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Environmental Control System (ECS) Malfunction Procedure - Reviewed 09-01-1967

National Aeronautics and Space Administration (NASA)

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*WAA Manual
12/12*

SYMPTOM	PROCEDURE	REMARKS
<p>SSR#2 SECONDARY LOOP ACTIVATION</p>	<p>(1) G&N DSE AND SIGNAL COND AIR HUT (CALCULATED ON SECONDARY LOOP, USAGE LIMITS FOR THIS EQUIPMENT ARE AS FOLLOWS. TBD)</p> <p>(2) PREPARE FOR CHANGEOVER <ul style="list-style-type: none"> ECS IND sel - SEC EVAP H2O CONT SEC VLV - AUTO GLY TO RAD SEC VLV - NORMAL (number 3 is changed) </p> <p>(3) DEACTIVATE PRIMARY <ul style="list-style-type: none"> EVAP H2O CONT PRIM VLV - OFF ECS RAD PRIM HTR - off (center) GLY EVAP STN PRESS AUTO - MAN GLY EVAP STN PRESS INCR - INCR for 45 Sec ECS GLY PUMP - OFF </p> <p>(4) ACTIVATE SECONDARY <ul style="list-style-type: none"> SEC COOL LOOP PUMP - AC1 GLY DISCH SEC PRESS ind - TBD P51g ECS RAD SEC HTR - SEC SEC COOL LOOP EVAP - EVAL GLY EVAP SEC OUT TEMP ind - 40-50.5°F </p> <p>(5) IF A RETURN TO PRIMARY OPERATION IS DESIRED, PROCEED AS FOLLOWS:</p> <p>(6) PREPARE FOR CHANGEOVER <ul style="list-style-type: none"> ECS IND sel - PRIM EVAP H2O CONT PRIM VLV - AUTO EVAP H2O CONT SEC VLV - OFF GLY TO RAD PRIM VLV - NORMAL SUIT CKT HEAT EXCH - ON CAB TEMP - AUTO GLY EVAP IN TEMP - AUTO </p> <p>(7) DEACTIVATE SECONDARY <ul style="list-style-type: none"> ECS IND SEC HTR - OFF GLY DISCH SEC PRESS ind - 40-50.5°F SEC COOL LOOP PUMP - off (center) </p> <p>(8) ACTIVATE PRIMARY <ul style="list-style-type: none"> ECS GLY PUMPS - AC1 GLY DISCH PRIM PRESS ind - 40-50.5°F GLY EVAP - AUTO GLY EVAP PRIM OUT TEMP ind - 40-50.5°F </p>	<p>(1) Secondary loop</p> <p>(2) The following steps insure that the Radiator Heater and Evap Controls are not activated without Glycol flow</p> <p>(3) SEC SUIT HT EXCH VLV IS IN FLOW. SEC CABIN TEMP IS IN FULL COOL (CW)</p> <p>(4) Full secondary loop</p> <p>(5) closes Back Press Vlv and removes power</p>
<p>CAUTION For simultaneous coolant loop operation, one Radiator of one coolant loop should be used. For loop by passing radiators: <ul style="list-style-type: none"> GLY TO RAD VLV - BYPASS ECS RAD HTR - OFF </p>	<p>(1) Primary loop operation?</p> <p>(2) NO</p> <p>(3) ACTIVATE Sec Loop <ul style="list-style-type: none"> ECS IND - SEC SEC COOLANT LOOP PUMP - AC1 (in ACS) GLY DISCH PRESS > 40 psi ECS RAD HTR - SEC (if req'd) EVAP H2O CONT SEC VLV - AUTO GLY TO RAD SEC VLV - NORMAL (if req'd) SEC COOLANT LOOP - EVAP GLY EVAP SEC OUT TEMP - 40-50.5°F SEC SUIT HT EXCH VLV - FLOW (if req'd) </p> <p>(4) Deactivate secondary <ul style="list-style-type: none"> — name — name — name EVAP H2O Cont Sec VLV - OFF </p> <p>(5) Activate Primary <ul style="list-style-type: none"> ECS IND - PRIM GLY TO RAD PRIM VLV - NORMAL ECS GLY PUMPS - AC1 GLY DISCH PRIM PRESS -> 40 psi ECS RAD PRIM HTR - PRIM GLY EVAP TEMP ind - AUTO ECS H2O CONT PRIM VLV - AUTO GLY EVAP STN PRESS - AUTO GLY EVAP PRIM OUT TEMP - 40-50.5°F SUIT HEAT HT EXCH - ON CABIN TEMP - AUTO </p>	<p>(A)</p>

G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION

SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK

*8/11/11
 removal NWA
 11/50 gals, note
 amount if*

SYMPTOM	PROCEDURE	REMARKS	G&N MALFUNCTION
26. FOOD PREP WATER TEMP LOW	<div style="border: 1px solid black; padding: 5px;"> 1 RESET H₂O HEATER <i>POTABLE WATER</i> HEATER - REPAIR <i>HEATER - REPAIR</i> <i>WATER BUS</i> • ALTERNATE BUS (MIN A OR B) WATER TEMP <i>INCREASES</i> INCREASES → NO CHANGE → </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> 2 CIRCUIT FAILURE FROM MN A OR B BUS </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> 3 <i>POTABLE H₂O</i> HEATER FAILED OR DEGRADED </div>	<p>① LOSS OF REDUNDANT WATER HEATER POWER SOURCE CAPABILITY. APPROX 4 HR RECOVERY TIME REQD.</p> <p>② HOT WATER SUPPLY LOST OR RECOVERY TIME EXTENDED.</p>	SCS MALFUNCTION
			SPS MALFUNCTION
			RCS MALFUNCTION
			EPS MALFUNCTION
			T/C MALFUNCTION
			EGS MALFUNCTION
			SEQ MALFUNCTION

ADP/67-167 Expires 9-15-67

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>27. POTABLE H₂O QUANTITY DECREASE RATE HIGH</p>	<p>1 ADJUST</p> <ul style="list-style-type: none"> PRESS RELIEF vlv - OFF <p>WATER USAGE RATE? <i>becomes normal</i></p> <p>YES → 5 <i>Relief the failure</i></p> <p>try each individually? 1, 2, if cannot isolate operate manually</p> <p>NO → HI → 2 LINE LEAKAGE</p> <p>HI → 3 ADJUST</p> <ul style="list-style-type: none"> H₂O QTY IND sw - WASTE <p>WATER QUANTITY? → EMPTY → 2</p> <p>→ PARTIALLY FULL → 4 ADJUST</p> <ul style="list-style-type: none"> H₂O QTY IND sw - POT PRESS RELIEF vlv - BOTH WASTE TK IN vlv - OFF <p>WATER USAGE RATE? → NORMAL → 5 WASTE TK INLET RELIEF VALVE FAILURE</p> <p>→ > NORMAL → 4</p> <p>→ HI → 6 CHECK VALVE FAILURE</p>	<p>① MONITOR CABIN HUMIDITY, CHECK FOR WATER IN C/M</p> <p>② RATE OF DECREASE OF POTABLE H₂O GREATER THAN EXPECTED DUE TO BOILING REQUIREMENTS</p> <p>③ POTABLE H₂O BEING USED BEFORE WASTE TANK EMPTY. WASTE TANK INLET RELIEF VALVE OPERATED MANUALLY FOR H₂O TRANSFER TO WASTE TANK.</p> <p>④ RATE OF DECREASE OF POT QTY IND GREATER THAN EXPECTED FOR OPERATIONAL MODE OR AS INDICATED BY MSFN</p> <p>⑤ FUEL CELL H₂O IS BYPASSING POTABLE TANK AND GOING TO WASTE TANK.</p>

rechecked 17/6 symptoms see back of 27th

This is a question but only one answer.

new work

Pot Sensor Fail Relief Valve Fault water tank outlet

How can Potable H₂O sensor fail?

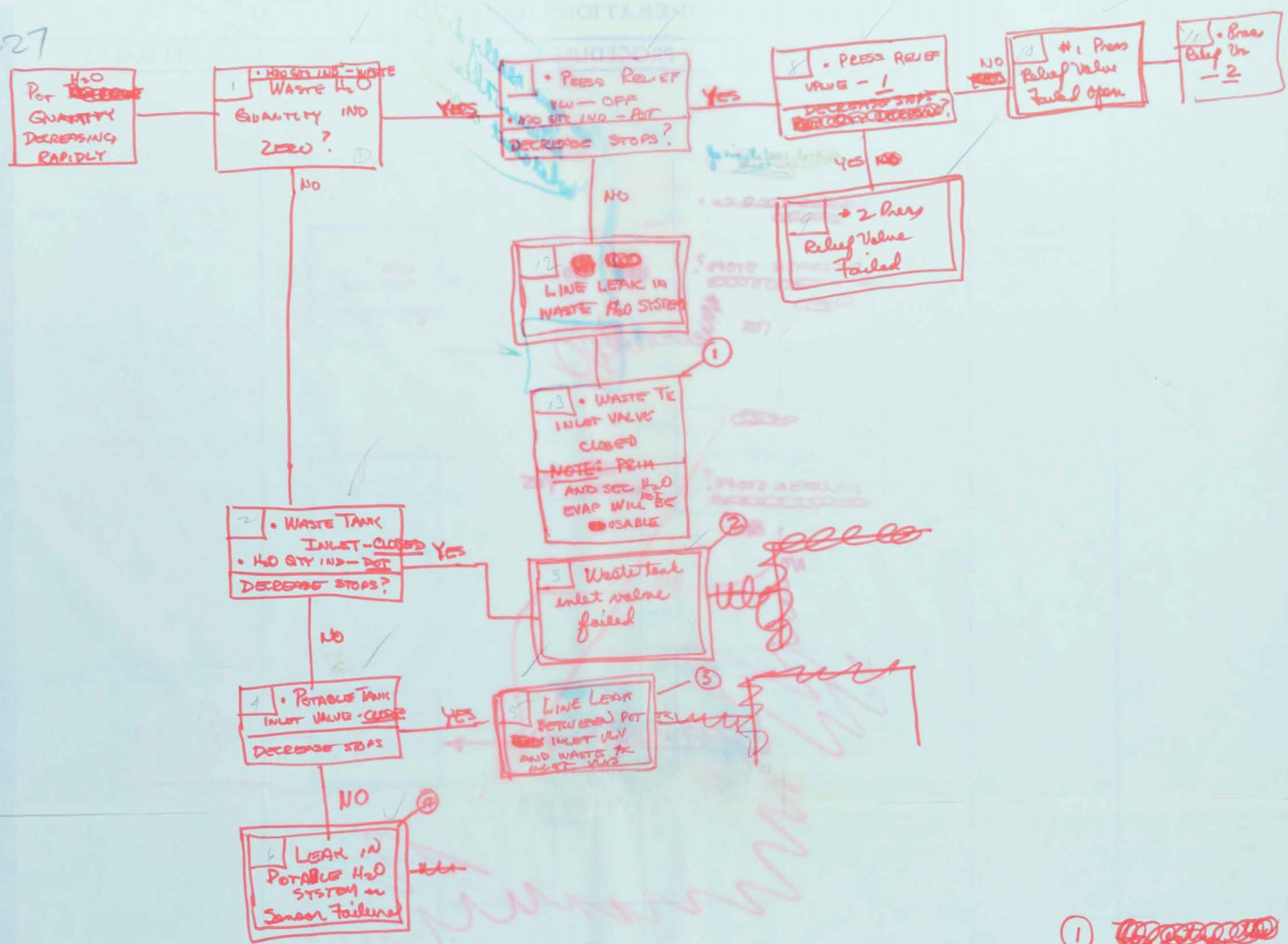
This can be determined by shutting tank outlet valve to check.

- G&N MALFUNCTION
- SCS MALFUNCTION
- SPS MALFUNCTION
- RCS MALFUNCTION
- EPS MALFUNCTION
- T/C MALFUNCTION
- ECS MALFUNCTION
- SEQ MALFUNCTION

ADMIN - 167 Expires 9-15-67

Sensor Pot tank level leak

#27



u

- ① ~~Waste tank inlet valve~~
H₂O evaporators can be used by periodically opening the Waste tank inlet valve for 2-3 min until the evaporator works are saturated. H₂O line leakage will occur during these periods.
- ② This failure is not serious, and will result in approximately equal quantities being maintained in potable and waste H₂O tanks.
- ③ Incoming Fuel cell water will still pass thru this leak.
- ④ Remaining water in Potable H₂O tanks may be saved by turning the Water and Hydrant tank Requester Valve OFF.

SYMPTOM	PROCEDURE	REMARKS
<p>28 ENTRAPPED GAS IN FOOD RECONSTITUTION OR DRINKING WATER</p>	<p style="text-align: center;">①</p> <p style="text-align: center;"><u>Warning</u></p> <p style="text-align: center;">GAS IN WASTE WATER SUBSYSTEM NOT READILY IDENTIFIABLE; HOWEVER, POSSIBLE REDUCTION IN EVAPORATOR PERFORMANCE MAY BE EXPECTED AS WELL AS A FALSE INDICATION IN QUANTITY → TBD</p> <p>2</p> <ul style="list-style-type: none"> WITHDRAW 4 LBS COLD WATER AT POTABLE WATER SUPPLY INTO FOOD RECONSTITUTION BAGS PROVIDED FOR COLD DRINKS. DRINK AS MUCH POSSIBLE AND STORE REMAINDER <p>3</p> <p>CK LIQUID QTY IN POTABLE H₂O TK</p> <ul style="list-style-type: none"> VERIFY THAT INDICATION CHANGES AS WATER IS DRAWN OUT <p>INDICATED QTY DROPPED?</p> <p>NO → [4]</p> <p>YES → [5]</p> <p>4</p> <p>O₂ LEAK INTO H₂O SUPPLY, PROBABLE POTABLE TANK BLADDER LEAK OR RUPTURE</p> <p>ECS</p> <p>1 1</p> <p>O₂ Flow Hi</p> <p>5</p> <ul style="list-style-type: none"> MONITOR H₂O/GAS RATIO FOR CONTINUED H₂O SUBSYSTEM OPERATION 	<p>① IT IS POSSIBLE TO INTRODUCE O₂ & H₂ INTO THE POTABLE AND WASTE WATER SUBSYSTEM</p> <p>How about turning tank up H₂ and seeing what happens to qty?</p> <p>We don't need to enter at step 4 of that procedure but when the tanks are checked</p>

7/6/67

From this procedure, if this is the best we have, I would say we need to look into this problem.

Returns per?

