SAN/0499-48
MDC G8263

DOE/SF/10499-T89
(STMPO-174)

10 MWe Solar Thermal Central Receiver Pilot Plant

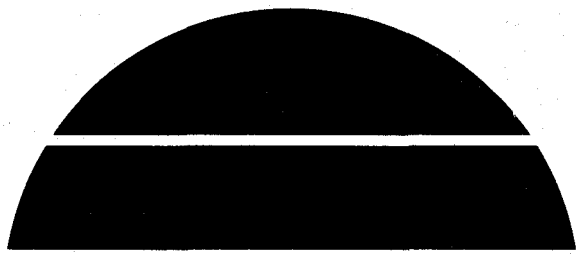
SOLAR FACILITIES DESIGN INTEGRATION

PILOT PLANT AVAILABILITY

May 1980

WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

STEARNS-ROGER ENGINEERING CORP
4500 CHERRY CREEK DRIVE
P.O. BOX 5888
DENVER, CO 80217



U.S. Department of Energy

MCDONNELL DOUGLAS CORPORATION

Solar Energy

SAN/0499-48
MDC G8263

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

PILOT PLANT AVAILABILITY

May 1980

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

PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC-03-79SF10499

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Section 1
GENERAL

1.1 INTRODUCTION

The System Specification (RADL Item 2-3), PRELIMINARY, dated November 1979 (MDC G8220), herein referred to as the System Specification, specifies the availability goal for the 10 MWe Solar Thermal Central Receiver Pilot Plant, herein referred to as the "pilot plant", and assigns availability goals to the subsystems of the pilot plant. This Pilot Plant Availability report presents the current predictions of the availability of the pilot plant and its subsystems.

1.2 PURPOSE

In addition to presenting the current predictions of availability, this report points out those subsystems and components which are major contributors to pilot plant unavailability so that the responsible design and other engineering disciplines may implement changes to increase equipment availability or reduce the effect of unavailability.

1.3 SCOPE

In determining availability, only functional components of the subsystem that are unavailable to perform their required functions due to component failure (component forced outage) and due to planned maintenance (component planned outage) are taken into account. Support equipment, such as site structures (i.e., receiver tower), facility service equipment (i.e., service trucks and cranes), operations control (i.e., computer software), and passive components (i.e., piping), are assumed to be functional 100% of the time the pilot plant is in operation. Availability analysis of this kind of support equipment is beyond the scope of this report.

The Beam Characterization Subsystem is not included in this availability analysis and the availability of the Collector Subsystem is assumed to be the assigned value (99.9%).

Section 2
APPLICABLE DOCUMENTS

1. MDC G8217, Piping and Instrumentation Diagrams (RADL Item 2-16), September 1979.

2. MDC G8220, System Specification (RADL Item 2-3) PRELIMINARY, November 1979.

3. MDC G8221, Failure Modes and Effects Analysis (RADL Item 2-23), December 1979.

4. EEI Publication No. 77-64, Report on Equipment Availability for the Ten-Year Period, 1967-1976, Prime Movers Committee, Edison Electric Institute.

5. ORNL/ENG/TM-2, Nuclear Reliability Assurance Data Source Guide, Oak Ridge National Laboratory.

6. RADC-TR-75-22, Nonelectric Reliability Notebook, Rome Air Development Center, January 1975.

7. NPRD-1, Nonelectric Parts Reliability Data, Rome Air Development Center, Summer 1978.

8. SP-862-05, Failure Rate Data Handbook, (FARADA), June 1973.

9. MIL-STD-217 C, Reliability Prediction of Electronic Equipment.

10. Drawings and Schematics
    a. Solar Flow Diagram; S10MW-PP, Rev. 6, Sep. 24, 1979.
    b. Receiver Subsystem (RS) OCS P&ID; C060479, Rev. B, Sep. 17, 1979.
    c. Receiver Subsystem (RS) Instrument Air and GN2 OCS P&ID's; C060579, Rev. A, Sep. 17, 1979.
    d. Thermal Storage Subsystem (TSS) Instrument Air P&ID; C060779, Rev. A, Sep. 17, 1979.
    e. Ullage Maintenance Unit (UMU) P&ID DAS & OCS; C060879, Rev. A, Sep. 17, 1979.
    f. Thermal Storage Subsystem (TSS) OCS P&ID; C061179, Rev. B, Sep. 17, 1979.
    g. P&ID, Electrical Power Generation Subsystem (EPGS) Steam; 40P7005133140, Rev. P3, Oct. 11, 1979.
    h. P&ID, Electrical Power Generation Subsystem (EPGS) Condensate & Feed Water; 40P7005133141, Rev. P3, Sep. 10, 1979.
    i. P&ID Thermal Storage Subsystem (TSS) Thermal Oil; 40P7005133142, Rev. P3, Sep. 11, 1979.

j. P&ID Thermal Storage Subsystem (TSS) Steam & Condesate; 40P7005133143, Rev. P3, Sep. 7, 1979.
k. P&ID Receiver Subsystem (RS) Steam & Feedwater; 40P7005133144, Rev. P3, Sep. 6, 1979.
l. P&ID Plant Support Subsystem (PSS) Water Treatment; 40P7005133145, Rev. P3, Sep. 6, 1979.

Section 3
SYSTEM DEFINITION AND ANALYSIS DATA

3.1 SYSTEM DESCRIPTION

The pilot plant is a solar thermal central receiver type. It derives thermal energy directly from incident solar radiation to heat water and converts the water to steam which is used to drive a conventional steam turbine to produce electricity. Part of the thermal energy derived from solar radiation may be stored and used during periods of no sunlight or on cloudy days to produce steam to drive the turbine. The pilot plant has a nominal 10MWe rating. It consists of seven subsystems which perform the following functions:

A. Collector Subsystem - array of sun-tracking mirrors (heliostats) which focus the incoming sun's radiation and reflect it to the tower - mounted receiver panels.

B. Receiver Subsystem - absorbs the redirected solar energy and uses it to convert feedwater into superheated steam.

C. Thermal Storage Subsystem - stores excess thermal energy produced by the Receiver Subsystem for use to produce steam during periods of nonsunshine.

D. Electrical Power Generation Subsystem - receives steam from the Receiver Subsystem and/or Thermal Storage Subsystem and converts its thermal energy into electrical power.

E. Master Control Subsystem - monitors and controls pilot plant operations.

F. Plant Support Equipment - interconnecting piping and wiring and support systems for pilot plant subsystems.

G. Beam Characterization Subsystem - consists of equipment used to calibrate heliostats.

Figure 3-1 schematically depicts the pilot plant. The schematics and drawings of the pilot plant and subsystems used in this analysis are listed in the applicable documents section and are included in this report for reference.

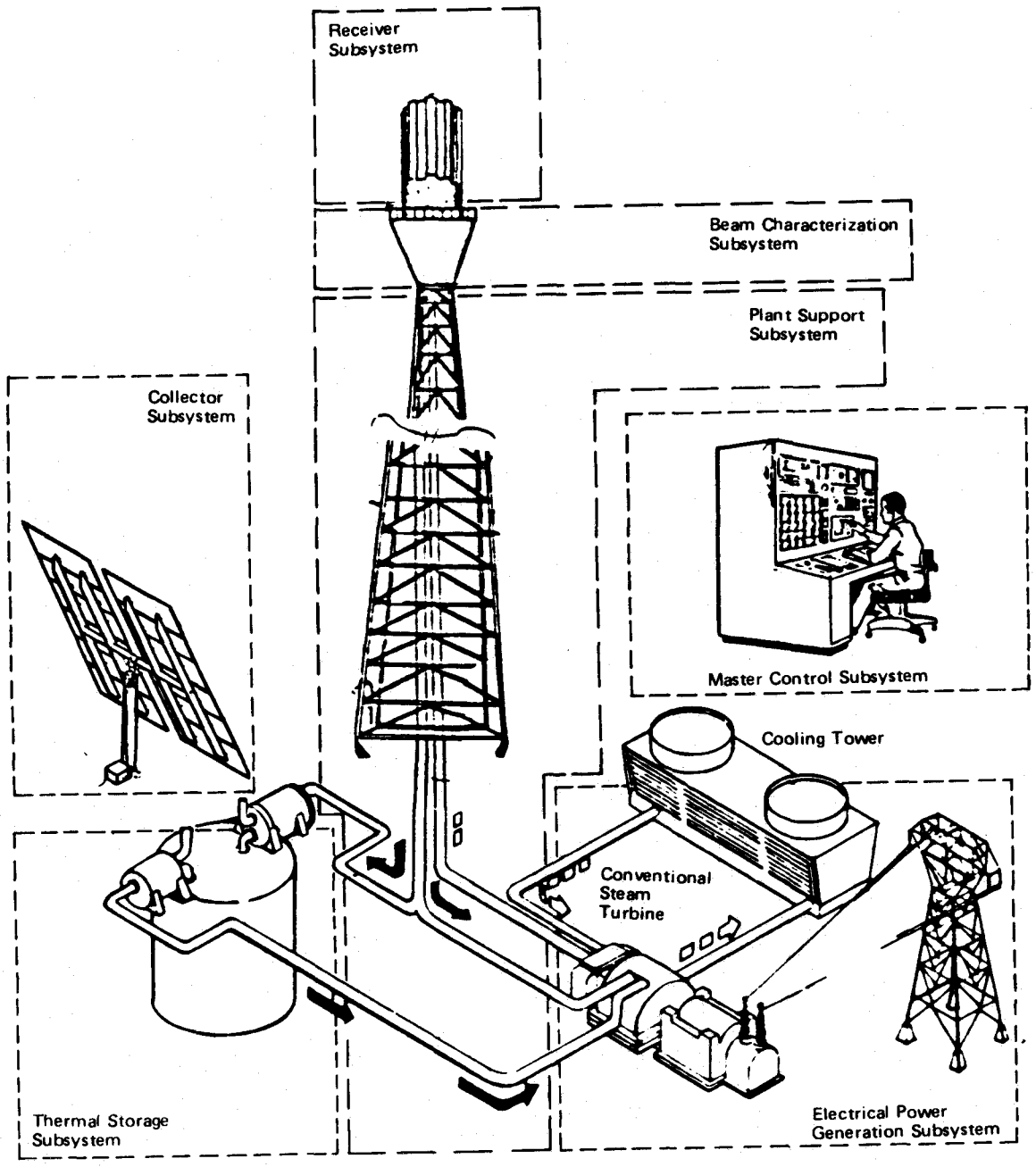


Figure 3-1. Central Receiver Baseline Concept

3.2 OPERATING TIMES

A summary of the operating times for the subsystems of the pilot plant to be used for calculating availability is given in Table 3-1.

3.2.1 Estimated Operating Hours

The "estimated" operating hours shown in Table 3-1 were determined as explained in the sections which follow and represent the number of hours per year that the specific subsystem would be operational if no failures occurred. The "actual" operating hours were determined by assuming a plant availability of 90%, the availability goal in the System Specification. Therefore, the total of forced outages and planned outages of one or more of the subsystems causes the actual operating hours of each subsystem to be 10% less than its estimated operating hours.

3.2.2 Subsystem Operating Calculations

1. Collector Subsystem

Estimated operating hours = total hours per year when the sun is at an angle greater than 10° above the horizon minus a 10% random cloud cover reduction plus a 1 hour per day allowance for heliostat operations before sunrise and after sunset.

= 3,366*+ 0.9 (365) = 3,695 hours

2. Receiver Subsystem

Estimated operating hours = gross sunshine hours (includes 10% random cloud cover reduction).

= 3,366* hours

3. Thermal Storage Subsystem - Charging Loop

Estimated operating hours = gross sunshine hours (includes 10% random cloud cover reduction).

= 3,366* hours

*From memo A3-202-EP-RGR-337, dated 30 April 1979 from R. W. Hallet, Jr. to Richard N. Schweinberg.

Table 3-1. ANNUAL OPERATING HOURS

Subsystem	Operating Hours	
	Estimated	Actual
Collector	3,695	3,326
Receiver	3,366	3,028
Thermal Storage		
Charging	3,366	3,029
Extraction	1,651	1,486
Charging and Extraction	4,680	4,212
Master Control	8,760	7,884
Electrical Power Generation (RS Steam Only)	3,366	3,029
(TSS Steam Only)	1,651	1,486
	4,680	4,212
Plant Support	8,760	7,884

4. Thermal Storage Subsystem - Extraction Loop

Estimated operating hours = 4 hours per day of gross sunshine days (includes 10% random cloud cover reduction) + 10% of maximum operating hours of Receiver Subsystem to account for operating periods when the Thermal Storage Subsystem is also delivering steam to the Electrical Power Generation Subsystem during cloudy daytime periods.

= 4 x 365 x 0.9 + 0.1 x 3,366

= 1,651 hours

5. Thermal Storage Subsystem - Common Equipment

Estimated operating hours = gross sunshine hours (including 10% random cloud cover reduction) + 4 hours per day of gross sunshine days (including 10% random cover reduction).

= 3,366 + 4 x 365 x 0.9

= 4,680 hours

6. Master Control and Plant Support

Estimated operating hours = continuous operation for year.

= 8,760 hours

7. Electrical Power Generation

When receiving steam from Receiver Subsystem only, estimated operating hours are same as for Receiver Subsystem.

= 3,366 hours

When receiving steam from Thermal Storage Subsystem only, estimated operating hours are same as for extraction loop of Thermal Storage Subsystem.

= 1,651 hours

EPGS operating hours for Common Equipment are the same as the Thermal Storage Subsystem while charging and extracting.

= 4,680 hours

3.3 GROUND RULES AND DEFINITIONS

3.3.1 Availability Goal

In accordance with paragraph 3.2.1.3 of the System Specification, the pilot plant shall have an availability goal of 90% over a 1-year period. Availability shall be as defined by the Edison Electric Institute (EEI-77-64) but in the context of a solar facility operation.

Component failures which cause power output reductions of less than 2% do not reduce subsystem or pilot plant availability.

Component failures which cause power output reductions of between 2% and 100% shall reduce subsystem or pilot plant availability in proportion to the reduction in power output.

The System Specification states "no availability penalty shall be assessed if plant operations can be maintained through a change in operating mode." In this analysis only the basic operating mode of the specific subsystem was taken into account. Therefore, availability predictions presented are lower than would be expected if other alternate operating modes were considered.

3.3.2 Failure Modes and Effects Analysis (FMEA)

Component failure modes and their effect on subsystem performance as determined in the FMEA, RADL Item 2-23, December 1979, were used to assess subsystem unavailability due to component failures. FMEA criticality category C failures,

failures that will have little or no effect on plant performance, or failures that will be corrected during nonoperating periods or on a noninterference basis, are assumed to have no effect on availability. Therefore, criticality category C failures are not listed in the availability analysis tabulations, but criticality category A and B failures are included. Category A includes failures that will cause complete plant shutdown and category B includes failures that will cause major reduction in plant efficiency.

Instrumentation failures which do not result in full or partial subsystem shutdown do not render the subsystem unavailable.

No availability penalty is assessed to a subsystem for component failures which do not reduce subsystem performance, i.e., single failures in redundant paths.

3.3.3 Forced and Planned Outages

The time shown in the Component Planned Outage column of the Availability Analysis tabulations is actual lost operating times per year due to planned maintenance. For example, if the subsystem is operational 10 hours each 24 hour day and the actual planned maintenance is performed in 168 hours each 1-1/2 years, the operational hours lost in one year is as follows:

$$\frac{168}{1.5} \times \frac{10}{24} = 47 \text{ hours}$$

The mean time to restore, (MTTR), the subsystem to operation after a component failure is multiplied by failures per year to determine component forced outage time. For two or more of the same component, the figure is further multiplied by the number of similar components to determine the subsystem unavailability. Where the MTTR is less than the daily operational period for the subsystem, it is assumed (worst case) that the entire forced outage occurs during the subsystem operational period. Where the MTTR is more than the daily operational period for the subsystem, the forced outage is adjusted to reflect only actual lost operational hours, (i.e., it is estimated that the MTTR of the Thermal Storage Unit tank is 3 months (2,160 hours), but this results in a forced outage of the Thermal Storage Subsystem of only 1,350 operational hours).

