

Fort Hays State University

FHSU Scholars Repository

Apollo One Investigation Materials

Cosmosphere Collection

2-12-1968

Environmental Control System (ECS) Malfunction Procedures Symptom 1 to 37 - SSR1 + Notes - Feb. 12, 1968 Group

National Aeronautics and Space Administration (NASA)

Follow this and additional works at: <https://scholars.fhsu.edu/apollo>

Recommended Citation

National Aeronautics and Space Administration (NASA), "Environmental Control System (ECS) Malfunction Procedures Symptom 1 to 37 - SSR1 + Notes - Feb. 12, 1968 Group" (1968). *Apollo One Investigation Materials*. 4.

<https://scholars.fhsu.edu/apollo/4>

This Document is brought to you for free and open access by the Cosmosphere Collection at FHSU Scholars Repository. It has been accepted for inclusion in Apollo One Investigation Materials by an authorized administrator of FHSU Scholars Repository.

ORGANIZATION OF ECS HALF PROC

	NEW NO	OLD NO	PAGE	length		
A	1 L	1 R	1 1/2	1 pg 6l		O2 Flow Hi Line On
O2	1a R	1a L				O2 Flow IND Hi
	2 R	2 I	2	2l	11 1/2 l pg 2	O2 Flow IND Low
	3 R	4	2	3 1/2		SURGE TANK PRESS Low
	4 L	3	3	2l	12l	SURGE TANK PRESS High
	5 L	13	3	7l		CABIN PRESS IND HIGH
	6 R	14	3	3l		CABIN PRESS IND Low
CABIN SUIT CO2	7 R	15	4	8 1/2	12l	CREW UNCOMFORTABLE IN CABIN
	8 R	10	4	3 1/2		CLIMING SUIT
	9 L	11	5	7l	13l	SUIT COMPRESSOR LT ON
	9a L	11a	5			SUIT COMP ΔP LOW
	10 R	9	5	6l		BALLOONED PSA P
	11	12	6	9 1/2	13l	CREW UNCOMFORTABLE IN SUIT LOOP
	11a R	12a				SUIT CRT HUMIDITY HIGH
	12	7a	6	3 1/2 l		CO2 PP LITE ON
	12a R	7b				CO2 PP IND HIGH
	12b					CO2 PP IND LOW
	13 R	8	7	1 1/2		CO2 FILTER SEIZURE
	14	16	7	7 1/2	13p	GLYCOL TEMP LOW LT ON
	14a R	16a				PRIM ECS RAD OUT TEMP LOW
	15 R	17	7	4		PRIM ECS RAD OUT TEMP HIGH
	16 R	18	8	1 pg		PRIM GLY EVAP OUT TEMP HIGH
PRIM GLYCOL	17 R	19	9	7 1/2 l	12 1/2 l	PRIM GLY EVAP OUT TEMP Low
	18	22	9	5l		PRIM ACCUM QTY HIGH
	18a R	22a				PRIM GLY DISCH PRESS Hi
	19 L	21	10	8 1/2	12 1/2 l	PRIM GLY ACCUM QTY Low OR DECP
	20 L	20	10	3 1/2		PRIM GLY DISCH PRESS Low
	21 L	29	11	7 1/2	13l	SEC GLY EVAP OUT Temp HIGH

NOTE:
"CAN PUT
BALLOONED
PSA'S
SUIT COMP
18l

ORGANIZATION OF ECS MAINT PROC

	NEW NO	OLD NO	PRCE	length		
↑	1 L	1 R	1 1/2	1 pg 6L		O2 FLOW HI LITE ON
O2	1a L	1a L				O2 FLOW IND HI
	2 R	2 I	2	2L	11 1/2 L pg 2	O2 FLOW IND LOW
	3 R	4	2	3 1/2		SURGE TANK PRESS LOW
↓	4 L	3	3	2L		SURGE TANK PRESS HIGH
↑	5 L	13	3	7L	12L	CABIN PRESS IND HIGH
	6 R	14	3	3L		CABIN PRESS IND LOW
CABIN SUIT CO2	7 R	15	4	8 1/2	12L	CREW UNCOMFORTABLE IN CABIN
	8 R	10	4	3 1/2		CLINGING SUIT
	9 L	11	5	7L	13L	SUIT COMPRESSOR LT ON
	9a L	11a	5			SUIT COMP ΔP LOW
	10 R	9	5	6L		BALLOONER PSAD
	11 R	12	6	9 1/2	13L	CREW UNCOMFORTABLE IN SUIT LOOP
	11a R	12a				SUIT CRT HUMIDITY HIGH
	12 R	7a	6	3 1/2 L		CO2 PP LITE ON
	12a R	7b				CO2 PP IND HIGH
	12b					CO2 PP IND LOW
↓	13 R	8	7	1 1/2		CO2 FILTER SEIZURE
↑	14 R	16	7	7 1/2	13P	GLYCOL TEMP LOW LT ON
	14a R	16a				PRIM ECS RAD OUT TEMP LOW
	15 R	17	7	4		PRIM ECS RAD OUT TEMP HIGH
PRIM GLYCOL	16 R	18	8	1 PG		PRIM GLY EVAP OUT TEMP HIGH
	17 R	19	9	7 1/2 L	12 1/2 L	PRIM GLY EVAP OUT TEMP LOW
	18 R	22	9	5L		PRIM ACCUM QTY HIGH
	18a R	22a				PRIM GLY DISCH PRESS HI
	19 L	21	10	8 1/2	12 1/2 L	PRIM GLY ACCUM QTY LOW OR DECP
↓	20 L	20	10	3 1/4		PRIM GLY DISCH PRESS LOW
↑	21 L	29	11	7 1/2	13L	SEC GLY EVAP OUT TEMP HIGH

NOTE:
IF CAN PUT
BALLOONER
PSAD before
SUIT Comp
date

SEC GLYCOL	• 22 ^R	28	11	5 $\frac{1}{2}$ l		See GLY EVAP OUT TEMP LOW
	• 23 ^R	24	12	3 $\frac{1}{2}$ l		See ECS RAD OUT TEMP HIGH
	• 24 ^R	23 ^R	12	2 $\frac{1}{2}$ l	12 $\frac{1}{2}$ l	See ECS RAD OUT TEMP LOW
	• 25 ^R	26	12	2 $\frac{1}{2}$ l		See GLY ACCUM QTY HIGH
	• 26 ^R	25	12	4l		See GLY ACCU QTY LOW
↓	• 27 ^R	27	13	3 $\frac{1}{2}$ l		See GLY DISCH PRESS LOW
↑	• 28 ^R	32	13	5 $\frac{1}{2}$ l	13l	POT H ₂ O QTY DEC
H ₂ O	• 28a ^R	33	13			WASTE H ₂ O QTY DEC
	• 30 ^R	30	13	2l		ENTRAPPED GAS IN FOOD RECONST.
↓	• 31 ^R	31	13	2l		FOOD PREP H ₂ O TEMP LOW
	• 31 ^R	34	14	2 $\frac{1}{2}$ l		URINE O'ED DUMP NOT DRAINING
	• 32 ^R	35	14	2 $\frac{1}{2}$ l	9	VACUUM CLEANER SUCTION
MISC	• 32a ^R	35a	14			FECAL CANNISTER VACUUM LOW
	• 33 ^R	36	14	2l		INADEQUATE VENTILATION AFTER LOG
↓	• 34 ^R	37	14	2l		WATER INFLOW AFTER LOGS
	SSR1 ^R	SSR1	15	5 $\frac{1}{2}$ l	11	SEC LOOP ACTIVATION
	SSR2 ^R	—	15	5 $\frac{1}{2}$ l		FROZEN STEAM DUCT.

[illegible]

ECS MALFUNCTION

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
1 (Cont)	<p>26</p> <p>29 • H₂O ACCUM 1 vlv - OFF O₂ flow high?</p> <p>NO → 30 NO. 1 H₂O ACCUM SOLENOID VLV FAILED OPEN → 31 • SUIT CKT H₂O ACCUM AUTO - 2</p> <p>YES → 32 • H₂O ACCUM 2 vlv - OFF • H₂O ACCUM 1 vlv - RMTE O₂ flow high?</p> <p>NO → 33 NO. 2 H₂O ACCUM SOLENOID VLV FAILED OPEN → 34 • SUIT CKT H₂O ACCUM AUTO - 1</p> <p>YES → 35 • H₂O ACCUM 2 vlv - RMTE • SUIT CKT H₂O ACCUM AUTO - 1 • CAB REPRESS vlv close (CW) → 36 High flow caused by open CAB REPRESS vlv</p> <p>O₂ flow high? YES → 11</p> <p>37 Close emer cabin press vlv • EMER CAB PRESS vlv - OFF O₂ flow high?</p> <p>NO → 38 "BAND-AID" procedure • EMER CAB PRESS vlv - BOTH • EMER CAB PRESS TO TEST pb - push (SEVERAL TIMES) O₂ flow high?</p> <p>YES → 39 TEMPORARY PEEL VLV SEATING PROBLEM</p> <p>YES → 40 EMER CAB PRESS vlv - 1 O₂ flow high?</p> <p>NO → 41 NO. 2 EMER CAB PRESS REG FAILURE</p> <p>YES → 42 NO. 1 EMER CAB PRESS REG FAILURE → 43 • EMER CAB PRESS vlv - 2</p> <p>YES → 44 EMER CAB PRESS vlv - BOTH • H₂O/GLY TK PRESS REG vlv - OFF O₂ flow high?</p> <p>NO → 45 • H₂O/GLY TK PRESS REG vlv - 1 • H₂O/GLY TK PRESS RELF vlv - 1 O₂ flow high?</p> <p>NO → 46 H₂O/GLY TK PRESS REG NO. 2 FAILED HIGH OR RELIEF VLV NO. 2 FAILED OPEN → 47 Continue operations on No. 1 reg & relief vlv</p> <p>YES → 48 LEAK IN CABIN PRESS REG OR IN 100 PSI LINE DOWNSTREAM OF FLOW SENSOR</p> <p>49 • H₂O/GLY TK PRESS REG vlv - 2 • H₂O/GLY TK PRESS RELF vlv - 2 O₂ flow high?</p> <p>NO → 50 H₂O/GLY TK PRESS REG NO. 1 FAILED HIGH OR RELF vlv NO. 1 FAILED OPEN → 51 Continue operations on No. 2 reg & relief vlv</p> <p>YES → 53 LEAK DOWNSTREAM OF H₂O/GLY TK PRESS RELF VLV → 54 • H₂O/GLY TK PRESS REG vlv - OFF • H₂O/GLY TK PRESS RELF vlv - OFF</p> <p>52 Determine leak rate • O₂ DEMAND REG vlv - OFF • Surge tank press decay rate used to determine magnitude of leak in cabin press reg or 100 psi line</p>	<p>9 Loss of electrical cyclic control of H₂O accumulator. Periodic manual valve operation the only means of actuating H₂O accumulator.</p> <p>10 PRESS-TO-TEST operation may reveal leaky peel valve.</p> <p>11 Steps 37, 38, 40 and 43 to be omitted if all crewmen are suited as valve is already off.</p> <p>12 If leak is not isolated and O₂ flow remains high, mission time may be extended by shutting off the main O₂ regulators, re-opening them when necessary to maintain cabin pressure and CO₂ scrubber. As required repressurize H₂O tanks by placing H₂O GLY TK PRESS REG & RELF valves in the BOTH position, then OFF.</p> <p>13</p>

EC3
MALFUNCTION

*Don't Press
fully shut and turn
clockwise
see proc*

*Reg failed high - capable
of 4.5 LB/HR
Ref valv failed open
9.0 LB/HR*

*well says two diff
types of seal
failure.*

*relf vlv - O₂ flow
to cabin - slightly hi
and fluct to 1.0 LB/HR
every few sec.
Don't Press Reg gone 0.3 LB/HR
steady increase.*

SM-2A-1504

Basic Date

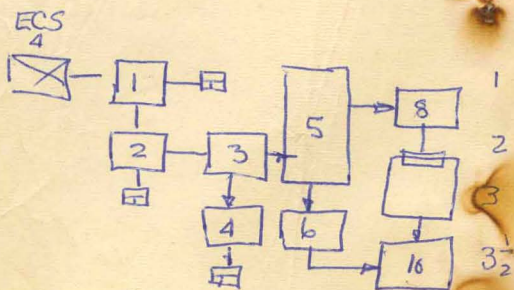
Change Date

Page

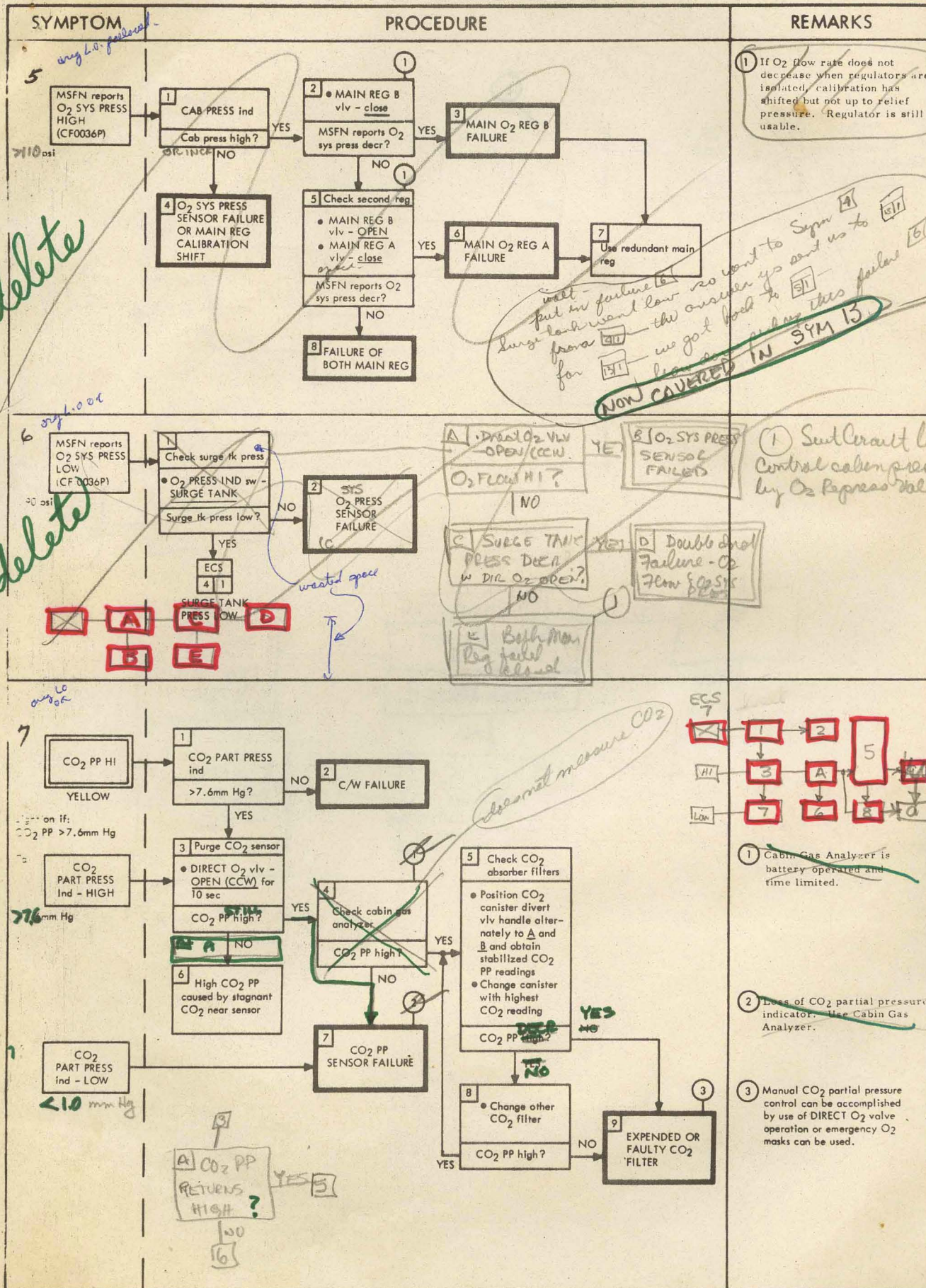
ECS MALFUNCTION

SYMPTOM	PROCEDURE	REMARKS
<p><i>no O₂ except stages</i></p> <p>2 O₂ FLOW ind - LOW Normal range 0-2-10 0.25-45 ccf/hr</p>	<p><i>why?</i></p> <p>1 Surge tk press • O₂ PRESS IND sw - SURGE TANK</p> <p>Surge tank press low? YES → ECS 4 1 SURGE TANK PRESS LOW</p> <p>NO → 2 Verify O₂ flow ind DIRECT O₂ vlv - OPEN (CCW) momentarily Momentary flow incr? YES → 4 Low system demand</p> <p>NO → 3 O₂ FLOW SENSOR OR IND FAILURE</p> <p><i>1 2 3 4</i></p>	<p>① MSFN can distinguish between these two failures.</p>
<p><i>look</i></p> <p>3 SURGE TANK PRESS HIGH >935 psi</p>	<p>1 Cryo tk press check • O₂ PRESS IND sw - TANK 1</p> <p>Either cryo tank press high? NO → 2 SURGE TANK PRESS SENSOR FAILURE</p> <p>YES → 3 CRYO O₂ STORAGE FAILURE → EPS-CRYO 1a 7 O₂ CRYO PRESS HI</p>	<p>① Use highest cryo tank indication to estimate surge tank pressure.</p>
<p><i>orig. h.o. followed</i></p> <p>4 SURGE TANK PRESS LOW <865 psi</p>	<p>1 Cab press high? YES → ECS 13 1 CABIN PRESS HIGH OR INCREASING</p> <p>NO → 2 O₂ FLOW ind O₂ flow HI? YES → HI → ECS 13 1 O₂ FLOW HI CABIN PRESS LOW.</p> <p>NO → 3 • O₂ PRESS IND sw - TANK 1 Cryo tk press low? YES → 4 CRYO O₂ STORAGE FAILURE → EPS-CRYO 1b 1 CRYO PRESS LOW</p> <p>NO → 5 Check for O₂ line obstruction • O₂ SM SUPPLY vlv - ON • O₂ PLSS vlv - OFF • O₂ SURGE TK vlv - OFF • DIRECT O₂ vlv - OPEN (CCW) • Increase O₂ flow to 0.95 lb/hr for 45 SEC • Monitor O₂ FLOW ind</p> <p>O₂ flow ind remains at 1.0 lb/hr? YES → 6 SURGE TK PRESS SENSOR FAILURE</p> <p>NO → 8 OBSTRUCTION OF O₂ RESTRICTORS, FILTERS OR LINE An obstruction severely limits O₂ supply rate. May essentially limit supply to that available in CM (surge tk plus repress O₂ tk). → 10 Reopen O₂ vlv • O₂ PLSS vlv - ON (when surge tank is 500 psi) • O₂ SURGE TK vlv - ON</p> <p>NO → 9 Low press caused by closed O₂ SM SUPPLY vlv</p> <p><i>LINE OBSTRUCTION CHECK</i></p> <p><i>went speed</i></p> <p><i>tank (when surge tank is 500 psi)</i></p>	<p>②</p>

