ARMY TM 5-6675-308-12
MARINE CORPS TM 08837A-12/1A

TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL
MAINTENANCE MANUAL
FOR

POSITION AND AZIMUTH
DETERMINING SYSTEM AN/USQ-70

PART NO. 880500-1

NSN 6675-01-071-5552

This manual supersedes TM 5-6675-308-12, dated 26 April 1985

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HEADQUARTERS, DEPARTMENT OF THE ARMY AND
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28 OCTOBER 1988

TM 5-6675-308-12
TM 08837A-12/1A
C 4

CHANGE

NO. 4

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WASHINGTON, D.C., 1 February 1994

Operator's and Organizational
Maintenance Manual
for
POSITION AND AZIMUTH
DETERMINING SYSTEM AN/USQ-70

PART NO. 880500-1
NSN 6675–01-071–5552
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POSITION AND AZIMUTH DETERMINING SYSTEM AN/USQ-70 PART NO. 880500-1 NSN 6675-01-071-5552

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4–29 and 4–30	4–29 and 4–30
D–9 and D–10	D–9 and D–10

D-13 and D-14	D-13 and D-14
F-1 and F-2	F-1 and F-2
Glossary 1 and Glossary 2	Glossary 1 and Glossary 2
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Index 7 and Index 8	Index 7 and Index 8

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Operator and Organizational Maintenance Manual for POSITION AND AZIMUTH DETERMINING SYSTEM AN/USQ–70 PART NO 880500–1 NSN 6675–01–071–5552

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1–23 and 1–24	1–23 and 1–24
2–7 and 2–8	2–7 and 2–8
2–49 and 2–50	2–49 and 2–50
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3–53 through 3–55/(3–56 blank)	3–53 through 3–56
– – –	3–57 through 3–59/(3–60 blank)
A–1 and A–2	A–1 and A–2
C–1 and C–2	C–1 and C–2
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Naval Facilities Engineering Command

H. E. REESE
Executive Director
Marine Corps Research, Development, and Acquisition Command

DISTRIBUTION;
To be distributed in accordance with DA Form 12–25A, Operator's and Unit Maintenance Requirements for Position and Azimuth Determining System (PADS) (AN/USQ–70).

WARNING

To prevent injury to personnel or damage to equipment, disconnect ground cable first, before working with, or around, batteries. Protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

WARNING

Battery box contains acid-filled batteries which may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skim flush area immediately with water; if it touches the eyes, flush immediately with water for 30 minutes and see a physician without delay.

WARNING

Isopropyl alcohol is flammable and gives off harmful vapors. Use only in well-ventilated area away from open flames and sparks. Avoid prolonged or repeated inhalation of vapors.

Refueling of the aircraft should not be performed while either utility truck or helicopter is running; start-up of the utility truck near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

WARNING

With a heavy crew and total PADS equipment installed, the OH-58 may easily exceed its forward center of gravity limits, which could result in mast bumping. The helicopter pilot shall perform a weight and balance calculation before each flight (Class 2 aircraft) to guarantee that the aircraft remains within its center of gravity limits for both takeoff and landing. The weight of the PADS equipment is 334 lbs. To calculate the moment/100, refer to the center of gravity limit chart in TM 55-1520-228-10 for the OH-58A, or in TM 55-1520-235-10 for the OH-58C. Should load adjustments be required, take the actions listed in order of preference:

a. Limit pilot and operator weight.

b. Leave behind unnecessary personal gear.

c. Remove chest armor.

d. Remove seat armor.

e. Remove PADS battery box.

f. Reduce fuel load.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to avoid becoming a missile hazard during a crash.

TECHNICAL MANUAL
No. 5-6675-308-12 (ARMY)
No. 08837A-12/1A (MARINE CORPS)

HEADQUARTERS, DEPARTMENT OF THE ARMY AND
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WASHINGTON, D.C., 28 October 1988

Operator's and Organizational Maintenance Manual

for

POSITION AND AZIMUTH DETERMINING SYSTEM AMUSQ-70

PART NO. 880500-1
NSN 6675-01-071-5552
EIC: YOA

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

Marine Corps users shall submit NAVMC Form 10772 (Recommended Changes to Technical Publications). Send to: Commanding General, Marine Corps Logistics Base (Code 850), Albany, GA 31704-5000

* This manual supersedes TM 5-6675-308-12, dated 26 April 1985.

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CHAPTER 1

INTRODUCTION

Section 1. GENERAL INFORMATION

1-1. Scope. This manual contains information and guidance for the operator of the Position and Azimuth Determining System ANLJSQ-70 (PADS).

a. Type of Material. This manual provides operating instructions and crew maintenance instructions. Only maintenance alloted to the crew is included. The Maintenance Allocation Chart in Appendix D assigns maintenance on each part and assembly. Maintenance which cannot be performed because of the need for tools, equipment, or supplies will be referred to a higher maintenance category.

b. Purpose of Equipment. The PADS provides a highly mobile, self-contained survey capability to support field artillery operations.

1-2. Maintenance Forms and Records. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps users shall refer to TM 4700-15/1.

NOTE

This equipment is not covered by an Equipment Serviceability Criteria (ESC).

1-3. Destruction of Army Material to Prevent Enemy Use. Refer to TM 750-244-3 for procedures for destruction of the is equipment to prevent enemy use. Marine Corps users may refer to Army TM 750-244-2.

1-4. Administrative Storage. Refer to TM 740-90-1 for procedures, forms and records, and inspections required during administrative storages of this equipment. Marine Corps users shall refer to MCO 4450.7.

1-5. Calibration. No scheduled calibration is required. Preventive maintenance checks and services are required every 30 days in accordance with Table 4-1.

1-6. Reporting Equipment Improvement Recommendations (EIR). EIRs can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just tell why the design is unfavorable or why a procedure is difficult. EIRs maybe submitted on SF (Standard Form) 368 (Quality Deficiency Report). Mail directly to:

Commander, U.S. Army Aviation and Troop
Command
ATTN: AMSAT-I-MDO
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798

Marine Corps users may submit Quality Deficiency Reports on accordance with MCO 4855.10. Mail directly to:

Commanding General
Marine Corps Logistics Base (P840)
Albany, GA 31704-5000

Marine Corps users are encouraged to submit EIRs in accordance with MCO 1650.17.

A reply will be sent directly to you.

Section I. GENERAL INFORMATION

1-7. Purpose of PADS. The PADS is a self-contained inertial surveying system, capable of rapidly determining accurate position, elevation and azimuth when used in either ground or airborne survey operations. The system may be installed in, and operate from an M151 series utility truck (Jeep), an M1009 series commercial utility cargo vehicle (CUCV), an M998 series high-mobility multi-purpose wheeled vehicle (HMMWV) and M973 series small utility support vehicle (SUSV). It may also be mounted on an OH-58 light observation helicopter, a UH-1D utility helicopter and a UH-60 utility helicopter (Blackhawk), or transported in a CH-47 cargo helicopter (by driving the land vehicle into the cargo compartment. PADS may be utilized within any vehicle, ground or air, capable of carrying and supplying required power and making periodic stops at five or ten minute intervals. PADS is used to conduct field artillery surveys critical to the fire-control function, providing a common grid for weapons and target acquisition systems. It will be determine the true or grid azimuth of azimuth lines used to orient weapons and target acquisition systems.

1-8. Description. PADS is described in figures 1-1 and 1-8.

1–9. Differences Between Models. There is only on e model of the PADS.

1–10. Capabilities and Features.

Self-contained

Mobile (may be used with land vehicles or helicopter)

Two–person crew

Horizontal position

Elevation

Azimuth

Built–in self–test circuits

1-11. Tabulated Data. A list of components required for use of PADS in helicopter and ground vehicles is given in table 1-1. PADS characteristics and performance data are given in table 1-2.

1-12. Items Comprising an Operable Equipment. All items illustrated and listed in figures 1-1 thru 1-8 are required for an operable equipment.

Legend for Figure 1-1

Index no.	Nomenclature	Description
1.	Installation kit	Contains the mounting hardware and electrical cable needed to install PADS in a 1/4-ton utility truck.
2.	Cable assembly WI	Connects CDU to computer.
3.	Primary pallet	Contains the basic electronic components for PADS.
4.	Battery Box	Provides standby battery power for PADS. Provides storage space for tools, cables, and helicopter CDU mount.
5.	Control and Display	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands.

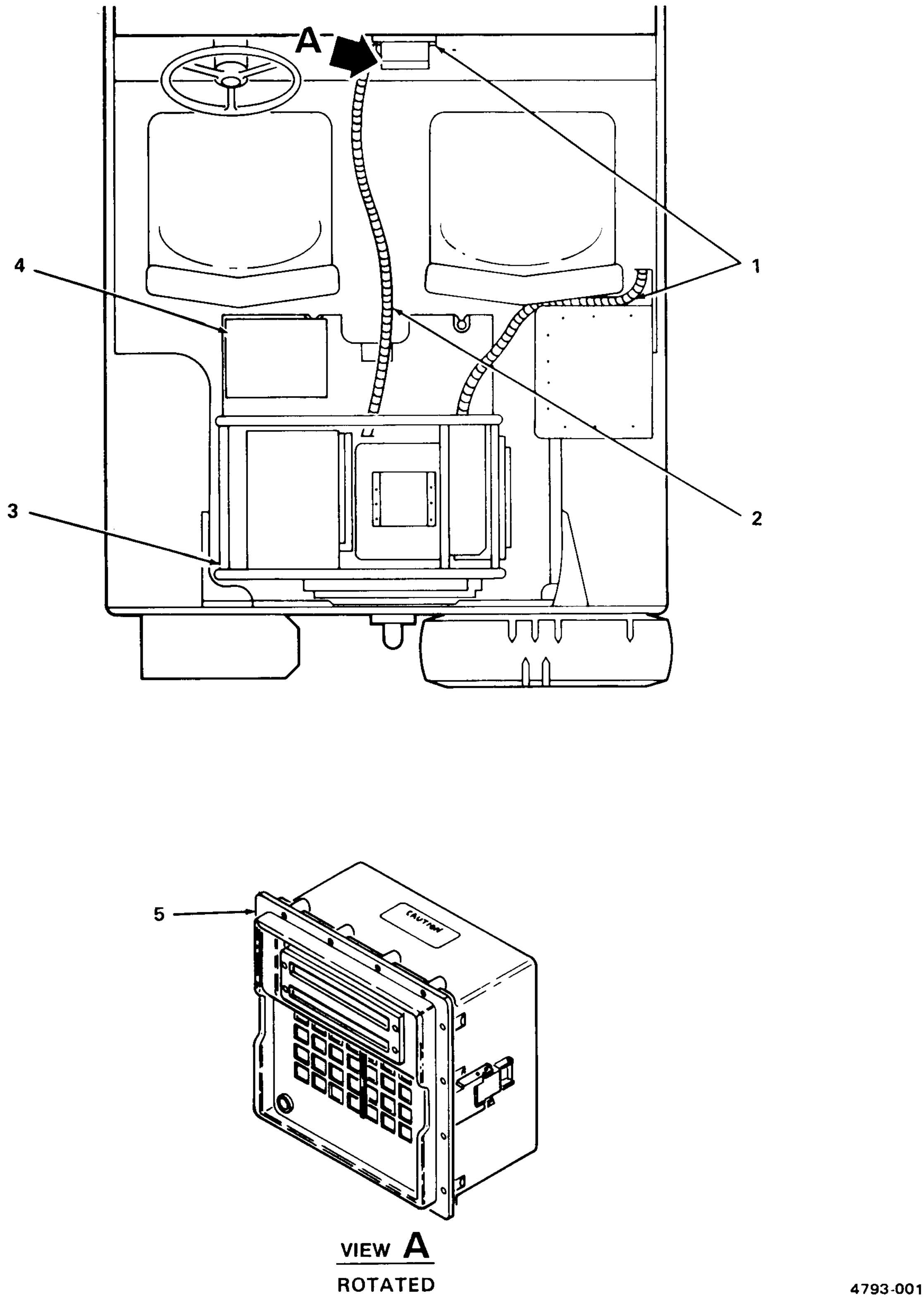


Figure 1-1. Location and Description of PADS in M151 Series Utility Truck (Jeep)

Legend for Figure 1–2

Index no.	Nomenclature	Description
1.	Installation kit	Contains the mounting hardware and electrical cable needed to install PADS in a commercial utility cargo vehicle.
2.	Cable assembly W1	Connects CDU to computer.
3.	Primary pallet	Contains the basic electronic components for PADS.
4.	Battery box	Provides standby battery power for PADS. Provides storage space for tools, cables and helicopter CDU mount.
5.	Control and display unit (CDU)	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands.

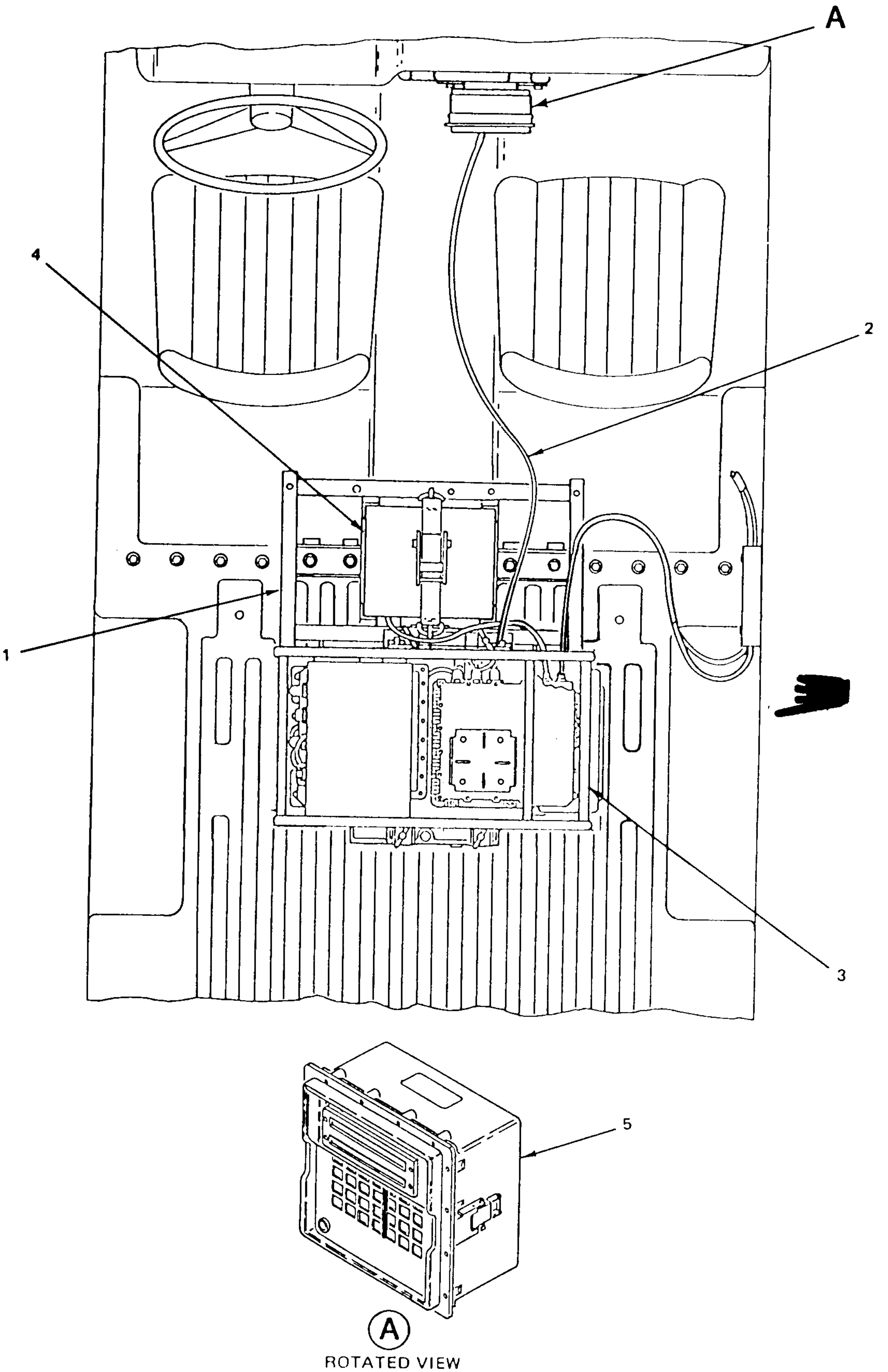


Figure 1-2. Location and Description of PADS in M1009 Series Commercial Utility Cargo Vehicle (CUCV)

Legend for Figure 1-3

Index no.	Nomenclature	Description
1.	Installation kit	Contains the mounting hardware and electrical cable needed to install PADS in a high–mobility, multi-purpose wheeled vehicle.
2.	Cable assembly W1	Connects CDU to computer.
3.	Primary pallet	Contains the basic electronic components for PADS.
4.	Battery box	Provides standby battery power for PADS. Provides storage space for tools, cables and helicopter CDU mount.
5.	Control and display unit (CDU)	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands.

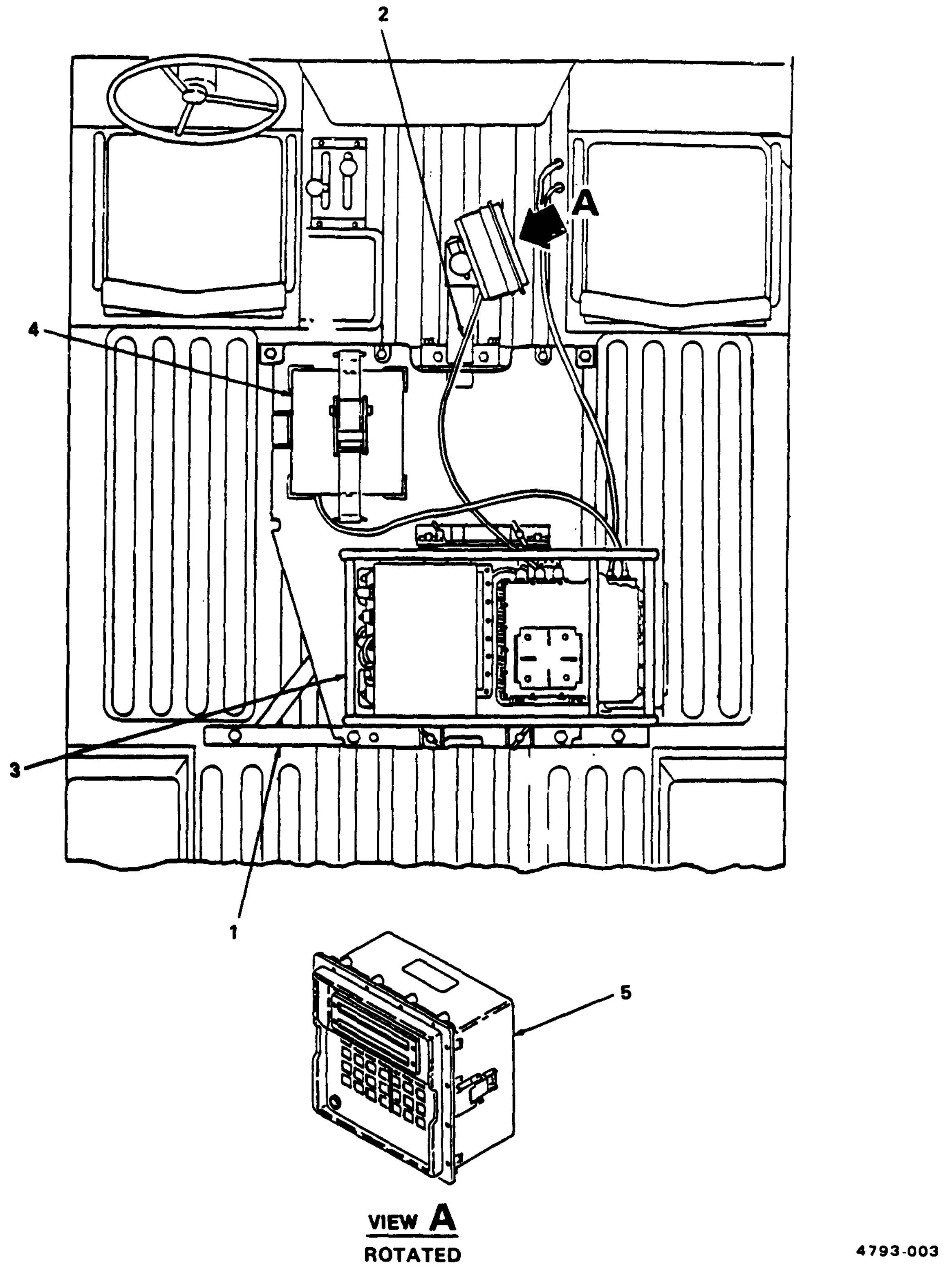


Figure 1-3. Location and Description of PADS in M998 Series High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)

Legend for Figure 1-3.1

Index no.	Nomenclature	Description
1.	Installation kit	Contains the mounting hardware and electrical cable needed to install PADS in a small utility support vehicle.
2.	Cable assembly W1	Connects CDU to computer.
3.	Primary pallet	Contains the basic electronic components for PADS.
4.	Battery box	Provides standby battery power for PADS.
5.	Control and display unit (CDU)	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands.
6.	Power cable connector J16	Connects PADS power cable W7 to vehicle power.

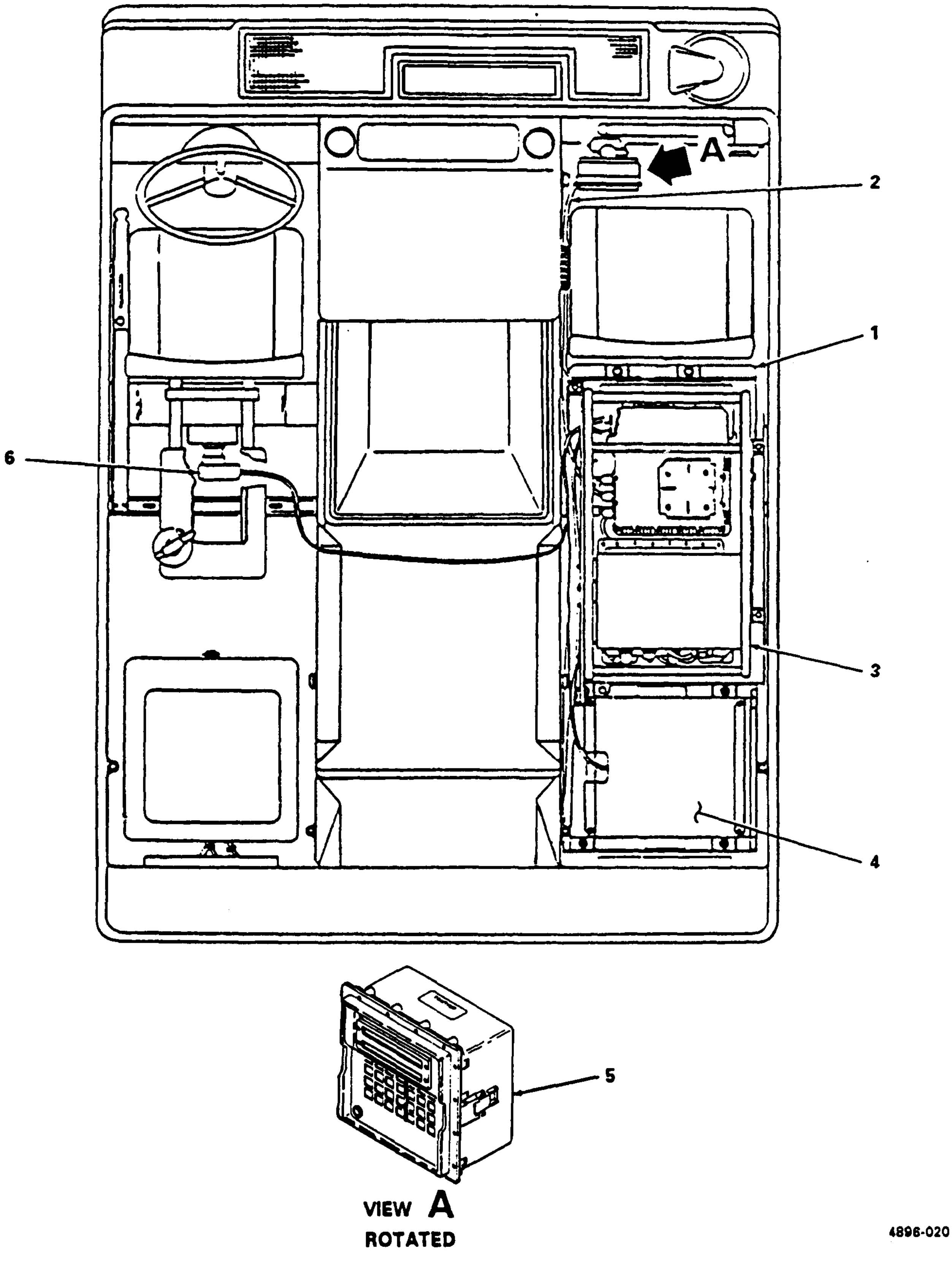
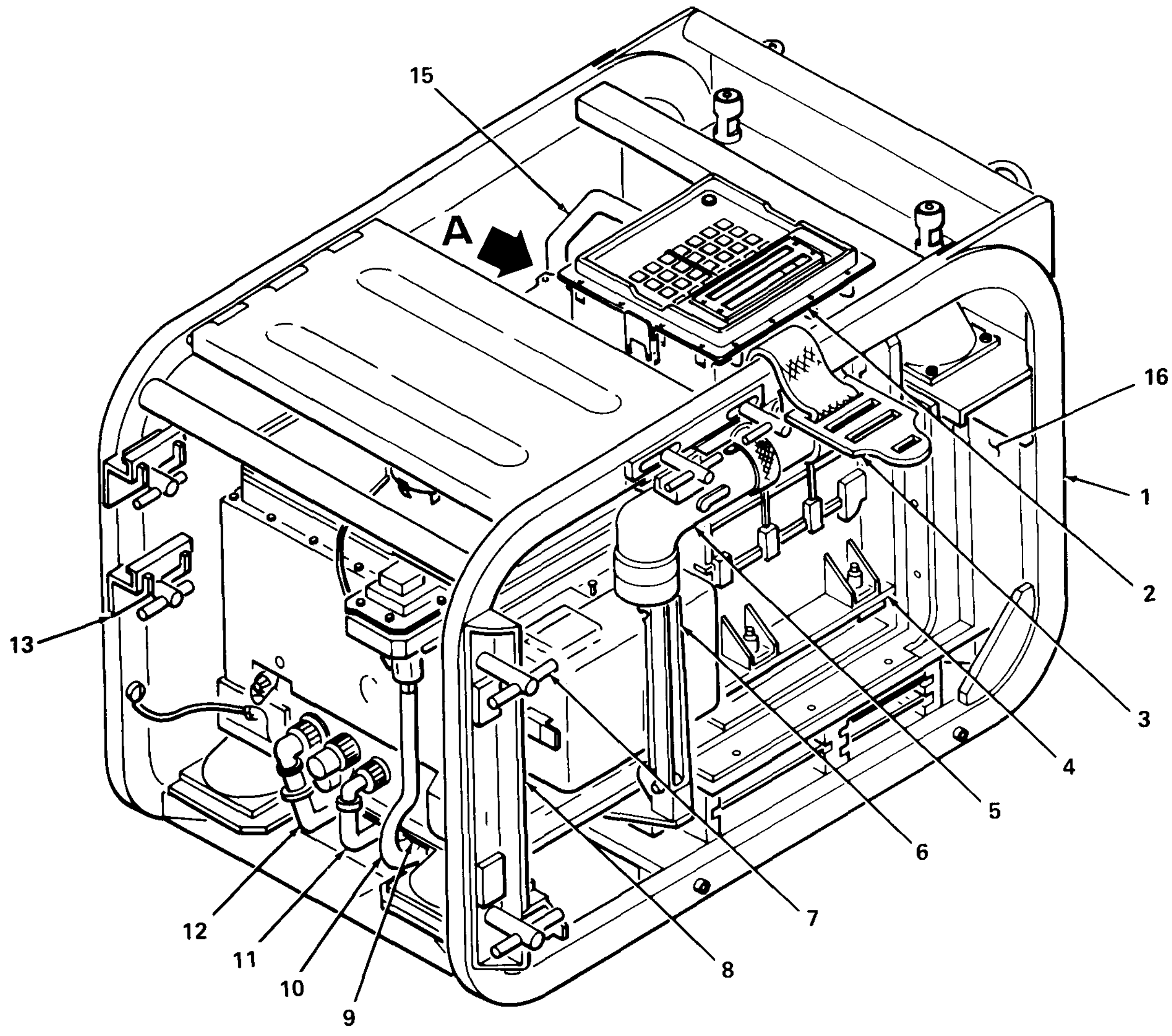


Figure 1-3.1 Location and Description of PADS in M973 Series Small Utility Support Vehicle (SUSV)

Legend for Figure 1-4

Index no.	Nomenclature	Description
1.	Electrical equipment mounting base	A frame assembly which contains the power supply and provides a shock- and vibration-isolated mounting platform for the inertial measurement unit (IMU) and computer
2.	Control and display unit (CDU)	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands
3.	Belt	Used to secure utility truck top bows
4.	Computer	Contains a general purpose digital computer and interface circuitry to process IMU data, compute survey data, provide system control functions, and accept data from and send data to the CDU
5.	Flashlight	Illuminates porro prism scale at night
6.	Plumb bob arm	Provides position reference point. Used to hang plumb bob
7.	T-handle (4 each)	Used to fasten alignment pin bracket and clamping brackets to subfloor or to primary pallet for storage
8.	Alignment pin bracket	Used to mount primary pallet to subfloor plate and OH-58 helicopter cargo pallet
9.	Inertial measurement unit (IMU)	Contains the gyroscope and accelerometer sensors and associated electronics necessary to maintain the survey coordinate frame and measure distance traveled to each coordinate axis
10.	Cable assembly W5	Connects upper IMU and fans to power supply
11.	Cable assembly W4	Connects IMU to power supply
12.	Cable assembly W2	Connects IMU to computer
13.	Clamping bracket	Used to mount primary pallet to subfloor plate, OH-58 helicopter cargo pallet, and transit case
14.	Cable assembly W3	Connects computer to power supply
15.	Cable assembly W1	Connects CDU to computer
16.	Power supply (PS)	Receives unregulated power from the transporting vehicle or PADS batteries and provides controlled and regulated power to the IMU, computer, and CDU



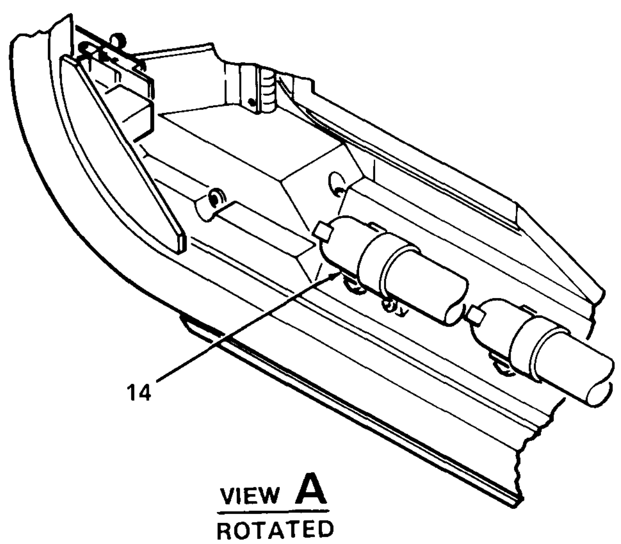


Figure 1-4. Location and Description of Primary Pallet Components

Legend for Figure 1-5

Index no.	Nomenclature	Description
1.	Operator's manual	TM 5-6675-308-12/TM 08837A-12/lA.
2.	Lamp modules	Spares for replacement of burned-out CDU lamp modules
3.	Battery box cover	Covers batteries and provides storage for cables, tools, and small hardware items
4.	Cable assembly W8	Used to extend cable assembly W7 when transferring an operating PADS between vehicles or between a vehicle and a helicopter
5.	Battery box chassis	Container for PADS batteries
6.	Cable assembly W6	Connects batteries to power supply
7.	Cable assembly W11	Interconnects batteries
8.	Battery (2 each, Government-furnished)	Provides backup to vehicle power system
9.	Cable assembly W9	Connects PADS power supply to helicopter power system
10.	Tool kit	Contains tools required for operator/crew maintenance and installation
11.	Helicopter CDU bracket	Attaches to operator's leg to mount CDU for helicopter operation
12.	Lamps	Spares for replacement of burned out lamps in CDU lamp modules
13.	Belt assembly	Used to secure battery box to subfloor plate or helicopter cargo pallet

