

Apollo 13

CSM MALFUNCTION
PROCEDURES

PART NO.	S/N
SKB32100082 - 341	1002

CSM MALFUNCTION PROCEDURES

G&C

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

G&C

G & C MALFUNCTION INDEX

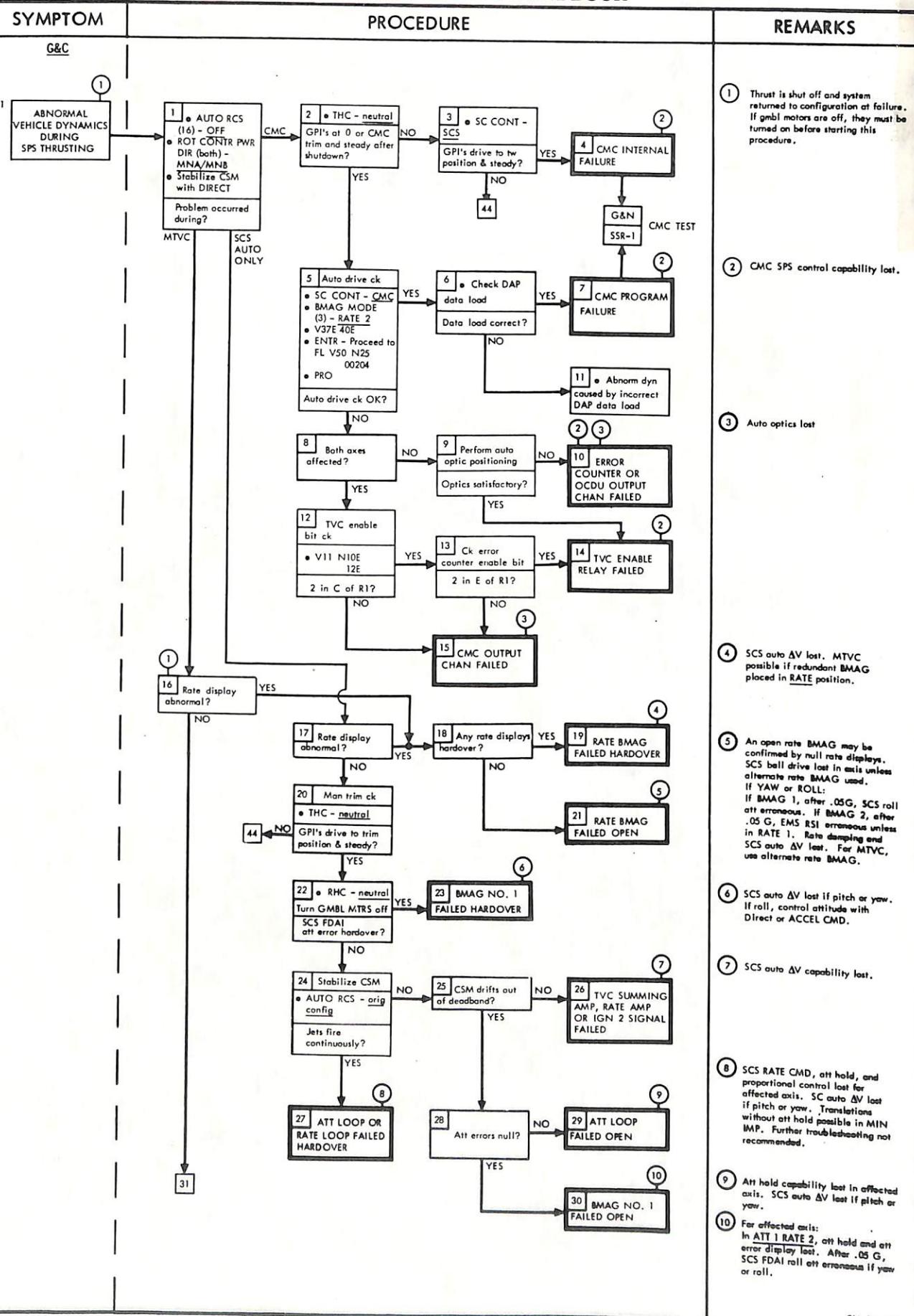
- 1 ABNORMAL VEHICLE DYNAMICS DURING SPS THRUSTING
- 2 FDAI ATT ERROR ABNORMAL
- 3 FDAI RATE IND ABNORMAL
- 4 FDAI TOTAL ATTITUDE DISPLAY ABNORMAL
- 5 FDAI FAILS TO SLEW WITH ORDEAL
- 6 FDAI TOTAL ATT DOES NOT RESPOND TO GDC ALIGN
- 7 GPI/FUEL PRESS IND(S) PEGGED OR ZERO
- 8 BMAG 1 (2) TEMP

A ABNORMAL VEHICLE DYNAMICS (NON-SPS THRUSTING LM-INACTIVE)

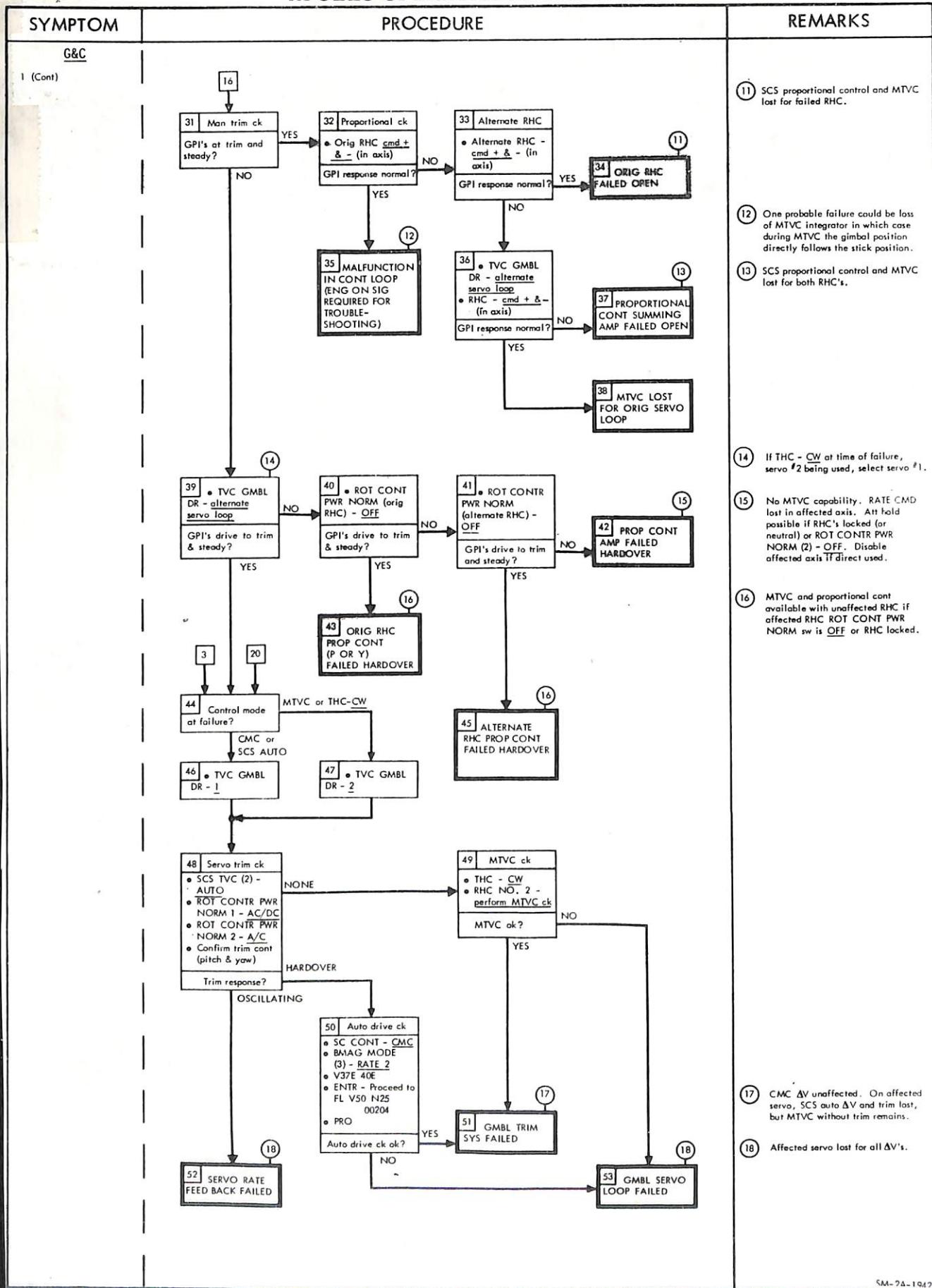
CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
 DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
G&C	<p>2 FDAI ATT ERROR ABNORMAL</p> <p>1 FDAI total att display normal? YES → 2 FDAI SEL sw? 1/2 → 3 Abnormal error on FDAI 1? NO → 4 o FDAI SEL - 2 • FDAI SOURCE - CMC Display normal? NO → 12</p> <p>NO → FDAI TOTAL ATT DISPLAY ABNORMAL 4 1</p> <p>5 o FDAI SEL - 1 (if 2) or 2 (if 1) Display normal? YES → 6 FDAI SEL orig at 1? YES → 7 FDAI NO. 1 ATT ERROR FAILED</p> <p>NO → 9 FDAI NO. 2 ATT ERROR FAILED</p> <p>Display normal? YES → 8 o FDAI SEL - 1 • FDAI SOURCE - GDC Display normal? NO → 11 BMAG NO. 1 FAILED (ATT ERROR MODE)</p> <p>10 FDAI SOURCE sw? ATT SET CMC → 12 Error counter ck</p> <ul style="list-style-type: none"> • V4BE, V21E, 0E PRO, PRO, PRO V46E • FDAI SCALE - 5/5 • V37E 00E • Load error counters V43E +00250 +00333 +00333 <p>Display normal? NO → 13 ERROR COUNTER FAILED</p> <p>YES → 14 Possible procedural or software problem. Reinitialize and repeat condition</p> <p>15 ATT SET sw? IMU GDC → 16 Att err ind null? YES → 17 o ATT SET sw - + & - Att err ind responds? NO → 18 ATT SET FUNCTION FAILED</p> <p>NO → 19 EDA OR GDC ENABLE RELAYS OR GDC EULER-TO-BODY CONVERSION FAILED</p> <p>YES → 20 EDA FAIL (IMU TO ATT SET) ENABLE RELAY - 117ABK 13, 14, 15, 16, 17, 18</p> <p>21 o ATT SET - IMU (if desired)</p> <p>22 o ATT SET - GDC (if desired)</p>	<p>(1) May be single or multi axis.</p> <p>(2) RATE 1 operation from this BMAG may not be available.</p> <p>(3) CMC attitude error, coarse align and SIVB attitude control lost for axis that showed abnormal in error counter check.</p> <p>(4) Cycling ATT SET sw may free sticking relays.</p> <p>(5) Attitude error functions are inoperative when FDAI SOURCE switch at ATT SET.</p> <p>(6) Failure of GDC enable relays will be determined by an inability to align GDC by GDC ALIGN pb.</p> <p>(7) SCS off set error display lost. If ATT SET - IMU, attitude errors displayed will be Euler angles.</p> <p>(8) IMU function of ATT SET sw lost.</p>
	<p>3 FDAI RATE IND ABNORMAL</p> <p>1 o FDAI SEL - 1/2 Both FDAI rate inds (affected axis) agree? YES → 2 Rate inds? HARDOVER → 3 SELECTED RATE BMAG FAILED HARDOVER</p> <p>NO → 4 FDAI RATE DISPLAY FAILURE</p> <p>NULL → 5 SELECTED RATE BMAG FAILED OPEN</p> <p>3 → 6 o BMAG MODE (affected axis) - alternate rate source</p>	<p>(1) May be single or multiple axes.</p> <p>(2) Attitude error display and attitude hold capability lost. SCS auto ΔV lost if pitch or yaw; for roll place MAN ATT ROLL - ACCEL CMD and control roll manually. If failure is No. 1 roll or yaw BMAG after .05 G, No. 2 FDAI roll ind will spin up.</p> <p>(3) If BMAG No. 2 failed: SCS auto ΔV lost unless in roll; then place BMAG MODE ROLL - ATT 1 RATE 2 and LIM CYCLE - on (up). RCS attitude hold available in all axes with BMAG MODE (3) - ATT 1 RATE 2 and LIM CYCLE on (up). If roll or yaw BMAG No. 1 failed, No. 2 FDAI roll ind erroneous after .05 G.</p>

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
G&C	<pre> graph TD A[4 FDAL TOTAL ATTITUDE DISPLAY ABNORMAL] --> B{1 Ordeal operating?} B -- NO --> C[7 FDAL SELECT sw?] B -- YES --> D[2 Ordeal FDAL sw (both) - INRTL] D -- Total att display norm? -- YES --> E[3 Alternate inertial source active and aligned in plane?] E -- YES --> F[5 Alternate ordeal FDAL sw - ORB RATE] F -- Alternate total att display norm for ordeal inputs? -- YES --> G[6 ORDEAL FAILED] F -- NO --> H[4 Orig inertial source - alternate FDAL] H -- Alternate total att display norm for ordeal inputs? -- YES --> G H -- NO --> I[10 ORDEAL RESOLVER FAILED FOR ORIG FDAL] I --> J[3] C -- 1 or 2 --> K[8 FDAL sel - 1 (if at 2) 2 (if at 1)] K -- Display norm? -- YES --> L[9 ORIG SELECTED FDAL FAILED] K -- NO --> M[11 V16 N20E Use gmb1 angle display to determine abnormal FDAL] M -- Abnormal motion on FDAL No. 1? -- YES --> N[12 FDAL SOURCE - CMC FDAL SEL - 2] N -- No. 2 FDAL display norm? -- YES --> O[13 FDAL NO. 1 FAILED] N -- NO --> P[14 Orig display IMU source?] P -- YES --> Q[15 CIRCUITRY FAILED BETWEEN IMU AND FDAL'S] P -- NO --> R[16 FDAL SOURCE - GDC FDAL SEL - 1] R -- FDAL No. 1 display norm? -- YES --> S[19 FDAL NO. 2 FAILED] R -- NO --> T[17 RHC - cmd mnvr by axis starting at 0, 0, 0] T -- FDAL response norm? -- YES --> U[18 EULER MODE RELAY FAILED (DE-ENERGIZED)] T -- NO --> V[20 BMAG MODE (3) alternate rate source RHC - cmd mnvr in affected axis 0, 0, 0] V -- FDAL response norm? -- YES --> W[21 BMAG ORIG SELECTED FOR RATE FAILED] V -- NO --> X[23 GDC FAILED] W --> Y[22 Continue to use alternate BMAG for rate in failed axis] Z[5 FDAL FAILS TO SLEW WITH ORDEAL] --> AA{1 Ordeal MODE - OPR/SLOW} AA -- FDI slews? -- YES --> BB[2 FAST SLEW FUNCTION FAILED] AA -- NO --> CC[3 SLEW FUNCTION FAILED] </pre>	<ul style="list-style-type: none"> (1) For GDC FDAL total attitude, if rate display(s) also hardover, enter "FDAL Rate Ind Abnormal" procedure. (2) Assumes inertial reference for orbital rate FDAL is aligned in plane. (3) Use alternate FDAL for subsequent orbital rate displays. (4) Confirm FDAL failure by placing alternate inertial source on affected FDAL. Normal total attitude with alternate inertial source indicative of Golden G relay failure. (5) Any failure of IMU itself would have been indicated by ISS light. (6) The FDAL can be aligned to 0, 0, 0 by the GDC align pb. (7) Attempt only single-axis maneuvers in order pitch, yaw and roll. This failure has no effect after .05 G since Euler mode relays are disabled. (8) Assumes alternate rate source operable. (9) After .05 G, if BMAG NO. 1 fails in yaw or roll, FDAL Roll Att will be erroneous; if BMAG NO. 2 fails in yaw or roll, EMS RSI attitude will be erroneous unless RATE 1 selected. (10) Entry capability can be determined from GDC FDAL roll ind and EMS RSI response when a yaw maneuver is commanded with .05 G sw and EMS ROLL sw - on (up). Total attitude capability lost for affected axis. After .05 G, if failure axis is: YAW - EMS RSI invalid ROLL - No. 2 FDAL roll ind invalid.
		<ul style="list-style-type: none"> (1) Slew FDAL at slow rate. (2) With an in-plane GDC alignment, FDAL pitch angle may be set by pressing GDC align pb and slewing pitch att set tw.

SOURCE AOH
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

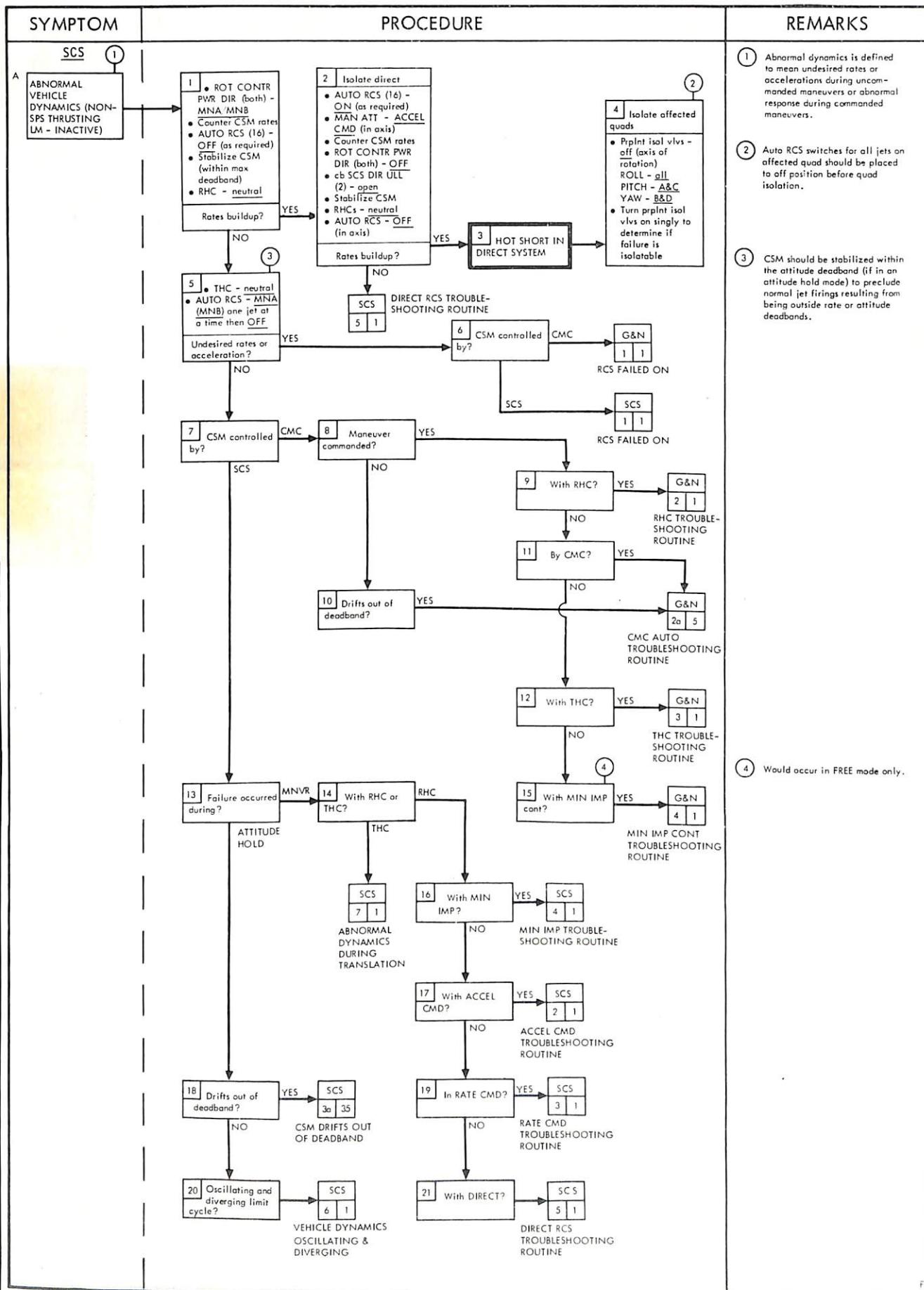
CSM MALFUNCTION PROCEDURES

SOURCE DATE MARCH 16, 1970

SYMPTOM	PROCEDURE	REMARKS
6 G&C	<pre> 1 Monitor FDAI for response to vehicle motion Response normal? YES 2 • FDAO SEL - 1 • FDAO SOURCE - ATT SET • ATT SET - GDC FDAO indicates att error in axis? NO 3 GDC ALIGN FUNCTION LOST YES 4 GDC ALIGN ATT SET ENABLE FUNCTION LOST </pre> <p>FDAI TOTAL ATT DISPLAY ABNORMAL</p>	<p>(1) May be single or multiple axes.</p> <p>(2) Att set error displays still operational.</p> <p>(3) GDC can be aligned to an arbitrary position by:</p> <ul style="list-style-type: none"> a. Fly CSM to indicated attitude to which GDC is to be aligned. b. Disable GDC. c. Fly CSM to prescribed inertial attitude (star or visual reference). d. Re-enable GDC.
7	<pre> 1 Both inds (of pair) pegged or zero? NO 2 One pitch (fuel) and one yaw (oxid) YES abnormal? NO 3 Ind usage for fuel? YES 4 DISPLAY FAILED NO 5 EDA 15 VDC PWR SUPPLY FAILURE 6 LOSS OF ONE PRESS DISPLAY. </pre> <p>GPI/FUEL PRESS IND(S) PEGGED OR ZERO</p> <pre> 7 Ind usage for fuel press? NO 8 GPI problem occurred during? YES CMC 9 Occurred during CMC trim test? YES G&C 1 5 NO 10 TANK PRESS SIG CONDITION- FAILURE NO MTVC or THC-CW SCS AUTO 11 TANK PRESS ABNORMAL </pre> <p>ABNORMAL VEHICLE DYNAMICS DURING SPS THRUSTING</p> <p>ABNORMAL VEHICLE DYNAMICS DURING SPS THRUSTING</p> <pre> 9 Are all four ind pegged or zero? YES 10 TANK PRESS SIG CONDITION- FAILURE NO 11 TANK PRESS ABNORMAL </pre>	<p>(1) Total attitude, attitude error & rate display lost for 1 FDAO.</p> <p>(2) Check GPI operation during first gimbal drive and trim check.</p> <p>(3) Utilize MSFN to monitor tank press.</p>
8	<pre> 1 • BMAG PWR - OFF (Affected BMAG) Temp It goes out? YES 2 After 30 min: • BMAG PWR - ON (Affected BMAG) BMAG It on and stays on continuously? YES 3 BMAG FAILED UNDERTEMP NO 5 BMAG FAILED OVERTEMP NO 6 • BMAG PWR - OFF (Affected BMAG). Turn on affected BMAG 30 min prior to use </pre> <p>BMAG 1 (2) TEMP</p> <p>Yellow It on if temp <168 >172</p> <p>C/W FAILURE</p>	<p>(1) BMAG rate information relatively unaffected by temperature out-of-tolerance. However attitude error information degrades ~4% per degree out of tolerance.</p> <p>(2) Time that the BMAG TEMP It is off is an indication of the temperature increase and period of accuracy for subsequent BMAG use.</p>

6 THRU A

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



CSM MALFUNCTION PROCEDURES

SCS

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

SCS MALFUNCTION INDEX

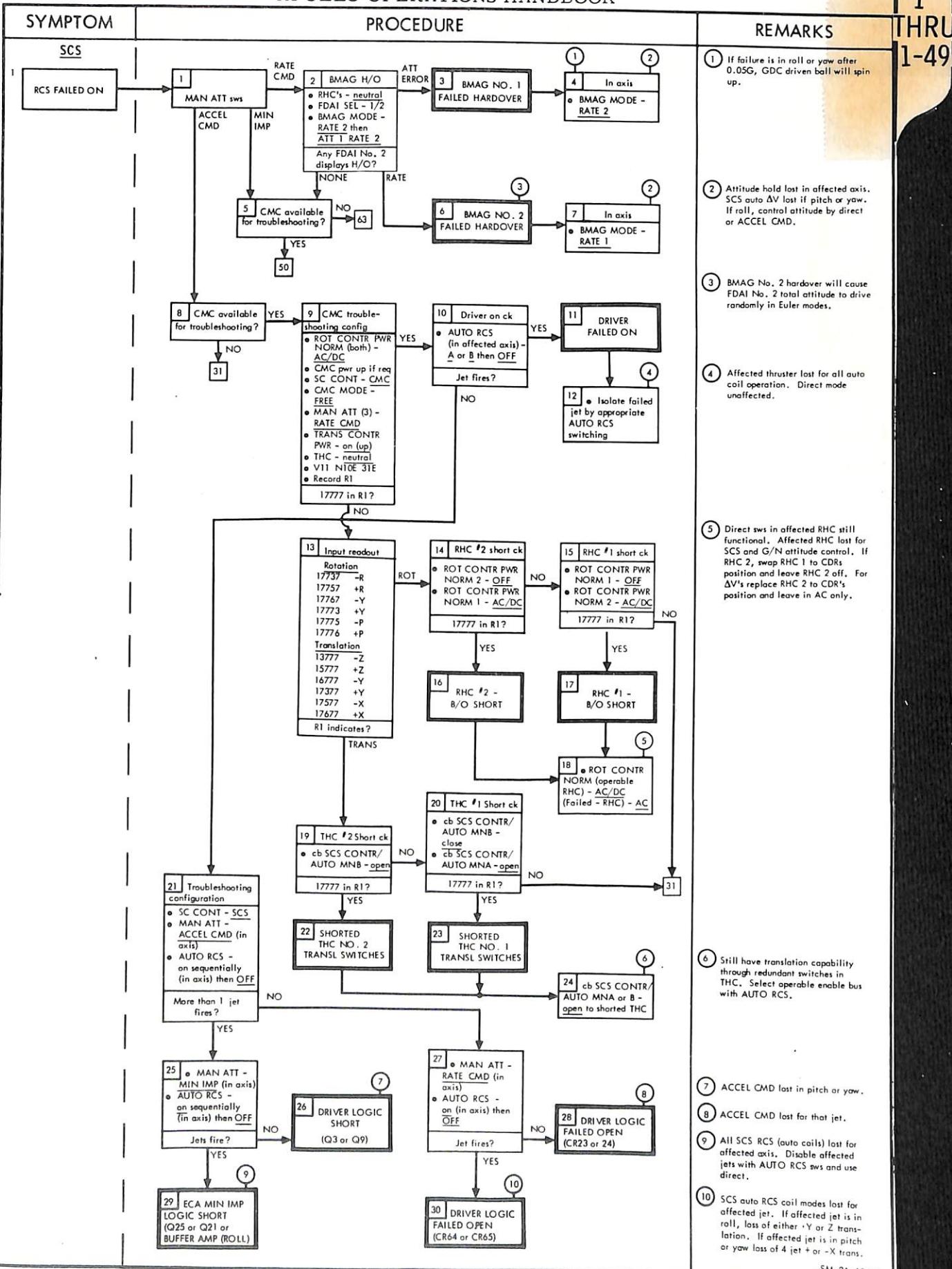
- 1 RCS FAILED ON
- 2 ACCEL CMD TROUBLESHOOTING ROUTINE
- 2a SUSPECTED REDUCED RCS AUTHORITY
- 3 RATE CMD TROUBLESHOOTING ROUTINE
- 3a CSM DRIFTS OUT OF DEADBAND
- 4 MIN IMP TROUBLESHOOTING ROUTINE
- 4a SUSPECTED REDUCED RCS AUTHORITY
- 5 DIRECT RCS TROUBLESHOOTING ROUTINE
- 6 VEHICLE DYNAMICS OSCILLATING AND DIVERGING
- 7 ABNORMAL VEHICLE DYNAMICS DURING TRANSLATION

SCS

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



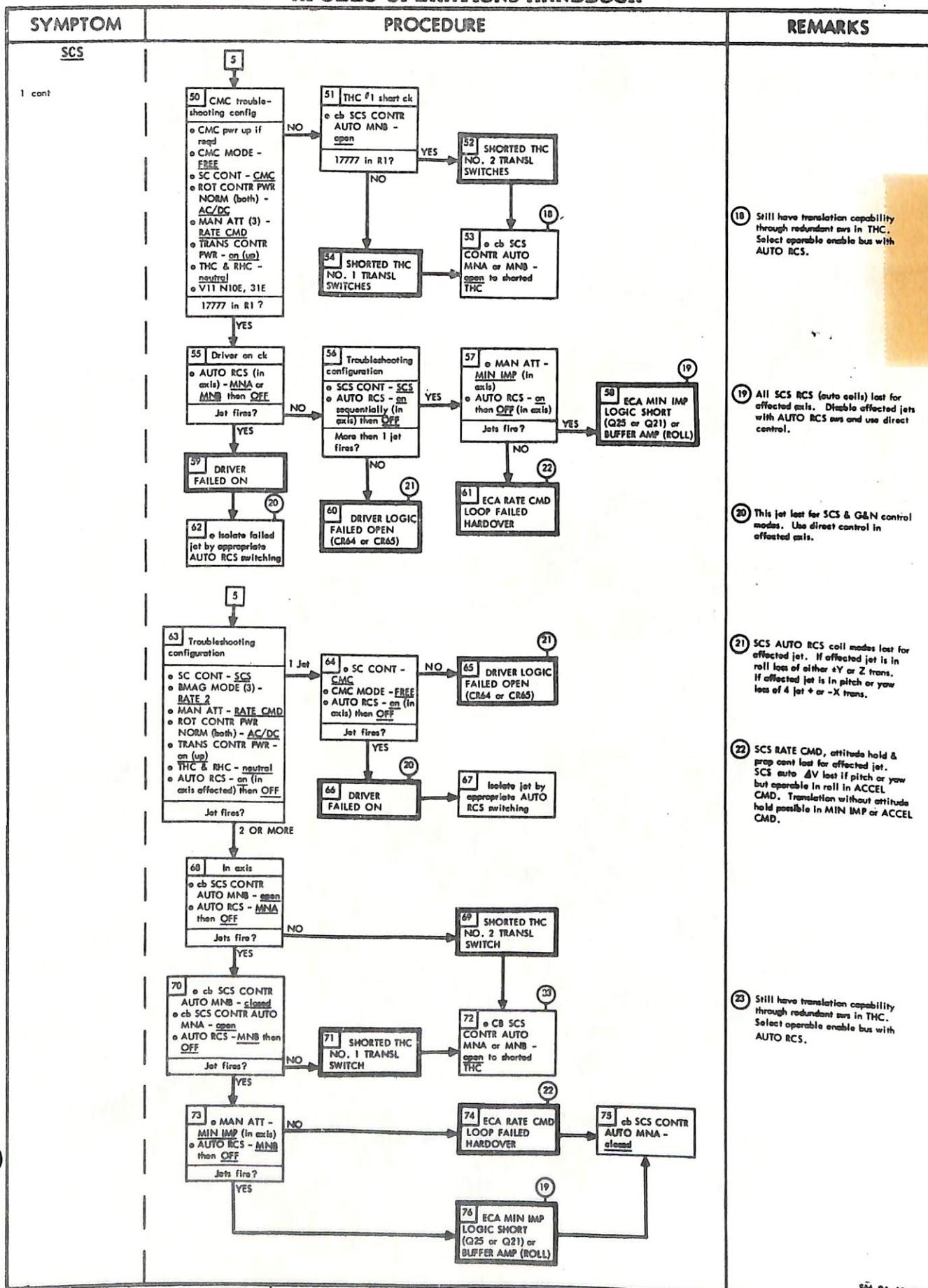
CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

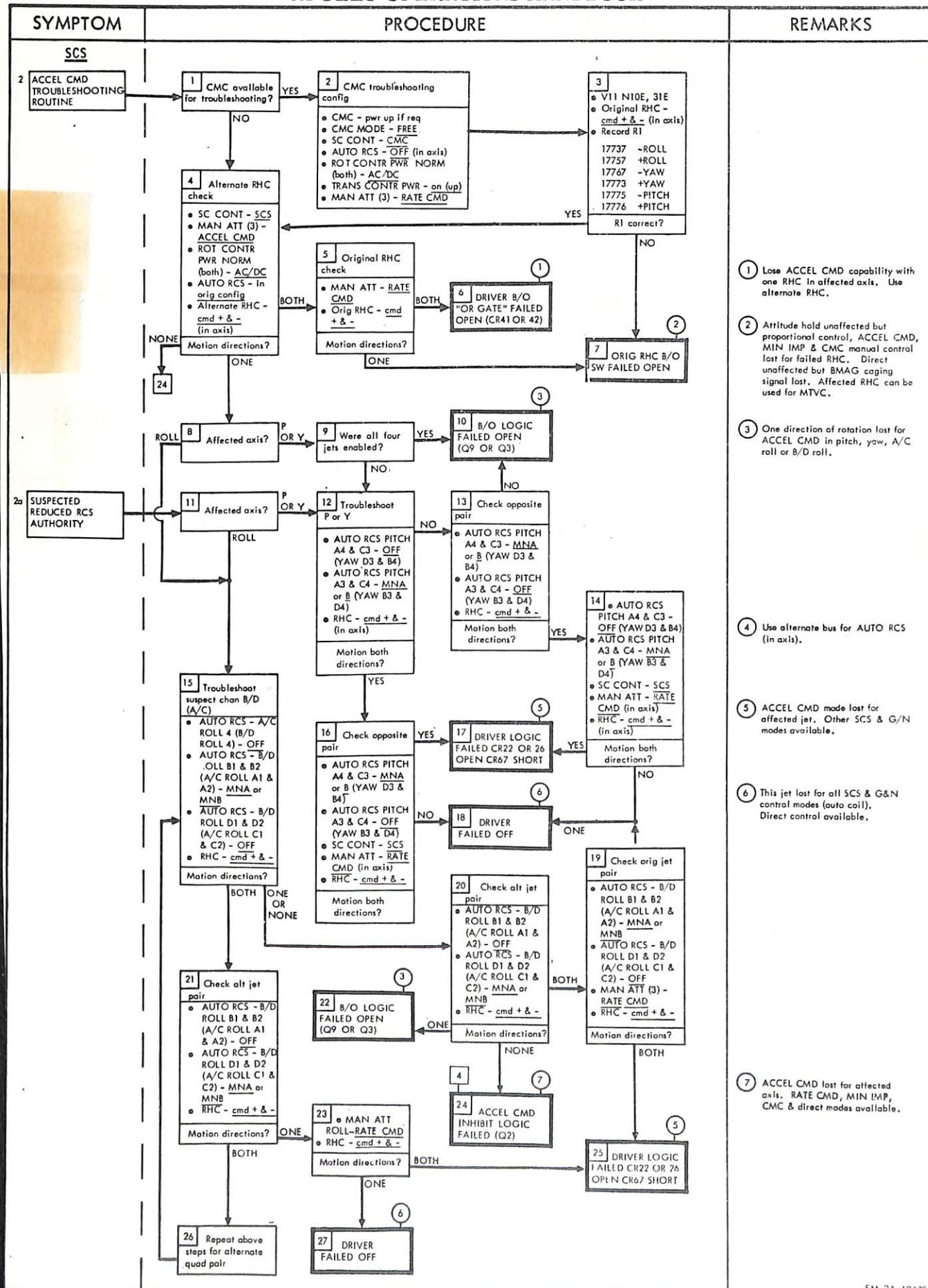
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
SCS 1 Cont	<p>15, 20, 8</p> <p>31 Troubleshooting configuration <ul style="list-style-type: none"> • SC CONT - SCS • MAN ATT - ACCEL CMD (in axis) • TRANS CONTR PWR - OFF • ROT CONTR PWR NORM (both) - OFF • AUTO RCS - on in axis affected then OFF </p> <p>32 Isolate trouble <ul style="list-style-type: none"> More than 1 jet firing? Jets fire? </p> <p>33 <ul style="list-style-type: none"> • MAN ATT - MIN IMP (in axis) • AUTO RCS - on then OFF (in axis) </p> <p>34 ECA MIN IMP LOGIC SHORT Q25 or Q21 or BUFFER AMP (ROLL)</p> <p>35 DRIVER LOGIC SHORT (Q3 or Q9)</p> <p>36 <ul style="list-style-type: none"> • MAN ATT - RATE CMD (in axis) • AUTO RCS - on then OFF (in axis) </p> <p>37 <ul style="list-style-type: none"> • SC CONT - CMC • CMC MODE - FREE • AUTO RCS - on then OFF (in axis) </p> <p>38 DRIVER FAILED ON</p> <p>39 DRIVER LOGIC FAILED OPEN (CR23 or CR24)</p> <p>40 DRIVER LOGIC FAILED OPEN (CR64 or CR65)</p> <p>41 RHC 1&2 short ck <ul style="list-style-type: none"> • ROT CONTR PWR NORM 1 - AC/DC • AUTO RCS - on then OFF (in axis) </p> <p>42 RHC NO. 1 B/O SHORT</p> <p>43 <ul style="list-style-type: none"> • ROT CONTR PWR NORM 1 - OFF • RHC PWR NORM 2 - AC/DC • AUTO RCS - on then OFF (in axis) </p> <p>44 RHC NO. 2 B/O SHORT</p> <p>45 <ul style="list-style-type: none"> • ROT CONTR PWR NORM (both) - AC/DC (usable RHC) AC (unusable RHC) </p> <p>46 THC 1&2 short ck <ul style="list-style-type: none"> • TRANS CONTR PWR - on (up) • cb SCS CONTR AUTO MNB - open • AUTO RCS - on then OFF (in axis) </p> <p>47 SHORTED THC NO. 1 TRANSL SWITCHES</p> <p>48 SHORTED THC NO. 2 TRANSL SWITCHES</p> <p>49 <ul style="list-style-type: none"> • cb SCS CONTR AUTO MNA or MNB - open to shorted THC </p>	<p>(11) All SCS RCS (auto coils) lost for affected axis. Disable affected jets with AUTO RCS sws and use direct control.</p> <p>(12) ACCEL CMD lost in pitch or yaw. Use alternate quad pair for roll.</p> <p>(13) This jet lost for all SCS & G/N control modes. Disable jet with AUTO RCS sws and use direct control.</p> <p>(14) ACCEL CMD lost for this jet.</p> <p>(15) SCS AUTO RCS coil modes lost for affected jet. If affected jet is in roll loss of either +Y or Z trans. If affected jet is in pitch or yaw, loss of 4 jet + or -X trans.</p> <p>(16) Direct sws in affected RHC still functional. Affected RHC lost for SCS and G/N attitude control. If RHC 2, swap RHC 1 to CDR's position and leave RHC 2 off. For AV's replace RHC 2 to CDR's position and leave in AC only.</p> <p>(17) Still have translation capability through redundant sws in THC. Select operable enable bus with AUTO RCS.</p>