3.3.4 Availability Methodology

Availability is the percent of time a subsystem, or the pilot plant, is capable of performing its specified function or provide its specified output during the subsystem, or pilot plant, annual operating periods. The mathematical expression is as follows:

$$A = \frac{OH - U}{OH} \times 100$$

or

$$= 100 - 100 \sum \left(\frac{\eta F}{YR} \times MTTR + PO \right)$$

where

A = availability - %

OH = component operational hours per year

U = unavailable time - hours per year

$\frac{F}{YR}$ = number of component failures per year

MTTR = mean time to restore - hours

PO = planned outage time - hours

U = unavailable time - hours

and

$$\frac{F}{YR} = \frac{OH}{MTBF}$$

where

MTBF = mean time between failures - hours/failure

Section 4
AVAILABILITY ANALYSIS AND PREDICTIONS

4.1 SUMMARY OF ANALYSIS RESULTS

Table 4-1 is a summary of the availability goals and current predictions for the pilot plant and each of its subsystems. The availability analysis tabulations listed the forced and planned outage figures and the unavailability contributed by each component of the subsystems. Table 4-2 is a summation of the results of the availability analysis tabulations. The component mean time between failures (MTBF) used in the Availability Analysis tabulations were derived from the failure rate source publications shown in the Applicable Documents section of this report and are listed in Table 4-3 for reference.

4.2 PILOT PLANT AVAILABILITY

Pilot Plant availability will be 92.05% if planned maintenance on all subsystems is performed during the same shutdowm period, and 88.5% if planned maintenance on the subsystems is performed during different shutdown periods. It is probable that neither method of planned maintenance will be used exclusively. Therefore, these figures represent the range into which the actual availability of the pilot plant will fall, the average being approximately 90.28%.

Table 4-1. Availability Predictions

Pilot Plant/Subsystem	Availability - % Goal/Assigned	Availability - % Predictions	Notes
Pilot Plant	90	88.5	(1)
Collector Subsystem	99.90	99.90	
Receiver Subsystem	98.05	97.44	
Thermal Storage Subsystem	98.10	96.23	
Master Control Subsystem	99.95	99.99	
Electrical Power Generation	95.00	96.33	
Plant Support Subsystem	99.00	98.61	

(1) If planned outages for all subsystems are concurrent, the pilot plant availability prediction increases from 88.50% to 92.05%.

Table 4-2. Unavailability Predictions

Subsystem	Outages (Hrs/Yr) Forced	Outages (Hrs/Yr) Planned	Operating Hours	Outage Rates (%) Forced	Outage Rates (%) Planned
Collector	3.70	0	3695	0.10	0
Receiver	39.54	47	3366	1.17	1.39
Thermal Storage					
Charging	17.55	0	3366	0.52	0
Discharge	7.08	0	1651	0.43	0
Common	85.16	47	4680	1.82	1.00
Master Control	0.79	0	8760	0.01	0
Elec. Power Gen. Receiver Steam	63.28	104	3366	1.35	2.22**
T. S. Steam	1.57	0	1651	0.10	0 *
Plant Support	20.57	101	8760	0.23	1.16
TOTALS				5.73	5.77

Pilot Plant Availability = 88.50 → 92.05

* Figures shown are for Electrical Power Generation Subsystem components which operate when the subsystem receives steam from the receiver subsystem.

** Figures shown are for the additional components that operate when the subsystem receives steam from the Thermal Storage Subsystem.

The Electrical Power Generation Subsystem accounts for 32% of the unavailability of the pilot plant. The next larger contributors are the Thermal Storage Subsystem with 33% of the unavailability and the Receiver Subsystem with 22% of the unavailability. The remaining three subsystems combined contribute only 13% of the unavailability of the pilot plant.

Table 4-3. Mean Time Between Failures (MTBF)

Component	MTBF (10^3 Hours)
Air Cooler	31
Boiler	91
Circuit Breaker	1000
Condenser	91
Controller	27.4
Deaerator	100
Demineralizer	100
Desuperheater	31.5
Filter, liquid	330
Filter, gas	830
Heaters	91
Heat Exchanger	31
Hiway Traffic Director	10
Manifold	1000
Orifices	270
Panel, preheater	62.5
Pump	16
Restrictor	80
Steam Trap	1000
Superheater	91
Strainer, Y Type	250
Strainer, cleanout	330
Separator, moisture	250
Tank	1000
Transmitter, pressure and flow rate	32.5
Transformer	500
Turbine-Generator	5.5
Valves	
- Butterfly, check and manual	250
- Control, regulator, 3 way	160
- Safety, relief	100

4.2.1 Collector Subsystem Availability

Collector Subsystem availability was taken as the assigned goal of 99.9%, which reflects the results of a previous analysis. Assuming the previously estimated MTBF of 17,000 hours for an entire heliostat and 330 days per year of operating time for the subsystem, 1.2 failures per day can be expected in a collector field of 1,818 heliostats. An outage of up to 36 heliostats, depending on their location and failure mode, will not reduce the pilot plant output more than 2%, and thus will not effect availability. Therefore, 99.9% appears to be a realistic estimate of the availability of the Collector Subsystem.

The Receiver Subsystem availability prediction is 97.44%. The assigned goal is 98.05%. There are several factors that contribute to this value. The largest contributor is the planned outage of 47 hours (1.39%) required for tube cleaning. The largest forced outage item is the failure of the 18 flow rate transmitters with a total outage of 10.044 hours per year. The next time is the 18 moisture separators with a failure rate of 0.030 per year, a MTTR of 9 hours and a component forced outage of 0.27 hours per year for each separator.

4.2.3 Thermal Storage Subsystem Availability

The Thermal Storage Subsystem availability prediction is 96.23%. This is below the assigned goal of 98.10%. Forced outages due to failures of components connected to the Thermal Storage Unit, 3 shutoff valves TFAIS-1, TUFIS and TUFFIS, contribute 40% of the unavailability of the entire subsystem. This is because replacement of any of these valves requires that the Thermal Storage tank be drained. The mean time to restore the subsystem to full operation after one of these valves fails is estimated to be 3 calendar months or 1,350 subsystem operational hours. Design improvements to eliminate the need to drain the Thermal Storage Tank in the event of a shutoff valve failure should be considered.

4.2.4 Master Control Subsystem Availability

The Master Control Subsystem availability prediction is 99.99%. This prediction exceeds the goal of 99.95%.

4.2.5 Electrical Power Generation Subsystem Availability

The Electrical Power Generation Subsystem availability predictions is 96.33%, which value exceeds the goal of 95.0%. Approximately 62% of the unavailability of the subsystem results from planned outage for maintenance of the major components in the subsystem - the turbine generator, condenser, low and high pressure heaters, desuperheaters, and demineralizers. The component planned outage for each of these components is estimated to require 104 subsystem operational hours per year. This subsystem has the largest planned mainte-annce outage of all of the subsystems.

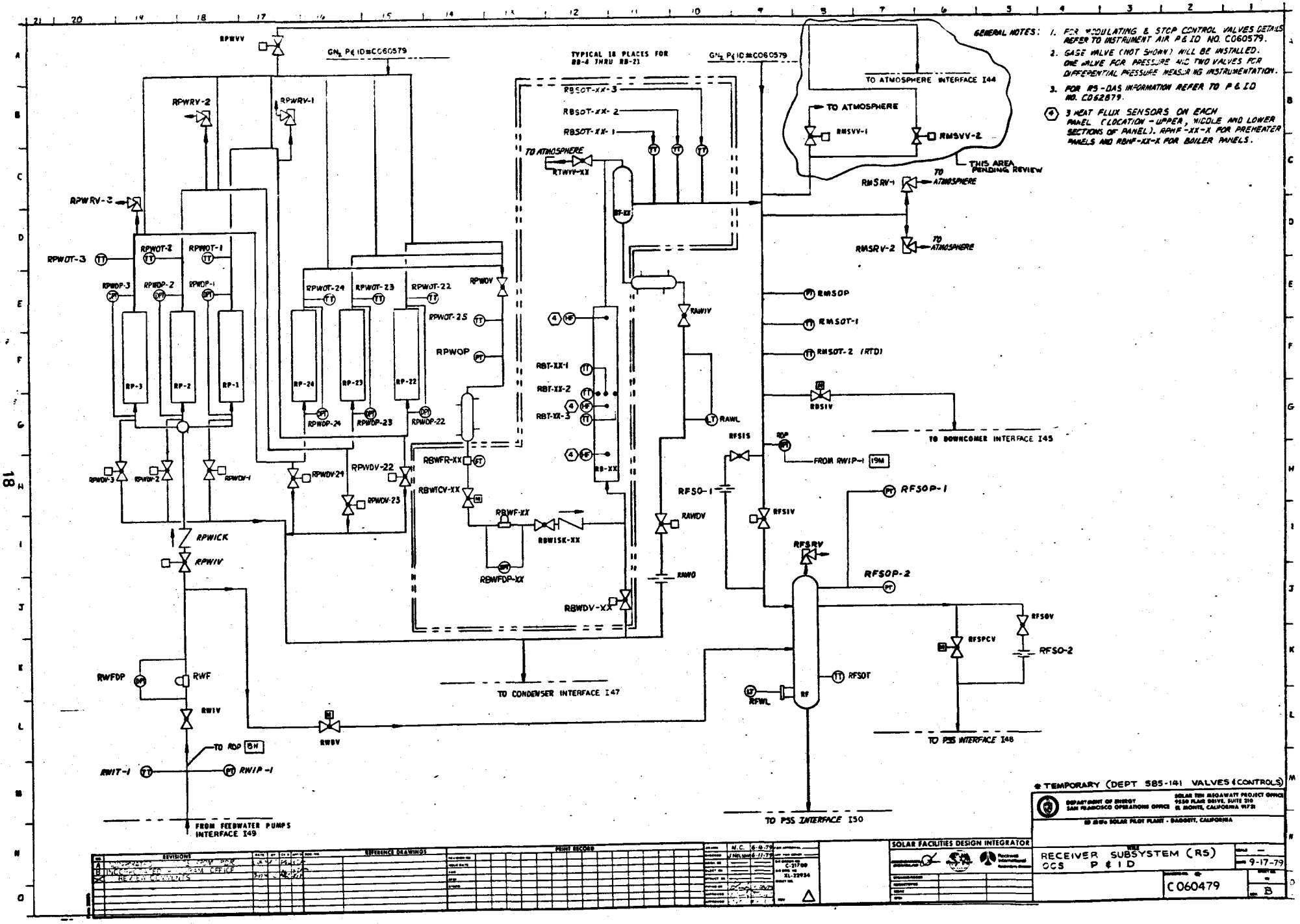
The second largest contributor to the unavailability of the subsystem is forced outage, 30.64 hours per year, for the turbine generator. This high component outage results because of the high failure rate predicted for the turbine generator, 5,500 hrs MTBF.

4.2.6 Plant Support Subsystem Availability

The Plant Support Subsystem availability prediction is 98.61%, which approximates the goal of 99.0%. The largest contributor to the unavailability of subsystem results from the estimate of 101 subsystem operational hours of outage required for planned maintenance of the cooling water heat exchanger. This accounts for 83% of the unavailability of the subsystem.

Section 5
SUBSYSTEM FIGURES AND AVAILABILITY ANALYSIS TABULATIONS

The figures used for the Availability Analyses as well as the tabulated results of the analyses, are contained in this section.


GENERAL NOTES:
1. FOR MODULATING & STOP CONTROL VALVES DETAILS REFER TO INSTRUMENT AIR P&ID NO. C060579.
2. GAGE VALVE (NOT SHOWN) WILL BE INSTALLED. ONE VALVE FOR PRESSURE AND TWO VALVES FOR DIFFERENTIAL PRESSURE MEASURING INSTRUMENTATION.
3. FOR RS-DAS INFORMATION REFER TO P&ID NO. C062879.
4 3 HEAT FLUX SENSORS ON EACH PANEL (LOCATION - UPPER, MIDDLE AND LOWER SECTIONS OF PANEL). RPHF-XX-X FOR PREHEATER PANELS AND RBHF-XX-X FOR BOILER PANELS.
TYPICAL 18 PLACES FOR RB-4 THRU RB-21
GN2 P&ID #C060579
TO ATMOSPHERE INTERFACE I44
TO ATMOSPHERE
THIS AREA PENDING REVIEW
RMSV-1
RMSV-2
RMSRV-1
RMSRV-2
TO ATMOSPHERE
RPWVV
RPWRV-2
RPWRV-1
RPWRV-3
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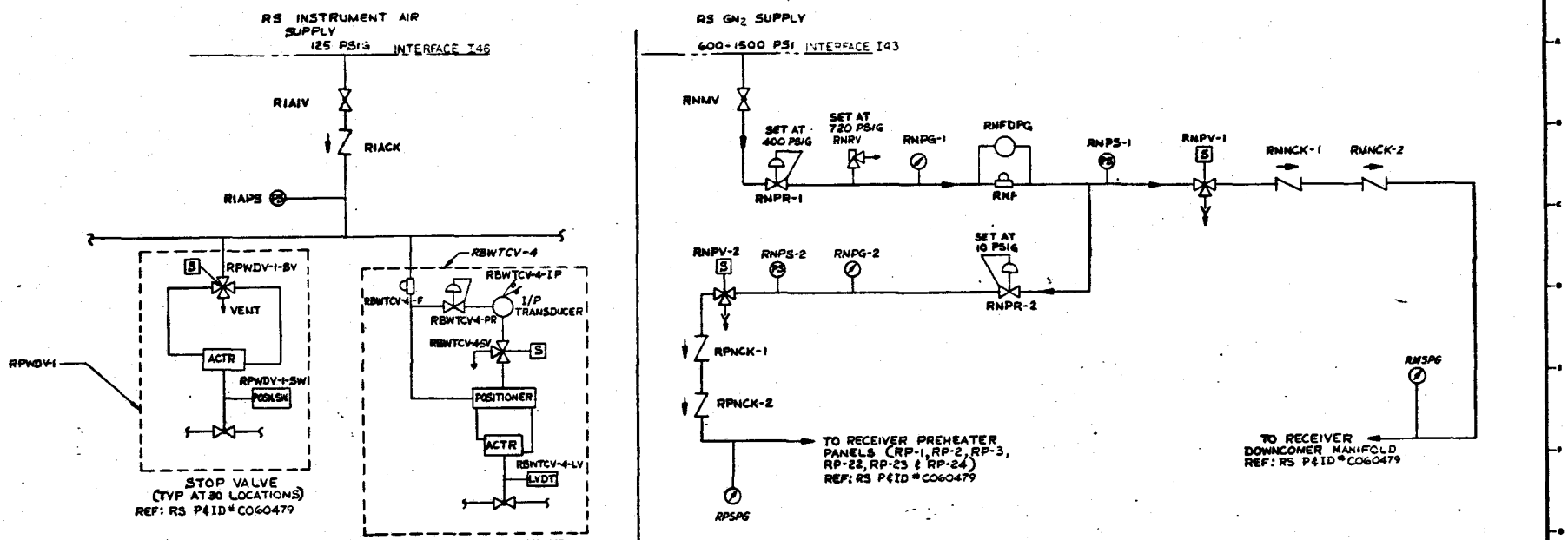
RAWL
RAWDV
RAWO
RMSOP
RMSOT-1
RMSOT-2 (RTD)
RDSIV
TO DOWNCOMER INTERFACE I45
RFSIS
RDP
FROM RWIP-1 19M
RFSO-1
RFSOP-1
RFSIV
RFSRV
RFSOP-2
RFSOV
RFSPCV
RFSO-2
RFSOT
RFWL
RF
TO PSS INTERFACE I48
TO CONDENSER INTERFACE I47
RWFDP
RWF
RWIV
RWBV
TO RDP 8W
RWIT-1
RWIP-1
FROM FEEDWATER PUMPS INTERFACE I49
TO PSS INTERFACE I50
* TEMPORARY (DEPT 585-141 VALVES & CONTROLS)
DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE
SOLAR TEN MEGAWATT PROJECT OFFICE
9650 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731
10 MWe SOLAR PILOT PLANT - BARSTOW, CALIFORNIA
SOLAR FACILITIES DESIGN INTEGRATOR
RECEIVER SUBSYSTEM (RS)
OCS P&ID
9-17-79
C060479
B
REVISIONS
REFERENCE DRAWINGS
PRINT RECORD

MCDONNELL DOUGLAS

19



TAG NO.	DESCRIPTION
RPWDV-1 THRU RPWDV-3	PREHEATER PANEL WATER DRAIN VALVE
RBWDV-4 THRU RBWDV-21	BOILER PANEL WATER DRAIN VALVE
RPWDV-22 THRU RPWDV-24	PREHEATER PANEL WATER DRAIN VALVE
RPWVV	PREHEATER PANEL WATER VENT VALVE
RAWDV	MOISTURE ACCUMULATOR WATER DRAIN VALVE
RFSIV	FLASH TANK STEAM INLET VALVE
RMSVV-1&2	DOWNCOMER MANIFOLD STEAM VENT VALVE
RPWIV	PREHEATER PANEL FEEDWATER INLET VALVE

TAG NO.	DESCRIPTION
RBWTCV-4 THRU RBWTCV-21	BOILER PANEL WATER TEMPERATURE CONTROL VALVE
RFSPCV	FLASH TANK STEAM PRESSURE CONTROL VALVE
RWBV	FEEDWATER BYPASS VALVE
RDSIV	DOWNCOMER STEAM INLET VALVE

GENERAL NOTES:

1. GAGE VALVE (NOT SHOWN) WILL BE INSTALLED. ONE VALVE EACH FOR ALL PRESSURE GAGES.
2. FOR RS-OCS COMPONENTS INFORMATION REFER TO P&ID NO. C060479.