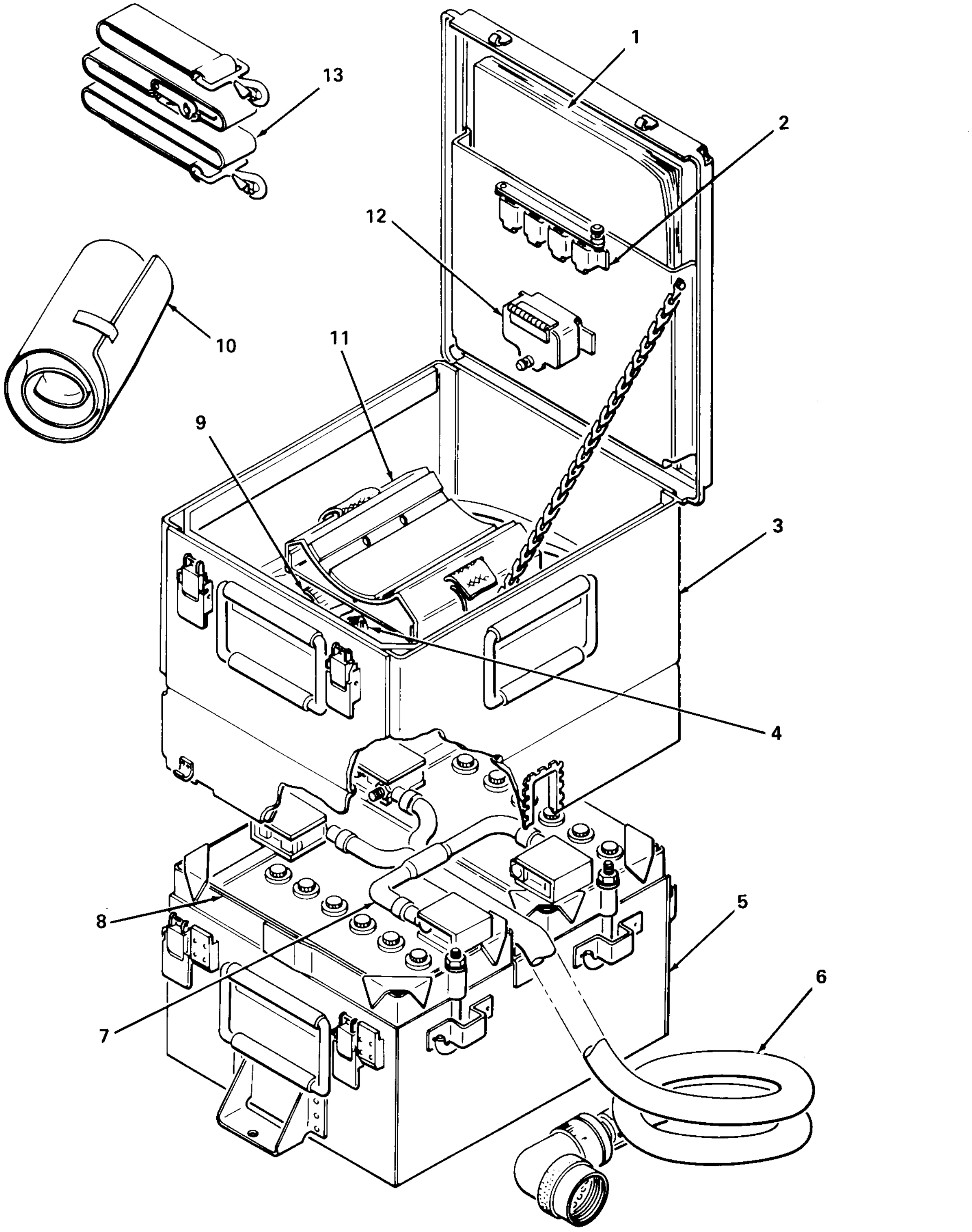


Figure 1-5. Location and Description of Battery Box Components

Legend for Figure 1-6

Index no.	Nomenclature	Description
1.	Battery carrier	Used to lift and carry PADS batteries
2.	Screwdriver	Flat-tip, 1/4-inch, 6-inch
3.	Screwdriver	Flat-tip, 3/16-inch, 3-inch
4.	Screwdriver	Cross-tip, no. 2, 4-inch
5.	Screwdriver	Cross-tip, no. 1, 3-inch
6.	Wrench	Combination, 3/4-inch
7.	Wrench	Adjustable, 6-inch
8.	Pliers	Long-nose, 6-inch
9.	Brush	2-inch
10.	Wrench	Combination, 5/8-inch
11.	Wrench	Combination, 9/16-inch
12.	Wrench	Open end, 1/2-inch and 7/16-inch
13.	Screwdriver	Flat-tip, 3/32-inch, 2-inch
14.	Screwdriver	Cross-tip, no. 1 and 2, double offset
15.	Key	Socket head, L-type handle, 3/16-inch
16.	Key	Socket head, L-type handle, 1/4-inch
17.	Tool pouch	Contains the above tools

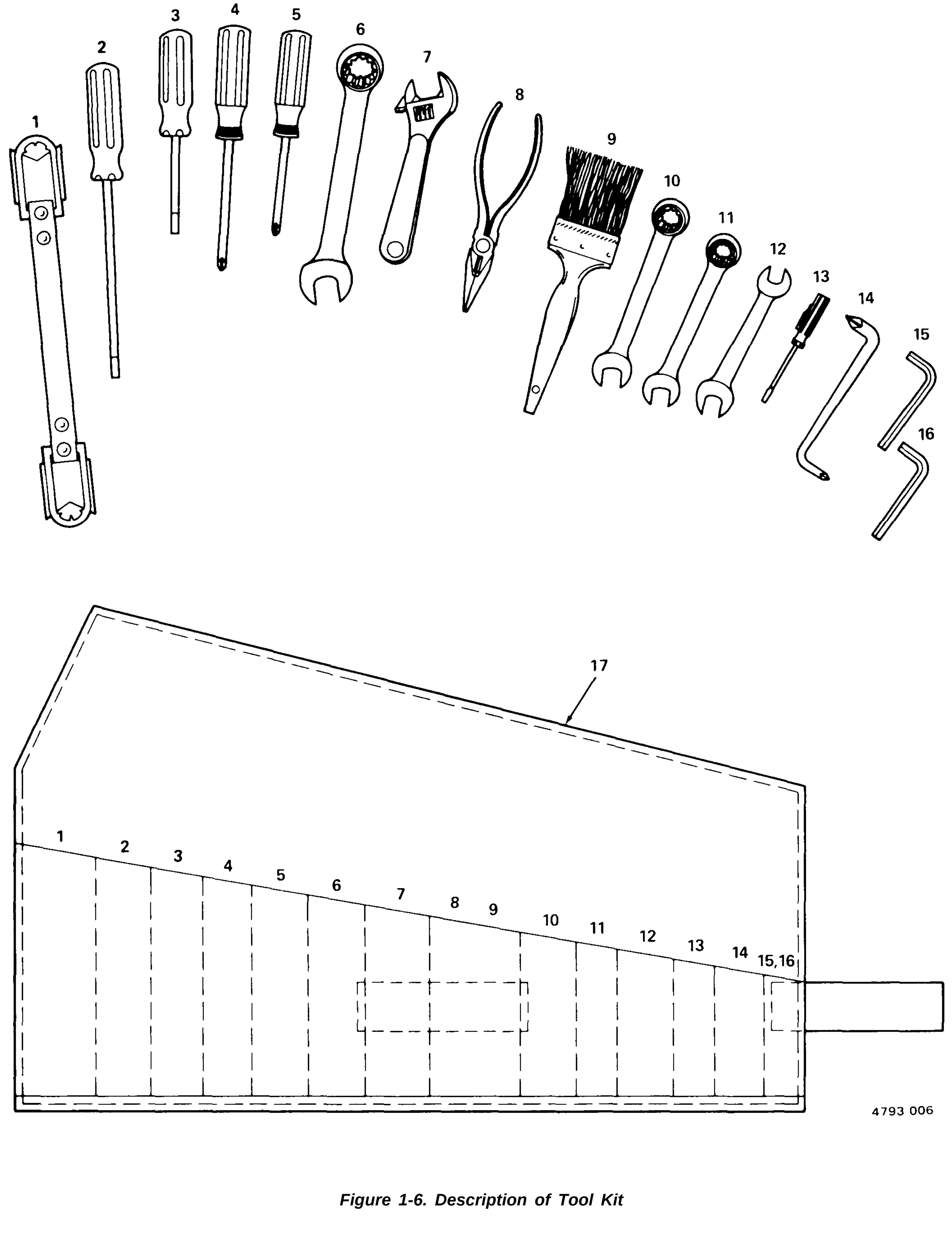


Figure 1-6. Description of Tool Kit

Table 1–1. Components Required for Use of PADS in Helicopter and Ground Vehicles

Nomenclature	Ident No/NSN	See Note	OH-58	UH-1	UH-60	CUCV	HMMWV	SUSV	JEEP
Bracket, CDU, Helicopter	880535/ 13222E1641 6675-01-118-5544	1	X	X	X				
Cable Assy, W9	880533/ 13222E1639 6675-01-124-5849	1	X	X					
Cable Assy, W7	880515/ 13222E1624 667541-125-0028	1,2			X				
Cable Assy, W14, PADS UH-1	880556/ 13222E1681 2540-01-250-3648	1		X					
Cable Assy, W15, UH-60 to Converter	13222E2283	1,6			X				
Converter	08748 4-055-01 6115-01-108-3642	1,6			X				
Enclosure, Converter	13222E2399	1,6			X				
Installation Kit, Issued with PADS	880510-7/ 13222E1619	3				X			X
Installation Kit, CUCV	884662/ 13222E2430	3				X			
Installation Kit, HMMWV	884679/ 13222E2495	3,5							
Installation Kit, SUSV	884700/ 13222E2450	3						X	
Pallet, Cargo	1560-00-181-4820		X						
Straps, Tie–Down, Cargo	1670-00-725-1437	4		X	X				

Table 1– 1. Components Required for Use of PADS in Helicopter and Ground Vehicles - Continued

Note	Comment
1	An Additional Authorized List item.
2	This is an extra W7 cable. The one supplied with the PADS remains in the vehicle.
3	See kit item list for required parts.
4	Host aircraft may or may not provide required tie-down straps. Be sure that required tie-down straps are available when re-questing a mission.
5	Must be used in conjunction with Installation Kit 880510-7, 13222E1619.
6	Before flying a PADS mission on the UH-60 helicopter, be sure to secure official approval to do so.

Legend for Figure 1-7

Index no.	Nomenclature	Description
1.	Cable assembly W7	Connects PADS to vehicle's batteries.
2.	Subfloor mounting bracket	Mounts the rear of the subfloor plate to the utility truck towing pintle.
3.	Subfloor plate	Mounts the primary pallet and battery box to the utility truck or the adapter frame of the HMMWV.
4.	Cable clamp	Secures cable assembly W7 to utility truck.
5.	CDU utility truck bracket	Mounts the CDU to the truck dashboard.
6.	Subfloor forward-facing slots	Mounts subfloor plate to seat-belt holes or mounting holes in HMMWV adapter frame.
7.	Adapter frame	Mounts the subfloor plate to the cargo bed of the HMMWV.
8.	CDU bracket mounting. post	Mounts CDU bracket to adapter frame.
9.	CDU bracket	Mounts CDU to mounting post.
10.	Locking pin	Locks CDU bracket to mounting post.
11.	Plumb bob bracket	Supports plumb bob on HMMWV.
12.	Mounting base	Mounts the primary pallet and battery box to cargo bed of CUCV.
13.	Spacer	Four used to install mounting base on CUCV cargo bed.
14.	J-hook	Two used to install mounting base on CUCV cargo bed.
15.	Anti-rotation washer	Use with J-hooks to install mounting base on CUCV cargo bed.
16.	Nut plate	Attaches CDU bracket to CUCV dash panel bracket.
17.	CDU bracket	Mounts CDU to CUCV dash panel bracket.
18.	Plumb bob bracket	Supports plumb bob on CUCV.
19.	Lower bracket	Installed in SUSV as base for CDU mount tube.
20.	Upper plate	Installed under dash panel handle in SUSV to support upper end of CDU mount tube.
21.	Radial washer	To support lower end of CDU mount tube in SUSV.
22.	Mount tube	To support CDU mount bracket in SUSV.
23.	Clamp	To secure CDU mount tube to upper plate in SUSV.
24.	CDU mount bracket	Mounts CDU to mount tube in SUSV.

Legend for Figure 1-7- Continued

Index no.	omenclature	Description
25.	Quick-release pin	To secure CDU mounting bracket to mount tube in SUSV.
26.	Chain	To attach quick-release pinto CDU mounting bracket in SUSV.
27.	Cable clamp	To secure cable W101 in SUSV.
28.	Plumb bob assembly	Used to hang plumb bob to establish position reference point in SUSV.
29.	Floor support plate	Installed under SUSV as stiffener base for SUSV body.
30.	Frame assembly	Installed on floor support plate in SUSV to mount PADS components.
31.	Left bracket	Used to secure PADS primary pallet to left side of frame assembly.
32.	Right bracket	Used to secure PADS primary pallet to right side of frame assembly.
33.	Cable assembly W100	Power cable for installation of PADS on SUSV.
34.	Cable assembly W101	For component interconnection on frame assembly in SUSV.
35.	Cable assembly W102	For interconnection of PADS installation components on SUSV.
36.	Power cable connector	To connect PADS installation to SUSV power through adapter.
37.	Connector adapter	To adapt power cable connector to SUSV auxiliary starting connector.
38.	Cable assembly W6	Power cable from back-up power source to PADS.
39.	Cable assembly W11	For interconnection of PADS batteries.
40.	Shock mount	Used for SUSV operation.
41.	Modified subfloor plate	Used with adapter frame, index no. 7.
42.	Subfloor mounting bracket	Used with modified subfloor plate when installed in utility truck.
Not shown	Hardware	l/4-inch diameter by 5/8-inch long bolt (four each), and flat washer (four each) to secure subfloor plate to subfloor mounting bracket.
		3/8-inch diameter by l-inch long bolt, flat washer, lockwasher, and nut to secure cable clamp to utility truck.
		Grommet (four each) for cable assembly W7 access holes in utility truck, CUCV and HMMWV.
		5/8-inch diameter by 1.38-inch long bolt (four each) and flat washer (four each) to secure mounting base and spacers into CUCV cargo bed.
		l/2-inch diameter nut (two each) and lockwasher (two each) used with J-bolts and anti-rotation washers to secure mounting base into CUCV cargo bed.

Legend for Figure 1-7–Continued

Index no.	Nomenclature	Description
		190-inch diameter by 38-inch long screws (two each) and lockwashers (two each) to secure nut plate to CUCV dash panel bracket.
		0.250-inch diameter by 0.656-inch long screws (three each) and lockwashers (three each) to secure CDU bracket to CUCV dash panel bracket.
		l/2-inch diameter by 3 l/2-inch long screw (five each), flat washer (five each) and lockwasher (five each) to install adapter frame to HMMWV cargo bed.
		3/8-inch diameter by l-inch long screw (four each), flat washer (four each) and lockwasher (four each) to install subfloor plate on adapter frame in HMMWV.
		0.375-24UNF x 1.75-in. lg cap screws (four each) and flat washers (four each) to secure right and left brackets, from SUSV installation kit, to primary pallet.
		0.312-24UNF x 8.75-in. lg cap screw (six each) and flat washer (six each) to secure primary pallet to mounting frame in SUSV.
		No. 6-32UNC-2A x 0.312-in. lg screw (one each) to attach 10-in. lg chain to quick-release pin on CDU bracket in SUSV.
		No. 8mm x 1.25 x 50mm lg bolts (four each), flat washer (four each), lockwasher (four each) and nut (four each) to install frame assembly in SUSV.
		Packing, O-ring 1.478-1.490 in. ID for CDU mount on SUSV.
		5/16-24 x 7/8 lg screw (two each), 5/16 washer (two each), 5/16 x 24 lock nut (two each) to secure mounting frame in SUSV.
		3/8-inch-24UNF x 3/4-inch long bolt (two each), flat washers (two each), and lockwashers (two each) to install subfloor mounting bracket, index no. 42.
		NOTE The following hardware is used on utility truck with seat belts.
		3/8-inch diameter by l-13/16-inch long bolt (two each) spacer (two each) flat washer (two each), lockwasher (two each), and nut (two each).
		NOTE The following hardware is used on utility truck without seat belts.
		3/8-inch diameter by l-inch long bolt (two each), flat washer (two each), lockwasher (two each), and nut (two each).

Legend for Figure 1-7 (cont)

Index no.	Nomenclature	Description
		NOTE The following hardware is used on utility truck without seat belts. 3/8-inch diameter by l-inch long bolt (two each), flat washer (two each), lockwasher (two each), and nut (two each).

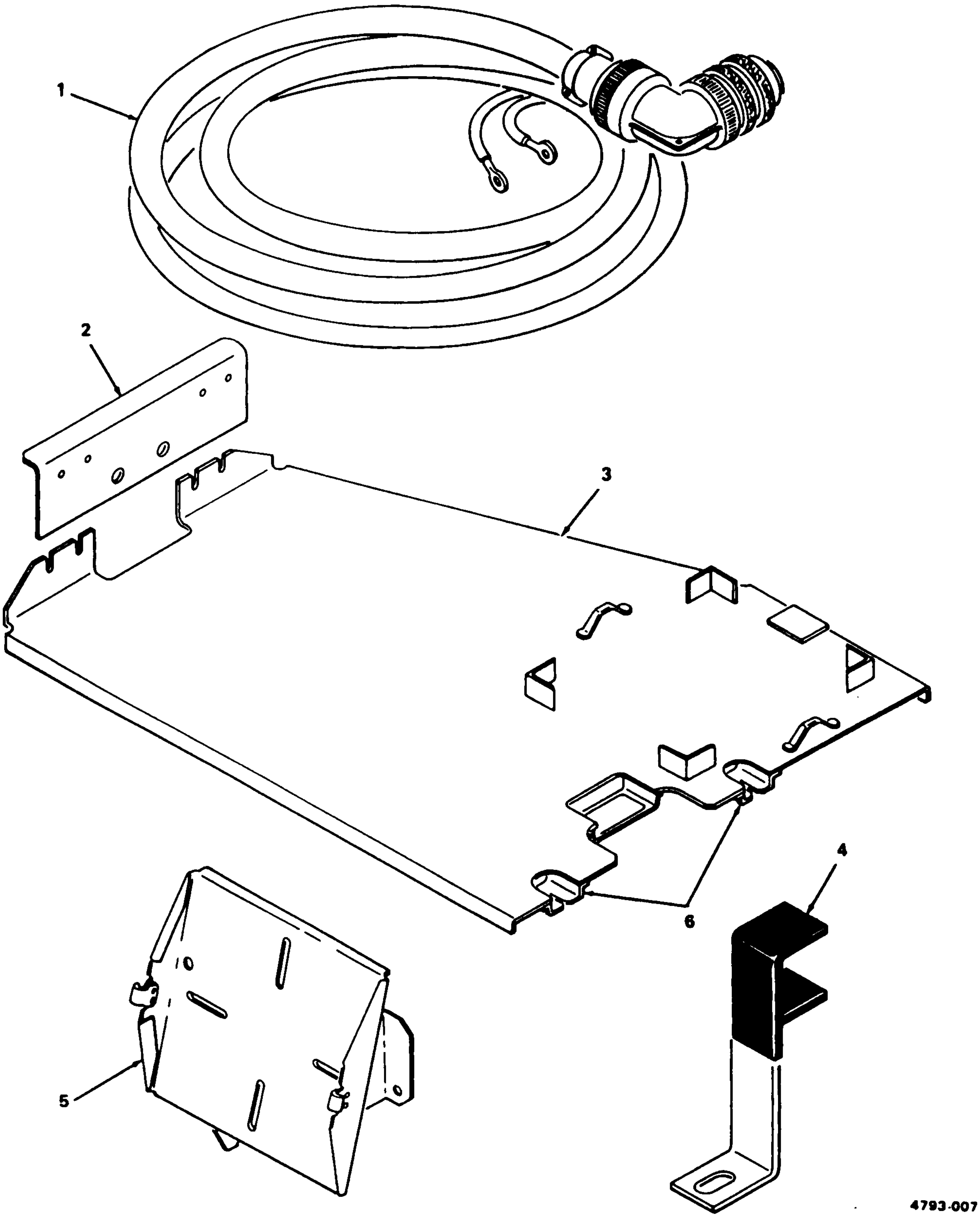


Figure 1-7. Description of Installation Kit Components (Sheet 1 of 7)

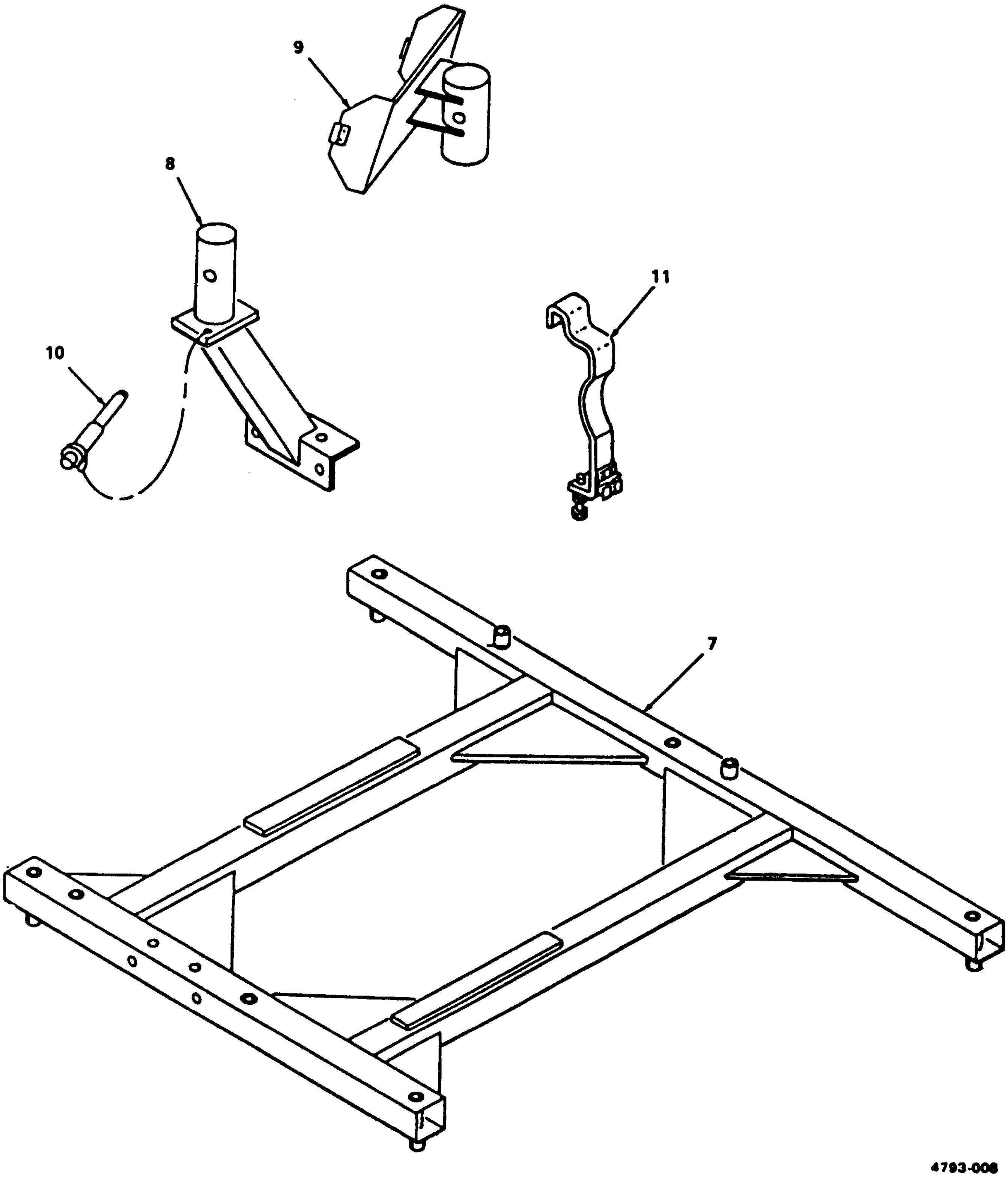


Figure 1-7. Description of Installation Kit Components (Sheet 2 of 7)

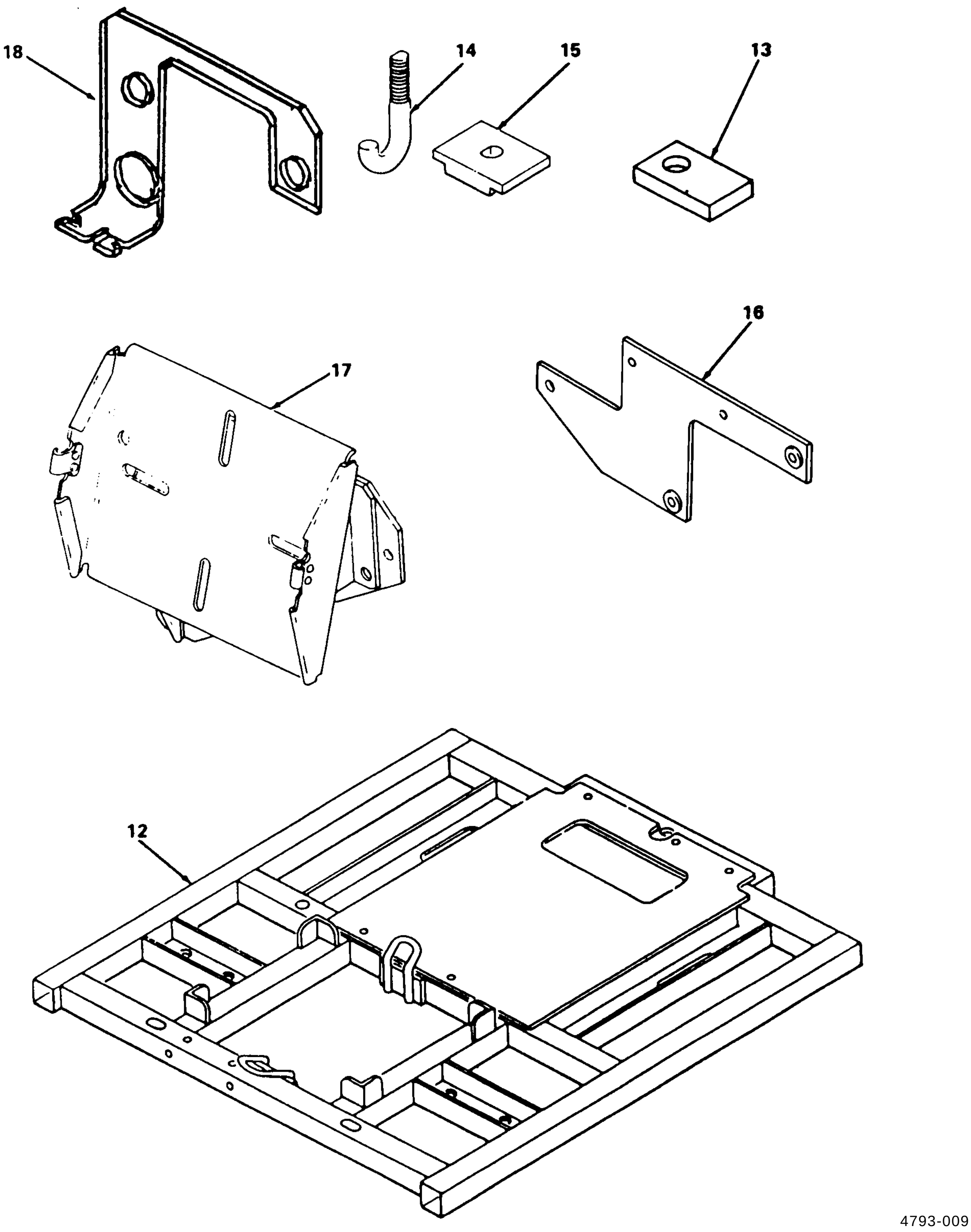


Figure 1-7. *Description of Installation Kit Components (Sheet* 3 *of* 7)

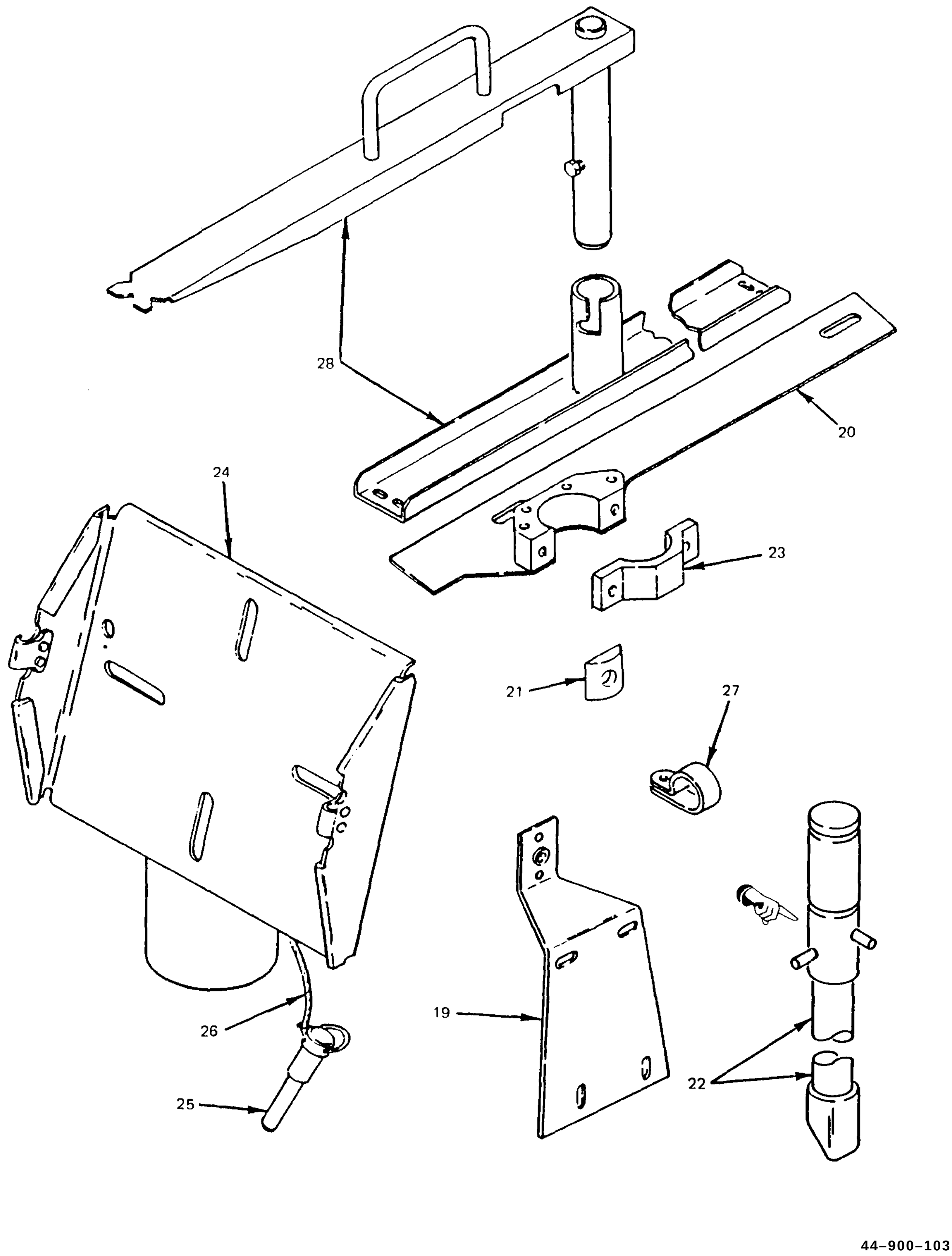


Figure 1-7. Description of Installation Kit Components (Sheet 4 of 7)

