STA/STEP	PROCEDURE	REMARKS
2.3.2	(Continued)	
g.	Connect GCTA connector of LRV/LCRU cable to GCTA control unit.	
h.	On TV camera, LM PWR Switch - OFF.	
i.	Disconnect LM/TV cable from TV camera and rest connector on tripod handle.	
j.	Remove TV camera from LM tripod and install on GCTA azimuth/ elevation unit.	
k.	Connect GCTA control unit connector to TV camera.	
2.3.3	16 mm Data Acquisition Camera Installation	Figure 2-14.
a.	Remove camera and staff from LM.	
b.	Assemble camera and staff into single unit.	
c.	Insert staff into receptacle on LRV right inboard handhold.	
d.	Verify staff locked in place by pulling up on the camera without depressing the push button on end of handhold. Camera staff should not move vertically.	
2.3.4	Low Gain Antenna Installation	Figure 2-14.
a.	Remove low gain antenna from LM stowage location.	
b.	Insert low gain antenna staff on LRV left inboard handhold.	
c.	Verify staff locked in vertically by pulling up on staff without depressing button on end of handhold. Low gain antenna staff should not move vertically.	

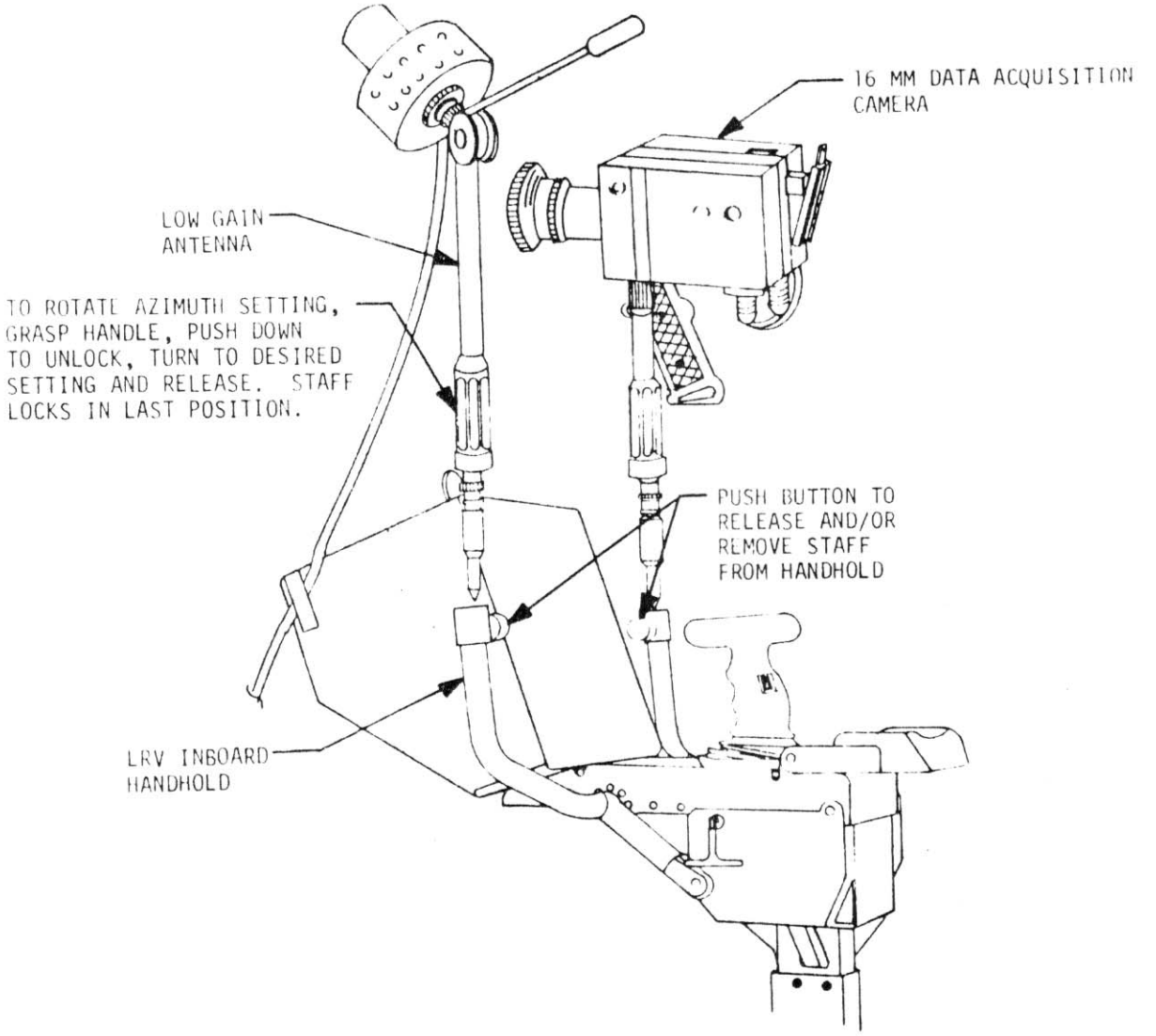


FIGURE 2-14 16 MM DAC AND LOW GAIN ANTENNA INSTALLATION

STA/STEP	PROCEDURE	REMARKS
2.3.4	(Continued)	
d.	Route low gain antenna cable to LCRU and secure to LRV with strap on console and clips on forward chassis.	Figure 2-15.
e.	Connect low gain antenna cable to LCRU.	
2.3.5	High Gain Antenna Installation.	Figure 2-13.
a.	Remove high gain antenna from LM stowage position.	
b.	Insert high gain antenna staff into the mounting receptacle on the left front corner of the LRV and lock.	Alignment marks are provided on HGA staff locking collar.
c.	Unfold and lock HGA staff.	
d.	Remove and discard optical sight retaining clamp.	
e.	Open and lock HGA dish.	
f.	Connect HGA cable to the LCRU.	
g.	Activate LCRU/GCTA and perform communication checks as required.	
h.	Deactivate LCRU/GCTA until needed.	
2.3.6	Aft Payload Pallet Installation	
a.	Release the pallet support post tiedown on LRV aft chassis.	Figure 2-16.
b.	Erect pallet support post.	
c.	Remove pallet from LM.	