ECS
MALFUNCTION

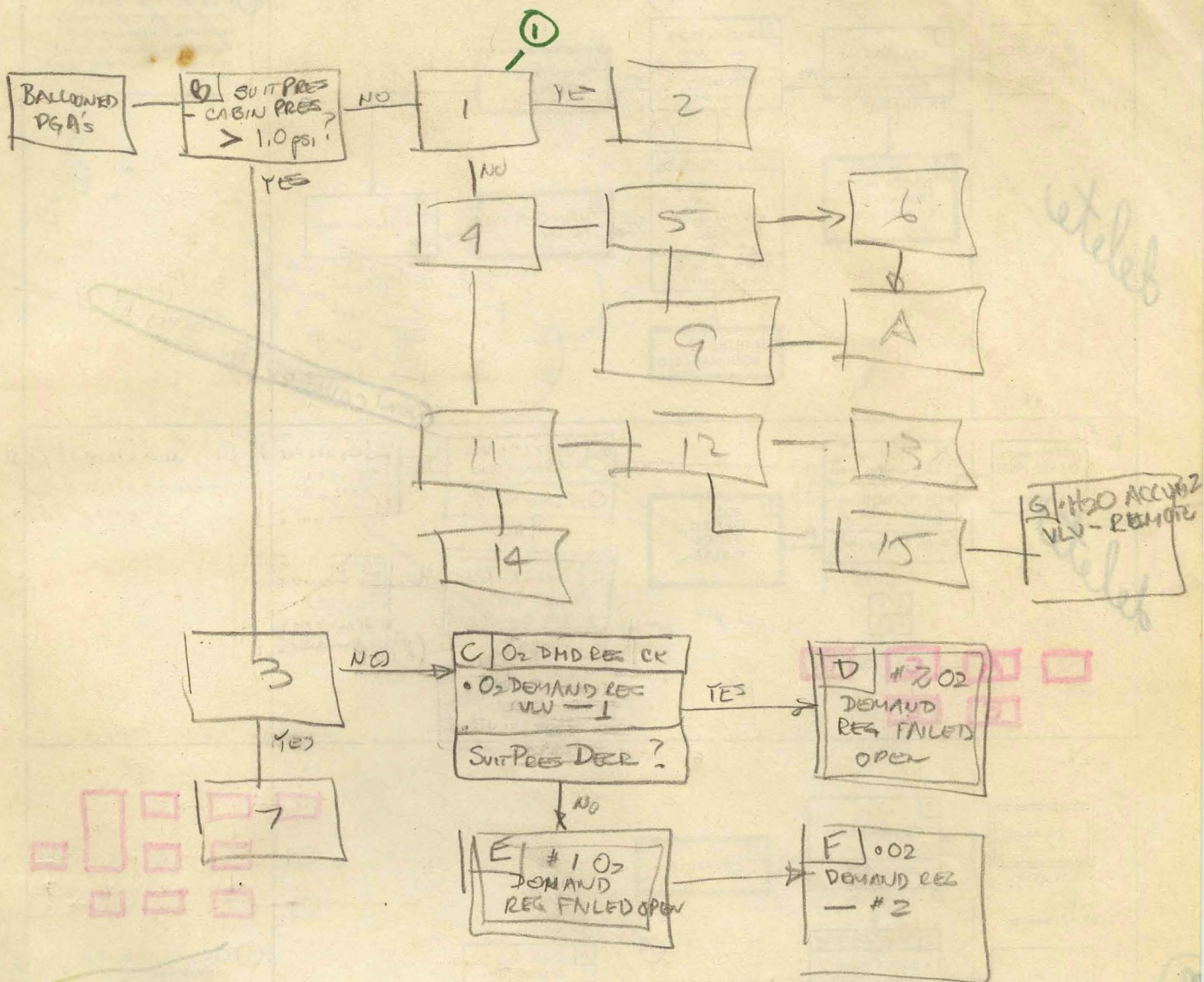


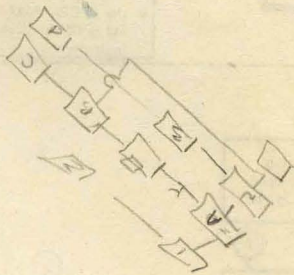
SM2A-03-SC101-(2)
APOLLO OPERATIONS HANDBOOK



ECS
MALFUNCTION

SM-2A-1506





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

SYMPTOM	PROCEDURE	REMARKS
<p>OK</p> <p>8 CO₂ FILTER SEIZURE WITHIN CANISTER</p>	<p>1 EXCESSIVE SWELLING OF CO₂ FILTER</p> <p>2 Single canister operation</p> <ul style="list-style-type: none"> SUIT FLOW RELF vlv - OFF CO₂ canister divert vlv - both (center) Divert flow through seized filter momentarily when replacement of operational filter is required Use CO₂ PART PRESS ind as filter replacement indicator 	<p>1 Immediately replace a filter suspected of swelling.</p>
<p>LOF except stagger</p> <p>9 BALLOONED PGAS</p> <p>CABIN PRESS > 3.5</p>	<p>1 DIRECT O₂ vlv - close (CW)</p> <p>O₂ flow decr? YES → 2 Ballooning caused by open DIRECT O₂ vlv</p> <p>NO → 3 SUIT TEST vlv - OFF</p> <p>O₂ flow decr? YES → 7 Ballooning caused by open SUIT TEST vlv</p> <p>NO → 4 O₂ DEMAND REG vlv - OFF</p> <p>O₂ flow decr? YES → 5 O₂ DEMAND REG vlv - BOTH</p> <p>NO → 11 O₂ DEMAND REG vlv - BOTH</p> <p>H₂O ACCUM vlv (2) - OFF</p> <p>O₂ flow decr? YES → 12 NO. 2 H₂O ACCUM SOLENOID VLV EXCESSIVE INTERNAL LEAKAGE</p> <p>NO → 14 UNIDENTIFIABLE INTERNAL LEAKAGE</p> <p>15 NO. 2 H₂O ACCUM SOLENOID VLV EXCESSIVE INTERNAL LEAKAGE</p>	<p>1 Ballooned means slightly overinflated and can be verified by the suit to cabin ΔP indicator > zero. Cabin to suit ΔP maintained at 0.09 to 0.13 psi. Suit pressure maintained at 25 ± 0.25 psi when cabin pressure is 15 psi.</p> <p>2 "BARDAHL" procedure may correct excessive O₂ flow.</p> <p>4 H₂O accumulators may be used manually for H₂O removal with excessive O₂ usage.</p>
<p>LOF except stagger</p> <p>10 CLINGING SUIT</p> <p>CABIN PRESS > 4.0 psi</p>	<p>1 Clinging suit for?</p> <p>ALL CREWMEN → 2 Verify valve positions</p> <ul style="list-style-type: none"> O₂ DEMAND REG vlv - BOTH Suit flow vlv (3) - SUIT FULL FLOW SUIT TEST vlv - OFF <p>Clinging suit? YES → 3</p> <p>NO → 6 Clinging suits caused by incorrectly positioned valve</p> <p>5 Suit flow vlv - SUIT FULL FLOW</p> <p>Clinging suit? YES → 9 REDUCED O₂ INFLOW BETWEEN SUIT FLOW VLV AND PGA</p> <p>NO → 10 Switch to spare umbilical hose</p> <p>PERFORM SUIT CIRCUIT CHECK FOR AFFECTED CREWMAN</p>	<p>10</p>

EGS
FUNCTION

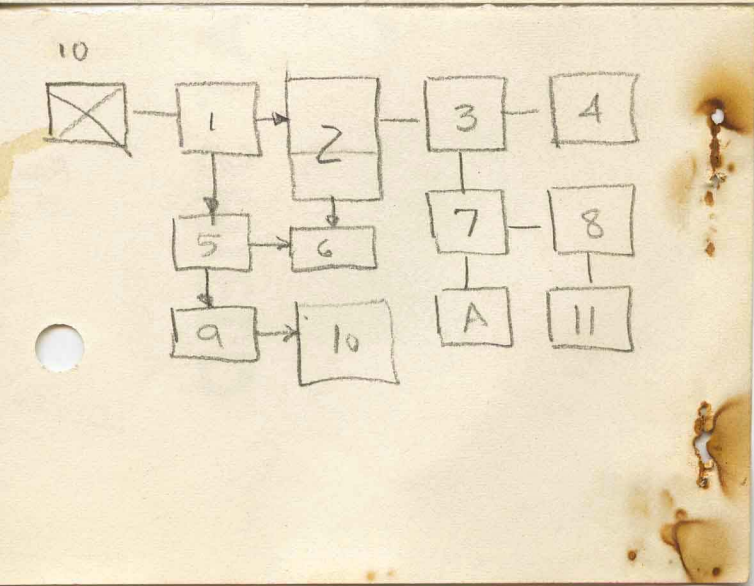
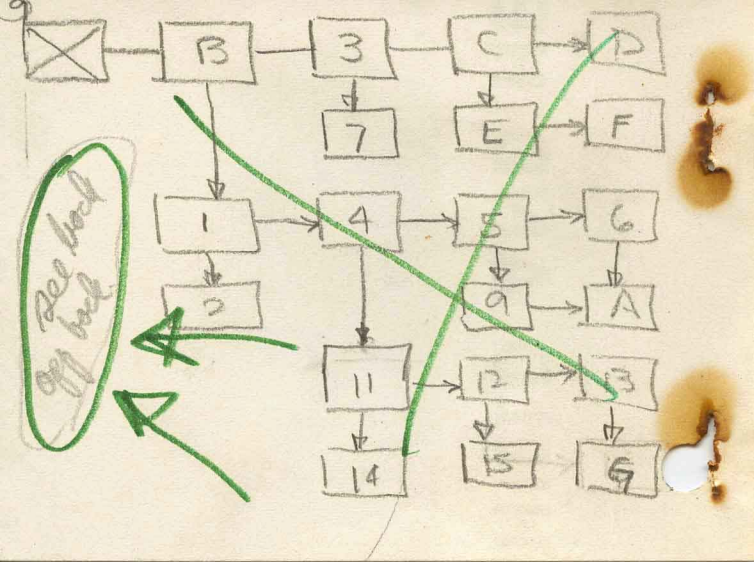
Basic Date

Change

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

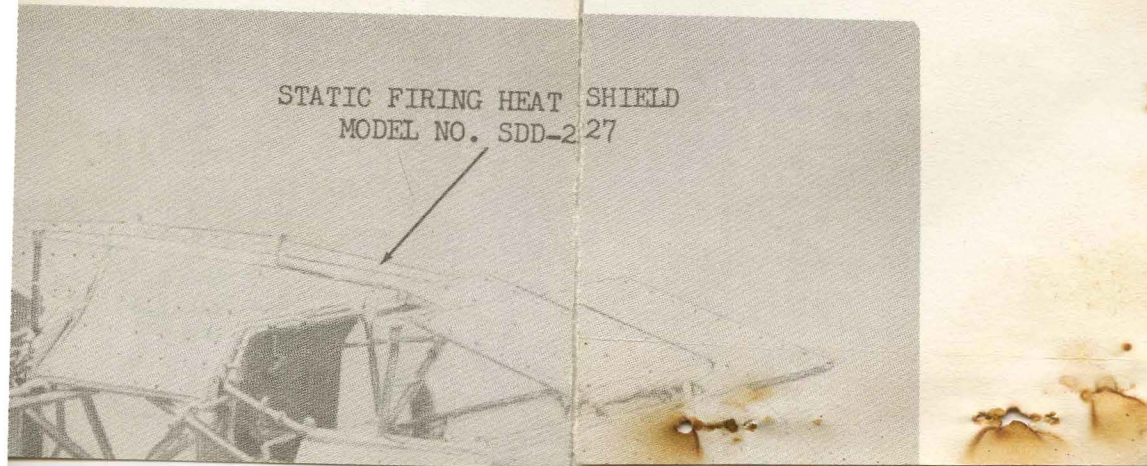
SYMPTOM	PROCEDURE	REMARKS
<p>OK</p> <p>8 CO₂ FILTER SEIZURE WITHIN CANISTER</p> <p><i>R</i></p>	<p>1 EXCESSIVE SWELLING OF CO₂ FILTER</p> <p>2 Single canister operation</p> <ul style="list-style-type: none"> SUIT FLOW RELF vlv - OFF CO₂ canister divert vlv - both (center) Divert flow through seized filter momentarily when replacement of operational filter is required Use CO₂ PART PRESS ind as filter replacement indicator 	<p>1 Immediately replace a filter suspected of swelling.</p>
<p>LOF except stagg</p> <p>9 BALLOONED PGAS</p> <p>CABIN PRESS > 3.5</p> <p><i>REDRAW</i></p> <p><i>R</i></p> <p><i>Private note: Suit relief valve failed closed considered & reported</i></p>	<p>1 DIRECT O₂ vlv - close (CW)</p> <p>O₂ flow decr? YES → 2 Ballooning caused by open DIRECT O₂ vlv</p> <p>NO → 3 SUIT TEST vlv - OFF</p> <p>O₂ flow decr? YES → 7 Ballooning caused by open SUIT TEST vlv</p> <p>NO → 4 O₂ DEMAND REG vlv - OFF</p> <p>O₂ flow decr? YES → 5 O₂ DEMAND REG vlv - 1</p> <p>O₂ flow decr? NO → 8 O₂ DEMAND REG vlv - 2</p> <p>O₂ flow decr? YES → 9 NO. 2 DEMAND REG EXCESSIVE INTERNAL LEAKAGE</p> <p>NO → 10 BOTH DEMAND REG EXCESSIVE INTERNAL LEAKAGE</p> <p>11 O₂ DEMAND REG vlv - BOTH</p> <p>H₂O ACCUM vlv (2) - OFF</p> <p>O₂ flow decr? YES → 12 H₂O ACCUM 1 vlv - RMTE</p> <p>O₂ flow incr? YES → 13 NO. 1 H₂O ACCUM SOLENOID VLV EXCESSIVE INTERNAL LEAKAGE</p> <p>NO → 15 NO. 2 H₂O ACCUM SOLENOID VLV EXCESSIVE INTERNAL LEAKAGE</p> <p>14 UNIDENTIFIABLE INTERNAL LEAKAGE</p> <p><i>Handwritten flowchart with numbers 1-15 and arrows indicating sequence.</i></p>	<p>1 Ballooned means slightly overinflated and can be verified by the suit to cabin ΔP indicator > zero. Cabin to suit ΔP maintained at 0.09 to 0.13 psi. Suit pressure maintained at 1.25 to 0.25 psi when cabin pressure is 1.5 psi.</p> <p>2 "BARDAHL" procedure may correct excessive O₂ flow.</p> <p>3 Leaking O₂ demand regulator is still operational and may be used for depressurized cabin mode.</p> <p>4 H₂O accumulators may be used manually for H₂O removal with excessive O₂ usage.</p> <p><i>Handwritten notes:</i></p> <ul style="list-style-type: none"> <i>Shallowly</i> <i>Recycling valve several times</i> <i>A. O₂ DEMAND REG VLV - REDUNDANT REG</i>
<p>LOF except stagg</p> <p>10 CLINGING SUIT</p> <p>CABIN PRESS > 4.0 psi</p> <p><i>R</i></p> <p><i>Down hose?</i></p>	<p>1 Clinging suit for?</p> <p>ALL CREWMEN → 2 Verify valve positions</p> <ul style="list-style-type: none"> O₂ DEMAND REG vlv - BOTH Suit flow vlv (3) - SUIT FULL FLOW SUIT TEST vlv - OFF <p>Clinging suit? YES → 3 Perform suit circuit and PGA check</p> <p>Suit maintains pressure? NO → 4 SUIT LOOP PLUMBING LEAK</p> <p>YES → 7 Verify O₂ system press with MSFN</p> <p>System press low? YES → 11 Use DIRECT O₂ vlv to meter O₂ into suit loop</p> <p>NO → 8 BOTH O₂ DEMAND REG FAILED CLOSED</p> <p>5 Suit flow vlv - SUIT FULL FLOW</p> <p>Clinging suit? YES → 9 REDUCED O₂ INFLOW BETWEEN SUIT FLOW VLV AND PGA</p> <p>NO → 6 Clinging suits caused by incorrectly positioned valve</p> <p>10 Switch to spare umbilical hose</p> <p><i>Handwritten notes:</i></p> <ul style="list-style-type: none"> <i>MSFN reports O₂ SYS PRESS LOW</i> <i>O₂ FLOW TO</i> <i>CIRCUIT CHECK FOR DIFFERENT CREWMAN</i> 	<p>7 DIRECT O₂ VLV - OPEN (CW)</p> <p>O₂ FLOW INCR? YES → 8</p> <p>11 BOTH MAIN O₂ REGS FAILED</p> <p>Metabolic requirement per crewman is approximately 0.1 lb/hr.</p> <p><i>Handwritten notes:</i></p> <ul style="list-style-type: none"> <i>note: still OK</i>

EGS
MALFUNCTION



SHIELD AND HEAT SHIELD

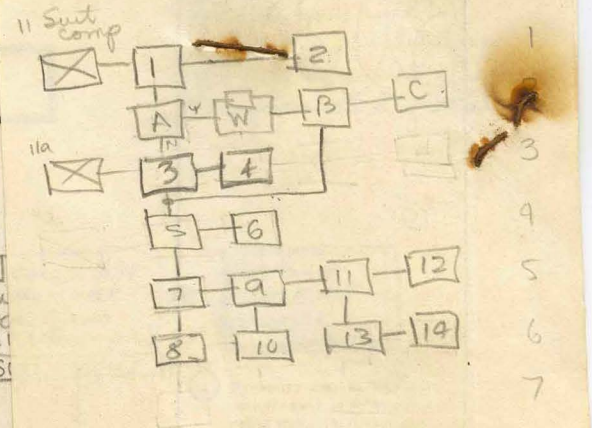
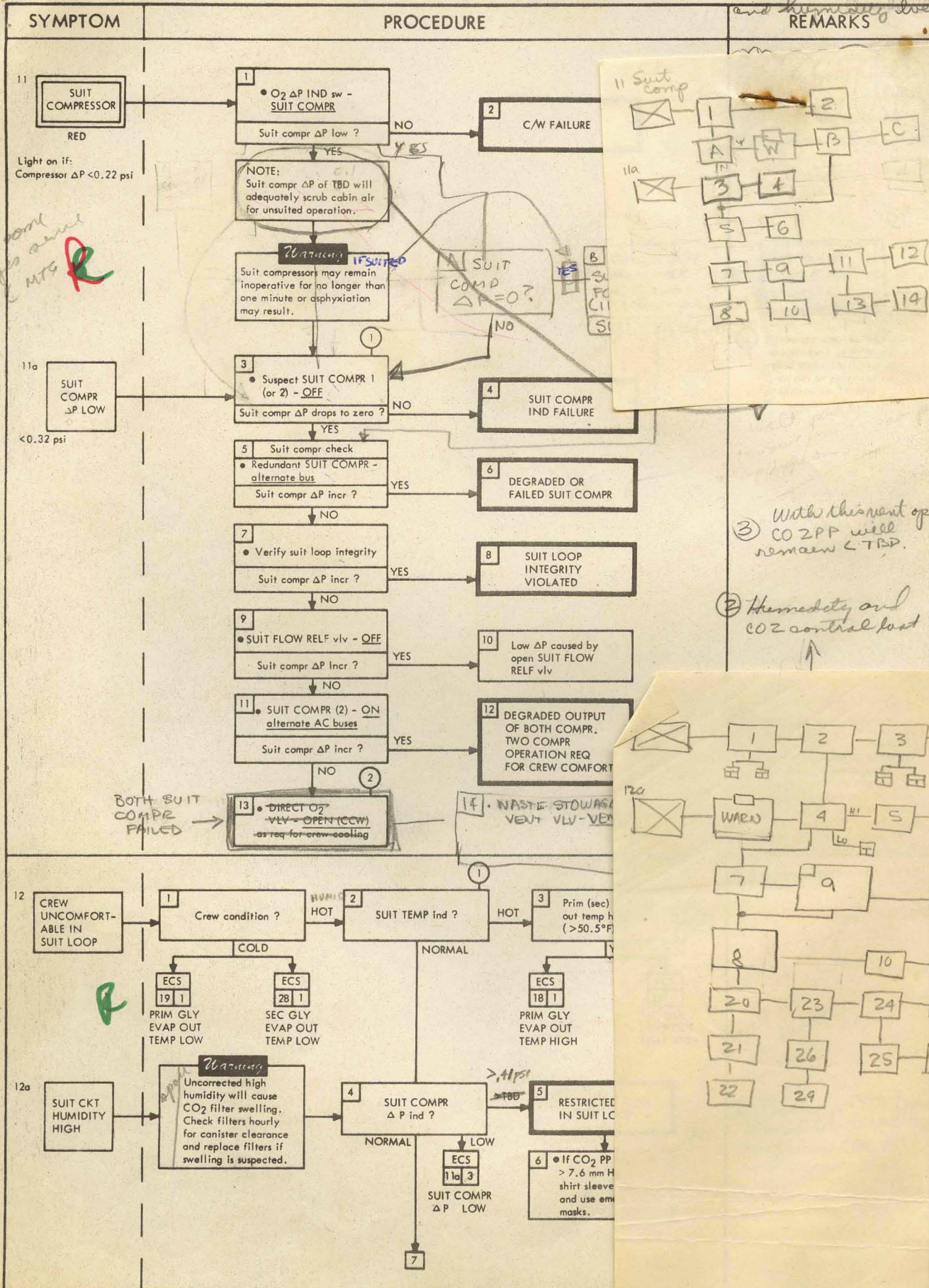
STATIC FIRING HEAT SHIELD
MODEL NO. SDD-2 27