* TEMPORARY (DEPT 585-141 VALVES & CONTROLS)

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DR. #S, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - BARSTOW, CALIFORNIA

SOLAR FACILITIES DESIGN INTEGRATOR

TITLE
RECEIVER SUBSYSTEM (RS) INSTRUMENT AIR AND GN2 OCS P & ID'S

DATE 9-17-79

DRAWING NO. * C060579

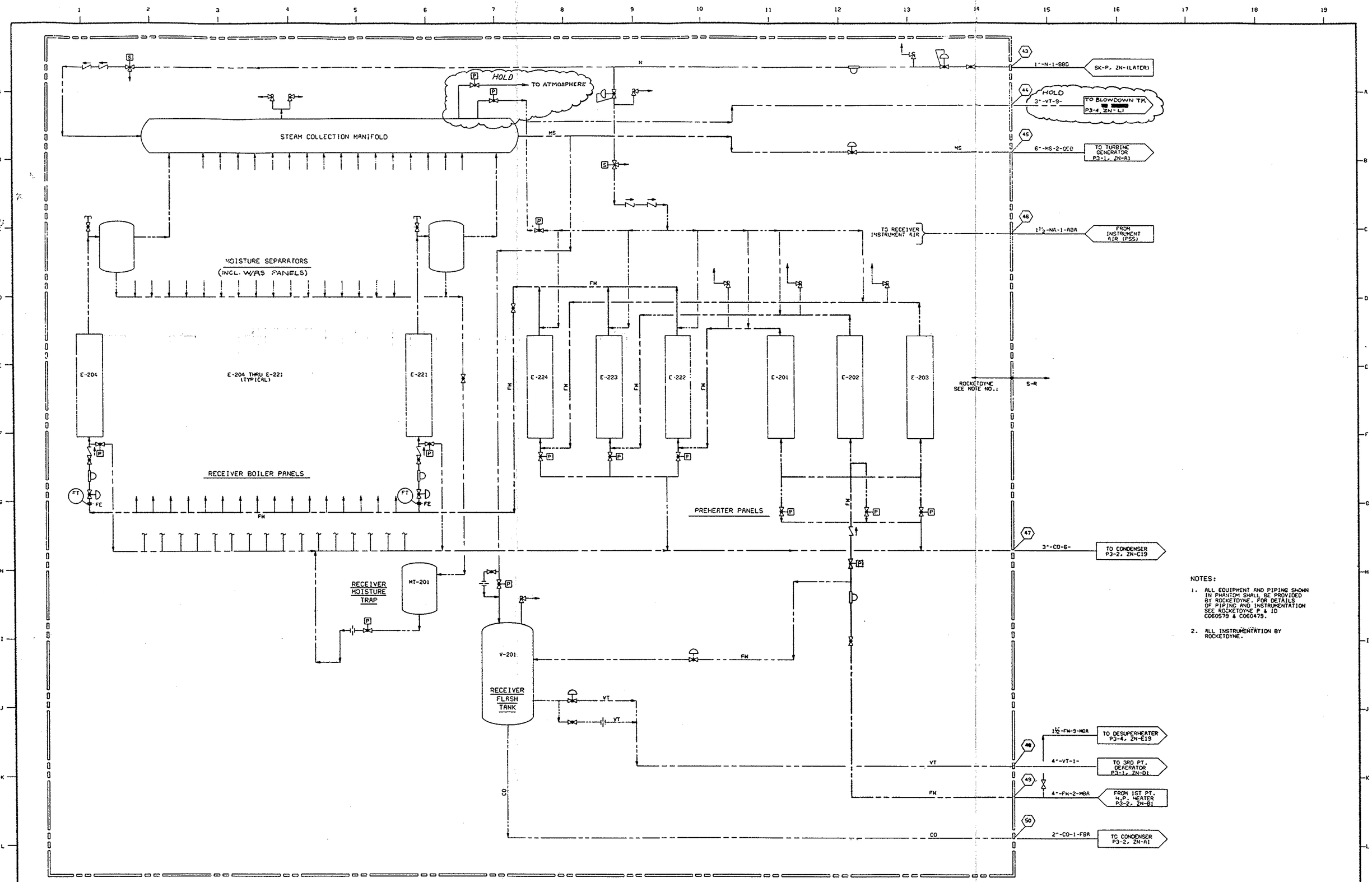
SIZE A

REVISIONS: REVIEW COMMENTS

REFERENCE DRAWINGS

PRINT RECORD

DRAWN 6-5-79
CHECKED 6-11-79
C-1700
XL-22934



NOTES:

1. ALL EQUIPMENT AND PIPING SHOWN IN PHANTOM SHALL BE PROVIDED BY ROCKETDYNE. FOR DETAILS OF PIPING AND INSTRUMENTATION SEE ROCKETDYNE P & ID C060579 & C060479.
2. ALL INSTRUMENTATION BY ROCKETDYNE.

9-12-79 ⚠ REVISIONS: ADDED INTERFACE NUMBERS, LINE NUMBERS N-1, VT-9, NA-1, CO-6, VT-1 & CO-1. CHANGED PREHEATER & BOILER PANEL NUMBERS. ADDED "HOLD".

IGS NO. BF9178
9/10/79

NO.	REVISIONS	DATE	BY	CK'D	DOC. NO.

REFERENCE DRAWINGS

PRINT RECORD

REVISION NO.	
ISSUE DATE	
FOR	
SCALE	
STAMP	

DRAWN	IGS	5/14/79
CHECKED		
MECH. ENGR.		
ELECT. ENGR.		
STRUCT. ENGR.		
PIPING ENGR.		
APPROVED		
APPROVED		

FOR APPROVAL
APP. FOR CONST.
S.R. STOCK NO. C-21700
S.R. DWG. NO. XL-22934
SHEET NO. P3-S

SOLAR FACILITIES DESIGN INTEGRATOR

DRAWING NUMBER
ROCKETDYNE
MDAC
OTHER

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
3550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

TITLE
PIPING AND INSTRUMENT DIAGRAM
RECEIVER SUBSYSTEM (RS)
STEAM & FEEDWATER

SCALE: NONE
DATE: 9-6-79

P&ID(P3-S)

DRAWING NO. 40P7005133144

SHEET NO. 1 OF 1

REV. 5

AVAILABILITY ANALYSIS

ITEM 5.1 RECEIVER SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Downcomer Input Valve, RDSIV	3,029	160,000	0.019	8.5	0.162	0	A	0.162	
Flush-Tank Input Valve, RFSIV	3,029	160,000	0.019	8.5	0.162	0	A	0.162	
Receiver Flash Tank, RF	3,029	1,000,000	0.003	6	0.018	0	A	0.018	
Flash-Tank Relief Valve, RFSRV	3,029	1,000,000	0.003	9	0.027	0	B	0.027	
Flash-Tank Pressure Control Valve, RFSPCV	3,029	160,000	0.019	8.5	0.162	0	A	0.162	
Receiver-Water Bypass Valve, RWBV	3,029	160,000	0.019	8.5	0.162	0	B	0.162	
Main Nitrogen Valve, RNMV	3,029	160,000	0.019	8.5	0.162	0	B	0.162	
Nitrogen High-Pressure Regulator, RNPR-1	3,029	160,000	0.019	8.5	0.162	0	B	0.162	
Relief Valve, RNRV	3,029	100,000	0.030	9	0.270	0	B	0.270	
Filter, RNF	3,029	830,000	0.004	6	0.024	0	B	0.024	
Pressure Regulator, RNPR-2	3,029	160,000	0.019	8.5	0.162	0	B	0.162	
Control Valve, RNPV-2	3,029	160,000	0.019	9	0.171	0	B	0.171	

AVAILABILITY ANALYSIS

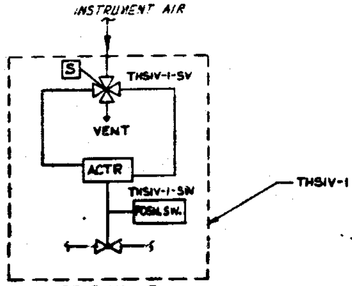
ITEM 5.5 PLANT SUPPORT SUBSYSTEM

PREPARED BY HAROLD BURG

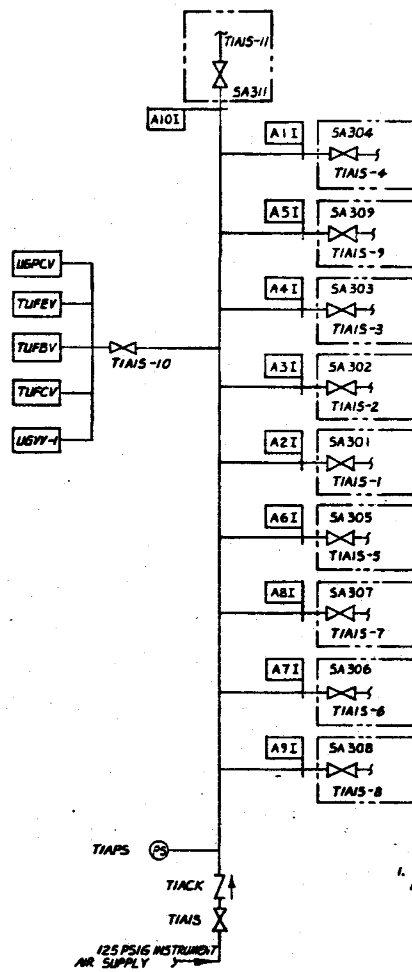
DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Cooling-Tower Transformer	7,884	500,000	0.016	4.0	0.064	0	A	0.064	
Cooling-Tower Transformer Output Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-L Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-A Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-B Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Receiver PPA Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Centers for Power Panels	7,884	250,000	0.032	3.0	0.096	0	A	0.024	

TSS INSTRUMENT AIR OPERATED STOP VALVES		SKID NO.
TAG NO	DESCRIPTION	
THSIV-1	THERMAL STORAGE HEATER, TH-1 STEAM INLET CONT VALVE	SA 302
THSIV-2	THERMAL STORAGE HEATER, TH-2 STEAM INLET CONT VALVE	SA 303
THSWV-1	THERMAL STORAGE HEATER, TH-1 BLANKET STEAM CONT VALVE	SA 302
THSWV-2	THERMAL STORAGE HEATER, TH-2 BLANKET STEAM CONT VALVE	SA 303
TTSVV-1	STEAM TRAP TT-1 VENT CONTROL VALVE	SA 302
TTSVV-2	STEAM TRAP TT-2 VENT CONTROL VALVE	SA 303
UGVV-1	THERMAL STORAGE UNIT ULLAGE VENT VALVE	
TFSWV	FLASH TANK BLANKET STEAM CONTROL VALVE	SA 301
TFCPBV	CHARGING PUMP INTERCONNECT CONTROL VALVE	SA 304
TFEPBV	EXTRACTION PUMP INTERCONNECT CONTROL VALVE	SA 309
TFAV	THERMAL STORAGE AUXILIARY FLUID CONTROL VALVE	SA 309
TFAIV-1	THERMAL STORAGE AUXILIARY FLUID INLET CONTROL VALVE	SA 307
TFAIV-2	THERMAL STORAGE AUXILIARY FLUID INLET CONTROL VALVE	SA 308
TSSWV-1	STEAM GENERATOR BLANKET STEAM CONTROL VALVE	SA 307
TSSWV-2	STEAM GENERATOR BLANKET STEAM CONTROL VALVE	SA 308
TSSBV-1	STEAM GENERATOR BLEED CONTROL VALVE	SA 307
TSSBV-2	STEAM GENERATOR BLEED CONTROL VALVE	SA 308
TUFEV	THERMAL STORAGE UNIT, TU FLUID EXTRACTION CONT VALVE	
TUFBV	THERMAL STORAGE UNIT, TU BYPASS CONTROL VALVE	
TUFCV	THERMAL STORAGE UNIT, TU INLET/OUTLET CONTROL VALVE	
TBWBLV-1	BOILER WATER BLOWDOWN VALVE	SA 307
TBWBLV-2	BOILER WATER BLOWDOWN VALVE	SA 308
UGVV-2	ULLAGE STORAGE TANK VENT VALVE	SA 311
UGPCV	ULLAGE GAS PRESSURE CONTROL VALVE	



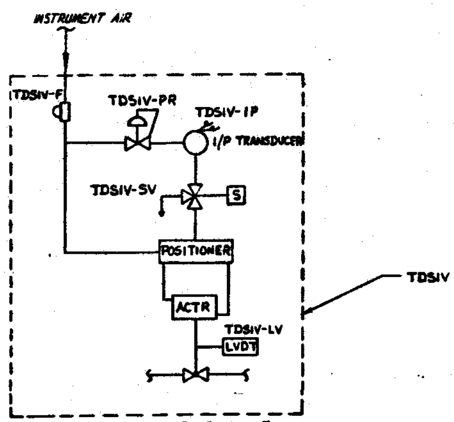
STOP VALVE
(TYP AT 24 LOCATIONS)



GENERAL NOTES:

1. PRESSURE SENSING INSTRUMENTS HAVE LINE ISOLATION VALVES NOT SHOWN.

TSS INSTRUMENT AIR OPERATED MODULATING VALVES		SKID NO.
TAG NO	DESCRIPTION	
TDSIV	DESUPERHEATER INLET STEAM PRESS CONT VALVE	SA 301
TDWTCV	DESUPERHEATER COOLANT WATER CONTROL VALVE	SA 301
TTWPCV-1	STEAM TRAP TT-1 WATER PRESSURE CONTROL VALVE	SA 302
TTWPCV-2	STEAM TRAP TT-2 WATER PRESSURE CONTROL VALVE	SA 303
THFIV-1	THERMAL STORAGE HEATER TH-1 FLUID CONTROL VALVE	SA 304
THFIV-2	THERMAL STORAGE HEATER TH-2 FLUID CONTROL VALVE	SA 304
TBFFCV-1	BOILER TB-1 FLUID CONTROL VALVE	SA 307
TBFFCV-2	BOILER TB-2 FLUID CONTROL VALVE	SA 308
TFAPCV	AUXILIARY FLUID FLOW CONTROL VALVE	SA 309
TSFTCV-1	SUPERHEATER TS-1 STEAM TEMP (FLUID) CONT VALVE	SA 307
TSFTCV-2	SUPERHEATER TS-2 STEAM TEMP (FLUID) CONT VALVE	SA 308
TPWCV-1	SUPERHEATER TS-1 WATER CONTROL VALVE	SA 305
TPWCV-2	SUPERHEATER TS-2 WATER CONTROL VALVE	SA 306



