APOLLO 15	
LM MALFUNCTION PROCEDURES	
PART NO.	S/N
SKB32100116-386	1001

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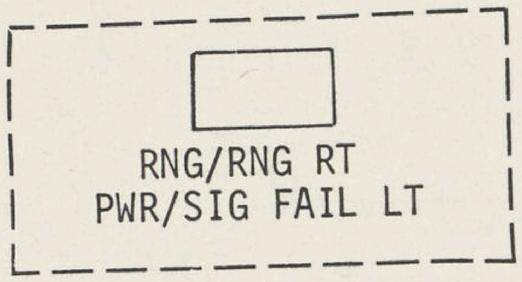
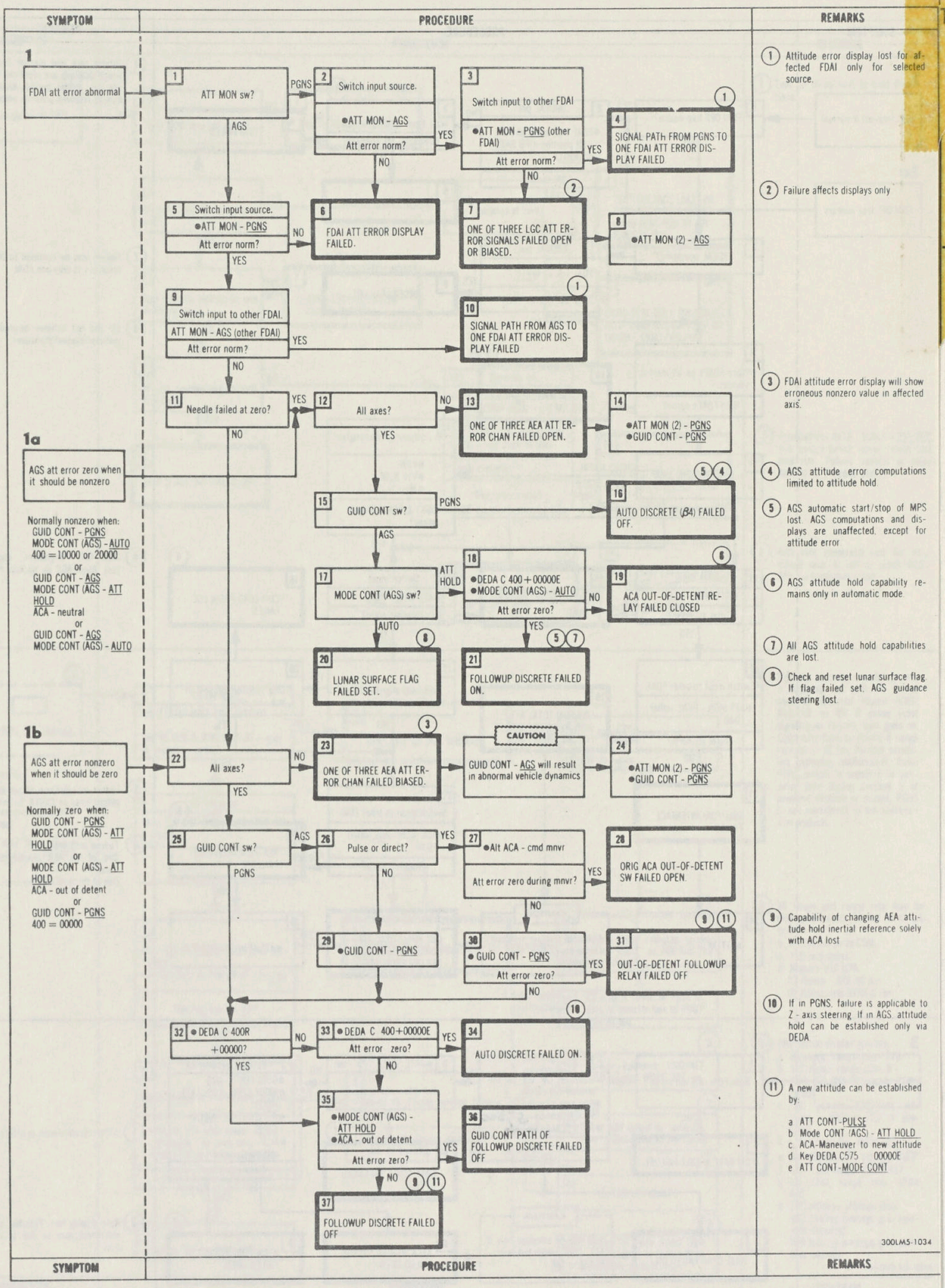
G & C DISPLAYS MALFUNCTION INDEX

1 FDAI ATT ERROR ABNORMAL
1a AGS ATT ERROR ZERO
1b AGS ATT ERROR NON ZERO
2 FDAI TOTAL ATT ABNORMAL
2a FDIA OFF FLAG APPEARS
3 RATE DISPLAY ABNORMAL
4 RATE GYRO TEST FAILS

5




SYMPTOM
PROCEDURE
REMARKS
1
FDAI att error abnormal
1 ATT MON sw?
PGNS
AGS
2 Switch input source. •ATT MON - AGS Att error norm?
YES
NO
3 Switch input to other FDAI •ATT MON - PGNS (other FDAI) Att error norm?
YES
NO
4 SIGNAL PATH FROM PGNS TO ONE FDAI ATT ERROR DISPLAY FAILED
5 Switch input source. •ATT MON - PGNS Att error norm?
NO
YES
6 FDAI ATT ERROR DISPLAY FAILED.
7 ONE OF THREE LGC ATT ERROR SIGNALS FAILED OPEN OR BIASED.
8 •ATT MON (2) - AGS
9 Switch input to other FDAI. ATT MON - AGS (other FDAI) Att error norm?
YES
NO
10 SIGNAL PATH FROM AGS TO ONE FDAI ATT ERROR DISPLAY FAILED
11 Needle failed at zero?
YES
NO
12 All axes?
NO
YES
13 ONE OF THREE AEA ATT ERROR CHAN FAILED OPEN.
14 •ATT MON (2) - PGNS •GUID CONT - PGNS
1a
AGS att error zero when it should be nonzero
Normally nonzero when:
GUID CONT - PGNS
MODE CONT (AGS) - AUTO
400 = 10000 or 20000
or
GUID CONT - AGS
MODE CONT (AGS - ATT HOLD
ACA - neutral
or
GUID CONT - AGS
MODE CONT (AGS) - AUTO
15 GUID CONT sw?
PGNS
AGS
16 AUTO DISCRETE (β4) FAILED OFF.
17 MODE CONT (AGS) sw?
ATT HOLD
AUTO
18 •DEDA C 400 + 00000E •MODE CONT (AGS) - AUTO Att error zero?
NO
YES
19 ACA OUT-OF-DETENT RELAY FAILED CLOSED
20 LUNAR SURFACE FLAG FAILED SET.
21 FOLLOWUP DISCRETE FAILED ON.
1b
AGS att error nonzero when it should be zero
Normally zero when:
GUID CONT - PGNS
MODE CONT (AGS) - ATT HOLD
or
MODE CONT (AGS) - ATT HOLD
ACA - out of detent
or
GUID CONT - PGNS
400 = 00000
22 All axes?
NO
YES
23 ONE OF THREE AEA ATT ERROR CHAN FAILED BIASED.
CAUTION
GUID CONT - AGS will result in abnormal vehicle dynamics
24 •ATT MON (2) - PGNS •GUID CONT - PGNS
25 GUID CONT sw?
AGS
PGNS
26 Pulse or direct?
YES
NO
27 •Alt ACA - cmd mnvr Att error zero during mnvr?
YES
NO
28 ORIG ACA OUT-OF-DETENT SW FAILED OPEN.
29 •GUID CONT - PGNS
30 • GUID CONT - PGNS Att error zero?
YES
NO
31 OUT-OF-DETENT FOLLOWUP RELAY FAILED OFF
32 • DEDA C 400R +00000?
NO
YES
33 • DEDA C 400+00000E Att error zero?
YES
NO
34 AUTO DISCRETE FAILED ON.
35 •MODE CONT (AGS) - ATT HOLD •ACA - out of detent Att error zero?
YES
NO
36 GUID CONT PATH OF FOLLOWUP DISCRETE FAILED OFF
37 FOLLOWUP DISCRETE FAILED OFF
1 Attitude error display lost for affected FDAI only for selected source.
2 Failure affects displays only
3 FDAI attitude error display will show erroneous nonzero value in affected axis.
4 AGS attitude error computations limited to attitude hold.
5 AGS automatic start/stop of MPS lost. AGS computations and displays are unaffected, except for attitude error.
6 AGS attitude hold capability remains only in automatic mode.
7 All AGS attitude hold capabilities are lost.
8 Check and reset lunar surface flag. If flag failed set, AGS guidance steering lost.
9 Capability of changing AEA attitude hold inertial reference solely with ACA lost.
10 If in PGNS, failure is applicable to Z - axis steering. If in AGS, attitude hold can be established only via DEDA.
11 A new attitude can be established by:
a ATT CONT-PULSE
b Mode CONT (AGS) - ATT HOLD
c ACA-Maneuver to new attitude
d Key DEDA C575 00000E
e ATT CONT-MODE CONT
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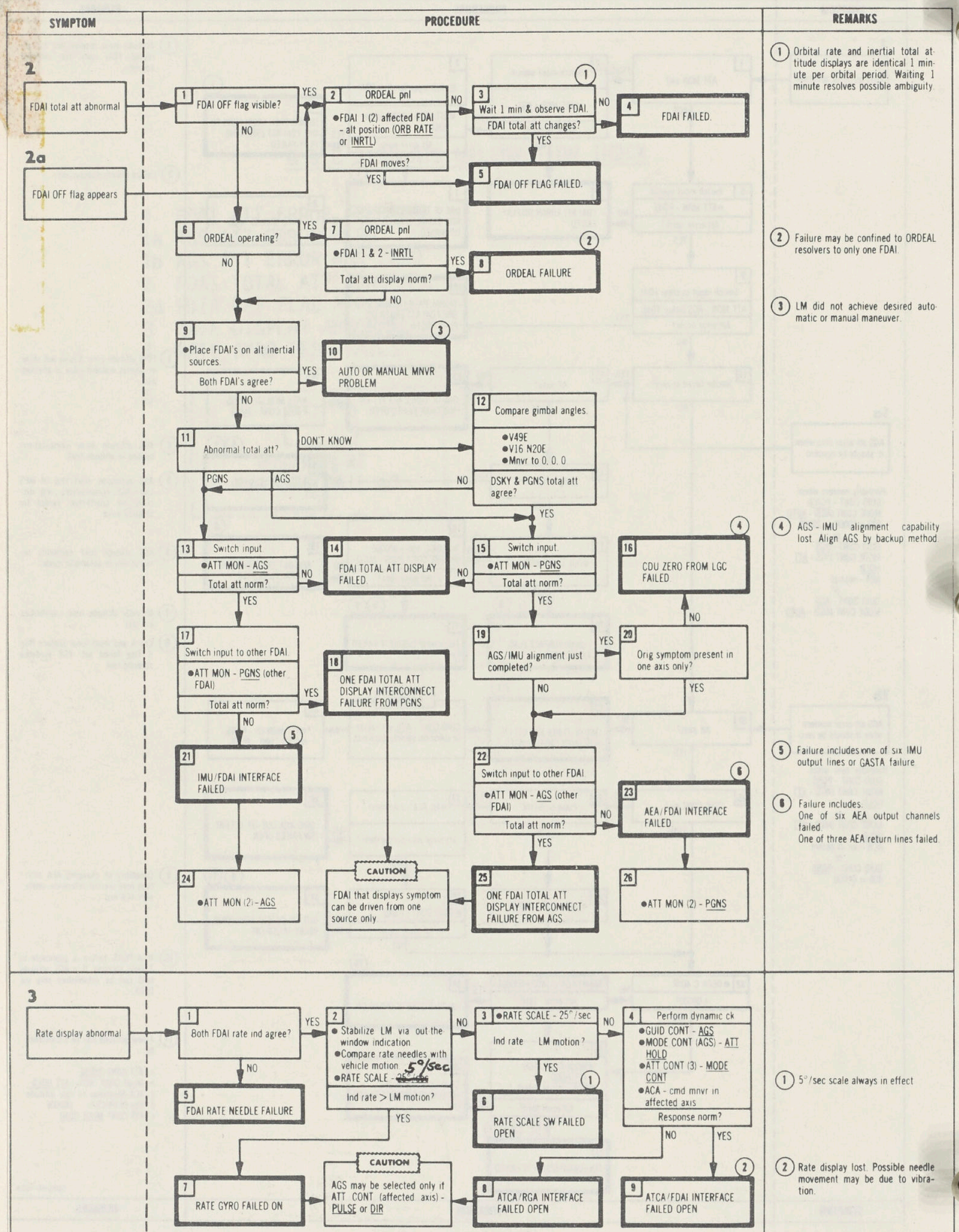
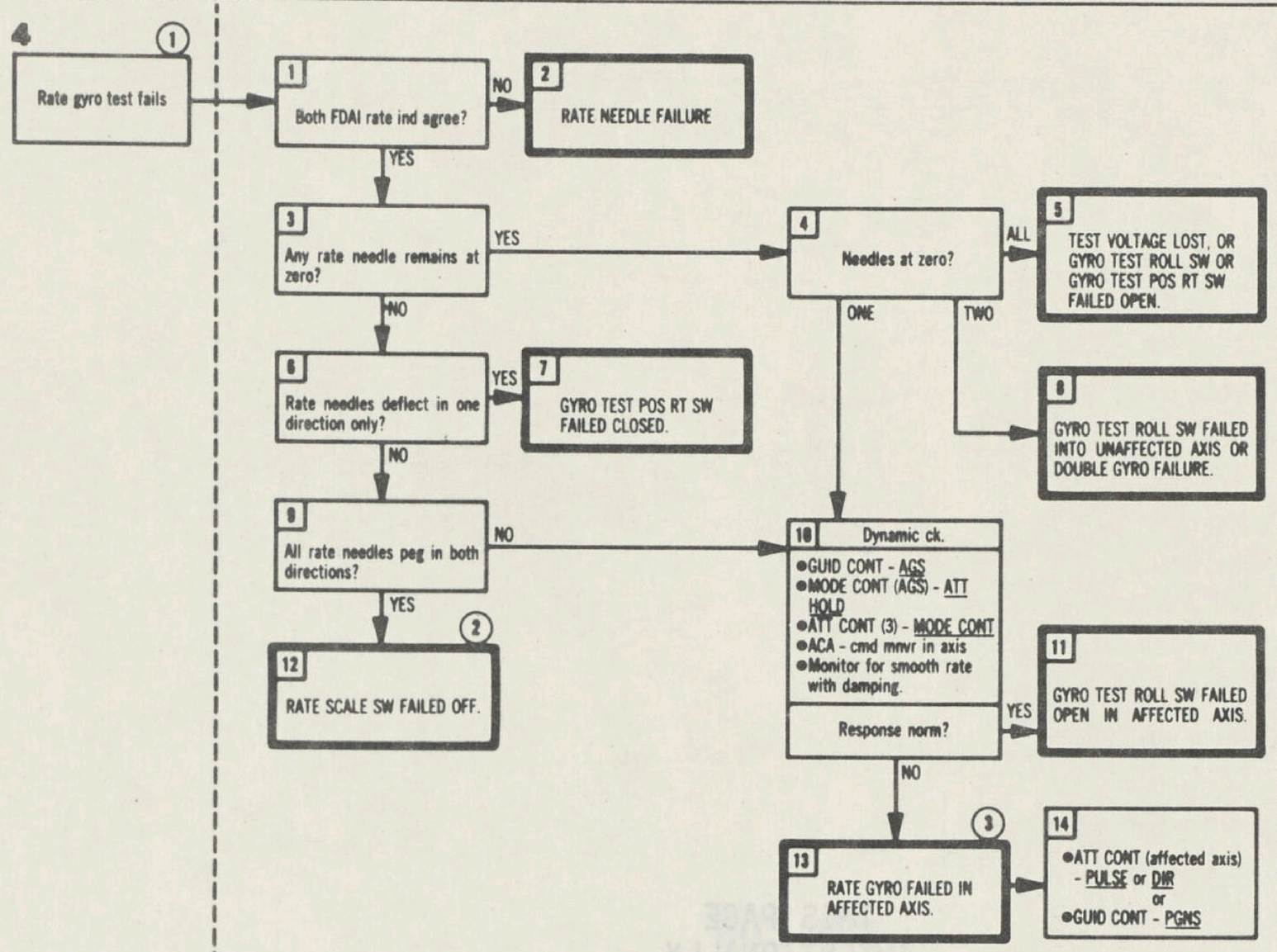

SYMPTOM
PROCEDURE
REMARKS
2
FDAI total att abnormal
2a
FDAI OFF flag appears
1 FDAI OFF flag visible?
YES
NO
2 ORDEAL pnl
●FDAI 1 (2) affected FDAI - alt position (ORB RATE or INRTL)
FDAI moves?
YES
NO
3 Wait 1 min & observe FDAI.
FDAI total att changes?
NO
YES
4 FDAI FAILED.
5 FDAI OFF FLAG FAILED.
6 ORDEAL operating?
YES
NO
7 ORDEAL pnl
●FDAI 1 & 2 - INRTL
Total att display norm?
YES
NO
8 ORDEAL FAILURE
9 ●Place FDAI's on alt inertial sources.
Both FDAI's agree?
YES
NO
10 AUTO OR MANUAL MNVR PROBLEM
11 Abnormal total att?
DON'T KNOW
PGNS
AGS
12 Compare gimbal angles.
●V49E
●V16 N20E
●Mnvr to 0, 0, 0
DSKY & PGNS total att agree?
NO
YES
13 Switch input
●ATT MON - AGS
Total att norm?
NO
YES
14 FDAI TOTAL ATT DISPLAY FAILED.
15 Switch input.
●ATT MON - PGNS
Total att norm?
NO
YES
16 CDU ZERO FROM LGC FAILED.
17 Switch input to other FDAI.
●ATT MON - PGNS (other FDAI)
Total att norm?
YES
NO
18 ONE FDAI TOTAL ATT DISPLAY INTERCONNECT FAILURE FROM PGNS
19 AGS/IMU alignment just completed?
YES
NO
20 Orig symptom present in one axis only?
NO
YES
21 IMU/FDAI INTERFACE FAILED.
22 Switch input to other FDAI.
●ATT MON - AGS (other FDAI)
Total att norm?
NO
YES
23 AEA/FDAI INTERFACE FAILED
24 ●ATT MON (2) - AGS
CAUTION
FDAI that displays symptom can be driven from one source only.
25 ONE FDAI TOTAL ATT DISPLAY INTERCONNECT FAILURE FROM AGS.
26 ●ATT MON (2) - PGNS
1 Orbital rate and inertial total attitude displays are identical 1 minute per orbital period. Waiting 1 minute resolves possible ambiguity.
2 Failure may be confined to ORDEAL resolvers to only one FDAI.
3 LM did not achieve desired automatic or manual maneuver.
4 AGS - IMU alignment capability lost. Align AGS by backup method.
5 Failure includes one of six IMU output lines or GASTA failure.
6 Failure includes:
One of six AEA output channels failed.
One of three AEA return lines failed.
3
Rate display abnormal
1 Both FDAI rate ind agree?
YES
NO
5 FDAI RATE NEEDLE FAILURE
2 ● Stabilize LM via out the window indication
●Compare rate needles with vehicle motion. 5°/sec
●RATE SCALE - ~~25°/sec~~
Ind rate > LM motion?
YES
3 ●RATE SCALE - 25°/sec
Ind rate LM motion?
NO
YES
6 RATE SCALE SW FAILED OPEN
4 Perform dynamic ck
●GUID CONT - AGS
●MODE CONT (AGS) - ATT HOLD
●ATT CONT (3) - MODE CONT
●ACA - cmd mnvr in affected axis
Response norm?
NO
YES
7 RATE GYRO FAILED ON
CAUTION
AGS may be selected only if ATT CONT (affected axis) - PULSE or DIR
8 ATCA/RGA INTERFACE FAILED OPEN
9 ATCA/FDAI INTERFACE FAILED OPEN
1 5°/sec scale always in effect
2 Rate display lost. Possible needle movement may be due to vibration.
A-300LM5-1019
SYMPTOM
PROCEDURE
REMARKS

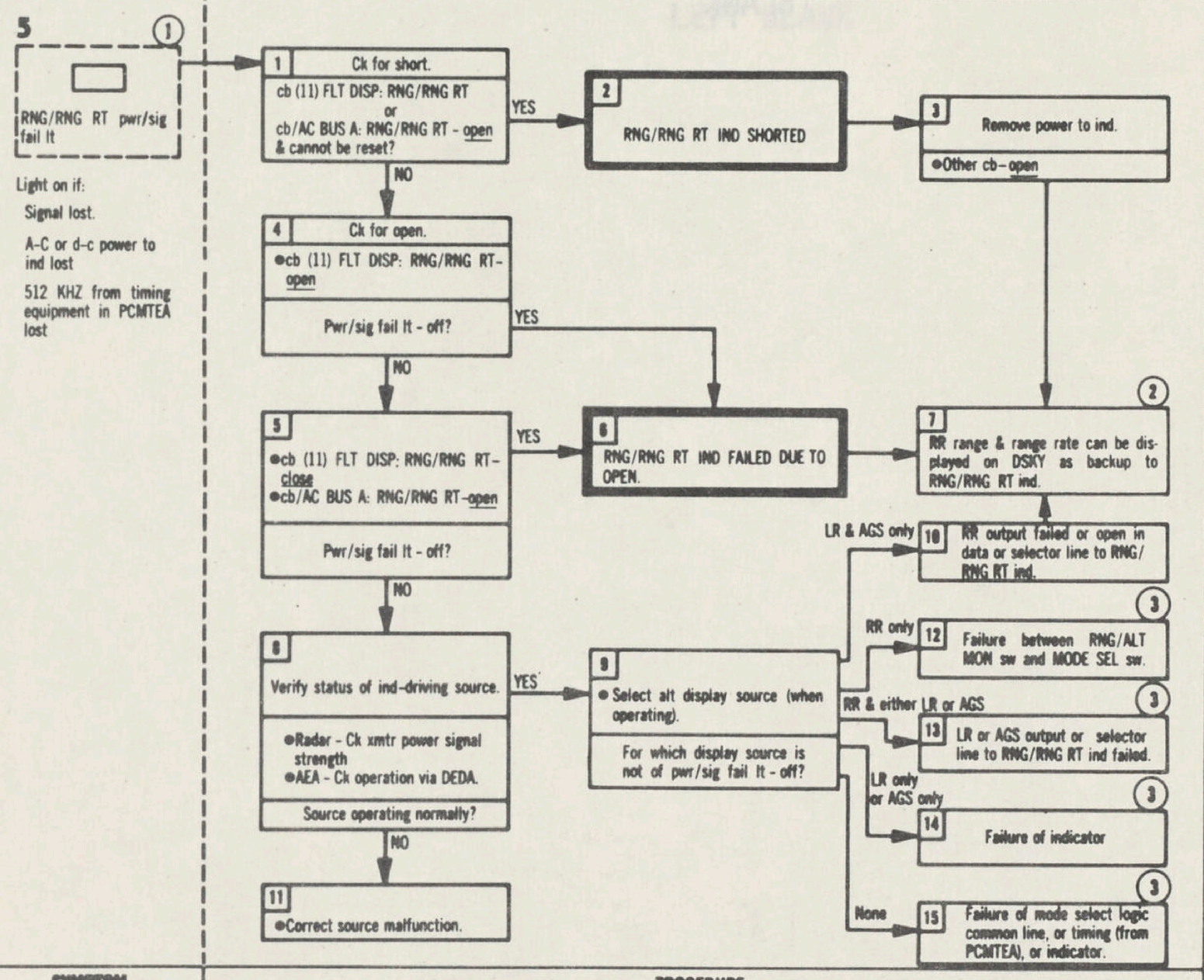
SYMPTOM	PROCEDURE	REMARKS



1 Test all three axes in both directions.

2 Assumption: RATE SCALE - 25°/SEC, but switch failed open when test was run. Failure results in selection of 5°/second scale.

3 AGS rate command lost for affected axis. If roll or pitch, AGS DPS burn capability lost.



1 Light is normally on when power is supplied and indicator is not used by selected source PGNS, AGS, LR, or RR. If either input signal goes to zero, light goes on. Light may flash randomly if range rate is < 10 fps. Neither condition indicates malfunction. Since PGNS output is supplied to indicator only during average g at powered descent or ascent, PGNS is not considered in the malfunction analysis.

2 RR range and range rate may be displayed if a and (b and / or c) are true.
a. RR locked on to CSM.
b. P20 in process.
c. Monitor V16 N78:
R1 Range XXX.XX nm
R2 Range rate XXXX.X fps

3 Alternative display sources:
a. RR range, range-rate - N78
b. LGC range, range-rate, θ - N54 (if R31 in process by V83E)
c. LGC latitude, longitude, altitude - N43 (if P21 in process)
d. LM altitude (h) - DEDA 337
e. Altitude rate ($\dot{h}$) - DEDA 367
f. LM - CSM range - DEDA 317
g. LM - CSM range - rate DEDA 440
h. LGC altitude, altitude rate:
N63 (during average g in powered descent)
N94 (during average g in powered ascent)

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SYMPTOM	PROCEDURE	REMARKS

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PGNS MALFUNCTION INDEX

1 TRACKER

2 ISS

3 TEMP

4 GIMBAL LOCK

5 LGC

5a RESTART

6 ALT

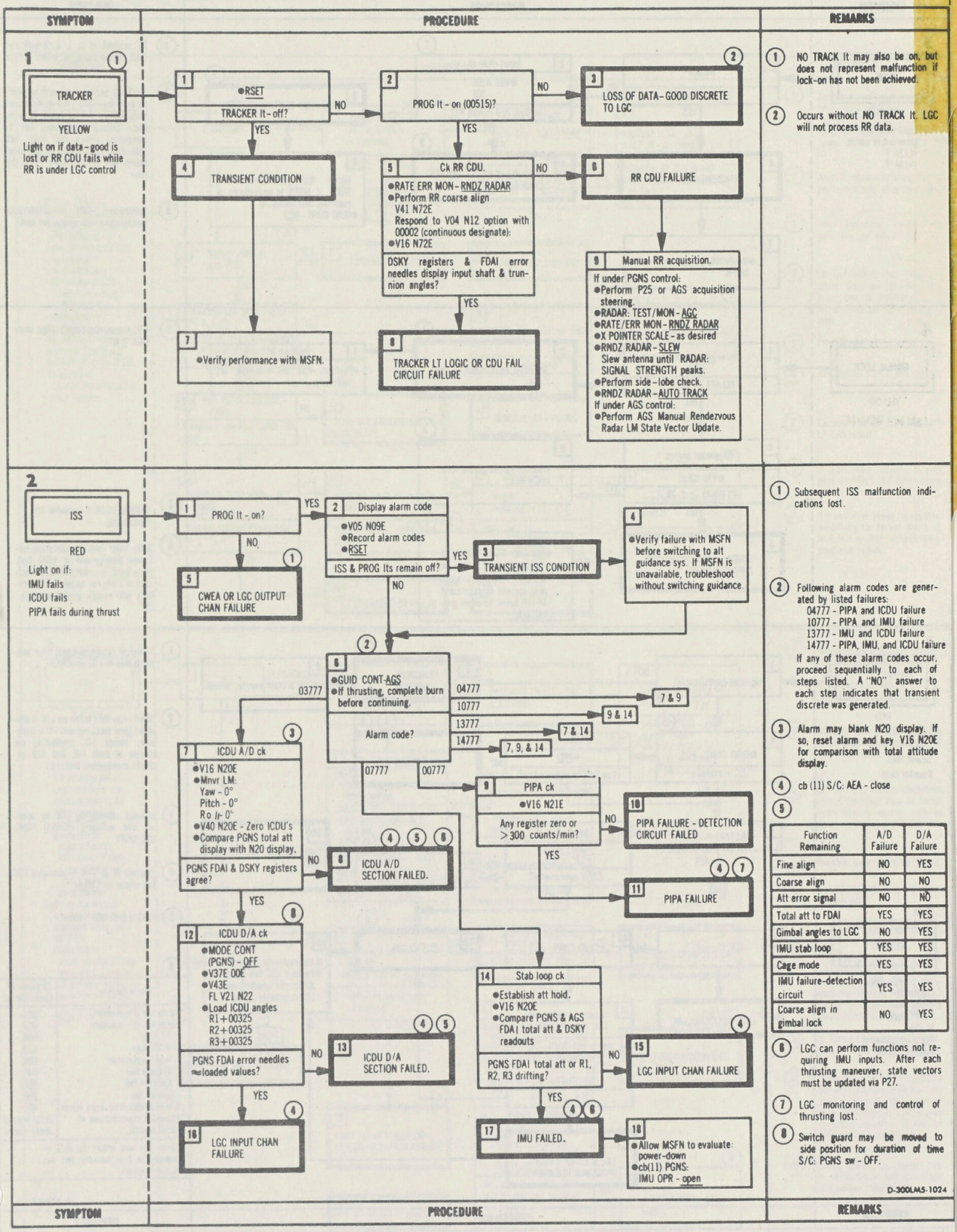
7 VEL

8 RNDZ RDR

8a NOTRACK

SSR-1 LGC SELF-TEST

SYMPTOM	PROCEDURE	REMARKS



REMARKS

1. NO TRACK lt may also be on, but does not represent malfunction if lock-on has not been achieved.
2. Occurs without NO TRACK lt. LGC will not process RR data.

1. Subsequent ISS malfunction indications lost.
2. Following alarm codes are generated by listed failures:
   04777 - PIPA and ICDU failure
   10777 - PIPA and IMU failure
   13777 - IMU and ICDU failure
   14777 - PIPA, IMU, and ICDU failure
   If any of these alarm codes occur, proceed sequentially to each of steps listed. A "NO" answer to each step indicates that transient discrete was generated.
3. Alarm may blank N20 display. If so, reset alarm and key V16 N20E for comparison with total attitude display.
4. cb (11) S/C: AEA - close
5.

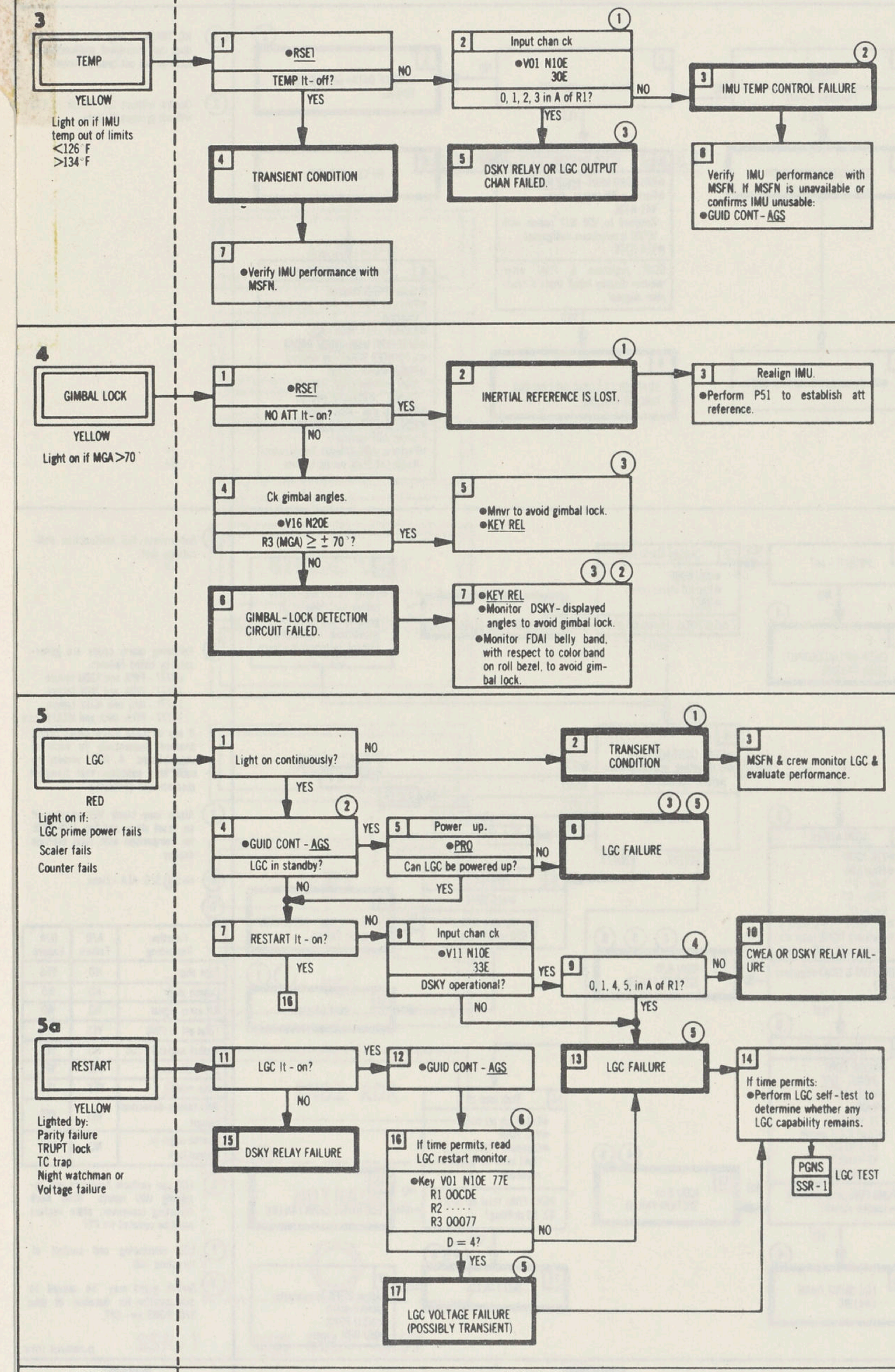
Function Remaining	A/D Failure	D/A Failure
Fine align	NO	YES
Coarse align	NO	NO
Att error signal	NO	NO
Total att to FDAI	YES	YES
Gimbal angles to LGC	NO	YES
IMU stab loop	YES	YES
Cage mode	YES	YES
IMU failure-detection circuit	YES	YES
Coarse align in gimbal lock	NO	YES

6. LGC can perform functions not requiring IMU inputs. After each thrusting maneuver, state vectors must be updated via P27.
7. LGC monitoring and control of thrusting lost.
8. Switch guard may be moved to side position for duration of time S/C: PGNS sw - OFF.

D-300LM5-1024

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



REMARKS

1. R1 readout of 0, 1, 2, 3 indicates IMU temperature is within limits.
2. GN & CS performance will be unaffected by IMU out-of-tolerance temperature for at least 15 minutes. Critical maneuvers can be conducted within this time. IMU stab loop and velocity measurements will be degraded after this time.
3. Subsequent IMU out-of-tolerance temperature indications are lost.

1. LGC commands coarse align when MGA ≥ 85°.
2. GIMBAL LOCK lt unusable for monitoring.
3. Belly band covers separation between hemisphere of FDAI ball. Belly band, in color bands on each side of FDAI roll bezel, would indicate IMU middle gimbal angle ≥ 75°.

1. Transient condition could have existed either in LGC or CWEA.
2. DSKY relay that turns on LGC lt disables gyro torquing and PIPA capability. Hence, LGC monitoring and control of both TVC and RCS attitude maneuvers lost.
3. Attempt repowering LGC by opening and reclosing cb (11) PGNS: LGC/DSKY.
4. Readout of 0, 1, 4, 5 indicates LGC fail signal to CWEA.
5. cb (11) S/C: AEA - close
6.

Alarm Source	Channel 77 Code (Octal)
*Parity fail (F—memory)	001
*Parity fail (E—memory)	003
TC trap	004
RUPT lock	010
Night watchman	020
Voltage fail	040
Counter fail	100
Scaler fail	200
Scaler double frequency alarm	400
*Allowable combinations of above alarms	Octal sum of above codes

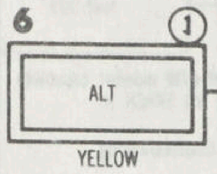
*Parity fail will either be in E—memory or F—memory, but not in combination.

A-300LM5-1017

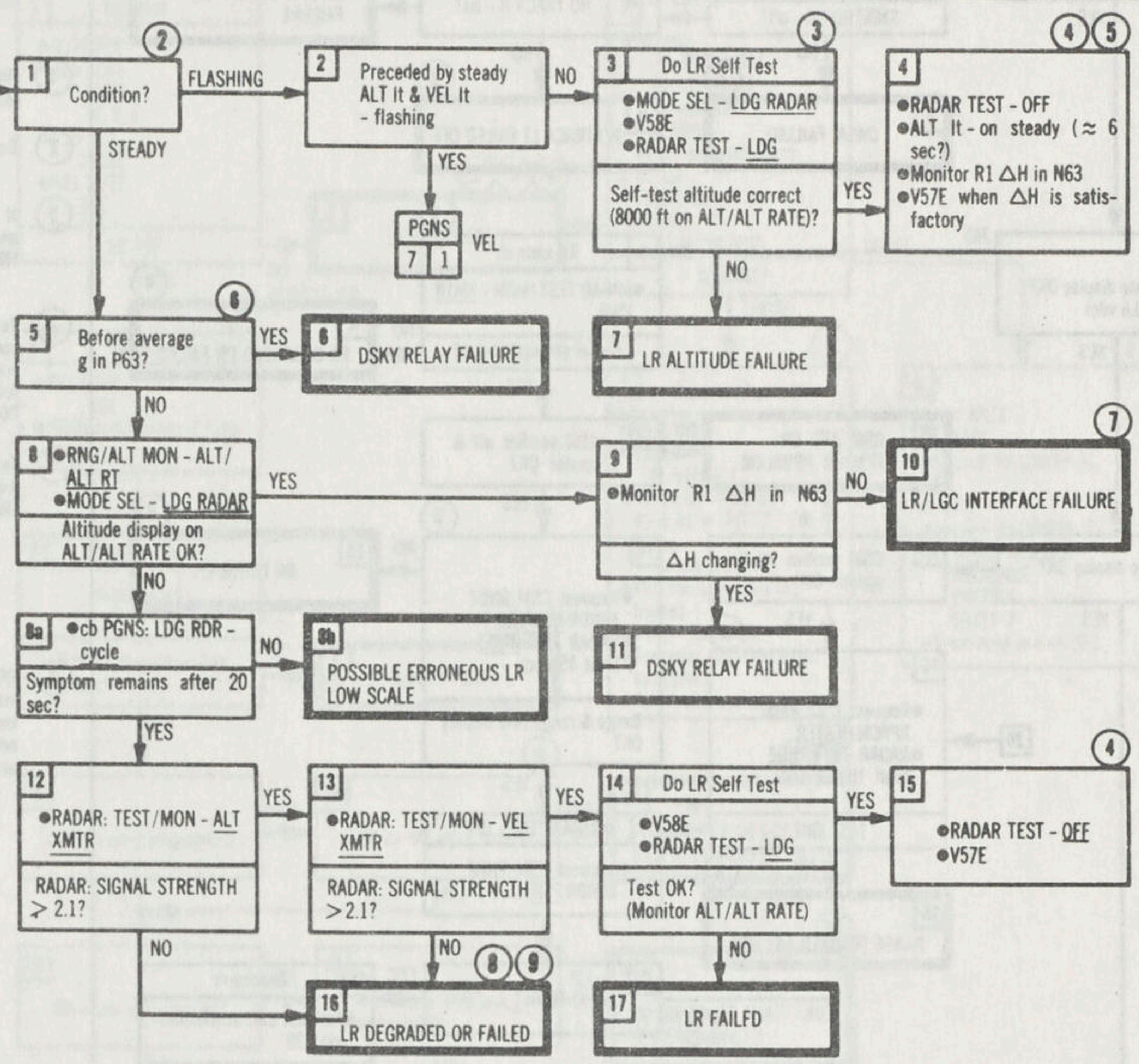
SYMPTOM	PROCEDURE	REMARKS

SYMPTOM | PROCEDURE | REMARKS

6

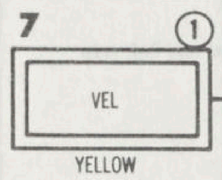


Light on steady if:
LR range data-good discrete not present when LGC tries to read LR altitude (R20)
Expected at:
High altitudes
Off-nominal attitudes (including "belly down")
Zero Doppler
Light flashing if:
LR altitude reasonableness test failed below high-gate (R12)
Expected at:
Lurain discontinuities
Zero Doppler

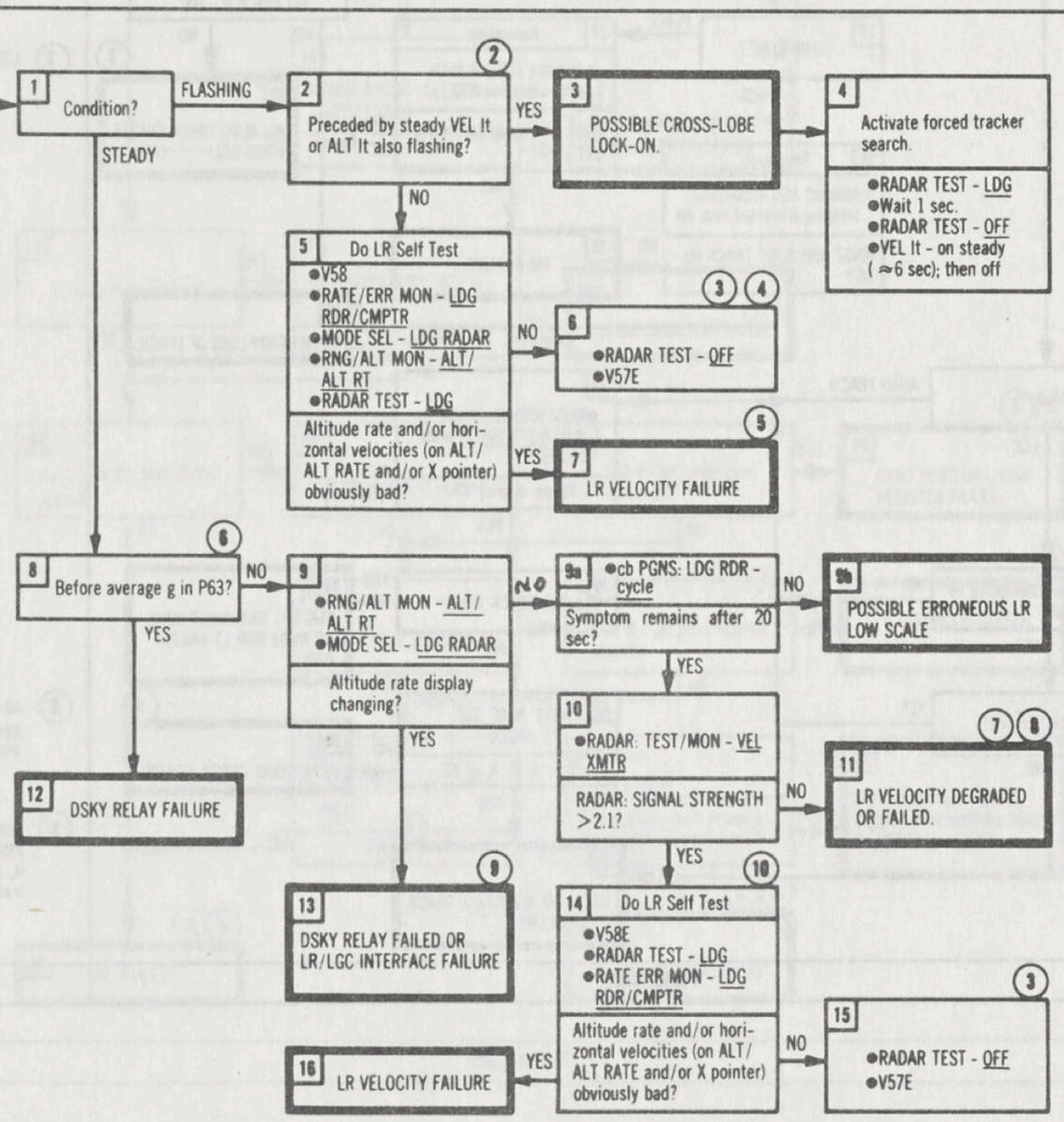


1. Expected zero Doppler regions:
   LR antenna position No. 1 - about 7000 to 5000 feet
   LR antenna position No. 2 - about 350 to 150 feet
2. Altitude reasonabeleness test is performed only after high gate.
3. Time limitations below high gate may not permit test.
4. LR self-test cannot determine cause. Symptom may be temporary due to causes such as those listed in SYMPTOM column.
5. Possible data interface failure.
6. Assumption: R04 is not running.
7. Capability of updating LGC with LR data is lost.
8. If transmitter corona is suspect, cb PGNS: LDG RDR - cycle.
9. If transmitter power, or receiver sensitivity for beams No. 1, 2, or 4, is degraded, altitude data-good may be late.