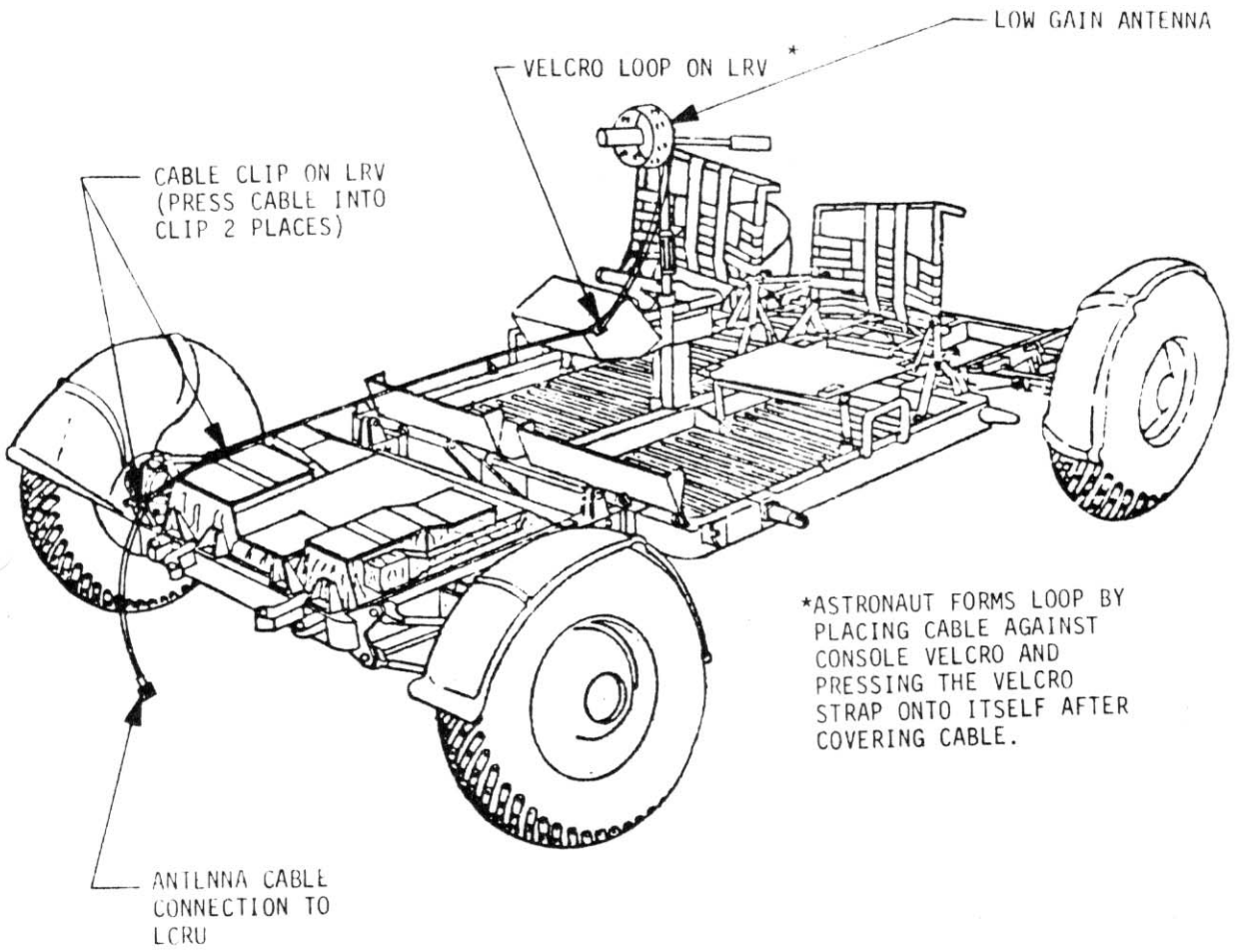


FIGURE 2-15 LCRU LOW GAIN ANTENNA CABLE INSTALLATION ON LUNAR SURFACE

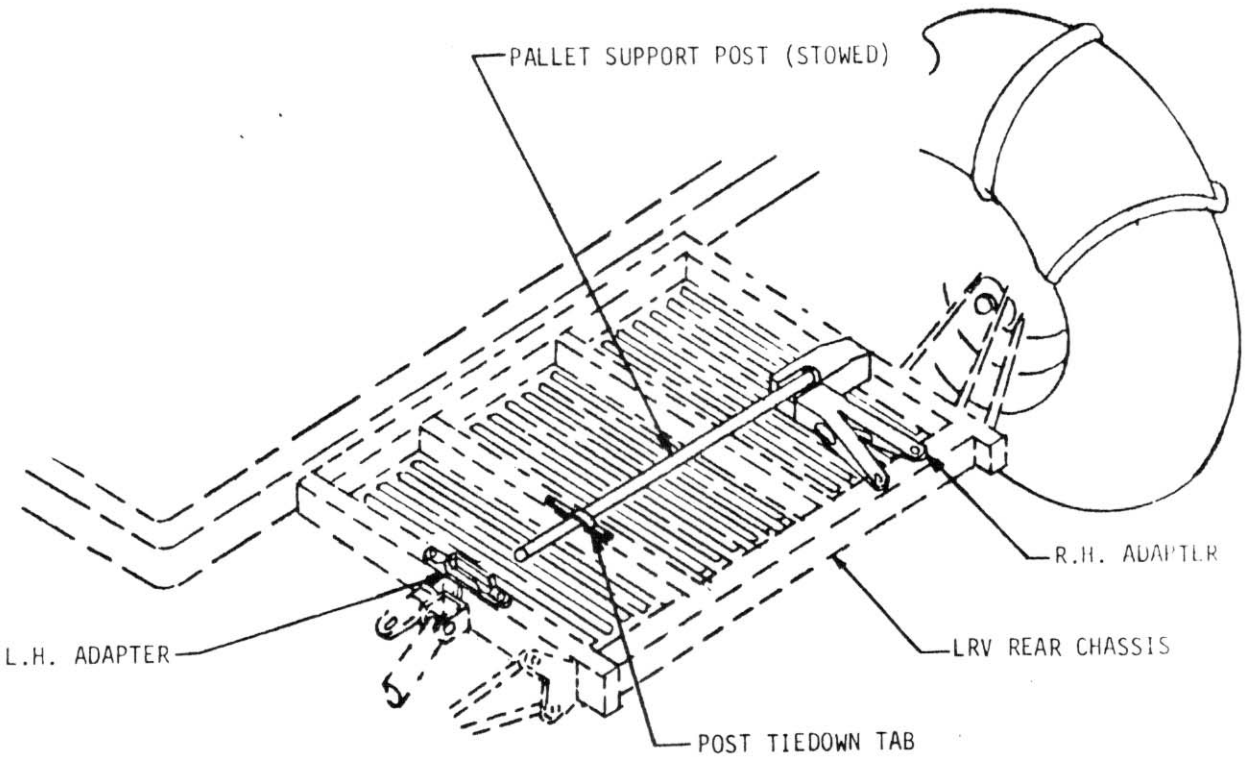


FIGURE 2-16 LRV REAR PAYLOAD PALLET ADAPTERS

STA/STEP	PROCEDURE	REMARKS
2.3.6	(Continued)	
d.	Connect pallet to pallet support post.	
e.	Rotate pallet about support post until pallet locks in pallet adapter on LRV LH aft chassis.	Figure 2-17.
2.3.7	Buddy SLSS Installation	
a.	Remove BSLSS bag from LM.	
b.	Release BSLSS support strap on back of right seat.	
c.	Feed strap through BSLSS bag handle and secure to PLSS support velcro on front of back seat.	Figure 2-18.