12/2 to be reviewed by NAA ASAP

- G&N MALFUNCTION
- SCS MALFUNCTION
- SPS MALFUNCTION
- RCS MALFUNCTION
- EPS MALFUNCTION
- T/C MALFUNCTION
- ECS MALFUNCTION
- SEQ MALFUNCTION

SYMPTOM	PROCEDURE	REMARKS
<p>29. URINE BACK-UP (URINE OVERBOARD DUMP NOT DRAINING)</p>	<p>1 ADJUST • REPLACE FILTER</p> <p>URINE FLOW? NORMAL → 2 URINE FILTER PLUGGED</p> <p>BACK-UP → 3 ADJUST • URINE DUMP SW - HTR B</p> <p>URINE FLOW? NORMAL → 4 HEATER A FAILED</p> <p>BACK-UP → 5 HEATERS A & B FAILED</p> <p>WASTE TK < 90% → 7 ADJUST • ORIENT S/C</p> <p>WASTE TK ≥ 90% → 6 ADJUST • OPERATE GLY EVAP IN TEMP VIB TO MAX HEAT MANUALLY TO MAINTAIN WASTE TK QUANTITY < 90%</p> <p>WASTE TK ≥ 90% → 9 ADJUST • EACH ASTRONAUT DRINK 300 H₂O • FUEL CELL 90%</p> <p>1 Urine Backs Up? YES → 2 Replace Urine Filter NO → 3 Plugged Urine Filter</p> <p>2 Urine Backs Up? YES → 7 ADJUST • PREPARE TO ABORT</p> <p>NO → 4 • ORIENT S/C TO POINT OVER URINE DUMP POAT • URINE DUMP HEATER - ALTERNATE HEATER URINE OVB DRAIN FLOW RESUMES</p> <p>HEAT → ORIGINAL SELECTED URINE HEATER FAILED</p> <p>NO → 4</p> <p>5 FROZEN URINE OVB DRAIN</p> <p>6</p>	<p>① USE FILTER ASSOCIATED WITH EITHER VACUUM CLEANER IN FECAL CANISTER.</p> <p>② ASSUMES INITIAL POSITION HEAT ALLOW TIME FOR URINE TIP HEATER OPERATION.</p> <p>③ LOSS OF REDUNDANT URINE NOZZLE HEATER CAPABILITY</p> <p>④ PRIMARY VENT, FECAL CANISTER, VACUUM CLEANER, FECAL STORAGE VENT, WATER TANKS H₂+O₂ BLEED, & WATER DUMP CAPABILITY LOST. LOSS OF WATER DUMP CAPABILITY WILL RESULT IN OVERPRESSURIZING WATER SYSTEM IF WASTE TANK IS FULL AND LOSS OF FUEL CELLS IF WASTE AND POTABLE TANKS FULL.</p> <p>⑤ ORIENT S/C FOR MAX EXTERNAL HEAT ON URINE DUMP NOZZLE IN ATTEMPT TO CLEAR. PROBABILITY OF SUCCESS VERY LOW.</p> <p>⑥ WASTE TANKS FULL</p> <p>⑦ LACK OF URINE STORAGE CAPABILITY REQUIRES ABORT.</p>

G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION

revised 11/1/67
gls, nms,

gls 11/12/67

format!
Wow! this needs work

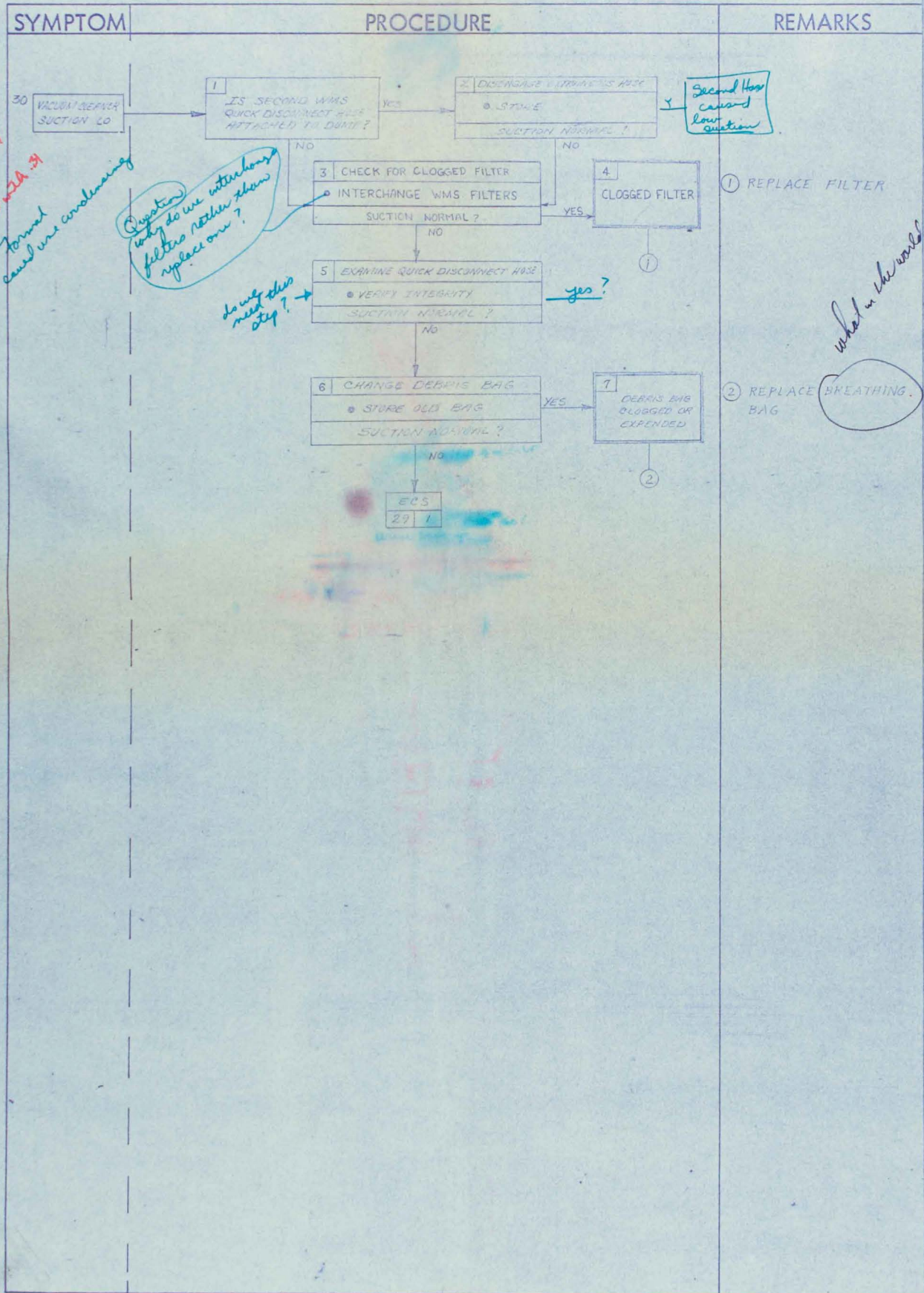
Question
Corrected attempt
to filter manual
operation

use heating to rather
other, wouldn't you
just

Perhaps we need a
urine overboard dump
not draining

ADMIN - 367 Expires 9-15-67

SM2A-03-SC101-(2)
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es 11/12/67
revised 12/4/67
As combined with 39
Formal could use condensing

Question why do we interchange filters rather than replace one?

do we skip step 7?

Second hose caused low suction

what in the world

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

ADMAN - 167 Expires 2-15-67

SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>31 FEED CRUISER FREQUENT LEW</p> <p><i>revised 12/16 combined with 30</i></p> <p><i>Since this procedure is identical to Proc 30 why not combine them</i></p>	<p>1 IS SECOND WMS QUICK DISCONNECT HOSE ATTACHED TO LINE?</p> <p>Yes → 2 ENGAGE FITTINGS HOSE • STORE SUCTION NORMAL?</p> <p>No → 3 CHECK FOR CLOGGED FILTER • INTERCHANGE WMS FILTERS SUCTION NORMAL?</p> <p>Yes → 4 CLOGGED FILTER ①</p> <p>No → 5 EXAMINE QUICK DISCONNECT HOSE • VERIFY INTEGRITY SUCTION NORMAL?</p> <p>No → ② CCS 29 V</p>	<p>① REPLACE CLOGGED FILTER</p> <p>② USE FEED BAG IN CANISTER WITHOUT SUCTION</p>
<p>30 Vacuum Cleaner Leaking</p> <p>31 Fuel Control Leaking</p>	<p>C • Change debris bag • Interchange WMS filters SUCTION NORMAL?</p> <p>Yes → D Clogged Filter</p> <p>No → CCS 29 V URINE BACKUP</p>	<p>① Assume second WMS disconnect hose disengaged.</p>
	<p>A • Change debris bag SUCTION NORMAL?</p> <p>Yes → B Debris bag Clogged on Expanded</p> <p>No → I</p>	
	<p>Flowchart: [] → [A] → Y → [B] → [] [] → [C] → Y → [D] → [] [] → [E] → []</p>	

G&N	MAJUNCTION
SCS	MAJUNCTION
SPS	MAJUNCTION
RCS	MAJUNCTION
EPS	MAJUNCTION
T/C	MAJUNCTION
ECS	MAJUNCTION
SEC	MAJUNCTION

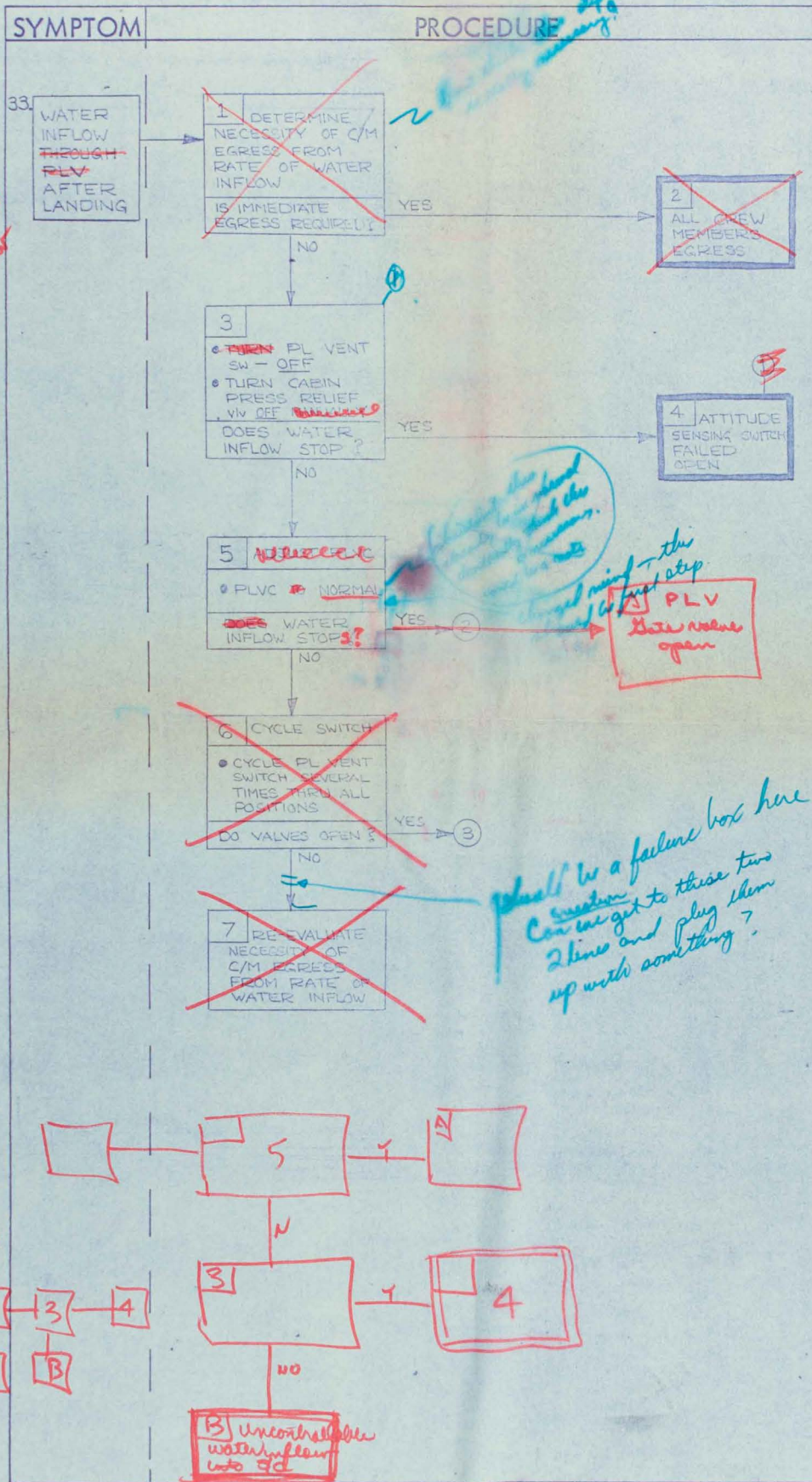
ASB-101-167 7 pages 10-40

SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	T ARKS	G&N MALFUNCTION SCS MALFUNCTION RCS MALFUNCTION EPS MALFUNCTION T/C MALFUNCTION ECS MALFUNCTION SEQ MALFUNCTION
32. INADEQUATE VENTILATION AFTER LANDING <i>9/6 9/12 revised NAM 11/30/67 AMZ gfr, amw jfb if the Post landing blower fan fell to operate but the exhaust valve did open after 5 min. This qualification was not in the PLV control and/or the valves might provide the necessary path for the air</i>	<p>1 CHECK PLV LOGIC PINS PULLED</p> <p>2 CYCLE POST LANDING VENT SWITCH</p> <p>PL VENT OFF PL VENT HIGH</p> <p>VENTILATION INCREASE?</p> <p>YES</p> <p>NO</p> <p>3 DOES VENTILATION INCREASE?</p> <p>YES</p> <p>NO</p> <p>4 POST LANDING VENT SWITCH FAILURE</p> <p>5 ACTUATE PLVC</p> <p>PLVC - OPEN</p> <p>VENTILATION INCREASE?</p> <p>YES</p> <p>NO</p> <p>6 DOES VENTILATION INCREASE?</p> <p>YES</p> <p>NO</p> <p>7 ATTITUDE SENSING SWITCH FAILURE</p> <p>8 POST LANDING VENT VALVES FAILED OR FAN INOPERATIVE</p> <p>Post Landing Blower Failure</p>	<p>1 PLV LOGIC PINS PULLED PL VENT VALVE PLV A LOW</p> <p>Results attitude sensor relay to require for operation</p> <p>1 Post landing vent switch must be cycled to OFF and back to HIGH (LOW) any time SK attitude exceeds 60° to react the attitude control relay</p> <p>2 EGRES MAY BE REQUIRED</p>	

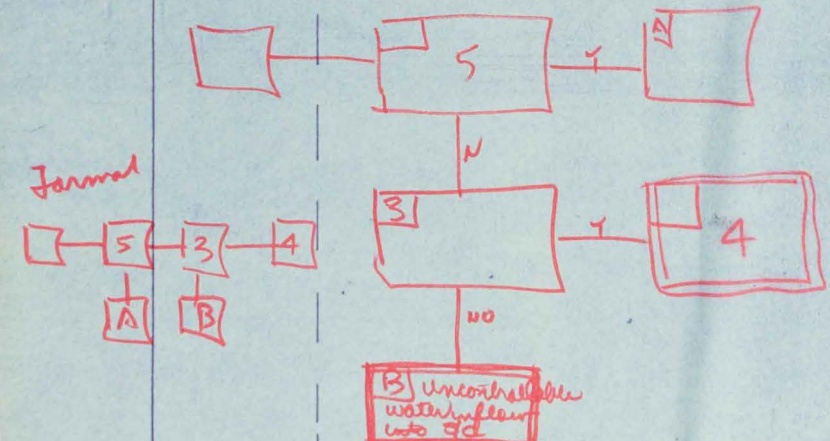
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SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK



33
 11/12/67
 removed 11/20/67
 for, sure, cover

Formal



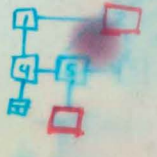
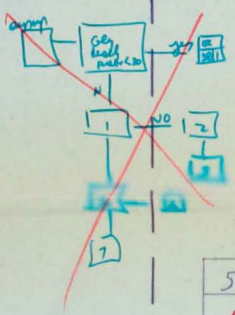
G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECSS	MALFUNCTION
1 SEG	MALFUNCTION

ADMAN - 167 Expires 9-15-67

SYMPTOM	PROCEDURE	REMARKS
<p>34. ECS RAD TEMP SEC OUT LOW SEC RAD TEMP L 40°F</p>	<p>1 REACTIVATE HEATER <i>Secondary Heater check</i> • Check temp <i>temp</i> of current • ECS RAD HTR SEC SW - OFF • Check temp <i>temp</i> VC current DOES ECS RAD TEMP PRIM SEC IN DECREASE? Both heaters <i>Both heaters operating?</i></p> <p>2 REACTIVATE HEATER HEATER CIRCUIT DUO OR BOTH HEATERS FAILED</p> <p>3 ECS RAD HTR SEC SW - OFF REACTIVATE SEC FOR SEC RAD TEMP WARMING ORIENTATIONS AND INCREASE ECS ELECTRICAL LOADS</p> <p>4 REACTIVATE HEATER • ECS RAD HTR SEC SW - OFF <i>ON</i> IS GLY DISCH. PRESS. < 30 PSIG? YES → ECS 381 NO → 5</p> <p>5 SEC GLY EVAP OUT TEMP ~ SEC RAD OUT TEMP? NO NO NO SEC RAD TEMP BELOW 70°F</p> <p>6 ECS HEAT LOAD TOO LOW</p> <p>7 ECS RAD OUT SEC INDIC SEC RAD TEMP SEC RAD TEMP FAILED</p>	<p><i>Assumes Secondary loop is in operation</i></p> <p><i>When heaters are switched off, Δ current will be approx 30 amps if both heaters are operating 15amps if one heater is operating</i></p> <p><i>Use Sec Gly Evap out temp with Sec Rad in temp to estimate Sec Rad out temp</i></p>

glo 11-12-67
revised at 11/29/67
g, m, e, e, om, g
Question the order

Secondary Heater check



SEE GLY DISCH POWER LOW

G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION

SM2A-03-SC101-(2)
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See Reverse side

11/10
 NAA Review 11/6/66
 of combined with
 temp high 3
 Temp low

Needs work

SYMPTOM	PROCEDURE	REMARKS	
18. CABIN HUMIDITY HIGH	<p>1 DETERMINE RELATIVE HUMIDITY</p> <ul style="list-style-type: none"> USE HAND HELD HYGROMETER IF AVAILABLE TO DETERMINE RELATIVE HUMIDITY AND DEW POINT <p>RELATIVE HUMIDITY NORM? YES → 2 NO CABIN HUMIDITY PROBLEM CHECK SUIT IF SUITABLE</p> <p>NO → 3 INSPECT FOR POSSIBLE LEAKS</p> <p>EVALUATE CASIN INTERIOR FOR AIR LEAKS AND BUBBLE LEAKS IF POSSIBLE</p> <ul style="list-style-type: none"> VERIFY SUIT NOT RETURN SHUT-OFF VIA SCREEN CLEAN AND FLOW PATH UNOBSTRUCTED CHECK RELATIVE HUMIDITY <p>RELATIVE HUMIDITY NORM? YES → 4 PROBLEM CORRECTED</p> <p>NO CHANGE → ECS 13 1 HIGH SUIT HUMIDITY</p> <p>check Suit Circuit air return check Valve screen clean Humidity decreases</p> <p>Hygrometer</p>	<p>① HIGH HUMIDITY NOTED BY CREW DISCOMFORT</p> <p>② Should be remark "Suit compressor should be off while vacuuming screen."</p> <p>of the crew is uncomfortable because of high humidity what would the hygromete tell them</p>	C&N MALFUNCTION C MALFUNCTION SPS MALFUNCTION MALFUNCTION MALFUNCTION MALFUNCTION EPS MALFUNCTION MALFUNCTION T/C MALFUNCTION MALFUNCTION ECS MALFUNCTION MALFUNCTION SEC MALFUNCTION

a note or remark

the step should come after check of the suit vents return or check vlo.