MODULATING VALVE
(TYP AT 13 LOCATIONS)

* TEMPORARY (DEPT 585-141 VALVES & CONTROLS)

REVISIONS
A INCORPORATED PROGRAM OFFICE REVIEW COMMENTS

SOLAR FACILITIES DESIGN INTEGRATOR

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

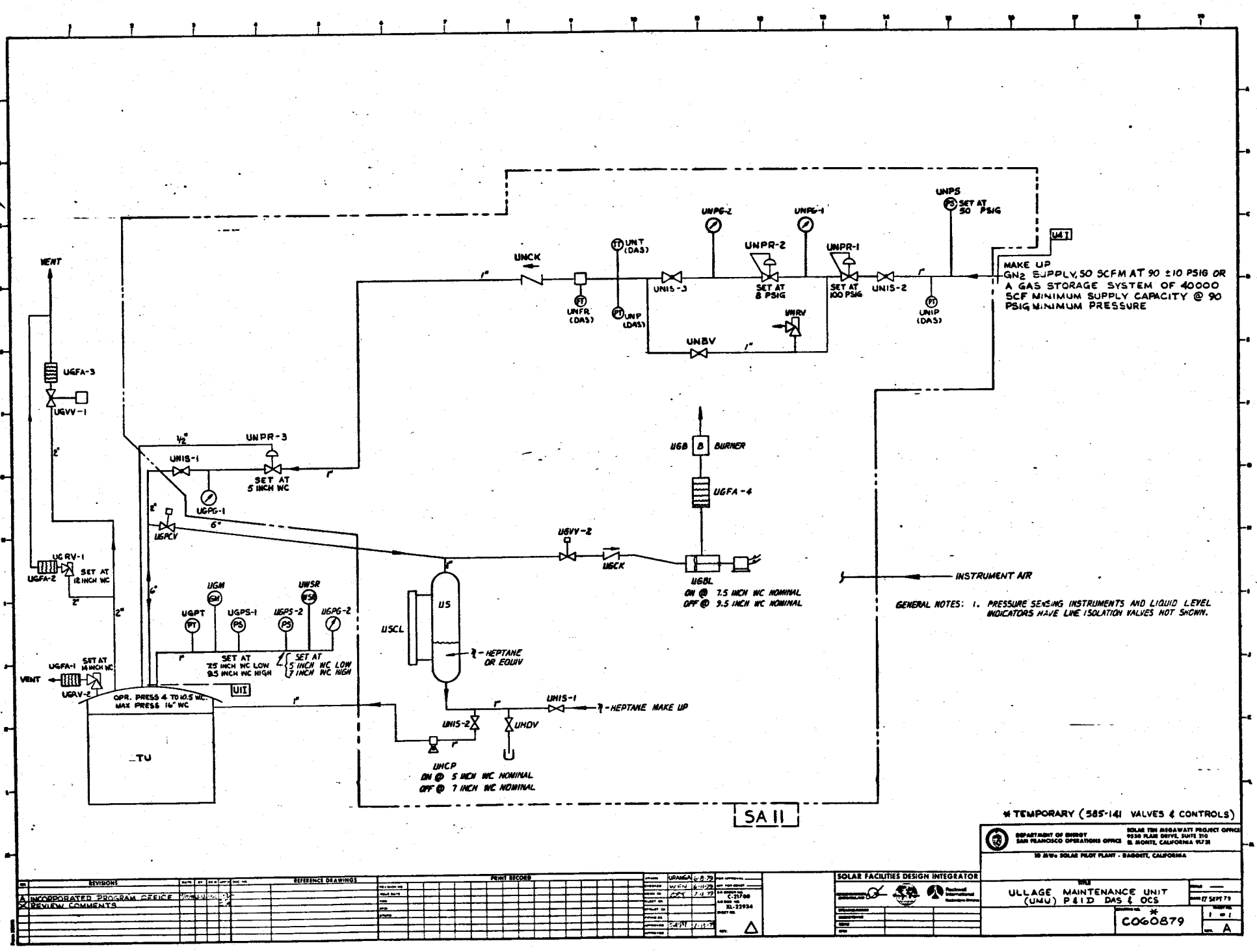
SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - BAGGETT, CALIFORNIA

TITLE: THERMAL STORAGE SUBSYSTEM (TSS) INSTRUMENT AIR P & ID

17 SEPT 79

C060779 A



REVISIONS					REFERENCE DRAWINGS	PRINT RECORD		
A INCORPORATED PROGRAM OFFICE REVIEW COMMENTS						URANGA	6-8-79	
						W.C.N.	6-11-79	
							7-18-79	
						C-31780		
						SL-23934		
							7-13-79	

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 310
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - BARSTOW, CALIFORNIA

SOLAR FACILITIES DESIGN INTEGRATOR

McDonnell Douglas Astronautics Company

Rockwell International Energy Systems Group

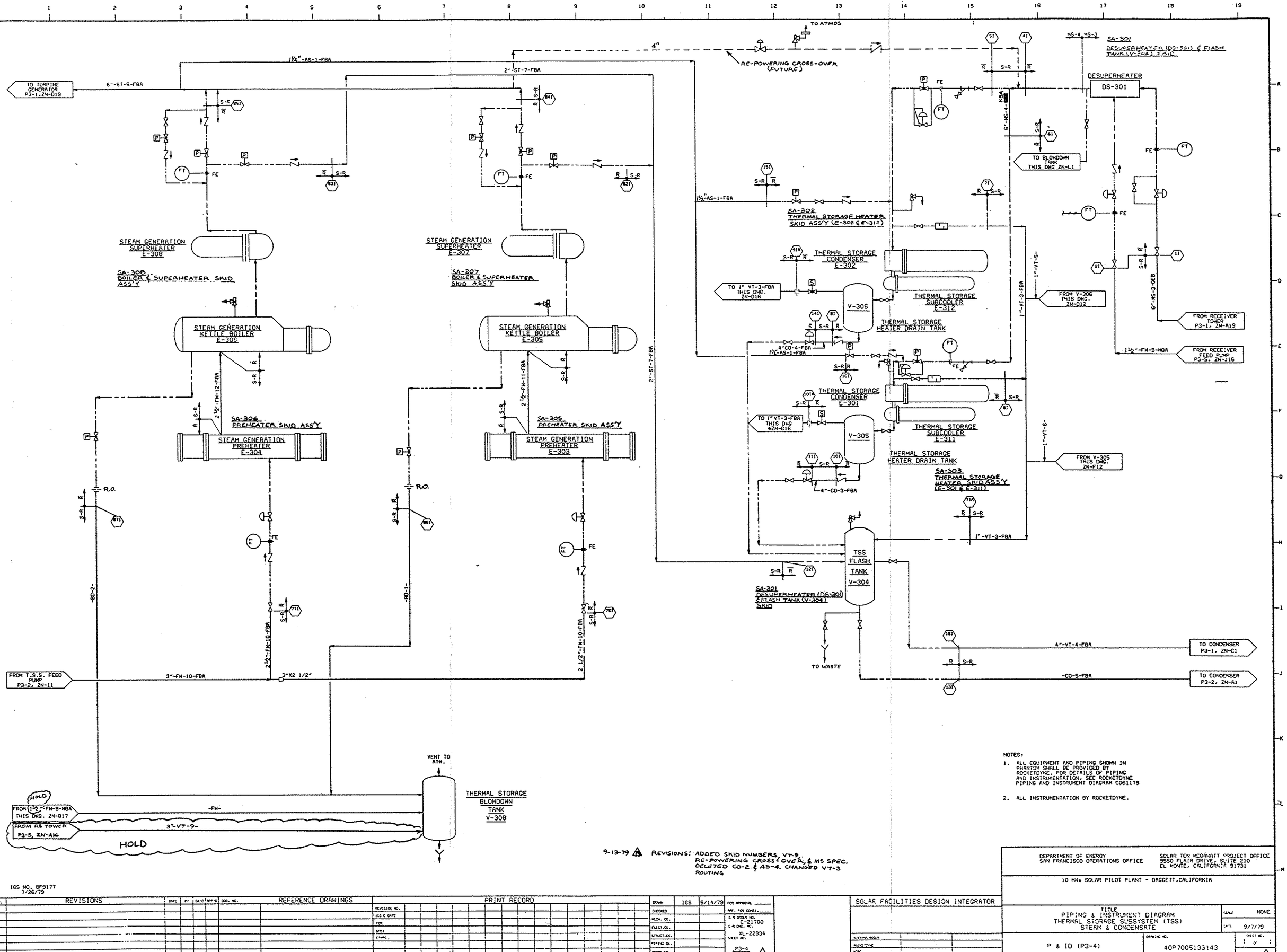
ULLAGE MAINTENANCE UNIT (UMU) P&ID DAS & OCS

DATE 17 SEPT 79

SHEET NO. 1 of 1

DRAWING NO. * C060879

REV. A



NOTES:

1. ALL EQUIPMENT AND PIPING SHOWN IN PHANTOM SHALL BE PROVIDED BY ROCKETDYNE. FOR DETAILS OF PIPING AND INSTRUMENTATION, SEE ROCKETDYNE PIPING AND INSTRUMENT DIAGRAM C061179
2. ALL INSTRUMENTATION BY ROCKETDYNE.

9-13-79 ⚠3 REVISIONS: ADDED SKID NUMBERS, VT-9, RE-POWERING CROSS OVER P. & MS SPEC. DELETED CO-2 & AS-4. CHANGED VT-3 ROUTING

IGS NO. BF9177
7/26/79

NO.	REVISIONS	DATE	BY	CK'D	APP'D	DOC. NO.	REFERENCE DRAWINGS

PRINT RECORD

REVISION NO.			
ISSUE DATE			
FOR			
BY(S)			
STAMPS			

DRAWN	IGS	5/14/79	FOR APPROVAL
CHECKED			APP. FOR CONST.
MECH. CK.			S & E ORDER NO. C-21700
ELECT. CK.			S & E DWG. NO. XL-22934
STRUCT. CK.			SHEET NO. P3-4
PIPING CK.			⚠3
APPROVED			
APPROVED			

SOLAR FACILITIES DESIGN INTEGRATOR

ELECTRIC MODELS			
ROCKETDYNE			
NONE			
DATE			

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

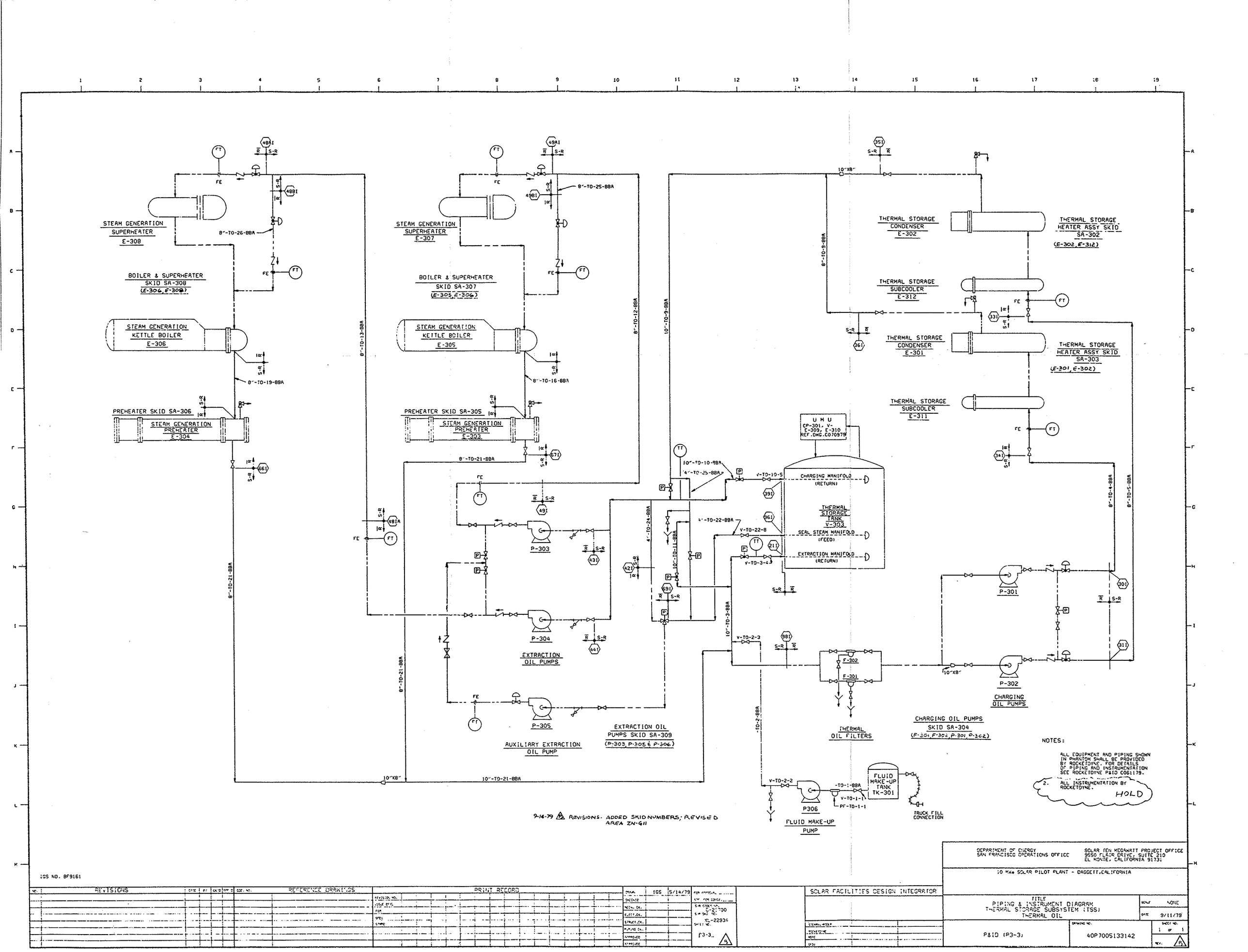
TITLE
PIPING & INSTRUMENT DIAGRAM
THERMAL STORAGE SUBSYSTEM (TSS)
STEAM & CONDENSATE

