SAN/0499-78
MDC G9330

10-MWe Solar-Thermal
Central-Receiver Pilot Plant

SOLAR-FACILITIES DESIGN INTEGRATION

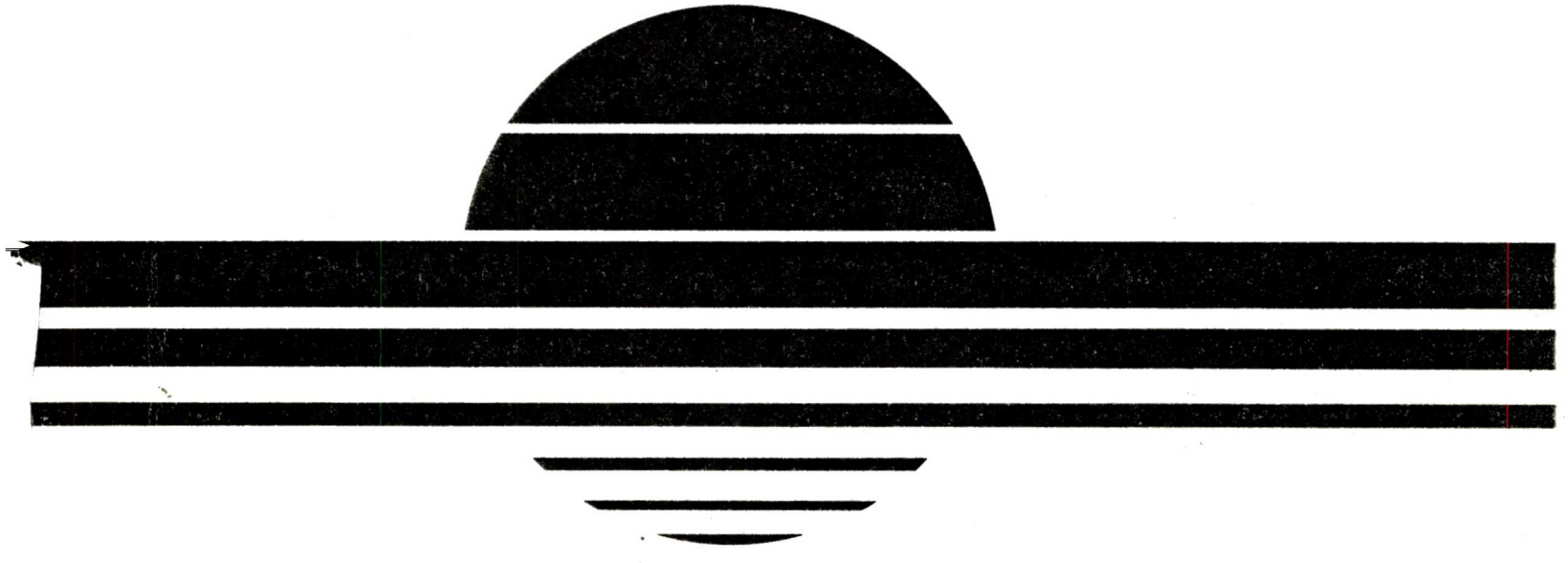
PILOT-PLANT STARTUP AND ACCEPTANCE-TEST PLAN (RADL ITEM 2-46)

PRELIMINARY

December 1980

WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
5301 BOLSA AVENUE
HUNTINGTON BEACH, CA 92647



U.S. Department of Energy

MCDONNELL DOUGLAS

Solar Energy

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10-MWe Solar-Thermal Central-Receiver Pilot Plant Solar-Facilities Design Integration

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PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC03-79SF10499

PREFACE

This plan for pilot plant startup and acceptance testing is provided by the McDonnell Douglas Astronautics Company (MDAC) in accordance with Contract Number DE-AC03-79SF10499.

Questions pertaining to the plan should be directed to R. G. Riedesel at (714) 896-3357.

CONTENTS

Section 1
INTRODUCTION

1.1 SCOPE

The purpose of this document is to provide a test plan for the pilot plant preoperational and acceptance test activities to be performed at the pilot plant test site which is located adjacent to the Coolwater Generation Station in Daggett, 12 miles southeast of Barstow in San Bernardino County, California.

Presented in the document is a description of the overall test program (Section 2), the pilot plant system breakdown structure (Section 3), preoperational and acceptance test specifications (Section 4), and test management, data, and documentation requirements (Section 5). Also presented as appendices are expanded pilot plant startup test schedules (Appendix A) and a brief summary of startup-related construction tests (Appendix B).

1.2 APPLICABLE DOCUMENTS

1.2.1 Reports and Deliverable List (RADL) Documents

System Description (RADL Item 2-1)

System Specification (RADL Item 203)

CS-MCS and CS-Plant Interface Requirements Document (RADL Item 2-30-1)

System Integration Laboratory Test Plan (RADL Item 6-4)

Construction Package 5A - Receiver Tower Structural Steel (RADL Item 7-39)

Construction Package 7 - TS and PSS Foundations (RADL Item 7-32)

Construction Package 9 - Piping and Mechanical Equipment Installation (RADL Item 7-33)

Construction Package 10 - TSS Field Erected Tanks - Parts I and II (RADL Item 7-34)

Construction Package 10A - PSS Field Erected Tanks (RADL Item 7-42)

Construction Package 11 - Plant Electrical (RADL Item 7-35)

Construction Package 11A - Collector Field Electrical (RADL Item 7-41)

Heat and Mass Balance Design Analysis (RADL Item 2-15)

1.2.2 Other Documents

Solar Startup and Test Program Manual

Solar One Master Startup Schedule

Section 2
TEST PROGRAM DESCRIPTION

2.1 TESTING APPROACH

The plant preoperational and acceptance tests (startup tests) identified in this plan allow for an orderly and sequential turnover of plant systems from construction and will culminate in the verification of plant operation in the manual and automatic control modes required of the plant design. In all cases, individual systems or groups of systems will be tested in accordance with test procedures which have been approved by the Test Working Group (TWG) prior to the initiation of the test. A particular test is completed when all activity defined by the test procedure is complete as verified by the test engineer and approved by the TWG.

Due to the simultaneous nature of the construction and startup test activities planned for Solar One, some elements of a particular test procedure may be delayed and completed at a later date pending construction completion of the required equipment. In that event, other tests may be initiated on approval of the TWG. The original procedure, however, may not be closed out until all items have been completed per the stated acceptance criteria or as waived by the TWG.

Test procedures for the preoperational and acceptance tests will be prepared in accordance with established Southern California Edison guidelines as discussed in Section 5.3. In general, the purpose of these tests and the associated test procedures is to demonstrate the operational status of all plant systems.

2.2 TEST INDEX

The startup test activities as shown in Figure 2-1 have been divided into two periods; preoperational tests consisting of intra-system tests and inter-system tests and acceptance tests consisting of manual control tests and automatic control tests with turbine roll defining the termination of the preoperational tests and the initiation of the acceptance tests.

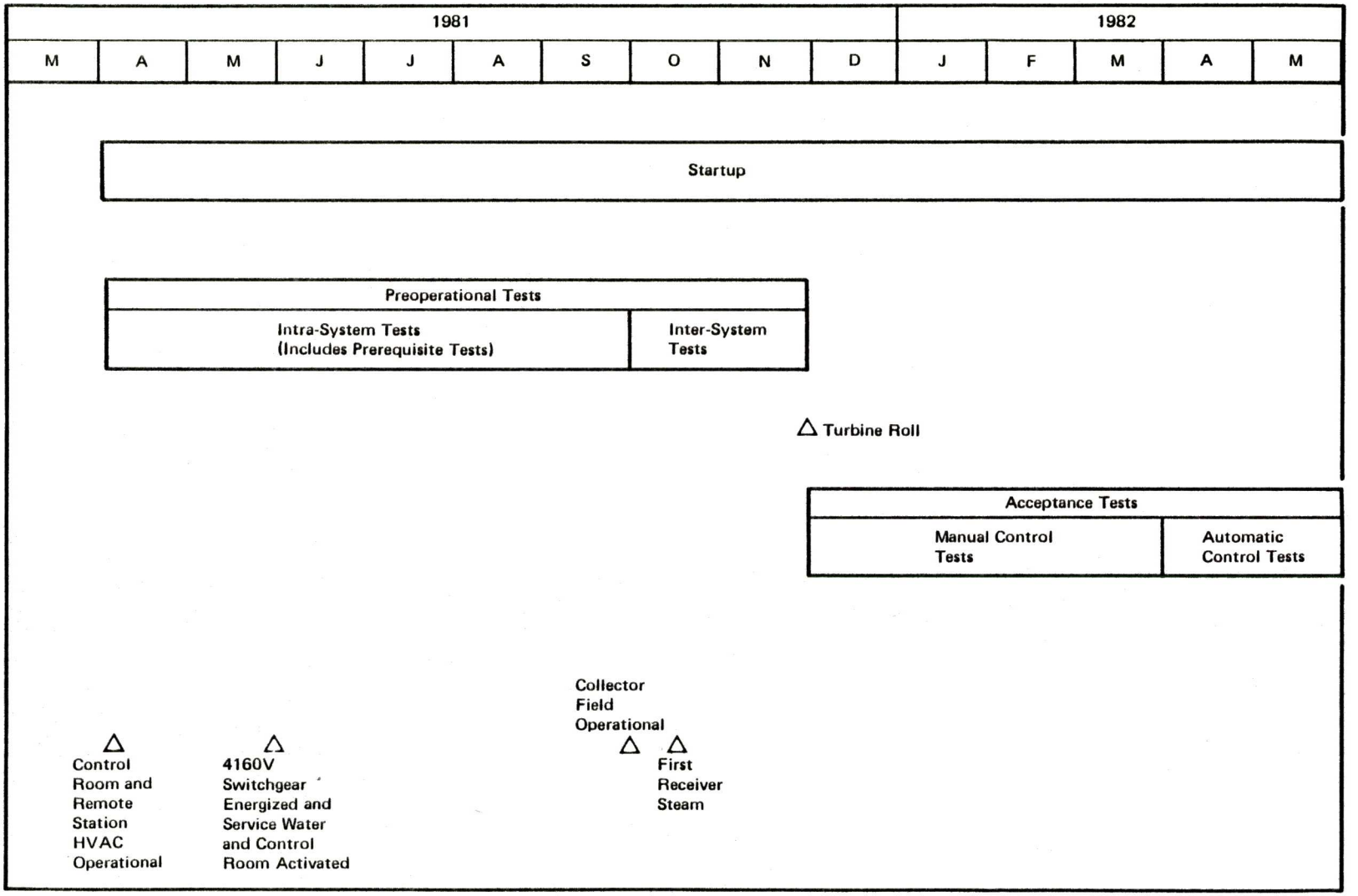


Figure 2-1. Solar One Startup Activities

The index of tests (procedures) to be conducted is shown in Table 2-1 (Preoperational Tests) and Table 2-2 (Plant Acceptance Tests) along with the organization responsible for the procedure preparation and the planned test implementation date. The indicated elements of the intra-system preoperational tests (test procedure numbers 000-980) correspond to unique plant systems which have been defined as a result of a plant "scoping" exercise. The number designators were assigned on the basis of the overall plant breakdown structure presented in Section 3.0, Figure 3-1. Related systems were then identified and combined into the common startup procedures listed in Table 2-1.

2.3 TEST SCHEDULE

The schedule for the individual tests has been developed in accordance with milestones and significant activities as defined by the Solar One Master Startup Schedule. The detailed startup test implementation schedule is shown in Figure 2-2 on an individual procedure basis (note that one procedure can include the startup activities of several related systems). The indicated test times encompass the total period of time required to complete the startup testing for all of the systems contained in that procedure. An expanded schedule of the startup tests as defined on an individual system basis is contained in Appendix A to this plan.

The test procedure development activities required as prerequisites to implementing the test program are also shown in Figure 2-2. For each of the procedures, it is assumed that a complete 1st draft will be available for review by the TWG at least 10 weeks prior to the scheduled implementation date. All reviews will be accomplished during the subsequent 6 week period, with final TWG review and approval scheduled for 4 weeks prior to the implementation date to permit publication and a familiarity review period by the test operations personnel.

Table 2-1. Preoperational Test Procedure Index

		Preparation Responsibility	Implementation Date
(Intra-System Tests)			
000	Receiver System	SFDI (Rocketdyne)	August 10, 1981
(001)	Preheat System		
(006)	Boiler System		
(011)	Receiver Flash Tank		
(016)	Receiver Vent and Drain		
(021)	Receiver GN_2 System		
100	Collector System		
(101)	Heliostat Readiness	Martin	August 10, 1981
(106)	Heliostat Array Controller (HAC)/Heliostat Field Controller (HFC) Interfaces		
(111)	Heliostat Array Controller (HAC) Initialization		
(116)	Heliostat Targeting Verification		
(118)	Functional Test		
150	Beam Characterization System	SFDI (MDAC)	June 5, 1981
(121)	Beam Characterization Target System		
(126)	Beam Characterization Camera System		
(311)	OSC/HAC/BCS Interface		
205	Thermal Storage Oil System	SFDI (Rocketdyne)	July 15, 1981
(201)	TS Tank System		
(206)	TS Tank External Piping System		
(231)	TS Charging Oil System		
(236)	Caloria Make-up System		
(241)	Ullage Maintenance System		
(246)	TS Extraction Oil System		

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
250	Thermal Storage Steam System (211) TS Charging Heat Exchanger System (216) TS Charging Steam System (221) TS Charging Heater Vent and Drain System (226) TS Flash Tank System (251) TS Extraction Heat Exchanger Vents, Blowdown and Drain System (256) TS Steam Generation System	SFDI (Rocketdyne)	July 25, 1981
305	System Distributed Process Controllers (SDPC) (301) System Distributed Process Control System (321) Data Acquisition System (Interface) (331) Data Acquisition Remote Multiplexing System (Interface) (345) Meteorological and Collector Field Data System (Interface)	SFDI (MDAC)	May 10, 1981
340	Operating Control System (303) System Distributed Process Controllers/OCS Interface (311) Operational Control System (321) Data Acquisition System and OCS Interface (250) Infrared Scanning System	SFDI (MDAC)	May 10, 1981
360	Heliostat Array Controller (114) Heliostat Array Controller (Control Room Interface) (311) Operating Control System/HAC Interface (321) Data Acquisition System/HAC Interface (345) Meteorological & Collector Field Data System (355) Receiver Trip/HAC Interface	SFDI (MDAC)	May 10, 1981
405	Main/Admission Steam System (401) Main Steam System (406) Steam Dump System (411) Admission Steam System	SFDI (S-R)	August 3, 1981

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
420	Miscellaneous Steam Systems (421) Auxiliary Steam System (426) Auxiliary Boiler System (431) Blanketing Steam System	SCE	July 15, 1981
505	Condensate (416) Turbine Extraction Steam System (526) Feedwater/Condensate Chemical Feed System (536) Condensate Drain System (541) Condensate System (546) Inline Polishing Demineralizer System (551) L.P. Heater Vent and Drain System (556) Condenser Vacuum System (919) Demineralizer Chemical Storage and Transfer System	SCE	August 1, 1981
550	Feedwater (501) Receiver Feedwater System (506) H.P. Feedwater Heater Vent and Drain System (511) Receiver Feed Pump Lube Oil System (516) Feed Pump Seal Water System (521) TS Feedwater System (531) Auxiliary Boiler/TS Feedwater System	SCE	August 5, 1981
600	Circulating Water (601) Circulating Water and Cooling Tower System (606) Cooling Tower Chemical Feed System (611) Cooling Tower Fan System	SCE	June 1, 1981
705	Turbine Generator - Mechanical Systems (701) Turbine Generator System (706) Turbine Gland Seal Steam System (711) Turbine Drains System	SCE	July 10, 1981

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
705	Turbine Generator - Mechanical Systems (Cont.) (716) Turbine Hydraulic Control System (721) Turbine Generator Lube Oil System (726) Turbine Generator Lube Oil Conditioning/Purifying System (731) Turbine Generator Lube Oil Transfer and Storage System		
750	Turbine Generator - Electrical and Control Systems (746) Generator Excitation and Voltage Regulation System (751) Generator Leads and Electrical System (761) Turbine Generator Control and Interlock System	SCE	August 10, 1981
805	Main/Auxiliary Power Transformers (801) Main Transformer System (806) Off-Site Power System (811) Auxiliary Power System (816) 4160 V Plant System	SCE	March 16, 1981
820	Collector Power (821) 4160 V Collector Field System (826) 208 V Collector Field System	SFDI (S-R)	April 1, 1981
830	Load Centers and MCC's (831) Station Service Transformer and 480 V Bus (836) Load Center "A" (841) Cooling Tower Transformer and Bus (846) Power Panel "A" (847) MCC "A" (848) MCC "B" (849) MCC "C" (850) MCC "L" (886) Construction Power System (889) Warehouse Power Panels	SCE	April 1, 1981

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
855	Low Voltage Systems (851) Plant Low Voltage System (853) RS Power Distribution System	SCE	June 15, 1981
860	DC and UPS (861) DC System (866) UPS System	SCE	March 15, 1981
871	Heat Tracing System	SFDI (S-R)	August 10, 1981
880	Grounding Systems (881) Grounding System (882) Equipment Grounding System (883) Instrument Grounding System (884) Collector Field Grounding System	(Startup accomplished during construction tests and as part of the startup of individual equipment and instrumentation.)	
901	Instrumentation and Service Air Systems (902) Service Air System (904) Instrument Air System	SCE	June 26, 1981
905	Nitrogen (266) TSS GN_2 System (776) Turbine Generator (906) GN_2 Supply System	SFDI (S-R)	July 20, 1981
910	Water Supply Systems (911) Raw and Service Water System (916) Demineralized Water System (917) Demineralized Water Tank System (918) Demineralized Water Transfer System (920) Demineralizer Area Chemical Safety System	SFDI (S-R)	May 15, 1981

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
930	Fire Protection		
	(261) TS Fire Protection System	(Startup accomplished during construction testing - See Appendix B)	
	(771) TG Fire Protection System		
	(931) Plant Fire Protection System		
	(932) Diesel Pump Fire Protection System		
	(933) Diesel Pump Fuel System		
	(934) Diesel Fire Pump and Diesel Engine		
940	Plant Drains and Sumps	SFDI (S-R)	June 1, 1981
	(941) Plant Drain System		
	(943) Maintenance Oil Sump System		
	(946) Oil Water Separator System		
951	Cooling Water System	SCE	July 27, 1981
956	Sampling System	SCE	September 10, 1981
960	Mechanical Support Systems		
	(961) Tower Elevator System	(Startup accomplished during construction testing - See Appendix B)	
	(962) Building Elevator System		
	(966) Tower Crane and Hoist System		
970	HVAC Systems		
	(971) HVAC (Control Room & RS4)	(Startup accomplished during construction testing - See Appendix B)	
	(972) HVAC (RS1)		
	(973) HVAC (RS 2 & 3)		
	(974) HVAC (RS 5)		
	(975) Miscellaneous HVAC Systems		
980	Flushing and Steam Blows	SFDI (S-R)	August 10, 1981
	(981) Temporary Steam Blowing System		
	(982) Temporary Chemical Cleaning System		
	(991) Temporary Velocity Flushing System		

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
(Inter-System Tests)			
1010	Receiver "Cold Flow" (Controls) Test	SFDI (MDAC)	October 1, 1981
(1010.1)	Receiver flash Tank Controlled GN_2 Pressurization Test		
(1010.2)	Feed Pump Low Pressure/Low Flow Test		
(1010.3)	Receiver Flash Tank Cold Flow Test		
(1010.4)	Receiver Flash Tank Level Valve Control "Tuning" Test		
(1010.5)	Receiver Fill and Vent Test		
(1010.6)	Panel Cold Flow Test		
(1010.7)	Receiver Drain and GN_2 Back-fill Test		
1020	Thermal Storage "Low Temperature" (Controls) Test (Energy Supplied by Rental Boiler)	SFDI (MDAC)	September 15, 1980
(1020.1)	Charging and Extraction Pump Controls Development Test		
(1020.2)	Oil Pump/Control Valve Open and Closed Loop Control Test (Charging and Extraction)		
(1020.3)	TS Feed Pump Operational Test		
(1020.4)	TS Surge Tank Pressure/Level Valve Open and Closed Loop Control		
(1020.5)	Steam Inlet Valve Open and Closed Loop Control Test		
(1020.6)	TS Flash Tank Level Valve Control "Tuning" Test		
(1020.7)	TS Flash Tank Drain Pump Control Test		
(1020.8)	TS Flash Tank Pressure Valve Control Test		
(1020.9)	Steam Generator Inlet Water Valve Control Test		
1030	Receiver Steam Generation (Controls) Test	SFDI (MDAC)	October 10, 1981
(1030.1)	Feed Pump Operational and Control Test		
(1030.2)	Collector STANDBY/TRACK Verification Test		
(1030.3)	Receiver Incident Flux Verification Test		

Table 2-1. Preoperational Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1030	Receiver Steam Generation (Controls) Test (Cont.)		
	(1030.4) Collector System Trip Test		
	(1030.5) Collector System "Loss of Power" Test		
	(1030.6) Receiver Flash Tank Pressure Valve Open and Closed Loop Test		
	(1030.7) Receiver Moisture Separator Verification Test		
	(1030.8) Receiver Panel Control Valve Open and Closed Loop Test		
	(1030.9) Steam Dump/Desuperheater Open and Closed Loop Test		
	(1030.10) Steam Line Warmup and Condensate Drain Test		
1040	Thermal Storage Charging and Extraction (Controls) Test (Energy Supplied by Receiver Steam)	SFDI (MDAC)	November 10, 1981
	(1040.1) TS Desuperheater Open and Closed Loop Control Test		
	(1040.2) Oil Pump/Control Valve Open and Closed Loop Test (Charging and Extraction)		
	(1040.3) TS Surge Tank Pressure/Level Valve Open and Closed Loop Control Test		
	(1040.4) TS Charging Loop Trip Test		
	(1040.5) Steam Generator Inlet Water Valve Control Test		
	(1040.6) TSU Top and Bottom Manifold Performance Test		
	(1040.7) Ullage Maintenance/GN_2 Inerting System Test		

Table 2-2. Acceptance Test Procedure Index

			Preparation Responsibility	Implementation Date
1100	Manual Operation		SFDI (MDAC)	December 1, 1981
	1105	Preliminary Acceptance Tests o Mode 1 o Mode 5 o Mode 6 o Mode 3 o Mode 4 o Mode 7 } Preliminary Demonstration/Trouble Shooting Tests (Conducted Prior to Formal Acceptance Tests).		
	1110	Mode 1 - Turbine Direct	SFDI (MDAC)	January 1, 1982
		(1110.1) Plant (turbine) Startup to Mode 1 Operation		
		(1110.2) Low Power Stability Test		
		(1110.3) High Power Stability Test		
		(1110.4) 10 MWe Performance Test		
		(1110.5) Low-to-High and High-to-Low Power Transition Stability Test		
		(1110.6) Turbine Trip Test		
		(1110.7) Receiver Trip Test		
		(1110.8) Plant Transition to Shutdown Test		
		(1110.9) Cloud Passage Operational Test (Optional)		
	1120	Mode 2 - Turbine Direct and Charging	SFDI (MDAC)	January 26, 1982
		(1120.1) Mode 1 ↔ Mode 2 Transition Test (Startup/ Shutdown TS Charging Loop)		
		(1120.2) Mode 5 ↔ Mode 2 Transition Test (Startup/ Shutdown Turbine)		
		(1120.3) Low Power/Flow Stability Tests (Sun Following/ Load Following)		
		(1120.4) High Power/Flow Stability Tests (Sun Following/ Load Following)		
		(1120.5) Low-to-High and High-to-Low Power Transition Stability Tests (Sun Following/Load Following)		

Table 2-2. Acceptance Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1120	Mode 2 - Turbine Direct and Charging (Cont.)		
	(1120.6) Sun Following ↔ Load Following Control Strategy Transition Tests		
	(1120.7) Turbine Trip Transition to Mode 5 Test		
	(1120.8) TS Charge Loop Trip Transition to Mode 1 Test		
	(1120.9) Maximum "Turndown" Operational Test (Optional)		
	(1120.10) Cloud Passage Operational Test (Optional)		
1130	Mode 3 - Storage Boosted	SFDI (MDAC)	February 26, 1982
	(1130.1) Mode 1 ↔ Mode 3 Transition Test (Startup/ Shutdown TS Extraction Loop)		
	(1130.2) Mode 6 ↔ Mode 3 Transition Test (Startup/ Shutdown Receiver and Turbine Main Steam Piping)		
	(1130.3) Low Power/Flow Stability Tests (Sun Following/ Load Following)		
	(1130.4) High Power/Flow Stability Tests (Sun Following/ Load Following)		
	(1130.5) Low-to-High and High-to-Low Power Transition Stability Tests (Sun Following/Load Following)		
	(1130.6) Sun Following ↔ Load Following Control Stability Transition Tests		
	(1130.7) TS Extraction Loop or Turbine Admission Valve Trip Transition to Mode 1 Test		
	(1130.8) Receiver or Turbine Main Steam Valve Trip Transition to Mode 5 Test		
	(1130.9) Maximum "Turndown" Operational Test (Optional)		
	(1130.10) Cloud Passage Operational Test (Optional)		
1140	Mode 4 - In-Line Flow	SFDI (MDAC)	February 10, 1982
	(1140.1) Mode 5 ↔ Mode 4 Transition Test (Startup/ Shutdown TS Extraction Loop and Turbine Admission Steam Piping)		

Table 2-2. Acceptance Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1140	Mode 4 - In-Line Flow (Cont.)		
	(1140.2) Mode 6 ↔ Mode 4 Transition Test (Startup/ Shutdown Receiver and TS Charging Loop)		
	(1140.3) Low Power/Flow Stability Tests (Derated/ Rated Steam Conditions)		
	(1140.4) High Power/Flow Stability Tests (Derated/ Rated Steam Conditions)		
	(1140.5) Low-to-High and High-to-Low Power Transition Stability Tests (Derated/Rated Steam Conditions)		
	(1140.6) TS Extraction Loop or Turbine Admission Valve Trip Transition to Mode 5 Test		
	(1140.7) Receiver or TS Charging Loop Trip Transition to Mode 6 Test		
	(1140.8) Cloud Passage Operational Test (Optional)		
1150	Mode 5 - Charging Only	SFDI (MDAC)	January 15, 1982
	(1150.1) Plant (TS Charge Loop) Startup to Mode 5 Operation		
	(1150.2) Low Power Stability Tests (Derated/Rated Steam Conditions)		
	(1150.3) High Power Stability Tests (Derated/Rated Steam Conditions)		
	(1150.4) 10 MWe Equivalent Thermal Storage Charge Rate Performance Test		
	(1150.5) Low-to-High and High-to-Low Power Transition Stability Tests (Derated/Rated Steam Conditions)		
	(1150.6) TS Charging Loop Trip Transition to Steam Dump Operations Test		
	(1150.7) Receiver Trip Transition to Shutdown Test		
	(1150.8) Normal Plant Transition to Shutdown Test		
	(1150.9) Cloud Passage Operational Test (Optional)		

Table 2-2. Acceptance Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1160	Mode 6 - Storage Discharging	SFDI (MDAC)	January 15, 1982
(1160.1)	Plant (Turbine Startup from Admission Steam) Startup to Mode 6 Operation		
(1160.2)	Low Power Stability Test		
(1160.3)	High Power Stability Test		
(1160.4)	7 MWe for 4 Hours Performance Test		
(1160.5)	Low-to-High and High-to-Low Power Transition Stability Tests		
(1160.6)	TS Extraction Loop or Turbine Admission Steam Valve Trip Transition Test		
(1160.7)	Normal Plant Transition to Shutdown		
(1160.8)	Maximum "Turndown" Operational Test (Optional)		
1170	Mode 7 - Dual Flow	SFDI (MDAC)	March 10, 1982
(1170.1)	Mode 2 ↔ Mode 7 Transition Test (Startup/ Shutdown TS Extraction Loop and Admission Steam System)		
(1170.2)	Mode 3 ↔ Mode 7 Transition Test (Startup/ Shutdown TS Charging Loop)		
(1170.3)	Mode 4 ↔ Mode 7 Transition Test (Startup/ Shutdown Turbine Main Steam System)		
(1170.4)	Low Power/Flow Stability Tests		
(1170.5)	High Power/Flow Stability Tests		
(1170.6)	Low-to-High and High-to-Low Power Transition Stability Tests		
(1170.7)	TS Extraction Loop or Turbine Admission Valve Trip Transition to Mode 2 Test		
(1170.8)	TS Charging Loop Trip Transition to Mode 3 Test		
(1170.9)	Turbine Main Steam Valve Trip Transition to Mode 4 Test		
(1170.10)	Receiver Trip Transition to Mode 6 Test		
(1170.11)	Plant Parasitic Power Test (Optional)		

Table 2-2. Acceptance Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1180	Mode 8 - Inactive	SFDI (MDAC)	October 1, 1981
(1180.1)	TS Blanket Steam Generation Test		
(1180.2)	Auxiliary Electric Boiler Blanket Steam Generation Test		
(1180.3)	Deaerator "Pegging" During Condensate Cleanup Test		
(1180.4)	Plant Blanketing Test		
(1180.5)	Water Chemistry Degradation During Nighttime Shutdown Test (Optional)		
1200	OCS Controlled Operation	SFDI (MDAC)	April 1, 1982
1210	Cascade Plant Control and Plant Transitions		
(1210.1)	Mode 1 Stability Test		
(1210.2)	Mode 1 Trip Transition Tests (2)		
(1210.3)	Mode 1 to Mode 2 Automatic and Manual Transition Tests		
(1210.4)	Mode 2 Stability Test		
(1210.5)	Mode 2 to Mode 1 Automatic and Manual Transition Tests		
(1210.6)	Mode 2 to Mode 5 Manual Transition Tests		
(1210.7)	Mode 2 Trip Transition Tests (3)		
(1210.8)	Mode 3 Stability Test		
(1210.9)	Mode 1 to Mode 3 Automatic and Manual Transition Tests		
(1210.10)	Mode 3 to Mode 1 Automatic and Manual Transition Tests		
(1210.11)	Mode 3 to Mode 6 Automatic and Manual Transition Tests		
(1210.12)	Mode 3 Trip Transition Tests (4)		
(1210.13)	Mode 4 Stability Test		
(1210.14)	Mode 4 to Mode 5 Manual Transition Test		
(1210.15)	Mode 4 to Mode 6 Manual Transition Test		

Table 2-2. Acceptance Test Procedure Index (Continued)

		Preparation Responsibility	Implementation Date
1210	Cascade Plant Control and Plant Transitions (Cont.)		
	(1210.16) Mode 4 Trip Transition Tests (4)		
	(1210.17) Mode 5 Stability Test		
	(1210.18) Mode 5 Trip Transition Tests (2)		
	(1210.19) Mode 6 Stability Test		
	(1210.20) Mode 6 Trip Transition Tests (2)		
1220	Coordinated Control and Plant Transitions	SFDI (MDAC)	April 4, 1982
	(1220.1) Mode 2 Coordinated Control Stability Test		
	(1220.2) Mode 2 Cascade ↔ Coordinated Control Strategy Transition Tests		
	(1220.3) Mode 2 Trip Transition Tests (3)		
	(1220.4) Mode 3 Coordinated Control Stability Test		
	(1220.5) Mode 3 Cascade ↔ Coordinated Control Strategy Transition Tests		
	(1220.6) Mode 3 Trip Transition Tests (4)		
1230	Clear Day Scenario	SFDI (MDAC)	May 6, 1982

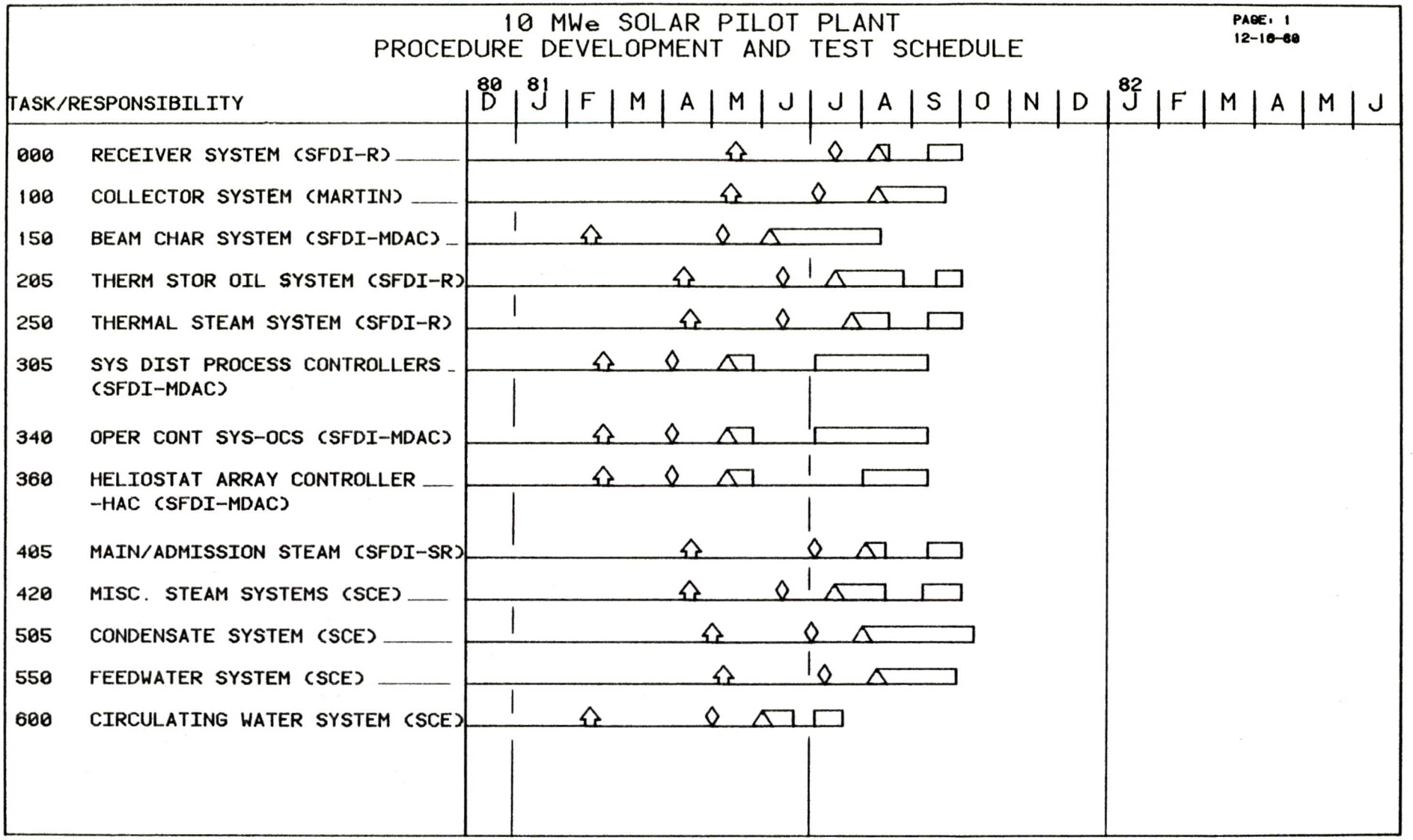
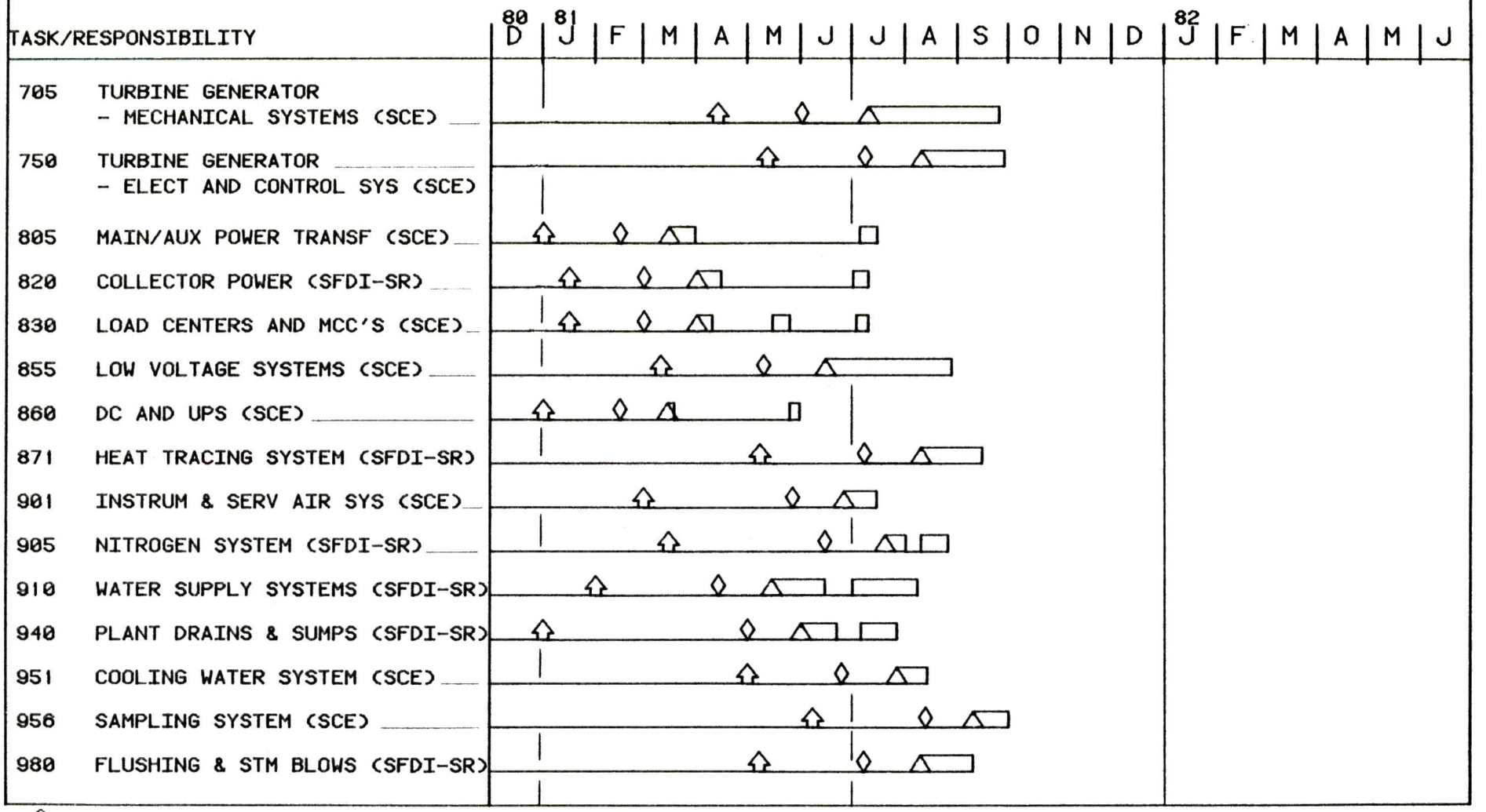