ADMIN - 107 Expires 9-15-67

16-17-8/8



NAA Action:
 Can Cabin M. Exchange capacity be checked?
 NAA to supply figures

- ① Cabin temp changes are slow reacting.
- ② If the Secondary Glycol System is ~~empty~~ the action to take temp control is obtained by manually positioning the Secondary Cabin Temperature control valve.
- ③ Suit compressors should be OFF while vacuuming screen
- ④ The hand held hygrometer can be used to verify humidity level & humidity

NAA ACTION:
 Dechlorane correct need to be positioned individually each low speed

Cabin Temp Control failed or Cabin M. Exchanger capacity exceeded

18 Cabin Temp Control by the M. Exchanger - BYPASS - In control temp control on Suit PGA to temp control on Turnoff Cabin fans on reduce concave air flow thru Cab. Exchanger

1 Cabin Temp High

2 Cabin Temp - MAN

3 Auto Cabin Temp Control Failed

4 Cabin Temp High

5 Cabin Temp - MAN

6 Auto Cabin Temp Control Failed

7 Cabin Temp High

8 Cabin Temp - MAN

9 Auto Cabin Temp Control Failed

10 Cabin Temp High

11 Cabin Temp - MAN

12 Auto Cabin Temp Control Failed

13 Cabin Temp High

14 Cabin Temp - MAN

15 Auto Cabin Temp Control Failed

16 Cabin Temp High

17 Cabin Temp - MAN

18 Auto Cabin Temp Control Failed

19 Cabin Temp High

20 Cabin Temp - MAN

21 Auto Cabin Temp Control Failed

22 Cabin Temp High

23 Cabin Temp - MAN

24 Auto Cabin Temp Control Failed

25 Cabin Temp High

26 Cabin Temp - MAN

27 Auto Cabin Temp Control Failed

28 Cabin Temp High

29 Cabin Temp - MAN

30 Auto Cabin Temp Control Failed

31 Cabin Temp High

32 Cabin Temp - MAN

33 Auto Cabin Temp Control Failed

34 Cabin Temp High

35 Cabin Temp - MAN

36 Auto Cabin Temp Control Failed

37 Cabin Temp High

38 Cabin Temp - MAN

39 Auto Cabin Temp Control Failed

40 Cabin Temp High

41 Cabin Temp - MAN

42 Auto Cabin Temp Control Failed

43 Cabin Temp High

44 Cabin Temp - MAN

45 Auto Cabin Temp Control Failed

46 Cabin Temp High

47 Cabin Temp - MAN

48 Auto Cabin Temp Control Failed

49 Cabin Temp High

50 Cabin Temp - MAN

51 Auto Cabin Temp Control Failed

52 Cabin Temp High

53 Cabin Temp - MAN

54 Auto Cabin Temp Control Failed

55 Cabin Temp High

56 Cabin Temp - MAN

57 Auto Cabin Temp Control Failed

58 Cabin Temp High

59 Cabin Temp - MAN

60 Auto Cabin Temp Control Failed

61 Cabin Temp High

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63 Auto Cabin Temp Control Failed

64 Cabin Temp High

65 Cabin Temp - MAN

66 Auto Cabin Temp Control Failed

67 Cabin Temp High

68 Cabin Temp - MAN

69 Auto Cabin Temp Control Failed

70 Cabin Temp High

71 Cabin Temp - MAN

72 Auto Cabin Temp Control Failed

73 Cabin Temp High

74 Cabin Temp - MAN

75 Auto Cabin Temp Control Failed

76 Cabin Temp High

77 Cabin Temp - MAN

78 Auto Cabin Temp Control Failed

79 Cabin Temp High

80 Cabin Temp - MAN

81 Auto Cabin Temp Control Failed

82 Cabin Temp High

83 Cabin Temp - MAN

84 Auto Cabin Temp Control Failed

85 Cabin Temp High

86 Cabin Temp - MAN

87 Auto Cabin Temp Control Failed

88 Cabin Temp High

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91 Cabin Temp High

92 Cabin Temp - MAN

93 Auto Cabin Temp Control Failed

94 Cabin Temp High

95 Cabin Temp - MAN

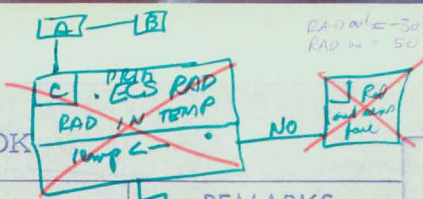
96 Auto Cabin Temp Control Failed

97 Cabin Temp High

98 Cabin Temp - MAN

99 Auto Cabin Temp Control Failed

100 Cabin Temp High



do
11/10
revised via
11/15

maybe 38°F
0.5°/min

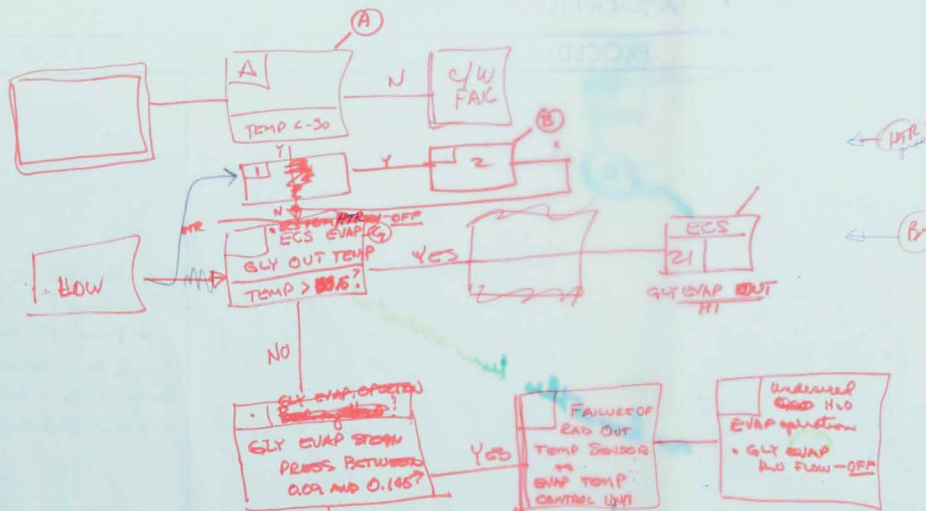
Failure
Monitor
Flow temp. vlt.
Sensitivity vlt.
Speed temp
Alarm set out for 200 count
work needed in
order to logic
particularly in steps 7-12.

HTR's

SYMPTOM	PROCEDURE	REMARKS	C&N	MALFUNCTION
<p>19. GLY TEMP LOW AMBER</p> <p>LIGHT IS ON IF ECS RAD TEMP PRIM OUT IS 4-30°F</p> <p>ECS RAD TEMP PRIM OUT LOW</p> <p>TEMP < -30°!</p>	<p>1 ACTIVATE REDUNDANT HEATER</p> <p>• ECS RAD HTR PRIM sw - PRIM 2</p> <p>• DOES ECS RAD TEMP PRIM/SEC IN INCR?</p> <p>YES → 2</p> <p>NO → 3</p> <p>2 FAILED PRIMARY HEATER CIRCUIT</p> <p>3 CONTINUE REDUNDANT HEATER OPERATION</p> <p>4 REDUNDANT FLOW PROPORTIONING SYS</p> <p>• ECS RAD HTR PRIM sw - OFF (CENTER)</p> <p>• ECS RAD FLOW CONT AUTO sw - 2</p> <p>• DOES ECS RAD TEMP PRIM OUT INCR?</p> <p>YES → 5</p> <p>NO → 7</p> <p>5 FAILED ISOLATION VALVE</p> <p>6 CONTINUE REDUNDANT FLOW PROPORTIONING</p> <p>• ECS RAD HTR sw - PRIM 1</p> <p>7 CHECK WITH MSFN ON CPO157R</p> <p>FLOW RATE - GLYCOL PRIM COLDPLATE OUTLET?</p> <p>LOW (<180% NORMAL (180 TO 200 VME)</p> <p>8 MANUALLY INCR RAD FLOW</p> <p>• GLY EVAP TEMP IN sw - MAN</p> <p>• GLY EVAP TEMP IN VIV - COOL (CCW)</p> <p>• ECS RAD TEMP PRIM OUT INCR?</p> <p>YES → 10</p> <p>NO → 9</p> <p>10 GLY TEMP IN VLT FAILED IN FULL BYPASS SYSTEM</p> <p>9 MONITOR EVAP OUT AND WATER USAGE</p> <p>11 MANUALLY CONTROL BYPASS TO MAINTAIN ECS RAD TEMP PRIM OUT > 37°F</p> <p>• ECS RAD HTR PRIM sw - PRIM 1</p> <p>• GLY EVAP TEMP IN VIV - HEAT (CW) OR COOL (CCW) AS REQ'D</p> <p>12 MANUALLY SELECT RAD 1</p> <p>• GLY EVAP TEMP IN sw - AUTO</p> <p>• ECS RAD MAN SEL sw - RAD 1</p> <p>• ECS RAD FLOW CONT PWR sw - MAN SEL MODE</p> <p>13 STAGNATED PANEL 2</p> <p>14 MANUALLY SELECT RAD 2</p> <p>• ECS RAD MAN SEL sw - RAD 2</p> <p>15 STAGNATED PANEL 1</p> <p>16 RETURN TO NORMAL RADIATOR CONTROL</p> <p>• ECS RAD FLOW CONT PWR sw - PWR</p> <p>• ECS RAD MAN SEL sw - RAD 1</p> <p>17 NO FLOW IN COOLANT LOOP</p> <p>18</p>	<p>1 ALTITUDE AND/OR ELECTRICAL LOAD CORRECTION SHOULD HAVE BEEN MADE WHEN RAD OUTLET DROPPED TO 20°F FTL (LOW) (MIN) MISSION RULE. IF 150°F IS REACHED IT IS ASSUMED THAT A MALFUNCTION EXISTS.</p> <p>2 FAILURE COULD BE CONTROLLING FUNCTION OF HEATER.</p> <p>3 HEATER IS SHUT OFF TO AVOID POSSIBLE BOILING OF WATER GLYCOL. WITH NO FLOW, BOILING MAY NOT BE DETECTABLE AT ECS RAD TEMP PRIM/SEC IN INDICATOR.</p> <p>4 CAUTION - DO NOT ALLOW EVAP IN TEMP TO GO BELOW 37°F</p> <p>5 A CHECK WITH MSFN TO DETERMINE AN INCREASE IN RATE GLYCOL PRIMARY COLDPLATE OUTLET (CPO157R) MAY BE MADE TO PROVIDE A FAST INDICATION THAT FLOW HAS RESUMED.</p> <p><i>It would seem that if the glycol bypass valve were to fail open, there would be low glycol temp. and also there has been given a large cal. and the rate is not to decrease too.</i></p> <p><i>we never check gly trap out temp why?</i></p> <p><i>wrong well cause temp is</i></p> <p><i>Because of the thermal constants involved there would be time to verify ECS rad out temp with MSFN as the rad temp was dropping.</i></p>		

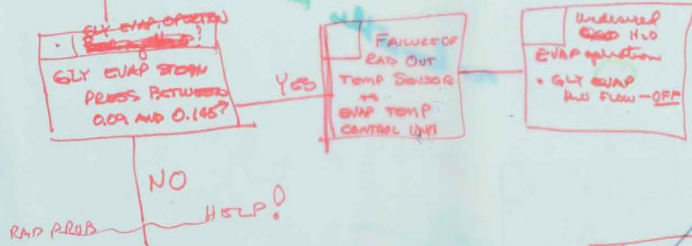
SYMPTOM	PROCEDURE	REMARKS
<p>19. (cont'd)</p>	<div style="text-align: center;"> <p>13 15</p> <p>6</p> <p>18 THAW STAGNATED PANEL</p> <ul style="list-style-type: none"> • REORIENT S/C TO DIRECT STAGNATED PANEL TOWARD SUN • ECS RAD FLOW CONT AUTO sw - 1 • ECS RAD FLOW CONT PWR sw - PWR • WAIT 17 SECS FOR ISOLATION VALVES TO POSITION • ECS RAD FLOW CONT PWR sw - OFF (AUTO) • WAIT 10 MINUTES FOR PANEL TO THAW <p>19 RESUME NORMAL RAD OPERATION</p> <ul style="list-style-type: none"> • ECS RAD HTR PRIM sw - PRIM 1 • ECS RAD FLOW CONT PWR sw - FWR • ECS RAD FLOW CONT AUTO sw - AUTO <p>7</p> <p>20 IF FAILURE CONTINUES, ISOLATE BLOCKED PANEL AND ORIENT S/C FOR MOST FAVORABLE HEAT REJECTION</p> </div> <p><i>low in this line arrival of</i></p>	<p>6 THE THAWING PROCESS MAY BE EXPEDITED BY ACTIVATING THE SECONDARY COOLANT LOOP</p> <p>6 Panel 1 is located on bays 253 (between +Y and +Z axes) Panel 2 is located on bays 536 (between -Y and -Z axes)</p> <p>7 DELOCKAGE OF RAD FLOW CANNOT BE DISTINGUISHED FROM A STAGNATED PANEL. SINGLE PANEL IS LESS EFFECTIVE. ELECTRICAL LOADS SHOULD BE REDUCED.</p>

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

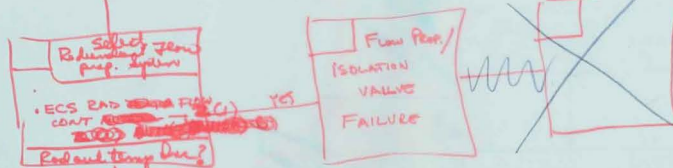


- (B) Continue troubleshooting. Heater failure may not be only failure. Time taken 40% for troubleshooting after pipe radiators are fixed.
- (C) By Pass Valve Problem