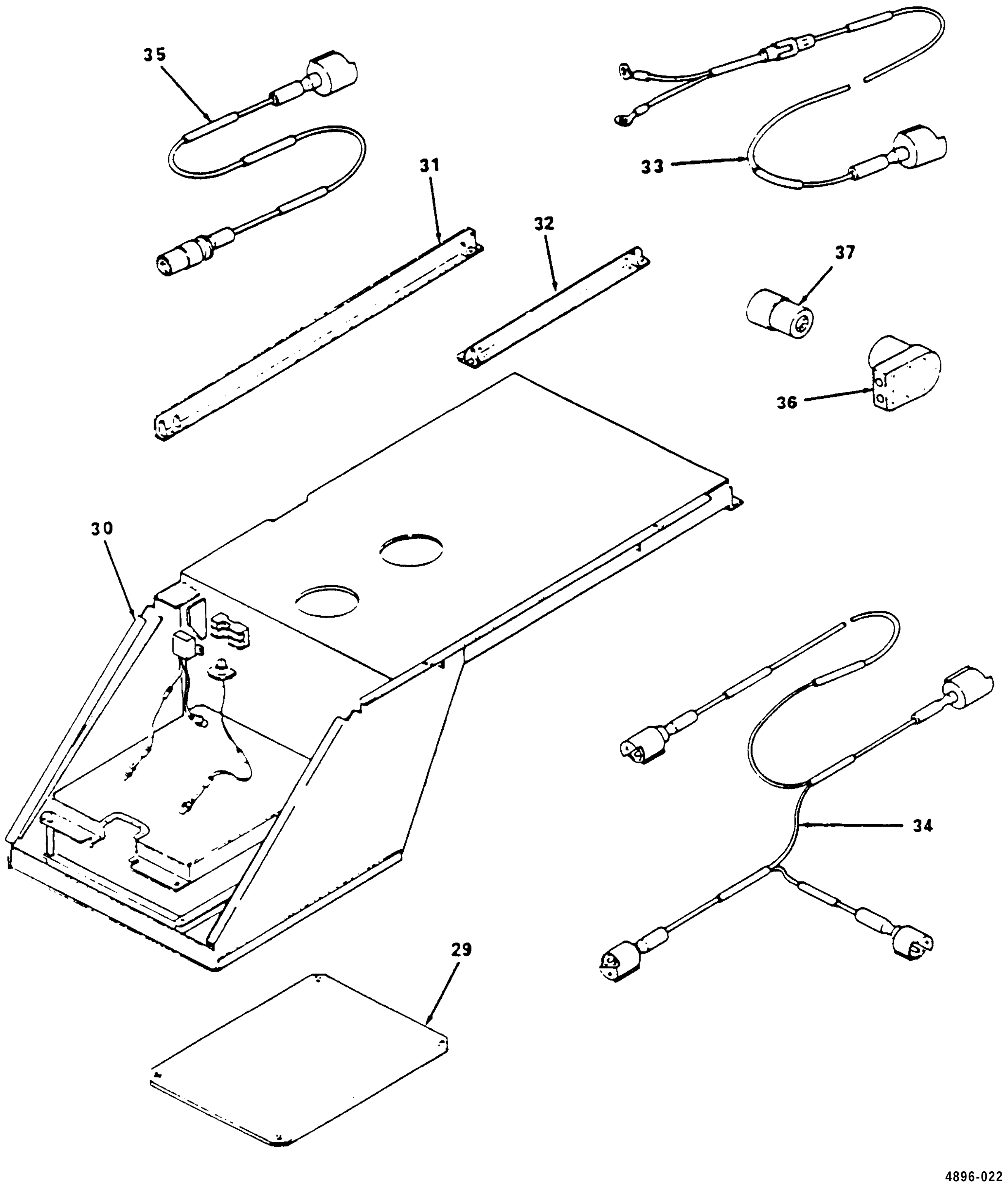


Figure 1-7. *Description of Installation Kit Components (Sheet 5 of 7)*

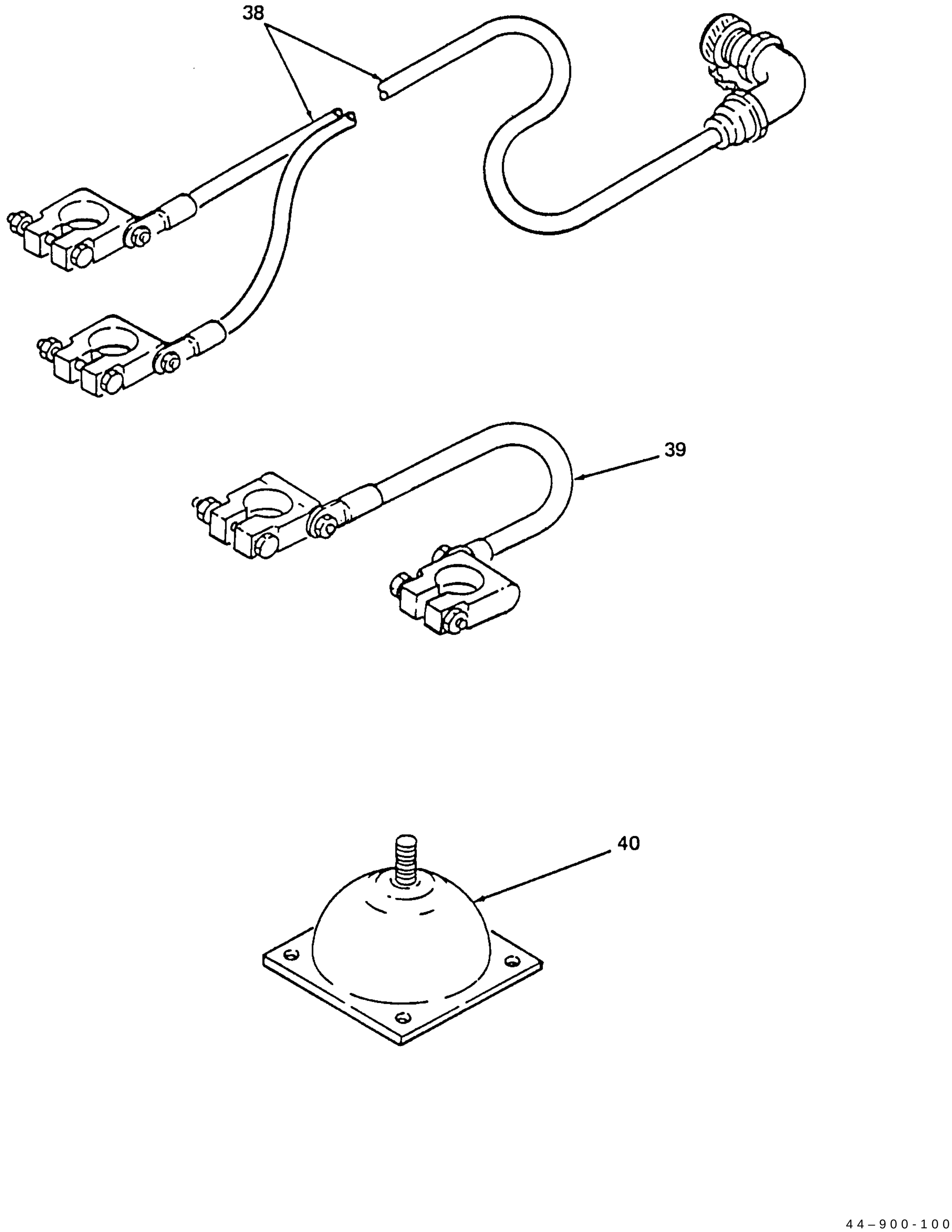


Figure 1-7. *Description of Installation Kit Components (Sheet 6 of 7)*

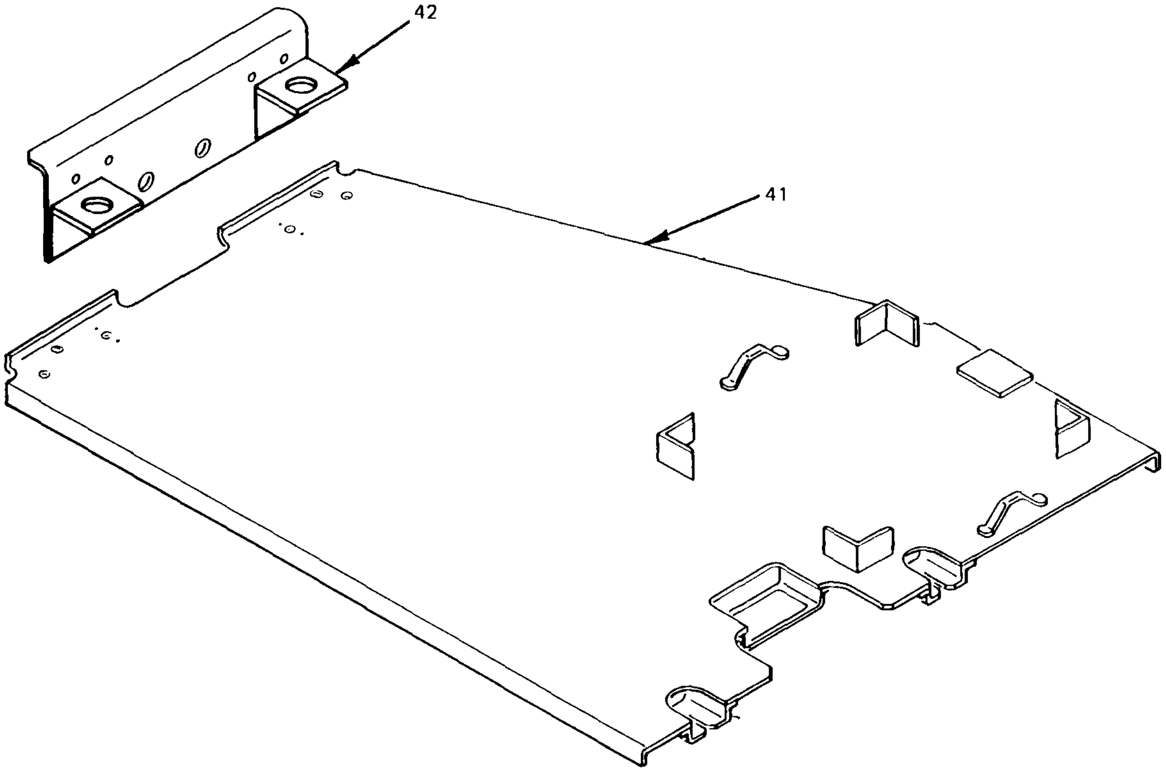


Figure 1-7. *Description of Installation Kit Components (Sheet 7 of 7)*

Legend for Figure 1-8

Index no.	Nomenclature	Description
1.	Standardized electrical component case (transit case)	Provides a shock- and vibration-isolated protective enclosure for the PADS
2.	Control and display unit	Contains keyboard and alphanumeric display for operator entry and display of survey data and system commands
3.	Primary pallet	Contains the basic electronic components for PADS

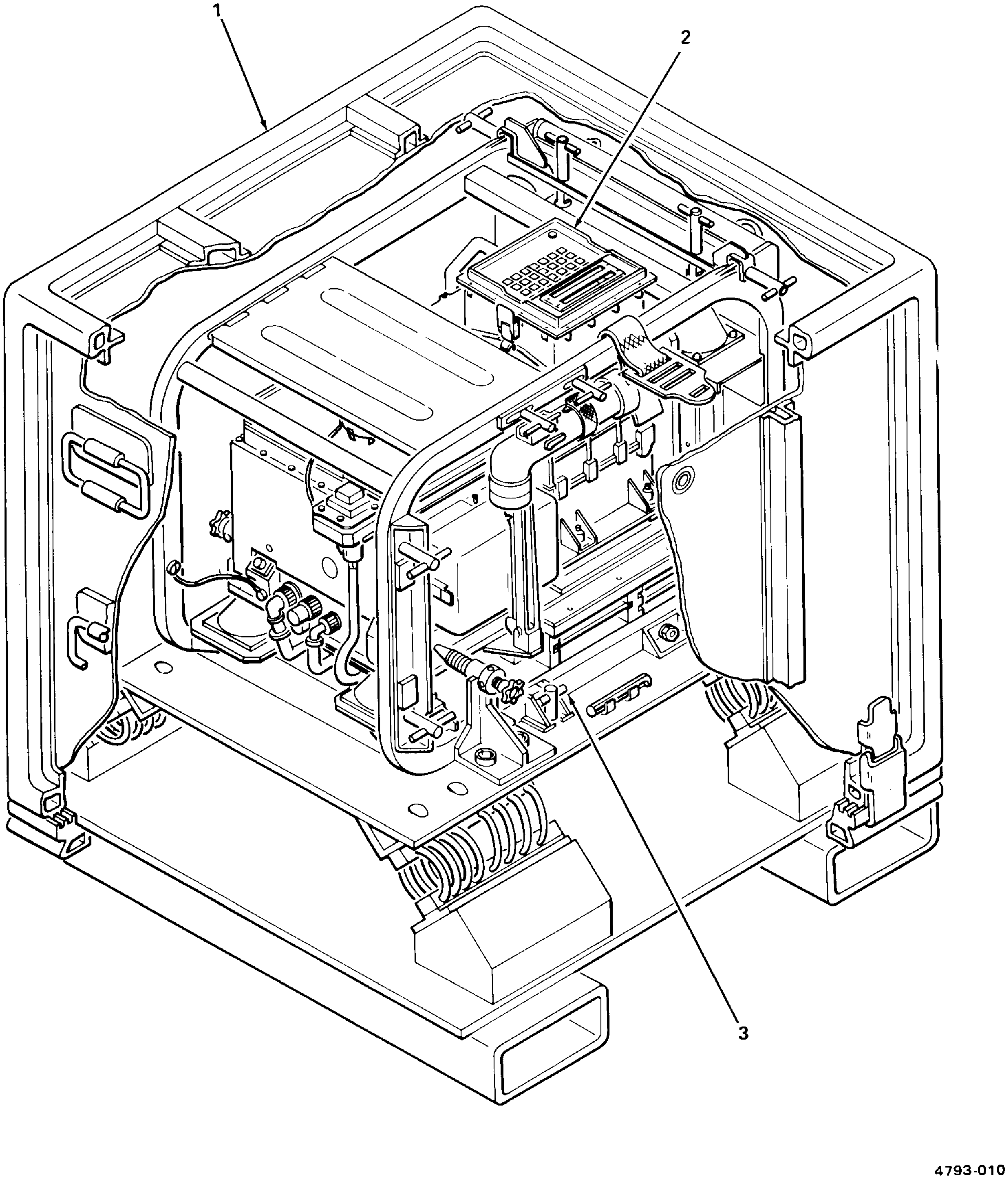


Figure 1-8. PADS Installed in Transit Case

Table 1-2. Characteristics and Performance Data

Item	Value
Primary Pallet	
Height	654.0 mm. (25.8 in.)
Width	775.0 mm. (30.5 in.)
Depth	495.0 mm (19.5 in.)
Weight	95.5 kg. (210.0 lb.)
Battery Box	
Height	454.0 mm. (17.9 in.)
Width	343.0 mm. (13.5 in.)
Depth	356.0 mm. (14.0 in.)
Weight	56.4 kg. (124 lb.)
Transit Case	
Height	983.0 mm. (38.7 in.)
Width	1003.0 mm. (39.5 in.)
Depth	947.0 mm. (37.3 in.)
Weight	93.2 kg. (205 lb.)
Ambient Temperature Limits:	
Operation	-45° to +52°C (-50° to +125°F)
Storage	-45° to +71°C (-50° to +160°F)
Altitude Limits:	
Operation	-150 to +4,500 meters (–500 to +15,000 feet), mean sea level
Transportation	-150 to +15,000 meters (–500 to +50,000 feet), mean sea level
Warmup, Initialization, and Alignment Time	30 minutes, increasing to 45 minutes below –20°C (–5°F)
Optical Azimuth Transfer Limits:	±15° pitch and roll
Position Transfer Limits (with plumb bob):	
M151 Series Utility Truck	±15° pitch and roll
M1009 Series Commercial Utility Cargo Vehicle	±15° pitch and roll
M998 Series High-Mobility Multi-Purpose wheeled Vehicle	±15° pitch and roll
M973 Series Small Utility Support Vehicle	±15° pitch and roll
OH-58 Helicopter	±l0° pitch and roll
UH-1 Helicopter	±10° pitch and roll
UH-60 Helicopter	±10° pitch and roll

Table 1–2. Characteristics and Performance Data

Item	Value	
Power Requirements:		
Steady state load	961 watts (40.0 amp at 24 VDC)	
Transient (warmup) load	2338 watts (97.4 amp at 24 VDC)	
Total Mission Duration:	Up to 7 hours	
Latitude Limits:	+75°N to –75°S	
Survey Area	Within a circle with radius of 55 kilometers from the last update point	
Surveying Accuracy:		
Battalion Survey Operations	(10 Min. Zero Velocity Correction)	
Latitude (Degrees)	0-65 North/South	65–75 North/South
Horizontal Position (Meters CEP)	7.0	10.0
Vertical Position (Meters PE)	3.0	3.0
Azimuth (Mils PE)	0.4	0.6
DIVARTY Survey Operations	(5 Min. Zero Velocity Correction)	
Latitude (Degrees)	0-65 North/South	65–75 North/South
Horizontal Position (Meters CEP)	4.0	7.0
Vertical Position (Meters PE)	2.0	2.0
Azimuth (Mils PE)	0.4	0.6

CHAPTER 2

SERVICE UPON RECEIPT AND INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. General.

a. PADS is shipped in one crate. This crate contains the primary pallet, CDU, system transit case, battery box, and the vehicle installation kit.

b. Batteries, theodolite, tripods, and other survey equipment required to effectively operate the PADS are unit Table of Organization and Equipment (TO&E) items.

2-2. Unpacking Instructions.

CAUTION

PADS includes delicate electronic units; use extreme care when removing each item from its container. The loaded transit case weighs nearly 400 lbs. Use a forklift to move it.

a. Disassemble wooden crate to access the PADS transit case (figure 2-1). Remove the plastic sheet.

b. Remove eight bolts, washers, and lockwashers fastening the two pallet boards to the wooden crate and pull the pallet boards out of the transit case skids.

c. Remove the transit case from the crate bottom.

d. Remove four nuts, washers, and bolts and remove battery box from crate bottom. Remove loose items from top compartment of battery box. Hardware items are packaged separately in plastic bags.

e. Unpack the vehicle installation kit from its cardboard cartons. Hardware items are packaged separately in plastic bags.

2-3. Removal of PADS from Transit Case.

WARNING

The primary pallet weighs approximately 210 lbs. Use at least three persons to lift and move it. Two persons are required to lift the transit case cover over PADS.

a. Press pressure relief valve until air pressure is equalized (figure 2-2, sheet 2 of 2, detail A).

b. Release 12 latches securing cover to base of transit case (figure 2-2, sheet 2 of 2, detail B).

c. Lift off transit case cover.

d. Remove four T-handles securing upper frame bracket (figure 2-2, sheet 1 of 2).

e. Use sockethead key to loosen (turn counterclockwise) the two jamnuts. Turn out the two isolator blocking pins approximately 1 inch (figure 2-2, sheet 1 of 2).

f. Remove the two hex head bolts and Iockwashers securing the shorter isolator blocking pin housing (figure 2-2, sheet 2 of 2, detail C) to the transit case platform. Remove housing (figure 2-2, sheet 2 of 2, detail C).

g. Remove three T-handles and clamping brackets securing rimary pallet frame to the transit case platform figure 2-2, sheet 2 of 2, detail C).

h. Slide primary pallet away from lower pin assembly and move to a smooth, flat surface.

i. Secure tsvo clamping brackets to primary pallet frame with T-handles (figure 1-2, index no. 13).

j. Secure isolator blocking pin housing, one clamping bracket, upper frame bracket, five T-handles, and sockethead key to transit case platform (figure 2-3).

k. Lock jamnuts on isolator blocking pins.

l. Inspect shock and vibration isolator mounts. They must be replaced if frayed, broken, or loose. Defective mounts are replaced at direct support maintenance.

m. Inspect humidity indicator (figure 2-1, detail A).

n. Replace and latch transit case cover.

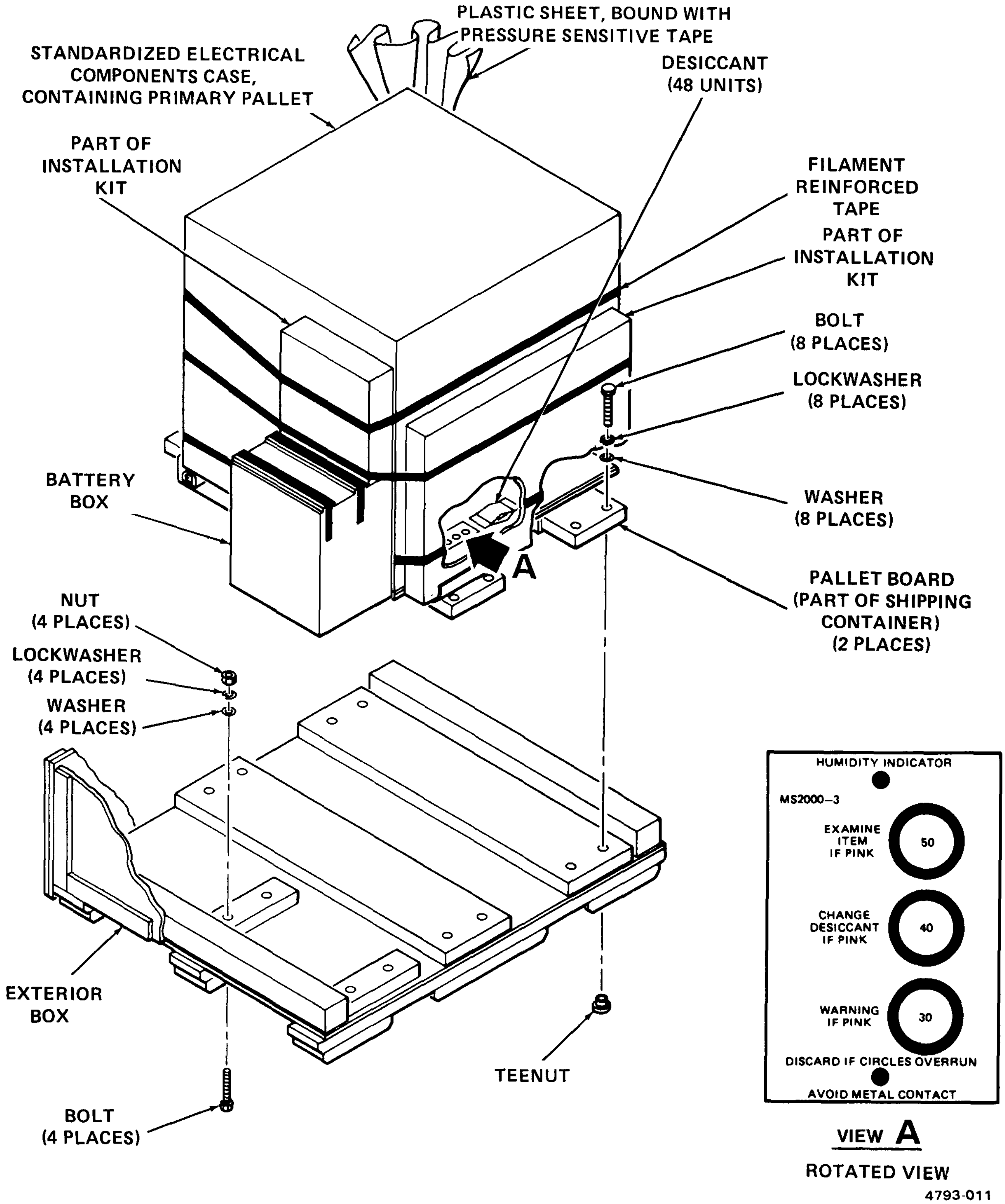


Figure 2-1. Wooden Shipping Crate

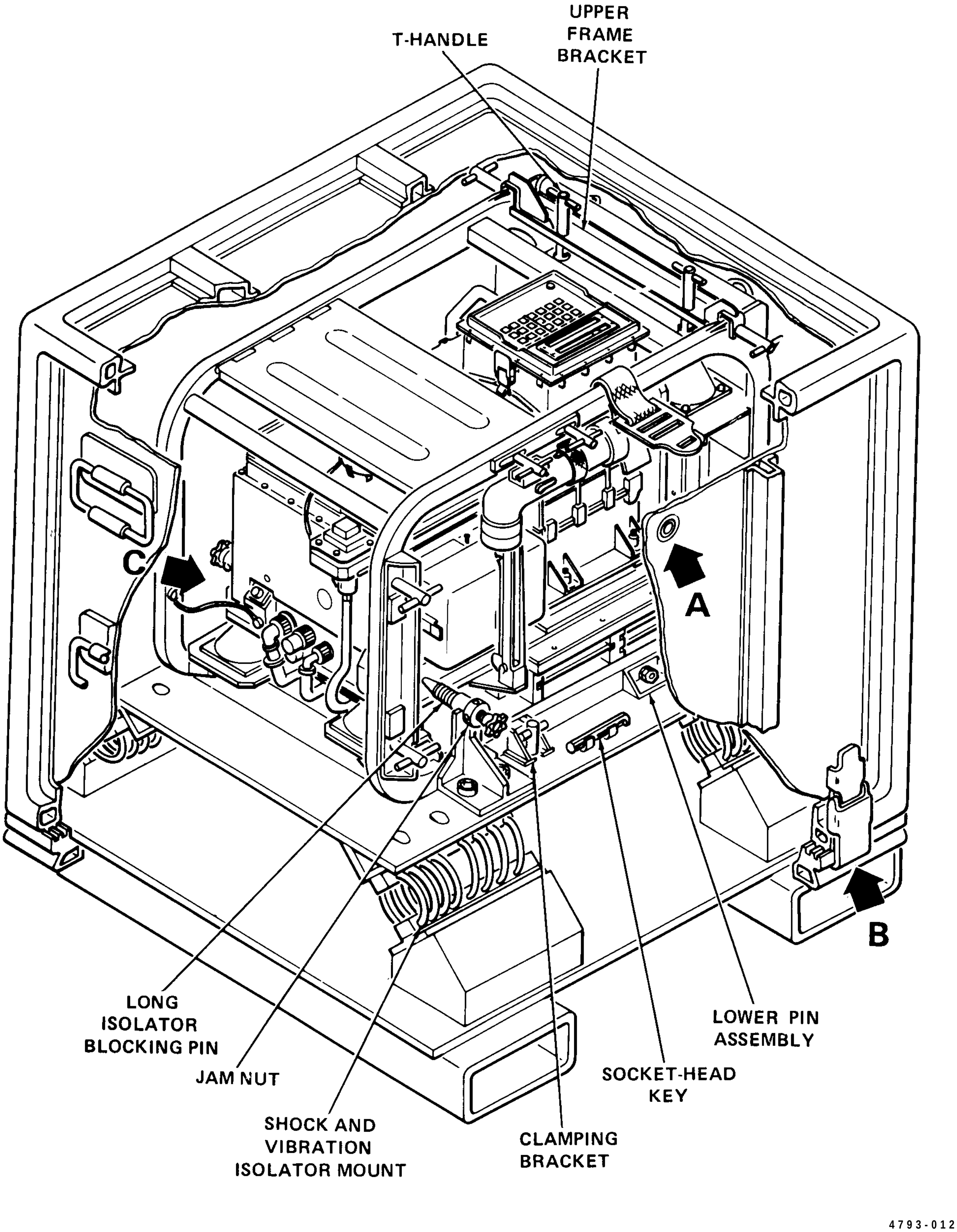
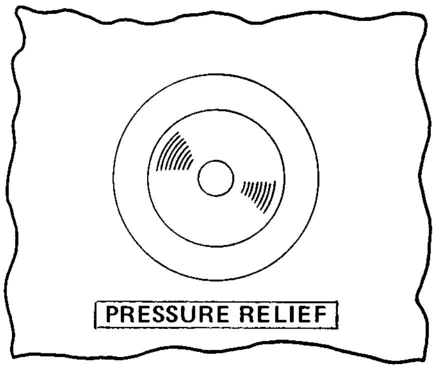
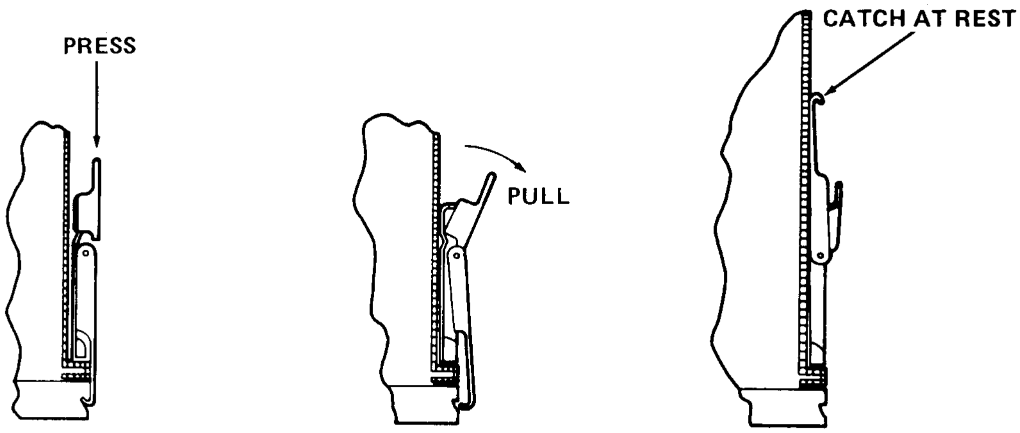


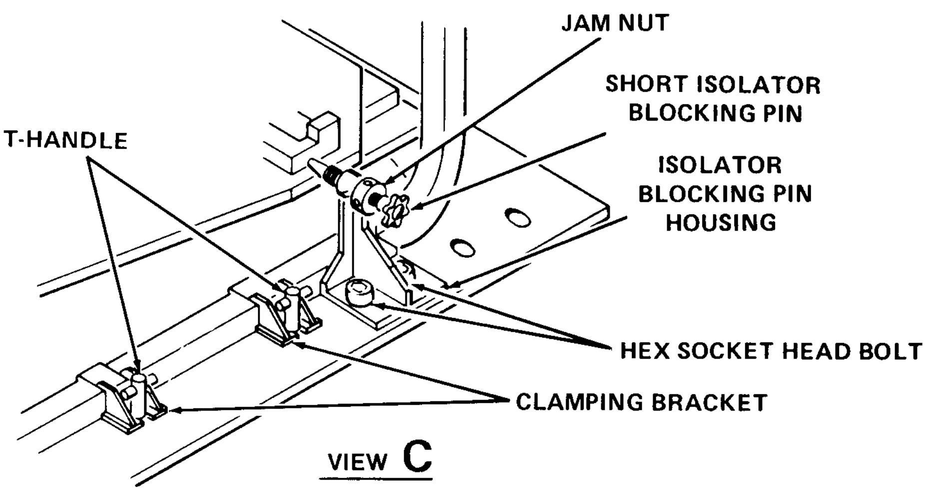
Figure 2-2. PADS in Transit Case (Sheet 1 of 2)



VIEW **A**
ROTATED



VIEW **B**
ROTATED



VIEW **C**
ROTATED

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Figure 2-2. PADS in Transit Case (Sheet 2 of 2)

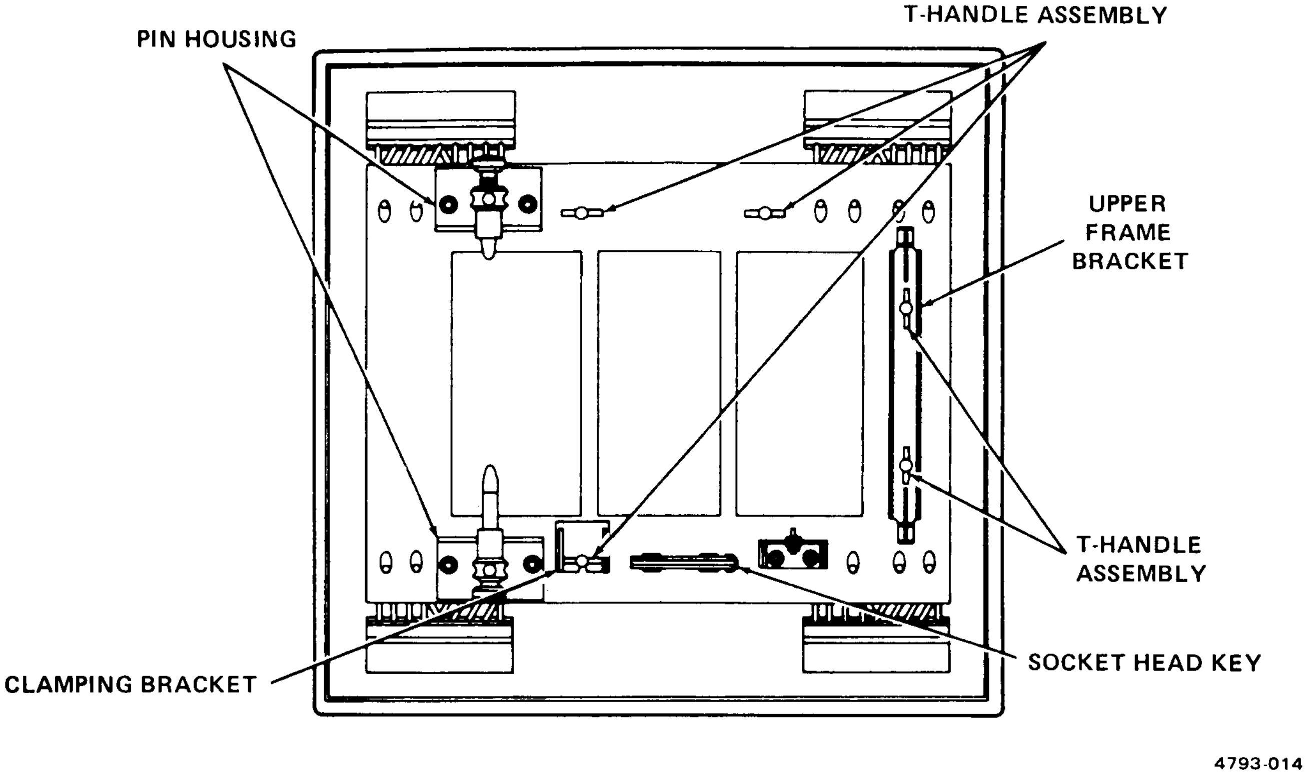


Figure 2-3. Empty Transit Case

CAUTION

To prevent damage, a primary pallet must be installed in a transit case when shipped.