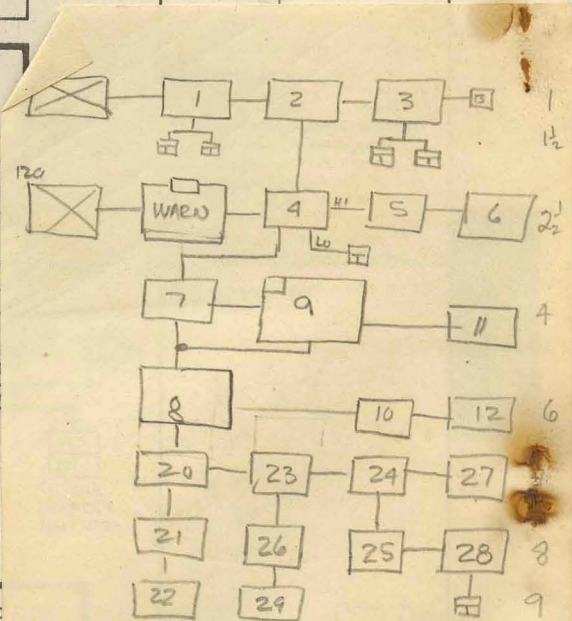
See still letter

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

⑥ Subsequent compressor operations verified by monitoring supply hose and humidity levels



③ With this vent open CO₂ PP will remain < 7.6 mm Hg.
② Humidity and CO₂ control lost

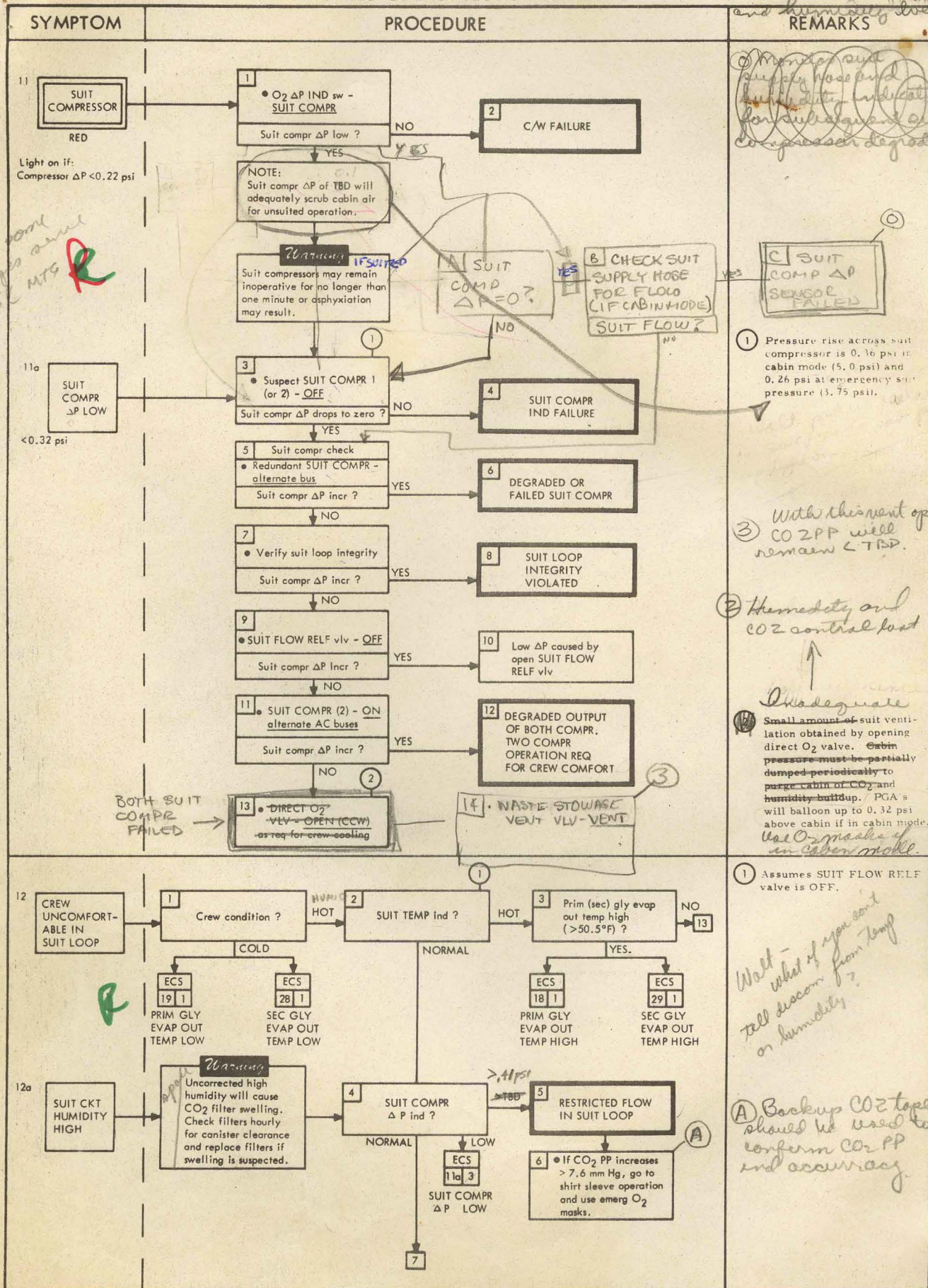


Basic Date

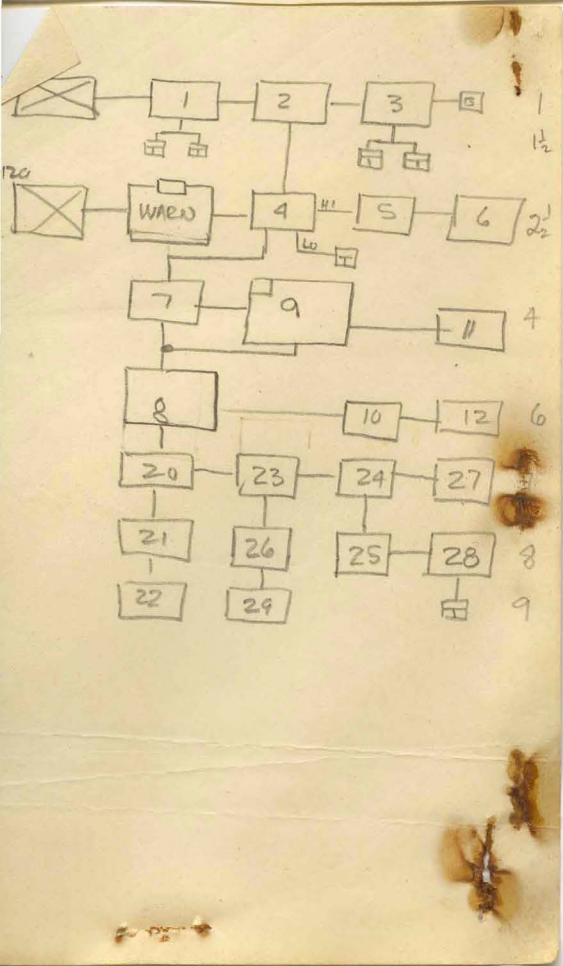
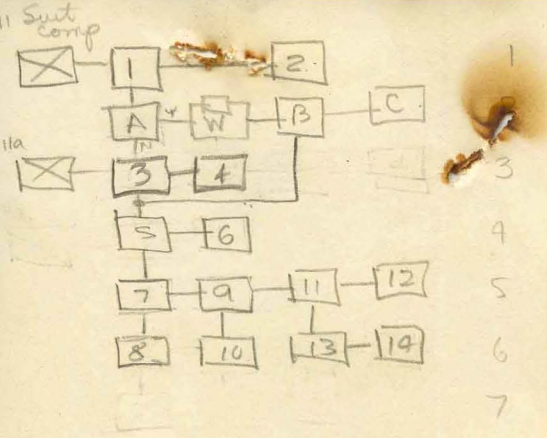
Change Date

⑥ Subsequent compressor operations verified by monitoring supply hose and humidity levels.

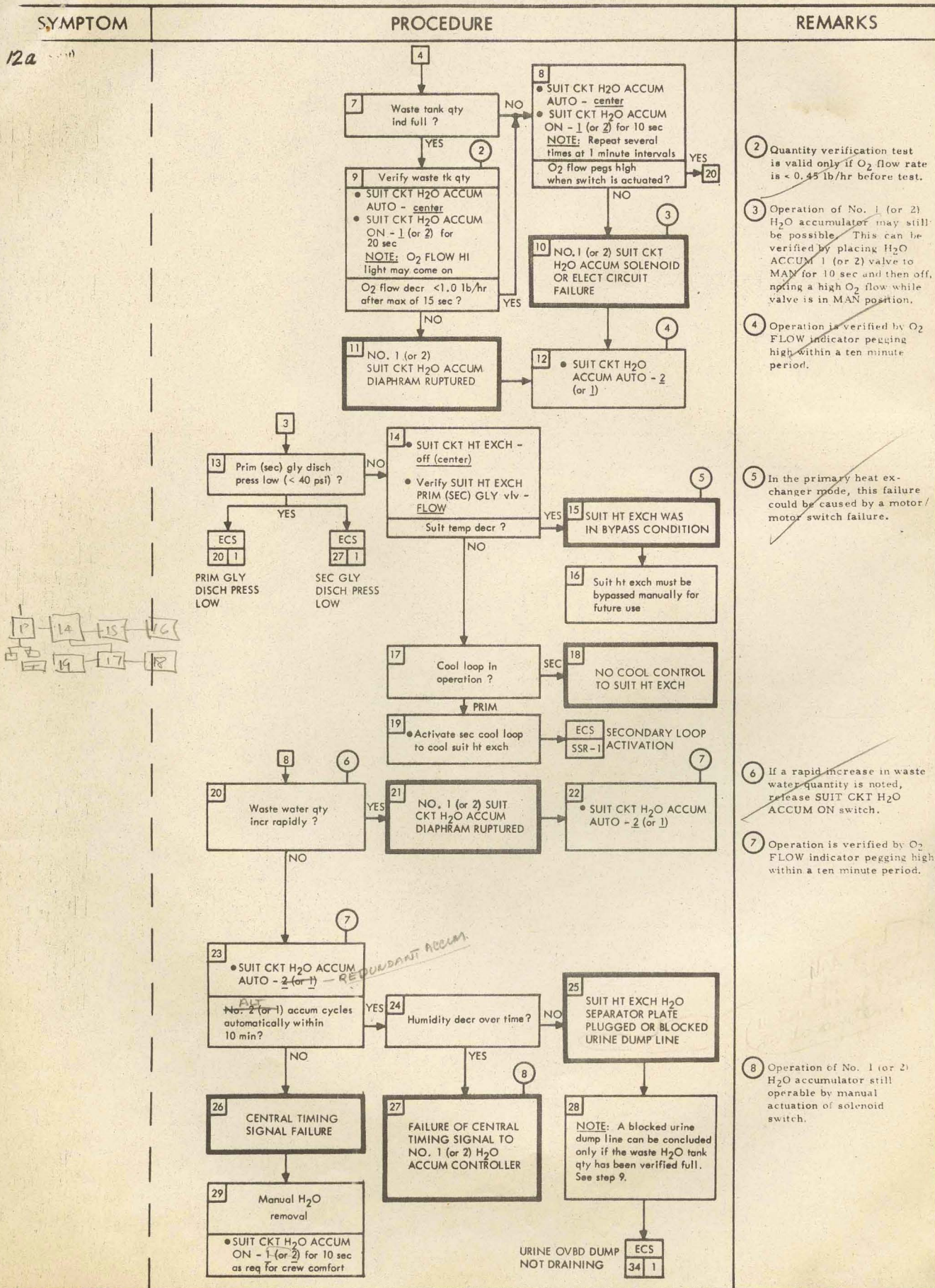
see still letter



ECS
MALFUNCTION

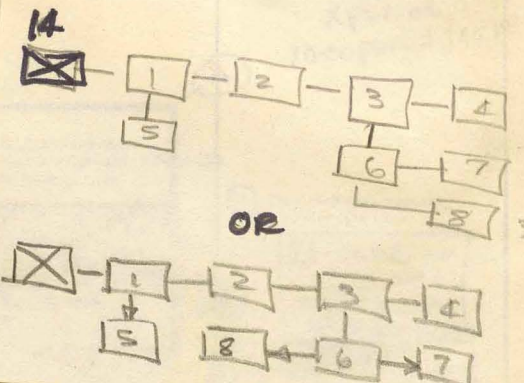
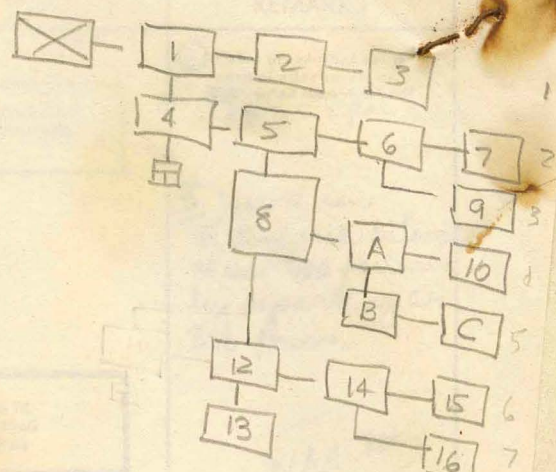
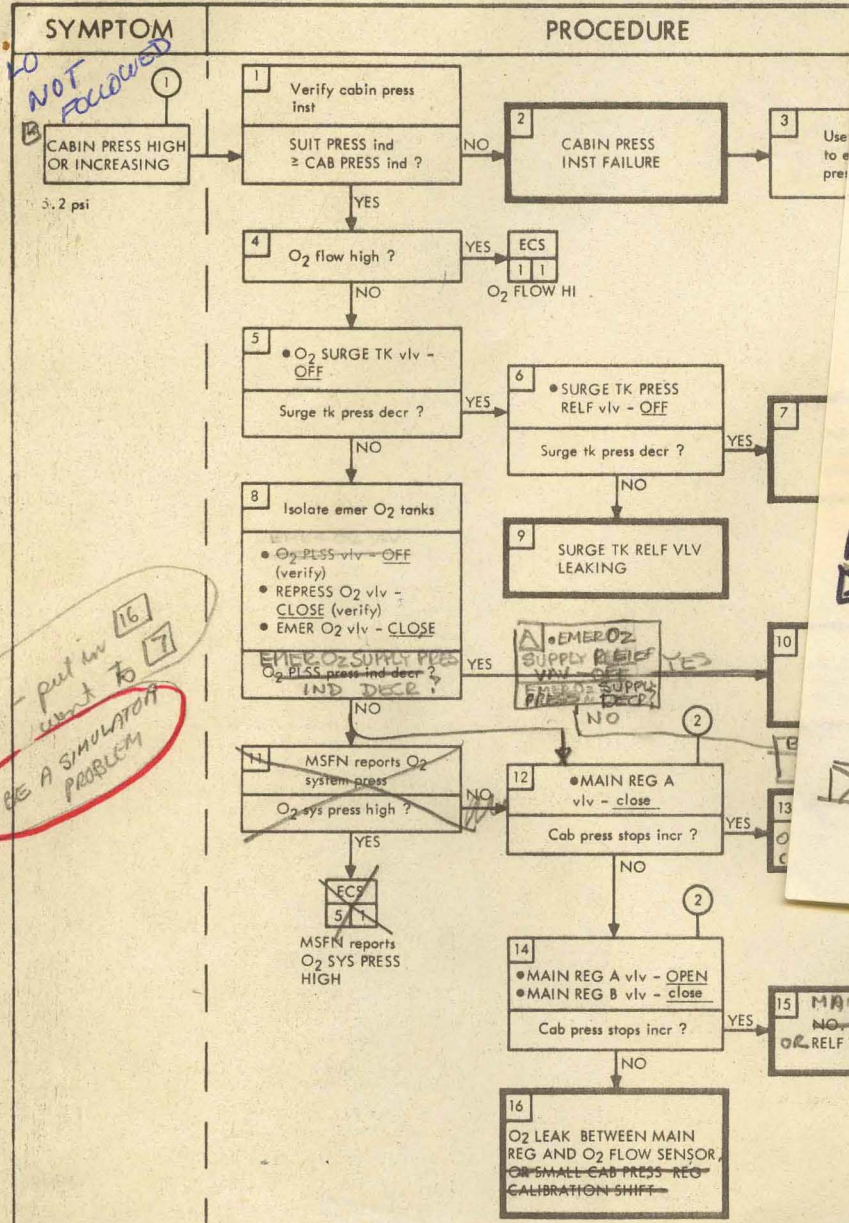


SM2A-03-SC101-(2)
APOLLO OPERATIONS HANDBOOK

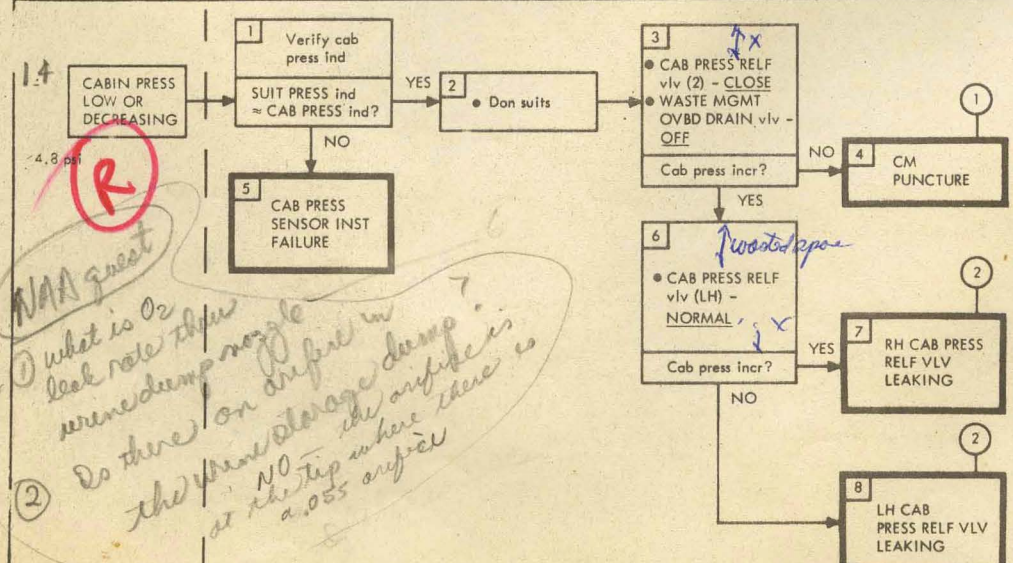


ECS
MALFUNCTION

13



subsequent
A if O₂ mask use
necessary, turn
PLSS vlv - full.
Excessive O₂
consumption results

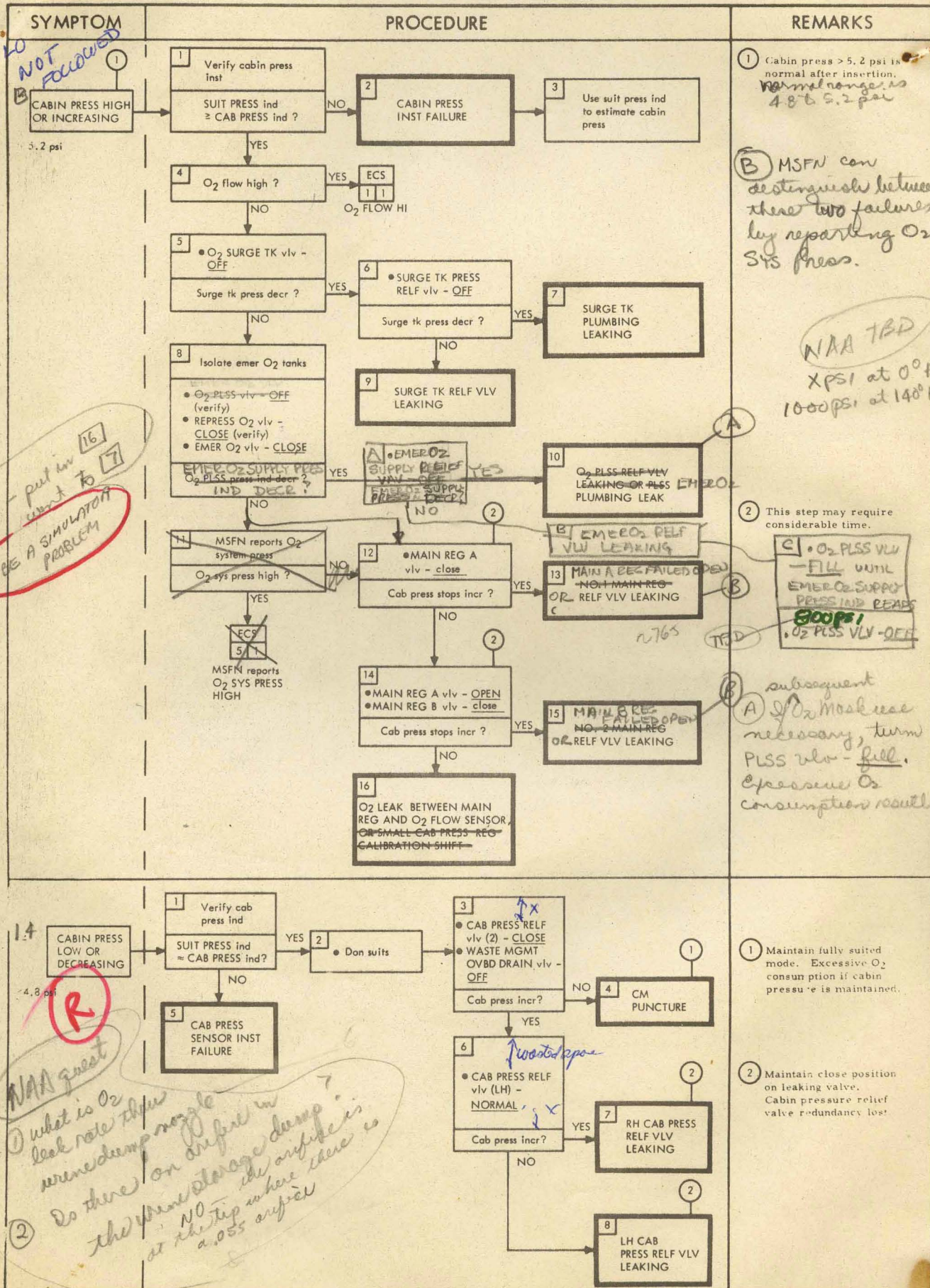


- ① Maintain fully suited mode. Excessive O₂ consumption if cabin pressure is maintained.
- ② Maintain close position on leaking valve. Cabin pressure relief valve redundancy lost.

