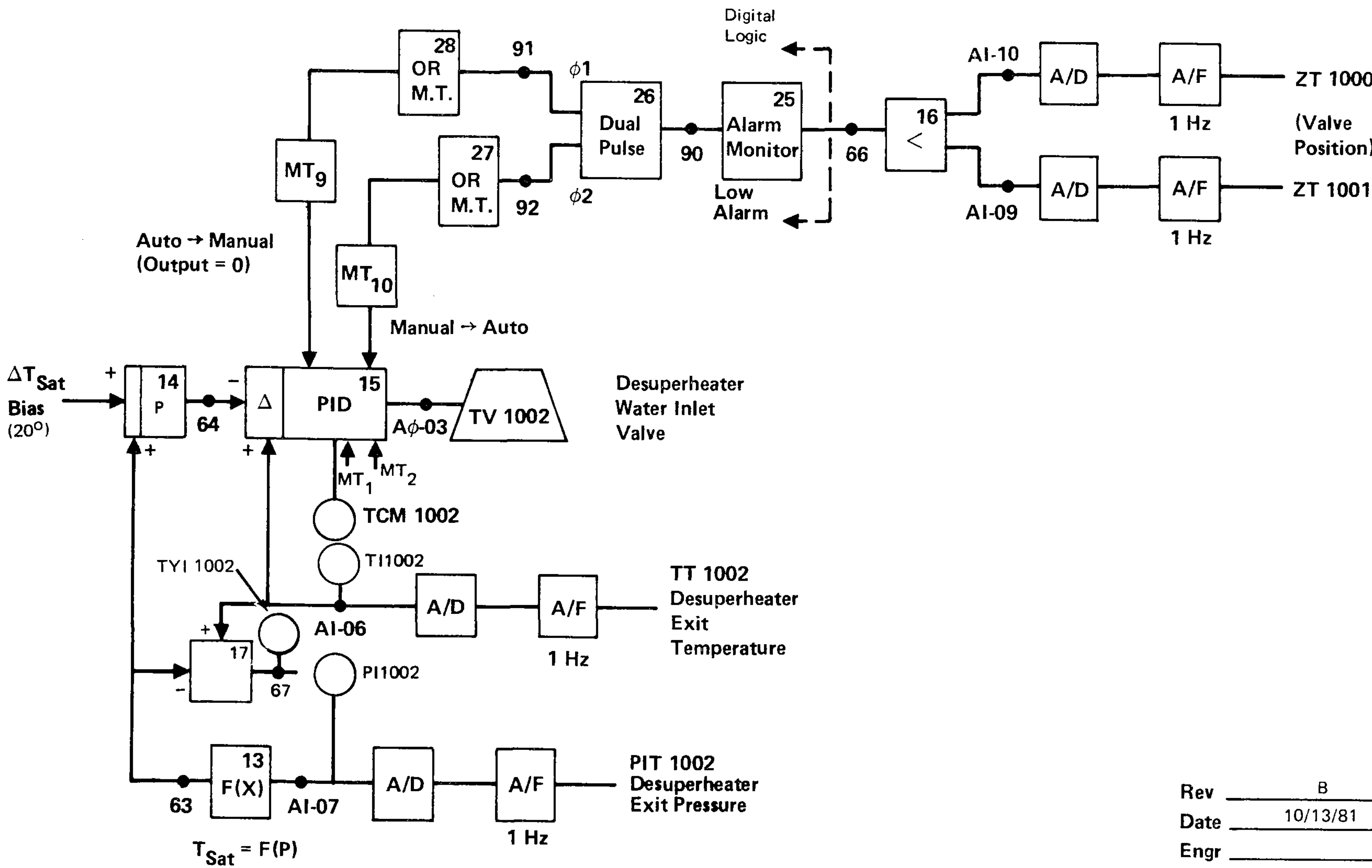


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Figure 8.3.2-1. Steam Dump Line Desuperheater Temperature Controller Functional Block Diagram – TC1002

| | Initial | Date |
|---|---|---|

B) Increase temperature setpoint on TC 1002 to 40°F and observe the response on the strip chart.

C) Decrease TC 1002 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C2-5, AL-15) as required.

E) Repeat steps B thru D as required until response is satisfactory.

F) Increase TC 1002 setpoint to 40°F and observe resoonse.

G) Decrease TC 1002 setpoint to nominal value and observe temoerature response.

H) Increase/decrease reset gain, K2 (C2-5, AL-15) in the ± 10% increments as required.

I) Repeat steps F thru H as required until response is satisfactory.

J) Establish TC 1002 start-up controller gains and record.

K) Adjust setpoints, alarms, limits as required.

| | Initial | Date |
|---|---|---|
| 8.3.2.6 Observe the current pressure value indicated by PI 1001 and adjust the pressure control set point of PC 1001 to 20 psi below the indicated value (PC 1001 still in manual). | | |
| 8.3.2.7 Switch controller PC 1001 to automatic (pressure control) and allow system to stabilize. Observe conditions both at the steam dump valve and in the receiver flash tank which may be sharing the total receiver output flow. Switch flash tank pressure controller PC 2906 to manual. Verify proper operation of the steam dump desuperheater. | | |

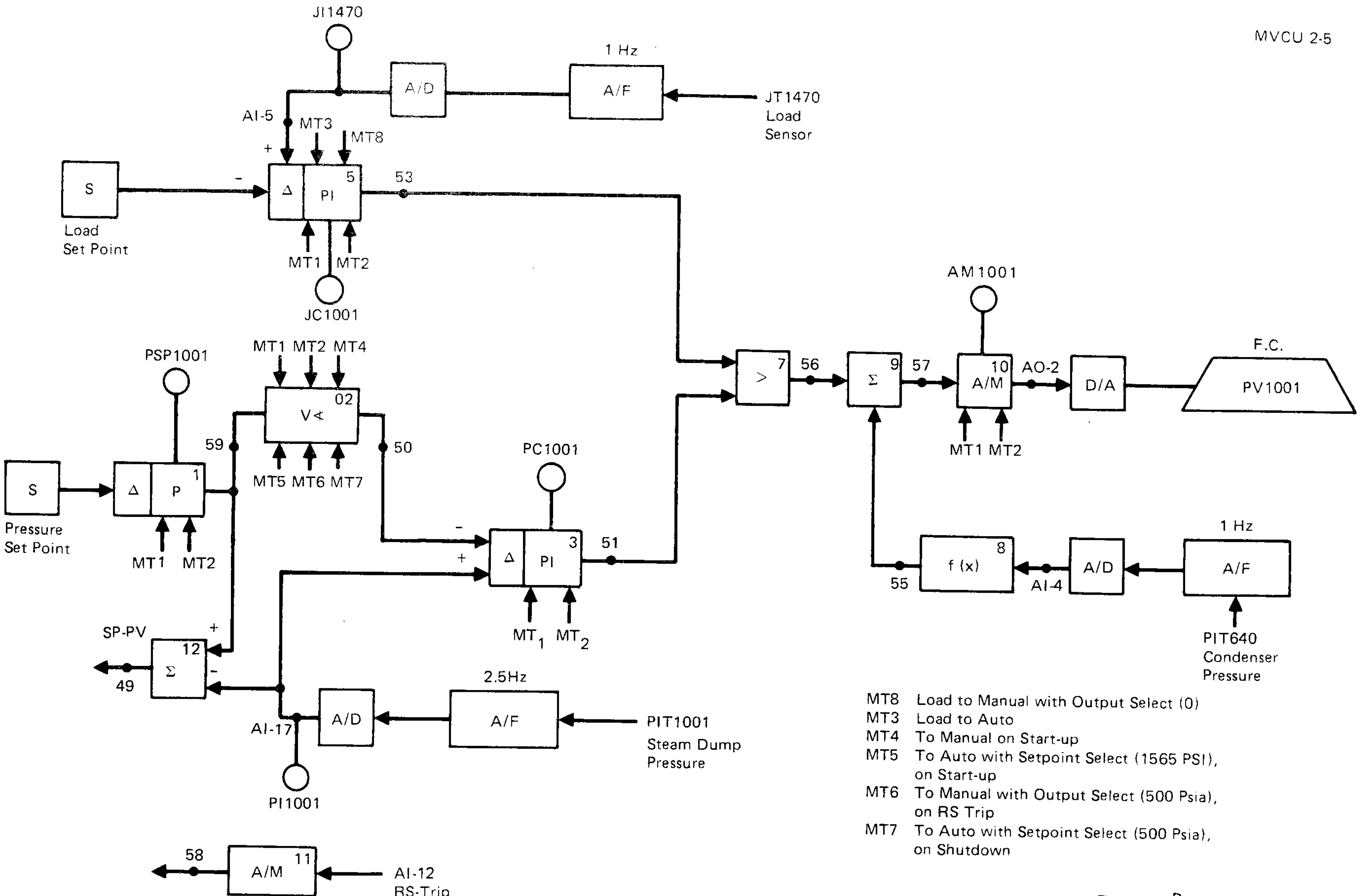
8.3.2.8 Perform closed loop tests of PC 1001 (see Figure 8.3.2-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease pressure setpoint on PC 1001 by 40 psi and observe the response on the strip chart.

C) Increase PC 1001 setpoint back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C2-5, AL-3) as required.




MT8 Load to Manual with Output Select (0)
MT3 Load to Auto
MT4 To Manual on Start-up
MT5 To Auto with Setpoint Select (1565 PSI), on Start-up
MT6 To Manual with Output Select (500 Psia), on RS Trip
MT7 To Auto with Setpoint Select (500 Psia), on Shutdown

**Figure 8.3.2-2. Steam Dump System Controller Functional Block Diagram PC1001**

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| E) Repeat steps B thru D as required until response is satisfactory.<br><br>F) Decrease PC 1001 setpoint 40 psi and observe response.<br><br>G) Increase PC 1001 setpoint to nominal value and observe pressure response.<br><br>H) Increase/decrease reset gain, K2 (C2-5, AL-3) in the ± 10% increments as required.<br><br>I) Repeat steps F thru H as required until response is satisfactory.<br><br>J) Establish PC 1001 start-up controller gains and record.<br><br>K) Adjust setpoints, alarms, limits as required. | | |
| 8.3.2.9 Close the receiver flash tank inlet valve AOV 2911 (HS 2911) and allow total receiver flow to pass through the steam dump system. Verify stable system operation. Return flash tank pressure control valve controller PC 2906 to the automatic mode. | | |
| 8.3.2.10 Verify that the receiver feed pump is in valve control and operating properly i.e., no pump problems are observed that would prevent a speed increase and a buildup of system pressure to the full operating level. | | |

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| 8.3.2.11 Adjust receiver steam temperature setpoint (TSP 2929) to 660°F and allow steam conditions to stabilize. | | |
| 8.3.2.12 Adjust steam dump valve pressure setpoint to 900 psi. Observe pressure ramp by monitoring PI 1001. Monitor the receiver control valve positions and pump speed and verify that they response properly to the pressure ramp. Monitor the receiver steam generation process and verify that no significant upset in the process occurs. | | |
| 8.3.2.13 Perform closed loop tests of PC 1001 (see Figure 8.3.2-2). Tune control loop if required by carrying out the following steps using loop tuning form.<br><br>A) Set receiver console to configure mode.<br><br>B) Decrease pressure setpoint on PC 1001 by 50 psi and observe the response on the strip chart.<br><br>C) Increase PC 1001 setpoint back to nominal value and observe the response on the strip chart.<br><br>D) Increase/decrease proportional gain, K1 (C2-5, AL-3) as required.<br><br>E) Repeat steps B thru D as required until response is satisfactory. | | |

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| F) Decrease PC 1001 setpoint to 50 psi and observe response. | | |
| G) Increase PC 1001 setpoint to nominal value and observe pressure response. | | |
| H) Increase/decrease reset gain, K2 (C2-5), AL-3) in the ± 10% increments as required. | | |
| I) Repeat steps F thru H as required until response is satisfactory. | | |
| J) Establish PC 1001 start-up controller gains and record. | | |
| K) Adjust setpoint, alarms, limits as required. | | |
| 8.3.2.14 Adjust steam dump valve pressure setpoint to 1505 psi. Observe pressure ramp by monitoring PI 1001. Monitor the receiver control valve position and pump speed and verify that they respond properly to the pressure ramp. Monitor the receiver steam generation process and verify that no significant upset in the process occurs. | | |
| 8.3.2.15 Perform closed loop tests of PC 1001 (see Figure 8.3.2-2). Tune control loop if required by carrying out the following steps. | | |
| A) Set receiver console to configure mode. | | |

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| B) Decrease pressure set point on PC 1001 by 50 psi and observe the response on the strip chart. | | |
| C) Increase pressure set point back to nominal value and observe the response on the strip chart. | | |
| D) Increase/decrease proportional gain, K1 (C2-5, AL-3) as required. | | |
| E) Repeat steps B thru D as required until response is satisfactory. | | |
| F) Decrease PC 1001 set point to 50 psi and observe response. | | |
| G) Increase PC 1001 set point to nominal value and observe pressure response. | | |
| H) Increase/decrease reset gain, K2 (C2-5, AL-32) in the ± 10% increments as required. | | |
| I) Repeat steps F thru H as required until response is satisfactory. | | |
| J) Establish PC 1001 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |

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| 8.3.2.16 Reduce the pressure set point for PC 1001 to 500 psi. Monitor the pressure decay process. Verify stable equipment operation (feed pump, receiver control valves, steam dump valve, etc). Verify that a process upset condition does not occur in the receiver. 8.3.2.17 Increase the pressure set point for PC 1001 to 1505 psi and allow process conditions to stabilize. | | |
| 8.3.2.18 Input a simulated receiver trip signal into MVCU 2-5. Observe the steam dump system automatically ramp the system pressure down to 485 psi. Verify that process conditions remain stable. Remove simulated trip signal. | | |
| Proceed to Section 8.3.3 or carryout a system shutdown. | | |

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8.3.3 Control Tests - Receiver Feedpump - Rated Pressure

8.3.3.1 Obtain loop process control data required for control tuning of the receiver feed pump (PC1105 - refer to Figure 8.3.3-1). Determine pressure, flow, speed response characteristics to commanded pump speed changes for flow rates of 100 thru 120,000 lb/hr at rated receiver pressure.

8.3.3.1.1 Configure the system to the desired test conditions by carrying out the following steps:

1) Adjust receiver incident power to achieve a flow rate of ∿100,000 to 120,000 lb/hr.

2) Confirm all panels are in temperature control i.e., (TC2301 thru TC2803) are in auto and console mode.

3) Set FCM 2301 to manual.

4) Set FCM 2501 to manual.

5) Set AM 1105 to manual.

6) Confirm receiver system is in steady state.