SOURCE AOH
 DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

**1-50
THRU
2a**

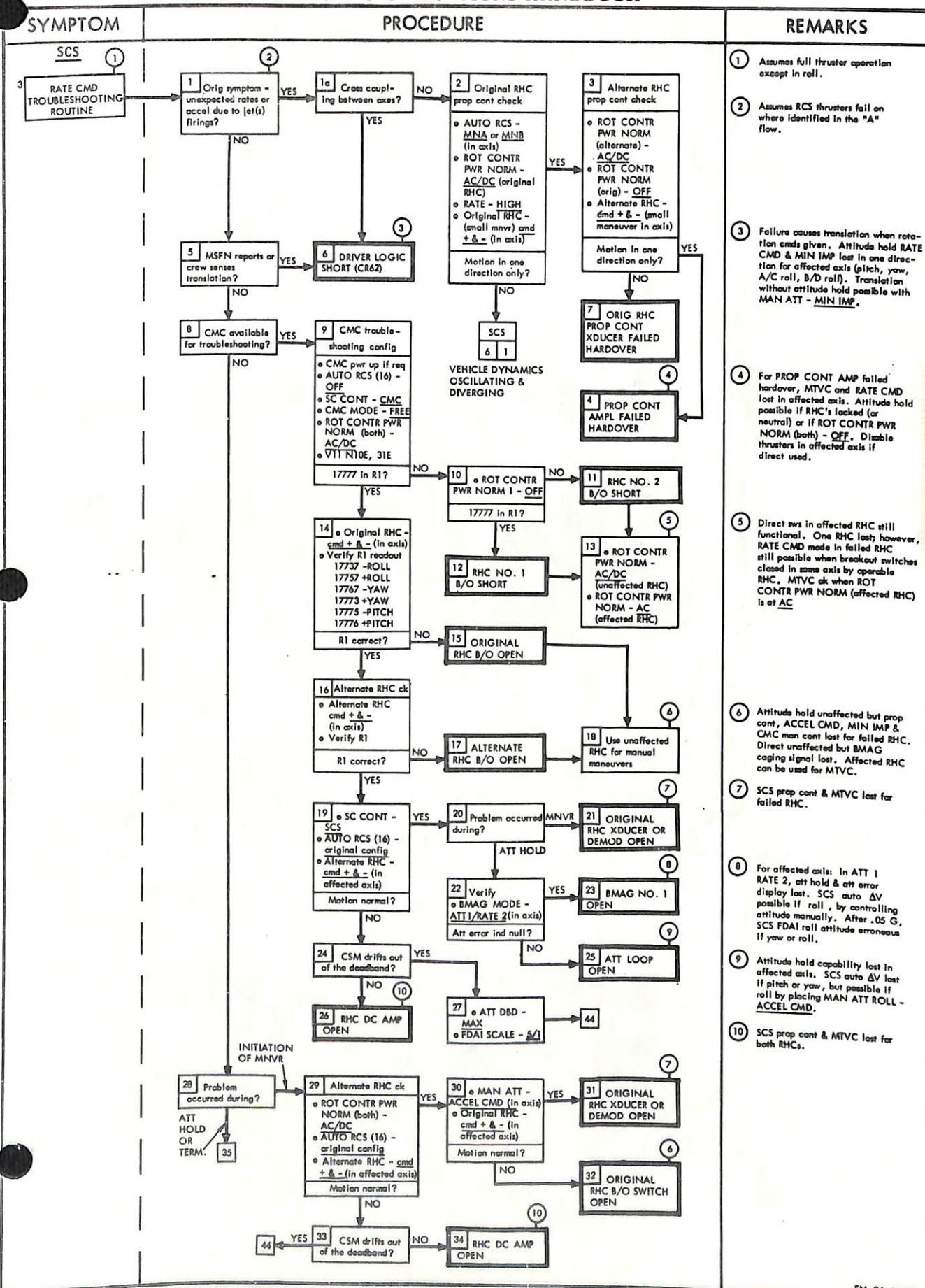
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



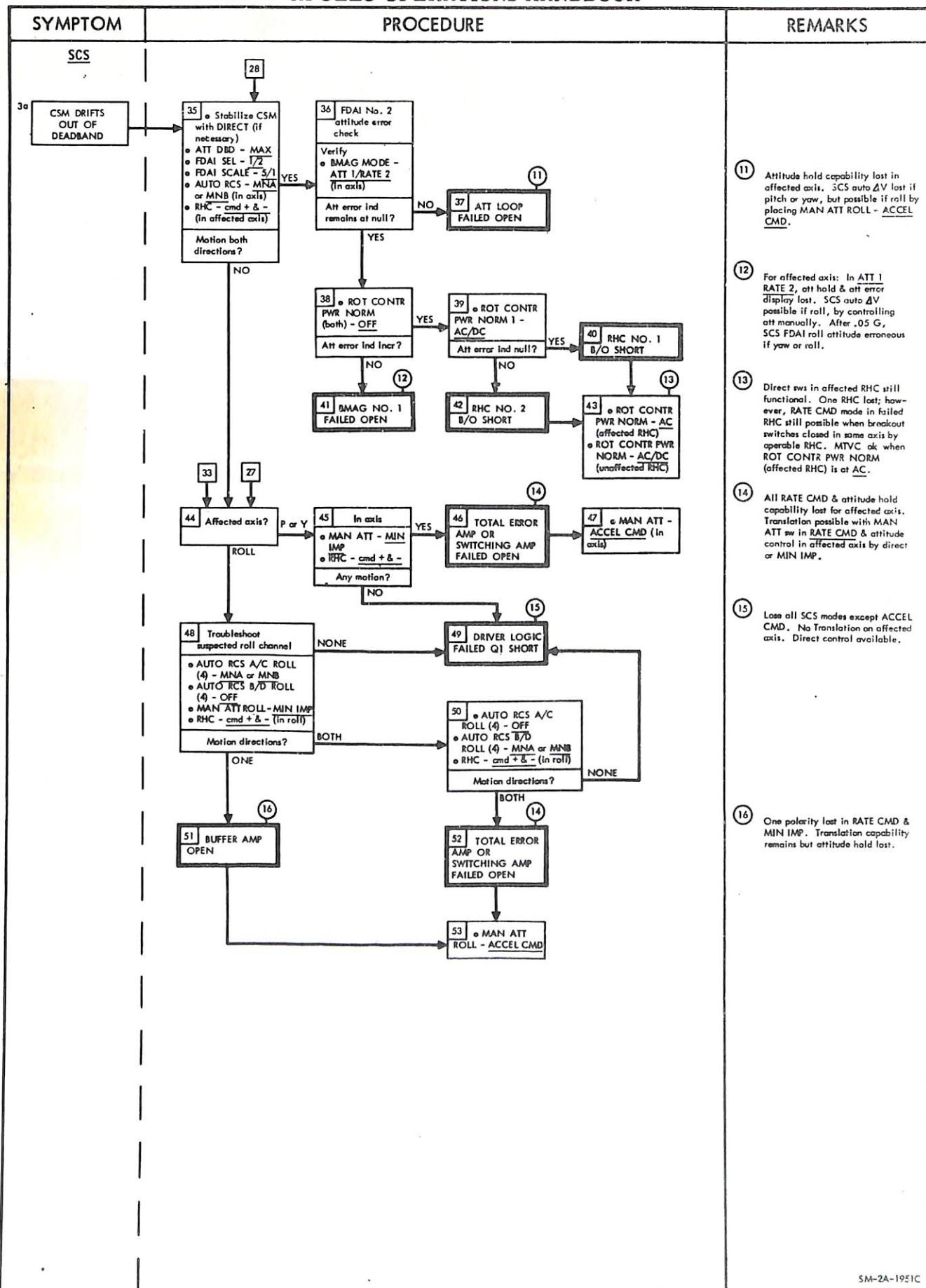
SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

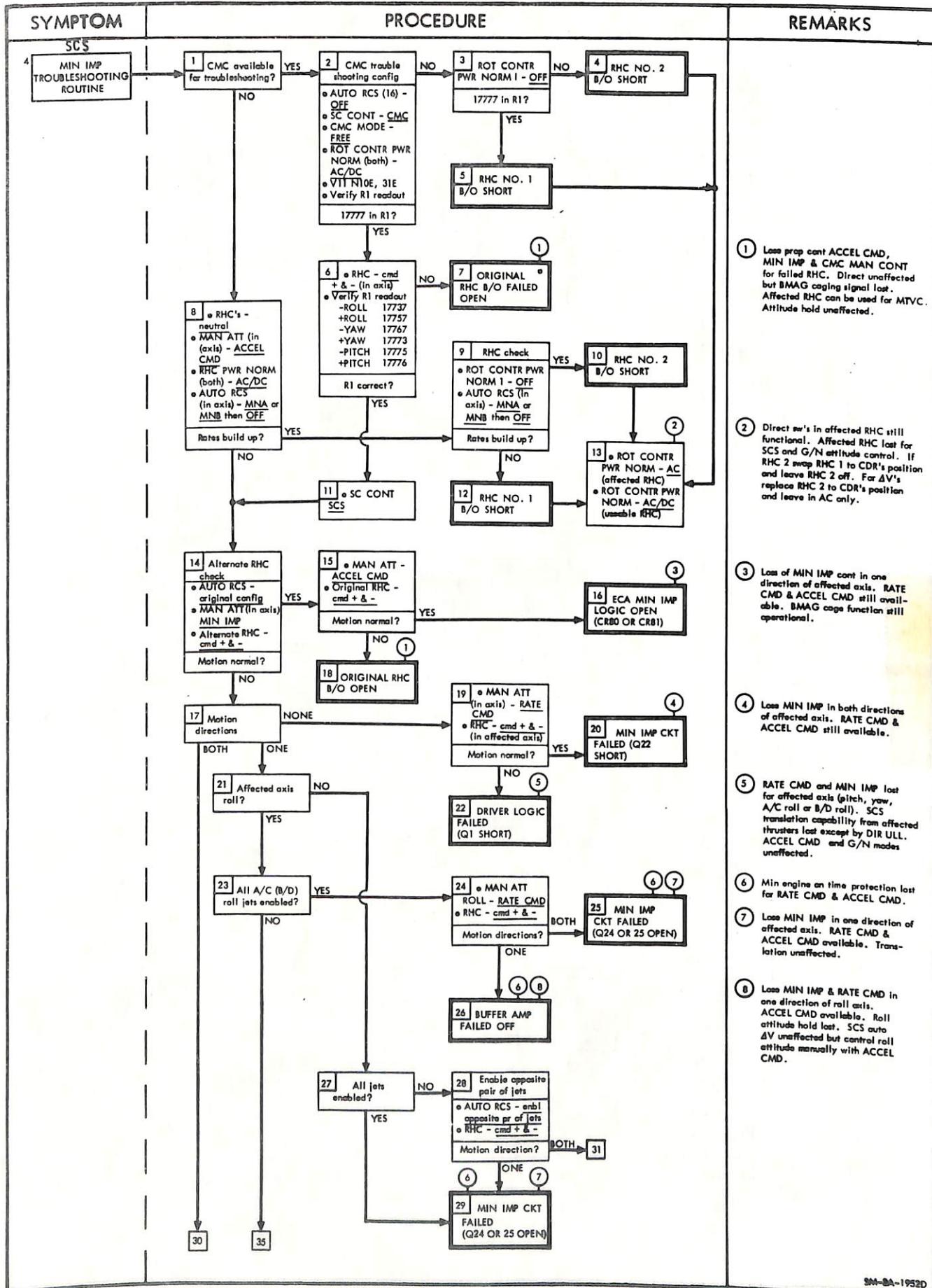
SOURCE AOH
DATE MARCH 16, 19703
THRU
3a

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



4
THRU
4a

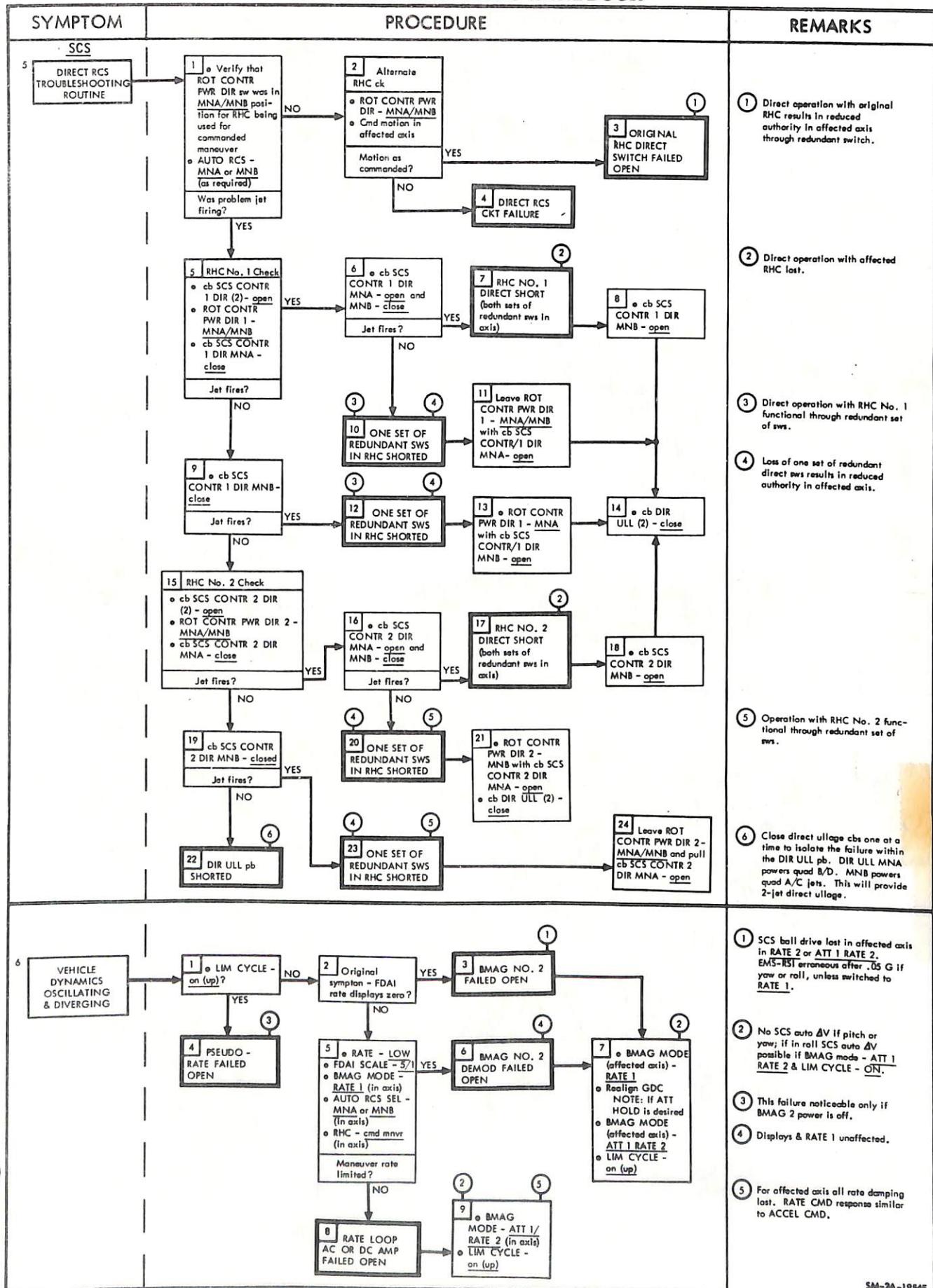
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<u>SCS</u> 4 (cont)	<pre> graph TD A[4a SUSPECTED REDUCED RCS AUTHORITY] --> B{Affected axis roll?} B -- NO --> C[31 Disable 2 jets] C --> D{Motion directions?} D -- ONE --> E[33 DRIVER FAILED OFF] D -- BOTH --> F{Check opposite pair} F --> G{Motion directions?} G -- ONE --> H[34 DRIVER LOGIC FAILED - (CR63 OR 67 OPEN)] G -- BOTH --> I[32 Check opposite pair] I --> J{Motion directions?} J -- ONE --> K[33 DRIVER FAILED OFF] J -- BOTH --> L[34 DRIVER LOGIC FAILED - (CR63 OR 67 OPEN)] B -- YES --> M[23 Enable roll jets A/C (B/D)] M --> N{Motion directions?} N -- ONE --> O[36 MAN ATT RATE CMD - (in axis)] O --> P{Motion directions?} P -- ONE --> Q[37 MIN IMP CKT FAILED (Q24 OR 25 OPEN)] P -- BOTH --> R[38 BUFFER AMP OPEN] M -- BOTH --> S[39 AUTO RCS - original config] S --> T{Motion directions?} T -- ONE --> U[41 MAN ATT ROLL - ACCEL CMD] U --> V{Motion directions?} V -- ONE --> W[42 DRIVER FAILED OFF] V -- BOTH --> X[43 DRIVER LOGIC FAILED (CR63 OR 67 OPEN)] M -- NONE --> Y[40 Enable 2 roll jets on 1 quad] Y --> Z{Motion directions?} Z -- ONE --> AA[41 MAN ATT ROLL - ACCEL CMD] AA --> BB{Motion directions?} BB -- ONE --> CC[42 DRIVER FAILED OFF] BB -- BOTH --> DD[43 DRIVER LOGIC FAILED (CR63 OR 67 OPEN)] Y -- BOTH --> EE[44 Repeat above step for 2 roll jets on each quad] EE --> FF[45 DRIVER LOGIC SHORT (Q1)] </pre>	<p>(9) This jet lost for all SCS & G/N control modes. Direct mode of operation available.</p> <p>(10) Lose RATE CMD & MIN IMP modes. ACCEL CMD still available.</p> <p>(11) Lose MIN IMP in one direction of affected axis. RATE CMD & ACCEL CMD available. Translation unaffected.</p> <p>(12) Lose MIN IMP & RATE CMD in one direction of roll axis. ACCEL CMD available.</p> <p>(13) RATE CMD and MIN IMP lost for affected axis (pitch, yaw, A/C roll or B/D roll). SCS translation capability from affected thrusters lost except by DIR ULL. ACCEL CMD and G&N modes unaffected.</p>

SOURCE AOH
DATE MARCH 16, 1970

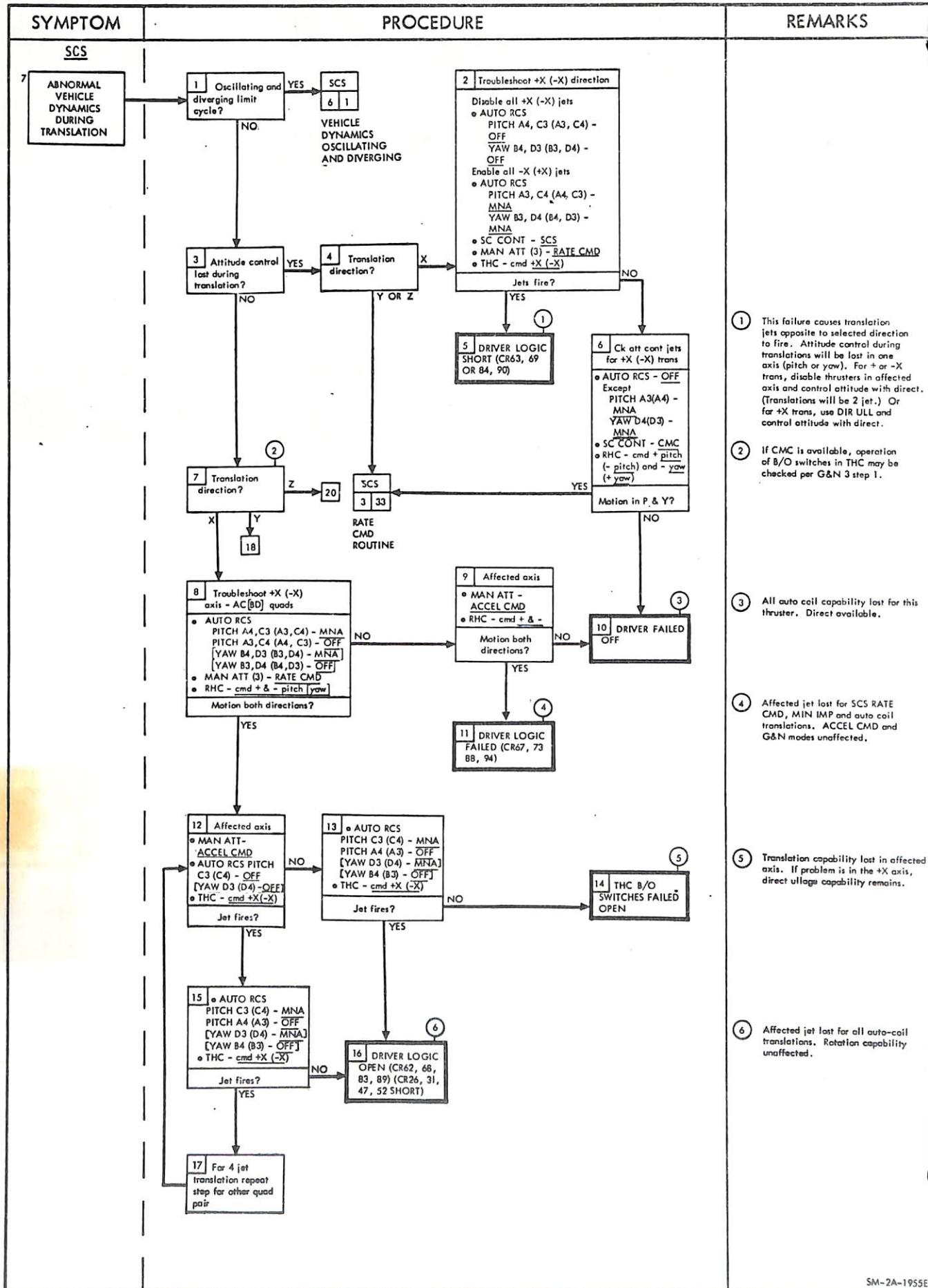
CSM MALFUNCTION PROCEDURES

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



5
THRU
7-17

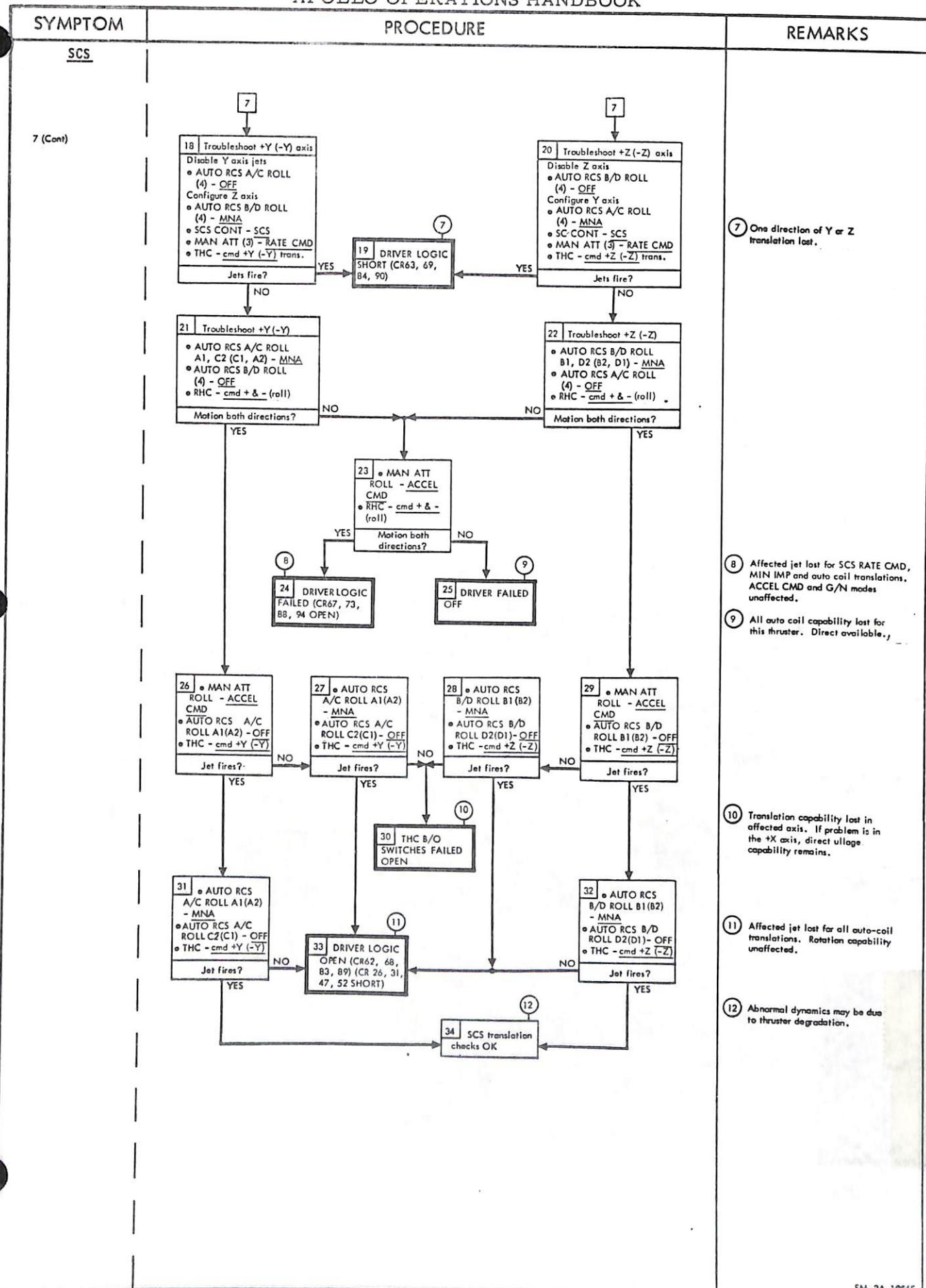
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 19707-18
THRU
7-34

THIS PAGE
INTENTIONALLY
LEFT BLANK

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

G&N

SOURCE MOCATA
DATE MARCH 16, 1970

G & N MALFUNCTION INDEX

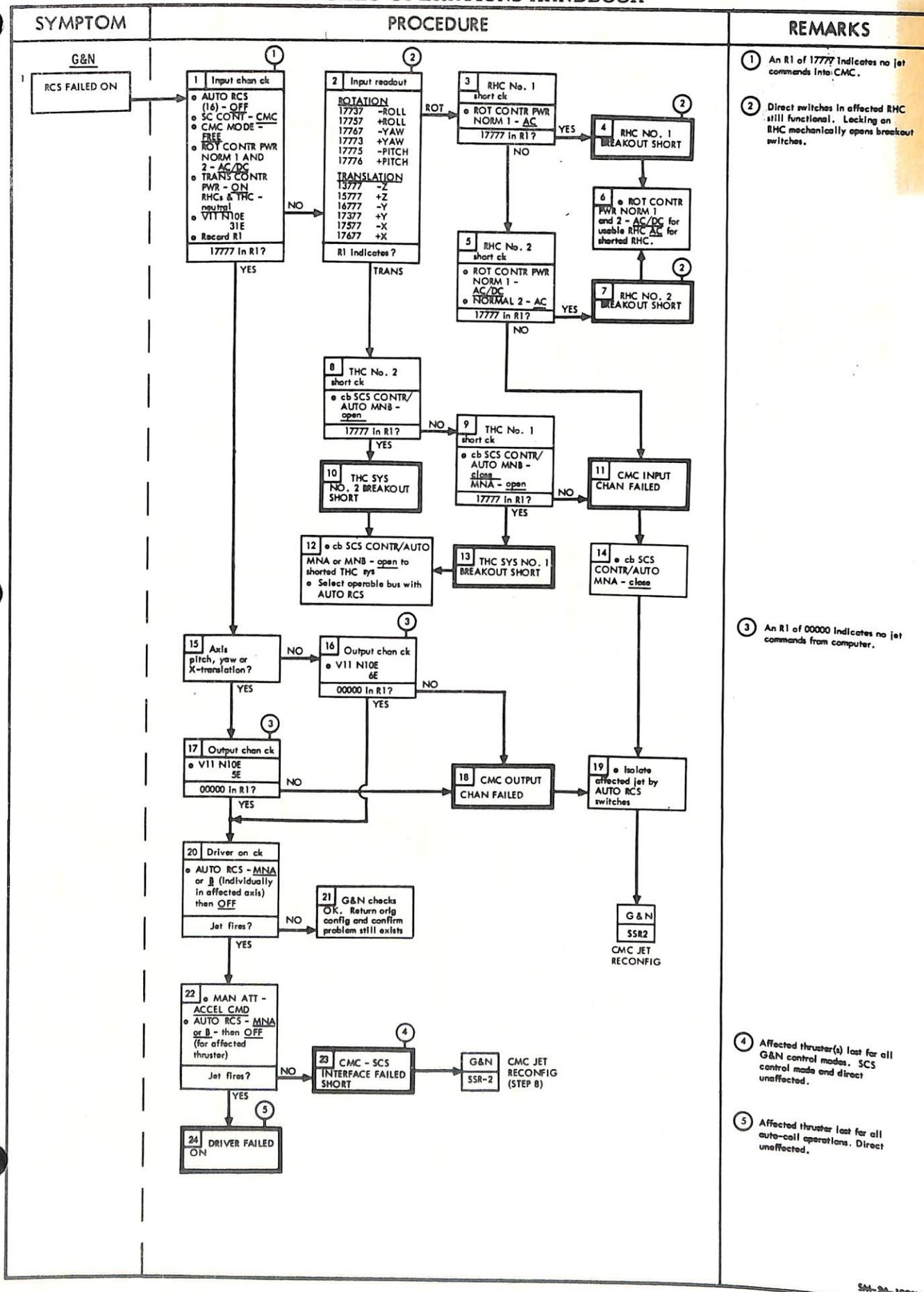
- G&N
- 1 RCS FAILED ON
 - 2 RHC TROUBLESHOOTING ROUTINE
 - 2a CMC AUTO TROUBLESHOOTING ROUTINE
 - 2b SUSPECTED REDUCED RCS AUTHORITY
 - 3 THC TROUBLESHOOTING ROUTINE
 - 4 MIN IMP CONT TROUBLESHOOTING ROUTINE

- 5 CMC
- 6 ISS
- 7 GIMBAL LOCK
- 8 TEMP
- 9 RESTART
- 10 TRACKER
- 11 PROG

12 ALARM CODES

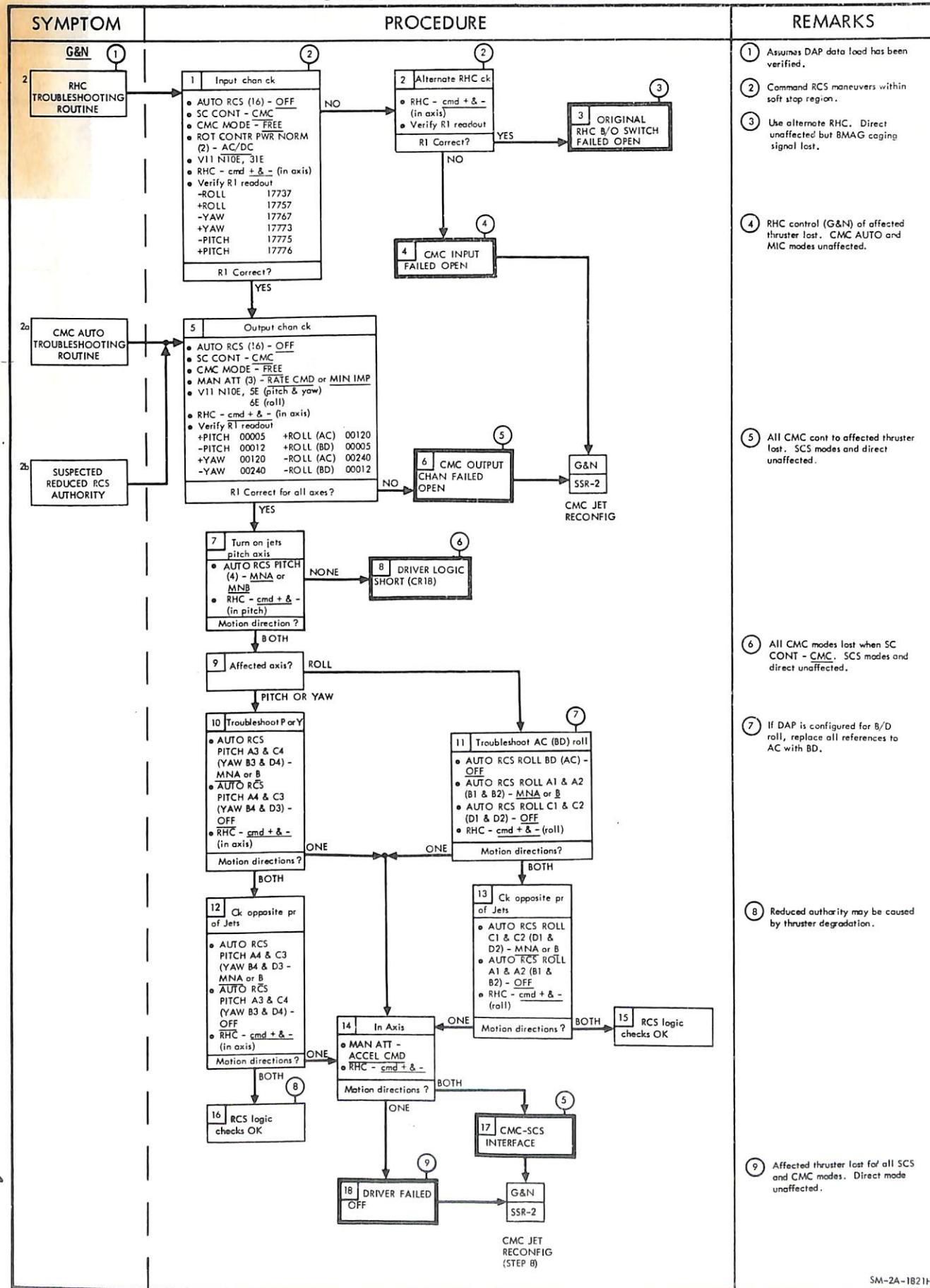
- SSR-1 CMC SELF CHECK
- SSR-2 CMC JET RE-CONFIG
- SSR-3 FRESH START

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



1
THRU
2

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

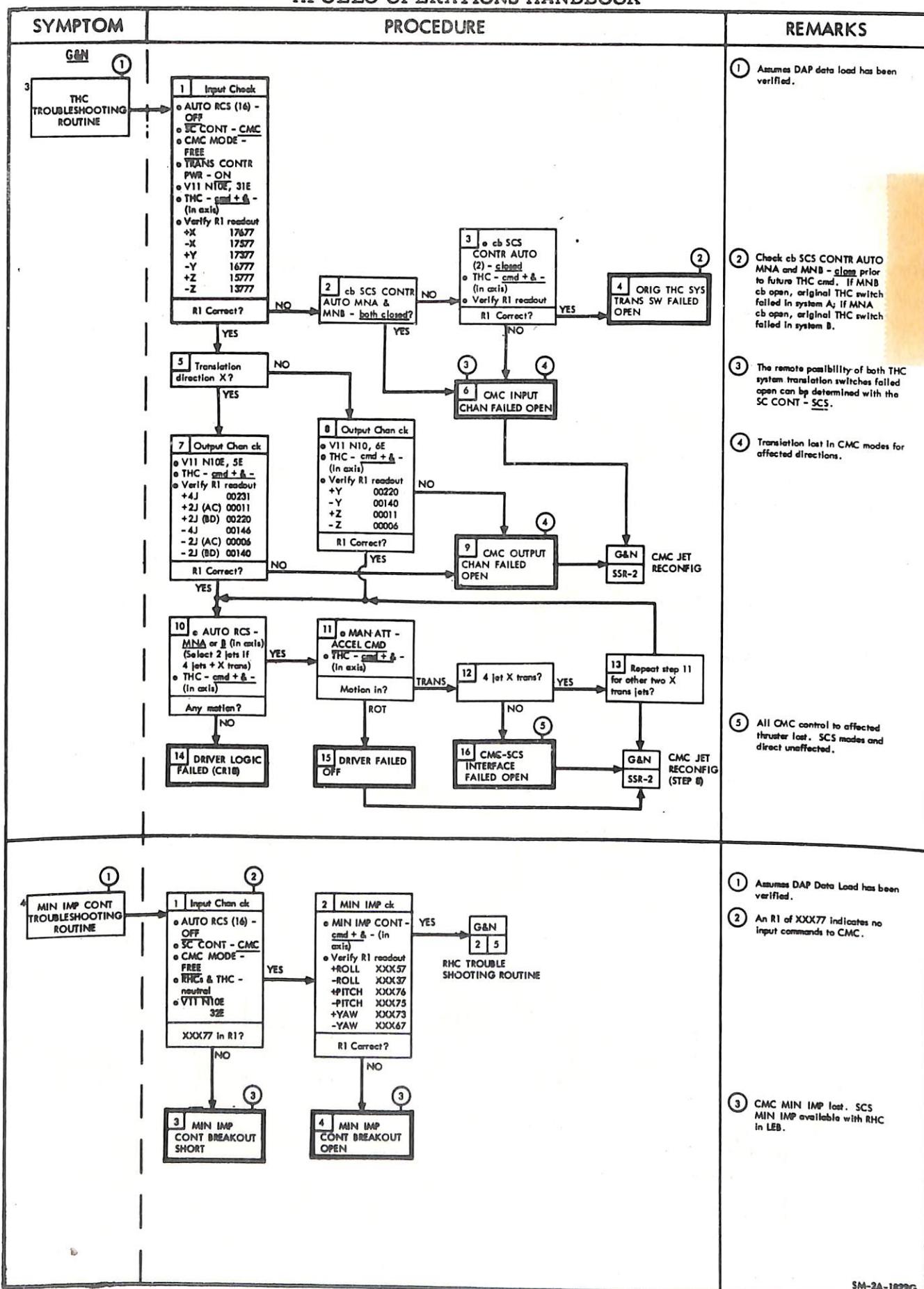


SOURCE AOH
 DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

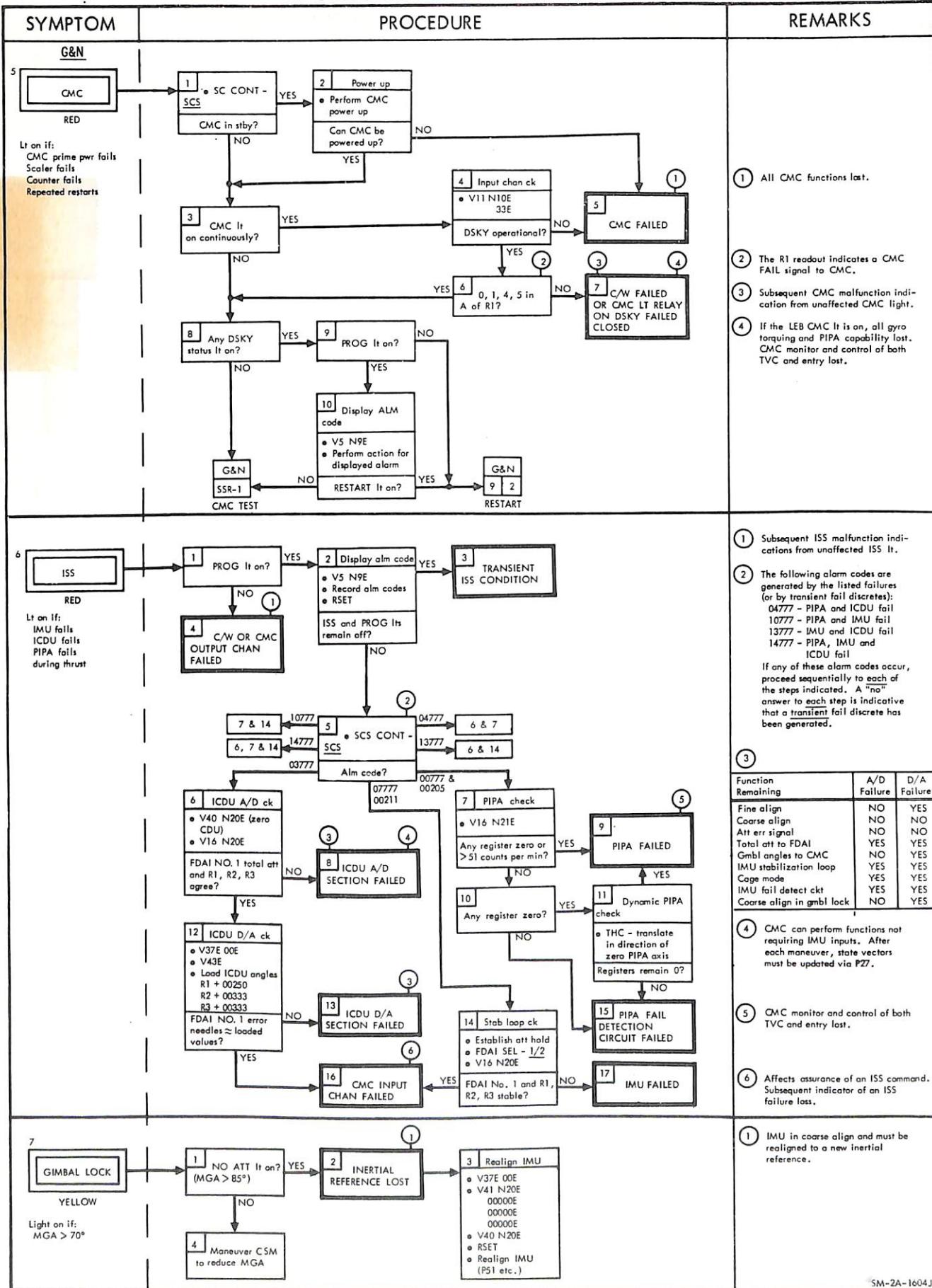
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES