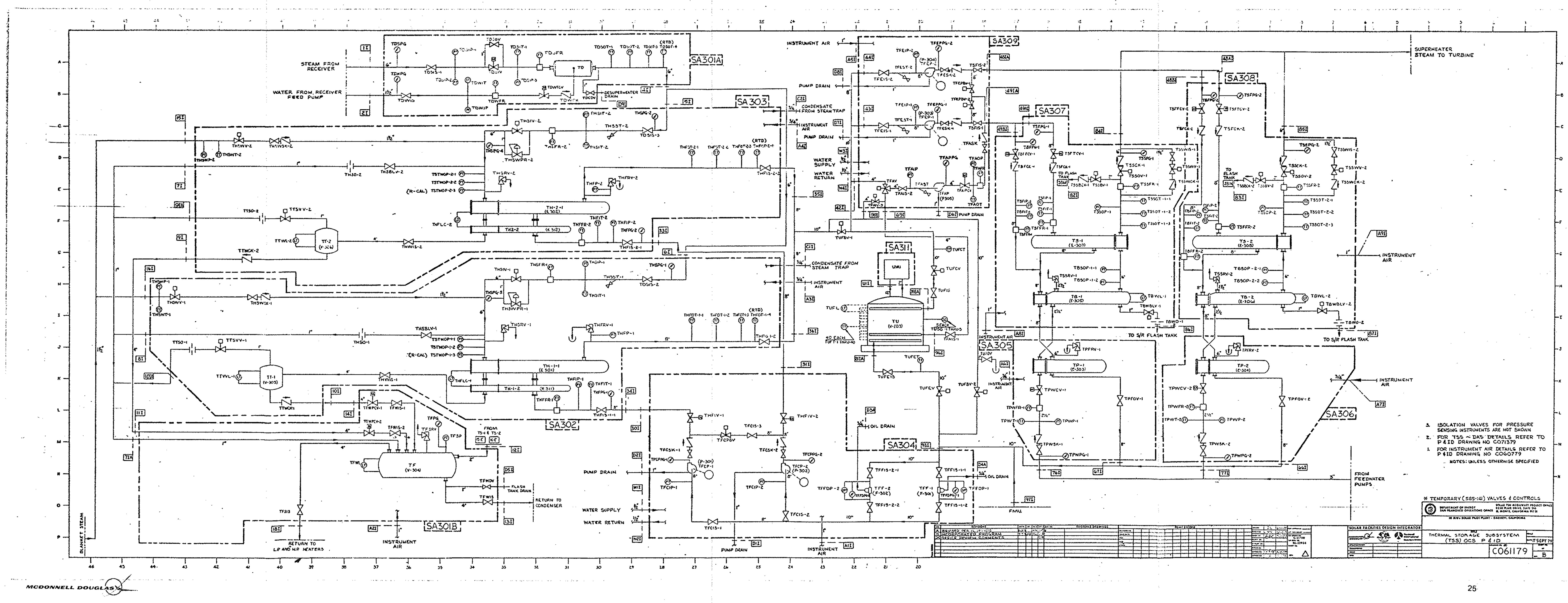
SCALE NONE
DATE 9/7/79

P & ID (P3-4)

DRAWING NO. 40P7005133143

SHEET NO. 1 OF 1
REV. ⚠3


STEAM GENERATION SUPERHEATER E-308
BOILER & SUPERHEATER SKID SA-308 (E-306, E-308)
STEAM GENERATION KETTLE BOILER E-306
PREHEATER SKID SA-306
STEAM GENERATION PREHEATER E-304
STEAM GENERATION SUPERHEATER E-307
BOILER & SUPERHEATER SKID SA-307 (E-305, E-306)
STEAM GENERATION KETTLE BOILER E-305
PREHEATER SKID SA-305
STEAM GENERATION PREHEATER E-303
P-303
P-304
P-305
EXTRACTION OIL PUMPS
AUXILIARY EXTRACTION OIL PUMP
EXTRACTION OIL PUMPS SKID SA-309 (P-303, P-305 & P-306)
THERMAL STORAGE CONDENSER E-302
THERMAL STORAGE HEATER ASSY SKID SA-302 (E-302, E-312)
THERMAL STORAGE SUBCOOLER E-312
THERMAL STORAGE CONDENSER E-301
THERMAL STORAGE HEATER ASSY SKID SA-303 (E-301, E-302)
THERMAL STORAGE SUBCOOLER E-311
U M U CP-301, V-E-309, E-310 REF.DWG.C070979
CHARGING MANIFOLD (RETURN)
THERMAL STORAGE TANK V-303
SEAL STEAM MANIFOLD (FEED)
EXTRACTION MANIFOLD (RETURN)
P-301
P-302
CHARGING OIL PUMPS
CHARGING OIL PUMPS SKID SA-304 (F-301, F-302, P-301, P-302)
F-302
F-301
THERMAL OIL FILTERS
P306
FLUID MAKE-UP PUMP
FLUID MAKE-UP TANK TK-301
TRUCK FILL CONNECTION
8"-TO-26-BBA
8"-TO-25-BBA
8"-TO-13-BBA
8"-TO-12-BBA
8"-TO-19-BBA
8"-TO-16-BBA
8"-TO-21-BBA
10"-TO-10-BBA
10"-TO-9-BBA
10"-TO-21-BBA
4"-TO-24-BBA
10"-TO-11-BBA
8"-TO-22-BBA
10"-TO-3-BBA
8"-TO-4-BBA
8"-TO-5-BBA
10"-TO-2-BBA
10"X8"
NOTES:
1. ALL EQUIPMENT AND PIPING SHOWN IN PHANTOM SHALL BE PROVIDED BY ROCKETDYNE. FOR DETAILS OF PIPING AND INSTRUMENTATION SEE ROCKETDYNE P&ID C061179.
2. ALL INSTRUMENTATION BY ROCKETDYNE.
HOLD
9-14-79 Δ REVISIONS. ADDED SKID NUMBERS; REVISED AREA ZN-G11
IGS NO. BF9161
DEPARTMENT OF ENERGY SAN FRANCISCO OPERATIONS OFFICE
SOLAR TEN MEGAWATT PROJECT OFFICE 9550 FLAIR DRIVE, SUITE 210 EL MONTE, CALIFORNIA 91731
10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA
SOLAR FACILITIES DESIGN INTEGRATOR
TITLE
PIPING & INSTRUMENT DIAGRAM THERMAL STORAGE SUBSYSTEM (TSS) THERMAL OIL
SCALE NONE
DATE 9/11/79
P&ID (P3-3)
DRAWING NO. 40P7005133142
SHEET NO. 1 OF 1
REV. A
REVISIONS
REFERENCE DRAWINGS
PRINT RECORD
DRAWN IGS 9/14/79
CHECKED
DESIGN ENG.
ELECT. ENG.
STRUCT. ENG.
PIPING ENG.
APPROVED
RELEASED
S-A CONTRACT NO. 955-2700
S-A DWG. NO. XL-22934
SHEET NO. P3-3
A


STEAM FROM RECEIVER
WATER FROM RECEIVER FEED PUMP
INSTRUMENT AIR
PUMP DRAIN
CONDENSATE FROM STEAM TRAP
WATER SUPPLY
WATER RETURN
SUPERHEATER STEAM TO TURBINE
SA301A
SA301B
SA302
SA303
SA304
SA305
SA306
SA307
SA308
SA309
SA311
TO S/H FLASH TANK
FROM FEEDWATER PUMPS
RETURN TO LP AND HP HEATERS
RETURN TO CONDENSER
BLANKET STEAM
3. ISOLATION VALVES FOR PRESSURE SENSING INSTRUMENTS ARE NOT SHOWN
2. FOR TSS ~ DAS DETAILS REFER TO P & ID DRAWING NO C071379
1. FOR INSTRUMENT AIR DETAILS REFER TO P & ID DRAWING NO C060779
NOTES: UNLESS OTHERWISE SPECIFIED
* TEMPORARY (585-141) VALVES & CONTROLS
SOLAR FACILITIES DESIGN INTEGRATOR
THERMAL STORAGE SUBSYSTEM (TSS) OCS P & ID
17 SEPT 79
C061179
B
MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Control Valves, TSSWV-1 & -2	1,486	160,000	0.009	4.0	0.036	0	B	0.036	Each Loop Provides 50% of Total Flow
Check Valves, TSSWCK-1 & -2	1,486	250,000	0.006	3.0	0.018	0	B	0.018	Each Loop Provides 50% of Total Flow
Check Valves, TSSCK-1 & -2	1,486	250,000	0.006	4.0	0.024	0	B	0.024	Each Loop Provides 50% of Total Flow
Control Valves, TSSBV-1 & -2	1,486	160,000	0.009	4.0	0.036	0	B	0.036	Each Loop Provides 50% of Total Flow
Check Valves, TSSBCK-1 & -2	1,486	250,000	0.006	3.0	0.018	0	B	0.018	Each Loop Provides 50% of Total Flow
Shutoff Valves, TSSWIS-1 & -2	1,486	250,000	0.006	3.0	0.018	0	B	0.018	Each Loop Provides 50% of Total Flow
Flow Orifices, TBWO-1 & 2	1,486	80,000	0.019	4.0	0.076	0	B	0.076	Each Loop Provides 50% of Total Flow
Relief Valves, TSSRV-1 & 2	1,486	100,000	0.015	4.0	0.060	0	B	0.060	Each Loop Provides 50% of Total Flow
Flow-Rate Transmitters, TSSFR-1 & -2	1,486	32,500	0.046	5.0	0.230	0	B	0.230	Each Loop Provides 50% of Total Flow
Control Valves, TPWCV-1 & -2	1,486	160,000	0.009	4.5	0.041	0	B	0.041	Each Loop Provides 50% of Total Flow
Relief Valves, TPFRV-1 & -2	1,486	100,000	0.015	4.5	0.068	0	B	0.068	Each Loop Provides 50% of Total Flow
Bypass Valves, TBWBLV-1 & -2	1,486	160,000	0.009	4.0	0.036	0	B	0.036	Each Loop Provides 50% of Total Flow
Stop-Check Valves, TPWSK-1 & -2	1,486	250,000	0.006	3.0	0.018	0	B	0.018	Each Loop Provides 50% of Total Flow
Flow-Rate Transmitters, TPWFR-1 & -2	1,486	32,500	0.045	4.0	0.180	0	B	0.180	Each Loop Provides 50% of Total Flow

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Thermal-Storage Boilers, TB-1 & -2	1,486	91,000	0.016	82	1.312	23	B	24.312	Each Loop Provides 50% of Total Flow
Thermal-Storage Preheaters, TP-1 & -2	1,486	91,000	0.016	82	1.312	23	B	24.312	Each Loop Provides 50% of Total Flow
Shutoff Valves, TPFOV-1 & 2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	Each Loop Provides 50% of Total Flow
Flow-Rate Transmitters, TSFFR-1 & -2	1,486	32,500	0.045	5.0	0.225	0	B	0.225	Each Loop Provides 50% of Total Flow
Thermal-Storage Superheaters, TS-1 & -2	1,486	91,000	0.016	82	1.312	23	B	24.312	Each Loop Provides 50% of Total Flow
Flow-Rate Transmitters, TBFFR-1 & -2	1,486	32,500	0.045	6.0	0.270	0	B	0.270	Each Loop Provides 50% of Total Flow
Control Valves, TSFTCV-1 & -2	1,486	160,000	0.009	6.5	0.059	0	B	0.059	Each Loop Provides 50% of Total Flow
Check Valves, TSFCK-1 & -2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	Each Loop Provides 50% of Total Flow
Shutoff Valves, TSFIS-1 & -2	1,486	250,000	0.006	4.0	0.024	0	B	0.024	Each Loop Provides 50% of Total Flow
Control Valves, TBFFCV-1 & -2	1,486	160,000	0.009	6.5	0.059	0	B	0.059	Each Loop Provides 50% of Total Flow
Check Valves, TBFCK-1 & -2	1,486	250,000	0.005	4.5	0.023	0	B	0.023	Each Loop Provides 50% of Total Flow
Extraction Pumps, TFEP-1 & -2	1,486	16,000	0.093	4.5	0.419	0	B	0.419	Each Loop Provides 50% of Total Flow

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Stop-Check Valves, TFESK-1 & -2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	Each Loop Provides 50% of Total Flow
Control Valves, TFEPBV-1 & 2	1,486	160,000	0.009	6.0	0.054	0	B	0.054	Each Loop Provides 50% of Total Flow
Shutoff Valves, TFEIS-1 & 2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	Each Loop Provides 50% of Total Flow
Y-Type Strainers TFSEST-1 & -2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	Each Loop Provides 50% of Total Flow
Control Valve, TFAIV-3	1,486	160,000	0.009	6.0	0.054	0	B	0.054	
3-Way Valve, TFAV	1,486	160,000	0.009	6.0	0.054	0	B	0.054	
Y-Type Strainer TFAST	1,486	250,000	0.006	4.5	0.027	0	B	0.027	
Auxiliary Pump, TFAP	1,486	16,000	0.093	4.5	0.419	0	B	0.419	
Control Valve, TFAPCV	1,486	160,000	0.009	6.5	0.054	0	B	0.054	
Flow-Rate Transmitter, TFAFR	1,486	32,500	0.046	6.0	0.275	0	B	0.275	
Shutoff Valve, TFAIS-2	1,486	250,000	0.006	4.5	0.027	0	B	0.027	
Extraction-Loop Controller	1,486	27,400	0.054	2.0	0.108	0	A	0.108	

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Control Valve, TUFBV-1	3,029	160,000	0.019	6.0	0.114	0	B	0.114	
Upper and Lower Tank Manifolds	4,212	1,000,000	0.004	1350.0	5.400	0	A	5.400	*
Seal-Steam Manifold	4,212	1,000,000	0.004	1350.0	5.400	0	B	5.400	*
Shutoff Valve, TFAIS-1	4,212	250,000	0.017	1350.0	22.950	0	B	22.950	*
Shutoff Valve, TUFDV	3,029	250,000	0.012	4.0	0.048	0	B	0.048	
Charging-Loop Controller	3,029	27,400	0.111	2.0	0.222	0	B	0.222	
Thermal-Storage-Unit Fluid Control Valve, TUFCV	3,029	160,000	0.019	6.0	0.114	0	A	0.114	
Shutoff Valve, TUFIS	4,212	250,000	0.017	1350.0	22.950	0	A	22.950	*
Flow-Rate Transmitters, THFFR-1 & -2	3,029	32,500	0.093	6.0	0.558	0	B	1.116	
Relief Valves, THFRV-1 & -2	3,029	100,000	0.030	4.5	0.136	0	B	0.272	
Shutoff Valves, THFIS-1-1 & -2-1	3,029	250,000	0.012	4.5	0.540	0	B	1.080	
Shutoff Valve, TFCIS-3	3,029	250,000	0.012	4.5	0.540	0	B	0.540	
Inlet Valves, THFIV-1 & -2	3,029	160,000	0.019	6.5	0.124	0	B	0.248	

*These components used during charging and extraction operations.

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Charging-Loop Thermal Transfer Media Pumps TFCP-1 & -2	3,029	16,000	0.189	4.5	0.851	0	B	0.851	Each Loop Provides 50% of Total Flow
Stop-Check Valves, TFCSK-1 & -2	3,029	250,000	0.012	4.5	0.540	0	B	0.540	Each Loop Provides 50% of Total Flow
Shutoff Valves, TFCIS-1 & 2	3,029	250,000	0.012	4.5	0.540	0	B	0.540	Each Loop Provides 50% of Total Flow
Relief Valve, TFSRV	3,029	100,000	0.030	4.0	0.120	0	B	0.120	
Shutoff Valve, TUFEIS	4,212	250,000	0.012	1350.0	22.950	0	A	22.950	*
Output Valve, TUFEV	4,212	160,000	0.019	6.0	0.114	0	A	0.114	*
Flow Orifices, THSO-1 & -2	3,029	80,000	0.038	4.0	0.152	0	B	0.304	
Shutoff Valves, TFWIS-1 & -2	3,029	250,000	0.012	4.0	0.048	0	B	0.096	
Thermal-Storage Flash Tank, TF	3,029	1,000,000	0.003	14.0	0.030	47	B	47.030	
Vent Valves, TTSVV-1 & -2	3,029	160,000	0.019	4.0	0.076	0	B	0.152	
Flow Orifices, TTSO-1 & -2	3,029	80,000	0.038	4.0	0.152	0	B	0.304	
Check Valves, TTWCK-1 & -2	3,029	250,000	0.012	4.0	0.048	0	B	0.096	
Flash-Tank Control Valves, TTWPCV-1 & -2	3,029	160,000	0.019	6.0	0.114	0	B	0.114	Each Loop Provides 50% of Total Flow

*This component used during charging and extraction operations.