NOTE

Return transit case to Battalion Supply for storage when PADS has been installed in its vehicle.

2-4. Repacking PADS. (See figure 2-2.)

a. Press pressure relief valve until air pressure is equalized. Unlatch and remove transit case cover.

b. Remove five T-handles, upper frame bracket, and clamping bracket from transit case platform.

c. Use sockethead key to remove two screws, washers, and lockwashers securing shorter isolator blocking pin housing.

d. Set primary pallet onto transit case platform and engage lower pin assembly in pallet frame socket. Orient primary pallet with IMU at isolator blocking pins end. If the lower pin does not freely enter the socket, adjust in accordance with paragraph 4-15b.

e. Remove two T-handles and clamping brackets from primary pallet.

f. Use sockethead key to reinstall isolator blocking pin housing.

g. Fasten primary pallet to transit case platform with three clamping brackets and T-handles.

h. Use sockethead key to loosen two jamnuts. Turn in both isolator blocking pins approximately 1 inch to firmly engage holes in the IMU mounting blocks. Use sockethead key to lock both jamnuts against the isolator blocking pin housing. Replace sockethead key.

i. Secure primary pallet isolated platform to the frame using the upper frame bracket and four T-handles.

j. Secure CDU to bracket on top of computer.

k. Check and insure that 48 units of desiccant and the humidity indicator are in transit case. Replace transit case cover.

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

Battery box contains acid-filled batteries which mav generate hydrogen gas. Keep heat and Ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water; if it touches the eyes, flush immediately with water for 30 minutes and see a physician without delay.

1. Install equipment in battery box as shown in figure 1-3.

CAUTION

Remove batteries before packaging battery box.

m. Package installation kit, battery box, and mounting hardware in appropriate containers.

2-5. Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (Packaging Improvement Report). Marine Corps users will report damage on DD Form 6 in accordance with MCO 4430.3, Report of Item and Packaging Discrepancies (ROD).

b. Check the equipment against requirements in appendix B and the packing slip to see if shipment is complete. Report discrepancies in accordance with paragraph 1-2. The equipment should be placed in service even though a minor assembly or part that does not affect proper functioning is missing. Marine Corps personnel will submit SF 361, Discrepancy in Shipment Report (DISREP), as prescribed by MCO P4610.19C.

c. Check to see whether the equipment has been modified. (Equipment which has been modified will have the MWO number on the front panel, near the nomenclature plate.) Check also to see whether all currently applicable MWO'S have been applied. (Current MWO'S applicable to the equipment are listed in DA PAM 750-10 or for Marine Corps users, in SL l-2/SL 1-3.)

d. For dimensions, weights, and volume of packaged items, see SB 700-20.

e. Check humidity indicator in transit case for evidence of excess moisture (see figure 2-1, detail A). Take the action shown on the indicator.

Section II. INSTALLATION INSTRUCTIONS

2-6. Vehicle Configuration.

CAUTION

A vehicle used with PADS must supply at least 60 amperes or more at 24 volts DC for PADS operation.

a. PADS is designed for operation in an M151A2 utility truck with the normal 60 ampere alternator and predrilled holes for seat belts. The Generator/Alternator Kit, Part No. 11630593, Manufacturer Code 19207, NSN 2920-00-143-4388 is recommended for M151 series vehicles equipped with a generator/alternator rated less than 60 amperes. Installation instructions are in TM 9-2320-218-20.

b. The installation kit components required for using PADS in the M151 utility truck (Jeep), the M1009 utility cargo vehicle (CUCV), the M998 multi-purpose wheeled vehicle (HMMWV) and the M973 small utility support vehicle (SUSV) are described in figure 1-7. The accompanying legend indicates which kit components are used with each vehicle. PADS operators install the components. Alternate instructions are provided for installation in a utility truck without predrilled seat-belt holes.

c. An M151 vehicle equipped with a hardtop and/or gasoline-freed heater, and the M1009, M998 and M973 vehicles must be prepared for PADS by direct support maintenance personnel in accordance with TM 5-6675-308-34, or Marine Corps TM 08837A-34/2.

d. No installation kit is required to mount PADS in an Army OH-58A, UH-lD, or UH-60 helicopter. To use PADS in an Army OH-58C helicopter, the cargo pallets must be modified by direct support maintenance personnel in accordance with TM 5-6675-308-34, or Marine Corps TM 088367A-34/2. Unique power adapters and cables are defined in table 1-1.

e. Operators must install batteries in battery box for use in all vehicles.

2-7. Tools Required for Installation. Tools required for installation in a standard M151A2 utility truck, M1009 series utility cargo vehicle, M998 series multi-purpose wheeled vehicle and M973 small utility support vehicle are listed in table 2-1.

2-8. Installing Kit in Standard M151 Utility Truck.

a. **Subfloor Installation. See figure 2-4** and perform subfloor installation as follows:

(1) Clear canvas and remove rear and right front seat, spare tire, and gas can from vehicle. Remove two seat belt anchor bolts, seat belts, washers, and nuts from the two jeep inboard seat belt holes. If seat belts are not installed, there may be plastic plugs in these holes remove plugs. If seat belt holes do not exist, these holes must be drilled by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.

(2) At rear panel of utility truck, use 3/4-inch wrench and adjustable wrench to remove the top (of four) nuts and washers from pintle bolts which secure the towing pintle to utility truck body retain nuts and washers for later use.

(3) Install subfloor mounting bracket over exposed pintle bolts with flared surface up and facing rearward. Reinstall washers and nuts removed in step (2).

(4) Place subfloor plate in utility truck and loosely attach it to subfloor mounting bracket, using four bolts (1/4-inch diameter) and washers provided in M151 series vehicle kits. Use the 7/16-inch wrench.

NOTE

- If there are no seat belt holes, before continuing with installation these holes must be drilled by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.
- Nuts or washers can easily fall into the utility truck frame. You can block access to the frame with rags before installing the hardware. Remove rags after installation. Perform the following step if seat belts are not installed.

(5) Align the forward-facing slots in the subfloor plate over the seat belt holes and loosely install, in each hole, a bolt (3/8-inch diameter), large washer, and from below, a lockwasher and nut (figure 2-4, detail A). Use hardware provided in PADS utility truck installation kit.

NOTE

Perform the following step if seat belts are to be installed.

Table 2-1. Tools Required for Installation

Item	Purpose	Applicable Publication
PADS tool kit	Furnished with the PADS and described in figure 1-6, Tools are used to remove and replace various hardware items.	Not applicable
Wrench, combination, 3/8-inch	To remove and reinstall radio equipment mounting bracket from utiiity cargo vehicle (CUCV) and to install mounting base.	Not applicable
Wrench, combination, l/4-inch	To install CDU bracket in utility cargo vehicle (CUCV).	Not applicable
Wrench, open end, 10 mm	To remove right rear door handle in SUSV front car. To remove heater access cover and brace in SUSV. To remove cIips to driver's seat and backrest supports in SUSV. To install plumb bob assembly in SUSV.	Not applicable
Wrench, open end, 13 mm	To remove toolbox from under right seat in SUSV. To remove dash panel handle in SUSV. To disconnect cable from SUSV battery terminal. To install frame assembly in SUSV.	Not applicable
Wrench, open end, 17 mm	To remove right rear seat belt in SUSV.	Not applicable

(6) Align the forward-facing slots in the subfloor plate over the seat belt holes and loosely install, in each hole, a bolt (3/8-inch diameter), seat belt, spacer, large washer, and from below. a lockwasher and nut (figure 2-4, detail A). Use hardware provided in PADS utility truck installation kit.

(7) Tighten the four bolts securing the subfloor plate to subfloor mounting bracket (installed in step (4)).

(8) Using 9/16- and 5/8-inch wrench, tighten the two bolts (installed in step (5) or (6)).

b. CDU Bracket Installation. See figure 2-5 and perform CDU bracket installation.

(1) Remove two screws securing the right side of the instrument cluster on the dash panel; retain hardware.

NOTE

If utility truck does not have a handle, before bracket installation (step (3), below), a l/4-inch hole must be drilled by direct support maintenance personnel.

(2) Remove left bolt, lockwasher, and nut securing handie to dash panel; retain hardware.

(3) Install utility truck CDU bracket and secure with two screws, bolt, lockwasher, and nut removed in steps (1) and (2).

c. Cable W7 Installation. See figure 2-6 and perform cable W7 installation as follows:

WARNING

To prevent injury to personnel or damage to equipment, all rings, watches, bracelets, etc. must be removed. Disconnect ground cable first, before working with, or around, batteries, Protect the ground cable from accidental contact with other battery cables or posts, When finished with work, connect ground cable last.

(1) Remove utility truck battery cover.

(2) Remove utility truck battery-terminal cover and ground cable clamp from negative post of right battery and protect from accidental contact with other cables or battery posts.

(3) Insert each lug end of cable W7 through a knockout in utility truck floor in the tool compartment insert iugs through a second pair of knockouts, between tool compartment and battery compartment; route cable to batteries. Make sure cable Y is flat against vehicle side.

(4) Place a grommet over the cable near a knockout hole and work the grommet into the hole so the cable is protected. Repeat for three remaining knockout holes.

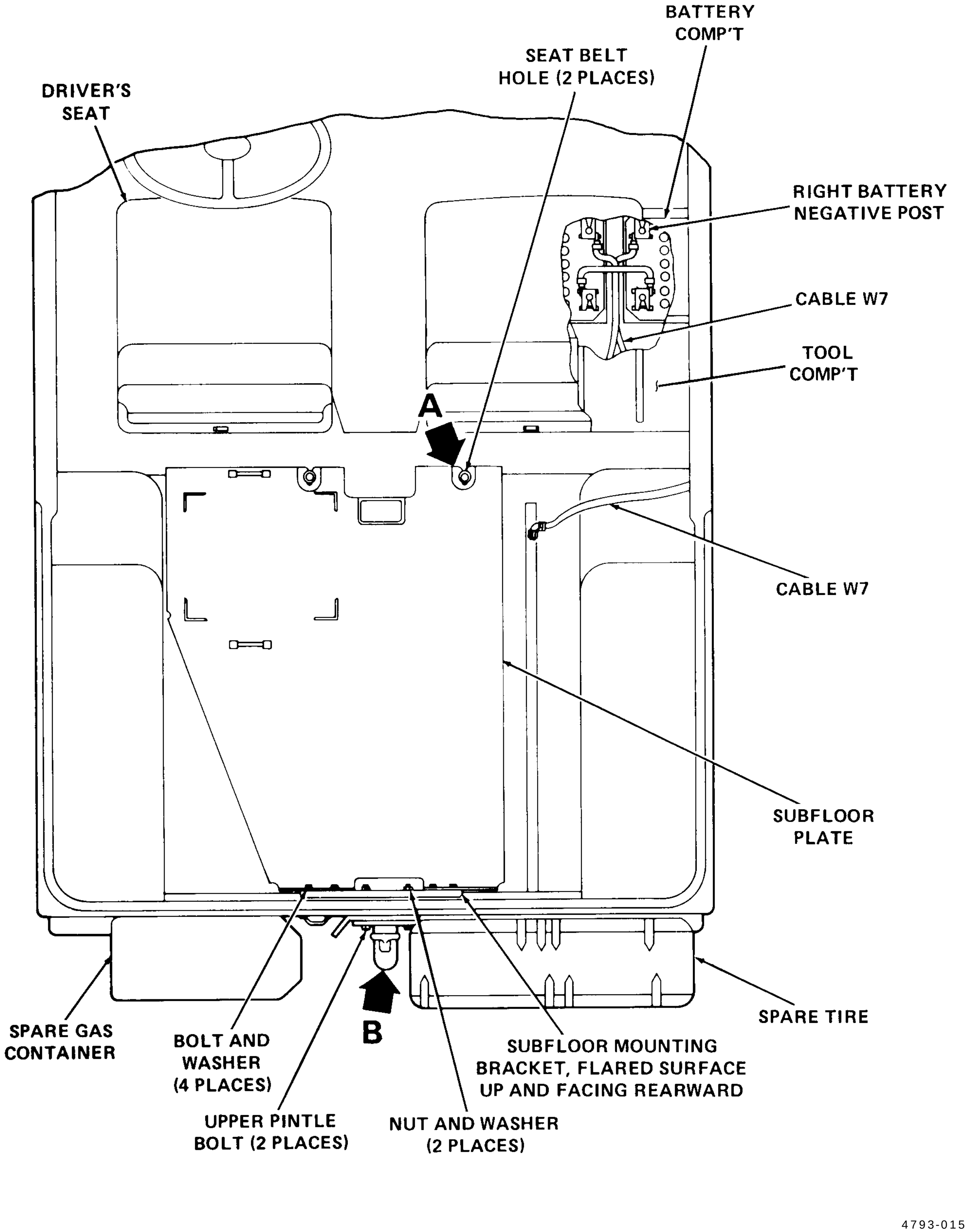
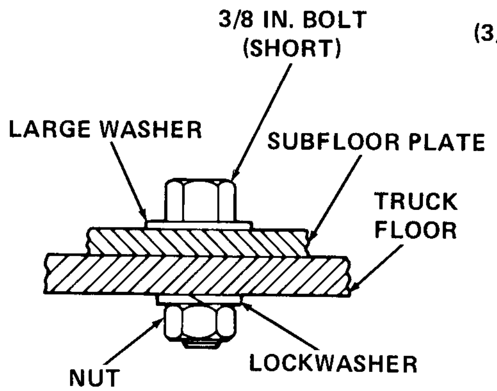
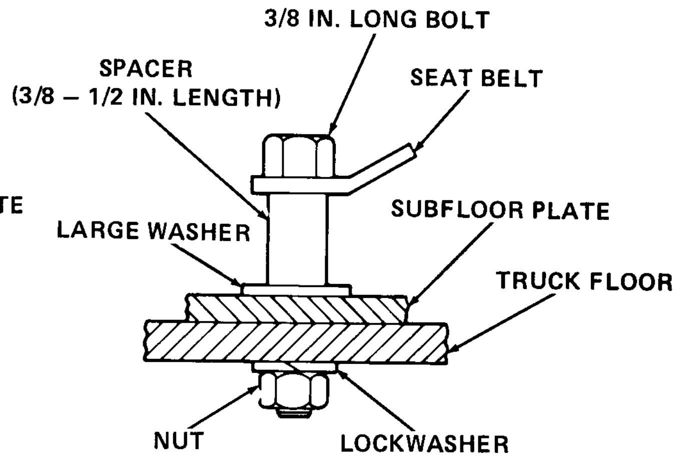


Figure 2-4. Utility Truck Installation (Sheet 1 of 2)



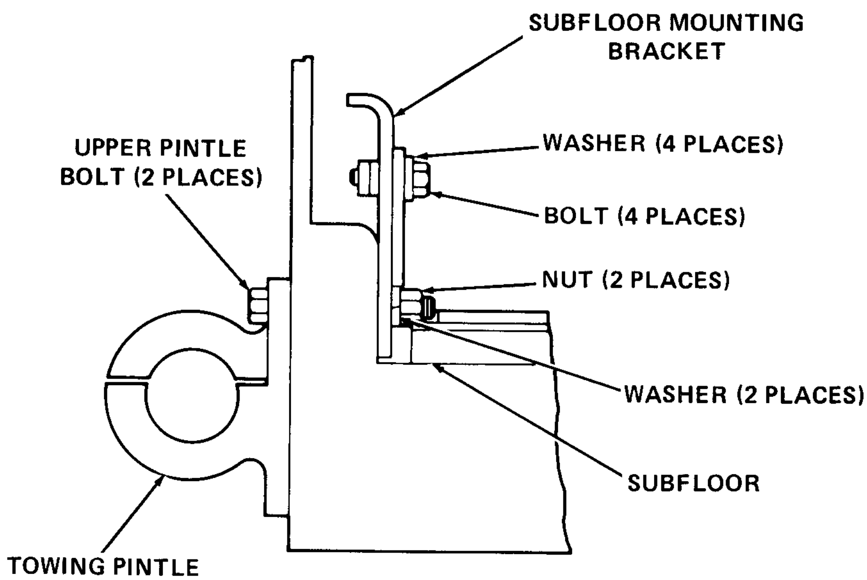
VIEW A

ROTATED VIEW
(WITHOUT SEAT BELT)



VIEW A

ROTATED VIEW
(WITH SEAT BELT)



VIEW B

ROTATED

4793-016

Figure 2-4. Utility Truck Installation (Sheet 2 of 2)

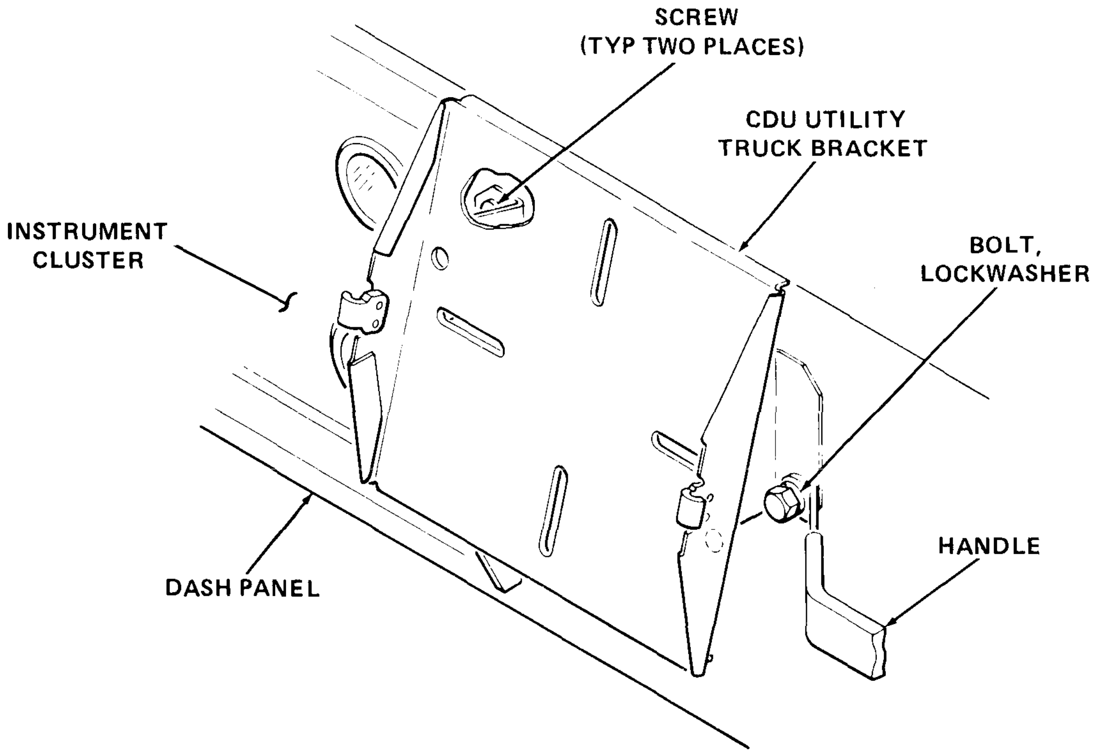


Figure 2-5. CDU Bracket Installation in Standard Utility Truck

CAUTION

To prevent damage to equipment, ensure polarity of cable lugs match polarity of battery posts. The positive wire is color coded red and the negative, black. See figure 2-6 for vehicle-battery configuration.

(5) Connect positive (+) lug of cable W7 to positive battery terminal adapter on positive post of left battery. Use 9/16-inch wrench.

(6) Connect negative (–) lug of cable W7 to the utility truck negative battery terminal adapter. Use 9/16-inch wrench.

(7) Using a 9/16- and a 5/8-inch wrench, remove seat belt anchor bolt, seat belt, washer and nut from passenger side outboard seat belt hole. If seat belts are not installed, there may be a plastic plug in this hole; remove plastic plug. If seat belt holes do not exist, a hole must be drilled by direct support maintenance personnel on outboard passenger side well (see figure 2-6, detail B) in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.

(8) Install cable clamp over cable W7 and position cable to allow clearance for seat and tool compartment lid.

(9) Install a bolt (3/8-inch diameter), flat washer, cable clamp, and seat belt or large flat washer, and (under chassis), large flat washer, lockwasher, and nut. Use a 9/16- and a 5/8-inch wrench.

(10) Reinstall utility truck battery-terminal cover and ground cable, removed in step (2), on negative post of right battery.

(11) Reinstall utility truck battery box cover.

2-9. Installing Kit in Winterized M151 Utility Truck. The PADS installation kit can be installed by the operators in an M151 utility truck equipped with hardtop and/or gasoline heater only after the vehicle has been equipped with a vehicle winterization kit modified by direct support maintenance personnel.

a. <u>Subfloor Installation.</u>

NOTE

Cut away any thermal insulation where subfloor and mounting bracket are attached to the vehicle to make good metal-to-metal contact.

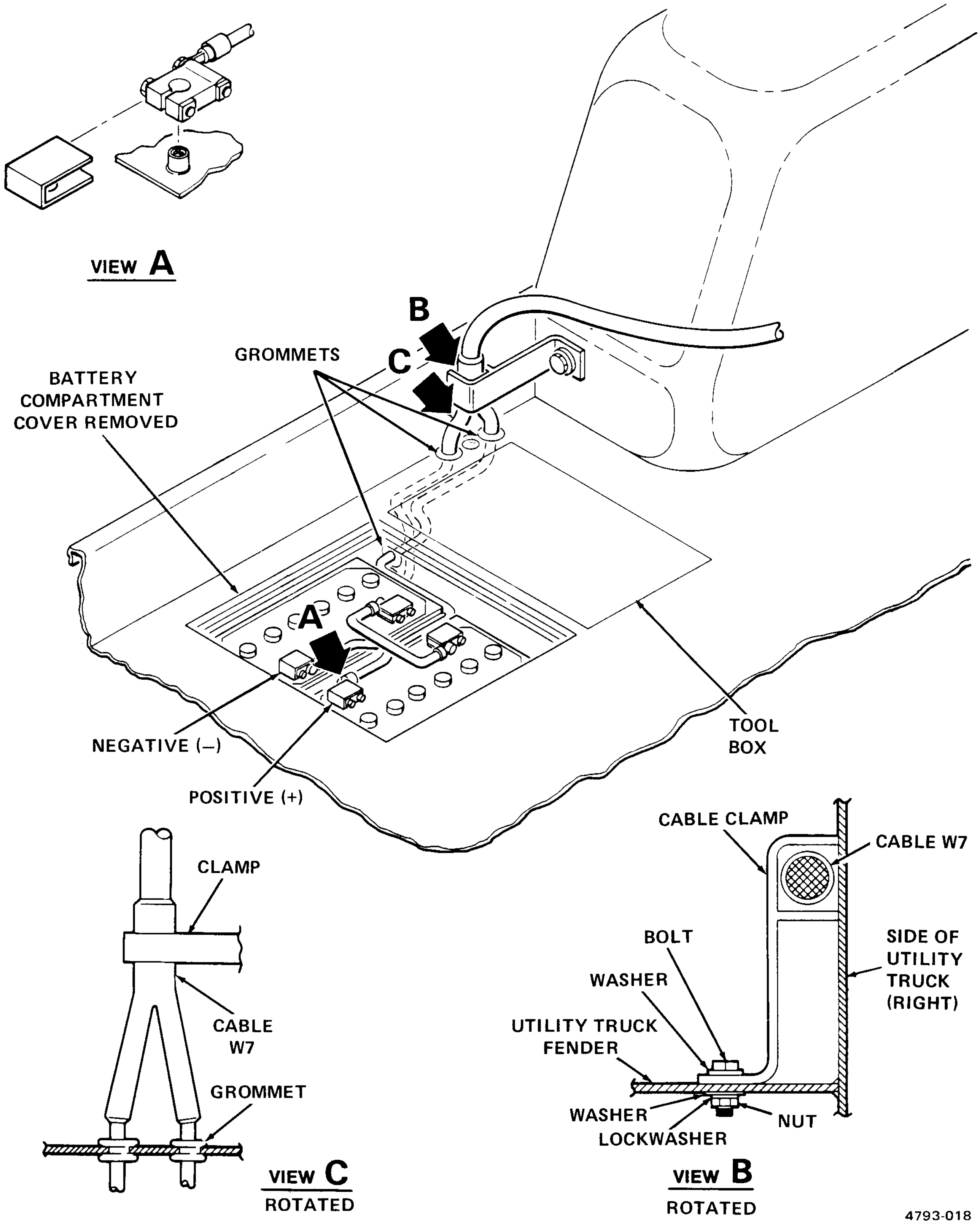


Figure 2-6. Cable W7 Installation

Install subfloor plate and subfloor mounting bracket as described in paragraph 2-8a.

b. CDU Bracket Installation. See figure 2-7 and perform CDU bracket installation as follows:

(1) Remove dashboard handle, if still in place. Locate three holes which were drilled in dashboard during winterization kit installation.

(2) Using hardware supplied in M151 series vehicle winterization kit, install utility truck CDU bracket and secure to the dashboard with three flat washers, lockwashers, nuts and screws (10/32-thread, 7/16-inch length).

c. Cable W7 Installation. Install cable W7 as described in paragraph 2-8c.

2-10. PADS Battery Installation. See figure 2-8 and perform PADS battery installation as follows:

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

Battery box contains acid-filled batteries which may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water; if it touches the eyes, flush immediately with water for 30 minutes and see a physician without delay.

NOTE

Use battery carrier to lift batteries.

a. Obtain two Type BB-249/U (2HN) batteries and install in battery box chassis, oriented as in figure 2-8.

b. Install battery retainers and secure with hook bolts, washers, and nuts. Place a battery terminal cover on each battery terminal, oriented with the bend toward the closest side of the battery box chassis.

NOTE

Battery terminal adapters have different sized holes for positive and negative terminals and are marked P + and N—, respectively. Install the adapters on the ends of the cables marked with the same polarity.

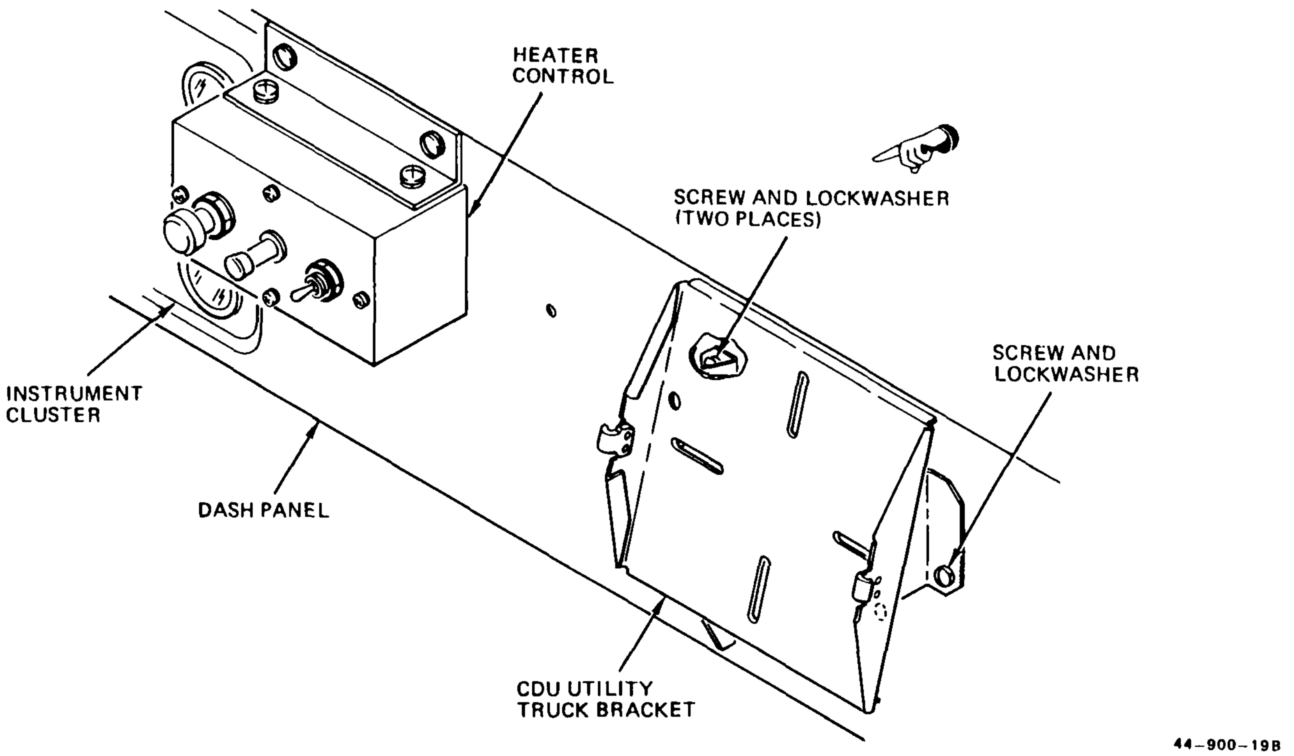


Figure 2-7. CDU Bracket Installation in Winterized Utility Truck

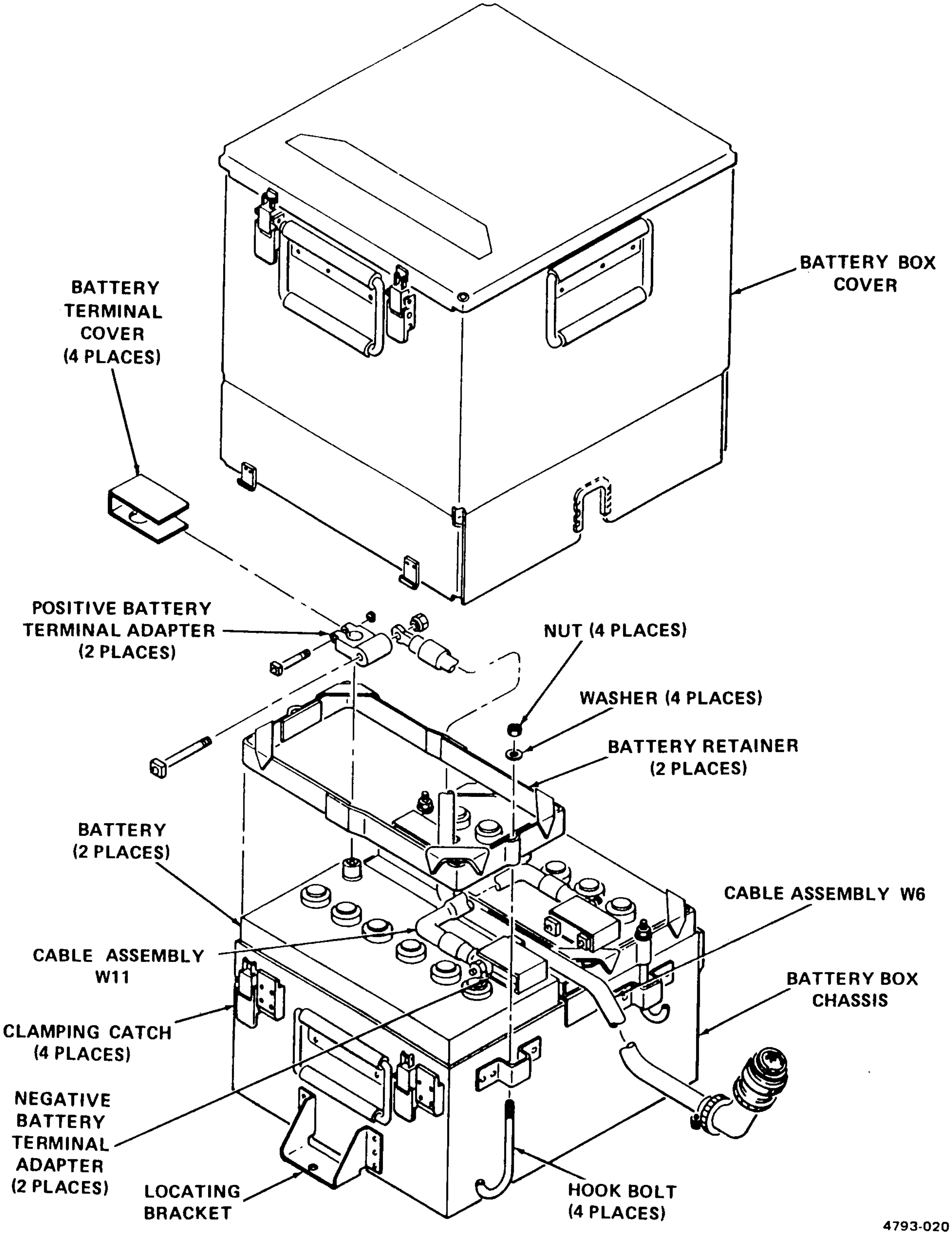


Figure 2-8. Battery Installation

c. Connect battery terminal adapters to both lugs of the cable assembly W6 and cable assembly W11 as shown in figure 2-8.