Figure 2-2 (1 of 4)

10 MWe SOLAR PILOT PLANT
PROCEDURE DEVELOPMENT AND TEST SCHEDULE



⇧ – SUGGESTED FIRST DRAFT DATE
◇ – TWG FINAL REVIEW
△ – IMPLEMENTATION OF PROCEDURE
▭ – TESTS

REVISION 2

Figure 2-2 (2 of 4)

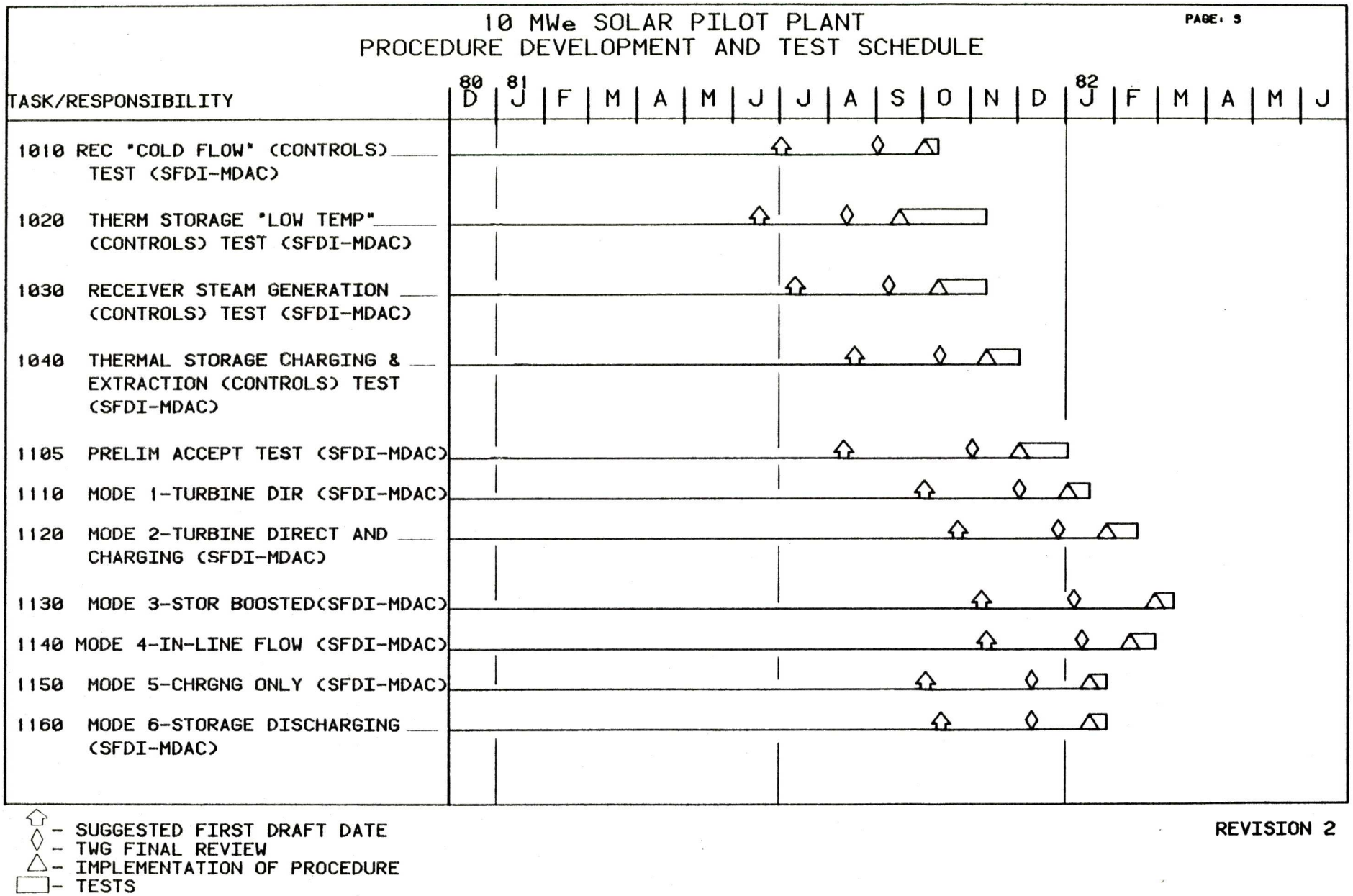
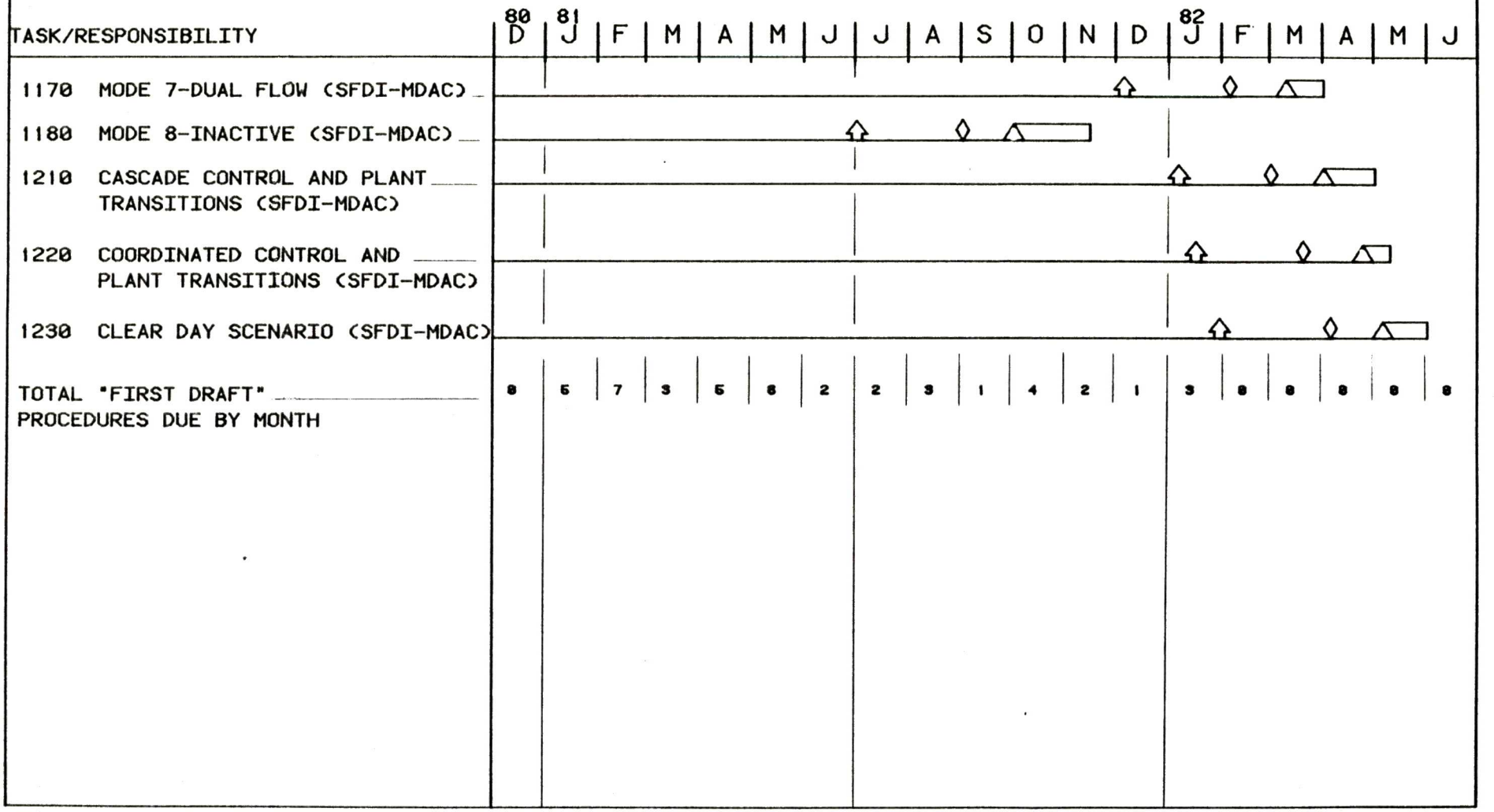


Figure 2-2 (3 of 4)

10 MWe SOLAR PILOT PLANT
PROCEDURE DEVELOPMENT AND TEST SCHEDULE



△ - SUGGESTED FIRST DRAFT DATE
◇ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE
▭ - TESTS

REVISION 2

Figure 2-2 (4 of 4)

2.4 TEST SUMMARY

It is the purpose of this section to present in summary fashion the activities related to the preoperational and acceptance tests. Detailed discussions of the individual tests are contained in Section 4 of this plan. In Appendix B, a summary of startup-related construction tests is presented.

2.4.1 Preoperational Tests

Preoperational tests commence upon completion of construction and culminate in turbine roll and will demonstrate the operability of the various plant systems. Special tests have been defined during the latter portion of the preoperational tests (inter-system tests) that treat the initial operation of the solar unique equipment and related control system issues.

The intra-system portion of the preoperational tests are the first tests carried out subsequent to release from construction. Prior to demonstrating the operability of the system under test, selected prerequisite tests will be conducted. Examples of these prerequisite tests are:

Mechanical

- Hydrostatic Tests
- Leak Tests
- Hanger Set (Hot and Cold)
- Alignment Checks
- Rotation Tests
- Lubrication Checks
- Operational Readiness

Electrical

- Insulation Resistance Tests (Cables, Motors, Generators)
- Continuity
- Operational Readiness

Instrumentation and Control

- Wiring Checks
- Functional Checkout
- Software Verification
- Operational Readiness

The extent to which prerequisite tests will be carried out on any one system will depend on the criticality and value of particular elements within

the system. For example, motor rotation and alignment prerequisite tests for the receiver feed pump (750HP) will be substantially greater than the corresponding activities involving a fractional horsepower chemical feed pump.

The specific prerequisite tests will be defined explicitly in each test procedure as attachments to the main procedure. Standard prerequisite test procedures (step-by-step activities) will be used wherever possible to prevent unnecessary duplication. Attachments to the preoperational procedures will contain specific forms and check lists to be applied to the particular equipment being tested.

Upon completion of the required prerequisite tests, the preoperational test will be carried out in accordance with the procedure. The preoperational test is designed to verify as completely as possible (subject to restrictions of the availability of other systems and limited operating environments) that the system operates as designed. Typical functions to be verified include:

- equipment startup and shutdown
- normal equipment operating functions (including interlocks)
- emergency equipment operating functions
- failure status (fail open/fail closed)
- instrumentation sensing, control, and display functions
- alarming functions
- tripping functions
- system control parameters
- selected system capacities, i.e., pump capacities

Upon completion of the intra-system procedures identified in this plan, all secondary systems (those not associated with the primary process) will be operational. Primary process systems such as the receiver, thermal storage, feedwater, condensate, main/admission steam systems, etc., will be functionally ready for operation at actual process design conditions. The control systems for these primary systems will not yet be adjusted and "tuned" for actual plant operations. In addition, all systems tested will be demonstrated to be safe from both a personnel and equipment damage standpoint.

The inter-system preoperational tests have been designed to demonstrate satisfactory operation of the primary process systems and to provide the

necessary data required for control system settings and adjustments prior to rolling the turbine and entering the acceptance period of the test program. This series of tests will be the first time that actual plant steaming operation is performed and verified.

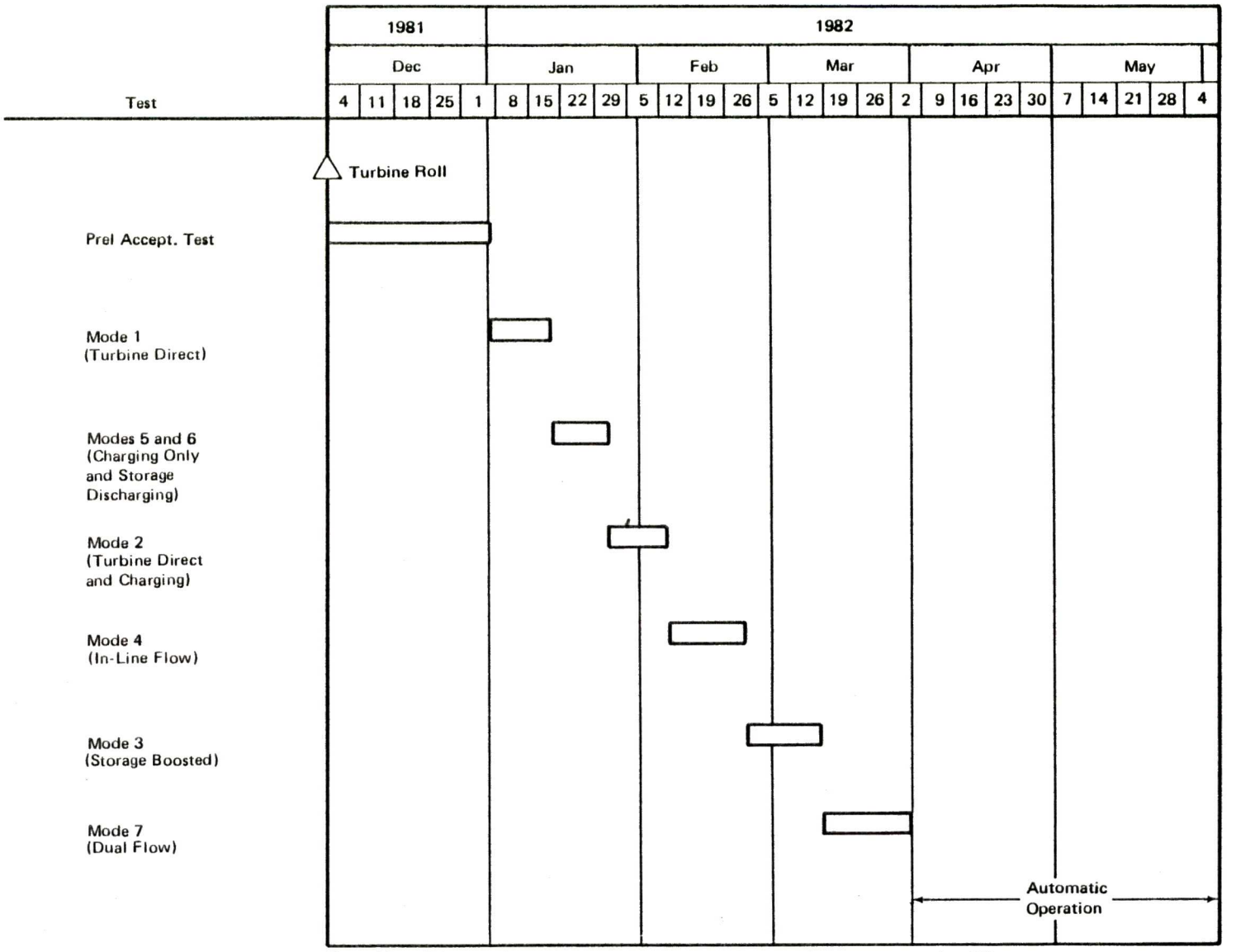
Inter-systems tests will be initiated with individual functional tests of the receiver and thermal storage systems followed by integrated collector/receiver tests and integrated solar system tests. Primary objectives of the inter-system tests will be to verify and adjust all flow control equipment and to checkout collector/receiver/thermal storage interactions. A rental boiler will be used to aid in the conditioning and initial control development tests for the thermal storage system.

Due to the development nature of this testing, particularly as it applies to the receiver control system, extensive use of the steam dump system will be made during this test period to protect the rest of the system from undesirable or damaging transient conditions. These tests will continue until a reliable and safe steam source is available per the test acceptance criteria which can then be used for turbine roll.

The test plan as presented in this document permits turbine roll from either receiver or thermal storage generated steam. As a baseline for planning purposes, this plan assumes that the turbine roll will occur from receiver steam since this path requires fewer components to satisfactorily complete the preoperational startup tests. As the inter-system tests are being conducted, an evaluation of the test results by the TWG will be performed to verify this baseline test sequence or to select thermal storage as the source of steam for initial turbine roll.

2.4.2 Acceptance Tests

Acceptance tests begin with turbine roll and are completed with the execution of the "Clear Day" operating scenario under automatic control. The initial 4 months of the 6 month acceptance test period will be devoted to plant acceptance under manual control as shown in Figure 2-3. This activity will be initiated with a preliminary acceptance test followed by manual operation within each of the required operating modes.



Note: Mode 8 (Inactive) will be demonstrated during the Inter-System Preoperational Tests.

Figure 2-3. Post Turbine Roll Startup Schedule — Manual Control Acceptance Tests

The preliminary acceptance test (during the first month) will check plant operation in the required operating modes on a "quick look" basis to verify the operational readiness of all equipment and control systems. This test has been included to provide an early indication of potential problem areas that may be experienced during subsequent mode-by-mode acceptance testing. With the insight gained from this test, changes to the hardware, software, and/or operating procedures can be implemented early in the formal acceptance tests thereby minimizing the generation of questionable data.

The acceptance tests (manual operation) will verify plant operation in each of the 7 active plant operating modes. The sequence of tests will start with the simplest operating modes (on the basis of number of operating loops) and proceed to the more complex modes. Testing within each operating mode will include the following functions:

- Operate at selected "steady state" points within each mode
- Demonstrate selected performance "design" points
- Transition between "steady state" operating points
- Transition into and out of test operating modes
- Transition between control strategies within appropriate operating modes
- Demonstrate operation during cloud passage (optional tests designed for gathering basic plant operating data)
- Demonstrate plant startup and shutdown as appropriate
- Demonstrate system and plant trips

Satisfactory completion of testing within each of the operating modes will be based on satisfying the acceptance criteria contained in the procedure or as determined by the TWG based on (1) the acceptance criteria contained in the procedure or (2) on overall considerations of the test plan and schedule. Because of uncertainties associated with weather conditions, significant flexibility will be exercised during this test period. Day to day decisions regarding the execution of this phase of testing will be made by the TWG.

Upon completion of the manual portion of the acceptance tests, a two month period will be devoted to demonstrating automatically controlled plant

operation as shown in Figure 2-4. The three major activities during this period will be to:

- Demonstrate controlled operation (through OCS) in five operating modes.
- Demonstrate operation through twelve OCS-controlled transitions.
- Demonstrate the automatic execution of the "clear day" operating scenario.

The specific operating modes and transitions to be evaluated are shown in Figure 2-5. All of the transitions indicated are initiated through the OCS computer in either a manual (M) or automatic (A) fashion. The mode sequence to be automatically executed during the "clear day" operating scenario is shown in Figure 2-6.

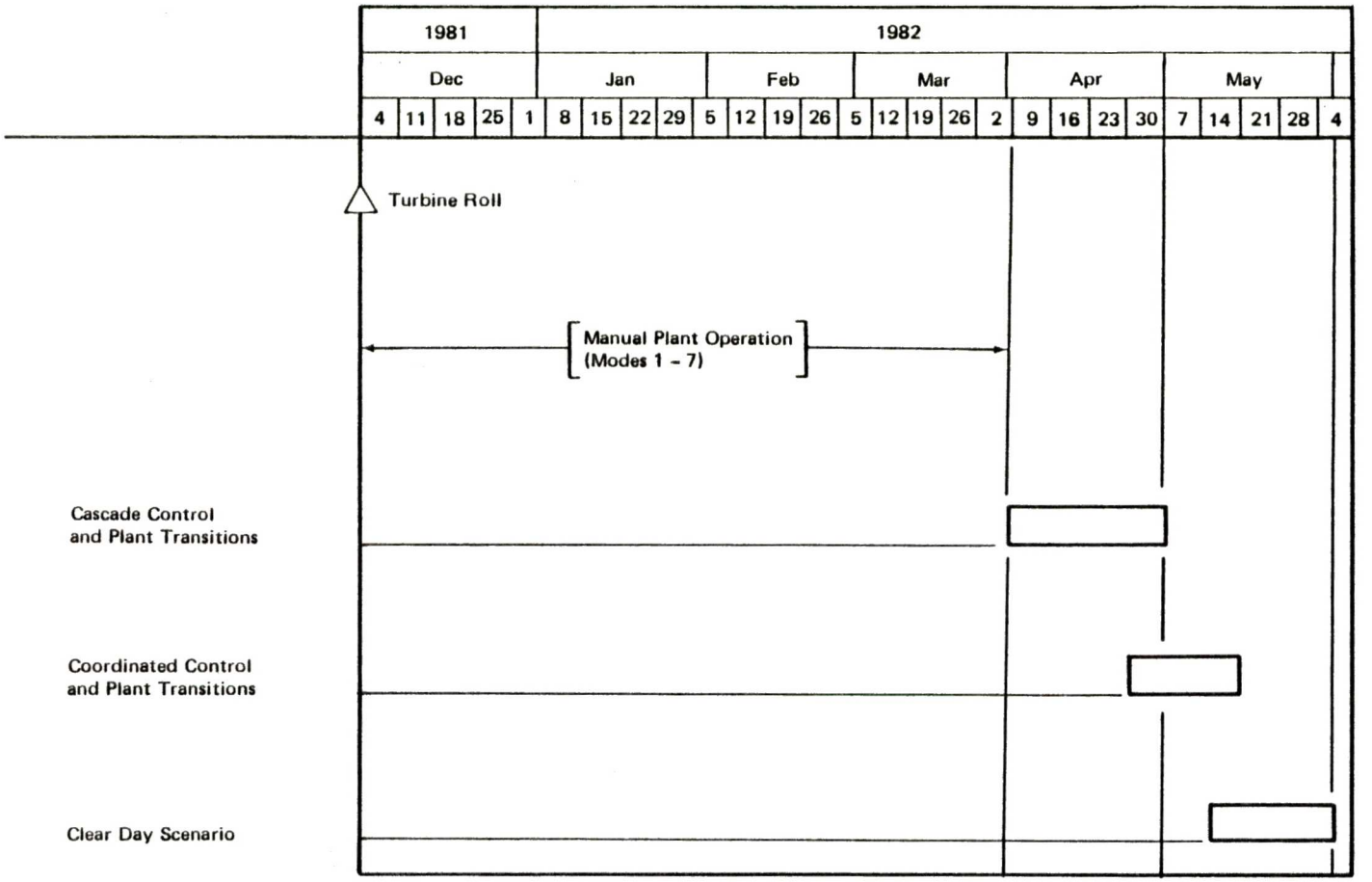


Figure 2-4. Post Turbine Roll Startup Schedule – Automatic Control Acceptance Tests

From Mode \ To Mode	1	2	2CO	3	3CO	4	5	6	7	8
1	–	A M		A M						
2	A M	–	M				M			
2CO		M	–							
3	A M			–	M			A M		
3CO				M	–					
4						–	M	M		
5							–			
6								–		
7									–	
8										–

A Automatic Detection and Transition
M Manually Initiated OCS Transition

Figure 2-5. Required Transitions Controlled Through the Operational Control System (OCS)

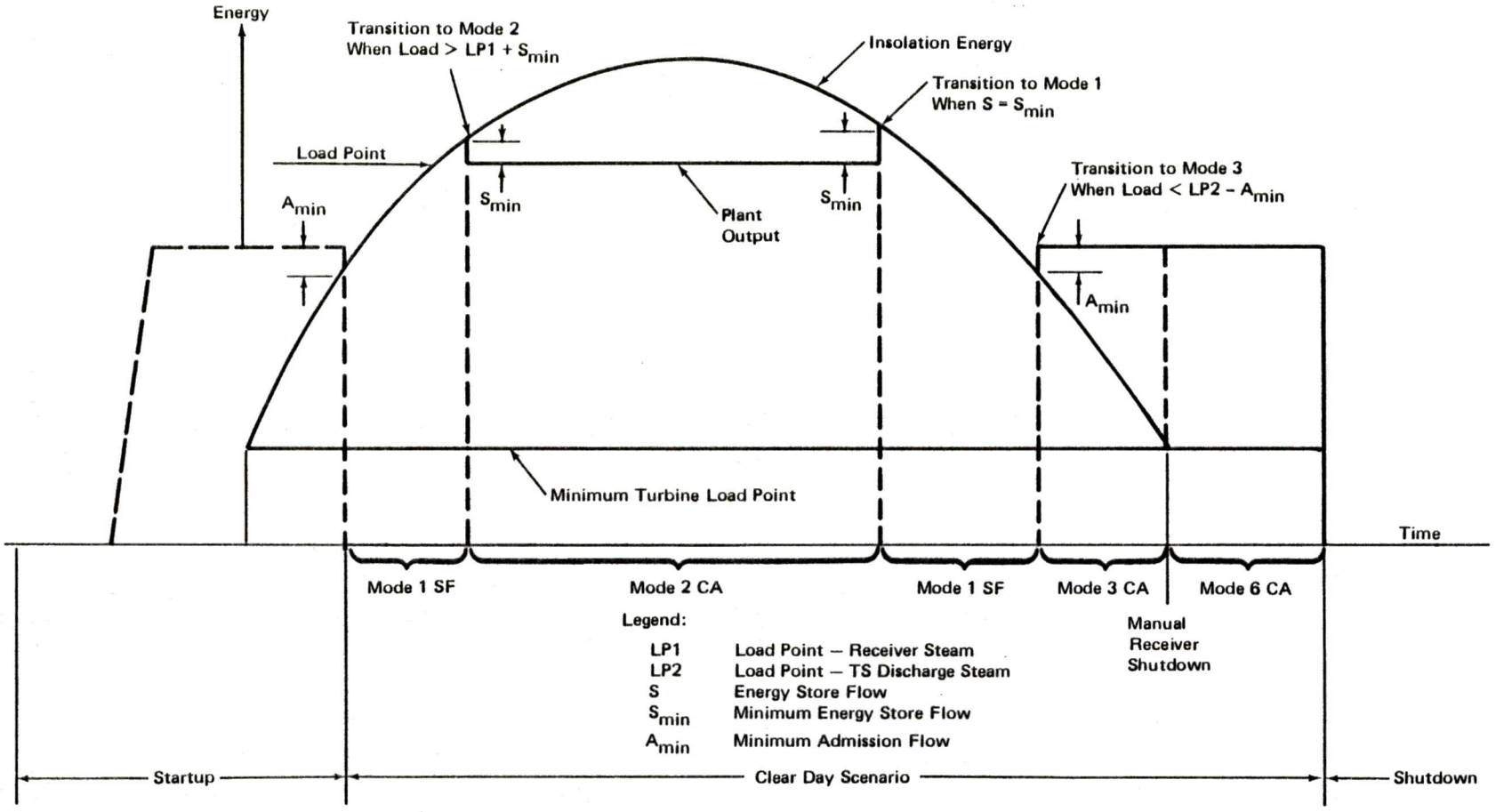


Figure 2-6. Clear-Day Scenario

Section 3
SYSTEM BREAKDOWN STRUCTURE

The overall pilot plant system breakdown structure is presented in Figure 3-1. Detailed descriptions of each of the designated systems are contained in the Pilot Plant System Description document (RADL Item 2-1).

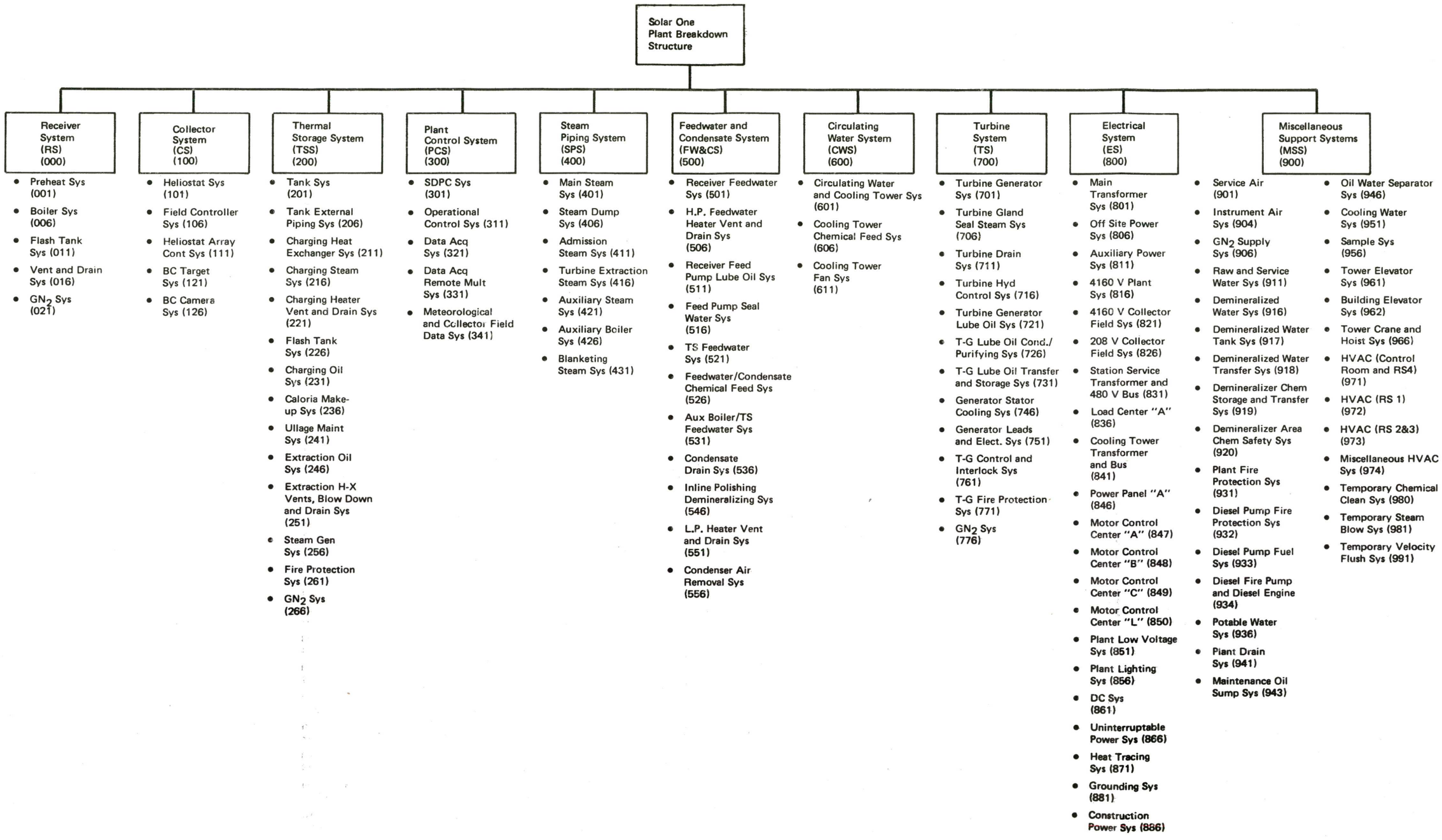


Figure 3-1. Plant Breakdown Structure

Section 4
PREOPERATIONAL AND ACCEPTANCE TEST SPECIFICATIONS

The purpose of this section is to describe the test objectives associated with each test as defined in the Test Procedure Index (Tables 2-1 and 2-2). These objectives serve as the basis for the development of detailed test definitions and procedures. It is the intent of these tests to demonstrate the operational readiness of the plant.

This section is divided into four subsections, each assigned to a specific test sequence (test number grouping).

4.1 - Intra-System Preoperational Tests (Test Numbers 000-980)
4.2 - Inter-System Preoperational Tests (Test Numbers 1010-1040)
4.3 - Manual Control Acceptance Tests (Test Numbers 1105-1180)
4.4 - Automatic Control Acceptance Tests (Test Numbers 1210-1230)

For reference purposes, the test descriptions are organized in ascending numerical order which does not necessarily correspond to the intended time sequence of tests (see Figure 2-2).

4.1 INTRA-SYSTEM PREOPERATIONAL TESTS

Intra-system preoperational tests are designed to demonstrate the basic operability of the equipment associated with each plant system. The tests are time phased to allow for an orderly progression of startup testing through all plant elements with consideration being given to necessary prerequisite testing.

Test data to be recorded during these tests will be limited to entries made in the test procedure in compliance with the test requirement and data archived on selected logging and recording equipment. Since the DAS system will be undergoing startup testing during this period, no data gathering and archiving will be carried out with the DAS equipment. The DAS system however will be functioning as an integral part of subsequent preoperational (inter-system) tests and plant acceptance tests.