3 THR THRU 7

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



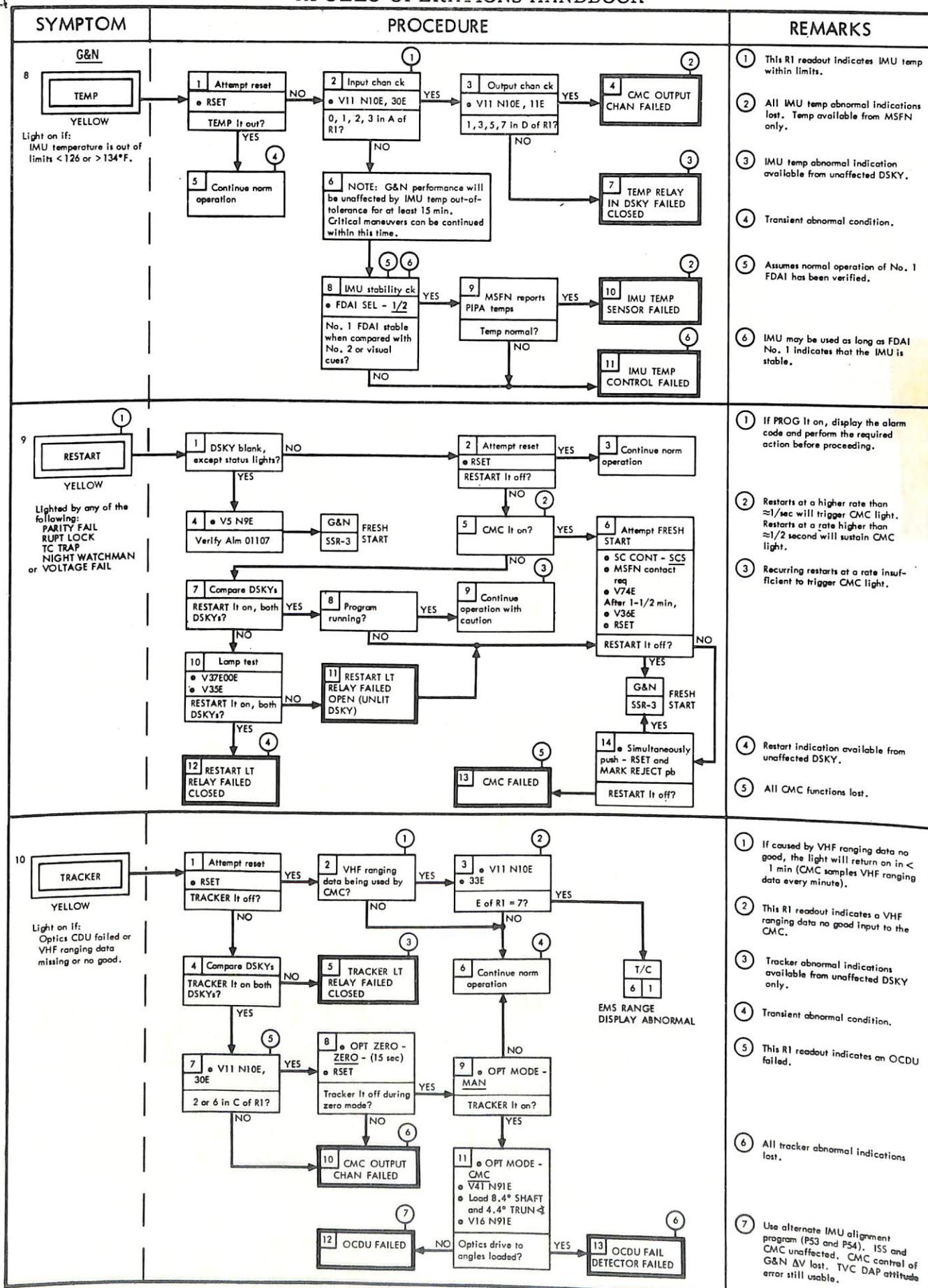
CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

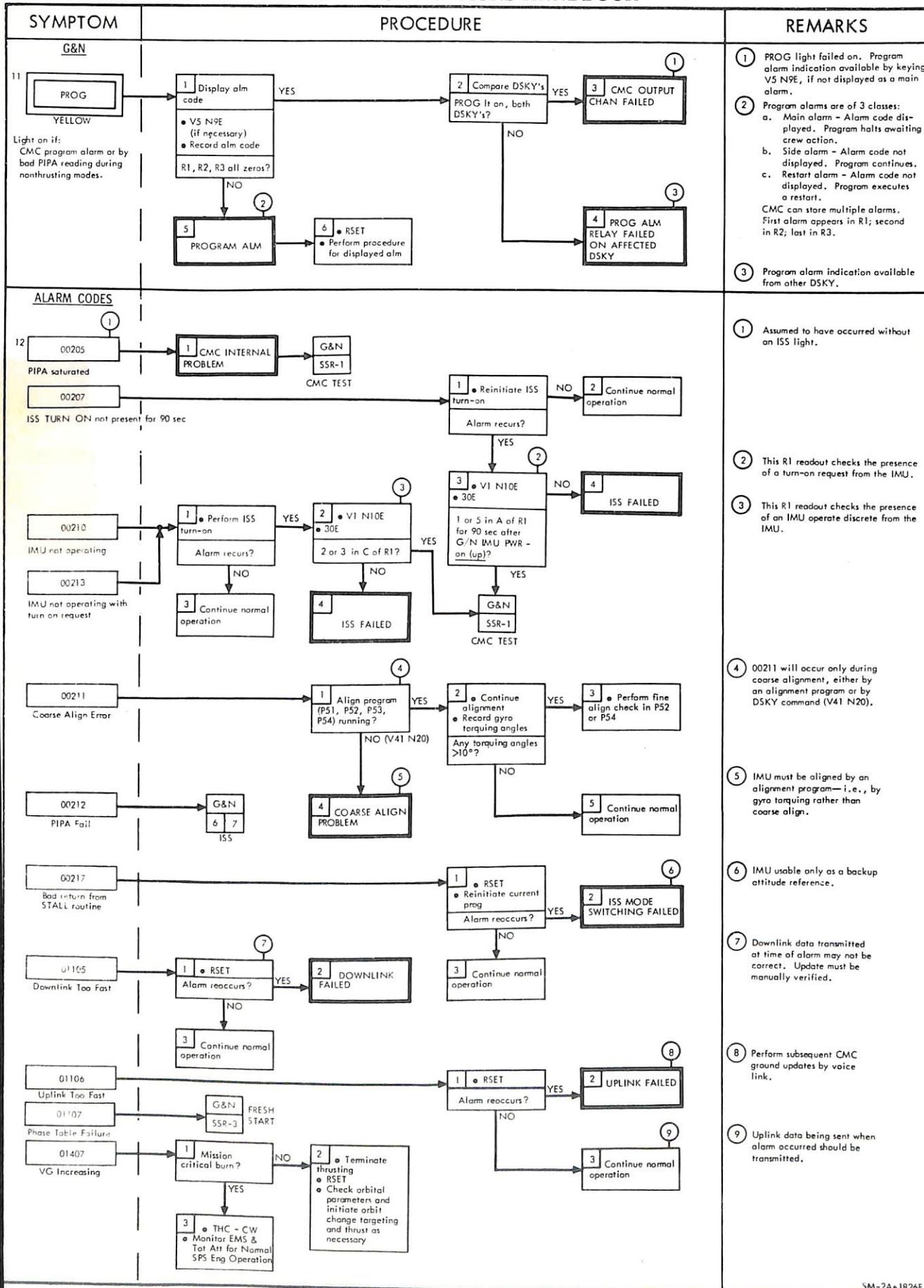
SM-2A-1604 J

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES



8 THRU 12

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

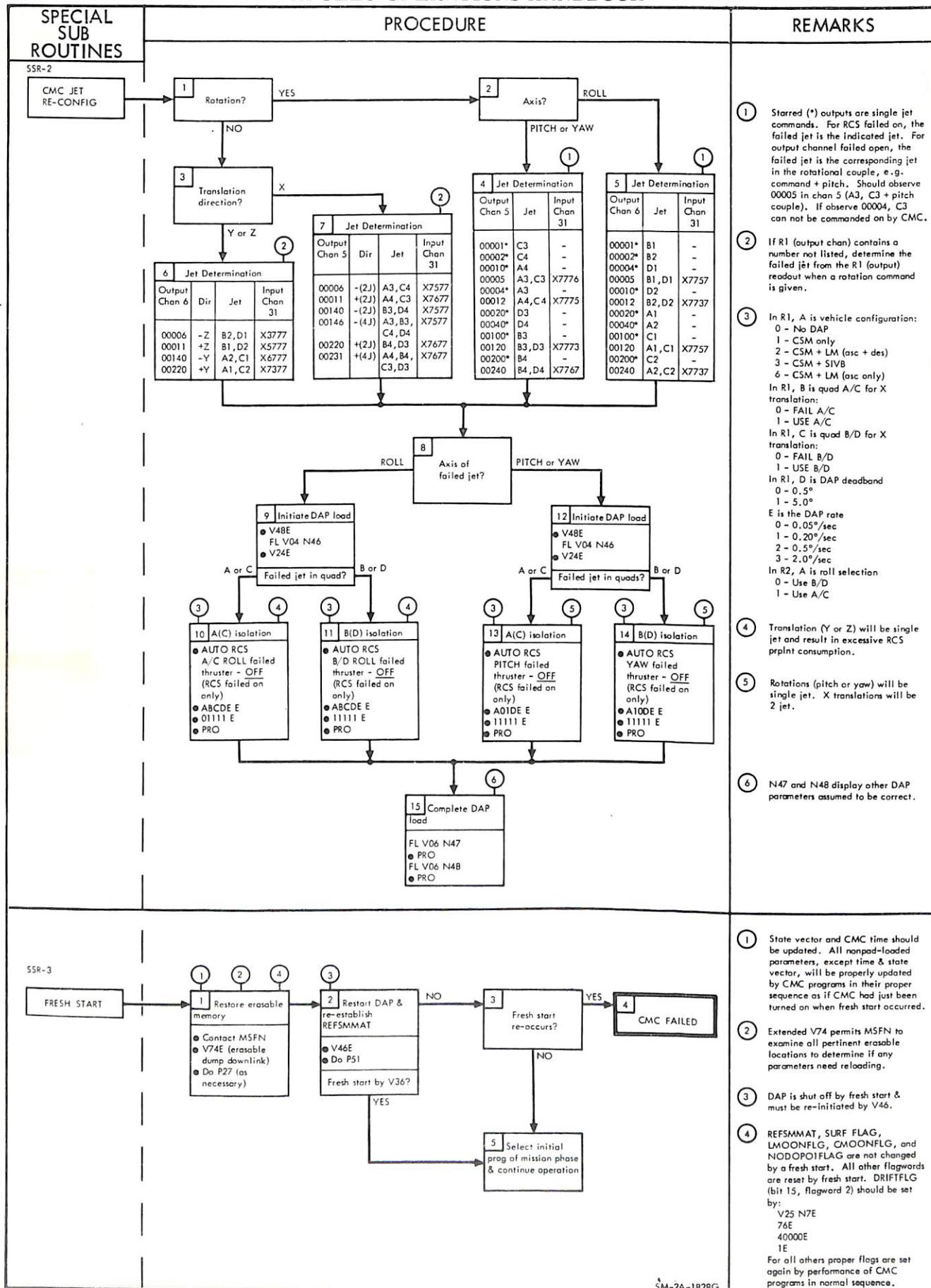
SM2A-03-SC103-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SYMPTOM	PROCEDURE	REMARKS
SPECIAL SUB ROUTINES		
<p>SSR-1</p>	<p>(1) R2 00001 for 7 SEC R2 00002 for 43 SEC</p> <p>(2) Subsequent use of CMC dependent on MSFN evaluation (via downlink) of the succeeding steps in self-test.</p> <p>(3) Problem is in erasable memory.</p> <p>(4) CMC self check tests only erasable and fixed memory. Other internal problems cannot be determined by self check.</p> <p>(5) All CMC functions lost.</p> <p>(6) Do not use CMC control for attitude maneuvers.</p> <p>(7) RCS DAP unusable since T6 counter controls DAP jet firing times.</p> <p>(8) TVC DAP and auto optics positioning lost.</p> <p>(9) Optics/CMC interface lost. Use alternate LOS marking routine (P53, P54).</p> <p>(10) CMC uplink unusable.</p> <p>(11) IMU cannot be fine aligned.</p> <p>(12) IMU cannot be coarse aligned. Align by caging and/or fine align. CMC attitude error display lost in axis. CMC control of SIVB lost.</p> <p>(13) CMC TVC and entry control lost.</p> <p>(14) IMU usable as attitude reference only.</p>	

SSR-1
THRU
SSR-3SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SPS

SOURCE MOCATA
DATE MARCH 16, 1970

SPS

SPS MALFUNCTION INDEX

1 SPS PRESS

- 1a FUEL AND/OR OXID PRESS HIGH
- 1b FUEL AND/OR OXID PRESS LOW
- 1c FUEL AND OXID $\Delta P > 20$ PSI

2 PITCH (YAW)
GMBL 1 (2)

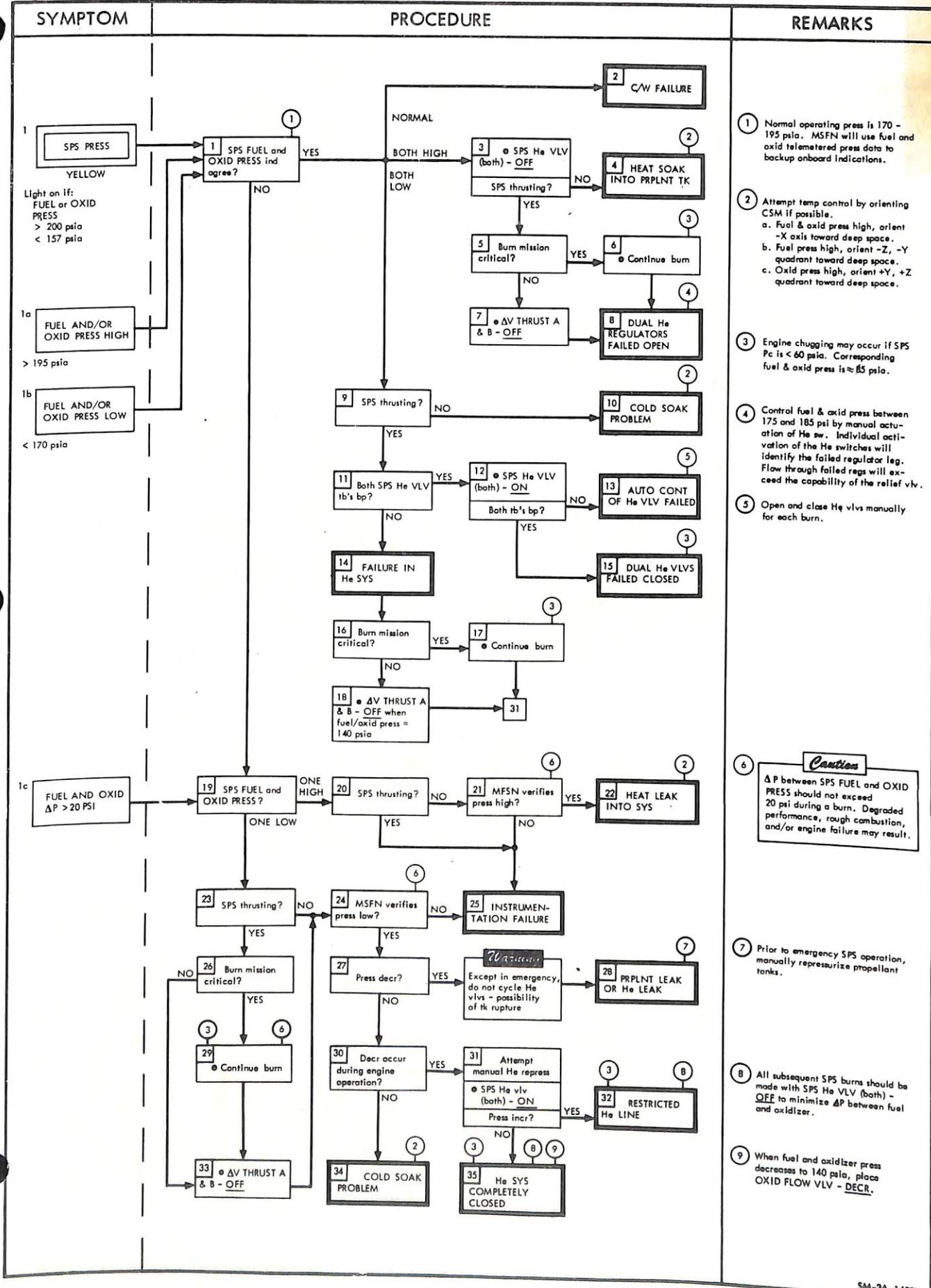
- 3 SPS PREMATURE SHUTDOWN
- 3a NO SPS IGNITION
- 4 SPS ENG DOES NOT SHUTDOWN AUTO
- 4a SPS THRUST LT ON NON THRUSTING
- 5 SPS P_c ABNORMAL
- 6 SPS He VLV tb-ABNORMAL
- 7 He PRESS LOW OR DECR
- 8 GN2 A(B) PRESS LOW
- 8a SPS INJ VLV PARTIALLY OPEN
- 9 SPS INJ VLV IND ABNORMAL
- 10 NO PRPLNT TEMP CONTROL
- 11 NO RESPONSE OF SPS OXID VLV tb
DURING FLOW ADJUST
- 12 SPS OXID UNBAL IND ERRATIC OR PEGGED
- 13 SPS OXID (FUEL) QTY IND READOUT ABNORMAL

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

1
THRU
3a



SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

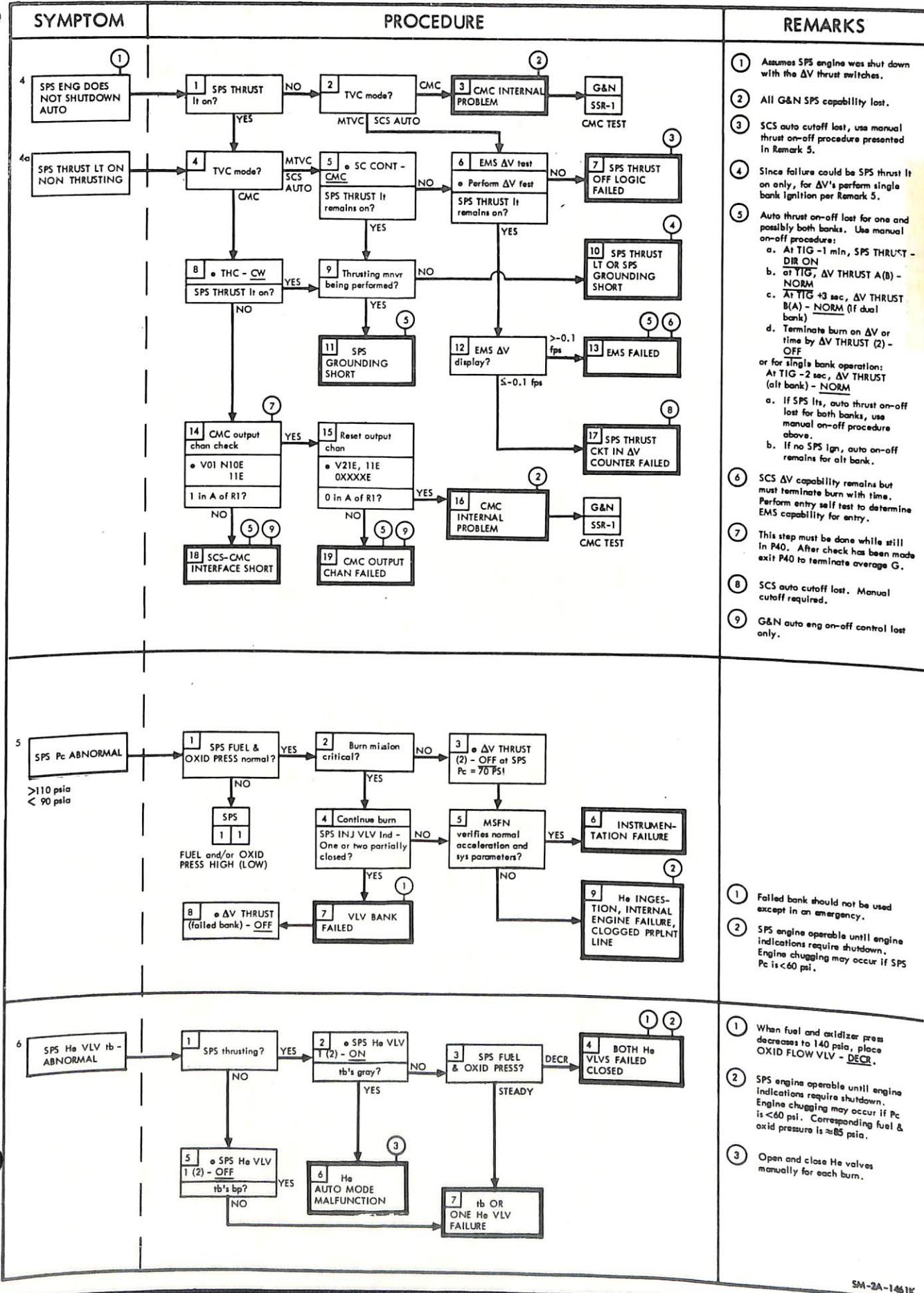
SYMPOTM	PROCEDURE	REMARKS
<p>2 PITCH (YAW) GMBL 1 (2)</p> <p>YELLOW Light on if: Overcurrent occurs in respective drive motor or gimbal actuator.</p>	<pre> graph TD A[2 PITCH (YAW) GMBL 1 (2)] --> B[1 After SPS shutdown and before SPS GMBL MOT shutdown • TVC GMBL DR PITCH (YAW) - 1 (2) • Perform gimbal trim check] B --> C{Gimbal control maintained?} C -- NO --> D[Caution Gimbal drive circuits are not C/B protected. Before proceeding with step 2, MSFN may be able to provide failure identification.] C -- YES --> E[4 C/W FAILURE] D --> F[2 DC load check • DC IND sel - FC 1 (2, 3) • SPS GMBL MOT PITCH (YAW) - 1 (2) - Start and hold for check] F --> G{Amps abnormally high?} G -- NO --> H[5 OVERCURRENT SENSOR FAILED] G -- YES --> I[3 GIMBAL MOTOR FAILED] </pre>	<p>① Automatic transfer from the primary system to secondary occurs with an overcurrent provided the TVC GMBL DR switch is at AUTO.</p> <p>② For subsequent ΔV's, place TVC GMBL DR sw to alternate servo position in affected axis.</p> <p>③ Selected gimbal motor is operational when SPS Pitch (yaw) 1 (2) cb is opened while affected gimbal motor switch is held at START. However, overcurrent protection and switch-over capability will not be available. Close the cb to turn off the gimbal motor.</p>
<p>3 SPS PREMATURE SHUTDOWN</p> <p>NO SPS IGNITION</p>	<pre> graph TD A[3 SPS PREMATURE SHUTDOWN] --> B{Single or dual bank?} B -- SINGLE --> C{SC CONT mode?} C -- SCS --> D[Output chan ck • ΔV THRUST (2) - OFF • Recycle to ignition in P40 • FL V99 N40 • PRO • VO1 N10E, 11E 1 in A of R1?] D --> E[4 CMC INTERNAL PROBLEM] E --> F[G&N SSR-1 CMC TEST] D -- NO --> G[5 CMC-SCS INTERFACE FAILED OPEN] G --> H[7 VLV PAIR FAILED CLOSED] H --> I[9 ENG VLV CKTRY FAILED] I --> J[6 All SPS INJ VLV ind (4) CLOSE?] J -- NO --> K[7 VLV PAIR FAILED CLOSED] J -- YES --> L{cb SPS He VLV or cb PILOT VLVs - open?} L -- YES --> M[11 EMS ΔV counter ≤ - 0.1 fps] M --> N[12 EMS COUNTER RESET PREMATURELY] M -- NO --> O[13 SPS THRUST It - on?] O -- NO --> P[14 • ΔV THRUST (2) - OFF • AUT ORCS SEL +X (4) - OFF • THC - cmd +X • THRUST ON pb - push] O -- YES --> Q[16 ONE BANK FAILED] P --> R[18 • THC - CW • THC - cmd +X • THRUST ON pb - push] R --> S[19 SC CONT ENABLE PWR LOST] S --> T[22 • cb DIR ULL (2) - open • DIR ULL pb - push • THRUST ON pb - push] T --> U[23 +X TRANS LOGIC FAILED] U --> V[24 EMS-SCS INTERFACE FAILED SHORT] S -- NO --> W[20 CMC INTERNAL PROBLEM] W --> X[G&N SSR-1 CMC TEST] Q --> Y[21 CMC-SCS INTERFACE FAILED OPEN] Y --> Z[15 Output chan ck • ΔV THRUST (2) - OFF • Recycle to ignition in P40 • FL V99 N40 • PRO • VO1 N10E, 11E 1 in A or R1?] Z --> A </pre>	<p>① Troubleshooting assumes original switch positions at time of shutdown.</p> <p>② All G&N SPS capability lost.</p> <p>③ Manual on-off procedure <ul style="list-style-type: none"> a. At TIG -1 min, SPS THRUST - DIR ON b. At TIG, ΔV THRUST A(B) - NORM c. At TIG +3 sec, ΔV THRUST B(A) - NORM (if dual bank) d. Terminate burn on ΔV or time by ΔV THRUST (2) - OFF. </p> <p>④ G&N SPS on-off control lost. TVC DAP unaffected.</p> <p>⑤ ΔV capability lost for affected bank.</p> <p>⑥ Perform EMS ΔV test and if OK, use ΔV counter to monitor time. Use manual on-off procedure (Remark 3).</p> <p>⑦ Affected bank may still be available using SPS THRUST - DIR ON. Alternate bank unaffected.</p> <p>⑧ THC must be CW for SCS ΔV capability. SCS auto ΔV lost.</p> <p>⑨ For SCS ΔV use DIR ULL pb for eng on initiation (+X TRANS logic function lost).</p> <p>⑩ CMC ΔV capability unaffected. SCS ΔV auto on-off lost. For SCS ΔV use manual on-off procedure (Remark 3).</p>

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM FUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
7 He PRESS LOW OR DECR	<pre> graph LR A[He PRESS LOW OR DECR] --> B[MSFN verifies SPS-He PRESS low or decr?] B -- YES --> C[2 LEAK IN He SUPPLY] B -- NO --> D[3 He INSTRUMENTATION FAILURE] </pre>	<p>(1) MSFN will monitor redundant He press instrumentation.</p> <p>(2) He depletion imminent. SPS engine operable until engine indications require shutdown. Engine chugging may occur if SPS P_c is < 60 psi. Corresponding fuel & oxid pressure is ≈ 85 psia.</p> <p>(3) When fuel and oxidizer press decreases to 140 psia, place OXID FLOW VLV - DECR.</p>
8 GN2 A (B) PRESS LOW < 400 PSI 8a SPS INJ VLV PARTIALLY OPEN	<pre> graph TD A[GN2 A (B) PRESS LOW < 400 PSI] --> B[Ind check • SPS PRESS IND w/N2A, N2B, He] B -- NO --> C[2 IND FAILED] B -- YES --> D[3 GN2 A (B) LEAK OR FAILED SNSR] D --> E[4 Operate engine on alternate bank] </pre>	<p>(1) Operation at <350 psi results in partially open ball vlv and <u>hazardous engine operation</u>.</p>
9 SPS INJ VLV IND ABNORMAL One open during non-thrusting One or two closed during burn period (or burn attempt)	<pre> graph TD A[SPS INJ VLV IND ABNORMAL One open during non-thrusting One or two closed during burn period (or burn attempt)] --> B[SPS thrusting?] B -- YES --> C[Double or single bank operation?] C -- DOUBLE --> D[Continue burn] C -- SINGLE --> E[5 INSTRUMENTATION FAILURE] D --> F[4 ONE PAIR OF BALL VLVS FAILED CLOSED] F --> G[6 INSTRUMENTATION FAILURE] E --> H[7 MFSN verifies vlv open?] H -- YES --> I[8 ONE PAIR OF BALL VLVS FAILED OPEN] H -- NO --> J[9 INSTRUMENTATION FAILURE] I --> K[10 ΔV THRUST (Failed bank) - OFF] </pre>	<p>(1) SPS operable on redundant bank if one bank failed.</p> <p>(2) Failed bank should not be used except in an emergency.</p>
10 NO PRPLNT TEMP CONTROL	<pre> graph TD A[NO PRPLNT TEMP CONTROL] --> B[SPS PRPLNT TEMP ind?] B -- HIGH AND INCR --> C[4 SYS TEST (2) - 5A] B -- LOW AND DECR --> D[2 SYS TEST (2) - 5A] D --> E[3 INSTRUMENTATION FAILURE] C --> F[5 SPS LINE HTRS FAILED ON] F --> G[6 SPS LINE HTRS A/B] G -- Temp incr? -- YES --> H[7 SPS LINE HTRS A INSUFFICIENT OR FAILED OFF] G -- NO --> I[8 INSTRUMENTATION FAILURE] H --> J[9 cb SPS HTRS (2) - open] I --> K[10 SPS LINE HTRS A & B FAILED OFF] </pre>	<p>(1) Normal range 45-75°F.</p> <p>(2) Assumes CSM not in inertial hold mode which might normally result in differences between SPS prplnt temp and SPS oxid line temp.</p> <p>(3) Use oxid line temp for SPS prplnt temp.</p> <p>(4) Prplnt temp may be incr by CSM orientation or by firing SPS engine. At 27°F the propellants become slushy and the fuel & oxid ratio becomes unpredictable.</p>

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SYMPTOM	PROCEDURE	REMARKS
11 NO RESPONSE OF SPS OXID VLV fb DURING FLOW ADJUST (OXID FLOW VLV PRIM - PRIM)	<pre> graph TD A[11 NO RESPONSE OF SPS OXID VLV fb DURING FLOW ADJUST (OXID FLOW VLV PRIM - PRIM)] --> B[1 OXID FLOW VLV INCR - NORM Wait 5 seconds: • OXID FLOW VLV PRIM - SEC • OXID FLOW VLV INCR - INCR (DECR)] B -- YES --> C[4 PRIM OXID FLOW VLV FAILED] B -- NO --> D[2 OXID FLOW VLV fb FAILED] D --> E[3 OXID FLOW VLV INCR - NORM Wait 5 seconds: • OXID FLOW VLV PRIM - PRIM • OXID FLOW VLV INCR sw - as desired] </pre>	<p>① OXID FLOW VLV INCR sw cannot operate unless power applied through a thrust on signal or through the SPS QTY TEST sw. If flow vlv position was changed by the SPS QTY TEST sw, % FUEL & % OXID quantity readouts must be returned to original values.</p> <p>② The secondary sliding gate vlv must be in the nominal flow position (rather than INCR or DECR) before switching to the prim oxid flow vlv or misalignment of the secondary vlv could make the primary vlv inoperative.</p> <p>③ Sec vlv has sufficient range to compensate for prim vlv failure in any position and still provide vlv openings for INCR, NORM or DECR oxid flow.</p>
12 SPS OXID UNBAL IND ERRATIC OR PEGGED	<pre> graph TD A[12 SPS OXID UNBAL IND ERRATIC OR PEGGED] --> B[1 PUG MODE - AUX OXID UNBAL ind normal?] B -- NO --> C[2 OXID UNBAL ind check • SPS QTY TEST - 1 for 10 sec, then 2 for 10 sec] C -- NO --> D[3 OXID UNBAL ind FAILED] C -- YES --> E[5 PRIM UNBAL SYS FAILED] E --> F[4 Return to normal PUG mode • PUG MODE - PRIM • Perform qty test • PUG MODE - NORM] </pre>	<p>① Assumes qty indicating sys normal.</p> <p>② The unbalance meter will behave erratically for approximately 25 seconds after engine ignition. This is caused by propellant dynamics.</p> <p>③ Assumes CSM is still thrusting. If thrust has terminated, proceed with step 2.</p> <p>④ Actuation of SPS QTY TEST sw here will realign digital display to prim sys.</p>
13 SPS OXID (FUEL) QTY IND READOUT ABNORMAL	<pre> graph TD A[13 SPS OXID (FUEL) QTY IND READOUT ABNORMAL] --> B[1 PUG MODE - AUX % OXID (% FUEL) readout normal?] B -- NO --> C[2 Prim qty test • PUG MODE - PRIM • SPS QTY TEST - 1 • Incr % oxid by 5.0%] C -- NO --> D[5 PRIM SYS SERVO AMP FAILED] C -- YES --> E[4 Aux qty test • SPS QTY TEST - 1 • Incr % oxid by 5.0%] E -- NO --> F[3 CAPACITANCE PROBE FAILED] E -- YES --> G[6 Use aux sys • PUG MODE - AUX] F --> H[7 DISPLAY FAILED] </pre>	<p>① Assumes SPS is still thrusting. If thrusting terminated before step 1 is complete, proceed to step 4.</p> <p>② Complete thrusting prior to qty test.</p> <p>③ MSFN must now supply any print quantity data.</p>

11
THRU
13

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

RCS

SOURCE MOCATA
DATE MARCH 16, 1970

RCS MALFUNCTION INDEX1 SM RCS A(BCD)

- 1a SM RCS PKG TEMP LOW
- 1b SM RCS PKG TEMP HIGH
- 1c SM RCS SEC FUEL PRESS LOW
- 1d SM RCS SEC FUEL PRESS HIGH
- 2 SM RCS HE PRESS LOW OR DECR
- 2a SM RCS PRPLNT QTY LOW OR DECR