NOTE

Orient cable assembly W6 to exit battery box as shown in figure 2-8.

d. Connect battery terminal adapter of positive branch of cable assembly W6 to positive post of battery as shown in figure 2-8; secure by tightening nut on battery terminal adapter.

e. Connect battery terminal adapter of cable assembly W6 negative branch to negative post of other battery as shown in figure 2-8; secure by tightening nut on battery terminal adapter.

f. Connect battery terminal adapter of cable assembly W11 to positive post of other battery as shown in figure 2-8; secure by tightening nut on battery terminal adapter.

g. Connect negative batatery terminal adapter of cable assembly W11 to negative post of first battery as shown in figure 2-8; secure by tightening nut on battery terminal adapter.

CAUTION

Check that battery connections are positioned to not interfere with battery box cover and battery filler caps.

h. Check that cable assembly W6 is properly routed to clear battery box cover; install cover on battery box chassis and secure with four clamping catches.

2-11. Installation of PADS in Utility Truck. See figures 2-9 and 2-10 and install PADS in utility truck as follows:

a. Check that cables are connected as shown in figure 2-9.

b. Remove four T-handle assemblies (index no. 7, figure 1-2) to remove alignment pin bracket (index no. 8, figure 1-2) and two clamping trackets (index no. 13, figure 1-2) from stowed positions on mounting base frame.

c. Secure alignment pin bracket to rear of subfloor using two T-handles. The alignment pins face forward.

d. Load primary pallet into vehicle as follows:

(1) Standard utility truck.

(a) Remove spare tire and spare gas container, and clear rear canvas, if any, out of the way. PADS will come in over the rear panel (See figure 2-11.)

WARNING

The primary pallet weight exceeds the two-person lift criteria. Use three persons to lift it.

(b) With the power supply end leading, lift primary pallet into the utility truck and allow the power supply end to rest on subfloor plate.

(c) Raise the IMU end of primary pallet high enough to permit the pallet to be rotated about the power supply end so that the IMU end rests on the left rear fender. This requires that the pallet frame make approximately a 45-degree angle with the subfloor plate.

(d) Carefully lower IMU end so that primary pallet reaches the position shown in figure 2-10.

(2) Utility truck with hardtop.

(a) Remove spare tire and spare gas container.

(b) Remove rear panel of hardtop.

NOTE

If vehicle is equipped with a gasoline fired heater, it may be necessary to loosen two clamps securing flex hose to heater flange and transition joint. Remove flex hose and clamps. (See figure 2-12.)

(c) Load primary pallet in vehicle in accordance with steps 2-11d(l)(b) thru 2-11d(l)(d).

e. Slide primary pallet rearward until pins of alignment-pin bracket are fully mated in alignment pin receptacles of bottom rail of mounting base frame. If alignment pins do not fit freely into receptacles, adjust in accordance with paragraph 4-15b.

f. Secure forward bottom rail of pallet frame to subfloor with two clamping brackets and T-handles.

g. Load battery box as follows:

CAUTION

Check that power supply (PS) circuit breakers CB1 and CB2 are in the OFF position.

(1) Bring battery box through right side into cargo area of utility truck. Place battery box on subfloor plate between angle brackets (figure 2-10).

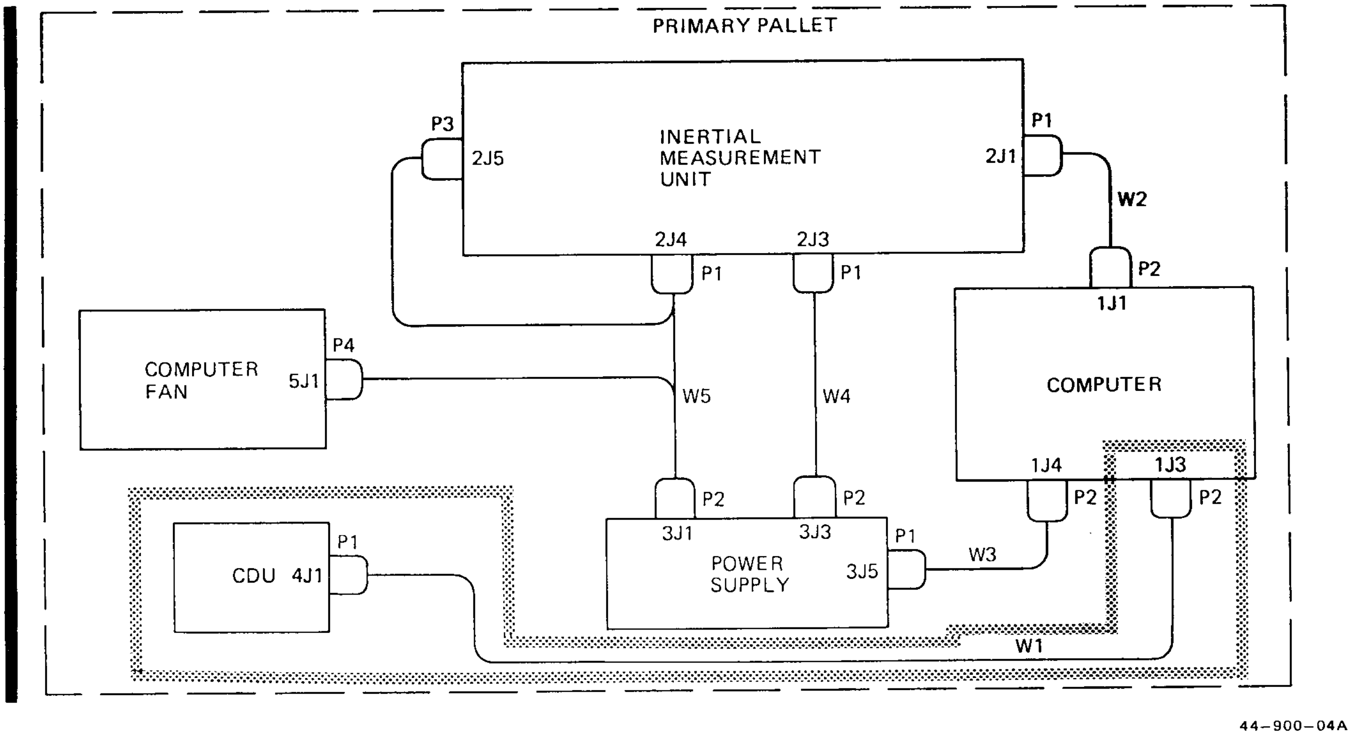


Figure 2-9. Primary Pallet Interconnection Diagram

(2) Secure battery box in position with tiedown belt assembly hooked to corresponding tiedowms on subfloor plate. (See figure 2-13.)

(3) Connect cable assembly W6 connector W6Pl to PS connector 3J2 as shown in figure 2-14.

(4) Return passenger seat into position and secure.

h. Connect cable assembly W7 connector W7P1 to PS connector 3J4 as shown in figure 2-14.

NOTE

If vehicle is equipped with a hardtop and gasoline fired heater, slide two clamps onto previously removed flex hose. Slip ends of flex hose onto heater flange and base of transition joint. Secure hose with clamps. (See figure 2-12.)

i. Unsnap CDU from its bracket on computer top. Route CDU and cable assembly W1 as shown in figure 2-10. Secure CDU to utility truck CDU bracket using two clamping catches. See figure 2-15 showing how CDU is attached to bracket.

j. Top bows of utility truck may be strapped to the primary pallet as shown in figure 2-16.

k. Position theodolite and tripods as shown in figure 2-10. Check that cooling airflow to PADS units is not blocked. Check that shock mount base has room to move freely and that equipment is not placed on cables or cable connectors.

l. Complete preliminary checks, paragraph 2-15.

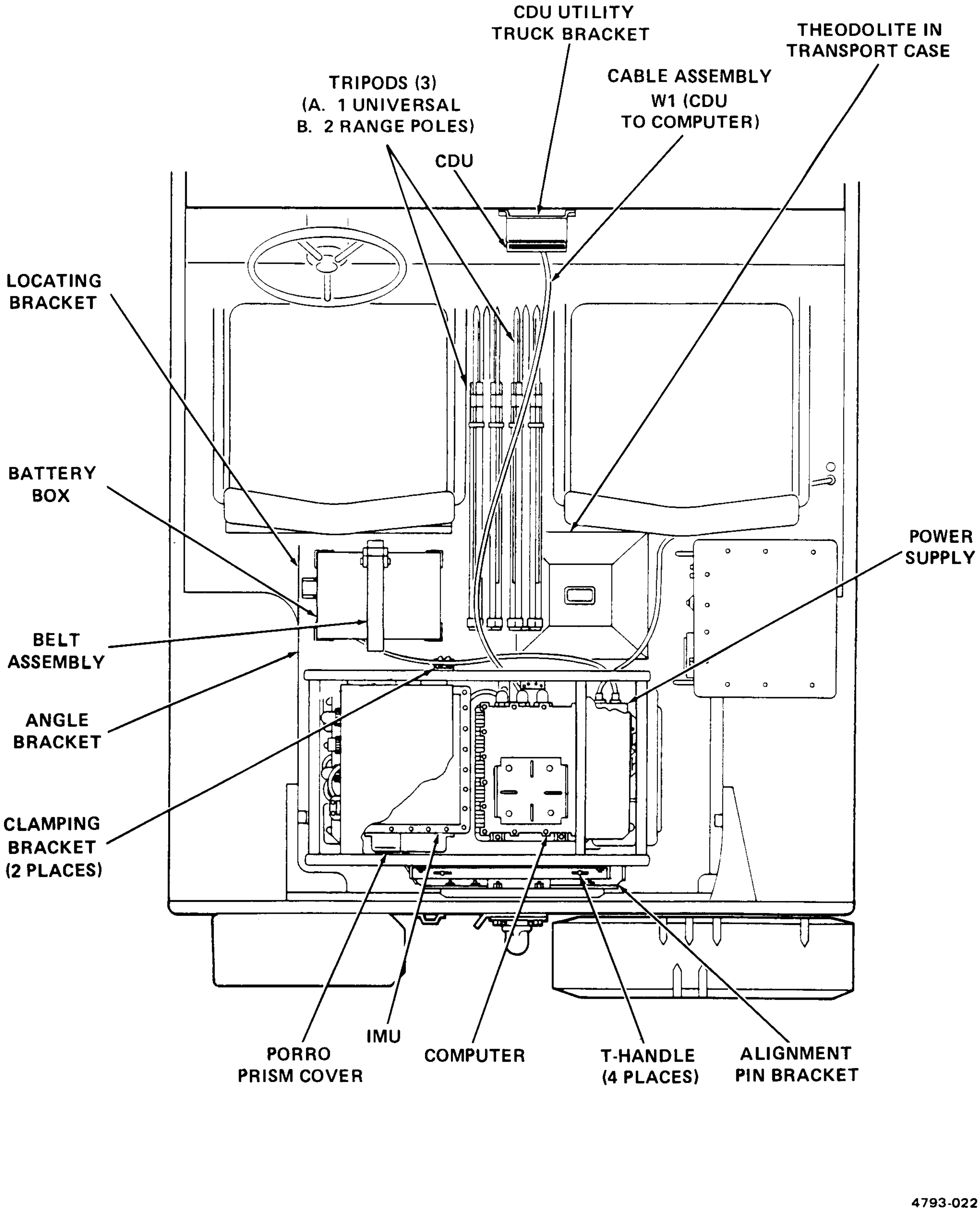


Figure 2-10. PADS Installed in Utility Truck

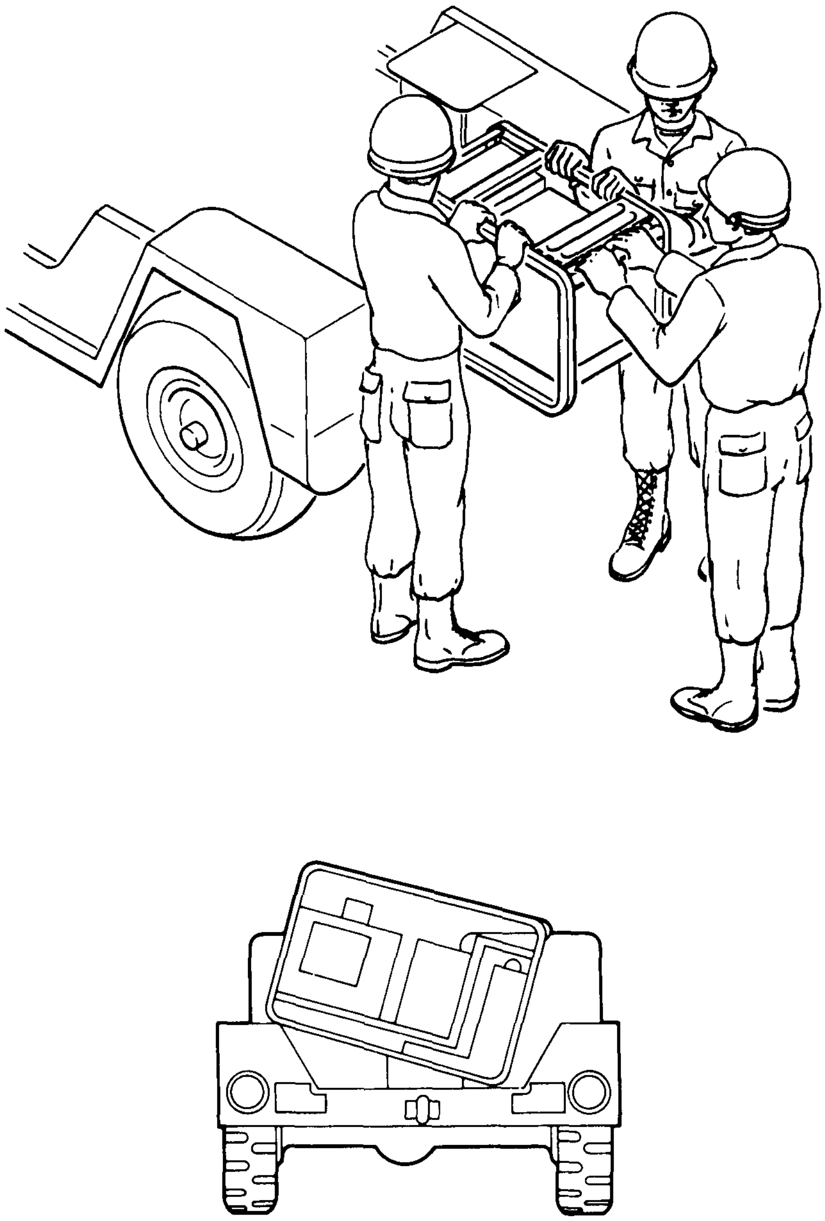


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Figure 2-11. PADS Installation

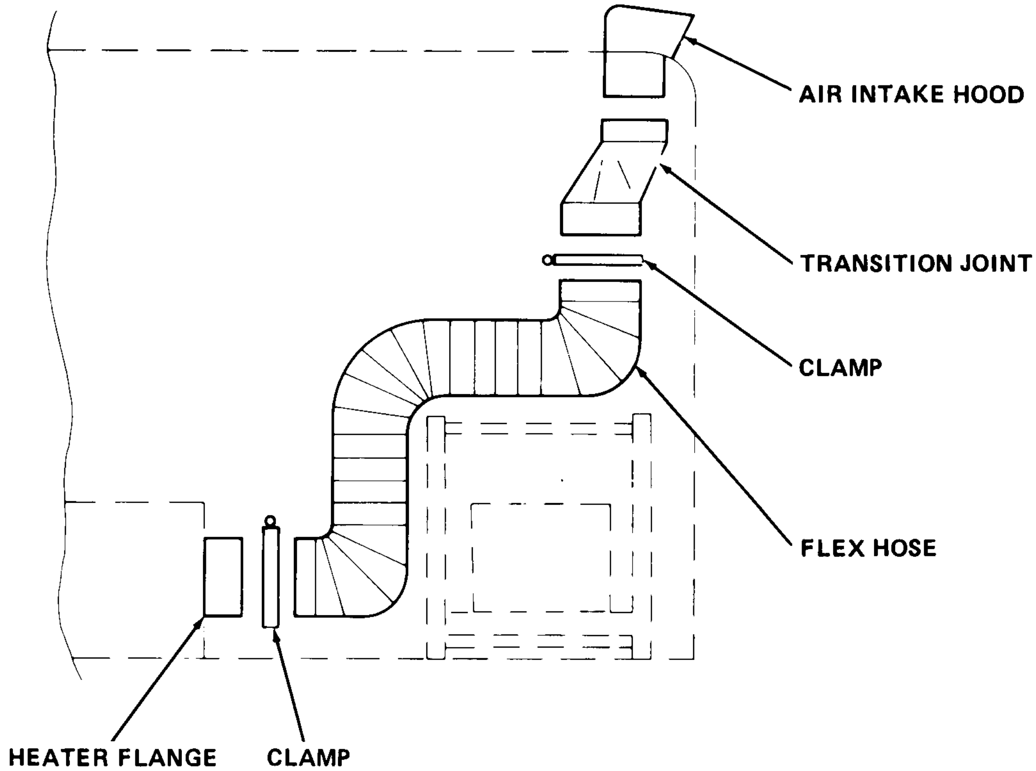
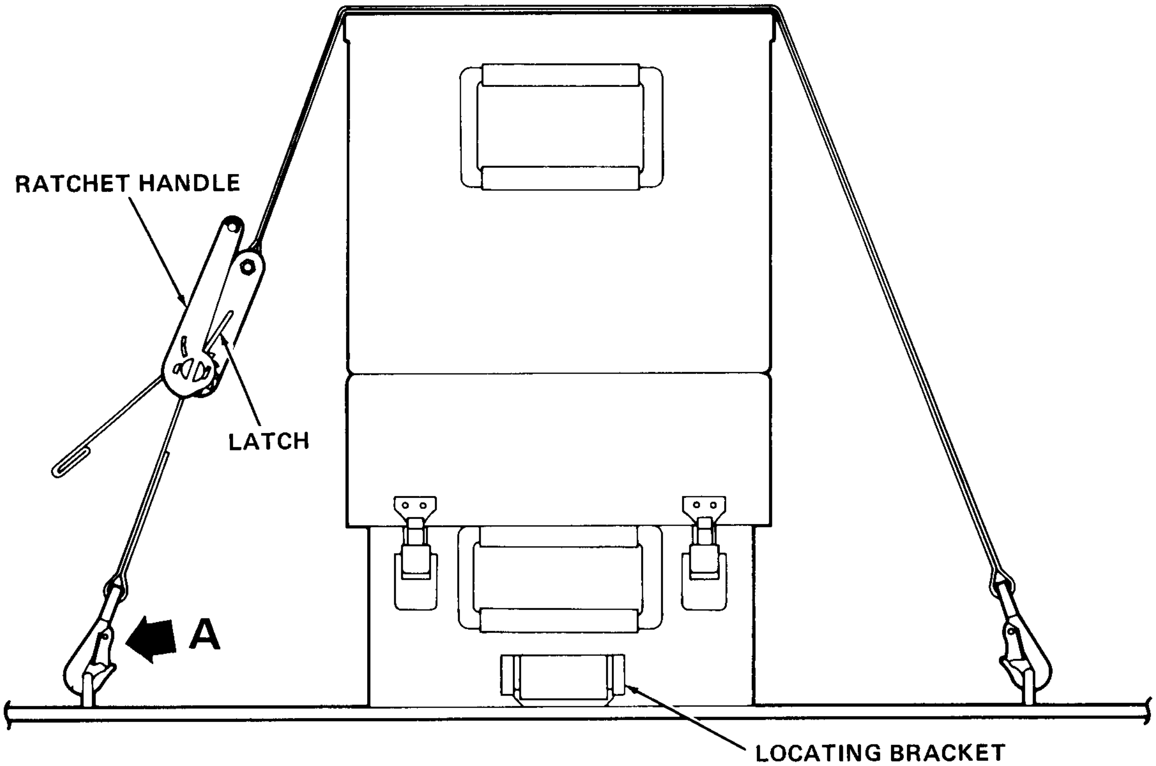
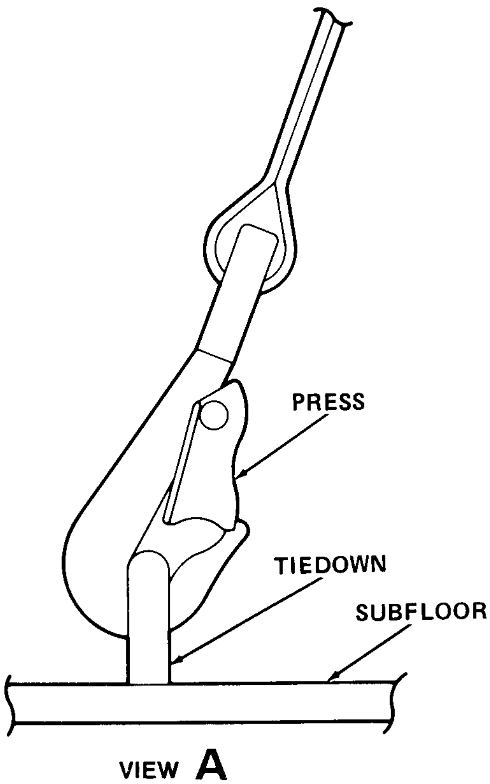


Figure 2-12. Vehicle Heater Duct Installation





TO ATTACH BELT

1. RELEASE LATCH TO LOOSEN BELT
2. PRESS SPRING-LOADED GUARD AND ATTACH HOOK TO SUBFLOOR TIEDOWN
3. RUN BELT OVER BATTERY BOX AND PRESS SPRING-LOADED GUARD AND ATTACH HOOK ON OTHER END OF BELT TO SUBFLOOR TIEDOWN
4. PULL AND RELEASE RATCHET HANDLE UNTIL BATTERY BOX IS SECURED TO SUBFLOOR

TO RELEASE BELT

1. RELEASE LATCH AND LOOSEN BELT
2. PRESS SPRING-LOADED GUARD AND RELEASE HOOK FROM SUBFLOOR TIE DOWN

4793-025

Figure 2-13. Battery Box Belt Operation

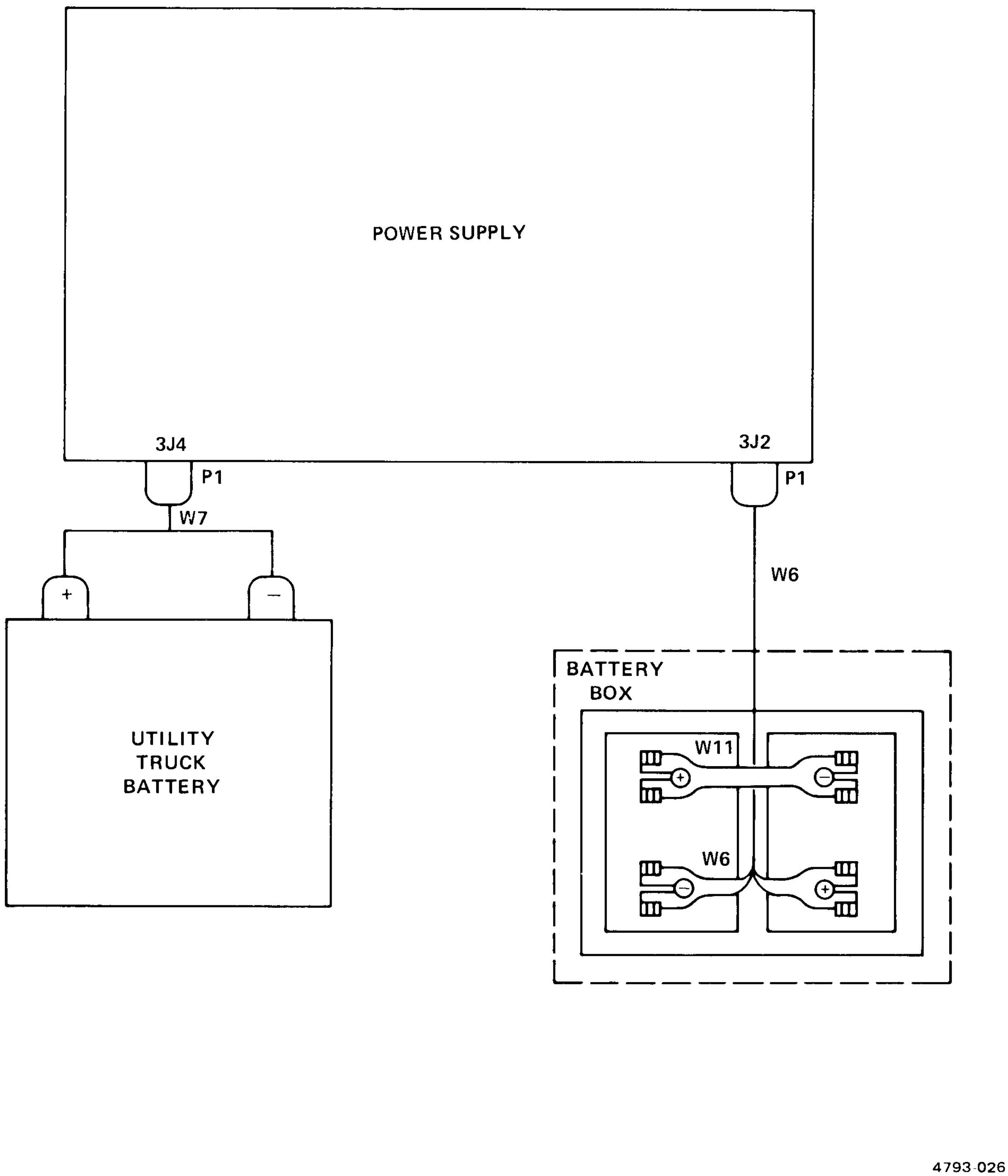
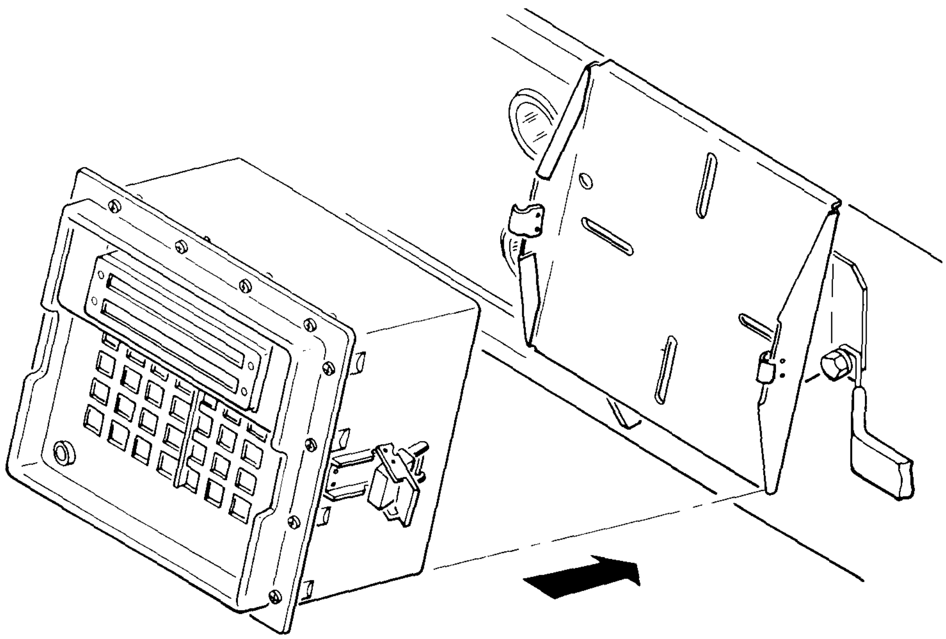
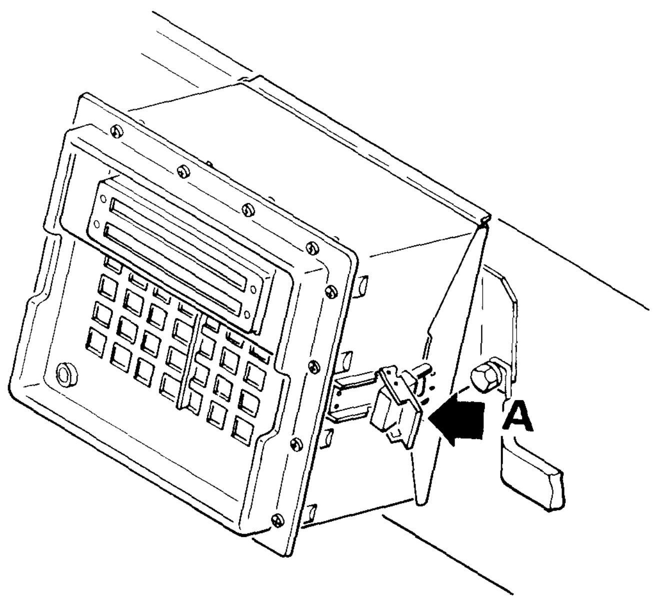


Figure 2-14. Utility Truck Electrical Connections



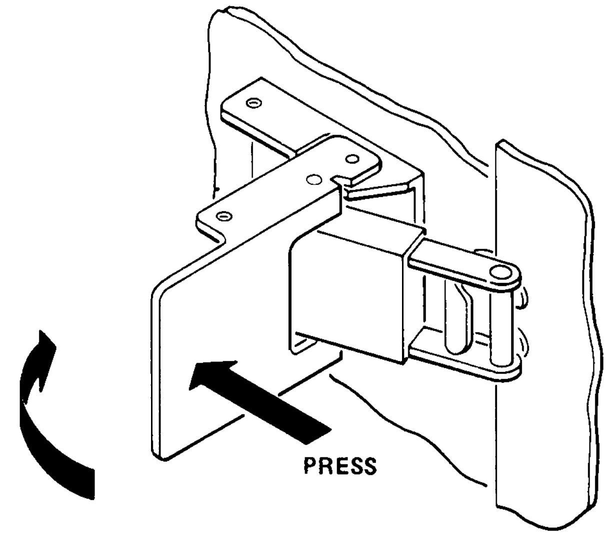
MOUNT CDU ON BRACKET



SECURE LATCH ON BOTH SIDES

4793-027

Figure 2–15. CDU Clamping Catch Operation (Sheet 1 of 2)