TEST SPECIFICATION

TEST NUMBER 000 DATE 10-2-80

TEST TITLE RECEIVER SYSTEM REVISION NO. 0

PAGE 1 of 2

Note: This test will address startup issues required as a precursor to the flush and steam blow operations as well as other objectives that can be demonstrated with a dry receiver. The subsequent Receiver "Cold Flow" Test (1010) and the Thermal Storage "Low Temperature" Test (1020) will address objectives required to demonstrate actual receiver operations.

1.0 Objectives

1.1 Demonstrate manual (keyboard) operation of the receiver water inlet valve (AOV-2004) along with related interlock and RLU functions.

1.2 Demonstrate the operation of all (18) boiler water inlet control valves TV-2301---TV-2803.

1.3 Demonstrate the manual operation of the steam downcomer inlet valve UV-2905 through the SDPC hand switch function along with related interlock and RLU functions (ILS and RLU functions shall be verified based on simulated sensor inputs).

1.4 Demonstrate all RLU generated receiver trips.

1.5 Demonstrate that all powered valves fail to their design position upon loss of power.

1.6 Demonstrate the manual hand switch operation and related ILS and RLU functions for the following flash tank inlet valves:

(a) AOV-2901
(b) AOV-2911
(c) PV-2002

1.7 Demonstrate the interlocked operation of bleed orifice isolation valves AOV-2914 and AOV-2915.

1.8 Demonstrate the functional operation of the following flash tank control valves (including appropriate ILS and RLU functions):

(a) PV-2906
(b) PV-1000
(c) FV-1007
(d) PV-647B
(e) LV-74A
(f) LV-74C

TEST SPECIFICATION

TEST NUMBER 000 DATE 10-2-80

TEST TITLE RECEIVER SYSTEM REVISION NO. 0

1.9 Demonstrate the hand switch operation of the receiver vent valves (AOV-2007, AOV-2902, and AOV-2903) along with appropriate interlock and RLU functions.

1.10 Test operate and verify set points of the following safety valves:

(a) PSV-2021
(b) PSV-2022
(c) PSV-2023
(d) PSV-2909
(e) PSV-2910
(f) PSV-2912

1.11 Demonstrate the hand switch operation of the receiver panel drain valves (24) along with appropriate interlock functions.

1.12 Demonstrate that the GN_2 system is capable of delivering high pressure nitrogen to the flash tank at the design pressure.

1.13 Demonstrate that the GN_2 system is capable of delivering low pressure nitrogen to the receiver system at the design pressure.

1.14 Demonstrate the hand switch and interlock functions associated with the GN_2 system isolation valves (SOV-2016A and SOV-2019A) and vent valves (SOV-2016B and SOV-2019B).

1.15 Verify all receiver system SDPC display and alarm functions.

1.16 Verify all receiver system DAS functions.

TEST SPECIFICATION

TEST NUMBER 100 DATE 11-24-80

TEST TITLE COLLECTOR SYSTEM REVISION NO. 0

Note: This test demonstrates all collector system functions except those that require the receiver to be illuminated with reflected sunlight (included as part of test No. 1020) and interfaces between the HAC and other plant computers (included as part of test No. 360). The actual procedures for this test are the responsibility of Martin Marietta Co and will be developed per the following organization:

Procedure Number	
40 0 500 29 0	Master Control Procedure, Heliostat Installation and Checkout
40 0 500 21 0	Manual Control Box and HAC/Heliostat Checkout Tests
40 0 500 30 0	Heliostat Checkout with Simulator
40 0 500 22 0	Canting Verification
40 0 500 26 0	Encoder Bias Measurement
40 0 500 28 0	Encoder Bias Measurement System Verification
40 0 500 37 0	Functional Test Procedure

Additional procedures will be developed which address functions defined in the CS-MCS and CS-Plant Interface Requirements Document (RADL 2-30-1) which are not explicitly contained in the above procedures.

1.0 Objectives

1.1 Demonstrate proper heliostat movement, speed, and the operation of heliostat limit switches in response to position commands issued by the manual control box.

1.2 Demonstrate proper heliostat movement, speed, and the operation of heliostat limit switches in response to position commands issued by the HAC.

1.3 Demonstrate proper heliostat movement, speed, and the operation of heliostat limit switches in response to position commands issued by the simulator (not required if objectives 1.1 and 1.2 have been satisfied.

1.4 Demonstrate that canting of individual heliostat panels is as designed.

1.5 Demonstrate that heliostat encoder bias can be determined using the encoder bias measurement system (EBMS) and loaded into the heliostat controller.

1.6 Verify and/or update the encoder bias data for each heliostat using the BCS.

1.7 Verify that special standby and track coordinates (away from the actual receiver) are operational in the HAC and HFC's.

1.8 Demonstrate the proper heliostat and display response to the following commands (selectively demonstrate by heliostat, arc, segment, ring, wedge, field controller, entire field as appropriate).

1.8.1	STOW	(USE SPECIAL STANDBY POINT)
1.8.2	ALT1STOW	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.3	ALT2STOW	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.4	UNSTOW	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.5	STANDBY	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.6	TRACK	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.7	DECREASE	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.8	INCREASE	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.9	DEFOCUS	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.10	STHIWIND	(USE SPECIAL TRACK AND STANDBY POINTS)
1.8.11	WASH	
1.8.12	BCSTRACK	(USE SPECIAL STANDBY POINT)
1.8.13	RETURN	(USE SPECIAL STANDBY POINT)
1.8.14	POSITION	
1.8.15	SAVE/RESTORE	
1.8.16	OFFLINE	
1.8.17	ONLINE	
1.8.18	HOLD	
1.8.19	RLHIWIND	
1.8.20	DEFRLSE	
1.8.21	AIMPOINT	
1.8.22	RELWASH	
1.8.23	MARK	
1.8.24	STATUS	
1.8.25	ESTANDBY	(USE SPECIAL TRACK AND STANDBY POINT)
1.8.26	ESTOW	(USE SPECIAL TRACK AND STANDBY POINT)

1.9 Demonstrate proper operation of collector system alarming and logging functions.

TEST SPECIFICATION

TEST NUMBER 100 DATE 11-24-80

TEST TITLE COLLECTOR SYSTEM REVISION NO. 0

1.10 Demonstrate proper operation of the heliostat beam exclusion function.

1.11 Demonstrate the ability of the HAC to store commands and issue them as specified times.

TEST SPECIFICATION

TEST NUMBER 150 DATE 11-19-80

TEST TITLE BEAM CHARACTERIZATION SYSTEM REVISION NO. 0

Note: The System Integration Laboratory (SIL) test program (Reference RADL Item 6-4) carried out prior to this test has demonstrated the data gathering, software, display, and most of the communication functions of the BCS. This test will selectively reverify test results obtained during the SIL program and then verify site unique elements of the BCS system.

1.0 Objectives

1.1 Demonstrate the local handswitch operation of the BCS fluid receiver pump P-201.

1.2 Demonstrate the functional operation of the temperature control valve TV-1418.

1.3 Demonstrate the coolant fluid high temperature alarm function (TAH-1418).

1.4 Demonstrate the functional operation of the BCS cooling system fans.

1.5 Demonstrate the automatic operation of the target shutters by activating solenoid valves SOV-1410, SOV-1411, SOV-1412, and SOV-1413.

1.6 Demonstrate proper operation of the target pyroheliometers (YT-1414 A-D, YT-1415 A-D, YT-1416 A-D, and YT-1417 A-D).

1.7 Demonstrate the validity of the SIL tests (selected retest of hardware and software).

1.8 Demonstrate the proper operation of the 4 BCS cameras (BCS-901A, BCS-902A, BCS-903A, and BCS-904A) and supporting equipment.

1.9 Demonstrate the capability of the BCS to accurately locate the centroid from a reference (calibration) light source.

1.10 Demonstrate the proper operation of the theoretical beam power algorithm based on actual measured conditions.

1.11 Demonstrate proper operation of the camera switcher unit.

TEST SPECIFICATION

TEST NUMBER 150 DATE 11-19-80

TEST TITLE BEAM CHARACTERIZATION SYSTEM REVISION NO. 0

1.12 Demonstrate proper HAC/OCS message traffic (as appropriate to the BCS functions).

1.13 Demonstrate proper BCS system operating using actual heliostat image data.

1.14 Demonstrate the proper operation of the off-line candidate list generation function in the OCS.

TEST SPECIFICATION

TEST NUMBER 205 DATE 10-2-80

TEST TITLE THERMAL STORAGE OIL SYSTEM REVISION NO. 0

PAGE 1 of 3

1.0 Objectives

1.1 Verify the proper operation of the SDPC instrumentation and alarm functions and associated RLU functions as they apply to the

- TS Tank System
- TS Tank External Piping System
- TS Charging Oil System
- Ullage Maintenance System
- TS Extraction Oil System

1.2 Verify the proper operation and recording functions of DAS as they apply to the

- TS Tank System
- TS Charging Oil System
- TS Extraction Oil System

1.3 Demonstrate the proper operation of the tank nitrogen purge/ pressurization control system PCV-4006.

1.4 Demonstrate the manual hand switch operation and related ILS and RLU functions for the following valves (TS Tank External Piping System):

(a) AOV-3001
(b) AOV-3002
(c) AOV-3003
(d) AOV-3004
(e) AOV-3005
(f) AOV-3907

1.5 Demonstrate charging oil pumps (P-301 and P-302) will start and stop manually through the keyboard and dedicated hand switches (verify associated interlock and RLU functions).

TEST SPECIFICATION

TEST NUMBER 205 DATE 10-2-80

TEST TITLE THERMAL STORAGE OIL SYSTEM REVISION NO. 0

1.6 Demonstrate that the charging oil pumps operating capacities are as designed.

1.7 Demonstrate that the operating speed range of the charging oil pumps is as designed.

1.8 Demonstrate the operating function of the thermal storage charging temperature control valves (TV-3410 and TV-3411).

1.9 Demonstrate local manual startup and shutdown of the caloria make-up pump (P-306).

1.10 Demonstrate the automatic startup and shutdown of the ullage pump (P-308) along with its associated interlock functions.

1.11 Demonstrate the automatic startup and shutdown of the ullage blower (FA-301).

1.12 Demonstrate the controller operation of the pilot gas supply (PCV-4026 and SOV-4024) along with associated interlock functions.

1.13 Demonstrate the automatic operation of ullage gas pressure control and vent valves (AOV-4014 and AOV-4015) along with associated interlock functions.

1.14 Verify the operation of the ullage gas pressure switches PS-4010 and PS-4011.

1.15 Demonstrate extraction oil pumps (P-303 and P-304) will start and stop manually through the keyboard and dedicated hand switches (verify associated interlock and RLU functions).

1.16 Demonstrate that the extraction oil pumps operating capacities are as designed.

1.17 Demonstrate the operating speed range of the extraction oil pumps is as designed.

TEST SPECIFICATION

TEST NUMBER 205 DATE 10-2-80

TEST TITLE THERMAL STORAGE OIL SYSTEM REVISION NO. 0

PAGE 3 of 3

1.18 Demonstrate the keyboard startup and shutdown of the auxiliary extraction oil pump (verify associated interlock and RLU functions).

1.19 Demonstrate that the auxiliary extraction oil pump operating capacity is as designed.

1.20 Demonstrate the functional operation from the keyboard and associated interlock functions of the oil bypass valves (AOV-3905 and AOV-3906).

1.21 Demonstrate the functional operation and associated interlock and RLU functions of the following control valves:

(a) TV-3710
(b) PV-3702
(c) TV-3810
(d) PV-3802
(e) PV-3910

TEST SPECIFICATION

TEST NUMBER 250 DATE 10-2-80

TEST TITLE THERMAL STORAGE STEAM SYSTEM REVISION NO. 0

1.0 Objectives

1.1 Verify the proper operation of the SDPC instrumentation and alarm functions and associated RLU functions as they apply to the

- TS Charging Heat Exchanger System
- TS Charging Steam System
- TS Flash Tank System
- TS Extraction Heat Exchanger Vents, Blowdown, and Drain Systems
- TS Steam Generation System
- Blanketing Steam System

1.2 Verify the proper operation of DAS measurement and recording functions for the

- TS Charging Heat Exchanger System
- TS Charging Steam System
- TS Flash Tank System
- TS Steam Generation System
- Blanketing Steam System

1.3 Demonstrate the keyboard (functional) operation and corresponding interlock and RLU functions associated with the following isolation valves:

(a) AOV-3206
(b) AOV-3306
(c) AOV-3220
(d) AOV-3320
(e) PV-3110
(f) PV-3111
(g) SOV-3209
(h) SOV-3309

1.4 Demonstrate the proper operation from the keyboard, including interlock functions, of the thermal storage steam inlet valve (MOV-1030).

1.5 Demonstrate the functional operation of the TS inlet steam control valve UV-3102 and the desuperheater spray water temperature control valve TV-3105 along with corresponding RLU functions.

1.6 Verify set points and operational status of the charging steam system safety valves (PSV-3221 and PSV-3321).

1.7 Demonstrate the functional operation of the low-point steam traps which automatically drain to the flash tank (5 traps).

1.8 Demonstrate the manual (keyboard) and automatic startup and shutdown of the thermal storage flash tank drain pump P-307 along with associated RLU and interlock functions.

1.9 Test operate and verify set point of TS flash tank pressure safety valve PSV-3115.

1.10 Demonstrate the functional operation of the flash tank level control valves LV-74B, LV-74D-1, and LV-74D-2.

1.11 Demonstrate the functional operation of the flash tank pressure control valves PV-647C and PV-640.

1.12 Test operate and verify set point of the boiler safety valves PSV-3719 and PSV-3819.

1.13 Demonstrate the manual (keyboard) operation of the blowdown isolation valves AOV-3708 and AOV-3808 along with the corresponding interlock and RLU functions.

1.14 Demonstrate the functional operation of the blowdown tank spray water temperature control valve TV-1420.

1.15 Demonstrate the functional operation of the boiler level control valves (LV-3505 and LV-3605) along with associated RLU functions.

1.16 Demonstrate the manual (keyboard) operation and associated interlock and RLU functions for the following isolation valves:

(a) AOV-3117
(b) AOV-3118
(c) AOV-3707
(d) AOV-3807
(e) AOV-3717
(f) AOV-3817
(g) AOV-3218
(h) AOV-3318

TEST SPECIFICATION

TEST NUMBER 305 DATE 11/20/80

TEST TITLE System Distributed Process Controllers (SDPC) REVISION NO. 0

PAGE 1 of 2

Note: This test addresses startup of the control electronics equipment required as a precursor to other preoperational test procedures involving instrumentation and control checkouts. End-to-end instrumentation and control tests will be accomplished by the other preoperation test procedures.

1.0 Objectives

1.1 Demonstrate compatibility of SDPC items noted below with Control Room power, air conditioning, lighting, wiring, and physical environment.

Console items:	CON-701	Loggers:	CON-706
	CON-702		CON-707
	CON-703		CON-708
	CON-704		
	CON-705		

1.2 For the SDPC items listed in 1.1, demonstrate functional operation of keyboards, light pens, alarm panels, displays, trending, reporting, graphics, and external communication with hardware items ILS-601 and 21-E1-4 in the Equipment Room.

1.3 Demonstrate compatibility of Interlock Logic System (ILS) items listed below with Equipment Room power, air conditioning, wiring, and physical environment.

Processors:	ILS-603	Input/Output:	ILS-601
	ILS-604		ILS-602

1.4 For the ILS items listed in 1.3, demonstrate functional operation of keyboards, displays, failover, and external communication of ILS-601 with hardware items CON-705 and 21-E1-14.

1.5 Load and verify CCM configurations for the receiver system, thermal storage system, and turbine generator system hardware items, CON-702 and CON-704.

1.6 Load and verify ILS configuration into ILS processors, hardware items ILS-603 and ILS-604.

1.7 Demonstrate compatibility of remotely located SDPC, ILS, and SCU equipment with remote station power, air conditioning, wiring, and physical environment.

TEST SPECIFICATION

TEST NUMBER 305 DATE 11/20/80

TEST TITLE System Distributed Process Controllers (SDPC) REVISION NO. 0

1.8 Demonstrate functional operation of the MVCU's using the Operational Interface Units (OPIU's).

1.9 Load and verify MVCU control software using the OPIU's.

1.10 Demonstrate communication between remote stations and the Control/Equipment Rooms.

1.11 Demonstrate functional operation of IPAC and ILS remote equipment using SDPC control console.

1.12 Demonstrate functional operation of SCU's and integrate SCU's with MVCU's, IPAC's, and ILS.

1.13 Demonstrate functional operation of total SDPC/ILS system by sampling simulated inputs at SCU and MVCU's, IPAC's, and ILS and accompanying outputs at the MVCU's, ILS, and at the control console displays.

1.14 Demonstrate the functional operation and interfaces of the DAS with the SDPC.

1.15 Demonstrate the functional operation and interface of the DARMS with the SDPC.

1.16 Demonstrate the functional operation of the meteorological equipment.

TEST SPECIFICATION

TEST NUMBER 340 DATE 12/1/80

TEST TITLE Operating Control System (OCS) REVISION NO. 0

PAGE 1 of 1

Note: This test addresses startup of OCS-related electronics equipment located in the Control Room, Data Evaluation Room, and Equipment Room. Some aspects of this test must be completed as a precursor to carrying out other preoperational tests.

1.0 Objectives

1.1 Demonstrate compatibility of OCS-related equipment installed in the Control Room, Data Evaluation Room, and Equipment Room with power, air conditioning, lighting, wiring, and physical environment.

1.2 Demonstrate functional operation of the OCS control console including keyboard, light pen, alarm panel, displays, trending, reporting, graphics, and external communications.

1.3 Load and verify the OCS software configuration.

1.4 Demonstrate proper interface communications between the OCS and SDPC, HAC, DAS, and time-of-day clock.

1.5 Demonstrate proper operation of the OCS "Tool" software

- OCS executive
- Data base generation and management
- OCS data acquisition

1.6 Demonstrate the proper operation of the Infrared Scanning System.

TEST SPECIFICATION

TEST NUMBER 360 DATE 11-21-80

TEST TITLE HELIOSTAT ARRAY CONTROLLER (HAC) REVISION NO. 0

Note: This test addresses startup of the heliostat array controller (HAC) as it interfaces with other plant equipment external to the collector. System tests are carried out as part of test No. 100.

1.0 Objectives

1.1 Verify that the HAC/control room interface operates properly (this is a selective reverification of functions originally demonstrated in Test No. 100).

1.2 Verify the physical communication interfaces between the operating control system (OCS) and HAC's (A and B) are properly established through the two MODCOMP 4811 Asynchronous Communications Interface Units.

1.3 Demonstrate that all communications (alarms, messages, addressing, and responses) are accepted, properly validated, and processed in an appropriate manner by the HAC and OCS respectively. Demonstrate proper communications before and after HAC failover.
Note: Messages requiring collector field activity will be used only during non sunshine periods.

1.4 Verify that both the physical communications interfaces between DAS and HAC's (A and B) are properly established through the two MODCOMP 4811 Asynchronous Communications Interface Units.

1.5 Demonstrate that all communications (messages, addressing, and responses) are accepted by HAC and DAS respectively. Proper communications shall be demonstrated before and after HAC failover.

1.6 Verify that both the physical interfaces between the receiver and HAC's (A and B) are properly established through the receiver trip signal TTL wires.

1.7 Demonstrate that a receiver trip signal results in the heliostats being slewed from track to standby. The trip signal shall result in proper defocus operation before and after HAC failover.
Note: This objective shall be verified during a non-sunshine period in order to permit tracking the receiver.

TEST SPECIFICATION

TEST NUMBER 360 DATE 11-21-80

TEST TITLE HELIOSTAT ARRAY CONTROLLER (HAC) REVISION NO. 0

1.8 Demonstrate that subsequent to a trip command, command messages from the OCS to the HAC do not result in collector field activity unless the DEFRLSE command is first given to the HAC from the collector system console. Demonstrate this function before and after HAC failover.

1.9 Verify the physical interface between the Power Supply System and the HAC is properly established through the field power loss signal TTL wires.

1.10 Demonstrate that a loss of power to the collector field and a field power loss signal received by the HAC results in a collector system condition which will respond properly to ESTANDBY and ESTOW commands as issued by the OCS. Demonstrate this function before and after HAC failover.

TEST SPECIFICATION

TEST NUMBER 405 DATE 10-3-80

TEST TITLE MAIN/ADMISSION STEAM SYSTEM REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Verify the main/admission steam system SDPC display and alarm functions.

1.2 Verify the main/admission steam system DAS functions.

1.3 Demonstrate the manual (keyboard) operation of the main steam isolation valve MOV-1031 along with associated interlock functions.

1.4 Demonstrate the functional operation and associated interlocks for the following control valves:

(a) PV-1001
(b) FV-1006
(c) TV-1002

TEST SPECIFICATION

TEST NUMBER 420 DATE 10-3-80

TEST TITLE MISCELLANEOUS STEAM SYSTEMS REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Verify the miscellaneous steam system SDPC display and alarm functions.

1.2 Demonstrate the operational functions of the following auxiliary steam pressure and temperature control valves:

(a) PV-1003
(b) PV-1005
(c) TV-1004

1.3 Demonstrate the manual (keyboard) operation and associated interlock functions of the auxiliary steam isolation valves AOV-1008 and AOV-1009.

1.4 Demonstrate the automatic control function of the auxiliary steam pressure control valve (PV-647A).

1.5 Verify the set point and operational status of the auxiliary steam safety valve (PSV-612).

1.6 Demonstrate the manual startup of the auxiliary electric boiler B-901.

1.7 Demonstrate the automatic operational capability of the auxiliary electric boiler.

1.8 Demonstrate the auxiliary steam boiler operating pressure is as designed.

TEST SPECIFICATION

TEST NUMBER 505 DATE 10-3-80

TEST TITLE CONDENSATE REVISION NO. 0

1.0 Objectives

1.1 Verify all condensate SDPC instrumentation, display, and alarm functions.

1.2 Verify all DAS instrumentation and display/recording functions.

1.3 Demonstrate the manual operation of the 3rd and 4th point extraction steam stop valves (MOV-628 and MOV-630) from the keyboard along with the associated interlock functions.

1.4 Demonstrate the operation and related interlock functions of the 3rd and 4th point extraction non-return valves (NV-629A, NV-629B, and NV-631).

1.5 Demonstrate the manual operation of the hydrazine feed pump (P-933) from the keyboard and through the local hand switch along with the associated interlock functions.

1.6 Demonstrate the automatic operation of the hydrazine feed pump (P-933) and associated interlock functions based on signals from AC-725.

1.7 Demonstrate the manual operation of the ammonia feed pump (P-934) from the keyboard and through the local hand switch along with the associated interlock functions.

1.8 Demonstrate the automatic operation of the ammonia feed pump (P-934) and associated interlock functions based on signals from CC-726.

1.9 Demonstrate the manual (keyboard) and automatic operation along with the corresponding interlock and alarm functions of the following drain level control valves:

(a) LV-1010
(b) LV-1011
(c) LV-1012
(d) LV-1013
(e) LV-1015
(f) LV-1016
(g) LV-3116

1.10 Demonstrate the proper operation of the low point steam traps from the high and low pressure steam piping.

(a) T-MS-10-6
(b) T-MS-3-1
(c) T-MS-9-5
(d) T-VT-1-1
(e) T-ST-6-3
(f) T-VT-4-2
(g) T-AS-1-1
(h) T-AS-1-2

1.11 Demonstrate the automatic operation of the hotwell level control equipment (LV-146A and LV-146B).

1.12 Demonstrate manual keyboard operation of the condenser vacuum breaker valve MOV-140.

1.13 Demonstrate the manual keyboard operation of the feedwater motor isolation valve (MOV-110).

1.14 Demonstrate the manual operation and interlock functions of the condensate hotwell pump (P-907) using the keyboard and dedicated hand switch functions.

1.15 Demonstrate the operating capacity of the condensate hotwell pump (P-907) is as designed.

1.16 Demonstrate the local manual operation and appropriate interlock functions of the inline demineralizer inlet and outlet valves.

(a) HV-400
(b) HV-404
(c) HV-408
(d) HV-412

*

1.17 Demonstrate the condensate hotwell pump recirculation valve (FV-112) maintains a minimum flow rate under pump "dead head" conditions.

1.18 Demonstrate the tubeside pressure drop for the 4th point heater (E-904) is less than or equal to the design value.

*Valve numbers removed from SCE P&ID 40P9005133304-0

1.19 Demonstrate the automatic operation of the deaerator level control valve (LV-83B).

1.20 Verify that the minimum deaerator water level exceeds the minimum acceptable level for receiver and/or thermal storage feed pump operation.

1.21 Demonstrate the manual (keyboard) operation of the following drain motor operated valves:

(a) MOV-609
(b) MOV-615
(c) MOV-623
(d) MOV-675
(e) MOV-637
(f) MOV-650
(g) MOV-676
(h) MOV-652

1.22 Demonstrate the proper operation of the turbine extraction steam traps.

(a) ST-1
(b) ST-2
(c) ST-3
(d) ST-4
(e) ST-6
(f) ST-7

1.23 Demonstrate that the demineralized system capacity and discharge water quality are as designed.

1.24 Demonstrate the local hand switch operation and appropriate interlock functions of the following demineralizer valves:**

(a) HV-401
(b) HV-402
(c) HV-403

**Hold pending review of Cochrane Demineralizer System drawings. Component tag numbers have been removed from SCE P&ID 40P9005133304-0.

(d) HV-409
(e) HV-410
(f) HV-411
(g) HV-414
(h) HV-415
(i) HV-416
(j) HV-417
(k) HV-420
(l) HV-425
(m) HV-426
(n) HV-428
(o) HV-431

1.25 Demonstrate the manual operation of the sluice water pumps (P-939 and P-940).**

1.26 Demonstrate the manual operation of the caustic feed pumps (P-919 and P-920).**

1.27 Demonstrate the manual operation of the acid feed pumps (P-931 and P-932).**

1.28 Demonstrate the functional operation of the temperature control equipment (TV-427).**

1.29 Demonstrate the operation of the caustic day tank (H-905).**

1.30 Demonstrate the manual operation of the acid transfer pump (P-935).

1.31 Demonstrate the manual operation of the caustic transfer pump (P-943).

1.32 Demonstrate the operation of the caustic tank heater (H-904).

1.33 Demonstrate the functional operation of the deaerator and 4th point heater level control equipment (LV-83A and LV-104).

1.34 Demonstrate the manual keyboard operation of the deaerator motor operated vent valve (MOV-653) and flow control valve (FV-659).

TEST SPECIFICATION

TEST NUMBER 505 DATE 10-3-80

TEST TITLE CONDENSATE REVISION NO. 0

1.35 Verify proper set point and operational status of the following pressure safety valves:

(a) PSV-645
(b) PSV-646
(c) PSV-654
(d) PSV-101

1.36 Demonstrate the manual keyboard operation of the vacuum system through HS-155.

1.37 Demonstrate that a condenser vacuum of $\leq$2.5 in. Hg absolute can be drawn and maintained.

TEST SPECIFICATION

TEST NUMBER 550 DATE 10-4-80

TEST TITLE FEEDWATER REVISION NO. 0

PAGE 1 of 2

1.0 Objectives

1.1 Verify all feedwater SDPC instrumentation, display, and alarm functions.

1.2 Verify all DAS instrumentation and display/recording functions.

1.3 Demonstrate the manual operation and interlock functions of the receiver feedwater pump (P-917) using the keyboard and dedicated hand switch functions.

1.4 Demonstrate the operating capacity of the receiver feedwater pump is as designed.

1.5 Demonstrate the receiver feedwater pump variable speed drive can operate satisfactorily over the speed range as designed.

1.6 Demonstrate that the minimum flow control valve FV-37 automatically permits minimum flow to be maintained in the receiver feedwater pump under pump "dead head" conditions.

1.7 Demonstrate the manual (keyboard) operation and interlock function of the feedwater motor isolation valve (MOV-33).

1.8 Verify proper set point and operational status of the high pressure heater safety valves.

(a) PSV-5
(b) PSV-21
(c) PSV-610
(d) PSV-634

1.9 Demonstrate the functional operation of the high pressure heater level control equipment associated with the following control valves:

(a) LV-8
(b) LV-24A
(c) LV-24B

1.10 Demonstrate that the seal water flow to the receiver feed pump is as designed.

TEST SPECIFICATION

TEST NUMBER 550 DATE 10-4-80

TEST TITLE FEEDWATER REVISION NO. 0

PAGE 2 of 2

1.11 Demonstrate the manual operation and interlock functions of the thermal storage feedwater pump (P-903) using the keyboard and dedicated hand switch function.

1.12 Demonstrate the operating capacity of the thermal storage feedwater pump is as designed.

1.13 Demonstrate that the minimum flow control valve FV-56 automatically permits minimum flow to be maintained in the thermal storage feedwater pump under pump "dead head" conditions.

1.14 Demonstrate the manual (keyboard) operation of the TS feedwater motor isolation valve (MOV-1132).

1.15 Demonstrate the manual (keyboard) and automatic operational functions of auxiliary boiler/thermal storage feedwater pump (P-904).

1.16 Demonstrate the manual (keyboard) operating functions for the auxiliary boiler/thermal storage feedwater pump discharge valves (LV-1 and LV-31).

1.17 Demonstrate the manual operation of the 1st and 2nd point extraction steam stop valves (MOV-624 and MOV-626) from either the keyboard or dedicated hand switches along with the associated interlock functions.

1.18 Demonstrate the operation and related interlock functions of the 1st and 2nd point extraction non-return valves (NV-625 and NV-627).

(511) - Receiver Feed Pump Lube Oil System

(TBD)

TEST SPECIFICATION

TEST NUMBER 600 DATE 10-1-80

TEST TITLE CIRCULATING WATER REVISION NO. 0

1.0 Objectives

1.1 Demonstrate circulating water pumps (P-905 and P-906) will start and stop through the keyboard and dedicated hand switches (verify associated startup interlock functions).

1.2 Demonstrate hand switch operation of pump discharge motor valves MOV-222 and MOV-243 and verify hand switch interlock function with pump operation.

1.3 Demonstrate that the circulating water pumps operating capacities are as designed.

1.4 Verify all circulating water and cooling tower system displays and alarm functions.

1.5 Demonstrate condenser tubeside pressure drop is as designed.

1.6 Demonstrate circulating water flow and proper distribution to each of the cooling tower cells.

1.7 Demonstrate proper operation of service water spray system in each cooling tower cell through the appropriate SDPC hand switch and timer functions.

1.8 Demonstrate operation of cooling tower basin level control system (LIT-210/LV-210).

1.9 Demonstrate cooling water heat exchanger tubeside pressure drop is as designed.

1.10 Demonstrate the remote operation of MOV-229 by means of the SDPC keyboard hand switch function.

1.11 Demonstrate the controlled operation of the circulating water blowdown control (CV-241) based on circulating water conductivity.

1.12 Demonstrate the manual startup and shutdown of the cooling tower acid pump (P-912) and the related interlock functions through the SDPC and local hand switch functions.

1.13 Verify all cooling tower chemical feed system alarms and displays.

TEST SPECIFICATION

TEST NUMBER 600 DATE 10-1-80

TEST TITLE CIRCULATING WATER REVISION NO. 0

1.14 Demonstrate the manual startup and shutdown of the sodium hypochlorite pump (P-930) using hand switch HS-204 and the automatic pump interlock logic.

1.15 Demonstrate the sodium hypochlorite pump operating flow is as designed.

1.16 Demonstrate manual startup and shutdown of the cooling tower polyacrylate feed pump.

1.17 Demonstrate manual startup, low speed, high speed, and shutdown along with the operating interlock functions for each of the cooling tower fans (FA-901, FA-902, and FA-903).

1.18 Verify the lube oil level and vibration alarms and demonstrate the related interlock with the fan motor (3 fans).

TEST SPECIFICATION

TEST NUMBER	705	DATE	12/1/80
TEST TITLE	Turbine Generator - Mechanical Systems	REVISION NO.	0
		PAGE	1 of 1

The turbine generator-mechanical system test objectives shall be as specified by Southern California Edison. They shall include necessary startup activities associated with the:

- Turbine generator system
- Turbine gland seal steam system
- Turbine drains
- Turbine hydraulic control system
- Turbine generator lube oil system
- Turbine generator lube oil conditioning/purifying system
- Turbine generator lube oil transfer and storage system

TEST SPECIFICATION

TEST NUMBER	750	DATE	12/1/80
TEST TITLE	Turbine Generator - Electrical and	REVISION NO.	0
	Control Systems	PAGE	1 of 1

The turbine generator-electrical and control system test objectives shall be as specified by Southern California Edison. They shall include necessary startup activities associated with the:

- Generator excitation and voltage regulation system
- Generator leads and electrical system
- Turbine generator control and interlock system

TEST SPECIFICATION

TEST NUMBER 805 DATE 11-26-80

TEST TITLE MAIN/AUXILIARY POWER TRANSFORMERS REVISION NO. 0

1.0 Objectives

(801) Main Transformer System

1.1 Verify the number and size of ground bus and straps to the applicable project drawings.

1.2 Test oil for dielectric and water content.

1.3 Hi-pot or power factor (Doble) test each transformer winding and bushing.

1.4 Test polarity and turns ratio of the transformer windings.

1.5 Test polarity and turns ratio of the current transformers.

1.6 Check pressure relief valve and sudden pressure relay.

1.7 Check control circuits and operation of transformer cooling equipment.

(806) Off-Site Power System (OCB 501)

1.8 Verify the number and size of grounds to the applicable project drawings.

1.9 Check heaters (where used) for size, connection and operation.

1.10 Power factor test each breaker bushing.

1.11 Test oil for dielectric and neutralization.

1.12 Verify all electrical and mechanical adjustments and measurements of breaker and operating mechanism.

1.13 Operate breaker electrically, conduct time-motion tests per manufacturer's specifications. Test air tank for number of operations without compressor.

1.14 High potential test the breaker, both line-to-load (contacts open) and line to ground (contacts closed).

1.15 Power factor test the breaker in accordance with manufacturer's instructions or applicable industry standard.

(811) Auxiliary Power System

1.16 Verify the number and size of ground bus and straps to the applicable project drawings.

1.17 Test oil for dielectric and water content.

1.18 Hi-Pot or power factor (Doble) test each transformer winding and bushing.

1.19 Test polarity and turns ratio of the transformer windings.

1.20 Test polarity and turns ratio of the current transformers.

1.21 Check pressure relief valve and sudden pressure relay.

1.22 Check control circuits and operation of transformer cooling equipment.

1.23 Compare switchgear breaker and device nameplate information with the project drawings.

1.24 Verify the number and size of grounds to the applicable project drawings.

1.25 Test insulation of each bus, phase-to-phase and phase-to-ground with a suitable meghommeter.

1.26 Operate drawout devices and racking mechanisms, manually and electrically (where appropriate), check operation of shutters and interlocks.

1.27 Energize the control busses, make polarity and voltage checks. Operate each breaker through all control stations. Operate all relay, sensor and interlocking contacts manually to test operation of all circuits related to tripping of each breaker.

1.28 Calibrate each protective relay per manufacturer's specification using current sources that do not require correction curves to compensate for wave shape distortion, adjust to settings furnished by owner/engineer. Clean where appropriate, record values.

1.29 Test each instrument and meter for proper operation, correct rotation and circuitry. Instruments and meters energized from Instrument Transformers shall be tested at transformer secondary level.

1.30 Hi-Pot test the primary bus in accordance with the manufacturers instructions and the applicable industry standard.

1.31 Power factor test each breaker pole and the primary bus in accordance with applicable standards or manufacturers recommendations.