7



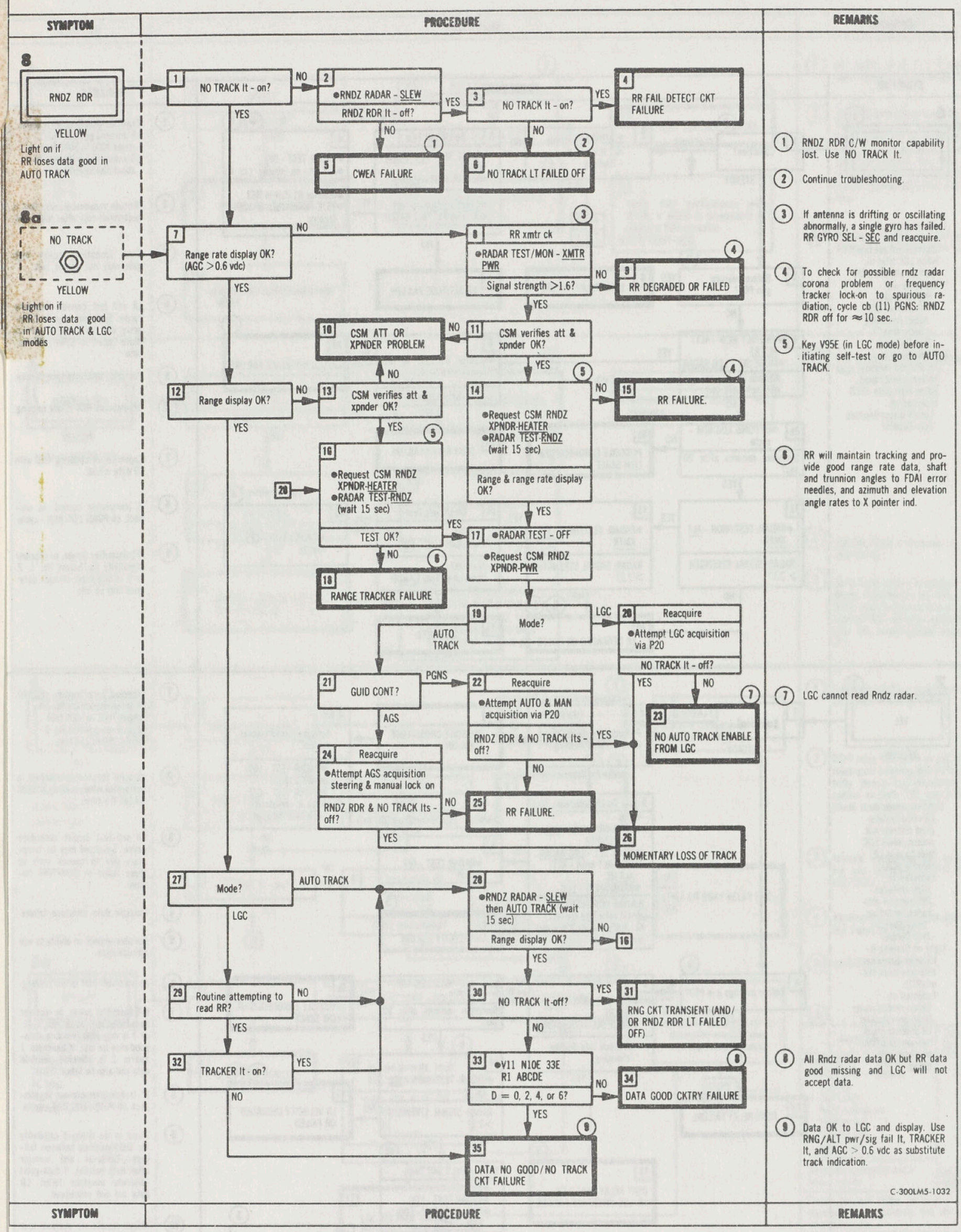
Light on steady if:
LR velocity data-good discrete not present when LGC tries to read LR velocity (R20)
Expected at:
High altitudes
Off-nominal attitudes (including "belly down")
Zero Doppler
Light on flashing if:
LR velocity reasonableness tests failed (R12)
Expected at:
Lurain discontinuity
Near-zero Doppler
LR antenna stuck between positions (at higher altitudes)



1. Expected zero Doppler regions:
   LR antenna position No. 1 - about 7000 to 5000 feet
   LR antenna position No. 2 - about 350 to 150 feet
2. Velocity reasonableness test is performed when velocity < 6000 fps (all the time).
3. LR self-test cannot determine cause. Symptom may be temporary due to causes such as those listed in SYMPTOM column.
4. Possible data interface failure.
5. Possible impact on ability to use altitude data.
6. Assumption: R04 is not running.
7. If transmitter power, or receiver sensitivity for beam No. 1, 2, or 3 is degraded, velocity data-good may be late. If beam No. 1 and/or 2 is affected, altitude data will also be late.
8. If transmitter corona is suspect, cb PGNS: LDG RDR - cycle.
9. There is no onboard capability for distinguishing between failures. Continue and monitor other data sources. If data-good -discrete interface failed, LR data are not processed.
10. Unless results are obvious, test is inconclusive without report of downlink from MSFN.

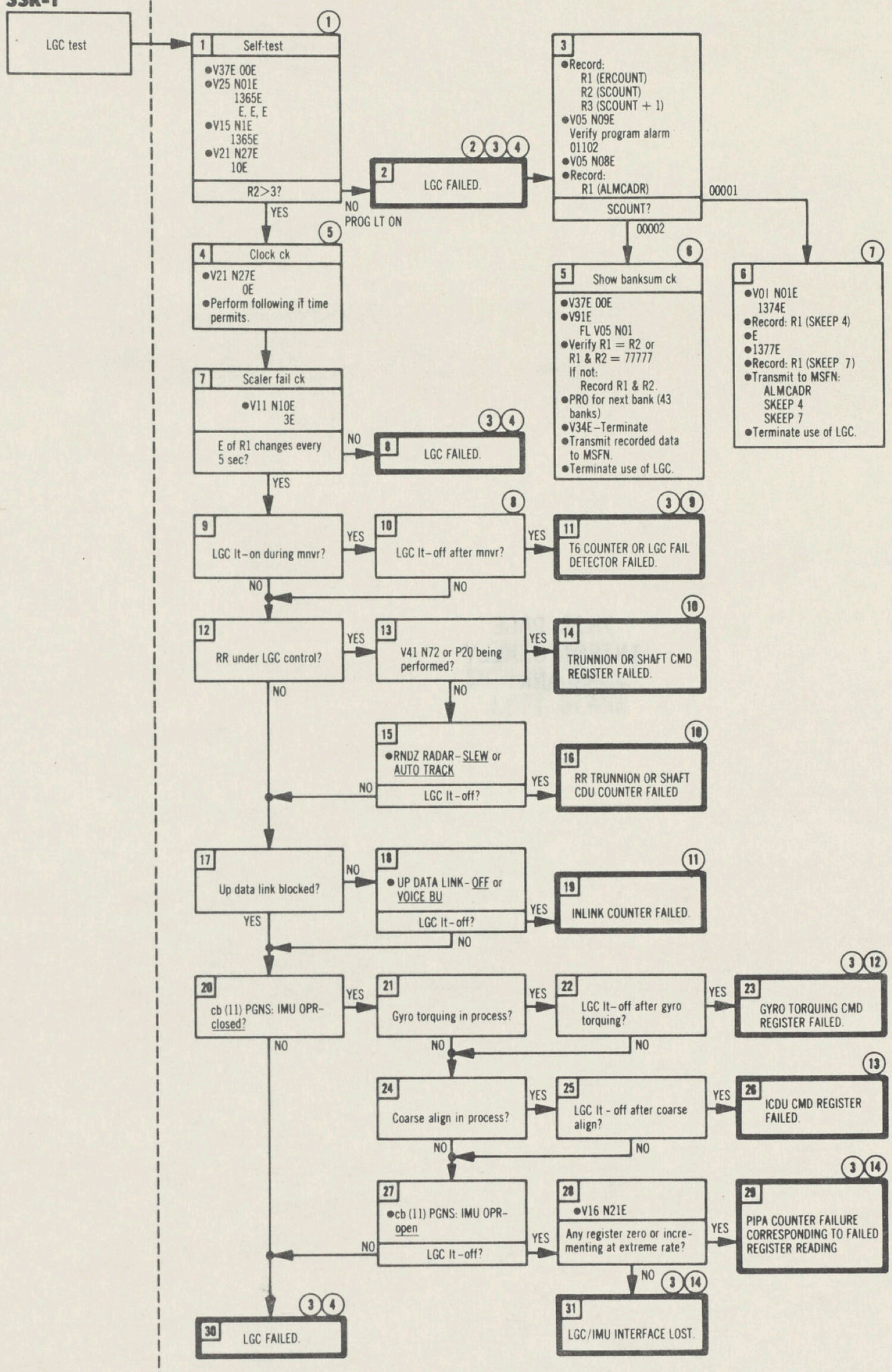
C-300LM5-1040

SYMPTOM | PROCEDURE | REMARKS


SYMPTOM
PROCEDURE
REMARKS
8
RNDZ RDR
YELLOW
Light on if RR loses data good in AUTO TRACK
8a
NO TRACK
YELLOW
Light on if RR loses data good in AUTO TRACK & LGC modes
1 NO TRACK lt - on?
2 •RNDZ RADAR - SLEW
RNDZ RDR lt - off?
3 NO TRACK lt - on?
4 RR FAIL DETECT CKT FAILURE
5 CWEA FAILURE
6 NO TRACK LT FAILED OFF
7 Range rate display OK? (AGC >0.6 vdc)
8 RR xmtr ck
•RADAR TEST/MON - XMTR PWR
Signal strength >1.6?
9 RR DEGRADED OR FAILED
10 CSM ATT OR XPNDER PROBLEM
11 CSM verifies att & xpnder OK?
12 Range display OK?
13 CSM verifies att & xpnder OK?
14 •Request CSM RNDZ XPNDR-HEATER
•RADAR TEST-RNDZ (wait 15 sec)
Range & range rate display OK?
15 RR FAILURE.
16 •Request CSM RNDZ XPNDR-HEATER
•RADAR TEST-RNDZ (wait 15 sec)
TEST OK?
17 •RADAR TEST - OFF
•Request CSM RNDZ XPNDR-PWR
18 RANGE TRACKER FAILURE
19 Mode?
20 Reacquire
•Attempt LGC acquisition via P20
NO TRACK lt - off?
21 GUID CONT?
22 Reacquire
•Attempt AUTO & MAN acquisition via P20
RNDZ RDR & NO TRACK lts - off?
23 NO AUTO TRACK ENABLE FROM LGC
24 Reacquire
•Attempt AGS acquisition steering & manual lock on
RNDZ RDR & NO TRACK lts - off?
25 RR FAILURE.
26 MOMENTARY LOSS OF TRACK
27 Mode?
28 •RNDZ RADAR - SLEW then AUTO TRACK (wait 15 sec)
Range display OK?
29 Routine attempting to read RR?
30 NO TRACK lt-off?
31 RNG CKT TRANSIENT (AND/OR RNDZ RDR LT FAILED OFF)
32 TRACKER lt - on?
33 •V11 N10E 33E R1 ABCDE
D = 0, 2, 4, or 6?
34 DATA GOOD CKTRY FAILURE
35 DATA NO GOOD/NO TRACK CKT FAILURE
YES
NO
AUTO TRACK
LGC
PGNS
AGS
1 RNDZ RDR C/W monitor capability lost. Use NO TRACK lt.
2 Continue troubleshooting.
3 If antenna is drifting or oscillating abnormally, a single gyro has failed. RR GYRO SEL - SEC and reacquire.
4 To check for possible rndz radar corona problem or frequency tracker lock-on to spurious radiation, cycle cb (11) PGNS: RNDZ RDR off for ≈10 sec.
5 Key V95E (in LGC mode) before initiating self-test or go to AUTO TRACK.
6 RR will maintain tracking and provide good range rate data, shaft and trunnion angles to FDAI error needles, and azimuth and elevation angle rates to X pointer ind.
7 LGC cannot read Rndz radar.
8 All Rndz radar data OK but RR data good missing and LGC will not accept data.
9 Data OK to LGC and display. Use RNG/ALT pwr/sig fail lt, TRACKER lt, and AGC > 0.6 vdc as substitute track indication.
C-300LM5-1032

SPECIAL SUBROUTINE	PROCEDURE	REMARKS

SSR-1



1. R2 00001 for at least 13 seconds
   R2 00002 for at least 52 seconds
2. Subsequent use of LGC depends upon MSFN evaluation of succeeding steps in self-test.
3. cb (11) S/C: AEA - close
4. All LGC functions lost.
5. LGC self-test checks only erasable and fixed memory. Other internal problems cannot be determined by self-test.
6. Problem is in erasable memory.
7. Problem is in fixed memory.
8. Do not use LGC control for attitude maneuvers.
9. RCS DAP unusable because T6 counter controls set firing times.
10. LGC control of RR lost.
11. LGC uplink lost
12. IMU cannot be fine aligned.
13. IMU cannot be coarse aligned. Align by caging and/or fine align.
14. IMU usable as attitude reference only.

B-300LM5-1020

SPECIAL SUBROUTINE	PROCEDURE	REMARKS

G&C DISPLAYS

3 THRU 5a

PGNS

8 THRU 8a

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G&C DISPLAYS

PGNS

AGS

AGS MALFUNCTION INDEX

1	AGS
2	DEDA RESPONSE ABNORMAL

SYMPTOM	PROCEDURE	REMARKS

1

AGS

RED

Light on if:

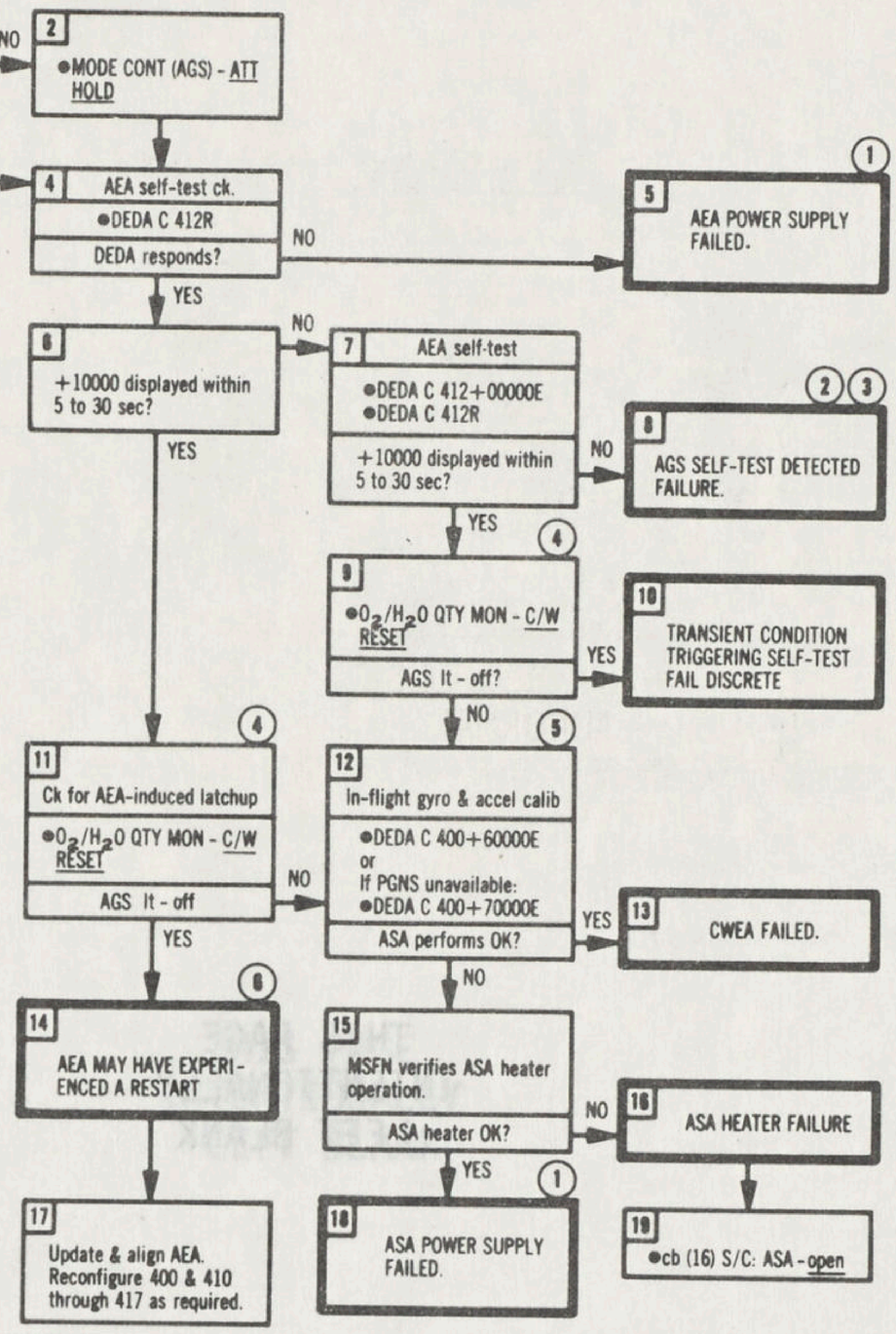
ASA power supplies out of tolerance

ASA heater fails on (activated at 150° ± 5°F)

AEA fails to complete minor cycle within 20 milliseconds

AEA test mode discrete signals failure condition

Light latches on when AEA failure is detected. O_2/H_2O QTY MON must be set to C/W RESET position to unlatch.



(1) AGS lost.

(2) AGS self-test status
412+ X0000
X = 0 Test not complete
X = 1 Test successful
X = 3 Logic test failure
X = 4 Memory test failure
X = 7 Logic and memory test failure

(3) AGS operations not recommended.

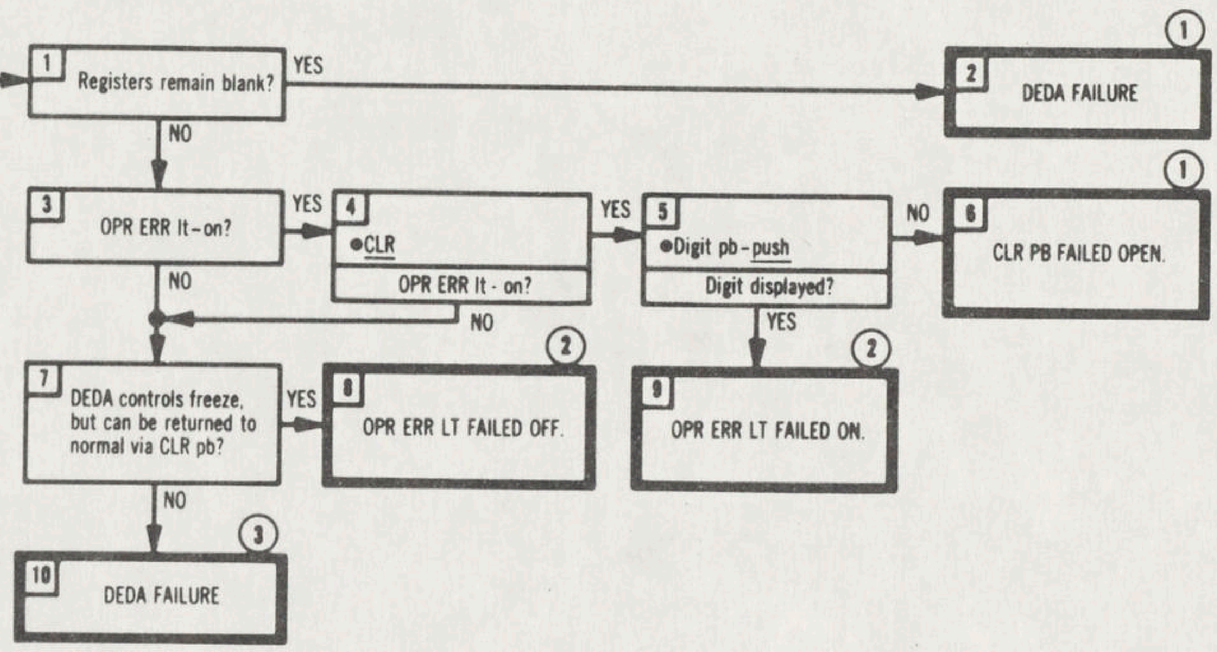
(4) O_2/H_2O QTY MON performs latch-up release when set to C/W RESET.

(5) For PGNS unavailable:
C 400+70000 checks accelerometers only.

(6) AEA restart changes:
470 to −73320, 400 and 410 through 417 to +00000.

2

DEDA response abnormal



(1) Readout and enter functions are lost. AGS flight displays are available, but will become less and less reliable due to inability to be updated, aligned or calibrated.

(2) OPR ERR display lost.

(3) MSFN can confirm DEDA readouts.
a. For following failures, AGS/DEDA capability is unaffected:
EL segments
HOLD pb open
b. For following failure, readout and enter capability is lost:
CLR pb closed
Digit pb closed
ENTR pb closed
HOLD pb closed
READOUT pb closed
AGS flight displays are available, but will become less and less reliable due to inability to be updated, aligned, or calibrated.
c. The pb capability is lost for following failures:
Digit pb open
ENTR pb open*
+ or − pb open*
*AGS can no longer be aligned, updated, or calibrated. AEA routines via SXX entry are lost.

A-300LM5-1011

SYMPTOM	PROCEDURE	REMARKS

G&C DISPLAYS

PGNS

AGS

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CES MALFUNCTION INDEX

1 ABNORMAL VEHICLE DYNAMICS (NON-MPS)
2 LM DRIFTS OUT OF DEADBAND
3 PGNS MINIMUM IMPULSE (V76) COMMANDS ABNORMAL
4 AGS PULSE OR DIRECT COMMANDS ABNORMAL
5 PROPORTIONAL COMMANDS ABNORMAL
6 TTCA COMMANDS ABNORMAL
7 ABNORMAL DYNAMICS DURING MPS THRUSTING

8 ENG GMBL

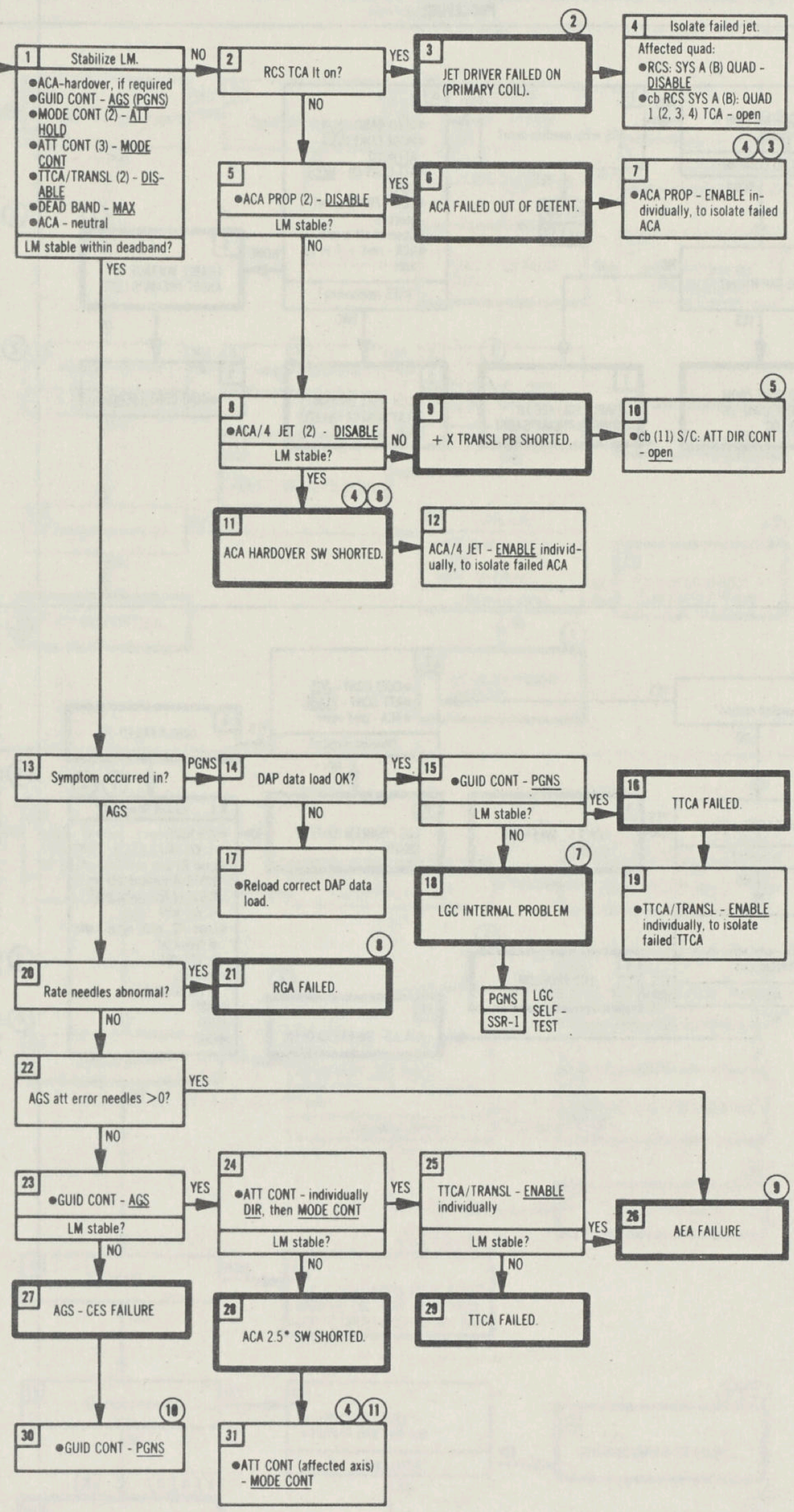
9 NO MPS SHUTDOWN
9a PREMATURE MPS IGNITION
10 NO MPS IGNITION AT TIG = 0
11 ENG THRUST AND CMD THRUST IND DO NOT AGREE

12 PRE AMPS

13 CES AC

14 CES DC

SYMPTOM	PROCEDURE	REMARKS



1 For abnormal dynamics during commanded maneuvers, refer to symptom for associated mode.

2 Single RCS jet failed on, when compensated for by opposing jets, consumes 0.12%/second of total RCS propellant.

3 AGS attitude hold capability remains only in automatic mode

4 Alternative is to replace defective ACA with shorting plug. See CES symptom No. 5, remark No. 6.

5 + X TRANSL pb, hardover, DIRECT mode, and PULSE mode lost.

6 Hardover mode is lost.

7 Internal failure may be confined to LGC input/output channel, which can be determined from RCS cold-fire check.

8 AGS rate command and FDAI rate monitoring lost. If roll or pitch, AGS DPS burn capability lost.

9 Perform AEA self-test.

10 AGS MODE CONT and possibly PULSE mode lost. DIRECT mode is unaffected.

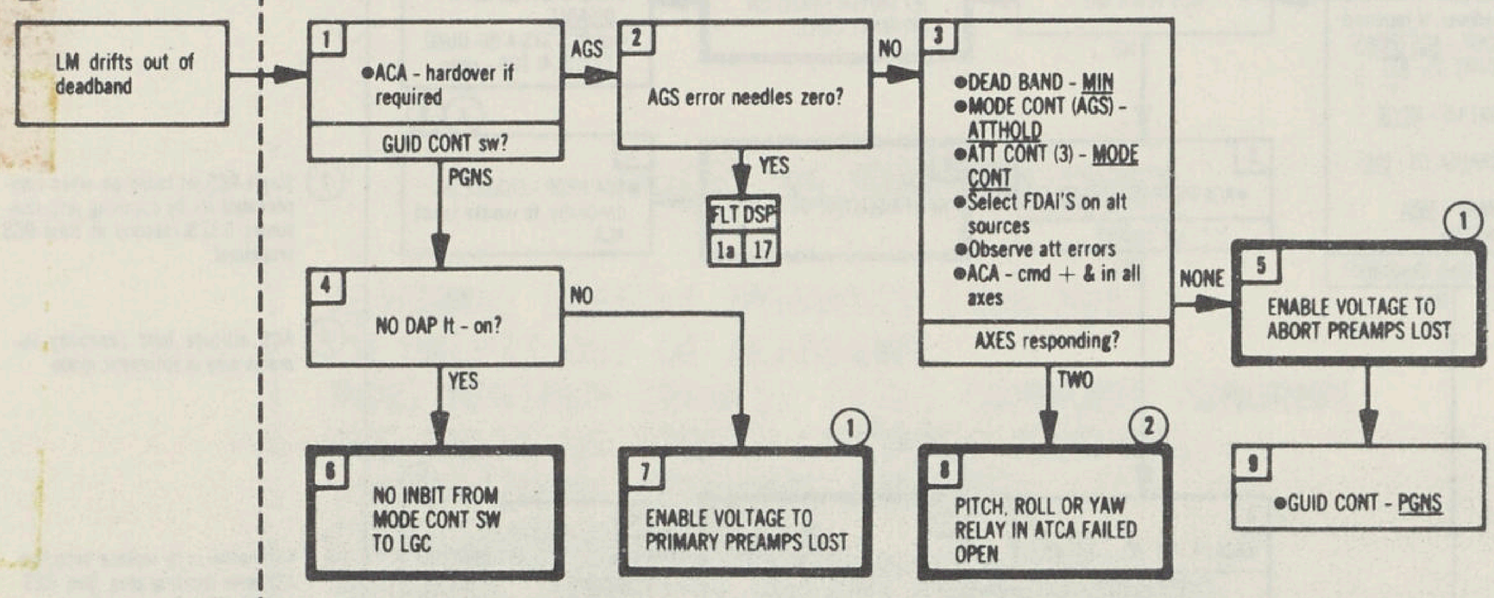
11 DIRECT and PULSE modes lost for affected axis. PGNS minimum impulse mode may be lost in affected axis.

C-300LM5-102

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS

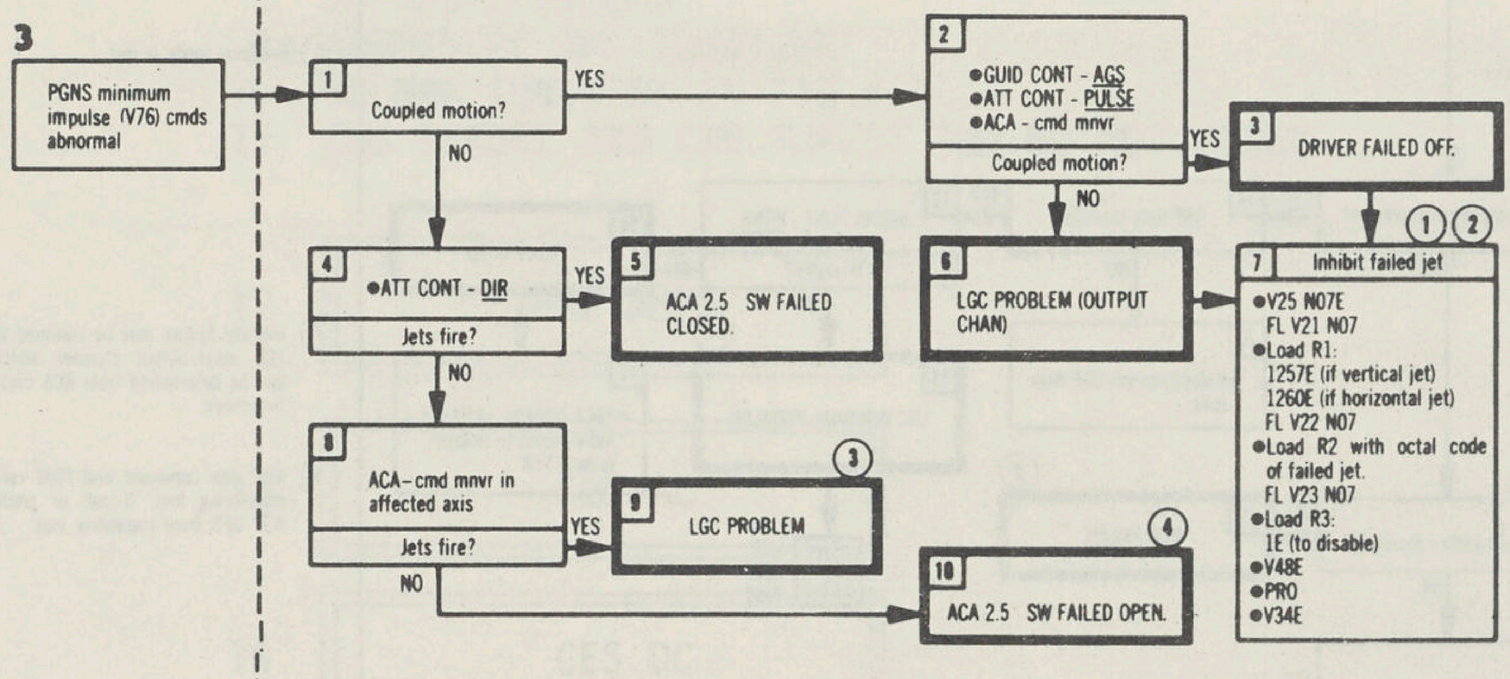
2



(1) RCS control lost for affected pos. of GUID CONT sw. If ATCA circuit breaker for associated guidance system opened, a return to that system for control is impossible.

(2) Only AGS PULSE and DIRECT control are available in affected axis.

3



(1) Alternative procedure -
Affected system:
RCS: SYS (affected quad) - DISABLE; tb - bp
Thruster disable discrete to LGC may be reset by recycling RCS: SYS (affected quad) - ENABLE; tb - gray

(2) Octal code of failed jet:

1U - 100E	4U - 1E
1D - 200E	4D - 2E
1F - 4E	4F - 2E
1L - 200E	4R - 100E
2U - 20E	3U - 4E
2D - 40E	3D - 10E
2A - 10E	3A - 1E
2I - 20E	3R - 40E

(3) If problem is in pitch or roll, LPD is lost.

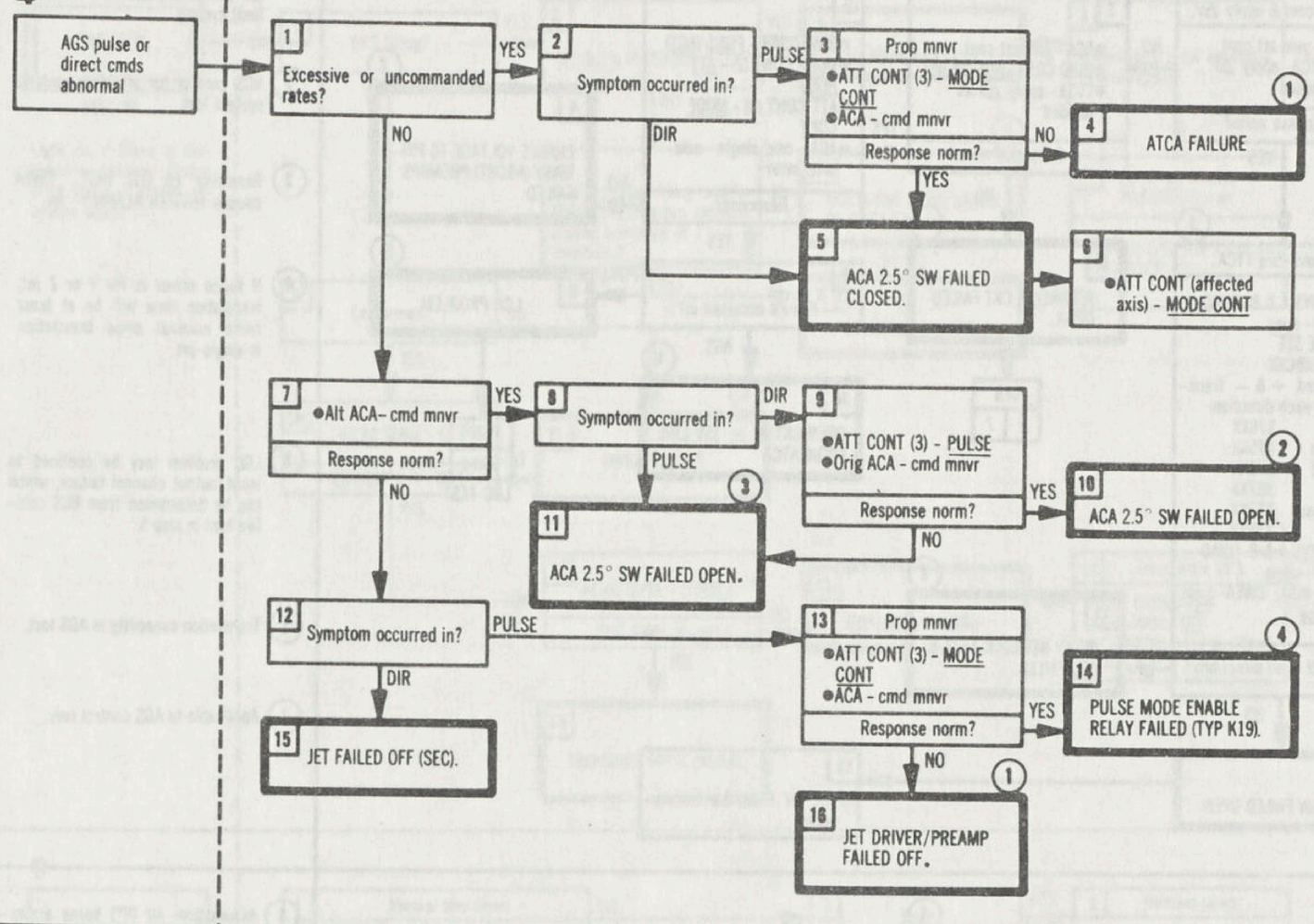
(4) LGC minimum implse, AGS pulse, and one-half of direct authority are lost for affected ACA.

B-300LM5-1014

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS

4



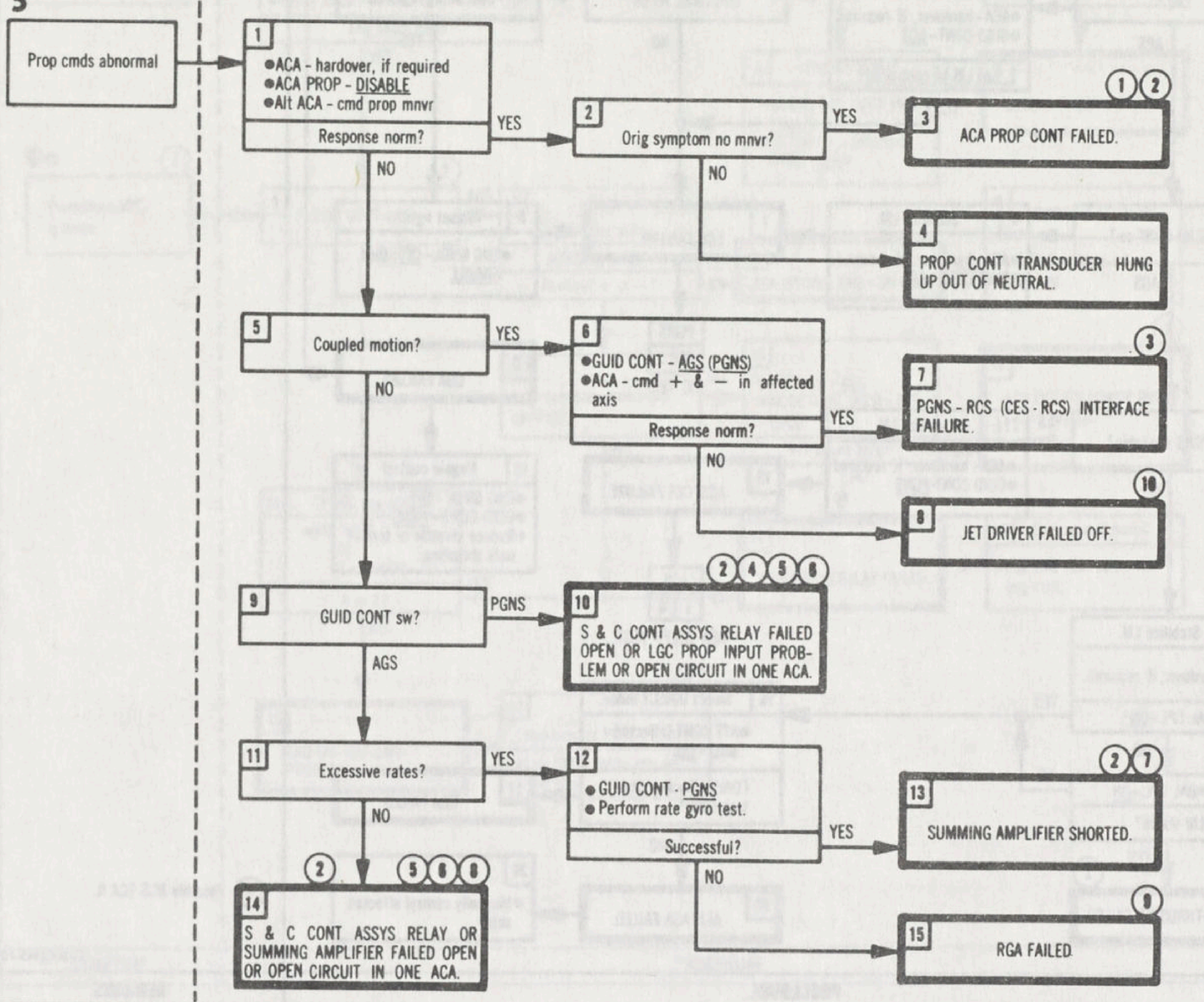
(1) Affected axis may be available in PGNS (if preamp failed).

(2) One-half of DIRECT authority lost for affected ACA.

(3) LGC minimum impulse, AGS PULSE, and one-half of DIRECT authority lost for affected ACA.

(4) AGS PULSE mode lost for affected axis.

5



(1) Prop control lost for affected ACA.

(2) Failure may be single or multiaxis.

(3) Failure could be open LGC output channel, summing amplifier, pulse rate module, or preamplifier.

(4) Prop control lost for affected guidance system. DIRECT and PULSE control unaffected.

(5) If symptom is present in both guidance modes, malfunction may be open circuit in one ACA.

(6) To remove ACA and replace with shorting plug:
- •cb (11) S/C:
  ATT DIR CONT - open
  ATCA (PGNS) - open
- •cb (16) S/C: ATCA (AGS) - open
- •cb (11) COMM: CDR - open (for CDR ACA)
  or
  cb (16) COMM: SE - open (for LMP ACA)
- •ACA PROP (2) - DISABLE
- •AUDIO CONT (2) - NORM

On suspected ACA:
- •P & J 709 - disconnect
- •P & J 708 - disconnect
- •Install jumper plug on J 709.
- •Install dust cap on J 708.
- •Close above cb's & reconfigure switches.

Since vehicle attitude control is lost during switch over, use of this procedure during controlled flight is not recommended.

(7) PGNS and DIRECT control unaffected. PULSE control may be available in AGS.

(8) DIRECT control unaffected. Prop control may be OK in alternative guidance system.