ECS
MALFUNCTION

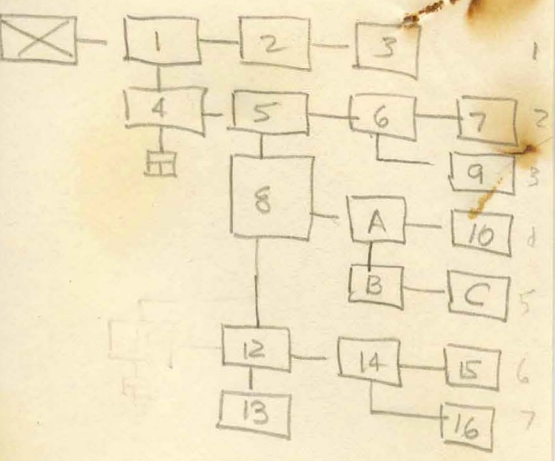
NAA quest
① What is O₂ leak rate thru
wiredump nozzle
② Do there on airfare in
the wiredump dump?
NO - the airfare is
at the tip where there is
a .055 orifice

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

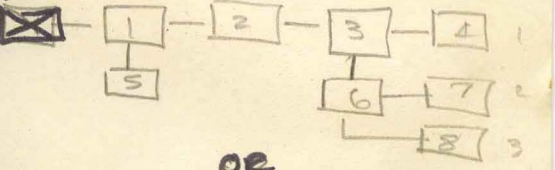


ECS MALFUNCTION

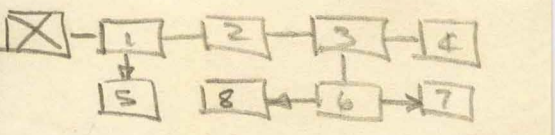
13



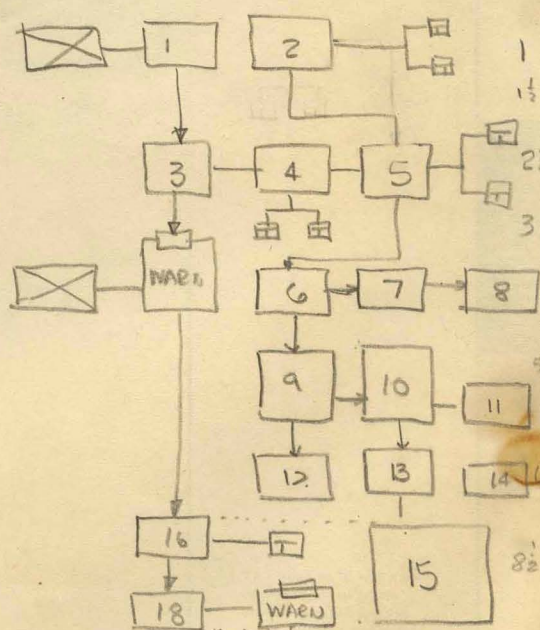
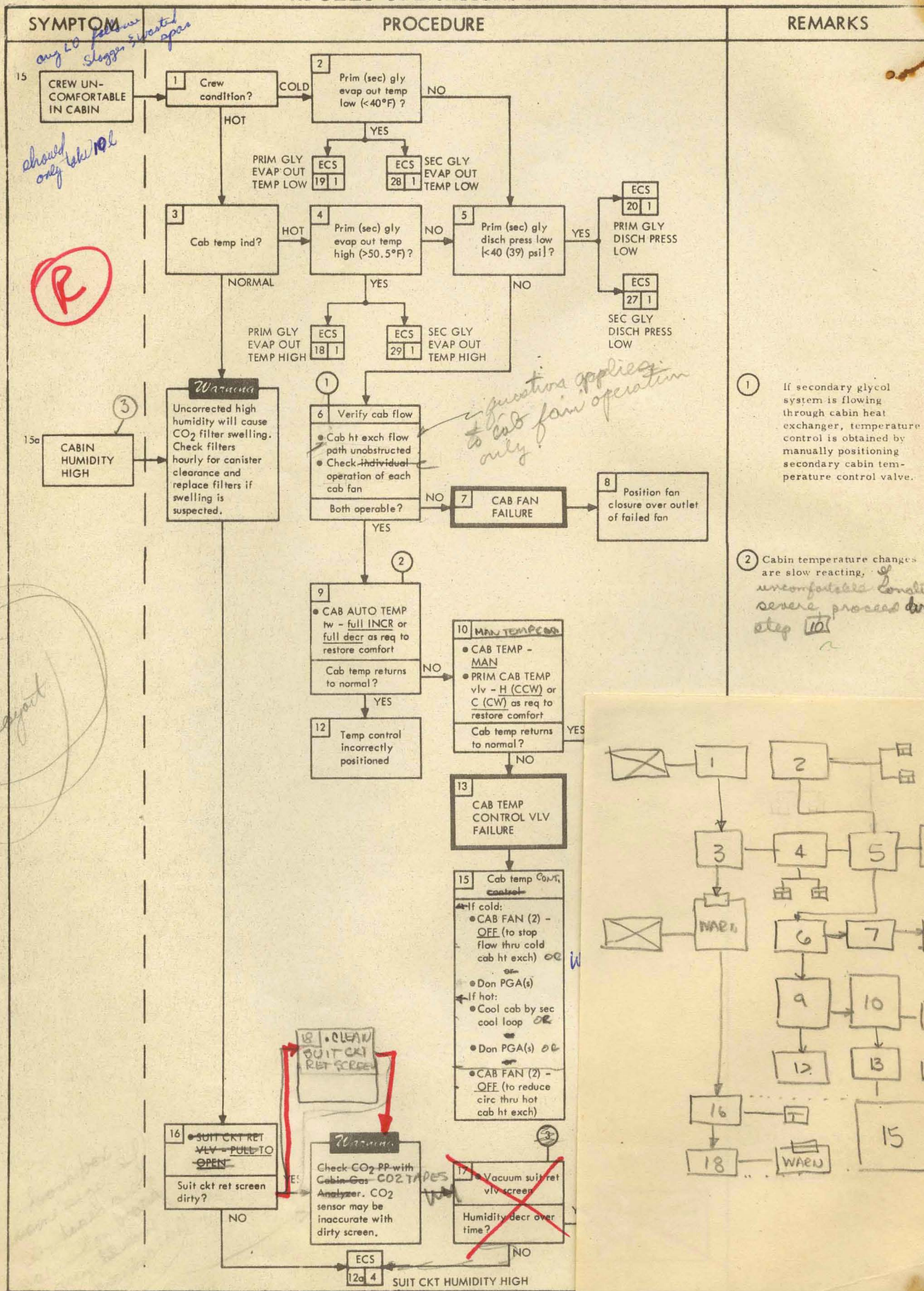
14



OR

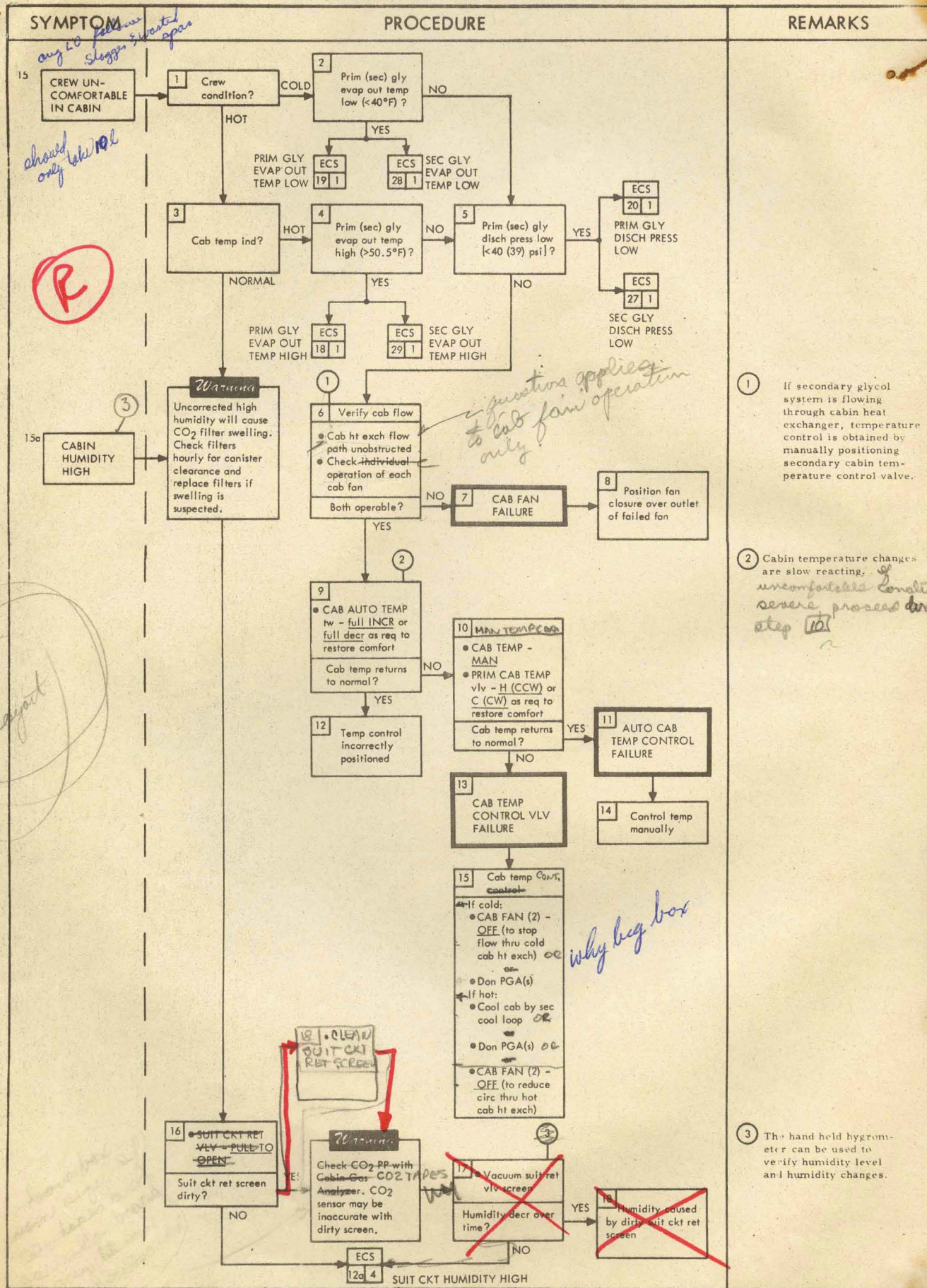


APOLLO OPERATIONS HANDBOOK



Basic Date

Change Date



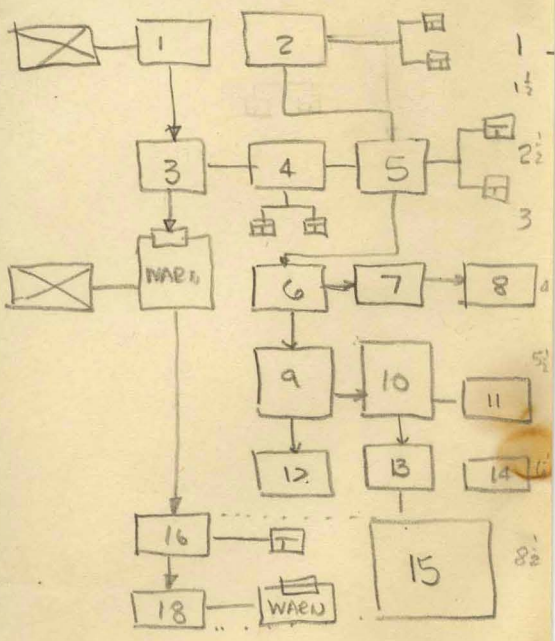
SM-2A-1511

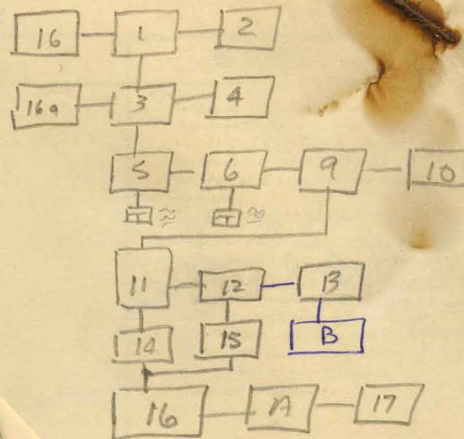
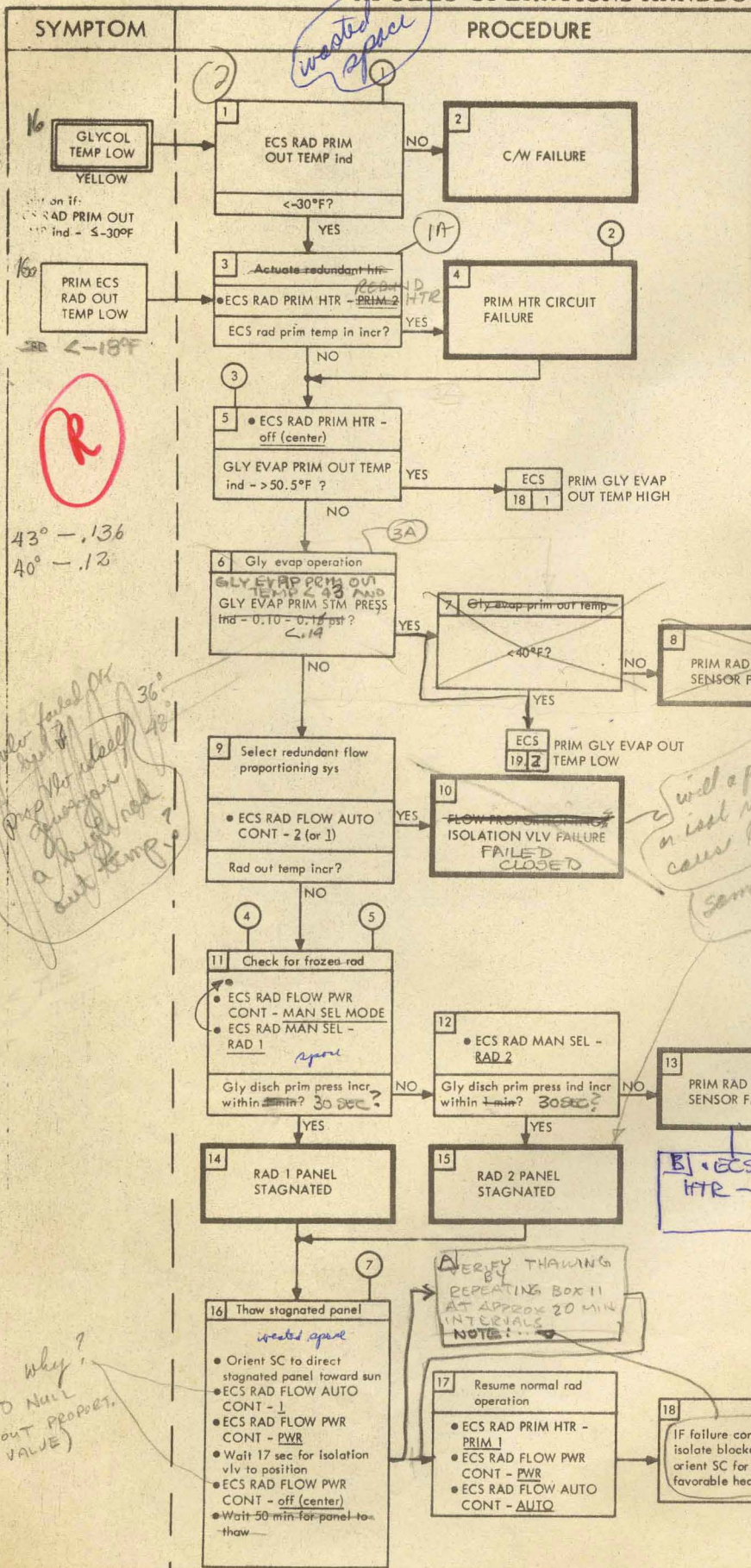
Basic Date

Change Date

Page

ECS
MALFUNCTION





low flow, of boiling
glycol in line. Monitor Gly. Evap
outlet temp for >35°F

3A MSFN can aid in
determining gly evap
operation by comparing
gly evap temp in and out.
Evap out
boiling 40-43°F
not boiling 43-48°F
initiated when rad
out 48-50.5°F

will a prop valve
or isol valve failure
cause low gly temp
same for stagnated panel

4 MSFN can aid in deter-
mining frozen/stagnated
panel by telemetered
primary radiator bay
temperature out
measurements and
primary glycol flow rate.