1.32 Test each current and voltage transformer for ratio and polarity.

(816) 4160 V. Plant System

1.33 Compare switchgear breaker and device nameplate information with the project drawings.

1.34 Verify the number and size of grounds to the applicable project drawings.

1.35 Test insulation of each bus, phase-to-phase and phase-to-ground with a suitable meghommeter.

1.36 Operate drawout devices and racking mechanisms, manually and electrically (where appropriate), check operation of shutters and interlocks.

1.37 Energize the control busses, make polarity and voltage checks. Operate each breaker through all control stations. Operate all relay, sensor and interlocking contacts manually to test operation of all circuits related to tripping of each breaker. Check key interlocks where applicable.

TEST SPECIFICATION

TEST NUMBER 805 DATE 11-26-80

TEST TITLE MAIN/AUXILIARY POWER TRANSFORMERS REVISION NO. 0

1.38 Calibrate each protective relay per manufacturer's specification using current sources that do not require correction curves to compensate for wave shape distortion, adjust to settings furnished by owner/engineer. Clean where appropriate, record values.

1.39 Test each instrument and meter for proper operation, correct rotation and circuitry. Instruments and meters energized from Instrument Transformers shall be tested at transformer secondary level.

1.40 Hi-Pot test the primary bus in accordance with the manufacturers instructions and the applicable industry standard.

1.41 Power factor test each breaker pole and the primary bus in accordance with applicable standards or manufacturers recommendations.

1.42 Test each current and voltage transformer for ratio and polarity.

TEST SPECIFICATION

TEST NUMBER 830 DATE 11-24-80

TEST TITLE LOAD CENTERS AND MOTOR CONTROL CENTERS REVISION NO. 0

1.0 Objectives

(831) Station Service Transformer and 480 V Bus

(836) Load Center "A"

(841) Cooling Tower Transformer and Bus

1.1 Verify the number and size of ground bus and straps to the applicable project drawings.

1.2 Test oil for dielectric and water content.

1.3 Hi-Pot or power factor (Doble) test each transformer winding and bushing.

1.4 Test polarity and turns ratio of the transformer windings.

1.5 Test polarity and turns ratio of the current transformers.

1.6 Check pressure relief valve and sudden pressure relay.

1.7 Check control circuits and operation of transformer cooling equipment.

1.8 Compare load center breaker and device nameplate information with the project drawings.

1.9 Test insulation of each bus, phase-to-phase and phase-to-ground with a suitable meghommeter.

1.10 Operate drawout devices and racking mechanisms, manually and electrically (where appropriate), check operation of shutters and interlocks.

1.11 Energize the control busses, make polarity and voltage checks. Operate each breaker through all control stations. Operate all relay, sensor and interlocking contacts manually to test operation of all circuits related to tripping of each breaker.

1.12 Calibrate each protective relay per manufacturer's specification using current sources that do not require correction curves to compensate for wave shape distortion, adjust to settings furnished by owner/engineer. Clean where appropriate, record values.

1.13 Test each instrument and meter for proper operation, correct rotation and circuitry. Instruments and meters energized from Instrument Transformers shall be tested at transformer secondary level.

1.14 Hi-Pot test the primary bus in accordance with the manufacturers instructions and the applicable industry standard.

1.15 Power factor test each breaker pole and the primary bus in accordance with applicable standards or manufacturers recommendations.

1.16 Test each current and voltage transformer for ratio and polarity.

(846) Power Panel "A"

1.17 Megger each secondary cable.

(847) Motor Control Center "A"

(848) Motor Control Center "B"

(849) Motor Control Center "C"

(850) Motor Control Center "L"

1.18 Compare the control center, starter, breaker and fuse nameplate information with the one line diagram.

1.19 Verify the number and size of grounds to the applicable project drawings.

1.20 Test insulation of the bus phase-to-phase and phase-to-ground with a suitable megohmmeter.

TEST SPECIFICATION

TEST NUMBER 830 DATE 11-24-80

TEST TITLE LOAD CENTERS AND MOTOR CONTROL CENTERS REVISION NO. 0

1.21 Check operation of each breaker in each starter manually. Test door interlocking. Test insulation of each unit phase-to-phase and phase-to-ground with a suitable megohmmeter.

1.22 Check each contactor and thermal overload for proper size and operation.

1.23 Operate each starter through all control stations.

TEST SPECIFICATION

TEST NUMBER 855 DATE

TEST TITLE LOW VOLTAGE SYSTEMS REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Megger test control power sources.

TEST SPECIFICATION

TEST NUMBER 860 DATE 11-25-80

TEST TITLE DC AND UPS REVISION NO. 0

1.0 Objectives

(861) DC System

A. Batteries

1.1 Check physical condition of each battery including checking for loose connections, dropped plates, sulfating of plates, cracked covers and the presence of flame arrester vent plugs.

1.2 Check specific gravity of each cell.

1.3 Check voltage of each cell and total battery voltage across all cells.

1.4 Check to determine that fuses in battery disconnect switch are suitable for operation.

1.5 If sulfation of plates is evident, or if cell voltage or specific gravity are low, have battery placed on equalizing charge and monitor until normal conditions are restored.

B. Battery Chargers

1.6 Megger AC Power input circuits (disconnected from the charger).

1.7 Check DC output circuits. If charger is equipped with DC output filters, the filter capacitors must be discharged before checking with multimeter by bridging capacitor with a 1000 OHM, 10 watt resistor.

1.8 Perform functional and control checks. The DC output breaker should be closed prior to closing the AC input breaker to charge the output filter capacitors from the battery prior to applying AC to the charger.

1.9 Check operation of the equalizing charge timer.

1.10 Check operation of alarm relays and metering.

1.11 Check settings of float voltage, equalize voltage and equalize limit adjustments.

C. D.C. Distribution Panel

1.12 Megger busses and circuit breakers.

1.13 Check trip settings of circuit breakers to applicable project drawings.

1.14 Before each breaker is energized, check for grounds.

(866) UPS System

1.15 Perform a complete check of UPS batteries and battery charger per T.NO. 860 paragraphs 1.1 thru 1.11.

1.16 Perform a complete check of the two inverters including the switching from one inverter to the other and vice versa.

1.17 Check operation of the complete metering system and of the alarm relays.

TEST SPECIFICATION

TEST NUMBER 871 DATE 11-25-80

TEST TITLE HEAT TRACING SYSTEM REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Megger the heat tracing panel feed, panel busses and breakers.

1.2 Check trip settings of circuit breakers to applicable project drawings.

1.3 Check ammeter, current transformers, control transformers, thermostats and contactors as applicable to project drawings.

1.4 Before each breaker is energized check for grounds.

1.5 Check circuit amperages to applicable project drawings.

TEST SPECIFICATION

TEST NUMBER 901 DATE 11-24-80

TEST TITLE INSTRUMENT AND SERVICE AIR SYSTEMS REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate all SDPC display and alarm functions.

1.2 Demonstrate the manual (keyboard) startup and shutdown and related interlock and timer functions of the service and instrument air compressors CP-901 and CP-902.

1.3 Demonstrate proper operation of the inner cooler, moisture separator, air receiver, and instrument air pre filter condensate traps (7 traps).

1.4 Verify proper set points and operational status of the following safety valves:

(a) PSV-509
(b) PSV-510
(c) PSV-519
(d) PSV-520
(e) PSV-522
(f) PSV-542
(g) PSV-544
(h) PSV-546
(i) PSV-548

1.5 Demonstrate that the air compressors are capable of supplying air to the air receiver at the design pressure.

1.6 Demonstrate that the service air header pressure is as designed.

1.7 Verify that service air is available at all service air stations (8 locations).

1.8 Verify that instrument air is available at the thermal storage skids, TSU, Raw/Service Water Pump Building, and receiver.

TEST SPECIFICATION

TEST NUMBER 905 DATE 10-1-80

TEST TITLE NITROGEN SYSTEM REVISION NO. 0

PAGE 1 of 1

1.0 Objective

1.1 Demonstrate that the GN_2 system is capable of supplying nitrogen at the specified pressure.

1.2 Demonstrate that the nitrogen pressure supplied to the TSV pressure control valve PCV-4006 and the US pressure control valve PCV-4023 is as designed.

1.3 Demonstrate all DAS functions related to the TSS GN_2 system.

1.4 Demonstrate GN_2 SDPC low pressure alarm.

1.5 Demonstrate nitrogen pressure supplied to the feedwater heaters PCV-605 and condenser PCV-660 is as designed.

TEST SPECIFICATION

TEST NUMBER 910 DATE 10-19-80

TEST TITLE WATER SUPPLY SYSTEM REVISION NO. 0

1.0 Objectives

1.1 Demonstrate raw water storage tank level is maintained at proper level through the operation of OV-1702.

1.2 Demonstrate raw water storage tank local level indicator LI-1701 and high level alarm function LAH-1703.

1.3 Demonstrate manual operation of raw water service pumps P-703 and P-704 and related interlock function.

1.4 Demonstrate standby mode operation of raw water service pumps P-703 and P-704 and related interlock function.

1.5 Demonstrate minimum flow recirculation through PV-1703 and related interlock function.

1.6 Demonstrate raw/service water pump head rises are as designed (P-703 and P-704).

1.7 Demonstrate that the makeup package demineralizer (D-701) is capable of producing demineralized water at the specified capacity and at or below the specified water chemistry limits.

1.8 Demonstrate operation of the conductivity monitoring CI-1205 and high conductivity alarm functions CAH-1205.

1.9 Demonstrate the operation of the demineralized water storage tank (TK-702) level control and interlock functions.

1.10 Demonstrate the demineralized water storage tank (TK-702) high/low level alarm and local indicator functions.

1.11 Demonstrate manual operation of pump P-710 and the related interlock function.

1.12 Demonstrate that the demineralized water transfer pump (P-710) head pressure is as designed.

1.13 Demonstrate that the polishing demineralizers are capable of producing condensate at the specified capacity and at or below the specified water chemistry limits.

1.14 Demonstrate the condensate storage tank (TK-902) inlet level control function.

1.15 Demonstrate the condensate storage tank (TK-902) remote and local level indicating and alarm functions.

TEST SPECIFICATION

TEST NUMBER 930 DATE 11-24-80

TEST TITLE FIRE PROTECTION SYSTEM REVISION NO. 0

PAGE 1 of 1

Note: No fire protection system startup tests beyond those carried out by the mechanical contractor as required for acceptance, certification, and approval will be conducted. Detailed requirements pertaining to these tests and required reports and documentation are contained in the Mechanical construction package (CP-9) DOE No. 40M700-65 Volume II, Section 7.1.

Summary test information for each of the fire protection system functions is contained below.

Function	Compliance Document
System flush and hydrostatic test	Form No. 85-Contractor's Material and Test Certificate
Semi-Automatic Foam Monitoring System	NFPA Standard No. 11
Automatic Total Flooding Halon 1301 Systems	NFPA Standard No. 12A
Automatic Detectors	NFPA Standards No. 72A and 72E.

TEST SPECIFICATION

TEST NUMBER 940 DATE 11-24-80

TEST TITLE PLANT DRAINS AND SUMPS REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate operation of Raw/Service Water Sump Pump P-715 through LS 1605.

1.2 Demonstrate operation of TSU area Sump Pump P-717 through LS 1606.

1.3 Demonstrate normal operation of the Maintenance Oil Sump Pump P-718.

1.4 Demonstrate normal operation of the Oil Sump Pump P-714.

1.5 Demonstrate normal operation of the Sludge Pump P-716.

1.6 Demonstrate manual operation of Separator Waste Water Pumps P-711 and P-712 and related interlock functions.

1.7 Demonstrate standby mode of Separator Waste Water Pumps P-711 and P-712 and related interlock functions.

1.8 Demonstrate that the Separator Waste Water Pumps are capable of pumping at the design capacities.

1.9 Demonstrate that the bearing lube water is controlling through the operation of SOV-1602.

1.10 Demonstrate the Oil Water Separator SE-701 high level alarm function LAH-1602.

TEST SPECIFICATION

TEST NUMBER 951 DATE 10-1-80

TEST TITLE COOLING WATER SYSTEM REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate cooling water surge tank level control function (LV-307).

1.2 Verify all cooling water system SDPC displays and alarms.

1.3 Demonstrate that the cooling water pump (P-901) head rise is as designed.

1.4 Demonstrate the manual (keyboard) startup and shutdown of the cooling water pump (P-901).

1.5 Demonstrate the proper operation of the generator temperature control system (TV-354).

1.6 Demonstrate the temperature control functions (TCV-341 and TCV-342) for two turbine hydraulic oil coolers.

1.7 Demonstrate the turbine lube oil temperature control function (TV-308).

1.8 Demonstrate manual startup and shutdown of the sample chiller pump (P-925).

TEST SPECIFICATION

TEST NUMBER 956 DATE 11-24-80

TEST TITLE SAMPLING SYSTEM REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate proper operation of all SDPC display, record, and alarm functions involving the measurement of pH, hydrazine, conductivity, cation conductivity, oxygen, and sodium.

1.2 Demonstrate proper operation of all local indicating and recording functions.

1.3 Verify proper set points and operational status of the following safety valves:

(a) PSV-702
(b) PSV-712
(c) PSV-722
(d) PSV-710
(e) PSV-732

1.4 Demonstrate the local manual operation and interlock functions for solenoid valves HY-715A, HY-715B, HY-733A and HY-733B.

TEST SPECIFICATION

TEST NUMBER 970 DATE 11-26-80

TEST TITLE HVAC SYSTEMS REVISION NO. 0

PAGE 1 of 2

Note: The HVAC systems consist of exhaust fans, electric unit heaters, air handling units, air conditioning units, air-cooled condensing units, humidifiers, and power operated louvers. Due to the extent of testing required of the mechanical construction contractor,* no additional startup testing is required. For reference, the following tests are required of the mechanical contractor/and or equipment suppliers.

1. All rotating equipment shall be factory balanced both statically and dynamically.

2. Electric motors shall be tested in accordance with the latest applicable NEMA, IEEE, and ANSI Standards.

3. Noise emission shall be measured and verified to be less than the maximum permissible noise exposure for eight hours per day as specified by OSHA.

4. Exhaust fan units shall be shop tested in accordance with AMCA Standard Test Code No. 210.

5. Powered louvers shall be tested in accordance with AMCA certification procedure No. 511. Air leakage through closed louvers shall not exceed 10 cfm per square foot of face area at a static differential pressure of 0.435 in H_2O (30 mile per hour wind).

6. Area humidifiers shall be factory tested.

7. Refrigeration systems shall be pressure tested.

8. HVAC control system equipment shall be tested in accordance with the construction specification.

9. All equipment, fans, and motors shall be run after installation at their required speed without undue vibration, objectionable noise, or sparking.

10. All equipment motors, bearings, and journals shall be properly lubricated.

TEST SPECIFICATION

TEST NUMBER 970 DATE 11-26-80

TEST TITLE HVAC SYSTEMS REVISION NO. 0

11. All roof top air conditioning units, air handling units, duct-work, and air distribution devices shall be tested, adjusted, and balanced to deliver air quantities specified for each outlet and inlet or as required in accordance with the procedures and standards described in the latest "SMACNA Balancing and Adjusting Manual".

12. Operating tests of heating, ventilating and air conditioning systems shall be conducted during heating and cooling seasons of the first year of operation at times when directed for periods of 6 hours minimum for each system.

*Assumes that the SCE mechanical contractor will be assigned the same test responsibilities as the DOE mechanical contractor.

TEST SPECIFICATION

TEST NUMBER 980 DATE 11-24-80

TEST TITLE FLUSHING AND STEAM BLOWS REVISION NO. 0

PAGE 1 of 1

Note: This activity differs from the other tests specified in this section in that it is not a startup test but rather a procedure to clean the main process lines (water and steam) and make the system ready for operation. The following tasks will comprise the flushing and steam blow function:

1.1 Velocity flush the lines (125% operating velocity) to remove loose material.

1.2 Manually clean condenser hotwell, deaerator, and system low points where debris may be trapped.

1.3 Alkaline flush the system with a solution of 0.5% sodium hydroxide plus 1% trisodium phosphate plus 0.1% Pen-5 surfactant at 200°F for 6 to 12 hours to remove grease, paint, and loose corrosion products. Follow with demineralized water flush.

1.4 Acid flush the system with a solution of 3% Hyfor plus 0.1% OSI-1 acid inhibitor at 200°F for 4 to 6 hours to remove mill scale and iron oxide. Follow with a neutralization and passuration flush with 200 ppm hydrazine at a pH of $\sim$10.

1.5 Steam blow the steam lines with 400 psig saturated steam from the rental boiler at a sufficient velocity to produce a cleaning ratio greater than one.

1.6 Lay up system with inhibited water or GN_2 as appropriate.

4.2 INTER-SYSTEMS PREOPERATIONAL TESTS

Inter-system preoperational tests (1000 Series Tests) are primarily designed to support the controls development and "tuning" activities required as a prerequisite to the acceptance test period. These tests will also involve the first integrated operations of the collector and receiver systems thus allowing basic startup procedures to be verified.

Test data to be gathered and recorded during this test period will involve the use of the display, hardcopy, logging, and DAS capabilities discussed in Section 5.2.1. Specific data requirements for each test are listed in Section 5.2.2.

TEST SPECIFICATION

TEST NUMBER 1010 DATE 11/18/80

TEST TITLE Receiver "Cold Flow" (Controls) Test REVISION NO. 0

PAGE 1 of 1

Note: This test is carried out subsequent to Test 000 and is designed to demonstrate receiver operation under cold flow conditions using plant feedwater. This test is a precussor to the hot flow (steaming test) carried out as part of Test 1030.

1.0 Objectives

1.1 Demonstrate that the GN_2 flash tank pressurization control is capable of preventing feedwater cavitation across the bypass valve PV-2002 and the boiler panel inlet temperature control valves (18 valves).

1.2 Demonstrate satisfactory closed loop operation of the flash tank discharge level control valves LV-74A and LV-74C.

1.3 Demonstrate the satisfactory receiver fill and vent operations.

1.4 Demonstrate that the flash tank initial GN_2 charge remains trapped in the flash tank during the receiver fill operation.

1.5 Demonstrate satisfactory low flow, low pressure feed pump operation.

1.6 Gather process data required for final adjustment of feed pump controller PC1105.*

1.7 Demonstrate the ability to satisfactorily drain and vent the receiver.

*Data gathering function in support of controls development testing.

TEST SPECIFICATION

TEST NUMBER 1020 DATE 11/18/80

TEST TITLE Thermal Storage "Low Temperature" (Controls) Testing REVISION NO. 0

PAGE 1 of 2

Note: This test is designed primarily as a controls development test involving the thermal storage charging and extraction functions. It will be carried out subsequent to tests 205 and 250 and in conjunction with TSU bed conditioning activities. It will draw energy from the rental boiler which supplies saturated steam at 400 psig. Subsequent controls development testing involving receiver steam at actual plant operating temperatures and pressures is contained in test 1040.

1.0 Objectives

1.1 Demonstrate the operation of the charging and extraction oil pumps (P301——304) and gather open loop pump speed vs flow data.

1.2 Gather open loop oil temperature vs pump speed/valve position data for the charging pump/control valves (P301/TV3411 and P302/TV3410)

1.3 Gather closed loop control and model verification data for the charging pumps and the control valves defined in 1.2.

1.4 Gather open loop oil temperature and TS condenser pressure vs valve position data for the charging steam inlet control valve UV-3102.

1.5 Gather closed loop control and model verification data for the automatic operating of valve UV-3102 (pumps P301 and P302 and valves TV3410 and TV3411 maintained in an open loop control configuration).

1.6 Gather open loop surge tank level and pressure data vs discharge valve (PV3110 and PV3111) position.

1.7 Gather closed loop control and model verification data for the automatic operation of valves PV3110 and PV3111 in both the pressure and level control modes.

TEST SPECIFICATION

TEST NUMBER 1020 DATE 11/18/80

TEST TITLE Thermal Storage "Low Temperature" (Controls) Testing REVISION NO. 0

1.8 Demonstrate the satisfactory closed loop operation of the thermal storage flash tank level control valves LV74B, LV74D-1, and LV74F-2.

1.9 Demonstrate the satisfactory closed loop operation of the thermal storage flash tank drain pump.

1.10 Demonstrate the satisfactory closed loop operation of the flash tank pressure control valves PV647C and PV640.

1.11 Gather open loop steam temperature and pressure vs valve position data for the extraction oil control valves TV3710/PV3702 and TV3810/PV3802.*

1.12 Gather closed loop and model verification data for the extraction pump and control valves P303/TV3710/PV3702 and P304/TV3810/PV3802.*

1.13 Gather open loop water level vs valve position data for thermal storage inlet feedwater control valves LV3505 and LV3605.

1.14 Gather closed loop control and model verification data for the feedwater level control valves LV3505 and LV3605.

*Steam generation rate limited to 10% of design flow.

TEST SPECIFICATION

TEST NUMBER	1030	DATE	11/18/80
TEST TITLE	Receiver Steam Generation (Controls)	REVISION NO.	0
	Test	PAGE	1 of 3

Note: This test is designed as a collector field operation and controls development test. This is the first test which investigates the collector/receiver optical interactions and the operation of the receiver and steam dump control system under actual steaming operation. Collector system stand alone tests which verify collector system operation (except as it interacts with the receiver) were carried out as part of Test No. 100.

1.0 Objectives

(Collector System-Related Objectives)

1.1 Demonstrate the satisfactory operation of the collector system in TRACK and STANDBY control modes originating from the HAC or OCS computer.

1.2 Demonstrate the satisfactory operation of the collector system in all transitions involving the TRACK mode including the INCREASE and DECREASE functions as controlled from the HAC and OCS computer.

1.3 Demonstrate that a satisfactory receiver heat flux distribution is created with each of the heliostat aim strategies.

1.4 Verify the collector system display functions involving the TRACK and STANDBY functions.

1.5 Demonstrate the collector system trip function originating from the receiver operates as designed.

1.6 Demonstrate the satisfactory operation of the collector field following a "loss of power" signal.

(Receiver System-Related Objectives)

1.7 Gather open loop steam pressure and temperature vs valve position data for the flash tank pressure control valves PV2906, PV647B, and PV1000.

1.8 Gather closed loop control stability margin data for the flash tank pressure control valves defined in 1.7.

1.9 Demonstrate satisfactory closed loop operations of the flash tank pressure controls defined in 1.7.

1.10 Demonstrate the satisfactory closed loop operation of the desuperheater loop DS901/TV1002 during flash tank operation (part flow condition).

1.11 Demonstrate the satisfactory operation of the receiver moisture separators and discharge level control valve AOV2901 under actual steaming conditions.

1.12 Gather open loop steam temperature, metal temperature, steam pressure, and flow response data to variations in valve positions (TV2301-TV2303 · · · TV2801-TV2803), pump speed (P917), and panel power.

1.13 Gather closed loop control and stability margin data for the boiler panel temperature control valves and receiver feed pump defined in 1.12.

1.14 Demonstrate satisfactory operation of the boiler panel temperature control valves and receiver feed pump while flowing to the flash tank (low pressure/low flow operation).

1.15 Demonstrate satisfactory operation of the main steam downcomer valve UV2906 during actual steaming operation.

1.16 Gather open loop steam temperature, metal temperature, and steam pressure response to temperature valve position (TV2301-TV2303 · · · TV2801-TV2803), pump speed (P917), and steam dump valve position (PV1001).

1.17 Gather closed loop control and stability margin data for the valves and pump defined in 1.16.

TEST SPECIFICATION

TEST NUMBER	1030	DATE	11/18/80
TEST TITLE	Receiver Steam Generation (Controls)	REVISION NO.	0
	Test	PAGE	3 of 3

1.18 Demonstrate satisfactory operation of the boiler panel temperature control valves, steam dump valve, and receiver feed pump while flowing at plant design temperature, pressure, and flowrate conditions.

1.19 Demonstrate the satisfactory closed loop operation of the desuperheater loop DS901/TV1002 during steaming operation through the main steam downcomer.

1.20 Demonstrate the satisfactory keyboard operation of the main steam drain valves (before and after seat for the inlet stop valve) MOV905 and MOV906 during warmup operation.

TEST SPECIFICATION

TEST NUMBER	1040	DATE	11/18/80
TEST TITLE	Thermal Storage Charging and Extraction (Controls) Test	REVISION NO.	0
		PAGE	1 of 3

Note: This test is primarily associated with controls development issues associated with thermal storage. As a precussor to this test, test 1030 has been completed thus allowing receiver steam (at actual operating temperatures and pressures) to be used as the input energy source. Receiver steam generated during this test will flow primarily to the steam dump system. Upon completion of this test, the thermal storage system will be capable of controlled, stable operation.

1.0 Objectives

(Charging system)

1.1 Gather open loop control data related to the operation of the thermal storage desuperheater by measuring steam temperature and pressure response to valve (UV3102 and TV3105) position.

1.2 Gather open loop oil temperature vs valve positions (valve UV3102 and TV3105).

1.3 Gather closed loop control and stability margin data for the inlet steam valve UV3102 and spray water valve TV3105.

1.4 Demonstrate the satisfactory closed loop operation of the desuperheater inlet steam valve UV3102 and the spray water valve TV3105.

1.5 Gather open loop oil temperature vs pump speed/valve position data for the charging pump/control valve (P301/TV3411 and P302/TV3410).

1.6 Gather closed loop control and stability margin data for the charging pumps and temperature control valves defined in 1.5.

1.7 Demonstrate the satisfactory closed loop operation of the charging oil pumps and temperature control valves defined in 1.5.

TEST SPECIFICATION

TEST NUMBER	1040	DATE	11/18/80
TEST TITLE	Thermal Storage Charging and Extraction (Controls) Test	REVISION NO.	0
		PAGE	2 of 3

1.8 Gather open loop surge tank level and pressure data vs discharge valve (PV3110 and PV3111) position.

1.9 Gather closed loop control and stability margin data for the automatic operation of the valves defined in 1.8.

1.10 Demonstrate the satisfactory closed loop operation of the valves listed in 1.8.

1.11 Demonstrate satisfactory plant operation during a trip of the TS charging system (steam flow diverted to the steam dump system).

(Extraction System)

1.12 Gather open loop steam pressure and temperature vs valve position/pump speed for the extraction oil control valves and pumps (TV3710/PV3702/P303 and TV3810/PV3802/P304).

1.13 Gather closed loop control and stability margin data for the extraction pumps and control valves defined in 1.12.*

1.14 Demonstrate satisfactory closed loop operation of the extraction oil pumps and control valves defined in 1.12.*

1.15 Gather open loop water level vs valve position data for thermal storage inlet feedwater control valves LV3505 and LV3605.

1.16 Gather closed loop control and stability margin data for thermal storage inlet feedwater control valves LV3505 and LV3605.

*Steam generation rate limited to 10% of design flow.

1.17 Demonstrate satisfactory closed loop operation of the feedwater control valves LV3505 and LV3605.

1.18 Demonstrate the remote (keyboard) operation of the admission steam line warmup valves (MOV903 and MOV904) during warmup operation.

(Thermal Storage Unit)

1.19 Demonstrate satisfactory performance of the TSU top manifold.

1.20 Demonstrate satisfactory performance of the TSU bottom manifold.

1.21 Demonstrate satisfactory operation of the ullage maintenance unit.

4.3 MANUAL CONTROL ACCEPTANCE TESTS

Manual control acceptance tests (1100 Series Tests) are designed to demonstrate the required performance and operating characteristics of the plant in each of the 7 operating modes (plus Mode 8-Inactive) as defined in the System Specification (RADL Item 2-3). Specific data requirements for each of these tests are listed in Section 5.2.2.

TEST SPECIFICATION

TEST NUMBER 1105 DATE 11/18/80

TEST TITLE Preliminary Acceptance Test REVISION NO. 0

PAGE 1 of 1

Note: This test is carried out prior to the initiation of plant level acceptance tests (No.'s 1110-1230). It is intended to provide "quick look" information involving manual plant operation and an early indication of possible problem areas associated with individual operating modes. The implementation of tests related to the specific objectives will be at the discretion of the TWG.

1.0 Objectives

1.1 Gather data pertaining to low and high power receiver operation using the steam dump system

1.2 Gather data pertaining to transitions in receiver temperature set point.

1.3 Gather data pertaining to transitions in receiver input power.

1.4 Gather data pertaining to turbine startup from receiver steam for a cold, warm, and hot turbine.

1.5 Gather data pertaining to the startup of the thermal storage charging loop when receiver steam is flowing to the steam dump system.

1.6 Gather data pertaining to the startup of the thermal storage charging loop when the turbine is operating from receiver steam.

1.7 Gather data pertaining to low and high power of the thermal storage charging loop.

1.8 Gather data pertaining to the operation of the thermal storage charging loop during transients in input power and transition in receiver outlet temperature.

1.9 Gather data pertaining to admitting steam to the turbine through the admission steam port while the turbine is operating on receiver generated steam.

1.10 Gather data pertaining to turbine transition between main and admission steam operation.

TEST SPECIFICATION

TEST NUMBER 1110 DATE 11/19/80

TEST TITLE Mode 1 - Turbine Direct REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate that the plant (turbine) can be started manually from receiver steam subject to the steam temperature and pressure limits as established by the turbine.

1.2 Demonstrate satisfactory operation of the turbine over-speed trip.

1.3 Demonstrate 10 MWe net plant power output at a simulated winter 2PM design point.

1.4 Demonstrate that Mode 1 - sun following operation can be controlled to maintain stable steam conditions within established steam temperature and pressure control limits ("steady state" operation - no cloud passage).

1.5 Demonstrate controlled steam conditions during transitions between low and high power operation (transitions created by modulating collector field power).

1.6 Demonstrate satisfactory plant operation following a trip of the turbine main steam inlet valve.

1.7 Demonstrate satisfactory plant operation following a receiver trip.

1.8 Demonstrate satisfactory manual plant shutdown from Mode 1 operation.

1.9 Gather plant control and operational data during Mode 1 - cloud passage conditions.*

*Optional test to be included in the test procedure. Implementation to be at the discretion of the TWG.

TEST SPECIFICATION

TEST NUMBER 1120 DATE 11/19/80

TEST TITLE Mode 2 - Turbine Direct and Charging REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate that the plant can be manually transitioned from Mode 1 to Mode 2 operation and back in a satisfactory manner.

1.2 Demonstrate that the plant can be manually transitioned from Mode 5 to Mode 2 operation and back in a satisfactory manner.

1.3 Demonstrate that the plant can be operated manually in Mode 2 with a sun following control strategy in a satisfactory manner at the following conditions (See Figure 4-1):

1.3.1 Low turbine flow, low TS change flow
1.3.2 High turbine flow, low TS charge flow
1.3.3 Low turbine flow, high TS charge flow

1.4 Demonstrate that the plant can be operated manually in Mode 2 as defined in 1.3 with a load following control strategy.

1.5 Demonstrate satisfactory Mode 2 operations during transitions between low and high steam flow conditions to the turbine and to the TS charging heat exchangers during sun following and load following operation. (Transitions are as shown in Figure 4-1).

1.6 Demonstrate that controlled Mode 1 operation can be maintained following a trip of the thermal storage charging heat exchangers.

1.7 Demonstrate that controlled Mode 5 operation can be maintained following a trip of the turbine main steam valve.

1.8 Demonstrate a satisfactory plant shutdown following a receiver trip.

1.9 Gather maximum turndown data for thermal storage charging heat exchangers and inlet desuperheater to establish operating limits for hot standby.*

*Optional test to be specified in test procedure. Test implementation is at the discretion of the TWG.

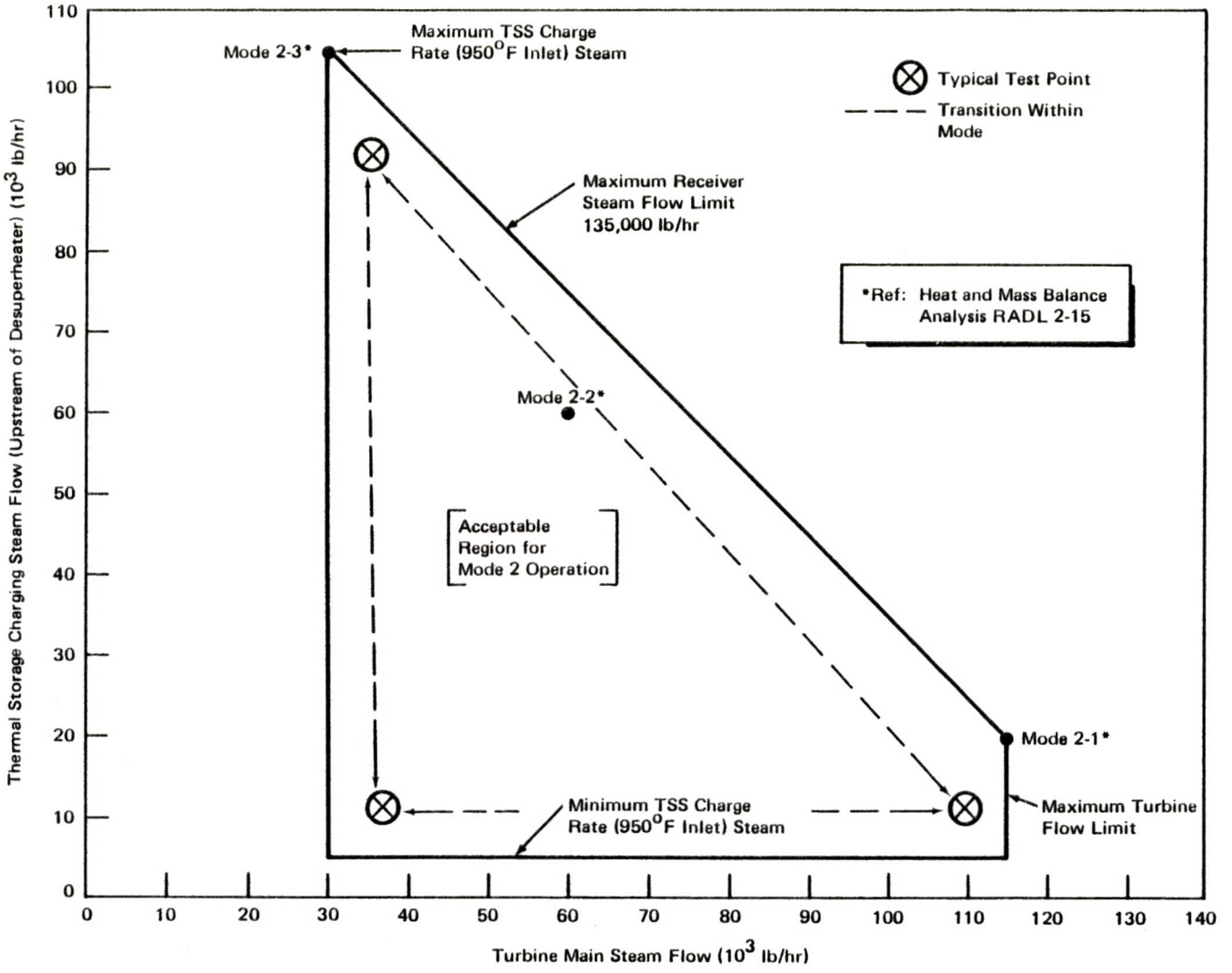


Figure 4-1. Mode 2 Steam Flow Operating Envelope

TEST SPECIFICATION

TEST NUMBER 1130 DATE 11/19/80

TEST TITLE Mode 3 - Storage Boosted REVISION NO. 0

PAGE 1 of 1

1.0 Objective

1.1 Demonstrate the plant can be manually transitioned from Mode 1 to Mode 3 and back again in a controlled manner.

1.2 Demonstrate the plant can be manually transitioned from Mode 6 to Mode 3 and back again in a controlled manner.

1.3 Demonstrate stable and controlled Mode 3 operation for a load following control strategy for the following steam flow conditions (See Figure 4-2):*

1.3.1 Low receiver flow, low admission steam flow
1.3.2 High receiver flow, low admission steam flow
1.3.3 Low receiver flow, high admission steam flow

1.4 Demonstrate stable and controlled Mode 3 operation during transitions between low and high receiver and admission steam flows (See Figure 4-2).*

1.5 Demonstrate that the plant operates in a stable and controlled Mode 1 following the trip of the thermal storage extraction loop or turbine admission steam inlet valve.