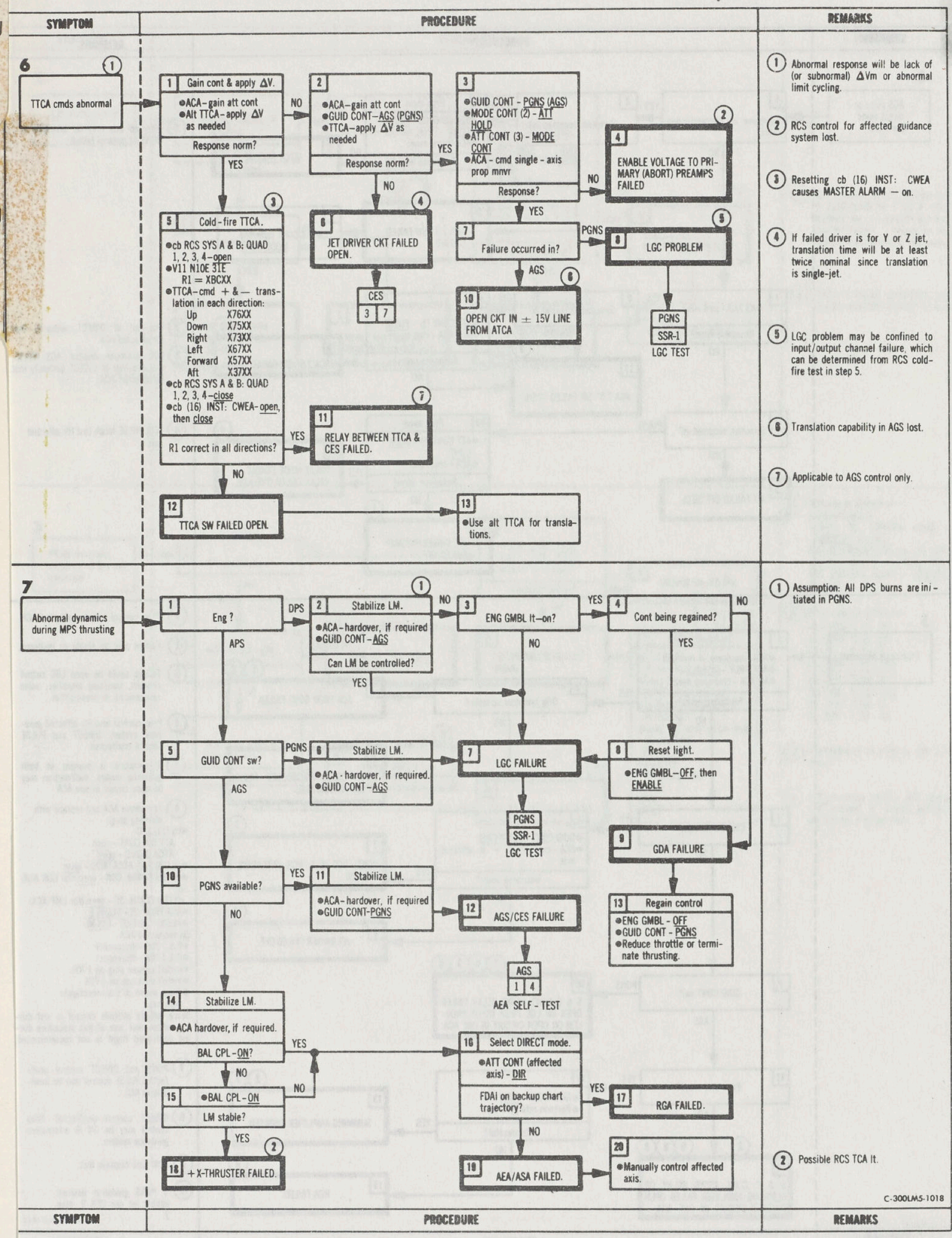
(9) FDAI rate displays lost.

(10) If PGNS guidance desired, inhibit jet per CES 3, step 7.

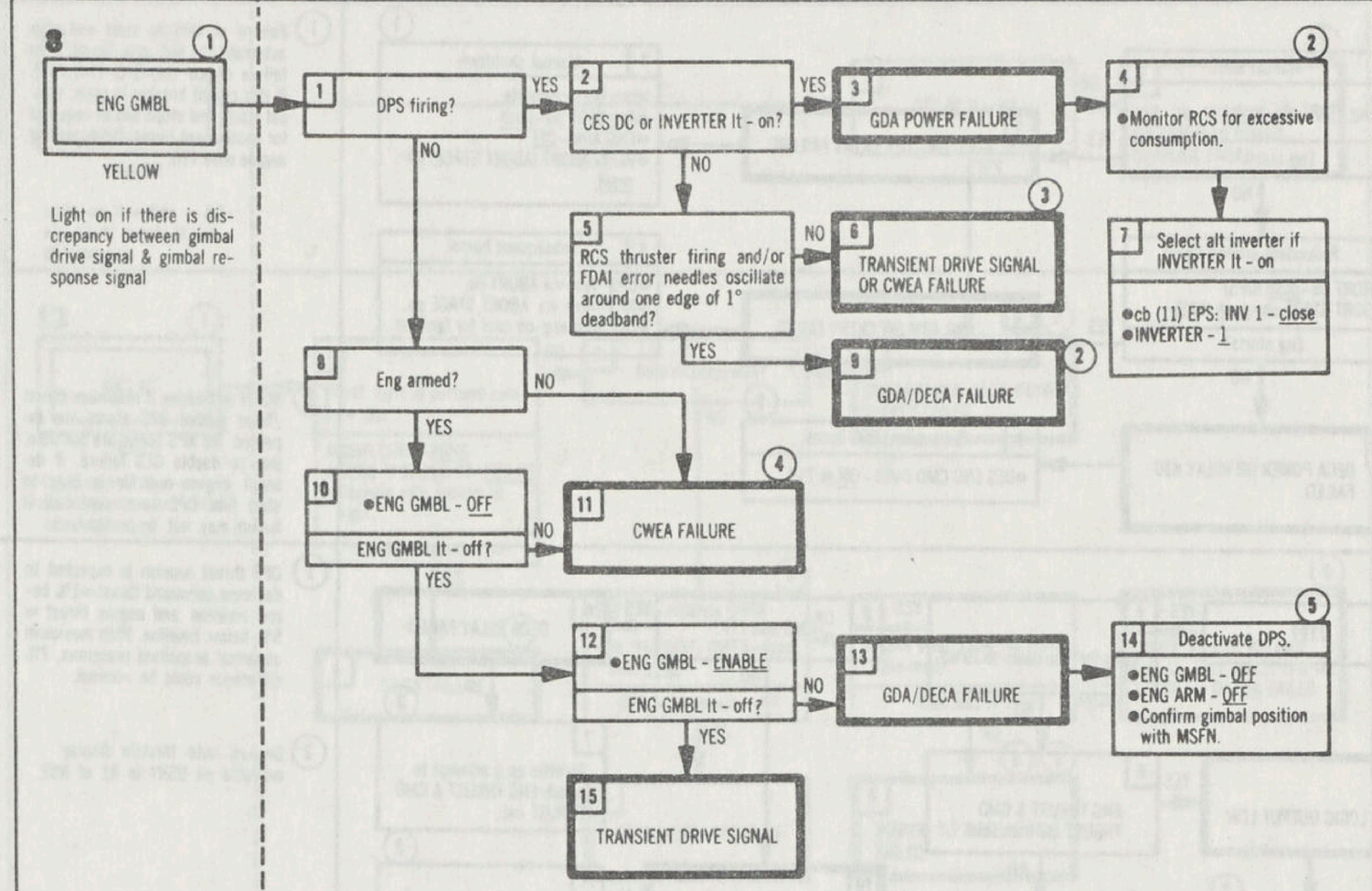
B-300LM5-1012

SYMPTOM	PROCEDURE	REMARKS

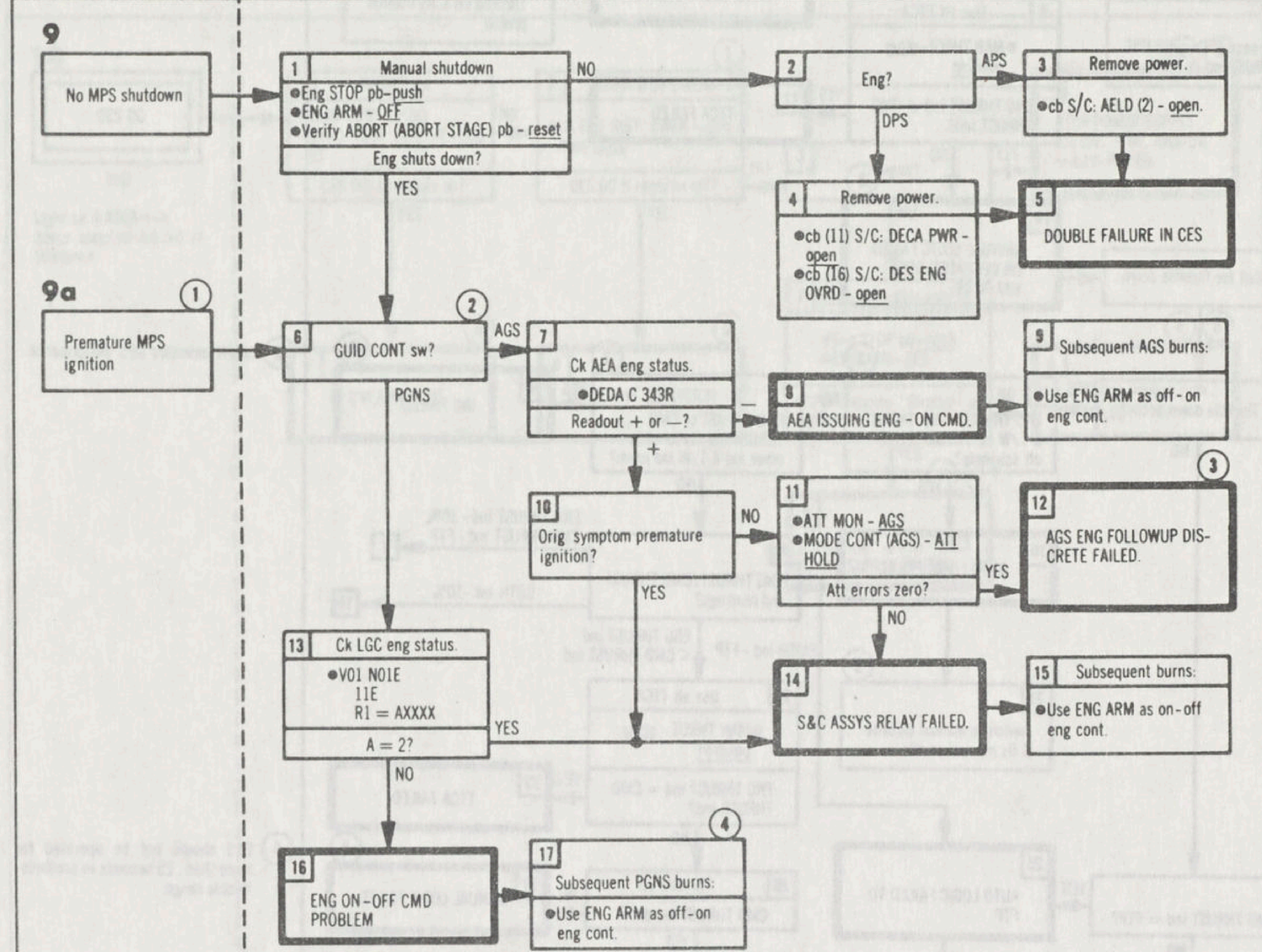
G&C DISPLAYS 2 THRU 3 | PGNS 6 THRU 7 | AGS | CES



SYMPTOM	PROCEDURE	REMARKS



1. Light is inhibited when ENG ARM - OFF.
2. Mission rules dictate crew action. Continuation of powered descent will result in abnormal RCS fuel consumption and possible violation of thermal constraints.
3. It is possible to distinguish between these failures by resetting ENG GMBL It. (ENG GMBL - OFF, then ENABLE.)
4. C/W monitoring of GDA lost.
5. It may be possible to reset gimbal position, using alternative guidance system and MSFN information.

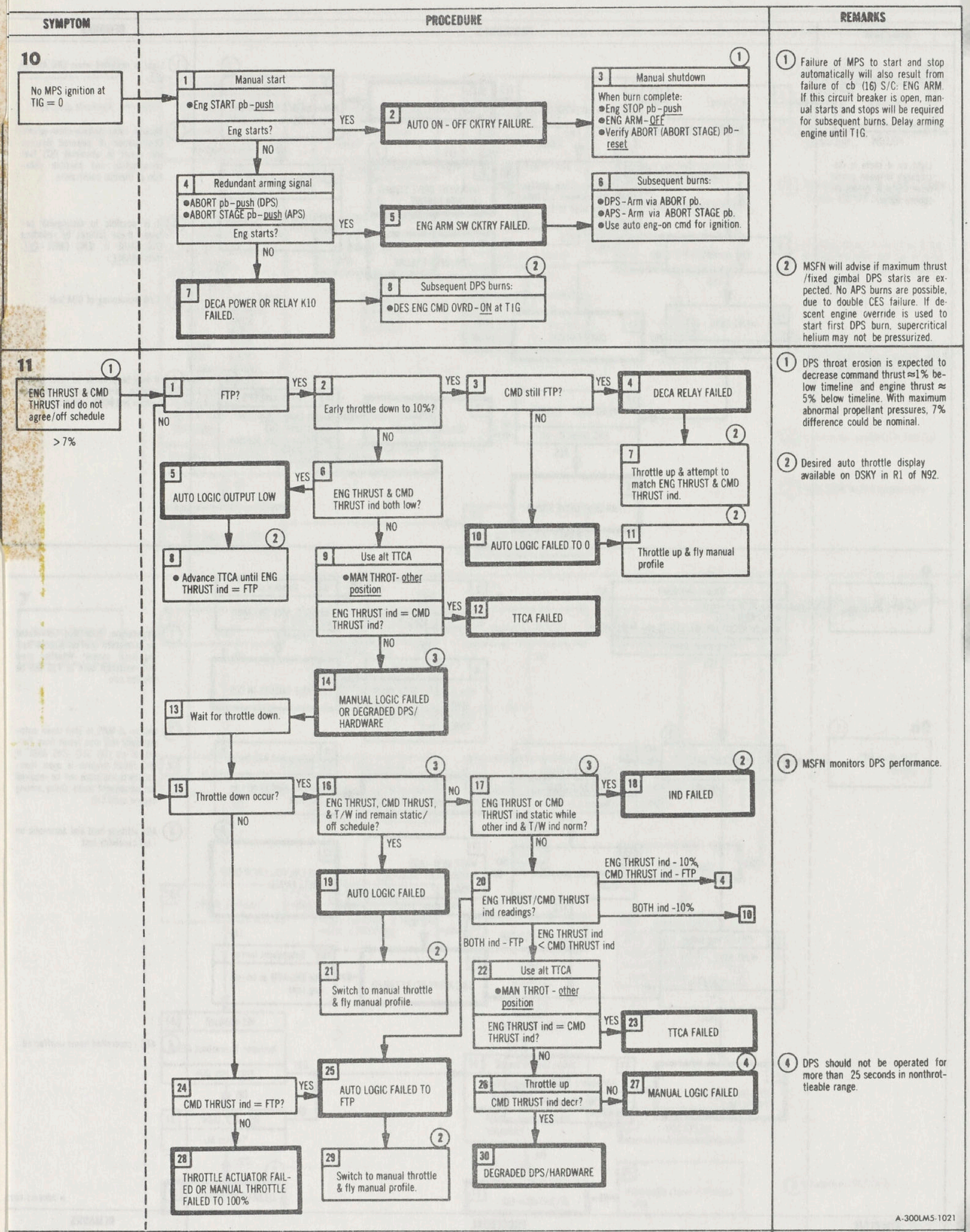


1. Assumption: Burn was terminated on premature ignition (except during lunar ascent). Whether crew will reattempt burn at TIG will be mission rule.
2. Failure of MPS to shut down automatically will also result from failure of cb (16) S/C: ENG ARM. If this circuit breaker is open, manual starts and stops will be required for subsequent burns. Delay arming engine until TIG.
3. AGS attitude hold and automatic on - off capability lost.
4. AGS - controlled burns unaffected.

A-300LM5-102

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



REMARKS

(1) Failure of MPS to start and stop automatically will also result from failure of cb (16) S/C: ENG ARM. If this circuit breaker is open, manual starts and stops will be required for subsequent burns. Delay arming engine until TIG.

(2) MSFN will advise if maximum thrust /fixed gimbal DPS starts are expected. No APS burns are possible, due to double CES failure. If descent engine override is used to start first DPS burn, supercritical helium may not be pressurized.

(1) DPS throat erosion is expected to decrease command thrust ≈1% below timeline and engine thrust ≈ 5% below timeline. With maximum abnormal propellant pressures, 7% difference could be nominal.

(2) Desired auto throttle display available on DSKY in R1 of N92.

(3) MSFN monitors DPS performance.

(4) DPS should not be operated for more than 25 seconds in nonthrottleable range.

A-300LM5-1021

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS
12 PRE AMPS — YELLOW. Light on if either −4.7-vdc power supply is out of tolerance	1 CES AC lt-on? NO → 2 ONE OR BOTH −4.7-VDC PREAMP BIAS POWER SUPPLIES FAILED. (1) YES ↓	(1) Sporadic jet firings are possible if both power supplies failed.
13 (1) CES AC — RED. Light on if ATCA a-c power supplies are out of tolerance	1 Reset light & perform rate gyro test. ●GUID CONT-PGNS ●GYRO TEST POS RT-POS RT ●Observe rate needles & light. CES AC lt remains on? YES → 4 CWEA FAILURE (4). NO → 2 Rate displays null? YES → 3 SINGLE-PHASE ATCA POWER SUPPLY FAILED. (2)(3). NO → 5 Reinitialize CWEA (5) ●cb (16) INST: CWEA-open, then close. CES AC lt remains off? YES → 8 TRANSIENT CONDITION. NO → 6 ●Make small mnvr via PGNS rate mode. Rate inds >0? YES → 7 POWER SUPPLY VOLTAGE OUT OF TOLERANCE (1ϕ OR 3ϕ) OR 1ϕ OF 3ϕ FAILED. (6). NO → 9 POWER TO RATE GYRO FAILED. (2)(7)	(1) If AGS is in control, true CES a-c failure causes loss of damping. (2) AGS control of LM lost, but AEA remains for computation purposes only. (3) RR usable only in LGC mode. Shaft and trunnion power lost in SLEW and AUTO TRACK. (4) Subsequent CES a-c monitoring lost. (5) Resetting cb (16) INST: CWEA causes MASTER ALARM — on. (6) Rate gyro assembly will probably not restart after shutdown. (7) FDAI rate needles are invalid, but rates may be displayed on error needles via V60E (full-scale deflection = ± 1.25°/sec).
14 CES DC — RED. Light on if ATCA d-c power supplies are out of tolerance	1 Reset light. ●GUID CONT-PGNS ●GYRO TEST POS RT-POS RT. CES DC lt remains on? YES → 5 CWEA FAILURE (4). NO → 2 Reinitialize CWEA. (1) ●cb (16) INST: CWEA-open, then close. CES DC lt remains off? YES → 6 TRANSIENT CONDITION (5). NO → 3 Staged? YES → 4 ATCA POWER SUPPLY (±15V, +6V, AND/OR +4.3V) FAILED. (2)(3). NO → 7 Enable throttle actuator. ●Eng STOP pb-push ●ENG ARM-DES. MSFN reports throttle at max? NO → 8 +6V ATCA POWER SUPPLY FAILED. (4)(6). YES → 9 +15V OR +4.3V ATCA POWER SUPPLY FAILED. (4)(7)	(1) Resetting cb (16) INST: CWEA causes MASTER ALARM — on. (2) AGS attitude control lost. (3) Subsequent APS burns should be started manually. (4) Subsequent CES d-c monitoring lost. (5) This transient condition may have caused throttle to lock in 100% position. Cycle cb AC BUS A: DECA GMBL and/or check throttle position with MSFN. (6) DPS and APS operation is normal in PGNS. (7) DPS fixed at maximum throttle with gimbal locked.

B-300LM5-1013

SYMPTOM	PROCEDURE	REMARKS

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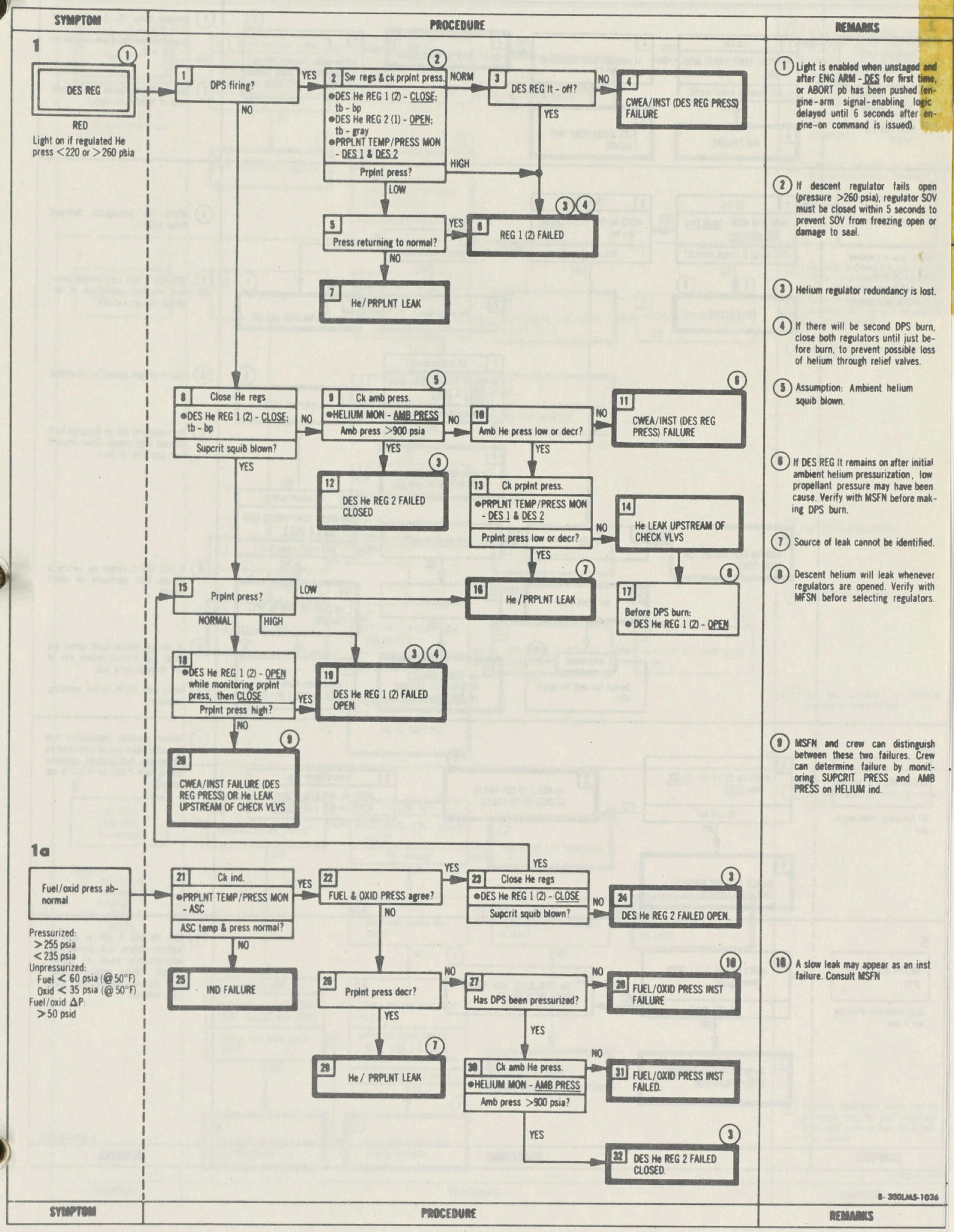
DPS ~~DSP~~ MALFUNCTION INDEX

1 DES REG

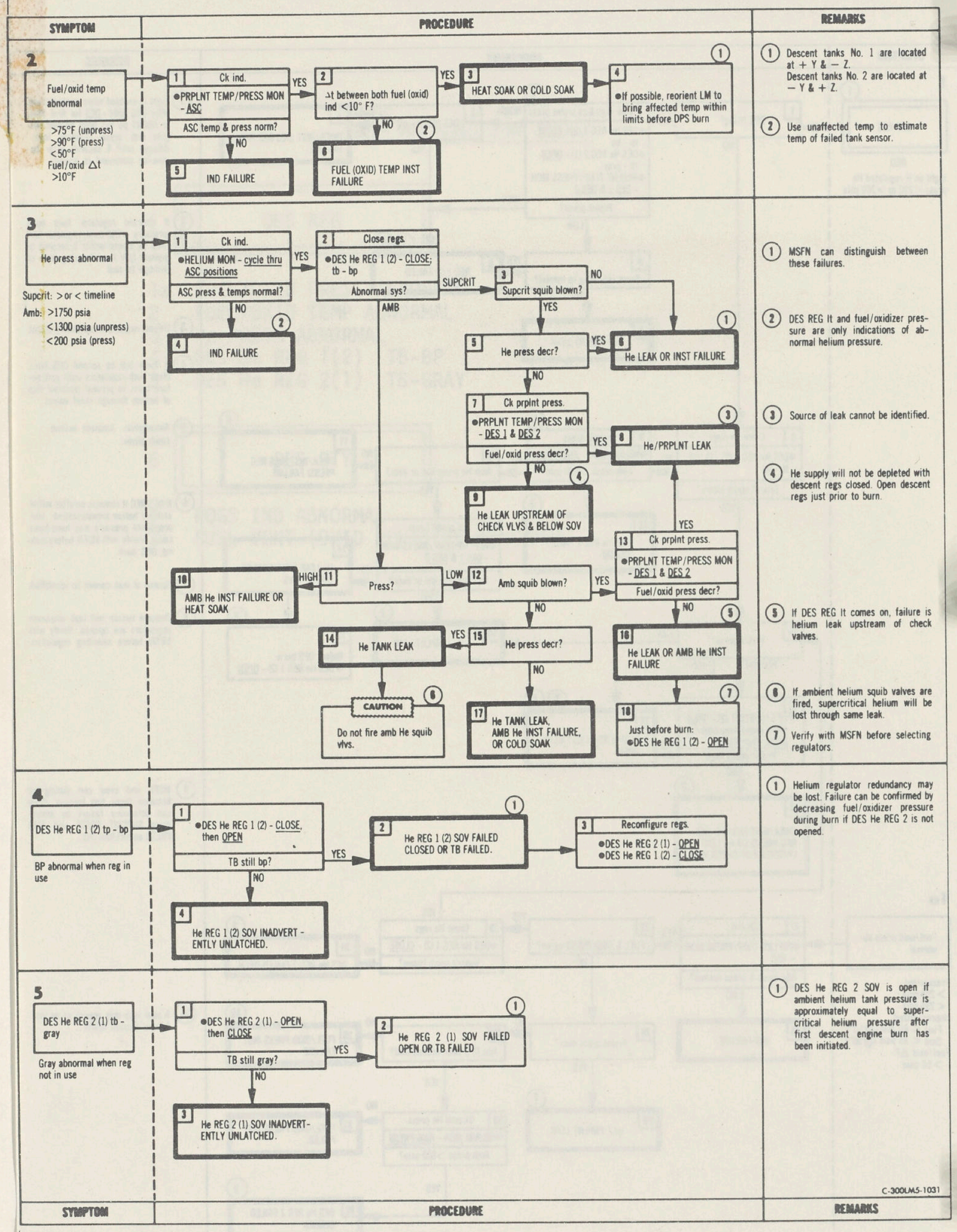
1a FUEL/OXID PRESS ABNORMAL
2 FUEL/OXID TEMP ABNORMAL
3 He PRESS ABNORMAL
4 DES He REG 1(2) TB-BP
5 DES He REG 2(1) TB-GRAY

6 DES QTY

7 PQGS IND ABNORMAL
8 FUEL VENT (OXID VENT) TB-ABNORMAL

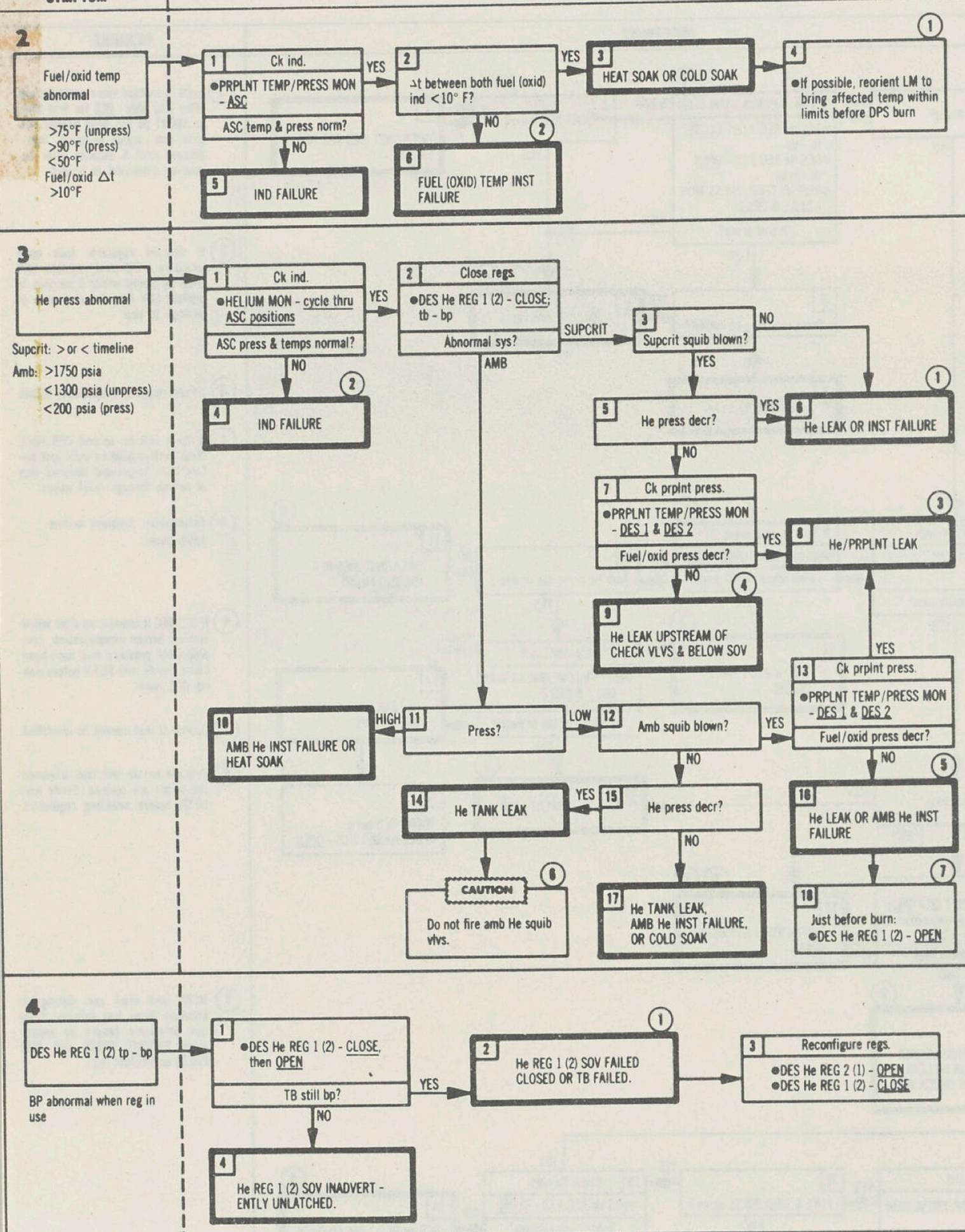

SYMPTOM
PROCEDURE
REMARKS
1
DES REG
RED
Light on if regulated He press <220 or >260 psia
1 DPS firing?
YES
NO
2 Sw regs & ck prplnt press.
●DES He REG 1 (2) - CLOSE; tb - bp
●DES He REG 2 (1) - OPEN; tb - gray
●PRPLNT TEMP/PRESS MON - DES 1 & DES 2
Prplnt press?
NORM
HIGH
LOW
3 DES REG lt - off?
NO
YES
4 CWEA/INST (DES REG PRESS) FAILURE
5 Press returning to normal?
YES
NO
6 REG 1 (2) FAILED
7 He/PRPLNT LEAK
8 Close He regs
●DES He REG 1 (2) - CLOSE; tb - bp
Supcrit squib blown?
9 Ck amb press.
●HELIUM MON - AMB PRESS
Amb press >900 psia
10 Amb He press low or decr?
11 CWEA/INST (DES REG PRESS) FAILURE
12 DES He REG 2 FAILED CLOSED
13 Ck prplnt press.
●PRPLNT TEMP/PRESS MON - DES 1 & DES 2
Prplnt press low or decr?
14 He LEAK UPSTREAM OF CHECK VLVS
15 Prplnt press?
NORMAL
HIGH
LOW
16 He/PRPLNT LEAK
17 Before DPS burn:
● DES He REG 1 (2) - OPEN
18 ●DES He REG 1 (2) - OPEN while monitoring prplnt press, then CLOSE
Prplnt press high?
19 DES He REG 1 (2) FAILED OPEN
20 CWEA/INST FAILURE (DES REG PRESS) OR He LEAK UPSTREAM OF CHECK VLVS
1a
Fuel/oxid press abnormal
Pressurized:
>255 psia
<235 psia
Unpressurized:
Fuel < 60 psia (@ 50°F)
Oxid < 35 psia (@ 50°F)
Fuel/oxid ΔP:
>50 psid
21 Ck ind.
●PRPLNT TEMP/PRESS MON - ASC
ASC temp & press normal?
22 FUEL & OXID PRESS agree?
23 Close He regs
●DES He REG 1 (2) - CLOSE
Supcrit squib blown?
24 DES He REG 2 FAILED OPEN.
25 IND FAILURE
26 Prplnt press decr?
27 Has DPS been pressurized?
28 FUEL/OXID PRESS INST FAILURE
29 He/PRPLNT LEAK
30 Ck amb He press.
●HELIUM MON - AMB PRESS
Amb press >900 psia?
31 FUEL/OXID PRESS INST FAILED.
32 DES He REG 2 FAILED CLOSED.
(1) Light is enabled when unstaged and after ENG ARM - DES for first time, or ABORT pb has been pushed (engine-arm signal-enabling logic delayed until 6 seconds after engine-on command is issued).
(2) If descent regulator fails open (pressure >260 psia), regulator SOV must be closed within 5 seconds to prevent SOV from freezing open or damage to seal.
(3) Helium regulator redundancy is lost.
(4) If there will be second DPS burn, close both regulators until just before burn, to prevent possible loss of helium through relief valves.
(5) Assumption: Ambient helium squib blown.
(6) If DES REG lt remains on after initial ambient helium pressurization, low propellant pressure may have been cause. Verify with MSFN before making DPS burn.
(7) Source of leak cannot be identified.
(8) Descent helium will leak whenever regulators are opened. Verify with MFSN before selecting regulators.
(9) MSFN and crew can distinguish between these two failures. Crew can determine failure by monitoring SUPCRIT PRESS and AMB PRESS on HELIUM ind.
(10) A slow leak may appear as an inst failure. Consult MSFN
B-300LM5-1026

G&C DISPLAYS 2 THRU 5 | PGNS | AGS | CES | DPS



2 THRU 5

SYMPTOM	PROCEDURE	REMARKS



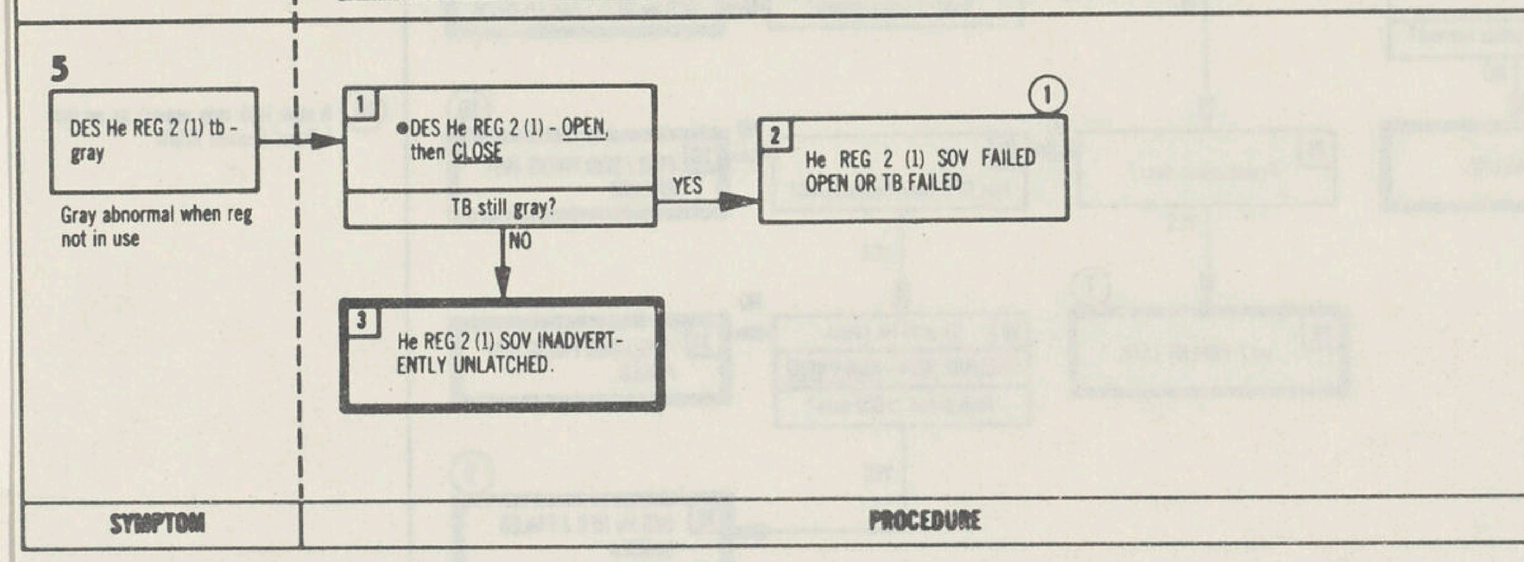
REMARKS

1. Descent tanks No. 1 are located at + Y & − Z. Descent tanks No. 2 are located at − Y & + Z.
2. Use unaffected temp to estimate temp of failed tank sensor.

1. MSFN can distinguish between these failures.
2. DES REG It and fuel/oxidizer pressure are only indications of abnormal helium pressure.
3. Source of leak cannot be identified.
4. He supply will not be depleted with descent regs closed. Open descent regs just prior to burn.
5. If DES REG It comes on, failure is helium leak upstream of check valves.
6. If ambient helium squib valves are fired, supercritical helium will be lost through same leak.
7. Verify with MSFN before selecting regulators.

REMARKS

1. Helium regulator redundancy may be lost. Failure can be confirmed by decreasing fuel/oxidizer pressure during burn if DES He REG 2 is not opened.



REMARKS

1. DES He REG 2 SOV is open if ambient helium tank pressure is approximately equal to supercritical helium pressure after first descent engine burn has been initiated.

C-300LM5-1031

SYMPTOM	PROCEDURE	REMARKS

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APS MALFUNCTION INDEX

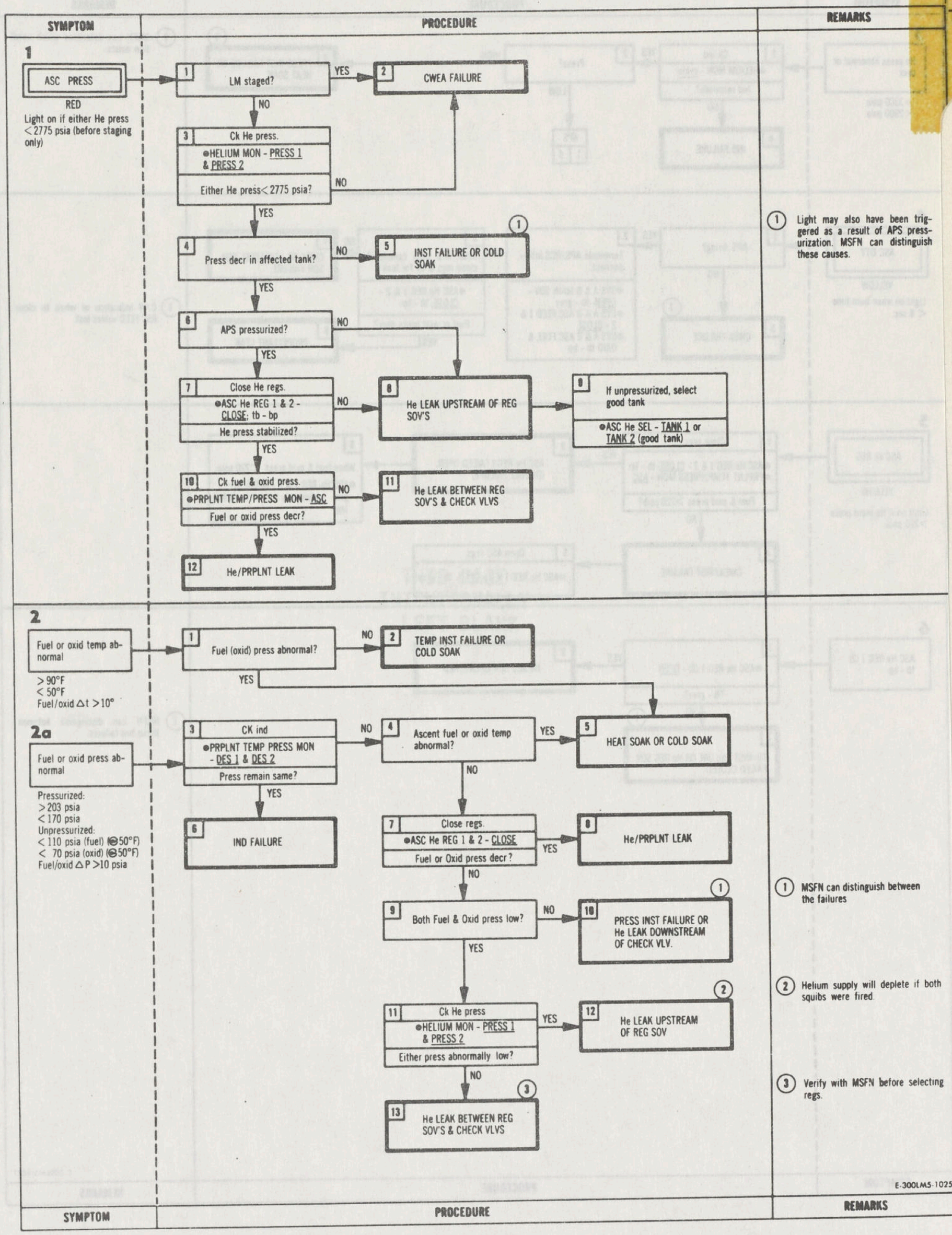
1 ASC PRESS

2 FUEL OR OXID TEMP ABNORMAL
2a FUEL OR OXID PRESS ABNORMAL
3 He PRESS ABNORMAL OR DECR

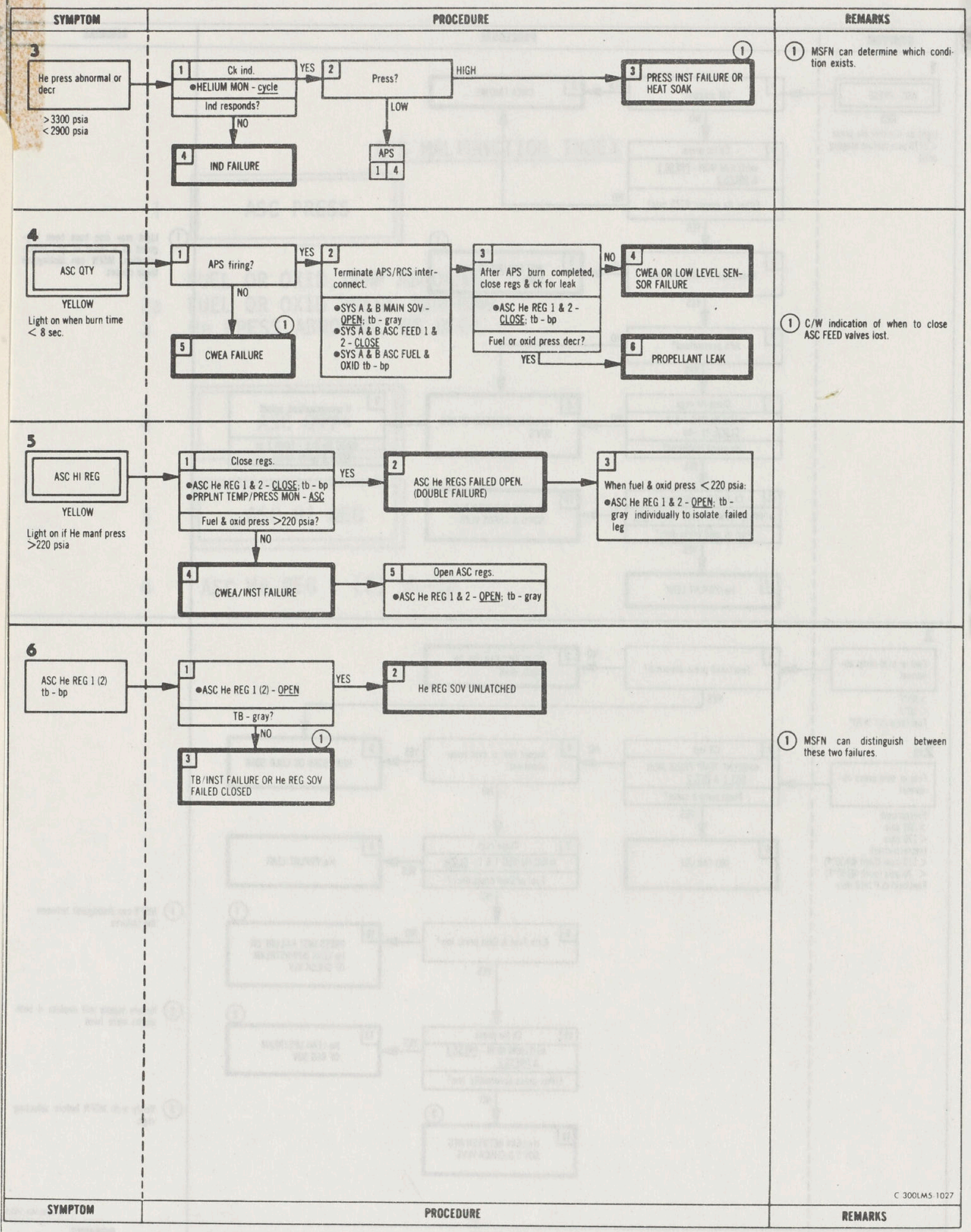
4 ASC QTY

5 ASC HI REG

6 ASC He REG 1 (2) tb-bp


SYMPTOM
PROCEDURE
REMARKS
1
ASC PRESS
RED
Light on if either He press < 2775 psia (before staging only)
1 LM staged?
YES
2 CWEA FAILURE
NO
3 Ck He press.
●HELIUM MON - PRESS 1 & PRESS 2
Either He press < 2775 psia?
NO
YES
4 Press decr in affected tank?
NO
5 INST FAILURE OR COLD SOAK
YES
6 APS pressurized?
NO
YES
7 Close He regs.
●ASC He REG 1 & 2 - CLOSE; tb - bp
He press stabilized?
NO
8 He LEAK UPSTREAM OF REG SOV'S
9 If unpressurized, select good tank
●ASC He SEL - TANK 1 or TANK 2 (good tank)
YES
10 Ck fuel & oxid press.
●PRPLNT TEMP/PRESS MON - ASC
Fuel or oxid press decr?
NO
11 He LEAK BETWEEN REG SOV'S & CHECK VLVS
YES
12 He/PRPLNT LEAK
1 Light may also have been triggered as a result of APS pressurization. MSFN can distinguish these causes.
2
Fuel or oxid temp abnormal
> 90°F
< 50°F
Fuel/oxid Δt > 10°
1 Fuel (oxid) press abnormal?
NO
2 TEMP INST FAILURE OR COLD SOAK
YES
2a
Fuel or oxid press abnormal
Pressurized:
> 203 psia
< 170 psia
Unpressurized:
< 110 psia (fuel) (@50°F)
< 70 psia (oxid) (@50°F)
Fuel/oxid ΔP > 10 psia
3 CK ind
●PRPLNT TEMP PRESS MON - DES 1 & DES 2
Press remain same?
NO
4 Ascent fuel or oxid temp abnormal?
YES
5 HEAT SOAK OR COLD SOAK
NO
YES
6 IND FAILURE
7 Close regs.
●ASC He REG 1 & 2 - CLOSE
Fuel or Oxid press decr?
YES
8 He/PRPLNT LEAK
NO
9 Both Fuel & Oxid press low?
NO
10 PRESS INST FAILURE OR He LEAK DOWNSTREAM OF CHECK VLV.
YES
11 Ck He press
●HELIUM MON - PRESS 1 & PRESS 2
Either press abnormally low?
YES
12 He LEAK UPSTREAM OF REG SOV
NO
13 He LEAK BETWEEN REG SOV'S & CHECK VLVS
1 MSFN can distinguish between the failures
2 Helium supply will deplete if both squibs were fired.
3 Verify with MSFN before selecting regs.
E-300LM5-1025
SYMPTOM
PROCEDURE
REMARKS