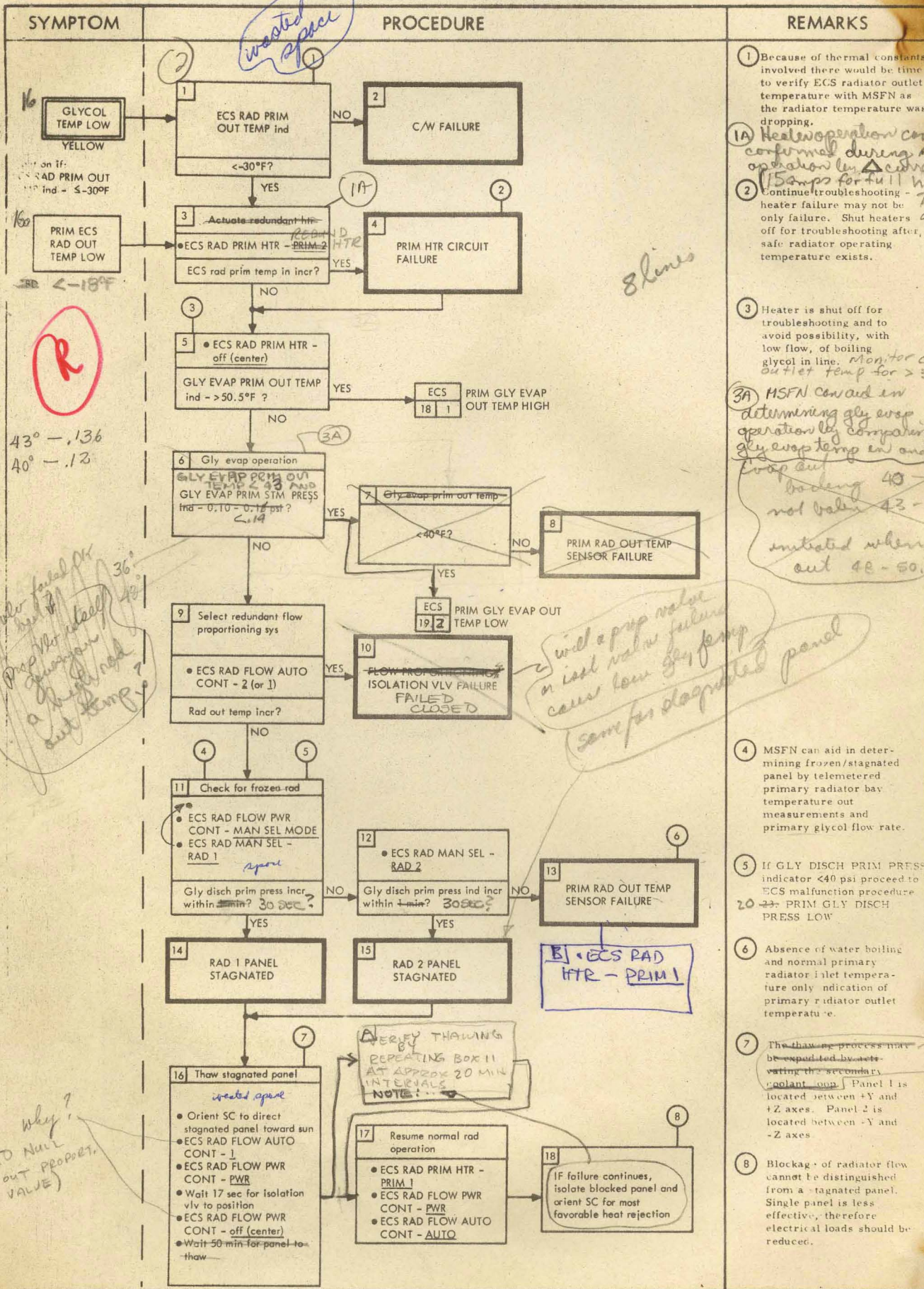
5 If GLY DISCH PRIM PRESS
indicator <40 psi proceed to
ECS malfunction procedure
20 PRIM GLY DISCH
PRESS LOW

6 Absence of water boiling
and normal primary
radiator inlet tempera-
ture only indication of
primary radiator outlet
temperature.

7 The thawing process may
be expedited by acti-
vating the secondary
coolant loop. Panel 1 is
located between +Y and
+Z axes. Panel 2 is
located between -Y and
-Z axes.

8 Blockage of radiator flow
cannot be distinguished
from a stagnated panel.
Single panel is less
effective, therefore
electrical loads should be
reduced.

ECS
MALFUNCTION

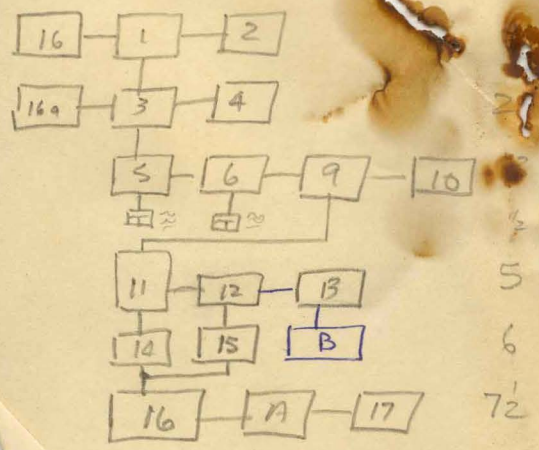


SM-2A-1512

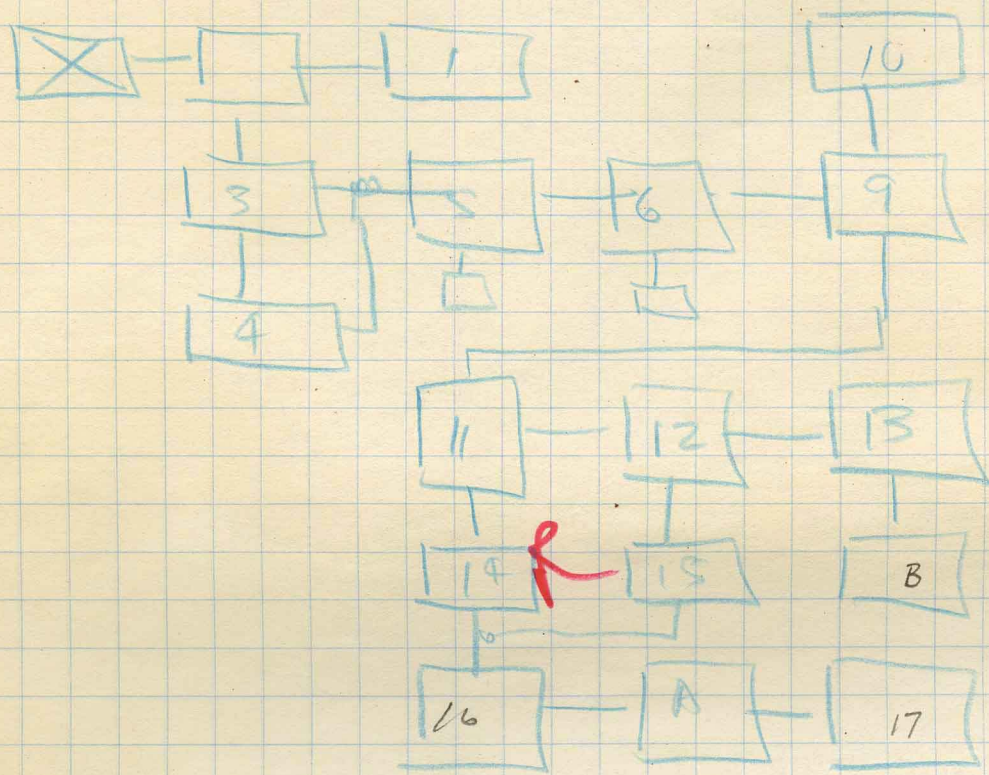
Basic Date

Change Date

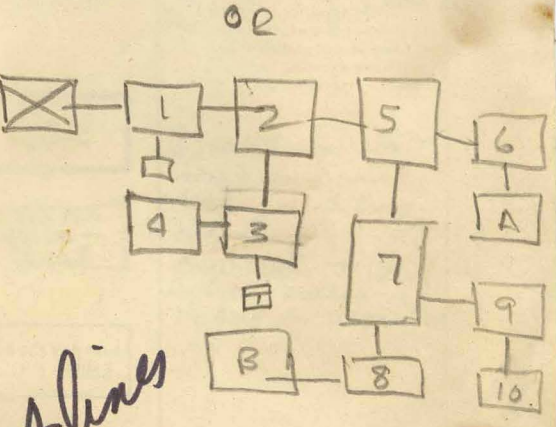
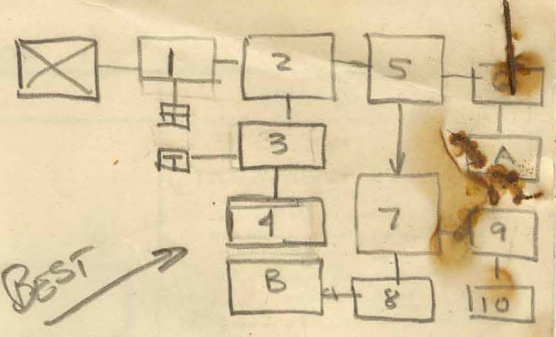
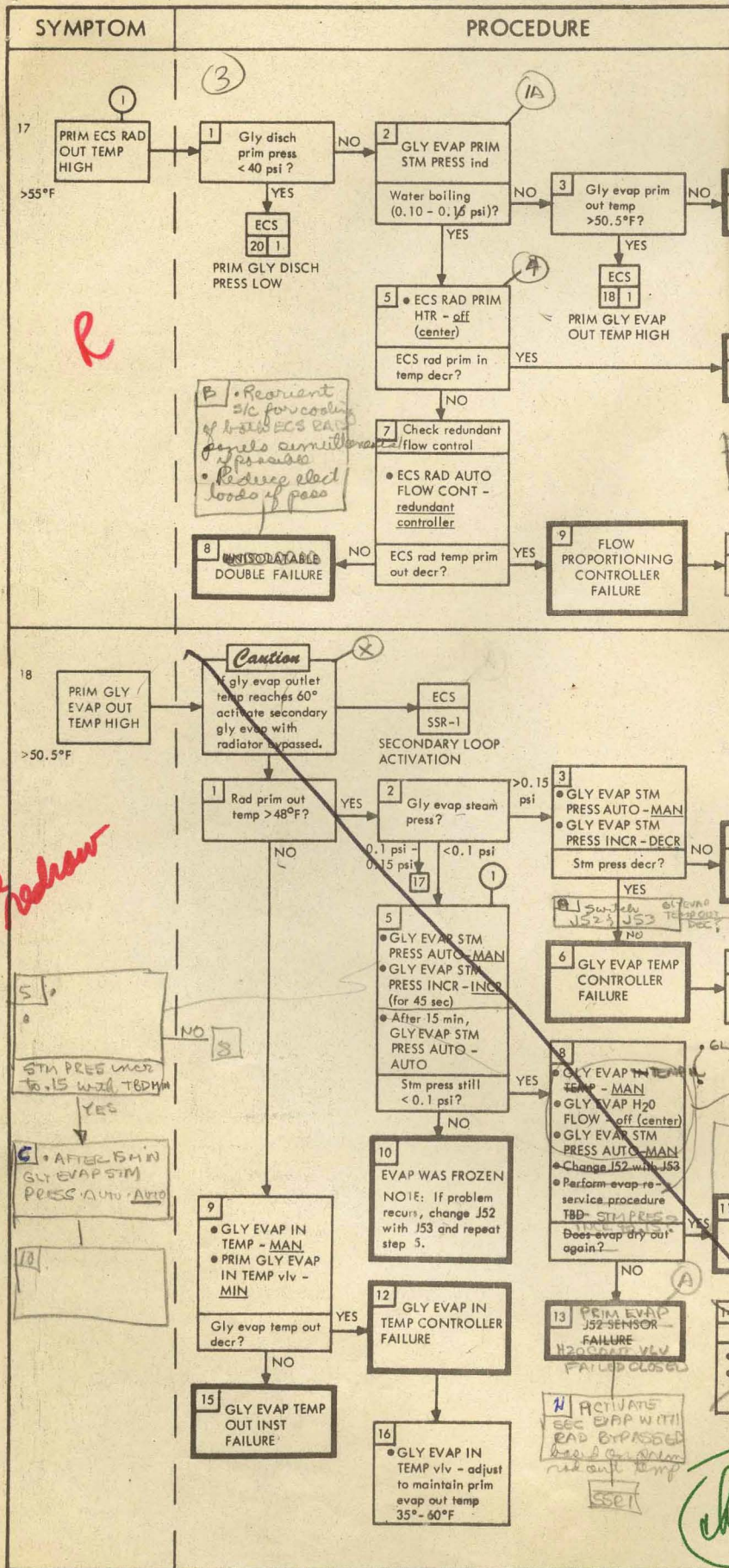
Page



16

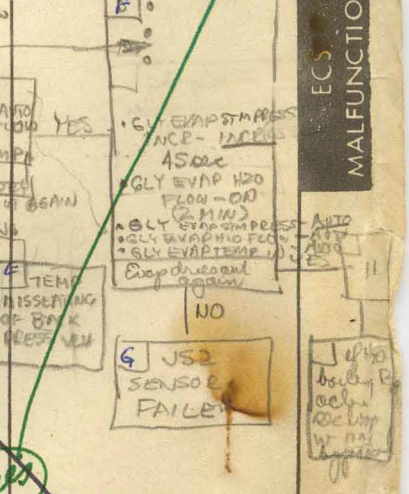


- 1
- 2
- 3
- 3 1/2
- 4 1/2
- 6

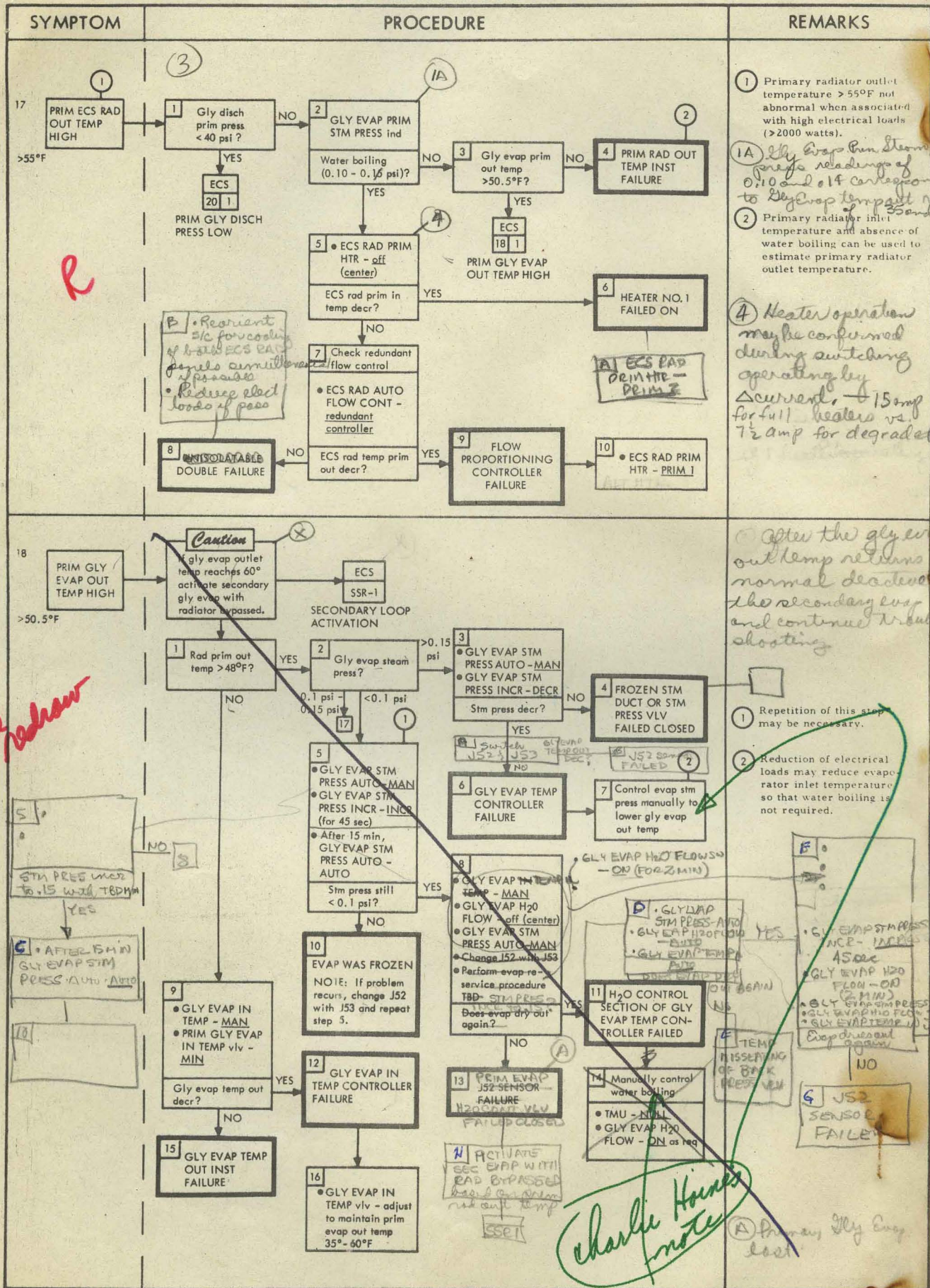


and continued trouble shooting

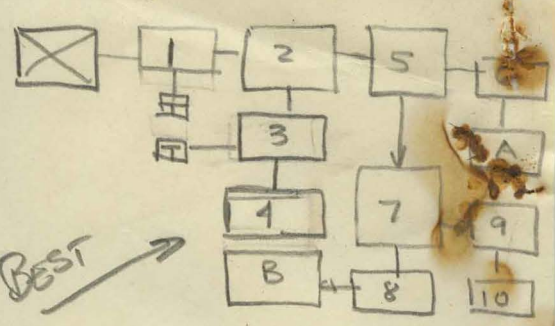
- 1 Repetition of this step may be necessary.
- 2 Reduction of electrical loads may reduce evaporator inlet temperature so that water boiling is not required.