1.6 Demonstrate that the plant operates in a stable and controlled Mode 6 following the trip of the receiver or turbine main steam inlet valve.

1.7 Gather Mode 3 manual control plant operating data during cloud passage.**

1.8 Gather maximum turndown data for thermal storage extraction heat exchangers and establish operating limits for hot standby.**

*Test to be carried out during clear day operation.

**Optional test to be specified in the procedure. Implementation of the test is at the discretion of the TWG.

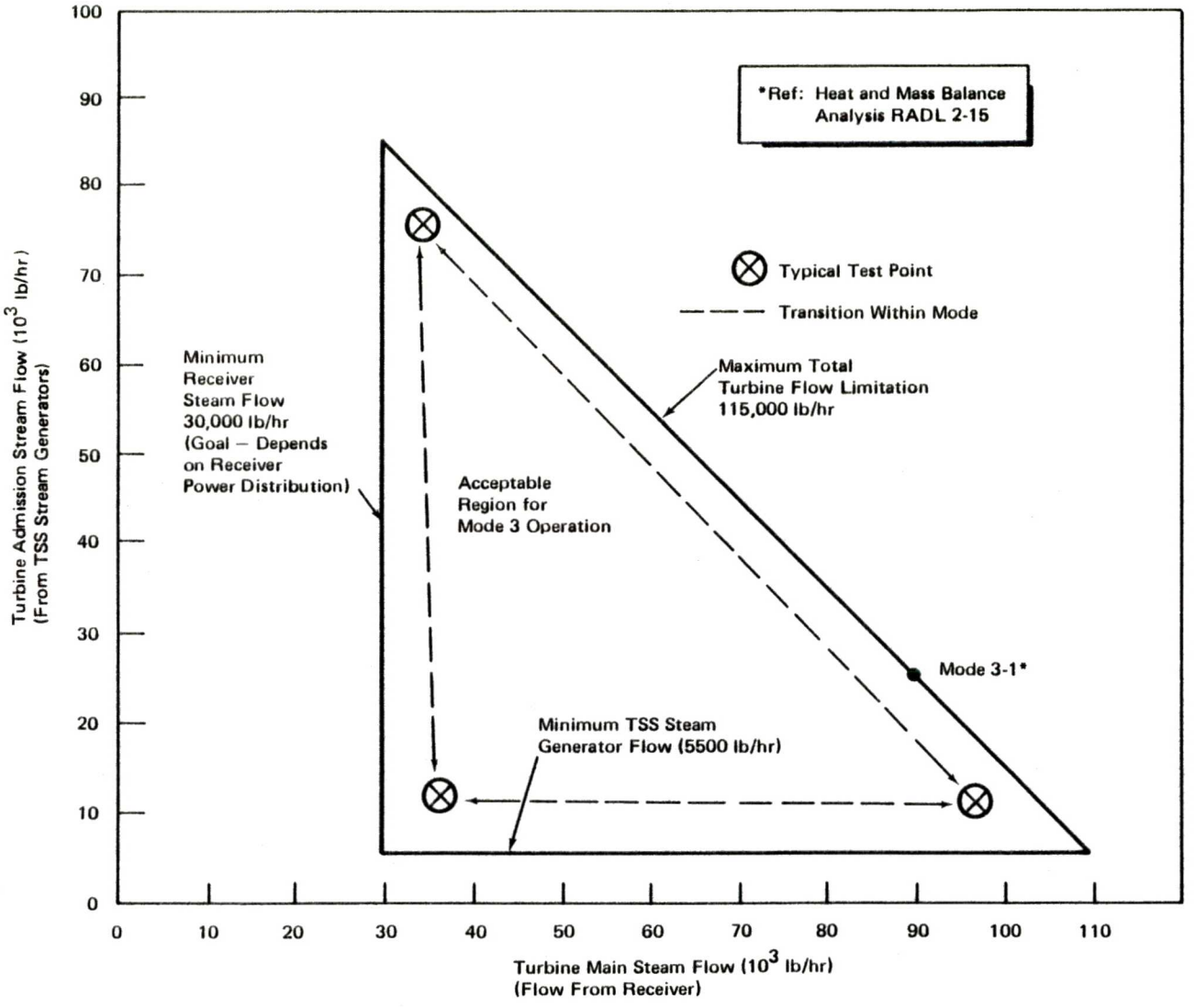


Figure 4-2. Mode 3 Steam Flow Operating Envelope

TEST SPECIFICATION

TEST NUMBER 1140 DATE 11/19/80

TEST TITLE Mode 4-In-Line Flow REVISION NO. 0

PAGE 1 of 2

1.0 Objectives

1.1 Demonstrate the plant can be manually transitioned from Mode 5 to Mode 4 and back again in a controlled manner.

1.2 Demonstrate the plant can be manually transitioned from Mode 6 to Mode 4 and back again in a controlled manner.

1.3 Demonstrate stable and controlled Mode 4 operation for a cascade control strategy for the following receiver steam conditions (See Figure 4-3): *

1.3.1 Low receiver flow, derated (660°F) steam temperature
1.3.2 Low receiver flow, rated (960°F) steam temperature
1.3.3 High receiver flow, derated (660°F) steam temperature
1.3.4 High receiver flow, rated (960°F) steam temperature

(The thermal storage extraction flow shall be set such that a net TS charging and extraction condition exists for the high and low receiver flows respectively).

1.4 Demonstrate stable and controlled Mode 4 operation during transitions between low and high steam flow rates (as applied to the receiver and turbine admission steam flow rates) and between rated and derated receiver steam temperatures (see Figure 4-3). *

1.5 Demonstrate that the plant operates in a stable and controlled Mode 5 following a trip of the thermal storage extraction loop or turbine admission steam inlet valve.

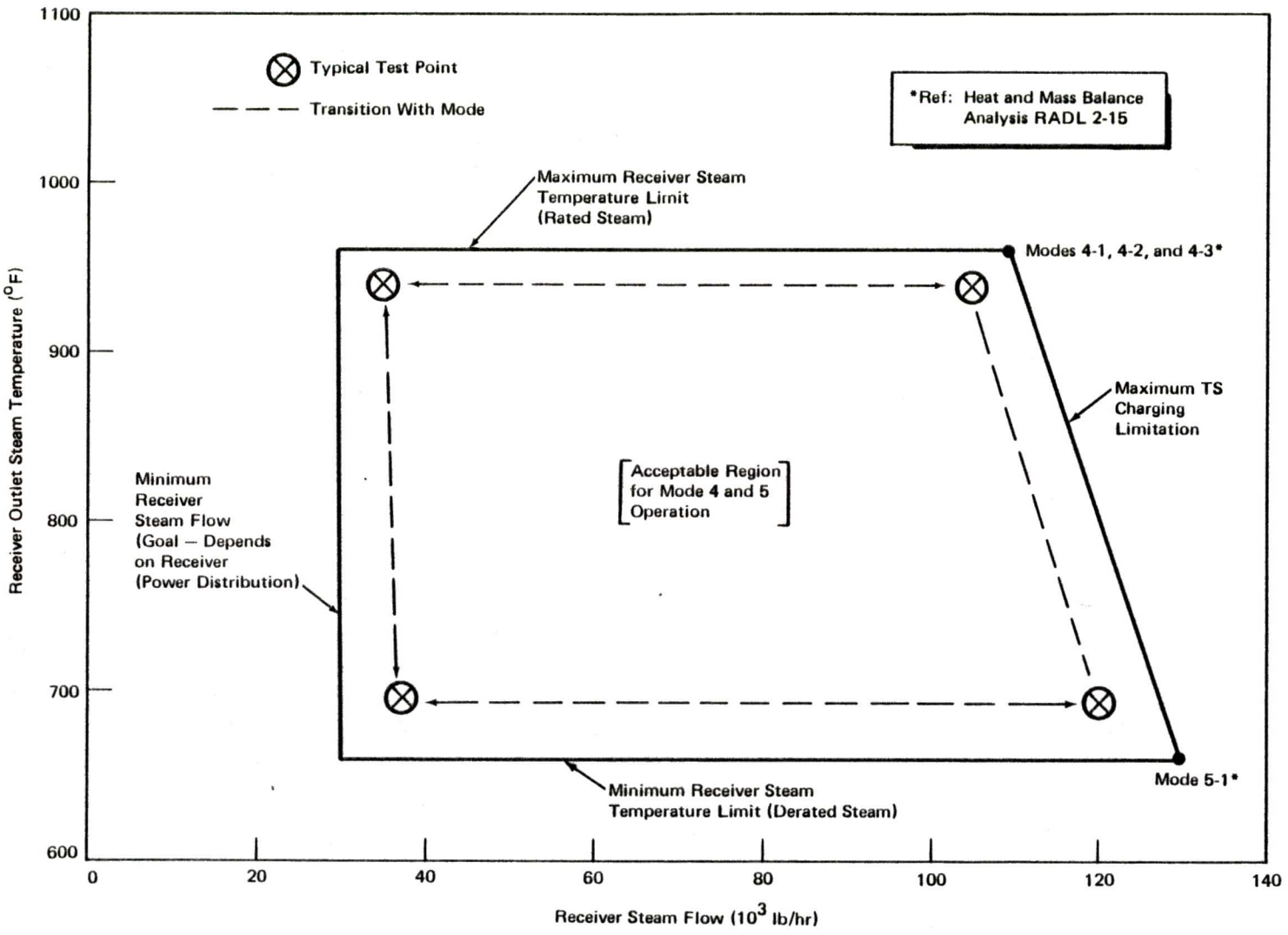


Figure 4-3. Mode 4 and 5 Charging Flow Operating Envelope

TEST SPECIFICATION

TEST NUMBER 1140 DATE 11/19/80

TEST TITLE Mode 4-In-Line Flow REVISION NO. 0

PAGE 2 of 2

1.6 Demonstrate that the plant operates in a stable and controlled Mode 6 following a receiver trip or a trip of the thermal storage charging loop. (Note that the latter trip condition will activate the steam dump system which could overload the condenser if high receiver and admission steam flows occured simultaneously).

1.7 Gather Mode 4 manual control plant operating data during cloud passage for rated, intermediate, and derated steam conditions. **

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*Test to be carried out during clear day operation.

**Optional test to be specified in the procedure. Implementation of the test is at the discretion of the TWG.

TEST SPECIFICATION

TEST NUMBER 1150 DATE 11/19/80

TEST TITLE Mode 5 - Charging Only REVISION NO. 0

PAGE 1 of 1

Note: Due to the need to discharge thermal storage periodically to allow the execution of this charging test procedure, Mode 5 tests (No 1150) and Mode 6 tests (No 1160) are to be carried out on an overlapping basis.

1.0 Objectives

1.1 Demonstrate that the plant can be manually started from receiver steam and transitioned into Mode 5 operation in a satisfactory manner.

1.2 Demonstrate 10 MWe equivalent thermal storage charge rate.

1.3 Demonstrate stable and controlled Mode 5 operation in a sun following control strategy for the following receiver steam conditions (See Figure 4-3): *

1.3.1 Low receiver flow, derated (660°F) receiver steam temperature
1.3.2 Low receiver flow, rated (960°F) receiver steam temperature
1.3.3 High receiver flow, derated (660°F) receiver steam temperature
1.3.4 High receiver flow, rated (960°F) receiver steam temperature

1.4 Demonstrate stable and controlled Mode operation during transitions between low and high steam flow rates and between rated and derated receiver steam temperatures (see Figure 4-3).

1.5 Demonstrate that controlled and stable receiver operations can be maintained through the steam dump system following a trip of the thermal storage charging loop.

1.6 Demonstrate proper system response to a receiver trip.

1.7 Demonstrate proper plant manual shutdown from Mode 5 operation.

1.8 Gather Mode 5 manual control plant operating data during cloud passage for rated, intermediate, and derated receiver steam conditions. **

* Tests to be carried out during clear day operations.

** Optional tests to be specified in the procedure. Implementation of the test is at the discretion of the TWG.

TEST SPECIFICATION

TEST NUMBER 1160 DATE 11/19/80

TEST TITLE Mode 6 - Storage Discharging REVISION NO. 0

PAGE 1 of 1

Note: Because of the need to charge thermal storage prior to the initiation of this test, it will be carried out in conjunction with Mode 5 - (Test No. 1150) operation.

1.0 Objectives

1.1 Demonstrate that the plant (turbine) can be started manually from admission steam subject to steam temperature and pressure limits as established by the turbine.

1.2 Demonstrate satisfactory operation of the turbine over-speed trip as it effects admission steam operation.

1.3 Demonstrate that the plant can produce 7MWe net power to the grid for a period of 4 hours while using thermal power derived exclusively from thermal storage.

1.4 Demonstrate controlled and stable plant operation in a load following control strategy during low power operation (2 MWe).

1.5 Demonstrate controlled and stable plant operation in a load following control strategy during high power operation (7 MWe).

1.6 Demonstrate stable and controlled operation during transitions between low power and high power operation while maintaining Mode 6 operation.

1.7 Demonstrate satisfactory plant operation following a trip of the turbine admission steam valve or thermal storage extraction loop.

1.8 Demonstrate proper plant manual shutdown from Mode 6 operation.

TEST SPECIFICATION

TEST NUMBER 1170 DATE 11/19/80

TEST TITLE Mode 7 - Dual Flow REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate the plant can be transitioned from Mode 2 to Mode 7 and back again in a controlled manner.

1.2 Demonstrate the plant can be transitioned from Mode 3 to Mode 7 and back again in a controlled manner.

1.3 Demonstrate the plant can be transitioned from Mode 4 to Mode 7 and back again in a controlled manner.

1.4 Demonstrate the controlled and stable Mode 7 operation with cascade control at the test points shown in Figure 4-4.

1.5 Demonstrate controlled and stable Mode 7 operations during transitions between low and high power test points for the 3 active steam paths as shown in Figure 4-4.

1.6 Demonstrate the plant operates in a stable and controlled manner in Mode 2 following a trip of the thermal storage extraction loop or the turbine admission steam valve.

1.7 Demonstrate the plant operates in a stable and controlled manner in Mode 3 following a trip of the thermal storage charging loop.

1.8 Demonstrate the plant operates in a stable and controlled manner in Mode 4 following a trip of the turbine main steam stop valve.

1.9 Demonstrate the plant operates in a stable and controlled manner in Mode 6 following a trip of the receiver.

1.10 Gather data related to parasitic power operation during Mode 7 max flow and min flow operation. *

*Optional test to be specified in the procedure. Test implementation is at the discretion of the TWG.

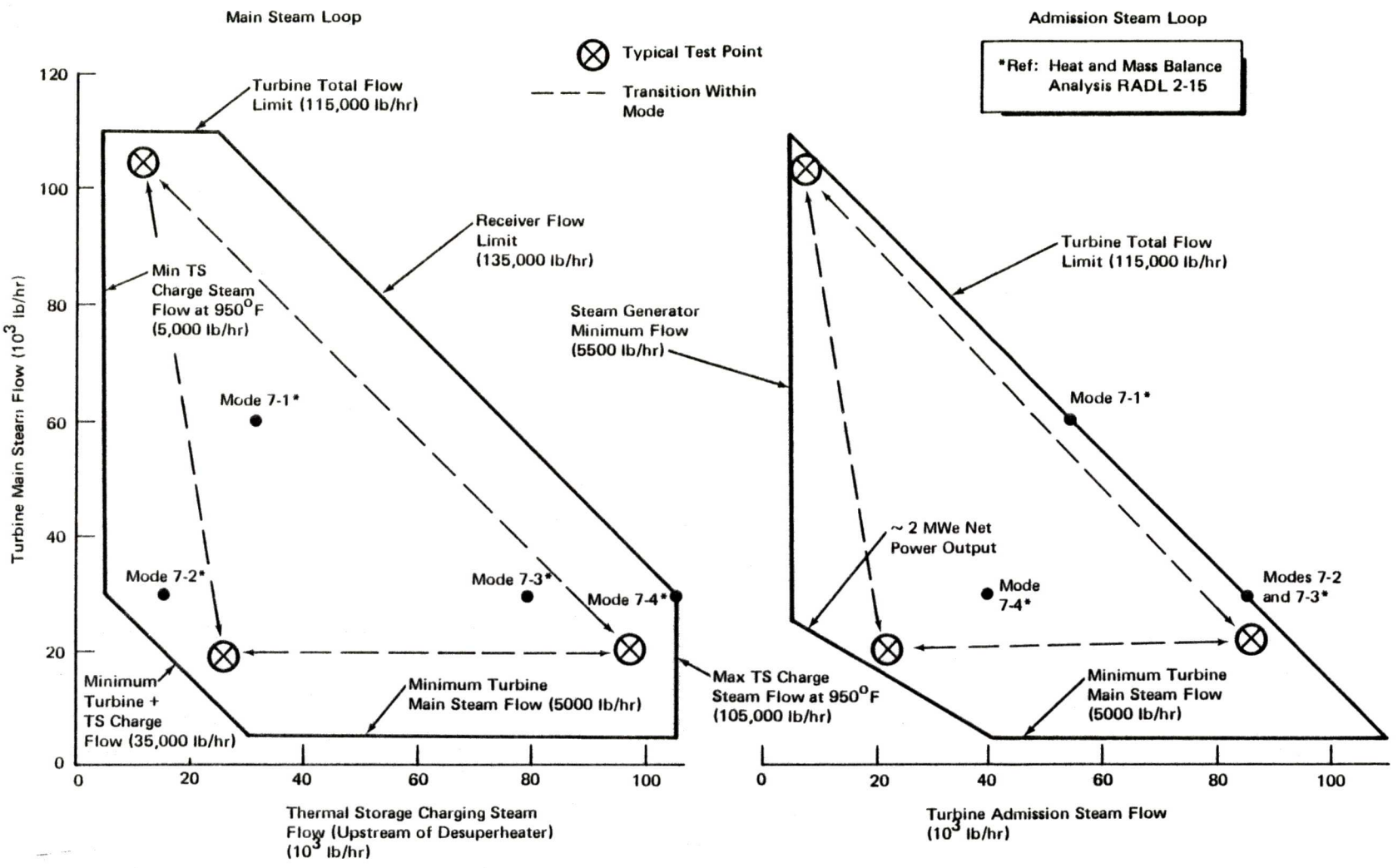

Figure 4-4. Mode 7 Steam Flow Operating Envelope

TEST SPECIFICATION

TEST NUMBER 1180 DATE 11/26/80

TEST TITLE Mode 8 - Inactive REVISION NO. 0

PAGE 1 of 2

Note: It is the purpose of Mode 8 operation to maintain the plant in a "blanketed" condition that would be used during normal evening shutdown periods. The "blanketing" can be provided by steam generated in either the thermal storage steam generator or auxiliary electric boiler or though the GN_2 system. Selected aspects of Mode 8 operation have been previously demonstrated during earlier tests as follows:

Test	Mode 8 Related Issue
205	Operation of TS auxiliary oil pump (P-305)
420	Operation of auxiliary electric boiler (B-901)
505	Operation of condenser vacuum breaker
505	Operation of auxiliary Boiler/Thermal Storage Feedwater Pump (P-904)
905	Pressurization of GN_2 equipment

This test demonstrates the remaining objectives associated with plant blanketing and initial startup functions. This test is required as a prerequisite to Test No. 1030.

1.0 Objectives

1.1 Demonstrate the controlled and stable generation of blanketing steam by the thermal storage steam generators while supplying heated oil with the auxiliary extraction pump P-305 and storage feedwater pump (P-904).

1.2 Demonstrate the controlled and stable generation of blanketing steam by the auxiliary electric boiler during actual blanketing operation.

1.3 Demonstrate that the deaerator steam pressure can be pegged with auxiliary steam as designed during stagnant period and during condensate circulation associated with water cleanup.

TEST SPECIFICATION

TEST NUMBER 1180 DATE 11/26/80

TEST TITLE Mode 8 - Inactive REVISION NO. 0

PAGE 2 of 2

1.4 Demonstrate that non-operating pipes and equipment can be maintained at the design temperature for blanketing operation.

1.5 Gather data related to the amount of water chemistry deterioration during non-operating periods and the rate at which subsequent cleanup can be accomplished. *

*Optional test to be contained in the test procedure. Implementation of the test shall be at the discretion of the TWG.

4.4 AUTOMATIC CONTROL ACCEPTANCE TESTS

Automatic control acceptance tests (1200 Series Tests) are designed to demonstrate both manual and automatic plant operation through the OCS computer. These tests exercise the plant in 5 modes, through 12 transitions, and through an automatic clear day scenarios. Specific data requirements for each of these tests are listed in Section 5.2.2.

TEST SPECIFICATION

TEST NUMBER 1210 DATE 11-19-80

TEST TITLE CASCADE CONTROL AND PLANT TRANSITIONS REVISION NO. 0

Note: During this test, plant operations are under control of the OCS computer and can be controlled in a manual or fully automatic manner as specified in the objectives. Control of the plant is in a cascade control strategy.

1.0 Objectives

1.1 Demonstrate that the plant operates in a stable and controlled fashion in Mode 1.

1.2 Demonstrate while in Mode 1, the proper OCS response to the following trips:

1.2.1 Receiver trip
1.2.2 Turbine main steam inlet valve trip

1.3 Demonstrate that the plant can be transitioned from Mode 1 to Mode 2 both manually and automatically.

1.4 Demonstrate that the plant can be transitioned from Mode 1 to Mode 3 both manually and automatically.

1.5 Demonstrate that the plant operates in a stable and controlled fashion in Mode 2.

1.6 Demonstrate that the plant can be transitioned from Mode 2 to Mode 1 both manually and automatically.

1.7 Demonstrate that the plant can be manually transitioned from Mode 2 to Mode 5.

1.8 Demonstrate while in Mode 2, the proper OCS response to the following trips:

1.7.1 Receiver trip
1.7.2 Turbine main steam inlet valve trip
1.7.3 Thermal storage charging loop trip

1.9 Demonstrate that the plant operates in a stable and controlled fashion in Mode 3.

1.10 Demonstrate that the plant can be transitioned from Mode 3 to Mode 1 both manually and automatically.

1.11 Demonstrate that the plant can be transitioned from Mode 3 to Mode 6 both manually and automatically.

1.12 Demonstrate while in Mode 3, the proper OCS response to the following trips:

1.12.1 Turbine admission steam inlet valve trip
1.12.2 Thermal storage extraction loop trip
1.12.3 Turbine main steam inlet valve trip
1.12.4 Receiver trip

1.13 Demonstrate that the plant operates in a stable and controlled fashion in Mode 4.

1.14 Demonstrate that the plant can be manually transitioned from Mode 4 to Mode 5.

1.15 Demonstrate that the plant can be manually transitioned from Mode 4 to Mode 6.

1.16 Demonstrate while in Mode 4, the proper OCS response to the following trips:

1.16.1 Thermal storage charging loop trip
1.16.2 Receiver trip
1.16.3 Thermal storage extraction loop trip
1.16.4 Turbine admission steam inlet valve trip

1.17 Demonstrate that the plant operates in a stable and controlled fashion in Mode 5.

1.18 Demonstrate while in Mode 5 the proper OCS response to the following trips:

1.18.1 Thermal storage charging loop trip
1.18.2 Receiver trip

1.19 Demonstrate that the plant operates in a stable and controlled fashion in Mode 6.

1.20 Demonstrate while in Mode 6 the proper OCS response to the following trips:

1.20.1 Turbine main steam inlet valve trip
1.20.2 Receiver trip

TEST SPECIFICATION

TEST NUMBER 1220 DATE 11-19-80

TEST TITLE COORDINATED CONTROL AND PLANT TRANSITIONS REVISION NO. 0

PAGE 1 of 1

Note: During this test, plant operations are under the control of the OCS computer. Control of the plant is in a coordinated control strategy or involves transitions between cascade and coordinated control strategies.

1.0 Objectives

1.1 Demonstrate from steady state operation in Mode 2 that the plant can be properly transitioned (OCS manual) from a cascade to coordinated control strategy.

1.2 Demonstrate that Mode 2 coordinated control can be maintained within established operating limits.

1.3 Demonstrate from steady state operation in Mode 2 that the plant can be properly transitioned (OCS manual) from a coordinated to cascade control strategy.

1.4 Demonstrate while in Mode 2, coordinated control strategy, the proper OCS response to the following trips:

1.4.1 Turbine main steam inlet valve trip
1.4.2 Thermal storage charging loop trip
1.4.3 Receiver trip

1.5 Demonstrate from steady state operation in Mode 3 that the plant can be properly transitioned (OCS manual) from a cascade to coordinated control strategy.

1.6 Demonstrate that Mode 3 coordinated control can be maintained within established operating limits.

1.7 Demonstrate from steady state operation in Mode 3 that the plant can be properly transitioned (OCS manual) from a coordinated to a cascade control strategy.

1.8 Demonstrate while in Mode 3, coordinated control strategy, the proper OCS response to the following trips:

1.8.1 Turbine main steam inlet valve trip
1.8.2 Receiver trip
1.8.3 Turbine admission steam inlet valve trip
1.8.4 Thermal storage extraction loop trip

TEST SPECIFICATION

TEST NUMBER 1230 DATE 11-19-80

TEST TITLE CLEAR DAY SCENARIO REVISION NO. 0

PAGE 1 of 1

1.0 Objectives

1.1 Demonstrate that the OCS can properly control the plant through a typical clear day scenario (see Figure 4-5) by performing the following automatic transitions, starting with the plant in steady state operation in Mode 1, OCS automatic control:

Mode Transitions	
(from)	(to)
1	2
2	1
1	3
3	6
6	Shutdown (Operator input)

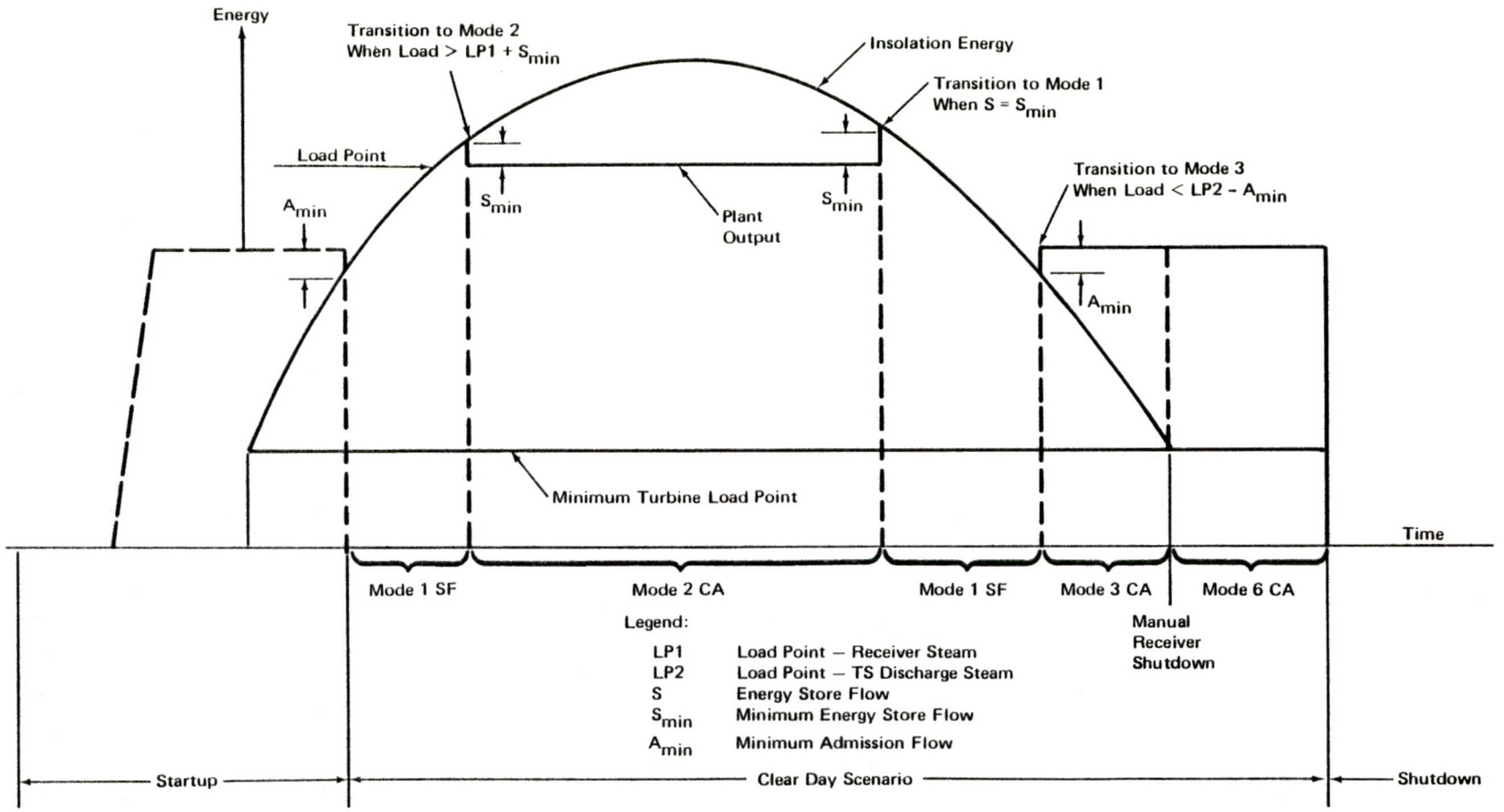

Figure 4-5. Clear-Day Scenario

Section 5
TEST MANAGEMENT, DATA AND DOCUMENTATION REQUIREMENTS

5.1 TEST MANAGEMENT

The management of the Solar One startup test activities will be carried out by three working groups designed to provide complementary functions. Participants from major program organizations have been assigned to each group.

The working groups are:

1) Steering Committee
2) Test Working Group (TWG)
3) Test Analysis Group (TAG)

The membership and responsibilities of each group are shown in Figure 5-1 along with the relationship between the three groups.

5.1.1 Steering Committee

The primary function of the Steering Committee is to provide top-down direction to the Test Working Group (TWG) and Test Analysis Group (TAG). Meetings are convened on an as required basis to provide the necessary direction or to resolve contractual issues that may develop during the detailed test planning and implementation activities.

5.1.2 Test Working Group (TWG)

The TWG is responsible for the technical planning and implementation of the startup test program. As a result, its members will be involved in the development of the test plans plus the detailed preparation and review of individual test procedures.

During the conduct of the test program, the TWG will be responsible for the day to day progression of the planned test program. Key members will meet on a daily basis to review progress and plan the following days

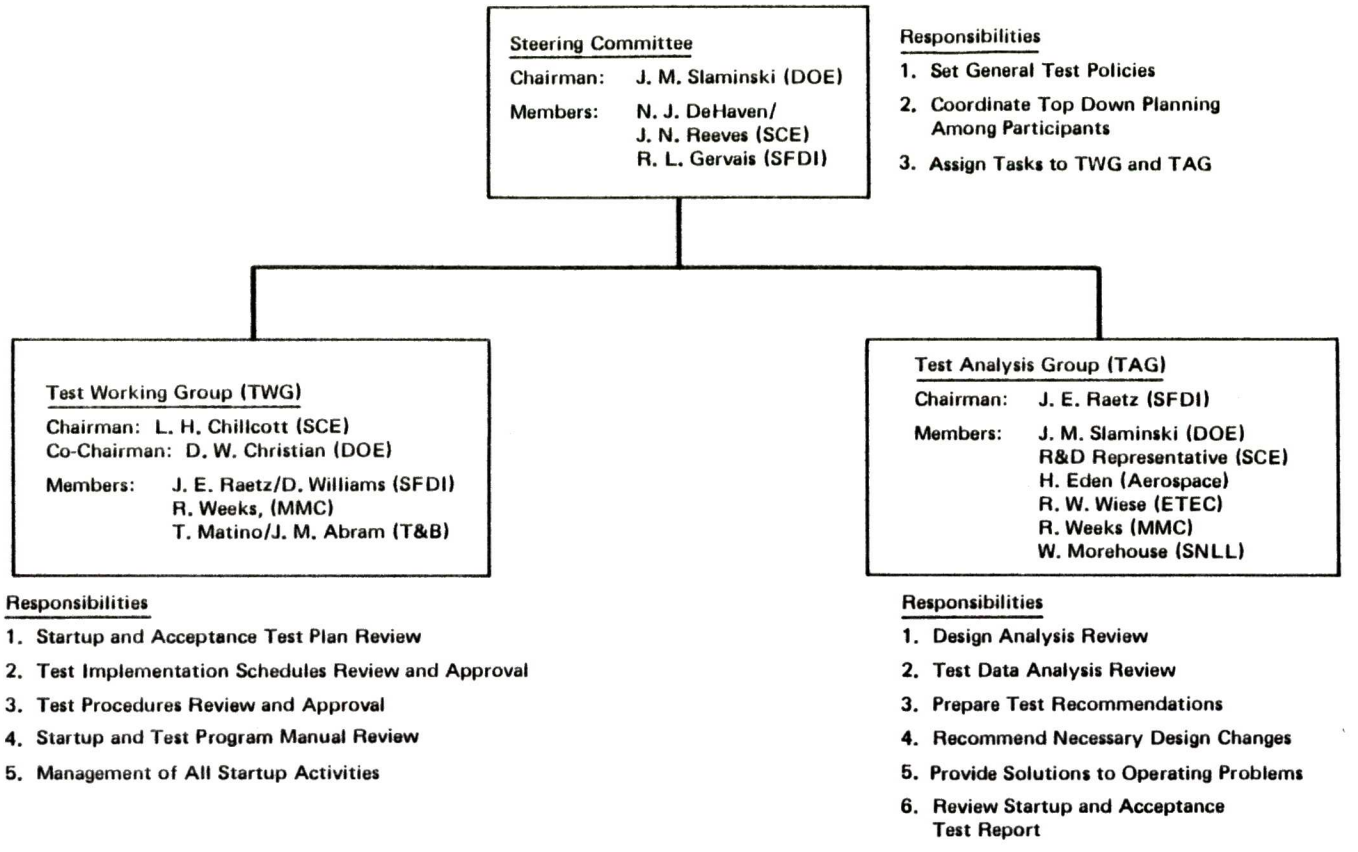

Figure 5-1. Startup and Acceptance Test Management Diagram 10 MWe Solar Central Receiver Pilot Plant

activities. The roles, responsibilities, and authorities of the TWG during the conduct of the test program are as follows:

- Ensure that adequate preparation has been made for individual tests
- Verify the completion of individual startup tests as presented by the cognizant startup engineer
- Alter or modify the test plan and/or procedure on a real time basis.
- Prepare and implement work around plans in the event of startup problems as well as assigning repair/restoration responsibility.
- Waive specific test requirements based on schedule considerations or hardware limitations.
- Review and approve (or veto) the implementation of special tests as requested by the TAG or other organization.
- Ensure that the necessary personnel are available to support the execution of individual tests.

Decisions of the TWG will be based on majority rule with the SCE representative retaining absolute veto power over any TWG action. TWG members may choose not to participate in decisions in which they have no direct interest or concern. For example, it is not necessary to have the Martin Marietta representative involved in decisions effecting PSS equipment not related to the collector field.