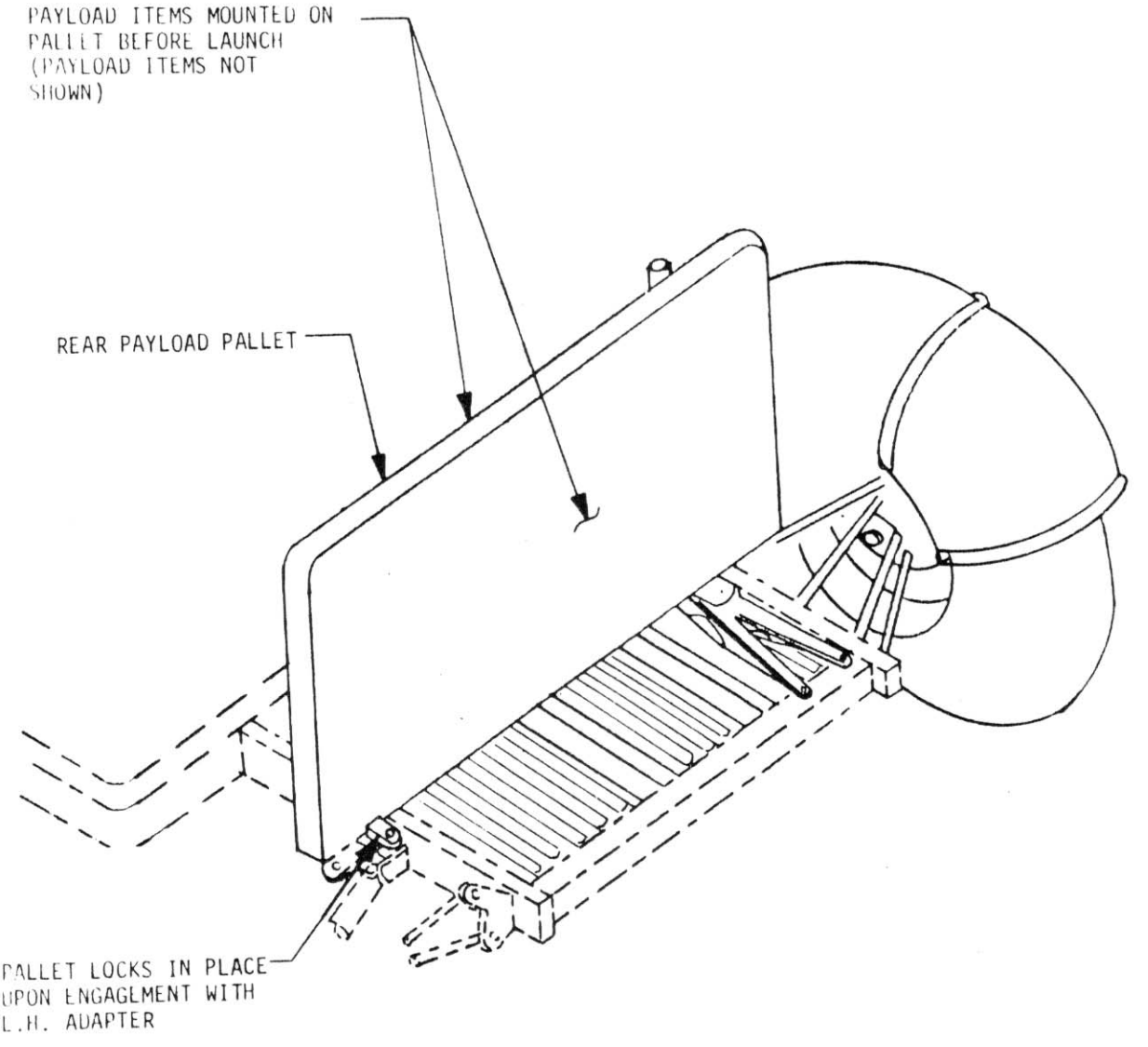


FIGURE 2-17 REAR PAYLOAD PALLET INSTALLED

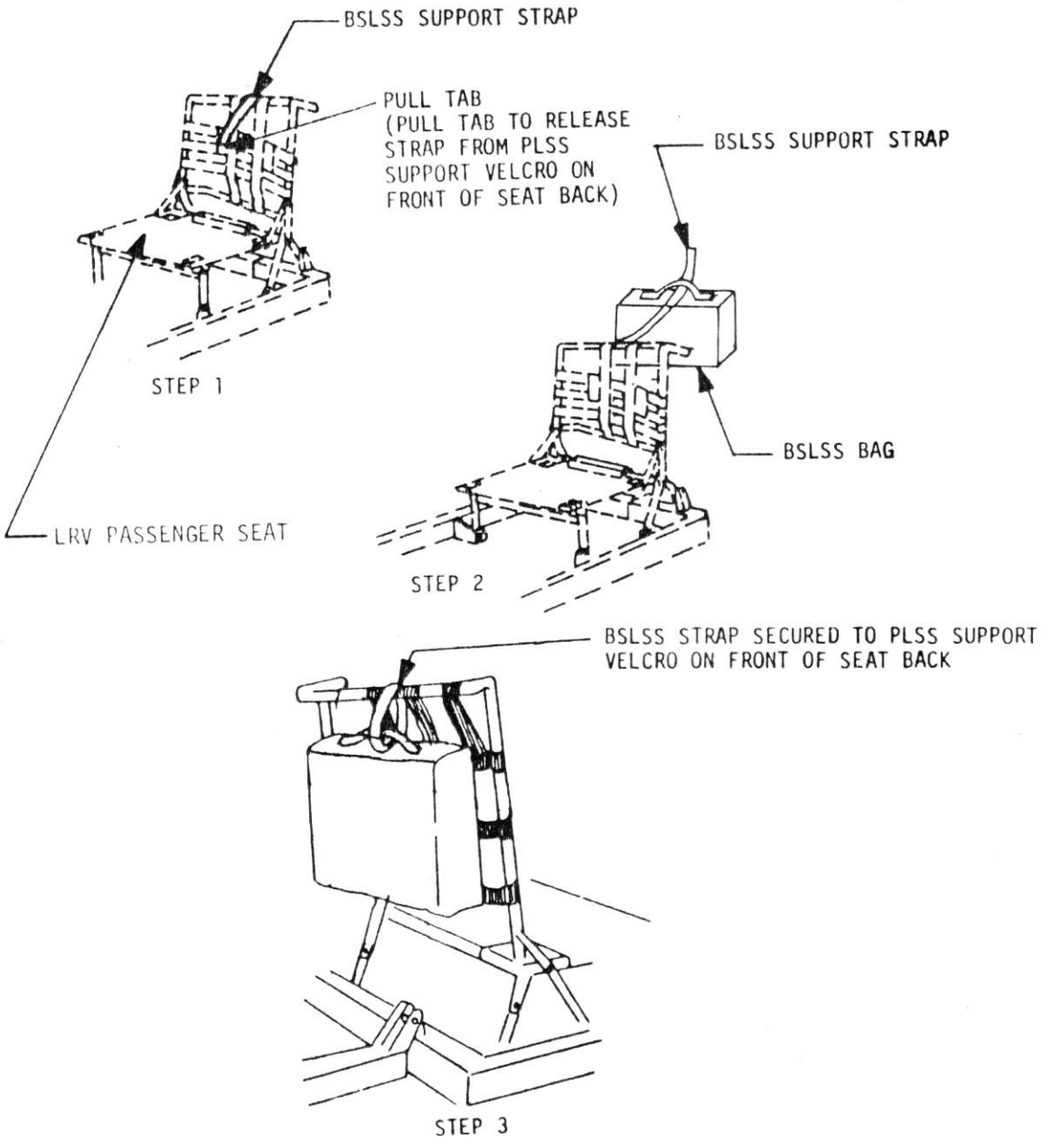


FIGURE 2-18 BUDDY SLSS INSTALLATION

STA/STEP	PROCEDURE	REMARKS
2.4	PRE SORTIE CHECKOUT AND PREPARATION	
a.	Verify battery and SPU dust covers closed.	
b.	Verify hand controller in parking brake and neutral throttle position and reverse inhibit switch is on (pushed down).	Board left seat first and verify parking brake set prior to other crewman boarding. Do not board both seats simultaneously.
	CAUTION Do not grasp the 16 MM Data Acquisition camera staff or low gain antenna staff during ingress. The handholds are designed for ingress by grasping the handhold horizontal and vertical members below the payload staffs.	
c.	LRV driver ingress LRV left seat and fasten seat belt.	
d.	Other crewman ingress LRV, and fasten seat belt.	
	CAUTION Do not grasp the 16 MM Data Acquisition camera staff or low gain antenna staff during ingress. The handholds are designed for ingress by grasping the handhold horizontal and vertical members below the payload staffs.	
	NOTE: If this is the first LRV sortie and this procedure sequence immediately follows initial payload loading (2.3) and LRV post deployment checkout (2.2), then at this point the C/D panel is in a power down configuration in accordance with step 2.2.ad. If this is the case then step 2.4 need only be a verification as it has been previously accomplished.	

STA/STEP	PROCEDURE	REMARKS
2.4	(Continued)	
e.	BUS A, BUS B, BUS C, BUS D CB's - Close.	
f.	NAV POWER CB - Close.	Nav gyro is allowed to warm up and stabilize during payload loading.
	CAUTION Do not torque nav gyro until nav power has been on for 3 minutes.	
g.	Report BAT 1 and BAT 2 AMPS.	
h.	BATTERY Switch - VOLTX x 1/2.	
i.	Report BAT 1 and BAT 2 VOLTS.	
j.	Report BAT 1 and BAT 2 AMP-HR. Insure reading is stabilized, indicating the amp-hr integrator has had adequate warmup time.	
k.	BATTERY Switch - AMPS.	
l.	DRIVE ENABLE LF and RF Switches - PWM 1.	
m.	DRIVE ENABLE LR and RR Switches - PWM 2.	
n.	± 15 VDC Switch - PRIM.	
o.	STEERING FORWARD Switch - BUS A.	Forward steering operates from Battery No. 1.
p.	STEERING REAR Switch - BUS D.	Rear steering operates from Battery No. 2.
	CAUTION The hand controller should be in park brake position and the drive enable switches must be set to an active PWM prior to setting any drive power switch to an energized bus. If the drive power switch is turned on and	The PWM select switch determines which PWM is active. The hand controller was verified in park brake position in step 2.2.ac.

STA/STEP	PROCEDURE	REMARKS
2.4	(Continued) CAUTION (Continued) the corresponding drive enable switch is not selected to an active PWM, then full power will be applied to the corresponding drive motor when the hand controller is released from brake position. Should this condition occur the hand controller should be immediately returned to park brake position.	The PWM select switch was verified in "BOTH" position in step 2.2.b. The drive enable switches were set to active PWM positions in steps 2.4.l and 2.4.m.
q.	DRIVE POWER LF Switch - BUS A.	Front wheels operate from Battery No. 1.
r.	DRIVE POWER RF Switch - BUS A.	
s.	DRIVE POWER LR Switch - BUS D.	Rear wheels operate from Battery No. 2.
t.	DRIVE POWER RR Switch - BUS D.	
u.	Drive LRV to level area (± 6° pitch) near the LM.	
v.	Deploy SUN SHADOW DEVICE (SSD).	
w.	Deploy Vehicle Attitude Indicator to read roll.	
x.	Park down sun (within ± 3° per SSD) and level (within ± 6° roll) and set brake.	
y.	Report sun shadow device readings and LRV pitch and roll angles.	
z.	Fold (or reset) Sun Shadow Device (SSD).	Reset SSD to prevent it from obstructing drivers access to system reset switch.

STA/STEP	PROCEDURE	REMARKS
2.4	(Continued)	
aa.	Fold Vehicle Attitude Indicator to drive position (pitch read position).	
ab.	Pull system reset switch from detent move momentarily to reset position and return to off.	
ac.	Verify BEARING, DISTANCE, RANGE Indicators - ZERO.	
ad.	Receive calculated heading from MCC.	
	CAUTION Continuous torquing of nav gyro shall not exceed 2 minutes of any 7 minute period.	
ae.	Pull GYRO TORQUING Switch from detent and operate to LEFT or RIGHT for proper heading indication, then OFF.	Torque LEFT causes heading indication to move CCW. Torque RIGHT causes heading indication to move CW.
af.	Report battery 1 and 2 Amp-Hrs.	
ag.	Report battery and drive motor temperatures.	
ah.	Report battery current while vehicle is in motion one time between stops.	