3 THRU 6


SYMPTOM
PROCEDURE
REMARKS
3
He press abnormal or decr
>3300 psia
<2900 psia
1 Ck ind.
•HELIUM MON - cycle
Ind responds?
YES
NO
4 IND FAILURE
2 Press?
HIGH
LOW
APS
1 4
3 PRESS INST FAILURE OR HEAT SOAK
1
1 MSFN can determine which condition exists.
4
ASC QTY
YELLOW
Light on when burn time < 8 sec.
1 APS firing?
YES
NO
5 CWEA FAILURE
1
2 Terminate APS/RCS interconnect.
•SYS A & B MAIN SOV - OPEN; tb - gray
•SYS A & B ASC FEED 1 & 2 - CLOSE
•SYS A & B ASC FUEL & OXID tb - bp
3 After APS burn completed, close regs & ck for leak
•ASC He REG 1 & 2 - CLOSE; tb - bp
Fuel or oxid press decr?
NO
YES
4 CWEA OR LOW LEVEL SENSOR FAILURE
6 PROPELLANT LEAK
1 C/W indication of when to close ASC FEED valves lost.
5
ASC HI REG
YELLOW
Light on if He manf press >220 psia
1 Close regs.
•ASC He REG 1 & 2 - CLOSE; tb - bp
•PRPLNT TEMP/PRESS MON - ASC
Fuel & oxid press >220 psia?
YES
NO
2 ASC He REGS FAILED OPEN. (DOUBLE FAILURE)
3 When fuel & oxid press <220 psia:
•ASC He REG 1 & 2 - OPEN; tb - gray individually to isolate failed leg
4 CWEA/INST FAILURE
5 Open ASC regs.
•ASC He REG 1 & 2 - OPEN; tb - gray
6
ASC He REG 1 (2) tb - bp
1
•ASC He REG 1 (2) - OPEN
TB - gray?
YES
NO
2 He REG SOV UNLATCHED
3 TB/INST FAILURE OR He REG SOV FAILED CLOSED
1
1 MSFN can distinguish between these two failures.
C 300LM5-1027
SYMPTOM
PROCEDURE
REMARKS

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RCS MALFUNCTION INDEX

1 RCS

1a He PRESS LOW OR DECR
1b PQMD ABNORMAL
2 RCS PRESS OR TEMP ABNORMAL

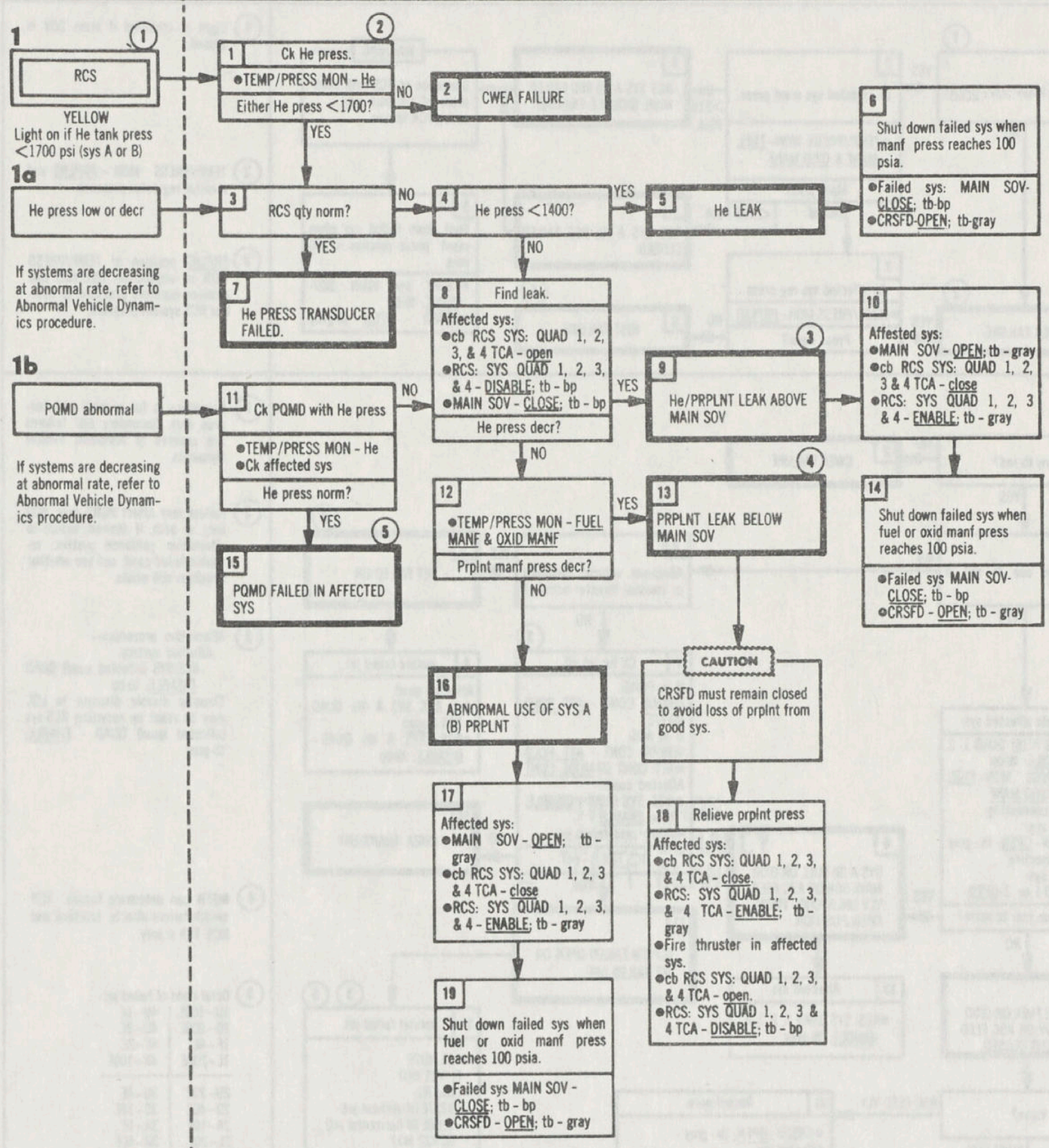
3 RCS A (B) REG

4 RCS TCA

5a TB ABNORMAL (QUAD)

5b TB ABNORMAL (MAIN SOV, CRSFD,ASC FEED VLVS).

SYMPTOM | PROCEDURE | REMARKS



(1) The direct and ACA hardover modes should not be used while trouble - shooting with this procedure.

(2) Light is reset when TEMP/PRESS MON is cycled to He.

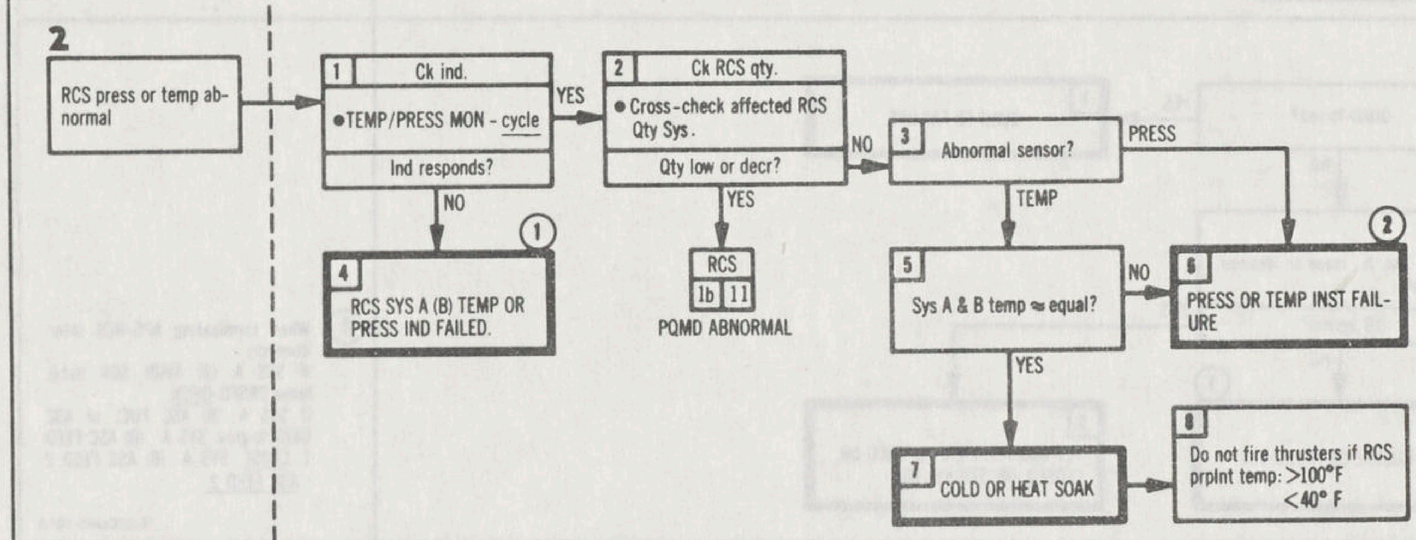
(3) If helium pressure <1400 psia, leak is helium. If >1400 psia, source of leak cannot be identified until system stabilizes.

(4) Translation capability lost in following axes for loss of RCS system A or B.

	System A Lost	System B Lost
(1) PGNS loses	+ Z, − Z	+ Z, − Z
(2)	− Y	+ Y
(3) AGS loses	+ Z, − Z	+ Z, − Z
(4)	− Y	+ Y
(5)	− X	+ X

Following conditions apply to above:
(1) PGNS will not command engine to fire.
(2) Translation totally lost.
(3) RCS thruster will fire, but LM will rotate and translate.
(4) Translation totally lost.
(5) Translation lost unless ATT/TRANSL - 4 JETS; then, two-jet translation will result.

(5) Use RCS quantity in unaffected system and helium pressure in affected system to estimate affected system quantity.



(1) Propellant temperature is indicated only in PRPLNT position. (Pointer drops to 20°F in other positions.) Use RCS It for low helium pressure and RCS A and B REG Its for high or low manifold pressure.

(2) Use temperature of unaffected system to estimate temperature of failed sensor. Use PQMD to estimate He pressure. Use alternate pressure (prplnt, fuel or oxid manf) to estimate pressure of failed sensor.

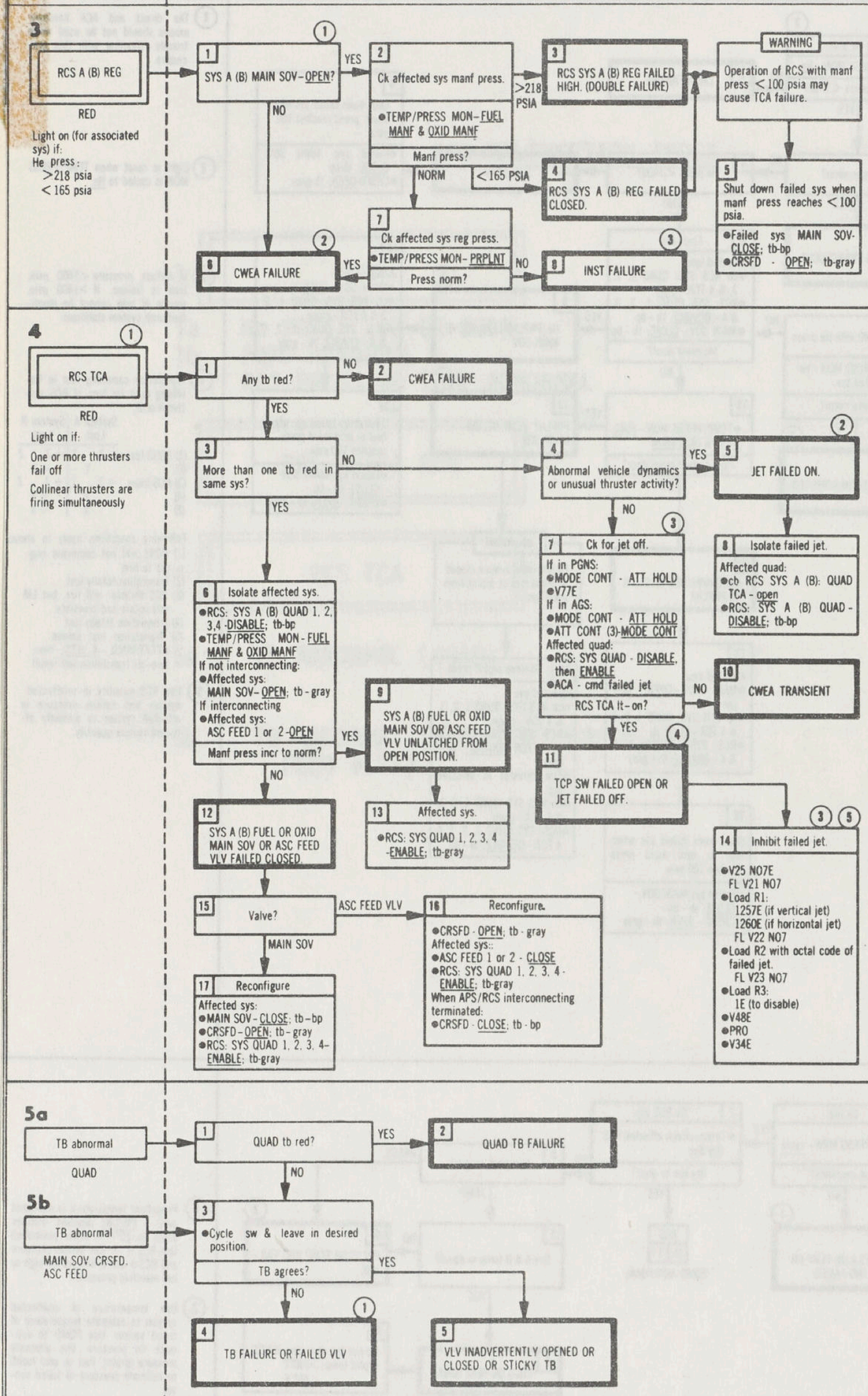
F-300LM5-103

SYMPTOM | PROCEDURE | REMARKS

G&C DISPLAYS 3 THRU 5b

PGNS AGS CES DPS APS RCS

SYMPTOM	PROCEDURE	REMARKS



(1) Light is inhibited if main SOV is closed.

(2) TEMP/PRESS MON - PRPLNT and monitor regulator pressure.

(3) PRPLNT position of TEMP/PRESS MON is inoperative. Use fuel and oxidizer manifold pressure to monitor RCS system pressure.

(1) Procedure is for primary coil failures only. Secondary coil failures are covered in Abnormal Vehicle Dynamics.

(2) Failure may affect PGNS only, AGS only, or both. If desired, switch to alternative guidance system, re-enable failed quad, and see whether symptom still exists.

(3) Alternative procedure—
Affected system:
RCS:SYS (affected quad) QUAD -DISABLE; tb-bp
Thruster disable discrete to LGC may be reset by recycling RCS-sys (affected quad) QUAD - ENABLE; tb-gray

(4) MSFN can determine failure. TCP switch failure affects talkback and RCS TCA lt only.

(5) Octal code of failed jet:

1U-100E	4U-1E
1D-200E	4D-2E
1F-4E	4F-2E
1L-200E	4R-100E
2U-20E	3U-4E
2D-40E	3D-10E
2A-10E	3A-1E
2L-20E	3R-40E

(1) When terminating APS/RCS interconnect:
If SYS A (B) MAIN SOV tb-bp, leave CRSFD-OPEN.
If SYS A (B) ASC FUEL or ASC OXID tb-gray, SYS A (B) ASC FEED 1-CLOSE, SYS A (B) ASC FEED 2 - ASC FEED 2.

E-300LM5-1015

SYMPTOM	PROCEDURE	REMARKS

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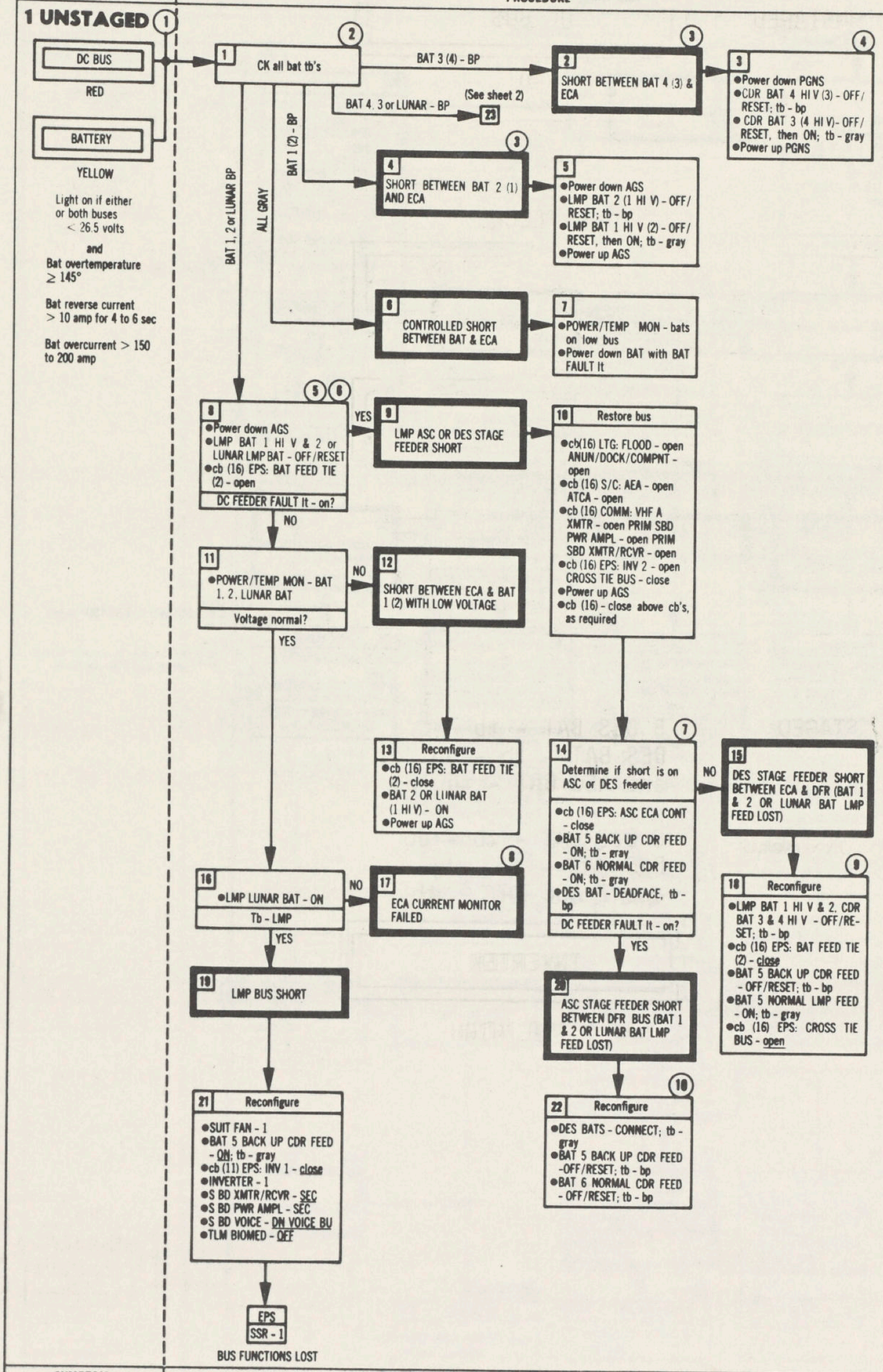
EPS MALFUNCTION INDEX

1	UNSTAGED	DC BUS RED
		BATTERY YELLOW
		DC BUS RED
2	STAGED	DC BUS
3	STAGED OR UNSTAGED	BATTERY
5a	STAGED OR UNSTAGED	One bat tb abnormal (bp)
5b	UNSTAGED	5 DES BAT - tb - bp DES BAT - tb - bp and ASC BAT - tb (5) - gray
5c	UNSTAGED	5 DES BAT - tb - bp DES BAT - tb - bp and 2 ASC BAT - tb - gray
6		INVERTER
6a		AC VOLTAGE HIGH
SSR-1		BUS FUNCTIONS LOST

SYMPTOM	PROCEDURE	REMARKS



REMARKS

1. Assumption: CROSS TIE is open. If CDR BUS voltage is lost for >20 minutes sublimator freeze up occurs.
2. DC FEEDER FAULT lt may or may not be on.
3. Short is on battery whose talkback is not bp. Good battery was disconnected by overcurrent.
4. Allow 5 minutes before closing cb PGNS:IMU OPR (IMU gyro constraint)
5. If failure occurs after PDI, refer to emergency procedure for CDR (LMP) BUS failure.
6. COMM will be lost for time required to bring up secondary S-band or while troubleshooting. Option of remaining on primary S-Band, without COMM, until LMP BUS status is ascertained may be exercised.
7. Remove 2.5 ampere-hours from each ascent battery before deadfacing.
8. BAT 2 can not be placed ON.
9. BAT 5 power is available through normal feed when deadfaced.
10. BAT 6 (if CDR FEEDER shorted) or BAT 5 (if LMP FEEDER shorted) power is available only through back-up feed and should be so used before abort stage to preclude placing BAT 6 (5) on shorted feeder.

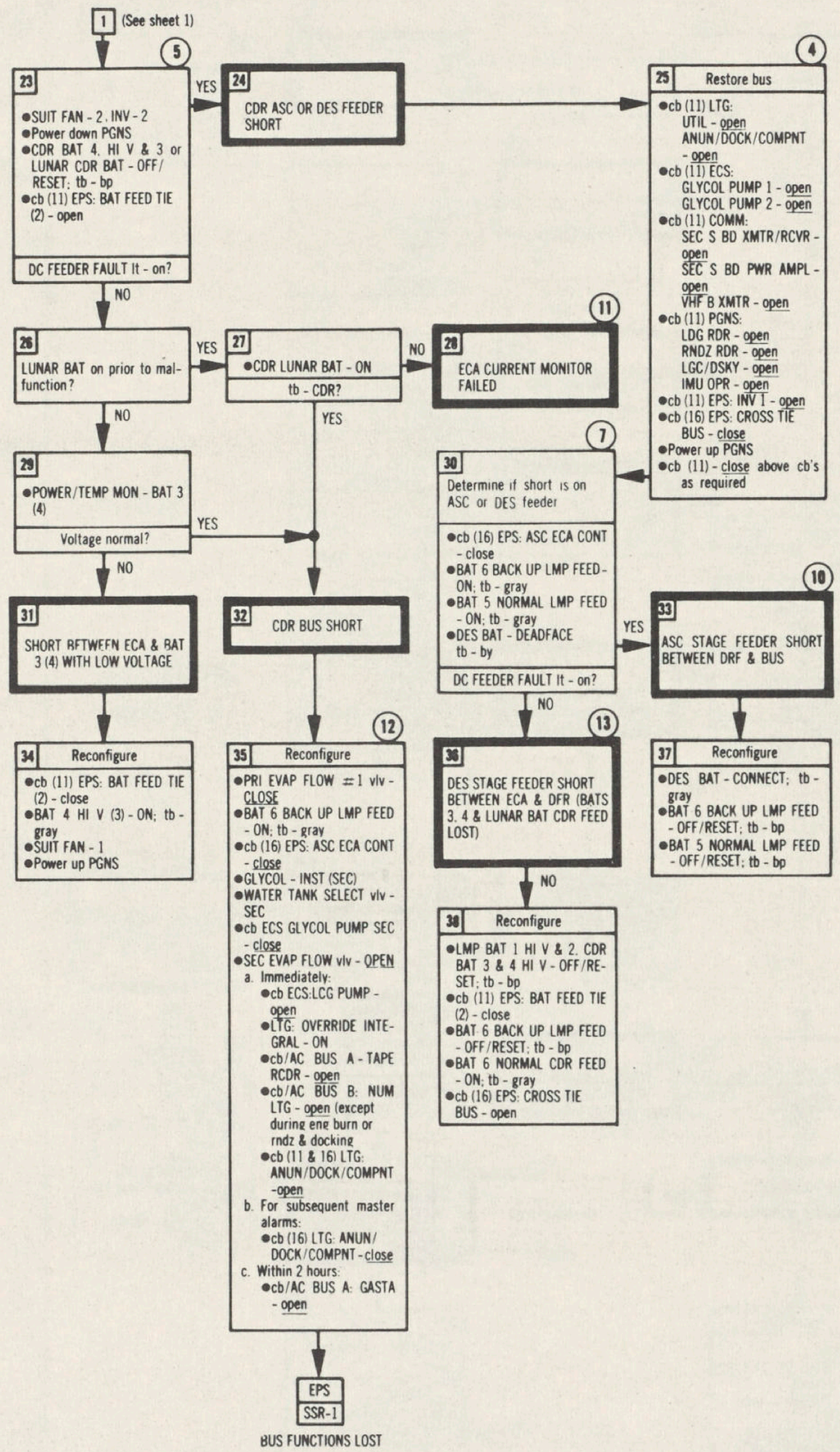
300LM10-9028-1

SYMPTOM	PROCEDURE	REMARKS

EPS PGNS AGS CES DPS APS RCS

1 (CONT)

SYMPTOM	PROCEDURE	REMARKS



(11) BAT 3 can not be placed ON.

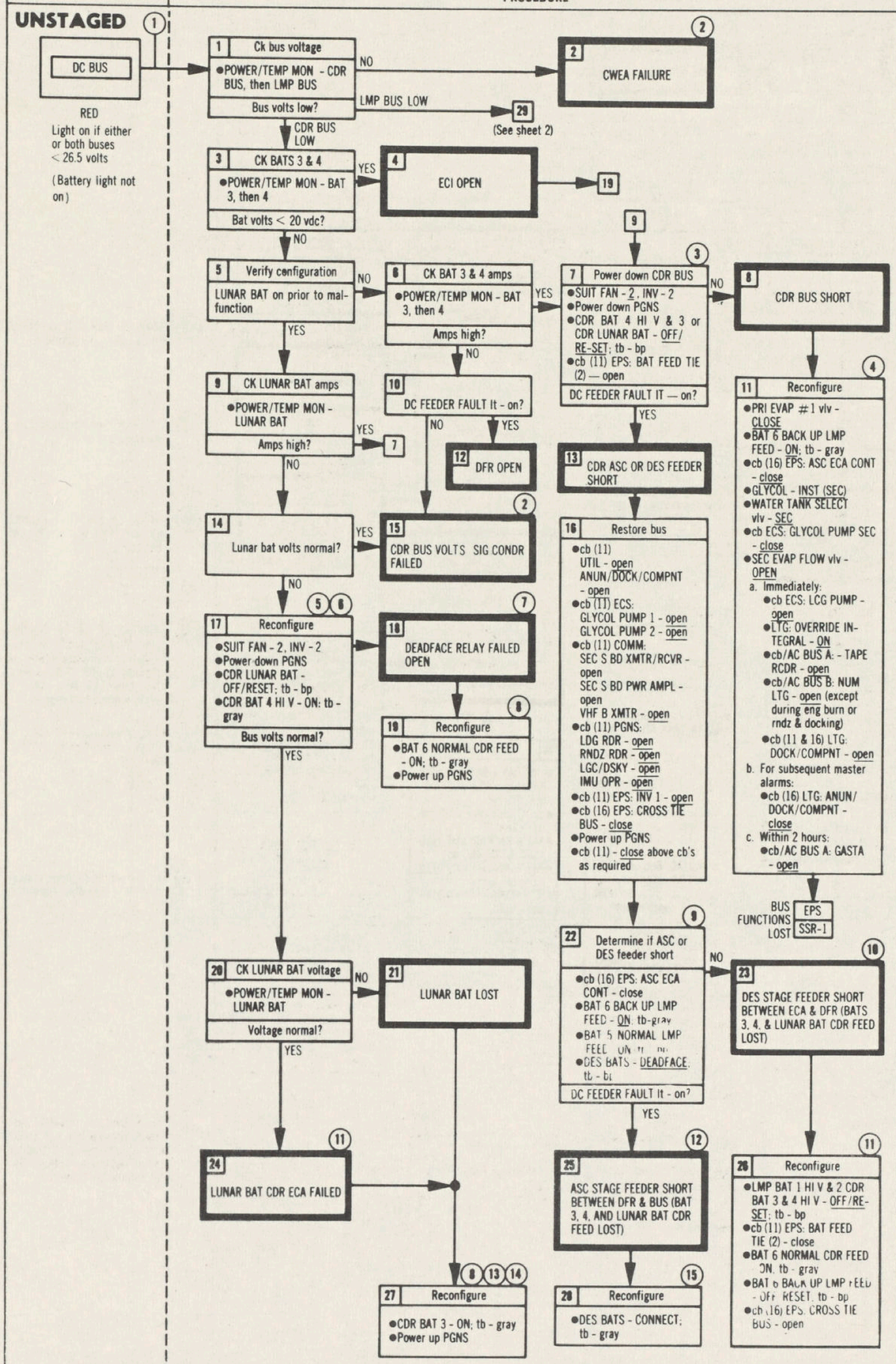
(12) PRIMARY GLYCOL LOOP is lost.

(13) BAT 6 power is available through normal feed when deadfaced.

300LM10 9028 2

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



REMARKS

1. Assumption: Cross tie circuit is open prior to entering this procedure.
2. DC BUS lt remains on and subsequent low bus voltage C/W monitoring is lost.
3. If failure occurs after PDI refer to emergency procedure for CDR BUS failure.
4. PRIMARY GLYCOL loop is lost.
5. BUS will lose power when LUNAR BAT OFF.
6. DE FEEDER FAULT lt may or may not be on.
7. CDR BUS OK. BATS 3, 4, and LUNAR BAT CDR FEED lost. LUNAR BAT LMP FEED still available.
8. Allow 5 minutes from time of PGNS power down before closing cb PGNS: IMU OPR (IMU GYRO constraint).
9. Remove 2.5 ampere-hours from each ascent battery before deadfacing.
10. BAT 6 power is available through normal feed only after deadfacing.
11. LUNAR BAT CDR FEED lost. LUNAR BAT LMP FEED still available.
12. BAT 6 power is available only through back-up feed and should be so used before abort stage to preclude automatically placing BAT on the shorted feeder.
13. O. C. RELAY failure prevents BAT 3 from being placed on.
14. LUNAR BAT is lost.
15. To power both buses with descent batteries only, remove nonessential equipment until total load 50 amps.

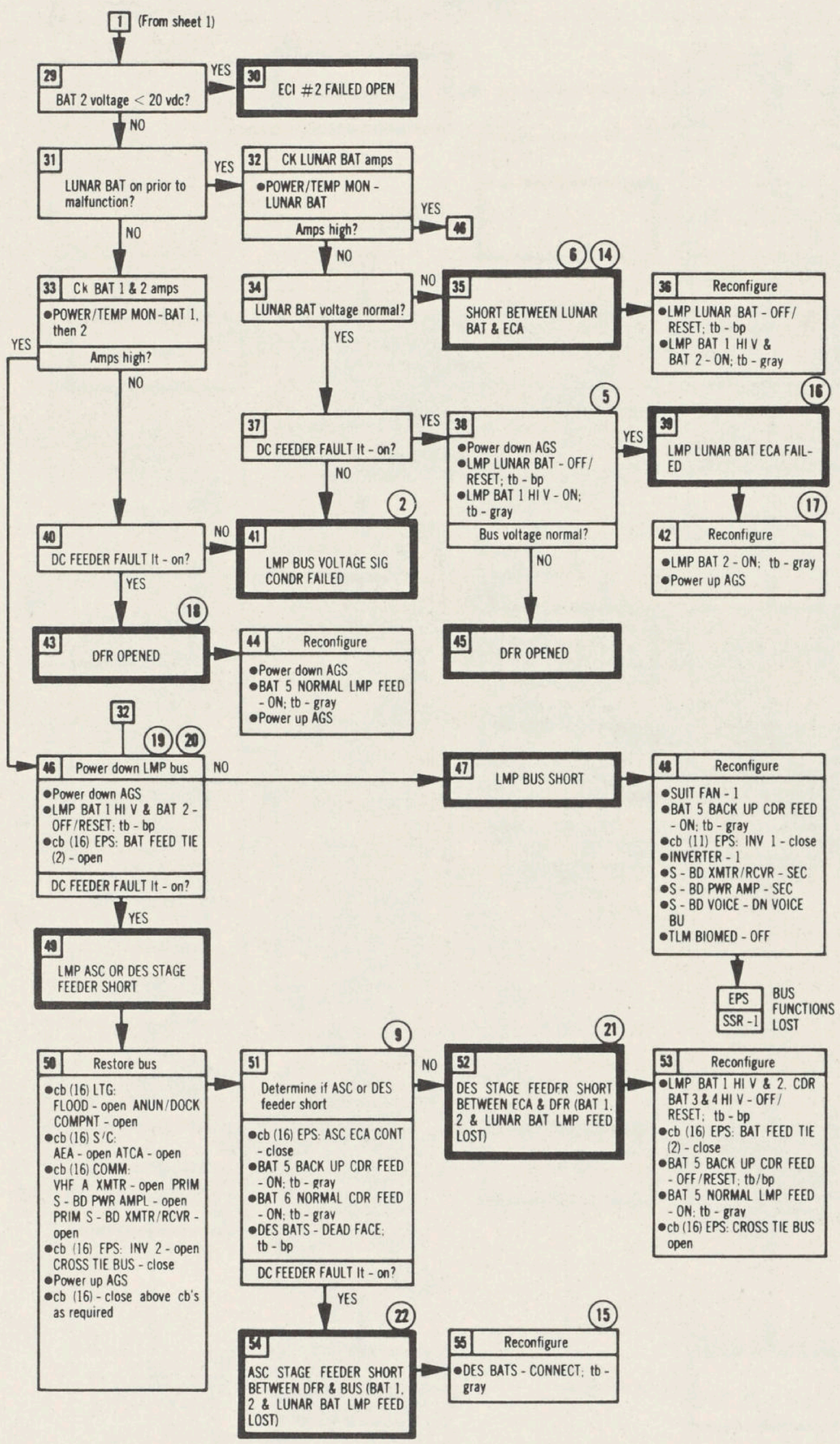
300LM10 9029 1

SYMPTOM	PROCEDURE	REMARKS

EPS PGNS AGS CES DPS APS RCS

1 (CONT)

SYMPTOM	PROCEDURE	REMARKS



(16) LUNAR BAT LMP FEED lost LUNAR BAT CDR FEED still available.

(17) O. C. RELAY failure prevents BAT 2 from being placed on.

(18) LMP BUS OK. BAT 1, 2, and LUNAR BAT LMP FEED lost. LUNAR BAT CDR FEED still available.

(19) COMM will be lost for time required to bring up SEC S-BD or while trouble shooting. Option of remaining on PRI S-BD without COMM until LMP BUS status is ascertained may be exercised.

(20) If failure occurs after PDI, refer to emergency procedure for LMP BUS failure.

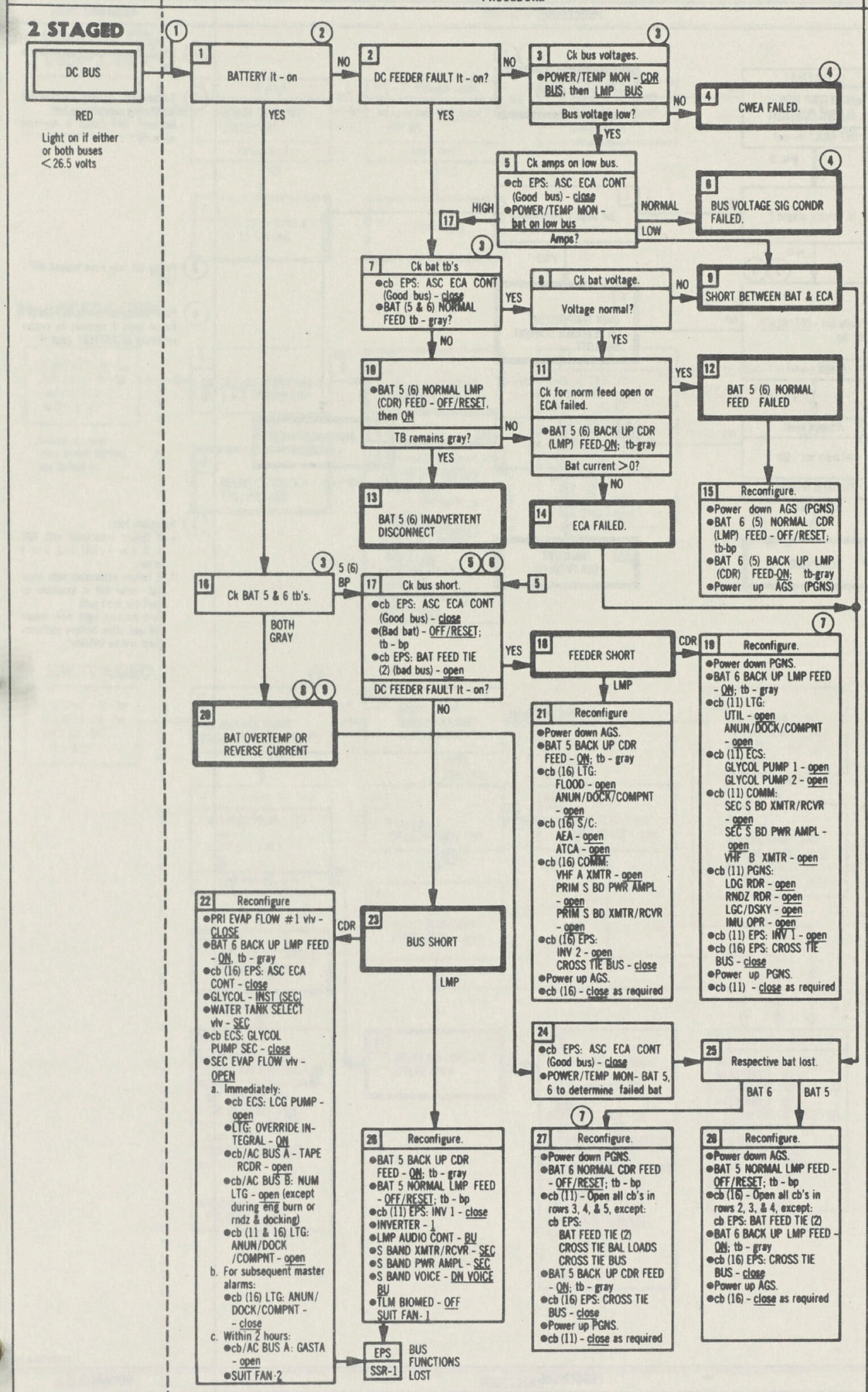
(21) BAT 5 power is available through normal feed only when deadfaced.

(22) BAT 5 power is available only through back-up feed and should be so used before abort stage to preclude automaticaly placing BAT 5 on the shorted feeder.

300LM10-9029-2

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



SYMPTOM	PROCEDURE	REMARKS

1. If CDR bus voltage is lost for >20 minutes, sublimator freeze-up occurs.
2. BATTERY lt may not go on instantaneously with DC BUS lt.
3. If CDR bus failure, SUIT FAN-2.
4. DC BUS lt remains on and subsequent low bus voltage C/W monitoring capability is lost.
5. If failure occurs after PDI or during ascent mission phase, refer to emergency procedure for CDR (LMP) bus failure.
6. Communications will be lost for time required to bring up secondary S-band or while troubleshooting. Option of remaining on primary S-band, without communications, until LMP bus status is ascertained may be exercised.
7. Allow 5 minutes for gyros to stop, before closing cb PGNS IMU OPR.
8. DC FEEDER FAULT light may or may not be on.
9. Reverse current only if buses are tied.

EPS 1 (CONT) | PGNS 3 | AGS | CES | DPS | APS | RCS

SYMPTOM	PROCEDURE	REMARKS

3 STAGED OR UNSTAGED

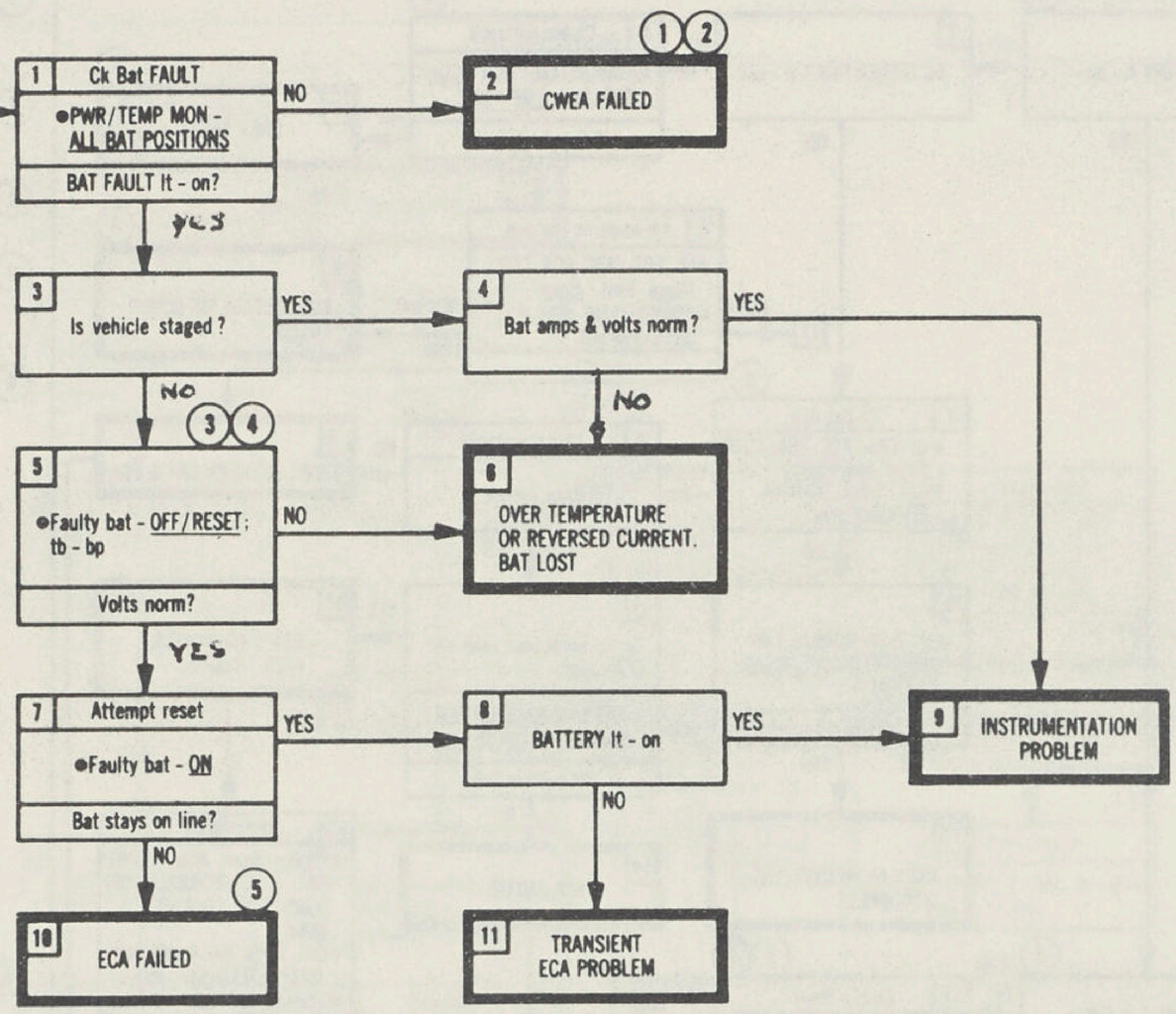
BATTERY

YELLOW

Light on if:
Bat overtemperature > 145°

Bat reverse current > 10 amp for 4 to 6 sec

Bat overcurrent > 150 to 200 amp



(1) Bat C/W monitoring capability is lost.