8.3.3.1.2 Perform open loop step response test on the receiver feed pump by carrying out the following steps:

1) Implement a step increase in speed command (AM 1005) by 10% of nominal

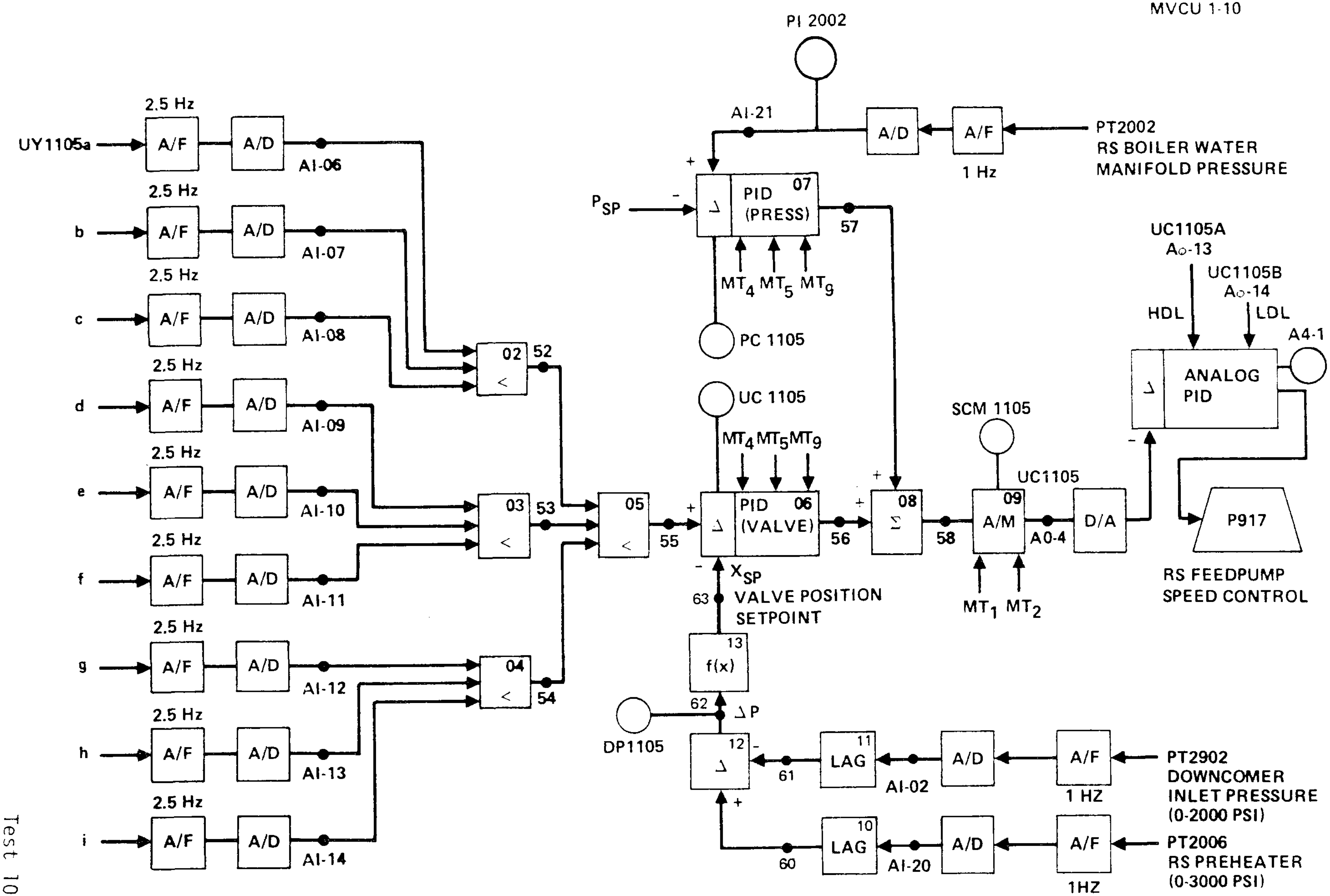


Figure 8.3.3-1. Feedwater Pump Controller Functional Block Diagram PC 1105

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and monitor on DAS strip charts PI 2007, PI 2006, FI 2301, PDTX 2330, ZI 2301, FI 2501, PDTX 2530, ZI 2501, FCM 2303, PDTX 2332, ZI 2302, FCM 2503, PDTX 2532, and ZI 2503. Allow system to reach steady state condition.

2) Apply a step decrease in speed command (AM 1105) back to nominal value and allow system to reach steady state.

3) Decrease speed command (AM 1105) by 10% (step) from nominal and allow system to reach steady state.

4) Increase speed command (step) back to nominal value and allow system to reach steady state.

5) Set FCM 2301, FCM 2501, and AM 1105 back to auto.

8.3.3.1.3 Perform open loop frequency response test on the receiver feed pump by carrying out the following steps:

1) Insert the controls test unit (CTU) on to the drive of the receiver feed pump (AM 1105 output - analog output #4, MVCU 1-10).

2) Verify AM 1105 in manual mode.

3) Verify FCM 2302 thru FCM 2803 (excluding FCM 2501) are in auto while FCM 2301 and FCM 2501 are in manual mode.

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| 4) Using the transfer function analyzer (TFA), insert a 0.1 Hz sin wave into the CTU and adjust the TFA output such that a ± 10% of nominal speed variation (peak to peak) is achieved. | | |
| 5) Verify that the variation in output flow and pressure on panels 204, 206, 210, and 212 are measurable on strip charts and on the DAS recording system. If not, adjust TFA amplitude to achieve desired response. | | |
| 6) Set the TFA frequency to 0.01 Hz and allow system to reach steady state (3-4 cycles). | | |
| 7) Repeat 6) at a frequency of 0.02 Hz | | |
| 8) Repeat 6) at a frequency of 0.05 Hz | | |
| 9) Repeat 6) at a frequency of 0.07 Hz | | |
| 10) Repeat 6) at a frequency of 0.1 Hz | | |
| 11) Repeat 6) at a frequency of 0.2 Hz | | |
| 12) Repeat 6) at a frequency of 0.5 Hz | | |
| 13) Repeat 6) at a frequency of 0.7 Hz | | |
| 14) Repeat 6) at a frequency of 1.0 Hz | | |
| 15) Repeat 6) at a frequency of 2.0 Hz | | |

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8.3.3.1.4 Restore the system to the desired conditions.

1) Remove CTU from system
2) Set FCM 2301 to auto
3) Set FCM 2501 to auto
4) Set AM 1105 to auto
5) Confirm PC 1105 in pressure control

8.3.3.2 Demonstrate satisfactory closed loop control of the receiver feedpump (PC 1105) in both the pressure and valve control modes. Obtain closed loop responses to setpoint changes.

8.3.3.2.1 Configure the system to the desired test conditions by carrying out the following steps:

1) Verify TC 2301 thru TC 2803 are operating on metal temperature control.

2) Verify PC 1105 is operating on pressure control.

8.3.3.2.2 Tune PC1105 receiver feedpump pressure controller (Figure 8.3.3-1) by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

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B) Decrease pressure set point on PC 1105 by 10% and observe the response on the strip chart.

C) Increase pressure set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C1-1, AL-7).*

E) Repeat steps B thru D as required until response is satisfactory.

F) Decrease PC 1105 set point 10% and observe response.

G) Increase PC 1105 set point to nominal value and observe pressure response.

H) Increase/decrease reset gain, K2 (C1-10, AL-7) in the ± 30% increments.

I) Repeat steps F thru H as required until response is satisfactory.

J) Establish preliminary PC1105 controller gains and record.

K) Adjust setpoints, alarms, limits as required.

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8.3.3.2.3 Demonstrate satisfactory closed loop control of the receiver feed pump while under valve control for rated flowrates, rated pressure.

8.3.3.2.4 Determine the receiver temperature controller with the most open control valve command at steady state conditions. Record valve (i.e. minimum C.O.)

Maximum Valve Command ___%___
Controller Tag ___FCM___

8.3.3.2.5 Select UC 1105. Switch to console mode and set valve command setpoint to previous valve determined in 8.3.3.2.4.

8.3.3.2.6 Switch PC 1105 from pressure control to valve control mode. Observe response on DAS strip charts for UC 1105, SI 1105, PI 2002, PI 2005, FCM 2301-FCM 2803 and PDTX 2230. Allow system to achieve steady state conditions.

8.3.3.2.7 Provide a step increase in temperature setpoint on controls TC (as determined in 8.3.3.2.4) by 10%. Monitor flowrate, valve position and temperature response on this panel. Allow system to reach steady state conditions.

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8.3.3.2.8 Implement a step decrease in temperature setpoint (back to nominal) on the selected controller. Monitor flowrate, valve position and temperature response. Adjust gains in C1-10, A1-6 if required. Repeat 8.3.3.2.7 if gains are adjusted.

8.3.3.3 Verify that the automatic pressure run-back capability on the combined steam dump/receiver feedpump system is satisfactory.

8.3.3.3.1 Confirm that TC 2301 thru TC 2803 are in metal temperature control mode.

8.3.3.3.2 Confirm that PC 1105 is in valve control mode.

8.3.3.3.3 Select PC 1001 and ramp setpoint from rated pressure to 500 psig in a 3 minute period. Allow system to reach steady state condition.

8.3.3.3.4 Select PC 1001 and ramp setpoint from 500 psig to rated pressure in a 3 minute period. Allow system to reach steady state condition.

8.3.3.3.5 Initiate an automatic pressure run-back transient into the coupled steam dump/ receiver feedpump system by implementing the following steps.

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| 1) Verify the receiver system is in steady state. | | |
| 2) Select PCT 1001, set to manual mode. Adjust output to 100%. This will initiate automatic run-back. | | |
| 8.3.3.3.6 Monitor system pressure, PC 1001, UC 1005 for satisfactory performance. Adjust control parameters and control logic if required. | | |
| 8.3.3.3.7 Select PCT 1001. Set output to 0%. | | |
| 8.3.3.3.8 Initiate pressure setpoint run-ups to simulate start-up pressure ramp by implementing the following steps.<br>1) Set PD 1001A to start-up<br>2) Set PDC 1001C to on - to initiate setpoint ramp. | | |
| 8.3.3.3.9 Monitor system pressure, PC 1001, UC 1005 for satisfactory performance. Adjust control logic if required. | | |
| 8.3.3.3.10 If control logic or parameters are adjusted in 8.3.3.3.6 or 8.3.3.3.9 then repeat 8.3.3.3.5 thru 8.3.3.3.9. | | |

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8.3.4 CONTROL TESTS - PANELS 214, 217, 219, & 221 - LOW FLOW

8.3.4.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 & TC2803) at rated pressure, derated temperature and low flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain both step and frequency response data to valve disturbances at a nominal temperature of 660°F. Obtain step/ramp response to flux disturbances.

8.3.4.1.1 Verify that the prerequisites have been met as required in Section 4.0.

8.3.4.1.2 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.4.1.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 660°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 1800 lb/hr.

8.3.4.1.4 Verify that all panels are in metal temperature control and a nominal setpoint of 660°F. Adjust TC2301 thru TC2803 setpoints as required.

8.3.4.1.5 Verify that control test unit (CTU) is installed and operating on TV2602, TC2702, TV2801, & TV2803.

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8.3.4.1.6 Confirm that the receiver feedpump controller (PC1105) is in pressure control mode (Select PD1105A).

8.3.4.1.7 Obtain open loop step response data on panel 214 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2602 to manual mode.

C) Implement a step decrease in FCM2602 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608, PI2902.

FCM2602 Output ________%
Command Change

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|---|---|---|

8.3.4.1.7 D) Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2602 back to auto.

8.3.4.1.8 Perform frequency response tests on panel 214 (See TC2602, Figure 8.3.4-1) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.7 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2602 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2602.

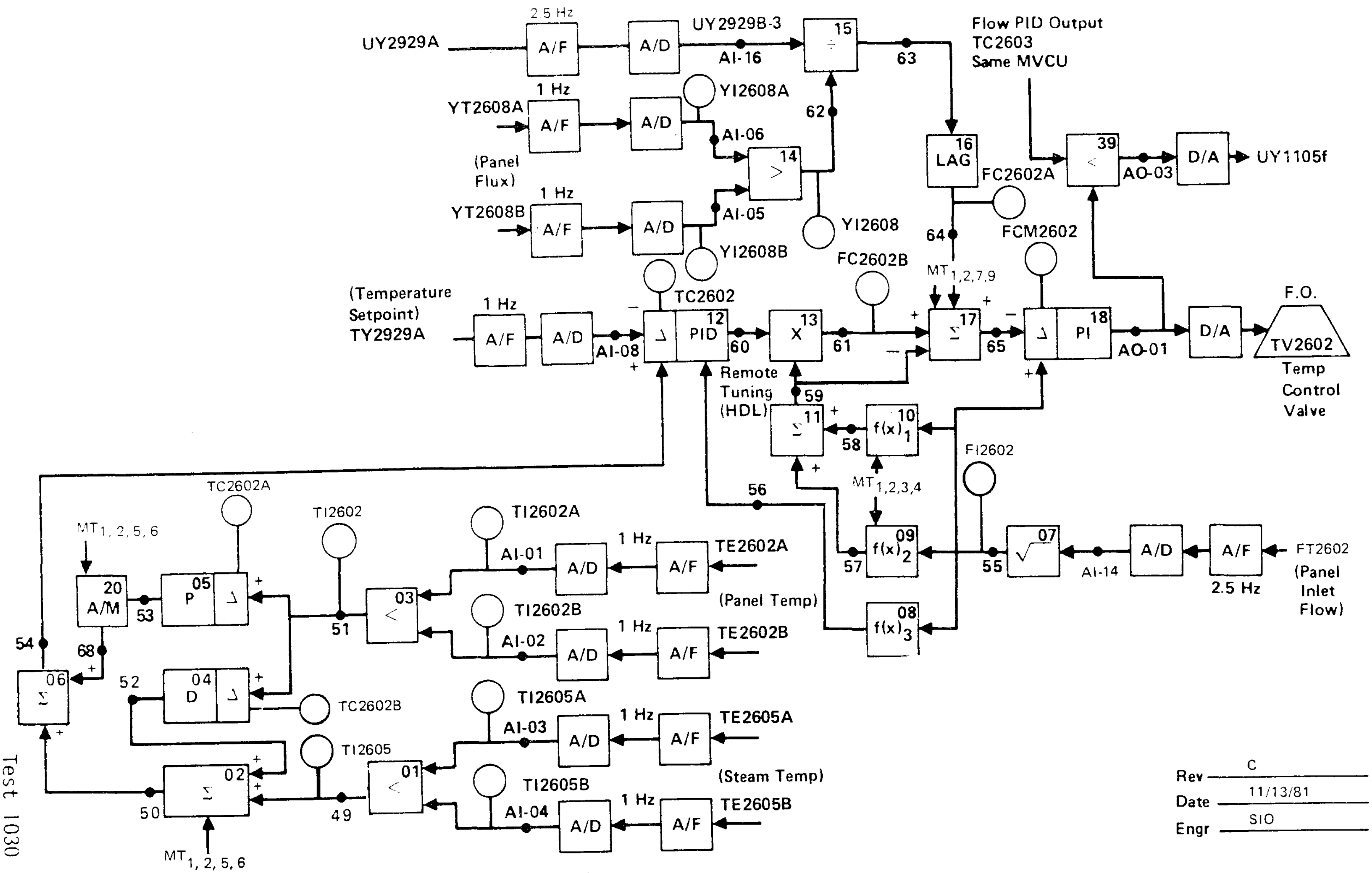


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Figure 8.3.4-1. RS Steam Temperature Controller Functional Block Diagram TC-2602

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8.3.4.1.8 6) Set FCM2602 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ   Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot successfully adjust - return to Step 5.

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| | | |

8.3.4.1.8 8) Switch TFA input out of CTU.

9) Set FCM2602 back to auto.

8.3.4.1.9 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2702 to manual mode.