STA/STEP	PROCEDURE	REMARKS
	2.5 LRV CONFIGURATION FOR SCIENCE STOP	
	a. Stop LRV and set hand controller in parking brake position; Neutral throttle.	See remarks for step 2.2.ac.
	b. Perform LRV partial power down as follows: DRIVE POWER Switches (4) - OFF. STEERING Switches (2) - OFF. +15 VDC Switch - OFF.	
	c. Report BEARING, DISTANCE, RANGE, HEADING, and BATTERY AMP-HOUR indications.	
	d. Crewman in right seat release and stow seat belt and egress vehicle.	
	e. Crewman in left seat release and stow seat belt and egress vehicle.	
	f. Align HGA.	
	g. LCRU mode Switch - FM/TV or TV RMT.	TV RMT will provide improved TV performance when the LM is available for voice relay.
	h. Open LCRU thermal blanket per ground request.	

STA/STEP	PROCEDURE	REMARKS
2.6	LRV CONFIGURATION PRIOR TO LEAVING SCIENCE STOP	
a.	Align LGA.	
b.	LCRU Mode Switch - PMI/WB.	
c.	Board LRV left seat and fasten seatbelt.	
	CAUTION Do not grasp the 16 MM Data Acquisition camera staff or low gain antenna staff during ingress. The handholds are designed for ingress by grasping the handhold horizontal and vertical members below the payload staffs.	
d.	Verify hand controller in parking brake and neutral throttle position and reverse inhibit switch is on (pushed down).	
e.	Other crewman ingress LRV right seat and fasten seat belt.	
	CAUTION Do not grasp the 16 MM Data Acquisition camera staff or low gain antenna staff during ingress. The handholds are designed for ingress by grasping the handhold horizontal and vertical members below the payload staffs.	
f.	Report Bearing, Distance, Range, Heading, and Battery Amp-Hour indications.	
g.	Update Nav System to correct for drift, if required by MCC.	
h.	± 15 VDC Switch - PRIM.	

STA/STEP	PROCEDURE	REMARKS
2.6	(Continued)	
i.	STEERING FORWARD Switch - BUS A.	
j.	STEERING REAR Switch - BUS D.	
	CAUTION The hand controller should be in park brake position and the drive enable switches must be set to an active PWM prior to setting any drive power switch to an energized bus. If the drive power switch is turned on and the corresponding drive enable switch is not selected to an active PWM, then full power will be applied to the corresponding drive motor when the hand controller is released from brake position. Should this condition occur the hand controller should be immediately returned to park brake position.	The PWM select switch determines which PWM is active. The hand controller was verified set in park brake position in step 2.6.d. The PWM select switch was verified in "BOTH" position in step 2.2.b. The drive enable switches were set to active PWM positions in steps 2.2.p and 2.2.q.
k.	DRIVE POWER LF Switch - BUS A.	
l.	DRIVE POWER RF Switch - BUS A.	
m.	DRIVE POWER LR Switch - BUS D.	
n.	DRIVE POWER RR Switch - BUS D.	

STA/STEP	PROCEDURE	REMARKS
2.7	POST SORTIE CHECKOUT	
a.	Park LRV cross sun from the right in view of LM windows.	Figure 5-2.
b.	Hand controller in parking brake position, throttle in neutral - SET BRAKE.	
c.	Report BEARING, DISTANCE, and RANGE.	
d.	Report BAT 1 and BAT 2 AMP-HR.	
e.	Report BAT 1 and BAT 2 VOLTS.	
f.	BATTERY Switch - AMPS.	
g.	Report battery and drive motor temperatures.	
h.	DRIVE POWER Switches (4) - OFF.	
i.	STEERING Switches (2) - OFF.	
j.	± 15 VDC Switch - OFF.	
k.	Nav Power Circuit Breaker - OPEN.	
l.	BUS A, BUS B, BUS C, BUS D Circuit Breakers - OPEN.	
m.	Crewman in right seat release and stow seat belts and egress LRV.	
n.	Crewman in left seat release and stow seat belts and egress LRV.	
o.	Align HGA.	
p.	LCRU mode Switch - TV RMT.	

STA/STEP	PROCEDURE	REMARKS
2.7	(Continued)	
q.	Open LRV Battery and SPU Dust Covers.	
r.	Prior to LM Ingress - Perform the following: LCRU Power Switch - OFF. Adjust LCRU Thermal Blankets per ground request.	

STA/STEP	PROCEDURE	REMARKS

2.8 DISPLAY READING SEQUENCE AND TIME INTERVALS

a. Report the following displays in the order shown at the time intervals specified below:

DISPLAY	TIME INTERVAL
BEARING and RANGE	At start of sortie and each 15 minutes or as requested by MCC.
AMP-HR and DISTANCE	At start of sortie and as requested by MCC.
BATTERY °F	At start of sortie and as requested by MCC.
AMPS	Steady state at start of sortie, each 15 minutes when at constant speed, when climbing steep obstacles and when climbing different slopes.
VOLTS x 1/2	At start of sortie and as requested by MCC.
MOTOR °F	When requested by MCC.
SPEED	When requested by MCC.
PITCH and ROLL	During Navigation System initialization and update.
HEADING	During Navigation System update

SECTION 3

MALFUNCTION PROCEDURES

3.0 INTRODUCTION

Malfunction procedures encompass the recognition, diagnosis, and corrective action for system malfunctions. In most cases, the crew is alerted to a malfunction condition by Control and Display Panel meters or indicators. The crew will then locate, correct, or isolate the malfunction and determine its effect on the scheduled mission. In general, the procedures cover significant single failures. Double unrelated failures are not covered to prevent procedures from becoming complex and unmanageable. Malfunctions of a minor nature not requiring detailed procedures are covered in Section 2.

The malfunction procedures are arranged in logic flow diagram format and arranged by symptom routine. A three column format is used for symptom routine logic flow diagrams. A description and use of each of these columns is as follows.

3.1 SYMPTOM COLUMN

The primary purpose of the symptom column is to allow entry into the malfunction procedures. This block explains and qualifies the situation so that the reader understands the symptom or condition that exists. All symptoms are numbered in sequence starting with the number 1.

3.2 PROCEDURE COLUMN

The procedure column presents a step-by-step logic flow diagram of actions and decisions used to isolate or correct a malfunction symptom. This information is presented with several types of logic blocks. These blocks contain the procedures, decisions, and actions to locate and isolate the failure. Remote event symbols are used to reference items in the remarks column or to refer to other procedural steps.

3.3 REMARKS COLUMN

This column will include the following information:

- Amplifying additional remarks related to the symptom.
- Amplifying remarks which relate to a decision and/or action items (e.g., why a step is taken, etc.)
- Explain resultant system status or operational capability after a failure has been identified, i.e., how subsystem is degraded, can degraded subsystem support primary mission, early termination of mission, etc.
- Cautions or warnings, as necessary, to cover conditions that may exist because of a failure.