(3) Heater is shut off for troubleshooting and to avoid possibility with low flow of boiling H₂O/Gly in lines



we know it isn't a flow prop valve just here



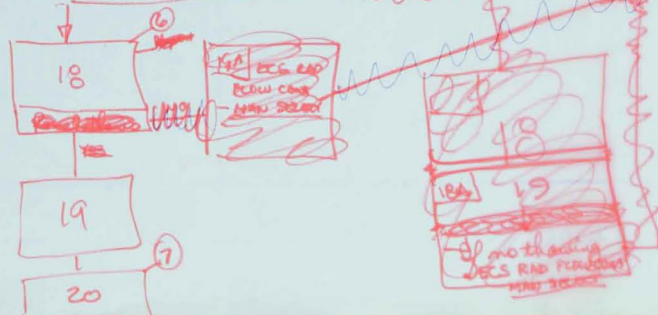
(D) MSFA can aid in determining frozen stagnated panel, by TM of Press Rad Bay Temp and measurements and pin level flow rate



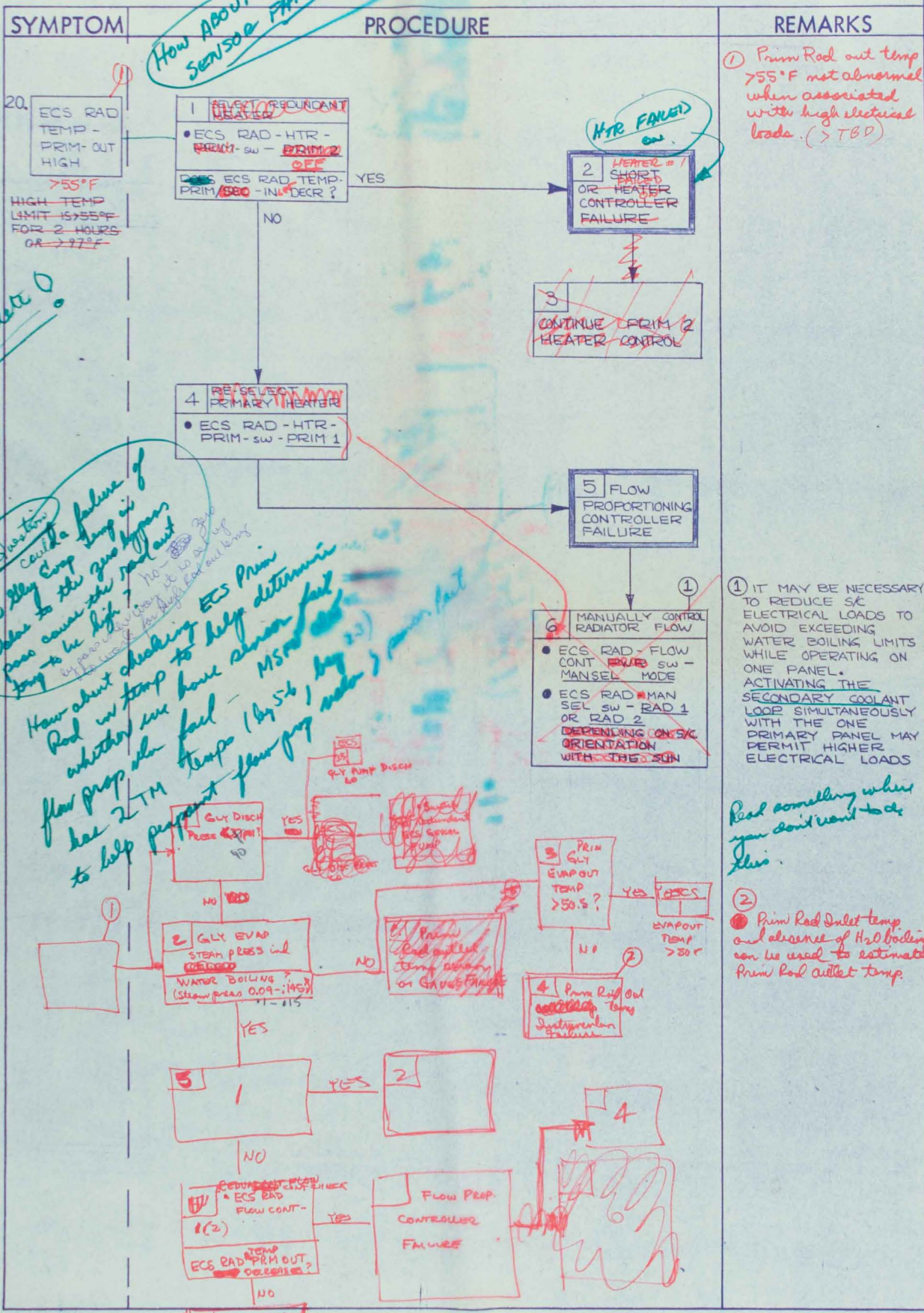
(F) If the pump dead, first repair procedure is PFM RAD OUT SENSORE FIXED



(E) Absence of H₂O boiling and normal Press Rad Inlet Temp only indication of Rad in Panel out temp.



G&N MALFUNCTION
 SCS MALFUNCTION
 SPS MALFUNCTION
 RCS MALFUNCTION
 EPS MALFUNCTION
 T/C MALFUNCTION
 ECS MALFUNCTION
 SEQ MALFUNCTION



How ABOUT sensor FAILURES

HTR FAILED out

10/10

Incomplete

Question: could a failure of the Galy Comp Temp in pass cause the rad out temp to be high? by pass allow temp to be high for Galy out temp

How about checking ECS Prim Rad in temp to help determine whether we have sensor fail or flow prop failure (by 5th, by 2nd) Prim Rad has 2 TM to help prevent flow prop failure

Read something when you don't want to do this.

② Prim Rad Inlet temp and absence of H₂O boiling can be used to estimate Prim Rad outlet temp.

Unidentified double 67 failures

SYMPTOM	PROCEDURE	REMARKS
<p>21 GLY EVAP TEMP-OUT ind 41.9 150.5°F >50.5°</p> <p>NORMAL EVAP OUTLET TEMP 40-50.5 °F</p> <p>MODES: (1) EVAPORATE: TEMP 40-43°F (2) MIXING: TEMP 42-48°F</p>	<p>1 PLUG REDUNDANT SENSOR</p> <ul style="list-style-type: none"> • GLYCOL TEMP IN - 40 • GLYCOL WAT H2O FLOW - 20 • GLYCOL WAT STROM PRESS - 20 <p>GLY EVAP TEMP OUT? DECREASES → 40-50.5°F → 2 SENSOR FAILURE</p> <p>NO → 3 CHECK ECS RAD TEMP - PRINT-OUT ind</p> <ul style="list-style-type: none"> • RAD OUT TEMP IN? 43.7°F → 4 RADIATOR FAILURE • RAD OUT TEMP 44.4 <p>NO → 5 READ EVAP INLET TEMP</p> <ul style="list-style-type: none"> • PLUG IN TEMP MEASUREMENT UNIT (TMU) • TMU SW - INLET <p>EVAP INLET TEMP? <48°F → 6 GAUGE FAILURE</p> <p>>48°F → 7 EVAP STEAM PRESS</p> <ul style="list-style-type: none"> • IS STEAM PRESS? <.18 PSI → 8 READ WICK TEMP • WICK TEMP 40.5 → 9 CLOSE BACK PRESS VALVE 15-30 MIN • GLY EVAP - STEAM PRESS - AUTO SW - MAN • GLY EVAP - STEAM PRESS - INCR SW - INCR FOR 45 SEC • EVAP OUT TEMP 45.5°F <p>NO → 12 MANUALLY CONTROL WATER</p> <ul style="list-style-type: none"> • SET TMU SW - NULL • GLY EVAP - H2O FLOW SW - AS READ <p>IS EVAP OUT TEMP? DECREASING → 13 H2O SECTION OF EVAPORATOR CONTROL FAILURE</p> <p>NO → 14 WATER SUPPLY FAILURE</p> <p>NO → 15</p>	<p>① REDUNDANT OUTLET TEMP SENSING LOST.</p> <p>② NORMAL PRESS RANGE - .05 TO .18 PSI</p> <p>③ REMAIN ON PRIMARY SYSTEM AND USE THE TMU TO AID IN MANUAL CONTROL OF THE EVAP. IF TIME IS CRITICAL GO TO SEC COOLANT LOOP</p> <p>④ GO TO SEC COOLANT LOOP</p>

revised 11-22 82, new 11-26 78
revised procedure on back of page 8
in remarks

Question: Can glycol temp in wicks fall in range before temp goes high temp temp out. We don't normally monitor the temp temp in wicks in this phase.

Shouldn't be the first step

Switches off for this installation

These are based on the chiller box - are we going to carry this?

Just as step in redundant sensor we have to take power off the temp control unit

can you immediately come to this conclusion! Seems that we should be sending the crew to a High rad out temp procedure

G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION

ADMIN - 107 Expires 9-16-67

PROCEDURE



SYMPTOM	PROCEDURE	REMARKS
<p>21. (CONT'D)</p>	<pre> graph TD 15["15 MANUALLY OPEN BACK PRESS. VALVE • GLY EVAP - STEAM PRESS AUTO SW - MAN • GLY EVAP - STEAM PRESS - INCR SW - DECR"] --> 16["16 BACK PRESS. SECTION OF EVAPORATOR FAILED"] 16 --> 17["17 ATTEMPT DUCT THAW • GLY EVAP - H2O FLOW SW - OFF (CENTER) • SET STEAM PRESS SW - AUTO • REORIENT SC STEAM DUCT TO SUN"] 17 --> 18["18 STEAM DUCT FROZEN"] 18 --> 19["19 REDUCE SC POWER • POWER DOWN SC • ORIENT RADIATOR TO DEEP SPACE EVAP OUT TEMP > 60"] 19 --> 20["20 GO TO SECONDARY LOOP OPERATION PRIOR TO INC. LOADS OR PRIOR TO ENTRY PREP."] 19 --> 21["21 GO TO SECONDARY LOOP OPERATION"] 20 --> 21 </pre> <p>WARNING EXCESSIVE MANEUVERING MAY DEplete FUEL SUPPLY</p> <p>⑤ USE T/MU TO VERIFY PROPER WATER CONTROL. CHECK ALL EVAPORATOR MEASUREMENTS FOR COMPLETE VERIFICATION OF PROPER OPERATION.</p> <p><i>Do we need this?</i></p>	

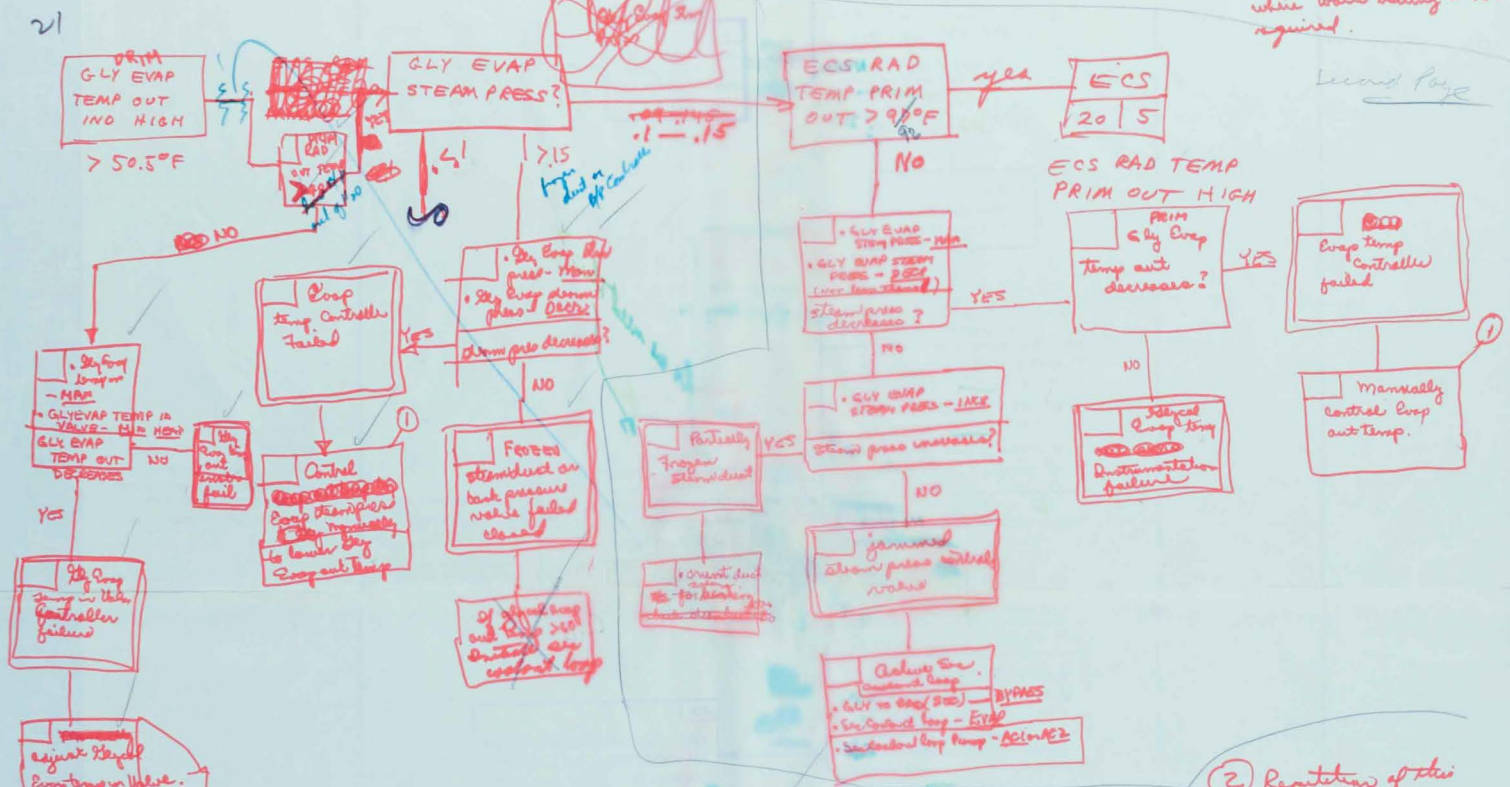
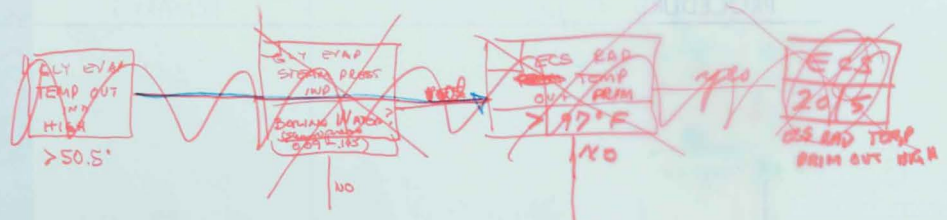
- G&N MALFUNCTION
- SCS MALFUNCTION
- SPS MALFUNCTION
- RCS MALFUNCTION
- EPS MALFUNCTION
- T/C MALFUNCTION
- ECS MALFUNCTION
- SEQ MALFUNCTION

Source fault -
water fault -

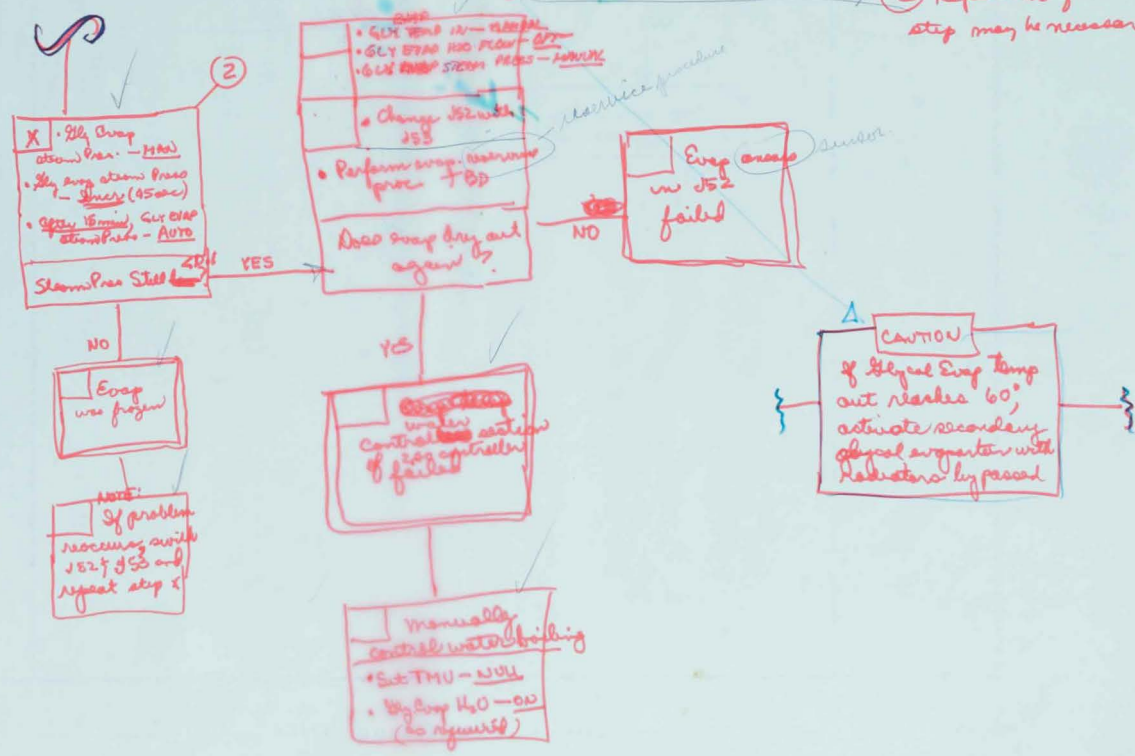
BLE controller fault
Sensor fault

① Reduction of electrical loads may reduce evaporator temp ~~to~~ ^{to} point where water boiling is not required.