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Bypass Valves, THSBLV-1 & -2	3,029	250,000	0.012	3.0	0.036	0	B	0.036	Each Loop Provides 50% of Total Flow
Steam Traps, TT-1 & -2	3,029	1,000,000	0.003	14.0	0.030	47	B	47.030	Each Loop Provides 50% of Total Flow
Relief Valves, THSRV-1 & -2	3,029	100,000	0.030	3.0	0.090	0	B	0.180	
Thermal-Storage Heaters, TH-1-1 & -2 and 2-1 & -2	3,029	31,000	0.098	34.2	3.35	47	B	53.700	Each Loop Provides 50% of Total Energy Requirements
Shutoff Valves, THWIS-1 & -2	3,029	250,000	0.012	4.0	0.048	0	B	0.048	Each Loop Provides 50% of Total Energy Requirements
Thermal-Storage-Heater Input Valves, THSIV-1 & -2	3,029	160,000	0.019	5.0	0.095	0	B	0.095	Each Loop Provides 50% of Total Energy Requirements
Pressure Regulators, THSWPR-1 & -2	3,029	160,000	0.019	4.0	0.076	0	B	0.076	Each Loop Provides 50% of Total Energy Requirements
Pressure Transmitters, TSTWOP-1-1, -2 & -3 and -2-1, -2 & -3	3,029	32,500	0.093	2.5	0.233	0	B	0.932	
Thermal-Storage Heater Shutoff Valves, TDSIS-2 & -3	3,029	250,000	0.012	4.0	0.048	0	B	0.048	Each Loop Provides 50% of Total Energy Requirements
Y-Type Strainers, THSST-1 & -2	3,029	250,000	0.012	4.0	0.048	0	B	0.048	Each Loop Provides 50% of Total Energy Requirements
Check Valve, TDWCK	3,029	250,000	0.012	3.0	0.036	0	B	0.036	

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.2 THERMAL STORAGE SUBSYSTEM - EXTRACTION LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Desuperheater-Team-Input Shutoff Valves, TDSIS-1	3,029	250,000	0.012	4.0	0.048	0	B	0.048	
Pressure Transmitter, TDSIP-1, -2 & -3	3,029	32,500	0.093	2.5	0.233	0	B	0.699	
Steam-Flow Control Valve, TDSIV	3,029	160,000	0.019	6.0	0.114	0	B	0.114	
Steam-Flow Input Valve, TDSBV	3,029	250,000	0.012	3.0	0.036	0	B	0.036	
Flow-Rate Transmitter, TDSFR	3,029	32,500	0.099	5.0	0.466	0	B	0.466	
Shutoff Flow-Control Valve, TDCDV	3,029	160,000	0.019	3.0	0.057	0	B	0.057	
Thermal-Storage Unit, TU	4,212	1,000,000	0.004	1350.0	5.400	47	A	52.40	*
Desuperheater, TD	3,029	31,500	0.096	14.0	0.960	47	B	47.960	
Desuperheater-Water-Input Shutoff Valve, TDWIS	3,029	250,000	0.012	3.0	0.036	0	B	0.036	

*This component used during charging and extraction operations.

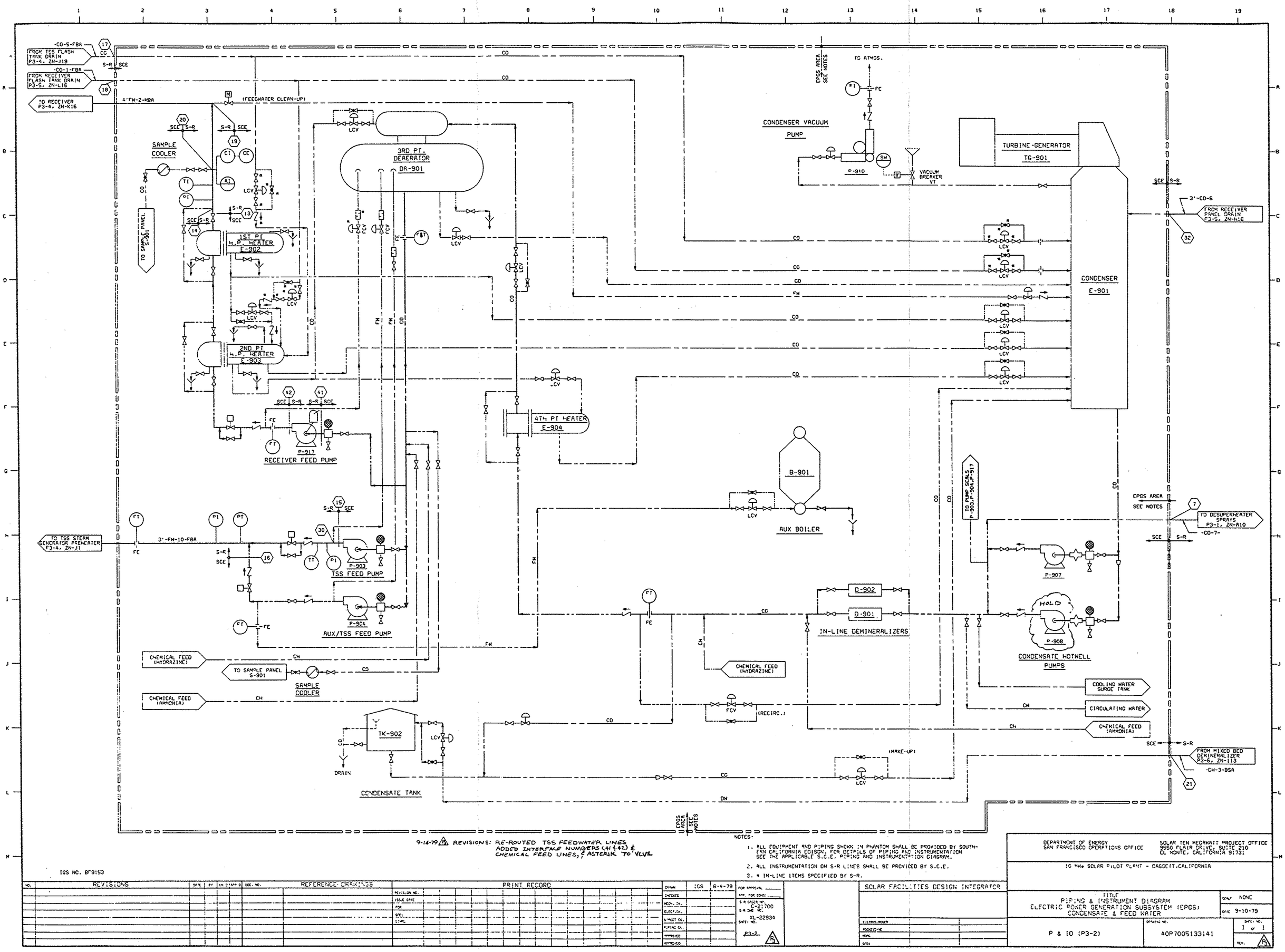
AVAILABILITY ANALYSIS

ITEM 5.3 MASTER CONTROL SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Hiway Traffic Director	7,884	10,000	0.788	1	0.788	0	B	0.788	



9-14-79 Ⓑ REVISIONS: RE-ROUTED TSS FEEDWATER LINES ADDED INTERFACE NUMBERS (41 & 42) & CHEMICAL FEED LINES, & ASTERIK TO VLVS.

NOTES:
1. ALL EQUIPMENT AND PIPING SHOWN IN PHANTOM SHALL BE PROVIDED BY SOUTHERN CALIFORNIA EDISON. FOR DETAILS OF PIPING AND INSTRUMENTATION SEE THE APPLICABLE S.C.E. PIPING AND INSTRUMENTATION DIAGRAM.
2. ALL INSTRUMENTATION ON S-R LINES SHALL BE PROVIDED BY S.C.E.
3. * IN-LINE ITEMS SPECIFIED BY S-R.

IGS NO. BF9153

NO.	REVISIONS	DATE	BY	CK'D	APP'D	DOC. NO.	REFERENCE DRAWINGS

PRINT RECORD

REVISION NO.	
ISSUE DATE	
FOR	
SPEC.	
COMP.	

DESIGN	IGS	6-4-79
CHECKED		
MECH. ENG.		
ELECT. ENG.		
I/NST. ENG.		
PIPING ENG.		
APPROVED		
APPROVED		

FOR APPROVAL
APP. FOR CONST.
S-R DRAWING NO. C-21700
S-R DWG NO. XL-22934
SHEET NO. P3-2
Ⓑ

SOLAR FACILITIES DESIGN INTEGRATOR

DRAWING NUMBER
PROJECT NO.
SPEC.

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

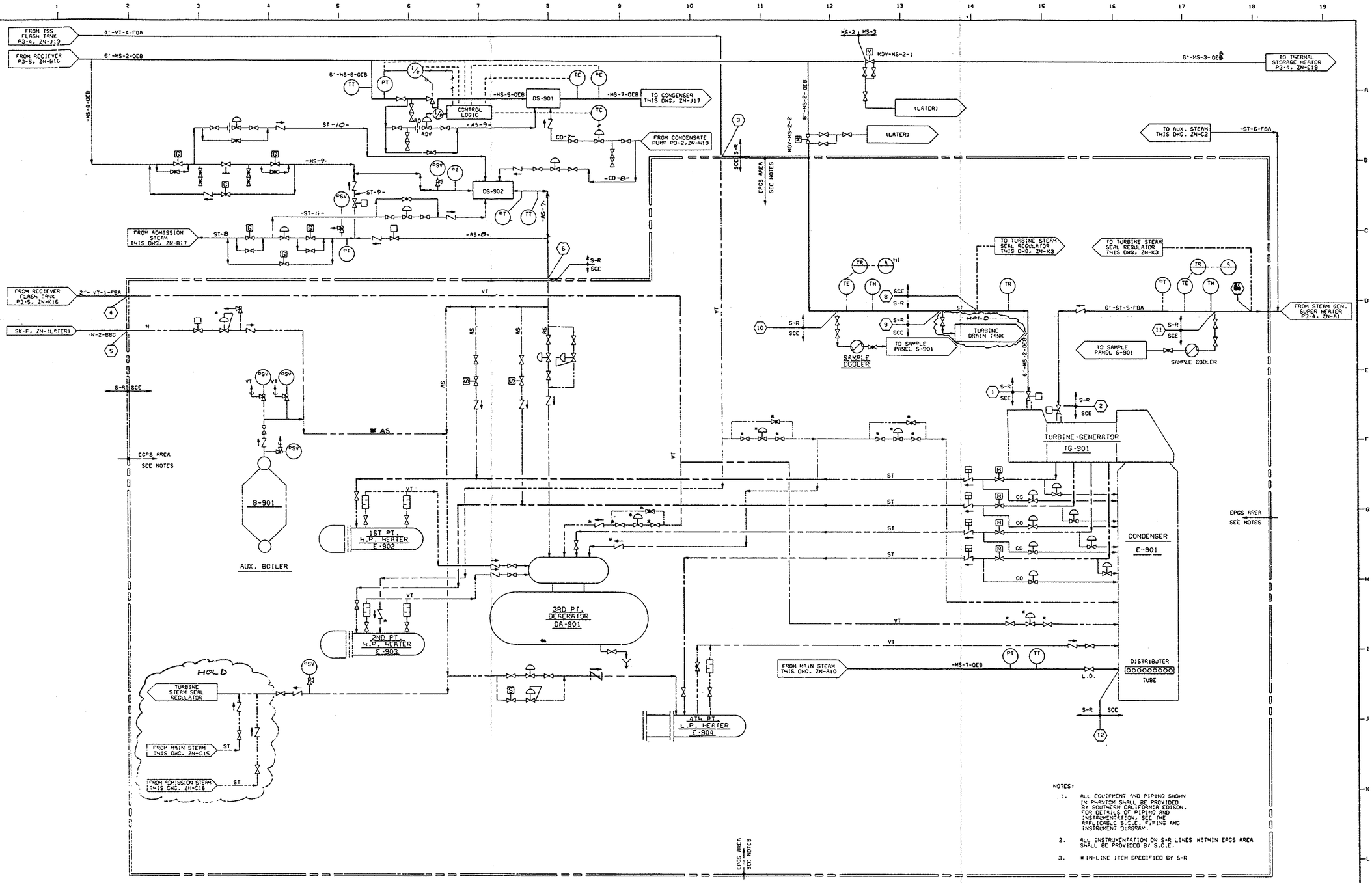
TITLE
PIPING & INSTRUMENT DIAGRAM
ELECTRIC POWER GENERATION SUBSYSTEM (EPGS)
CONDENSATE & FEED WATER

SCALE NONE
DATE 9-10-79

P & ID (P3-2)

DRAWING NO. 40P7005133141

SHEET NO. 1 OF 1
REV. Ⓑ



9-14-79 Δ2 REVISIONS: REVISED AUX. STEAM SYS. ADDED LINE NUMBERS TO AUX STEAM SYS & ASTERIKS TO VLVS.

IGS NO. BF9158

REVISIONS		REFERENCE DRAWINGS	PRINT RECORD		
				DRAWN IGS 12/4/78	FOR APPROVAL
				CHECKED	APP. FOR CONST.
				MECH. ENG.	S-R SPEC. NO. C-21700
				ELECT. ENG.	S-R DWG. NO. XL-22934
				STRUCTURAL	SHEET NO. P3-1 Δ3
				PIPING ENG.	
				APPROVED	
				APPROVED	

SOLAR FACILITIES DESIGN INTEGRATOR

SYSTEMS WORKS / FIELD SYSTEMS / M.E.R.T. / S.C.E.

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

TITLE
PIPING AND INSTRUMENT DIAGRAM
ELECTRICAL POWER GENERATION SUBSYSTEM (EPGS)
STEAM

SCALE NONE
DATE 10-11-79

P & ID (P3-1)

DRAWING NO. 4CP7005133140

SHEET NO. OF

REV. Δ2

5.4 ELECTRICAL POWER GENERATION SUBSYSTEM
ITEM - CONDENSATE AND FEEDWATER LOOP

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG
DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Turbine Generator, TG-901	4,212	5,500	0.766	40.0	30.640	104	TBD	134.640	
Condenser, E-901	4,212	91,000	0.046	10.0	0.460	104		104.460	
Condenser Vacuum Pump, P-910	4,212	16,000	0.263	6.0	1.578	0		1.578	
Shutoff Valve (Condenser Vacuum)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Shutoff Valves (Condenser Vacuum Pump), 2 Each	4,212	250,000	0.017	3.0	0.051	0		0.102	
Control Valve (Condenser Vacuum Pump)	4,212	160,000	0.026	3.5	0.091	0		0.091	
Check Valve (Condenser Vacuum Pump)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Vacuum-Breaker Control Valve	4,212	160,000	0.026	3.5	0.091	0		0.091	
Shutoff Valves, 4 Each (Condensate Hotwell Pumps)	4,212	250,000	0.017	4.0	0.068	0		0.272	
Cleanout Strainers, 2 Each	4,212	330,000	0.013	3.0	0.039	0		0.039	Redundant Condensate Paths
Condensate Hotwell Pumps, P907, P908	4,212	16,000	0.263	10.0	2.630	0		2.630	Redundant Condensate Paths
Check Valves, 2 Each	4,212	250,000	0.017	4.0	0.068	0		0.068	Redundant Condensate Paths
Demineralizers, D 901 and D902	4,212	100,000	0.042	10.0	0.420	52		52.420	Redundant
Shutoff Valves, (Demineralizers) 4 Each	4,212	250,000	0.017	4.0	0.068	0	TBD	0.136	Redundant