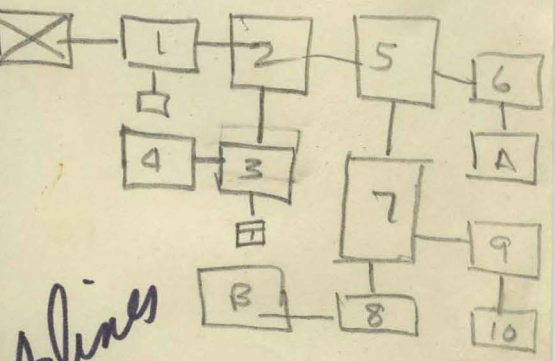
Charlie Haines note



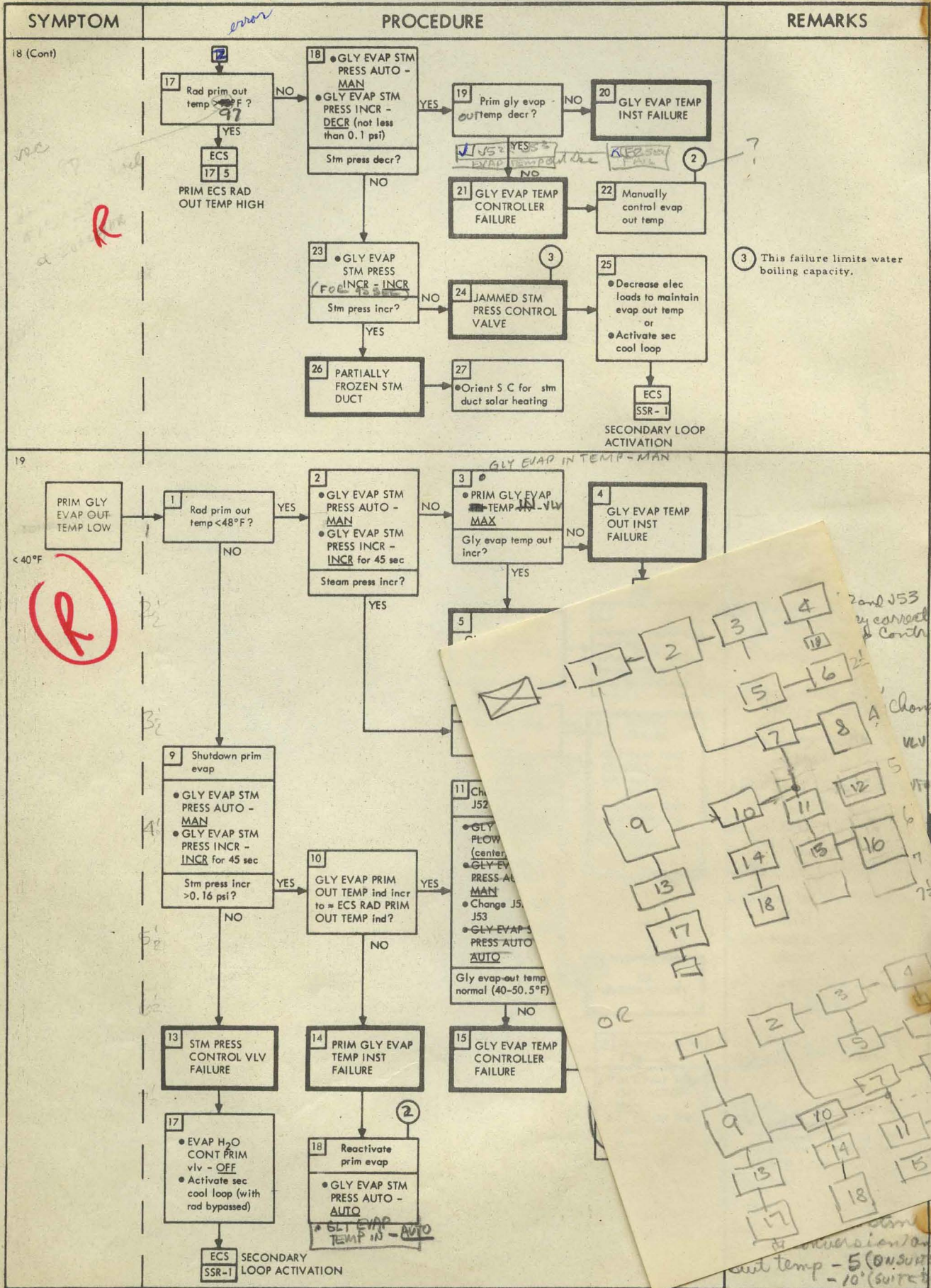
ECS MALFUNCTION



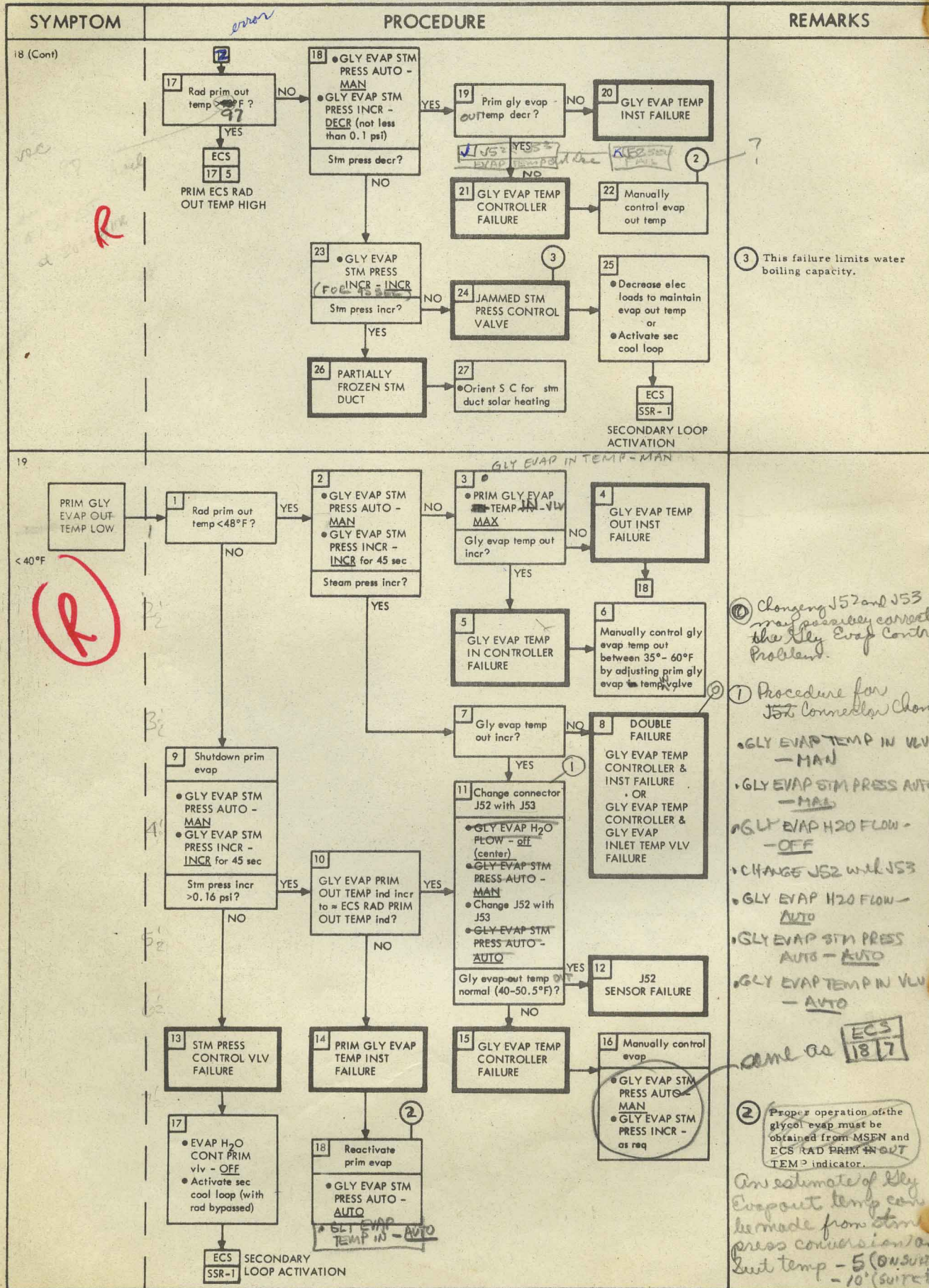
02



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



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

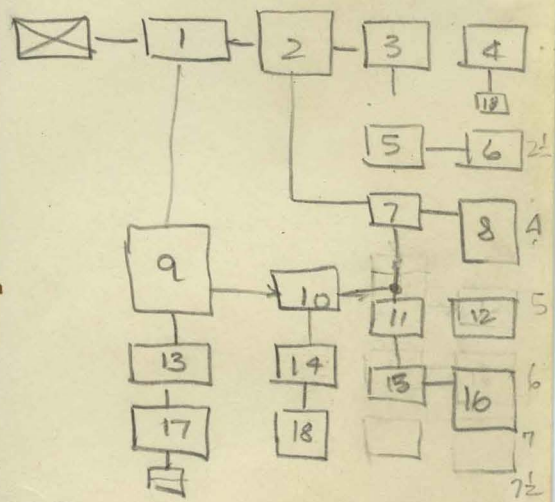


SM-2A-1514

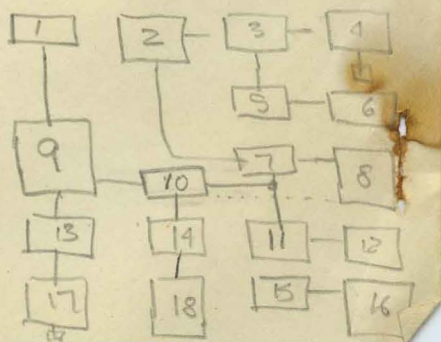
Basic Date _____

Change Date _____

Page _____



OR



SYMPTOM	PROCEDURE	REMARKS
<p>20 PRIM GLY DISCH PRESS LOW</p> <p><40 psi</p> <p><40 OR</p> <p>< ACC QTY 4 +32 psi</p>	<p>1 ACCUM PRIM QTY ind low (<30%)?</p> <p>YES</p> <p>ECS 21 1</p> <p>PRIM GLY ACCUM QTY LOW OR DECREASING</p> <p>2 Switch operating ECS gly pump to redundant bus Gly disch press incr?</p> <p>NO</p> <p>3 REDUCED PUMP OUTPUT DUE TO ELEC PROBLEM</p> <p>4 ECS GLY PUMPS - OFF (momentarily)</p> <p>Gly disch press decr?</p> <p>NO</p> <p>5 GLY DISCH PRESS IND FAILURE</p> <p>6 Return to original gly pump</p> <p>ECS RAD HTS - ORIG CONFIG</p> <p>7 Switch to redundant gly pump</p> <p>Gly disch press incr?</p> <p>NO</p> <p>8 DEGRADED GLY PUMP DEGRADED OR FAILED</p> <p>9 Verify sensor</p> <ul style="list-style-type: none"> ECS GLY PUMPS - OFF PRIM GLY ACCUM vlv - OFF (CW) PRIM ACCUM FILL vlv - ON <p>Gly disch press 18-22 psi?</p> <p>NO</p> <p>10 GLY DISCH PRESS SENSOR FAILURE</p> <p>11 Return to original gly pump</p> <p>12 PRIM ACCUM FILL vlv - OFF</p> <p>PRIM GLY ACCUM vlv - ON (CW)</p> <p>Gly disch press compatible for indicated accum qty?</p> <p>YES</p> <p>13 DEGRADED OUTPUT OF BOTH GLY PUMPS</p> <p>NO</p> <p>14 ACCUM PRIM QTY IND FAILURE</p> <p>15 Return to original gly pump</p>	<p>LOW VOLTAGE (AC?)</p> <p>LOW FREQ</p> <p>2 PHASES OF PUMP POWER</p> <p>(A) With Radiators bypassed, pumped press is nominally 2 psi lower than with radiators operating</p> <p>1 Degraded glycol pump may be verified by checking GLY PRIM COLDPLATE flow rate with MSFN</p> <p>2 With ECS GLY PUMPS - OFF, glycol discharge pressure should equal 1/4 accumulator quantity indication.</p>

what
go right to 14 from 12

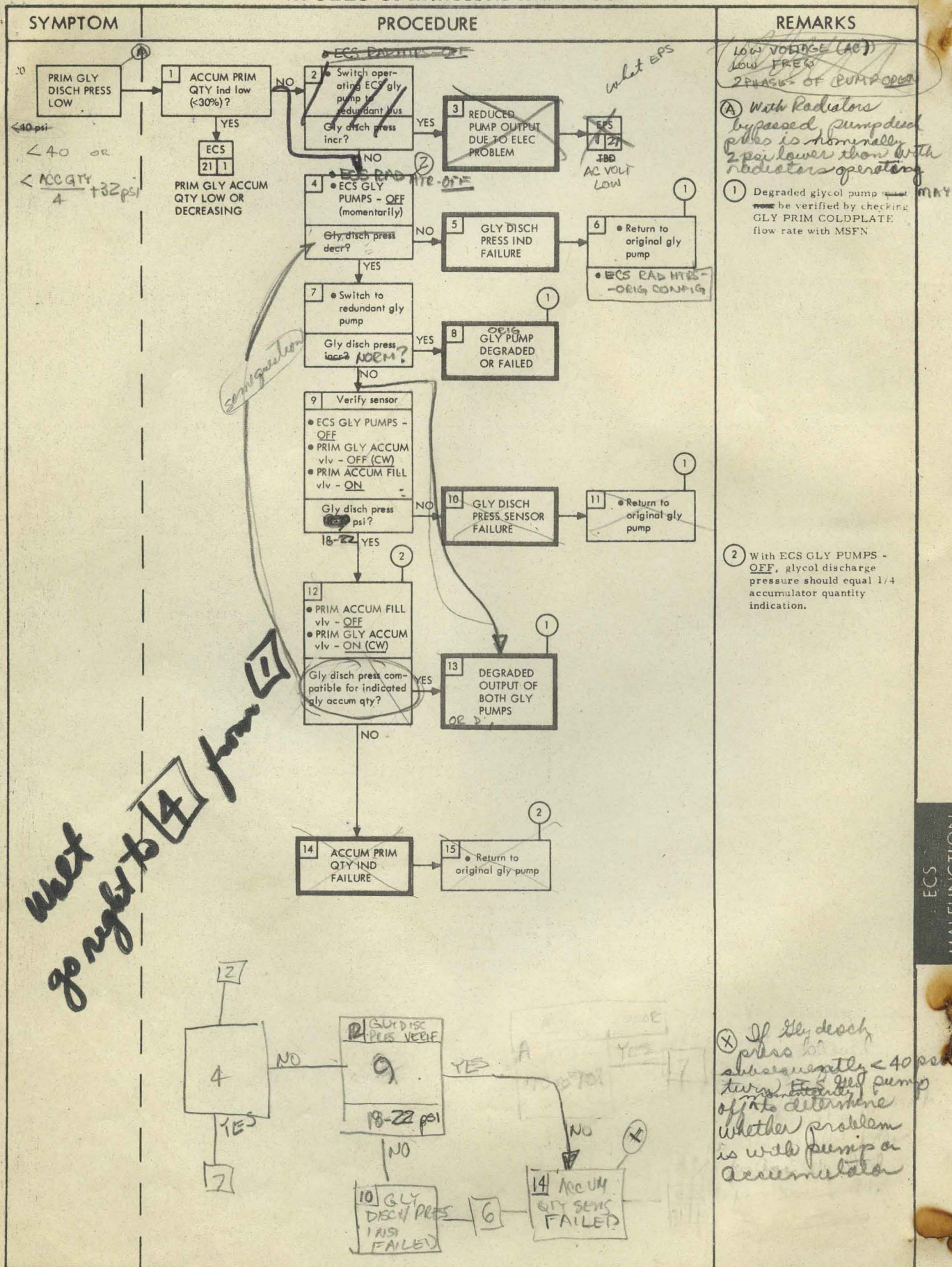
```

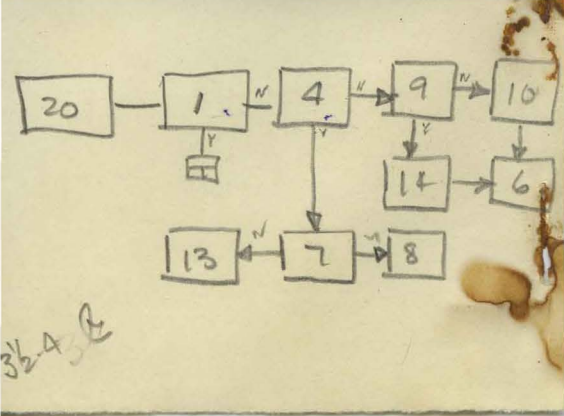
graph TD
    4[4] -- YES --> 7[7]
    4 -- NO --> 9[9]
    9 -- 18-22 psi --> 10[10 GLY DISCH PRESS IND FAILURE]
    9 -- NO --> 14[14 ACC QTY SENS FAIL]
    10 --> 6[6]
    14 --> 6
    6 --> 13[13]
    13 --> 7
    7 --> 8[8]
  
```

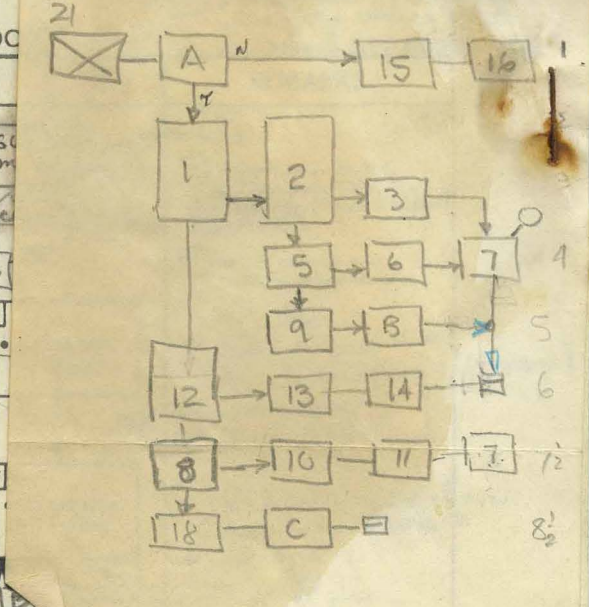
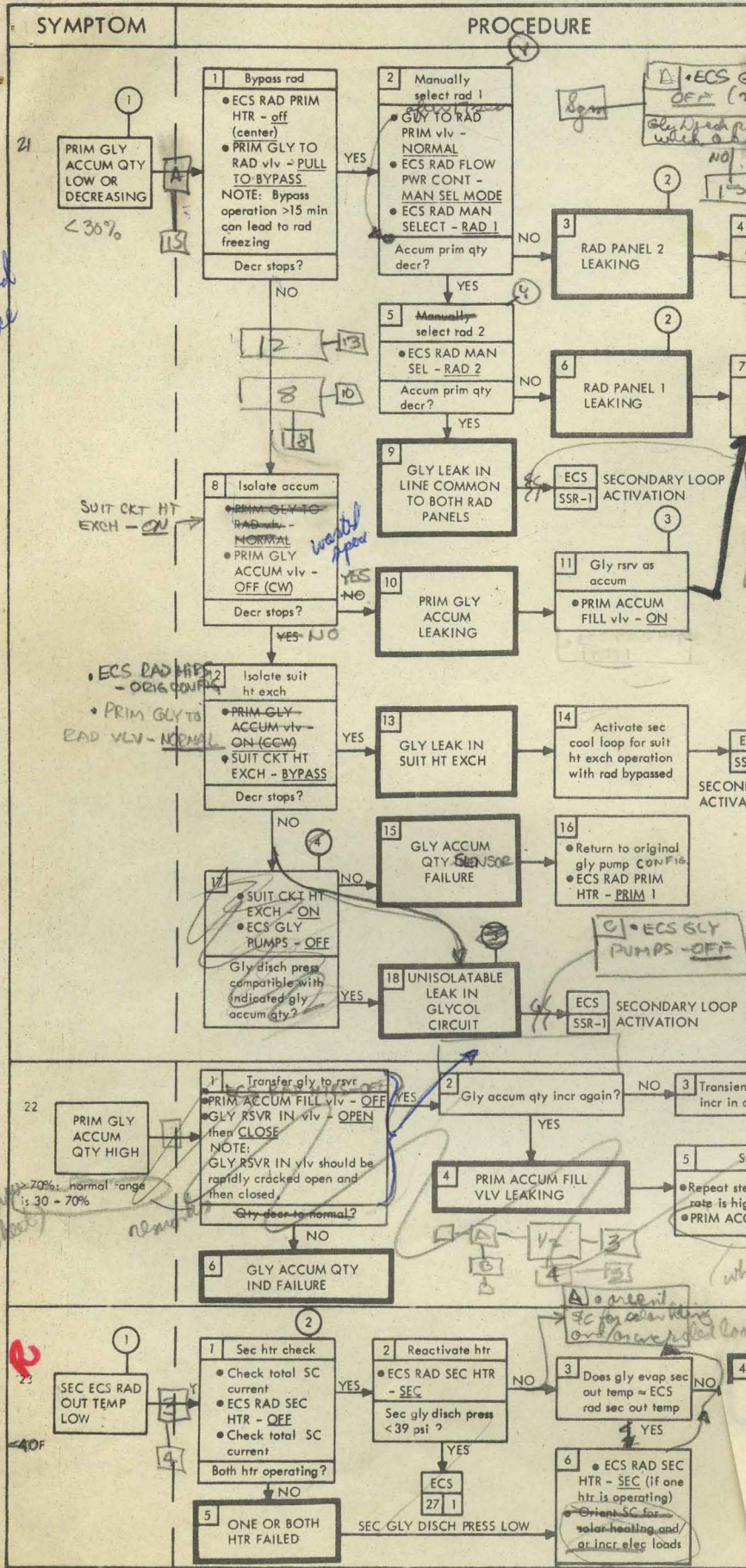
```

graph LR
    20[20] --> 1[1]
    1 --> 4[4]
    4 --> 9[9]
    9 --> 14[14]
    14 --> 13[13]
    13 --> 7[7]
    7 --> 8[8]
  
```


SM4A-U3-SC 101-(2)