Second Page



② Reiteration of this step may be necessary



adjust Range Evap temp in Valve. to increase Prim evap out temp between 55 and 60°

NOTE: If problem recurring with J52 & J53 and repeat step 1

CAUTION
If Glycol Evap temp out reaches 60°, activate secondary glycol evaporator with Radiators by passal

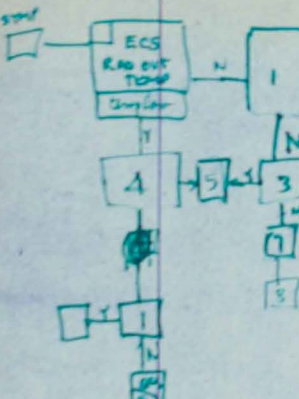
Manually control water boiling
Set TMU - 0.01
Glycol H₂O - 0.00 (no required)

SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK

revised 11/29
 of, new, see
 minor, for
 as new procedure
 look of page 23

why didn't we
 look at rad out
 temp first

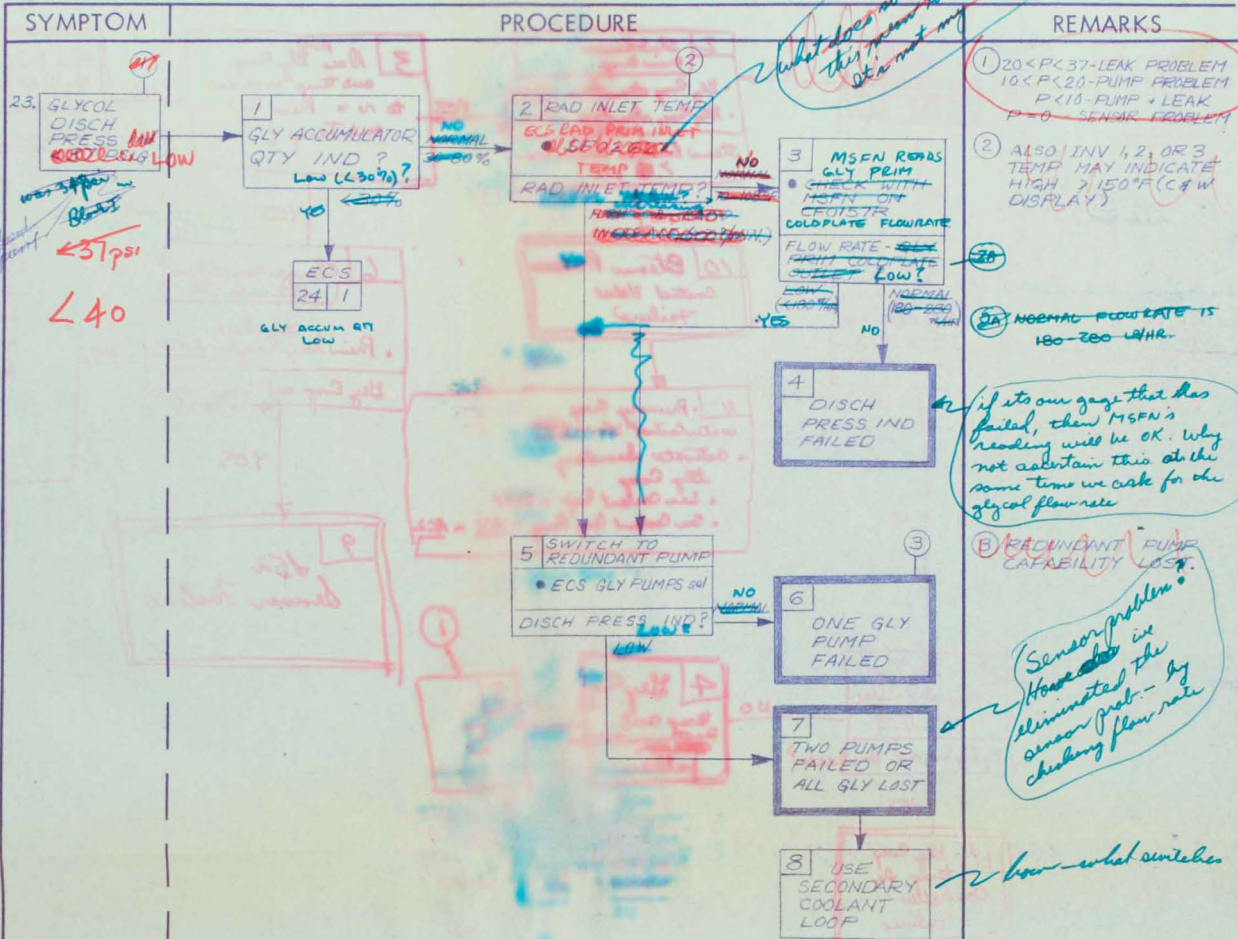
Will be off by 10
 temp be correct by:
 1) manual temp
 2) temp of gly temp in
 into factory in gas flow panel



How far the procedure
 at this point distinguished
 a gap failure
 how we want to narrow
 with temp with the TMO
 to distinguish between
 temp failure and
 the pressure controller
 failure

SYMPTOM	PROCEDURE	REMARKS
22 GLY EVAP TEMP OUT IN < 40 °F NORMAL EVAP OUTLET TEMP 40 - 50.5 °F MODES: EVAPORATE: TEMP 40-48 °F MIXING: TEMP 42-48 °F	1 PLUG IN REDUNDANT SENSOR EVAP OUT TEMP IS 40-50.5 °F YES → 2 NO → 3 3 PLUG IN EVAP TEMP MEAS UNIT • SW - INLET EVAP IN TEMP YES → 4 NO → 5 4 INCREASE EVAP STEAM PRESS • GLY EVAP TEM IN VAL - HEAT (CW) IS EVAP OUT TEMP < 40 °F YES → 7 NO → 8 8 INCREASE STEAM PR. • GLY EVAP STEAM PRESS - AUTO SW - MAN • GLY EVAP-STEAM PRESS - INCR SW - INCR IS EVAP STEAM PRESS ? < 0.05 PSI YES → 9 NO → 11 11 IS EVAP OUTLET TEMP ? < 40 °F YES → 12 NO → 15 12 MAN CONTROL OF BACK PRESS CONTROL VALVE REQUIRED 15 SWITCH TO SEC ECS • SW TO SEC PUMP • TURN PRI PUMP - OFF	1 REDUNDANT SENSOR CAPABILITY LOST 2 MANUAL CONTROL OF VALVE IS REQUIRED 3 POSSIBLE RADIATOR HEATER FAILURE. 4 ALLOW 15-30 MIN FOR EVAP TO THAW 5 CAUSED BY FAILED ITEM 2.40 OR ELSE BACK PRESS VALVE STUCK OPEN. 6 EVAP THAW WAS UNSUCCESSFUL. MAY POWER UP EC AND STAY ON PRIM COOLANT LOOP OR GO TO SEC LOOP AND RETURN AFTER PRIM EVAP IS THAWED.

GEN
 MALFUNCTION
 SC5
 MALFUNCTION
 SPS
 MALFUNCTION
 RCS
 MALFUNCTION
 EPS
 MALFUNCTION
 T/C
 MALFUNCTION
 ECS
 MALFUNCTION
 SEC
 MALFUNCTION



G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION

UAA number 11/17
glo, gl, nuc

was 50 psi
← 37 psi
← 40

What does normal thing like this mean to a crewmember? It's not my transducer + my gauge!

① 20 < P < 37 - LEAK PROBLEM
10 < P < 20 - PUMP PROBLEM
P < 10 - PUMP + LEAK
P = 0 - SENSOR PROBLEM

② ALSO INV 1, 2, OR 3 TEMP MAY INDICATE HIGH > 150°F (C&W DISPLAY)

③ NORMAL FLOW RATE IS 180-200 L/HR.

if its our gauge that has failed, then MSEN's reading will be OK. Why not calibrate this at the same time we ask for the glycol flow rate

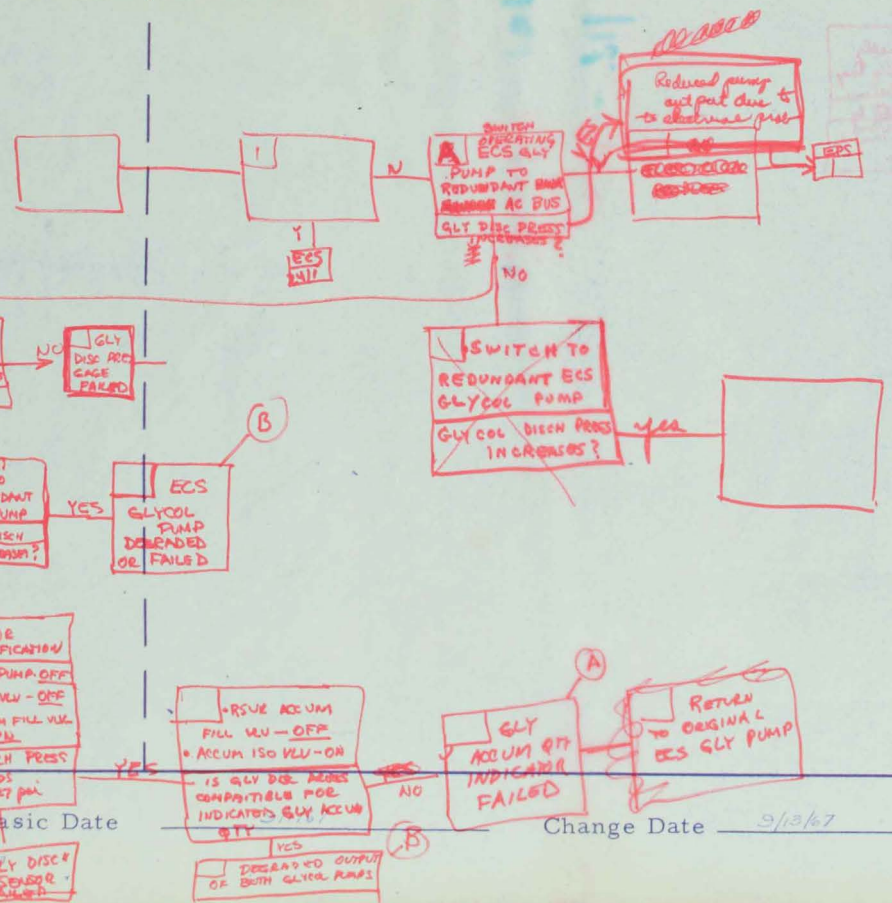
④ REDUNDANT PUMP CAPABILITY

Sensor problem - hose that is eliminated the sensor prob. - by checking flow rate

how what switches

⑤ GLY ACCUM QTY INDICATION MAY BE ESTIMATED BY GLY DISCH PRESS READING WITH ECS ON PUMP OFF

⑥ DEGRADED GLY PUMPS MAY BE VERIFIED BY CHECKING GLY PEIM COLDPLATE FLOWRATE WITH MSEN.



Basic Date

Change Date 9/13/67

Page

22

PCS RAD TEMP
PRIM OUT
< 40°

- Reaction to Problem
1. Isolation
 2. Lower inlet temp
 3. Mapping error
 4. Sensor

GLY EVAP
TEMP OUT low
< 40°F

1
~~Shutdown
Prin Pump~~

2
~~Shutdown
Prin Pump~~
• Gly Temp abnormal - HAN
• Gly Temp abnormal - DCA
• Steam Pressure abnormal
7.0, 1.6

3
Does Gly Temp
out temp increase
to re = Prim Rad
out Temp?

4
Prin
Gly Temp low
Instrumentally
Failure

5
Radical
Prin Temp
• Gly Temp low
Prin - GCS

19
Control
Failure

16
Gly Temp
Temp out
Decreases?

12
Gly Temp
Decreases - HAN
• Gly Temp from
Low - Over (100%)
Steam Press increases?

10
Steam Pressure
Control Value
Failure?

6
Change controller
V02 with V03
• Prin Gly Temp - AUTO
Gly Temp out Temp Normal
(40-50.5)

①
Proper
Operation of the
Glycol Temp must
be obtained from
HAN and Prim
Rad Inlet temp.

7
Gly
Temp Controller
(2.00 Controller)
Failure

8
Manually
Control
Temperature
• Gly Temp from HAN
• Gly Temp abnormal
Inlet - DCA by
RWS (100%)

11
Primary Glycol
water control Val - OFF
• activate standby
Gly Temp
• Inlet Glycol Temp - EVAP
• Inlet Glycol Temp - AC1 - AC2

9
152
Sensor Failure

13
Gly Temp
Temp out - Value
- MAX TEMP
Gly Temp out Decreases?

4
Gly Temp
Temp out
Decreases
Failure

5
5

14
Gly Temp
Temp in
Controller
Failure

15
Manually
control Gly Temp
out (between
25 and 30) by
adjusting temp
in valve

25 & 30

17
Gly Temp
Temp out
Decreases
Failure

18
Gly Temp
Temp out
Decreases
Failure

19
Gly Temp
Temp out
Decreases
Failure

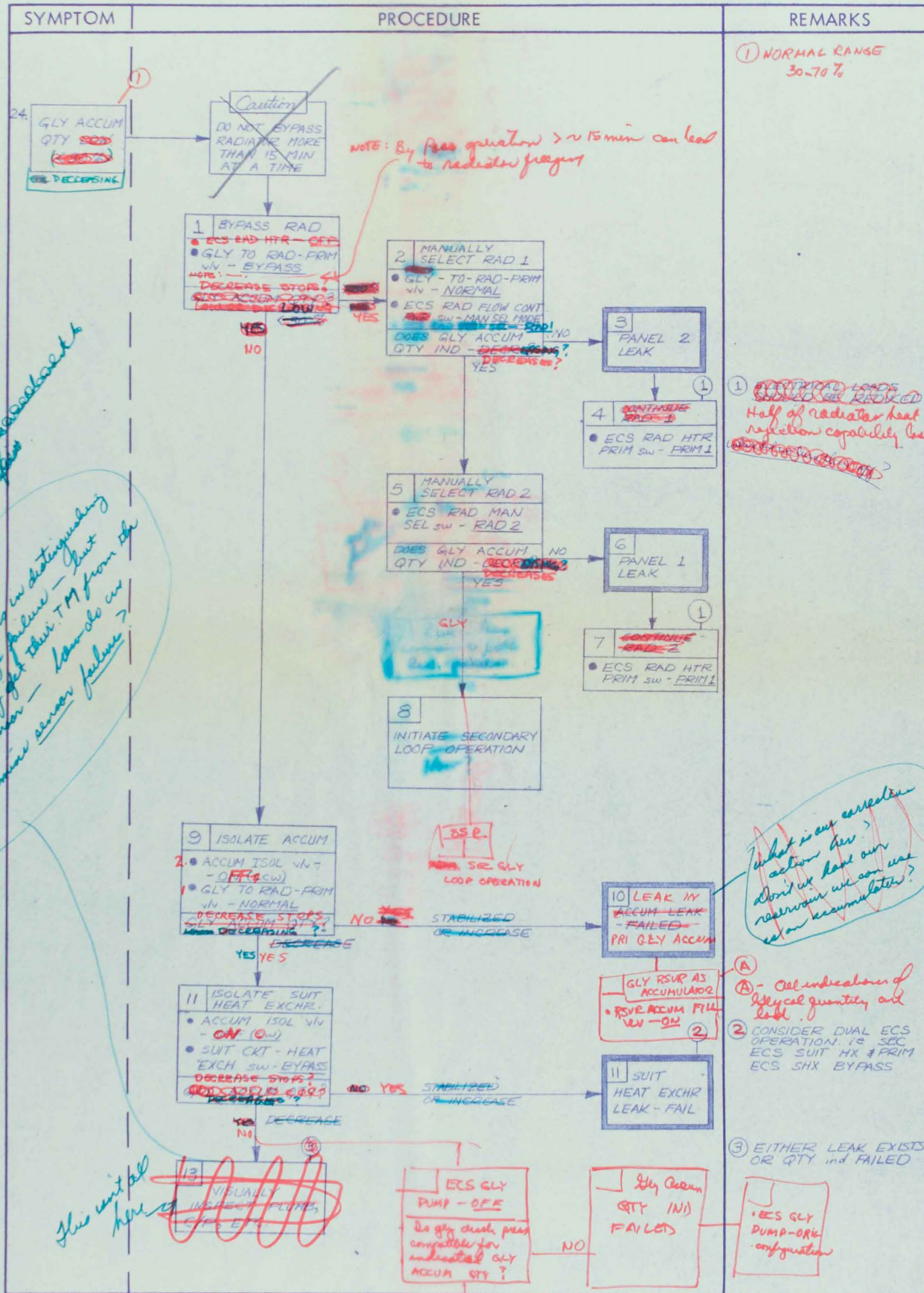
20
Gly Temp
Temp out
Decreases
Failure

No backflow
in
the
line
of
the
valve

Include proc for
change controller
V02 with V03

APOLLO OPERATIONS HANDBOOK

G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION



of 11/11/67
revised 11/17/67
of, new, etc.