3 CM RCS 1(2)

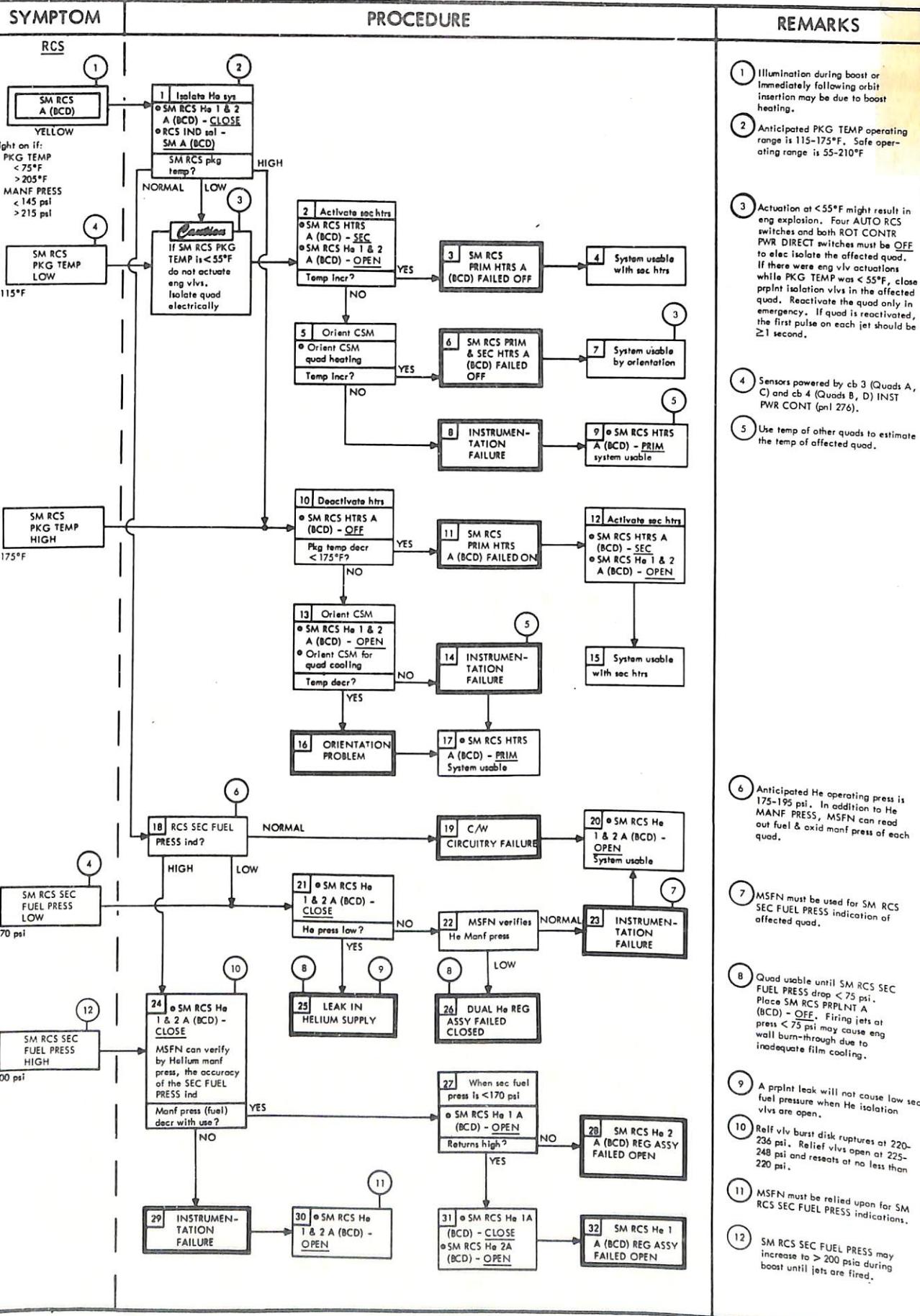
- 3a CM RCS MANF PRESS HIGH
- 3b CM RCS MANF PRESS LOW
- 4 CM RCS HE PRESS LOW OR DECR
- 5 CM RCS ENG TEMP FAILS TO INCR

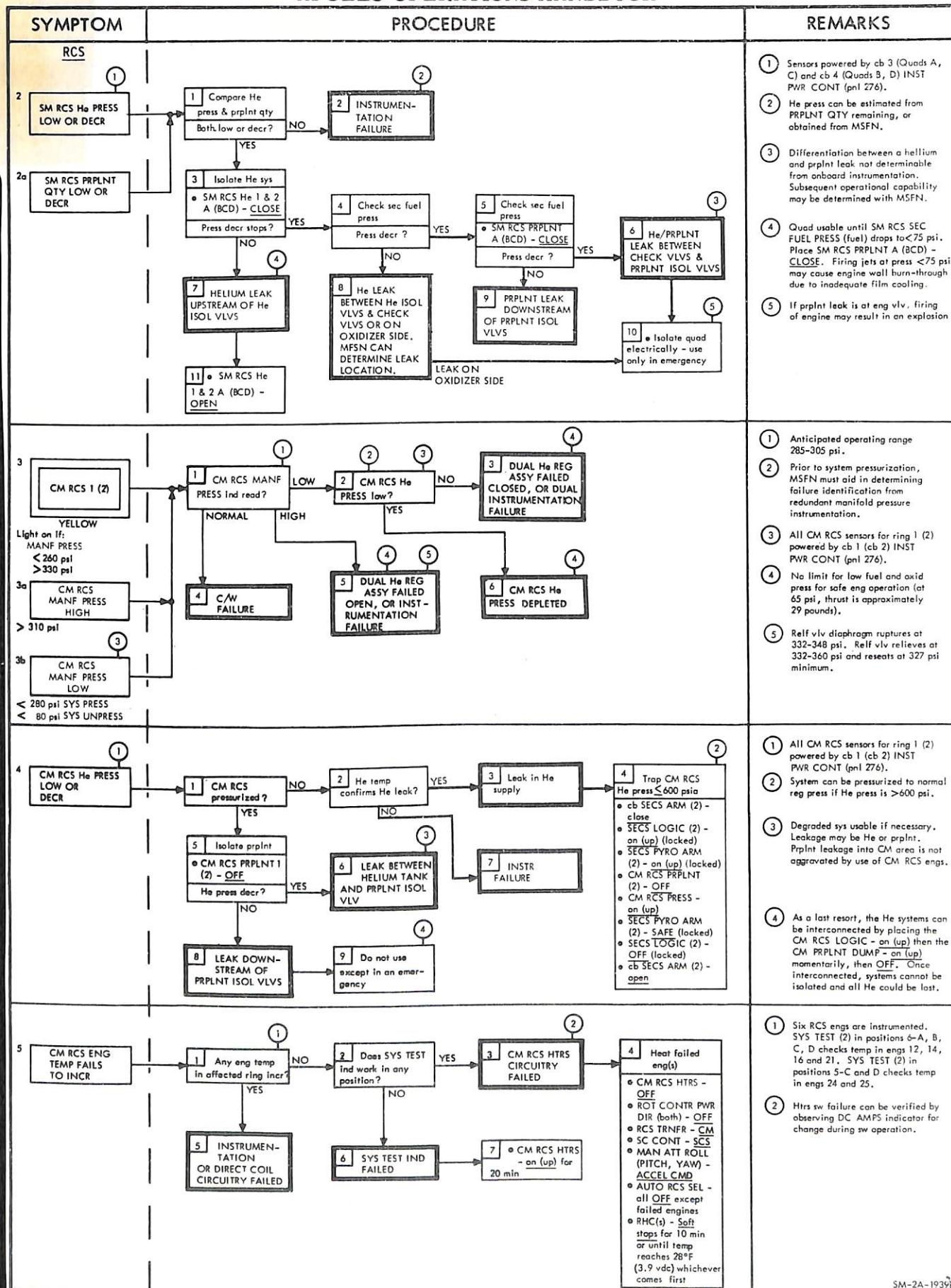
CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

RCS

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK


CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

CYRO

CRYO MALFUNCTION INDEX

1

CRYO PRESS

1a O₂(H₂) CRYO PRESS HI1b O₂(H₂) CRYO PRESS LOW

CSM MALFUNCTION PROCEDURES

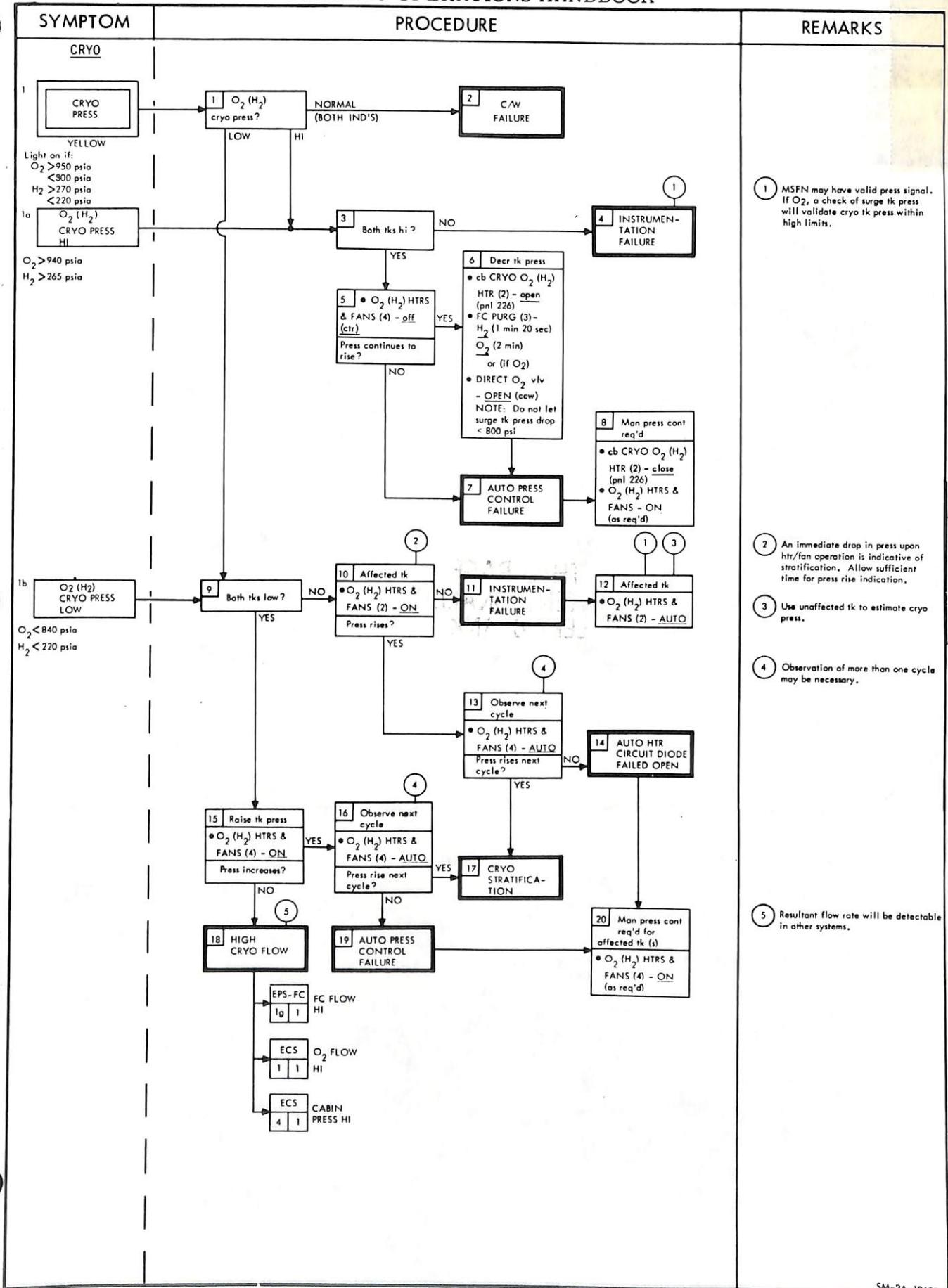
SOURCE MOCATA
DATE MARCH 16, 1970

CRYO

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

1
THRU
1b

CSM MALFUNCTION PROCEDURES



SOURCE AOH
DATE MARCH 16, 1970

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

FUEL CELL

FUEL CELL MALFUNCTION INDEX

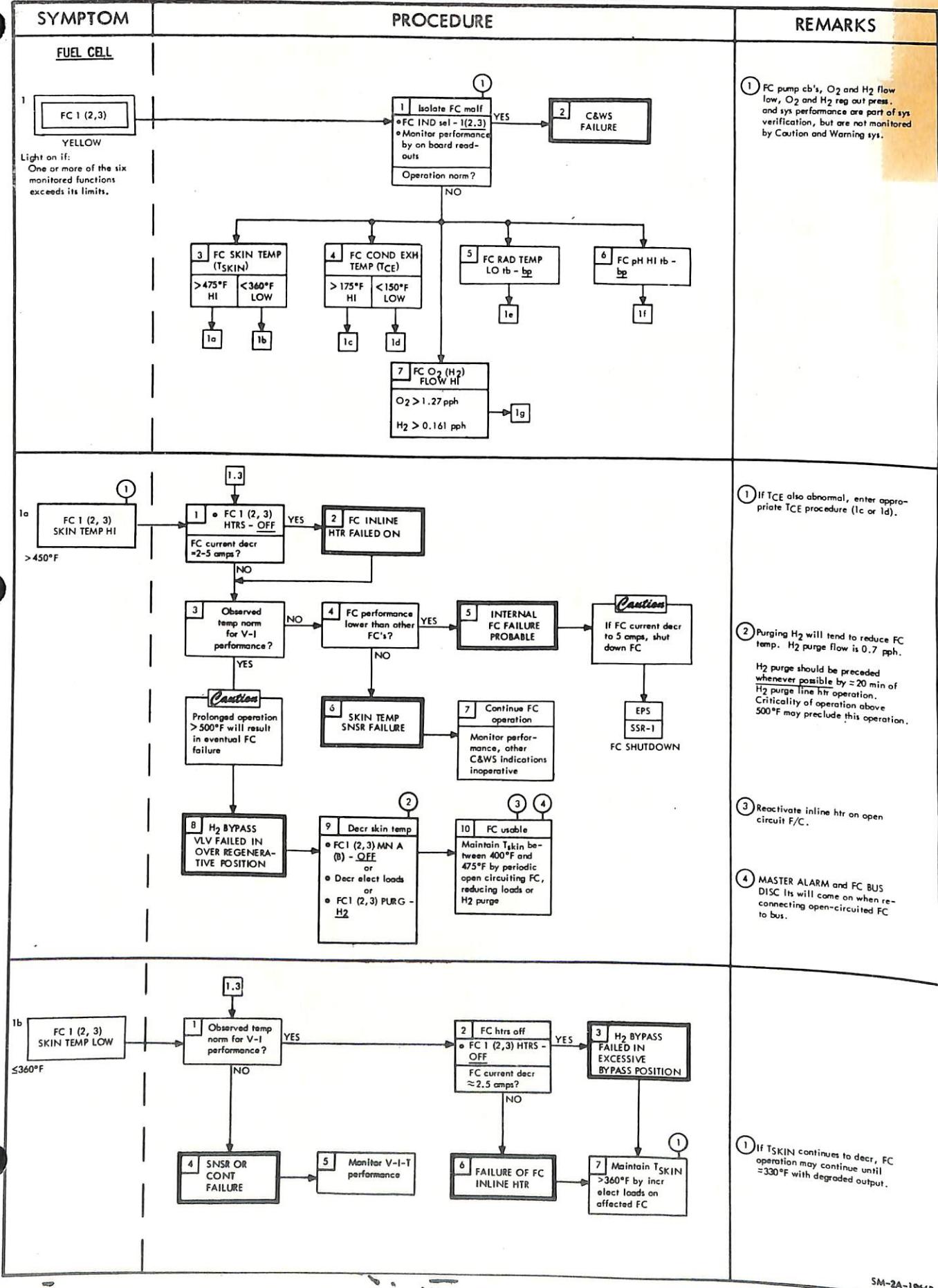
1 FC 1 (2,3)

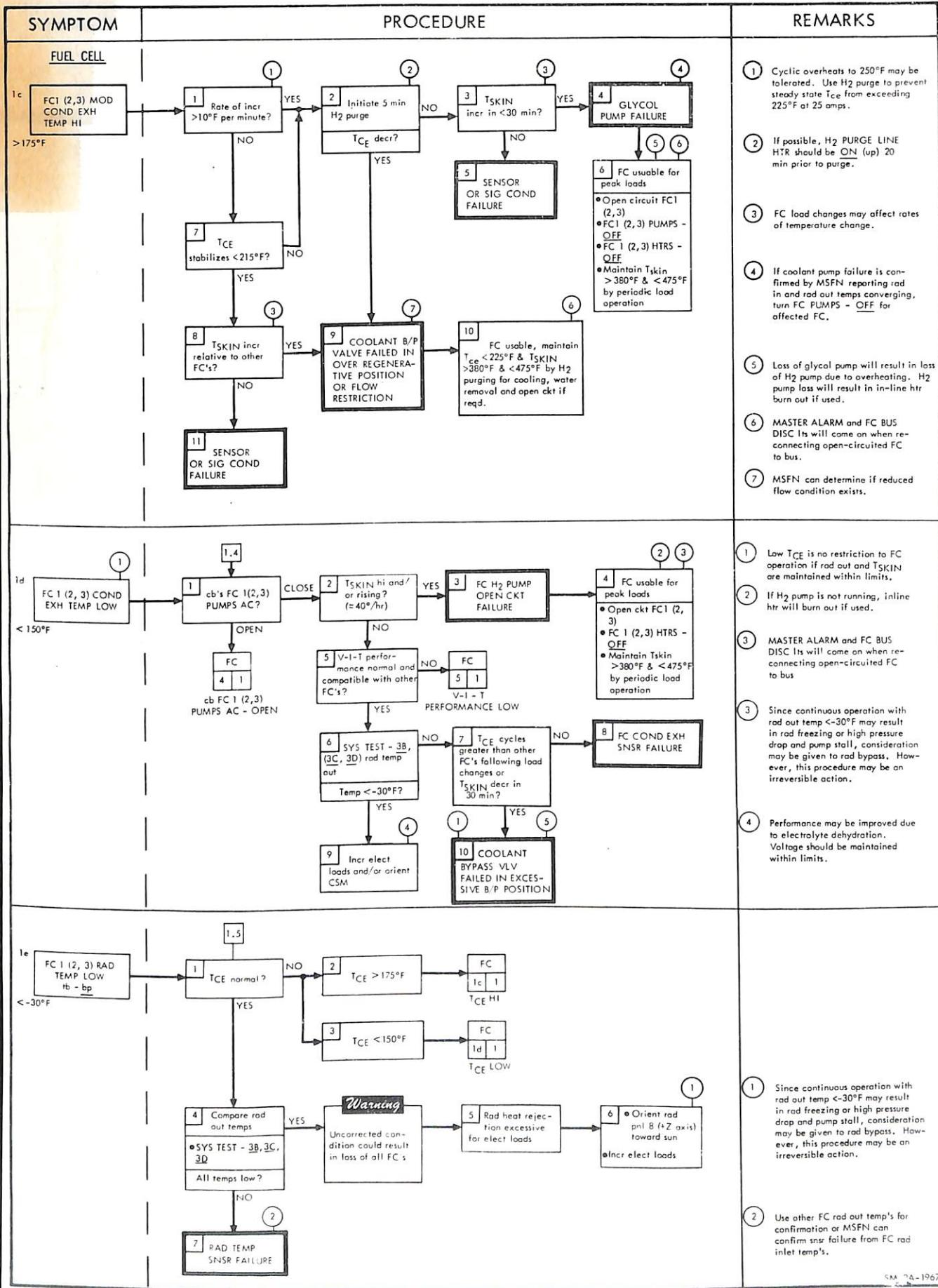
- 1a FC 1 (2,3) SKIN TEMP HI
- 1b FC 1 (2,3) SKIN TEMP LOW
- 1c FC 1 (2,3) MOD COND EXH TEMP HI
- 1d FC 1 (2,3) COND EXH TEMP LOW
- 1e FC 1 (2,3) RAD TEMP LOW tb - bp
- 1f FC 1 (2,3) pH HI tb - bp
- 1g FC 1 (2,3) O₂(H₂) FLOW HI
- 2 FC 1 (2,3) O₂(H₂) FLOW LOW
- 3 FC REG O₂(H₂) OUT PRESS HI
- 4 cbFC 1 (2,3) PUMPS AC ~ OPEN
- 5 FC 1 (2,3) V-1-T PERFORMANCE LOW

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-SC104-(2)
APOLLO OPERATIONS HANDBOOK



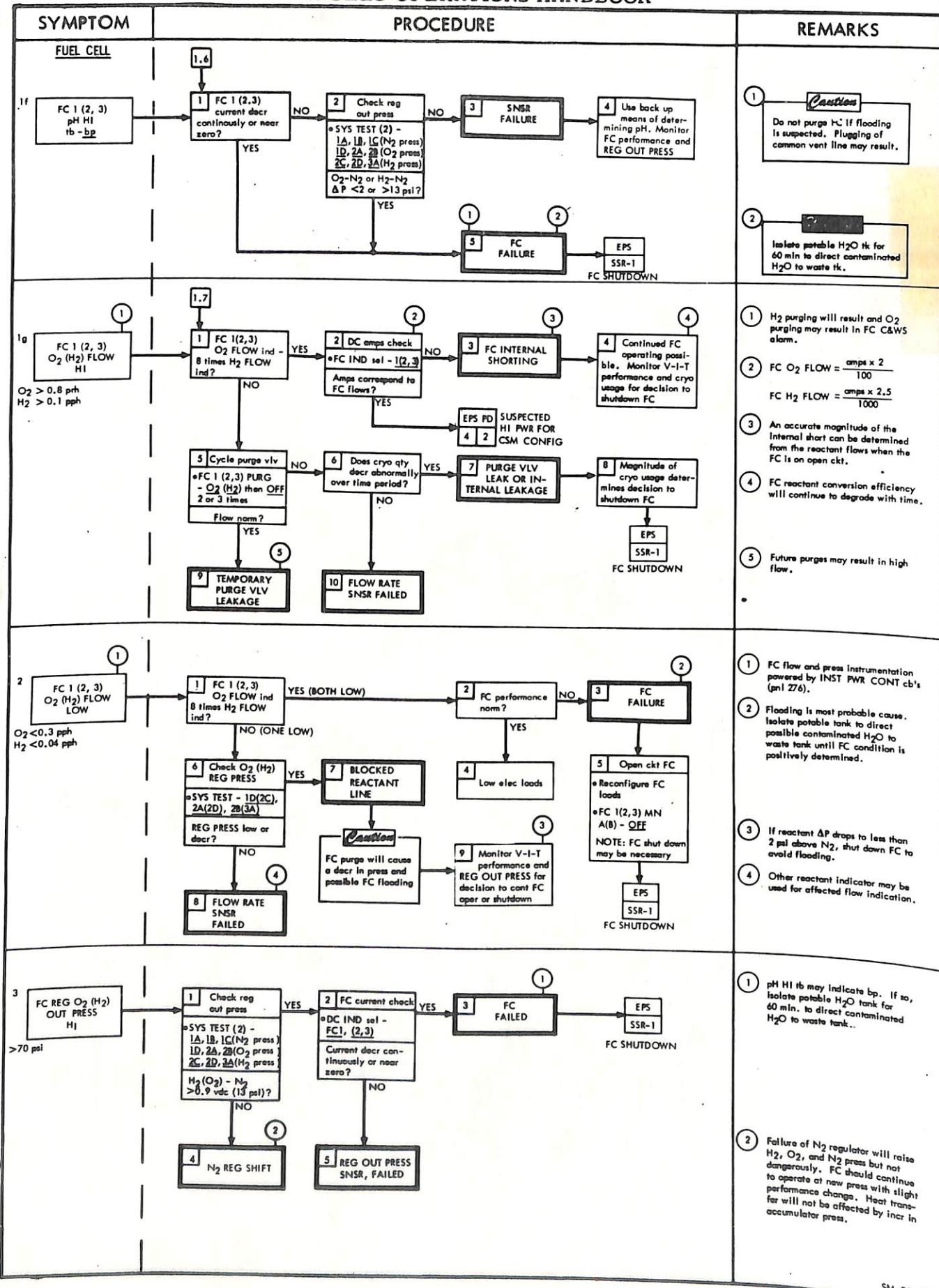


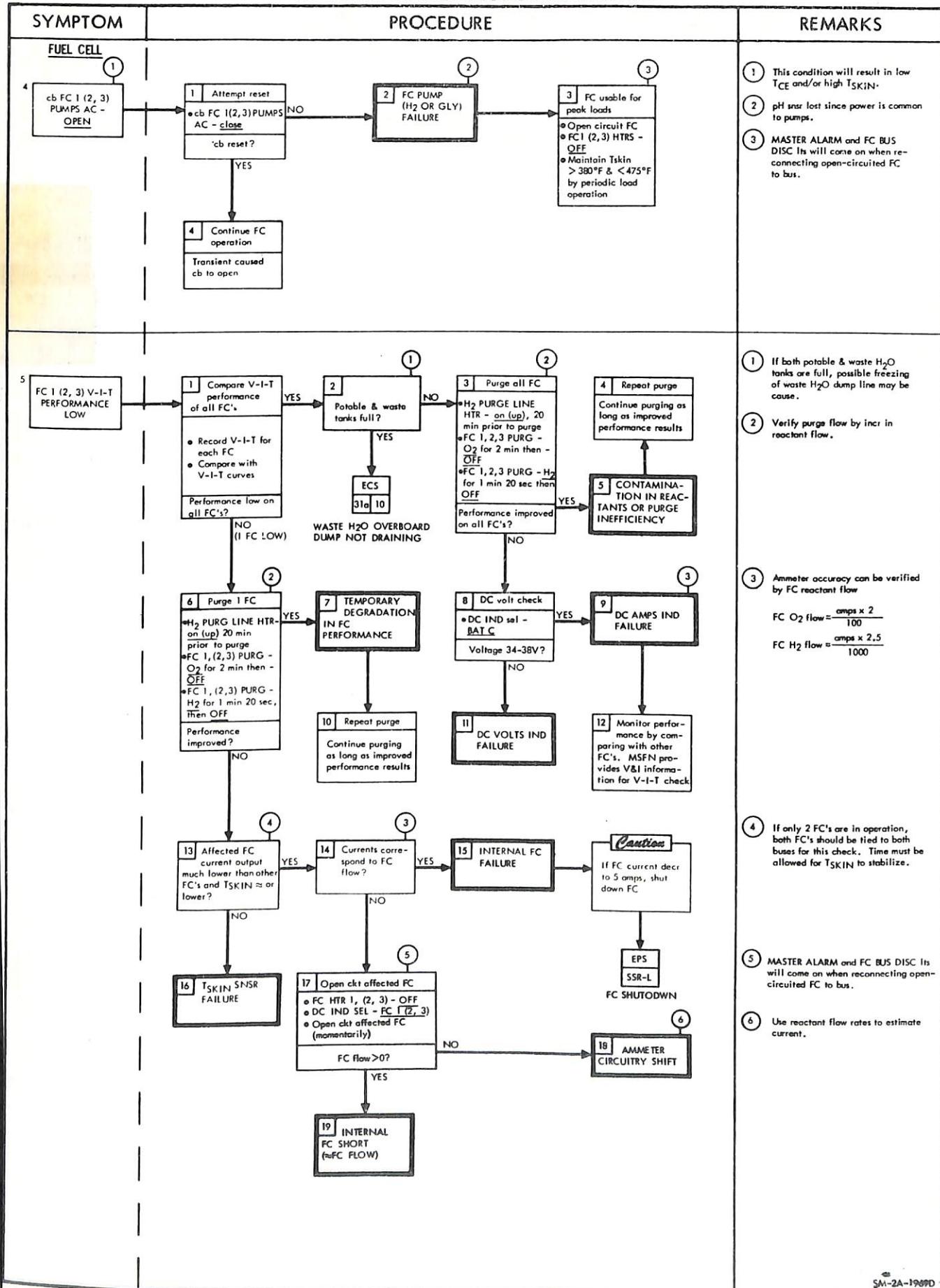
CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 19701f
THRU
5

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

 SOURCE AOH
 DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

THIS PAGE
INTENTIONALLY
LEFT BLANK

PWR

PWR

PWR DISTR MALFUNCTION INDEX

1 MN BUS A(B) UNDERVOLT

1a AC BUS 1(2)

1b AC BUS 1(2) OVERLOAD

1c MN BUS A(B) INDICATES < 26VDC

1d AC BUS 1(2) VOLTAGE LOW

1e AC BUS 1(2) VOLTAGE HIGH

2 INV 1(2,3) TEMP HI

3 FC BUS DISCONNECT

4 SUSPECTED HI CURRENT FOR CSM CONFIG

5 BAT CHGR CURRENT ZERO

6 BAT BUS A(B) CURRENT > 1.0 WITH MN BUS TIE(2) - OFF

6a FC tb's ALL GRAY

7 PYRO BAT VOLTAGE < 35 VDC

SSR-1 FUEL CELL SHUTDOWN

SSR-2 BUS SHORT ISOLATION

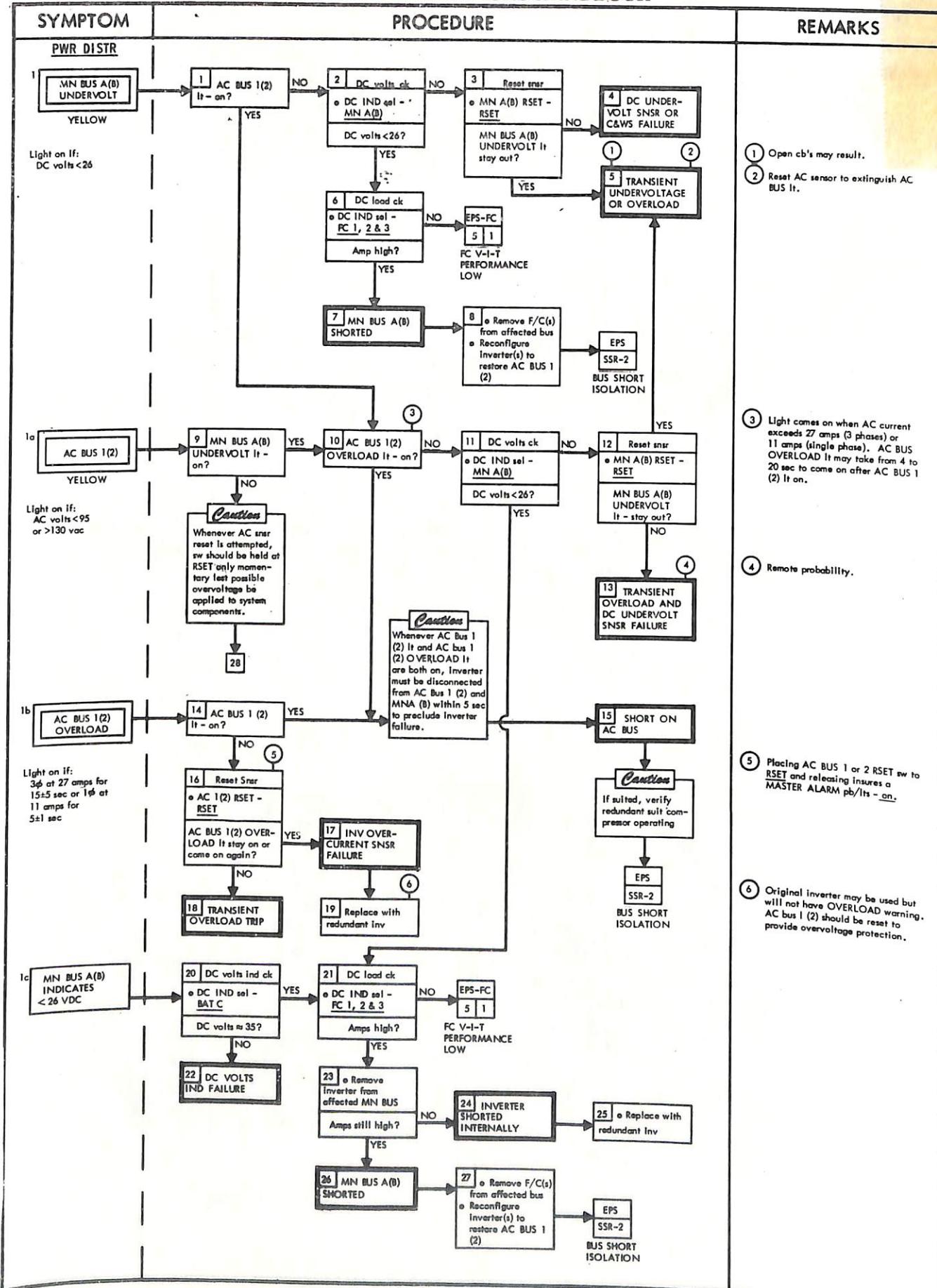
CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

1
THRU
2

CSM MALFUNCTION PROCEDURES



SYMPOTM

REMARKS

PROCEDURE

APOLLO OPERATIONS HANDBOOK

SM2A-03-BLOCK II-(2)

Placing AC BUS 1 or 2 RESET SW to
RESET and releasing insures a
MASTER ALARM pb/1s - on.

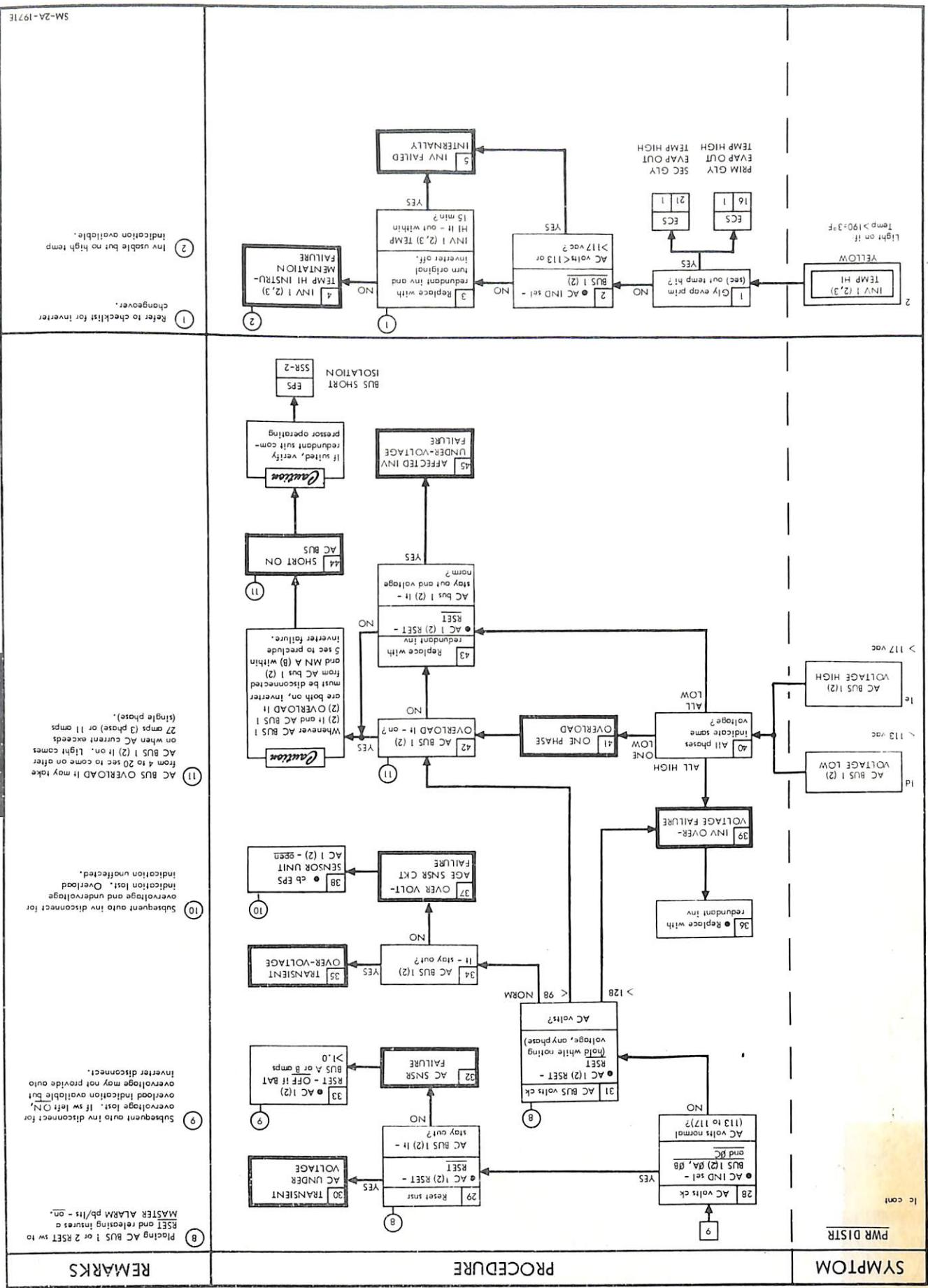
overvoltages lost. If SW left ON, overvoltage may not provide auto recovery after disconnection.

subsequent auto inv disconnection for
overvoltage and undervoltage indication lost. Overload
indication unaffected.