TABLE 3-1 MALFUNCTION PROCEDURES

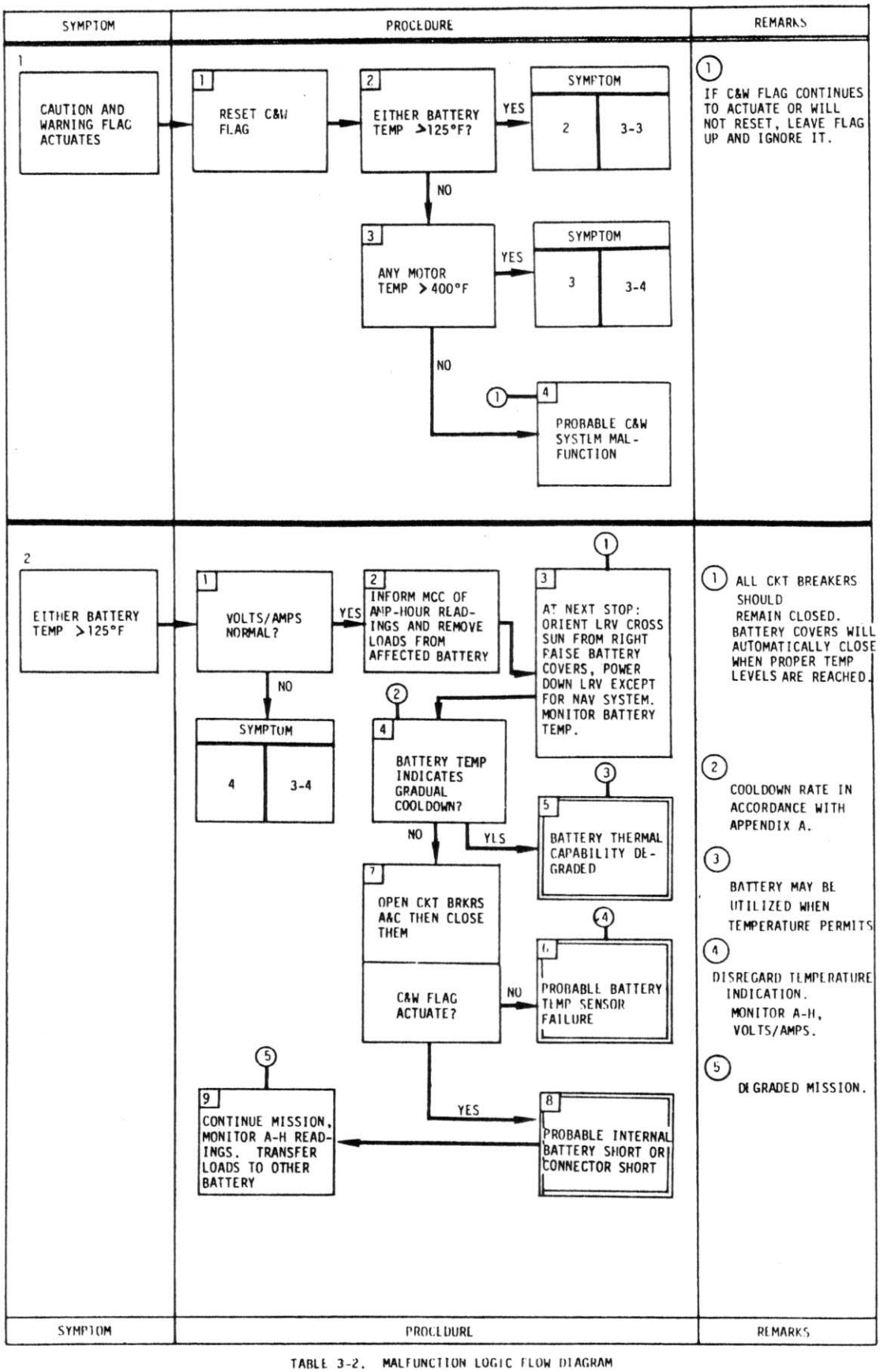


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM

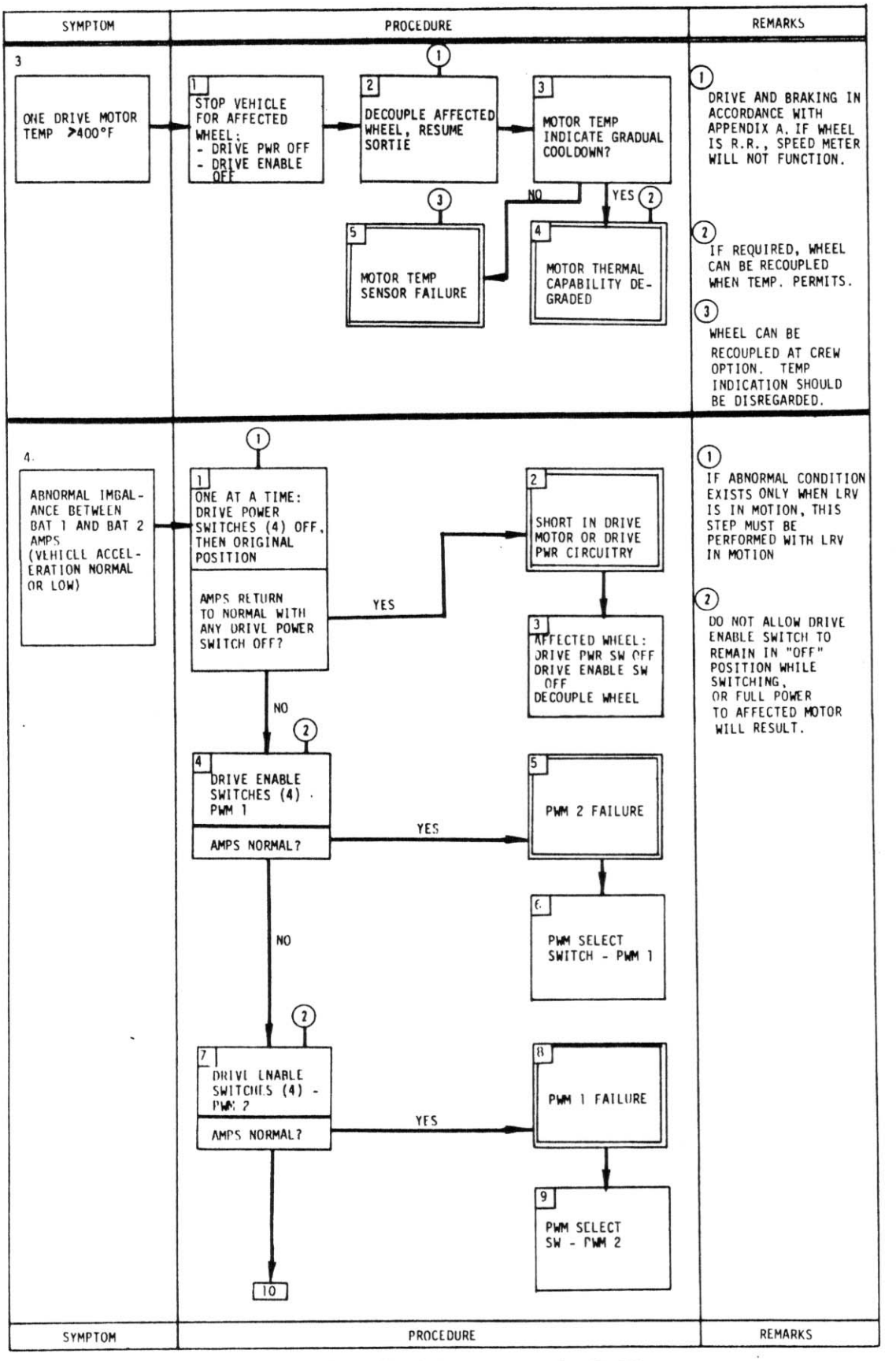


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

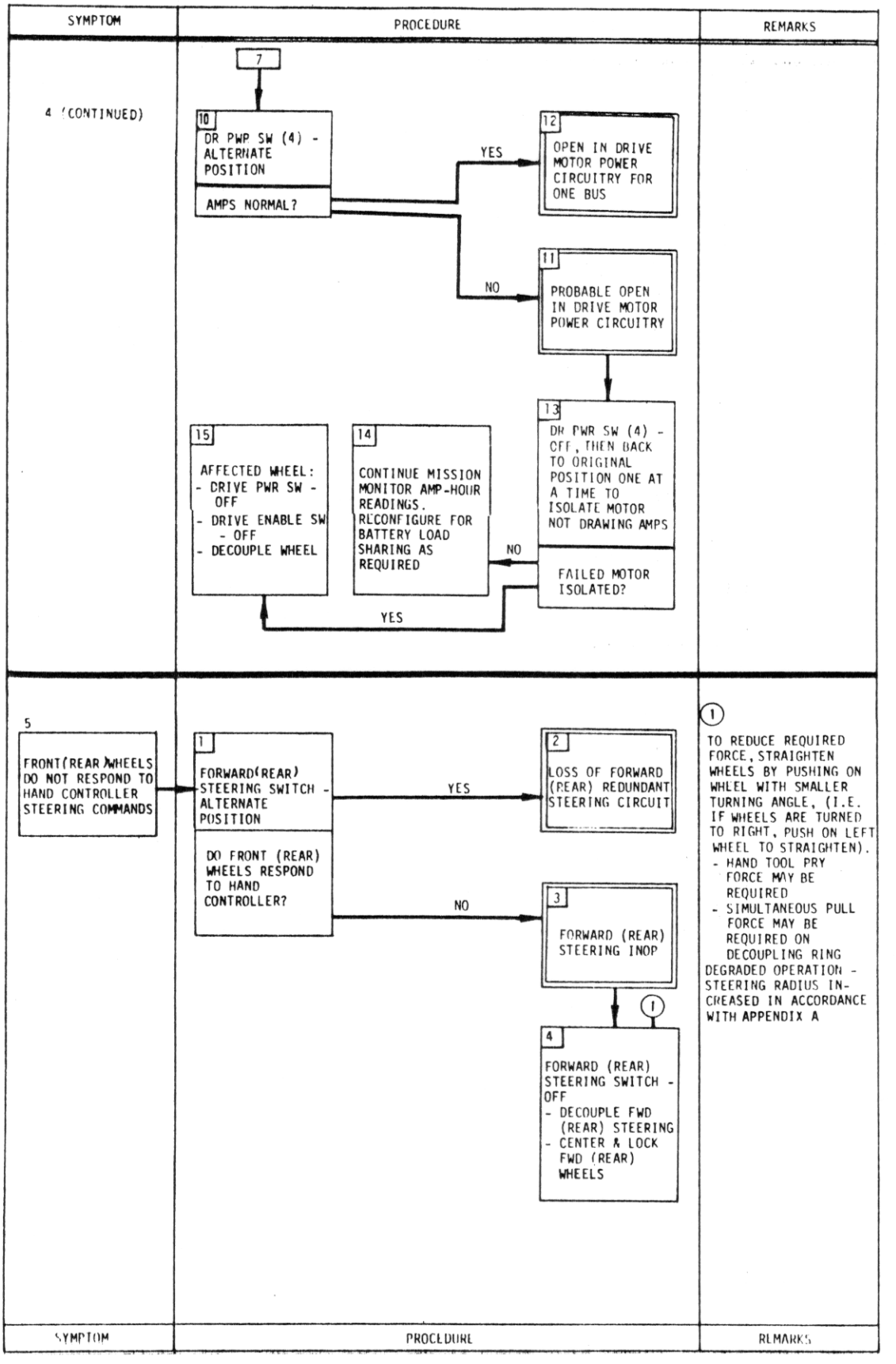