C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

FCM2702 Output ________%
Command Change

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| 8.3.4.1.9 D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2702 back to auto. | | |
| 8.3.4.1.10 Perform frequency response tests on panel 217 (See TC2702, Figure 8.3.4-2) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.9 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2702 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC 2702. | | |

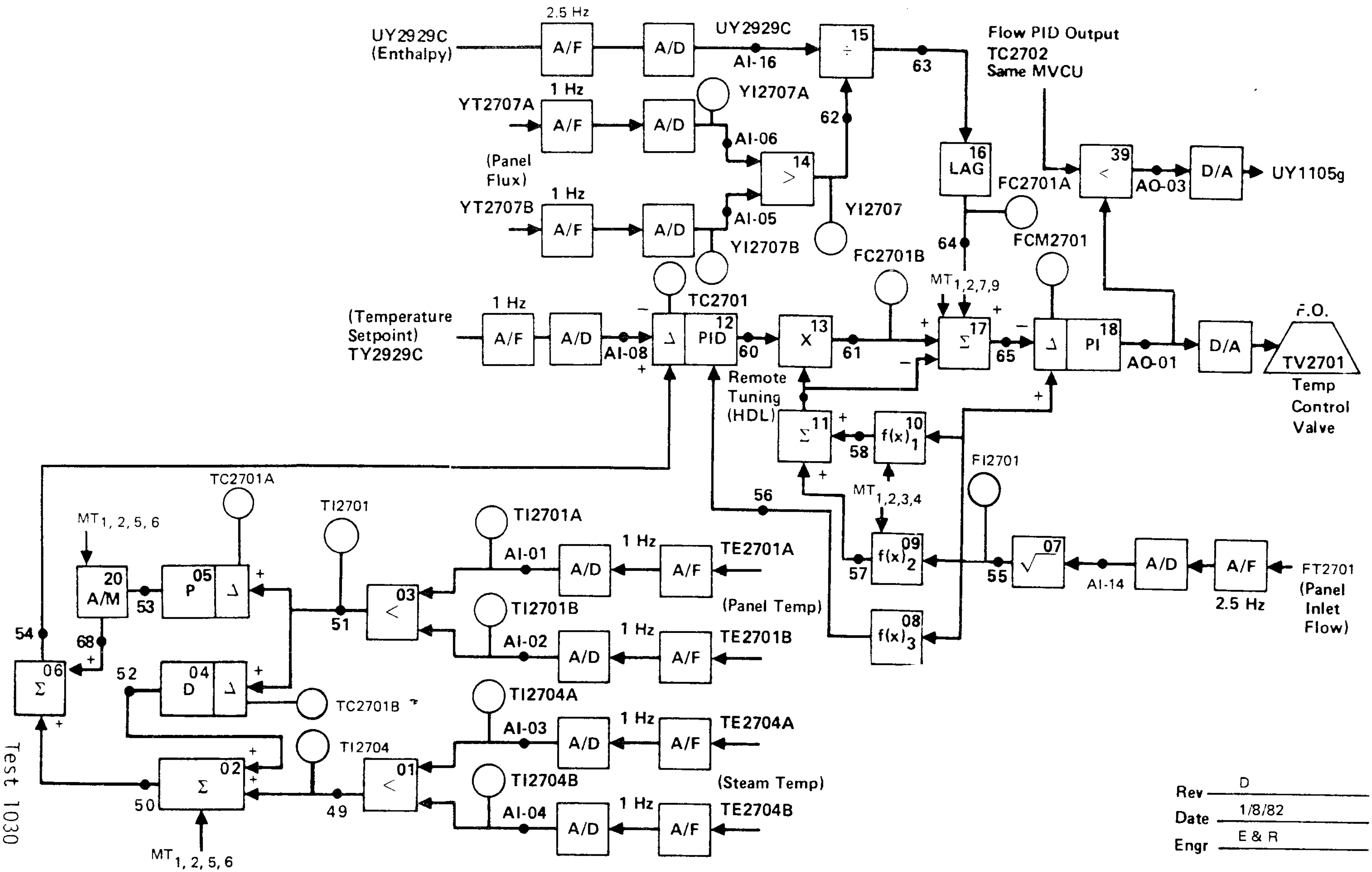


Figure 8.3.4-2. RS Steam Temperature Controller Functional Block Diagram TC-2701

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8.3.4.1.10 6) Set FCM2702 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ

Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

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| | | |

8.3.4.1.10 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2702 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2702 back to auto.

8.3.4.1.11 Obtain open loop step response data on panel 219 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2801 to manual mode.

C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters

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8.3.4.1.11 on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902.

D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2801 back to auto.

8.3.4.1.12 Perform frequency response tests on panel 219 (See TC2801, Figure 8.3.4-3) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.11 C.

Note: Verify that the TFA input to the CTU is switched out.

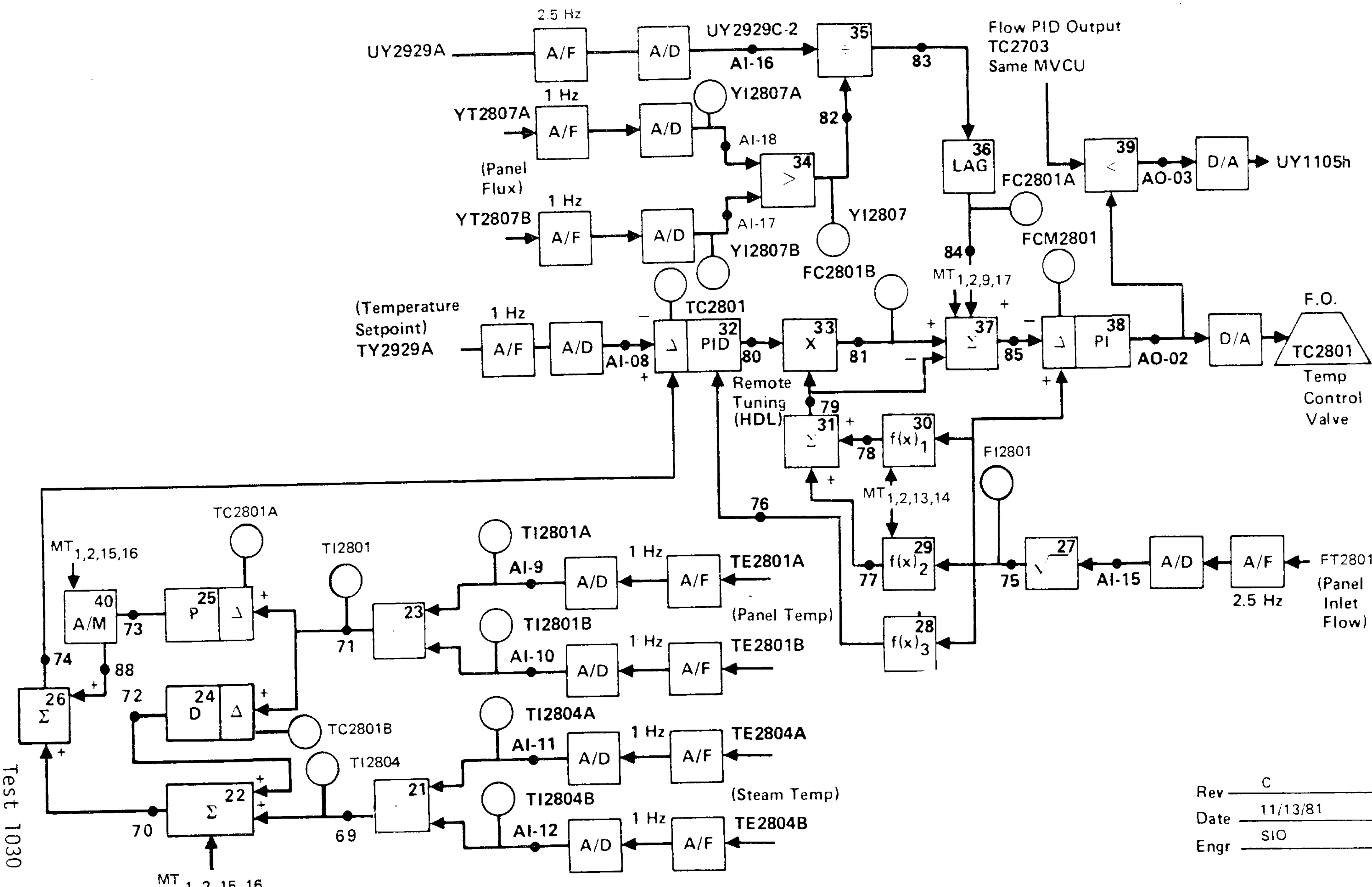


Figure 8.3.4-3. RS Steam Temperature Controller Functional Block Diagram TC-2801

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8.3.4.1.12 5) Select FCM2801 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2801.

6) Set FCM2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2801.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ Determined
Repeat 4) at a frequency of ____ HZ during test

Note: (1) The TFA output amplitude may need to be adjusted during the the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

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| 8.3.4.1.12 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2801 back to auto. | | |

8.3.4.1.13 Obtain open loop step response data on panel 221 by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2803 to manual mode. | | |
| C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. | | |

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a

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8.3.4.1.13 strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902.

FCM2803 Output ________%
Command Change

D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2803 back to auto.

8.3.4.1.14 Perform frequency response tests on panel 221 (See TC2803, Figure 8.3.4-4) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.13 C.

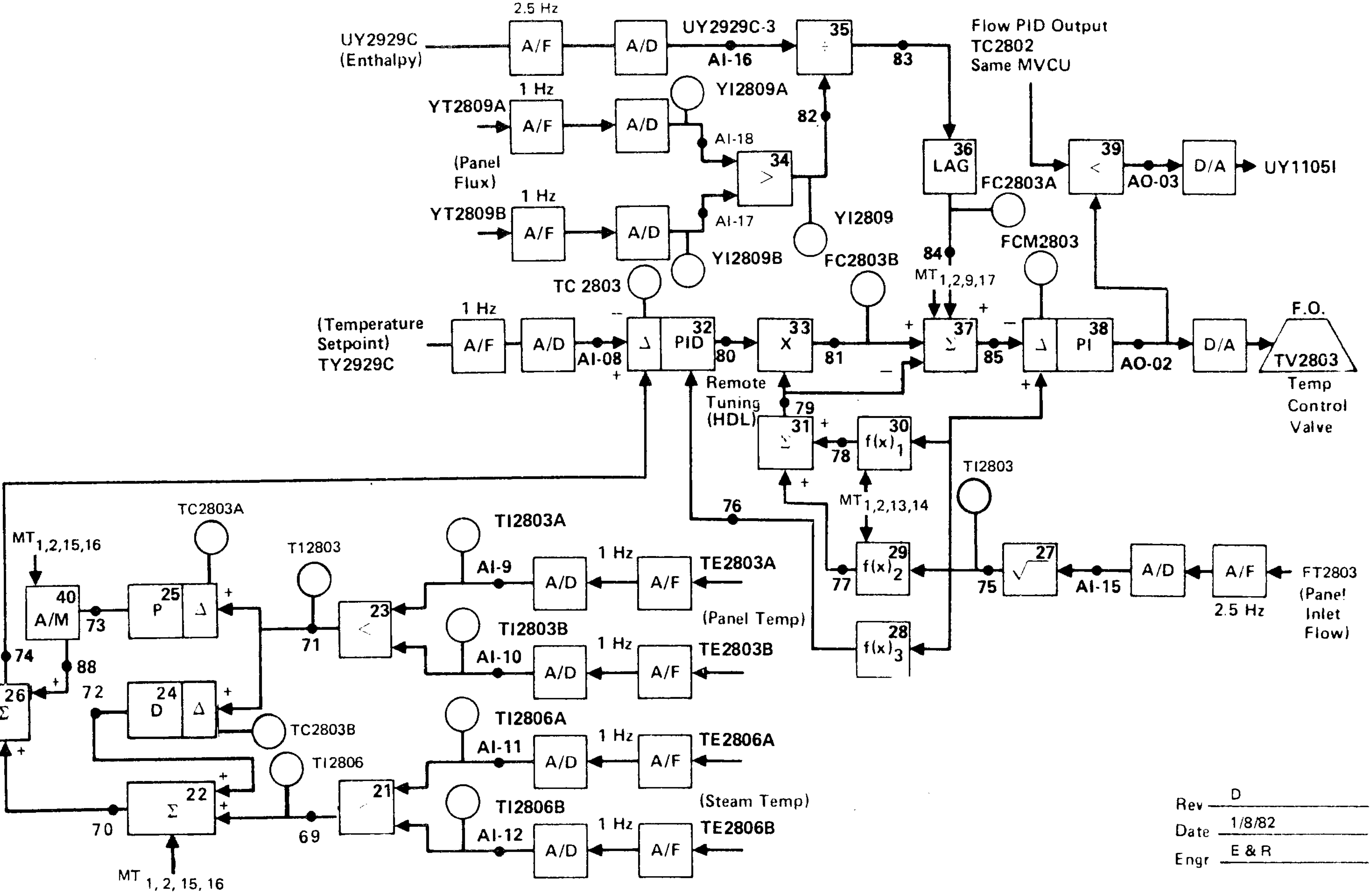


Figure 8.3.4-4. RS Steam Temperature Controller Functional Block Diagram TC-2803

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8.3.4.1.14 Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2803 and adjust setpoint to achieve a nominal 660°F steam outlet temperature on TC2803.

6) Set FCM2803 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ
Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

| | Initial | Date |
|---|---|---|

8.3.4.1.14 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2803 back to auto.

8.3.4.1.15 Obtain open loop step/ramp response to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2602, FCM2702, FCM2801, FCM2803, to manual mode.

C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: Panel flows, steam & metal temperatures, flux, valve commands & PI2902.

| | Initial | Date |
|---|---|---|
| 8.3.4.1.15 Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2602, FCM2702, FCM2801, FCM2803, back to auto. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4 CONTROL TESTS - PANELS 214, 217, 219, & 221 - LOW FLOW | | |
| 8.3.4.2 Obtain process control closed loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 & TC2803) at rated pressure, derated temperature and low flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step response data to setpoint changes at a nominal temperature of 660°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.4.2.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.4.2.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.4.2.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 660°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 1800 lb/hr. | | |
| 8.3.4.2.4 Verify that all panels are in metal temperature control and a nominal setpoint of 660°F. Adjust TC2301 thru TC2803 setpoints as required. | | |
| 8.3.4.2.5 Verify that control test unit (CTU) external input is switched out. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.2.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.4.2.7 Obtain closed loop response on TC2602 to a temperature setpoint change on panel 214 by carrying out the following steps. | | |
| A) Confirm that receiver panel 214 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 1800 lb/hr. | | |
| B) Confirm TC2602 is in metal temperature control mode. | | |
| C) Implement a step decrease in TC2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |
| D) Implement a step increase in TC2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following: | | |

| | Initial | Date |
|---|---|---|

8.3.4.2.7 E) 1) Set receiver console to configure mode.

2) Select C1-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.4.2.8 Obtain closed loop response on TC2702 to a temperature setpoint change on panel 217 by carrying out the following steps.

A) Confirm that receiver panel 2702 in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 1800 lb/hr.

B) Confirm TC2702 is in metal temperature control mode.

C) Implement a step decrease in TC2702 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam &

| | Initial | Date |
|---|---|---|
| 8.3.4.2.8 C) metal temperatures, flux valve position & command, setpoint. | | |
| D) Implement a step increase in TC2702 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following: 1) Set receiver console to configure mode. 2) Select Cl-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.4.2.9 Obtain closed loop response on TC2801 to a temperature setpoint change on panel 219 by carrying out the following steps. | | |

| | Initial | Date |
|---|---|---|

8.3.4.2.9 A) Confirm that receiver panel 219 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 1800 lb/hr.

B) Confirm TC2801 is in metal temperature control mode.