(2) Subsequent battery malfunction monitoring capability is lost. However, BAT FAULT lt operates normally.

(3) Faulty bat may have tripped OFF - LINE.

(4) Hold battery switch to OFF/RESET for at least 4 seconds to ensure resetting of BATTERY caut lt.

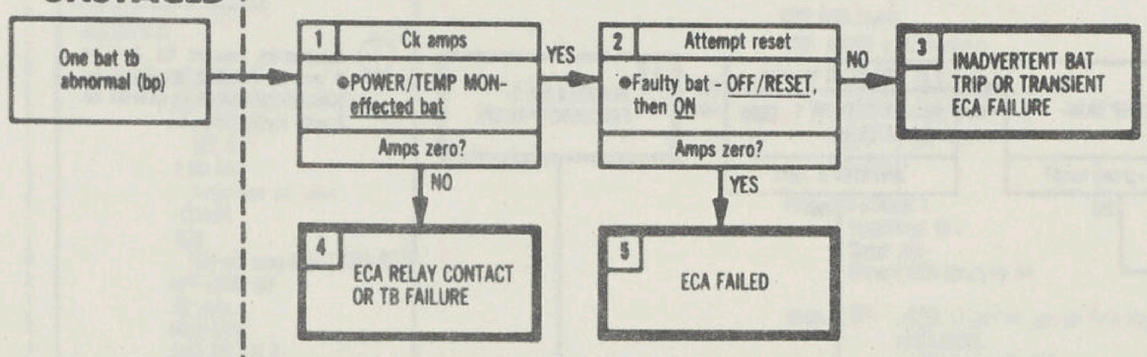
(5) Functions lost:
1. If failure associated with BAT 1, 2, 3 or 4 - BAT 1, 2, 3 or 4 is lost.
2. If failure associated with lunar bat - lunar bat is available on opposite feed path.
Batt warning light may remain ON and other battery malfunctions will be inhibited.

E-300LM4-1009

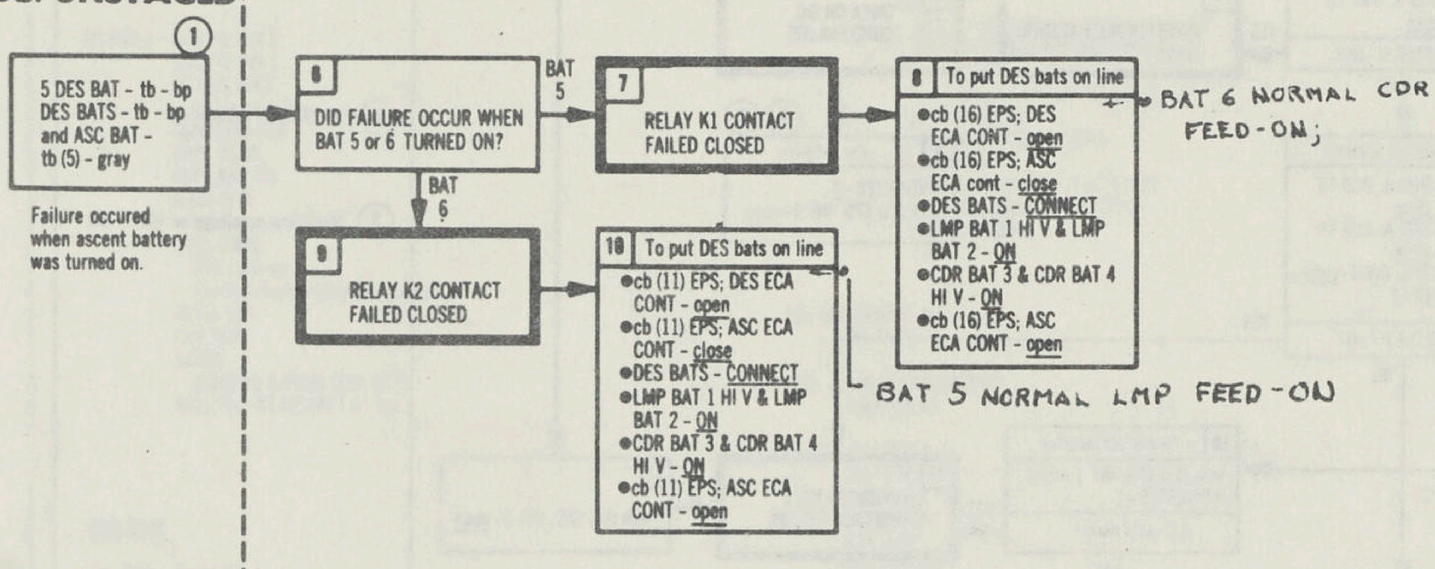
SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS

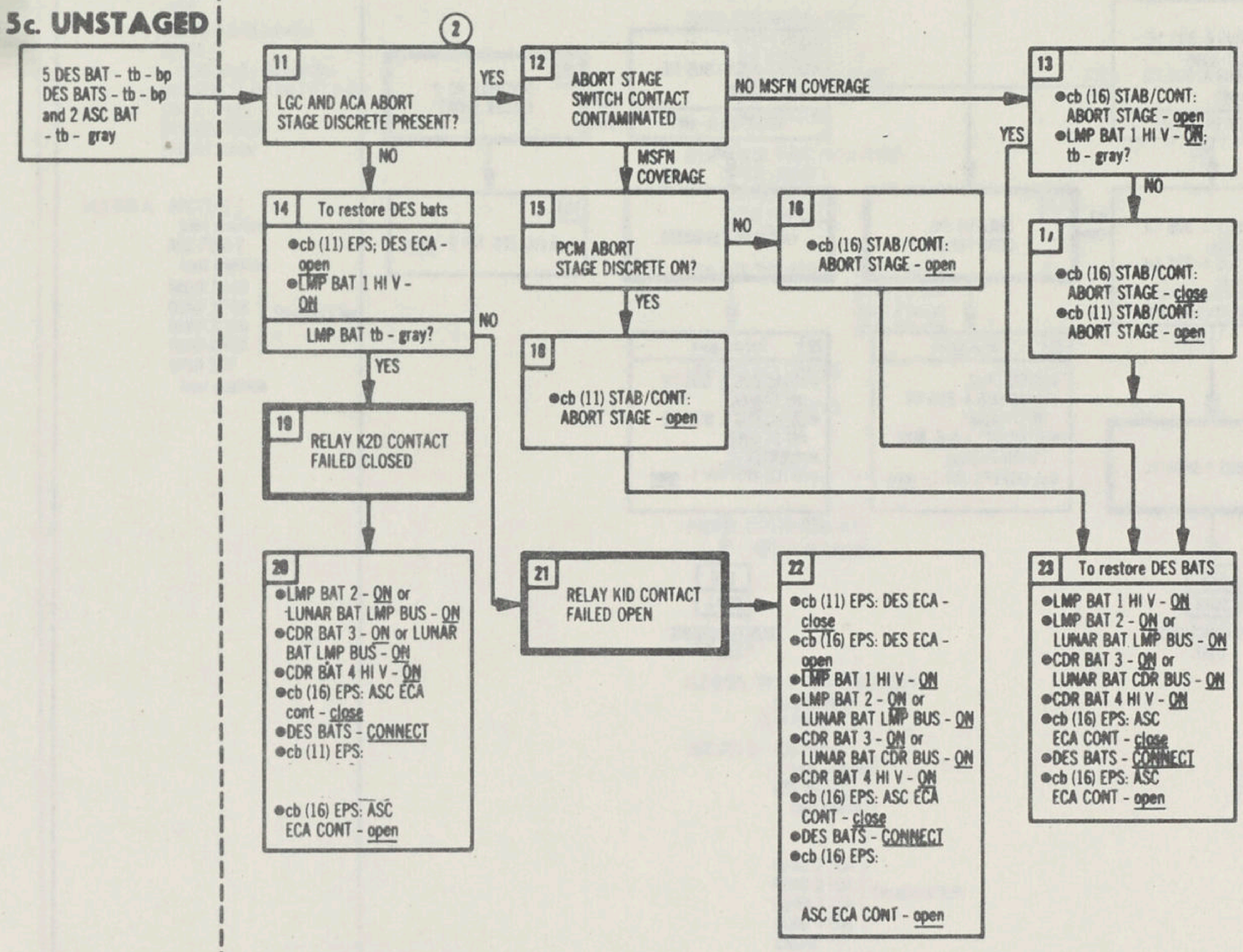
5a. STAGED OR UNSTAGED



5b. UNSTAGED



5c. UNSTAGED



(1) One bus will be lost if failure occurs when first ascent battery is turned on. Possible DC bus warning light.

(2) On the Lunar Surface when the ABORT CB's are open and computers are off, the failure could only be K10 or K20 relay contacts.

B-300LM4-1010

SYMPTOM	PROCEDURE	REMARKS

COMM

5a THRU 5c

ECS

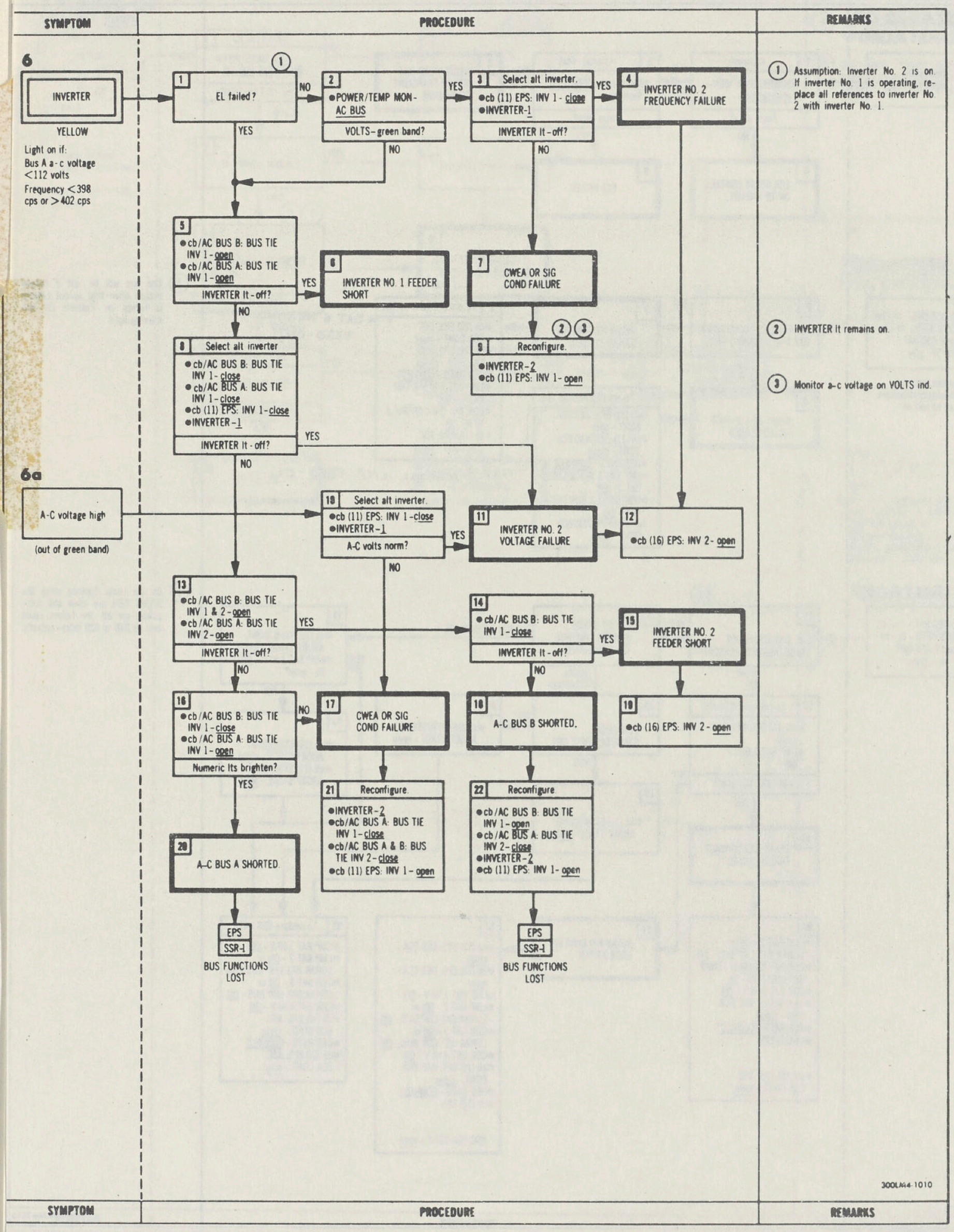
SSR-1

ED

HTRS

CAMERA

LRV


SYMPTOM
PROCEDURE
REMARKS
6
INVERTER
YELLOW
Light on if:
Bus A a-c voltage <112 volts
Frequency <398 cps or >402 cps
1 EL failed?
NO
YES
2 ●POWER/TEMP MON-AC BUS
VOLTS-green band?
NO
3 Select alt inverter.
●cb (11) EPS: INV 1-close
●INVERTER-1
INVERTER lt-off?
YES
NO
4 INVERTER NO. 2 FREQUENCY FAILURE
5 ●cb/AC BUS B: BUS TIE INV 1-open
●cb/AC BUS A: BUS TIE INV 1-open
INVERTER lt-off?
YES
NO
6 INVERTER NO. 1 FEEDER SHORT
7 CWEA OR SIG COND FAILURE
8 Select alt inverter
●cb/AC BUS B: BUS TIE INV 1-close
●cb/AC BUS A: BUS TIE INV 1-close
●cb (11) EPS: INV 1-close
●INVERTER-1
INVERTER lt-off?
YES
NO
9 Reconfigure.
●INVERTER-2
●cb (11) EPS: INV 1-open
6a
A-C voltage high
(out of green band)
10 Select alt inverter.
●cb (11) EPS: INV 1-close
●INVERTER-1
A-C volts norm?
YES
NO
11 INVERTER NO. 2 VOLTAGE FAILURE
12 ●cb (16) EPS: INV 2-open
13 ●cb/AC BUS B: BUS TIE INV 1 & 2-open
●cb/AC BUS A: BUS TIE INV 2-open
INVERTER lt-off?
YES
NO
14 ●cb/AC BUS B: BUS TIE INV 1-close
INVERTER lt-off?
YES
NO
15 INVERTER NO. 2 FEEDER SHORT
16 ●cb/AC BUS B: BUS TIE INV 1-close
●cb/AC BUS A: BUS TIE INV 1-open
Numeric lts brighten?
NO
YES
17 CWEA OR SIG COND FAILURE
18 A-C BUS B SHORTED.
19 ●cb (16) EPS: INV 2-open
20 A-C BUS A SHORTED.
EPS
SSR-1
BUS FUNCTIONS LOST
21 Reconfigure.
●INVERTER-2
●cb/AC BUS A: BUS TIE INV 1-close
●cb/AC BUS A & B: BUS TIE INV 2-close
●cb (11) EPS: INV 1-open
22 Reconfigure.
●cb/AC BUS B: BUS TIE INV 1-open
●cb/AC BUS A: BUS TIE INV 2-close
●INVERTER-2
●cb (11) EPS: INV 1-open
EPS
SSR-1
BUS FUNCTIONS LOST
1 Assumption: Inverter No. 2 is on. If inverter No. 1 is operating, replace all references to inverter No. 2 with inverter No. 1.
2 INVERTER lt remains on.
3 Monitor a-c voltage on VOLTS ind.
300LM4-1010
SYMPTOM
PROCEDURE
REMARKS

SPECIAL SUBROUTINE

SSR-1

Bus functions lost

AC BUS B

AC BUS B: SE WIND HTR
He/PQGS PROPUL DISP
He MON
DES QTY
S BD ANT
Auto/man ant slew
ORDEAL
AGS
AGS att mon & AGS ORB RATE
ACT LAMP (R)
SE FDAI
NUM LTG
BUS TIE INV 2
BUS TIE INV 1

AC BUS A

AC BUS A: BUS TIE INV 2
BUS TIE INV 1
AC BUS VOLT
AC bus monitor
CDR WIND HTR
TAPE RCDR
AOT LAMP (R)
RNDZ RDR
Auto/man ant slew
DECA GMBL
GDA lock-up
Limited manual throttle capability
INTGL LTG
CDR FDAI
GASTA
PGNS att & PGNS ORB RATE
RNG/RNG RT ALT/ALT RT ind

CDR BUS

FLT DISP: ORDEAL
COAS
CDR FDAI & alt needles
GASTA
PGNS alt & rate needles
RNG/RNG RT ALT/ALT RT meter
CDR X - PNTR
MISSION TIMER
THRUST meter

RCS SYS A: ASC FEED 1
Last position
ASC FEED 2
Last position
QUAD 1 TCA
QUAD 2 TCA
QUAD 3 TCA
QUAD 4 TCA
} Thrusters lost
MAIN SOV
Last position

CDR BUS (cont)

HTR: URINE LINE heaters
RNDZ RDR STBY heaters
RNDZ RDR OPR heaters
LDG RDR heater
DOCK window heater
AOT heater

INST: SIG CONDR 1
Propellant tb's
Some ind
Some CWEA lts come on

STAB/CONT: ABORT STAGE (R, except no auto eng arm)
ATCA PGNS
LGC controlof RCS
ability to switch from AGS to PGNS
AELD (R)
ENG CONT
DPS on capability except override ENG
STOP for DPS & APS AGS GMBL Trim
ATT DIR CONT
Secondary Coils AGS Pulse mode
ENG START OVRD
Manual start (DPS & APS)
DECA PWR
Auto & Manual DPS "on" & "off"
(Override only available) DPS
throttle (100%)

ED: LDG GEAR FLAG
LOGIC PWR A
UTIL
LTG: ANUN/DOCK/COMPNT
Lighting (R)

PGNS: IMU OPR
IMU STBY
LGC/DSKY
RNDZ RDR
LDG RDR
SIG STR DISP

COMM: CDR AUDIO center
VHF A RCVR
VHF B XMTR
SEC S BD PWR AMPL
SEC S BD XMTR/RCVR
UP DATA LINK

ECS: GLYCOL PUMP AUTO TRNFR
GLYCOL PUMP 1
GLYCOL PUMP 2
CABIN FAN
SUIT FAN 1

HTR RCS SYS A/B 1: QUAD 1 heater
QUAD 2 heater
QUAD 3 heater
QUAD 4 heater

EPS: DES ECA CONT (R)
DES ECA (R)
ASC ECA CONT (R)
ASC ECA (R)
INV 1
DC BUS VOLT

PROPUL: DES He REG/VENT
VENT - last position

LMP BUS

FLT DISP: EVENT TIMER/SE FDAI &
rate needles
SE X-PNTR

RCS SYS B: ASC FEED 1
Last position
ASC FEED 2
Last position

QUAD 1 TCA
QUAD 2 TCA
QUAD 3 TCA
QUAD 4 TCA
} Thrusters lost
CRSFD
Last position
TEMP/PRESS DISP FLAG
PQGS DISP
RCS qty
MAIN SOV
Last position

LMP BUS (cont)

PROPUL: DISP/ENG OVRD LOGIC
MPS ind inoperative
PQGS
FUEL/OXID qty
ASC He REG
Last position

INST: SIG CONDR 2
EPS tb's
Some ind
Some CWEA lts come on
PCM/TE
TM XMT
Timing signals
SIG SENSOR
CWEA

STAB/CONT: DES ENG OVRD
Override function
ATCA (AGS)
AGS stab cont ability to switch from
PGNS to AGS
ABORT STAGE
ASC ENG "ON" & arming
ATCA
RR SLEW & AUTO TRACK Modes
AGS stab Cont
FDAI Rate needles
Auto ASC ENG "on"
DPS Gmbl locked
Throttle goes to 100%
AELD (R)
Auto APS commands
ASA
AGS
ENG ARM
Auto engine on/off
(OPS & APS)
AEA
AGS

ED: LOGIC PWR B
Descent Engine override function

LTG: MASTER ALARM
ANUN/DOCK/COMPNT (R)
TRACK light
FLOOD lighting

COMM: DISP
S-bd ant
SE AUDIO
VHF A XMTR
VHF B RCVR
PRIM S BD PWR AMPL
PRIM S BD XMTR/RCVR
S BD ANT
Auto/man ant slew
PMP
VHF rcv
S-bd xmtr/rcv
TV

ECS: SUIT FLOW CONT
Torn-suit protection
DISP
GLYCOL PUMP SEC
CABIN FAN CONT
CABIN REPRESS
Auto repress
SUIT FAN 2
SUIT FAN ΔP
DIVERT VLV
Auto close
CO_2 SENSOR

EPS: DES ECA CONT (R)
DES ECA (R)
ASC ECA CONT (R)
ASC ECA (R)
INV 2
DC BUS VOLT
DISP
Volts/amps
Tb's

CAMR: SEQ

HTR RCS SYS A/B 2: S-BD ANT heater
DISP
QUAD 4 heater
QUAD 3 heater
QUAD 2 heater
QUAD 1 heater
MESA heaters

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COMM MALFUNCTION INDEX

1 LOSS OF ICS
2 ONE CREWMAN HAS ABNORMAL (UNSELECTED) HOT MIKE
3 LOSS OF VHF VOICE COMM WITH CSM
4 LOSS OF S-BAND VOICE COMM

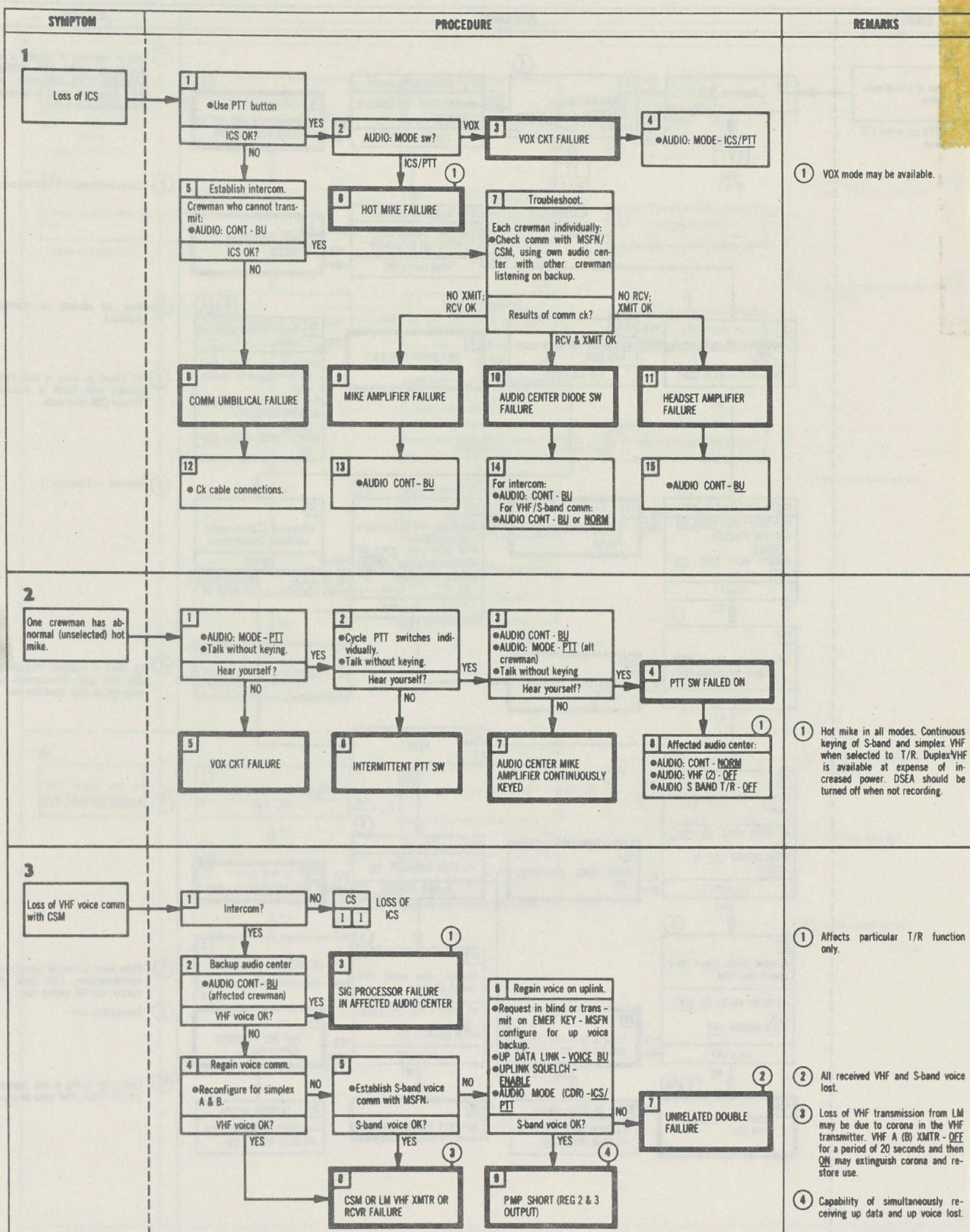
5 [S BD RCVR]

5a CANNOT ACQUIRE PHASE LOCK
6 MSFN REPORTS LOSS OF PCM. S-BAND VOICE OK

7 LOSS OF VOICE COMM WITH EVA (ONE MAN EVA)

8 CSM INFORMS LM OF VHF RANGING LOSS

SYMPTOM	PROCEDURE	REMARKS

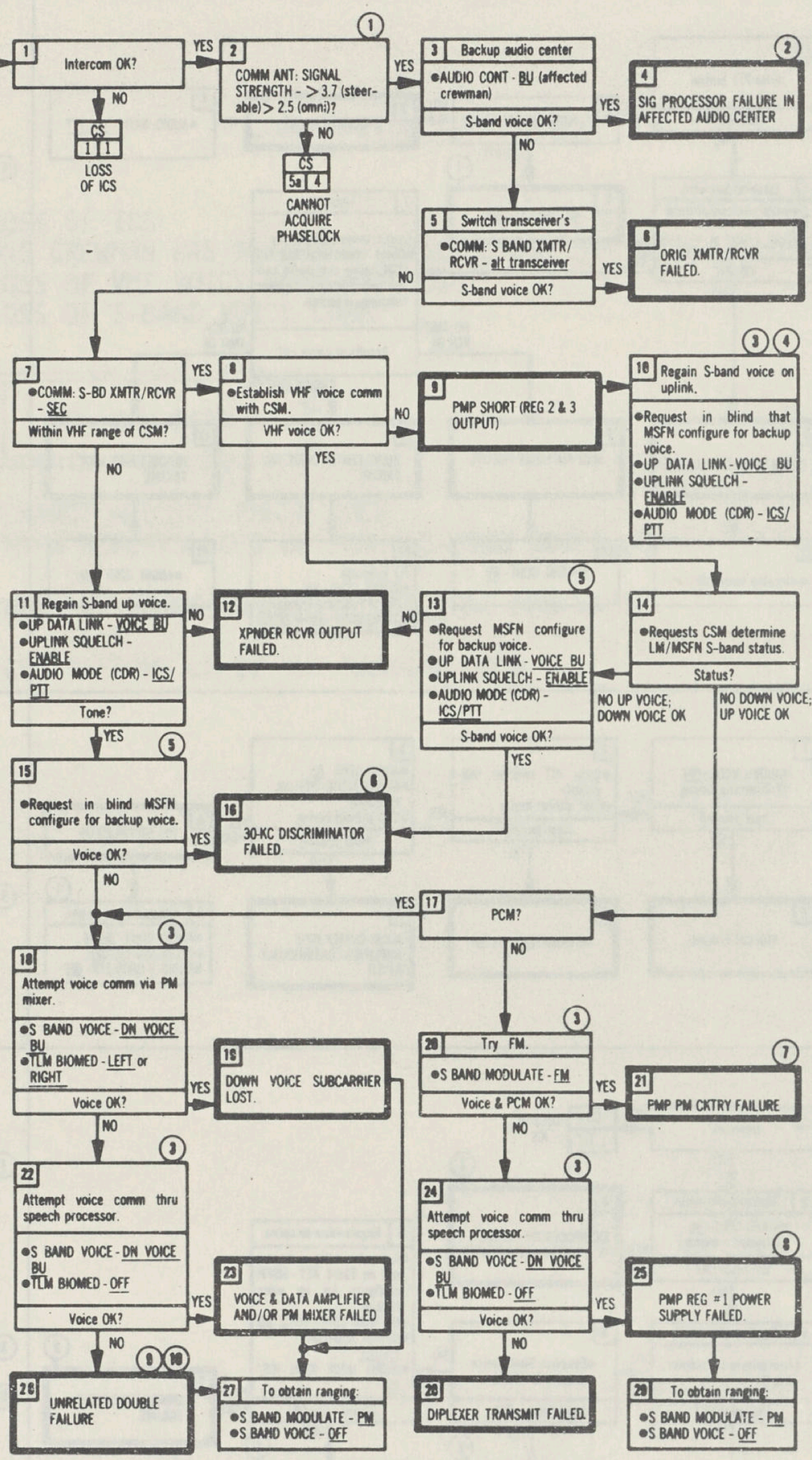


SYMPTOM	PROCEDURE	REMARKS

EPS | COMM | AGS | CES | DPS | APS | RCS

4

SYMPTOM	PROCEDURE	REMARKS



(1) Loss or near loss of up voice is indicated by COMM ANT: SIGNAL STRENGTH - <3.7 (steerable) or <2.5 (omni) and noise in headset if S-band squelch is off.

(2) Affects particular T/R function only

(3) Allow 30 seconds to reacquire phaselock.

(4) All S-band up voice is lost. Voice contact with MSFN is available through CSM relay mode.

(5) Requires ≈3 minutes.

(6) Up voice is available through up data link only. Simultaneous up voice and up data capability lost.

(7) Ranging lost while in FM.

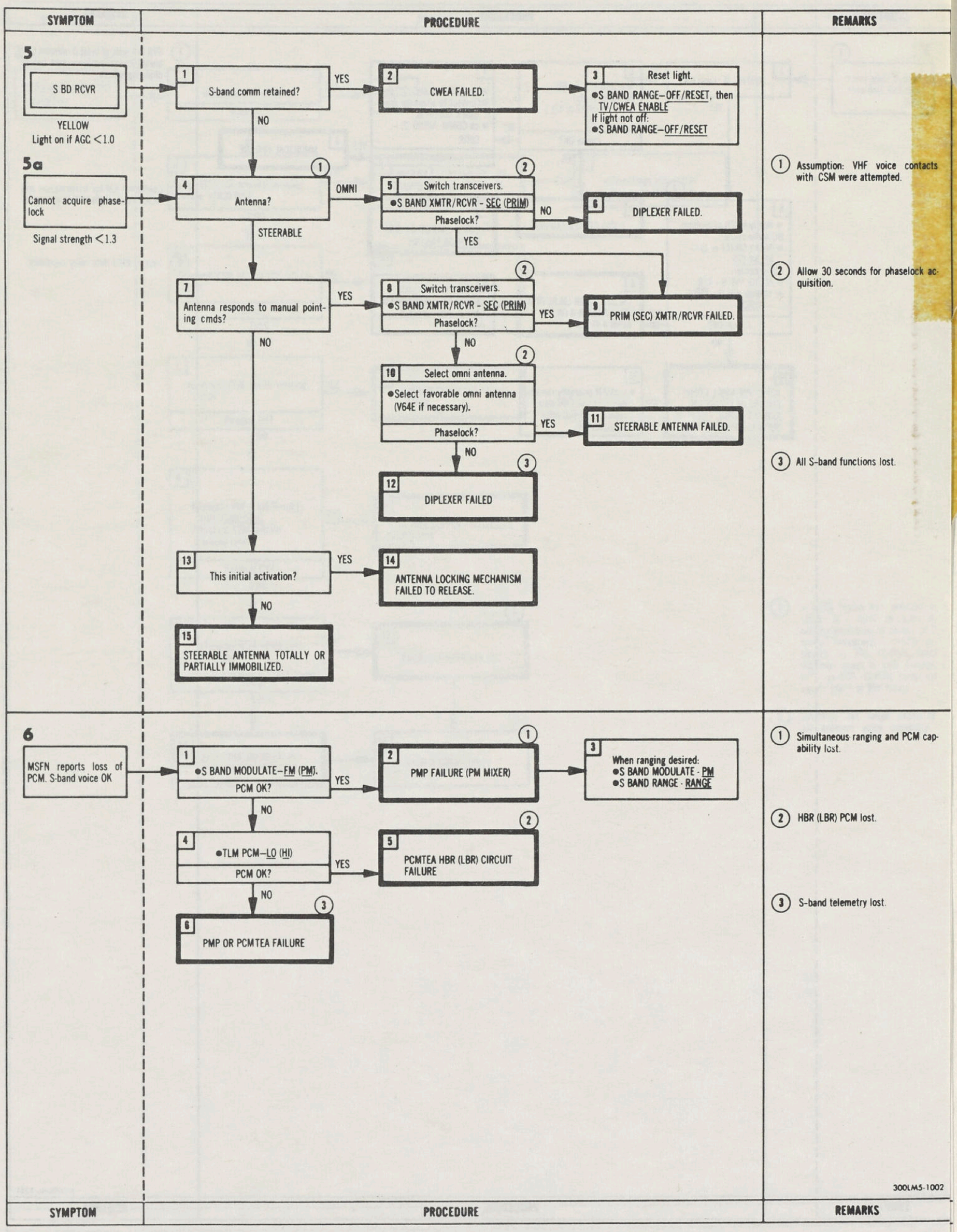
(8) Down voice subcarrier operational instrumentation, PCM data, PM control, and FM control lost.

(9) Biomed data lost.

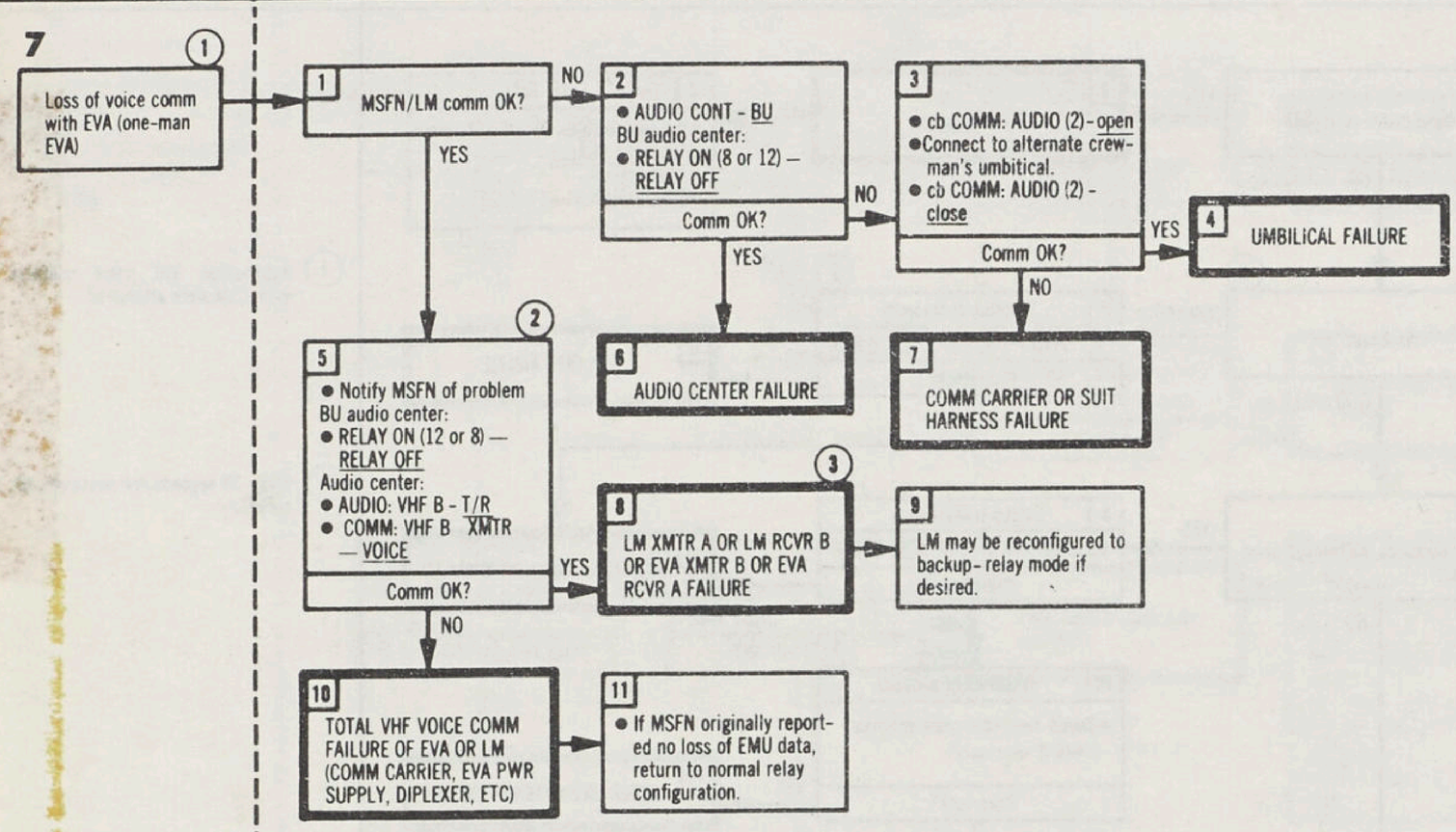
(10) Emergency keying is still available (cb (16) COMM: PMP must be open).

B-300LM5-1001

SYMPTOM	PROCEDURE	REMARKS


SYMPTOM
PROCEDURE
REMARKS
5
S BD RCVR
YELLOW
Light on if AGC <1.0
1 S-band comm retained?
YES
2 CWEA FAILED.
3 Reset light.
•S BAND RANGE–OFF/RESET, then TV/CWEA ENABLE
If light not off:
•S BAND RANGE–OFF/RESET
NO
5a
Cannot acquire phase-lock
Signal strength <1.3
4 Antenna?
OMNI
5 Switch transceivers.
•S BAND XMTR/RCVR - SEC (PRIM)
Phaselock?
NO
6 DIPLEXER FAILED.
YES
STEERABLE
7 Antenna responds to manual pointing cmds?
YES
8 Switch transceivers.
•S BAND XMTR/RCVR - SEC (PRIM)
Phaselock?
YES
9 PRIM (SEC) XMTR/RCVR FAILED.
NO
10 Select omni antenna.
•Select favorable omni antenna (V64E if necessary).
Phaselock?
YES
11 STEERABLE ANTENNA FAILED.
NO
12 DIPLEXER FAILED
13 This initial activation?
YES
14 ANTENNA LOCKING MECHANISM FAILED TO RELEASE.
NO
15 STEERABLE ANTENNA TOTALLY OR PARTIALLY IMMOBILIZED.
1 Assumption: VHF voice contacts with CSM were attempted.
2 Allow 30 seconds for phaselock acquisition.
3 All S-band functions lost.
6
MSFN reports loss of PCM. S-band voice OK
1 •S BAND MODULATE–FM (PM).
PCM OK?
YES
2 PMP FAILURE (PM MIXER)
3 When ranging desired:
•S BAND MODULATE - PM
•S BAND RANGE - RANGE
NO
4 •TLM PCM–LO (HI)
PCM OK?
YES
5 PCMTEA HBR (LBR) CIRCUIT FAILURE
NO
6 PMP OR PCMTEA FAILURE
1 Simultaneous ranging and PCM capability lost.
2 HBR (LBR) PCM lost.
3 S-band telemetry lost.
300LM5-1002

SYMPTOM	PROCEDURE	REMARKS



(1) EVA will wait at least 3 minutes following communications loss before changing modes.

(2) Configures LM for transmission and reception on both VHF frequencies.

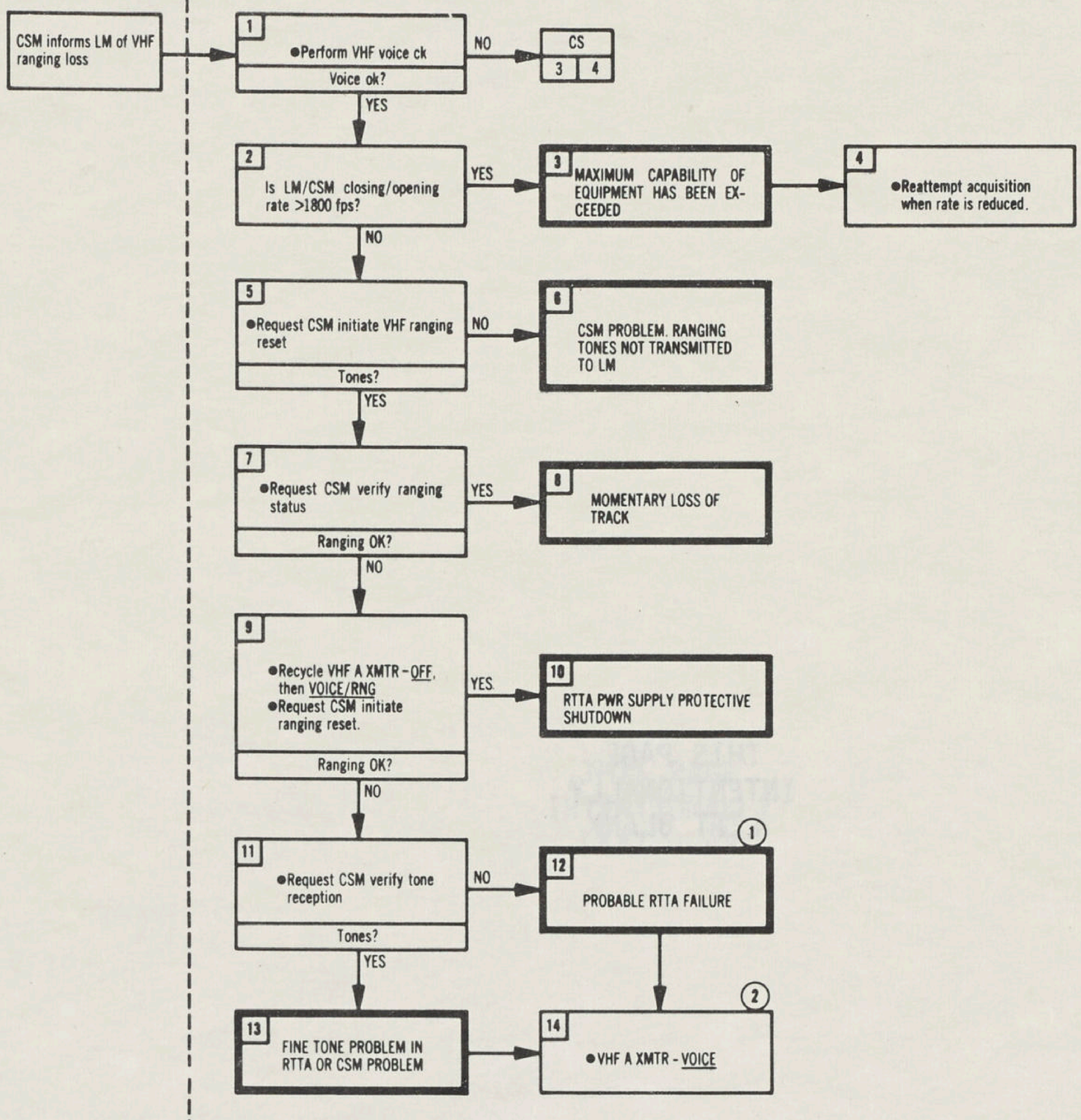
(3) Loss of EMU data relay capability.