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

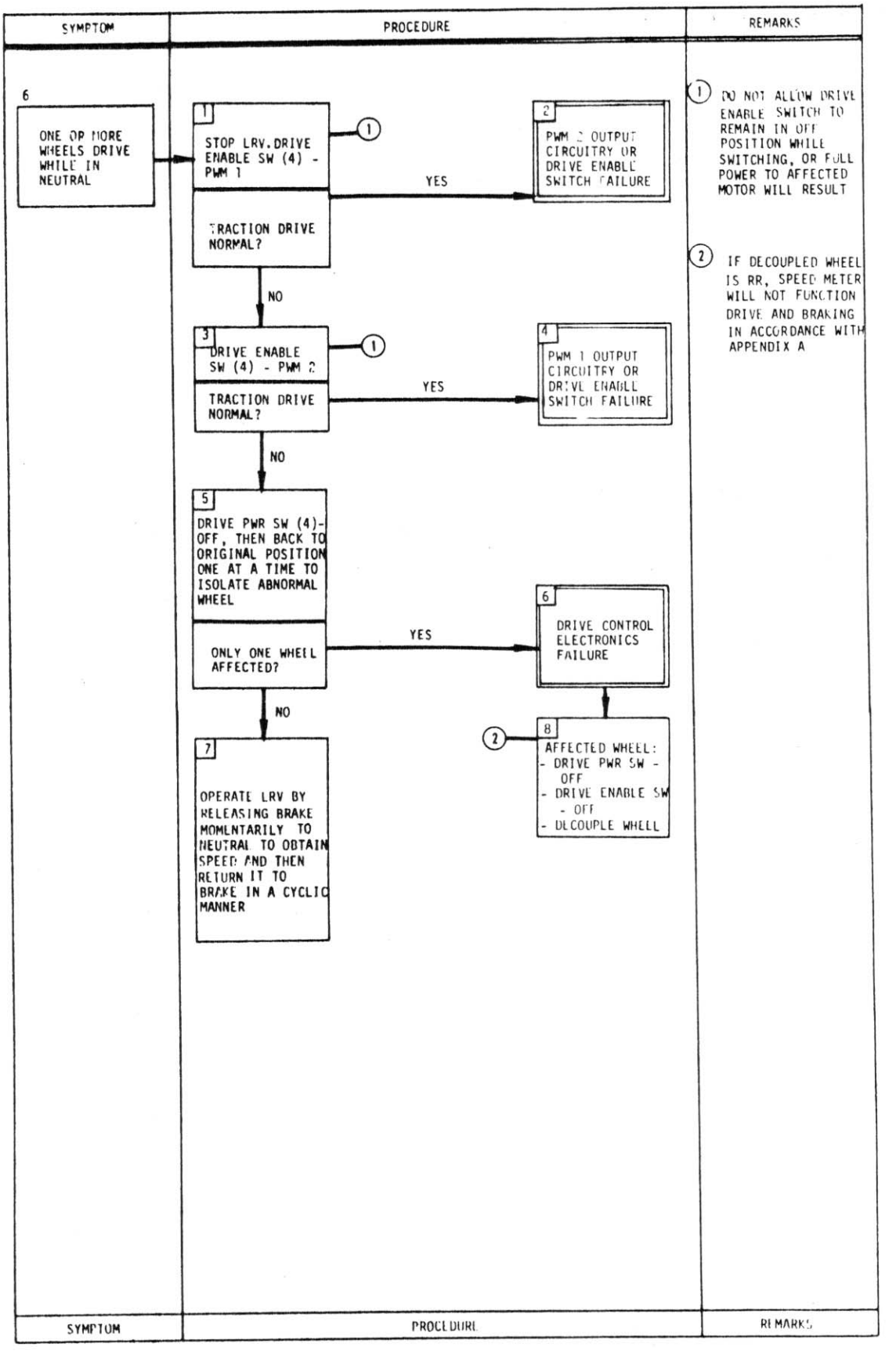


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

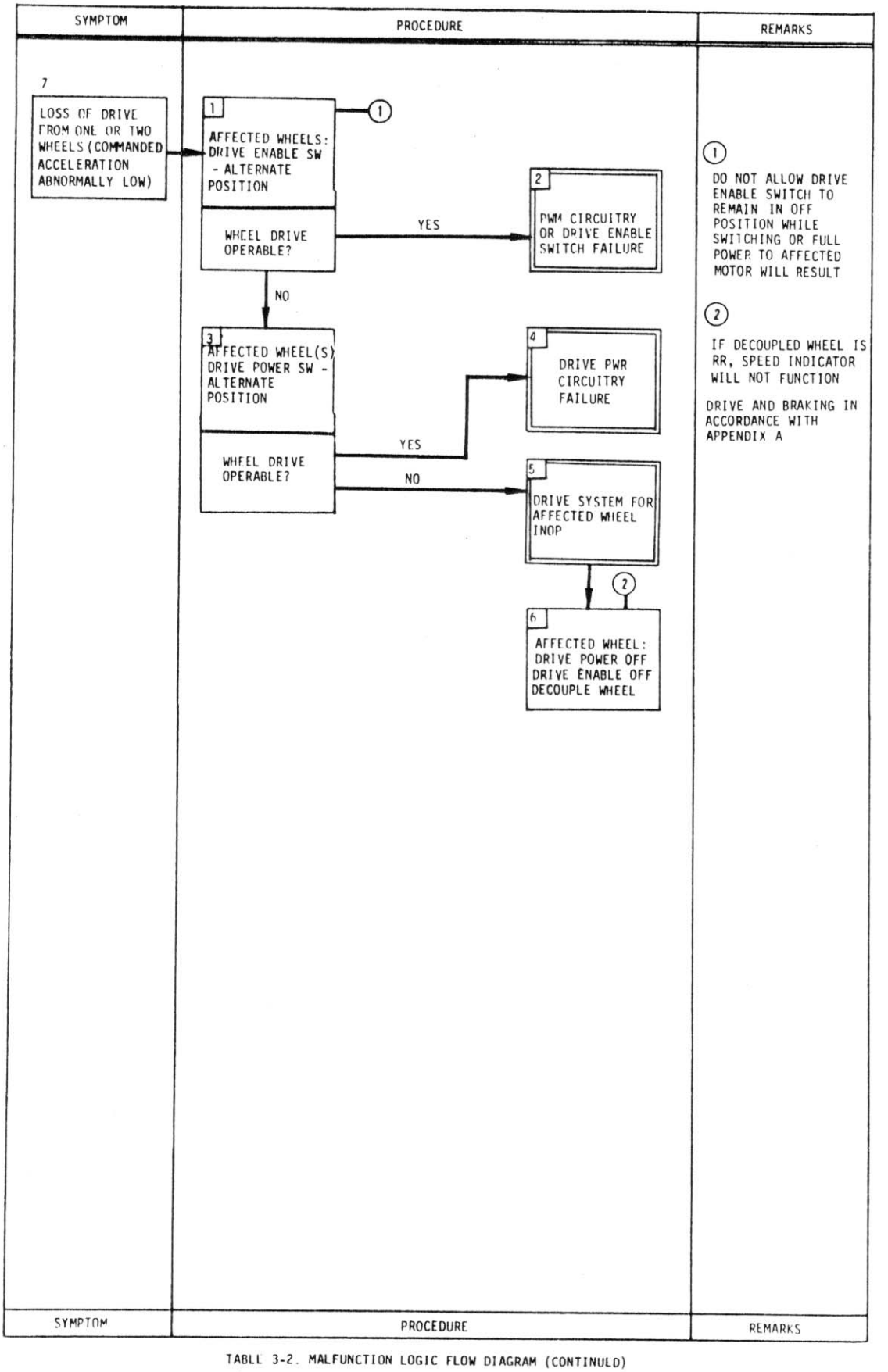


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