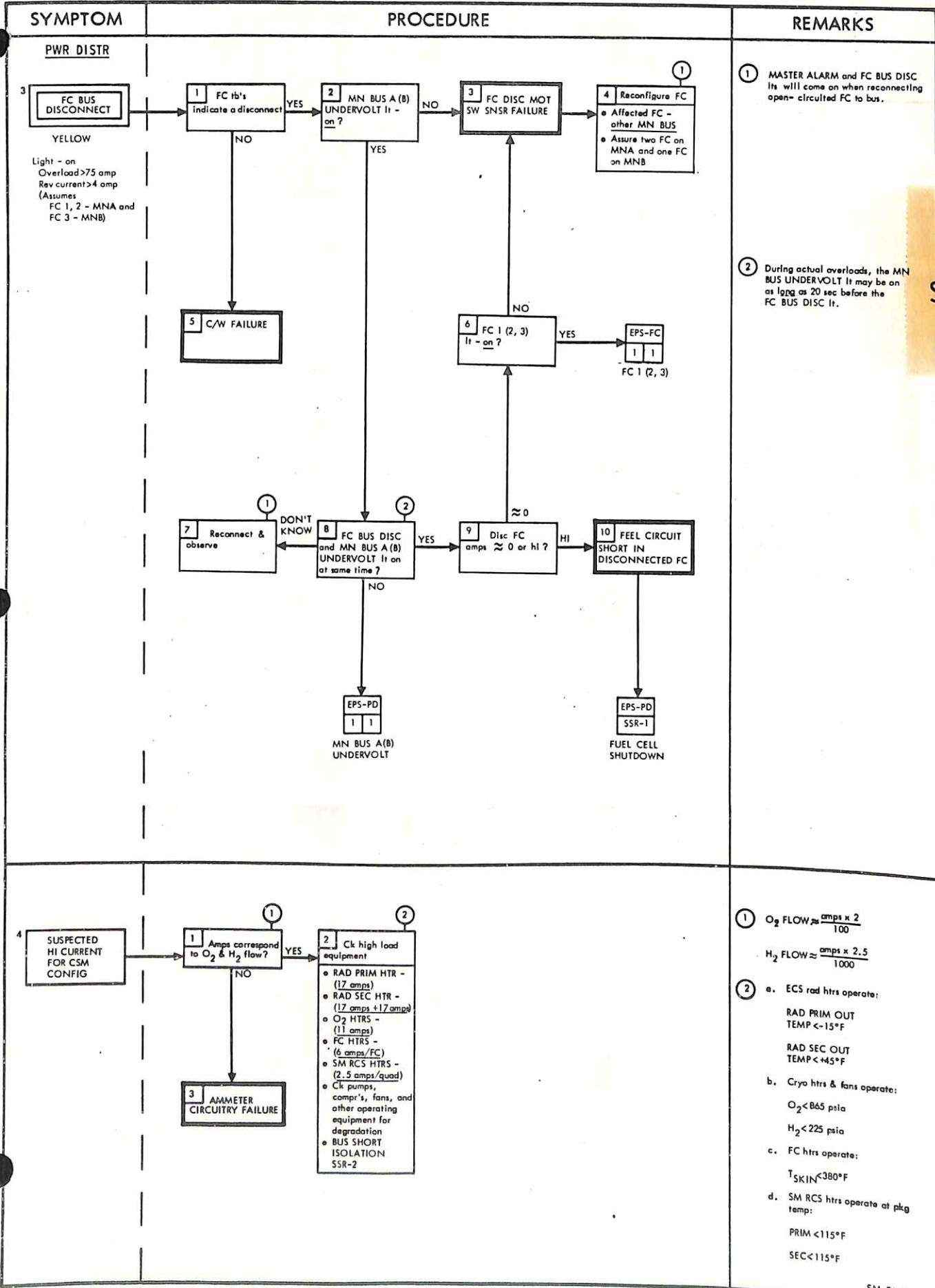
AC BUS OVERLOAD is may take from 4 to 20 sec to come on after AC BUS 1 or 2 it on. Light fault comes when AC current exceeds 27amps (3 phase) or 11amps (single phase).

Refer to checklist for inverter
changeover.

Inv usable but no high temp
indication available.

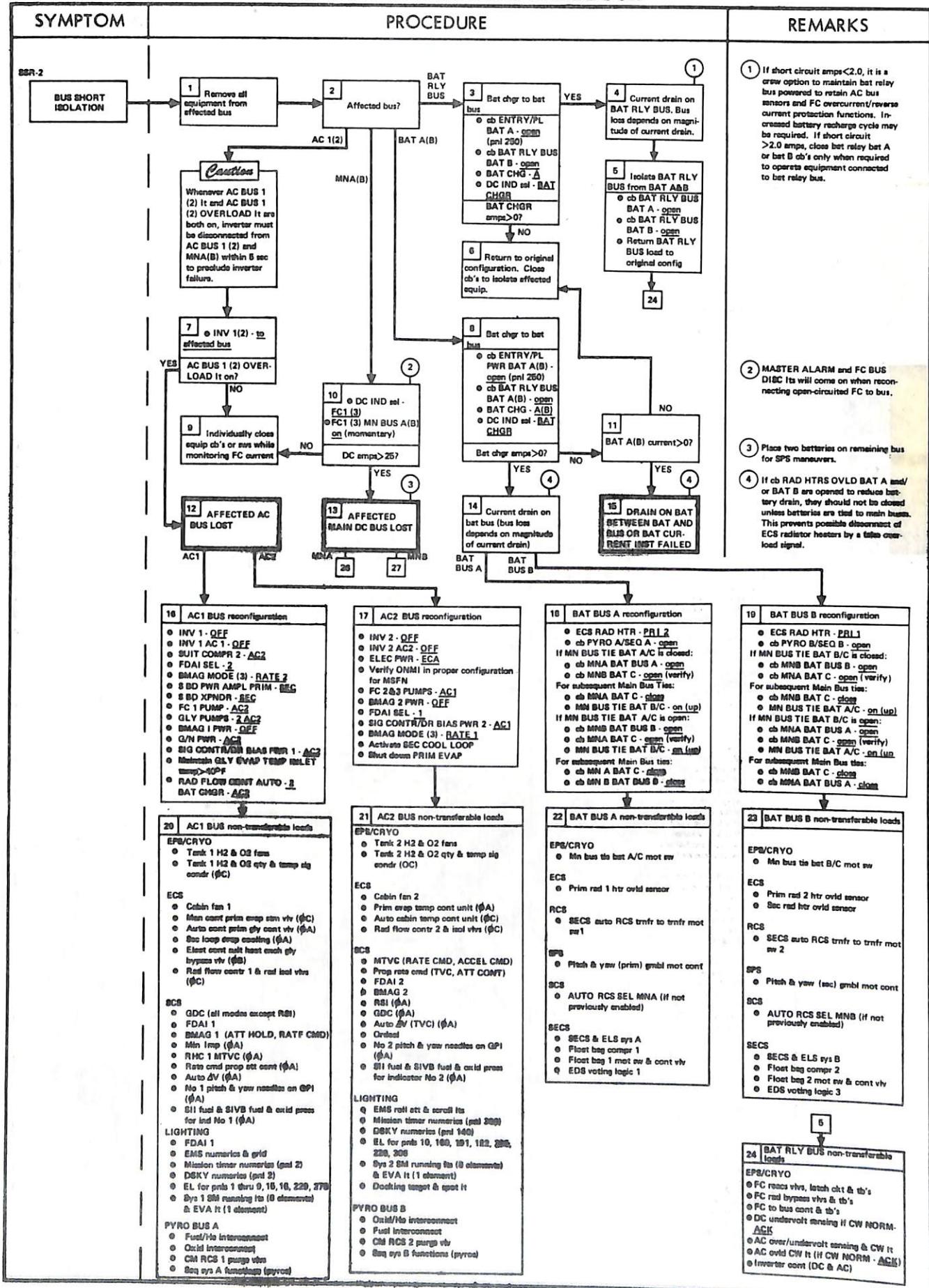


CSM MALFUNCTION PROCEDURES



SM2A-03--BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
PWR DISTR	<p>5 BAT CHGR CURRENT ZERO</p> <p>1 Bat chgr volts >38? YES → 2 • BAT CHG - other bats Current still zero? YES → 3 OPEN CKT IN ONE BAT CHGR CKT NO → 4 • BAT CHG - other bats Bat chgr volts >38? YES → 5 DC AMMETER FAILED (AND ORIG BAT LOW) NO → 8 BAT CHGR OR CHGR CONT RELAY FAILED</p> <p>2 • BAT CHG - A(B,C) • cb BAT CHGR BAT A(B,C) CHG - open Chgr volts incr? YES → 7 DC AMMETER FAILURE NO → 9 OPEN BAT CHARGING CKT TO ALL BATS</p>	<p>(1) Affected battery might still be charged through BAT TIE cb's</p> <p>(2) Battery charging capability lost.</p>
6 BAT BUS A(0) CURRENT >1.0 WITH MN BUS TIE (2) - OFF	<p>1 • DC IND sel - BAT BUS B(A) Current >1.0? NO → 2 • cb MN A(B) BAT BUS A(0) - open Current still >1.0? YES → 3 BAT BUS A(B) SHORTED EPS SSR-2 YES → 4 BAT RLY BUS SHORTED NO → 5 MN BUS TIE MOT SW FAILURE</p> <p>BUS SHORT ISOLATION</p>	<p>(1) Bat bus current will be <1.0 amps for all mission phases except: a. Pre-launch (<3.0 amps) b. Boost & insertion c. 4V maneuvers d. Deorbit & entry.</p> <p>(2) If a, b & c batts on MN buses, cycling MN bus tie switches may correct the problem. If not, MN bus tie will have to be accomplished by cb action. May have to change battery through other battery bus.</p> <p>(3) Not valid after CM/SM separation.</p>
7 PYRO BAT VOLTAGE <35 VDC	<p>1 Replace pyro bat with entry bat • cb PYRO A(B) SEQ A(B) - open • cb PYRO A(B) BAT BUS A(B) - close • DC IND sel - PYRO BAT A(B) • Verify DC volts - BAT BUS A(B) • DC IND sel - BAT BUS A(B)</p> <p>BAT BUS A(B) amps incr? YES → 2 PYRO A(B) FEED CKT SHORTED NO → 3 PYRO BAT A(B) FAILED</p>	<p>(1) It is crew option to leave a main battery connected to a known short to retain redundant pyro circuit capability. If dc amps >30, expect cb PYRO A(B) BAT BUS A(B) to open within 1 to 5 min and loss of redundant pyro circuit.</p>
SPECIAL SUB ROUTINE	<p>SSR-1 FUEL CELL SHUTDOWN</p> <p>1 Configure for 2 FC's with one FC on each bus</p> <p>2 • FC 1 (2,3) PUMPS - OFF • cb FC 1 (2,3) PUMPS AC - open • cb FC 1 (2,3) REACS - close • FC 1 (2,3) REACS - OFF • cb FC 1 (2,3) REACS - open</p> <p>3 Relieve press on KOH of faulty FC at $T_{SKIN} \leq 200^{\circ}\text{F}$ • H₂ PURG LINE HTR - (on up) 20 min prior to purge • FC 1 (2,3) PURG - O₂ • FC 1 (2,3) PURG - H₂ (when O₂ approaches stable value) • FC 1 (2,3) PURG - OFF (after H₂ approaches stable value) • H₂ PURG LINE HTR - OFF</p>	<p>(1) FC will not reach $T_{SKIN} = 200^{\circ}\text{F}$ for approximately 24 hours. KOH will be solidified at $T_{SKIN} \leq 200^{\circ}\text{F}$. The press is relieved to reduce the possibility of corrosive fluid leaking into the SM and to insure sealing of the check vlv, isolating the potable water from the FC.</p>

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK


SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
	13	
	26 MN BUS A reconfiguration	13
	<ul style="list-style-type: none"> • FC 2 MNB - on (up) • FC 1 MNB - on (up) (if req'd) • FC 1 MNA - OFF • INV 1 AC1 - OFF • INV 1 - OFF • INV 3 - MNB • cb MNA BAT BUS A - open • cb MNA BAT C - close • SUIT H2O ACCUM AUTO - 2 • BMAG MODE (3) - RATE 2 • FDAI SEL - 2 • URINE DUMP - HTR B • WASTE H2O DUMP - HTR B • ROT CONTR PWR DIR 2 - MNB • AUTO RCS SEL (16) - MNA (as req'd) • RAD PRIM HTR - 1 • SPS LINE HTRS - A/B (as req'd) • RAD FLOW CONT AUTO - 2 • SPS LINE HTRS - A/B (as req'd) • RAD FLOW CONT AUTO - 2 • SCS TVC (2) - RATE CMD • Use RHC's for RCS dump, not CM PRPLNT DUMP sw 	
	27 MN BUS B reconfiguration	
	<ul style="list-style-type: none"> • FC 3 MNA - on (up) (if req'd) • FC 3 MNB - OFF • INV 2 AC2 - OFF • INV 2 - OFF • INV 3 - MNA • cb MNB BAT BUS B - open • cb MNA BAT C - close • BMAG MODE (3) - RATE 1 • ROT CONTR PWR DIR 1 - MNA • AUTO RCS SEL (16) - MNA • ELEC PWR - ECA • RAD PRIM HTR - 2 • RAD FLOW CONT AUTO - 1 • Use RHC's for RCS dump, not CM PRPLNT DUMP sw 	
	28 MN BUS A non-transferable loads	29 MN BUS B non-transferable loads
	<p>EPS/CRYO</p> <ul style="list-style-type: none"> • Tank 1 H2 & O2 hrs • Inverter 1 pwr • Utility outlets (pnl 15 & 16) • Tank 1 O2 vac-ion pump <p>ECS</p> <ul style="list-style-type: none"> • CO2PP ind, CW It & PCM • Prim 2 rad htr cont • Rad flow contr 1 & auto select • Rad isol vlv man sel • H2O accum 1 auto & man cont • Urine & waste H2O dump htr A • Steam duct htr A • Sec rad htr cont • Sec rad in & out temp ind & PCM <p>RCS</p> <ul style="list-style-type: none"> • CM sys 1 hrs • CM sys 1 fuel & oxid purge • CM oxid interconnect • CM fuel/H2 interconnect • CM sys 1 prplnt dump(42 sec TD) • CM sys 1 prplnt isol vlv & tb • SM B & D htrs • SM B & D He 1 & 2 isol vlv & tb • SM B & D prim/sec prplnt isol vlv & tb • SM B & D sec fuel press isol vlv • Transfer mot sw 1 <p>SPS</p> <ul style="list-style-type: none"> • Pitch & yaw (prim) gimbal mnts • Enable pwr sol driver 1 • He vlv 1 & tb • Pilot vlv 1 & 2 • Prim pilot pre vlv • Line hrs A • PUGS test <p>SCS</p> <ul style="list-style-type: none"> • FDAI 1 total attitude • GDC (except RSI) • BMAG 1 hr & CW temp It (eventually loss BMAG 1 as temp decreases) • Auto coils CM RCS 1 (if prior to CM/SM sep) • Direct ullage yaw D3 & B4 • Auto ΔV • Auto attitude hold • Rate 1 MTVC • Rot contr pwr dir 1 <ul style="list-style-type: none"> a. MNA/MNB to half of jets b. MNA to all jets • Rot cont pwr dir 2, MNA/MNB to half of jets <p>LIGHTING</p> <ul style="list-style-type: none"> • RH girth shelf flood (fixed mode) • RH couch flood (fixed mode) • LH girth shelf flood (variable mode) • LH couch flood (variable mode) • LH & RH strut flood (variable mode) • LH optical align sight • Rendezvous lt • Sys A tunnel lts (6 elements) <p>DISPLAYS & CONTROLS</p> <ul style="list-style-type: none"> • Mission elapsed timer (pnl 2) <p>DOCKING</p> <ul style="list-style-type: none"> • Sys A probe connector (however A & B connectors may be switched) 	<p>EPS/CRYO</p> <ul style="list-style-type: none"> • O2 high flow CW It • Prim 1 rad htr cont • Rad flow contr 2 • Prim rad in temp ind & PCM • H2O accum 2 auto & man cont • Urine & waste dump htr B • Steam duct htr B <p>RCS</p> <ul style="list-style-type: none"> • CM sys 2 hrs • CM sys 2 fuel & oxid purge • CM fuel interconnect • CM oxid/H2 interconnect • CM sys 2 prplnt dump(42 sec TD) • CM sys 2 prplnt isol vlv & tb • SM A & C htrs • SM A & C He 1 & 2 isol vlv & tb • SM A & C prim/sec prplnt isol vlv & tb • SM A & C sec fuel press isol vlv • Transfer mot sw 2 <p>SPS</p> <ul style="list-style-type: none"> • Pitch & yaw (sec) gimbal mnts • Enable pwr sol driver 2 • He vlv 2 & tb • Pilot vlv 3 & 4 • Sec pilot pre vlv • Line hrs B <p>SCS</p> <ul style="list-style-type: none"> • FDAI 2 total attitude • GDC • BMAG 2 hr & CW temp It (eventually loss BMAG 2 as temp decreases) • Auto coils CM RCS 2 (if prior to CM/SM sep) • Direct ullage pitch C3 & A4 • Auto ΔV (maybe degraded) • Min imp increase to = 42 MS • RSI • Ordeal • Rot contr pwr dir 1, MNA/MNB to half of jets • Rot contr pwr dir 2 <ul style="list-style-type: none"> a. MNA/MNB to half of jets b. MNB to all jets <p>LIGHTING</p> <ul style="list-style-type: none"> • LH girth shelf flood (fixed mode) • LH couch flood (fixed mode) • LH & RH strut flood (fixed mode) • RH couch flood (variable mode) • RH girth shelf flood (variable mode) • RH optical align sight • Sys B tunnel lts (6 elements) • Spotlight door initiator <p>DISPLAYS & CONTROLS</p> <ul style="list-style-type: none"> • Mission elapsed timer (pnl 306) <p>DOCKING</p> <ul style="list-style-type: none"> • Sys B probe connector (however A & B connectors may be switched)

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

T/C

TELECOMM MALFUNCTION INDEX

- 1 ONE CREWMAN HAS NO INTERCOM CAPABILITY
- 2 LOSS OF INTERCOM (ALL CREWMEN)
- 3 ONE CREWMAN HAS UNSELECTED HOT MIKE CONDITION
- 4 LOSS OF VHF COMM WITH MSFN
- 5 LOSS OF VHF COMM WITH LM
- 6 EMS RANGE DISPLAY ABNORMAL
- 7 LOSS OF S-BD VOICE COMM (MSFN WITHIN VHF RANGE)
- 8 LOSS OF S-BD VOICE COMM (MSFN NOT WITHIN VHF RANGE)
- 9 MSFN REPORTS LOSS OF RANGING
- 10 MSFN REPORTS LOSS OF REAL TIME PCM
- 11 HI GAIN ANTENNA DOES NOT RESPOND PROPERLY TO MANUAL POINTING COMMANDS
- 12 CANNOT ACQUIRE OR MAINTAIN PHASELOCK WITH HIGH GAIN ANTENNA
- 13 CANNOT ACQUIRE PHASELOCK WITH OMNIANTENNAS

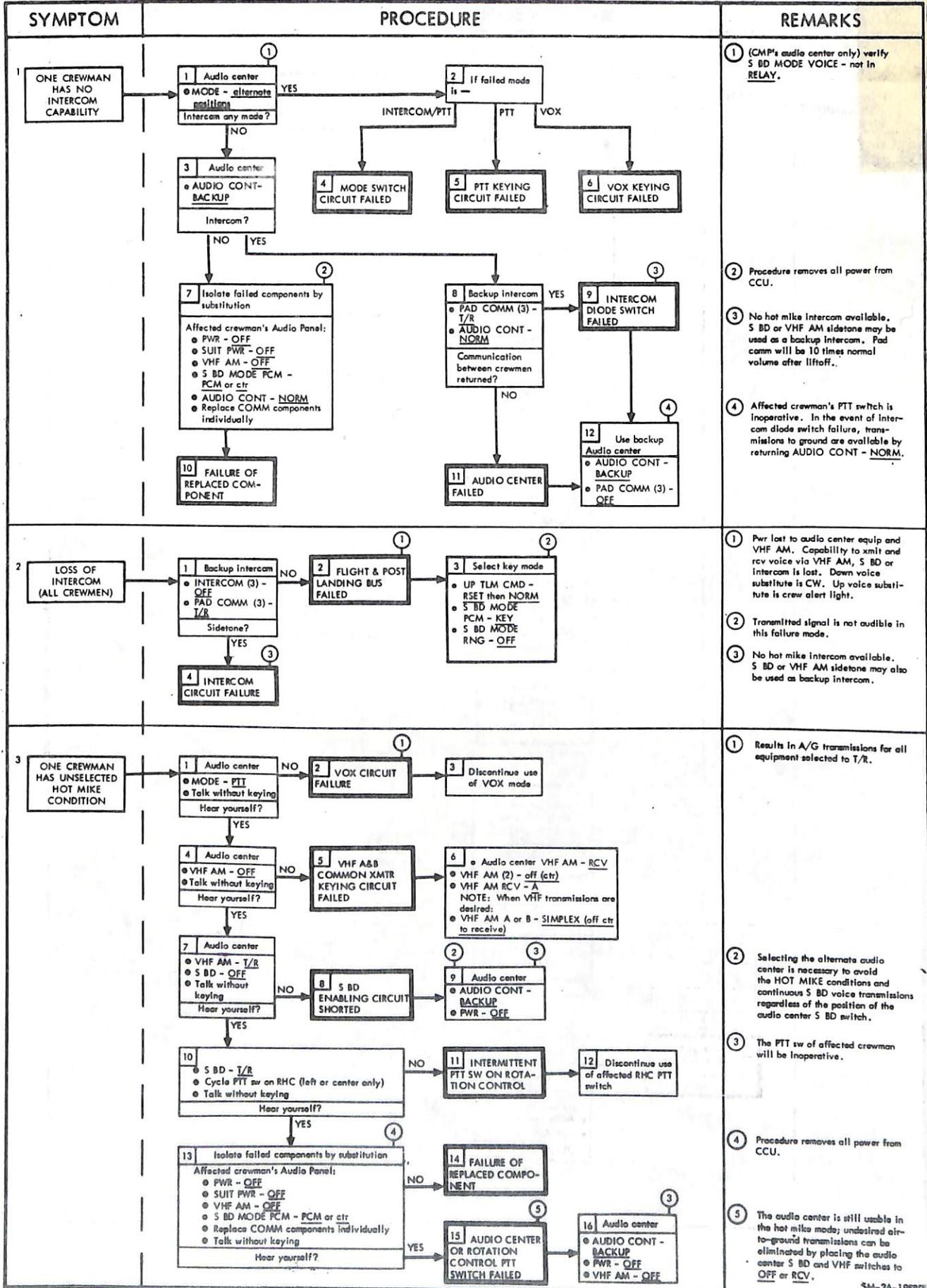
CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

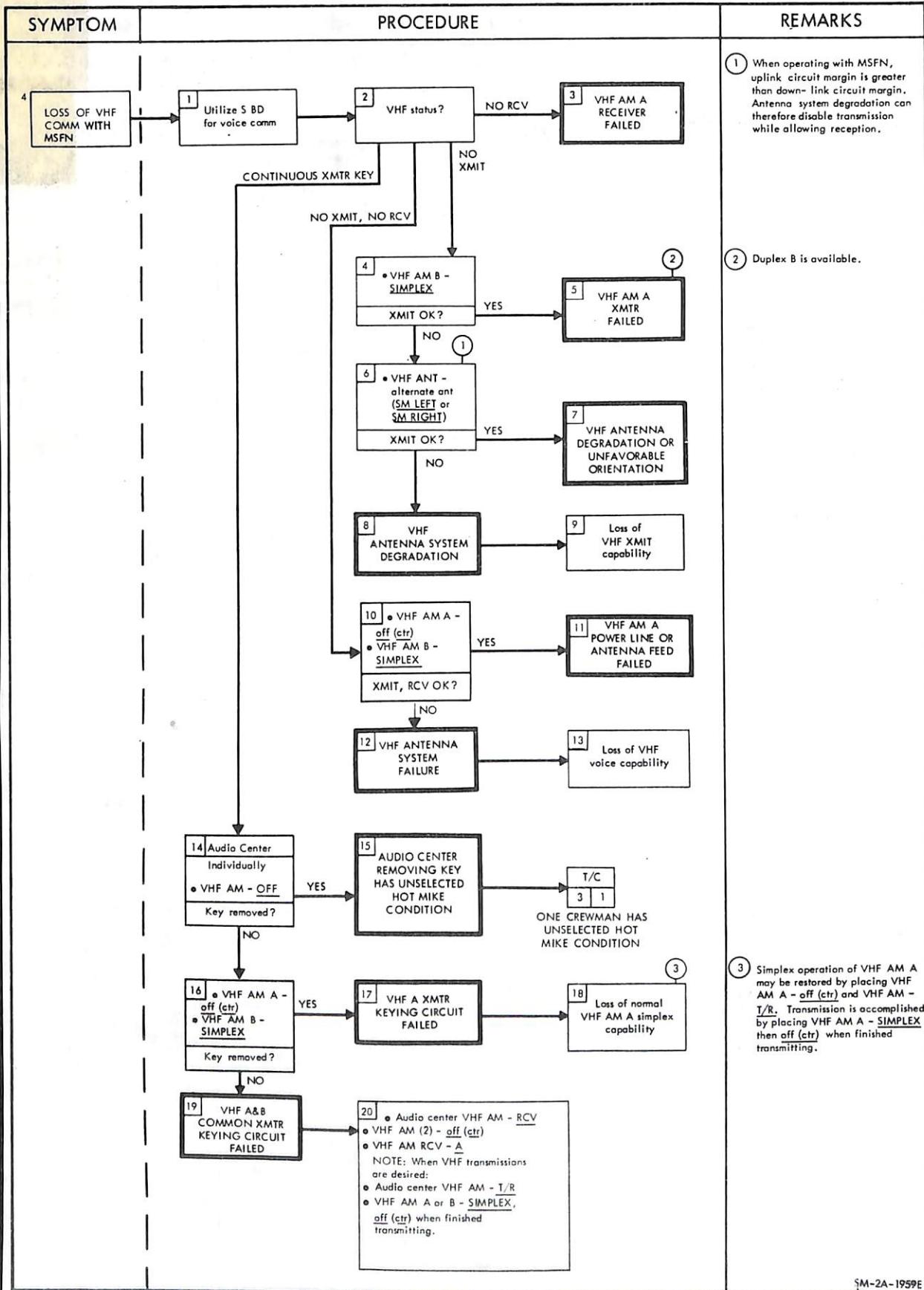
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

1
THRU
4

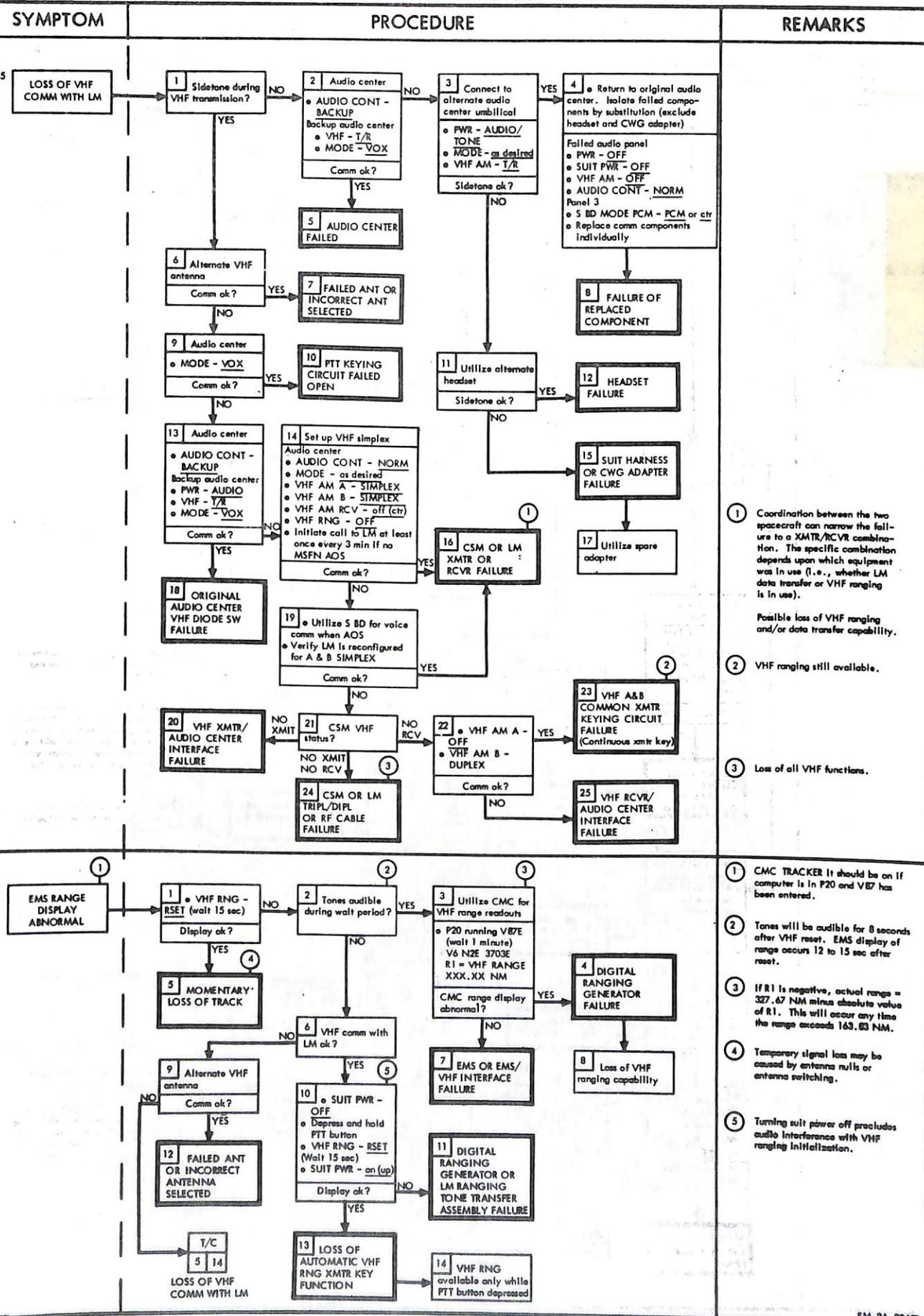
CSM MALFUNCTION PROCEDURES



SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

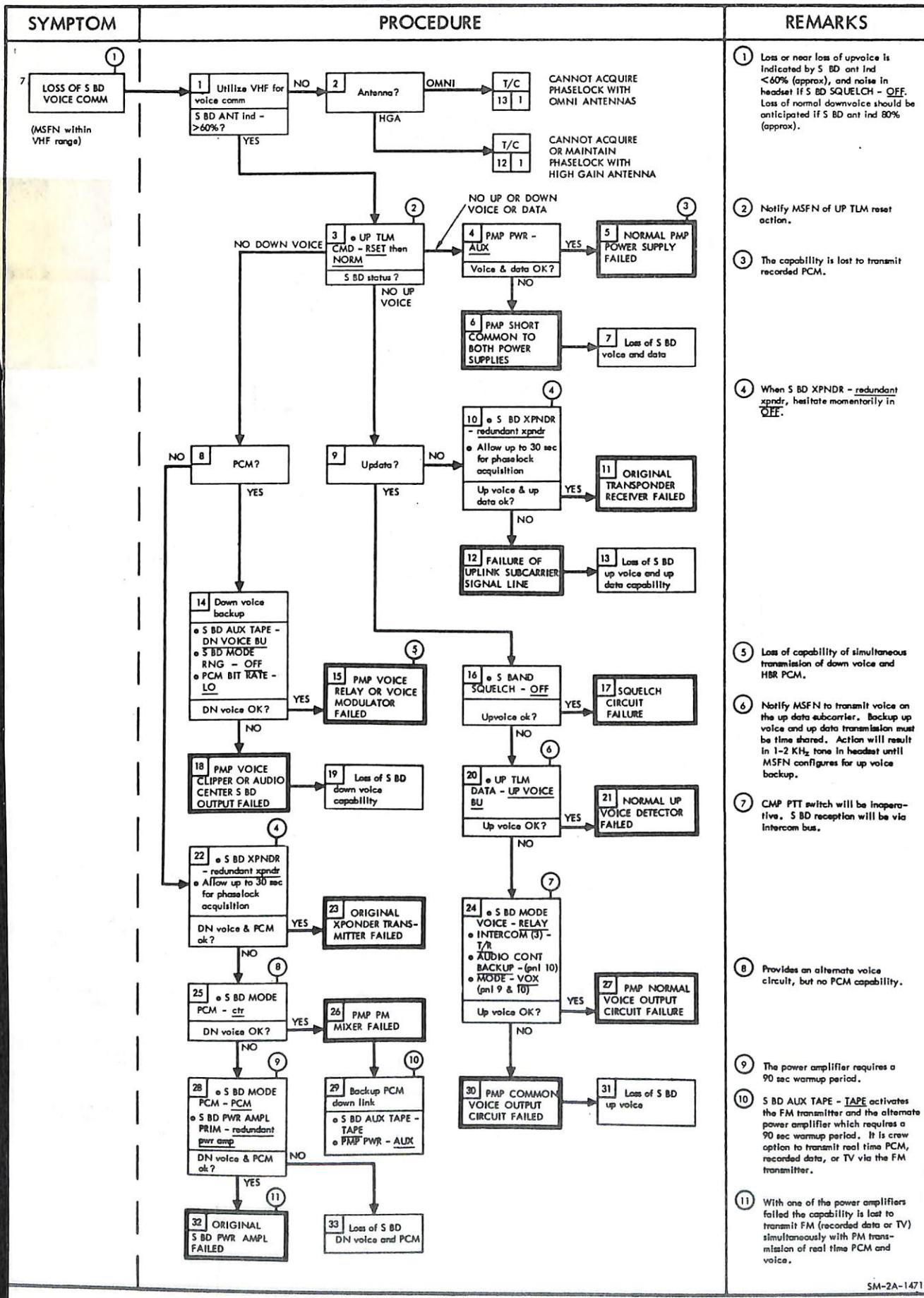


SOURCE AOH
DATE, MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

 SOURCE AOH
 DATE MARCH 16, 1970

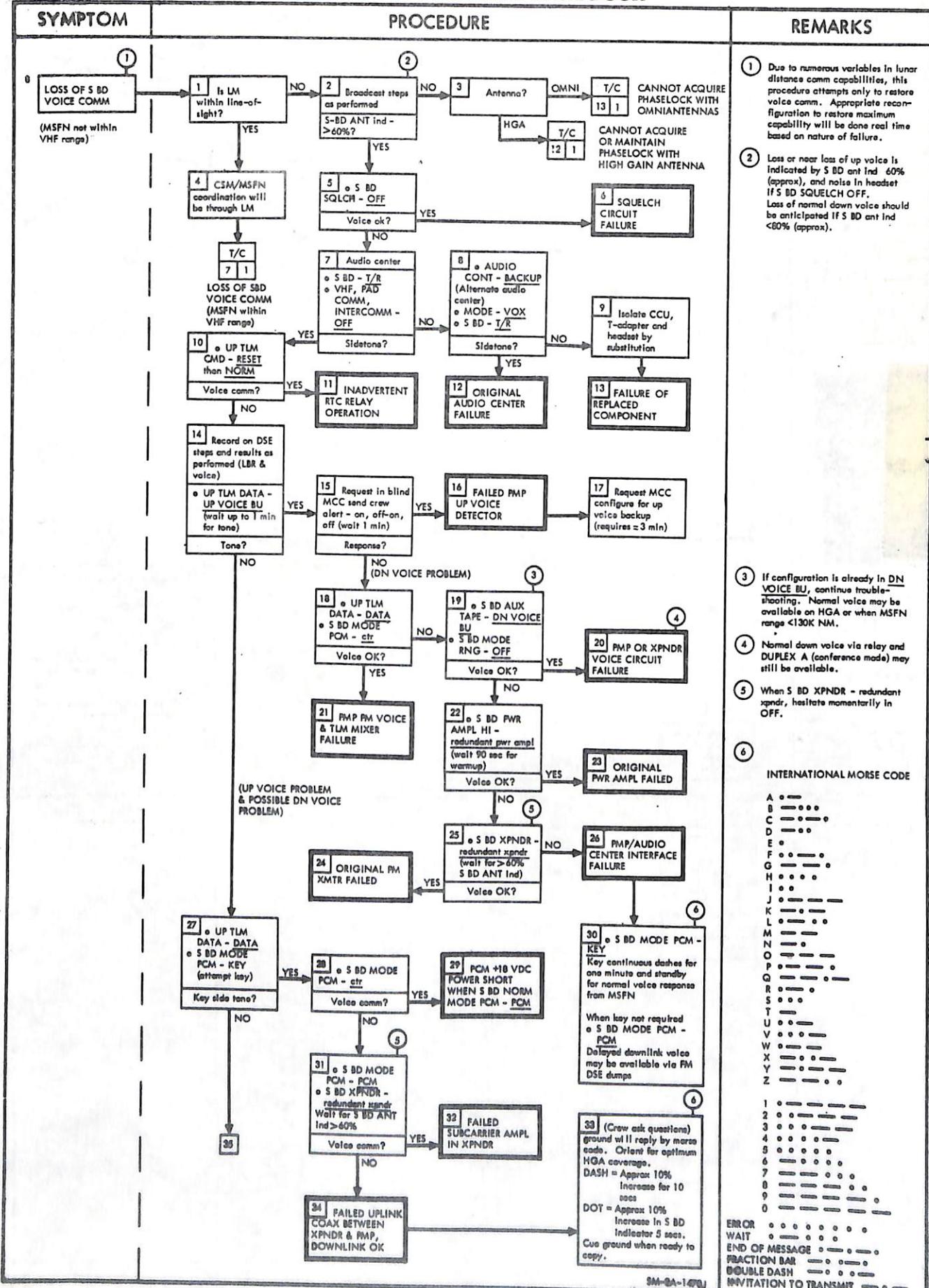
 5 THRU
 7

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



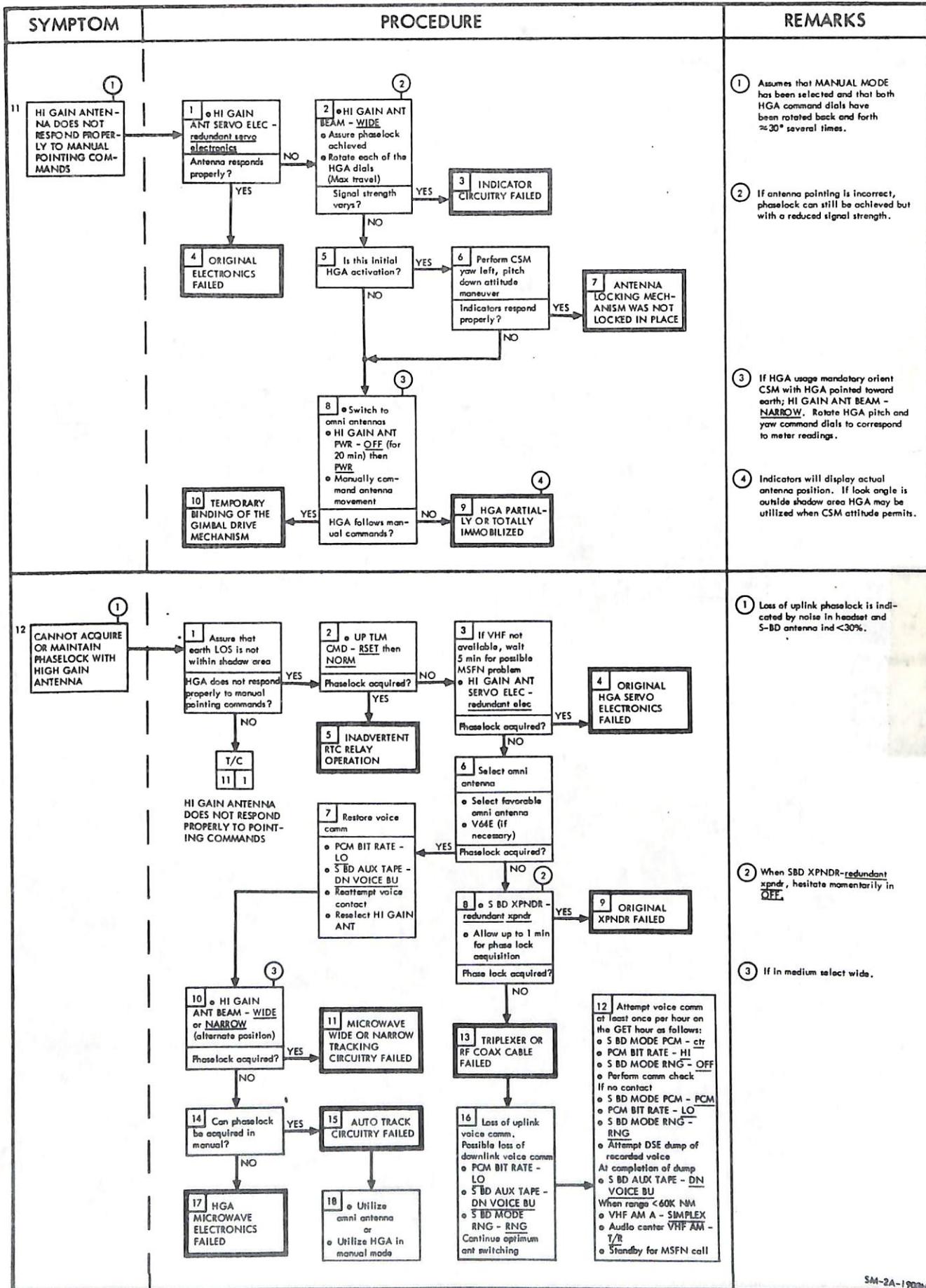
SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
8 (Cont)	<pre> graph TD Z7[] --> S35[S 35 o PMP PWR - AUX (attempt key)] S35 -- NO --> S36[S 36 o S BD MODE VOICE - RELAY PCM - PCM o CMP Audio Center: S BD - T/R MODE - VOX VOX SENS fw - 6 o INTERCOM (3) - T/R] S35 -- YES --> S38[S 38 PMP +18 VDC PWR SPLY FAILED] S38 --> S39[S 39 o S BD MODE PCM - PCM] S39 --> S40[S 40 e UP TLM CM - ACCEPT] S40 --> S41[S 41 Request MCC send CREW ALERT on-out, reset MASTER ALARM, on-out, reset MASTER ALARM] S41 -- NO --> S43[S 43 o S BD AUX TAPE - DN VOICE BU] S43 --> S44[S 44 o S BD AUX TV - SCI] S44 --> S45[S 45 o S BD AUX TAPE - TAPE] S45 --> S46[S 46 LOSS OF PMP POWER SUPPLY] S43 --> S47[S 47 S BD AUX TAPE - TAPE OR OFF POSITION SHORTED] S44 --> S48[S 48 S BD AUX TV - TV OR OFF POSITION SHORTED] S45 --> S49[S 49 S BD AUX TAPE - CTR SW OR DN VOICE BU POSITION SHORTED] S49 --> S50[S 50 o Configure for TV and use cue cards for downlink. Up comm per step 33] S41 -- YES --> S42[S 42 LOSS OF S BD UP VOICE CAPABILITY] S42 --> S40 S43 --> S47 S44 --> S48 S45 --> S49 S47 --> S48 S48 --> S49 S49 --> S50 </pre>	<p>(7) In relay mode for UP VOICE, CMP audio center DN VOICE not available. CMP select backup audio center. CDR and LMP use sidetone to copy up voice.</p>
9	<pre> graph TD S9[MSFN REPORTS LOSS OF RANGING] --> S1[S 1 o UP TLM CMD - RSET then NORM o S BD MODE RNG - RNG] S1 -- NO --> S2[S 2 o S BD XPNDR - redundant xpndr o Allow up to 30 sec for phaselock acquisition] S2 -- NO --> S3[S 3 RANGING ENABLE CIRCUIT FAILURE] S3 --> S4[S 4 Ranging limited to skin tracking] S1 -- YES --> S5[S 5 LOSS OF UDL CONTROL OF RANGING FUNCTION] S2 -- YES --> S6[S 6 RANGING CIRCUIT IN ORIGINAL S BD XPNDR FAILED] </pre>	<p>(1) Coordinate with MSFN (2) When SBD XPNDR-redundant xpndr, hesitate momentarily in OFF. (3) Skin tracking performed by ground radar; no crew action required. (4) Original XPNDR is usable for all functions except ranging.</p>
10	<pre> graph TD S10[MSFN REPORTS LOSS OF REAL TIME PCM] --> S1[S 1 o PMP PWR - AUX] S1 -- YES --> S2[S 2 PMP NORMAL BI-PHASE MODULATOR FAILED] S1 -- NO --> S3[S 3 PCM EQUIPMENT FAILED] </pre>	<p>(1) The capability is lost to transmit recorded PCM simultaneously with real time PCM.</p>