A-300LM5-1051

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS

8



(1) If RTTA failure has resulted in 100% duty cycle on xmtr A, ranging operation, in excess of 2 min at temperatures >67°F indicated on ECS: GLYCOL temp ind, may result in xmtr damage. 67°F on ECS: GLYCOL temp ind equals 100°F at ERA flange.

(2) Switching out range capability will enhance voice capability.

300LM8-2063

SYMPTOM	PROCEDURE	REMARKS

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EPS
COMM
ECS
CES
DPS
APS
RCS

ESC MALFUNCTION INDEX

1 H_2O LOW OR DECR ABNORMALLY

2 CABIN

2a CABIN PRESS-LOW OR DECR
3 CABIN PRESS - HIGH

4 SUIT/FAN

4a SUIT PRESS-LOW
5 SUIT PRESS-HIGH (EGRESS MODE)

6 O_2 QTY

6a O_2 QUANTITY - LOW OR DECR

7 ECS

7a SUIT FAN

7b H_2O SEP

7c CO_2

7d PART PRESS CO_2 - HIGH

7e GLYCOL

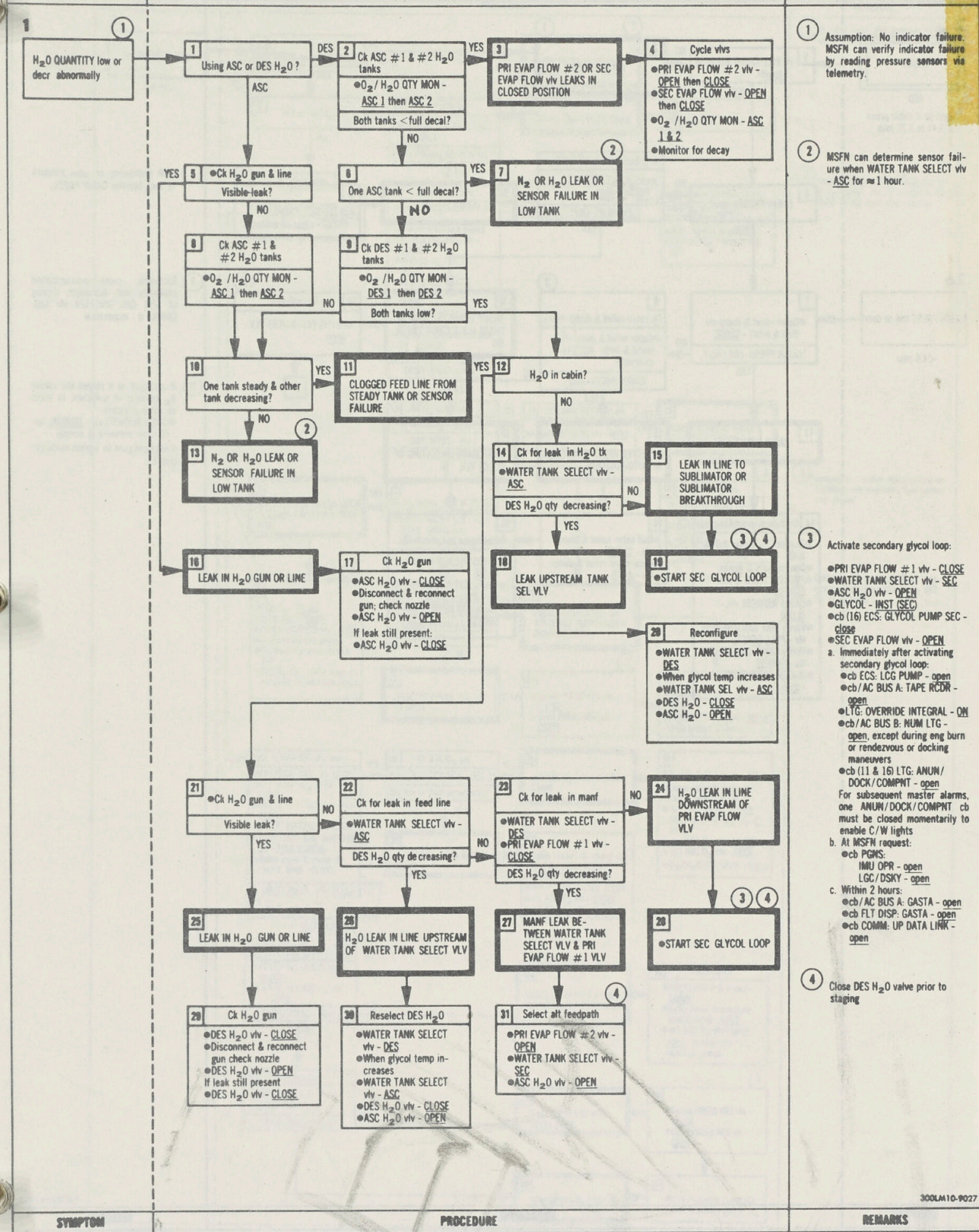
8 GLYCOL

8a GLYCOL TEMP - HIGH OR INCR

9 GLYCOL

10 GLYCOL PRESS LOW OR DECR

SYMPTOM	PROCEDURE	REMARKS



(1) Assumption: No indicator failure. MSFN can verify indicator failure by reading pressure sensors via telemetry.

(2) MSFN can determine sensor failure when WATER TANK SELECT vlv - ASC for ≈1 hour.

(3) Activate secondary glycol loop:

- •PRI EVAP FLOW #1 vlv - CLOSE
- •WATER TANK SELECT vlv - SEC
- •ASC H_2O vlv - OPEN
- •GLYCOL - INST (SEC)
- •cb (16) ECS: GLYCOL PUMP SEC - close
- •SEC EVAP FLOW vlv - OPEN

a. Immediately after activating secondary glycol loop:
- •cb ECS: LCG PUMP - open
- •cb/AC BUS A: TAPE RCDR - open
- •LTG: OVERRIDE INTEGRAL - ON
- •cb/AC BUS B: NUM LTG - open, except during eng burn or rendezvous or docking maneuvers
- •cb (11 & 16) LTG: ANUN/DOCK/COMPNT - open

For subsequent master alarms, one ANUN/DOCK/COMPNT cb must be closed momentarily to enable C/W lights

b. At MSFN request:
- •cb PGNS:
  - IMU OPR - open
  - LGC/DSKY - open

c. Within 2 hours:
- •cb/AC BUS A: GASTA - open
- •cb FLT DISP: GASTA - open
- •cb COMM: UP DATA LINK - open

(4) Close DES H_2O valve prior to staging

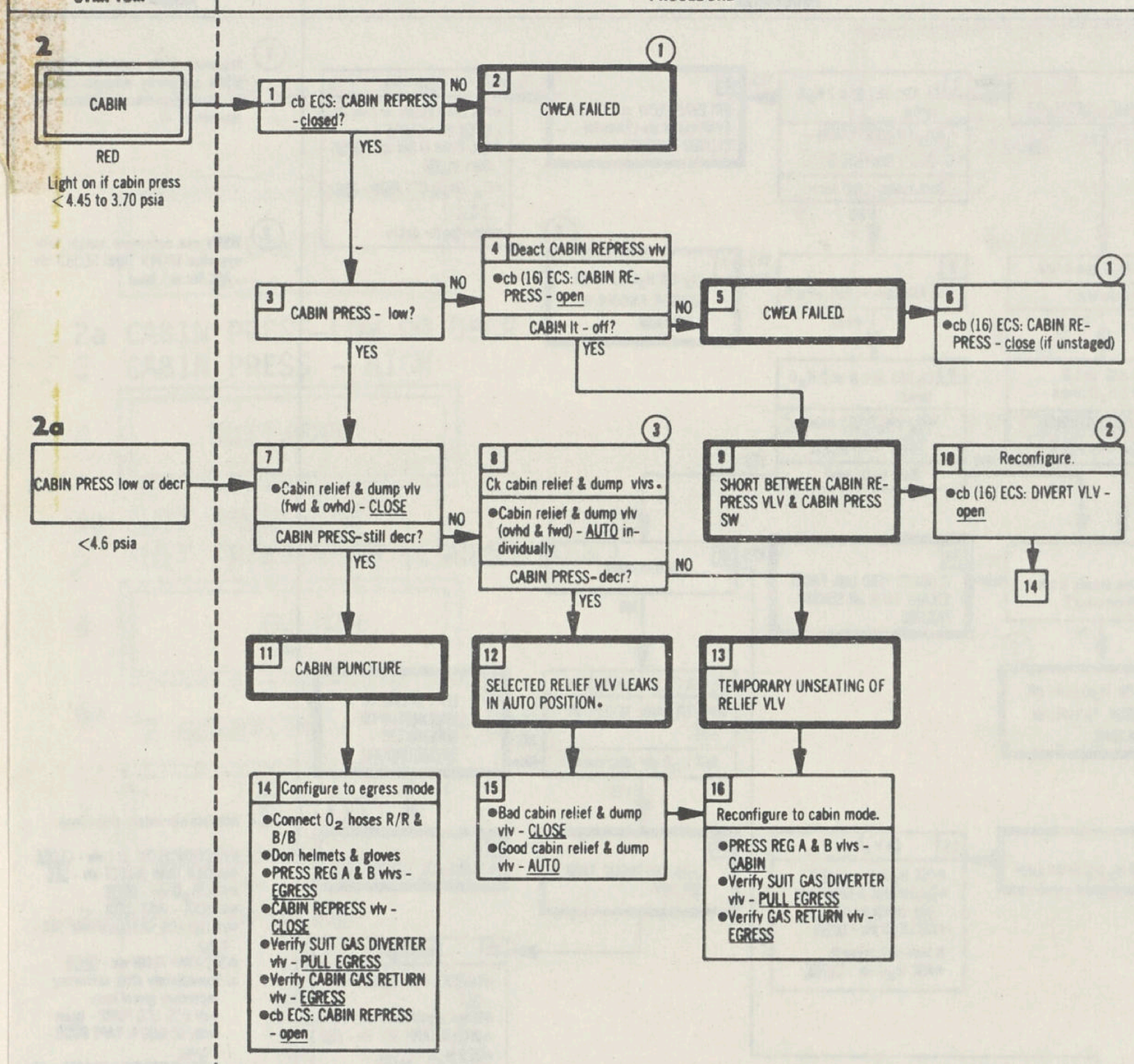
300LM10-9027

SYMPTOM	PROCEDURE	REMARKS

2 THRU 2a

EPS | COMM | ECS | CES | DPS | APS | RCS

SYMPTOM	PROCEDURE	REMARKS



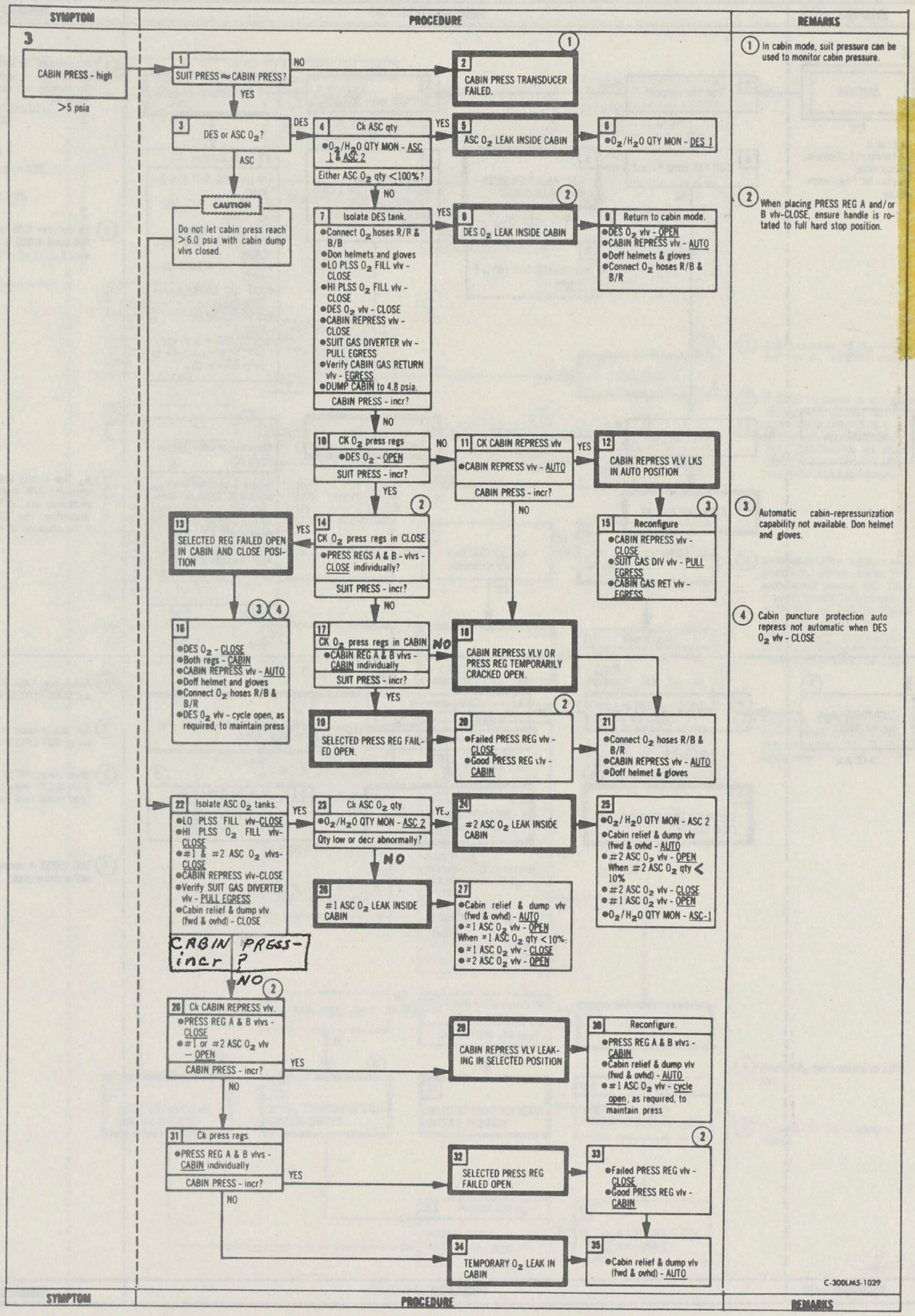
(1) C/W monitoring of cabin pressure is lost. Monitor CABIN PRESS.

(2) Automatic cabin-repressurization capability lost. Automatic closing of SUIT GAS DIVERTER vlv lost. CABIN lt inoperative.

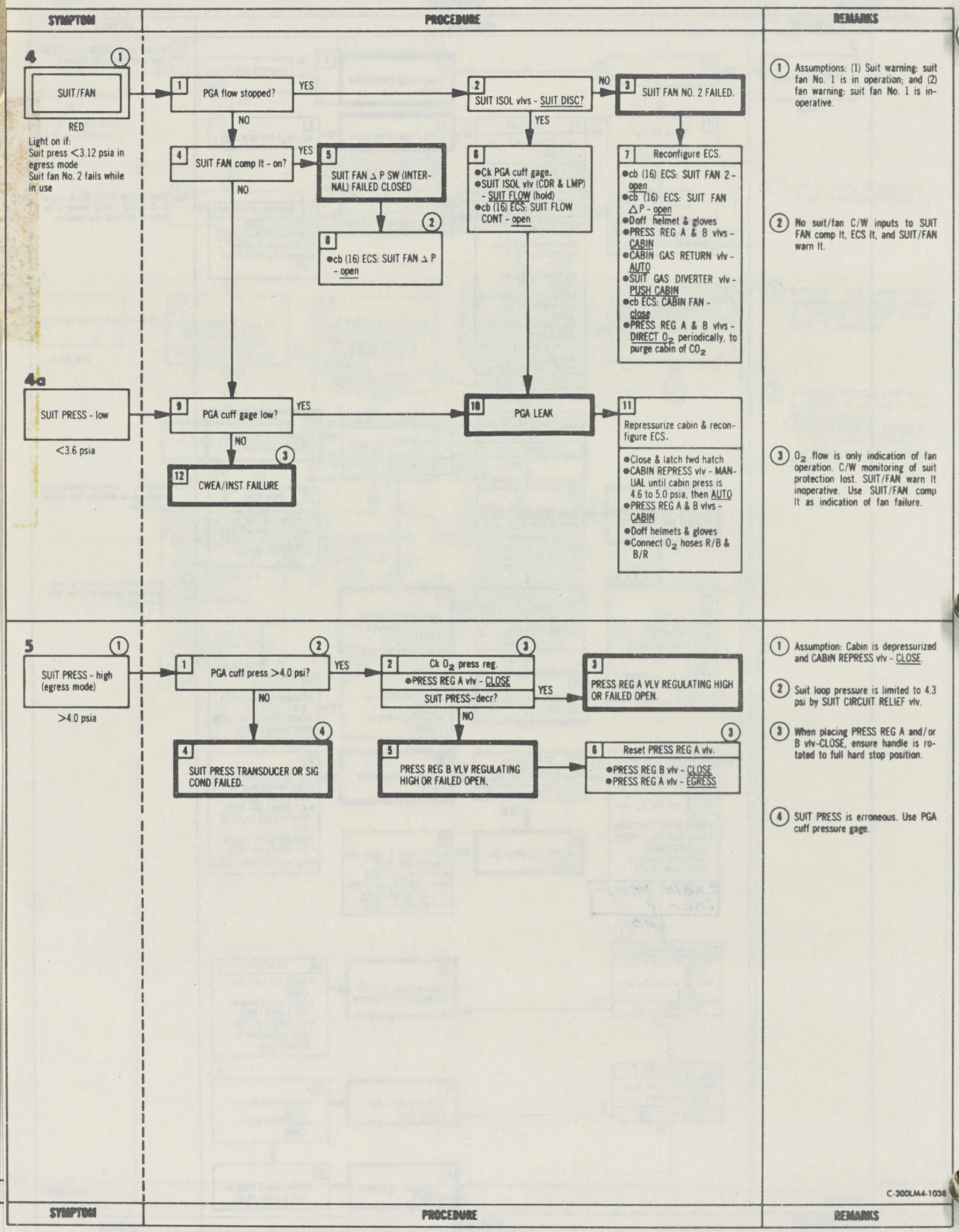
(3) If unstaged, or if staged and ascent O_2 quantity is sufficient to make up cabin pressure:
•CABIN REPRESS vlv - MANUAL until cabin pressure is normal.
If not, configure to egress mode per step 14.

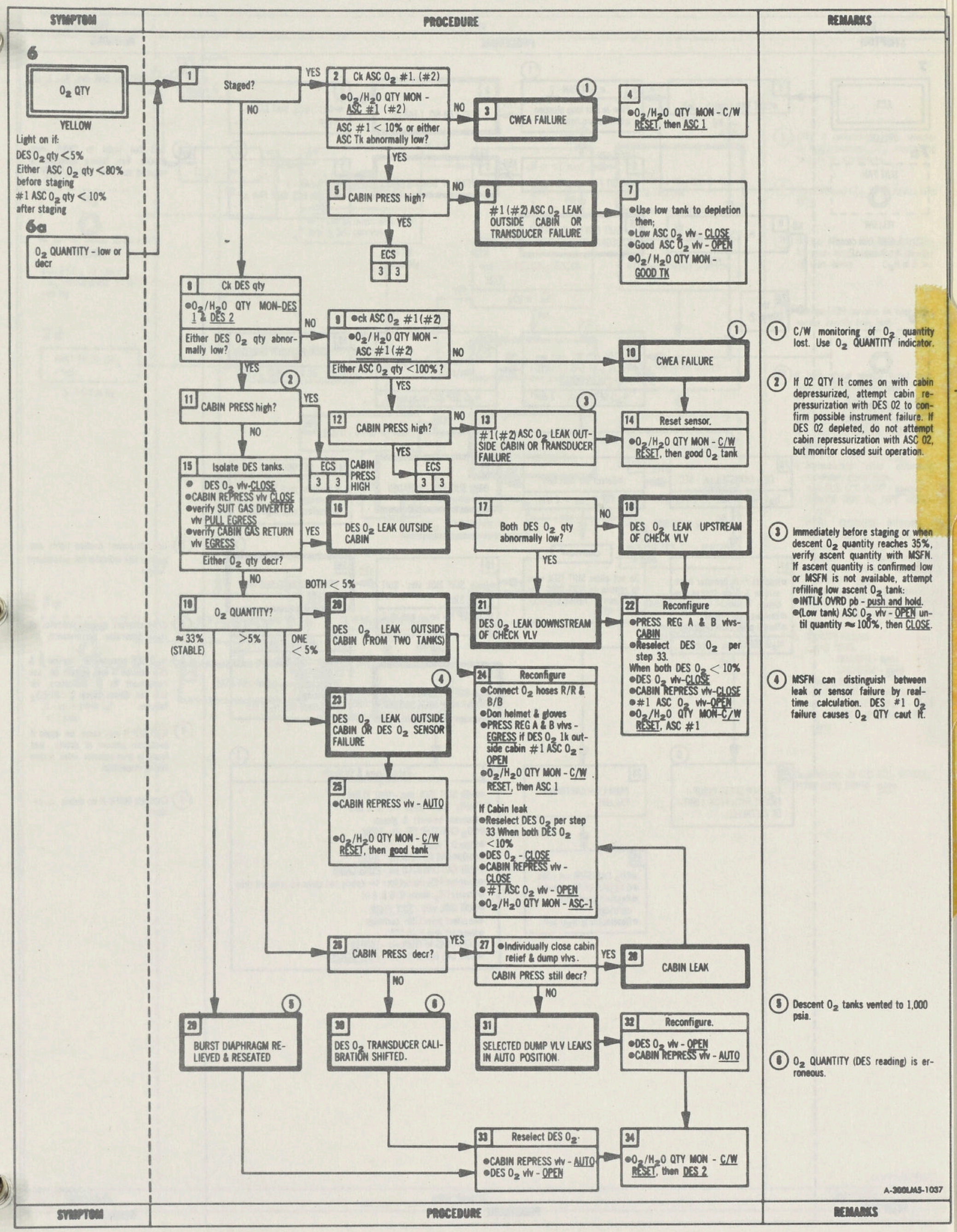
F-300LM5-1033

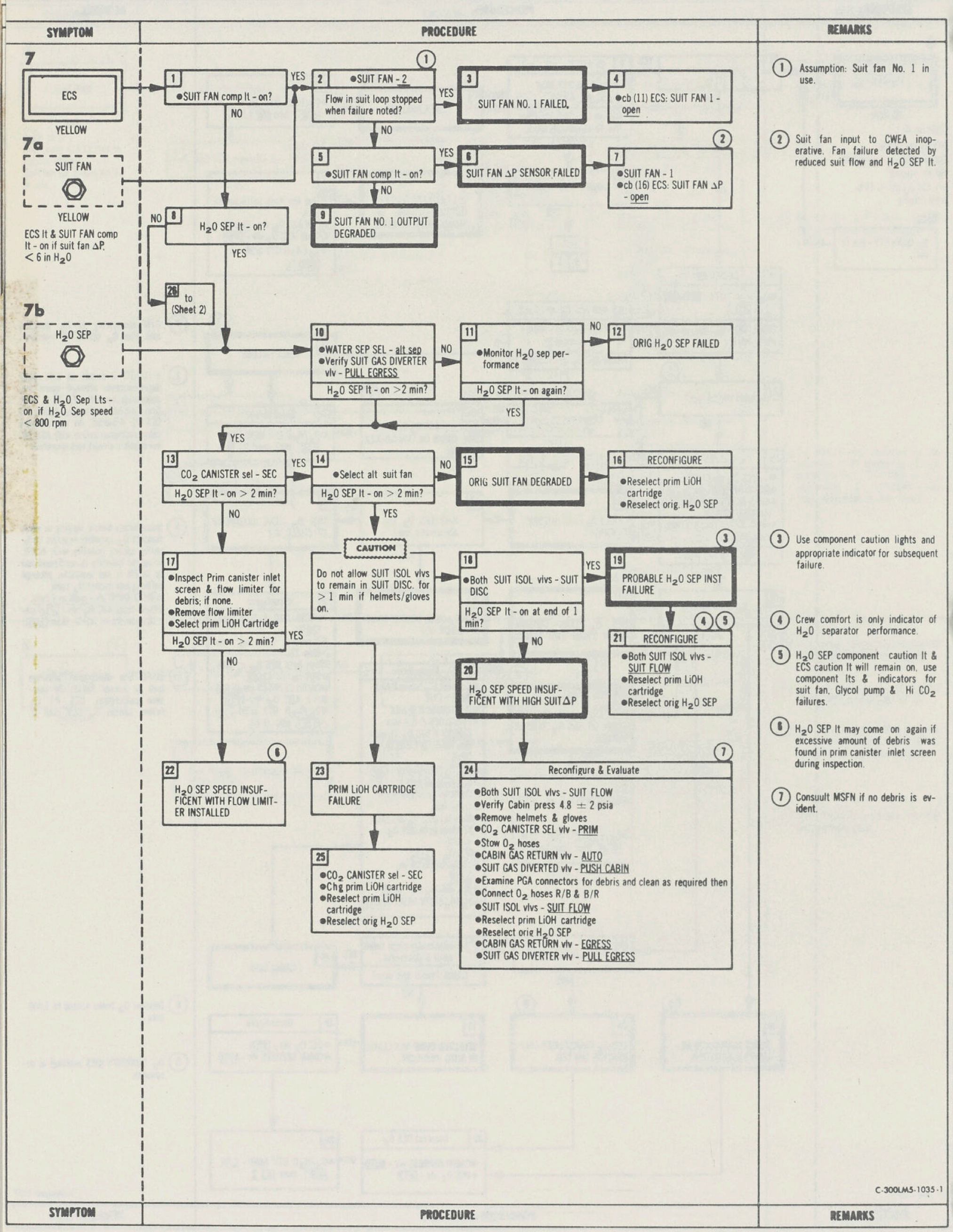
SYMPTOM	PROCEDURE	REMARKS


SYMPTOM
PROCEDURE
REMARKS
3
CABIN PRESS - high
>5 psia
1 SUIT PRESS ≈ CABIN PRESS?
NO
YES
2 CABIN PRESS TRANSDUCER FAILED.
3 DES or ASC O2?
DES
ASC
4 Ck ASC qty
•O2/H2O QTY MON - ASC 1 & ASC 2
Either ASC O2 qty <100%?
5 ASC O2 LEAK INSIDE CABIN
6 •O2/H2O QTY MON - DES 1
CAUTION
Do not let cabin press reach >6.0 psia with cabin dump vlvs closed.
7 Isolate DES tank.
•Connect O2 hoses R/R & B/B
•Don helmets and gloves
•LO PLSS O2 FILL vlv - CLOSE
•HI PLSS O2 FILL vlv - CLOSE
•DES O2 vlv - CLOSE
•CABIN REPRESS vlv - CLOSE
•SUIT GAS DIVERTER vlv - PULL EGRESS
•Verify CABIN GAS RETURN vlv - EGRESS
•DUMP CABIN to 4.8 psia.
CABIN PRESS - incr?
8 DES O2 LEAK INSIDE CABIN
9 Return to cabin mode.
•DES O2 vlv - OPEN
•CABIN REPRESS vlv - AUTO
•Doff helmets & gloves
•Connect O2 hoses R/B & B/R
10 CK O2 press regs
•DES O2 - OPEN
SUIT PRESS - incr?
11 CK CABIN REPRESS vlv
•CABIN REPRESS vlv - AUTO
CABIN PRESS - incr?
12 CABIN REPRESS VLV LKS IN AUTO POSITION
13 SELECTED REG FAILED OPEN IN CABIN AND CLOSE POSITION
14 CK O2 press regs in CLOSE
•PRESS REGS A & B - vlvs - CLOSE individually?
SUIT PRESS - incr?
15 Reconfigure
•CABIN REPRESS vlv - CLOSE
•SUIT GAS DIV vlv - PULL EGRESS
•CABIN GAS RET vlv - EGRESS
16 •DES O2 - CLOSE
•Both regs - CABIN
•CABIN REPRESS vlv - AUTO
•Doff helmet and gloves
•Connect O2 hoses R/B & B/R
•DES O2 vlv - cycle open, as required, to maintain press
17 CK O2 press regs in CABIN
•CABIN REG A & B vlvs - CABIN individually
SUIT PRESS - incr?
18 CABIN REPRESS VLV OR PRESS REG TEMPORARILY CRACKED OPEN.
19 SELECTED PRESS REG FAILED OPEN.
20 •Failed PRESS REG vlv - CLOSE
•Good PRESS REG vlv - CABIN
21 •Connect O2 hoses R/B & B/R
•CABIN REPRESS vlv - AUTO
•Doff helmet & gloves
22 Isolate ASC O2 tanks.
•LO PLSS FILL vlv-CLOSE
•HI PLSS O2 FILL vlv-CLOSE
•#1 & #2 ASC O2 vlvs-CLOSE
•CABIN REPRESS vlv-CLOSE
•Verify SUIT GAS DIVERTER vlv - PULL EGRESS
•Cabin relief & dump vlv (fwd & ovhd) - CLOSE
23 Ck ASC O2 qty.
•O2/H2O QTY MON - ASC 2
Qty low or decr abnormally?
24 #2 ASC O2 LEAK INSIDE CABIN
25 •O2/H2O QTY MON - ASC 2
•Cabin relief & dump vlv (fwd & ovhd - AUTO
•#2 ASC O2 vlv - OPEN When #2 ASC O2 qty < 10%
•#2 ASC O2 vlv - CLOSE
•#1 ASC O2 vlv - OPEN
•O2/H2O QTY MON - ASC-1
26 #1 ASC O2 LEAK INSIDE CABIN
27 •Cabin relief & dump vlv (fwd & ovhd) - AUTO
•#1 ASC O2 vlv - OPEN When #1 ASC O2 qty < 10%:
•#1 ASC O2 vlv - CLOSE
•#2 ASC O2 vlv - OPEN
CABIN PRESS - incr ?
NO
28 Ck CABIN REPRESS vlv.
•PRESS REG A & B vlvs - CLOSE
•#1 or #2 ASC O2 vlv - OPEN
CABIN PRESS - incr?
29 CABIN REPRESS VLV LEAKING IN SELECTED POSITION
30 Reconfigure.
•PRESS REG A & B vlvs - CABIN
•Cabin relief & dump vlv (fwd & ovhd) - AUTO
•#1 ASC O2 vlv - cycle open, as required, to maintain press
31 Ck press regs.
•PRESS REG A & B vlvs - CABIN individually
CABIN PRESS - incr?
32 SELECTED PRESS REG FAILED OPEN.
33 •Failed PRESS REG vlv - CLOSE
•Good PRESS REG vlv - CABIN
34 TEMPORARY O2 LEAK IN CABIN
35 •Cabin relief & dump vlv (fwd & ovhd) - AUTO
1 In cabin mode, suit pressure can be used to monitor cabin pressure.
2 When placing PRESS REG A and/or B vlv-CLOSE, ensure handle is rotated to full hard stop position.
3 Automatic cabin-repressurization capability not available. Don helmet and gloves.
4 Cabin puncture protection auto repress not automatic when DES O2 vlv - CLOSE
C-300LM5-1029

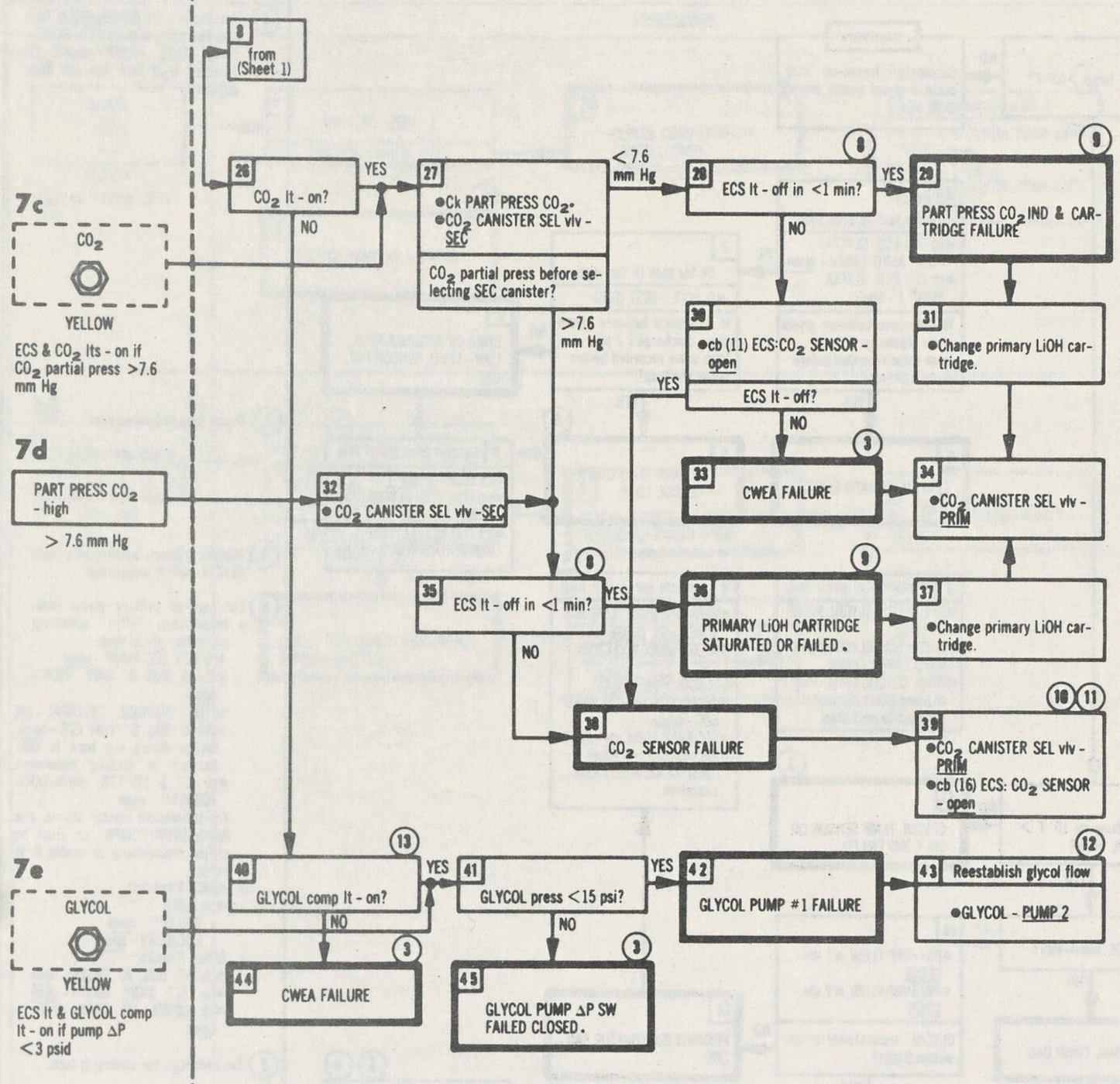
EPS 2 THRU 2a | COMM 4 THRU 5 | ECS | CES | DPS | APS | RCS




SYMPTOM
PROCEDURE
REMARKS
6
O_2 QTY
YELLOW
Light on if:
DES O_2 qty < 5%
Either ASC O_2 qty < 80% before staging
#1 ASC O_2 qty < 10% after staging
6a
O_2 QUANTITY - low or decr
1 Staged?
YES
NO
2 Ck ASC O_2 #1. (#2)
•O_2/H_2O QTY MON - ASC #1 (#2)
ASC #1 < 10% or either ASC Tk abnormally low?
3 CWEA FAILURE
4 •O_2/H_2O QTY MON - C/W RESET, then ASC 1
5 CABIN PRESS high?
6 #1 (#2) ASC O_2 LEAK OUTSIDE CABIN OR TRANSDUCER FAILURE
7 •Use low tank to depletion then;
•Low ASC O_2 vlv - CLOSE
•Good ASC O_2 vlv - OPEN
•O_2/H_2O QTY MON - GOOD TK
ECS 3 3
8 Ck DES qty
•O_2/H_2O QTY MON-DES 1 & DES 2
Either DES O_2 qty abnormally low?
9 •ck ASC O_2 #1 (#2)
•O_2/H_2O QTY MON - ASC #1 (#2)
Either ASC O_2 qty < 100% ?
10 CWEA FAILURE
11 CABIN PRESS high?
12 CABIN PRESS high?
13 #1 (#2) ASC O_2 LEAK OUTSIDE CABIN OR TRANSDUCER FAILURE
14 Reset sensor.
•O_2/H_2O QTY MON - C/W RESET, then good O_2 tank
CABIN PRESS HIGH
15 Isolate DES tanks.
• DES O_2 vlv-CLOSE
•CABIN REPRESS vlv CLOSE
•verify SUIT GAS DIVERTER vlv PULL EGRESS
•verify CABIN GAS RETURN vlv EGRESS
Either O_2 qty decr?
16 DES O_2 LEAK OUTSIDE CABIN
17 Both DES O_2 qty abnormally low?
18 DES O_2 LEAK UPSTREAM OF CHECK VLV
19 O_2 QUANTITY?
≈ 33% (STABLE)
>5%
ONE < 5%
BOTH < 5%
20 DES O_2 LEAK OUTSIDE CABIN (FROM TWO TANKS)
21 DES O_2 LEAK DOWNSTREAM OF CHECK VLV
22 Reconfigure
•PRESS REG A & B vlvs-CABIN
•Reselect DES O_2 per step 33.
When both DES O_2 < 10%
•DES O_2 vlv-CLOSE
•CABIN REPRESS vlv-CLOSE
•#1 ASC O_2 vlv-OPEN
•O_2/H_2O QTY MON-C/W RESET, ASC #1
23 DES O_2 LEAK OUTSIDE CABIN OR DES O_2 SENSOR FAILURE
24 Reconfigure
•Connect O_2 hoses R/R & B/B
•Don helmet & gloves
•PRESS REG A & B vlvs - EGRESS if DES O_2 lk outside cabin #1 ASC O_2 - OPEN
•O_2/H_2O QTY MON - C/W RESET, then ASC 1
If Cabin leak
•Reselect DES O_2 per step 33 When both DES O_2 < 10%
•DES O_2 - CLOSE
•CABIN REPRESS vlv - CLOSE
•#1 ASC O_2 vlv - OPEN
•O_2/H_2O QTY MON - ASC-1
25 •CABIN REPRESS vlv - AUTO
•O_2/H_2O QTY MON - C/W RESET, then good tank
26 CABIN PRESS decr?
27 •Individually close cabin relief & dump vlvs.
CABIN PRESS still decr?
28 CABIN LEAK
29 BURST DIAPHRAGM RELIEVED & RESEATED
30 DES O_2 TRANSDUCER CALIBRATION SHIFTED.
31 SELECTED DUMP VLV LEAKS IN AUTO POSITION.
32 Reconfigure.
•DES O_2 vlv - OPEN
•CABIN REPRESS vlv - AUTO
33 Reselect DES O_2.
•CABIN REPRESS vlv - AUTO
•DES O_2 vlv - OPEN
34 •O_2/H_2O QTY MON - C/W RESET, then DES 2
1 C/W monitoring of O_2 quantity lost. Use O_2 QUANTITY indicator.
2 If 02 QTY lt comes on with cabin depressurized, attempt cabin repressurization with DES 02 to confirm possible instrument failure. If DES 02 depleted, do not attempt cabin repressurization with ASC 02, but monitor closed suit operation.
3 Immediately before staging or when descent O_2 quantity reaches 35%, verify ascent quantity with MSFN. If ascent quantity is confirmed low or MSFN is not available, attempt refilling low ascent O_2 tank:
•INTLK OVRD pb - push and hold.
•(Low tank) ASC O_2 vlv - OPEN until quantity ≈ 100%, then CLOSE.
4 MSFN can distinguish between leak or sensor failure by real-time calculation. DES #1 O_2 failure causes O_2 QTY caut lt.
5 Descent O_2 tanks vented to 1,000 psia.
6 O_2 QUANTITY (DES reading) is erroneous.
A-300LM5-1037


SYMPTOM
PROCEDURE
REMARKS
7
ECS
YELLOW
7a
SUIT FAN
YELLOW
ECS lt & SUIT FAN comp lt - on if suit fan ΔP < 6 in H2O
7b
H2O SEP
ECS & H2O Sep Lts - on if H2O Sep speed < 800 rpm
1 ●SUIT FAN comp lt - on?
YES
NO
2 ●SUIT FAN - 2 Flow in suit loop stopped when failure noted?
YES
NO
3 SUIT FAN NO. 1 FAILED.
4 ●cb (11) ECS: SUIT FAN 1 - open
5 ●SUIT FAN comp lt - on?
YES
NO
6 SUIT FAN ΔP SENSOR FAILED
7 ●SUIT FAN - 1 ●cb (16) ECS: SUIT FAN ΔP - open
9 SUIT FAN NO. 1 OUTPUT DEGRADED
8 H2O SEP lt - on?
NO
YES
28 to (Sheet 2)
10 ●WATER SEP SEL - alt sep ●Verify SUIT GAS DIVERTER vlv - PULL EGRESS
H2O SEP lt - on >2 min?
11 ●Monitor H2O sep performance
H2O SEP lt - on again?
12 ORIG H2O SEP FAILED
13 CO2 CANISTER sel - SEC
H2O SEP lt - on > 2 min?
14 ●Select alt suit fan
H2O SEP lt - on > 2 min?
15 ORIG SUIT FAN DEGRADED
16 RECONFIGURE ●Reselect prim LiOH cartridge ●Reselect orig. H2O SEP
CAUTION
Do not allow SUIT ISOL vlvs to remain in SUIT DISC. for > 1 min if helmets/gloves on.
17 ●Inspect Prim canister inlet screen & flow limiter for debris; if none. ●Remove flow limiter ●Select prim LiOH Cartridge
H2O SEP lt - on > 2 min?
18 ●Both SUIT ISOL vlvs - SUIT DISC
H2O SEP lt - on at end of 1 min?
19 PROBABLE H2O SEP INST FAILURE
21 RECONFIGURE ●Both SUIT ISOL vlvs - SUIT FLOW ●Reselect prim LiOH cartridge ●Reselect orig H2O SEP
20 H2O SEP SPEED INSUFFICENT WITH HIGH SUIT ΔP
22 H2O SEP SPEED INSUFFICENT WITH FLOW LIMITER INSTALLED
23 PRIM LiOH CARTRIDGE FAILURE
25 ●CO2 CANISTER sel - SEC ●Chg prim LiOH cartridge ●Reselect prim LiOH cartridge ●Reselect orig H2O SEP
24 Reconfigure & Evaluate
●Both SUIT ISOL vlvs - SUIT FLOW
●Verify Cabin press 4.8 ± 2 psia
●Remove helmets & gloves
●CO2 CANISTER SEL vlv - PRIM
●Stow O2 hoses
●CABIN GAS RETURN vlv - AUTO
●SUIT GAS DIVERTED vlv - PUSH CABIN
●Examine PGA connectors for debris and clean as required then
●Connect O2 hoses R/B & B/R
●SUIT ISOL vlvs - SUIT FLOW
●Reselect prim LiOH cartridge
●Reselect orig H2O SEP
●CABIN GAS RETURN vlv - EGRESS
●SUIT GAS DIVERTER vlv - PULL EGRESS
1 Assumption: Suit fan No. 1 in use.
2 Suit fan input to CWEA inoperative. Fan failure detected by reduced suit flow and H2O SEP lt.
3 Use component caution lights and appropriate indicator for subsequent failure.
4 Crew comfort is only indicator of H2O separator performance.
5 H2O SEP component caution lt & ECS caution lt will remain on, use component lts & indicators for suit fan, Glycol pump & Hi CO2 failures.
6 H2O SEP lt may come on again if excessive amount of debris was found in prim canister inlet screen during inspection.
7 Consuult MSFN if no debris is evident.
C-300LM5-1035-1

SYMPTOM	PROCEDURE	REMARKS



(8) CO_2 lt remains on while selector is in SEC position. CO_2 should drop to zero in <1 minute.

(9) Use ECS and CO_2 lts to detect high CO_2.

(10) Normal life of primary canister is 41 man-hours; secondary canister, 16 man-hours.

(11) Change LiOH canister on time. CO_2 sensor usually fails high.