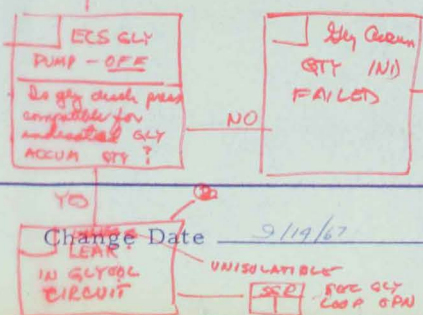
MSFN can aid in distinguishing since they get their TM from the same sensor - however can determine sensor failure

this unit all here

NOTE: By pass operation > 15 min can lead to radiator freeze



BSP. SEC GLY LOOP OPERATION



SYMPTOM	PROCEDURE	REMARKS
<p>25 GLY ACCUM QTY HIGH</p> <p><i>Handwritten:</i> Normal >70%</p>	<p>1 TRANSFER GLY TO RSVR</p> <ul style="list-style-type: none"> RSVR ACCUM FILL VLV GLY RSVR-IN VLV OPEN THRU CLOSED <p>NOTE: DECREASE TO NORMAL</p> <p>GLY ACCUM QTY</p> <p><i>Handwritten:</i> NO 30-70% YES</p> <p>2 GLY ACCUM QTY INDICATOR FAILURE</p> <p><i>Handwritten:</i> NO CHANGE >70%</p> <p>3 ISOLATE RSVR</p> <ul style="list-style-type: none"> GLY RSVR-IN VLV CLOSE <p>GLY ACCUM QTY?</p> <p><i>Handwritten:</i> INCREASE NORMAL 30-70% NO</p> <p>4 PRIM ACCUM FILL VLV OFF</p> <p><i>Handwritten:</i> INCREASE YES</p> <p>5 RSVR ACCUM VALVE LEAK FAILURE FILL VLV LEAKING</p> <p>6 PRIM ACCUM FILL VLV POSITION WRONG</p> <p>7 SHUTOFF PRIM ACCUM FILL</p> <ul style="list-style-type: none"> PRIM ACCUM FILL VLV OFF <p>GLY ACCUM QTY?</p> <p><i>Handwritten:</i> YES INCREASE NO STABLE</p> <p>8 STATUS OK</p> <ul style="list-style-type: none"> REPEAT STEP 1 AS NECESSARY IF LEAK RATE IS LARGE! RSVR ACCUM FILL VLV ON <p><i>Handwritten:</i> TRANSIENT CONDITION CAUSED INCREASE IN ACCUM QTY</p>	<p><i>Handwritten:</i> NOTE</p> <p>GLY RSVR-IN VALVE SHOULD BE RAPIDLY CRACKED OPEN & THEN CLOSED IN ORDER TO GET 30 TO 70% FULL AT GLY ACCUM</p>

Handwritten: 11/17/67

G&N MALFUNCTION

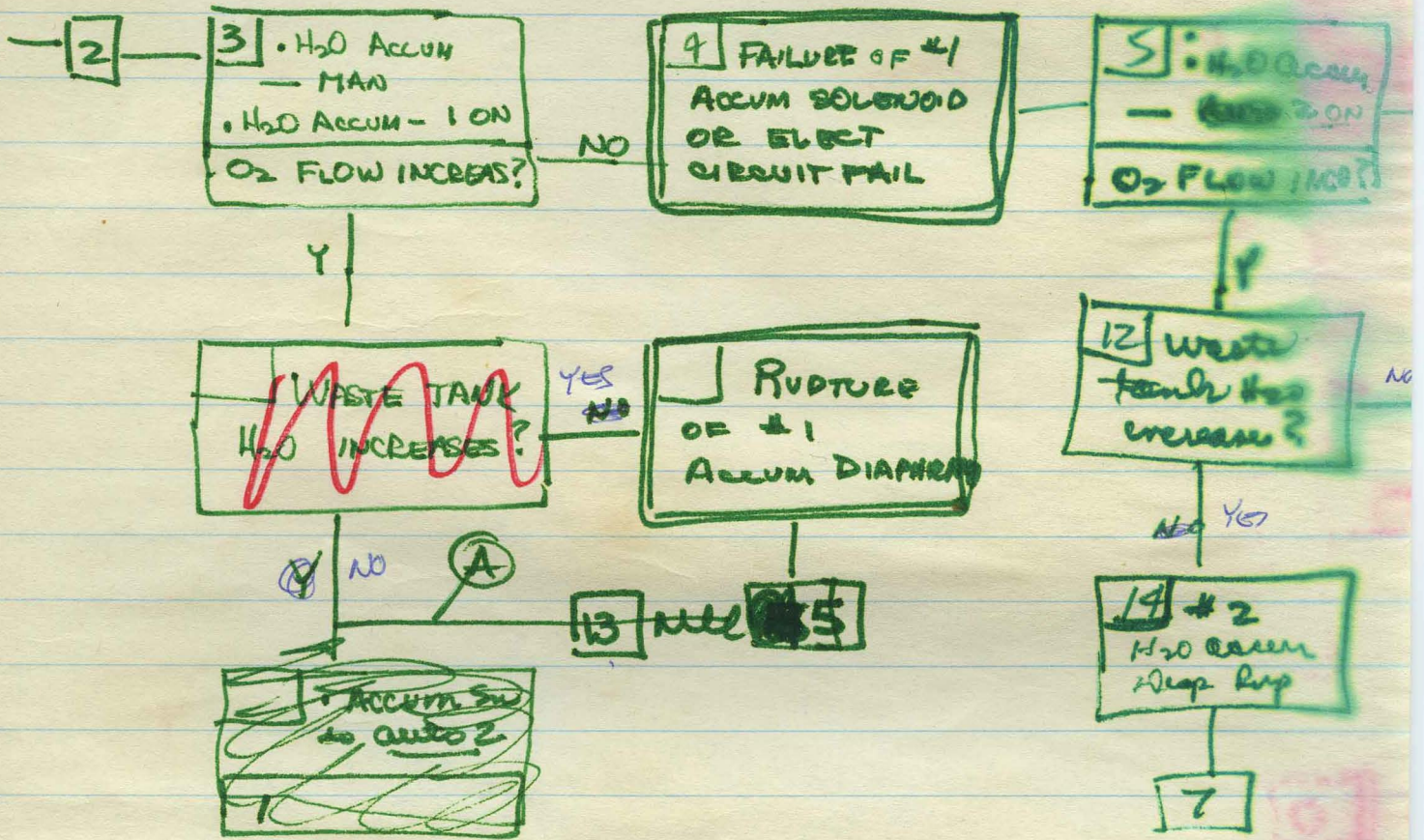
SCS MALFUNCTION

SPS MALFUNCTION

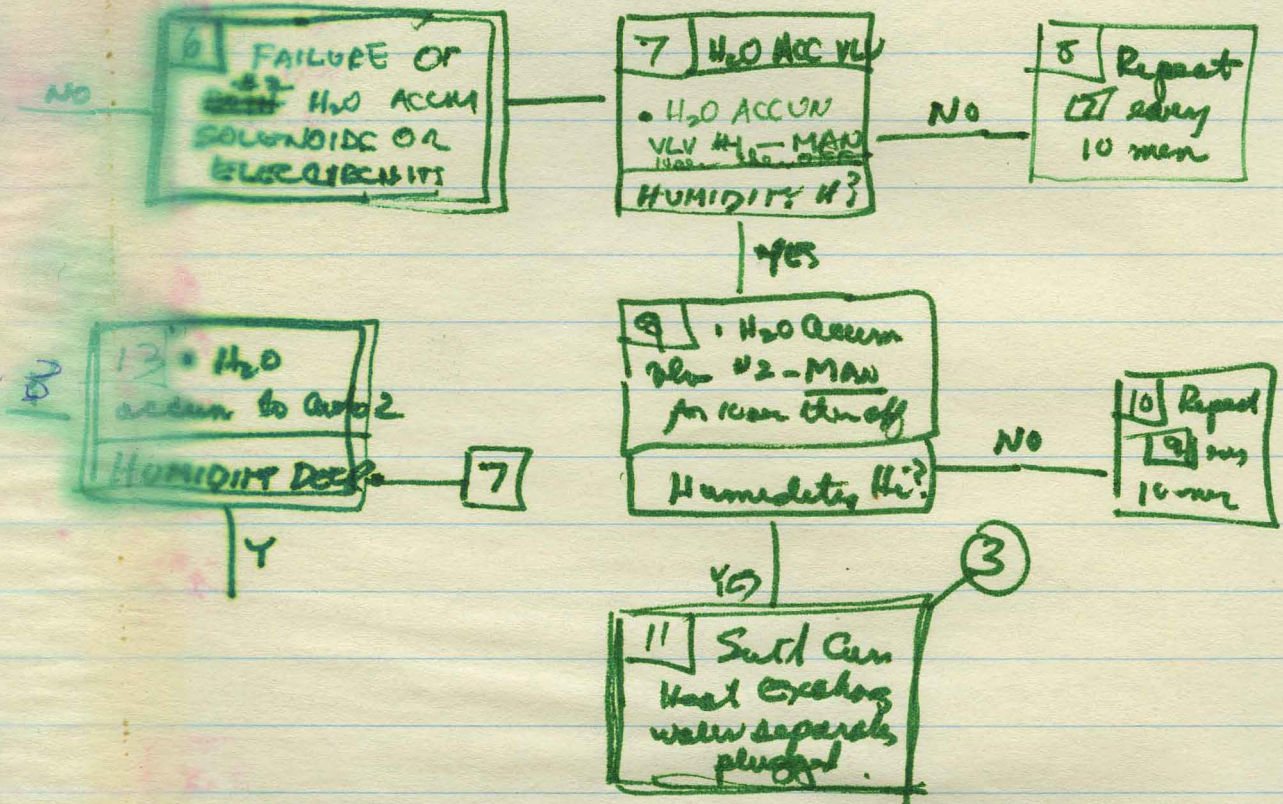
RCS MALFUNCTION

EPS MALFUNCTION

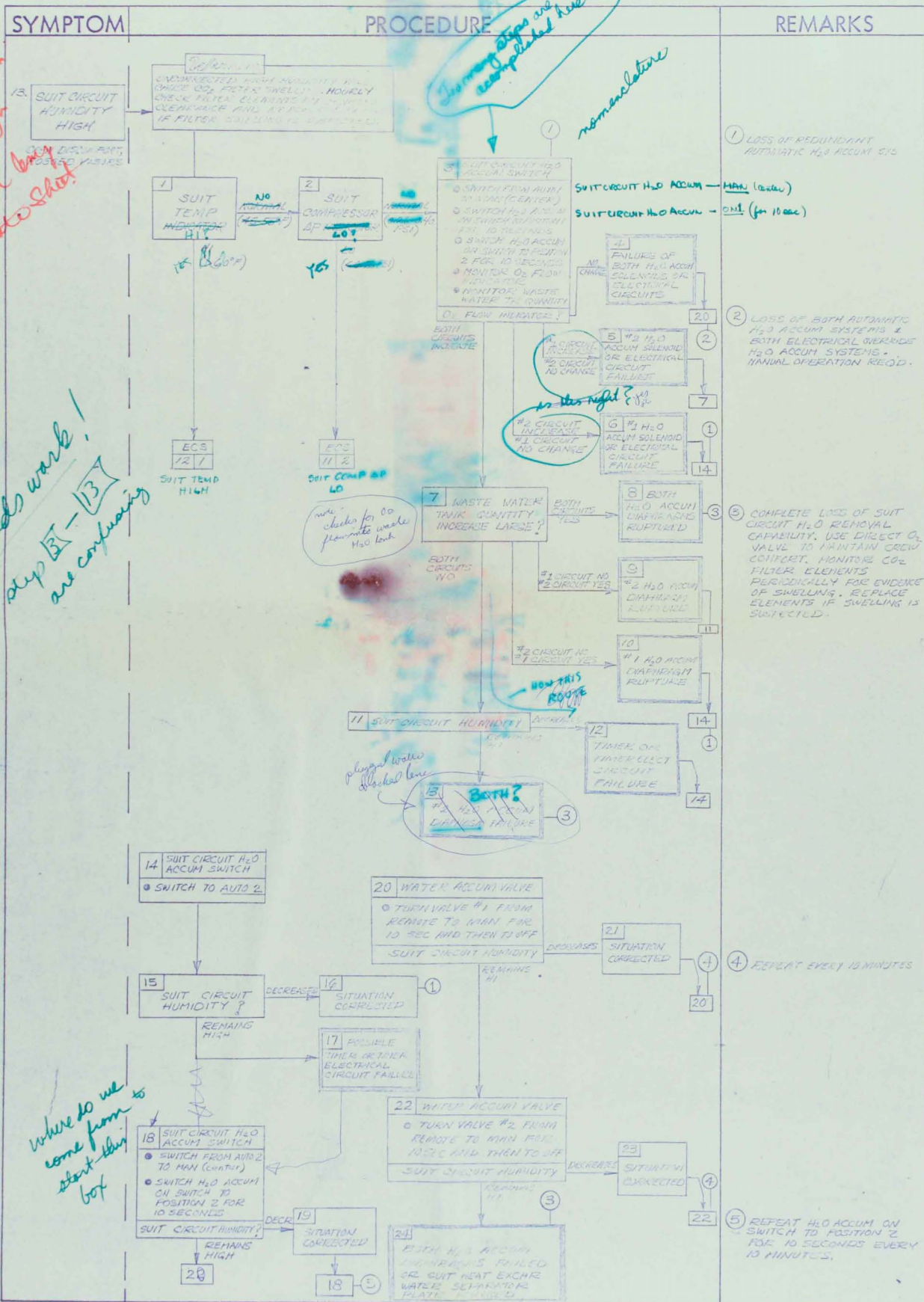
T/C MALFUNCTION



(A) #1 Accum Serv, operate in manual pass valve only.