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>13 CANNOT ACQUIRE PHASELOCK WITH OMNIANTENNAS</p>	<pre> graph TD 13[CANNOT ACQUIRE PHASELOCK WITH OMNIANTENNAS] --> 1_1[1 Select V64E check ant selected] 1_1 -- NO --> 1_2[2 Select proper antenna wait 1 min for phaselock] 1_1 -- YES --> 1_3[3 ORIGINAL ANT LOOK ANGLE BAD] 1_2 --> 1_4[4 S BD XPNDR redundant XPNDR Allow up to 30 sec for phaselock acquisition] 1_4 --> 1_5[5 If VHF not available, wait 5 min for possible MSFN problem] 1_4 --> 1_6[6 UP TLM CMD - RESET then NORM] 1_6 --> 1_7[7 INADVERTENT RTC RELAY OPERATION] 1_5 -- NO --> 1_8[8 ORIGINAL XPNDR FAILED] 1_5 -- YES --> 1_9[9 Do attitude and propellant constraints allow roll maneuver?] 1_9 -- NO --> 1_10[10 S BD ANT OMNI - HI GAIN Attempt phaselock acquisition utilizing HGA] 1_10 --> 1_11[11 Loss of uplink voice comm. Possible loss of downlink voice comm. PCM BIT RATE - LO S BD AUX TAPE - DN VOICE BU S BD MODE RNG - RNG Continue optimum ant switching. Attempt voice comm at least once per hour on the GET hour as follows: S BD MODE PCM - ctr PCM BIT RATE - HI S BD MODE RNG - OFF Perform comms check If no contact - S BD MODE PCM - PCM PCM BIT RATE - LO S BD MODE RNG - RNG Attempt DSE dump of recorded voice At completion of dump - S BD AUX TAPE - DN VOICE BU When range <60 KNM VHF AM A - SIMPLEX Audio Center VHF AM - T/R Standby for MSFN call] 1_10 --> 1_12[12 Roll CSM not less than 45° Allow up to 30 sec for phaselock acquisition Attempt phaselock acquisition with all omniantennas] 1_12 --> 1_13[13 TRIPLEXER OR RF COAX CABLE FAILED] 1_12 --> 1_14[14 FAILURE OF RF SWITCH TO HI GAIN POSITION OR OMNI-ANTENNA FAILED] 1_12 --> 15[15 OMNI-ANTENNA FAILED] 1_12 --> 16[16 S BD COMM limited to HGA or remaining omnis] </pre>	<ul style="list-style-type: none"> (1) Loss of uplink phaselock is indicated by noise in headset and S BD antenna ind < 30%. (2) When SBD XPNDR-redundant xpndr, hesitate momentarily in OFF. (3) Performing roll maneuver eliminates omniantenna as failure.

CSM MALFUNCTION PROCEDURES

ECS

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

ECS MALFUNCTION INDEX

ECS

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

- O₂ FLOW HI**
- 1a O₂ FLOW HIGH
 - 2 O₂ FLOW LOW
 - 3 SURGE TANK PRESS HIGH
 - 4 CABIN PRESS HIGH OR INCREASING
 - 5 SURGE TANK PRESS LOW
 - 6 CABIN PRESS LOW OR DECREASING
 - 7 CREW UNCOMFORTABLE IN CABIN
 - 7a CABIN HUMIDITY HIGH
 - 8 CLINGING SUIT

SUIT COMPRESSOR

 - 9a SUIT COMPR Δ P LOW
 - 10 BALLOONED PGA'S
 - 11 CREW UNCOMFORTABLE IN SUIT LOOP
 - 11a SUIT CKT HUMIDITY HIGH

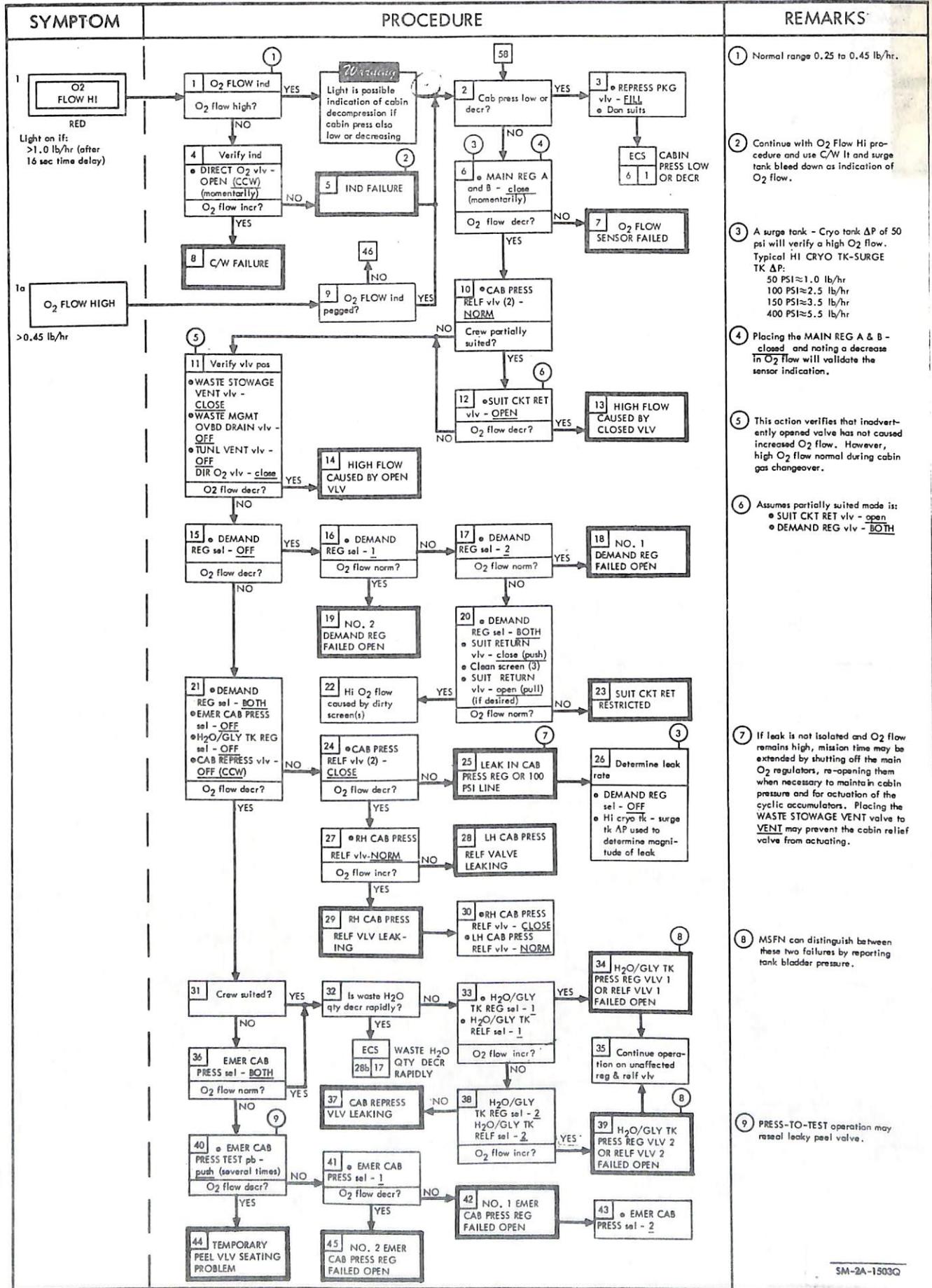
CO₂ PP HI

 - 12a CO₂ PART PRESS HIGH
 - 12b CO₂ PART PRESS LOW
 - 13 CO₂ FILTER SEIZURE WITHIN CANISTER

GLYCOL TEMP LOW

 - 14a PRIM ECS RAD OUT TEMP LOW
 - 15 PRIM ECS RAD OUT TEMP HIGH
 - 16 PRIM GLY EVAP OUT TEMP HIGH
 - 16a PRIM STEAM PRESS LOW
 - 17 PRIM GLY EVAP OUT TEMP LOW
 - 18 PRIM GLY ACCUM QTY HIGH
 - 18a PRIM GLY DISCH PRESS HIGH
 - 19 PRIM GLY ACCUM QTY LOW OR DECREASING
 - 20 PRIM GLY DISCH PRESS LOW
 - 21 SEC GLY EVAP OUT TEMP HIGH

- 21a SEC STEAM PRESS LOW
- 22 SEC GLY EVAP OUT TEMP LOW
- 23 SEC ECS RAD OUT TEMP HIGH
- 24 SEC ECS RAD OUT TEMP LOW
- 25 SEC GLY ACCUM QTY HIGH
- 26 SEC GLY ACCUM QTY DECREASING
- 27 SEC GLY DISCH PRESS LOW
- 28 H₂O DUMPING OVERBOARD
- 28a POTABLE H₂O QUANTITY DECREASING RAPIDLY
- 28b WASTE H₂O QUANTITY DECREASING RAPIDLY
- 29 FOOD PREP WATER TEMP LOW
- 30 ENTRAPPED GAS IN POTABLE H₂O
- 31 URINE OVERBOARD DUMP NOT DRAINING
- 31a WASTE H₂O OVERBOARD DUMP NOT DRAINING
- 32 INADEQUATE VENTILATION AFTER LANDING
- 33 WATER INFLOW AFTER LANDING
- SSR-1 SECONDARY LOOP ACTIVATION
- SSR-2 FROZEN STEAM DUCT

1
THRU
4SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

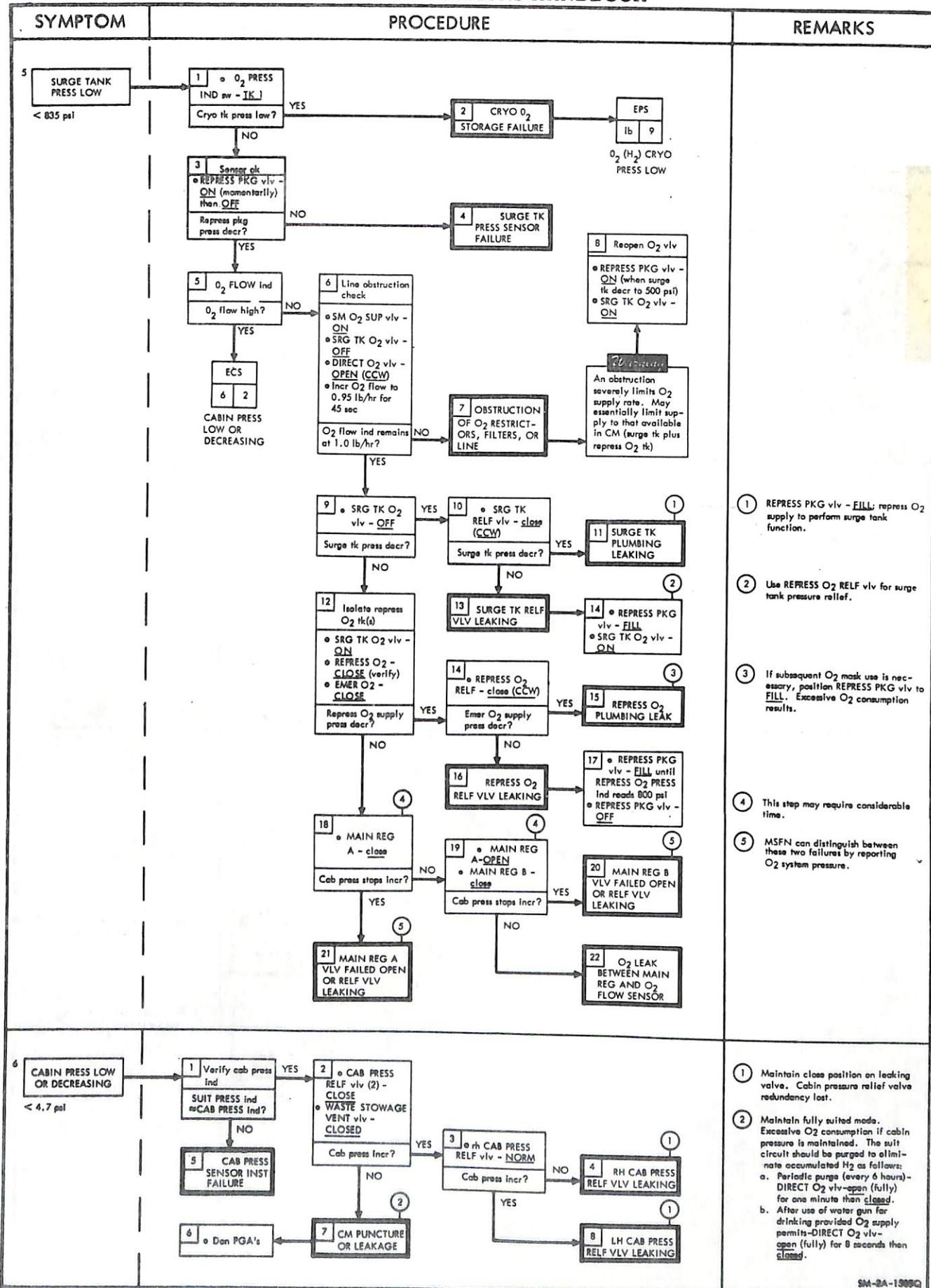
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
1(Cont)	<pre> graph TD 9[] --> 46[46 Check flow sensor • MAIN REG A and B - CLOSE (momentarily) O2 flow decr?] 46 -- NO --> 47[47 O2 FLOW SENSOR FAILED] 46 -- YES --> 48[48 • SUIT H2O ACCUM AUTO - redundant accum O2 flow decr?] 48 -- NO --> 49[49 • SUIT H2O ACCUM AUTO - CLR O2 flow decr?] 49 -- NO --> 50[50 INCORRECT CENTRAL TIMER SIGNAL TO AUTO CYCLE CONTROL UNITS] 49 -- YES --> 51[51 NO. 1 OR 2 H2O ACCUM FAILED ON] 51 --> 52[52 Cycle accum solenoid vlv • SUIT CKT H2O ACCUM ON - 1 then 2 (several times) O2 flow decr?] 52 -- NO --> 53[53 H2O ACCUM SOLENOID VLV FAILED OPEN] 53 --> 54[54 Return to original sw configuration] 52 -- YES --> 55[55 H2O ACCUM 1 - OFF O2 flow decr?] 55 -- NO --> 56[56 NO. 1 H2O ACCUM SOLENOID VLV FAILED OPEN] 56 --> 57[57 • SUIT H2O ACCUM AUTO - 2] 55 -- YES --> 58[58 • H2O ACCUM 2 - OFF • H2O ACCUM 1 - RMTE] 58 -- NO --> 59[59 NO. 2 H2O ACCUM SOLENOID VLV FAILED OPEN] 59 --> 60[60 • SUIT H2O ACCUM AUTO - 1] 58 -- YES --> 2[2] </pre>	<ul style="list-style-type: none"> (10) Removes power from H₂O accumulator. (11) H₂O accumulator can be manually operated. (12) Max O₂ bleed into suit loop will be 0.55 lb/hr (from which metabolic use and cabin leakage will be taken). (13) This failure does not necessarily preclude manual operation of the affected H₂O accumulator. (14) Cycling operation may free sticking valve. (15) Loss of electrical cyclic control of affected H₂O accumulator. Periodic manual valve operation the only means of actuating H₂O accumulator.
2	<pre> graph TD 1[1] --> 2[2 O2 FLOW LOW < .25 lb/hr] 2 --> 1[1 Verify O2 FLOW ind • DIRECT O2 vlv - OPEN (ccw) (momentarily)] 1 -- NO --> 2[2 O2 FLOW SENSOR OR IND FAILURE] 1 -- YES --> 3[3 Low system demand] </pre>	<ul style="list-style-type: none"> (1) Normal range 0.25 - 0.45 lb/hr. (2) MSFN can distinguish between these two failures.
3	<pre> graph TD 1[1] --> 2[2 O2 PRESS IND sw - SURGE TK • REPRESS PKG vlv - FILL (momentarily) Repress pack O2 meter incr > 935 psi?] 2 -- NO --> 3[3 CRYO O2 STORAGE FAILURE] 2 -- YES --> 4[4 SURGE TANK SENSOR FAILURE] 4 --> 5[5 SURGE TK/CRYO TK1 METER FAILURE] 5 --> 6[6 EPS-CRYO 1a 3 O2 (H2) CRYO PRESS HI] </pre>	<ul style="list-style-type: none"> (1) Use highest cryo tank indication to estimate surge tank pressure. (2) Surge tank pressure may be determined by momentarily positioning REPRESS PKG vlv - FILL and read repress pack press meter after stabilization.
4	<pre> graph TD 1[1] --> 2[2 CAB PRESS INST FAILURE] 2 --> 3[3 Use SUIT PRESS ind to estimate cab press] 3 --> 4[4 O2 flow high?] 4 -- NO --> 5[5 ECS 1 1 SURGE TANK PRESS LOW] 4 -- YES --> 6[6 O2 FLOW HI] </pre>	<ul style="list-style-type: none"> (1) Cabin pressure > 5.3 psi is normal after insertion. Normal range is 4.7 to 5.3 psi.

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

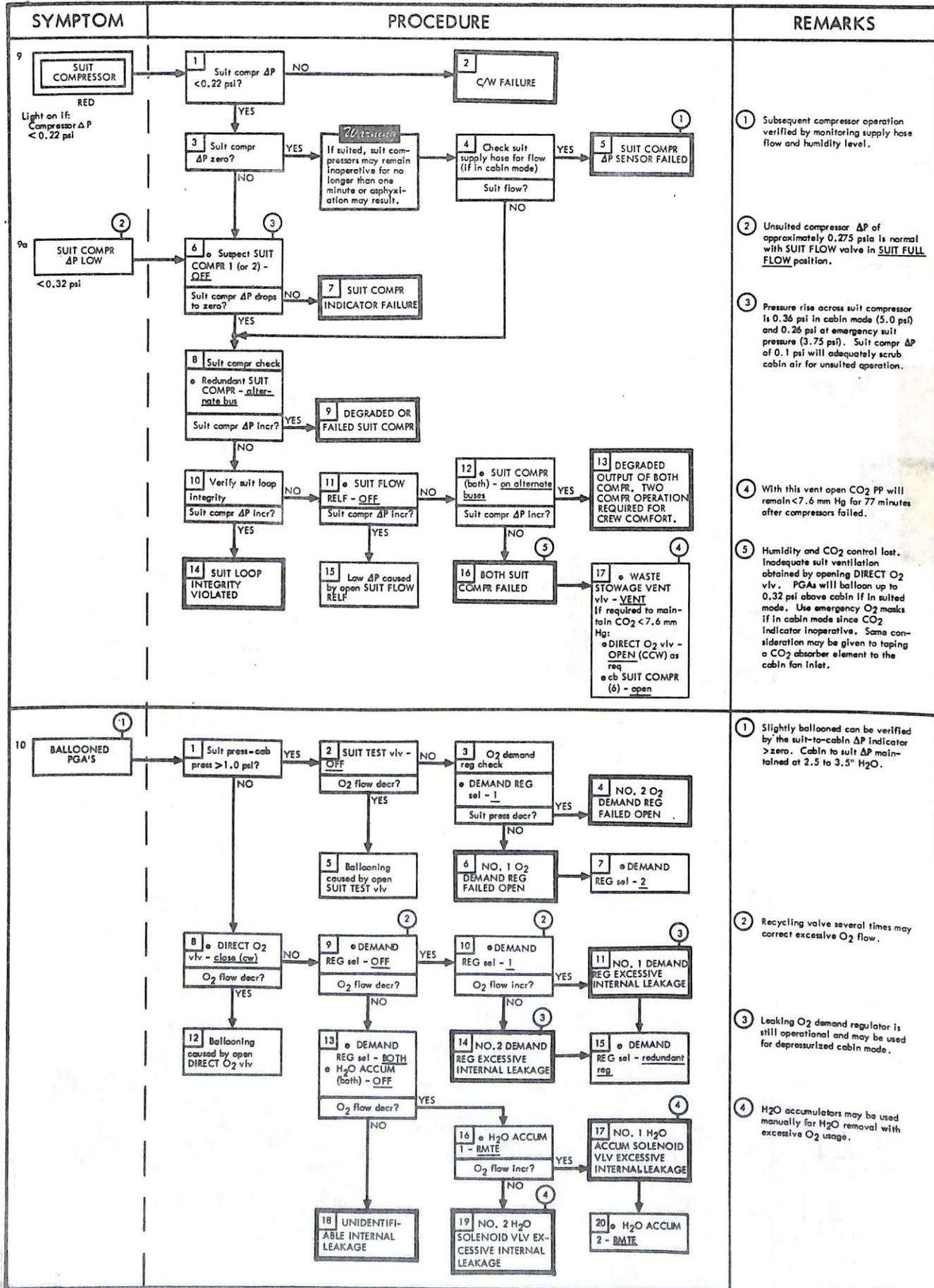
SOURCE AOH
DATE MARCH 16, 19705 THRU
8

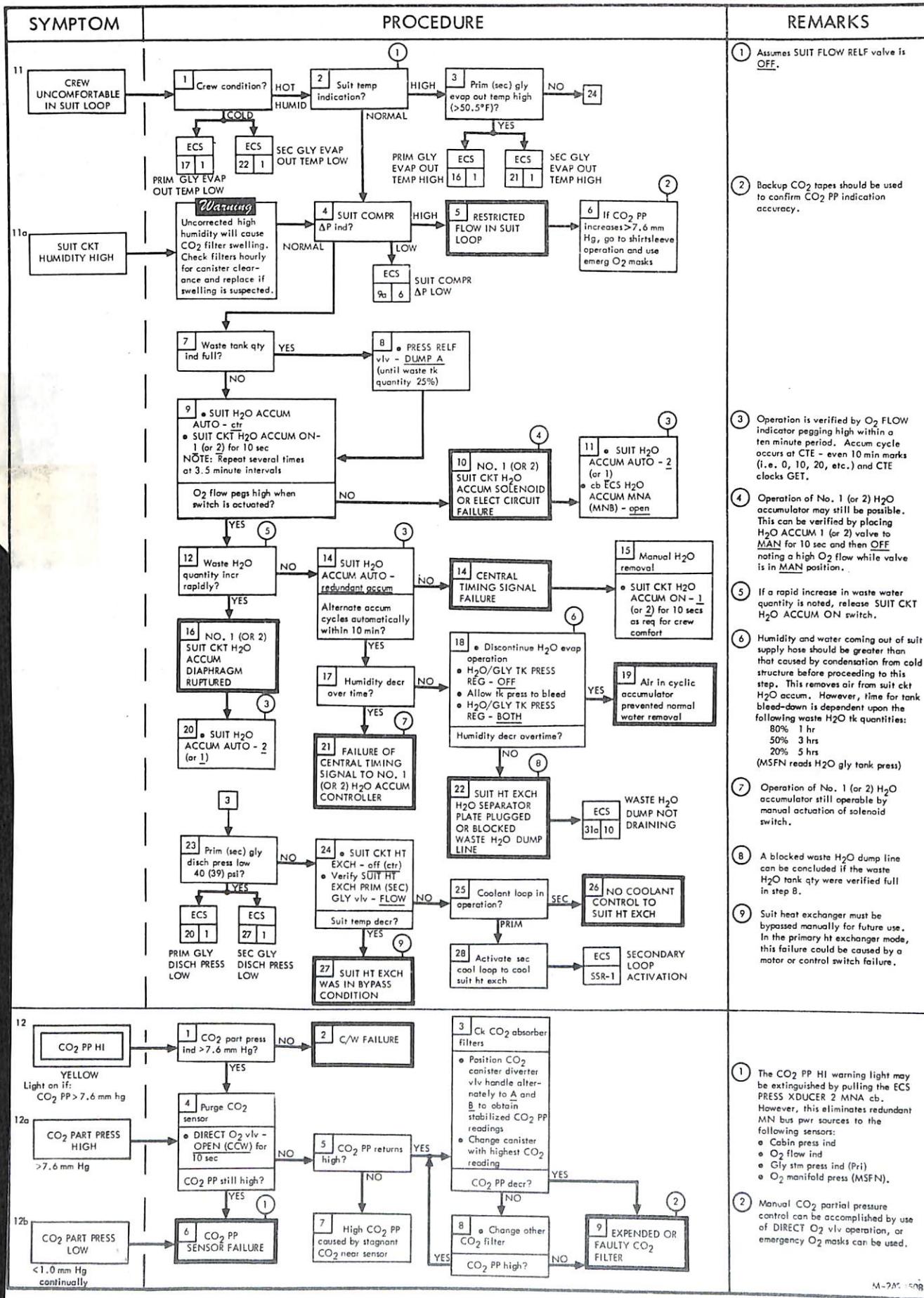
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
7 CREW UNCOMFORTABLE IN CABIN	<p>1 Crew condition? COLD YES → ECS 17 1 PRIM GLY EVAP OUT TEMP LOW</p> <p>NO → ECS 22 1 SEC GLY EVAP OUT TEMP LOW</p> <p>2 Prim (sec) gly evap out temp low (<40°F)? YES → ECS 20 1 PRIM GLY DISCH PRESS LOW</p> <p>NO → ECS 27 1 SEC GLY DISCH PRESS LOW</p> <p>3 Cab temp indication? HOT YES → ECS 16 1 PRIM GLY EVAP OUT TEMP HIGH</p> <p>NO → ECS 21 1 SEC GLY EVAP OUT TEMP HIGH</p> <p>4 Prim (sec) gly evap out temp high (>50.5°F)? YES → ECS 11 24 CREW UNCOMFORTABLE IN SUIT LOOP</p> <p>NO → ECS 5 Prim (sec) gly disch press low (<40(39) psi)? YES → ECS 20 1 PRIM GLY DISCH PRESS LOW</p> <p>NO → ECS 27 1 SEC GLY DISCH PRESS LOW</p>	
7a CABIN HUMIDITY HIGH	<p>Uncorrected high humidity will cause CO₂ filter swelling. Check filters hourly for canister clearance and replace filters if swelling is suspected.</p> <p>6 Suit ckt ret screen dirty? NO → ECS 11a 4 SUIT CKT HUMIDITY HIGH</p> <p>YES → 7 Clean suit ckt ret screen → Check CO₂ tapes. CO₂ sensor may be inaccurate with dirty screen.</p>	
8 CLINGING SUIT	<p>CAB PRESS > 4.2 psi Helmet/gloves doffed</p> <p>ALL CREWMEN ONE CREWMAN</p> <p>1 Clinging suit for CABIN PRESSURE > 4.2 psi Helmet/gloves doffed</p> <p>2 Verify valve positions • PGA/umbilical connector QD's (6) • MAIN REG (2) - OPEN • DEMAND REG = 1 - BOTH • SUIT FLOW vlv (3) - SUIT FULL FLOW • SUIT TEST vlv - OFF</p> <p>3 O₂ FLOW ind pegged at 0.2 lb/hr? YES → 4 BOTH MAIN O₂ REG FAILED CLOSED</p> <p>5 Verify • PGA/umbilical connector QD's (2) • SUIT FLOW vlv - SUIT FULL FLOW</p> <p>6 Clinging suits caused by incorrectly positioned valve or unsatisfactory PGA/umbilical interconnect</p> <p>7 • DIRECT O₂ vlv - OPEN (CCW) (momentarily) • PGA's inflate? YES → 8 BOTH O₂ DEMAND REG FAILED CLOSED</p> <p>8 Doff PGA's</p> <p>9 REDUCED O₂ INFLOW BETWEEN SUIT FLOW VLV AND PGA</p> <p>10 Use DIRECT O₂ vlv to meter O₂ into suit loop</p>	<p>1 Valid only for non-reversed hose configuration.</p> <p>2 MSFN can verify loss of 100 psi circuit. Open/close REPRESS vlv to maintain 5 psia cabin press.</p> <p>3 Doff PGA's closed suit operations are lost.</p> <p>4 Metabolic requirement per crewman is approximately 0.1 lb/hr.</p>

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 19709
THRU
12

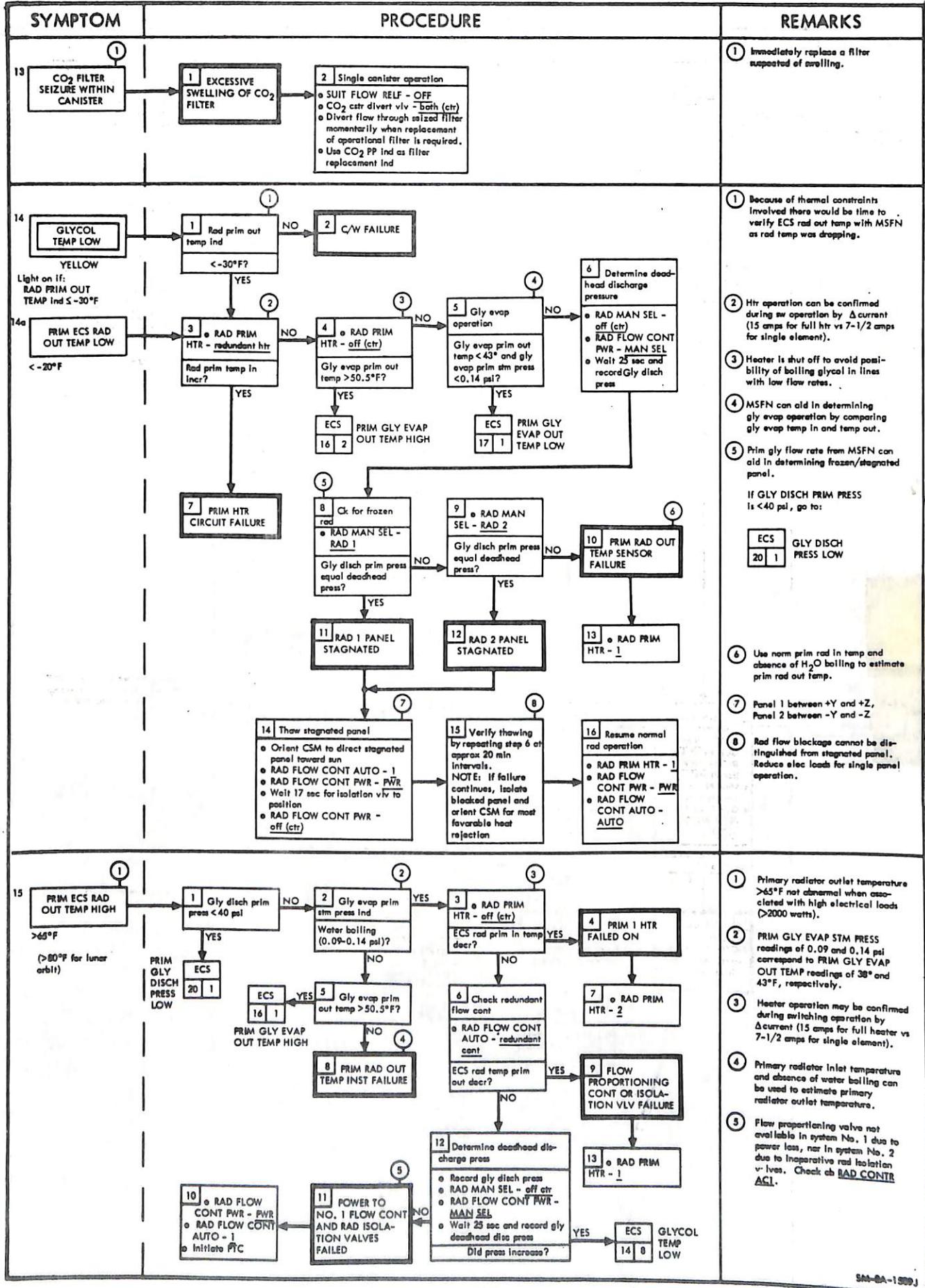
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK


CSM MALFUNCTION PROCEDURES

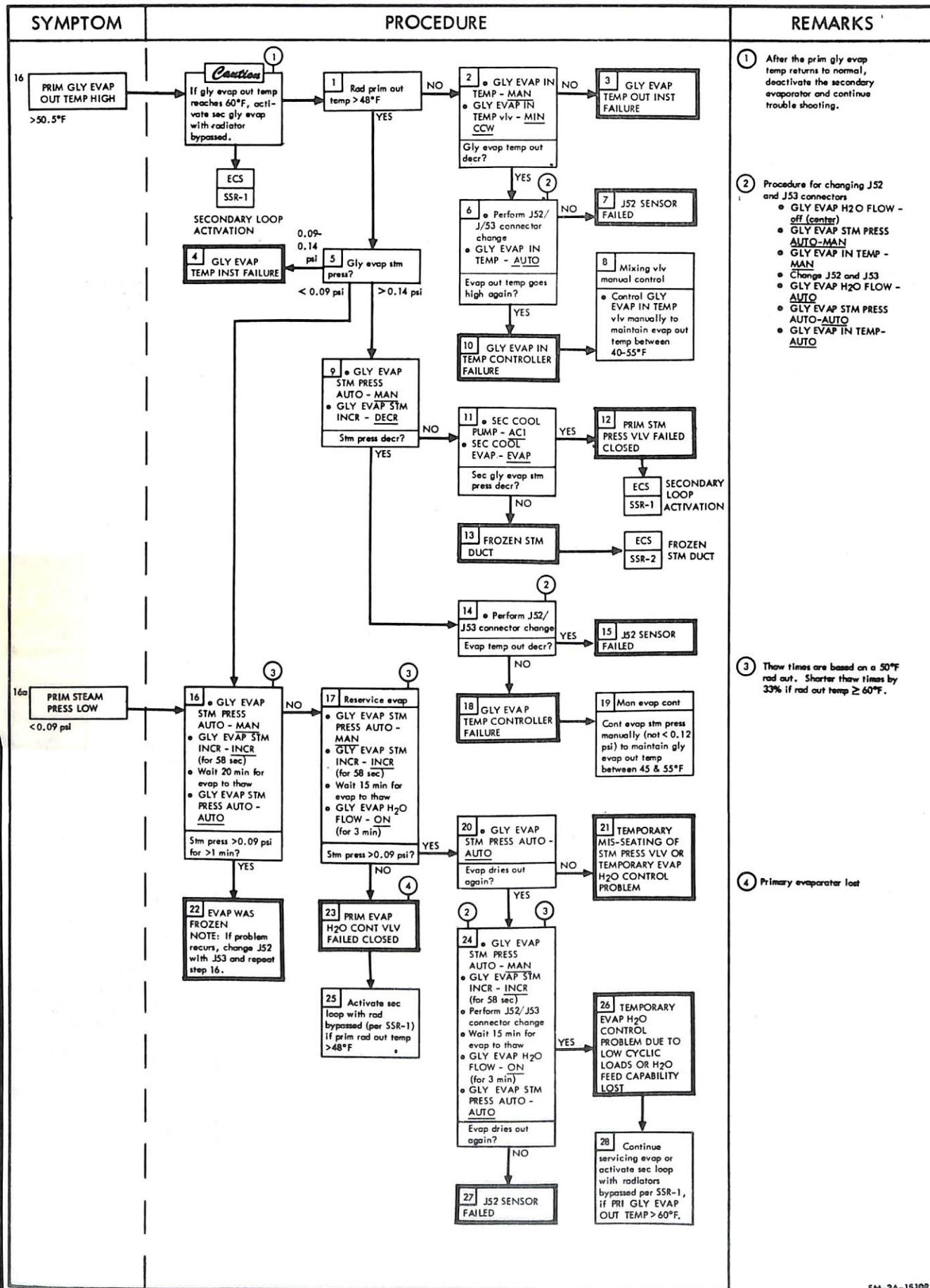
SOURCE AOH DATE MARCH 16, 1970

SM2A-03-SC104-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

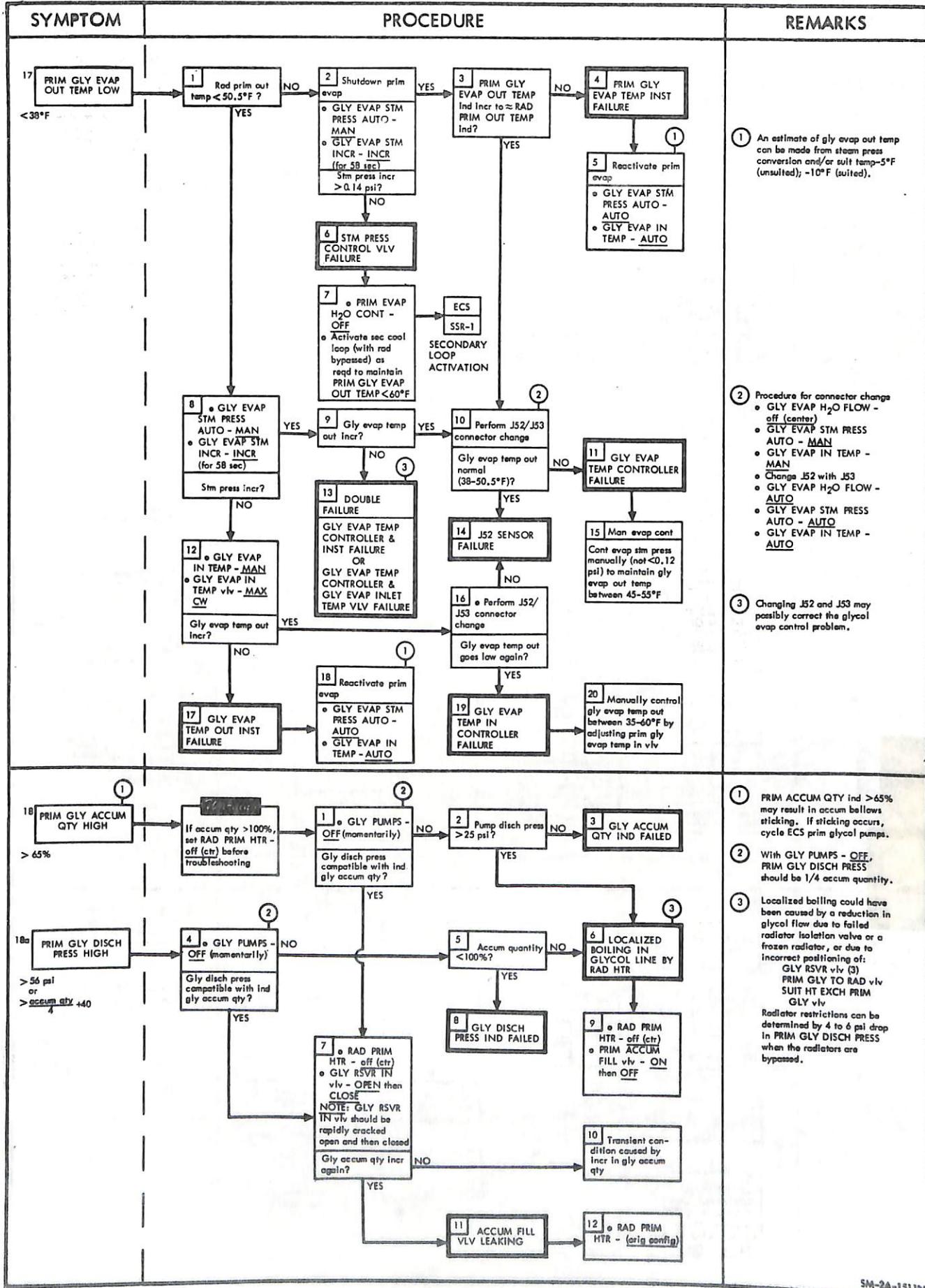
13
THRU
16

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

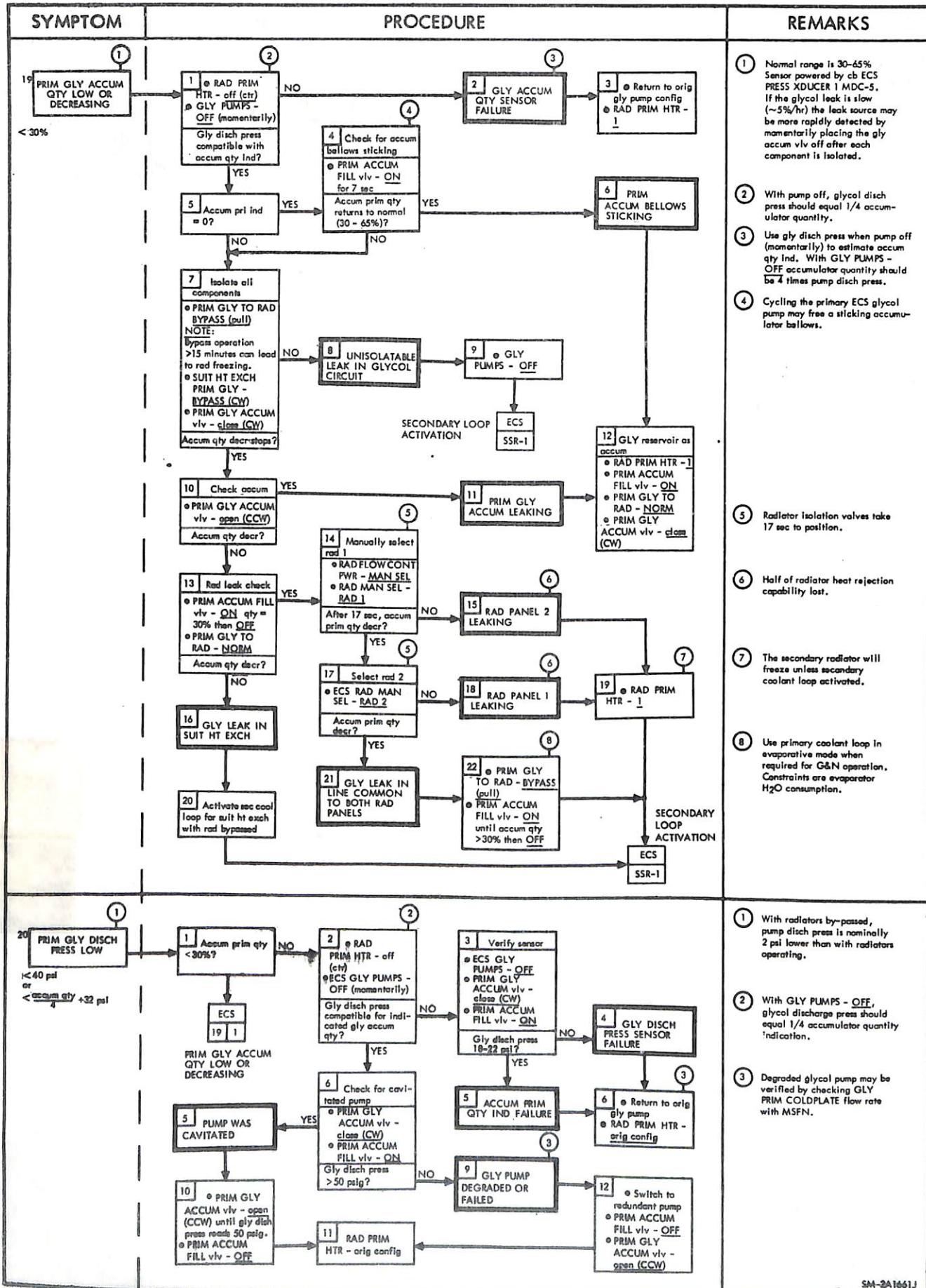


SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



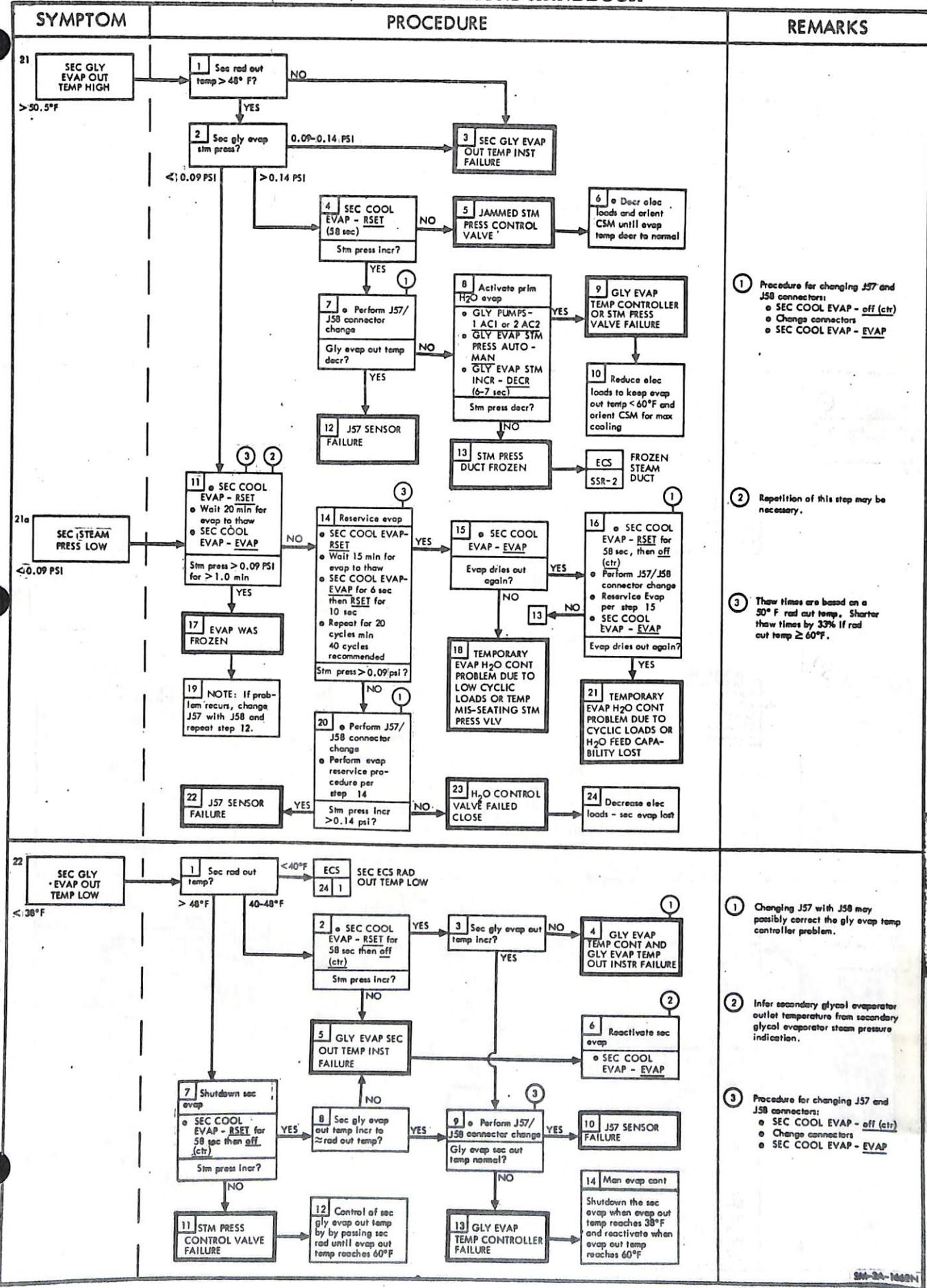
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

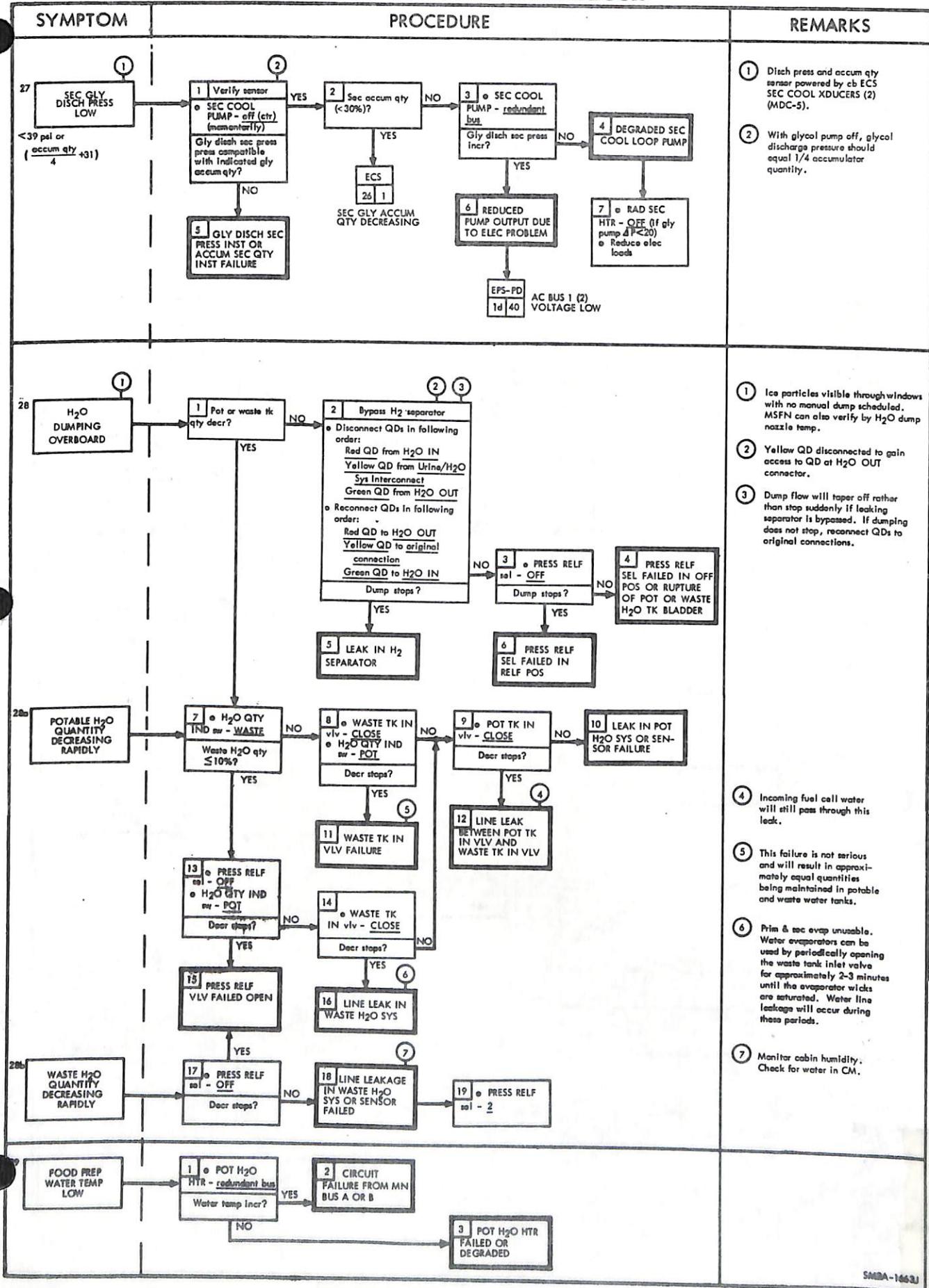
SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-SC104-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
23 SEC ECS RAD OUT TEMP HIGH > 70°F (except for Lunar Orbit)	<p>1 Sec gly disch pres <39 psi? NO → 2 Sec gly evap operating normally? (stat pres 0.1 - 0.14 psi) NO → 3 Sec gly evap out temp > 50.5°F NO → 4 SEC RAD OUT TEMP INST FAILURE</p> <p>YES → ECS 27 1 SEC GLY DISCH PRESS LOW</p> <p>5 Deactivate htr • RAD SEC HTR - OFF Sec rod in temp decr? NO → 8 EXCESSIVE HEAT LOAD FOR SEC COOL LOOP</p> <p>YES → 1 SEC GLY EVAP OUT TEMP HIGH 6 SEC HTR FAILED ON</p> <p>7 Manually cont htr • Monitor RAD SEC OUT TEMP ind • Above 48°F, RAD SEC HTR - OFF • Below 40°F, RAD SEC HTR - SEC</p> <p>9 Decr sec ECS heat load • RAD SEC HTR - SEC</p>	<p>① Heater operation can be confirmed by ammeter change during switching operation. Δ current will be: 30 amp - both operating 15 amp - one operating</p>
24 SEC ECS RAD OUT TEMP LOW < 38°F	<p>1 Does gly evap sec out temp = rad sec out temp? YES → 2 Sec htr check • Check total CSM current • RAD SEC HTR - OFF • Check total CSM current Both htrs operating? NO → 6 ONE OR BOTH HTR FAILED</p> <p>3 Reactivate htr • RAD SEC HTR - SEC Sec gly disch press < 39 psi? YES → ECS 27 1 SEC GLY DISCH PRESS LOW 7 • RAD SEC HTR - SEC (if one htr is operating)</p> <p>4 Orient CSM for solar heating and/or incr elec loads</p>	<p>① Assumes secondary loop is in operation. Sensor is powered by cb ECS RAD CONT/HTRS MNA (MDC-5).</p> <p>② Heater operation can be confirmed by ammeter change during switching operation. Δ current will be: 30 amp - both operating 15 amp - one operating</p> <p>③ Use SEC GLY EVAP OUT TEMP Indicator with ECS RAD SEC IN TEMPERATURE Indicator to estimate secondary radiator outlet temperature.</p>
25 SEC GLY ACCUM QTY HIGH > 55%	<p>1 If sec accum qty ≥ 100%, shut RAD SEC HTR - OFF before troubleshooting</p> <p>2 SEC COOL PUMP - off (ctr) (momentarily) Gly disch sec pres compatible with gly accum qty? NO → 4 SEC GLY ACCUM QTY INST FAILURE</p> <p>YES → 2 RAD SEC HTR - OFF Accum qty decr? YES → 5 LOCALIZED BOILING BY RAD HTR 6 Monitor sec ECS gly system for other indications of flow restrictions. If restriction is indicated, bypass radiators.</p>	<p>① Normal range 30-55%.</p> <p>② With glycol pump off, glycol discharge pressure should equal 1/4 accumulator quantity.</p>
26 SEC GLY ACCUM QTY DECREASING	<p>1 Sensor check • SEC COOL PUMP - off (ctr) (momentarily) Gly disch sec pres compatible for indicated gly accum qty? NO → 5 GLY ACCUM QTY INST FAILURE</p> <p>YES → 2 Isolate possible leaks • RAD SEC HTR - OFF • GLY TO RAD SEC vlv - BYPASS • SUIT HT EXCH SEC GLY - BYPASS</p> <p>NOTE: Bypass operation > 15 min can lead to rad freezing. Gly accum qty stabilized? YES → 3 Reactivate rad • RAD SEC HTR - SEC (if reqd) • GLY TO RAD SEC vlv - NORM Gly accum qty stabilized? YES → 6 SUIT HT EXCH LEAKING 7 Isolate rad • RAD SEC HTR - OFF • GLY TO RAD SEC vlv - BYPASS • Reduce CSM elec loads</p> <p>NO → 4 RADIATOR SYSTEM LEAKING</p> <p>8 Reactivate • SEC COOL PUMP - AC1 or (AC2) (if reqd) • RAD SEC HTR - SEC (if reqd) • GLY TO RAD SEC vlv - NORM • SUIT HT EXCH SEC GLY - FLOW</p> <p>9 LEAKING SYSTEM (CANNOT BE ISOLATED)</p> <p>10 NOTE: Keep suit ht exch isolated unless required. Check CO₂ filters periodically for seizure.</p>	<p>① This symptom is also valid when secondary glycol loop is not in operation. Accum qty and disch pres sensors powered by cb SEC COOL XDUCER (MDC-5). Normal range is 30-55%.</p> <p>② With pump off, glycol discharge pressure should equal 1/4 gly accum quantity.</p> <p>③ Humidity control and suit loop cooling not available from secondary loop when suit ht exch is bypassed. A glycol leak will exist whenever the secondary suit ht exch is used and could result in glycol contamination in the suit loop.</p> <p>④ If leak is determined, temporary deactivation of pump may conserve glycol for future use. Radiator heater to be OFF when pump is OFF.</p>

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

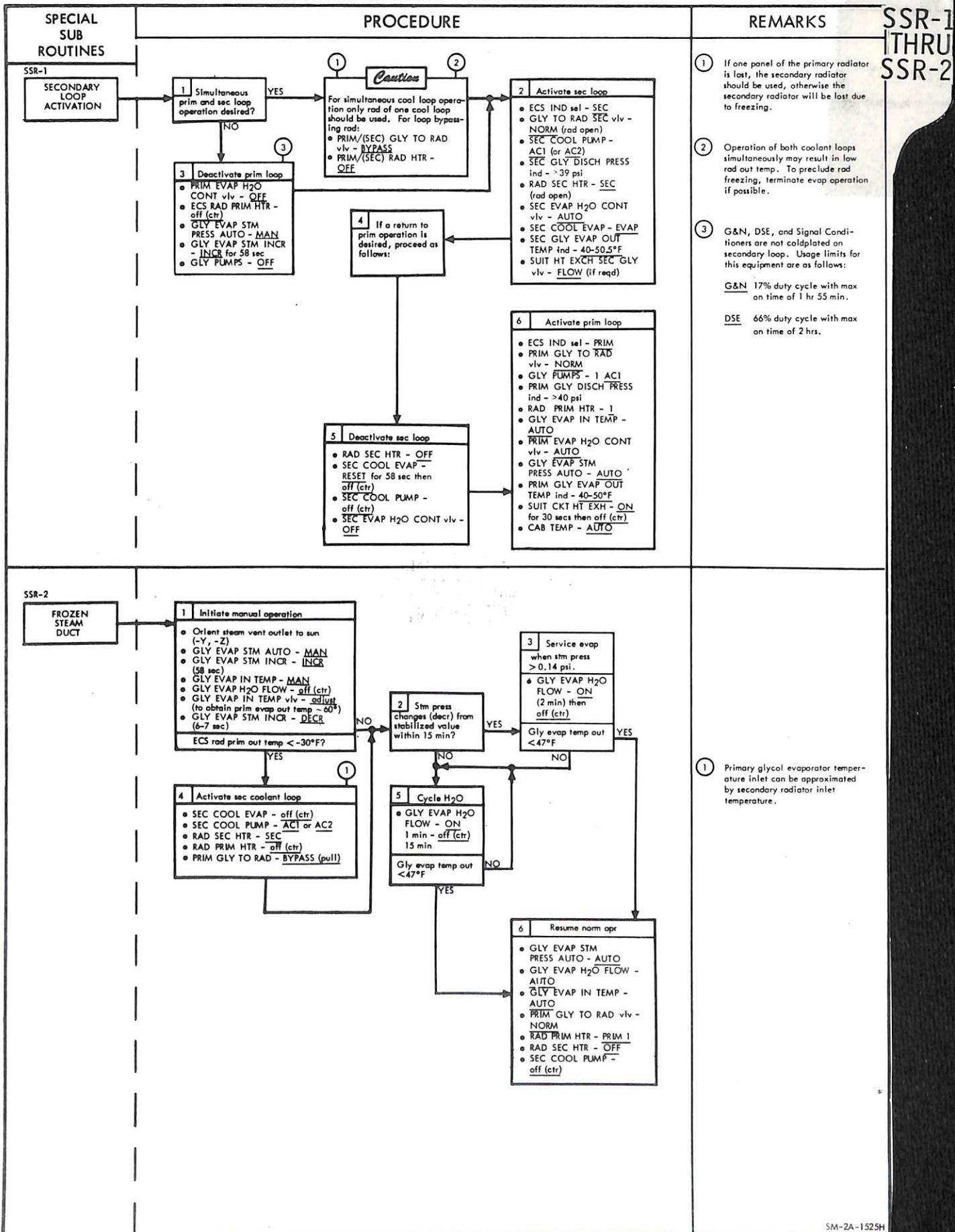
SYMPTOM	PROCEDURE	REMARKS
30 ENTRAPPED GAS IN POTABLE H ₂ O	<pre> graph TD A[ENTRAPPED GAS IN POTABLE H2O] --> B{Pot qty full?} B -- YES --> C[Isolate pot tk] C --> D[POT TK IN vlv - CLOSE H2O QTY IND sw - POT Draw off 1 qt H2O (water gun)] C -- NO --> E[GAS IS HYDROGEN] D --> F{Pot qty decr 5%?} F -- YES --> G[GAS IS OXYGEN FROM PRESS SYSTEM] F -- NO --> E </pre>	<p>(1) System is usable. Quantity gaging capability is compromised.</p> <p>(2) If suited, purge suit periodically.</p>
31 URINE OVERBOARD DUMP NOT DRAINING	<pre> graph TD A[URINE OVERBOARD DUMP NOT DRAINING] --> B{Replace urine filter Urine backs up?} B -- NO --> C[5 PLUGGED URINE FILTER] B -- YES --> D[2 Use other UTS] D --> E{Urine backs up?} E -- NO --> F[4 BLOCKED UTS RECVR ASSY] E -- YES --> G[3 Orient CSM to heat ovbd dump nozzle URINE DUMP - redundant htr] G --> H{Urine ovbd drain flow resumes?} H -- NO --> I[6 BLOCKED URINE OVBD DRAIN] H -- YES --> J[4 URINE HEATER FAILURE] F --> K[8 Change UTS recvr assy] I --> L[7 Use waste H2O vent line] J --> M[7 Use waste H2O vent line] M --> N{Urine ovbd drain flow resumes?} N -- YES --> O[4 URINE HEATER FAILURE] N -- NO --> P[3 Auxiliary dump capability through sids hatch is also available] K --> Q[9 BLOCKED UTS RECVR ASSY] Q --> R[5 PLUGGED URINE FILTER] </pre>	<p>(1) Allow 2 hrs for heater operation. Orient CSM for maximum external heat on dump nozzle (-Y -Z) in attempt to clear probable ice block.</p> <p>(2) Fecal storage vent and water tanks H₂ and O₂ bleed capability lost unless waste H₂O dump line interconnected.</p> <p>(3) Auxiliary dump capability through sids hatch is also available.</p> <p>(4) Spare UTS receiver assy stowed in R-11.</p> <p>(5) Battery vent capability lost unless urine dump line interconnected.</p>
31a WASTE H ₂ O OVERBOARD DUMP NOT DRAINING	<pre> graph TD A[WASTE H2O OVERBOARD DUMP NOT DRAINING] --> B[10 Orient CSM to heat ovbd dump nozzle WASTE H2O DUMP - redundant htr] B -- NO --> C[11 BLOCKED WASTE H2O DUMP NOZZLE] C --> D[13 WASTE H2O DUMP HTR FAILED] C -- NO --> E[12 Use urine dump line] E --> F[11 BLOCKED WASTE H2O DUMP NOZZLE] F -- NO --> G[12 Use urine dump line] F -- NO --> H[11 BLOCKED WASTE H2O DUMP NOZZLE] H -- NO --> I[12 Use urine dump line] I --> J[11 BLOCKED WASTE H2O DUMP NOZZLE] J -- NO --> K[12 Use urine dump line] K --> L[11 BLOCKED WASTE H2O DUMP NOZZLE] L -- NO --> M[12 Use urine dump line] </pre>	
32 INADEQUATE VENTILATION AFTER LANDING	<pre> graph TD A[INADEQUATE VENTILATION AFTER LANDING] --> B{Cycle PL vent Ventilation incr?} B -- NO --> C[2 Actuate PLVC PLVC sw - OPEN] C --> D{Ventilation incr?} D -- YES --> E[3 ATTITUDE SENSING SW FAILED] D -- NO --> F[5 PLV FAN FAILURE] B -- YES --> G[4 Resets attitude sensor relay to resume PLV operation] </pre>	<p>(1) Postlanding vent switch must be cycled to OFF and back to HIGH (LOW) anytime CM attitude exceeds 60° to reset the attitude control relay.</p> <p>(2) Ventilation available only by opening either hatch.</p>
33 WATER INFLOW AFTER LANDING	<pre> graph TD A[WATER INFLOW AFTER LANDING] --> B[1 PLVC sw - NORM Water inflow stops?] B -- NO --> C[2 PL VENT - OFF CAB PRESS RELF vlv (2) - CLOSE] C --> D{Water inflow stops?} D -- YES --> E[3 UNCONTROLLABLE WATER INFLOW INTO CM] D -- NO --> F[5 ATTITUDE SENSING SWITCH FAILED OPEN] B -- YES --> G[4 Inflow caused by open PLV vlv] </pre>	

CSM MALFUNCTION PROCEDURES

SOURCE AOH DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES



THIS PAGE
INTENTIONALLY
LEFT BLANK

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

EMS

SOURCE MOCATA
DATE MARCH 16, 1970

EMS MALFUNCTION INDEX

- 1 .05G LT ON (TEST 1)
- 2 G/V SCROLL ASSY DOES NOT SLEW (TEST 1)
- 3 .05G LT OUT (TEST 2)
- 4 LIFT VECTOR DN LT WILL
NOT COME ON (TEST 3)
- 4a RNG IND WILL NOT SLEW (TEST 3)
- 5 V-AXIS ONLY OR MULTIPLE DISPLAYS ABNORMAL (TEST 4)
- 6 RNG IND ONLY ABNORMAL (TEST 4)
- 7 G-AXIS ONLY ABNORMAL (TEST 4)
- 8 LIFT VECTOR UP LT
NOT ON (TEST 5)
- 8a G-AXIS DOES NOT DRIVE (TEST 5)
- 9 RNG IND DOES NOT SLEW IN RNG SET
- 9a G-AXIS DOES NOT ZERO IN RNG SET
- 10 V-AXIS DOES NOT SLEW IN VO SET
- 11 ΔV /RNG IND ABNORMAL IN ΔV TEST
- 12 SPS THRUST LT NOT ON
IN ΔV TEST
- 13 ΔV IND DOES NOT SLEW IN ΔV SET
- 14 ΔV /RNG IND FAILS TO COUNT DURING ΔV 'S
- 15 EITHER LIFT VECTOR LT
ON AFTER 2G

CSM MALFUNCTION PROCEDURES

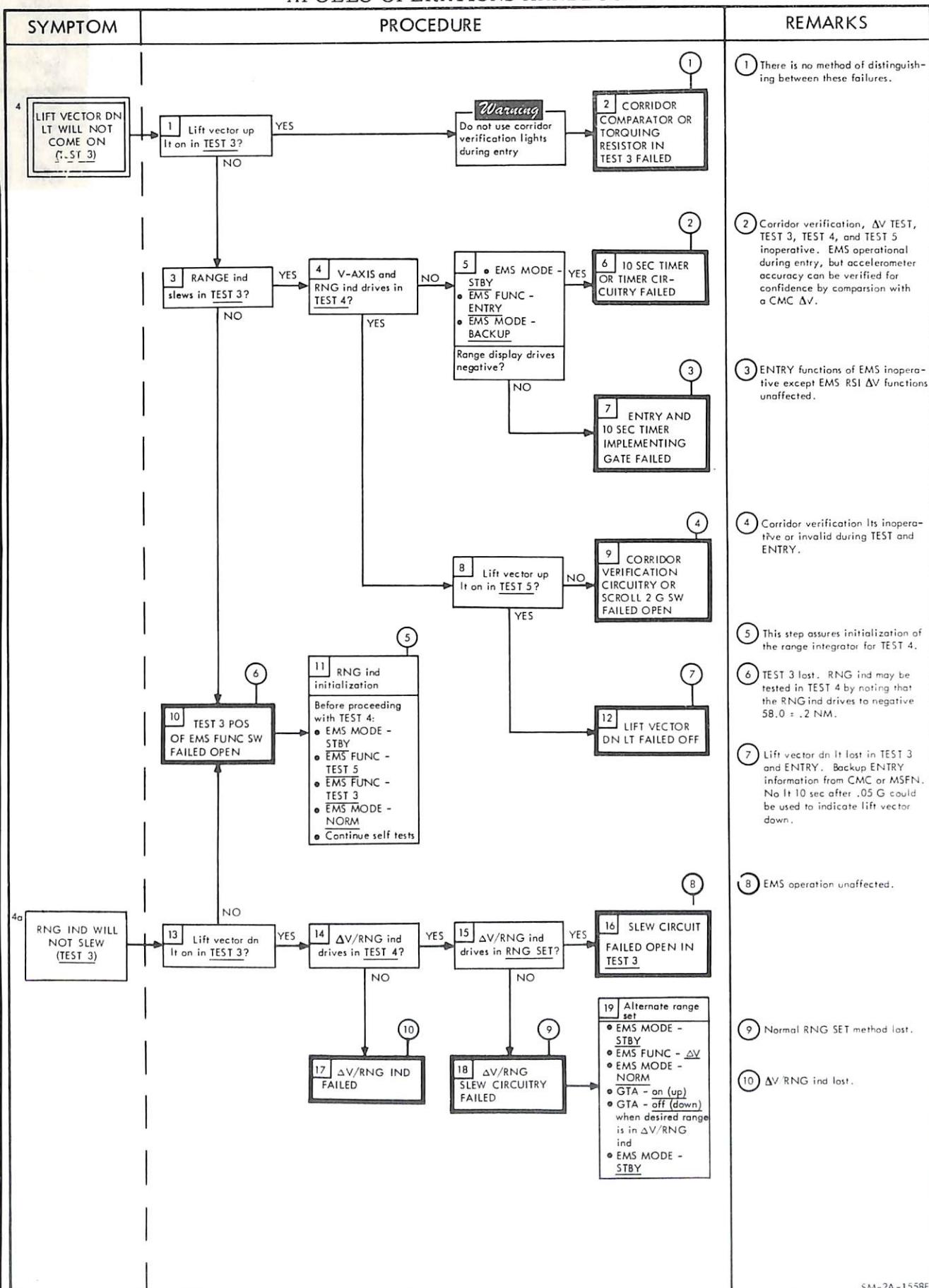
SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