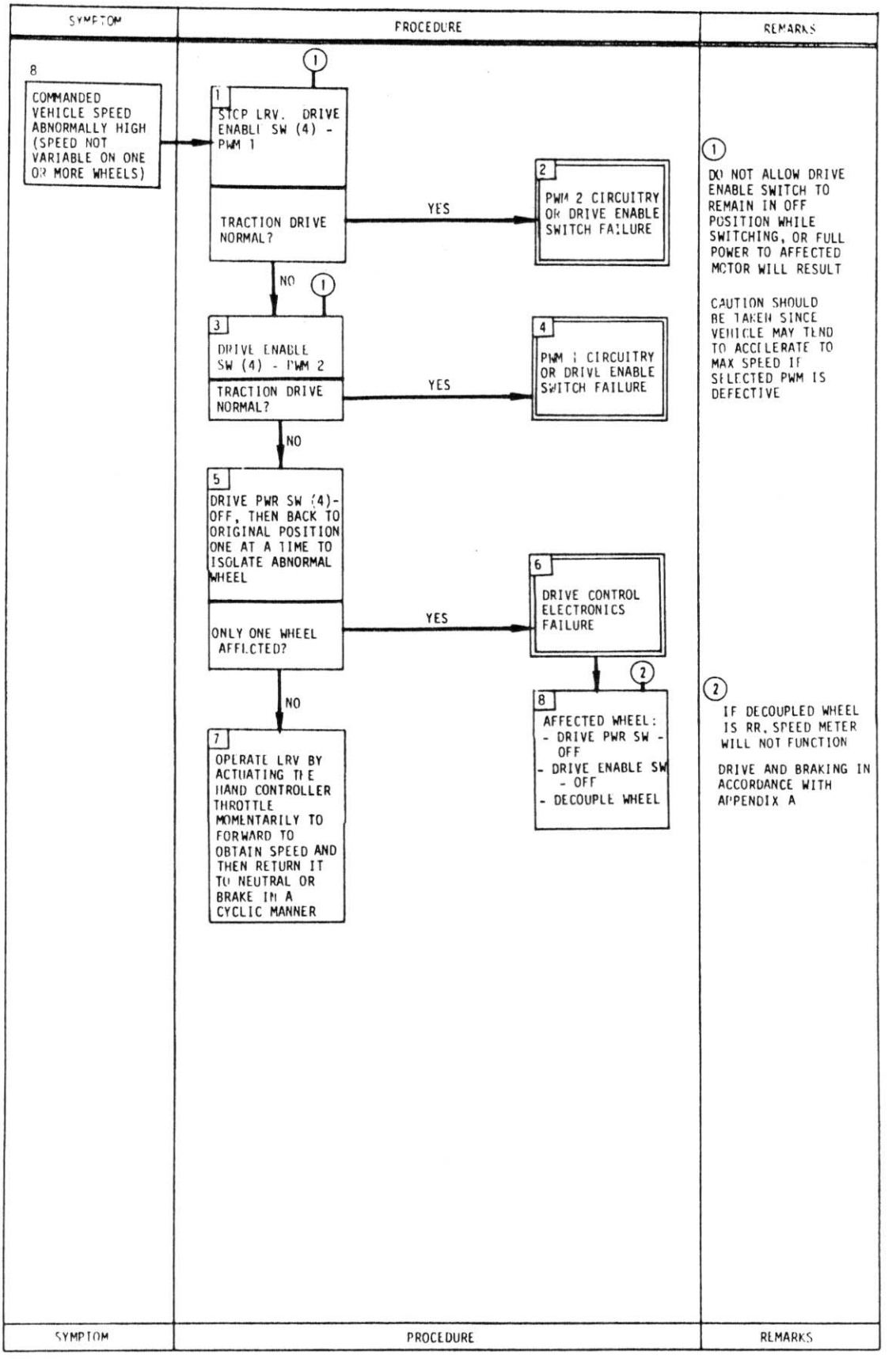


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

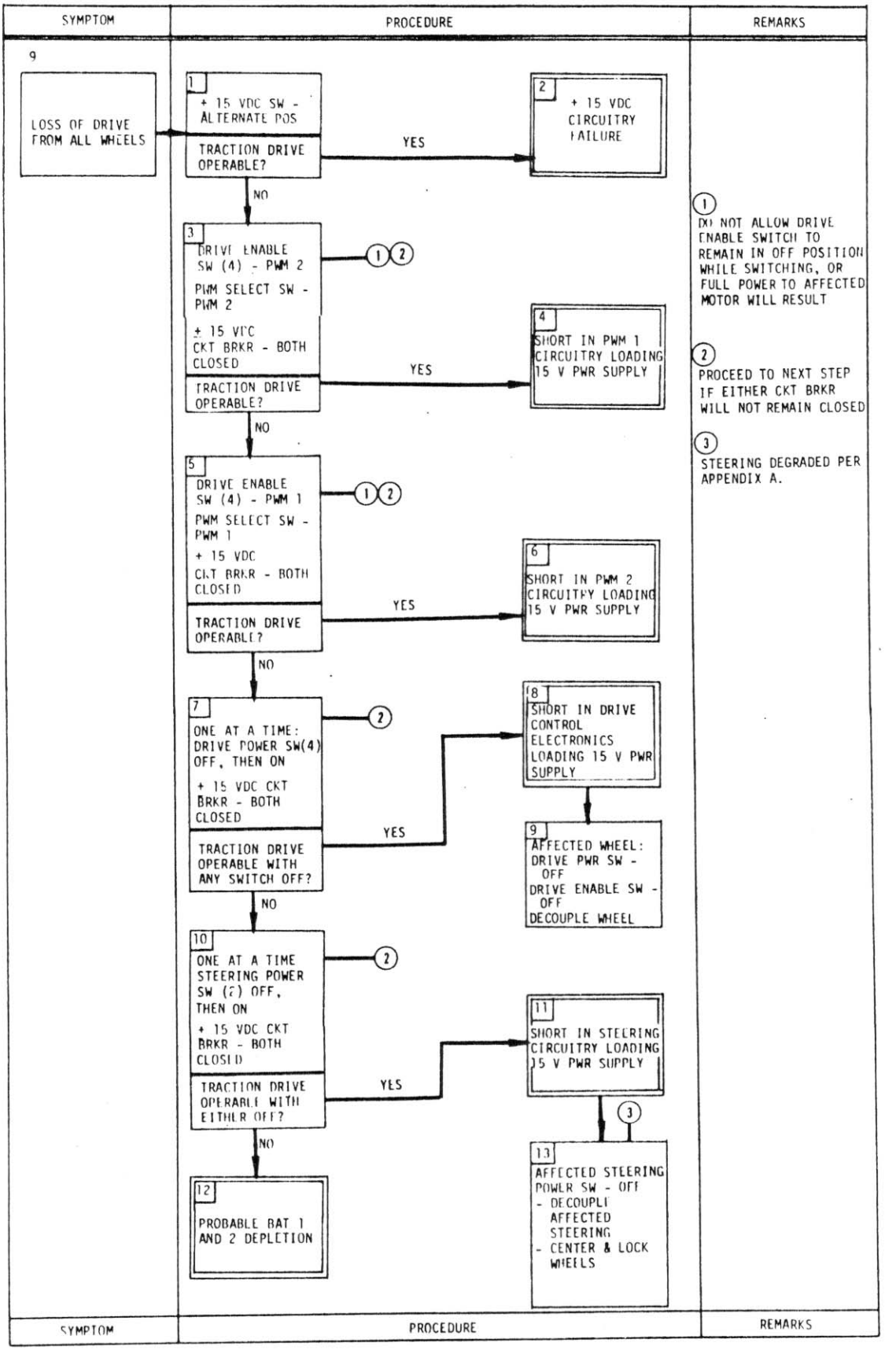


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

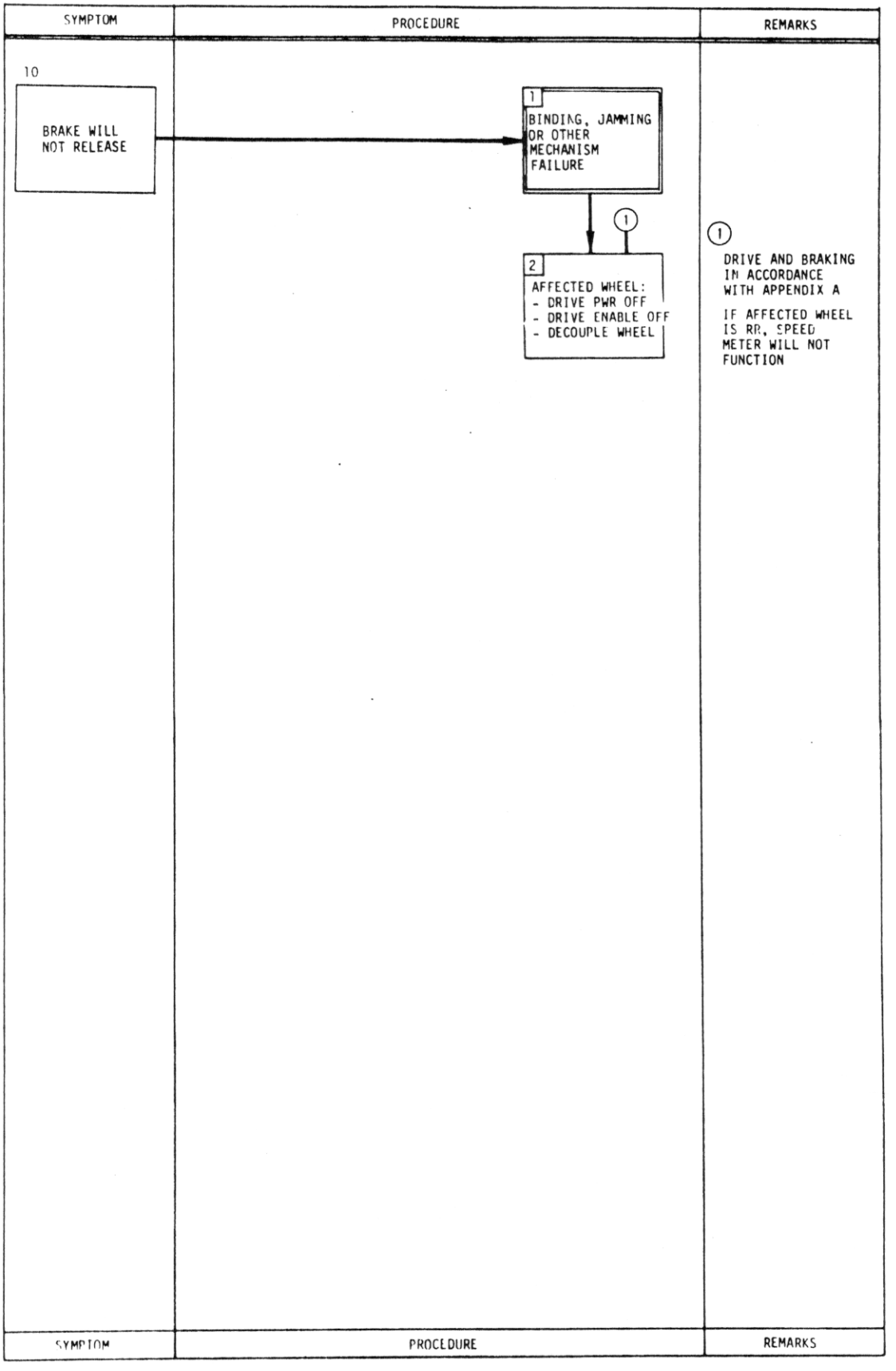


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