5.1.3 Test Analysis Group (TAG)

The TAG is responsible for carrying out an independent review of critical plant design and test related activities and to provide technical support to the TWG during and after the conduct of individual tests. As part of the independent review function, the TAG shall identify areas of the design requiring specific attention during the test program and make specific recommendations regarding individual tests to be conducted. As test data become available, the TAG will review the results to determine the detailed behavior of the systems or elements in question. This review will be in concert with the objectives and acceptance criteria as stated in the test procedure and subject to data availability limitations as outlined in Section 5.2. The

TAG will also review the Startup and Acceptance Test Report which will be prepared and distributed as described in Section 5.3.

The TWG-related support involves short and long term problem solving activities such as recommendations regarding special tests, potential design changes, and changes in operating procedures.

5.2 TEST DATA ACQUISITION AND EVALUATION

Significant data gathering activities will be carried out as part of the Inter-System Preoperational Tests (1010-1040)* and both the manual control (1105-1180)* and automatic control (1210-1230)* portions of the Plant Acceptance Tests.** Evaluation of selected parameters will then be carried out to verify that the test objectives have been satisfied based on the stated acceptance criteria.

5.2.1 Data Gathering Capabilities

Data gathering will involve the simultaneous use of some or all of the data display and recording equipment shown in Figure 5-2. The types and extent of the data to be gathered depends on the specific data requirements defined in each test procedure. Summary tabulations contained in Section 5.2.2 identify the generic types of data to be recorded and reduced during the Inter-System Preoperational Tests and both the manual control and automatic control acceptance tests. Before finalizing the data requirements for each test, a careful evaluation relative to the data transmission and equipment limitations must be made. Requirements for extremely large quantities of data or high data rates for large numbers of parameters may saturate the data links or be physically impossible due to the low priority assigned to data transmission in a particular computer.

The following paragraphs define the data gathering and recording capabilities that are available to operating and plant evaluation personnel. Due to continuing design activities and negotiations between DOE and the solar-

*Test procedure number

**Test data to be recorded during Intra-System tests (000-980) will be limited to entries made in the test procedures in compliance with the test requirements and data archived on selected recording equipment.

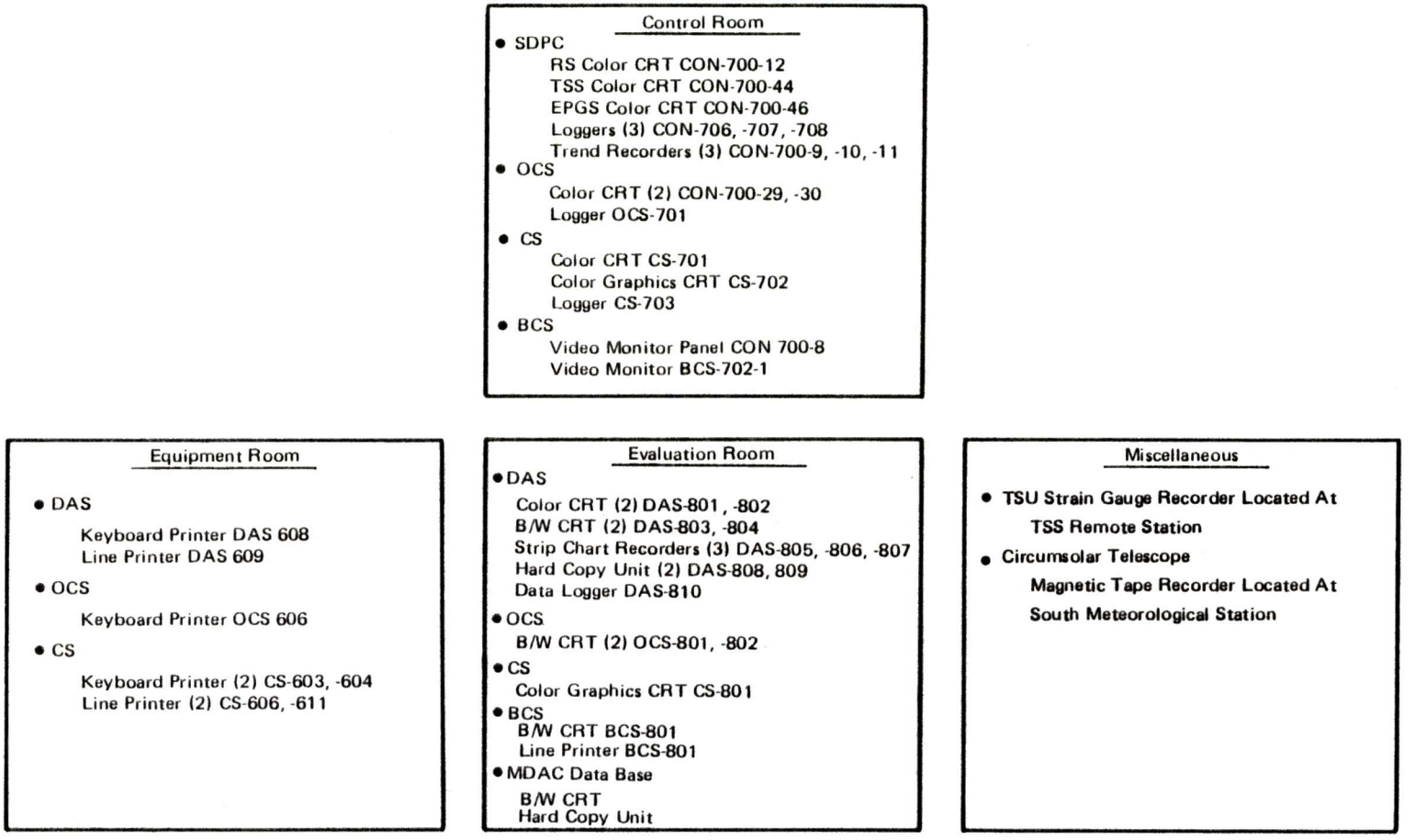

Figure 5-2. On-Site Data Display and Recording Equipment

equipment suppliers, some changes to the data gathering and recording capability over what is presented in the following paragraphs may occur, particularly involving the HAC to DAS interface, SDPC to DAS interface, and circumsolar telescope.

5.2.1.1 SDPC Data

Each of the three SDPC color CRT's is capable of displaying overview, group, loop, trend, and alarm summary data which is part of the standard Beckman MV-8000 system capability (3 MV-8000 systems used in the plant). In addition, a total of 99 subsystem graphics displays can be allocated between the 3 MV-8000 systems for custom display information. The 3 CRT terminals can be used interchangeably from a control and display stand point. The displays however are limited to data contained in the particular MV-8000 systems being serviced by the CRT terminal. Information contained in these CRT displays will be limited for the most part to data required for plant operations by the operating personnel.

Loggers are dedicated to each of the MV-8000 systems and provide a permanent record of "broadcast" messages (alarms and operator commands) associated with that MV-8000. In addition, the logger can record the controller characteristics (constants, gains, etc.) for the MV-8000 controllers. The logger can also produce a hard copy of the graphic displays shown on the CRT. During the generation of this hard copy, other logging functions are interrupted. This interruption can be circumvented by commanding a second control terminal to interface with the MV-8000 system of interest and using the related logger to produce the desired hard copy.

Trend recorders are available to provide analog equivalent data. The three trend recorders can record 18 parameters from the entire SDPC system with a maximum of 12 parameters being taken from one MV-8000 system. Parameters that can be trend recorded are "tagged" parameters such as process variables, set points, and controller outputs. The ability to record true analog information is limited however since the measured data is digitized prior to being sent to the trend recorders and refreshed only at the characteristic update rate of the MV-8000 system.

5.2.1.2 OCS Data

The OCS data available during plant operation is available in the forms of CRT displays (2 color/2 black and white) and a dedicated logger located in the control room. The color CRTs located in the control room can display tabular and graphical information. Data for the displays can be drawn on a simultaneous basis from the 3 MV-8000 systems as well as the HAC and DAS computers. The black and white CRTs located in the Data Evaluation Room will display OCS system information related to software development, system diagnosis, and maintenance. As such, the black and white CRT's will not be a primary source of preoperational and acceptance test data.

The OCS logger located in the Control Room provides a time tagged record of selected OCS parameters such as plant status (operating mode or mode transitions), internal (software generated) commands, OCS alarms, and calculated outputs. The logger along with its associate CRT terminal can be diverted to assume the function of one of the dedicated MV-8000 terminals. In this way, it can assume the display and logging functions described in Section 5.2.1.1 for the MV-8000 terminal.

5.2.1.3 Collector System Data

The collector system data are available through 3 CRT's located in the Control and Data Evaluation Rooms, a support logger located in the Control Room, and 2 line printers located in the Equipment Room. The graphics CRT's (one each in the Control and Data Evaluation Rooms) will display the field status and segment status graphics along with BCS control information as it applies to the HAC computer. Operator interaction with the CS is available however only through the Control Room CRT terminal while displays for the Data Evaluation Room CRT may be independently requested at that terminal.

The remaining control console CRT located in the Control Room displays the field status information in terms of numbers of heliostats in various modes and CS alarm information. Upon request, mode status displays (11), individual heliostat displays (1818), and ring track displays (5) can be shown on the CRT.

Control Room logging functions record CS command and alarm information as well as BCS non-critical alarm information involving errors in image centroid location or beam power. Collector field status data is recorded on the line printers located in the Equipment Room along with CS software, maintenance, and diagnostic information.

5.2.1.4 Data Acquisition System Recording and Archiving (On-Site)

On-site DAS recording functions as shown in Figure 5-3 are accomplished by continually updating the DAS storage buffers from the global data base and simultaneously (although at possibly a different rate) diverting the data in each buffer to magnetic tape for permanent archiving. Six independent buffers are used for this function. These buffers are:

- BUFHA (HAC buffer)
- BUFOC (OCS buffer)
- BUFSD (SDPC buffer)
- BUFDA (DARMS buffer)
- BUFSH (SHIMMS buffer)
- BUFTR (High speed trip buffer)

In all cases, the archived data will be in the form of "raw" data which is neither dimensionalized nor expressed in engineering units. In each buffer, a predefined and ordered scan list of parameters is used to gather and store the raw data in the buffer and subsequently divert it to the archiving tape. Since the archived data is "stacked" on the tape with no tag numbers, the buffer scan list along with calibration data is entered as a header to each archiving tape. Prior to a test, the operator has the option of whether or not to archive the data in each buffer independent from the other buffers and the archiving rate for that buffer. Note that the entire buffer measurement list will be archived at the specified rate.

BUFHA

(Subject to change) The HAC buffer can accommodate responses to the "Field Status" request and "Ring Status" request (applied to each of the 5 rings) as defined in the CS-MCS and CS-Plant Interface Requirements Document (RADL 2-30-1). Due to data flow limitations and low HAC priority, the data

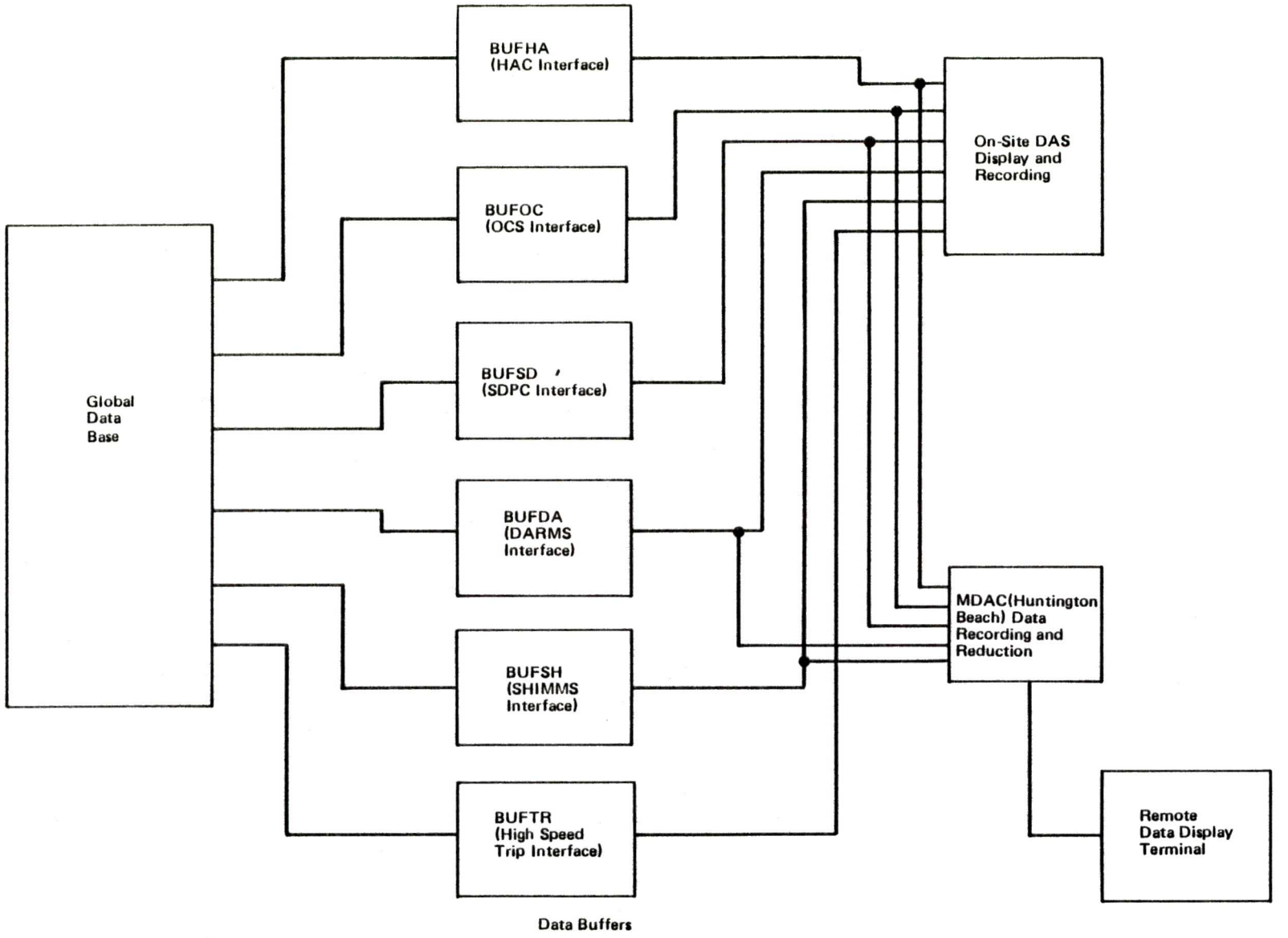

Figure 5-3. DAS Data Recording

in the buffer will be refreshed at a maximum rate of once every 64 seconds. The archiving rate may be specified by the operator.

BUFOC

The OCS buffer can accommodate 200 entries (16 bit words) which can be used to store OCS data as well as command and alarm information.

BUFSD

The SDPC buffer accommodates scan list information involving measured parameters, set points, and controller outputs, as well as SDPC "broadcast" messages resulting from commands and alarms. In addition, parameters internal to an MVCU (derived parameters) may be archived by properly tagging the parameters and including them in the scan list. Data pertaining to MVCU controller configurations (up to 50 parameters per controller) will be transmitted to the DAS at the beginning of a test and will be included as a special section or as tape header information. Subsequent changes to the controller configurations during the course of a test will be archived in the form of "broadcast" (command) messages.

Depending on the specific test requirements, a particular scan list can be loaded into the DAS prior to an individual test. Once the DAS is activated the scan list and archiving frequency can not be changed. When final design of all equipment is complete, the refresh rate for the SDPC buffer will be every 2-5 seconds.

BUFDA

The DARMS buffer can accommodate data at a rate of up to 40 times per second for those parameters wired directly to the DARMS port. Archiving will be on the basis of preloaded scan lists. As in the case of the SDPC buffer, the scan list and archiving frequency can not be changed once the DAS is activated to carryout its recording function.

BUFSH

The SHIMMS buffer accommodates all meteorological and instrumented heliostat data (when available from the field) with a refresh rate of once

per minute. All data* can be archived on site at the rate specified by the operator.

BUFTR

The buffer associated with the high-speed trip data permits the archiving of this data without interrupting the normal DAS recording functions. The recorded data will correspond to the entries contained in the high speed scan list used during that particular test.

5.2.1.5 Data Acquisition System Recording and Archiving (MDAC-Huntington Beach)

The ability to record and archive DAS data at MDAC-Huntington Beach is identical to the buffer-by-buffer capability described in Section 5.2.1.4 (on-site recording) with the following exceptions and limitations:

(i) total data flow from the site to MDAC must be compatible with 5-9600 band data lines.

(ii) fast scan data from the high-speed trip buffer (BUFTR) will not be transmitted to MDAC.

(iii) instrumented heliostat data will not be transmitted to MDAC.

For each of the buffers, the operator can select a unique archive rate (which may also differ from the archive rate used for on-site recording) for the MDAC recording equipment. The buffer scan list will however be identical to that used for on-site recording.

In order to minimize the work load of plant operators and reduce the number of on-site evaluation personnel, the "Grandfather" tapes will be made at the MDAC facility. In this way, the data can be processed directly with existing MDAC data reduction programs while on-site tape changing and tape storage can be minimized. Sufficient data will be processed on-site however to ensure that for each test compliance with test acceptance criteria has been met.

*Data transmitted to MDAC Huntington Beach will be limited to meteorological information only.

5.2.1.6 Other Data Acquisition System On-Site Displays and Recording Capabilities

In addition to the magnetic tape data storage capabilities discussed in Sections 5.2.1.4 and 5.2.1.5, DAS data can be displayed and recorded through CRT displays, hard copy units, strip chart recorders, and data loggers.

CRT Displays

The DAS employs 4 CRT's (2 color and 2 black and white) which are located in the Data Evaluation Room for the purposes of displaying real time data (dimensionalized data in engineering units). The two color CRT's can display either plots or tabular data while the black and white CRT's can display tabular data only.

Each plot can contain up to 4 parameters which are displayed on a time history basis over a time scale ranging from 100 seconds to 5 hours (selectable by the DAS operator). A total of 20 displays are available with two of the displays being definable by the operator during the execution of the test. The remaining 18 displays must be defined (parameters and time scale) before the initiation of the test. Once the test starts, these displays are "firm" until the test is complete or the DAS system is removed from its recording function.

The tabulations are available in fixed and scrollable formats. In the fixed format displays (a total of 15 are available), each display can contain up to 20 parameters. One of the 15 displays can be defined by the operator during the course of a test while the other 14 must be defined prior to the test and are "firm" as long as the DAS system is carrying out its recording function.

The scrollable displays (a total of 15 are available) each contain up to 5 parameters which are updated as a function time and provide a time history of the desired parameters. As in the case of the fixed displays, 14 of the scrollable displays are "firm" during the operation of the DAS equipment while the 15th display can be defined by the operator during the test.

Hard Copy Units

Two hard copy units are available in the Data Evaluation Room to record CRT display information. They are connected only to the 2 color CRT's. No hard copy capability exists for the black and white CRT's.

Strip Chart Recorders

Three 8-channel strip chart recorders are provided in the Data Evaluation Room which can record any DAS parameter as an analog function at data rates of up to 40 times per second (drawing data from DARMS).

Data Logger

A data logger is available to record DAS-related information. No dedicated functions have yet been assigned to this equipment. It could however be used to provide hard copy of the information contained in the black and white CRT displays since the dedicated hard copy equipment is incapable of providing this function.

5.2.1.7 On-Site Data Terminal Dedicated to MDAC Data Base

A single CRT and hard copy unit will be located on-site which is directly connected to the MDAC data reduction programs and computer located in Huntington Beach. This unit will display any of the plots and tabular data available as outputs of the data reduction programs. The selection of the display is at the discretion of on-site personnel and is independent of displays being generated at other terminal locations by the data reduction computer. Data flow from Huntington Beach to the site will be limited by a single 1200 baud modem line. Depending on the complexity of the data reduction tasks and data transmissions, these displays will be within one to five minutes of the real time data acquisition function.

5.2.1.8 BCS Data Displays and Logging Functions

BCS data is displayed on CRT's and a line printer located in the Control Room and Data Evaluation Room. The Control Room CRT provides a picture of the target which allows for visual inspection of the heliostat image by the operator. A selector switch allows the operator to view any of the four BCS targets. Logging functions in the Control Room are provided through the CS

logger which records non-critical alarms involving the heliostat image on the target. Alarms will be issued on the basis of an error in centroid location or total beam power.

The BCS logging function in the Data Evaluation Room provides the record of all BCS related activities. It documents such information as centroid error, power error, beam power profiles, etc. on a heliostat-by-heliostat basis as the BCS functions are being carried out. It also time tags all measurement data for future reference. The related Data Evaluation Room BCS CRT displays routine machine related information and time tagged data which is subsequently diverted to the logger.

5.2.1.9 Thermal Storage Unit Strain Gauge Recorder

Strain gauge data from the thermal storage unit is recorded on 4 dedicated 8 channel strip chart recorders located in the thermal storage remote station. These recorders provide a continuous readout of tank strain during tank operation, starting with the initial tank fill. These data supplement dedicated DAS tank strain gauge data that can be recorded.

5.2.1.10 Circumsolar Telescope

The circumsolar telescope unit contains dedicated magnetic tape recording equipment which time tags and records the telescope measurements. The data rate will be every 2 or 15 minutes depending on the telescope configuration provided by Laurence Berkeley Laboratory. The data will provide the calibration standard against which the normal incident pyroheliometer data (recorded by DAS through the SHIMMS buffer) can be calibrated. At present, no interface exists between the circumsolar telescope and the DAS recording equipment. As a result, the insolation calibration data tape must be shipped to Laurence Berkeley Laboratory for reading and data reduction activities with a turn around time of one to two weeks.

5.2.1.11 SCE Operations and Maintenance Logs

Additional manually prepared data and information are available in the form of the operating and maintenance logs maintained by SCE operating personnel. Standard plant information as well as unique factors involving the solar portion of the plant will be recorded as part of operating and

maintenance personnel functions. The types and quantity of information to be logged by these personnel will be as specified by SCE Operations organization. Any manual logging functions for the purpose of plant evaluation required of the SCE operations and maintenance personnel must be carried out with the prior approval of SCE. The manual logs should be viewed as a secondary source of information since any additional plant evaluation related logging functions must not interfere with the job responsibilities of the SCE personnel.

5.2.2 Data Recording and Data Reduction

5.2.2.1 Data Recording

During the course of the test program (starting with Preoperational Test No. 1010), data will be displayed and/or recorded by all the equipment described in Section 5.2.1. However from a long term plant evaluation and data archiving stand point, the DAS will be by far the most important data gathering and recording equipment. This section defines the guidelines to be used in defining the DAS scan lists to be applied to each of the DAS buffers (defined in Section 5.2.1) and specifies critical parameters to be recorded for the 1000, 1100, and 1200 series tests.*

In defining the DAS scan lists to be applied to each of the buffers, care must be exercised not to "overwhelm" the data communication links or the recording capability through a combination of large scan lists and a fast archive rate. Therefore on a test-by-test basis, potential scan list entries will be screened on a priority basis with the final lists being verified against system data flow and recording frequency restrictions.

In general, the priority assignments will reflect the desire to complete Preoperational and Acceptance Testing in a timely fashion and an awareness that many of the detailed "research and development" issues as well as detailed performance-related issues will be treated during the subsequent 5 year Operational Test program. It is anticipated that during the Operational Test program, a significant reversal in data recording priorities will occur.

*No significant DAS data recording and archiving activities are planned for the Intra-System Preoperational Tests (Test Numbers 000-980).

During this Preoperational and Acceptance Test program, the following data recording priorities will be assigned to the potential scan list parameters:

Priority	Data Type
(1)	• "Essential" parameters required to demonstrate that the acceptance criteria as explicitly stated in the test procedure have been satisfied. • Control system "broadcast" messages such as alarms, trips, set point changes, operator or OCS issued commands, etc. • Trip-related data
(2)	• "Significant" parameters required to support "research and development" related issues. • Important process parameters • Data to aid in the diagnosis of plant alarms (note that significant alarm diagnostic data is available to the operator in the Control Room on a real time basis).
(3)	• "Routine" plant parameters particularly as they involve Miscellaneous Support Systems (see Figure 3-1).

In establishing the final scan lists and recording frequencies for each test, priority 1 data requirements regarding either quantity or recording frequency shall not be compromised by excessive archiving of lower priority data. It should be noted that the scan list can be changed on a test-by-test basis; however, no change is possible during the course of a test. Also, all scan list entries in a particular buffer will be updated (archieved) at the same rate. During simultaneous testing of more than one system, integrated scan lists will be required.

In addition to recording the parameters defined in the buffer scan lists, each tape will contain header information that defines:

- Test title
- Scan list (including parameter tag number and calibration data)
- SDPC (MVCU) controller configurations
- Initial plant configuration (valve lineup)

The content of related DAS displays (CRT plots and tabular data) will reflect the same priority as assigned to scan list entries since the primary function of these on-site displays will be to aid in the demonstration of the procedure test acceptance criteria.

Table 5-1 summarizes on a test-by-test basis the minimum scan list requirements for the "essential" and "significant" data categories.* It is recognized that during the detailed test design phase or during the course of a test it may be necessary to expand either of the data categories that comprise a particular scan list due to oversights or unexpected test results. The total data flow for a particular scan list shall not impede the collection and archiving of priority 1 data.

5.2.3 Data Reduction

The primary goals of the data reduction activities are to demonstrate compliance with the test acceptance criteria as defined in each of the test procedures and provide the necessary insight into system problem areas as may be required to define additional tests. As such, the following data reduction guidelines** will be applied to the archived data identified in Section 5.2.2:

(i) Data which are directly related to the test acceptance criteria will be reduced to demonstrate compliance with the criteria. For example, the need to demonstrate stable operation will involve the selective reduction of temperature, pressure, and/or flowrate data which is gathered at critical control points. Power performance tests such as the generation of 10 MWe at winter 2PM will use direct power measurements to demonstrate test compliance. If compliance is established, no additional data reduction will be performed regarding that specific test objective. In particular, no detailed subsystem-by-subsystem performance evaluations will be made.

(ii) In the event that compliance can not be demonstrated, additional data reduction will be carried out to isolate the particular problem areas and to aid in the definition of additional test requirements. Specific requirements involving additional testing will be coordinated through the Test Analysis Group (see Section 5.1). It will be the responsibility of the

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*Broadcast messages (alarms and commands) are excluded from Table 5-1 entries since they are not transmitted to the DAS and archived on a scan list basis.

**Guidelines apply to SFDI data reduction activities. Expanded data reduction activities may be carried out by other project organizations using archived test data.

Test Working Group to determine whether additional tests can be introduced into the current test program without significant impacts to cost, schedule, or the overall activities of the startup test program. Tests which can not be integrated into the present test program should be considered as important tests for the subsequent Operational Test Phase.

(iii) On the basis of unexpected* alarm data gathered during the course of a test, additional data reduction will be carried out to provide necessary insight. Additional test requirements may or not be established as a result of this effort.

(iv) Minimal SFDI-coordinated data reduction will be carried out to analyze research and development issues that are unrelated to the test objectives and acceptance criteria explicitly stated in the test procedures. It should be noted that the intent of this guideline is not to inhibit meaningful research and development related analysis. Instead, it is required to insure that proper attention to the Startup Test Program as defined by the test procedures is maintained subject to SFDI personnel limitations. Research and development related testing and analysis should comprise a major portion of the subsequent Operational Test Phase.

Reduced data will be generated (in engineering units) in plot and tabular formats that show parameters on a simultaneous (instantaneous "snap-shot") and/or time history basis. Representative portions of the reduced data will be used directly in the Startup and Acceptance Test Report described in Section 5.3.

5.3 TEST DOCUMENTATION

Preoperational and acceptance test documentation will consist of the following:

- Pilot Plant Startup and Acceptance Test Plan (RADL Item 2-46)

prepared by the SFDI with inputs and final review by members of the TWG. The Plan will be the controlling document for the preoperational and acceptance test requirements until such time as the Solar Startup and Test Program Manual is prepared and released.

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*Some alarms will be expected for many of the tests because of the required process conditions of a particular test. No additional data reduction will be carried out to investigate these alarms.

- Solar Startup and Test Program Manual prepared by SCE with inputs and final review by members of the TWG. Upon release, the Manual will be the controlling document for the preoperational and acceptance test requirements and test conduct.

- Preoperational and Acceptance Test Procedures prepared by the organization(s) shown in Section 2, Tables 2-1 and 2-2 with final review by members of the TWG. The procedures will be prepared and released in accordance with established SCE guidelines (as defined in the Solar Startup and Test Program Manual) and the schedule as shown in Section 2, Figure 2-2, respectively.

- Pilot Plant Startup and Acceptance Test Report (RADL Item 2-47) prepared by the SFDI with inputs and final review by members of the TAG. The Report will be prepared on an incremental basis; i.e., at the completion of each major preoperational inter-system test and acceptance test a brief test report will be prepared. Final document integration and submittal will take place after the completion of the acceptance automatic control tests.

Table 5-1. Minimum DAS Scan List Requirements

Test No.	Data Buffer	Essential Data	Significant Data
1010	BUFHA (HAC Buffer)	None	None
	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• Receiver feed pump
		  • Controller output
		  • Discharge flow
		• Receiver inlet conditions
		  • Temperature
		  • Pressure
		  • Flowrate
		• Receiver water manifold
		  • Temperature
		  • Pressure
		• Receiver flash tank
		  • Temperature
		  • Pressure
		  • Level
		• Receiver differential pressure
		• Receiver valve position
		  • Main inlet
		  • Panel drains (24)
		  • Vent valves (3)
		  • Flash tank inlet valves
		  PV-2002
		  AOV-2911
			• Condenser conditions
			  • Pressure
			  • Level
			• Condensate temperature
			• Condensate hotwell pump discharge pressure
			• Hotwell level valve controllers
			  • LV-146A
			  • LV-146B
			• Deaerator level valve controllers
			  • LV-83A
			  • LV-83B
			• Deaerator conditions
			  • Level
			  • Pressure
			• Parasitic electrical demands
			• Feedwater quality

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1010 (cont.)		• Control valve positions and controller outputs
		  • Panel temperature control valves (18)
		  • LV-74A
		  • LV-74C
		• Feedwater heater drain controllers
		  • LV-24A
		  • LV-24B
		• Second point heater level	

	BUFDA (DARMS Buffer)	None	None
	BUFSH (SHIMMS Buffer)	None	None
	BUFTR (High Speed Trip Buffer)	• Receiver (RLU)/feed pump trip critical parameters • Plant trip parameters	None
1020	BUFHA (HAC Buffer)	None	None
	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• Oil loop isolation valve positions
		  • AOV-3001
		  ⋮
			• All "Significant" data required for Test No. 1010

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1020 (cont.)		• AOV-3005
		• AOV-3905
		• AOV-3906
		
		• Oil loop pump (4) speed and controller output
		
		• Oil loop control valve controller output and position data
		  • TV-3410
		  • TV-3411
		  • TV-3710
		  • TV-3810
		  • PV-3702
		  • PV-3802
		
		• All oil loop charging and extraction process data
		  • Temperature
		  • Pressure
		  • Flowrate
		  (excluding those related to the Auxiliary Extraction Oil Pump P-305)
		
		• Charging steam/condensate valve position and controller outputs
		  • TV-3105
		  • UV-3102
		  • PV-3110
		  • PV-3111	

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1020 (cont.)		• Charging steam/condensate isolation valve positions
		  • AOV-3206
		  • AOV-3306
		  • AOV-3220
		  • AOV-3320
		• All charging steam/condensate process data
		  • Temperature
		  • Pressure
		  • Flowrate
		  • Level
		• Extraction steam/feedwater valve position and controller outputs
		  LV-3505
		  LV-3605
		• All extraction feedwater/steam process data
		  • Temperature
		  • Pressure
		  • Flowrate
		• Extraction steam/blowdown isolation valves
		  • AOV-3708
		  • AOV-3808
		  • AOV-3717
		  • AOV-3817
		  • AOV-3707
		  • AOV-3807
		  • AOV-3218	

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1020 (cont.)		• AOV-3318
		• AOV-3117
		• AOV-3118
		
		• TSS flash tank
		  • Pressure
		  • Level
		
		• TSS flash tank drain pump operation
		
		• TSS feedwater pump (P-903) operations
		
		• Flash tank steam pressure control valve positions and controller outputs
		  • PV-640
		  • PV-647C
		
		• Flash tank level control valve position and controller output
		  • LV-74B
		  • LV-74D-1
		  • LV-74D-2
		
		• TSU process/tank data
		  • Temperature
		  • Pressure
		  • Level
		
		• Ullage maintenance unit blower and pump operation	

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1020 (cont.)		• Ullage maintenance unit valve position
		  • AOV-4014
		  • AOV-4015	

	BUFDA (DARMS Buffer)	• Oil loop control valve position data
		  • PV-3702
		  • PV-3802
		  • TV-3710
		  • TV-3810
		  • TV-3410
		  • TV-3411
		• Charging steam/condensate valve positions
		  • UV-3102
		  • TV-3105
		  • PV-3110
		  • PV-3111
		• Extraction steam/feedwater valve positions
		  • LV-3505
		  • LV-3605
			• All oil loop charging and extraction process data
			  • Temperature
			  • Differential temperature
			  • Pressure
			  • Differential pressure
			  • Flowrate
			• All charging steam/condensate process data
			  • Temperature
			  • Pressure
			  • Flowrate
			• All extraction steam/feedwater process data
			  • Temperature
			  • Pressure
			  • Flowrate
			• TSU tank/bed temperature
			• TSU tank strain data
			• TSU foundation temperatures
			• TSU foundation heat flux

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1020 (cont.)			• Ullage maintenance unit GN_2 process data
			  • Temperature
			  • Pressure
			  • Flowrate

	BUFSH (SHIMMS Buffer)	None	None
	BUFTR (High Speed Trip Buffer)	• Thermal storage (RLU)/feed pump trip critical parameters • Plant trip parameters	None
1030	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• All "Essential" SDPC data required for Test No. 1010 excluding
		  • Panel drain valve position (24)
		  • Vent valve position (3)
		  • LV-74A position and controller output
		  • LV-74C position and controller output
		• Panel flux sensors (3 per panel)
		• Panel metal temperatures
			• All "Significant" SDPC data required for Test No. 1010
			• Control valve positions and controller outputs
			  • LV-74A
			  • LV-74C
			• Auxiliary steam process conditions
			  • Temperature
			  • Pressure

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1030 (cont.)		• Panel discharge temperature
		  • 6 preheat panels
		  • 18 boiler panels
		• Receiver steam manifold
		  • Temperature
		  • Pressure
		• Moisture separator level
		• Receiver-related isolation valve positions
		  • AOV-2901
		  • AOV-2914
		  • AOV-2915
		  • FV-1007
		  • UV-2905
		• Control valve positions and controller outputs
		  • PV-2906
		  • PV-1000
		  • PV-647B
		  • PV-1001
		  • TV-1002
		  • FV-1006
		• Downcomer/steam dump process conditions
		  • Temperature
		  • Pressure	

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1030 (cont.)	BUFDA (DARMS Buffer)	• Isolation valve positions
		  • AOV-2004
		  • AOV-2911
		  • UV-2905
		• Control valve positions
		  • Panel temp control valves (6)
		  • PV-1000
		  • PV-1001
			• Uncooled structural temperatures (6)
			• Receiver inlet water temperature
			• Water/steam process conditions
			  • Temperature
			  • Pressure
			  • Flowrate
			• Panel/piping metal temperature
			• Panel expansion

	BUFSH (SHIMMS Buffer)	• Insolation data	• Wind data • Temperature data • Heliostat loads (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	• Receiver (RLU)/feed pump trip critical parameters • Plant trip parameters • Collector field trip	None
1040	BUFHA (HAC Buffer)	None	• Collector "Field Status" • Collector "Ring Status" (all rings)
	BUFOC (OCS Buffer)	None	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.		Essential Data	Significant Data