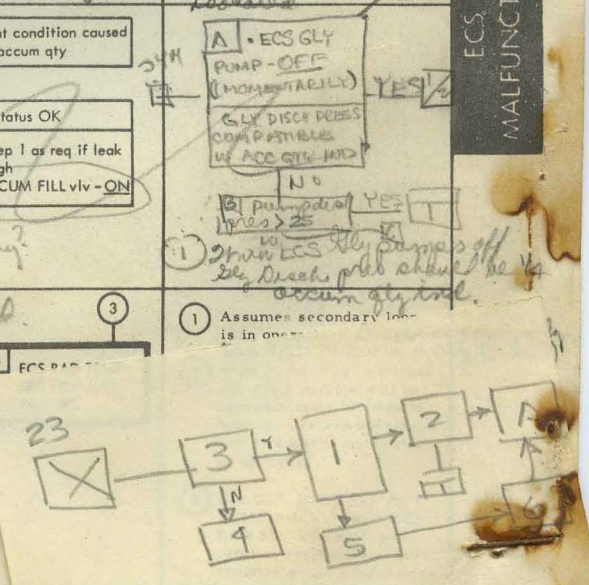


3 All indications of glycol quantity are lost.

4 With pump off glycol discharge pressure should equal 1/4 accumulator quantity.

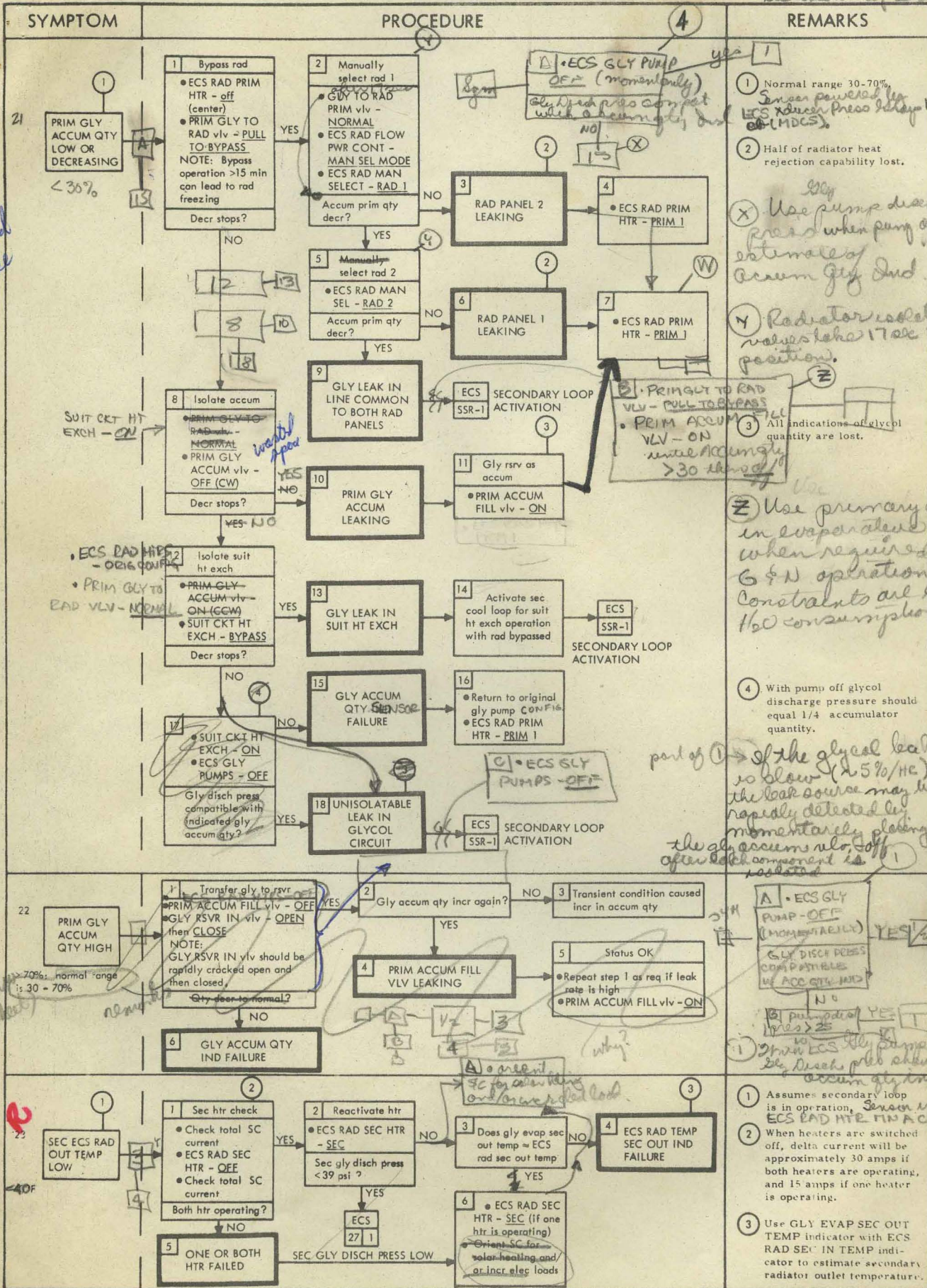
5 Use primary coolant in evaporator mode when required for G & N operation. Constraints are evaporator H₂O consumption.

6 If the glycol leak is slow (2.5%/hr) the leak source may be more rapidly detected by momentarily placing the gly accum vlv off after each component is isolated.



ECS MALFUNCTION

APOLLO OPERATIONS HANDBOOK



ECS MALFUNCTION

SM-2A-1516

Basic Date

Change Date

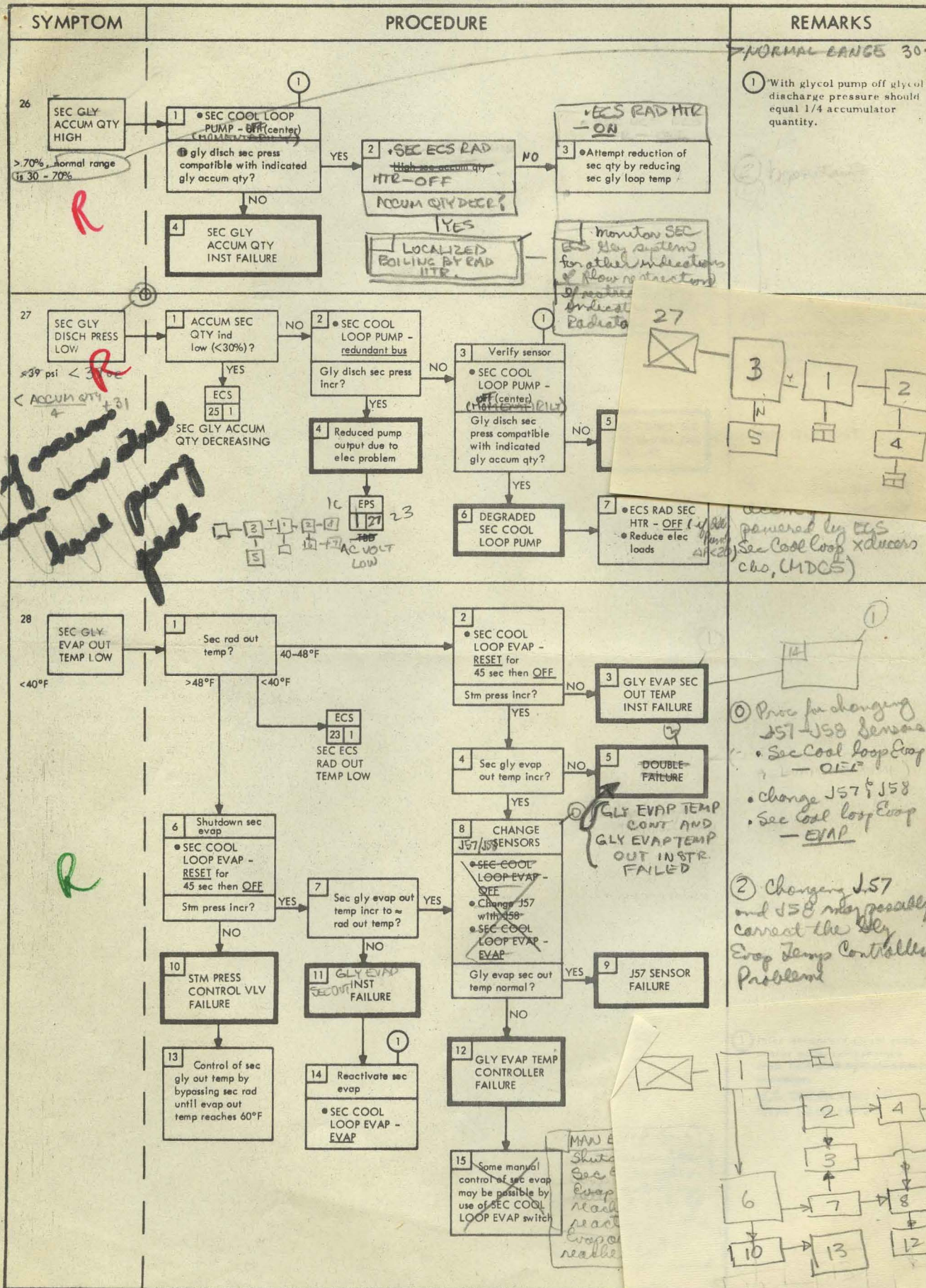
Page

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

SYMPTOM	PROCEDURE	REMARKS
<p>①</p> <p>24 SEC ECS RAD OUT TEMP HIGH</p> <p>>60°F</p>	<p>SEC GLY EVAP OPERATING NORMALLY?</p> <p>1 Sec gly disch press < 39 psi?</p> <p>YES ECS 27 1 SEC GLY DISCH PRESS LOW</p> <p>NO 2 Sec gly evap boiling H₂O (Stm press 0.1-0.15 psi)?</p> <p>YES ① 5 Deactivate htr • ECS RAD SEC HTR - OFF Sec rad in temp decr?</p> <p>NO 8 EXCESSIVE HT LOAD FOR SEC COOL LOOP 9 • Decr sec ECS heat load • ECS RAD SEC HTR - SEC</p> <p>NO 3 Sec gly evap out temp >50.5°F?</p> <p>YES ECS 29 1 SEC GLY EVAP OUT TEMP HIGH</p> <p>NO 4 SEC RAD OUT TEMP INST FAILURE</p> <p>6 SEC HTR FAILED ON</p> <p>7 Manually control htr • Monitor ECS RAD SEC OUT TEMP ind • Above 48°F, ECS RAD SEC HTR - OFF • Below 40°F, ECS RAD SEC HTR - SEC</p>	<p>① Heater operation can be confirmed by ammeter change during switching operation.</p> <p>30 amp - 1 hr operating</p>
<p>④</p> <p>25 SEC GLY ACCUM QTY DECREASING</p> <p>Normal range is 30 - 70%</p>	<p>ISOLATE POSSIBLE LEAKS</p> <p>1 Isolate possible leaks • ECS RAD SEC HTR - OFF • GLY TO RAD SEC vlv - BY PASS • SUIT HT EXCH SEC GLY vlv - BYPASS NOTE: Bypass operation >15 min can lead to rad freezing.</p> <p>Gly accum qty stabilized?</p> <p>YES 6 Reactivate rad • ECS RAD SEC HTR - SEC (if req) • GLY TO RAD SEC vlv - NORMAL Gly accum qty stabilized?</p> <p>NO 7 RADIATOR SYSTEM LEAKING 8 Isolate rad • ECS RAD SEC HTR - OFF • GLY TO RAD SEC vlv - BYPASS • Reduce S C elec loads</p> <p>NO 2 SERVO CK 2 • SEC COOL LOOP PUMP - OFF (center) gly disch sec press compatible for indicated gly accum qty?</p> <p>YES 4 LEAKING SYSTEM (CANNOT BE ISOLATED)</p> <p>NO 3 GLY ACCUM QTY INST FAILURE 5 Reactivate • SEC COOL LOOP PUMP - AC 1 (AC 2) (if req) • ECS RAD SEC HTR - SEC (if req) • GLY TO RAD SEC vlv - NORMAL • SUIT HT EXCH SEC GLY vlv - FLOW</p> <p>9 SUIT HT EXCH LEAKING 10 NOTE: Keep suit ht exch sec gly isolated except just prior to, and during entry to conserve coolant. Check FROTH connectors periodically for leakage</p>	<p>① This symptom is also valid when secondary glycol loop is not in operation. Accum Qty and Disch Press sensors powered by ECS for Cool Loop & Disch Press (CHDS)</p> <p>② With pump off glycol discharge pressure should equal 1/4 glycol accumulator quantity.</p> <p>③ Humidity control and suit loop cooling not available from secondary loop when suit heat exchanger is bypassed.</p> <p>A glycol leak will exist whenever the secondary suit ht. exch is used and could result in glycol contamination in the suit loop</p>

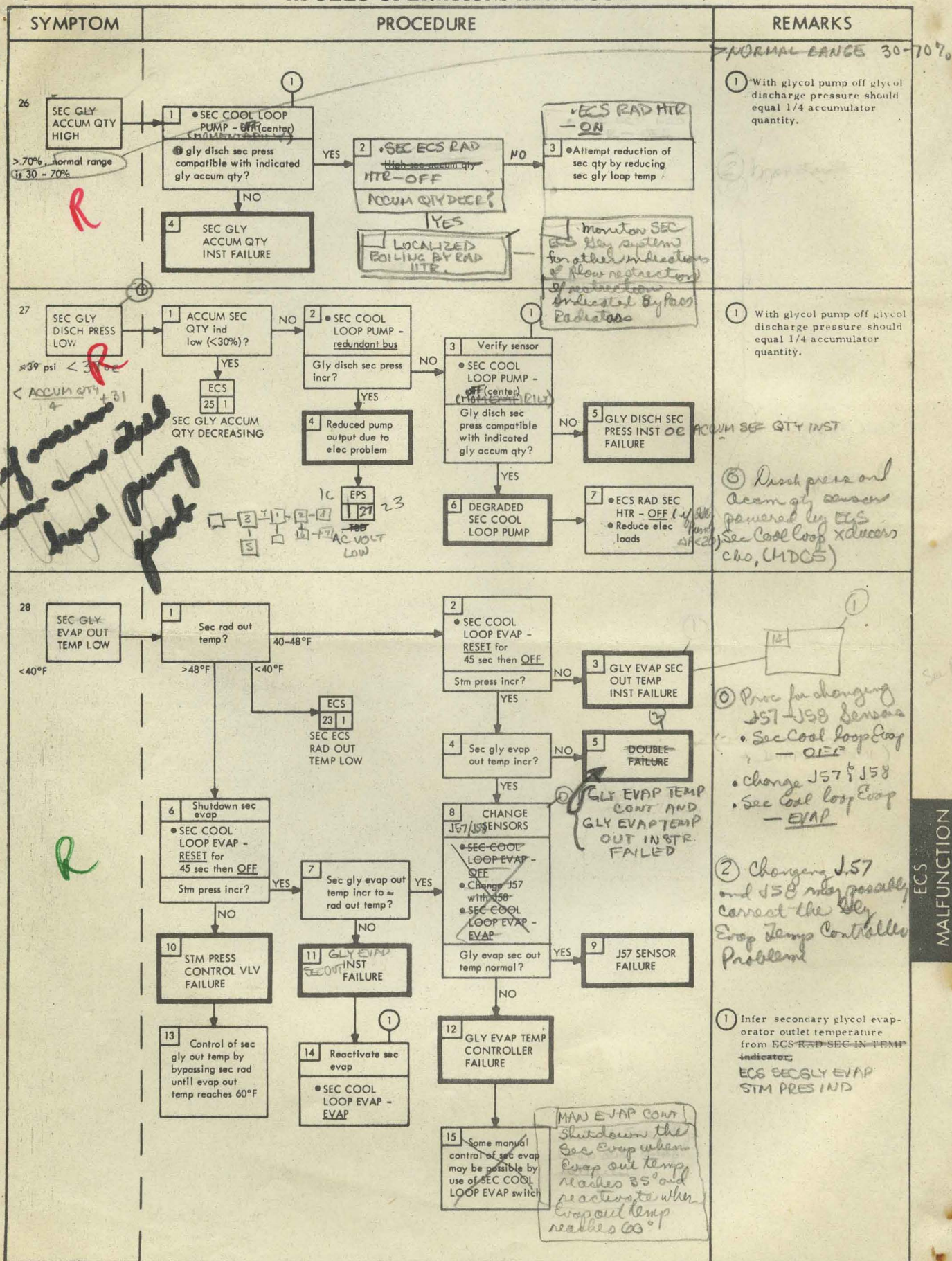
ECS
MALFUNCTION

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

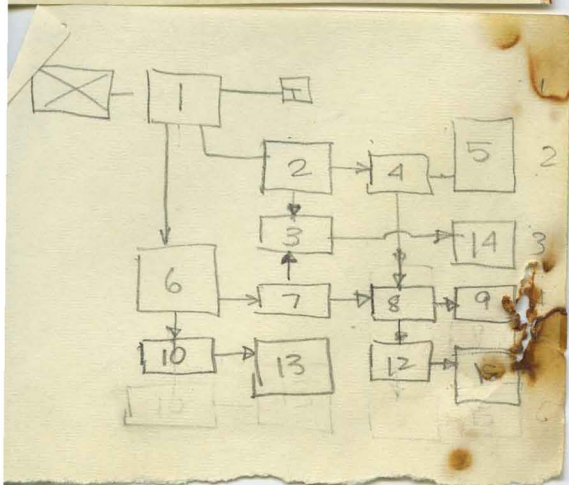
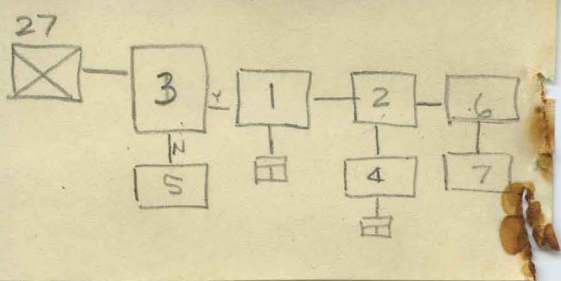


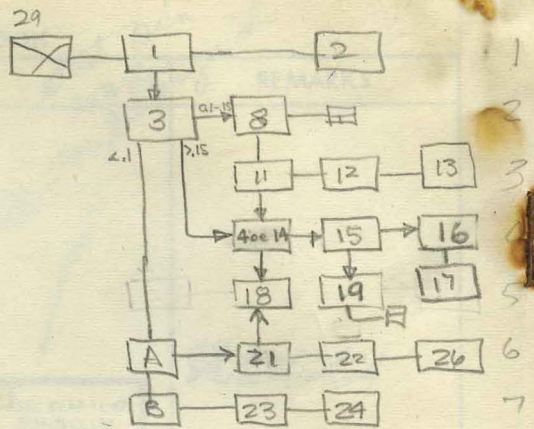
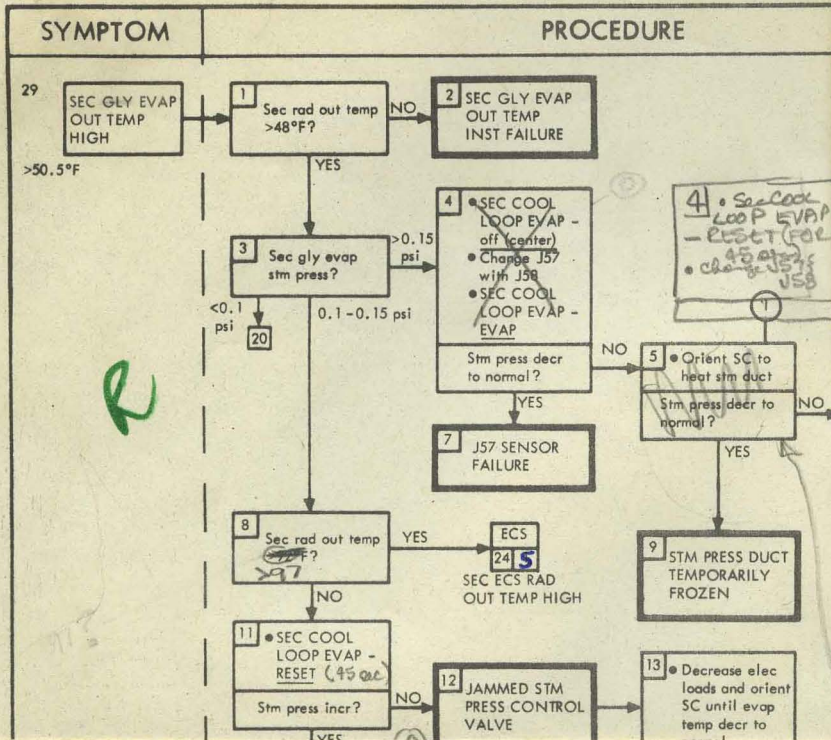
Basic Date