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G&N	MAJORITY
SCS	MAJORITY
SPS	MAJORITY
RCS	MAJORITY
EPS	MAJORITY
T/C	MAJORITY
ECS	MAJORITY
SFO	MAJORITY

ADDA101-167 1 pages 9-15-67

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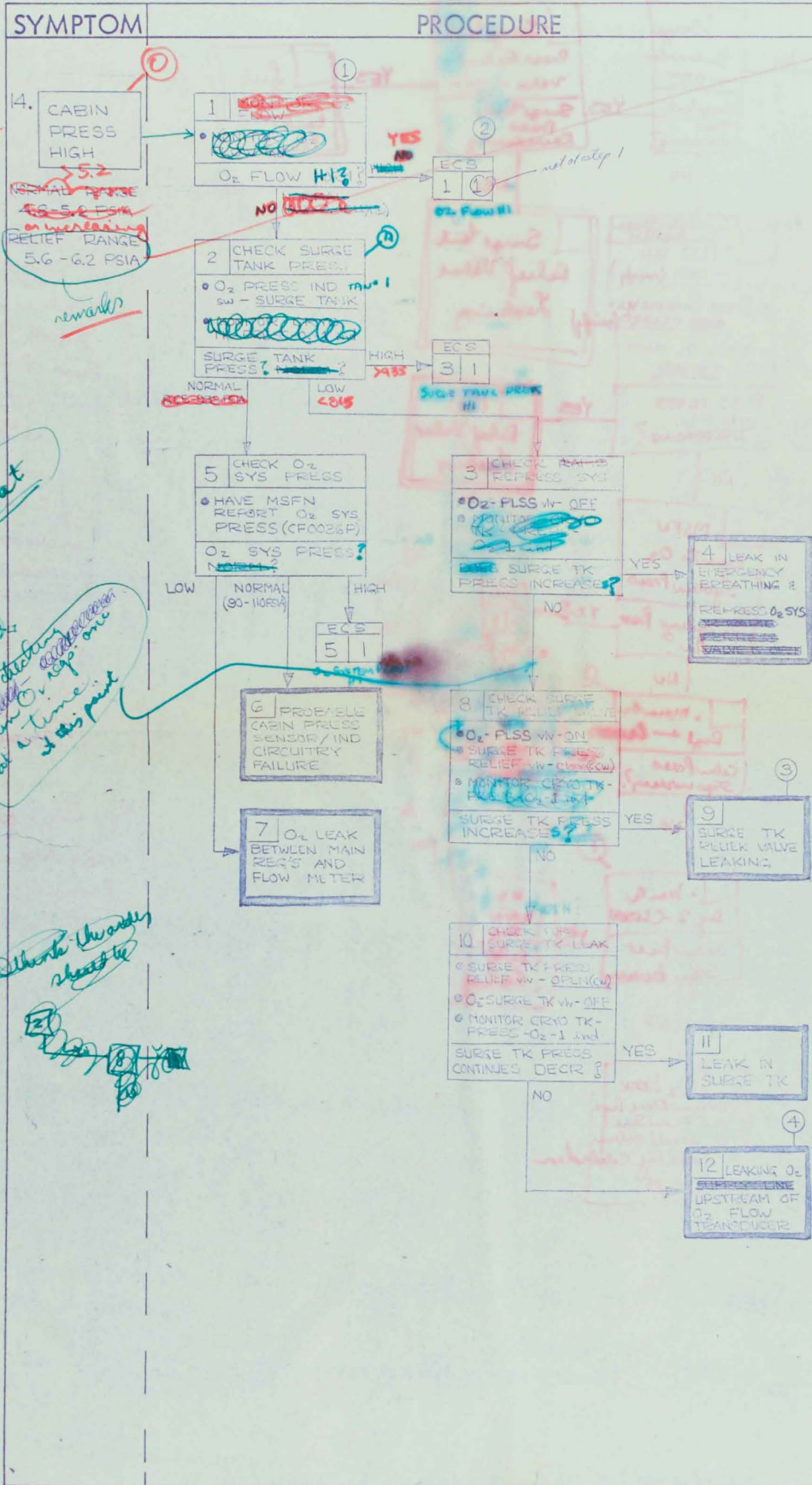
① Cabin Press > 5.2
 as normal after
 insertion

jis
 11/10
 removed
 17/11/67
 no, more,

Format

How about discontinue
 main O₂ supply
 at a time
 of this point

Should be used
 sheet to



① O₂ FLOW HI STATUS LIGHT ON AT FLOW RATE > 1.0 LB/HR

② MALFUNCTION OR LEAK DOWNSTREAM OF O₂ FLOW TRANSDUCER

③ REQUIRES MONITORING OF SURGE TK IF SURGE TK IS ISOLATED

④ IF LEAK IS NOT ISOLATED & CONTINUES TO DEplete O₂ SUPPLY, MISSION TIME MAY BE EXTENDED BY SHUTTING OFF THE MAIN O₂ REG'S (OR O₂-SYM SUPPLY VALVE IF LEAK IS UPSTREAM OF MAIN REG'S) AND OPENING VALVE AS GWT CREW MUST BE SWITCHED & CO₂ LEVEL CLOSELY MONITORED. IF O₂-SYM SUPPLY VALVE IS TURNED OFF ISOLATE SURGE TANK TO MAINTAIN SURGE TK PRESS. IF MAIN O₂ REG'S ARE SHUT OFF ISOLATE WATER & GLYCOL TK'S PRESS TO RETAIN SYS OPERATION, BUT CYCLE OPEN EACH TIME O₂ CYCLED ON.

C&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SFO	MALFUNCTION

AA-1111-107 Expires 9-16-67

#14

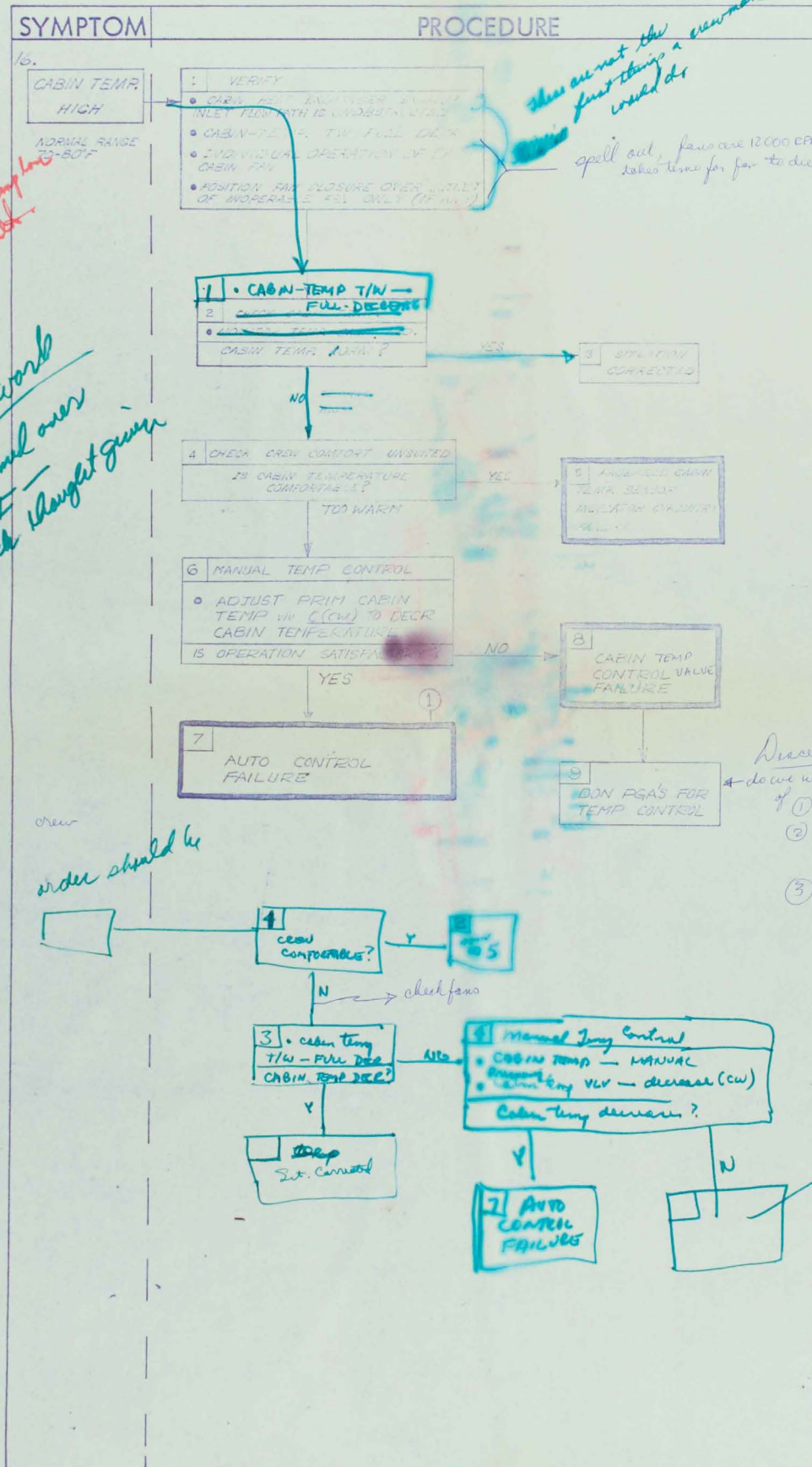


① This step may require consultation

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8/11-10
 NMA review
 12/16/67
 jls
 combined with temp loop
 and humidity

Needs work
 Just a warm over
 Bledt
 not much thought given



C&N
 SCS
 SPS
 RCS
 EPS
 T/C

MALFUNCTION
 MALFUNCTION
 MALFUNCTION
 MALFUNCTION
 MALFUNCTION
 MALFUNCTION
 MALFUNCTION

SM2A-03-SC101-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>7. CABIN TEMP LOW</p> <p>NORMAL RANGE 70 - 80°F</p>	<p>1 VERIFY</p> <ul style="list-style-type: none"> CABIN HEAT EXCH EXHAUST FLOW PATH UNOBSTRUCTED CABIN TEMP TW ± 1 INCH INDIVIDUAL OPERATION OF EACH CABIN FAN POSITION FAN CLOSURE OVER OUTLET OF INOPERABLE FAN ONLY (IF ANY) <p>2 CHECK CABIN TEMP</p> <ul style="list-style-type: none"> MONITOR TEMP - CABIN and CABIN TEMP NORM? <p>3 SITUATION CORRECTED</p> <p>4 CREW COMFORT UNSUITED</p> <p>IS CABIN TEMP COMFORTABLE?</p> <p>YES → 5 PROBABLE CABIN TEMP SENS AND CIRCUITRY FAILURE</p> <p>NO → 6 CONTROL TEMP MANUALLY</p> <ul style="list-style-type: none"> ADJUST PRIM CABIN TEMP VIA H (CCW) TO INCREASE CABIN TEMP OR C (CW) TO DECREASE CABIN TEMP <p>IS MANUAL CONTROL EFFICAC?</p> <p>YES → 7 AUTO CONTROL FAILURE</p> <p>NO → 8 CABIN TEMP CONTROL VALVE FAILURE</p> <p>9 DON PGA'S FOR TEMP CONTROL</p>	<p>1 CONTINUE MANUAL CABIN TEMP CONTROL</p>

*glo 11/10
 NAA reviewer 12/10/67
 -26*

Some comments as procedure 16

*1) crew comfortable - cover mess
 2) Auto control check - hand response
 3) Manual control - check
 4) fan ops
 5) Primary log book
 6) Secondary log book
 7) PGA's*

not noted as log cannot

C&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
BCS	MALFUNCTION
SEC	MALFUNCTION

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 APOLLO OPERATIONS HANDBOOK

10
 G&N MALFUNCTION
 SCS MALFUNCTION
 SPS MALFUNCTION
 RCS MALFUNCTION
 EPS MALFUNCTION
 T/C MALFUNCTION
 ECS MALFUNCTION
 SEQ MALFUNCTION

SYMPTOM	PROCEDURE	REMARKS
8. CO ₂ FILTER SEIZURE WITHIN CANISTER	1. PULL ON FILTER STRAP OR APPLY MECHANICAL ADVANTAGE. IS FILTER FREE? YES NO CONTINUED USE OF SEIZED FILTER AGGRAVATES SITUATION BY FURTHER ABSORBING WATER AND INCREASING PRESSURE DROP THROUGH DECREASED SCA FLOW RATE 3. REPLACE FILTER CHECK OTHER FILTER FOR CLEARANCE OPERATOR SUIT FLOW RELIEF VALVE UNDESIRABLE 4. EXCESSIVE SWELLING OF CO ₂ FILTER	① EXCESSIVE SWELLING OF CO ₂ FILTER DUE TO EXCESS ABSORPTION OF WATER. FLOW RELIEF VALVE AN INSUFFICIENT CO ₂ ABSORPTION ② IMMEDIATELY REPLACE A FILTER SUSPECTED OF SWELLING
8.	2. SINGLE CANISTER OPERATION SUIT FLOW RELIEF VALVE OFF DIVERTER VALVE TO SUIT FLOW THROUGH BOTH CANISTERS DIVERT FLOW THROUGH SEIZED FILTER MOMENTARILY WHEN REPLACEMENT OF OPERATIONAL FILTER IS REQUIRED MONITOR CO ₂ PP AND INDICATOR AS CO ₂ CANISTER REPLACEMENT INDICATOR. Caution SINGLE CANISTER OPERATION NECESSITATES OPERATIONAL FILTER REPLACEMENT EVERY 12 HOURS OR LESS	

initial gas
 11/10
 m.a. review
 11/15
 gl, ruc, jh

We should look to condense this into a smaller page

it would be better to replace a canister than to go the other way. The single canister will put more water in the suit. Then flow for the suit loop. The suit loop is not good for suited operations.

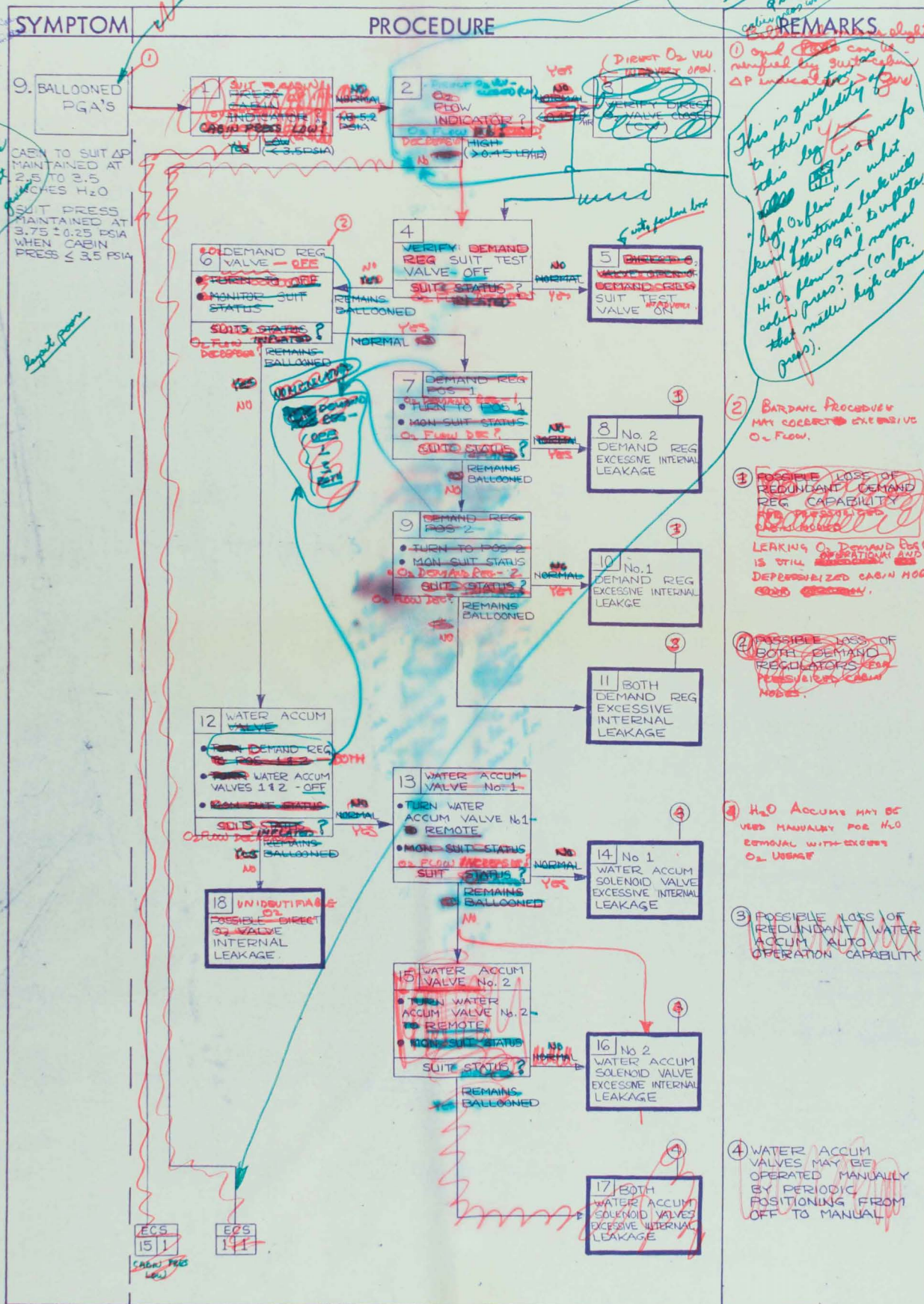
we cannot leave it as flow is thru one side only with both sides pressurized. Bypass will flow up to 50%.