C) Implement a step decrease in TC2801 set-point by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint.

D) Implement a step increase in TC2801 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.2.9 | F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| | G) Set receiver console back to monitor mode. | | |
| 8.3.4.2.10 | Obtain closed loop response on TC2803 to a temperature setpoint change on panel 221 by carrying out the following steps. | | |
| | A) Confirm that receiver panel 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 1800 lb/hr. | | |
| | B) Confirm TC2803 is in metal temperature control mode. | | |
| | C) Implement a step decrease in TC2803 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |
| | D) Implement a step increase in TC2803 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.2.10 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following: | | |
| 1) Set receiver console to configure mode. | | |
| 2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.4.2.11 Obtain closed loop response on TC2602, TC2702, TC2801, TC2803 to a flux disturbance on panel 214, 217, 219, 221 by carrying out the following steps. | | |
| A) Confirm that receiver panel 214, 217, 219, 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 1800 lb/hr. | | |
| B) Confirm TC2602, TC2702, TC2801, TC2803 are in metal temperature control mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.2.11 C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, setpoint. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature responses. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br><br>1) Set receiver console to configure mode.<br><br>2) Select AL-16 of appropriate MVCU and using loop tuning form increase/decrease gain and control parameters as required. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.2.11 F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.3 Obtain process control open loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801, TC2803) at rated pressure, derated temperature and low flow. (Refer to Figures 8.3.4-1 thru 8.3.4-4.) Obtain both step and frequency response data to valve disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.4.3.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.4.3.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.4.3.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if requested to achieve 800°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 1800 lb/hr. | | |
| 8.3.4.3.4 Verify that all panels are in metal temperature control and a nominal setpoint of 660°F. Adjust TC2301 - TC2803 setpoints as requested. | | |
| 8.3.4.3.5 Verify that the control test unit (CTU) is installed and operating on TV2602, TV2702, TV2801, TV2803. | | |

| | Initial | Date |
|---|---|---|

8.3.4.3.6 Confirm that the receiver field pump controller (PC1105) is in pressure control mode (Select PD1105A).

8.3.4.3.7 Obtain open loop step response data on panel 214 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2602 to manual mode.

C) Implement a step decrease in FCM2602 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608, PI2902.

FCM2602 Output __________%
Command Change

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.3.7 | D) Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| | E) Reset FCM2602 back to auto. | | |
| 8.3.4.3.8 | Perform frequency response tests on panel 214 (See TC2602, Figure 8.3.4-1) by carrying out the following steps. | | |
| | 1) Verify that the controls test unit (CIT) is installed and operating on TC2602. (Installation is in RS-1). | | |
| | 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| | 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| | 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.3.7 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| | 5) Select FCM2602 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2602. | | |

| | Initial | Date |
|---|---|---|

8.3.4.3.8 6) Set FCM2602 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ    Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|

8.3.4.3.8 8) Switch TFA input out of CTU.

9) Set FCM2602 back to auto.

8.3.4.3.9 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2702 to manual mode.

C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value
(increase valve opening)
and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

FCM2702 Output __________%
Command Change

| | Initial | Date |
|---|---|---|
| 8.3.4.3.9 D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2702 back to auto. | | |
| 8.3.4.3.10 Perform frequency response tests on panel 217 (See TC2707, Figure 8.3.4-2) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.9 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2702 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2702. | | |

| | Initial | Date |
|---|---|---|

8.3.4.3.10 6) Set FCM2702 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ   Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2702 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.3.4.3.10 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2702 back to auto. | | |

8.3.4.3.11 Obtain open loop step response data on panel 219 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2801 to manual mode.

C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902.

FCM2801 Output ________%
Command Change

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.3.11 | D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| | E) Reset FCM2801 back to auto. | | |
| 8.3.4.3.12 | Perform frequency response tests on panel 219 (See TC2801, Figure 8.3.4-3) by carrying out the following steps. | | |
| | 1) Verify that the controls test unit (CTU) is installed and operating on TC2801. Installation is in RS-1). | | |
| | 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| | 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| | 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.3.11 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| | 5) Select FCM2801 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2801. | | |

| | Initial | Date |
|---|---|---|

8.3.4.3.12 6) Set FCM2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2801.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ  Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|

8.3.4.3.12 8) Switch TFA input out of CTU.

9) Set FCM2801 back to auto.

8.3.4.3.13 Obtain open loop step response data on panel 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2803 to manual mode.

C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± .1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902.

FCM2803 Output ________%
Command Change

| | Initial | Date |
|---|---|---|
| 8.3.4.3.13 D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM2803 back to auto. | | |
| 8.3.4.3.14 Perform frequency response tests on panel 221 (See TC2803, Figure 8.3.4-4) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.3.13 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2803 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2803. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.3.14 6) Set FCM2803 to manual mode. | | |

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ Determined during test

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.3.4.3.14 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2803 back to auto. | | |
| 8.3.4.3.15 Obtain open loop step/ramp response to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 min. | | |
| B) Set FCM2602, FCM2702, FCM2801, FCM2803, to manual mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flows, steam & metal temperatures, flux, valve commands & PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.3.15 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2602, FCM2702, FCM2801, FCM2803 back to auto. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.4 | Obtain process control closed loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 & TC2803) at rated pressure, derated temperature and low flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step response data to setpoint changes at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.4.4.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.4.4.2 | Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.4.4.3 | Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 800°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 1800 lb/hr. | | |
| 8.3.4.4.4 | Verify that all panels are in metal temperature control and a nominal setpoint of 800°F. Adjust TC2301 thru TC2803 setpoints as required. | | |
| 8.3.4.4.5 | Verify that control test unit (CTU) external input is switched out. | | |

| | Initial | Date |
|---|---|---|
| 8.3.4.4.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.4.4.7 Obtain closed loop response on TC2602 to a temperature setpoint change on panel 214 by carrying out the following steps. | | |
| A) Confirm that receiver panel 214 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 1800 lb/hr. | | |
| B) Confirm TC2602 is in metal temperature control mode. | | |
| C) Implement a step decrease in TC2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |
| D) Implement a step increase in TC2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satsifactory. If not adjust control loop gains via the following: | | |

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.4.7 | E) 1) Set receiver console to configure mode. | | |
| | 2) Select Cl-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| | F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| | G) Set receiver console back to monitor mode. | | |
| 8.3.4.4.8 | Obtain closed loop response on TC2702 to a temperature setpoint change on panel 217 by carrying out the following steps. | | |
| | A) Confirm that receiver panel 217 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 1800 lb/hr. | | |
| | B) Confirm TC2702 is in metal temperature control mode. | | |
| | C) Implement a step decrease in TC2702 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, | | |

| | Initial | Date |
|---|---|---|

8.3.4.4.8 C) steam & metal temperatures, flux valve position & command, setpoint.

D) Implement a step increase in TC2702 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.4.4.9 Obtain closed loop response on TC2801 to a temperature setpoint change on panel 219 by carrying out the following steps.

A) Confirm that receiver panel 219 is in a steady state condition for approximately

| | Initial | Date |
|---|---|---|

8.3.4.4.9 A) 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 1800 lb/hr

B) Confirm TC2801 is in metal temperature control mode.

C) Implement a step decrease in TC2801 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the follow-in parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint.

D) Implement a step increase in TC2801 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

| | Initial | Date |
|---|---|---|
| 8.3.4.4.9 F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.4.4.10 Obtain closed loop response on TC2803 to a temperature setpoint change on panel by carrying out the following steps. A) Confirm that receiver panel 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 1800 lb/hr. | | |
| B) Confirm TC2803 is in metal temperature control mode. | | |
| C) Implement a step decrease in TC2803 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |
| D) Implement a step increase in TC2803 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| Initial | Date |
|---|---|

8.3.4.4.10 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.4.4.11 Obtain closed loop response on TC2602, TC2702, TC2801, TC2803 to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps.

A) Confirm that receiver panel 214, 217, 219, 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 1800 lb/hr.

B) Confirm TC2602, TC2702, TC2801, TC2803 is in metal temperature control mode.

| | Initial | Date |
|---|---|---|

8.3.4.4.11 C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, setpoint. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response, if temperature excursions exceed ± 50°F - adjust flux loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-X, AL-16 - using loop tuning form increase/decrease gain and control parameters as required.

| | | Initial | Date |
|---|---|---|---|
| 8.3.4.4.11 | F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.3.5 CONTROL TESTS - PANELS 214, 217, 219, AND 221 - MODERATE FLOW

8.3.5.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 and TC2803) at rated pressure, derated temperature and moderate flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain both step and frequency response data to valve disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

8.3.5.1.1 Verify that the prerequisites have been met as required in Section 4.0.

8.3.5.1.2 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.5.1.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 800°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 3600 lb/hr.

8.3.5.1.4 Verify that all panels are in metal temperature control and a nominal setpoint of 800°F. Adjust TC2301 thru TC2803 setpoints as required.

8.3.5.1.5 Verify that control test unit (CTU) is installed and operating on TV2602, TC2702, TV2801, and TV2803.

| | Initial | Date |
|---|---|---|
| 8.3.5.1.6 Confirm that the receiver feedpump controller (PC1105) is in pressure control mode (Select PD1105A). | | |
| 8.3.5.1.7 Obtain open loop step response data on panel 214 by carrying out the following steps. A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM 2602 to manual mode. | | |
| C) Implement a step decrease in FCM 2602 output by approximately 10% of nominal value, (increase valve opening) and allow pressures, flows, temperatures to reach steady state. Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608, PI2902. | | |
| FCM 2602 Output _________% Command Change | | |

| | Initial | Date |
|---|---|---|

8.3.5.1.7 D) Implement a step increase (back to nominal) in FCM 2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM 2602 back to auto.

8.3.5.1.8 Perform frequency response tests on panel 214 (see TC2602, Figure 8.3.4-1) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.5.1.7 C. Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM 2602 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2602.

| Initial | Date |
|---|---|
| | |

8.3.5.1.8 6) Set FCM 2602 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sine wave into the CTU and adjust the TFA output such that a ±400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles.

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of __ HZ
Repeat 4) at a frequency of __ HZ } Determined during test

Note (1): The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room).

(2): If panel temperature drifts off the nominal test condition - adjust FCM 2602 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | | Initial | Date |
|---|---|---|---|
| 8.3.5.1.8 | 8) Switch TFA input out of CTU. | | |
| | 9) Set FCM 2602 back to auto. | | |

8.3.5.1.9 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM 2702 to manual mode.

C) Implement a step decrease in FCM 2702 output by approximately 10% of nominal value, (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM 2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

FCM 2702 Output __________ %
Command Change

| | Initial | Date |
|---|---|---|

8.3.5.1.9 D) Implement a step increase (back to nominal) in FCM 2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM 2702 back to auto.

8.3.5.1.10 Perform frequency response tests on panel 217 (see TC2702, Figure 8.3.4-2) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1).

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.5.1.9 C. Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM 2702 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2702.

| | Initial | Date |
|---|---|---|

8.3.5.1.10 6) Set FCM 2702 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sine wave into the CTU and adjust the TFA output such that a ±400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles.

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of __ HZ
Repeat 4) at a frequency of __ HZ } Determined during test

Note (1): The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room).

(2): If panel temperature drifts off the nominal test condition - adjust FCM 2702 output from operator station to correct - if cannot successfuly adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.3.5.1.10 8) Switch TFA input out of CTU. | | |
| 9) Set FCM 2702 back to auto. | | |

8.3.5.1.11 Obtain open loop step response data on panel 219 by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM 2801 to manual mode. | | |
| C) Implement a step decrease in FCM 2801 output by approximately 10% of nominal value, (increase valve opening) and allow pressures, flows, temperatures to reach steady state.<br><br>Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM 2801 (PV & CO), TI2801, TI2804, YI2807, PI2902. | | |

FCM 2801 Output __________ %
Command Change

| | Initial | Date |
|---|---|---|
| 8.3.5.1.11 D) Implement a step increase (back to nominal) in FCM 2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM 2801 back to auto. | | |
| 8.3.5.1.12 Perform frequency response tests on panel 219 (See TC2801, Figure 8.3.4-3) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.1.1.1 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM 2801 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2801. | | |

| Initial | Date |
| --- | --- |

8.3.5.1.12 6) Set FCM 2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sine wave into the CTU and adjust the TFA output such that a +400 lb/hr peak-to-peak response is achieved on FI2801.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of __ HZ
Repeat 4) at a frequency of __ HZ } Determined during test

Note (1): The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room).

(2): If panel temperature drifts off the nominal test condition - adjust FCM 2801 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.3.5.1.12 8) Switch TFA input out of CTU. | | |
| 9) Set FCM 2801 back to auto. | | |

8.3.5.1.13 Obtain open loop step response data on panel 221 by carrying out the following steps.

| | | |
|---|---|---|
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM 2803 to manual mode. | | |
| C) Implement a step decrease in FCM 2803 output by approximately 10% of nominal value, (increase valve opening) and allow pressures, flows, temperatures to reach steady state.<br><br>Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measurable response change in flow and temperature - flow of ±0.1 lb/sec, temperatures of ±50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM 2803 (PV & CO), TI2803, TI2806, YI2809, PI2902. | | |

FCM 2803 Output ________%
Command Change

| | Initial | Date |
|---|---|---|
| 8.3.5.1.13 D) Implement a step increase (back to nominal) in FCM 2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions. | | |
| E) Reset FCM 2803 back to auto. | | |
| 8.3.5.1.14 Perform frequency response tests on panel 221 (See TC2803, Figure 8.3.4-4) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1). | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.5.1.13 C. Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM 2803 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2803. | | |

| | Initial | Date |
|---|---|---|

8.3.5.1.14 6) Set FCM 2803 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sine wave into the CTU and adjust the TFA output such that a +400 lb/hr peak-to-peak response is achieved on FI2803.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4) cycles.

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of __ HZ
Repeat 4) at a frequency of __ HZ $\left.\right\}$ Determined during test

Note (1): The TFA output amplitude may need to be adjusted during the test as required to obtain a measurable output response (determined by test by engineers in RS-1 or DAS room).

(2): If panel temperature drifts off the nominal test condition - adjust FCM 2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

| | Initial | Date |
|---|---|---|
| 8.3.5.1.14 8) Switch TFA input out of CTU. | | |
| 9) Set FCM 2803 back to auto. | | |
| 8.3.5.1.15 Obtain open loop step/ramp response to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 min. | | |
| B) Set FCM 2602, FCM 2702, FCM 2801, FCM 2803, to manual mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flows, steam and metal temperatures, flux, value commands and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$50 to 100°F are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.3.5.1.15 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM 2602, FCM 2702, FCM 2801, FCM 2803 back to auto. | | |

| | Initial | Date |
|---|---|---|
| 8.3.5.2 Obtain process control closed loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 and TC2803) at rated pressure, derated temperature (metal temperature control) and moderate flow (refer to Figures 8.3.4-1 through 8.3.4-4). Obtain step response data to setpoint changes at a nominal temperature of 800°F. Obtain step/ ramp response to flux disturbances. | | |
| 8.3.5.2.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.5.2.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.5.2.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 800°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$3600 lb/hr. | | |
| 8.3.5.2.4 Verify that all panels are in metal temperature control and a nominal setpoint of 800°F. Adjust TC2301 through TC2803 setpoints as required. | | |
| 8.3.5.2.5 Verify that control test unit (CTU) external input is switched out. | | |

| Initial | Date |
|---|---|

8.3.5.2.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B).