Change Date



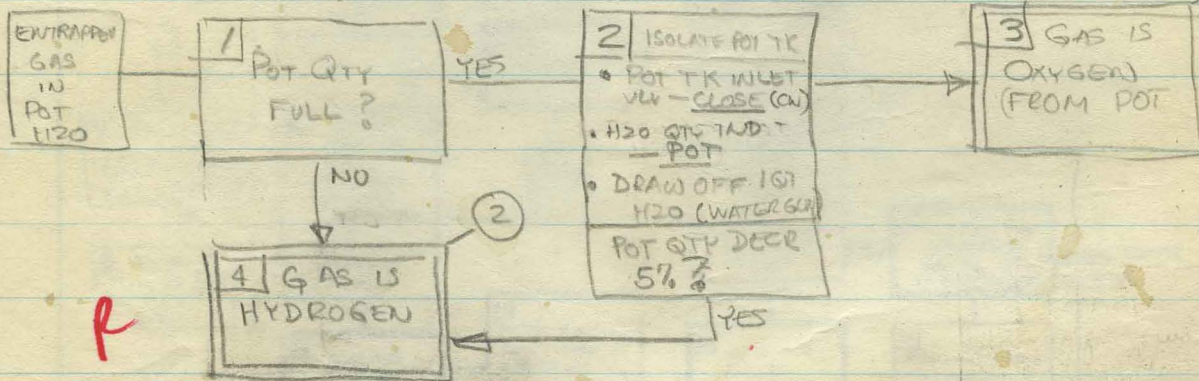
ECS
MALFUNCTION





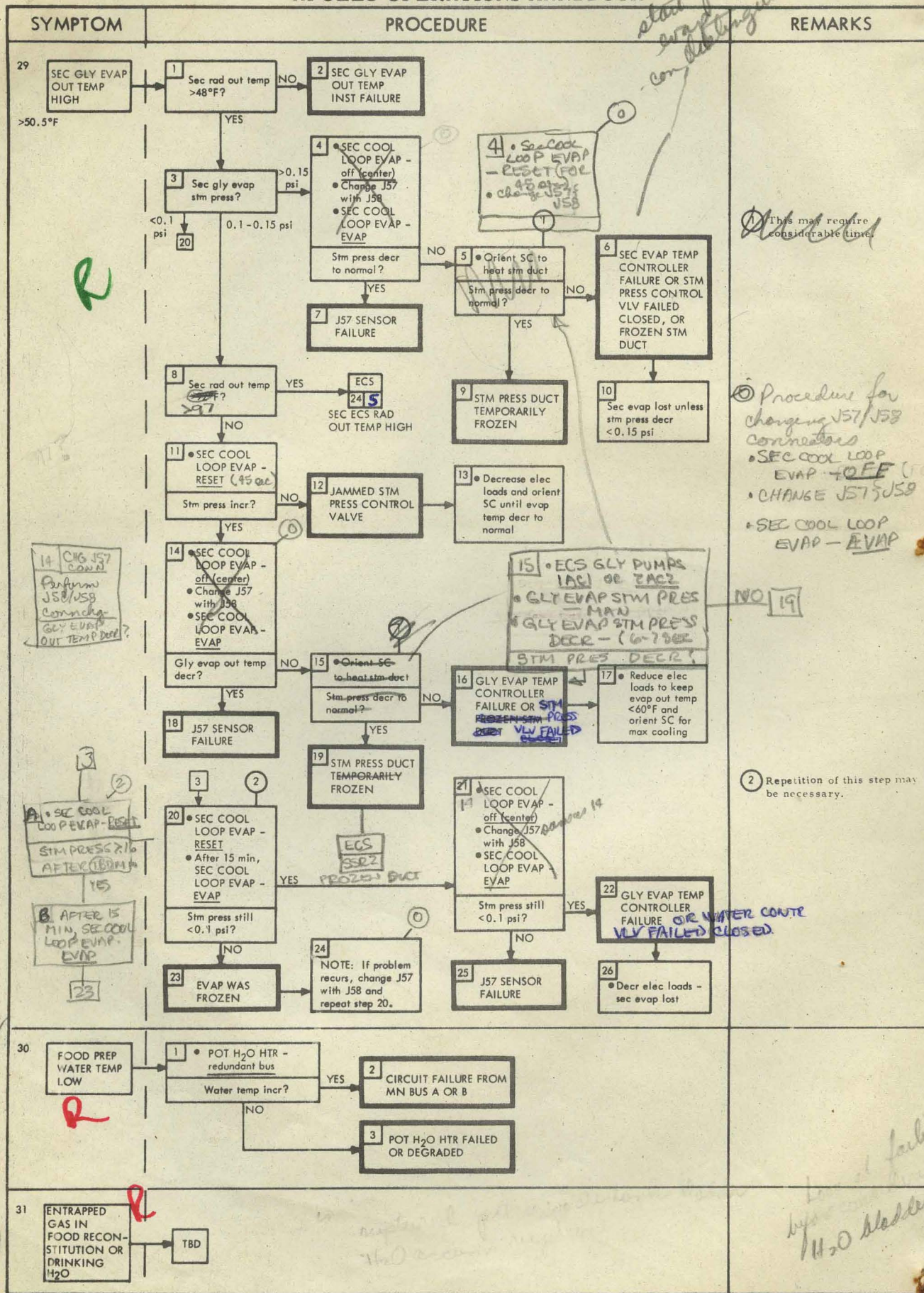
① Procedure for changing J57/J58 connectors
• SEC COOL LOOP EVAP - OFF (45 sec)
• CHANGE J57/J58
• SEC COOL LOOP

31



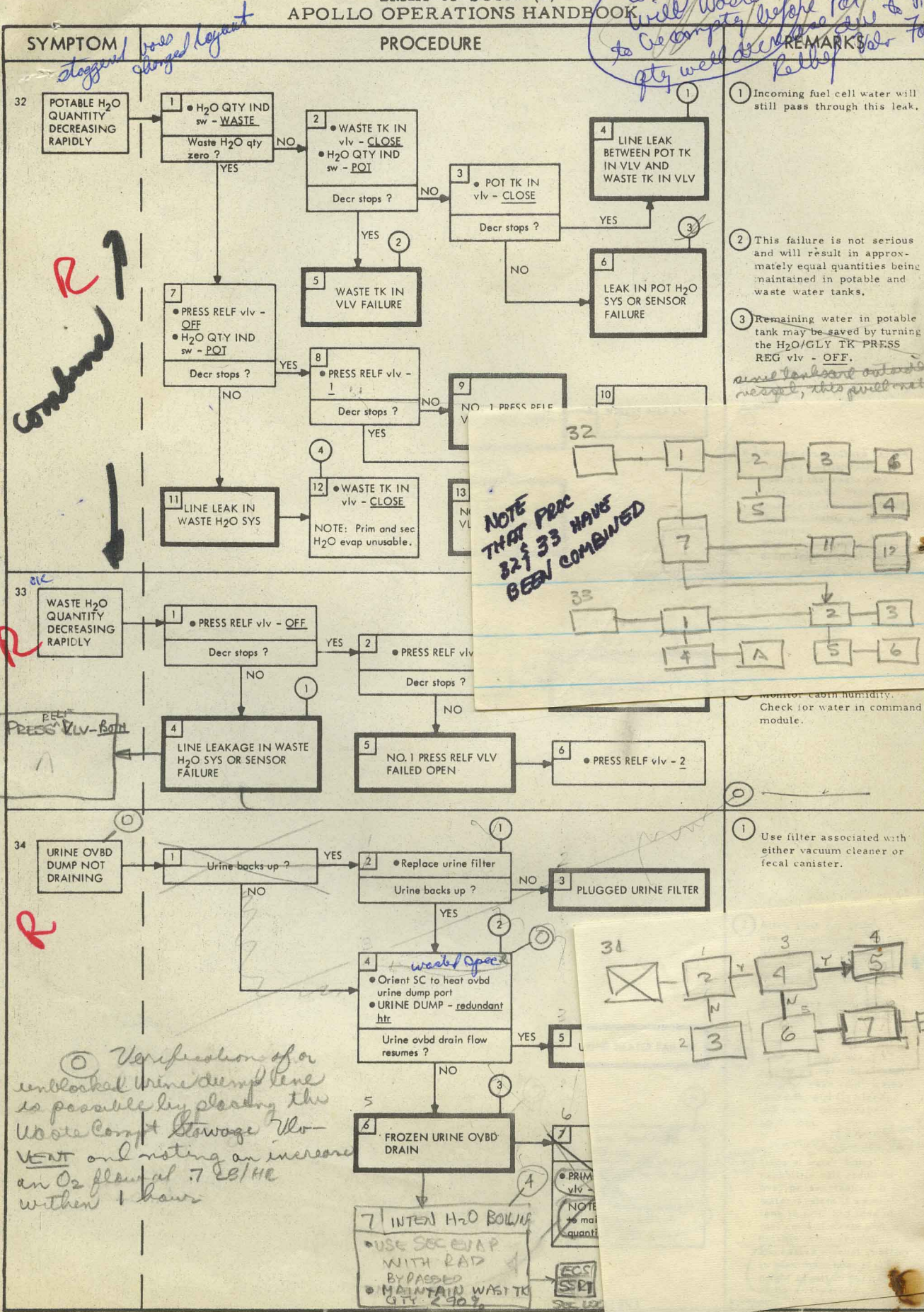
① Potable tank will be lost in time. Consideration should be given to drawing off and storing potable H₂O.

② Investigate FK Cond
EXA temp of each fuel cell
to associate fuel cell
causing H₂ gas entrainment



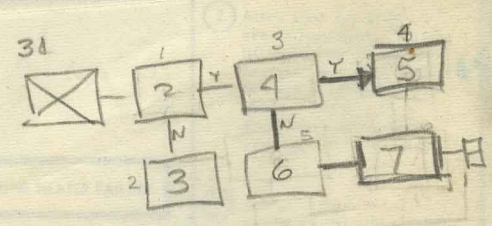
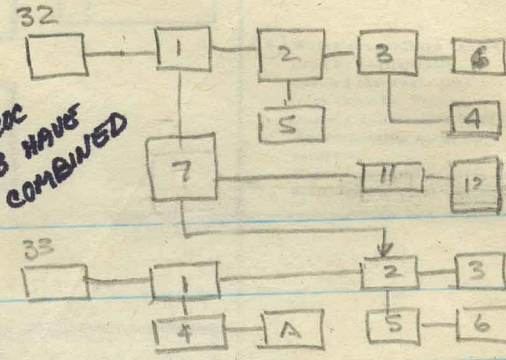
yes
ask Jim [unclear] if we have
will waste before Pot H₂O
to be empty before we go to Pass
pty well [unclear] failure
Relief

②



Combined

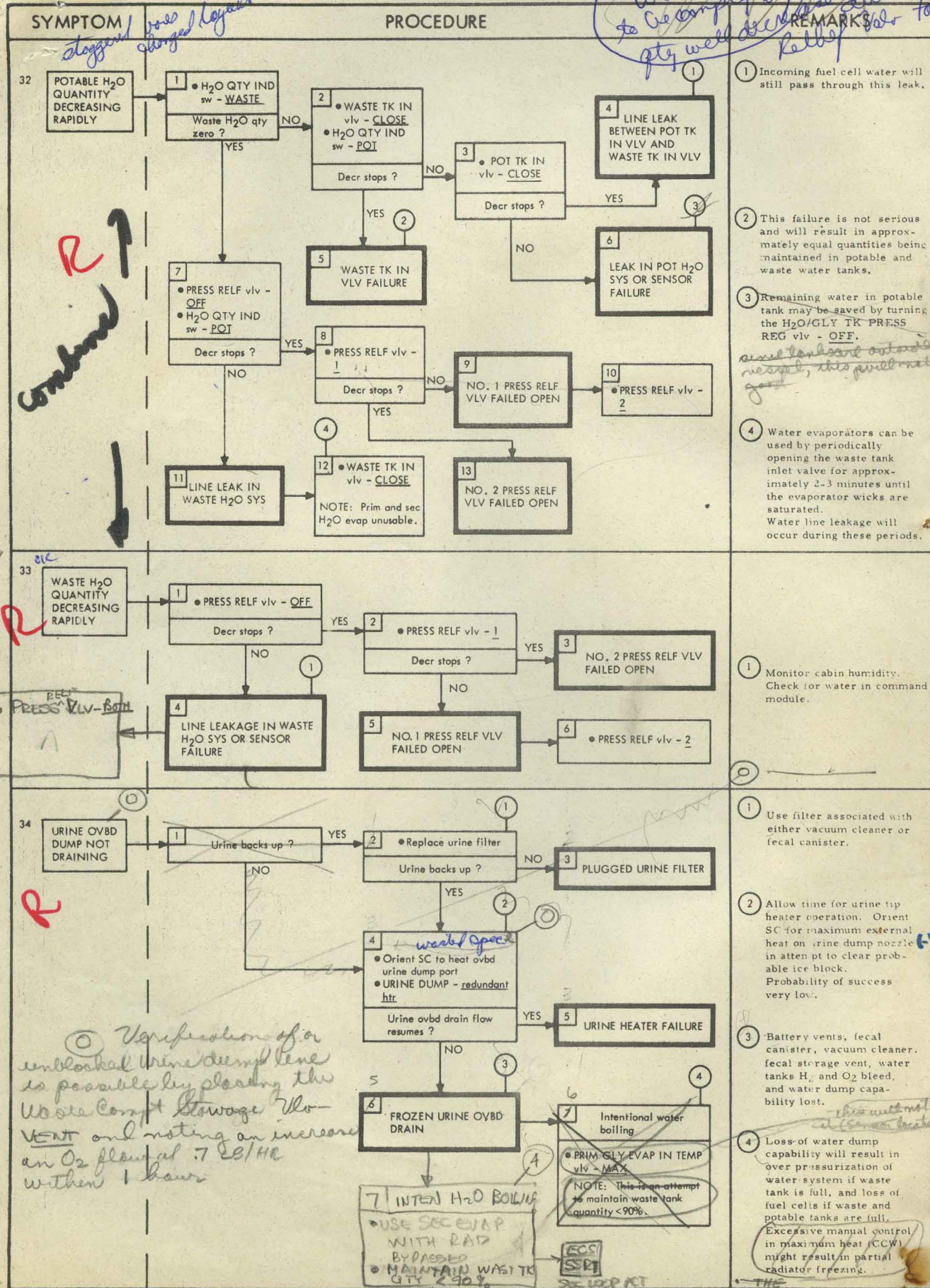
NOTE THAT PRX 32 & 33 HAVE BEEN COMBINED



③ Verification of or unblocked urine dump line is possible by placing the Waste Comp Storage Vlv - VENT and noting an increase in O₂ flow of .7 lb/hr within 1 hour

NOTE

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



Basic Date

Change Date

Page

SM-2A-1520

ECG
MALFUNCTION

ask Jentson will waste H₂O in line to be empty before Pot H₂O fails. pty well decrease due to failure

continued

some tankage outside pass needed, this will not do any good

Verification of a unblocked urine dump line is possible by placing the Waste Comp Storage VLV-VENT and noting an increase in O₂ flow at 7.28/Hr within 1 hour

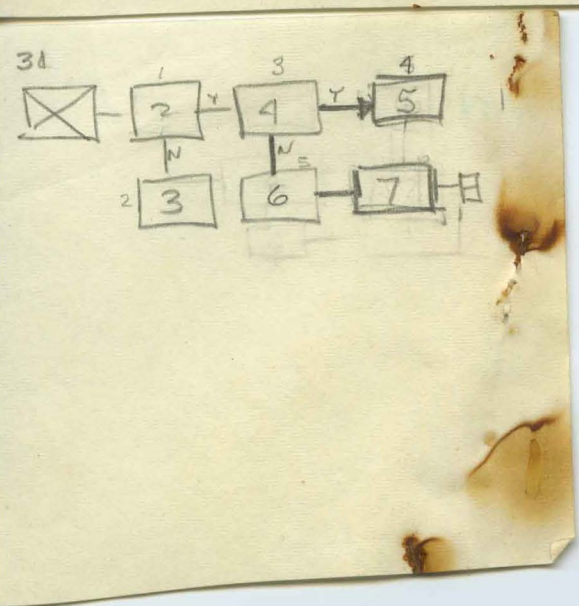
ECG SP1 DE WIP KT

32

C HAVE COMBINED

33

4 5



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>35 VACUUM CLEANER SUCTION LOW</p> <p>35a FECAL CANISTER VACUUM LOW</p>	<p>1 Change vacuum cleaner debris bag</p> <p>Suction normal ?</p> <p>YES 2 DEBRIS BAG CLOGGED OR EXPENDED</p> <p>NO</p> <p>3 Replace WMS filters</p> <p>Suction normal ?</p> <p>YES 4 CLOGGED FILTER</p> <p>NO</p> <p>ECS 34 3</p> <p>URINE OVBD DUMP NOT DRAINING</p> <p><i>note change</i></p>	<p>1 Assumes second WMS hose is disengaged.</p>
<p>36 INADEQUATE VENTILATION AFTER LANDING</p>	<p>1 Cycle PL vent sw</p> <p>Ventilation incr ?</p> <p>NO 2 Actuate PLVC</p> <p>PLVC - OPEN</p> <p>Ventilation incr ?</p> <p>YES 3 ATTITUDE SENSING SW FAILED CLOSED</p> <p>NO 5 PLV FAN FAILURE</p> <p>4 Resets attitude sensor relay to resume PLV operation</p>	<p>2 Ventilation available not opening either hatch</p> <p>1 Postlanding vent switch must be cycled to off and back to high (low) anytime SC attitude exceeds 60° to reset the attitude control relay.</p>
<p>37 WATER INFLOW AFTER LANDING</p>	<p>1 PLVC - NORMAL</p> <p>Water inflow stops ?</p> <p>NO 2 PL VENT - OFF</p> <p>CAB PRESS RELF vlv (2) - CLOSE</p> <p>Water inflow stops ?</p> <p>NO 3 UNCONTROLLABLE WATER INFLOW INTO SC</p> <p>YES 5 ATTITUDE SENSING SWITCH FAILED OPEN</p> <p>4 Inflow caused by open PLV vlv</p>	

ECS MALFUNCTION

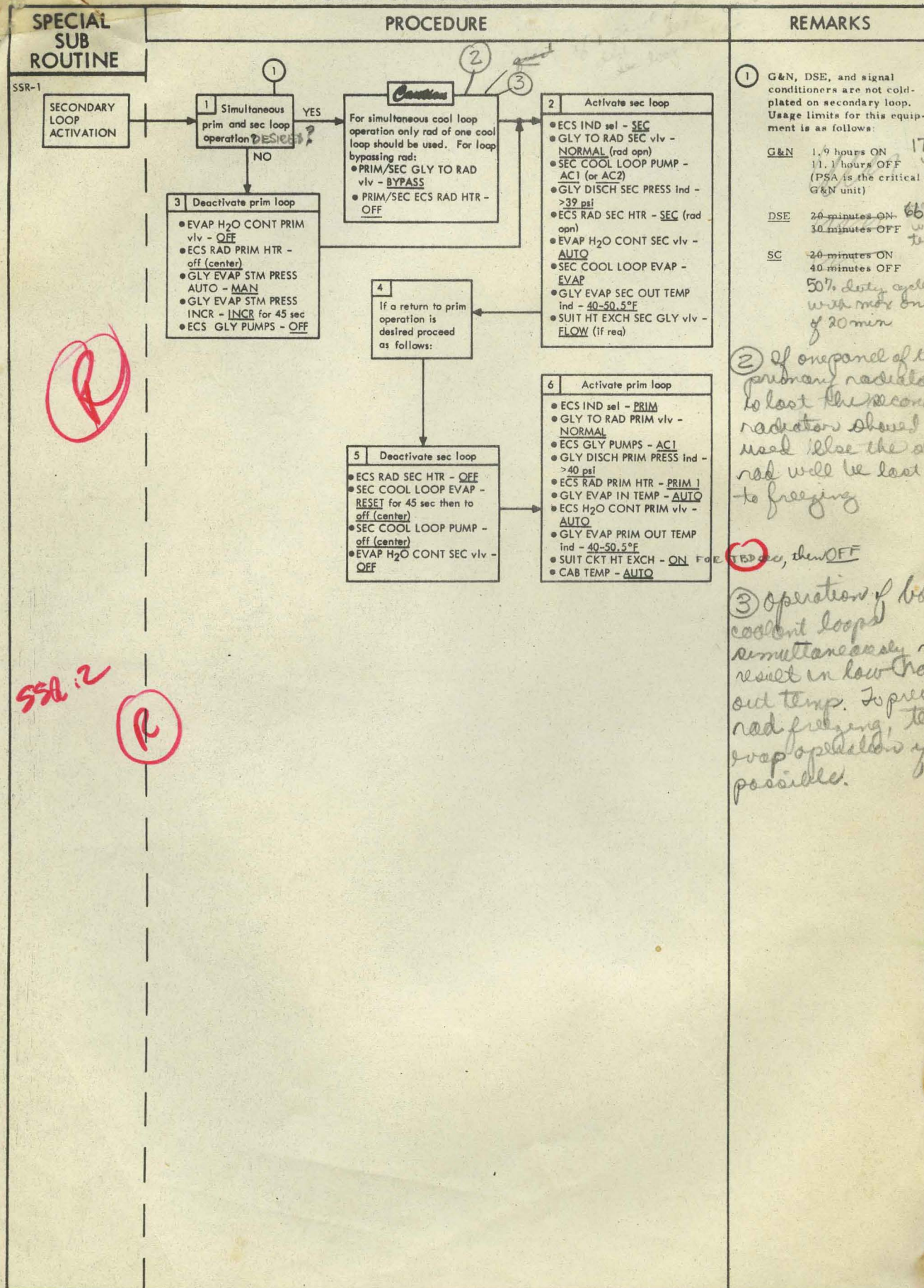
Basic Date _____

Change Date _____

Page _____

SM-2A-1521

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



ECS
MALFUNCTION