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could not 1 down
 my fuel gauge and
 give inflated rate 1/2
 or more
 1/2-1/4
 1/2-1/4
 1/2-1/4

11/10/67
 NAA review
 4/14
 This is a blank
 since put into logic
 much thought - not
 sure

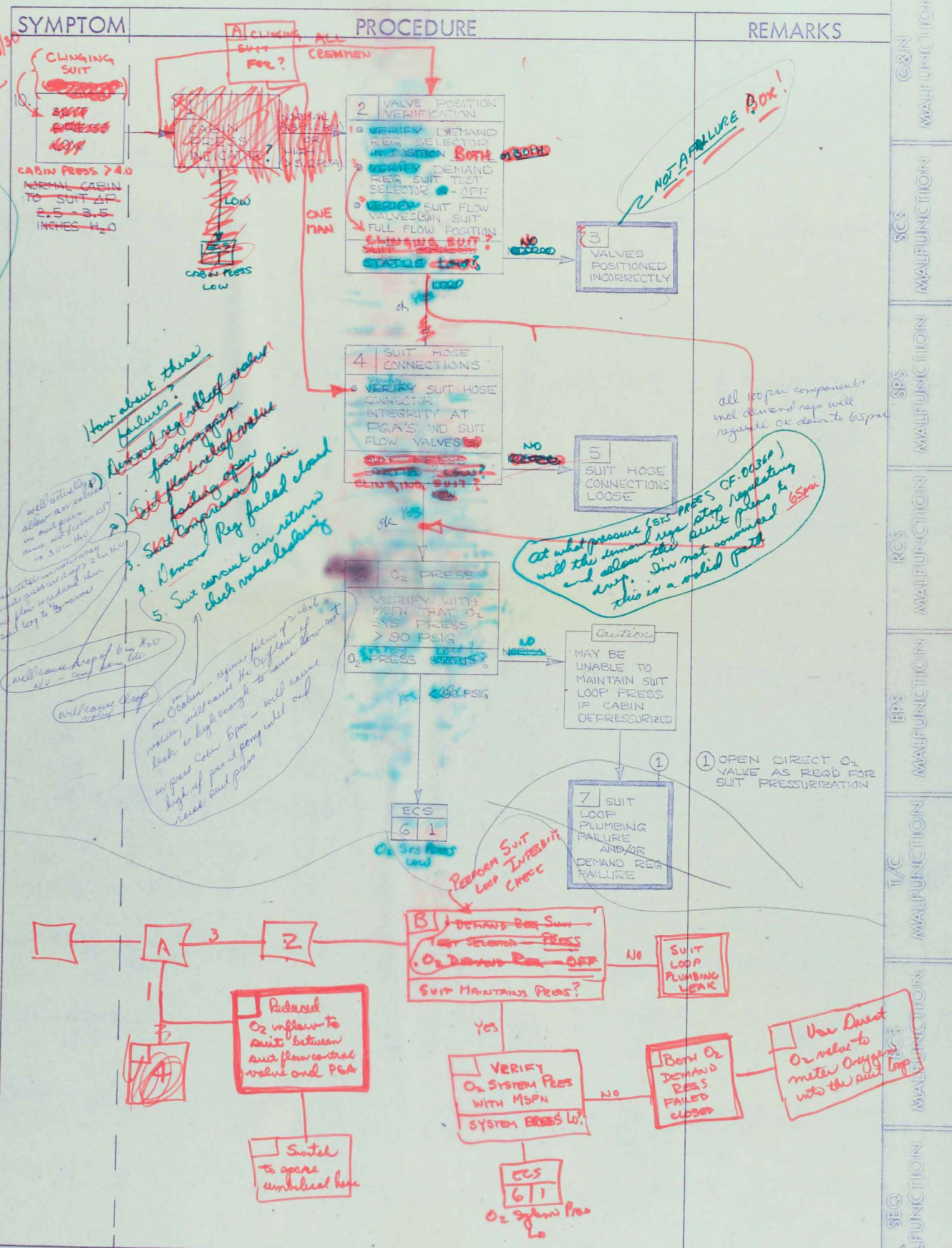


G&N MALFUNCTION
 SCS MALFUNCTION
 SPS MALFUNCTION
 RC MALFUNCTION
 EPS MALFUNCTION
 T/C MALFUNCTION
 EGS MALFUNCTION
 SEQ MALFUNCTION

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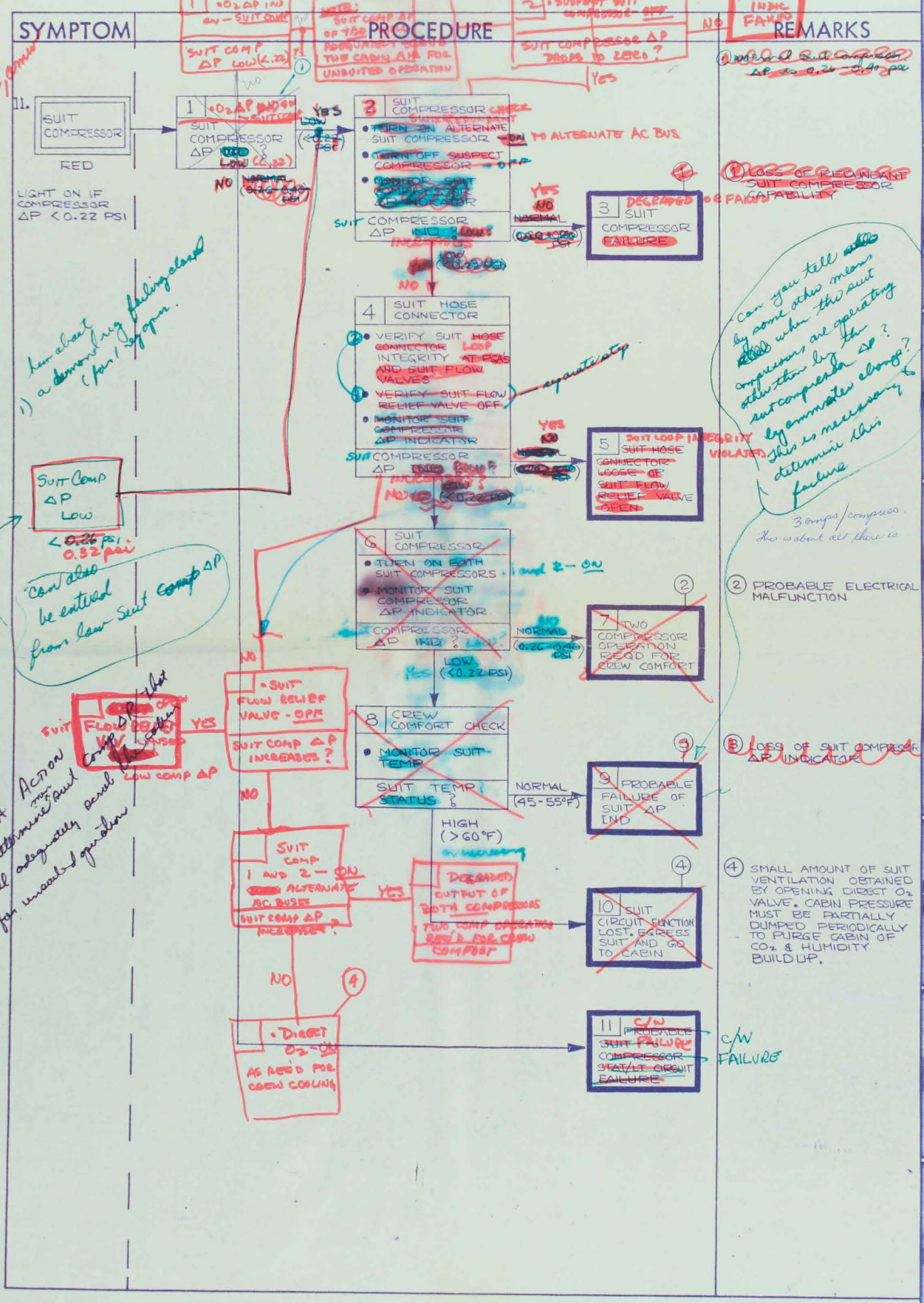
Who let
 go, new, owner
 App more
 work



G&N MALFUNCTION
 SCS MALFUNCTION
 RCS MALFUNCTION
 EPS MALFUNCTION
 T/C MALFUNCTION
 SCS MALFUNCTION
 SCS MALFUNCTION

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- G&N MALFUNCTION
- SCS MALFUNCTION
- SFS MALFUNCTION
- RGS MALFUNCTION
- EPS MALFUNCTION
- T/C MALFUNCTION
- EGS MALFUNCTION
- SEQ MALFUNCTION

*revised 11/30
 for new sec comm*

*low about
 a demanding failing class
 fan 1/2 open.*

*Can also
 be entered
 from low Suit Comp ΔP*

*NAA Action
 will determine fault
 will subsequently send
 for unavail question*

*Can you tell
 by some other means
 when the suit
 compressors are operating
 other than by the
 suit compressor ΔP?
 If affirmative, is
 this necessary to
 determine this
 failure*

*3amps/compress
 this is what all there is*

*2) PROBABLE ELECTRICAL
 MALFUNCTION*

*3) LOSS OF SUIT COMPRESSOR
 ΔP INDICATOR*

*4) SMALL AMOUNT OF SUIT
 VENTILATION OBTAINED
 BY OPENING DIRECT O2
 VALVE. CABIN PRESSURE
 MUST BE PARTIALLY
 DUMPED PERIODICALLY
 TO PURGE CABIN OF
 CO2 & HUMIDITY
 BUILDUP.*

*C/W
 FAILURE*

AD7411 - 167 (Apr 67) 9-15-67

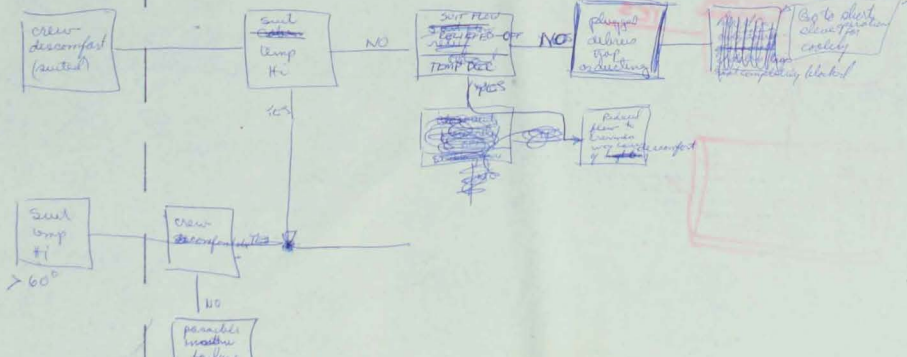
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 APOLLO OPERATIONS HANDBOOK

*NAA review
 Also go, rule, etc. omw*

SYMPTOM	PROCEDURE	REMARKS	Category	
12. SUIT CIRCUIT TEMP HIGH CREW UN COMFORTABLE	1 SUIT TEMP IND HIGH? NO YES YES NO YES NO YES NO	2 PRIMARY GLYCOL EVAPORATOR OUTLET TEMP? NORMAL (40-50°F) HIGH (>50.5°F) ECS 23 1 SUIT TEMP OUT HIGH	G&N MALSFUNCTION	
	3 PRIMARY GLYCOL DISCH PRES. NORMAL LOW (<37 PSIG) ECS 23 1 GYT DISC. PRES Low.	4 VALVE POSITION VERIFICATION 4 VERIFY SUIT FLOW RELIEF VALVE - OFF 5 VERIFY SUIT HEAT EXCHANGER GLYCOL VALVE IN BARGE 6 VERIFY SUIT HEAT EXCHANGER VALVE IN BARGE 6 VERIFY SUIT HEAT EXCHANGER VALVE IN BARGE 6 VERIFY SUIT HEAT EXCHANGER VALVE IN BARGE 6 VERIFY SUIT HEAT EXCHANGER VALVE IN BARGE SUIT TEMP HIGH HIGH (>50°F)	How about position of suit circuit heat exchanger switch - ON <i>do we need this?</i> INCOMPLETE	SCS MALSFUNCTION
		5 INCORRECT VALVE POSITION NO	① LOSS OF SUIT TEMP INDICATOR	RCS MALSFUNCTION
		6 MAIN RELIEFS GLYCOL FLOW INDICATION (CFOWSVR) LOW 7 23 1	PROBABLE INSTRUMENTATION FAILURE	EPS MALSFUNCTION
		7 23 1 23 1 23 1	① No humidity as CO2 control in this condition	T/C MALSFUNCTION
		8 23 1 23 1 23 1		ECS MALSFUNCTION
		9 23 1 23 1 23 1		SEC MALSFUNCTION

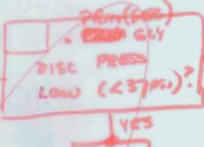
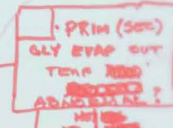
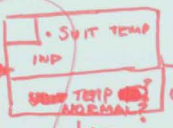
What do we do if we can't get control via the primary glycol?
 What about using the secondary system to cool the suits?

How we checked for:
~~1) ...~~
 2) ...
 3) ...
 4) ...
 5) ...
 6) ...
 7) ...



FORM 15-167 Expires 9-15-77

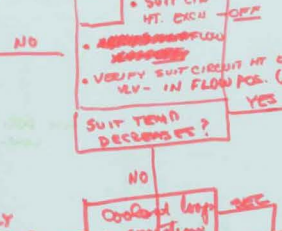
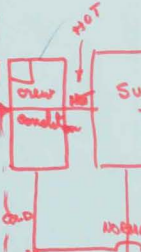
CREW UNCOMFORTABLE IN SUIT LOOP
COLD, HOT AND/OR HUMID



- ② In the prim ~~flow~~ Suit Ht. cycle mode, this failure could be caused by an ometer switch a motor failure
- ① Assumes Suit flow relief valve ~~is~~ OFF

look at in circuit with idea of deletion

12 CREW UNCOMFORTABLE IN SUIT LOOP



Suit Circuit Ht. Exch. not in By Pass Condition

WARN. (See 13d Bldg. pt)

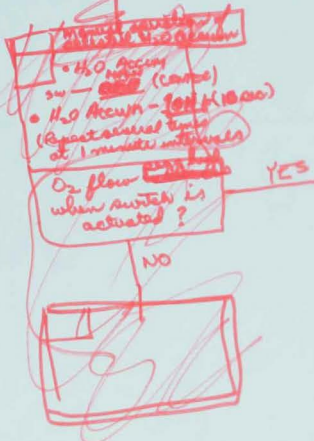


RESTRICTED FLOW IN SUIT BOY
If CO₂ PP increases > 7.5 , go to alert alarm operation and use emergency oxygen masks



Suit Circuit Ht. must be manually bypassed in the future.

12A Suit circuit Humidity High



WARNING
UNCORRECTED HIGH HUMIDITY WILL CAUSE CO₂ FILTER SWELLING. HOURLY CHECK FILTER ELEMENTS FOR CANISTER CLEARANCE AND REPLACE ELEMENTS IF FILTER SWELLING IS SUSPECTED