(12) If both glycol pumps failed, activate secondary glycol loop:
- •PRI EVAP FLOW #1 vlv - CLOSE
- •WATER TANK SELECT vlv - SEC
- •GLYCOL - INST (SEC)
- •cb (16) ECS: GLYCOL PUMP SEC - close
- •SEC EVAP FLOW vlv - OPEN

a. Immediately after activating secondary glycol loop:
- •cb ECS: LCG PUMP - open
- •cb/AC BUS A: TAPE RCDR - open
- •LTG: OVERRIDE INTEGRAL - ON
- •cb/AC BUS B: NUM LTG - open, except during eng burn or rendezvous or docking maneuvers
- •cb (11 & 16) LTG: ANUN/DOCK /COMPNT - open

For subsequent master alarms, one ANUN/DOCK/COMPNT cb must be closed momentarily to enable C/W lights.

b. At MSFN request:
- •cb PGNS:
  - IMU OPR - open
  - LGC/DSKY - open

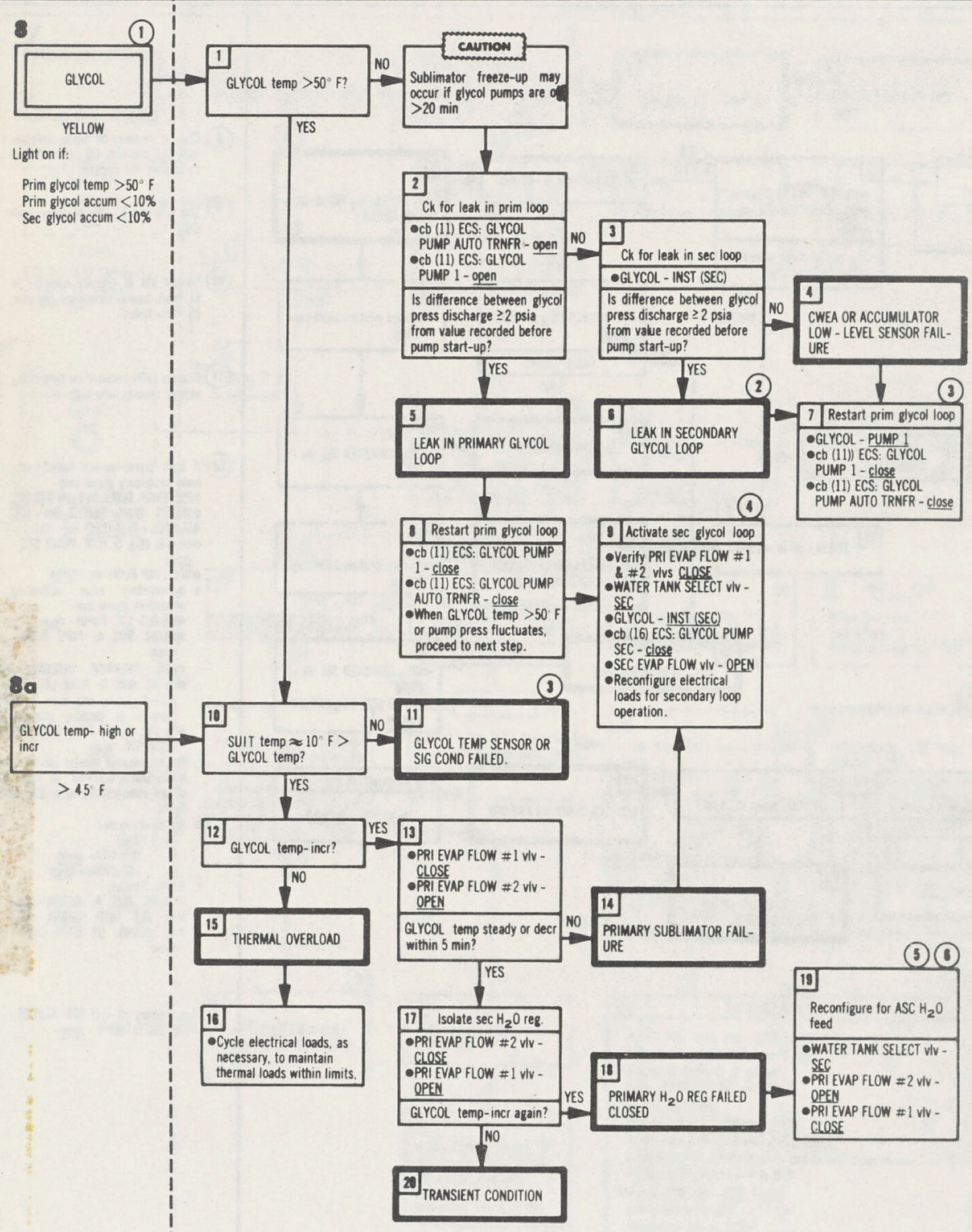
c. Within 2 hours:
- •cb/AC BUS A: GASTA - open
- •cb FLT DISP: GASTA - open
- •cb COMM: UP DATA LINK - open

(13) Assumption: cb (11) ECS: GLYCOL PUMP AUTO TRNFR - open

C-300LM5-1035-2

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



(1) Assumption: (1) Primary glycol loop was operating with cb ECS: GLYCOL PUMP AUTO TRNFR closed. (2) Selected H_2O tank has not been depleted.

(2) Glycol loop redundancy lost.

(3) Monitor system performance with GLYCOL caut lt inoperative.

(4) For loss of primary glycol loop:
a. Immediately after activating secondary glycol loop:
- •cb ECS: LCG PUMP - open
- •cb/AC BUS A: TAPE RCDR - open
- •LTG: OVERRIDE INTEGRAL - ON
- •cb/AC BUS B: NUM LTG - open, except during eng burn or rendezvous or docking maneuvers
- •cb (11 & 16) LTG: ANUN/DOCK /COMPNT - open

For subsequent master alarms, one ANUN/DOCK/COMPNT cb must be closed momentarily to enable C/W lights.

b. At MSFN request:
- •cb PGNS:
  - IMU OPR - open
  - LGC/DSKY - open

c. Within 2 hours:
- •cb/AC BUS A: GASTA - open
- •cb FLT DISP: GASTA - open
- •cb COMM: UP DATA LINK - open

(5) Descent H_2O for cooling is lost.

(6) VHF ranging failure at glycol temperature above 67°F indicated in cabin may result in VHF transmitter damage.

D-300LM5-1036

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS
9 GLYCOL YELLOW Light on if pump ΔP <3 psid	1 •GLYCOL - PUMP 2 GLYCOL comp lt - on? YES → 2 GLYCOL COMP LT RELAY FAILED CLOSED. → 3 Reselect pump No. 1. (1) •cb (11) ECS: GLYCOL PUMP AUTO TRNFR - open •GLYCOL - PUMP 1 •cb (11) ECS: GLYCOL PUMP AUTO TRNFR - close NO → 4 GLYCOL PUMP NO. 1 FAILED. (2)	(1) Glycol pump automatic transfer is operable. Monitor GLYCOL ind. for pump failures. (2) A temporary ΔP switch failure will result in automatic transfer. Confirm pump No. 1 failure by resetting automatic transfer circuit and reselecting pump No. 1 while monitoring glycol pressure. Do not stop glycol flow for >20 minutes if sublimator is operating.
10 GLYCOL press-low or decr <17 psia	1 Compare glycol pumps. •cb (11) ECS: GLYCOL PUMP AUTO TRNFR - open •GLYCOL - PUMP 2 GLYCOL press - normal? YES → 2 GLYCOL PUMP NO. 1 DEGRADED OR BYPASS VLV FAILED OPEN. → 3 •cb (11) ECS: GLYCOL PUMP 1 - open NO → 4 GLYCOL PRESS TRANSDUCER CALIBRATION SHIFTED. → 5 Reconfigure. •GLYCOL - PUMP 1 •cb (11) ECS: GLYCOL PUMP AUTO TRNFR - close	

A-300LM5-1041

SYMPTOM	PROCEDURE	REMARKS

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ED MALFUNCTION INDEX

1 **ED RELAYS**

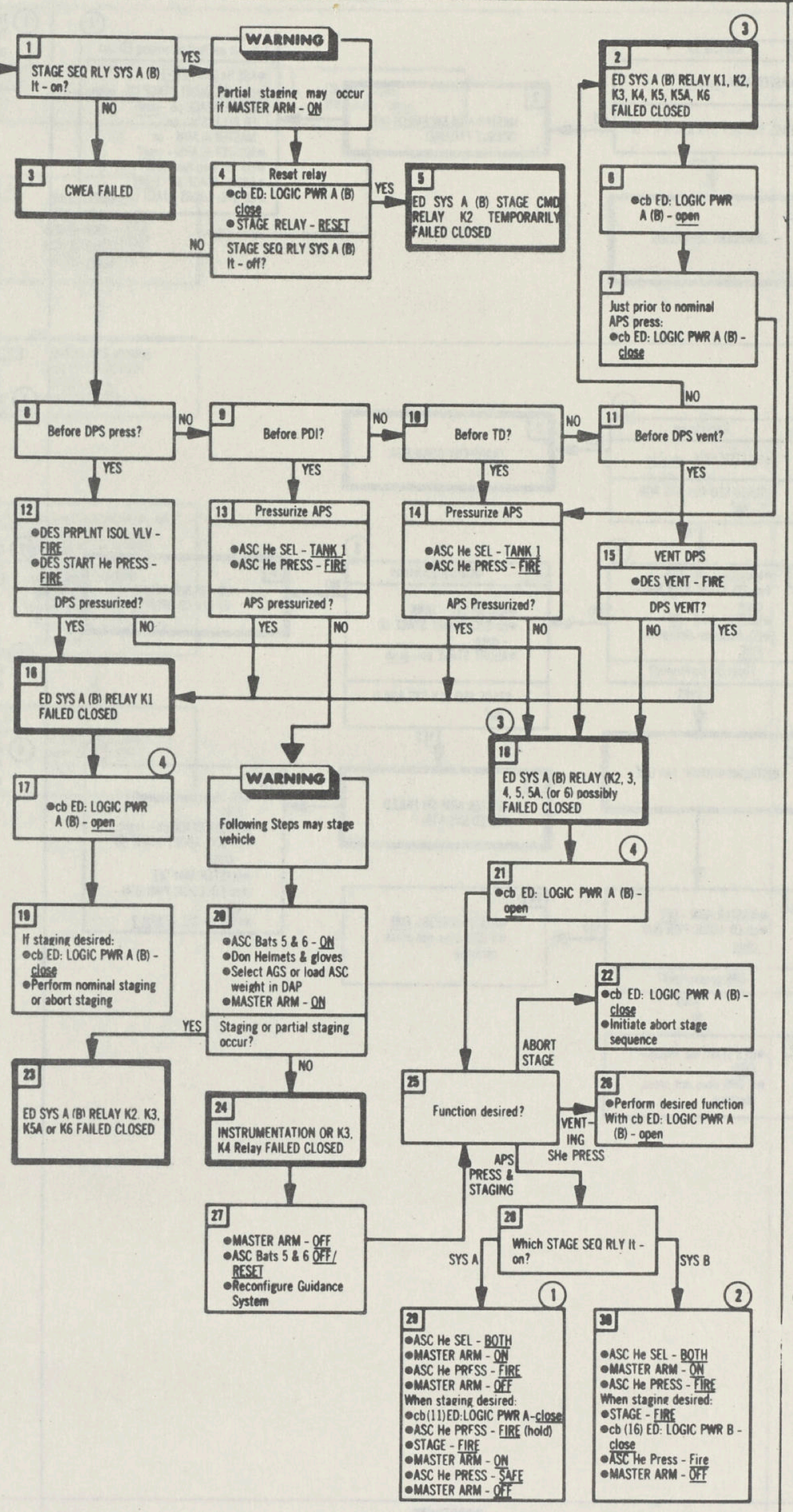
2 STAGE SEQ RLY SYS A & B
LTS - OFF WHEN MASTER ARM - ON

3 STAGE SEQ RLY SYS A OR B LT - OFF
WITH MASTER ARM - ON

4a MSFN ADVISES BOTH SYS A & B K7 - K15 FAILED

4b MSFN ADVISES BOTH SYS A & B K7 - K15 FAILED

SYMPTOM	PROCEDURE	REMARKS



(1) This procedure provides for APS pressurization with ED system B; followed by APS pressurization with ED system A, and staging with both systems.

(2) This procedure provides for APS pressurization with ED system A; staging with ED system A, then ED system B; and APS pressurization with ED system B.

(3) MSFN can confirm failure via telemetry. Consult MSFN before proceeding.

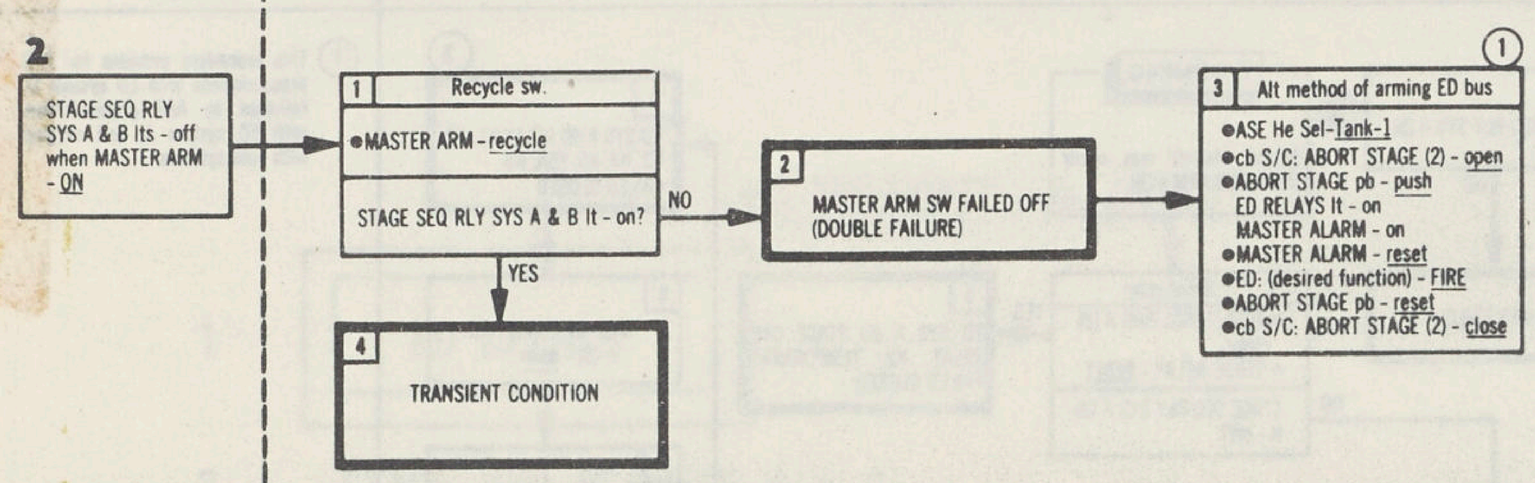
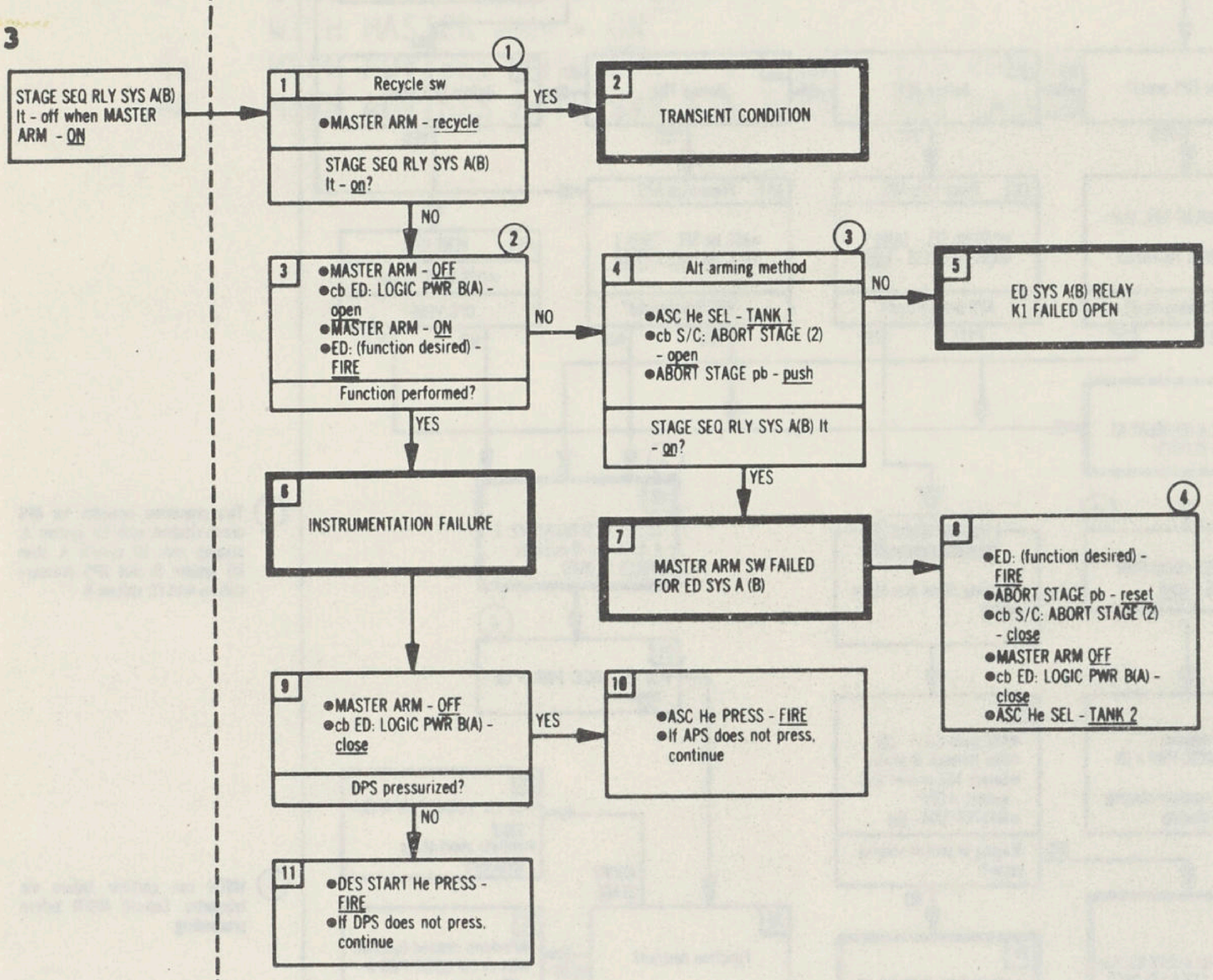
(4) Descent engine command override function is lost when cb ED: LOGIC PWR B - open

C-300LM5-1003

SYMPTOM	PROCEDURE	REMARKS

EPS | COMM | ECS | ED | DPS | APS | RCS

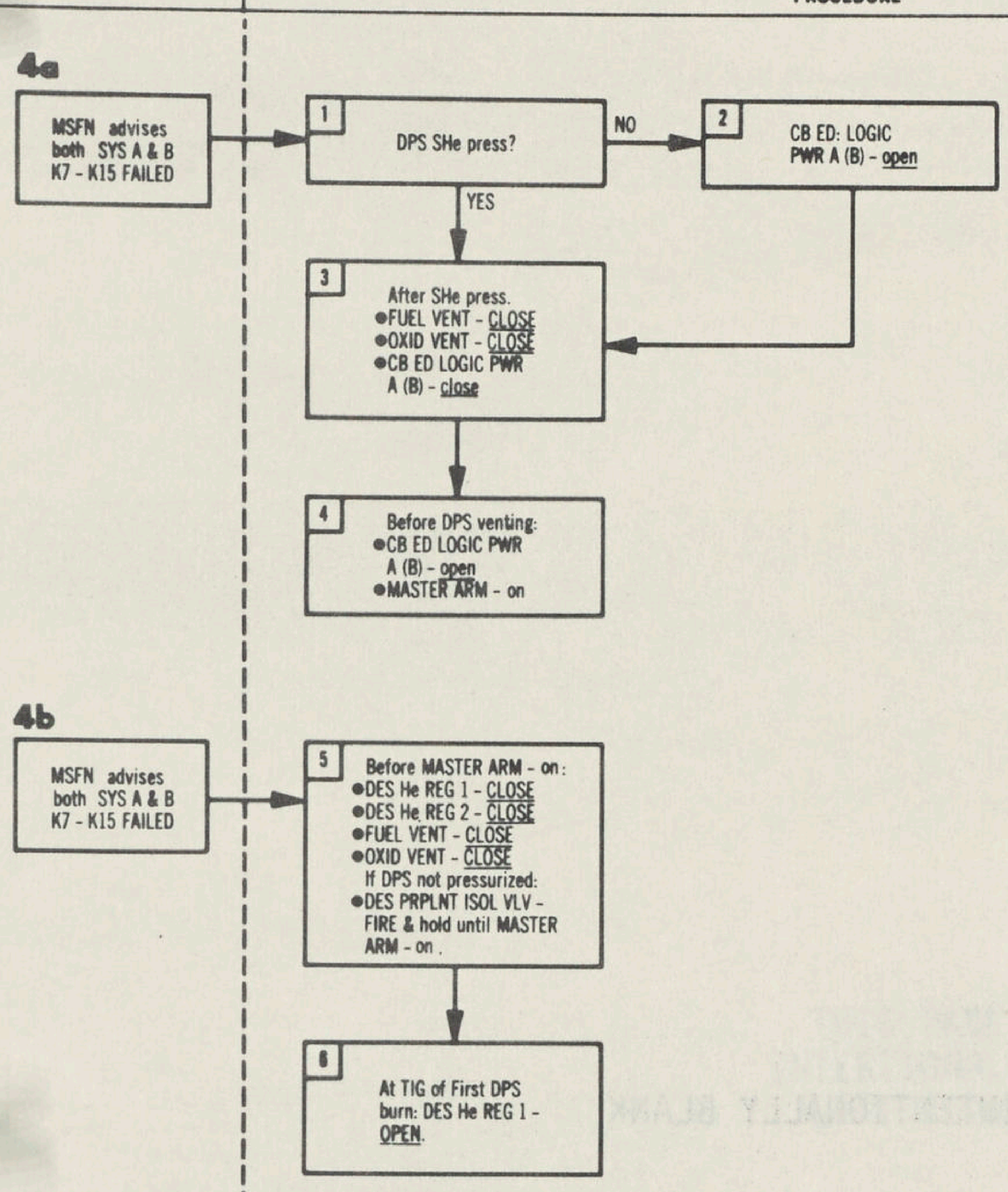
2 THRU 3

SYMPTOM	PROCEDURE	REMARKS
2		(1) This method pressurizes ASCENT Tank-1 as soon as ABORT STAGE pb is pushed.
3		(1) MSFN can confirm failure. Consult MSFN before proceeding. (2) Descent engine command override function is lost when cb ED: LOGIC PWR B - open (3) This method pressurizes ascent tank 1 as soon as abort stage pb is pushed. (4) ABORT STAGE pb must be pushed for staging. This ensures staging with two pyro systems.

A-300LM8-1055

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



Relay functions
K7 - RCS press.

K8 - LDG gear.

K9 - DPS SHE press.

K10 - ASC HE TANK 1.

K11 - ASC HE TANK 2.

K12 - ASC FUEL and OXID COMP vlv (SYS B only).

K12a - ACS FUEL and OXID COMP vlv.

K13 - DPS FUEL and OXID vent.

K14 - DPS AMB HE

K15 - DPS FUEL and OXID COMP vlv.

300LM10-9026

SYMPTOM	PROCEDURE	REMARKS

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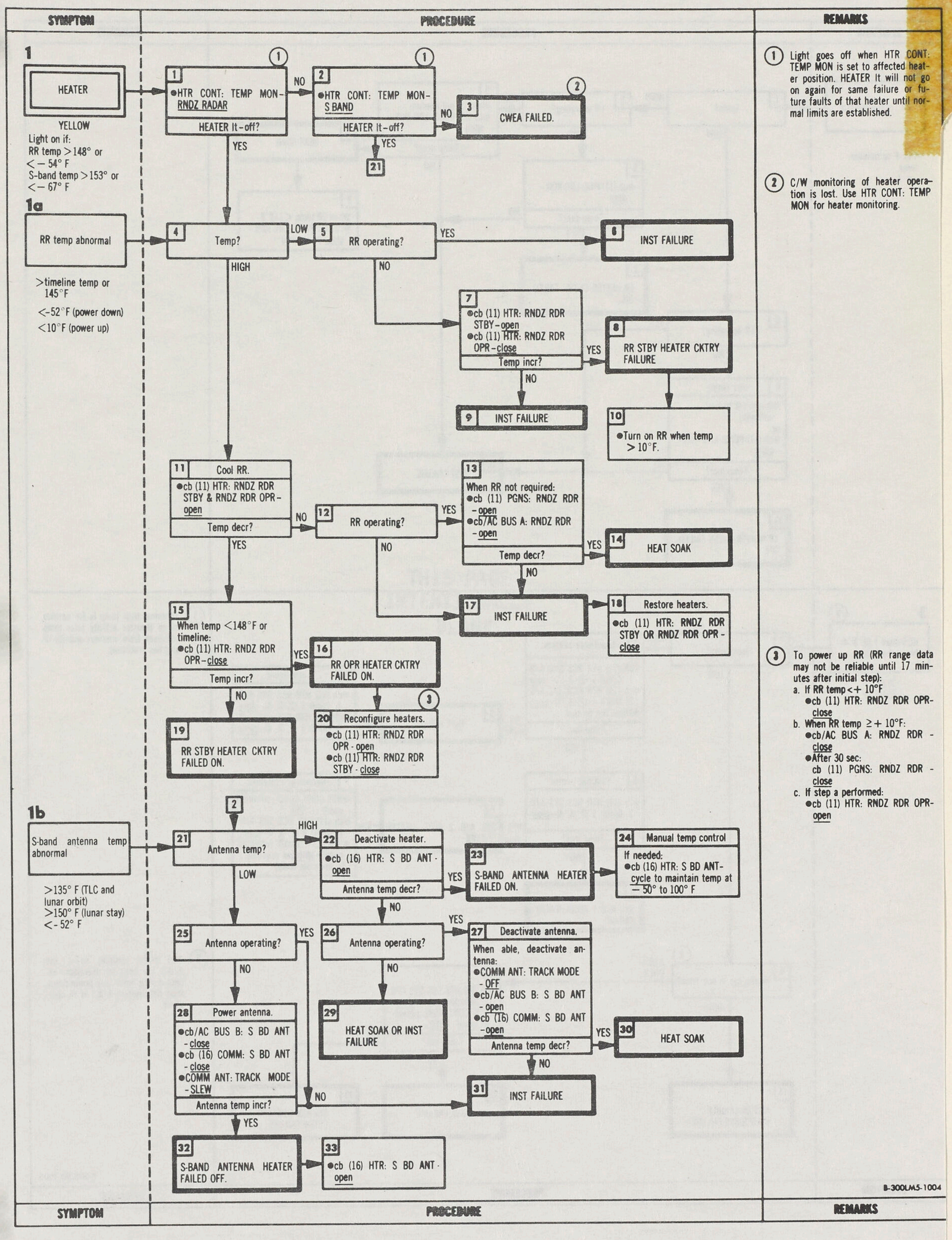
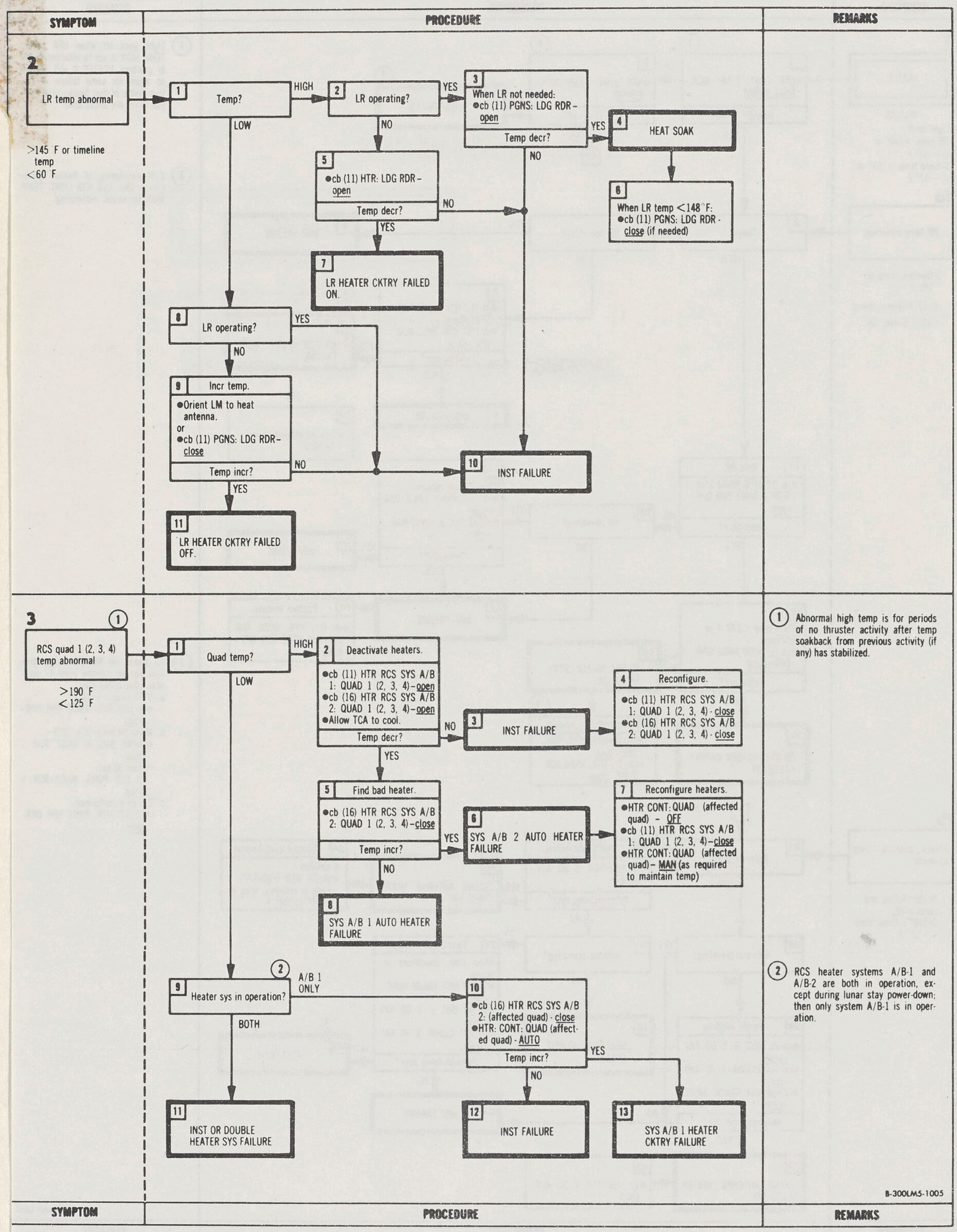
HTRS MALFUNCTION INDEX

1 HEATER

1a RR TEMP ABNORMAL
1b S-BAND ANTENNA TEMP ABNORMAL
2 LR TEMP ABNORMAL
3 RCS QUAD 1 (2, 3, 4,) TEMP ABNORMAL


SYMPTOM
PROCEDURE
REMARKS
1
HEATER
YELLOW
Light on if:
RR temp >148° or <−54° F
S-band temp >153° or <−67° F
1a
RR temp abnormal
>timeline temp or 145°F
<-52°F (power down)
<10°F (power up)
1b
S-band antenna temp abnormal
>135° F (TLC and lunar orbit)
>150° F (lunar stay)
<-52° F
1 ●HTR CONT: TEMP MON-RNDZ RADAR
HEATER lt-off?
2 ●HTR CONT: TEMP MON-S BAND
HEATER lt-off?
3 CWEA FAILED.
21
4 Temp?
5 RR operating?
6 INST FAILURE
7 ●cb (11) HTR: RNDZ RDR STBY-open ●cb (11) HTR: RNDZ RDR OPR-close
Temp incr?
8 RR STBY HEATER CKTRY FAILURE
9 INST FAILURE
10 ●Turn on RR when temp >10°F.
11 Cool RR. ●cb (11) HTR: RNDZ RDR STBY & RNDZ RDR OPR-open
Temp decr?
12 RR operating?
13 When RR not required: ●cb (11) PGNS: RNDZ RDR -open ●cb/AC BUS A: RNDZ RDR -open
Temp decr?
14 HEAT SOAK
15 When temp <148°F or timeline: ●cb (11) HTR: RNDZ RDR OPR-close
Temp incr?
16 RR OPR HEATER CKTRY FAILED ON.
17 INST FAILURE
18 Restore heaters. ●cb (11) HTR: RNDZ RDR STBY OR RNDZ RDR OPR-close
19 RR STBY HEATER CKTRY FAILED ON.
20 Reconfigure heaters. ●cb (11) HTR: RNDZ RDR OPR-open ●cb (11) HTR: RNDZ RDR STBY-close
2
21 Antenna temp?
22 Deactivate heater. ●cb (16) HTR: S BD ANT-open
Antenna temp decr?
23 S-BAND ANTENNA HEATER FAILED ON.
24 Manual temp control If needed: ●cb (16) HTR: S BD ANT-cycle to maintain temp at −50° to 100° F
25 Antenna operating?
26 Antenna operating?
27 Deactivate antenna. When able, deactivate antenna: ●COMM ANT: TRACK MODE -OFF ●cb/AC BUS B: S BD ANT -open ●cb (16) COMM: S BD ANT -open
Antenna temp decr?
28 Power antenna. ●cb/AC BUS B: S BD ANT -close ●cb (16) COMM: S BD ANT -close ●COMM ANT: TRACK MODE -SLEW
Antenna temp incr?
29 HEAT SOAK OR INST FAILURE
30 HEAT SOAK
31 INST FAILURE
32 S-BAND ANTENNA HEATER FAILED OFF.
33 ●cb (16) HTR: S BD ANT-open
YES
NO
HIGH
LOW
1 Light goes off when HTR CONT: TEMP MON is set to affected heater position. HEATER lt will not go on again for same failure or future faults of that heater until normal limits are established.
2 C/W monitoring of heater operation is lost. Use HTR CONT: TEMP MON for heater monitoring.
3 To power up RR (RR range data may not be reliable until 17 minutes after initial step):
a. If RR temp <+10°F ●cb (11) HTR: RNDZ RDR OPR-close
b. When RR temp ≥+10°F: ●cb/AC BUS A: RNDZ RDR -close ●After 30 sec: cb (11) PGNS: RNDZ RDR -close
c. If step a performed: ●cb (11) HTR: RNDZ RDR OPR-open
B-300LM5-1004

2 THRU 3



EPS
COMM
ECS
ED
HTRS
APS
RCS

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CAMERA MALFUNCTION INDEX

16mm

- A CANNOT START CAMERA
- B CANNOT STOP CAMERA
- C CAMERA STOPS IMMEDIATELY AFTER START
- D CAMERA RUNS 24 FPS IN ALL MODES SELECTED
- E CAMERA RUNS BUT FILM NOT TRANSPORTING
- F CAMERA RUNS BUT NO OPERATE LIGHT

70mm

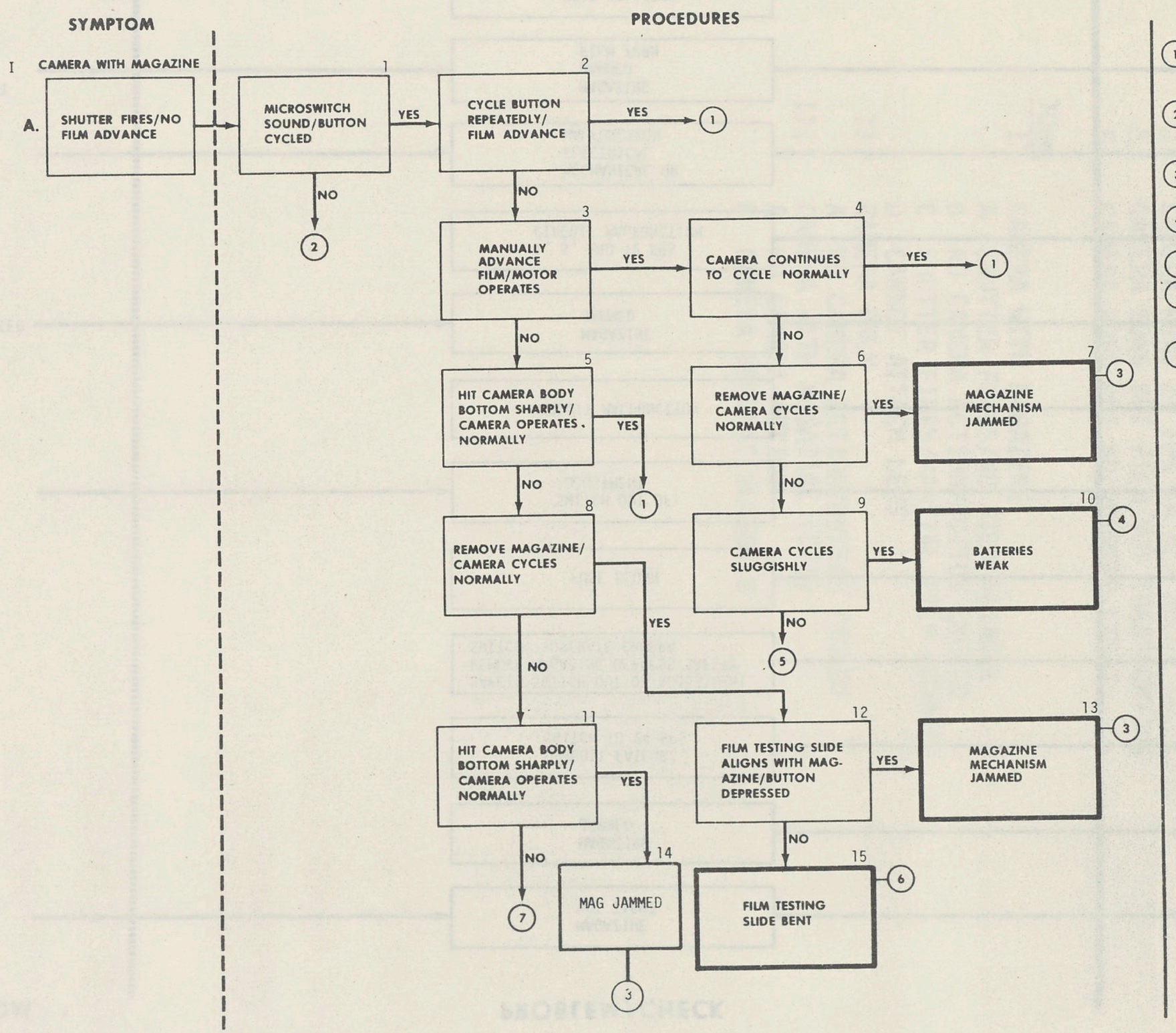
- I CAMERA WITH MAGAZINE
  - A SHUTTER FIRES/NO FILM ADVANCE
  - B NO CAMERA ACTION/BUTTON CYCLED
  - C SHUTTER FIRES/PARTIAL FILM ADVANCE
  - D CANNOT ATTACH LENS
- II CAMERA ONLY
  - A NO CAMERA ACTION/BUTTON CYCLED
- III CAMERA WITH MAGAZINE (EVA)
  - A NO CAMERA ACTION
  - B CAMERA BECOMES SLUGGISH

MALFUNCTIONS

16mm SYSTEMS

SYMPTOM	PROBLEM/CHECK	SOLUTION (IF SYMPTOM STILL EXISTS PROCEED TO NEXT PROBLEM/CHECK)
A. CAN NOT START CAMERA	MAGAZINE NOT TIGHT	WIGGLE MAGAZINE AND RETIGHTEN KNOB
	MAGAZINE JAMMED	REMOVE MAGAZINE INSTALL SUBSTITUTE
	CIRCUIT FAILURE SWITCH TO 24 FPS	OPERATIN IN 24 FPS MODE
	SAFETY SWITCH OUT OF ADJUSTMENT. REMOVE MAGAZINE DEPRESS SAFETY SWITCH. OPERATE CAMERA	IF CAMERA OPERATES PUT LAYERS OF TAPE ON SAFETY SWITCH AND INSTALL MAGAZINE
	FUSE BLOWN	REPLACE MAGAZINE REPLACE FUSE
B. CAN NOT STOP CAMERA	SWITCH OUT OF ADJUSTMENT	STOP CAMERA BY CHANG-ING MODE TO 24 FPS IF IN 1, 6 OR 12 OR VICE VERSA
	CIRCUIT MALFUNCTION	OPERATE USING UTILITY PWR SW AS OFF SW
C. CAMERA STOPS IMMEDIATELY AFTER START	MAGAZINE JAMMED	REMOVE MAGAZINE, INSTALL SUBSTITUTE
	1, 6, AND 12 FPS CIRCUIT MALFUNCTION	OPERATE IN 24 FPS ONLY
D. CAMERA RUNS 24 FPS IN ALL MODES SELECTED	MECHANICAL OR ELECTRICAL MALFUNCTION	LEAVE IN DESIRED MODE USE AS IS. PROPER OPER MAY RETURN
E. CAMERA RUNS BUT FILM NOT TRANSPORTING	MAGAZINE JAMMED FILM TORN	REMOVE MAGAZINE, INSTALL NEW MAGAZINE
F. CAMERA RUNS BUT NO OPERATE LIGHT	MODE SELECTOR NOT INDEXED	REINDEX MODE SELECTOR TO DESIRED MODE