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

ITEM 5.4 ELECTRICAL POWER GENERATION SUBSYSTEM - CONDENSATE AND FEEDWATER LOOP

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Check Valve	4,212	250,000	0.017	4.0	0.068	0	TBD	0.068	
Low-Pressure Heater, E-904	4,212	91,000	0.046	10.0	0.460	104		104.460	
Shutoff Valves, 2 Each (LP Heater)	4,212	250,000	0.017	6.0	0.102	0		0.204	
Bypass Valve (LP Heater)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Level Control Valve, (LP Heater)	4,212	160,000	0.026	5.0	0.130	0		0.130	
Shutoff Valves, 2 Each (LCV LP Heater)	4,212	250,000	0.017	4.0	0.068	0		0.136	
Drain Valve (Deaerator)	4,212	250,000	0.017	6.0	0.102	0		0.102	
Condensate-Level Control Valve (Deaerator)	4,212	160,000	0.026	5.0	0.130	0		0.130	
Shutoff Valve (Deaerator Condensate)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Deaerator, DA 901	4,212	100,000	0.042	10 0	0.420	52		52.420	
Flow Control Valve (Receiver Feed Pump)	4,212	160,000	0.026	5.0	0.130	0		0.130	
Restrictor	4,212	80,000	0.053	4.0	0.530	0		0.530	
Cleanout Strainer	4,212	330,000	0.013	3.0	0.039	0		0.039	
Receiver Feed Pump, P917	4,212	16,000	0.263	10.0	2.630	0		2.630	
Check Valve	4,212	250,000	0.017	4.0	0.068	0		0.068	
Control Valve	4,212	160,000	0.026	5.0	0.130	0	TBD	0.130	

MCDONNELL DOUGLAS

ITEM 5.4 ELECTRICAL POWER GENERATION SUBSYSTEM - CONDENSATE AND FEEDWATER LOOP

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Bypass Valve	4,212	250,000	0.017	4.0	0.068	0	TBD	0.068	
High-Pressure Heaters, E902 and E903	4,212	91,000	0.046	10.0	0.460	104		104.920	
Drain Valves, 6 Each (HP Heaters)	4,212	250,000	0.017	6.0	0.102	0		0.612	
Bypass Valves, 2 Each (HP Heaters)	4,212	250,000	0.017	4.0	0.068	0		0.136	
Shutoff Valves, 2 Each (HP Heater)	4,212	250,000	0.017	6.0	0.102	0		0.204	
Check Valves, 2 Each	4,212	250,000	0.017	4.0	0.068	0		0.136	
Level Control Valve 14 Each	4,212	160,000	0.026	5.0	0.130	0		1.820	
LCV Bypass Valve 14 Each	4,212	250,000	0.017	4.0	0.068	0		0.952	
Shutoff Valves (LCV), 28 Each	4,212	250,000	0.017	4.0	0.068	0		1.904	
Feedwater Clean-up Control Valve	4,212	160,000	0.026	5.0	0.130	0		0.130	
FW Shutoff Valve (Condenser)	4,212	250,000	0.017	4.0	0.068	0		0.068	
FW Control Valve (Condenser)	4,212	160,000	0.026	5.0	0.130	0		0.130	
FW Check Valve (Condenser)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Condensate Filters, 2 Each	4,212	330,000	0.013	4.0	0.052	0		0.104	
TSS Feed Pumps, P903 and P904	1,486	16,000	0.093	10.0	0.930	0	TBD	0.930	Redundant TSS Feed Paths

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

PREPARED BY HAROLD BURG

ITEM 5.4 ELECTRICAL POWER GENERATION SUBSYSTEM - CONDENSATE AND FEEDWATER LOOP

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Shutoff Valves, 2 Each (TSS Feed Pumps)	1,486	250,000	0.006	6.0	0.036	0	TBD	0.036	Redundant TSS Feed Paths
Cleanout Strainers, 2 Each	1,486	330,000	0.005	3.0	0.015	0		0.015	Redundant TSS Feed Paths
Check Valves, 2 Each	1,486	250,000	0.006	4.0	0.024	0		0.024	Redundant TSS Feed Paths
Control Valves, 2 Each (TSS Feed Pump)	1,486	160,000	0.009	5.0	0.045	0		0.045	Redundant TSS Feed Paths
Bypass Valves, 2 Each	1,486	250,000	0.006	4.0	0.024	0		0.024	Redundant TSS Feed Paths
Flow Control Valves, 2 Each (FW From TSS Feed Pumps)	1,486	160,000	0.009	5.0	0.045	0		0.090	
Restrictors, 2 Each	1,486	80,000	0.019	4.0	0.076	0		0.152	
Auxiliary Boiler, B901	1,486	91,000	0.016	10.0	0.160	0		0.160	
Drain Valve (Auxiliary Boiler)	1,486	250,000	0.006	6.0	0.036	0		0.036	
Chemical-Feed Shutoff Valves, 3 Each	4,212	250,000	0.017	6.0	0.102	0		0.306	
Circulating Water Shutoff Valve	4,212	250,000	0.017	3.0	0.051	0		0.051	
Surge-Tank Cooling Water Shutoff Valve	4,212	250,000	0.017	3.0	0.051	0	TBD	0.051	
Condensate Tank, TK 902, Drain Valve and Shutoff Valve									Included in Plant Support Subsystem Analysis

AVAILABILITY ANALYSIS

5.4 ELECTRICAL POWER GENERATION SUBSYSTEM
ITEM - STEAM LOOP

PREPARED BY HAROLD BURG
DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Control Valve (Receiver Steam)	4,212	160,000	0.026	6.0	0.156	0	TBD	0.156	
Control Valves, 2 Each (Turbine/ HP Heaters)	4,212	160,000	0.026	5.0	0.130	0		0.260	
Shutoff Valves, 2 Each (HP Heaters)	4,212	250,000	0.017	4.0	0.068	0		0.136	
Control Valve (Turbine/Deaerator Steam)	4,212	160,000	0.026	5.0	0.156	0		0.156	
Shutoff Valve (Deaerator)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Control Valve (Turbine LP Steam)	4,212	160,000	0.026	5.0	0.130	0		0.130	
Shutoff Valve (LP Heater)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Check Valves, 4 Each (Turbine Exhaust Steam)	4,212	250,000	0.017	4.0	0.068	0		0.272	
Control Valves, 8 Each (Turbine Steam Condensate)	4,212	160,000	0.026	5.0	0.156	0		1.248	
Control Valve (Vent Line From Receiver Flash Tank)	4,212	160,000	0.026	4.0	0.104	0		0.104	
Shutoff Valves, 2 Each	4,212	250,000	0.017	3.0	0.051	0		0.102	
Shutoff Valves, 2 Each (LP Heater/ Condenser Vent Line)	4,212	250,000	0.017	3.0	0.051	0		0.102	
Restrictor	4,212	80,000	0.053	3.0	0.159	0	TBD	0.159	

AVAILABILITY ANALYSIS

5.4 ELECTRICAL POWER GENERATION SUBSYSTEM
ITEM - STEAM LOOP

PREPARED BY HAROLD BURG
DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Control Valve (LP Heater)	4,212	250,000	0.017	4.0	0.068	0	TBD	0.068	
Lo Control Valve, (Main Steam/ Condenser)	4,212	250,000	0.017	4.0	0.068	0		0.068	
Control Valves, 3 Each (Vent Lines)	4,212	160,000	0.026	4.0	0.104	0		0.312	
Shutoff Valves, 6 Each (Vent Control Valves)	4,212	250,000	0.017	3.0	0.051	0		0.306	
Bypass Valves, 3 Each (Vent Control Valves)	4,212	250,000	0.017	3.0	0.051	0		0.153	
Check Valves, 4 Each (Deaerator Vent Lines)	4,212	250,000	0.017	3.0	0.051	0		0.204	
Shutoff Valves, 4 Each (HP Heaters Vent Lines)	4,212	250,000	0.017	3.0	0.051	0		0.204	
Restrictors, 4 Each (HP Heaters)	4,212	80,000	0.053	3.0	0.159	0		0.636	
Check Valve (HP Heater)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Pressure Regulator Valve (Auxiliary Steam)	4,212	160,000	0.026	4.0	0.104	0		0.104	
Bypass Valve (Aux Steam)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Control Valve (Aux Steam)	4,212	160,000	0.026	4.0	0.104	0		0.104	
Shutoff Valves, 2 Each (Aux Steam Control Valve)	4,212	250,000	0.017	3.0	0.051	0	TBD	0.102	

AVAILABILITY ANALYSIS

ITEM 5.4 ELECTRICAL POWER GENERATION SUBSYSTEM - STEAM LOOP

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Check Valves, 2 Each (Aux Steam)	4,212	250,000	0.017	3.0	0.051	0	TBD	0.102	
Safety Valve (Aux Steam)	4,212	100,000	0.042	3.0	0.126	0		0.126	
Shutoff Valve (Turbine Steam Seal Regulator)	4,412	250,000	0.017	3.0	0.051	0		0.051	
Safety Valves, 3 Each (Aux Boiler)	4,212	100,000	0.042	3.0	0.126	0		0.378	
Check Valve (Auxiliary Boiler)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Shutoff Valve (Auxiliary Boiler)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Control Valves 2 Each (Auxiliary Steam to HP Heaters)	4,212	160,000	0.026	4.0	0.104	0		0.208	
Shutoff Valves, 2 Each (Auxiliary Steam to HP Heaters)	4,212	250,000	0.017	3.0	0.054	0		0.108	
Pressure Regulator Valve (Auxiliary Steam to Deaerator Bypass)	4,212	160,000	0.026	4.0	0.104	0		0.104	
Bypass Valve (Auxiliary Steam to Deaerator)	4,212	250,000	0.017	3.0	0.051	0		0.051	
Control Valve (Auxiliary Steam to Deaerator)	4,212	160,000	0.026	4.0	0.104	0		0.104	
Shutoff Valves, 2 Each (Auxiliary Steam Control Valve)	4,212	250,000	0.017	3.0	0.051	0	TBD	0.102	

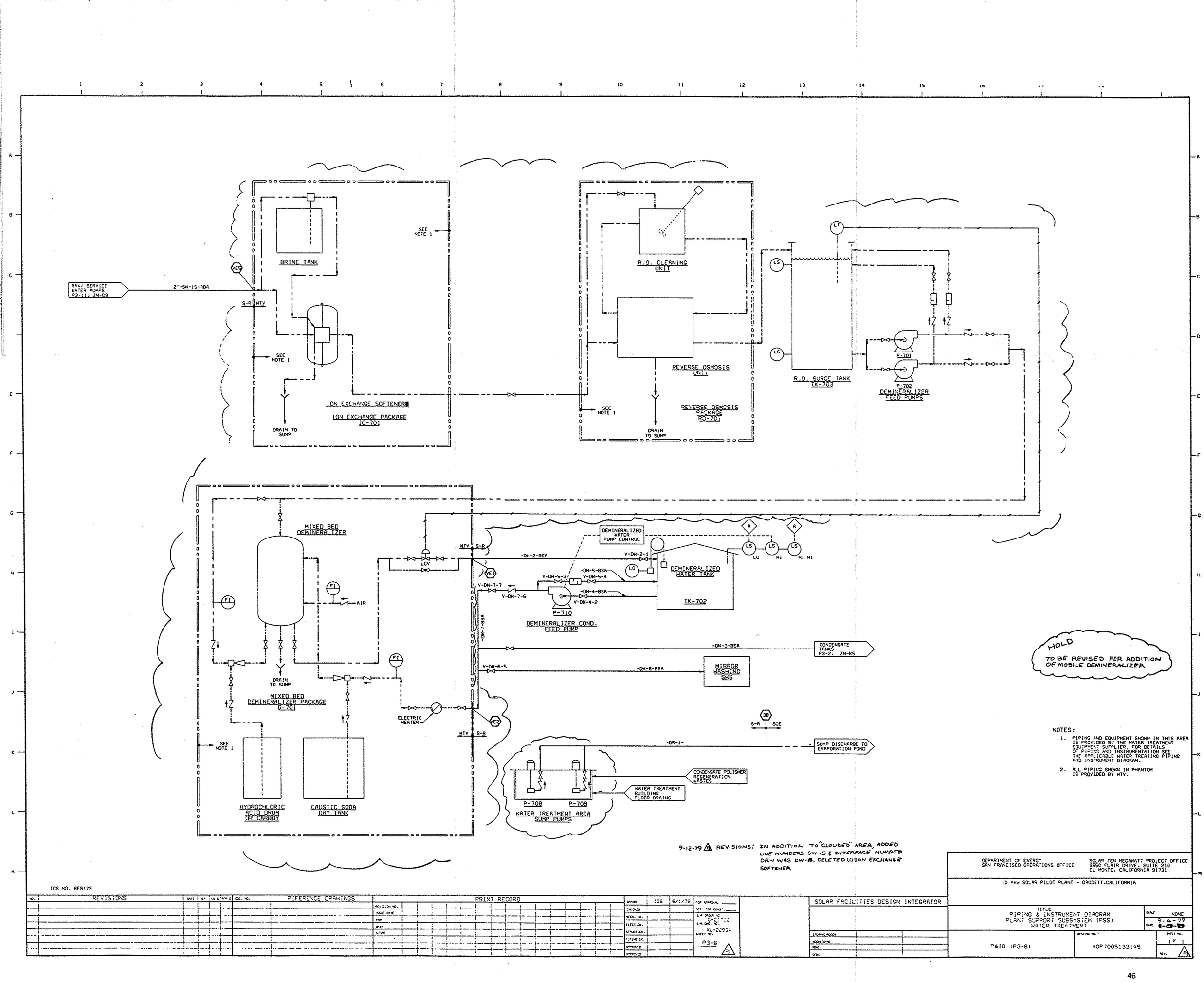
AVAILABILITY ANALYSIS

ITEM 5.4 ELECTRICAL POWER GENERATION SUBSYSTEM - STEAM LOOP

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Control Valve (Nitrogen Line)	4,212	160,000	0.026	3.0	0.078	0	TBD	0.078	
Pressure Regulator Valve (Nitrogen)	4,212	160,000	0.026	3.0	0.078	0		0.078	
Check Valve (Nitrogen)	4,212	250,000	0.017	2.5	0.043	0		0.043	
Check Valve (TSS Steam Gen. Super Heater)	1,486	250,000	0.006	4.0	0.024	0		0.024	
Control Valve (TSS Steam)	1,486	250,000	0.006	5.0	0.030	0		0.030	
Desuperheater, DS 901 and DS 902	4,212	31,500	0.134	10.0	1.340	52		54.680	
Control Valves, 14 Each	4,212	160,000	0.026	4.0	0.104	0		0.104	
Bypass Valves, 7 Each	4,212	250,000	0.017	3.0	0.051	0		0.357	
Check Valves, 7 Each	4,212	250,000	0.017	3.0	0.051	0		0.357	
Drain Valves, 10 Each	4,212	250,000	0.017	3.0	0.051	0		0.510	
Shutoff Valves, 12 Each	4,212	250,000	0.017	3.0	0.051	0		0.612	
Control Logic	4,212	27,400	0.154	4.0	0.616	0		0.616	
Pressure Safety Valves, 3 Each	4,212	100,000	0.042	3.0	0.126	0	TBD	0.378	



NOTES:

1. PIPING AND EQUIPMENT SHOWN IN THIS AREA IS PROVIDED BY THE WATER TREATMENT EQUIPMENT SUPPLIER. FOR DETAILS OF PIPING AND INSTRUMENTATION SEE THE APPLICABLE WATER TREATING PIPING AND INSTRUMENT DIAGRAM.
2. ALL PIPING SHOWN IN PHANTOM IS PROVIDED BY WTV.