1040 (cont.)	BUFSD (SDPC Buffer)	• All "Essential: SDPC data required for Test No. 1020 excluding
		  • Position and controller data for
		  LV-74B
		  LV-74D-1
		  LV-74D-2
			• All "Essential" SDPC data required for Test No. 1030
			• Flash tank level control valve position and controller output
			  • LV-74B
			  • LV-74D-1
			  • LV-74D-2

	BUFDA (DARMS Buffer)	• All "Essential" DARMS data required for Test No. 1020	• All "Essential: DARMS data required for Test No. 1030 • All "Significant" DARMS data required for Test No. 1030
	BUFSH (SHIMMS Buffer)	• Insolation data	• Wind data • Temperature data • Heliostat loads (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	• Receiver (RLU)/feed pump trip critical parameters • Thermal storage (RLU)/feed pump trip critical parameters • Plant trip parameters • Collector field trip	None
1105	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1105 (cont.)	BUFOC (OCS Buffer)	None	None
	BUFSD (SDPC Buffer)	All "Essential: SDPC data required for Test No's 1110, 1150, and 1160.	All "Significant" SDPC data required for Test No's 1110, 1150, and 1160.
	BUFDA (DARMS Buffer)	All "essential" DARMS data required for Test No's 1110, 1150, and 1160.	All "Significant" DARMS data required for Test No's 1110, 1150, and 1160.
	BUFSH (SHIMMS Buffer)	• Insolation data	• Wind data • Temperature data • Heliostat data (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	• Receiver (RLU)/feed pump trip critical parameters • Thermal storage (RLU)/feed pump trip critical parameters • Plant trip parameters • Collector field trip	None
1110	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• Receiver feed pump
		  • Controller output
		  • Discharge flow
		• Receiver inlet conditions
		  • Temperature
		  • Pressure
		  • Flowrate
			• Feedwater quality
			• Receiver isolation valve positions
			  • Main inlet
			  • Panel drains (24)
			  • Vent valves (3)
			  • UV-2905

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1110 (cont.)		• Receiver water manifold
		  • Temperature
		  • Pressure
		• Receiver flash tank
		  • Temperature
		  • Pressure
		  • Level
		• Panel flux sensors (3 per panel)
		• Receiver steam manifold
		  • Temperature
		  • Pressure
		• Downcomer/steam dump process conditions
		  • Temperature
		  • Pressure
		• Steam turbine process data
		  • Temperature
		  • Pressure
		• Turbine main steam stop valve position
		• Turbine speed
		• Electrical power production
			• Flash tank inlet valves
			  AOV-2901
			  AOV-2911
			  AOV-2914
			  AOV-2915
			  PV-2911
			• Receiver differential pressure
			• Receiver control valve positions
			  • Panel temp control valves (18)
			  • LV-74A
			  • LV-74C
			  • PV-2906
			  • PV-647B
			  • PV-1000
			• Downcomer/main steam piping isolation valve positions
			  • FV-1007
			  • MOV-905
			  • MOV-906
			• Downcomer/steam dump control valve positions
			  • PV-1001
			  • TV-1002
			  • FV-1006
			• Feedwater heater/deaerator process conditions
			  • Pressure
			  • Level

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Essential Data	Significant Data

1110 (cont.)		• Level valve controller output
		  • LV-74A
		  • LV-74C
		  • LV-146A
		  • LV-146B
		  • LV-83A
		  • LV-83B
		• Auxiliary steam process conditions
		  • Temperature
		  • Pressure
		• Condenser conditions
		  • Pressure
		  • Level
		• Condensate temperature
		• Condensate hotwell pump discharge pressure
		• Circulating water process conditions
		  • Temperature
		  • Differential pressure
		• Circulating water pump operations
		  • P-905
		  • P-906
		• Turbine steam pressure controller output
		• Parasitic electrical demands

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1110 (cont.)	BUFDA (DARMS Buffer)	• All "Essential" DARMS data required for Test No. 1030	• All "Significant" DARMS data required for Test No. 1030
			• Turbine extraction process conditions
			  • Temperature
			  • Pressure

	BUFSH (SHIMMS Buffer)	• Insolation data	• Wind data • Temperature data • Heliostat loads (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	• Receiver (RLU)/feed pump trip critical parameters • Plant trip parameters • Collector field trip	None
1120	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None
	BUFSD (SDPC Buffer)	• Integrated list containing "Essential" SDPC parameters required for Test No's 1110 and 1150	• Integrated list containing "Significant" SDPC parameters required for Test No's 1110 and 1150

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1120 (cont.)	BUFDA (DARMS Buffer)	• Integrated list containing "Essential" DARMS parameters required for Test No's 1110 and 1150	• Integrated list containing "Significant" DARMS parameters required for Test No's 1110 and 1150
	BUFSH (SHIMMS Buffer)	• Integrated list containing "Essential" SHIMMS parameters required for Test No's 1110 and 1150	• Integrated list containing "Significant" SHIMMS parameters required for Test No's 1110 and 1150
	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None
1130	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None
	BUFSD (SDPC Buffer)	• Integrated list containing "Essential" SDPC parameters required for Test No's 1110 and 1160	• Integrated list containing "Significant" SDPC parameters required for Test No's 1110 and 1160
	BUFDA (DARMS Buffer)	• Integrated list containing "Essential" DARMS parameters required for Test No's 1110 and 1160	• Integrated list containing "Significant" DARMS parameters required for Test No's 1110 and 1160
	BUFSH (SHIMMS Buffer)	• Integrated list containing "Essential" SHIMMS parameters required for Test No's 1110 and 1160	• Integrated list containing "Significant" SHIMMS parameters required for Test No's 1110 and 1160

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1130 (cont.)	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None
1140	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None
	BUFSD (SDPC Buffer)	• Integrated list containing "Essential" SDPC parameters required for Test No's 1150 and 1160	• Integrated list containing "Significant" SDPC parameters required for Test No's 1150 and 1160
	BUFDA (DARMS Buffer)	• Integrated list containing "Essential" DARMS parameters required for Test No's 1150 and 1160	• Integrated list containing "Significant" DARMS parameters required for Test No's 1150 and 1160
	BUFSH (SHIMMS Buffer)	• Integrated list containing "Essential" SHIMMS parameters required for Test No's 1150 and 1160	• Integrated list containing "Significant" SHIMMS parameters required for Test No's 1150 and 1160
	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None
1150	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1150 (cont.)	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• Receiver feed pump
		  • Controller output
		  • Discharge flow
		• Receiver inlet conditions
		  • Temperature
		  • Pressure
		  • Flowrate
		• Receiver water manifold
		  • Temperature
		  • Pressure
		• Receiver flash tank
		  • Temperature
		  • Pressure
		  • Level
		• Panel flux sensors (3 per panel)
		• Receiver steam manifold
		  • Temperature
		  • Pressure
		• Downcomer/steam dump process conditions
		  • Temperature
		  • Pressure
		• Charging oil loop pump (2) speed and controller output
			• Feedwater quality
			• Receiver isolation valve positions
			  • Main inlet
			  • Panel drains (24)
			  • Vent valves (3)
			  • UV-2905
			  • Flash tank valves
			  AOV-2901
			  AOV-2911
			  AOV-2914
			  AOV-2915
			  PV-2911
			• Receiver differential pressure
			• Receiver control valve positions
			  • Panel temp control valves (18)
			  • LV-74A
			  • LV-74C
			  • PV-2906
			  • PV-647B
			  • PV-1000
			• Downcomer/main steam piping isolation valve positions
			  • FV-1007
			  • MOV-1030

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1150 (cont.)		• All charging oil loop process data
		  • Temperature
		  • Pressure
		  • Flowrate
		• All charging steam/condensate process data
		  • Temperature
		  • Pressure
		  • Flowrate
		  • Level
		• TSS flash tank
		  • Pressure
		  • Level
			• Downcomer/steam dump control valve positions
			  • PV-1001
			  • TV-1002
			  • FV-1006
			• Charging steam/condensate valve position and controller outputs
			  • TV-3105
			  • UV-3102
			  • PV-3110
			  • PV-3111
			• Charging steam/condensate isolation valve positions
			  • AOV-3206
			  • AOV-3306
			  • AOV-3220
			  • AOV-3320
			• TS flash tank level control valve position and controller outputs
			  • LV-74B
			  • LV-74D-1
			  • LV-74D-2
			• TS flash tank drain pump operation
			• Condenser conditions
			  • Pressure
			  • Level
			• Condensate temperature

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1150 (cont.)			• Condensate hotwell pump discharge pressure
			• Level valve controller outputs
			  • LV-74A
			  • LV-74C
			  • LV-146A
			  • LV-146B
			  • LV-83A
			  • LV-83B
			• Feedwater heater/deaerator process conditions
			  • Pressure
			  • Level
			• Auxiliary steam process conditions
			  • Temperature
			  • Pressure
			• Circulating water process conditions
			  • Temperature
			  • Differential pressure
			• Circulating water pump operations
			  • P-905
			  • P-906
			• TS oil loop isolation valve positions
			  • AOV-3001
			  :
			  • AOV-3005

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1150 (cont.)			• TS charging oil loop control valve positions and controller outputs
			  • TV-3410
			  • TV-3411
			• Ullage maintenance unit valve positions
			  • AOV-4014
			  • AOV-4015

	BUFDA (DARMS Buffer)	• All "Essential" DARMS data required for Test No. 1030	• All "Significant" DARMS data required for Test No. 1030
			• All charging oil loop process data
			  • Temperature
			  • Differential temperature
			  • Pressure
			  • Differential pressure
			  • Flowrate
			• All charging steam/condensate process data
			  • Temperature
			  • Pressure
			  • Flowrate
			• TSU tank/bed temperatures
			• TSU tank strain data
			• TSU foundation temperature
			• TSU foundation heat flux

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1150 (cont.)			• Ullage maintenance unit GN_2 process data
			  • Temperature
			  • Pressure
			  • Flowrate

	BUFSH (SHIMMS Buffer)	• Insolation data	• Wind data • Temperature data • Heliostat loads (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None
1160	BUFHA (HAC Buffer)	None	None
	BUFOC (OCS Buffer)	None	None

	BUFSD (SDPC Buffer)	• Extraction oil loop pump (2) speed and controller output
		
		• All extraction oil loop process data
		  o Temperature
		  o Pressure
		  o Flowrate
		
		• TSS feed pump (P-903) operations
			• Oil loop isolation valve positions
			  • AOV-3001
			  :
			  • AOV-3005
			  • AOV-3905
			  • AOV-3906
			
			• Oil loop control valve controller output and position data
			  • TV-3710
			  • TV-3810
			  • PV-3702
			  • PV-3802

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1160 (cont.)		• All extraction feedwater/steam process data
		  • Temperature
		  • Pressure
		  • Flowrate
		• Steam turbine process data
		  • Temperature
		  • Pressure
		• Turbine admission steam stop valve position
		• Turbine speed
		• Electrical power production
			• Extraction steam/feedwater valve position and controller outputs
			  • LV-3505
			  • LV-3605
			• Extraction steam/blowdown isolation valves
			  • AOV-3708
			  • AOV-3808
			  • AOV-3717
			  • AOV-3817
			  • AOV-3707
			  • AOV-3807
			  • AOV-3218
			  • AOV-3318
			  • AOV-3117
			  • AOV-3118
			• Admission steam line drain valve positions
			  • MOV-903
			  • MOV-904
			• Feedwater quality
			• Condenser conditions
			  • Pressure
			  • Level
			• Condensate temperature
			• Condensate hotwell pump discharge pressure

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1160 (cont.)			• Level valve controller outputs
			  • LV-83A
			  • LV-83B
			  • LV-146A
			  • LV-146B
			• Feedwater heater/deaerator process conditions
			  • Pressure
			  • Level
			• Auxiliary steam process conditions
			  • Temperature
			  • Pressure
			• Circulating water process conditions
			  • Temperature
			  • Differential pressure
			• Circulating water pump operations
			  • P-905
			  • P-906
			• TS oil loop isolation valve positions
			  • AOV-3001
			  ⋮
			  • AOV-3005

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1160 (cont.)			• TS extraction oil loop control valve position and controller outputs
			  • PV-3702
			  • PV-3802
			  • TV-3710
			  • TV-3810
			• Ullage maintenance unit valve positions
			  • AOV-4014
			  • AOV-4015
			• Turbine admission controller output
			• Parasitic electrical demand

	BUFDA (DARMS Buffer)	None	• All extraction oil loop process data
			  • Temperature
			  • Differential temperature
			  • Pressure
			  • Differential pressure
			  • Flowrate
			• All extraction steam/feedwater process data
			  • Temperature
			  • Pressure
			  • Flowrate
			• TSU tank/bed temperatures

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1160 (cont.)			• TSU tank strain data
			• TSU foundation temperatures
			• TSU foundation heat flux
			• Turbine extraction steam conditions
			  • Temperature
			  • Pressure
			• Turbine admission valve controller output
			• Ullage maintenance unit GN_2 process data
			  • Temperature
			  • Pressure
			  • Flowrate

	BUFSH (SHIMMS Buffer)	None	• Heliostat loads (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	o Thermal storage (RLU)/feed pump trip critical parameters o Plant trip parameters	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1170	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	None	None
	BUFSD (SDPC Buffer)	• Integrated list containing "Essential" SDPC parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" SDPC parameters required for Test No's 1110, 1150, and 1160
	BUFDA (DARMS Buffer)	• Integrated list containing "Essential" DARMS parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" DARMS parameters required for Test No's 1110, 1150, and 1160
	BUFSH (SHIMMS Buffer)	• Integrated list containing "Essential" SHIMMS parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" SHIMMS parameters required for Test No's 1110, 1150, and 1160
	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None
1180	BUFHA (HAC Buffer)	None	None
	BUFOC (OCS Buffer)	None	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data

1180 (cont.)	BUFSD (SDPC Buffer)	• Auxiliary boiler/thermal storage feedwater pump (P-904) operation
		• Auxiliary extraction of oil pump (P-305) operation
		• TS extraction steam process conditions
		  • Temperature
		  • Pressure
		• Extraction oil loop pressure control valve position and controller output
		  • PV-3910
		• Auxiliary electric boiler process conditions
		  • Temperature
		  • Pressure
		• Feedwater heater/deaerator condenser pressure
		• Steam piping conditions
		  • Temperature
		  • Pressure
			• Extraction oil loop isolation valve position
			  • AOV-3001
			  ⋮
			  • AOV-3005
			  • AOV-3905
			  • AOV-3906
			  • AOV-3907
			• Extraction oil loop process conditions
			  • Temperature
			  • Pressure
			  • Flowrate
			• Auxiliary steam network process conditions
			  • Temperature
			  • Pressure
			• TSU tank pressure
			• TSU tank/bed temperatures
			• Ullage maintenance unit valve position

	BUFDA (DARMS Buffer)	None	• TSU tank/bed temperature • TSU tank strain data • TSU foundation temperature • TSU foundation heat flux

Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1180 (cont.)	BUFSH (SHIMMS Buffer)	None	• Heliostat loads data (high wind conditions only)
	BUFTR (High Speed Trip Buffer)	None	• Plant trips
1210	BUFHA (HAC Buffer)	• Collector "Field Status" • Collector "Ring Status" (all rings)	None
	BUFOC (OCS Buffer)	• All operator or machine-generated commands and alarms are recorded as part of the routine Broadcast Message recording function	None
	BUFSD (SDPC Buffer)	• Integrated list containing "Essential" SDPC parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" SDPC parameters required for Test No's 1110, 1150, and 1160
	BUFDA (DARMS Buffer)	• Integrated list containing "Essential" DARMS parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" DARMS parameters required for Test No's 1110, 1150, and 1160
	BUFSM (SHIMMS Buffer)	• Integrated list containing "Essential" SHIMMS parameters required for Test No's 1110, 1150, and 1160	• Integrated list containing "Significant" SHIMMS parameters required for Test No's 1110, 1150, and 1160
	BUFTR (High Speed Trip Buffer)	• All "Essential" trip data required for Test No. 1105	None

Table 5-1. Minimum DAS Scan List Requirements (Continued)

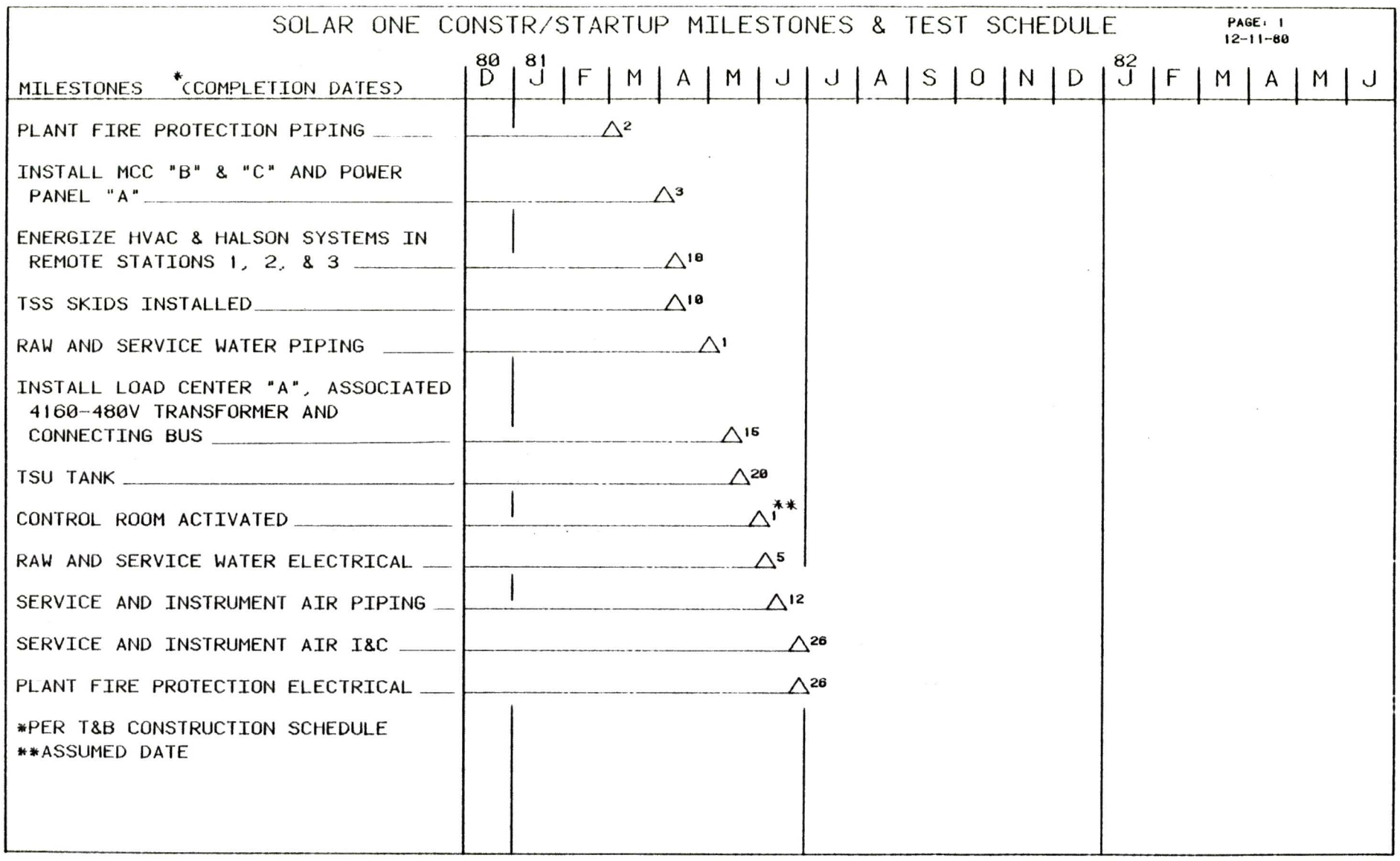
Test No.	Data Buffer	Essential Data	Significant Data
1220	BUFHA (HAC Buffer) BUFOC (OCS Buffer) BUFSD (SDPC Buffer) BUFDA (DARMS Buffer) BUFSM (SHIMMS Buffer) BUFTR (High Speed Trip Buffer)	See data requirements for Test No. 1210	See data requirements for Test No. 1210
1230	BUFHA (HAC Buffer) BUFOC (OCS Buffer) BUFSD (SDPC Buffer) BUFDA (DARMS Buffer) BUFSM (SHIMMS Buffer)		

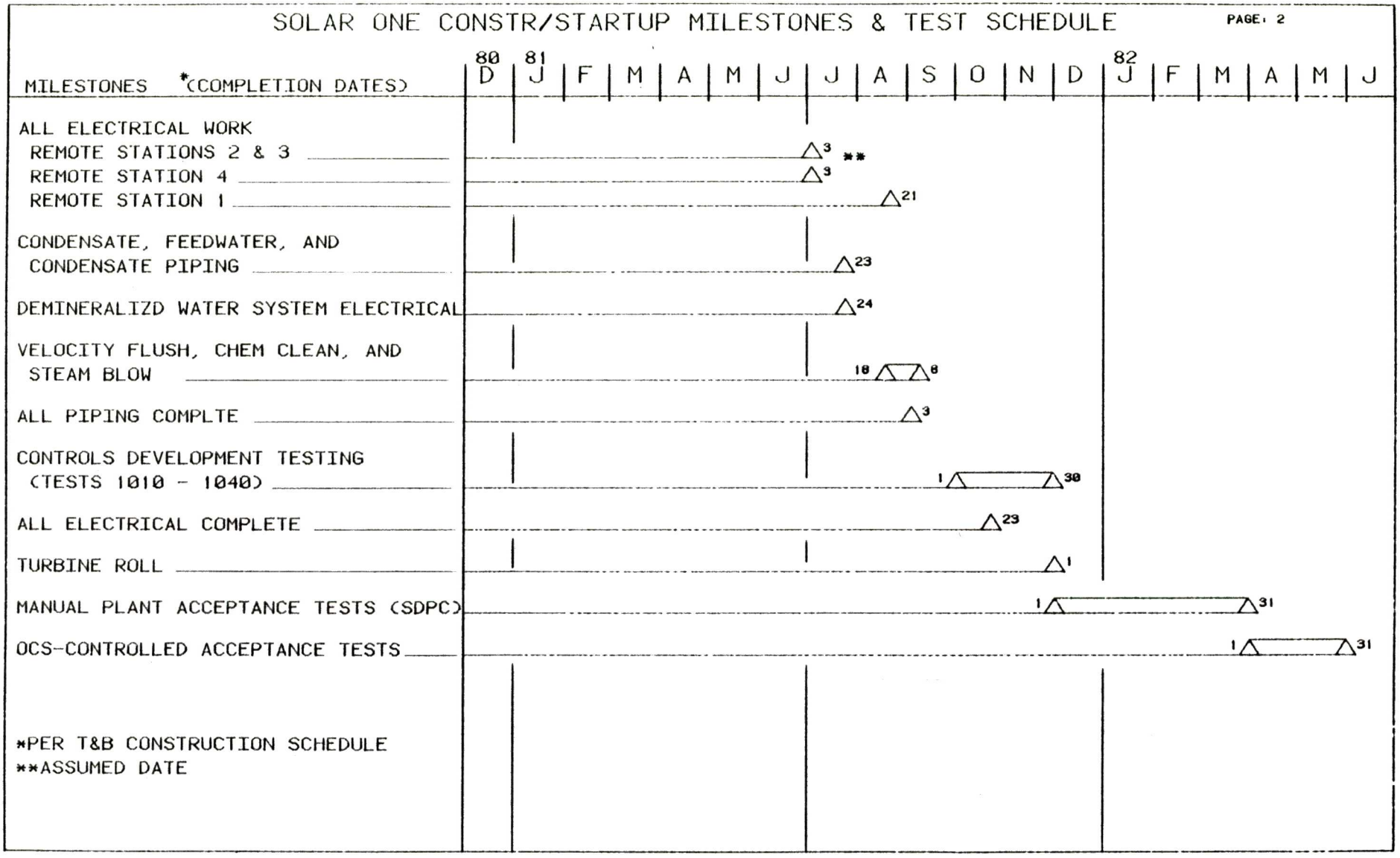
Table 5-1. Minimum DAS Scan List Requirements (Continued)

Test No.	Data Buffer	Essential Data	Significant Data
1230 (cont.)	BUFTR (High Speed Trip Buffer)	See data requirements for Test No. 1210	See data requirements for Test No. 1210

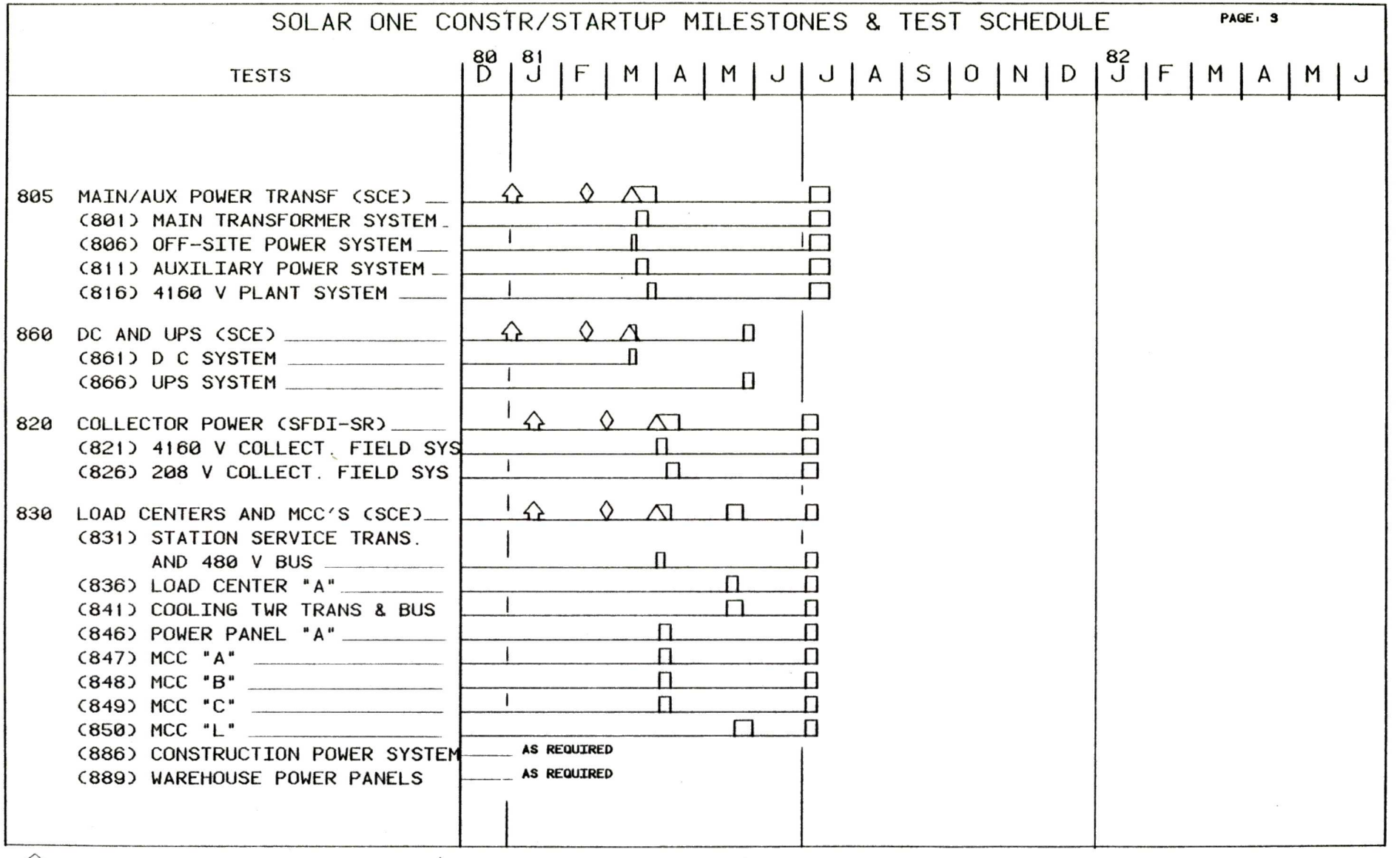
Appendix A
EXPANDED STARTUP TEST SCHEDULES

SOLAR ONE CONSTR/STARTUP MILESTONES & TEST SCHEDULE



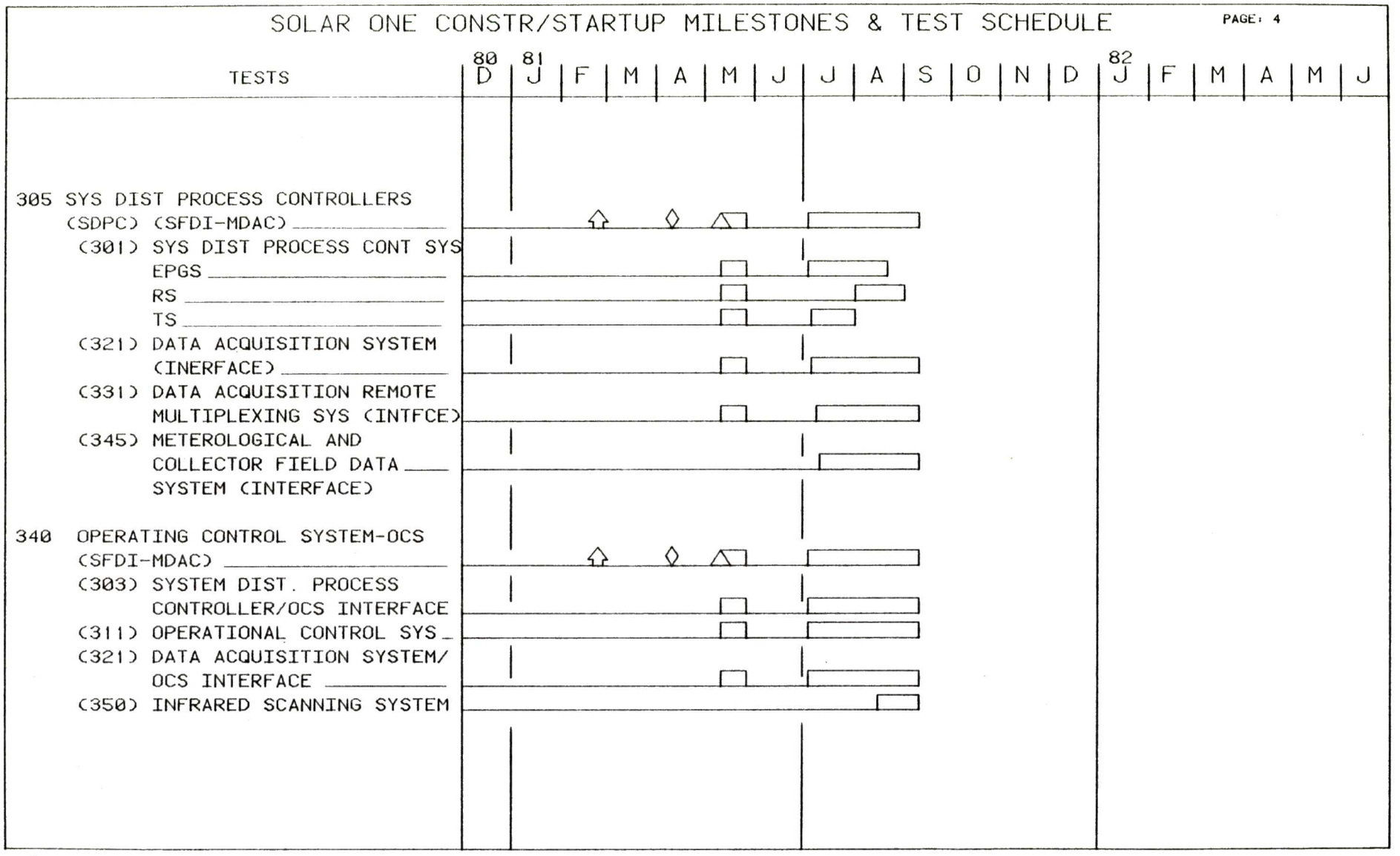

SOLAR ONE CONSTR/STARTUP MILESTONES & TEST SCHEDULE
PAGE: 2
MILESTONES *(COMPLETION DATES)
80 D
81 J F M A M J J A S O N D
82 J F M A M J
ALL ELECTRICAL WORK
REMOTE STATIONS 2 & 3 3 **
REMOTE STATION 4 3
REMOTE STATION 1 21
CONDENSATE, FEEDWATER, AND
CONDENSATE PIPING 23
DEMINERALIZD WATER SYSTEM ELECTRICAL 24
VELOCITY FLUSH, CHEM CLEAN, AND
STEAM BLOW 18 8
ALL PIPING COMPLTE 3
CONTROLS DEVELOPMENT TESTING
(TESTS 1010 - 1040) 1 30
ALL ELECTRICAL COMPLETE 23
TURBINE ROLL 1
MANUAL PLANT ACCEPTANCE TESTS (SDPC) 1 31
OCS-CONTROLLED ACCEPTANCE TESTS 1 31
*PER T&B CONSTRUCTION SCHEDULE
**ASSUMED DATE

REVISION 2



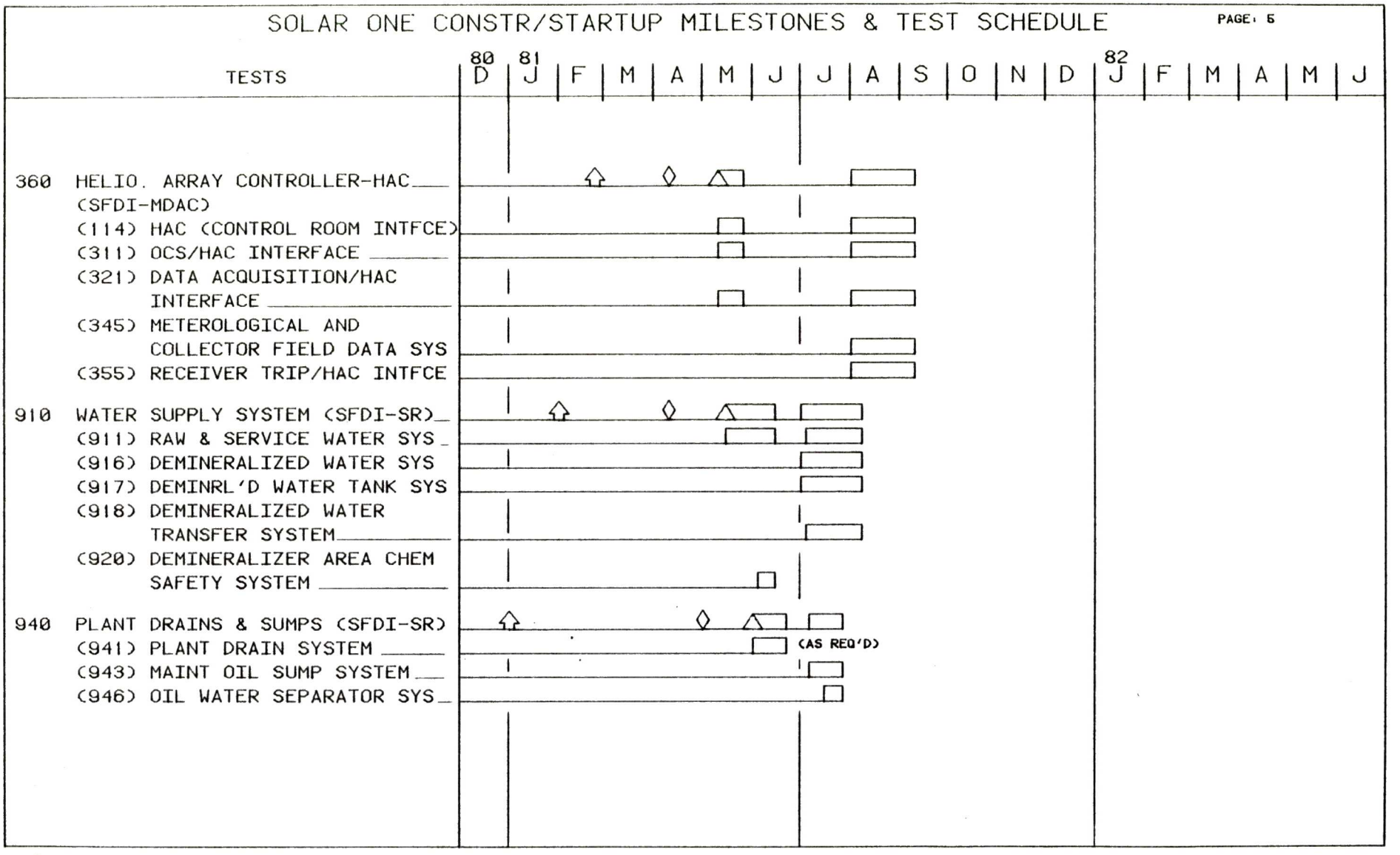
△ - SUGGESTED FIRST DRAFT DATE
◇ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