8.3.5.2.7 Obtain closed loop response on TC2602 to a temperature setpoint change on panel 214 by carrying out the following steps.

A) Confirm that receiver panel 214 in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F, P= 1450 psig; F= 3600 lb/hr.

B) Confirm TC2602 is in metal temperature control mode.

C) Implement a step decrease in TC2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point.

D) Implement a step increase in TC2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

| Initial | Date |
|---|---|

8.3.5.2.7 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.5.2.8 Obtain closed loop response on TC2702 to a temperature setpoint change on panel 217 by carrying out the following steps.

A) Confirm that receiver panel 2702 in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F; P= 1450 psig; F= 3600 lb/hr.

B) Confirm TC2702 is in metal temperature control mode.

| | Initial | Date |
|---|---|---|
| 8.3.5.2.8 C) Implement a step decrease in TC2702 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |

D) Implement a step increase in TC2702 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

| Initial | Date |
|---|---|

8.3.5.2.9 Obtain closed loop response on TC2801 to a temperature setpoint change on panel 219 by carrying out the following steps.

A) Confirm that receiver panel 219 in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F; p= 1450 psig; F= 3600 lb/hr.

B) Confirm TC2801 is in metal temperature control mode.

C) Implement a step decrease in TC2801 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point.

D) Implement a step increase in TC2801 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state conditon. Monitor and adjust as in Section C.

| | Initial | Date |
|---|---|---|

8.3.5.2.9 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.5.2.10 Obtain closed loop response on TC2803 to a temperature setpoint change on panel 221 by carrying out the following steps.

A) Confirm that receiver panel 221 in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F; P= 1450 psig; F= 3600 lb/hr.

B) Confirm TC2803 is in metal temperature control mode.

| | Initial | Date |
|---|---|---|

8.3.5.2.10 C) Implement a step decrease in TC2803 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point.

D) Implement a step increase in TC2803 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

| Initial | Date |
|---|---|

8.3.5.2.11 Obtain closed loop response on TC2602, TC2702, TC2801, TC2803 to a flux disturbance on panel 214, 217, 219, 221 by carrying out the following steps.

A) Confirm that receiver panel 214, 217, 219, 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F; P= 1450 psig; F= 3600 lb/hr.

B) Confirm TC2602, TC2702, TC2801, TC2803 is in metal temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$500 lb/hr are desired.

| | Initial | Date |
|---|---|---|
| 8.3.5.2.11 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response TI if temperature excursions exceed $\pm$ 50°F - adjust flux loop gains via the following. | | |
| 1) Set receiver console to configure mode. | | |
| 2) Select C1-X, AL-16 - using loop tuning form increase/decrease gain and control parameters required. | | |
| F) If gains are adjusted repeat Steps C through E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.3.6 CONTROL TEST - STEAM DUMP SYSTEM - HIGH FLOW

8.3.6.1 Demonstrate satisfactory closed loop control of the Steam Dump System for PC 1001, TC 1002 at rated pressure, moderate temperature and high flow. Obtain response to pressure setpoint and flow changes. Tune control loops as required.

8.3.6.1.1 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.6.1.2 Verify all panels are in metal temperature control with nominal setpoint if 800°F. Confirm that all panels are controlling in a satisfactory manner.

8.3.6.1.3 Confirm that the receiver feedpump controller (PC 1105) is in valve control mode (Select PD 1105B).

8.3.6.1.4 Implement a ramp increase in the power level on all panels from moderate to high power (80-90% of rated) over a 10 minute period. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point.

| | Initial | Date |
|---|---|---|
| 8.3.6.1.5 Confirm PC 1001 is controlling pressure to 1515 psig in a satisfactory manner. | | |

8.3.6.1.6 Perform closed loop tests of PC 1001 (see Figure 8.3.2-2). Tune control loop if required by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease pressure set point on PC 1001 by 100 psi and observe the response on the strip chart.

C) Increase PC 1001 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C2-5, AL-3) as required.

E) Repeat steps B thru D as required until response is satisfactory.

F) Decrease PC 1001 set point 100 psi and observe response.

G) Increase PC 1001 set point to nominal value and observe pressure response.

| | Initial | Date |
|---|---|---|
| H) Increase/decrease reset gain, K2 (C2-5, AL-3) in the ± 10% increments as required. | | |
| I) Repeat steps F thru H as required until response is satisfactory. | | |
| J) Establish PC 1001 start-up controller gains and record. | | |
| K) Adjust setpoints, alarms, limits as required. | | |
| 8.3.6.1.7 Reset receiver control console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.3.7 CONTROL TESTS - PANELS 214, 217, 219, & 221 - HIGH FLOW

8.3.7.1 Obtain process control open loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 & TC2803) at rated pressure, moderate temperature and high flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain both steps and frequency response data to valve disturbances at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

8.3.7.1.1 Verify that the prerequisites have been met as required in Section 4.0.

8.3.7.1.2 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.7.1.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 800°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 7200 lb/hr.

8.3.7.1.4 Verify that all panels are in metal temperature control and a nominal setpoint of 800°F. Adjust TC2301 thru TC2803 setpoints as required.

8.3.7.1.5 Verify that control test unit (CTU) is installed and operating on TV2602, TC2702, TV2801, and TV2803.

| | Initial | Date |
|---|---|---|

8.3.7.1.6 Confirm that the receiver feedpump controller (PC1105) is in pressure control mode (Select PD1105A).

8.3.7.1.7 Obtain the loop step response data on panel 214 by carrying out the following steps.

A. Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B. Set FCM2602 to manual mode.

C. Implement a step decrease in FCM2602 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608, PI2902.

FCM2602 Output __________%
Command Change

| | Initial | Date |
|---|---|---|
| 8.3.7.1.7 D) Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions | | |
| E) Reset FCM2602 back to auto. | | |
| 8.3.7.1.8 Perform frequency response tests on panel 214 (see TC2602, Figure 8.3.4-1) by carrying out the following steps. | | |
| 1) Verify that the controls test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1.) | | |
| 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 3.8.7.1.7.C. Note: Verify that the TFA input to the CTU is switched out. | | |

| | Initial | Date |
|---|---|---|

8.3.7.1.8 5) Select FCM2602 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2602.

6) Set FCM2602 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

Note: (1) The TFA output amplifier may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

*Determined during test

| | Initial | Date |
|---|---|---|
| 8.3.7.1.8 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2602 back to auto. | | |
| 8.3.7.1.9 Obtain open loop step response data on panel 217 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2702 to manual mode. | | |
| C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. | | |

| | Initial | Date |
|---|---|---|

8.3.7.1.9 Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

FCM 2702 Output Command Change _____%

D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2702 back to auto.

8.3.7.1.10 Perform frequency response tests on panel 217 (see TC2702, Figure 8.3.4-2) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

| | Initial | Date |
|---|---|---|

8.3.7.1.10 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.7.1.9.C

Note: Verify that the TFA output to the CTU is switched out.

5) Select FCM2702 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2702.

6) Set FCM2702 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

*Determined during test.

| | Initial | Date |
|---|---|---|

8.3.7.1.10 Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2702 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2702 back to auto.

8.3.7.1.11 Obtain open loop step response data on panel 219 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2801 to manual mode.

C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

| Initial | Date |
|---|---|

8.3.7.1.11 Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902.

FCM2801 Output __________%
Command Change

D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2801 back to auto.

8.3.7.1.12 Perform frequency response tests on panel 219 (see TC2801, Figure 8.3.4-3) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

| | Initial | Date |
|---|---|---|

8.3.7.1.12 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.7.1.11 C.

Note: Verify that the TFA input to the CTU is switched out.

5) Select FCM2801 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2801.

6) Set FCM2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2801.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ

| | Initial | Date |
|---|---|---|

8.3.7.1.12 Repeat 4) at a frequency of ___HZ*

Repeat 4) at a frequency of ___HZ*

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5. ______ ______

8) Switch TFA input out of CTU. ______ ______

9) Set FCM2801 back to auto. ______ ______

8.3.7.1.13 Obtain open loop step response data on panel 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. ______ ______

B) Set FCM2803 to manual mode. ______ ______

*Determined during test

| Initial | Date |
|---|---|

8.3.7.1.13 C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temprature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Recorded final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2092.
FCM2803 Output Command Change ____%

D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2803 back to auto.

8.3.7.1.14 Perform frequency response tests on panel 221 (see TC2803, Figure 8.3.4-4) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1).

| | Initial | Date |
|---|---|---|
| 8.3.7.1.14 2) Verify the receiver feedpump is in pressure control mode (PC1105). | | |
| 3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes. | | |
| 4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.7.1.13 C.<br><br>Note: Verify that the TFA input to the CTU is switched out. | | |
| 5) Select FCM2803 and adjust setpoint to achieve a nominal 800°F steam outlet temperature on TC2803. | | |
| 6) Set FCM2803 to manual mode. | | |
| 7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a + 400 lb/hr peak-to-peak response is achieved on FI2803.<br><br>Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).<br><br>Repeat 4) at a frequency of 0.05 HZ<br>Repeat 4) at a frequency of 0.07 HZ | | |

| | Initial | Date |
|---|---|---|

8.3.7.1.14 Repeat 4) at a frequency of 0.1 Hz
Repeat 4) at a frequency of 0.2 Hz
Repeat 4) at a frequency of 0.5 Hz
Repeat 4) at a frequency of 0.7 Hz
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

(2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2803 back to auto.

8.3.7.1.15 Obtain open loop step/ramp response to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

*Determined during test

| | Initial | Date |
|---|---|---|

8.3.7.1.15 B) Set FCM2602, FCM2702, FCM2801, FCM2803, to manual mode.

C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221, by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: Panel flows, steam and metal temperatures, flux, valve commands and PI2902.

Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and temperature changes $\geq$ 50 to 100°F are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Set FCM2602, FCM2702, FCM2801, FCM2803, back to auto.

| | Initial | Date |
|---|---|---|

8.3.7.2 Obtain process control closed loop data for tuning of receiver temperatures controllers (TC2602, TC2702, TC2801, and TC2803) at rated pressure, moderate temperature (metal temperature control) and high flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step respons- data to set-point changes at a nominal temperature of 800°F. Obtain step/ramp response to flux disturbances.

8.3.7.2.1 Verify that the prerequisites have been met as required in Section 4.0.

8.3.7.2.2 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.7.2.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 800°F output steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 7200 lb/hr.

8.3.7.2.4 Verify that all panels are in metal temperature control and a nominal setpoint of 800°F. Adjust TC2301 thru TC2803 setpoints as required.

| | Initial | Date |
|---|---|---|
| 8.3.7.2.5 Verify that control test unit (CTU) external input is switched out. | | |
| 8.3.7.2.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.7.2.7 Obtain closed loop response on TC2602 to a temperature setpoint change on panel 214 by carrying out the following steps.<br><br>A) Confirm that receiver panel 214 in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 7200 lb/hr. | | |
| B) Confirm TC2602 is in metal temperature control mode. | | |
| C) Implement a step decrease in TC2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step increase in TC2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.2.7 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select C1-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.7.2.8 Obtain closed loop response on TC2702 to a temperature setpoint change on panel 217 by carrying out the following steps.<br>A) Confirm that receiver panel 2702 in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 Psig; F = 7200 lb/hr. | | |
| B) Confirm TC2702 is in metal temperature control mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.2.8 C) Implement a step decrease in TC2702 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step increase in TC2702 set-point (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select C1-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.2.8 G) Set receiver console back to monitor mode. | | |
| 8.3.7.2.9 Obtain closed loop response on TC2801 to a temperature setpoint change on panel 219 by carrying out the following steps. | | |
| A) Confirm that receiver panel 219 in a steady state condition for approximately 2 minutes. Panel conditions: T= 800°F; P= 1450 psig; F= 7200 lb/hr. | | |
| B) Confirm TC2801 is in metal temperature control mode. | | |
| C) Implement a step decrease in TC2801 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, setpoint. | | |
| D) Implement a step increase in TC2801 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|

8.3.7.2.9 E) Confirm temperature response is satisfactory. If no adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select Cl-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.7.2.10 Obtain closed loop response on TC2803 to a temperature setpoint change on panel 221 by carrying out the following steps.

A) Confirm that receiver panel 221 in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 7200 lb/hr.

B) Confirm TC2803 is in metal temperature control mode.

| | Initial | Date |
|---|---|---|
| 8.3.7.2.10 C) Implement a step decrease in TC2803 set-point by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step increase in TC2803 set-point (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.2.11 Obtain closed loop response on TC2602, TC2702, TC2801, TC2803 to a flux disturbance on panel 214, 217, 219, 221 by carrying out the following steps. | | |
| A) Confirm that receiver panel 214, 217, 219, 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 800°F; P = 1450 psig; F = 7200 lb/hr. | | |
| B) Confirm TC2602, TC2702, TC2801, TC2803, is in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.2.11 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following. 1) Set receiver console to configure mode. | | |
| 2) Select Cl-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C through E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.3.7.3 | Obtain process control open loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 and TC2803) at rated pressure, rated temperature (metal temperature control) and high flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain both step and frequency response data to valve disturbances at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.7.3.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.7.3.2 | Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.7.3.3 | Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 7200 lb/hr. | | |
| 8.3.7.3.4 | Verify that all panels are in metal temperature control and a nominal setpoint of 960°F. Adjust TC2301 thru TC2803 setpoints as required. | | |

| | Initial | Date |
|---|---|---|

8.3.7.3.5 Verify that control test unit (CTU) is installed and operating on TV2602, TC2702, TV2801, and TV2803.

8.3.7.3.6 Confirm that the receiver feedpump controller (PC1105) is in pressure control mode (Select PD1105A).

8.3.7.3.7 Obtain open loop step response data on panel 214 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2602 to manual mode.

C) Implement a step decrease in FCM2602 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify the data is recorded: FCM2602 (PV & CO), TI2602, TI2605, YI2608, PI2902.

| | Initial | Date |
|---|---|---|

8.3.7.3.7 FCM2602 Output _________ %
Command Change

D) Implement a step increase (back to nominal) in FCM2602 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2602 back to auto.

8.3.7.3.8 Perform frequency response tests on panel 214 (see TC2602, Figure 8.3.4-1) by carrying out the following steps.

1) Verify that the control test unit (CTU) is installed and operating on TC2602. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.3.7 C. Note: Verify that the TFA input to the CTU is switched out.

| | Initial | Date |
|---|---|---|
| 8.3.7.3.8 5) Select FCM2602 and adjust setpoint to achieve a nominal 960°F steam outlet temperature on TC2602. | | |
| 6) Set FCM 2602 to manual mode. | | |

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2602.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

*Determined during test

| | Initial | Date |
|---|---|---|

8.3.7.3.8 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2602 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2602 back to auto.

8.3.7.3.9 Obtain open loop step response data on panel 217 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes.

B) Set FCM2702 to manual mode.

C) Implement a step decrease in FCM2702 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2702 (PV & CO), TI2702, TI2705, YI2708, PI2902.

| | Initial | Date |
|---|---|---|

8.3.7.3.9 FCM2702 Output ________ %
Command Change

D) Implement a step increase (back to nominal) in FCM2702 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E. Reset FCM2702 back to auto.

8.3.4.3.10 Perform frequency response tests on panel 217 (see TC2702, Figure 8.3.4-2) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2702. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.7.3.9 C. Note: Verify that the TFA input to the CTU is switched out.

| | Initial | Date |
|---|---|---|
| 8.3.7.3.10 5) Select FCM2702 and adjust setpoint to achieve a nominal 960°F steam output temperature on TC2702. | | |
| 6) Set FCM2702 to manual mode. | | |

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2702.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ____ HZ
Repeat 4) at a frequency of ____ HZ

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room.