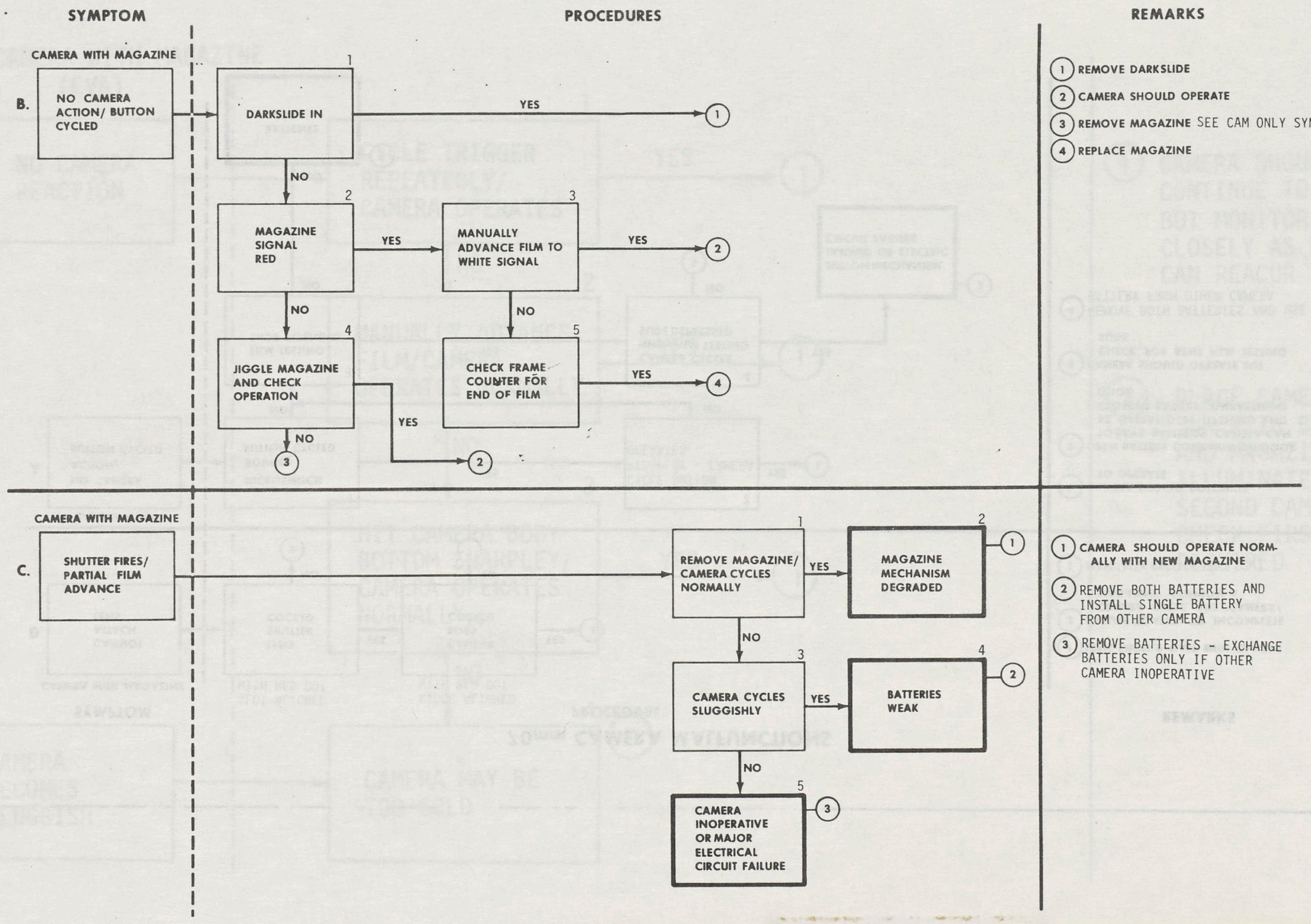
70mm CAMERA MALFUNCTIONS



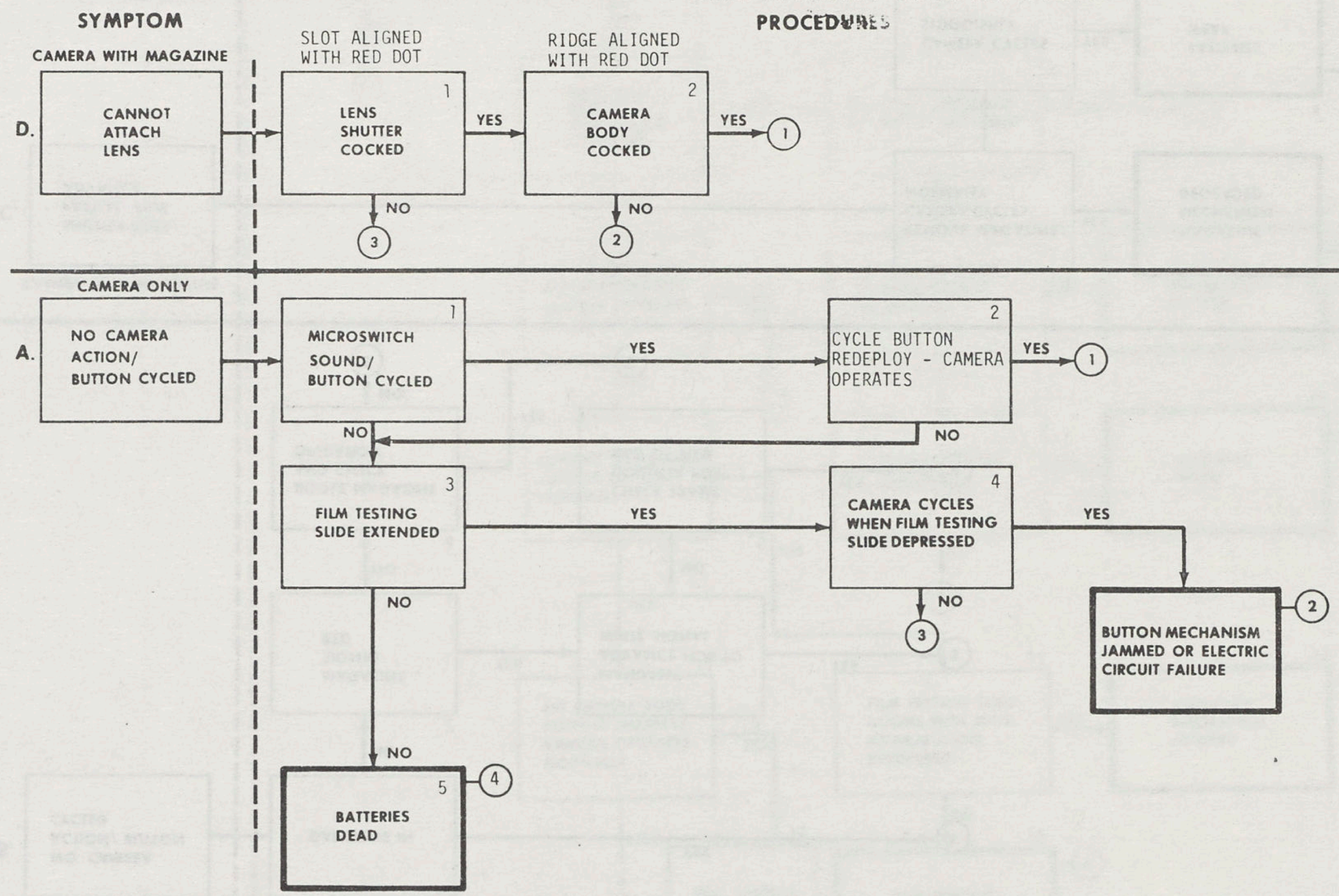
REMARKS

1. CAM SHOULD CONTINUE TO OPERATE BUT MONITOR OPERATION CLOSELY AS FAILURE CAN REOCCUR
2. REMOVE MAGAZINE AND SEE SYMPTOM A UNDER "CAMERA ONLY" SECTION
3. CAMERA SHOULD OPERATE NORMALLY WITH NEW MAGAZINE
4. INTERCHANGE ONE BATTERY WITH BATTERY FROM OTHER CAMERA
5. IMPROBABLE FAILURE MODE
6. ATTEMPT TO STRAIGHTEN FILM TESTING SLIDE AND CYCLE CAMERA/MAGAZINE
7. CAMERA INOPERATIVE

70mm CAMERA MALFUNCTIONS



70mm CAMERA MALFUNCTIONS

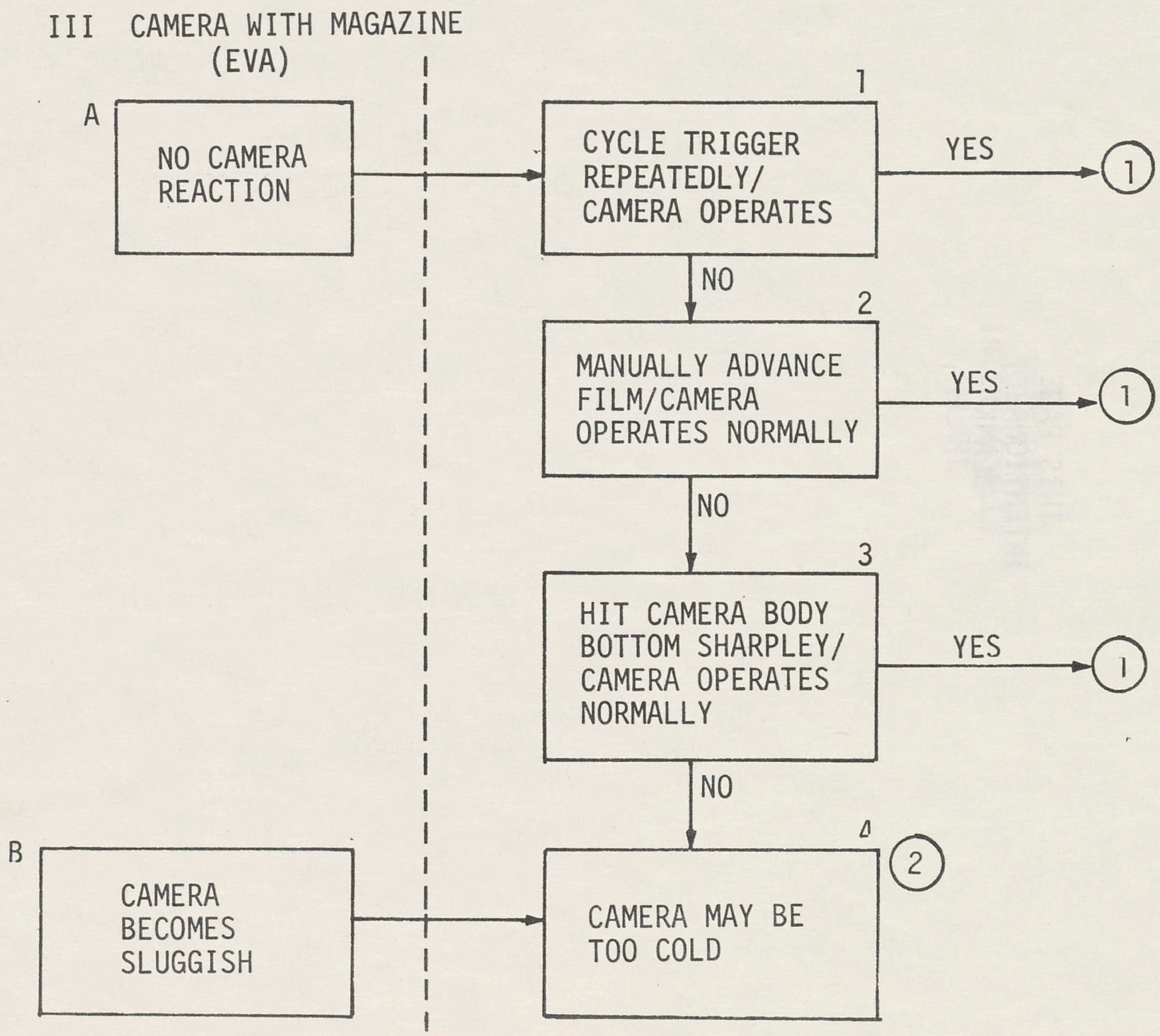


REMARKS

1. LENS SHOULD MATE WITH CAMERA
2. FAILURE RELATED TO INCOMPLETE CAMERA CYCLE. SEE "CAMERA/ MAGAZINE" SYMPTOM A
3. MANUALLY RECOCK LENS (CW)

1. CAMERA SHOULD CONTINUE TO OPERATE
2. OPEN BATTERY COMPARTMENT DOOR TO SAVE BATTERIES. CAMERA CAN BE OPERATED BY OPENING AND CLOSING BATTERY COMPARTMENT DOOR
3. CAMERA SHOULD OPERATE BUT CHECK FOR BENT FILM TESTING SLIDE
4. REMOVE BOTH BATTERIES AND USE SINGLE BATTERY FROM OTHER CAMERA

70 MM CAMERA MALFUNCTIONS PROCEDURES



(1) CAMERA SHOULD CONTINUE TO OPERATE BUT MONITOR OPERATION CLOSELY AS FAILURE CAN REACUR

(2) PLACE CAMERA IN SUN WITH BOTTOM AND MAGAZINE ILLUMINATED. USE SECOND CAMERA AND CHECK FIRST AS REQUIRED

70mm III

LRV

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LUNAR ROVING VEHICLE MALFUNCTION PROCEDURES

2 EITHER BATTERY TEMP > 125°F

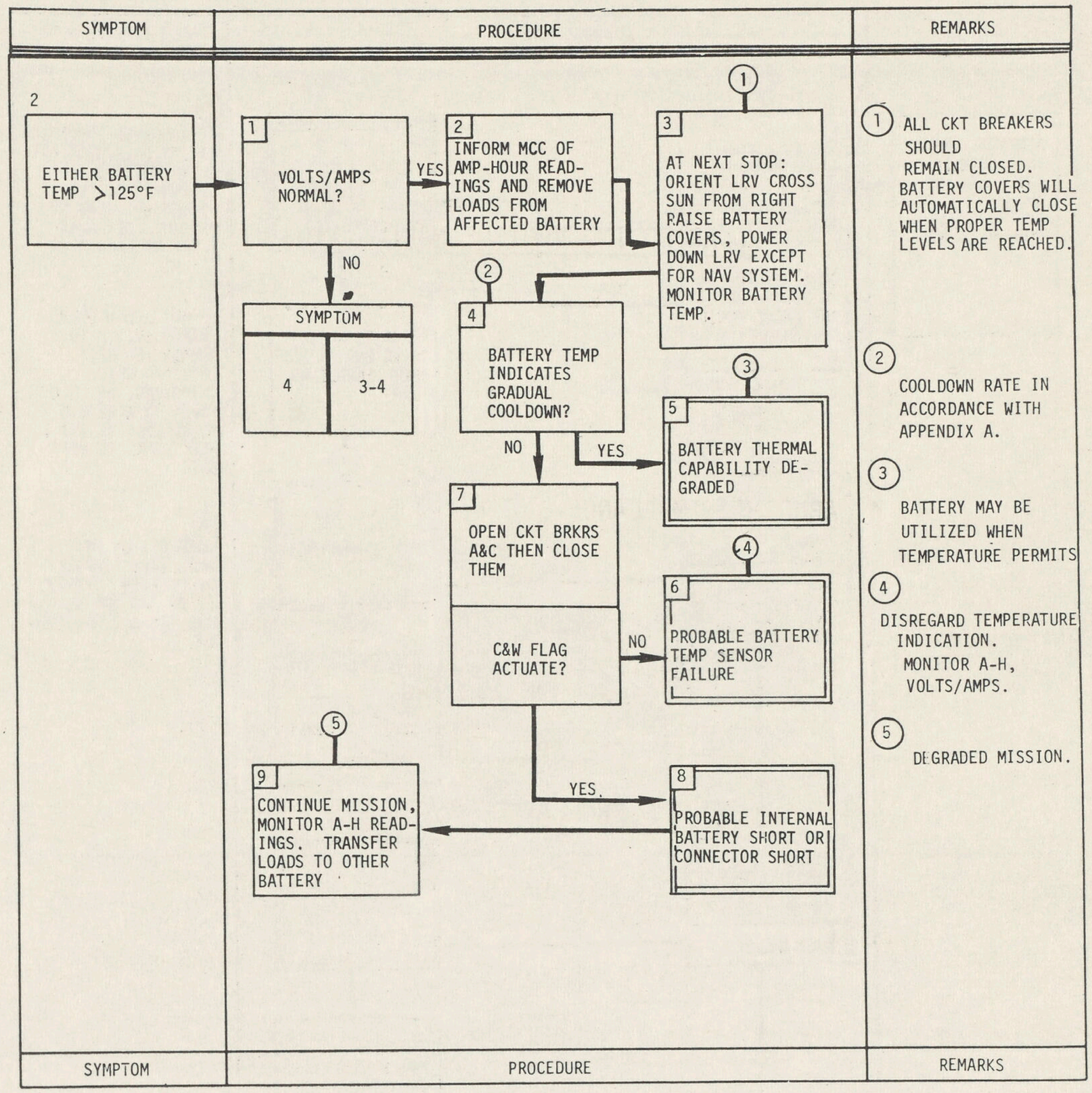
4 ABNORMAL IMBALANCE BAT 1 AND BAT 2 AMPS

7 LOSS OF DRIVE FROM ONE OR TWO WHEELS

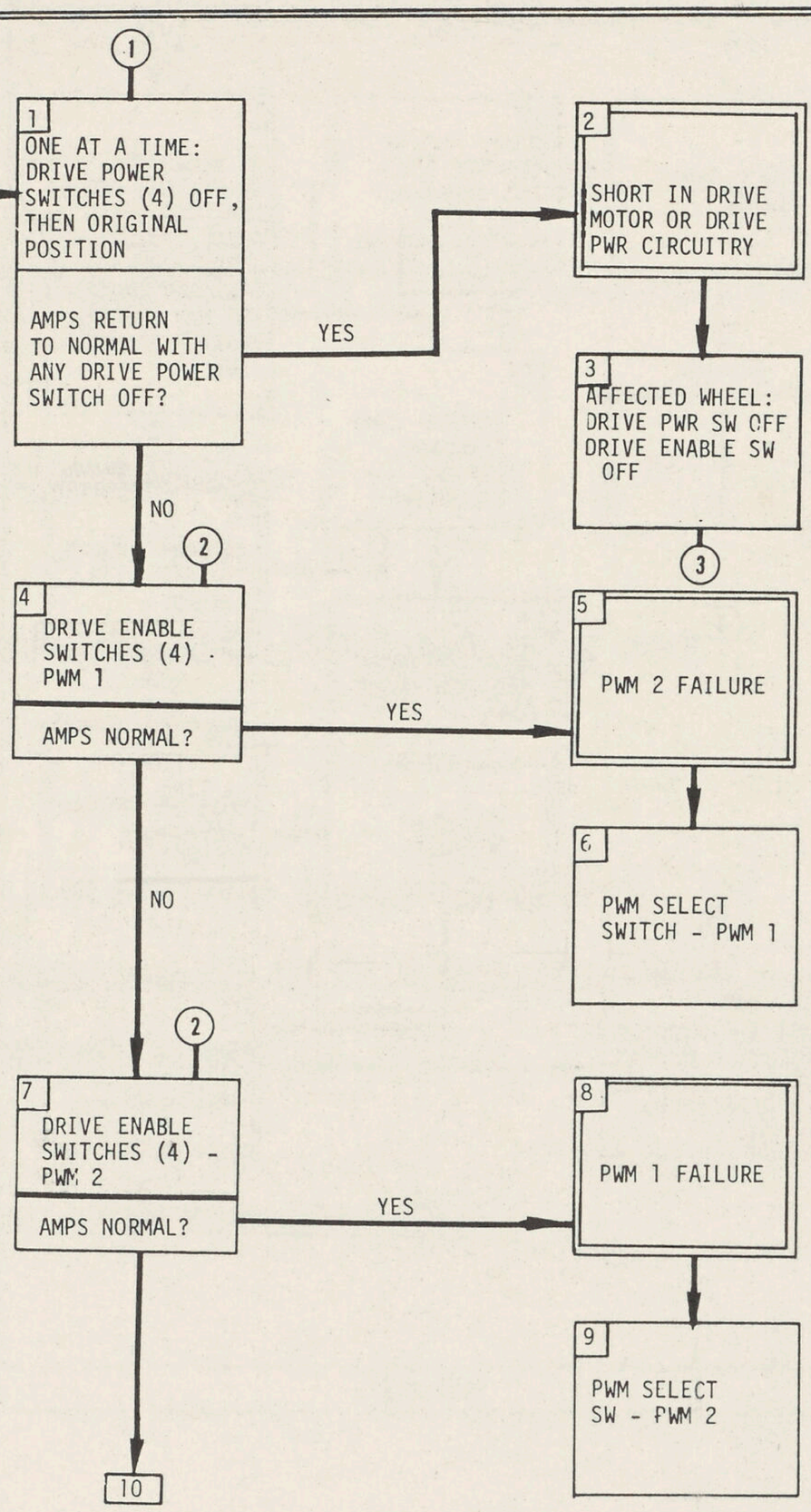
8 COMMANDED VEHICLE SPEED ABNORMALLY HIGH

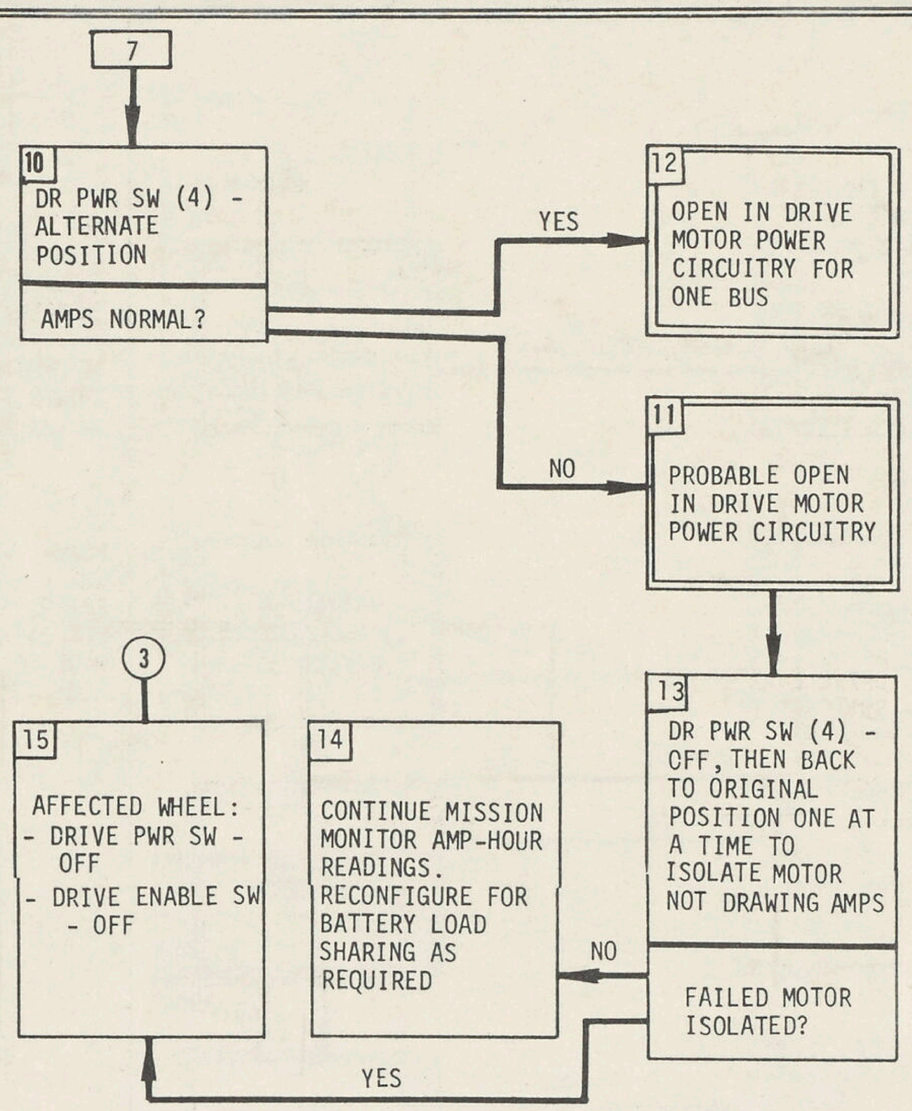
9 LOSS OF DRIVE FROM ALL WHEELS

11 LOSS OF VOICE COMM WITH MSFN


SYMPTOM
PROCEDURE
REMARKS
2
EITHER BATTERY TEMP >125°F
1
VOLTS/AMPS NORMAL?
YES
NO
SYMPTOM
4
3-4
2
INFORM MCC OF AMP-HOUR READINGS AND REMOVE LOADS FROM AFFECTED BATTERY
1
3
AT NEXT STOP: ORIENT LRV CROSS SUN FROM RIGHT RAISE BATTERY COVERS, POWER DOWN LRV EXCEPT FOR NAV SYSTEM. MONITOR BATTERY TEMP.
2
4
BATTERY TEMP INDICATES GRADUAL COOLDOWN?
NO
YES
3
5
BATTERY THERMAL CAPABILITY DEGRADED
7
OPEN CKT BRKRS A&C THEN CLOSE THEM
C&W FLAG ACTUATE?
NO
4
6
PROBABLE BATTERY TEMP SENSOR FAILURE
YES
5
9
CONTINUE MISSION, MONITOR A-H READINGS. TRANSFER LOADS TO OTHER BATTERY
8
PROBABLE INTERNAL BATTERY SHORT OR CONNECTOR SHORT
1 ALL CKT BREAKERS SHOULD REMAIN CLOSED. BATTERY COVERS WILL AUTOMATICALLY CLOSE WHEN PROPER TEMP LEVELS ARE REACHED.
2 COOLDOWN RATE IN ACCORDANCE WITH APPENDIX A.
3 BATTERY MAY BE UTILIZED WHEN TEMPERATURE PERMITS
4 DISREGARD TEMPERATURE INDICATION. MONITOR A-H, VOLTS/AMPS.
5 DEGRADED MISSION.
SYMPTOM
PROCEDURE
REMARKS

4

SYMPTOM	PROCEDURE	REMARKS
4 ABNORMAL IMBALANCE BETWEEN BAT 1 AND BAT 2 AMPS (VEHICLE ACCELERATION NORMAL OR LOW)		(1) IF ABNORMAL CONDITION EXISTS ONLY WHEN LRV IS IN MOTION, THIS STEP MUST BE PERFORMED WITH LRV IN MOTION. SET PARK BRAKE AT EACH STOP. (2) DO NOT ALLOW DRIVE ENABLE SWITCH TO REMAIN IN "OFF" POSITION WHILE SWITCHING, OR FULL POWER TO AFFECTED MOTOR WILL RESULT IF PARK BRAKE IS NOT SET. (3) POWER OFF ON RR WHEEL WILL DISABLE SPEED METER. POWER OFF ON ANY TWO WHEELS WILL DISABLE NAV SYSTEM.
SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS
4 (CONTINUED)		

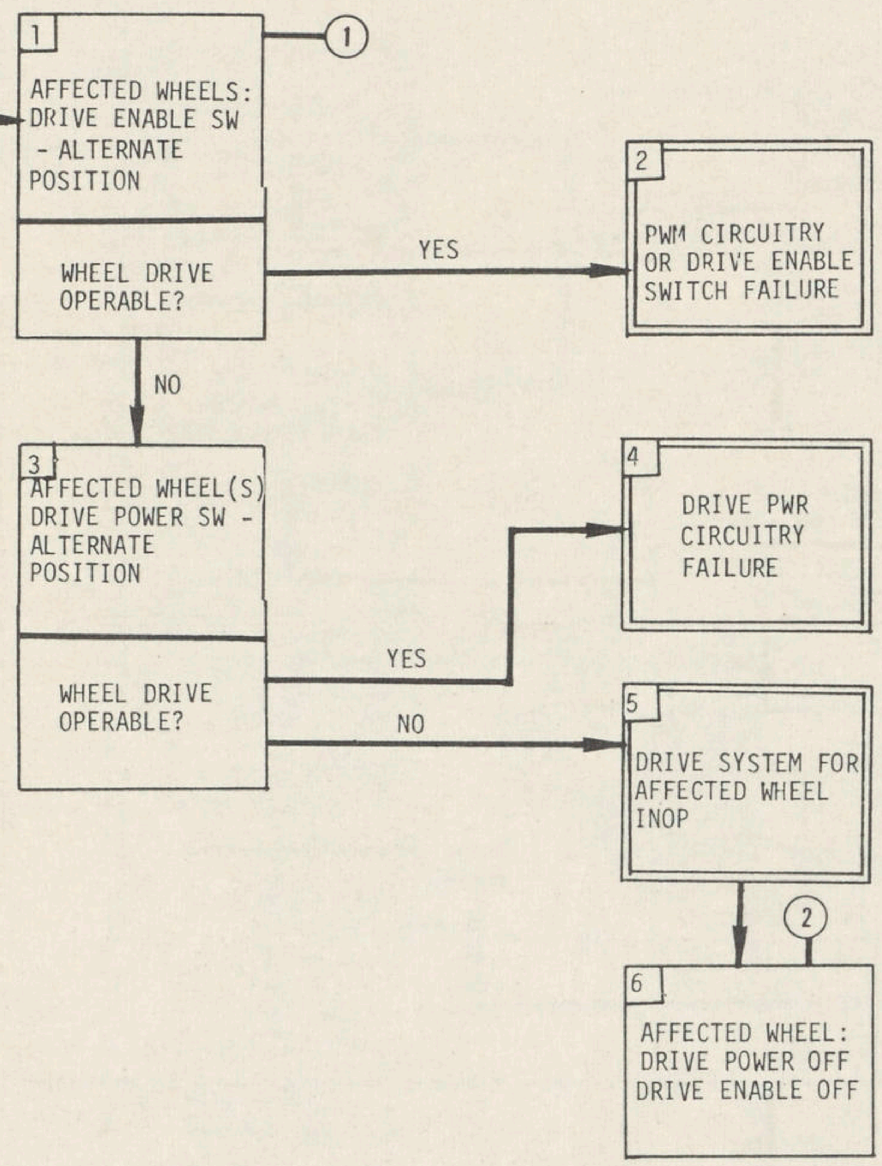
4

SYMPTOM	PROCEDURE	REMARKS

7

LOSS OF DRIVE FROM ONE OR TWO WHEELS (COMMANDED ACCELERATION ABNORMALLY LOW)

7



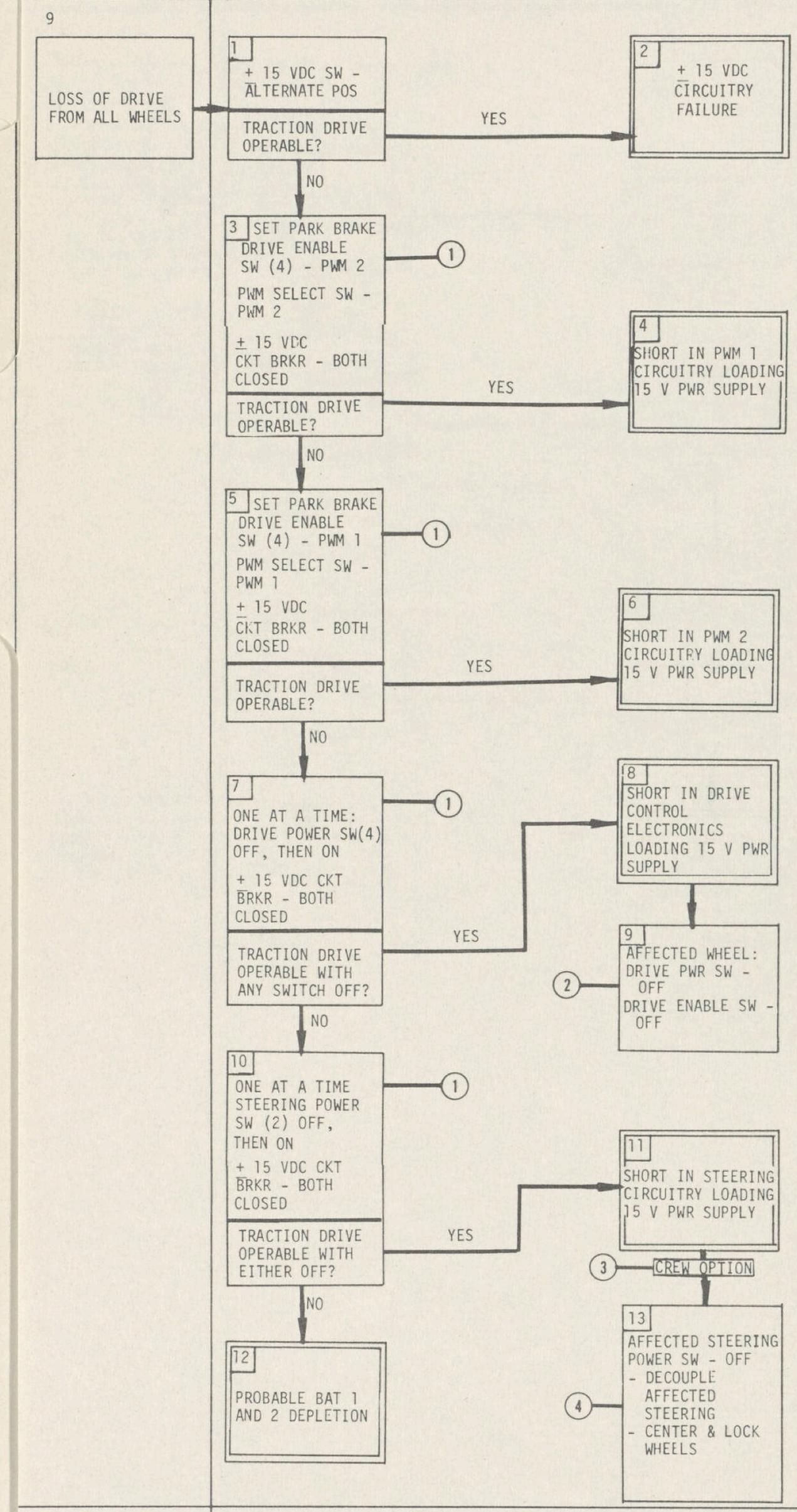
(1) DO NOT ALLOW DRIVE ENABLE SWITCH TO REMAIN IN OFF POSITION WHILE SWITCHING OR FULL POWER TO AFFECTED MOTOR WILL RESULT

(2) POWER OFF ON RR WHEEL WILL DISABLE SPEED METER. POWER OFF ON ANY TWO WHEELS WILL DISABLE NAV SYSTEM.

SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS
8 COMMANDED VEHICLE SPEED ABNORMALLY HIGH (SPEED NOT VARIABLE ON ONE OR MORE WHEELS)	(1) 1 STOP LRV. DRIVE ENABLE SW (4) - PWM 1 TRACTION DRIVE NORMAL? YES → 2 PWM 2 CIRCUITRY OR DRIVE ENABLE SWITCH FAILURE NO (1) 3 DRIVE ENABLE SW (4) - PWM 2 TRACTION DRIVE NORMAL? YES → 4 PWM 1 CIRCUITRY OR DRIVE ENABLE SWITCH FAILURE NO 5 DRIVE PWR SW (4)- OFF, THEN BACK TO ORIGINAL POSITION ONE AT A TIME TO ISOLATE ABNORMAL WHEEL ONLY ONE WHEEL AFFLCTED? YES → 6 DRIVE CONTROL ELECTRONICS FAILURE (2) 8 AFFECTED WHEEL: - DRIVE PWR SW - OFF - DRIVE ENABLE SW - OFF NO 7 OPERATE LRV BY ACTUATING THE HAND CONTROLLER THROTTLE MOMENTARILY TO FORWARD TO OBTAIN SPEED AND THEN RETURN IT TO NEUTRAL OR BRAKE IN A CYCLIC MANNER	(1) DO NOT ALLOW DRIVE ENABLE SWITCH TO REMAIN IN OFF POSITION WHILE SWITCHING, OR FULL POWER TO AFFECTED MOTOR WILL RESULT CAUTION SHOULD BE TAKEN SINCE VEHICLE MAY TEND TO ACCELERATE TO MAX SPEED IF SELECTED PWM IS DEFECTIVE (2) POWER OFF ON RR WHEEL WILL DISABLE SPEED METER. POWER OFF ON ANY TWO WHEELS WILL DISABLE NAV SYSTEM.
SYMPTOM	PROCEDURE	REMARKS

SYMPTOM	PROCEDURE	REMARKS



(1) PROCEED TO NEXT STEP IF EITHER CKT BRKR WILL NOT REMAIN CLOSED

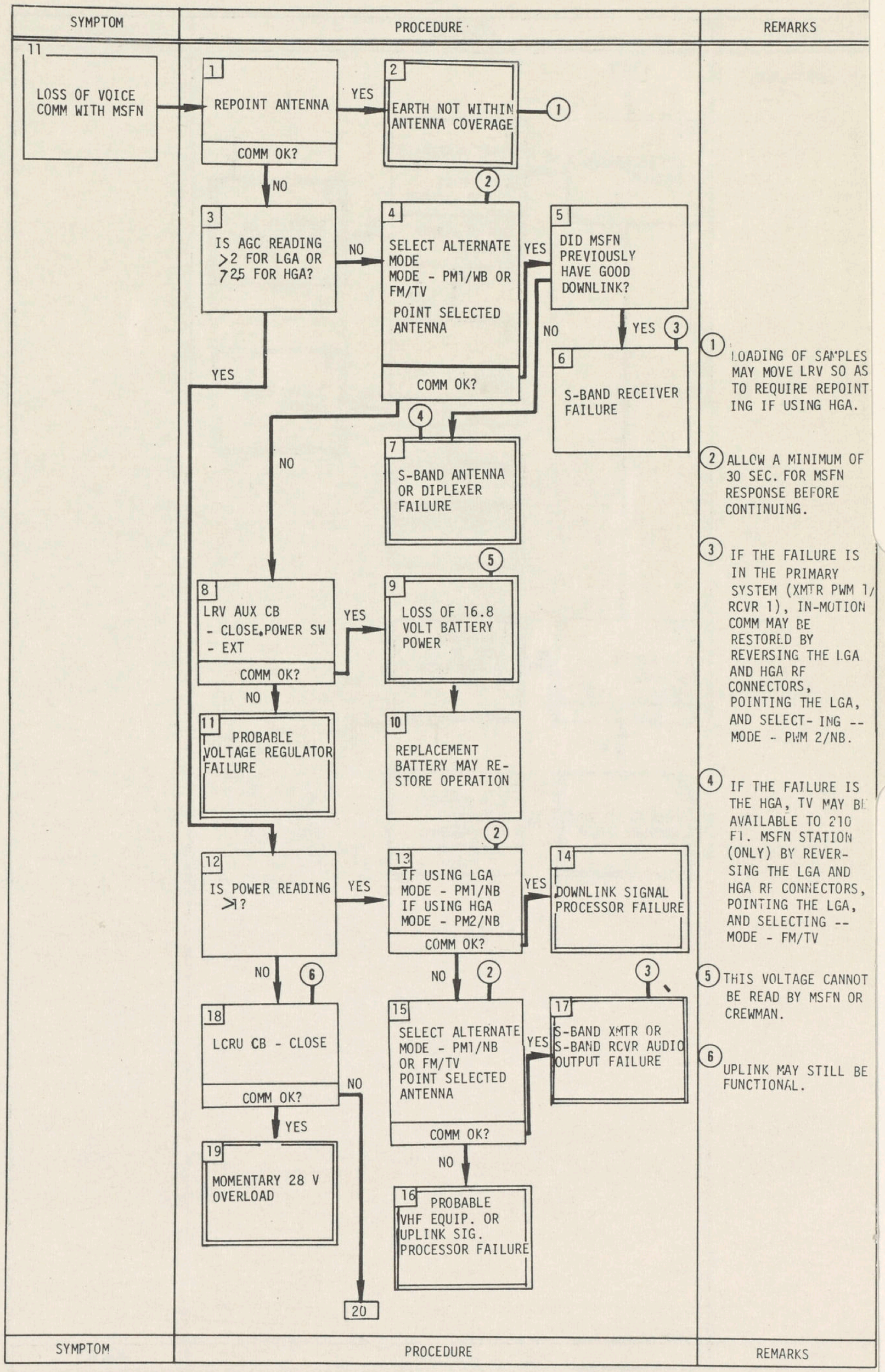
(2) POWER OFF ON RR WHEEL WILL DISABLE SPEED METER. POWER OFF ON ANY TWO WHEELS WILL DISABLE NAV SYSTEM.

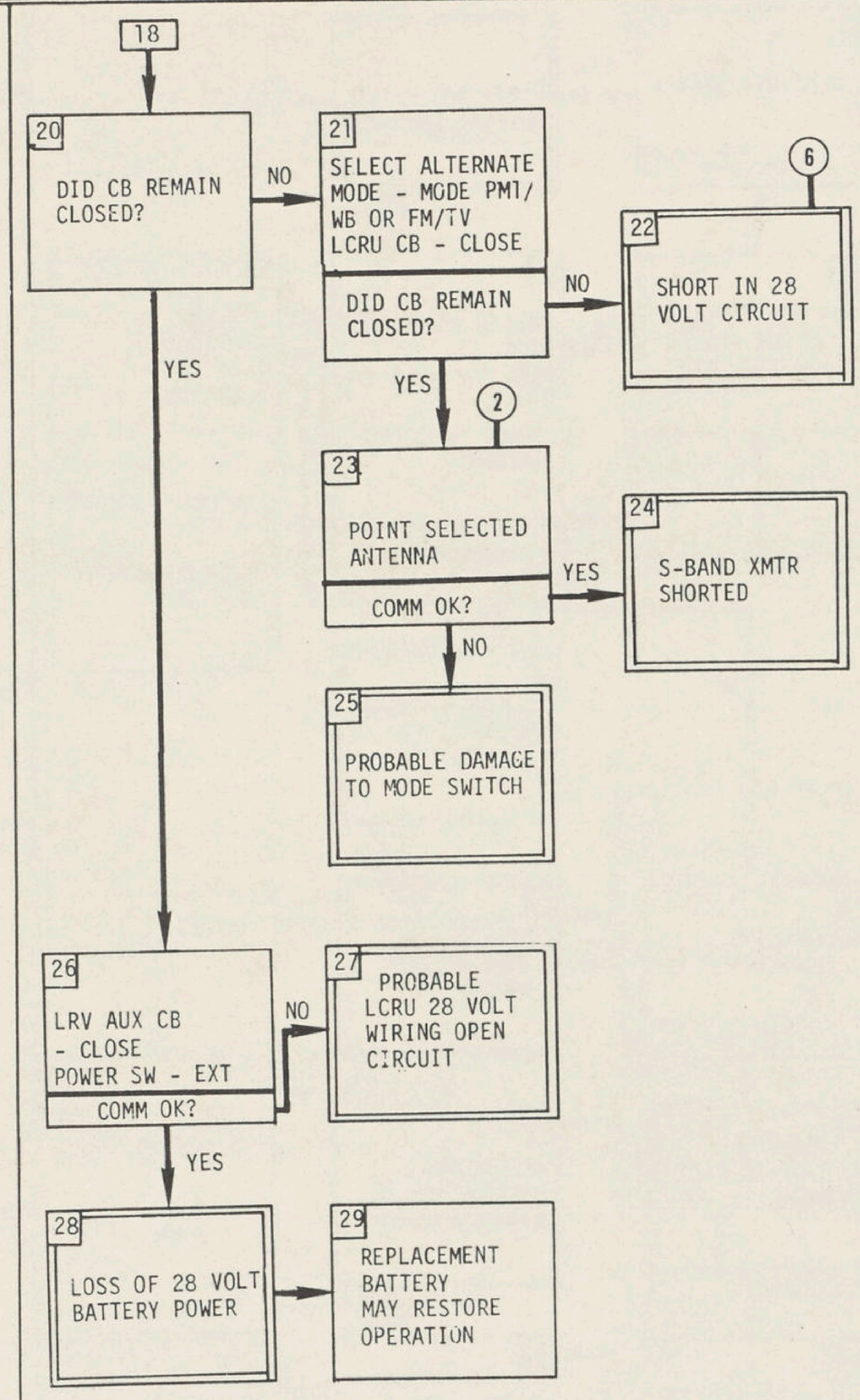
(3) IF WHEELS ARE IN NOMINAL NEUTRAL STEER POSITION, CREW MAY OPTIONALLY DRIVE WITHOUT MECHANICALLY DECOUPLING STEERING.
STEERING SWITCH MUST BE OFF.
STEERING DEGRADED PER APPENDIX A.

(4) TO REDUCE REQUIRED FORCE, STRAIGHTEN WHEELS BY PUSHING ON WHEEL WITH GREATER TURNING ANGLE, (I.E. IF WHEELS ARE TURNED TO RIGHT, PUSH ON RIGHT WHEEL TO STRAIGHTEN).
- HAND TOOL PRY FORCE MAY BE REQUIRED
- SIMULTANEOUS PULL FORCE MAY BE REQUIRED ON DECOUPLING RING

DEGRADED OPERATION - STEERING RADIUS INCREASED IN ACCORDANCE WITH APPENDIX A.
STEERING DECOUPLING PERFORMED IN ACCORDANCE WITH SECTION 2.9.

SYMPTOM	PROCEDURE	REMARKS


SYMPTOM
PROCEDURE
REMARKS
11
LOSS OF VOICE COMM WITH MSFN
1
REPOINT ANTENNA
COMM OK?
YES
2
EARTH NOT WITHIN ANTENNA COVERAGE
NO
3
IS AGC READING >2 FOR LGA OR >25 FOR HGA?
NO
4
SELECT ALTERNATE MODE MODE - PM1/WB OR FM/TV
POINT SELECTED ANTENNA
COMM OK?
YES
5
DID MSFN PREVIOUSLY HAVE GOOD DOWNLINK?
NO
YES
6
S-BAND RECEIVER FAILURE
YES
NO
7
S-BAND ANTENNA OR DIPLEXER FAILURE
8
LRV AUX CB - CLOSE POWER SW - EXT
COMM OK?
YES
9
LOSS OF 16.8 VOLT BATTERY POWER
NO
11
PROBABLE VOLTAGE REGULATOR FAILURE
10
REPLACEMENT BATTERY MAY RE-STORE OPERATION
12
IS POWER READING >1?
YES
13
IF USING LGA MODE - PM1/NB IF USING HGA MODE - PM2/NB
COMM OK?
YES
14
DOWNLINK SIGNAL PROCESSOR FAILURE
NO
NO
18
LCRU CB - CLOSE
COMM OK?
NO
YES
19
MOMENTARY 28 V OVERLOAD
20
15
SELECT ALTERNATE MODE - PM1/NB OR FM/TV POINT SELECTED ANTENNA
COMM OK?
YES
17
S-BAND XMTR OR S-BAND RCVR AUDIO OUTPUT FAILURE
NO
16
PROBABLE VHF EQUIP. OR UPLINK SIG. PROCESSOR FAILURE
1 LOADING OF SAMPLES MAY MOVE LRV SO AS TO REQUIRE REPOINTING IF USING HGA.
2 ALLOW A MINIMUM OF 30 SEC. FOR MSFN RESPONSE BEFORE CONTINUING.
3 IF THE FAILURE IS IN THE PRIMARY SYSTEM (XMTR PWM 1/ RCVR 1), IN-MOTION COMM MAY BE RESTORED BY REVERSING THE LGA AND HGA RF CONNECTORS, POINTING THE LGA, AND SELECT- ING -- MODE - PWM 2/NB.
4 IF THE FAILURE IS THE HGA, TV MAY BE AVAILABLE TO 210 FT. MSFN STATION (ONLY) BY REVER-SING THE LGA AND HGA RF CONNECTORS, POINTING THE LGA, AND SELECTING -- MODE - FM/TV
5 THIS VOLTAGE CANNOT BE READ BY MSFN OR CREWMAN.
6 UPLINK MAY STILL BE FUNCTIONAL.
SYMPTOM
PROCEDURE
REMARKS

SYMPTOM	PROCEDURE	REMARKS
11 (CONTINUED)		

SYMPTOM	PROCEDURE	REMARKS