⇧ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



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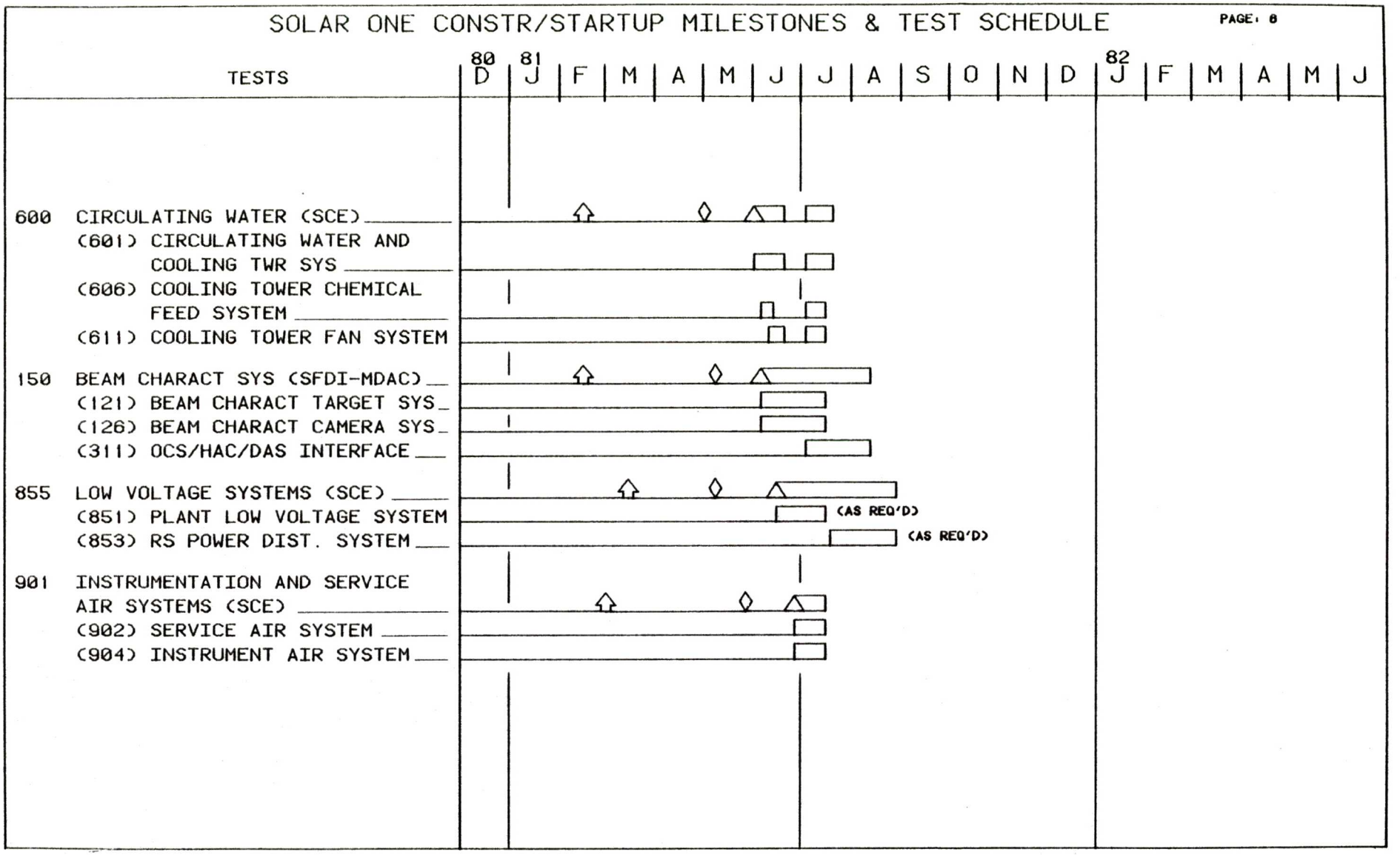
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



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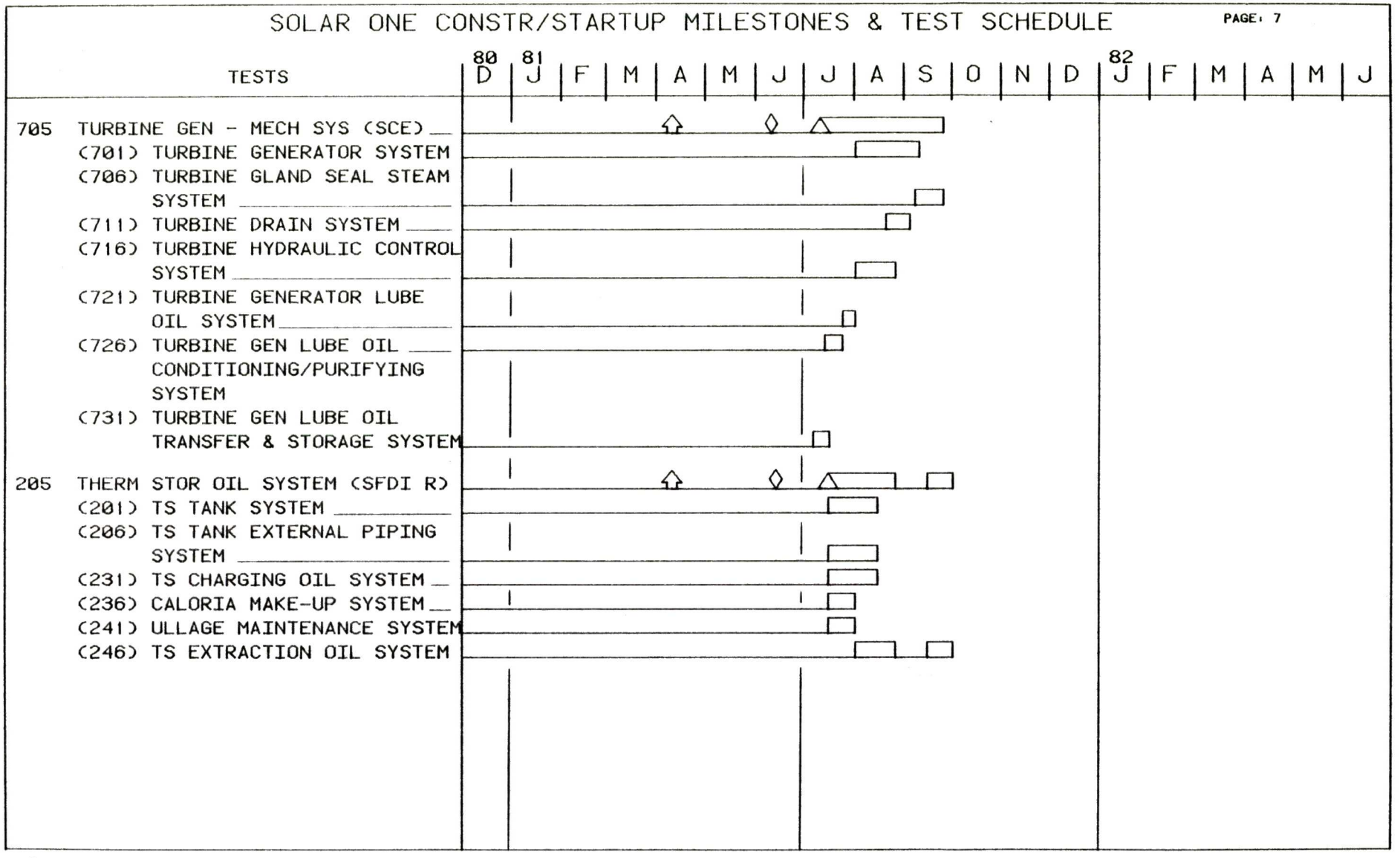
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

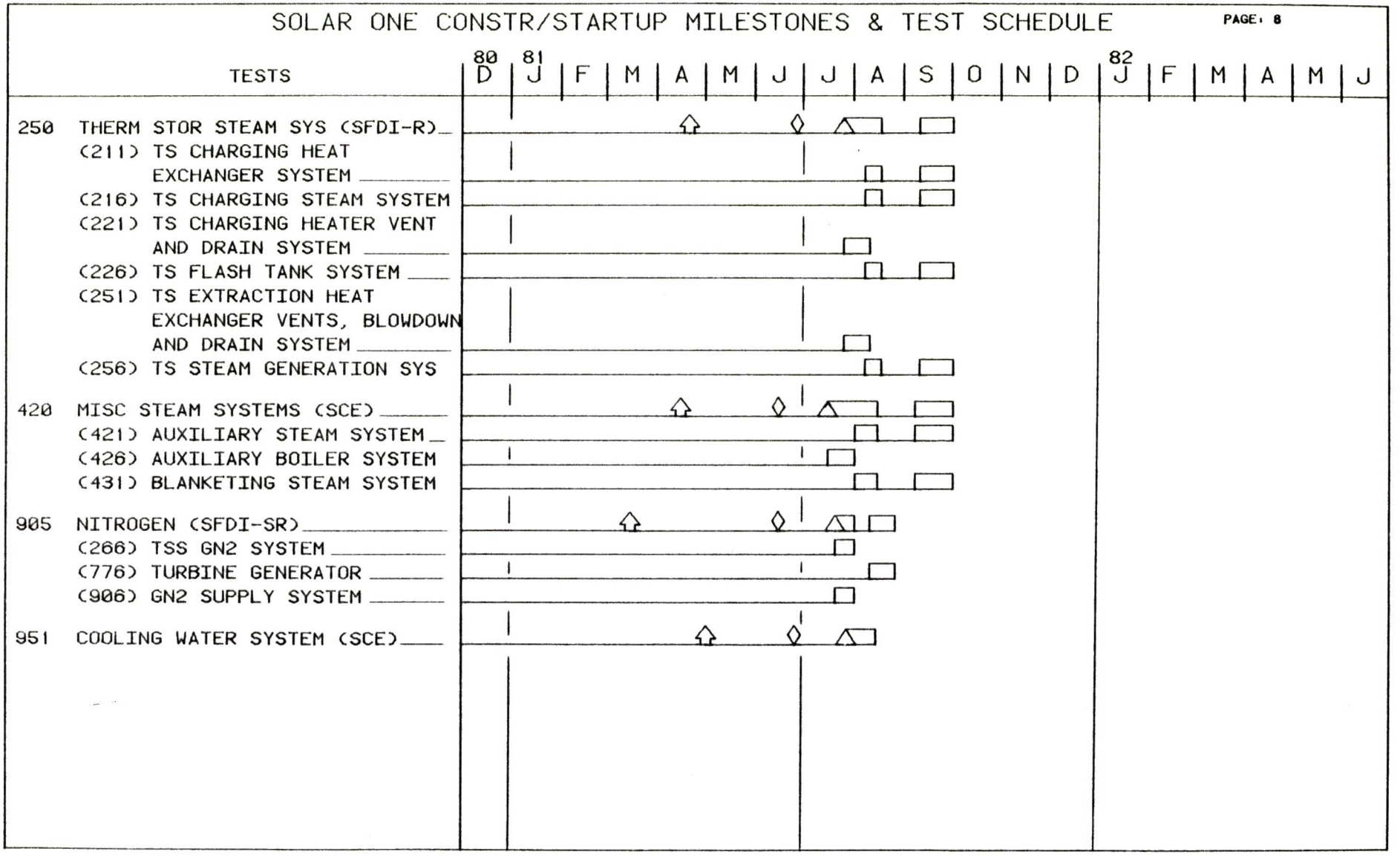
REVISION 2

Appendix A (6 of 12)



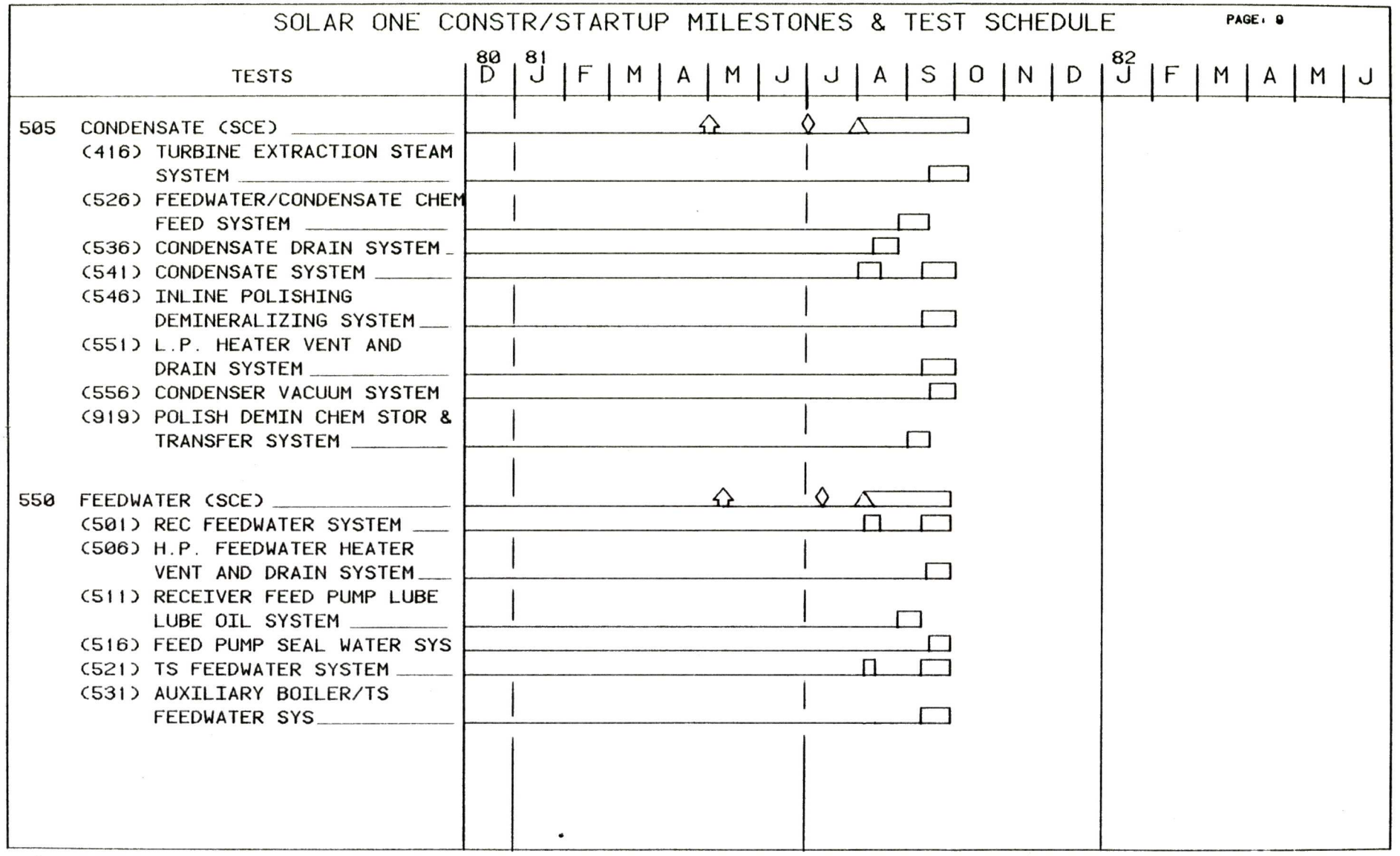
⇧ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



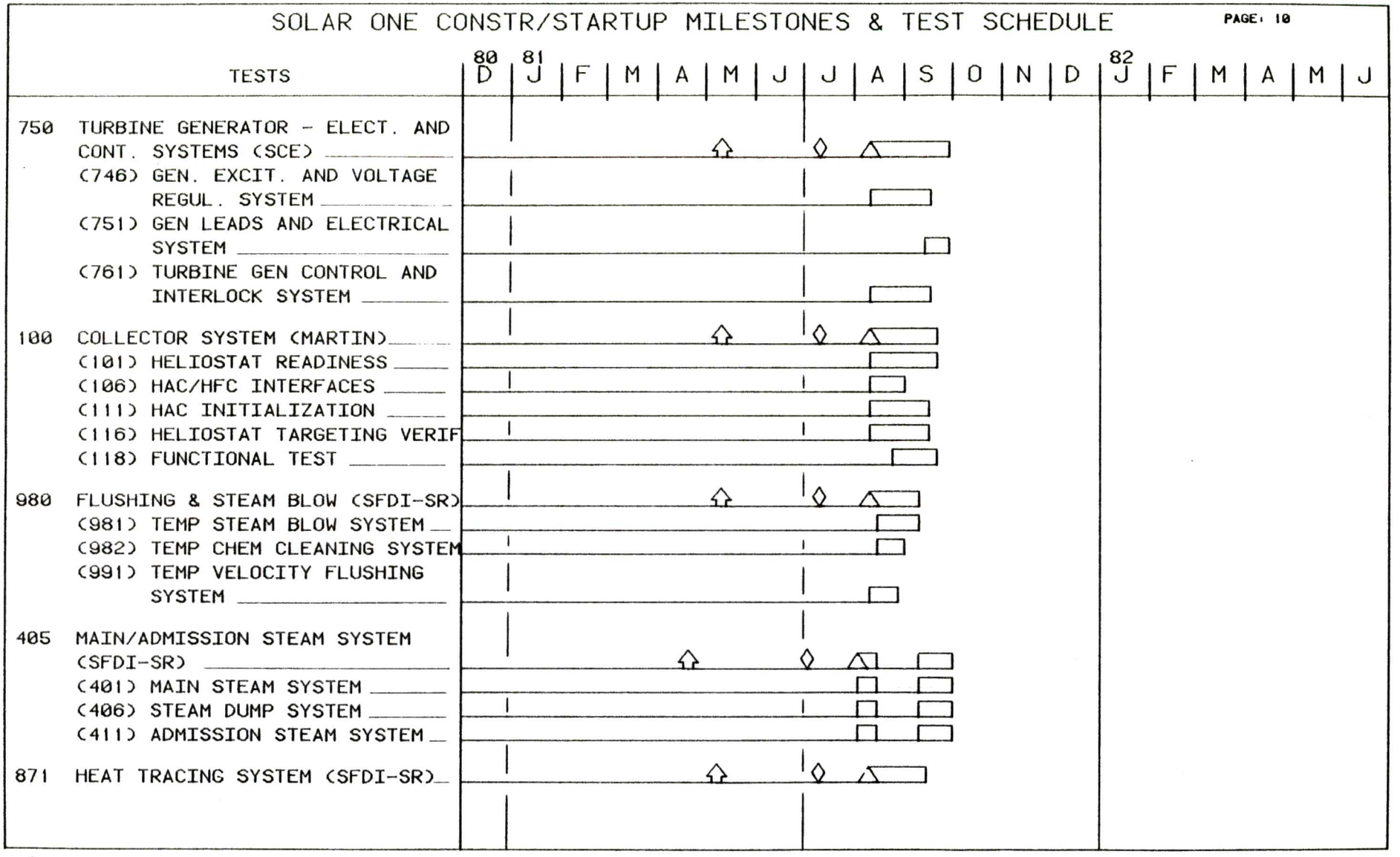
⇧ – SUGGESTED FIRST DRAFT DATE
◊ – TWG FINAL REVIEW
△ – IMPLEMENTATION OF PROCEDURE

REVISION 2



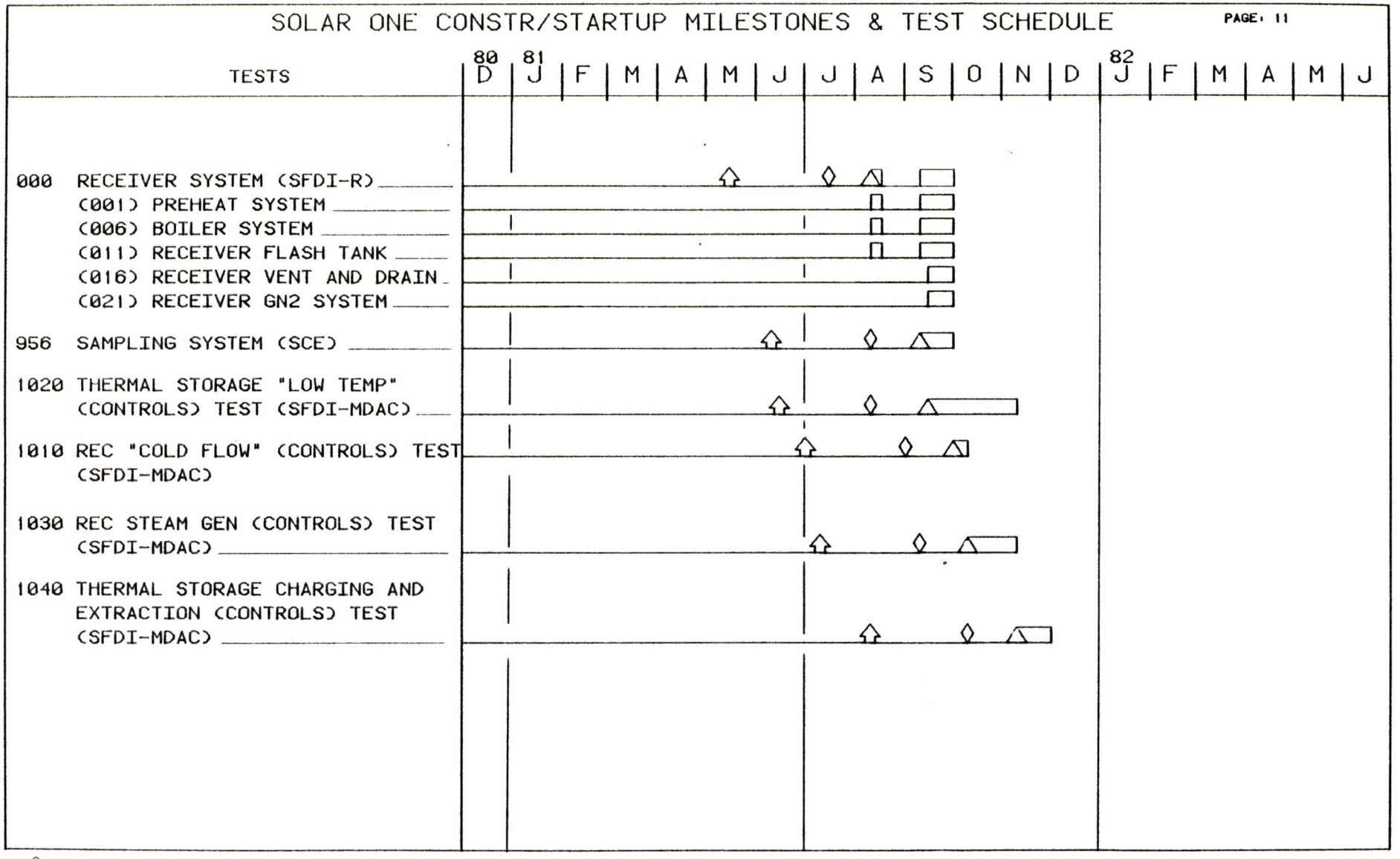
⇧ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



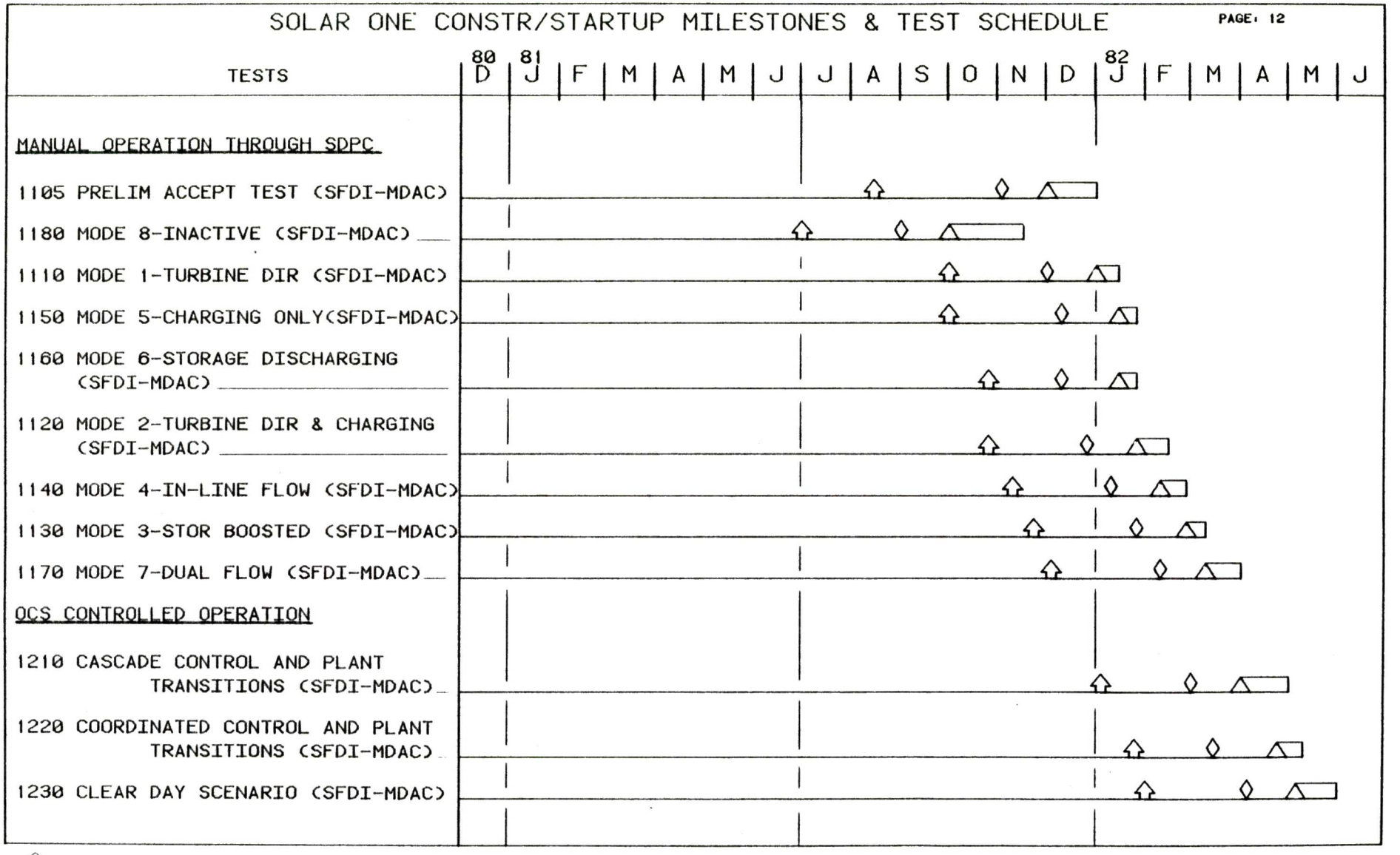
△ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



⇧ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2



⇧ - SUGGESTED FIRST DRAFT DATE
◊ - TWG FINAL REVIEW
△ - IMPLEMENTATION OF PROCEDURE

REVISION 2

Appendix B
STARTUP-RELATED CONSTRUCTION TEST SUMMARY

This appendix defines startup-related construction tests required of the DOE construction contractors as specified in the DOE construction packages. It is presented as reference information to aid in the detailed planning of individual preoperational and acceptance tests where issues of overlapping test activities are of concern. This listing ignores most of the detailed tests associated with construction materials and fabrication and should in no way be construed as a substitute for the construction test requirements as specified in the construction packages. Also where appropriate, the text associated with the construction tests has been condensed for the sake of brevity. Traceability however is maintained through the indicated construction package paragraph numbers.

Construction Package 5A - Receiver Tower Structural Steel

Paragraph	Test
9.7.1	(Electrical) Megger testing of all electrical cable upon receipt
9.7.2	Testing of 600-Volt and connected equipment for grounds and short circuits after the cables are installed and terminated.
9.7.3	Testing of permanent Receiver Tower grounding installation.
9.7.4	Energization and phasing out of the power circuits.
(Appendix 1)	(Receiver Crane)
8.1	Functional and load tests shall be performed in the builder's shop and after installation.
8.2	Each control station shall be operated, under no load and proof load at each speed.
8.3	Coasting distances under the high speeds shall be adjusted for smooth braking.

Paragraph	Test
8.4	Brakes shall hold the proof load for 30 minutes without any signs of slippage.
8.5	The proof loads, 125% of rated capacity, shall be lifted and the crane operated to stress each of its components to maximum. Both hoists need not be operated simultaneously.
8.6	The crane system shall be certified by an approved State of California Certificating Agency.
	(Personnel Hoist - Appendix 2)
4.1	Testing shall be performed as necessary to satisfactorily demonstrate proper operating capabilities, compliance with the specifications, and compliance with all applicable codes and standards.

Construction Package 7 - TSS and PSS Foundations

Paragraph	Test
9.4.2	Floor drain piping shall be proved to be leak free by filling the piping with water and testing at a minimum static head of 10 ft H_2O for a period of 8 hours.
9.4.3	Hot oil drain piping shall be leak checked by hydrostatic test at a pressure of 200 psi.
10.5.1	Thermocouples and lead wires shall be tested for grounds, short circuits, and open circuits with a 500-V dc megohmmeter and multimeter. Millivolt output of thermocouples shall be tested with a potentiometer after installation and termination of the lead wires.
10.5.2	Heat flux transducers and lead wires shall be tested for grounds, short circuits, and open circuits with multimeter and a wheatstone bridge after installation of the thermocouples.

Construction Package 9 - Piping and Mechanical Equipment Installation

Paragraph	Test
6.6.1.2	All piping and fittings shall be inspected and tested by the manufacturer in accordance with requirements specified in the applicable Piping Material Specification Sheet.
6.6.1.3	The extent, techniques, and acceptance standards for all specified inspections and tests of materials and welds shall be in accordance with ANSI B31.1 and as further specified herein.

Paragraph	Test
6.6.3.1	Weld joints on high pressure and/or high temperature safety valve discharge elbows shall all be radio-graphed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code.
6.6.4.1	In addition to the inspection requirements of ANSI B31.1 the following field welds shall be radiographed: • Five percent of all socket welds above 750°F (per system). • Five percent of all butt welds (per system) in systems not requiring radiography in accordance with ANSI B31.1.
6.6.4.2	All water, steam, condensate, oil, gas, and air piping and tubing shall be hydrostatically or pneumatically field-tested as specified on the Line Schedule Drawings.
8.3.1	All piping and above ground fire protection systems shall be tested per the following National Fire Protection Association Standards: (Standard No.) 11 - Semi-Automatic Foam Monitoring System 12A - Automatic Total Flooding Halon 1301 Systems 24 - Outside Protection 72A & 72E - Automatic Detectors Flushes and hydrostatic tests shall be carried out per Form No. 85, Part "A" General, Test Description.
10.6	All equipment shall be tested as directed by the equipment manufacturer's representative unless otherwise waived by the Construction Manager.
13.7.5	All HVAC equipment, fans, and motors shall be run at their required speed without vibration, objectionable noise, or sparking.
13.7.6	All HVAC equipment motors, bearings, and journals shall be properly lubricated.
13.7.7	Roof top air conditioning units, air handling units, and ductwork shall be tested, adjusted, and balanced to deliver specified air quantities. Air distribution devices shall be adjusted to deliver specified air quantities.

Paragraph	Test
13.7.10	Operating tests of heating, ventilating, and air conditioning systems shall be made during heating and cooling seasons of the first year.
14.3.1.1	All piping and tubing associated with government and contractor-furnished instrumentation shall be leak tested.
14.3.1.2	Functional tests and initial calibration of government and contractor-furnished instrumentation shall be performed.
15.1.1	Construction tests to be performed by the contractor include hydrostatic and leak tests and equipment alignment checks.

Construction Package 10 - TSS Field Erected Tanks (Part I)

Paragraph	Test
9.3	All instrumentation, excluding thermocouples, shall be procured with requirements for certified calibration by the instrument supplier.
11.6.3	All testing required to prove that the tank is free from leaks shall be performed by the contractor.
11.9.2	Relief valve performance shall be tested in accordance with API Standard No. 2000.
15.8.1.2	Each electrical conductor and conductor shield shall be tested for end to end continuity and correctness of connection.
15.8.1.3	Each insulated conductor shall be tested for insulation dielectric strength using the 500V DC megger method.

Construction Package 10 - TSS Field Erected Tanks Part II)

Paragraph	Test
6.1.9.1	All testing required to prove that the tank is free from leaks and all code requirements have been satisfied shall be performed by the contractor.

Construction Package 10A - PSS Field Erected Tanks

Paragraph	Test
11.1	All testing required to prove that each tank is free from leaks and all code requirements have been satisfied shall be performed by the contractor.

Construction Package 11A - Collector Field Electrical

Paragraph	Test
7.9.1	Megger testing of all electrical cable shall be performed upon receipt.
7.9.2	600-Volt and connected equipment shall be tested for grounds and short circuits with a 1000-volt dc megohmmeter after the cables are installed and terminated.
7.9.3	5000-Volt cables shall be tested after installation and termination using a dc hi-pot or power factor test.
7.9.4	Distribution transformers shall be tested prior to energization.
7.9.6	Heliostat Interface Load Interrupter Switchgear shall undergo functional checkout.
7.9.7	Collector field grounding resistance shall be tested in accordance with Stearns-Roger Engineering Standard No. JF18.13.11.
7.9.8	Roadway lighting fixtures shall be operationally verified.

Construction Package 11 - Plant Electrical

Paragraph	Test
7.9.1	Megger testing of all electrical cable shall be performed upon receipt.
7.9.2	Low voltage cable shall be tested for grounds and short circuits after the cables are installed but before the cables are terminated.
7.9.3	All cabling shall undergo continuity testing after installation and termination.
7.9.4	5000 volt cables shall be tested, either by a dc hi-pot or power factor test, after the cables are installed and terminated.
7.9.5	Distribution transformers shall be tested prior to energization and tap changers shall be set when testing is complete.
7.9.6	The power distribution system shall be energized and phased out.
7.9.7	480-Volt motor control centers shall undergo functional checkout and control testing.

Paragraph	Test
7.9.8	Trace heating system shall be tested.
7.9.9	Relays shall be set and tested.
7.9.10	Ground grid shall be resistance tested in accordance with Stearns-Roger Engineering Standard No. JF18.13.11.
7.9.11	Rotation tests shall be carried out on 4160 and 480-volt motors.
7.9.12	Lighting systems shall be operationally checked and tests shall be conducted as required to verify actual light levels.