*Determined during test.

| | Initial | Date |
|---|---|---|
| 8.3.7.3.10 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2702 output from operator station to correct - if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2702 back to auto. | | |

8.3.7.3.11 Obtain open loop step response data on panel 219 by carrying out the following steps.

| | Initial | Date |
|---|---|---|
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2801 to manual mode. | | |

C) Implement a step decrease in FCM2801 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state.

Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2801 (PV & CO), TI2801, TI2804, YI2807, PI2902.

| | Initial | Date |
|---|---|---|

8.3.7.3.11 FCM2801 Output ________%
Command Change

D) Implement a step increase (back to nominal) in FCM2801 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2801 back to auto.

8.3.7.3.12 Perform frequency response tests on panel 219 (see TC2801, Figure 8.3.4-3) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2801. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.4.3.11 C. Note: Verify that the TFA input to the CTU is switched out.

| | Initial | Date |
|---|---|---|

8.3.7.3.12 5) Select FCM2801 and adjust setpoint to achieve a nominal 960°F steam outlet temperature on TC2801.

6) Set FCM2801 to manual mode.

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2801.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room).

*Determined during test

| | Initial | Date |
|---|---|---|
| 8.3.7.3.12 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2801 output from operator station to correct - if cannot successfully adjust - return to Step 5. | | |
| 8) Switch TFA input out of CTU. | | |
| 9) Set FCM2801 back to auto. | | |
| 8.3.7.3.13 Obtain open loop step response data on panel 221 by carrying out the following steps. | | |
| A) Confirm that the receiver panels are in a steady state condition for approximately 5 minutes. | | |
| B) Set FCM2803 to manual mode. | | |
| C) Implement a step decrease in FCM2803 output by approximately 10% of nominal value (increase valve opening) and allow pressures, flows, temperatures to reach steady state. Note: An adjustment in the magnitude of the valve step command may be required in order to achieve a measureable response change in flow and temperature - flow of ± 0.1 lb/sec, temperatures of ± 50 to 100°F are desired. Record final command change. Monitor the following parameters on a strip chart to verify that data is recorded: FCM2803 (PV & CO), TI2803, TI2806, YI2809, PI2902. | | |

| Initial | Date |
|---|---|

8.3.7.3.13 FCM2803 Output ________ %
Command Change

D) Implement a step increase (back to nominal) in FCM2803 output (closing valve) and allow temperatures, pressure and flowrate to reach steady state conditions.

E) Reset FCM2803 back to auto.

8.3.7.3.14 Perform frequency response tests on panel 221 (see TC2803, Figure 8.3.4-4) by carrying out the following steps.

1) Verify that the controls test unit (CTU) is installed and operating on TC2803. (Installation is in RS-1.)

2) Verify the receiver feedpump is in pressure control mode (PC1105).

3) Confirm that the receiver panels are in a steady state condition for approximately 2 minutes.

4) Adjust the peak to peak amplitude on the transfer function analyzer output to be consistent with the required output change determined in Section 8.3.7.3.13 C. Note: Verify that the TFA input to the CTU is switched out.

| | Initial | Date |
|---|---|---|
| 8.3.7.3.14 5) Select FCM2803 and adjust setpoint to achieve a nominal 960°F steam outlet temperature on TC2803. | | |
| 6) Set FCM2803 to manual mode. | | |

7) Using the transfer function analyzer (TFA) insert a 0.1 HZ sin wave into the CTU) and adjust the TFA output such that a ± 400 lb/hr peak-to-peak response is achieved on FI2803.

Set the TFA to 0.02 HZ allow the system to reach steady state (3-4 cycles).

Repeat 4) at a frequency of 0.05 HZ
Repeat 4) at a frequency of 0.07 HZ
Repeat 4) at a frequency of 0.1 HZ
Repeat 4) at a frequency of 0.2 HZ
Repeat 4) at a frequency of 0.5 HZ
Repeat 4) at a frequency of 0.7 HZ
Repeat 4) at a frequency of 1 HZ
Repeat 4) at a frequency of ___ HZ*
Repeat 4) at a frequency of ___ HZ*

Note: (1) The TFA output amplitude may need to be adjusted during the test as required to obtain a measureable output response (determined by test by engineers in RS-1 or DAS room).

*Determined during test

| Initial | Date |
|---|---|

8.3.7.3.14 Note: (2) If panel temperature drifts off the nominal test condition - adjust FCM2803 output from operator station to correct - if cannot successfully adjust - return to Step 5.

8) Switch TFA input out of CTU.

9) Set FCM2803 back to auto.

8.3.7.3.15 Obtain open loop step/ramp response to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps.

A) Confirm that the receiver panels are in a steady state condition for approximately 5 min.

B) Set FCM2604, FCM2702, FCM2801, FCM2803, to manual mode.

C) Implement a step/ramp decrease in the power level on panels 214, 217, 219, 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve commands and PI2902. Note: An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in

| | Initial | Date |
|---|---|---|
| 8.3.7.3.15 flow and temperatures and flux. Flux changes ≥ 20% and temperature changes ≥ 50 to 100°F desired. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Set FCM2602, FCM2702, FCM2801, FCM2803, back to auto. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4 Obtain process control closed loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 and TC2803) at rated pressure, rated temperature and high flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step response data to setpoint changes at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.7.4.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.7.4.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.7.4.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 214-221 with minimum individual panel flowrates $\geq$ 7200 lb/hr. | | |
| 8.3.7.4.4 Verify that all panels are in metal temperature control and a nominal setpoint of 960°F. Adjust TC2301 thru TC2803 setpoints as required. | | |
| 8.3.7.4.5 Verify that control test unit (CTU) external input is switched out. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.7.4.7 Obtain closed loop response on TC2602 to a temperature setpoint change on panel 214 by carrying out the following steps. A) Confirm that receiver panel 214 in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 10,800 lb/hr. | | |
| B) Confirm TC2602 is in metal temperature control mode. C) Implement a step decrease in TC2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position & command, set point. | | |
| D) Implement a step increase in TC2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.7 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.7.4.8 Obtain closed loop response on TC2702 to a temperature setpoint change on panel 217 by carrying out the following steps.<br><br>A) Confirm that receiver panel 217 in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 7200 to 9000 lb/hr. | | |
| B. Confirm TC2702 is in metal temperature control mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.8 C) Implement a step decrease in TC2702 set-point by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step increase in TC2702 set-point (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select C1-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.8 G) Set receiver console back to monitor mode. | | |
| 8.3.7.4.9 Obtain closed loop response on TC2801 to a temperature setpoint change on panel 219 by carrying out the following steps. A) Confirm that receiver panel 219 in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 6300 lb/hr. | | |
| B) Confirm TC2801 is in metal temperature control mode. | | |
| C. Implement a step decrease in TC2801 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step increase in TC2801 set-point (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.9 E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select C1-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.7.4.10 Obtain closed loop response on TC2803 to a temperature setpoint change on panel by carrying out the following steps.<br>A) Confirm that receiver panel 221 in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 lb/hr. | | |
| B. Confirm TC2803 is in metal temperature control mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.10 C) Implement a step decrease in TC2803 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |
| D) Implement a step in TC2803 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.10 G) Set receiver console back to monitor mode. | | |
| 8.3.7.4.11 Obtain closed loop response on TC2602, TC2702, TC2801, TC2803 to a flux disturbance on panels 214, 217, 219, 221 by carrying out the following steps.<br><br>A) Confirm that receiver panel 214, 217, 219, 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T - 960°F; P - 1450 psig; F = 3600 to 10800 lb/hr. | | |
| B) Confirm TC2602, TC2702, TC2801, TC2803, is a metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the lower level on panels 214, 217, 219, 221 by by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set-point. An adjustment in the magnitude of the power change (number of heliostat on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.4.11 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response, if temperature excursions exceed ± 50°F - adjust loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select Cl-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | | Initial | Date |
|---|---|---|---|
| 8.3.7.5 | Obtain process control closed loop data for tuning of receiver temperature controllers (TC2602, TC2702, TC2801 and TC2803) at rated pressure, rated temperature and high flow (refer to Figures 8.3.7-1 through 8.3.7-18). Obtain step response data to setpoint changes at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.7.5.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.7.5.2 | Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.7.5.3 | Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 204-221 with minimum individual panel flowrates $\geq$3600 to 10,800 lb/hr. | | |
| 8.3.7.5.4 | Verify that all panels are in metal temperature control and a nominal setpoint of 960°F. Adjust TC2301 through TC2803 setpoints as required. | | |
| 8.3.7.5.5 | Verify that control test unit (CTU) External Input is switched out. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.5.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.7.5.7 Obtain closed loop response on TC2301 through TC2803 to a temperature setpoint change on panel 204 through 221 by carrying out the following steps. | | |
| A) Confirm that receiver panels 204 through 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T= 960°F; P= 1450 psig; F= 3600 to 10,800 lb/hr. | | |
| B) Confirm TC2301 through TC2803 are in metal temperature control mode and in cascade with TSP2929. Verify rate limits on TSP2929 are removed. | | |
| C) Implement a step decrease in TSP2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.5.7 D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-X. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C through E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.5.8 Obtain closed loop response on TC2301 through TC2803 to a flux disturbance on panels 204 to 221 by carrying out the following steps. | | |
| A) Confirm that receiver panels 204 to 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T= 960°F; P= 1450 psig; F= 3600 to 10,800 lb/hr. | | |
| B) Confirm TC2301 through TC2803 is in metal temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 204 through 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|
| 8.3.7.5.8 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response and if temperature excursions exceed ± 50°F - adjust flux loop gains via the following. | | |
| 1) Set receiver console to configure mode. 2) Select C1-X, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| Initial | Date |
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8.3.8 CONTROL TESTS - AUXILIARY STEAM - LOOP TUNING

8.3.8.1 Demonstrate satisfactory closed loop control of auxiliary steam pressure controller PC 1003 and temperature controller TC 1004. Obtain response to setpoint and flow charges. Tune control loops.

8.3.8.2 Confirm receiver outlet temperature and pressure are controlled and operating in a satisfactory manner.

8.3.8.3 Select TCM 1004, adjust setpoint to 345°F. Set to auto mode.

8.3.8.4 Select PCM 1003, adjust setpoint to 68 psig. Set to auto mode.

8.3.8.5 Tune PC 1003 - auxiliary steam pressure controller (Figure 8.3.8-1) by carrying out the following steps using loop tuning form.

A) Set receiver console to configure mode.

B) Decrease pressure set point on PC 1003 by 10% and observe the response on the strip chart.

C) Increase pressure set point back to nominal value and observe the response on the strip chart.

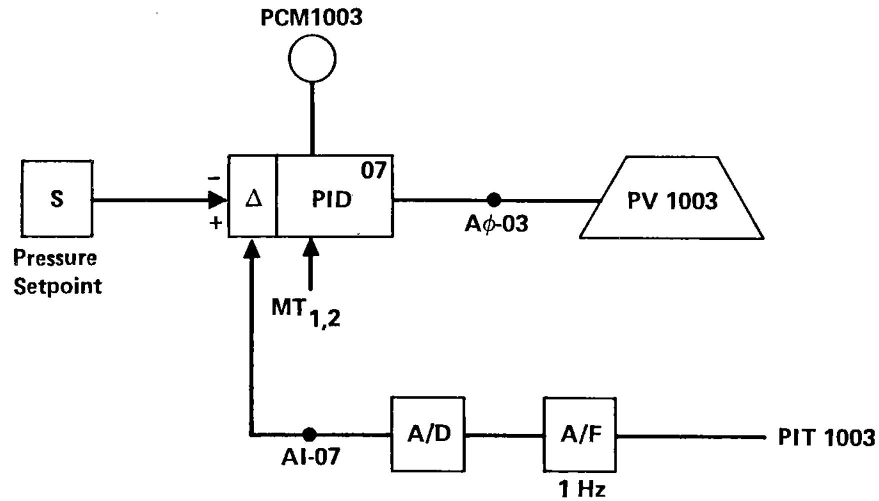


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Figure 8.3.8-1. Auxiliary Steam – Main Steam Pressure Controller Functional Block Diagram PC 1003

| | Initial | Date |
|---|---|---|
| D) Increase/decrease proportional gain, K1 (C2-4, AL-7).* | | |
| E) Repeat steps B thru D as required until response is satisfactory. | | |
| F) Decrease PC 1003 set point to 10% and observe response. | | |
| G) Increase PC 1003 set point to nominal value and observe pressure response. | | |
| H) Increase/decrease reset gain, K2 (C2-4, AL-7) in the ± 30% increments. | | |
| I) Repeat steps F thru H as required until response is satisfactory. | | |
| J) Establish preliminary PC 1003 controller gains and record. | | |
| K) Adjust setpoint, alarms, limits as required. | | |
| 8.3.8.6 Tune TC 1004 - desuperheater temperature controller (Figure 8.3.8-2) by carrying out the following steps using loop tuning form. | | |
| A) Set receiver console to configure mode. | | |
| B) Decrease temperature set point on TCM 1004 by 10% and observe the response on the strip chart. | | |

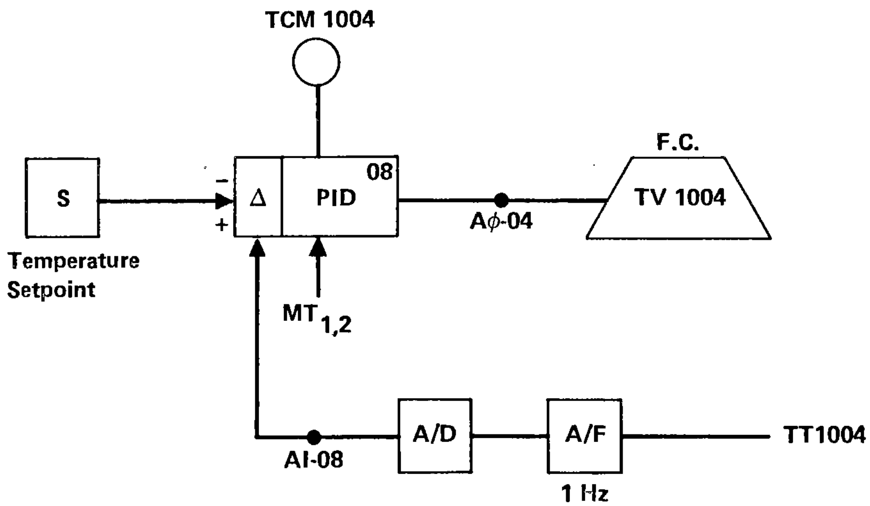




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Figure 8.3.8-2. Auxiliary Steam – Desuperheater Temperature Controller Functional Block Diagram TC 1004

| | Initial | Date |
|---|---|---|

C) Increase TCM 1004 set point back to nominal value and observe the response on the strip chart.

D) Increase/decrease proportional gain, K1 (C2-4, AL-8).*

E) Repeat steps B thru D as required until response is satisfactory.

F) Decrease TCM 1004 set point 10% and observe response.

G) Increase TCM 1004 set point to nominal value and observe temperature response.

H) Increase/decrease reset gain, K2 (C2-4, AL-8) in the ± 30% increments.

I) Repeat steps F thru H as required until response is satisfactory.

J) Establish preliminary TV 1004 controller gains and record.