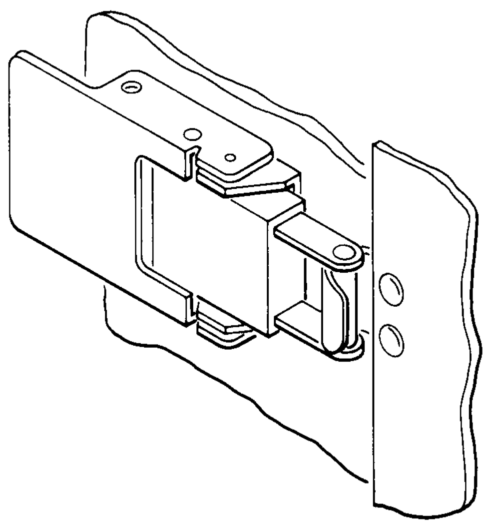
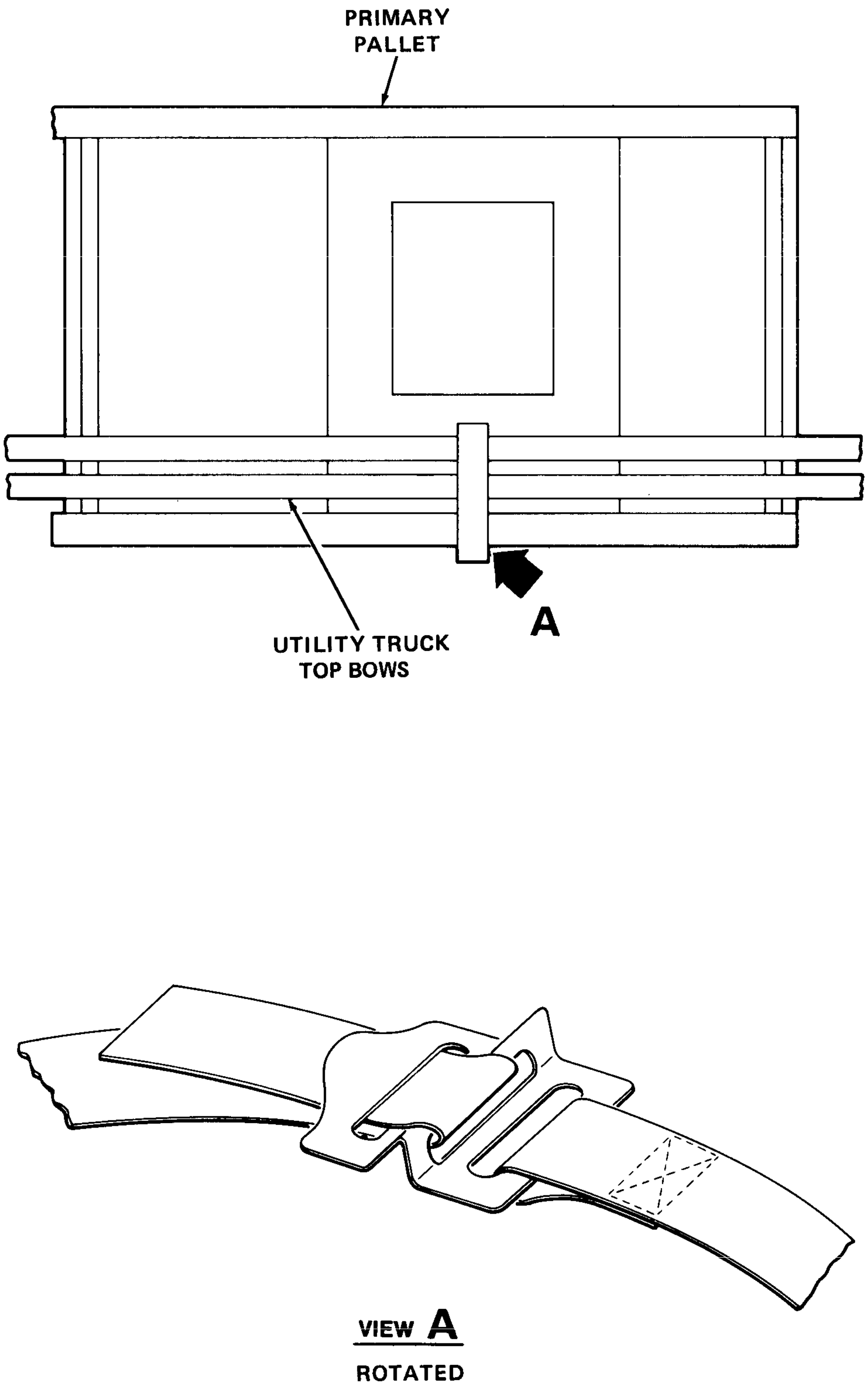


Figure 2-15. CDU Clamping Catch Operation (Sheet 2 of 2)



4793-029

Figure 2-16. Bows Tie-Down

2-12. Installing PADS in M1009 Series Commercial Utility Cargo Vehicle (CUCV)

a. **Preparation of Vehicle for Installation.** Prepare vehicle for installation as follows:

(1) Spare Tire Removal. Remove the spare tire for working room, if desired. Retain for reinstallation following installation of PADS.

(2) Radio and Mount Removal. Remove radio and radio mount, located adjacent to the rear passenger seat on the curbside of the vehicle (figure 2-17), as follows:

(a) Disconnect the radio power cable from thc terminal blocks in the engine compartment, or from the terminal blocks mounted on the vehicle sidewall just below the radio rack.

(b) Remove the radio and any accessories from the radio mount.

(c) Remove the radio mount by removing the six mounting bolts. Usc a l/2-inch wrench. Retain the mount and hardware.

(3) Rear Passenger Scat Removal. Remove rear seat as follows:

(a) Using handle at the rear of the rear passenger seat, lift and fold scat forward, exposing the front mounting bolts (figure 2-18).

(b) Remove two bolts, flat washers, and lockwashers securing rear passenger scat to cargo bed. Use l/2-inch wrench.

(c) Remove rear passenger seat through rear door.

(d) Reinstall two bolts, flat washers, and lockwashers in cargo bed.

(4) Rear Seat Belt Removal. Remove the rear set belt as follows:

(a) Remove two seat belt attachment bolts, using l/4-inch hex head key. Store the belts with the rear passenger seat.

(b) Reinstall the bolts in cargo bed.

(5) Radio and Radio Mount Installation. Reinstall the radio mount, radio, and accessories removed in step (2), above. Proceed as follows, referring to figure 2-17:

(a) Secure radio mount to vehicle side panel using six bolts and flat washers. Usc l/2-inch wrench.

(b) Install radio on radio mount.

(c) Connect radio power cable to terminal blocks.

b. **Mounting Base Installation.** Install the mounting base on the vehicle cargo bed as follows:

(1) Behind the front scats on cargo bed, remove fifth and sixth bolts and washers referenced from each side panel (total of four bolts and washers), as shown in figure 2-19. Use l/2-inch wrench.

(2) Place mounting base on cargo bed. Line up four holes in mounting base with holes in cargo bed where bolts were removed.

(3) Place four spacers (from installation kit) between mounting base and cargo bed at bolt locations. Place long end of spacers toward front of vehicle.

(4) Install four no. 5/16- 18UNC x 1.38 inch long bolts (from the installation kit) with flat washers through mounting base and spacers into cargo bed. Finger tighten bolts.

(5) Install two J-bolts, anti-rotation washers, lockwashers and 0.500 -20UNC nuts as shown in figure 2-19. Finger tighten nuts.

(6) Force mounting base forward, then tighten the four bolts and two nuts. Usc l/2-inch and 13/16-inch wrenchcs.

c. CDU Mounting Bracket Installation. Install the CDU mounting bracket as follows:

(1) Secure nutplate (from installation kit) to CUCV bracket located on the dash panel, as shown in figure 2-20. Use two no. 0.190-32UNF x .38-inch long screws and lockwashers from kit. Fit nutplate in behind existing dashboard bracket without removing it.

(2) Secure CDU bracket (from kit) to CUCV dash panel bracket with three .250-28UNF x .656-inch long screws and lockwashers from kit. Use 7/16-inch wrench.

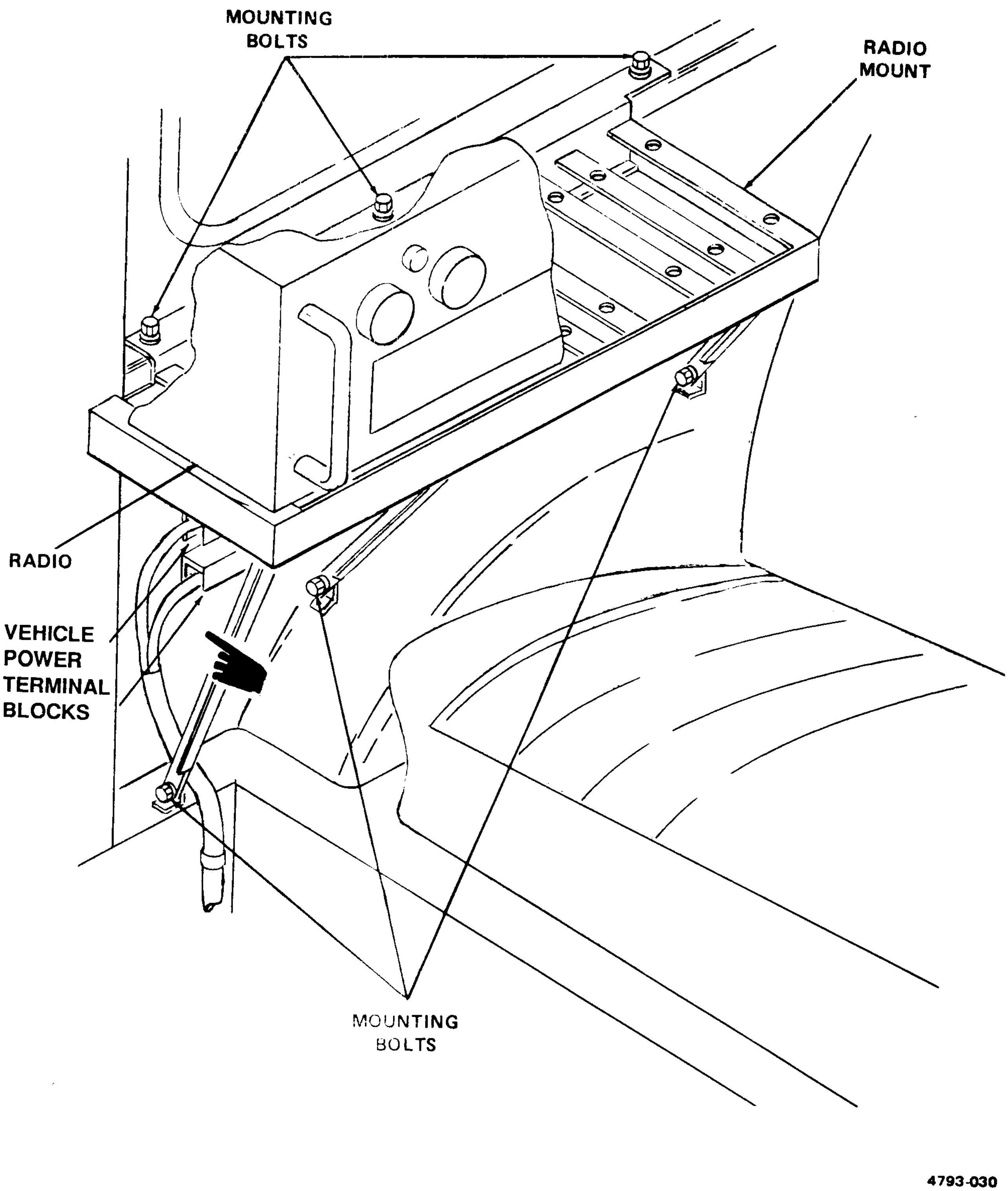


Figure 2-17. Radio Mount

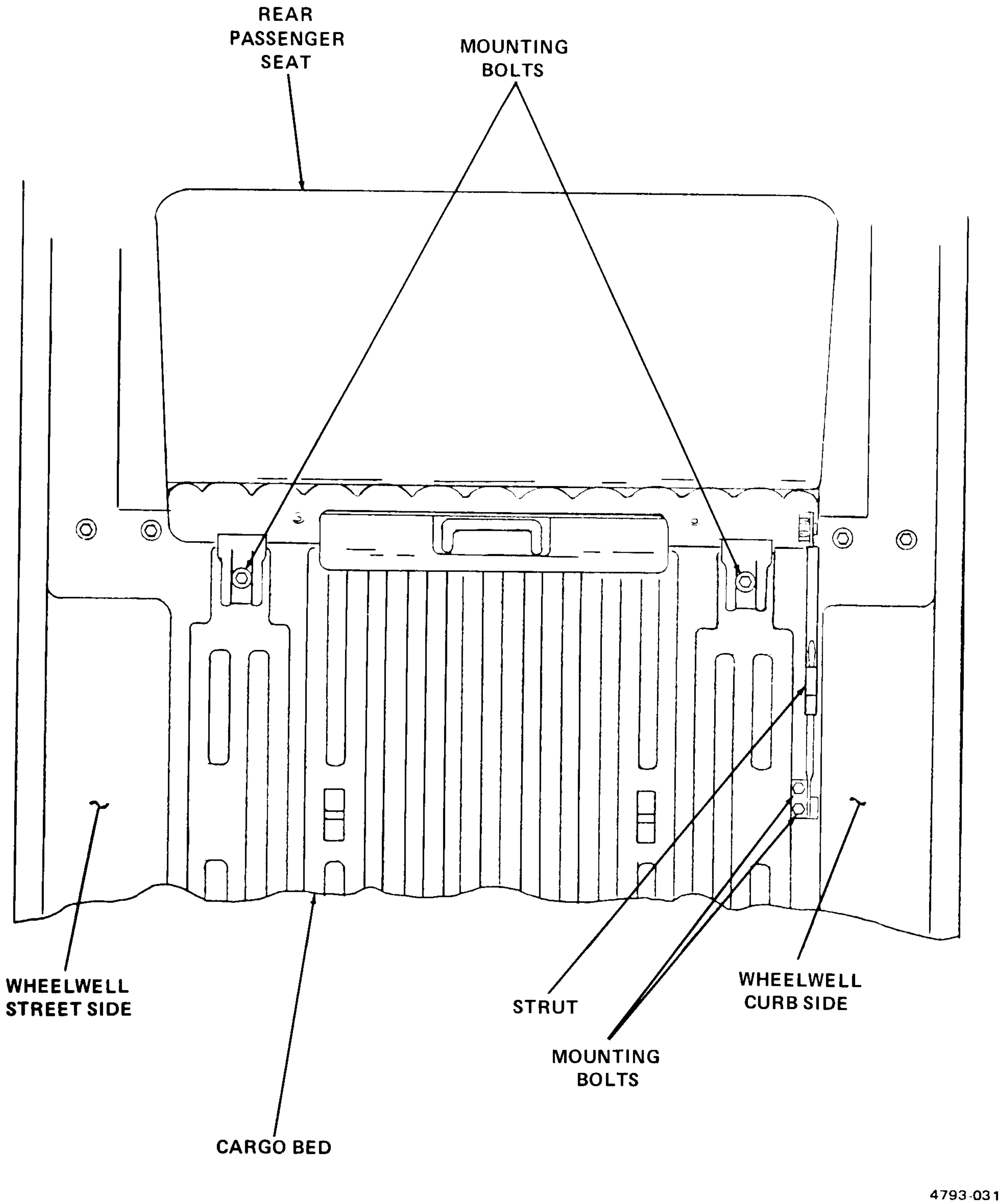


Figure 2-18. *Rear Seat Removal*

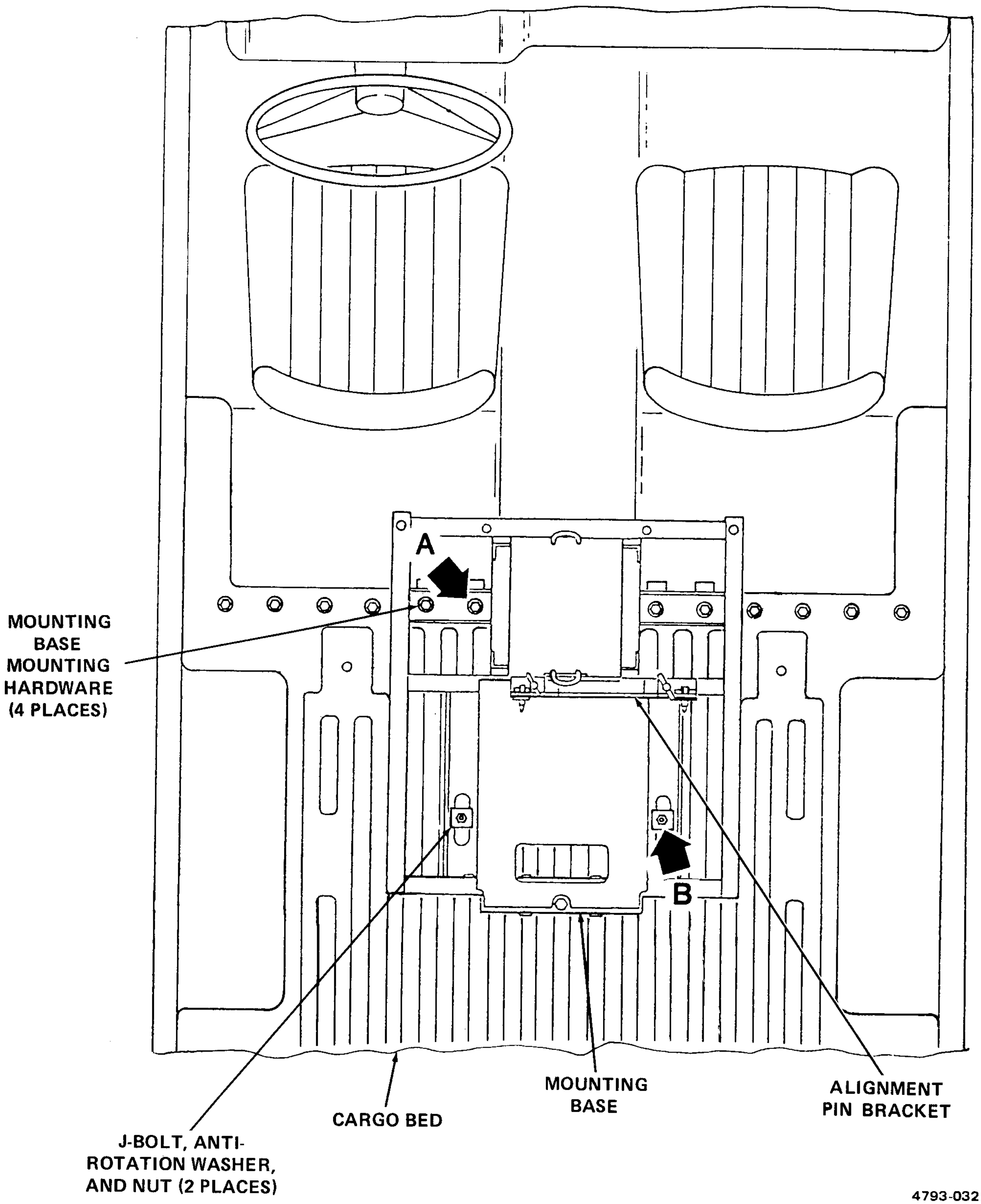


Figure 2-19. Mounting Base Installation (Sheet 1 of 2)

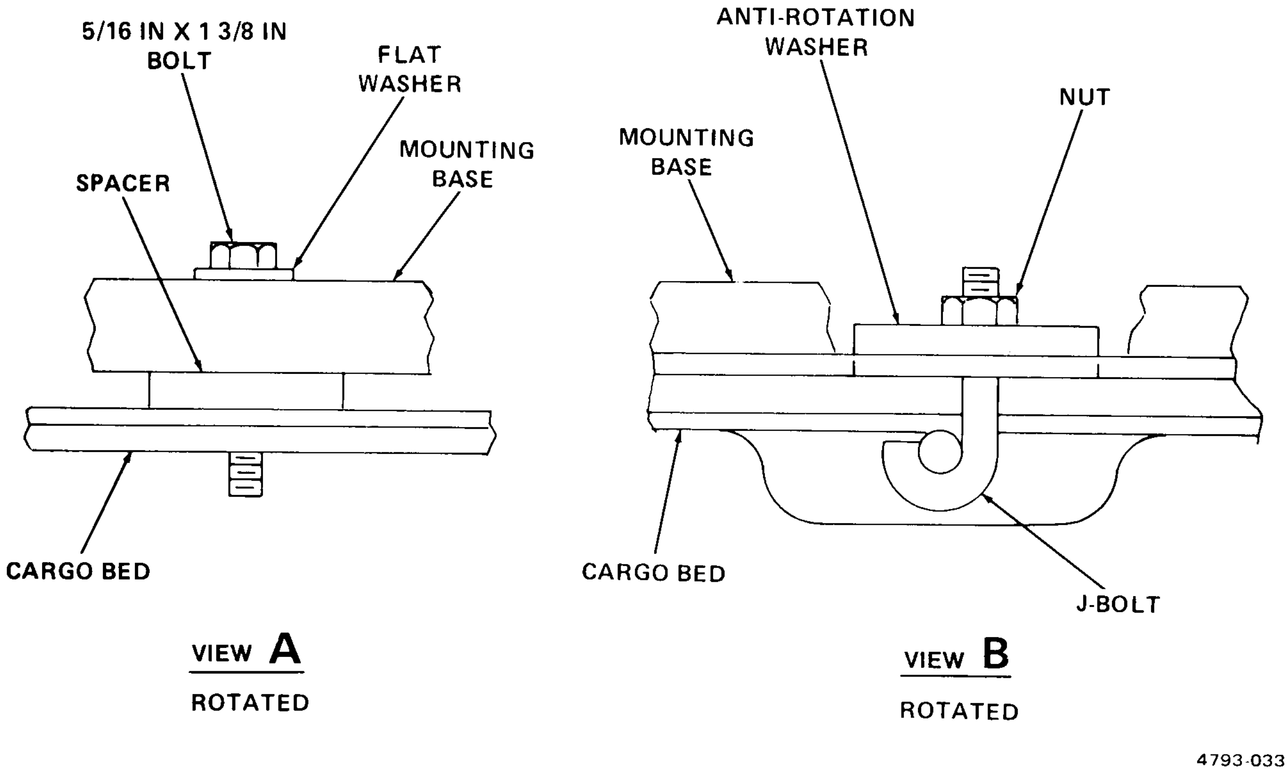


Figure 2-19. Mounting Base Installation (Sheet 2 of 2)

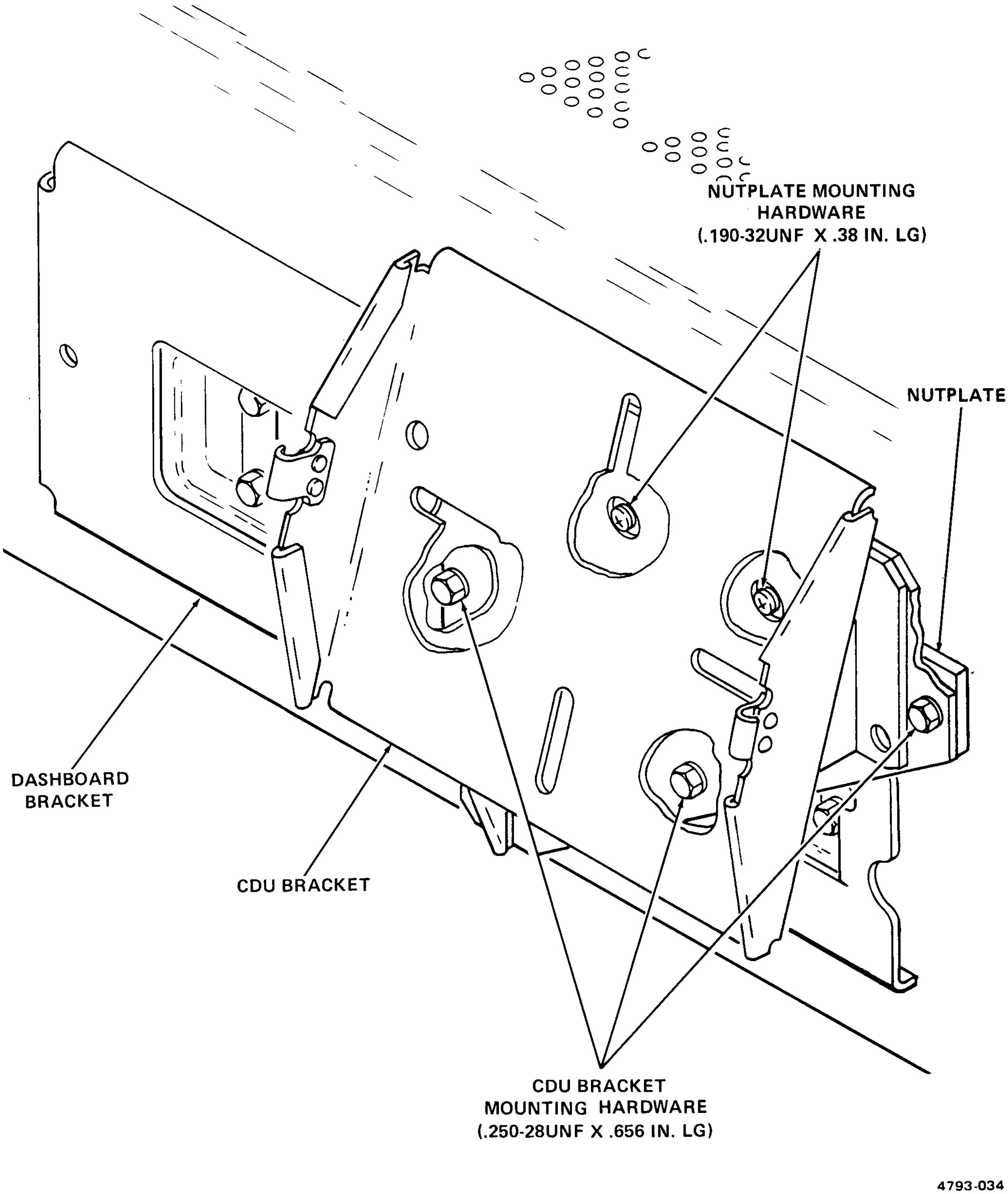


Figure 2-20. CDU Mounting Bracket Installation in CUCV

d. PADS Installation. lnstall PADS as follows:

(1) Install alignment pin bracket (part of the PADS) on mounting base at location shown in figure 2-21. Secure alignment pin bracket with two T-handles.

(2) Place battery box (with batteries installed) on mounting base as shown in figure 2-21. Ensure that locating bracket is in correct position.

(3) Secure battery box in position with belt assembly (item 13, figure 1-5) as shown in figure 2-21. Refer to figure 2-13 for operation of belt assembly.

WARNING

The weight of the primary pallet exceeds the two-person lift criteria. Usc three persons to lift it.

(4) Lift primary pallet onto cargo bed and position on mounting basc with plumb bob arm facing to the rear of the vehicle.

(5) Slide primary pallet forward until parts of alignment pin bracket are fully mated in alignment pin reccptacles in bottom rail of primary pallet frame. If alignment pins do not fit freely into receptacles, adjust in accordance with paragraph 4-15b.

(6) Securc rear bottom rail of the primary pallet frame to mounting base with two clamping brackets and T-handtcs (part of the PADS).

e. Power Cable W7 Installation. Referring to figures 2-22 through 2-24, as required, install power cable W7 as follows:

WARNING

To prevent injury to personnel or damage to equipment, all rings, watches, and bracelets must be removed. Disconnect ground cable first before working with, or around batteries. protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

(1) Open vehicle hood and remove battery cover.

(2) Remove ground cable clamp from negative post of battery arrd protect from accidental contact with other cables or battery posts.

CAUTION

To prevent damage to equipment, ensure polarity of cable lugs match polarily of battery posts. The positive wire is color-coded red and thc negativc wire is color-coded black.

NOTE

Steps (3) through (6), below, apply only to the CUCV where the terminal boxes are located on the curbside wall under the radio mount (see figure 2-22).

(3) Remove protective covers from the positive (+) and negative (-) terminal boxes.

(4) Connect the (+) end lug of cable W7 (item 1, figure 1-7) to the first terminal from the rear (of the vehicle) on the positive strip (figure 2-22) and (-) end lug of cable W7 to the first terminal from the rear on the nagative strip.

(5) Replace protective covers on terminal boxes.

(6) Reinstall the negative (-) cable on the battery. Reinstall the battery cover and close the vehicle hood.

NOTE

Steps (7) through (12), below, apply only to the CUCV where the terminal boxes are located in the compartment. Before proceeding with power cable W7 installation, ensure that the vehicle has been PADS modified by the presence of three cable access holes in the firewall as shown in figure 2-23. If the access holes arc not present, this modification must be performed by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM-8837A-43/2.

(7) Pass the (+) and (-) ends of power cable W7, and radio cable, through the prc-drilled holes in the firewall as shown in figure 2-23. Install three rubber grommets(part of PADS installation kit) in holes after cables have been passed through.

(8) Remove cable assembly W8 (item 4, figure 1-5) from from the battery box.

(9) Move to passenger compartment and connect W8 cable connector, W8P2, to W7 cable connector, W7P1.