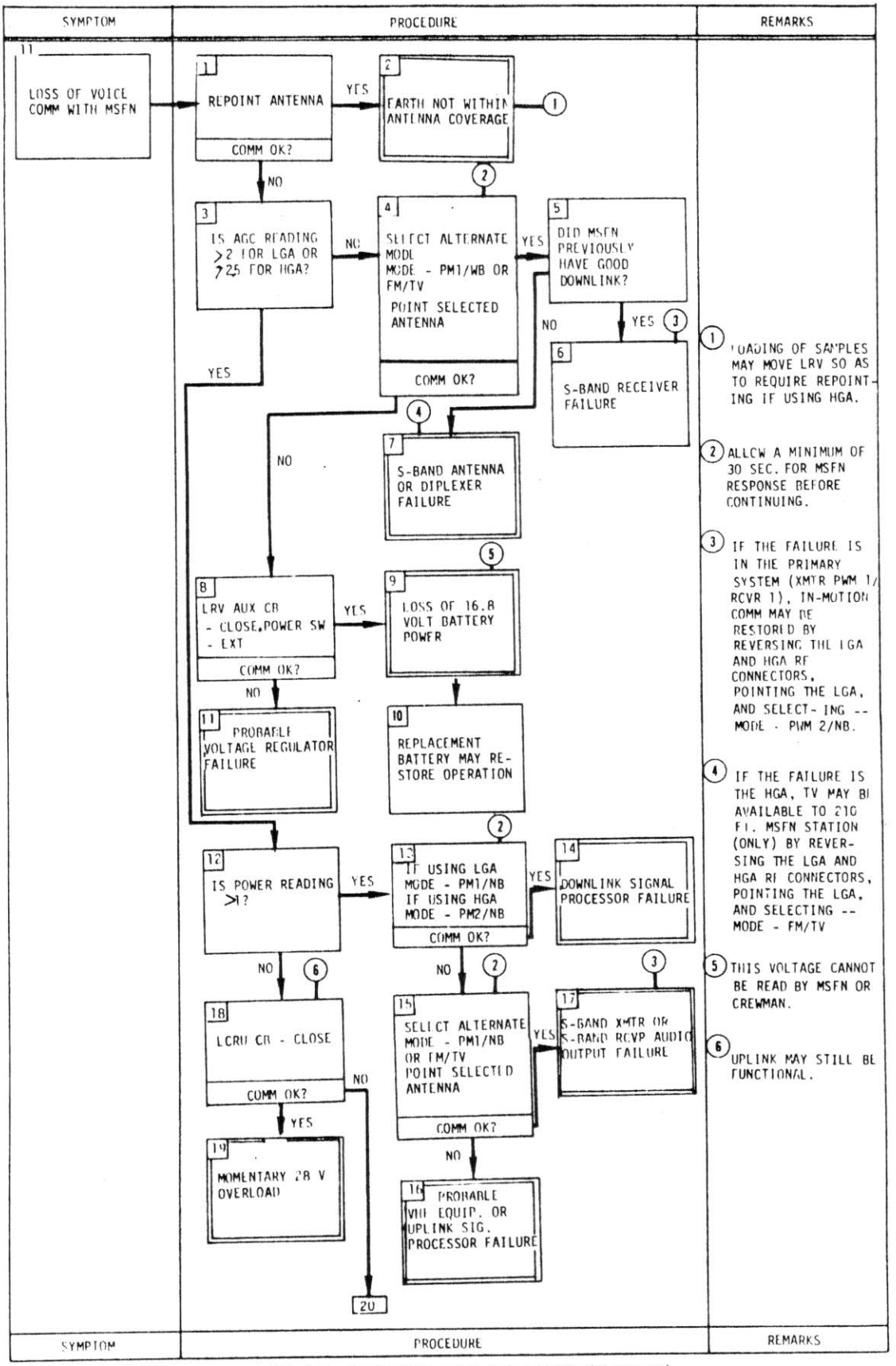
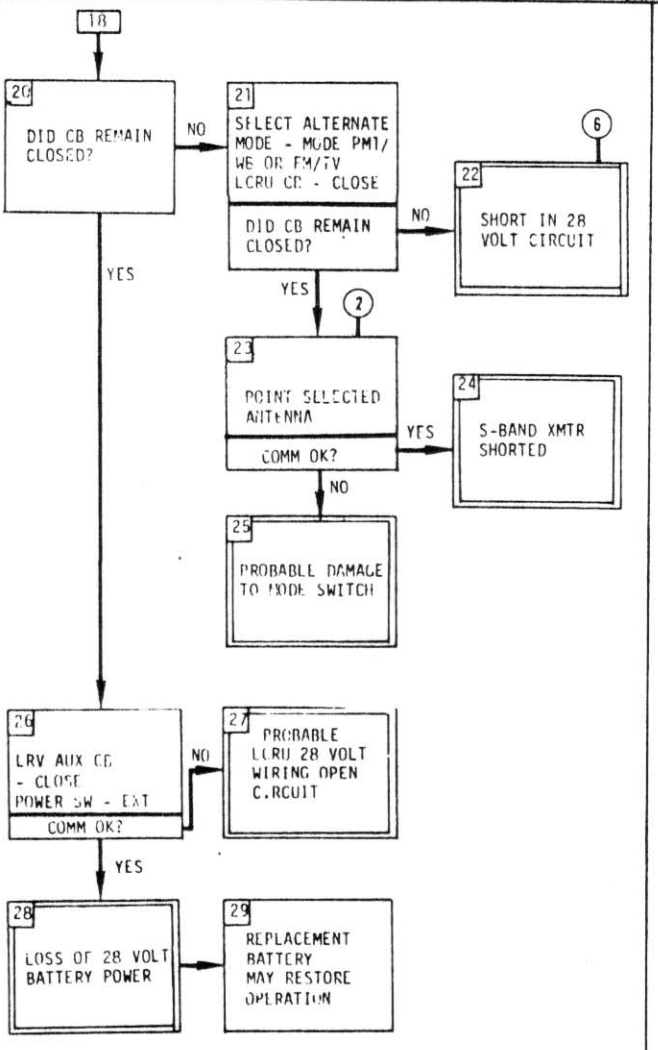


TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)

SYMPTOM	PROCEDURE	REMARKS
11 (CONTINUED)		

SYMPTOM	PROCEDURE	REMARKS

TABLE 3-2. MALFUNCTION LOGIC FLOW DIAGRAM (CONTINUED)