K) Adjust setpoints, alarms, limits as required.

| | | Initial | Date |
|---|---|---|---|
| 8.3.9 | CONTROL TESTS - PANELS 214, 217, 219, AND 221 - HIGH FLOW - BLENDED* TEMPERATURE CONTROL | | |
| 8.3.9.1 | Obtain process control closed loop data for tuning of receiver temperature controllers (TC 2602, TC 2702, TC 2801 and TC 2803) at rated pressure, derated temperature and high flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step response data to setpoint changes at nominal temperature of 960°F. Obtain step/ramp response to flux disturbances. | | |
| 8.3.9.1.1 | Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.9.1.2 | Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.9.1.3 | Verify that the heliostat field is in the receiver normal configuration. Adjust input power if required to achieve 960 outlet steam temperature on panels 214-221 with minimum individual panel flow-rates ≥ 3600 to 10,800 lb/hr. | | |
| 8.3.9.1.4 | Verify that all panels are in metal temperature control and a nominal setpoint of 960 F. Adjust TC 2301 thru TC 2803 set-points as required. | | |
| 8.3.9.1.5 | Verify that control test unit (CTU) external input is switched out. | | |

*Blended temperature control invovles controlling to a combined metal and steam temperature input signal.

| | | Initial | Date |
|---|---|---|---|
| 8.3.9.1.6 | Confirm that the receiver feedpump controller (PC 1105) is in valve control mode (Select PD 1105B). | | |
| 8.3.9.1.7 | Obtain closed loop response on TC 2602 to a temperature set point change on panel 214 by carrying out the following steps. | | |
| | A) Confirm that receiver panel 214 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 10,800 lb/hr. | | |
| | B) Select TD 2602C and switch controller TC 2602 to blended temperature control mode. | | |
| | C) Implement a step decrease in TC 2602 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point. | | |
| | D) Implement a step increase in TC 2602 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach steady state condition. Monitor and adjust as in Section C. | | |

| | Initial | Date |
|---|---|---|

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-6. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.9.1.8 Obtain closed loop response on TC 2702 a temperature setpoint change on panel 217 by carrying out the following steps.

A) Confirm that receiver panel 2702 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 7200 lb/hr.

B) Select TD 2702C and switch controller TC 2702 to blended temperature control mode.

| | Initial | Date |
|---|---|---|
| C) Implement a step decrease in TC 2702 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, set point. | | |
| D) Implement a step increase in TC 2702 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-7. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |

| | Initial | Date |
|---|---|---|
| G) Set receiver console back to monitor mode. | | |
| 8.3.9.1.9 Obtain closed loop response on TC 2801 to a temperature setpoint change on panel 219 by carrying out the following steps. | | |
| A) Confirm that receiver panel 219 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 6300 lb/hr. | | |
| B) Select TD 2801C and switch controller TC 2801 to blended temperature control mode. | | |
| C) Implement a step decrease in TC 2801 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, setpoint. | | |
| D) Implement a step increase in TC 2801 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |

| Initial | Date |
|---|---|

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-8. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.9.1.10 Obtain closed loop response on TC 2803 to a temperature setpoint change on panel 221 by carrying out the following steps.

A) Confirm that receiver panel 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 lb/hr.

B) Select TD 2803C and switch controller TC 2803 to blended temperature control mode.

| | Initial | Date |
|---|---|---|
| C) Implement a step decrease in TC 2803 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, setpoint. | | |
| D) Implement a step increase in TC 2803 setpoint (back to nominal). Allow panel tempertures, pressures, flux and flows to reach steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-9. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |

| | Initial | Date |
|---|---|---|
| G) Set receiver console back to monitor mode. | | |
| 8.3.9.1.11 Obtain closed loop response on TC 2602, TC 2702, TC 2801, and TC 2803 to a flux disturbance on panels 214, 217, 219 and 221 by carrying out the following steps. A) Confirm that receiver panels 214, 217, 219 and 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 → 10,8000 lb/hr. | | |
| B) Confirm TC 2602, TC 2702, TC 2801, and TC 2803 are in blended temperature control mode. | | |
| C) Implement a step/ranp decrease in the power level on panels 214, 217, 219 and 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux, valve position and command, setpoint. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux | | |

| Initial | Date |
|---|---|

changes ≥ 20% and flow changes ≥ 500 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select C1-X, AL-16 - using loop tuning form increase/decrease gain and control parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode.

8.3.9.2 Obtain process control loop data for tuning of receiver temperature controllers (TC 2301 thru TC 2803) at rated pressure, rated temperature and high flow (refer to Figures 8.3.4-1 thru 8.3.4-18). Obtain step response data to setpoint change at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances.

| | Initial | Date |
|---|---|---|
| 8.3.9.2.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.9.2.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.9.2.3 Verify that the heliostat field is in the receiver startup configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 214 → 221 with minimum individual panel flow-rates $\geq$ 3600 to 10,800 lb/hr. | | |
| 8.3.9.2.4 Select TD 2301C thru TD 2803C and switch to blended temperature control. Verify that all panels are in blended temperature control and nominal setpoint of 960°F. Adjust TC 2301 thru TC 2803 setpoints as required. | | |
| 8.3.9.2.5 Verify that control test unit (CTU) external input is switched out. | | |
| 8.3.9.2.6 Confirm that the receiver feedpump controller (CP 1105) is in valve control mode (Select PD 1105B). | | |
| 8.3.9.2.7 Obtain closed loop response on TC 2301 thru TC 2803 to a temperature setpoint change at high flow panels 204 thru 221 by carrying out the following steps. | | |

| | Initial | Date |
|---|---|---|
| A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr. | | |
| B) Confirm TC 2301 thru TC 2803 are in blended temperature control mode. Remove ramp rate limits on panel set point (C1-10, AL-24). | | |
| C) Implement a step decrease in TSP 2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, setpoint. | | |
| D) Implement a step increase in TSP 2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br><br>1) Set receiver console to configure mode. | | |

| Initial | Date |
|---|---|

2) Select C1-X. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.9.2.8 Obtain closed loop response on TC 2301 thru TC 2803 to a flux disturbance at high flow on panels 204 thru 221 by carrying out the following steps.

A) Confirm that receiver panels 214 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr.

B) Confirm TC 2301 thru TC 2803 are in blended temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 204 thru 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip

| Initial | Date |
|---|---|

chart recorder to verify data is recorded: panel flow, steam and metal temperatures, flux valve position and command, set point. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measurable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select C1-X, AL-16 - using loop tuning form increase/decrease gain and control parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode.

| | Initial | Date |
|---|---|---|

8.3.9.3 Obtain process control closed loop data for tuning of receiver temperature controllers (TC2301 thru TC2803) at rated pressure, rated temperature and moderate flow (refer to Figures 8.3.4-1 thru 8.3.4-4). Obtain step response data to setpoint change at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbances.

8.3.9.3.1 Verify that the prerequisites have been met as required in Section 4.0. _____ _____

8.3.9.3.2 Verify that the initial conditions have been established as required in Section 7.4.3. _____ _____

8.3.9.3.3 Verify that the heliostat field is in receiver start-up configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 204 thru 221 with minimum individual panel flowrates $\geq$ 1800 thru 7200 lb/hr. _____ _____

8.3.9.3.4 Select TD2301C thru TD2803C and switch to blended temperature control. Verify that all panels are in blended temperature control and a nominal setpoint of 960°F. Adjust TC2301 thru TC2803 setpoints as required. _____ _____

| | Initial | Date |
|---|---|---|
| 8.3.9.3.5 Verify that control test unit (CTU) external input is switched out. | | |
| 8.3.9.3.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.9.3.7 Obtain closed loop response to TC2301 thru TC2803 to a temperature setpoint change at moderate flow on panels 204 thru 221 by carrying out the following steps. A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 1800 thru 7200 lb/hr. | | |
| B) Confirm TC2301 thru TC2803 are in blended temperature control mode. Remove ramp rate limits on panel setpoint (C1-10, AL-24). | | |
| C) Implement a step decrease in TSP2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |

| | Initial | Date |
|---|---|---|

8.3.9.3.7 D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select Cl-x. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Set receiver console back to monitor mode.

8.3.9.3.8 Obtain closed loop response on TC2301 thru TC2803 to a flux disturbance at moderate flow by carrying out the following steps.

| | Initial | Date |
|---|---|---|

8.3.9.3.8 A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 1800 thru 7200 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 204 → 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flow-rate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, set point. An adjustment in the magnitude of the power change (number of helio-stats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux change $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

| | Initial | Date |
|---|---|---|
| 8.3.9.3.8 E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|
| 8.3.9.4 Obtain process control closed loop data for tuning of receiver temperature controllers (TC2301 thru TC2803) at rated pressure, rated temperature and low flow. Obtain step response data to setpoint change at a nominal temperature of 960°F. Obtain step/ramp response to flux disturbance. | | |
| 8.3.9.4.1 Verify that the prerequisites have been met as required in Section 4.0. | | |
| 8.3.9.4.2 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.9.4.3 Verify that the heliostat field is in the receiver start-up configuration. Adjust input power if required to achieve 960°F outlet steam temperature on panels 204-221 with minimum individual panel flowrates $\geq$ 900 thru 1800 lb/hr. | | |
| 8.3.9.4.4 Select TD2301C thru TD2803C and switch to blended temperature control. Verify that all panels are in blended temperature control and a nominal setpoint of 960°F. Adjust TC2301 thru TC2803 setpoints as required. | | |

| | Initial | Date |
|---|---|---|
| 8.3.9.4.5 Verify that control test unit (CTU) external input is switched out. | | |
| 8.3.9.4.6 Confirm that the receiver feedpump controller (PC1105) is in valve control mode (Select PD1105B). | | |
| 8.3.9.4.7 Obtain closed loop response on TC2301 thru TC2803 to a temperature setpoint change at low flow on panels 204 thru 221 by carrying out the following steps.<br><br>A) Confirm that receiver panels 204 thru 221 are in a steady state condition for appoximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 900 thru 1800 lb/hr. | | |
| B) Confirm TC2301 thru TC2803 are in blended temperature control mode. Remove ramp rate limits on panel set point (C1-23, AL-24). | | |
| C) Implement a step decrease in TSP2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |

| | Initial | Date |
|---|---|---|
| 8.3.9.4.7 D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following: 1) Set receiver console to configure mode. 2) Select C1-x. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| G) Set receiver console back to monitor mode. | | |
| 8.3.9.4.8 Obtain closed loop response to TC2301 thru TC2803 to a flux disturbance at low flow on panels 204 thru 221 by carrying out the following steps. | | |

| | Initial | Date |
|---|---|---|

8.3.9.4.8 A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 900 thru 1800 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 204 thru 221 by approximately 10% nominal power. Allow panel temperatures, pressure and flow-rate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, setpoint. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired.

D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

| | Initial | Date |
|---|---|---|
| 8.3.9.4.8 E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br><br>1) Set receiver console to configure mode.<br><br>2) Select Cl-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.3.10 CONTROL TESTS - LARGE SIGNAL FLUX/SETPOINT RESPONSE TESTS RATED STEAM CONDITIONS

8.3.10.1 Induce maximum flux gradients on the receiver panels via heliostat field configuration and verify satisfactory control response and operating conditions are within design limits.

8.3.10.1.1 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.10.1.2 Verify that the heliostat field is in the maximum power configuration.

8.3.10.1.3 Verify that all panels are in blended temperature control with a nominal setpoint of 960°F.

8.3.10.1.4 Adjust heliostat configuration to induce maximum flux gradients on the receiver panels - Refer to table 8.3.10.1.

8.3.10.1.5 Confirm that all receiver panels are in a steady state condition for at least 10 minutes and that maximum panel tube temperatures are within design limits.

8.3.10.1.6 Re-adjust heliostat field back to the "normal" maximum power configuration.

| | Initial | Date |
|---|---|---|

8.3.10.2 Verify satisfactory control system response on all panels to a maximum induced decreasing flux condition (100% to 10%) and a maximum increasing flux condition (10% to 100%).

8.3.10.2.1 Obtain closed loop response on TC2301 thru TC2803 to a flux disturbance on panel 204 thru 221 by carrying out the following steps.

A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 204 thru 221 from 100% to 50% of rated power in 1 minute. Allow panel temperatures, pressure and flow rate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, set point.

| | Initial | Date |
|---|---|---|
| 8.3.10.2.1 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response and if temperature excursions exceed ±50°F - adjust flux loop gains via the following.<br><br>1) Set receiver console to configure mode.<br><br>2) Select C1-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |
| F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode. | | |
| 8.3.10.2.2 Obtain closed loop response on TC2301 thru TC2803 to a flux disturbance on panels 204 thru 221 by carrying out the following steps. (Note - perform test only if 8.3.10.2.1 is satisfactory).<br><br>A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr. | | |

| | Initial | Date |
|---|---|---|
| 8.3.10.2.2 B) Confirm TC2301 thru TC2803 are in blended temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 204 thru 221 from 100% to 10% of rated power in 1 minute. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, set point. | | |
| D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| E) Observe temperature response and if temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select C1-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required. | | |

| | Initial | Date |
|---|---|---|

8.3.10.2.2 F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode.

8.3.10.3 Verify satisfactory control system response to a maximum temperature set point ramp rate from rated to derated steam conditions and from derated to rated steam conditions.

8.3.10.3.1 Obtain closed loop response on TC2301 thru TC2803 to a temperature setpoint change on panels 204 thru 221 by carrying out the following steps.

A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode.

C) Implement a step decrease in TSP2929 setpoint to 800°F. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint.

| | Initial | Date |
|---|---|---|

8.3.10.3.1 D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select Cl-x. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

G) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F - 3600 thru 10,800.

H) Confirm TC2301 thru TC2803 are in metal blended temperature control mode.

| | Initial | Date |
|---|---|---|
| 8.3.10.3.1 I) Implement a step decrease in TSP2929 setpoint to 660°F. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. | | |
| J) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:<br>1) Set receiver console to configure mode.<br>2) Select Cl-x. Using loop tuning form increase/decrease selected gains and tuning parameters as required. | | |
| K) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record. | | |
| L) Set receiver console back to monitor mode. | | |

| | Initial | Date |
|---|---|---|

8.3.11 CONTROL TESTS - DERATED STEAM CONDITIONS - BLENDED TEMPERATURE CONTROL

8.3.11.1 Demonstrate satisfactory closed loop control of receiver temperature for TC2301 thru TC2803 in the blended temperature control mode. Obtain response to temperature setpoint and flux changes at rated pressure, derated temperature and high flow conditions. Tune control as required.

8.3.11.1.1 Verify that the initial conditions have been established as required in Section 7.4.3.

8.3.11.1.2 Obtain closed loop response on TC2301 thru TC2803 to a temperature setpoint change at high flow on panels 204 thru 221 by carrying out the following steps.

A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode. Remove ramp rate limits on panel set point (C1-10, AL-14).

| | Initial | Date |
|---|---|---|

8.3.11.1.2 C) Implement a step decrease in TSP2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint.

D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select C1-x. Using loop tuning form increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

| | Initial | Date |
|---|---|---|
| 8.3.11.1.2 G) Set receiver console back to monitor mode. | | |
| 8.3.11.1.3 Obtain closed loop response on TC2301 thru TC2803 to a flux disturbance at high flow on panels 214 thru 221 by carrying out the following steps.<br><br>A) Confirm that receiver panels 214 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 960°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr. | | |
| B) Confirm TC2301 thru TC2803 are in blended temperature control mode. | | |
| C) Implement a step/ramp decrease in the power level on panels 204 thru 221 by approximately 10% of nominal power. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint. An adjustment in the magnitude of the power change (number of heliostats on/off target) may be required in order to achieve measureable response changes in flow and temperatures and flux. Flux changes $\geq$ 20% and flow changes $\geq$ 500 lb/hr are desired. | | |

| | Initial | Date |
|---|---|---|

8.3.11.1.3 D) Implement a step/ramp increase in panel power (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select C1-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode.