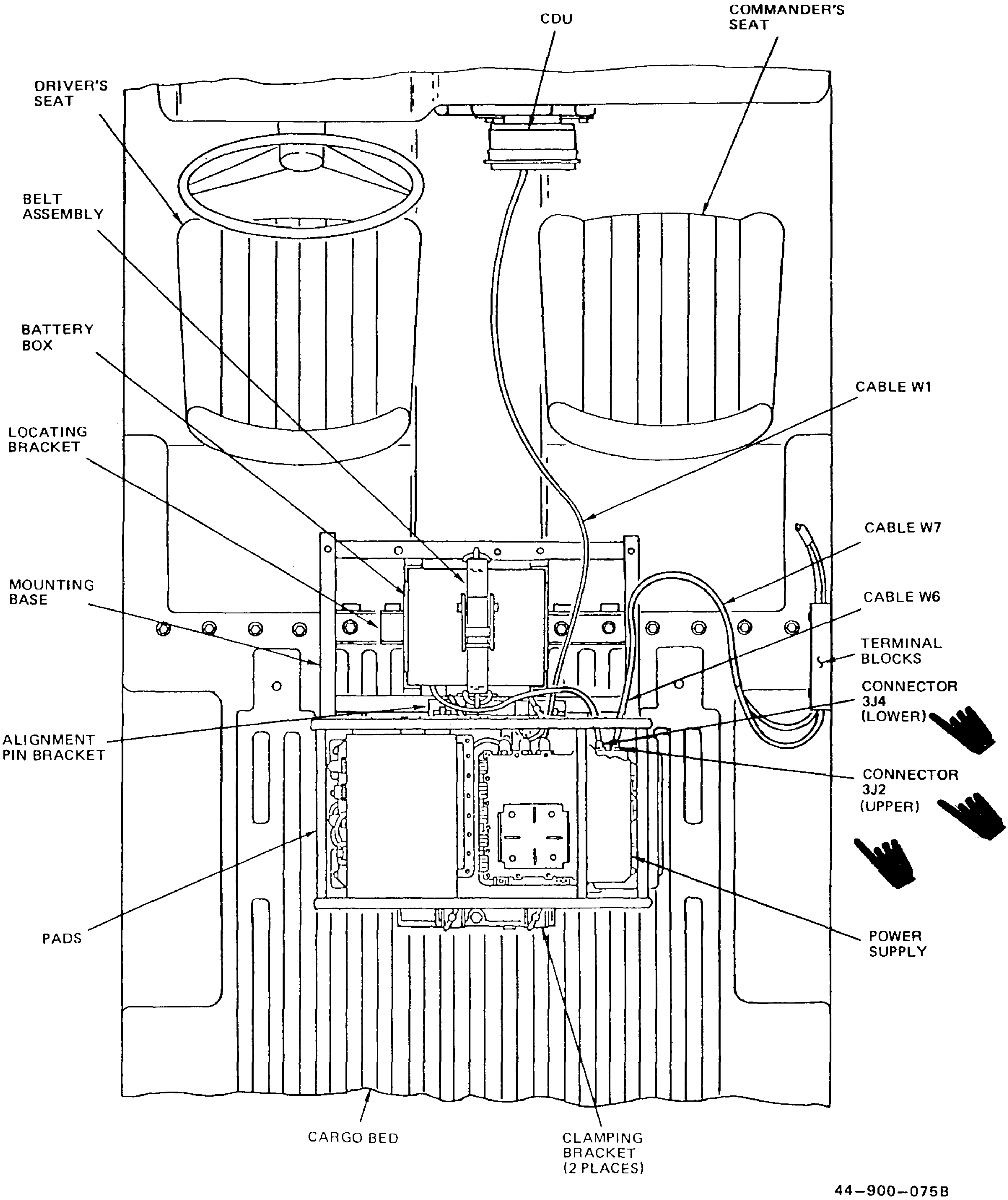


Figure 2-21. PADS Installation in CUCV

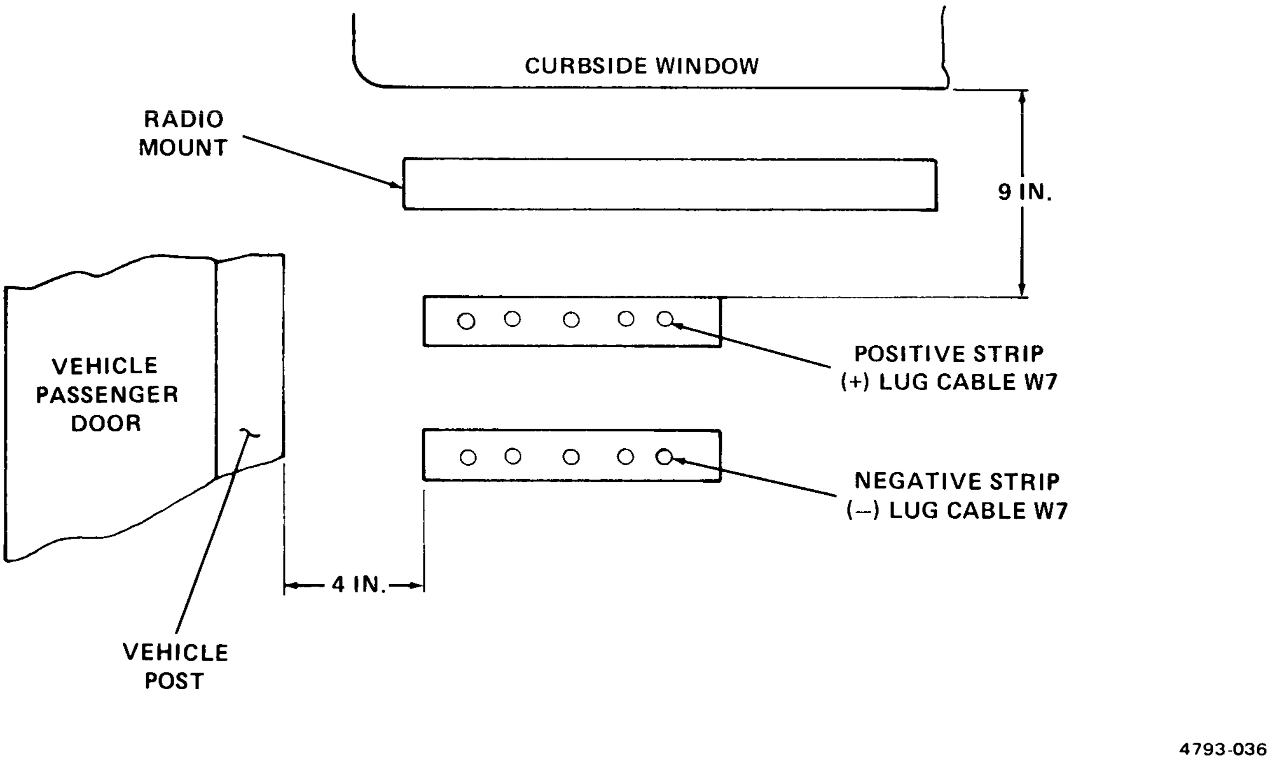


Figure 2-22. Terminal Box Locations on Curbside Wall

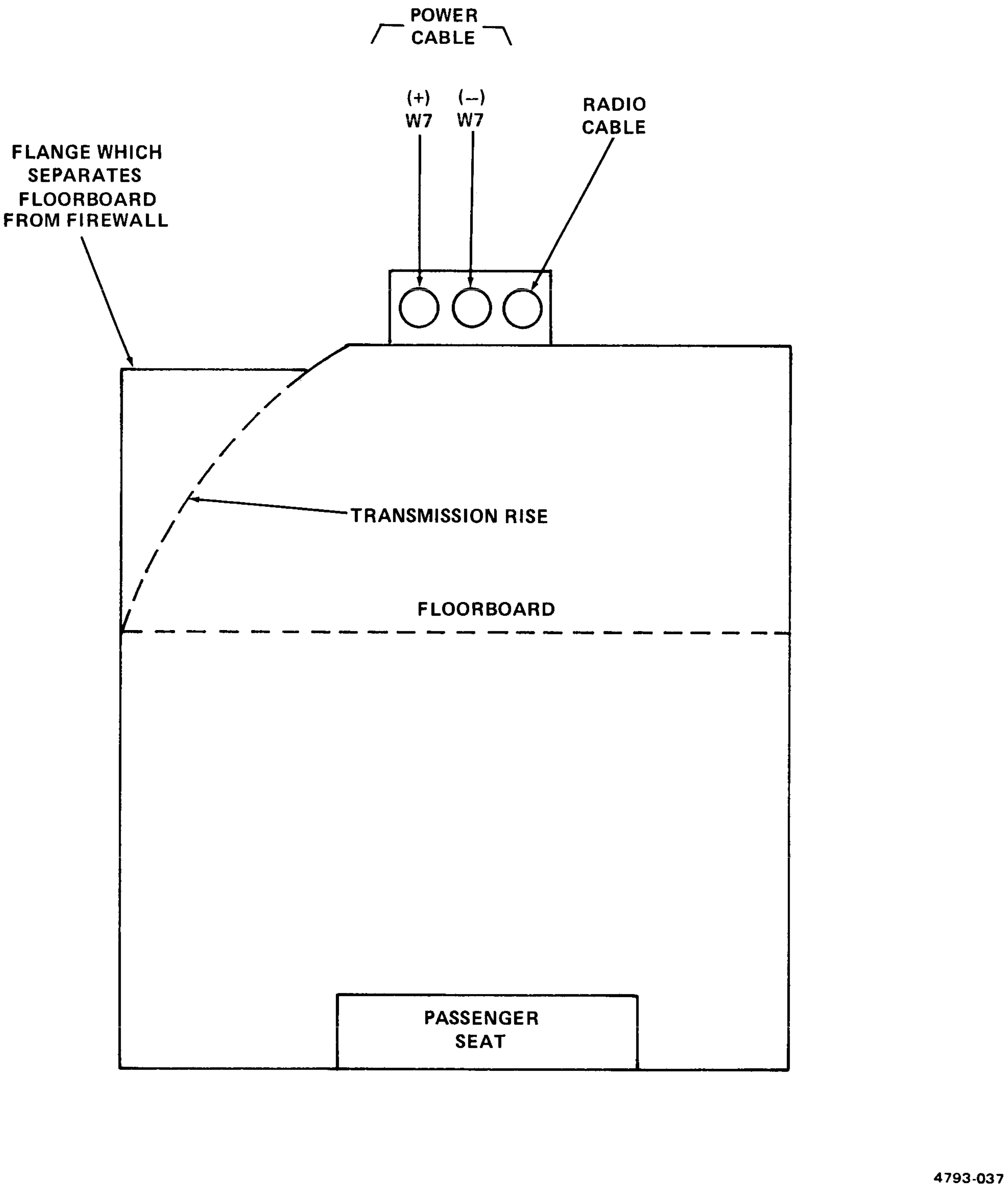


Figure 2-23. Hole Locations in Vehicle Firewall

(10) Remove protective covers from positive (+) and negative (-) terminal boxes located on the engine compartment firewall.

(11) Connect (+) end lug of cable W7 to the second terminal from the right on the positive strip and the (-) end lug of cable W7 to the center terminal of the negative strip. Refer to figure 2-24. Replace protective covers on terminal boxes.

(12) Reinstall negative (-) terminal on battery, replace battery cover and close vehiclc hood.

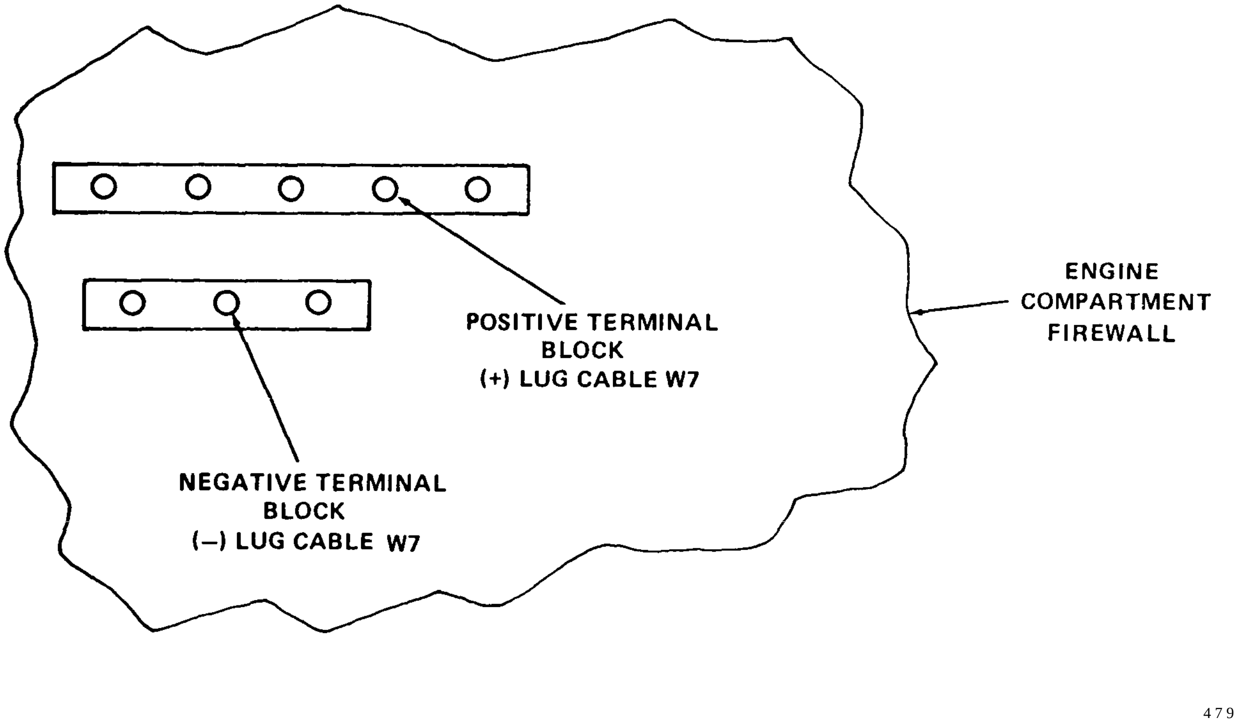


Figure 2-24. Terminal Blocks in CUCV Engine Compartment

f. Power Connections. Complete power connections as follows:

(1) Connect W6 cable (item 6, figure 1-5) from battery box to power supply connector 3J2 (see figure 2-25).

NOTE

The following step applies only to the CUCV where the terminal boxes are located in the engine compartment.

(2) Connect W8 cable connector, W8P1, to power supply connector, 3J4 (see figure 2-25, alternate setup). The power supply is on the right side of the PADS primary pallet as installed in the CUCV.

NOTE

The following step applies only to the CUCV where the terminal boxes are located on the curbside rear wall under the radio mount.

(3) Connect W7 cable connector, W7P1, to power supply connector, 3J4. Scc figure 2-25.

g. Plumb Bob Bracket Installation. Referring to figurc 2-26, install the plumb bob bracket as follows:

(1) Remove top two bolts, lockwashers and nuts from CUCV pintle. Use 3/4-inch wrench.

(2) Secure plumb bob bracket (part of installation kit) to pintle using the bolts, lockwashers and nuts removed in (1), above.

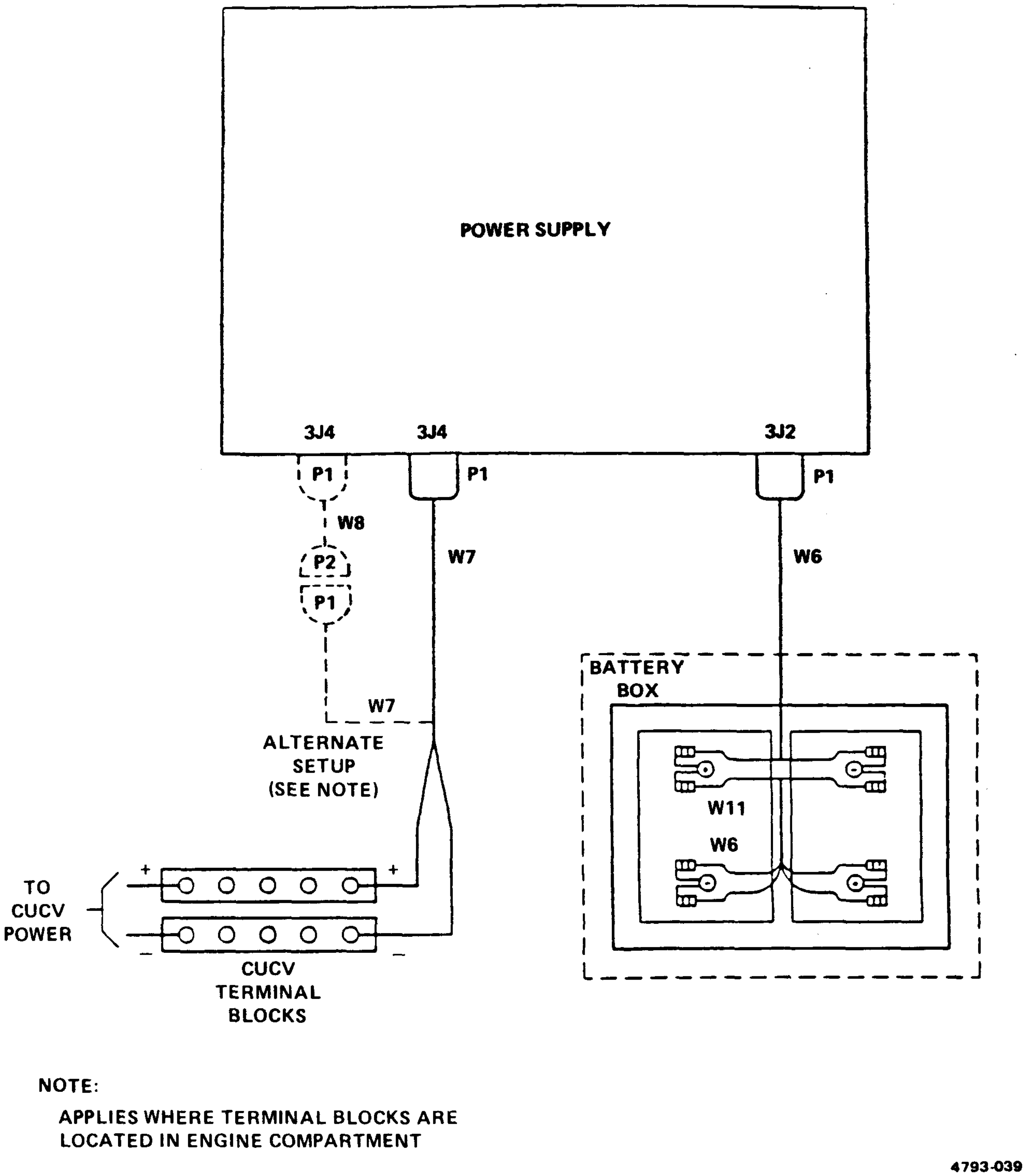


Figure 2-25. Power Cable Installation in CUCV

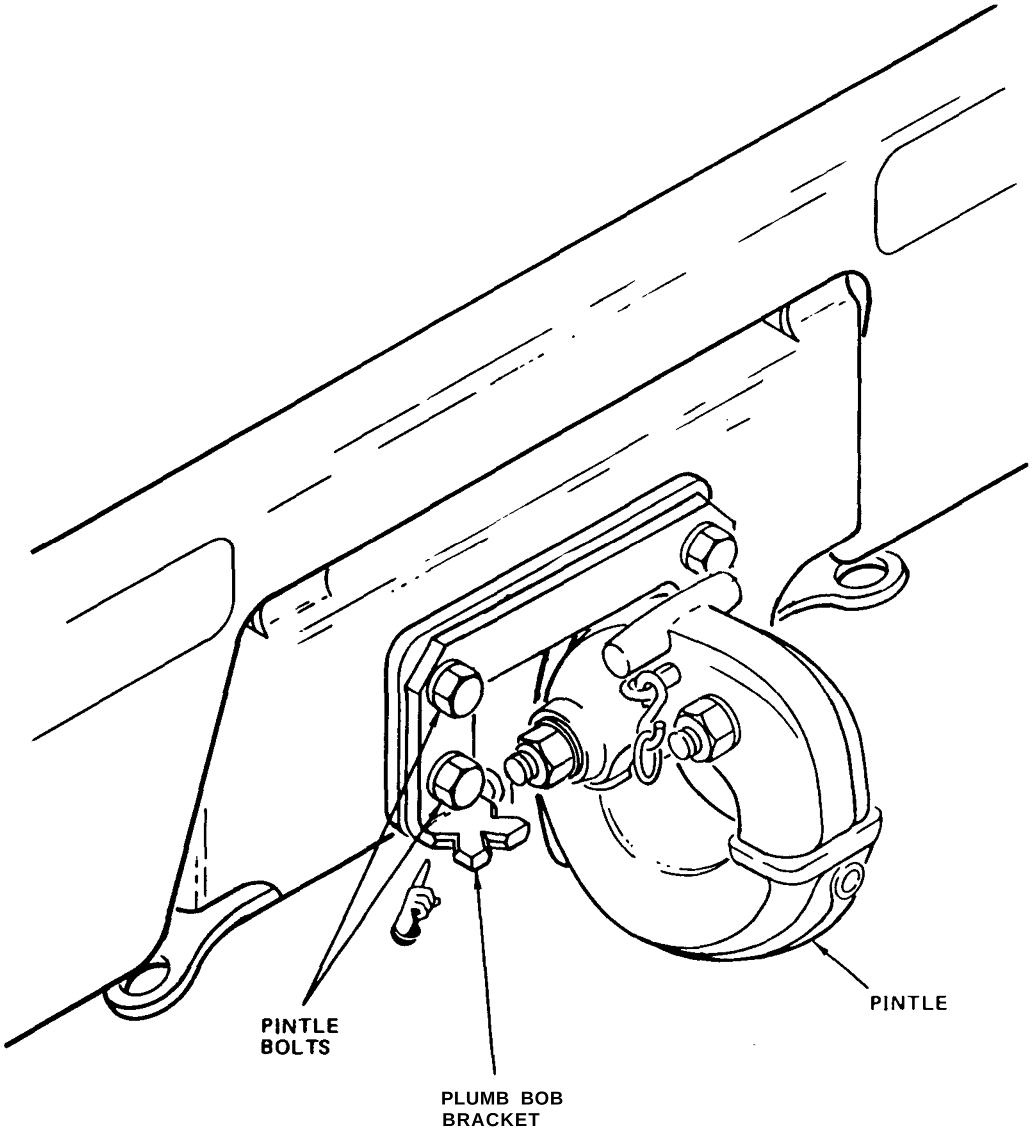


Figure 2-26. Plumb Bob Bracket Installation in CUCV

h. Control and Display Unit (CDU) Installation. Install the CDU as follows:

(1) Unsnap CDU from its bracket on top of the PADS primary pallet (item 2, figure 1-4). Route CDU and cable W1 as shown in figure 2-21.

(2) Secure CDU to CDU bracket on vehicle dashboard using the two clamping catches (see figure 2-15).

i. Spare Tire Reinstallation. Reinstall the spare tire if removed.

j. Preliminary Adjustment of Equipment. Perform the preliminary checks and services described in paragraph 2-14.

2-13. Installing PADS in M998 Series High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)

a. Preparation of Vehicle for Installation. Prepare vehiclc for installation as follows:

(1) The cargo bulkhead is installed with four bolts. Remove as follows:

(a) Using the 3/4-inch combination wrench, remove two bolts from the vehicle bed.

(b) Using the l/2-inch open-end wrench, remove two bolts from the vehicle side pillars.

(c) After removing the bulkhead, reinstall the two bolts in the vehicle side pillars. Retain the vehicle bed bolts for reinstallation.

(d) Store the cargo bulkhead.

(e) If the vehicle has been equipped with two l/2-inch thick wooden noise abatement plates located between the two front seats and the two rear seats, remove and store wilh the associated hardware. Remove the fire extinguisher and bracket from the forward plate and reinstall on the deck between two front seals, where it had previously been mounted.

(2) Cargo Tiedowns Removal. Remove the cargo tiedown rings as follows:

(a) Using the 3/4-inch combination wrench, remove the three tiedown rings and bolts near the center of the cargo bed. Retain two tiedown rings for reins reinstallation.

(b) Store the three bolts and one tiedown ring with the cargo bulkhead.

(3) Adapter Frame Installation. Install the adapter frame as follows:

(a) Place the adapter frame (figure 2-27) over the five holes in the vehicle cargo bed, two forward and three to the rear.

(b) Install five l/2-13UNC-2A by 3-1/2-inch long screws, flat washers, and lockwashers through the adapter frame slots into the vehicle cargo bed. Reinstall the tiedown rings on the rear bolts. Tighten finger-tight only. (See figure 2-28).

(c) Install the control and display unit (CDU) bracket on the bracket support as shown in figure 2-27. Secure in position with quick-release pin.

(d) Using the 9/16-inch wrench. tighten the four bracket support mounting bolts.

(c) Using the 3/4-inch wrench. tighten the five l/2-inch screws securing the adapter frame to the vehicle cargo bed.

(4) Subfloor Plate Preparation. Prepare the subfloor plate (item 3, figure 1-7) for installation on the adapter frame as follows:

NOTE

If the subfloor plate dots not have four holes along the rear edge (two inner holes with captive nuts), the missing outer holes must be drilled by direct support maintenance personnel in accordance with TM 5-6676-308-34 or Marine Corps TM 08837A-34/2.

(a) Using a hacksaw, cut labs from the right and left front comers of the subfloor plate as shown in figure 2-29 in order to clear thc protruding bolts heads of the installed adapter frame.

(b) Unscrew T-handle bolts from PADS primary pallet (itcm 7, figure 1-4) and remove alignment pin bracket (item 8, figure 1-4)

(c) The alignment pin bracket may be installed at either the front or rear subfloor plate mounting holes, at the installer's option. Ensure that the alignment pins are facing to the rear if the forward holes arc used; and facing to the front if the rear holes arc used. Secure the alignment pin bracket with the two T-handle bolts.

(5) Subfloor Plate Installation. Install the subfloor plate on the mounting frame as follows:

(a) Place the subfloor plate on the mounting frame with screw slots facing to the front of the vehicle as shown in figure 2-30.