9-12-79 ⚠ REVISIONS: IN ADDITION TO "CLOUDED" AREA, ADDED LINE NUMBERS SW-15 & INTERFACE NUMBER DR-1 WAS DW-8. DELETED (I)ION EXCHANGE SOFTENER

IGS NO. 8F9179

NO.	REVISIONS	DATE	BY	CK'D BY	DOC. NO.	REFERENCE DRAWINGS

PRINT RECORD

DRAWN	IGS	6/1/79	FOR APPROVAL
CHECKED			FOR CONST.
MECH. EN.			S.R. ORDER NO. C-7111
ELECT. EN.			S.R. DWG. NO. XL-02934
STRUCT. EN.			SHEET NO. P3-6
PIPING EN.			
APPROVED			
APPROVED			

SOLAR FACILITIES DESIGN INTEGRATOR

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

TITLE
PIPING & INSTRUMENT DIAGRAM
PLANT SUPPORT SUBSYSTEM (PSS)
WATER TREATMENT

SCALE NONE
DATE 9-6-79
8-23-80

P&ID (P3-6)

DRAWING NO. 40P7005133145

SHEET NO. 1 OF 1

REV. A

AVAILABILITY ANALYSIS

ITEM 5.5 PLANT SUPPORT SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Raw-Water Storage Tank, TK-701	7,884	1,000,000	0.008	5.0	0.040	0	B	0.040	
Demineralized-Water Tank, TK-702	7,884	1,000,000	0.008	5.0	0.040	0	B	0.040	
Shutoff Valve (Compressor Output to Air-Tank Input)	7,884	250,000	0.032	3.0	0.096	0	A	0.096	
Service and Instrument Air Receiver, V-701	7,884	1,000,000	0.008	8.0	0.064	0	A	0.064	
Relief Valve, 522	7,884	100,000	0.079	3.0	0.237	0	A	0.237	
Shutoff Valves, 2 Each (Air Receiver Drain Trap)	7,884	250,000	0.032	3.0	0.096	0	B	0.192	
Trap, T-3	7,884	1,000,000	0.008	3.0	0.024	0	A	0.024	
Bypass Valve, (Moisture Drain)	7,884	250,000	0.032	3.0	0.096	0	A	0.096	
Shutoff Valve (Air-Tank Output)	7,884	250,000	0.032	3.0	0.096		A	0.096	
Shutoff Valves, 4 Each, (System Prefilters)	7,884	250,000	0.032	2.5	0.080	0	B	0.320	
Shutoff Valves, 4 Each, (System Refrigerated Air Dryers)	7,884	250,000	0.032	2.5	0.080	0	B	0.320	
Shutoff Valve, (Plant Subsystems and Instrument Air)	7,884	250,000	0.032	2.5	0.080	0	A	0.080	

AVAILABILITY ANALYSIS

ITEM 5.5 PLANT SUPPORT SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Shutoff Valve, (Instrument Air System)	7,884	250,000	0.032	2.5	0.080	0	A	0.080	
Shutoff Valves, 4 Each (Instrument Air Hydrant Line)	7,884	250,000	0.032	2.5	0.080	0	A	0.320	
Butterfly Valve, (Surge Tank Input)	7,884	250,000	0.032	3.0	0.096	0	A	0.096	
Cooling-Water Surge Tank, TK-901	7,884	1,000,000	0.008	8.0	0.064	0	A	0.064	
Drain Valve, Cooling Water Surge Tank	7,884	250,000	0.032	8.0	0.256	0	B	0.256	
Butterfly Valve, (Cooling Water Surge Tank Output)	7,884	250,000	0.032	8.0	0.256	0	A	0.256	
Pressure Sensor, 313	7,884	32,500	0.243	2.5	0.608	0	A	0.608	
Butterfly Valve, (Cooling Water Heat Exchanger Input)	7,884	250,000	0.032	4.0	0.128	0	A	0.128	
Cooling-Water Heat Exchanger, E-905	7,884	31,000	0.254	8.0	2.032	101	A	103.032	
Shutoff Valves, 2 Each (Cooling Water Heat Exchanger Drain/ Vent)	7,884	250,000	0.032	4.0	0.128	0	B	0.256	
Butterfly Valve, (Cooling Water Heat Exchanger Output)	7,884	250,000	0.032	4.0	0.128	0	A	0.128	

AVAILABILITY ANALYSIS

ITEM 5.5 PLANT SUPPORT SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Chemical Feeder, CF-901	7,884	500,000	0.016	4.0	0.064	0	B	0.064	
Shutoff Valves, 10 Each (Air Cool Lines)	7,884	250,000	0.032	2.5	0.080	0	A	0.800	
Air Coolers, 10 Each	7,884	31,000	0.254	4.5	1.143	0	A	11.430	
Shutoff Valves, 10 Each (Air Cooler Lines)	7,884	250,000	0.032	2.5	0.080	0	A	0.800	
Auxiliary Transformer (13.8 KV to 4.16 KV)	7,884	500,000	0.016	8.0	0.128	0	A	0.128	
Solar One Generator Output Circuit Breakers	7,884	1,000,000/ 1,000 Cycles	0.008	6.0	0.048	0	A	0.048	
Auxiliary Transformer Output Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	6.0	0.048	0	A	0.048	
Station Service Transformer Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Station Service Transformer	7,884	500,000	0.016	4.0	0.064	0	A	0.064	
Station Service Transformer Output Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Receiver-Feed Pump Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	B	0.024	
Cooling-Tower Transformer Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	

MCDONNELL DOUGLAS

AVAILABILITY ANALYSIS

ITEM 5.5 PLANT SUPPORT SUBSYSTEM

PREPARED BY HAROLD BURG

DATE DECEMBER 1979

COMPONENT	OPERATION (HR/YR)	MEAN TIME BETWEEN FAILURE MTBF (HR)	FAILURE/YR	MEAN TIME TO RESTORE MTTR (HR)	COMPONENT FORCED OUTAGE (HR/YR)	COMPONENT PLANNED OUTAGE (HR/YR)	CRITICALITY CATEGORY	SYSTEM UNAVAIL (HR/YR)	COMMENTS
Cooling-Tower Transformer	7,884	500,000	0.016	4.0	0.064	0	A	0.064	
Cooling-Tower Transformer Output Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-L Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-A Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Center-B Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Receiver PPA Input Circuit Breaker	7,884	1,000,000/ 1,000 Cycles	0.008	3.0	0.024	0	A	0.024	
Motor-Control-Centers for Power Panels	7,884	250,000	0.032	3.0	0.096	0	A	0.024	

FILE STMPC-174

5301 Bolsa Avenue, Huntington Beach, CA 92647 (714) 896-3311

A3-202-EP-RGR-496
9 May 1980

Mr. R. N. Schweinberg, Director
Solar Ten Megawatt Project Office
Department of Energy
9550 Flair Drive, Suite 210
El Monte, California 91731

Subject: CONTRACT NO. DE-AC03-79SF10499
SOLAR FACILITIES DESIGN INTEGRATION
SUBMITTAL OF PILOT PLANT AVAILABILITY REPORT

Dear Dick:

This letter transmits copies of the Pilot Plant Availability Report (SAN/0499-48, dated May 1980) prepared as an output from the WBS 2.1.3.1 task of the SFDI Phase I contract effort, but which is not one of the items on the Reports and Deliverables List. The groundrules, definitions, and methodology used for the availability analyses are contained in the document, as well as the assigned goals and availability predictions for the following:

- Pilot Plant
- Collector Subsystem
- Receiver Subsystem
- Thermal Storage Subsystem
- Master Control Subsystem
- Plant Support Subsystem

Please feel free to call Mr. R. G. Riedesel at (714) 896-3357 if you have questions about this report.

Very truly yours,

R. W. Hallet, Jr.
Program Manager
Solar Facilities Design Integration

RGR:bj

Enclosure

Cy: R. N. Schweinberg, DOE/STMPO (10)
C. P. Winarski, SCE (3)
W. R. Lang, Stearns-Roger (3)
J. M. Friefeld, Rocketdyne (4)
L. L. Vant-Hull, EFT (1)
P. R. Brown, MMC (3)

(w/o enclosure)
J. M. Slaminski, DOE/STMPO
H. D. Eden, Aerospace/STMPO
R. O. Rogers, Aerospace/STMPO
K. L. Adler, ETEC/STMPO
R. W. Wiese, ETEC/STMPO
W. C. Morehouse, Sandia/STMPO
D. N. Tanner, Sandia-Livermore

MCDONNELL DOUGLAS CORPORATION

If you should have any questions or concerns please do not hesitate to contact me by telephone at, (619) 254-2672.

Sincerely,

S.D. Elliott, Jr., Director
DOE Solar One Project Office

SDE/aks
Project File: CCC002.RNO(SDO)

Encl: Nine Document Covers W/forms 70 and RA-426

cc: Roger Gaither, SAN/OPC
W.D. Matheny, DOE/TIC

bcc: Mike Lopez, DOE/SAN (FGS)
Mary Soderstrum, B&McD

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-AC03-79SF10499
Subcontract No.	(N/A)
Report No. (STMPO 174)	DOE/SF/10499-T89
Date of Report	May 1980
Name & Phone No. of DOE Technical Representative	S.D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM:
McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

1. Document Title: Pilot Plant Availability

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): _____

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine) would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

☐ 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages _____ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. _____.
ii. A disclosure of the invention was submitted to DOE on _____ (date)
iii. A disclosure of the invention will be submitted shortly _____ (approximate date)
iv. A waiver of DOE's patent rights to the contractor:
☐ has been granted, ☐ has been applied for; or ☐ will be applied for _____ (date)

☐ 5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: Provide copy of clearance to: Solar One Project Office
P.O. Box 366, Daggett, CA 92327

Reviewing/Submitting Official: Name (Print/Type) _____
Title _____
Signature _____ Date _____

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

☐ No patent objection to above-identified release.

☐ Please defer release until advised by this office.

Signed _____ Date Mailed _____

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10499-T89 (STMPO 174)	DE-AC03-79SF10499	UC-62, 62c, 62d

4. Title

Pilot Plant Availability

5. Type of Document ("x" one)

- [X] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference _____

_____ Date of conference _____

Exact location of conference _____ Sponsoring organization _____

- [ ] c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.)

6. Copies Transmitted ("x" one or more)

- [ ] a. Copies being transmitted for standard distribution by DOE–TIC.
- [ ] b. Copies being transmitted for special distribution per attached complete address list.
- [X] c. Two completely legible, reproducible copies being transmitted to DOE–TIC. (Classified documents, see instructions)
- [ ] d. Twenty-seven copies being transmitted to DOE–TIC for TIC processing and NTIS sales.

7. Recommended Distribution ("x" one)

- [ ] a. Normal handling (after patent clearance): no restraints on distribution except as may be required by the security classification.

Make available only [ ] b. To U.S. Government agencies and their contractors. [ ] c. within DOE and to DOE contractors. [ ] d. within DOE. [ ] e. to those listed in item 13 below.

- [X] f. Other (Specify) Archive/Issue on request

8. Recommended Announcement ("x" one)

- [X] a. Normal procedure may be followed. [ ] b. Recommend the following announcement limitations:

9. Reason for Restrictions Recommended in 7 or 8 above.

[ ] a. Preliminary information. [ ] b. Prepared primarily for internal use. [ ] c. Other (Explain)

10. Patent, Copyright and Proprietary Information

Does this information product disclose any new equipment, process or material? [ ] No [ ] Yes If so, identify page nos. _____

Has an invention disclosure been submitted to DOE covering any aspect of this information product? [ ] No [ ] Yes

If so, identify the DOE (or other) disclosure number and to whom the disclosure was submitted.

Are there any patent-related objections to the release of this information product? [ ] No [ ] Yes If so, state these objections.

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("x" one [ ] a. DOE patent clearance has been granted by responsible DOE patent group.

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Document [ ] a. does [ ] b. does not contain national security information

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14. Submitted by (Name and Position) (Please print or type)

S.D. Elliott, Jr., Director, DOE Solar One Project Office

Organization

P.O. Box 366 Daggett, CA. 92327 (619) 254-2672

Signature	Date

STMPO-174

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply To: DOE Solar One Project Office
P.O. Box 366
Daggett, CA 92327

Mr. Robert L. Gervais
Solar One Project Office
McDonnell Douglas Astronautics Corp.
P.O. Box 366
Daggett, CA 92327

AUG 13 1984

Subject: Clearance of Control Contract DE-AC03-79SF10499
Solar One Reports for DOE/TIC Inclusion.

Dear Bob:

Enclosed are copies of covers and title pages of nine reports prepared by McDonnell Douglas Astronautics Corporation for the Solar One Project under the above referenced contract. In preparation for delivery of these documents to DOE/TIC, I have prepared a SAN form 70 "Request for Patent Clearance" and a DOE form RA-426 "Recommendations for Announcement and Distribution of Documents" for each document.

Please have the appropriate MDAC personnel complete and sign these forms. As agreed, SAN form 70 should be forwarded to SAN/OPC by your office with copies of the completed SAN form 70 and the transmittal letter being sent to me. The completed DOE form RA-426 should be sent directly back to me.

The documents covered by this letter are:

Primary Document No.	Secondary No.	Brief Title
DOE/SF/10499-T67	STMPO 133	Construction Piping and Inst
DOE/SF/10499-T68	STMPO 111	Initial Project Design Review
DOE/SF/10499-T69	STMPO 112	Work Plan Revised
DOE/SF/10499-T70	STMPO 114	Overall Plant Design Description
DOE/SF/10499-T72	STMPO 120	Management Plan
DOE/SF/10499-T74	STMPO 141	Fourth Project Design Review
DOE/SF/10499-T88	STMPO 171	Subsystem Safety Analysis
DOE/SF/10499-T89	STMPO 174	Pilot Plant Availability
DOE/SF/10499-~~T90~~ T94	STMPO ~~175~~ 179	Receiver Tower Structural Analysis

Library Project Instructions

Purpose: Scan abstract to contractor.xls spreadsheet in Excel. Enter new entries, as needed.

How:

1. **Open up Excel-contractor.xls spreadsheet from directory D-Library.**
2. **To scan, have to be in Word.**
3. **Place abstract page in scanner.**
4. **File-Acquire text** **OR** **Alt-F-Q**
5. **Highlight text area and Perform OCR (button). This automatically spell-checks. If there are obvious spelling errors, correct. Otherwise, ignore. Also, check for special characters. This program doesn't pick up hyphens, degree signs, superscript/subscript, etc.** **PERFORM OCR**
6. **Once corrections have been made, Edit-Select All** **OR** **Ctrl-A,**
   Edit-Copy **OR** **Ctrl-C**
   Switch back to Excel [BE SURE CURSOR IS IN THE RIGHT CELL (ALWAYS "C") - TO INSERT ABSTRACT] **OR** **Alt-Tab**
7. **Edit-Paste.** **OR** **Ctrl-V**
   Take out extra spaces at bottom by backspacing.
8. **Press Enter, Spacebar, Backspace. This takes you to the next row.**

SPECIAL INSTRUCTIONS:

- a. **G Field is TRUE if the publication is in the library. If the publication can't be found in the library, make a comment in Notes field (H) "NOT IN LIBRARY"**
- b. **H field is for comments, i.e. MULTIPLE COPIES; NOT ON LIST, NOT IN LIBRARY, etc.**
- c. **When adding new entries, date field may appear FEB/00. To change it to the correct format, go to Format, Cell, Custom (and change the prompt line to mm/yy. Press Enter. Also left-justify that field, if needed.**

9. **At lunch break: SAVE OR Ctrl-S (saves into hard drive).**
10. **At the end of the day:**
    - a. **Save Excel spreadsheet (contractor.xls) before copying.**
    - b. **Close Word and Excel.**
    - d. **From Windows Explorer – locate D:Library. Copy contractor.xls, and paste on top of the last version of the spreadsheet "Copy (#) of contractor.xls". (More than likely this would be the one that shows for the previous day).**

H009-M-769

SAN FORM 70 10/80

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-AC03-79SF10499
Subcontract No.	(N/A)
Report No.	(STMPO 174) DOE/SF/10499-T89
Date of Report	May 1980
Name & Phone No. of DOE Technical Representative	S.D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM:
McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

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Reviewing/Submitting Official: Name (Print/Type) Donald L. Royer
Title Asst. Chief Patent Counsel, MDC (MS 122-23)
Signature Donald L. Royer Date 19 Sep 84

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
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☐ No patent objection to above-identified release.

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4. Title

Pilot Plant Availability

5. Type of Document ("x" one)

☒ a. Scientific and technical report

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