8.3.11.2 Demonstrate satisfactory closed loop control of receiver panel temperature for TC2602, TC2702, TC2801, & TC2803 using blended temperature control at rated pressure, derated temperature and low flow. Obtain response to temperature setpoint and flux changes. Tune control loops as required. Determine control system stability margins at low flow.

| | Initial | Date |
|---|---|---|
| 8.3.11.2.1 Verify that the initial conditions have been established as required in Section 7.3.11. | | |
| 8.3.11.2.2 Implement a ramp decrease in the power level on panels 204 thru 221 to a low power condition (40,000 lb/hr) over a 10 minute period. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flows, steam & metal temperatures, flux, valve position & command setpoint. | | |
| 8.3.11.2.3 Obtain closed loop response on TC2301 thru TC2803 to a temperature setpoint change at low flow on panels 204 thru 221 by carrying out the following steps.<br><br>A) Confirm that receiver panels 204 thru 221 are in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 900 thru 1800 lb/hr. | | |
| B) Confirm TC2301 thru TC2803 are in blended temperature control mode. Remove ramp rate limits on panel set point (C1-23, AL-24). | | |

| | Initial | Date |
|---|---|---|

8.3.11.2.3 C) Implement a step decrease in TSP2929 setpoint by approximately 10% of nominal. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux valve position & command, setpoint.

D) Implement a step increase in TSP2929 setpoint (back to nominal). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

E) Confirm temperature response is satisfactory. If not adjust control loop gains via the following:

1) Set receiver console to configure mode.

2) Select Cl-x. Using loop tuning form, increase/decrease selected gains and tuning parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned parameters. Adjust setpoints, alarms, and limits if required and record.

| | Initial | Date |
|---|---|---|

8.3.11.2.4 Stability margin test - TC2602, TC2702, TC2801, & TC2803 at derated temperature, low flow conditions

8.3.11.2.4.1 Confirm stability margin on TC2602 by carrying out the following steps.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint on TC2602 by 10% and observe the response on the strip chart.

C) Increase TC2602 setpoint back to nominal value and observe the response on the strip chart.

D) Increase proportional gain, K1 (C1-6, AL-12)*. By 20% - use loop tuning form.

E) Repeat steps B thru D as required until response is marginally stable (oscillatory).

F) Record gains for neutral stability.

G) Reset gains back to nominal condition.

| | Initial | Date |
|---|---|---|

8.3.11.2.4.2 Confirm stability margin on TC2702 by carrying out the following steps.

A) Set receiver console to configure mode.

B) Decrease temperature setpoint on TC2702 by 10% and observe the response on the strip chart.

C) Increase TC2702 setpoint back to nominal value and observe the response on the strip chart.

D) Increase proportional gain, K1 (C1-7, AL-32)*. By 20% - use loop tuning form.

E) Repeat steps B thru D as required until response is marginally stable (oscillatory).

F) Record gains for neutral stability.

G) Reset gains back to nominal condition.

8.3.11.2.4.3 Confirm stability margin on TC2801 by carrying out the following steps.

A) Set receiver console to configure mode.

| | Initial | Date |
|---|---|---|

8.3.11.2.4.3 B) Decrease temperature setpoint on TC2801 by 10% and observe the response on the strip chart.

C) Increase TC2801 setpoint back to nominal value and observe the response on the strip chart.

D) Increase proportional gain, K1 (C1-8, AL-32)*. By 20% - use loop tuning form.

E) Repeat steps B thru D as required until response is marginally stable (oscillatory).

F) Record gains for neutral stability.

G) Reset gains back to nominal condition.

8.3.11.2.4.4 Confirm stability on TC2803 by carrying out the following steps.

A) Set receiver console to configure mode.

B) Decrease temperature set point on TC2803 by 10% and observe the response on the strip chart.

C) Increase TC2803 set point back to nominal value and observe the response on the strip chart.

| | Initial | Date |
|---|---|---|

8.3.11.2.4.4 D) Increase proportional gain, K1 (C1-9, AL-32)*. By 20% - use loop tuning form.

E) Repeat steps B thru D as required until response is marginally stable (oscillatory).

F) Record gains for neutral stability.

G) Reset gains back to nominal condition.

8.3.11.3 Determine the low flow controllability limit on temperature control for the receiver panels.

8.3.11.3.1 Implement a step/ramp decrease in the power level on panels 204 thru 221 in minimum power increments at 10 minute intervals. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command, setpoint.

8.3.11.3.2 Continue decreasing power until temperature control is no longer stable or satisfactory.

| | Initial | Date |
|---|---|---|
| 8.3.11.4 Verify satisfactory control system response on all panels to a maximum induced decreasing flux condition (100% to 10%) and a maximum increasing flux condition (10% to 100%) at derated temperature conditions. | | |
| 8.3.11.4.1 Verify that the initial conditions have been established as required in Section 7.4.3. | | |
| 8.3.11.4.2 Verify that the heliostat field is in a receiver low power configuration. Adjust input power if required to achieve 660°F outlet steam temperature on panels 214 thru 221 with minimum individual panel flowrates $\geq$ 900 thru 1800 lb/hr. | | |
| 8.3.11.4.3 Implement a step/ramp increase in panel power (back to rated power conditions). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C. | | |
| 8.3.11.4.4 Observe temperature response. If temperature excursions exceed ± 50°F - adjust flux loop gains via the following.<br>1) Set receiver console to configure mode.<br>2) Select C1-x, AL-16 - Using loop tuning form increase/decrease gain and control parameters as required. | | |

| | Initial | Date |
|---|---|---|

8.3.11.4.5 Obtain closed loop response on TC2301 thru TC2803 to a flux disturbance on panels 204 thru 221 by carrying out the following steps.

A) Confirm that receiver panel 204 → 221 is in a steady state condition for approximately 2 minutes. Panel conditions: T = 660°F; P = 1450 psig; F = 3600 thru 10,800 lb/hr.

B) Confirm TC2301 thru TC2803 are in blended temperature control mode.

C) Implement a step/ramp decrease in the power level on panels 204 thru 221 from 100% to 10% of rated power in a 1 minute period. Allow panel temperatures, pressure and flowrate to reach steady state. Monitor the following parameters on a strip chart recorder to verify data is recorded: panel flow, steam & metal temperatures, flux, valve position & command setpoint.

D) Implement a step/ramp increase in panel power (back to rated power condition). Allow panel temperatures, pressures, flux and flows to reach a steady state condition. Monitor and adjust as in Section C.

| | Initial | Date |
|---|---|---|

8.3.11.4.5 E) Observe temperature response and if temperature excursions exceed ± 50°F - adjust flux loop gains via the following.

1) Set receiver console to configure mode.

2) Select Cl-x, AL-16 - using loop tuning form increase/decrease gain and control parameters as required.

F) If gains are adjusted repeat Steps C thru E. Record final tuned flux loops gain. Set console back to monitor mode.

| | Initial | Date |
|---|---|---|
| 8.3.12 MOISTURE SEPARATORS AND ACCUMULATOR (Test to be carried out during all of Section 8.3 when dry superheated steam is being produced by the individual boiler panels). | | |
| 8.3.12.1 Enable the moisture accumulator level drain function and permit normal automatic operation between the low and high setpoint values. | | |
| 8.3.12.2 Monitor LAHL2901 during steaming operation to detect the inability to pass sufficient flow (high level alarm caused by excessive moisture carryover). Low level alarms could be caused by an excessive drain rate or a natural drying process which occurs during normal high temperature steaming operation. Correlate high level alarms to setpoint steam temperature. | | |
| 8.3.12.3 Monitor the following thermocouples for indications of moisture carryover. Correlate moisture carryover with setpoint temperature, total steam flow, and panel gradients. | | |

| | | Initial | Date |
|---|---|---|---|
| 9.0 | SYSTEM RESTORATION | | |
| 9.1 | Shutdown the system and prepare for Mode 1 operation. | | |
| 9.2 | Initiate trace heating if a subfreezing condition is anticipated. | | |
| 9.3 | Remove supporting electronic checkout equipment e.g., strip chart recorders, control test unit, or transfer function analyzer from the individual MVCU's (unless required for subsequent testing) and restore control wiring. | | |
| 9.4 | Inform SCE station shift operating foreman that the test is completed and the plant may be prepared for the next test. | | |

AUG 13 1984

John Raetz and/or
Bob Riedesel

Were there letters of transmittal to STMPO for Test Procedures 1010 or 1030 (1030 came in two pieces, Sections 1-9 and Section 10-Appendices)? I've never seen transmittal letters or memos, and they may just have been handed to DOE without formal correspondence. (For heaven's sake, don't concoct any at this late date!).

Doug

AUG 1 3 1984

John Raetz and/or
Bob Riedesel

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Doug

Aug 16 1984

RG Riedesel

No letters of transmittal. for TPs 1010 or 1030, or for updates to TP 980. (per Raetz, too)

RGR

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply To: DOE Solar One Project Office
P.O. Box 366
Daggett, CA 92327

AUG 16 1984

Mr. Robert L. Gervais
Solar One Project Office
McDonnell Douglas Astronautics Corp.
P.O. Box 366
Daggett, CA 92327

Subject: Clearance of Control Contract DE-AC03-79SF10499
Solar One Reports for DOE/TIC Inclusion.

Dear Bob:

Enclosed are copies of covers and title pages of eight reports prepared by McDonnell Douglas Astronautics Corporation for the Solar One Project under the above referenced contract. In preparation for delivery of these documents to DOE/TIC, I have prepared a SAN form 70 "Request for Patent Clearance" and a DOE form RA-426 "Recommendations for Announcement and Distribution of Documents" for each document.

Please have the appropriate MDAC personnel complete and sign these forms. As agreed, SAN form 70 should be forwarded to SAN/OPC by your office with copies of the completed SAN form 70 and the transmittal letter being sent to me. The completed DOE form RA-426 should be sent directly back to me.

The documents covered by this letter are:

| Primary Document No. | Secondary No. | Brief Title |
|---|---|---|
| DOE/SF/10499-T117 | STMPO 581 | Test Procedure 210, Rev. 1 |
| DOE/SF/10499-T118 | STMPO 587 | Test Procedure 820, Rev. 0 |
| DOE/SF/10499-T119 | STMPO 588 | Test Procedure 871, Rev. 0 |
| DOE/SF/10499-T120 | STMPO 589 | Test Procedure 905, Rev. 0 |
| DOE/SF/10499-T121 | STMPO 590 | Test Procedure 910, Rev. 0 |
| DOE/SF/10499-T138 | STMPO 593 | Test Procedure 1010, Rev. 0 |
| DOE/SF/10499-T139 | STMPO 594 | Test Procedure 1030, Rev. 0, Sec. 1-9 |
| DOE/SF/10499-T140 | STMPO 595 | Test Procedure 1030, Rev. 0, Sec. 10 |

If you should have any questions or concerns please do not hesitate to contact me by telephone at, (619) 254-2672.

Sincerely,

S.D. Elliott, Jr., Director
DOE Solar One Project Office

SDE/aks
Project File: CCC005.RNO(SA3)

Encl: Eight Document Covers W/forms 70 and RA-426

cc: Roger Gaither, SAN/OPC
W.D. Matheny, DOE/TIC
Mike Lopez, DOE/SAN (FGS)
Mary Soderstrum, B&McD

SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

| | |
|---|---|
| Prime Contract No. | DE-AC03-79SF10499 |
| Subcontract No. | (N/A) |
| Report No. (STMPO 594) | DOE/SF/10499-T139 |
| Date of Report | July 1981 |
| Name & Phone No. of DOE Technical Representative | S.D. Elliott, Jr. (619) 254-2672 |

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM:
McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

1. Document Title: Receiver Steam Generation (Controls) Preoperational Test Procedure 1030, Revision 0, Sections 1 through 9

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): ________

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine) would be desired.

**SENDER IS TO CHECK BOX #4 OR #5 BELOW.**

☐ 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages ________ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. ________.
ii. A disclosure of the invention was submitted to DOE on ________ (date)
iii. A disclosure of the invention will be submitted shortly ________ (approximate date)
iv. A waiver of DOE's patent rights to the contractor:
☐ has been granted, ☐ has been applied for; or ☐ will be applied for ________ (date)

☐ 5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: Provide copy of clearance to: Solar One Project Office
P.O. Box 366, Daggett, CA 92327

Reviewing/Submitting Official: Name (Print/Type) ________
Title ________
Signature ________ Date ________

---

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

☐ No patent objection to above-identified release.

☐ Please defer release until advised by this office.

Signed ________ Date Mailed ________

DOE Form RA-426
(10/80)

# U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

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|---|---|---|

4. Title Receiver Steam Generation (Controls) Preoperational Test Procedure 1030, Revision 0, Sections 1 through 9

5. Type of Document ("x" one)
- ☒ a. Scientific and technical report
- ☐ b. Conference paper: Title of conference ______

______ Date of conference ______

Exact location of conference ______ Sponsoring organization ______

- ☐ c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.)

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S.D. Elliott, Jr., Director, DOE Solar One Project Office

Organization
P.O. Box 366, Daggett, CA 92327 (619) 254-2672

Signature | Date

H009-M-807

SAN FORM 70 10/80

**DEPARTMENT OF ENERGY**
**SAN FRANCISCO OPERATIONS OFFICE**

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

| | |
|---|---|
| Prime Contract No. | DE-AC03-79SF10499 |
| Subcontract No. | (N/A) |
| Report No. | (STMPO 594) DOE/SF/10499-T139 |
| Date of Report | July 1981 |
| Name & Phone No. of DOE Technical Representative | S.D. Elliott, Jr. ~~(619) 254-2672~~ |

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM:
McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

1. Document Title: Receiver Steam Generation (Controls) Preoperational Test Procedure 1030, Revision 0, Sections 1 through 9

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): ______

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine) would be desired.

**SENDER IS TO CHECK BOX #4 OR #5 BELOW.**

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a. Attention should be directed to pages ______ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. ______.
ii. A disclosure of the invention was submitted to DOE on ______ (date)
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☐ has been granted, ☐ has been applied for; or ☐ will be applied for ______ (date)

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P.O. Box 366, Daggett, CA 92327

Reviewing/Submitting Official: Name (Print/Type) Donald L. Royer
Title Asst. Chief Patent Counsel, MDC (MS 122-23)
Signature [signature] Date 26 Sep 84

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

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☐ Please defer release until advised by this office.

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2. Contract No. DE-AC03-79SF10499
3. Subject Category No. UC 62, 62c, 62d

4. Title Receiver Steam Generation (Controls) Preoperational Test Procedure 1030, Revision 0, Sections 1 through 9

5. Type of Document ("x" one)
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   - [ ] b. Conference paper: Title of conference ______ Date of conference ______
   
   Exact location of conference ______ Sponsoring organization ______
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    S.D. Elliott, Jr., Director, DOE Solar One Project Office

    Organization

    P.O. Box 366, Daggett, CA 92327 (619) 254-2672

    Signature | Date