1
THRU
4

SYMPTOM	PROCEDURE	REMARKS
	<pre> graph TD A[.05G LT ON (TEST 1)] --> B{Lift vector up It - on in TEST 3?} B -- YES --> C{Displays out of tolerance in TEST 4 and ΔV TEST?} C -- YES --> D{Null bias check failed?} D -- YES --> E[EMS ACCELEROMETER FAILED] D -- NO --> F[ACCEL LOW RANGE OUTPUT FAILED] F --> G{Compare EMS during CMC ΔV EMS agrees?} G -- YES --> H[TORQUE PWR SUPPLY FAILED] G -- NO --> I[THRESHOLD COMPARATOR FAILED] I --> J[.05 G LT FAILED ON] B -- NO --> K[EMS MODE - STBY • EMS FUNC - ENTRY • EMS MODE - NORM .05 G It on?] K -- YES --> L{RNG display drives in ENTRY?} L -- YES --> M[THRESHOLD COMPARATOR FAILED] M --> N[.05 G LT FAILED ON] L -- NO --> O[.05 G LT FAILED ON] K -- NO --> P[TORQUING RESISTOR IN TEST 1 FAILED] </pre>	<p>(1) The EMS MODE sw assumed to be in STBY for at least 5 sec before self-test started.</p> <p>(2) EMS lost except EMS RSI.</p> <p>(3) All self test capability lost. For entry, G-Drive, and corridor verification will be erroneous. ΔV/RNG ind, V AXIS and EMS RSI unaffected.</p> <p>(4) AUTO position functions of EMS MODE sw lost for entry only.</p> <p>(5) Corridor verification inoperative with EMS MODE sw - <u>BACKUP</u>.</p> <p>(6) EMS FUNC - TEST 1 lost only.</p> <p>(7) Loss of threshold cue only (.05 G It). RNG ind operation is indication of .05 G.</p>
	<pre> graph TD A[G/V SCROLL ASSY DOES NOT SLEW (TEST 1)] --> B{RNG display drives in TEST 3?} B -- YES --> C{V AXIS drives normally in TEST 4?} C -- YES --> D[TEST 1 POS OF EMS FUNC SW FAILED OPEN] C -- NO --> E[Slew scroll for TEST 4] E --> F{Alternate method: • EMS MODE - STBY • EMS FUNC - TEST 5 • Slew scroll to start of test pattern • EMS FUNC - TEST 1 • EMS MODE - NORM • Resume EMS self test} F --> G[V-AXIS DRIVE FAILED] </pre>	<p>(1) EMS FUNC - TEST 1 capability lost only.</p> <p>(2) RNG SET capability lost. SCS ΔV possible only if ΔV display is driven positive by placing the GTA sw - on (up), then - off (down) at the desired value. G&N or ΔV maneuver with the SPS THRUST - DIR ON can be monitored by the change in the ΔV display (down to -9999 fps). Vc can be set by using EMS FUNC - TEST 4 (repeatedly if necessary), stopping the V drive at the desired value by EMS FUNC - TEST 5. No backup capability available.</p> <p>(3) EMS lost for ENTRY except threshold, corridor, and EMS RSI. ΔV functions unaffected.</p>
SOURCE AOH DATE MARCH 16, 1970	<pre> graph TD A[.05 G LT OUT (TEST 2)] --> B{.05 G It on in other test positions?} B -- NO --> C[EMS MODE - STBY • EMS FUNC - ENTRY • EMS MODE - BACKUP Range display drives?] C -- NO --> D[MAN ENTRY IMPLEMENTING GATE FAILED] C -- YES --> E[TEST 2 POS OF FUNC SW FAILED OPEN] E --> F[.05 G LT FAILED] </pre>	<p>(1) ENTRY functions of EMS inoperative except EMS RSI. ΔV functions unaffected.</p> <p>(2) EMS FUNC - TEST 2 inoperative.</p> <p>(3) EMS operation unaffected. RNG Ind operation is indication of .05 G.</p>

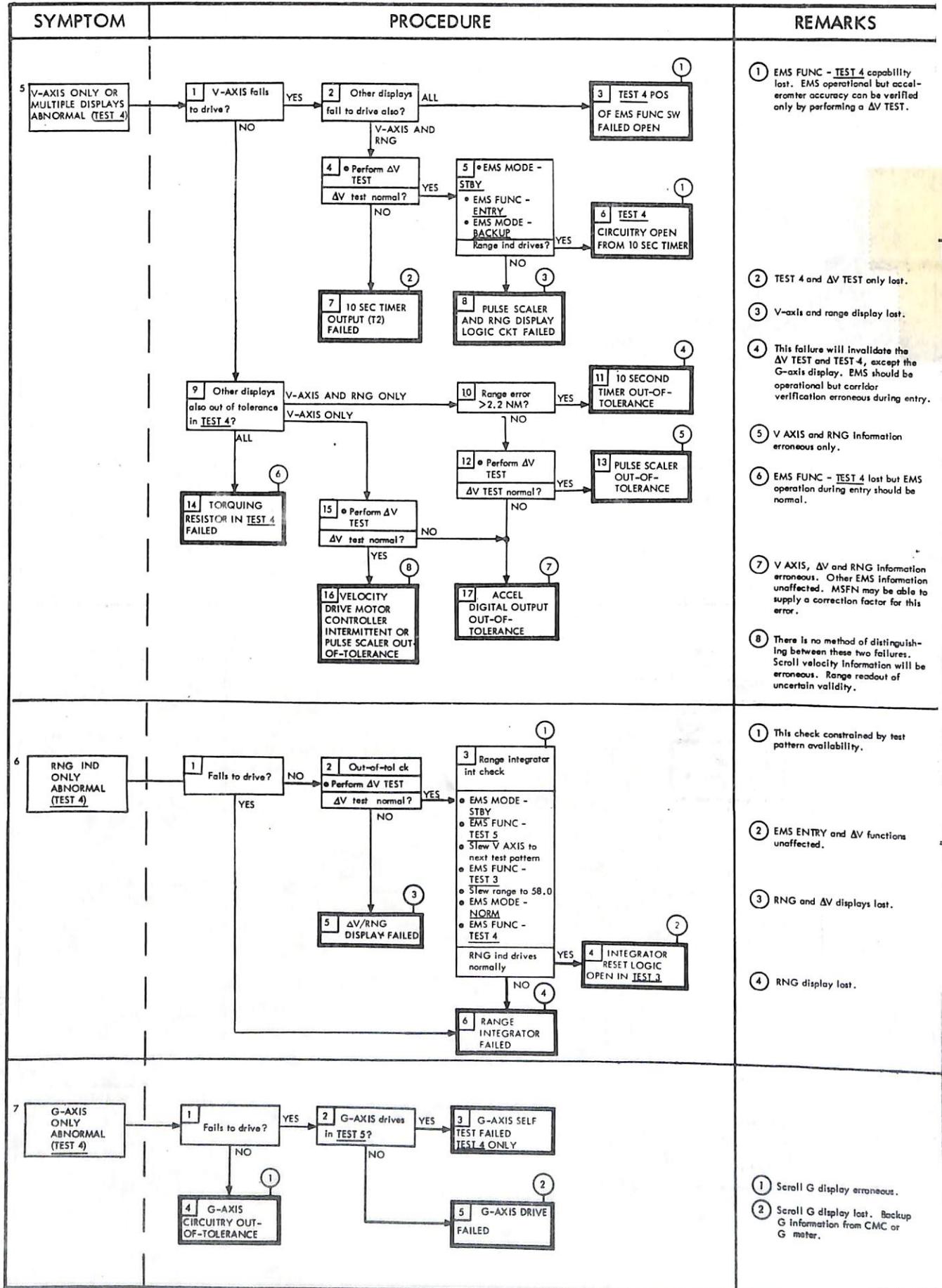
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK



SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

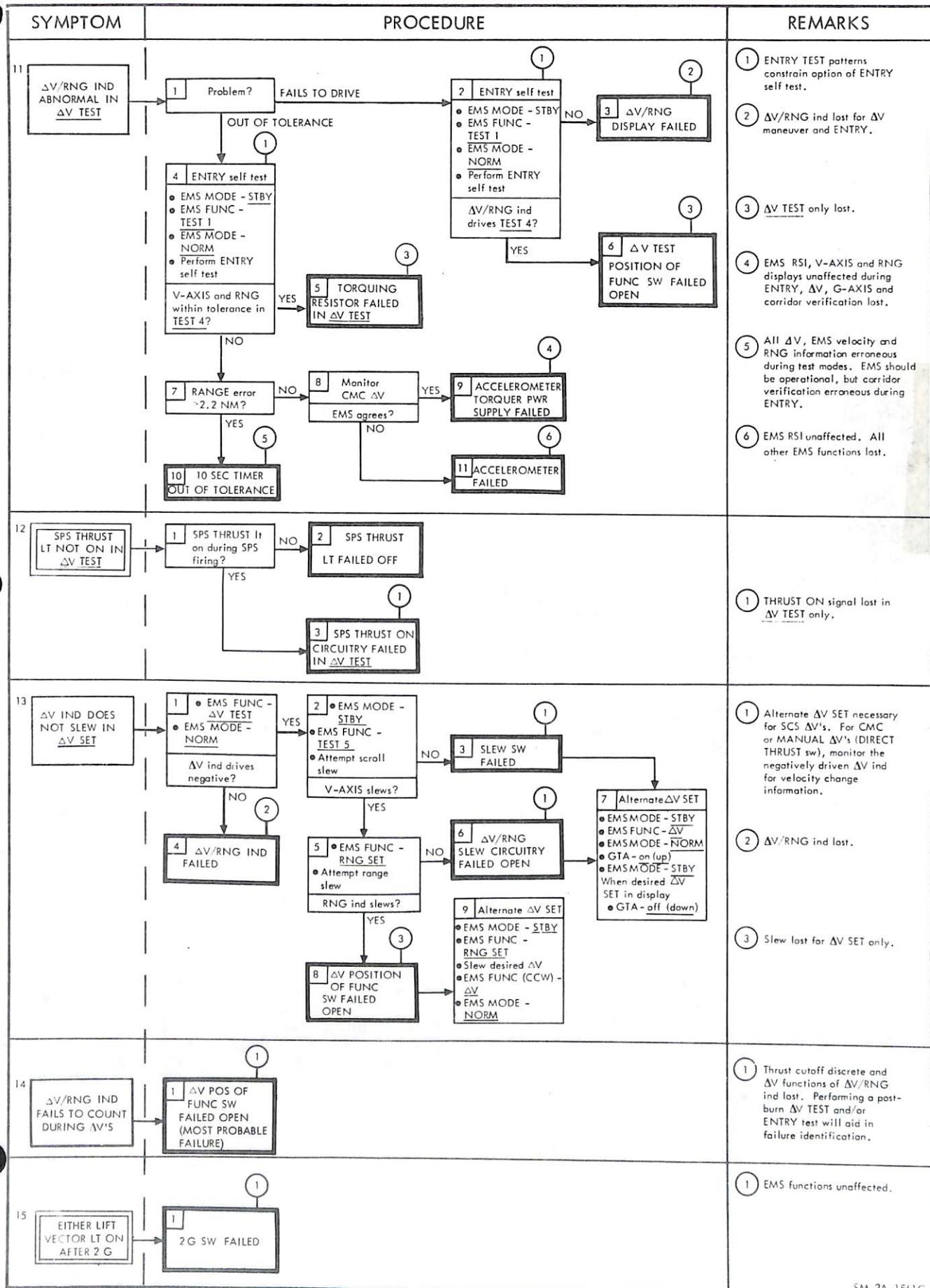
SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
8 LIFT VECTOR UP LT NOT ON (TEST 5)	<pre> graph TD A[1 Lift vector dn lt on in TEST 5?] -- NO --> B[2 G-AXIS drive normal in TEST 5?] B -- YES --> C[3 LIFT VECTOR UP LT FAILED OFF] B -- NO --> D[4 CORRIDOR COMPARATOR CIRCUIT FAILED] D --> E[5 Lift vector up lt on in TEST 5?] E -- NO --> F[6 EMS MODE - STBY * EMS FUNC - RNG SET * Slew display off zero * EMS FUNC - TEST 5 * RNG ind resets to zero?] F -- NO --> G[7 TEST 5 POS OF FUNC SW FAILED OPEN] F -- YES --> H[8 G-AXIS drives to zero in RNG SET?] H -- NO --> I[9 SCROLL G-AXIS FAILED (MECHANICAL)] H -- YES --> J[10 SCROLL G-AXIS CIRCUITRY OPEN TEST 5] </pre>	<p>(1) Lift vector up lt lost in TEST 5 and ENTRY. Backup entry angle information from CMC or MSFN. No lt 10 sec after .05 G could be used to indicate lift vector up.</p> <p>(2) Corridor verification lost during TEST 5 and ENTRY. Backup entry angle information from MSFN or CMC.</p> <p>(3) EMS FUNC - TEST 5 lost only.</p> <p>(4) Scroll G display inoperative.</p>
8a G-AXIS DOES NOT DRIVE (TEST 5)	<pre> graph TD A[5 Lift vector up lt on in TEST 5?] -- NO --> B[6 EMS MODE - STBY * EMS FUNC - RNG SET * Slew display off zero * EMS FUNC - TEST 5 * RNG ind resets to zero?] B -- NO --> C[7 TEST 5 POS OF FUNC SW FAILED OPEN] B -- YES --> D[8 G-AXIS drives to zero in RNG SET?] D -- NO --> E[9 SCROLL G-AXIS FAILED (MECHANICAL)] D -- YES --> F[10 SCROLL G-AXIS CIRCUITRY OPEN TEST 5] </pre>	
9 RNG IND DOES NOT SLEW IN RNG SET	<pre> graph TD A[1 G-AXIS zero's in RNG SET?] -- YES --> B[2 SLEW LOGIC IN RNG SET FAILED OPEN] A -- NO --> C[3 RNG SET POS OF FUNC SW FAILED OPEN] C --> D[4 Alternate RNG SET * EMS MODE - STBY * EMS FUNC - AV SET * Slew desired range * EMS FUNC (CW) - V0 SET * EMS MODE - NORM * Continue EMS checkout] </pre>	<p>(1) EMS operation unaffected. Use alternate RNG SET method.</p> <p>(2) ENTRY operation unaffected.</p>
9a G-AXIS DOES NOT ZERO IN RNG SET	<pre> graph TD A[5 RNG ind slews in RNG SET?] -- YES --> B[6 G-AXIS zero's in ENTRY?] A -- NO --> C[7 MECHANICAL G-AXIS OFF-SET ERROR] B -- NO --> D[8 G-AXIS CIRCUITRY OPEN IN RNG SET] B -- YES --> E[2 Alternate RNG SET * EMS MODE - STBY * EMS FUNC - AV SET * Slew desired range * EMS FUNC (CW) - V0 SET * EMS MODE - NORM * Continue EMS checkout] </pre>	<p>(3) This failure produces an error only in the initial phase of the G trace.</p>
10 V-AXIS DOES NOT SLEW IN V0 SET	<pre> graph TD A[1 V0 SET POS OF FUNC SW FAILED OPEN] --> B[2 Alternate slew - V-AXIS * EMS FUNC (CW) - TEST 5 * Slew desired V0 * EMS FUNC (CCW) - ENTRY] </pre>	<p>(1) Range display erroneous during ENTRY. Other ENTRY functions unaffected after V0 slewed by alternate methods.</p>

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 197011
THRU
15

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

DOCK &
HATCH

DOCK AND HATCH MALFUNCTION INDEXDOCKING

- 1 DOCK PROBE WILL NOT FOLD
- 2 DOCK PROBE EXTD/REL tb A (B) REMAINS GRAY AFTER CAPTURE (TLD ONLY)

HATCH

- 1 FWD HATCH WILL NOT UNLATCH
- 2 FWD HATCH WILL NOT LATCH

CSM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<u>DOCKING</u>	<p>1 DOCK PROBE WILL NOT FOLD</p> <p>1 LM manned? NO</p> <p>2 <ul style="list-style-type: none"> Remove drogue from LM side Connect probe umbilicals (2) (yellow) Cb DOCK PROBE (2) - <u>close</u> Verify LM tunnel hatch open and crew clear of tunnel PROBE EXTD/REL - EXTD/REL for 20 sec. max. Verify probe extension Cb DOCK PROBE (2) - <u>open</u> Using tools F, W and I, remove nut and bolt from one end of shock struts (3) Fold support beams by pulling probe toward CSM Disconnect probe umbilicals (2) (yellow) and remove probe from tunnel </p> <p>3 <ul style="list-style-type: none"> Verify probe support beams unloaded Using tools F, W and I, remove nut and bolt from one end of shock struts (3) Connect probe umbilicals (2) (yellow) Cock docking latches No. 1 & 3 Cb DOCK PROBE (2) - <u>closed</u> Cb SECS ARM (2) - <u>closed</u> After MSFN AOS, SECS LOGIC (both) - <u>on (up)</u> After go from MSFN, SECS PYRO ARM (2) - <u>on (up)</u> PROBE EXTD/REL - RETRACT PROBE RETRACT SEC - 1 PROBE RETRACT (2) - <u>off</u> SECS PYRO ARM (2) - <u>off</u> SECS LOGIC (both) - <u>off</u> Cb SECS ARM (2) - <u>open</u> Manually release docking latches 1 & 3 Preload the probe PROBE EXTD/REL - EXTD/REL for 20 sec. max. Verify extend latch indicator (red) is visible Depress probe BLEED button (red) at intervals to allow probe to extend slowly PROBE EXTD/REL - EXTD/REL and hold Pull probe aft (20 lb) to release from drogue PROBE EXTD/REL - OFF (release) Cb DOCK PROBE (2) - <u>open</u> Disconnect probe umbilicals (2) (yellow) and remove probe from tunnel </p>	D1 THRU H2
2 DOCK PROBE EXTD/REL lb A(B) REMAINS GRAY AFTER CAPTURE (TLD only)	<p>1 Attempt retraction</p> <p>PROBE EXTD/REL - RETR</p> <p>• PROBE RETR - PRIM 1 (SEC 1)</p> <p>Retraction?</p> <p>YES</p> <p>5 lb OR lb CIRCUIT FAILURE</p> <p>NO</p> <p>2 PROBE RETR - PRIM 2 (SEC 2)</p> <p>Retraction?</p> <p>YES</p> <p>6 PYRO OR GN2 BOTTLE FAILURE</p> <p>NO</p> <p>3 PROBE RETR - SEC-1 (PRIM-1)</p> <p>4 Troubleshoot System A(B) before removing probe as follows</p> <p>• PROBE RETR (2) - OFF</p> <p>• cb DOCK PROBE (2) - <u>open</u></p> <p>• Interchange probe umbilical connectors (cut cable retainers if necessary)</p> <p>• Cock docking latches 1 and 7</p> <p>• cb DOCK PROBE (2) - <u>close</u></p> <p>• PROBE EXTD/REL - RETR</p> <p>DOCK PROBE EXTD/REL lb B(A) - gray?</p> <p>YES</p> <p>7 SYSTEM A (B) CIRCUIT FAILURE IN PROBE</p> <p>8 <ul style="list-style-type: none"> Interchange umbilicals again Use SEC 2 (PRIM 2) to initiate only available GN₂ bottle when required Manually release docking latches No.'s 1 and 7 </p> <p>9 SYSTEM A (B) CIRCUIT FAILURE IN CSM</p> <p>10 <ul style="list-style-type: none"> Use SEC-1 (PRIM 1) and SEC-2 (PRIM 2) to initiate two available GN₂ bottles when required. Manually release docking latches No.'s 1 and 7 </p>	

CSM MALFUNCTION PROCEDURES

SOURCE AOH
DATE MARCH 16, 1970

SM2A-03-BLOCK II-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
HATCH 1 FWD HATCH WILL NOT UNLATCH	<pre> graph TD A[1 FWD HATCH WILL NOT UNLATCH] --> B{Does actr handle drive clutch engage gearbox?} B -- NO --> C[2 Assume failure of actr handle to engage and drive gearbox] B -- YES --> D[3 Assume failure is frozen gearbox.] C --> E[4 • Unstow actr handle and push to stop to unlock gearbox • AUX LATCH DRIVE - rotate 113° (use tool B) • Remove tool B and verify hatch unlatch] D --> E E --> F[5 • Remove gearbox mounting screws (3) and spacers (use tools W and 4) • Unstow actr handle and rotate away from hatch approx 30° • Push actr handle out-board rotating gearbox approx 40° CCW to release latches • Remove hatch from tunnel] F --> G[6 To reinstall hatch • Align hatch in tunnel • Rotate gearbox approx 40° CW and reinstall gearbox mounting screws (3)] </pre>	
2 FWD HATCH WILL NOT LATCH	<pre> graph TD A[2 FWD HATCH WILL NOT LATCH] --> B{Does actr handle drive gearbox?} B -- NO --> C[1 • Remove hatch to CM cabin • Attempt to latch mechanism] B -- YES --> D[2 Gearbox frozen • Gearbox disconnect - 180° CCW (tool B) • Position hatch in tunnel • AUX LATCH DRIVE - LATCH (113° CW - tool B) • Verify hatch latched, remove tool B (cannot remove hatch from LM side)] C --> D D --> E[3 Frozen latch • Inspect to identify frozen latch(es) • Remove dome nuts from long pivot screws of frozen latch. (Use tools F, W, 2 and 4) • Remove long pivot screws and rotate latch dog to clear striker plate • Unlatch mechanism • Install hatch] </pre>	

SOURCE AOH
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

CSM MALFUNCTION PROCEDURES

THIS PAGE
INTENTIONALLY
LEFT BLANK

SOURCE MOCATA
DATE MARCH 16, 1970

CAMERA

CAMERA MALFUNCTION INDEX16mm

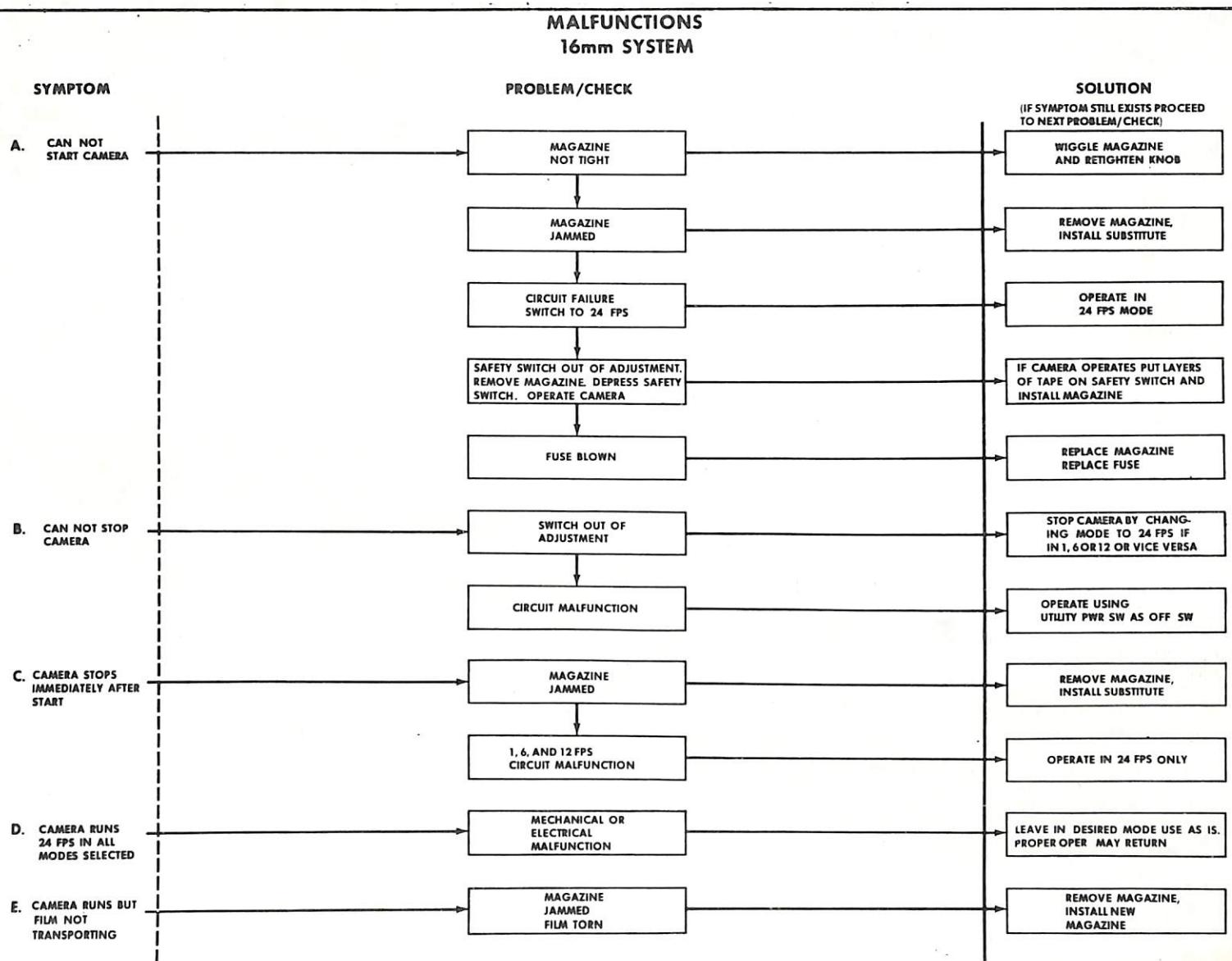
- A CAN NOT START CAMERA
- B CAN NOT STOP CAMERA
- C CAMERA STOPS IMMEDIATELY AFTER START
- D CAMERA RUNS 24FPS IN ALL MODES SELECTED
- E CAMERA RUNS BUT FILM NOT TRANSPORTING

70mm

- I CAMERA WITH MAGAZINE
 - A SHUTTER FIRES/NO FILM ADVANCE
 - B NO CAMERA ACTION/BUTTON CYCLED
 - C SHUTTER FIRES/PARTIAL FILM ADVANCE
 - D CANNOT ATTACH LENS
- II CAMERA ONLY
 - A NO CAMERA ACTION/BUTTON CYCLED
- III INTERVALOMETER WITH CAMERA AND MAGAZINE
 - A CAMERA DOES NOT CYCLE

LUNAR TOPOGRAPHIC CAMERA

- POWER ON LIGHT NOT ILLUMINATED
- MOTORS NOT OPERATING
- END OF FILM LIGHT ILLUMINATED BEFORE FILM IS EXPENDED
- FRAMES REMAIN INDICATOR NOT COUNTING END OF FILM LIGHT OFF
- FILM ADVANCE SWITCH NOT OPERATING
- CAMERA CYCLING RATE INCORRECT
- SINGLE FRAME NOT OPERABLE
- SPOOL LOCK KNOB INDICATORS ON MAGAZINE NOT ROTATING WHEN FRAMES REMAIN CHANGES
- END OF FILM LIGHT NEVER ILLUMINATES
- NO FMC, CAMERA MOVEMENT

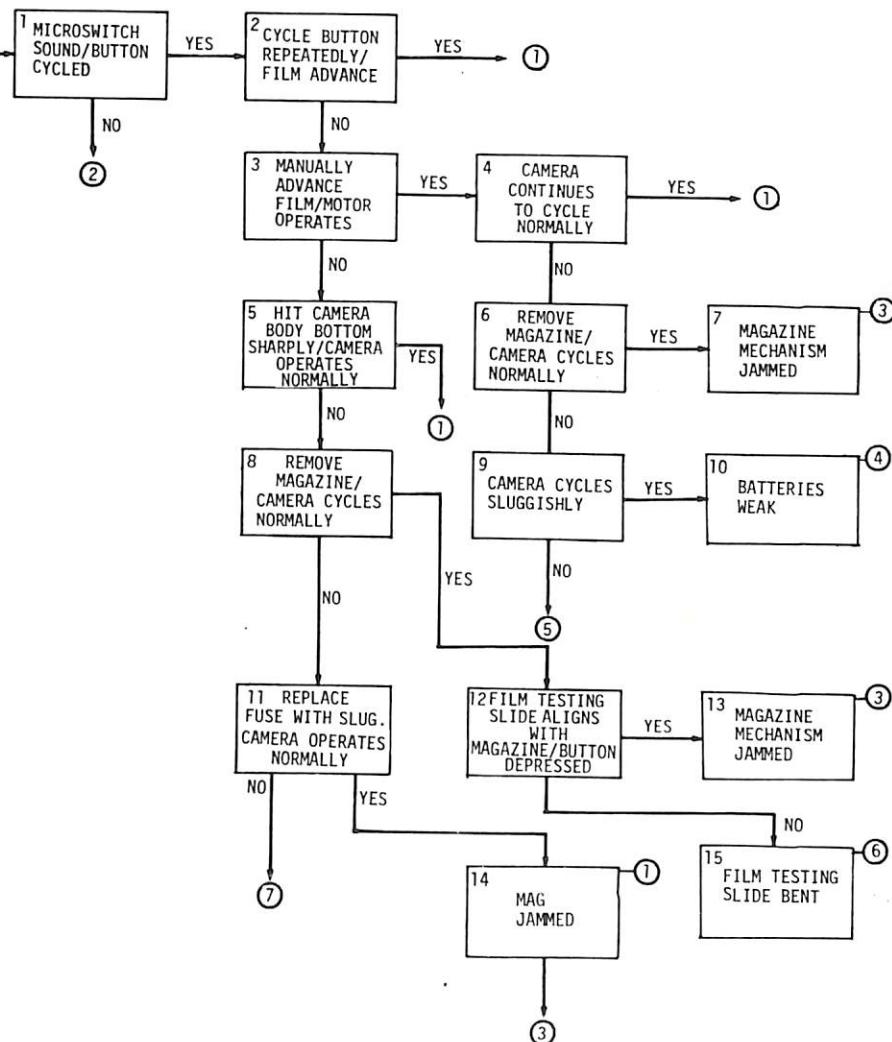


70mm CAMERA MALFUNCTIONS PROCEDURES

SYMPTOM

I. CAMERA WITH MAGAZINE

A. SHUTTER FIRES/NO FILM ADVANCE



REMARKS

- ① CAM SHOULD CONTINUE TO OPERATE BUT MONITOR OPERATION CLOSELY AS FAILURE CAN REOCUR
- ② REMOVE MAGAZINE AND SEE SYMPTOM A UNDER "CAMERA ONLY" SECTION
- ③ CAMERA SHOULD OPERATE NORMALLY WITH NEW MAGAZINE
- ④ REPLACE BOTH BATTERIES
- ⑤ IMPROBABLE FAILURE MODE
- ⑥ ATTEMPT TO STRAIGHTEN FILM TESTING SLIDE AND CYCLE CAMERA/MAGAZINE
- ⑦ CAMERA INOPERATIVE

SOURCE W. Teague
DATE MARCH 16, 1970

CSM MALFUNCTION PROCEDURES

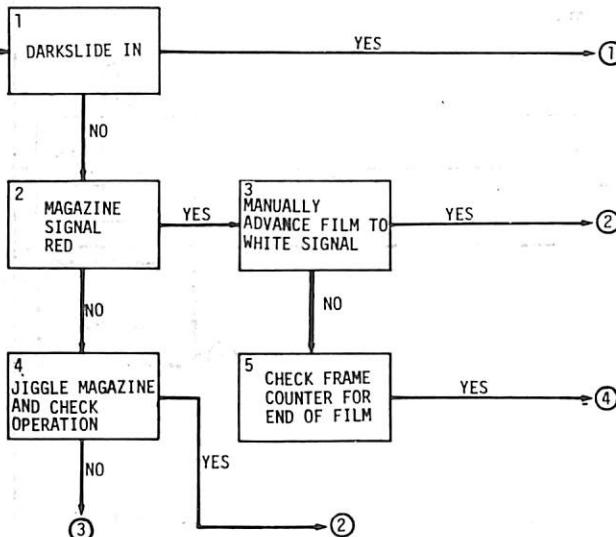
70mm CAMERA MALFUNCTIONS

PROCEDURES

SYMPTOM

CAMERA WITH MAGAZINE

I
B.
NO CAMERA
ACTION/BUTTON
CYCLED



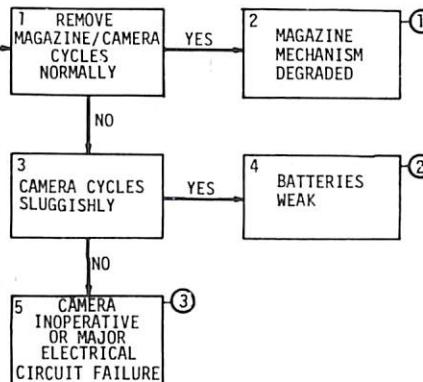
REMARKS

REMARKS

- ① REMOVE DARKSLIDE
- ② CAMERA SHOULD OPERATE
- ③ REMOVE MAGAZINE. SEE CAM ONLY SYMPTOM A
- ④ REPLACE MAGAZINE

CAMERA WITH MAGAZINE

I
C.
SHUTTER FIRES/
PARTIAL FILM
ADVANCE



- ① CAMERA SHOULD OPERATE NORMALLY WITH NEW MAGAZINE
- ② REPLACE BOTH BATTERIES AND INSTALL SINGLE BATTERY FROM OTHER CAMERA
- ③ REMOVE BATTERIES EXCHANGE BATTERIES ONLY IF OTHER CAMERA INOPERATIVE

REMARKS

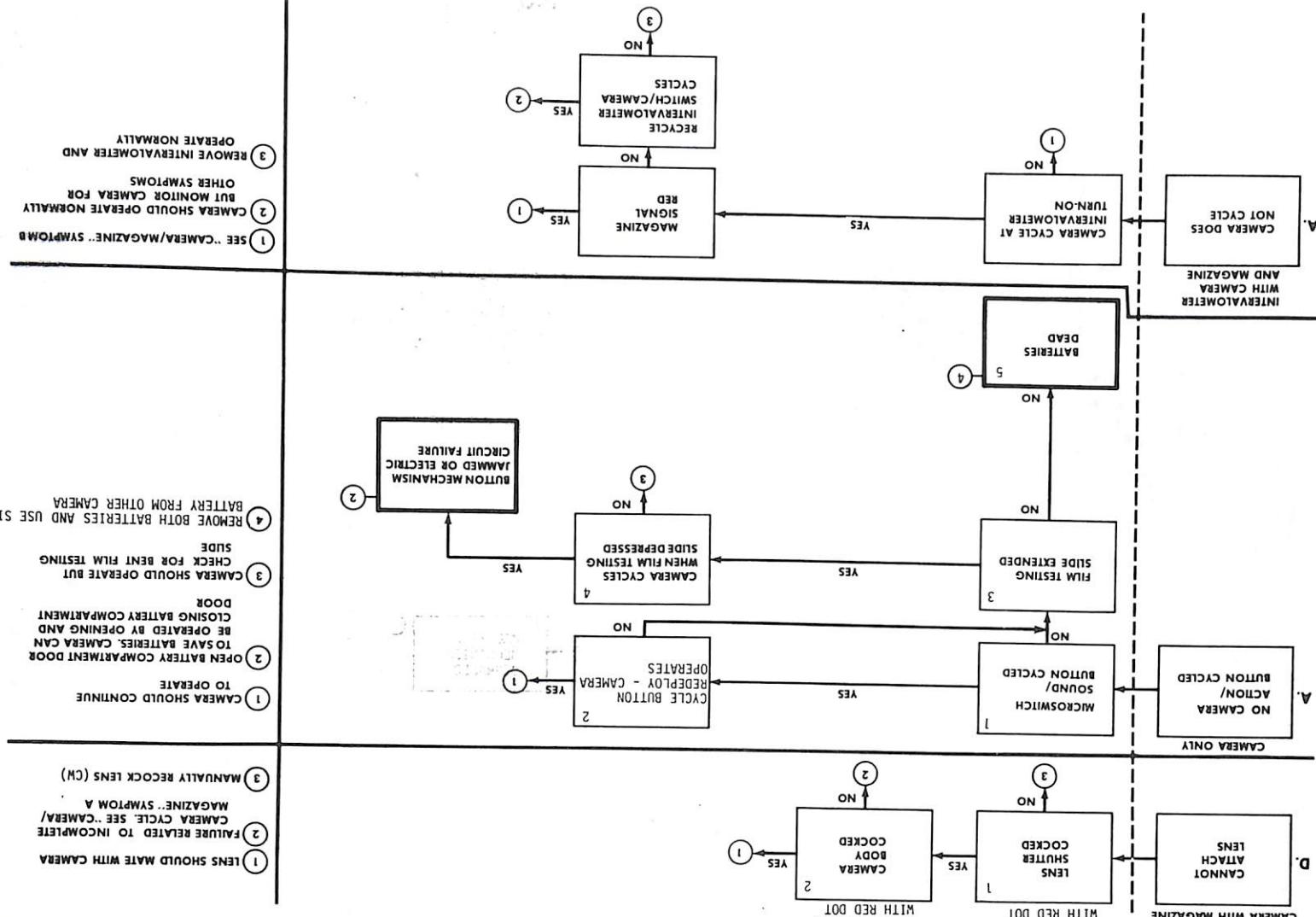
70mm CAMERA MALFUNCTIONS

- 1 LENS SHOULD MATE WITH CAMERA
- 2 FAILURE RELATED TO INCOMPLETE CYCLE SEE CAMERAS MAGAZINE SYMPTOM A
- 3 MANUALLY RECORD LENS (CW)

- ④ BATTERY FROM OTHER CAMERAS
- ③ REMOVE BOTH BATTERIES AND SLIDE CHECK FOR BENT FILM TESTING
- ② OPEN BATTERY COMPARTMENT DOOR
- ① TO SAVE BATTERIES, CAMERA CAN BE OPERATED BY OPENCING AND CLOSING BATTERY COMPARTMENT

 REMOVE BOTH BATTERIES AND USE BATTERY FROM OTHER CAMERA

- 1 SEE "CAMERA/MAGAZINE" SYMPTOMS
- 2 CAMERA SHOULD OPERATE NORMAL
BUT MONITOR CAMERA FOR
OTHER SYMPTOMS
- 3 REMOVE INTERVALOMETER AND
OPERATE NORMAL



PROCEDURE FOR: LUNAR TOPOGRAPHIC CAMERA (LTC) SYSTEM MALFUNCTIONS
HTD101-MP1

SYMPTOM	PROBLEM/CHECK	SOLUTION
POWER ON LIGHT NOT ILLUMINATED	DC POWER OFF (PANEL 227) ↓ MAGAZINE NOT SEATED ↓ MAGAZINE MOTOR OR INTERLOCK SWITCH FAILURE ↓ LIGHT BURNED OUT	(IF SYMPTOM STILL EXISTS PROCEED TO NEXT PROBLEM/CHECK) SCI INST. SWITCH ON (PANEL 227) ROTATE LOCKING KNOB FULLY CCW. PRESS MAGAZINE IN AND RETIGHTEN KNOB CW TO CLOSED POSITION INSTALL NEW MAGAZINE DISREGARD LIGHT INDICATION
MOTORS NOT OPERATING	AC POWER OFF (PANEL 201) ↓ AC POWER OFF AT MDC5 PANEL	AC UTIL PWR SWITCH ON (PANEL 201) RESET ECS CABIN FAN-2-AC 2 CB'S PNLS 5
END OF FILM LIGHT ILLUMINATED BEFORE FILM IS EXPENDED	END OF FILM SWITCH OUT OF ADJUSTMENT	DISREGARD LIGHT IF BOTH KNOBS ON MAGAZINE STILL ROTATE WHEN CAMERA CYCLING
FRAMES REMAIN INDICATOR NOT COUNTING END OF FILM LIGHT OFF	INOPERATIVE INDICATOR ↓ CIRCUIT MALFUNCTION ↓ CIRCUIT MALFUNCTION	WITH AUDIBLE INDICATION OF SHUTTER CURTAIN OPERATION DISREGARD COUNTER OPERATE IN SINGLE FRAME MODE USE DIFFERENT SHUTTER SPEED

TOPO