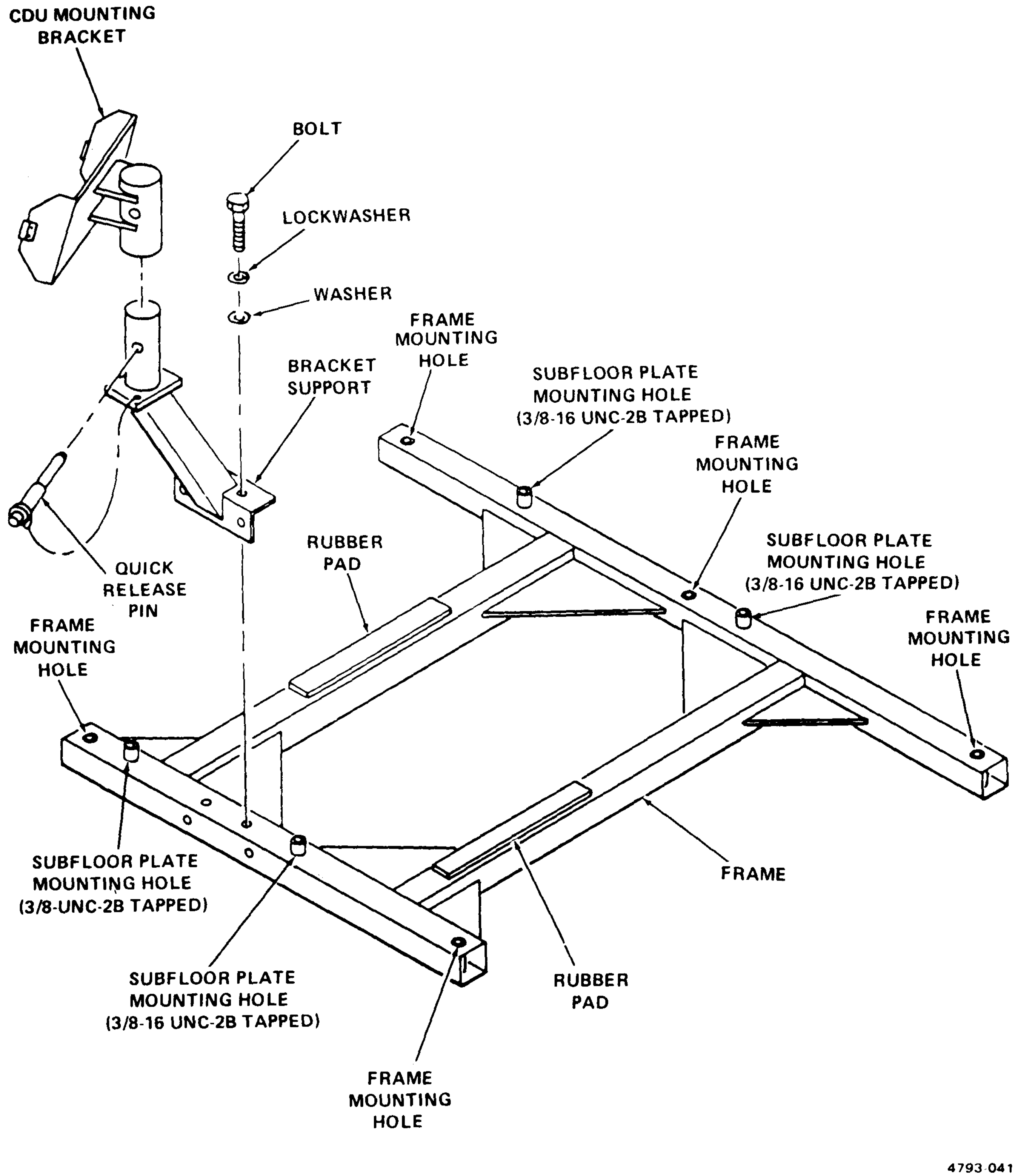


Figure 2-27. *Adapter Frame*

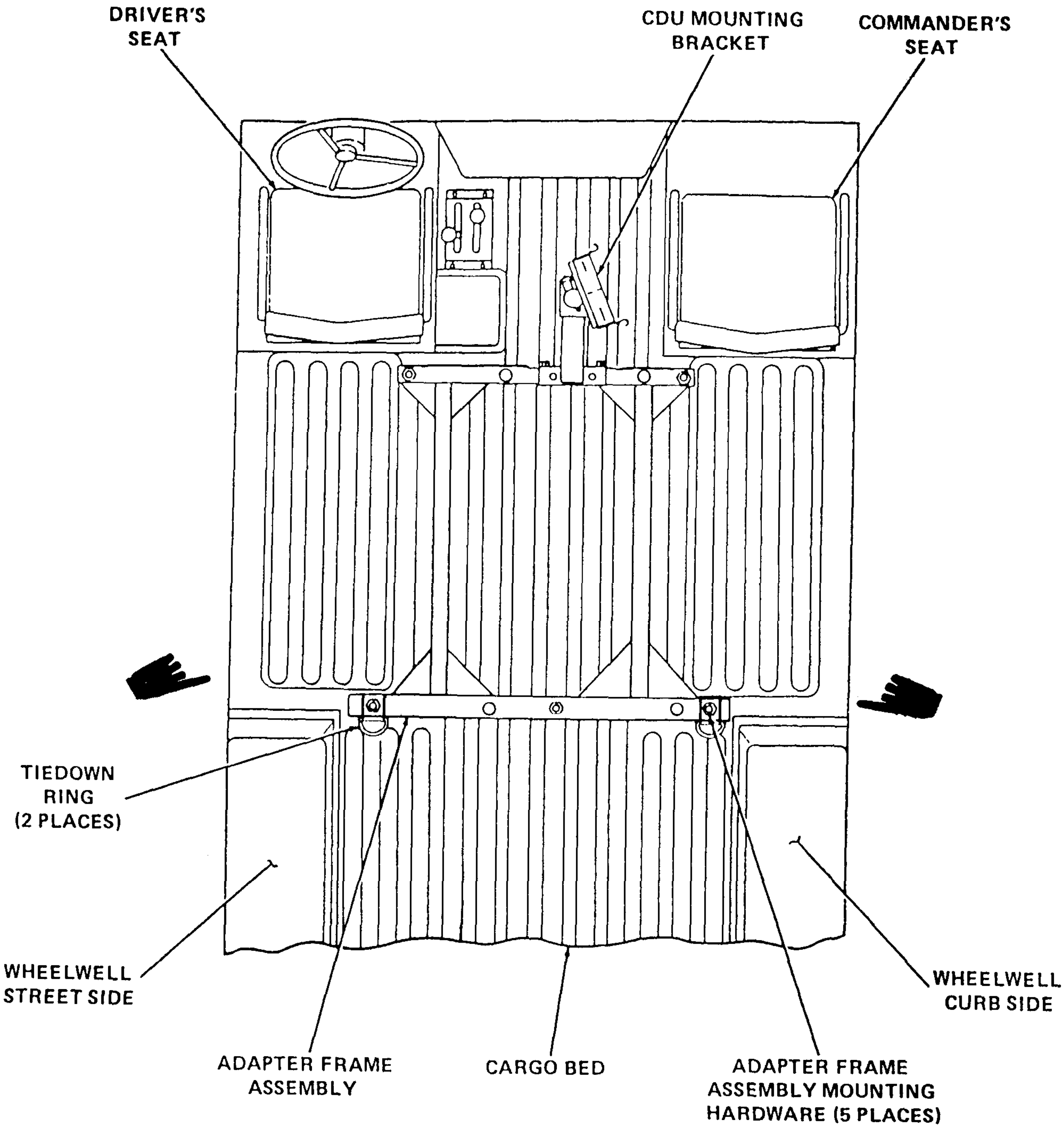


Figure 2-28. HMMWV Cargo Bed with Adapter Frame in Place

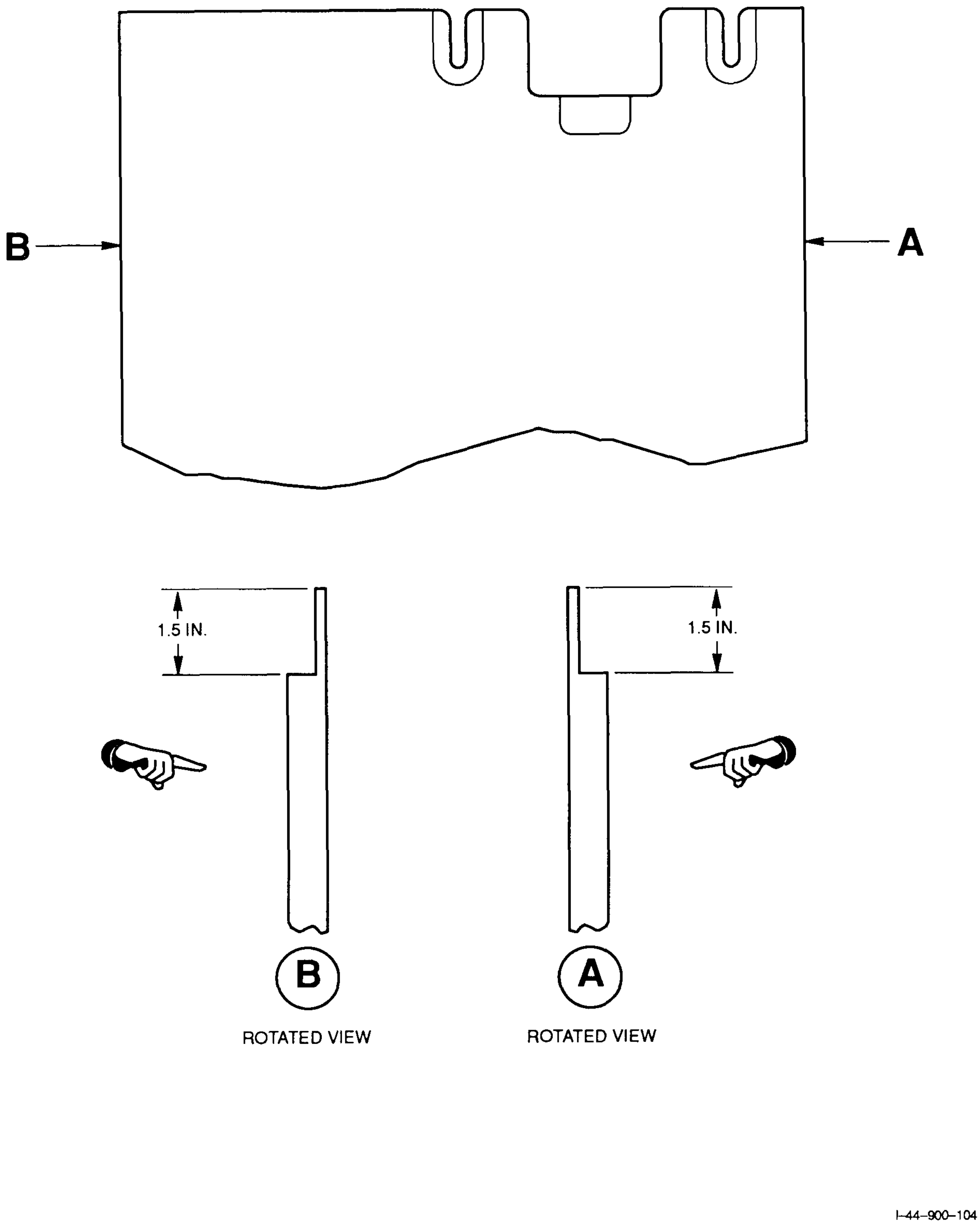


Figure 2-29. Subfloor Plate Modification

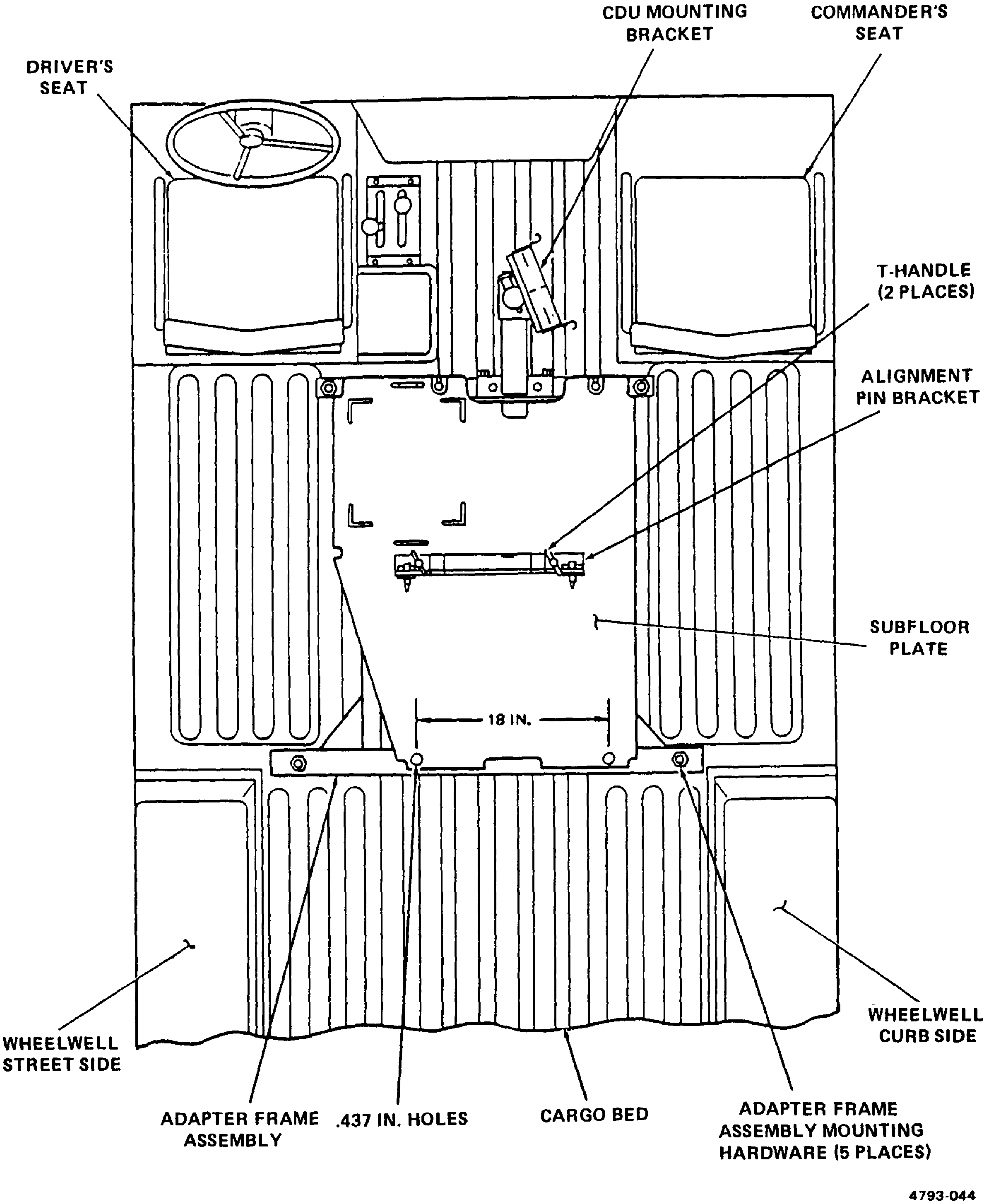


Figure 2-30. Subfloor Plate Location

(b) Using the 9/16-inch wrench, install four 3/8-inch diameter, l-inch long screws, flat washers, and lockwashers through subfloor plate into mounting frame holes.

b. **PADS Installation** Install PADS in the prepared vehicle as follows:

(1) Place PADS battery box (figure 2-8), with batteries installed in accordance with paragraph 2-10, on the subfloor plate within the angle brackets (see figure 2-31). Ensure that locating bracket is in correct position.

(2) Secure battery box with belt assembly (item 13, figure 1-5) as shown in figure 2-31. Refer to figure 2-13 for operation of the belt assembly.

(3) Place PADS primary pallet (figure 1-4) on subfloor plate with plumb bob arm (item 6, figure 1-4) facing to the rear.

(4) Slide PADS primary pallet into the pins of the alignment pin bracket (see figure 2-31), either forward or rearward as appropriate. Ensure that the pins of the alignment pin bracket are fully mated in the alignment pin receptacles of the bottom rail of the primary pallet.

NOTE

If alignment pins do not fit freely into receptacles, adjust in accordance with paragraph 4-15b.

(5) Secure the front or rear bottom rail of the primary pallet frame, not secured by the alignment pin bracket, to the subfloor plate with two clamping brackets and T-handles (item 13, figure 1-4) removed from the primary pallet, as shown in figure 2-31.

(6) Install the plumb bob bracket on the driver's side of the vehicle, approximately 13 1/2 inches forward of the rear of the driver's door edge as shown in figure 2-32. To hold the bracket in place, tighten thumbscrew in drain hole below first recess in body panel.

(7) Install power cables as follows:

WARNING

To prevent injury to personnel or damage to equipment, all rings, watches, bracelets, etc., must be removed. Disconnect ground cable first, before working with, or around, batteries. protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

NOTE

To allow power cable W7 to be routed to the vehicle battery box, two 1-inch holes must be drilled in the transmission tunnel forward of the existing radio cable. If these holes are not present, PADS modification must be performed on the vehicle by direct support maintenance personnel.

(a) Remove the front commander's seat by opening latch and lifting seat out of vehicle.

(b) Using a 9/16-inch wrench, disconnect ground connection of the battery.

(c) Remove the cable interconnecting the positive post of one battery and the negative post of the other battery.

(d) Install grommets on each branch of the W7 cable. Slide a grommet up each branch of the cable to approximately 6 inches from the fork of the cable.

(e) Route the end of each cable branch through the two l-inch holes in the transmission tunnel (see figure 2-33), under the vehicle body, and through the 1 l/2-inch hole in the battery box. This hole is located just below the current shunt mounted on the inside wall of the vehicle battery compartment.

(f) Route the branch of the W7 cable with the black band (wire marked negative) to the rear of the battery compartment and connect to the negative post of the battery (see figure 2-34). Install the hardware so the W7 cable battery connection can be removed without removing the existing battery connection. Tighten the hardware using the 9/16-inch wrench.

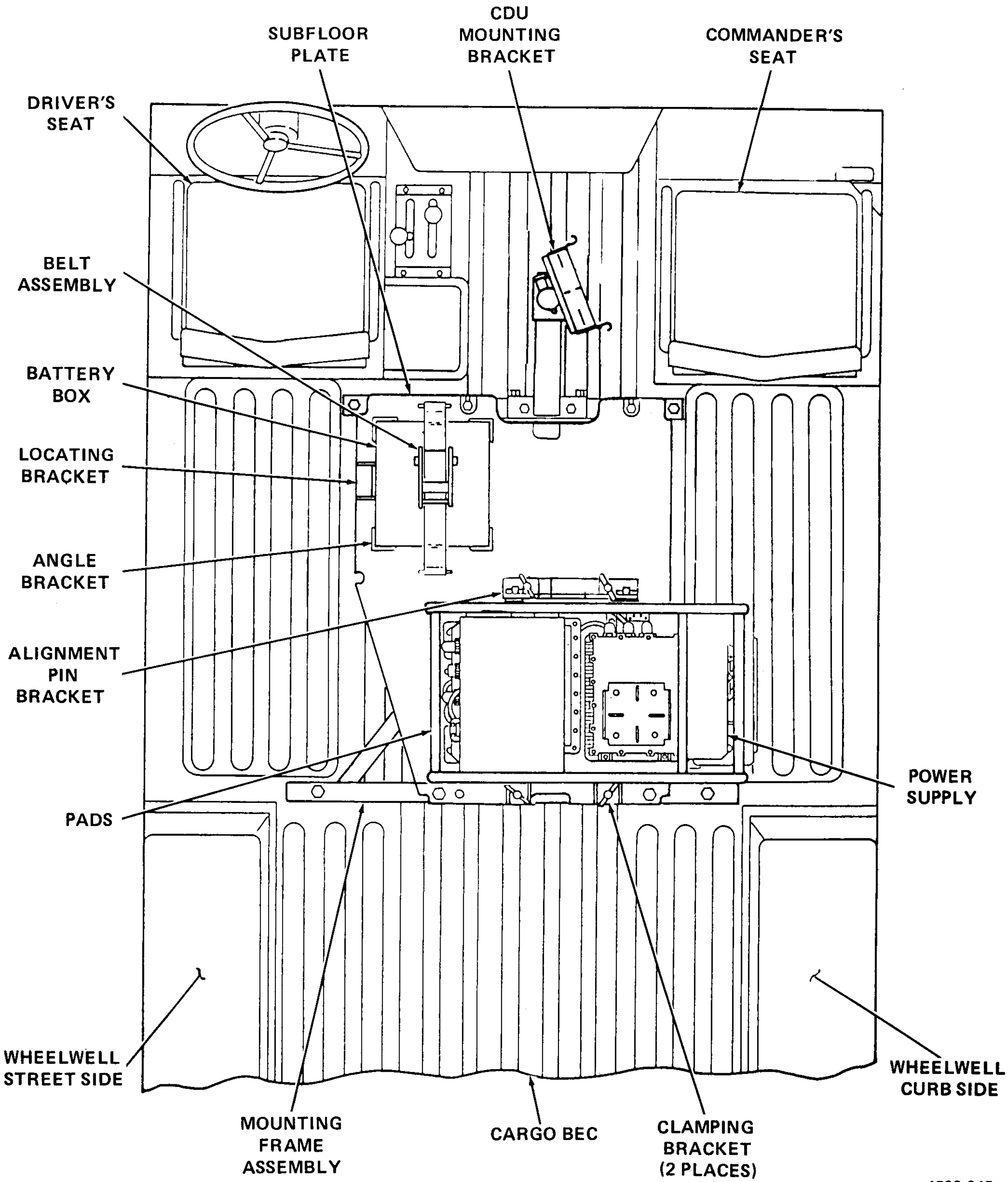


Figure 2-31. PADS Installed in HMMWV

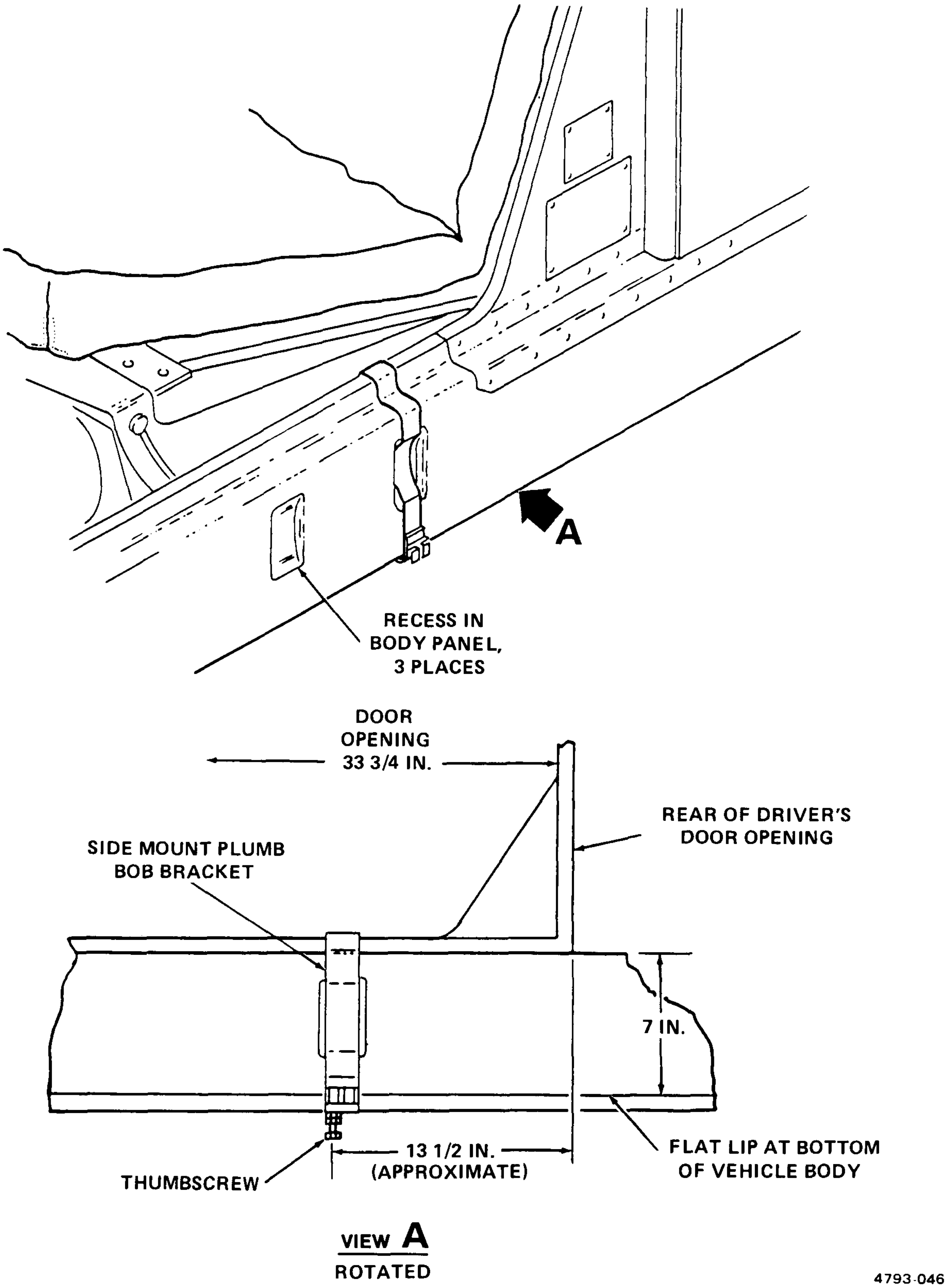


Figure 2-32. Plumb Bob Support Location on HMMWV

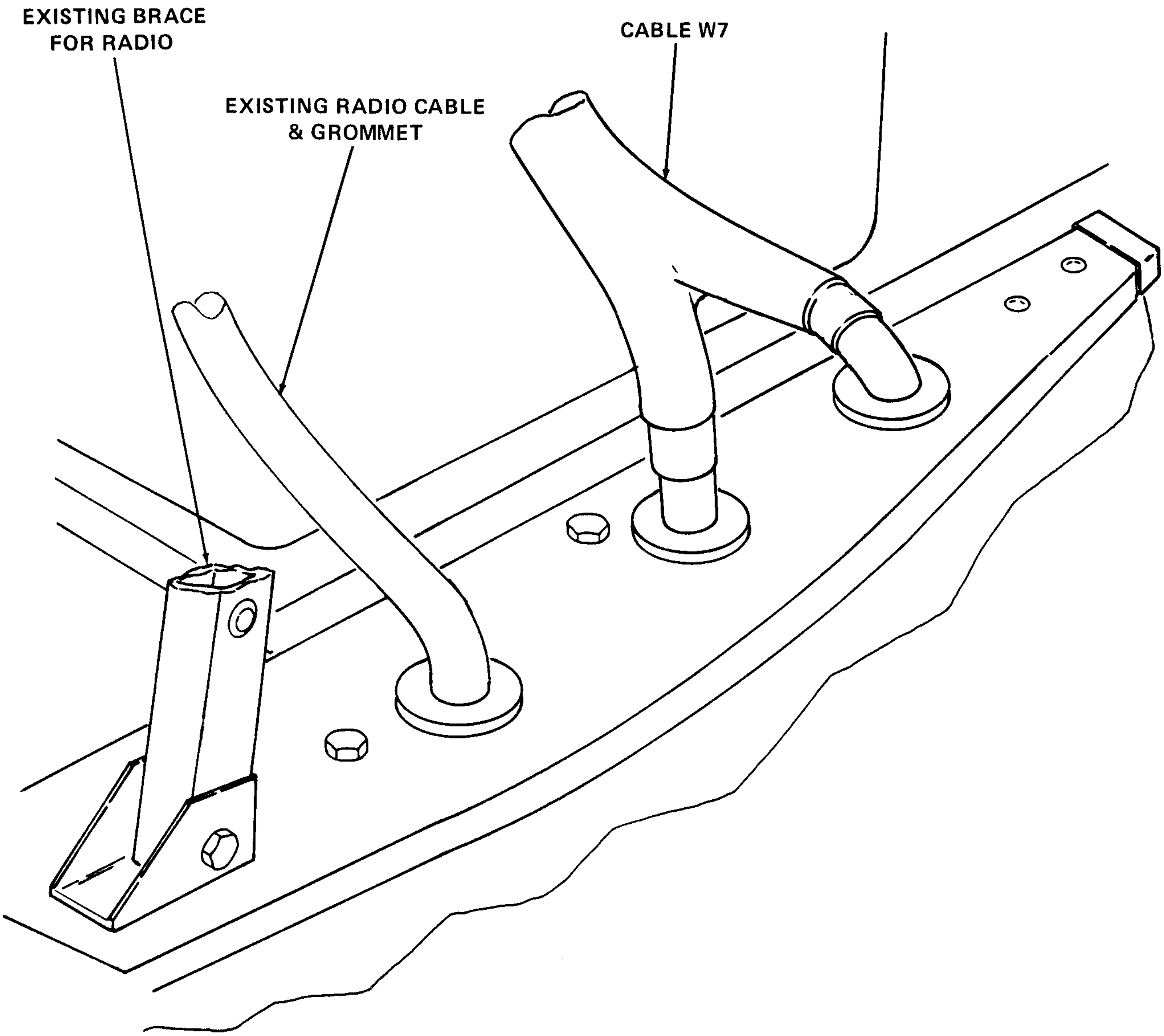


Figure 2-33. Location of Cable Holes in Transmission Tunnel

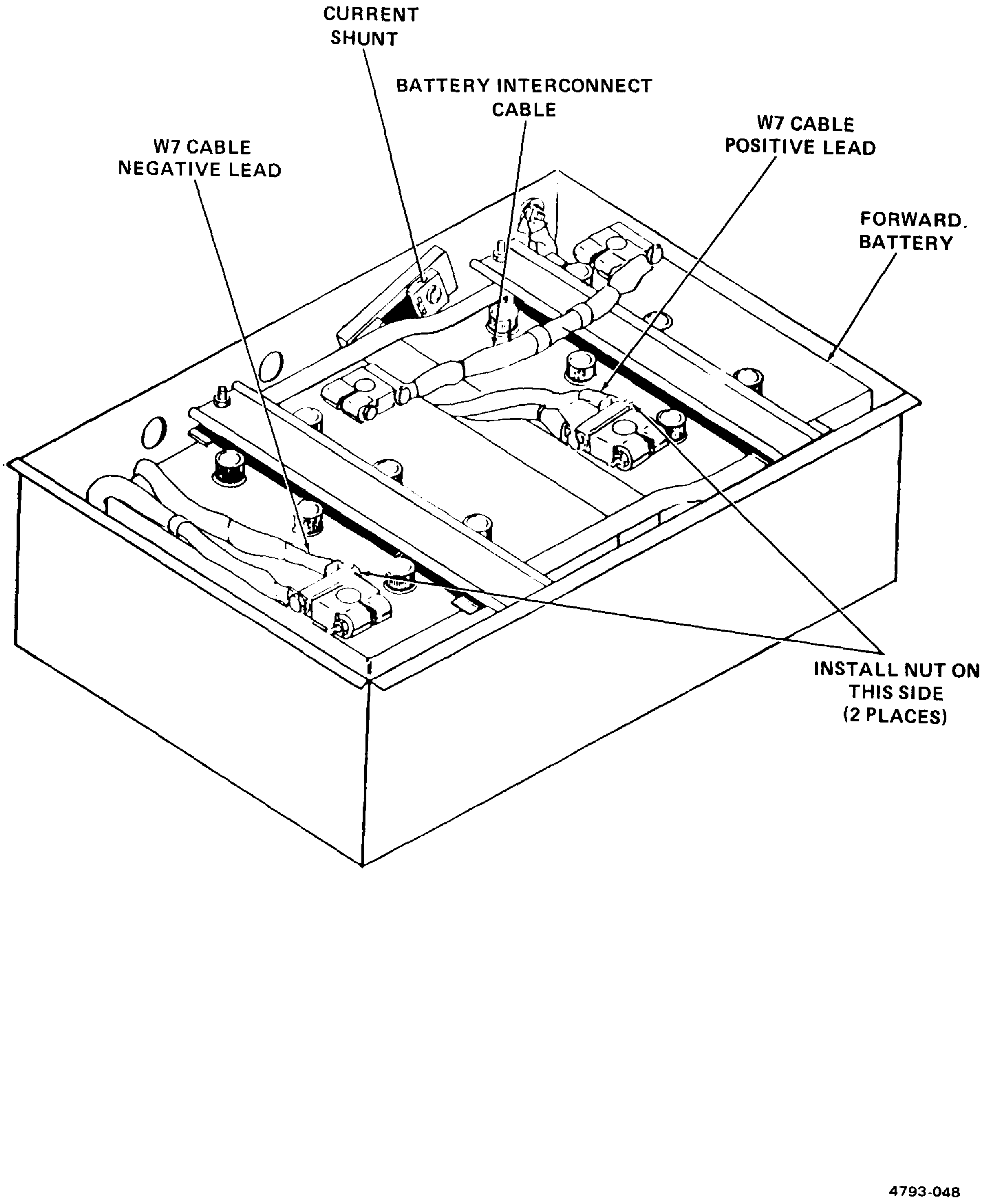


Figure 2-34. Battery Connections

(g) Route the branch of the W7 cable with the red band (wire marked positive) to the center of the battery compartment and connect to the positive post of the forward battery. Install the hardware so the W7 cable battery connection can be removed without removing the existing battery connection. Tighten the hardware using the 9/16-inch wrench.

(h) Install grommets, previously installed on cable branches, in both 1-inch holes (See figure 2-33).

(i) Replace the interconnect cable between the positive post of the rear battery and the negative post of the front battery. Tighten the hardware using the 9/16-inch wrench.

(j) Replace the vehicle ground cable and tighten the hardware using the 9/16-inch wrench.

(k) Replace the commander's seat; latch in place.

(l) Attach connector W7P1, on free end of cable W7, to power supply connector 3J4. The power supply is on the curb side of the PADS primary pallet as installed (see figure 2-35).

(m) Connect cable W6 (item 6, figure 1-5) from battery box to power supply connector 3J2 (see figure 2-35).

(8) Install the control and display unit (CDU) as follows:

(a) Unsnap CDU from its bracket on top of PADS primary pallet (item 2, figure 1-4). Route CDU and cable assembly W1 as shown in figure 2-35.

(b) Secure CDU to CDU bracket on the mounting frame using the two clamping catches (see figure 2-15).

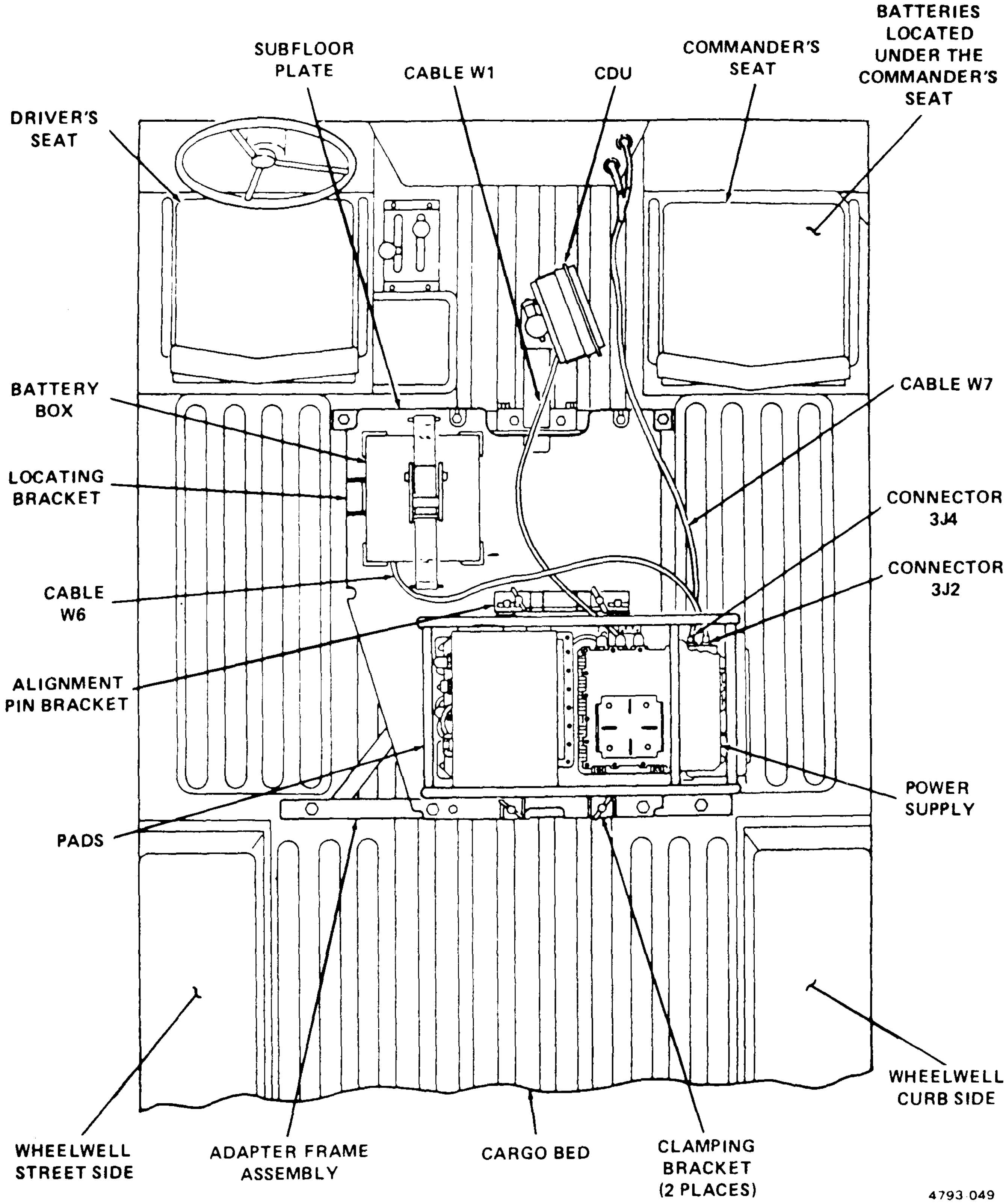


Figure 2-35. HMMWV Power Cable Installation

2-14. Installing PADS in M973 Series Small Utility Support Vehicle (SUSV).

a. **Preparation of Vehicle for PADS Installation.** Work should be performed in a heated, enclosed workshop free of grit, grime, dirt and dust. Ambient working temperature should be 15°C (60°F) or higher. All work to install PADS will be performed in front car. Prepare vehicle for installation as follows:

(1) **Removal of winch**. Winch is located in back seat area on right-hand side. Remove as follows:

(a) Remove 16-mm diameter L-shaped retaining pin from bottom of cradle that holds winch in place.

(b) Lift winch from cradle and stow in rear car with retaining pin.

(c) Open PADS battery box and remove belt assembly and strap winch to cargo tiedown hooks.

(2) **Removal of Right Rear Seat and Toolbox.** Remove as follows:

(a) **Deleted**

(b) Using 13-mm open end wrench, remove four bolts and washers securing SUSV toolbox and seat to the floor.

(c) Place the four bolts and washers in plastic bag and mark “Hardware for reinstalling toolbox. Use 13-mm open-end wrench.” Tie bag and stow in toolbox.

(d) Clean oil and dirt from seat and toolbox.

(e) Stow seat and toolbox in rear car. Secure with belt assembly to tiedown points in floor well.

(f) Remove rubber floor mat(s) from right rear side and stow in rear car.

(3) Cleaning the Vehicle. Clean as follows:

(a) Use diesel fuel solvent, or equivalent, and rags from shop supplies to remove grease and oil from rear compartment of front car where PADS will be installed. Clean mud and grime from underside of vehicle in area of the four bolt holes which held the toolbox.

(b) Finish the cleaning by using scrub brush, soap. water, and bucket obtained from shop supplies. Rinse with clean water and dry.

(4) **PADS Cable Arrangement.** Locate cable tie mounts for securing PADS cable assembly W102 as follows (see figure 2-36).

(a) Mark locations on vehicle, using chalk, for cable securing points as shown in figure 2-36. (There will be approximately 24 securing points running up the right rear comer, across the top, and down the left rear comer.)

(b) Obtain the epoxy adhesive and cable tiedown plates from the installation kit. Obtain a small container fur mixing adhesive, a sheet of medium grit sandpaper, and masking tape from the shop supplies.

(c) Rough up the fiberglass surface at each chalk mark with sandpiper and dust the surface. Keep the surface clean and free of oil and grease.

(d) Using small container and stirrer, mix enough epoxy adhesive to fasten the tiedown plates at the chalk markings. Apply epoxy adhesive to both surfaces. Use masking tape to hold the tiedown plates in place until epoxy hardens.

(5) **Removal of Right Rear Door Handle.** Remove the door handle as follows:

(a) Using a 10-mm open-end wrench, remove three bolts holding right rear door handle (bar). Remove handle.

(b) Place two bolts in a plastic bag and mark. “Hardware for attaching right rear door handle. Use 10-mm open-end wrench." Tie bag and attach it with another tie the the handle.

(c) Place door handle with attached bag in SUSV toolbox.

(d) Replace remaining bolt in door lock mechanism (far right).

(6) **Removal of Right Rear Seat Belt.** Remove seat belt as follows:

(a) Using 17-mm open-end wrench, remove two bolts and one locknut securing seat belt.

(b) Outboard bolt can be reached and removed from inside the vehicle.

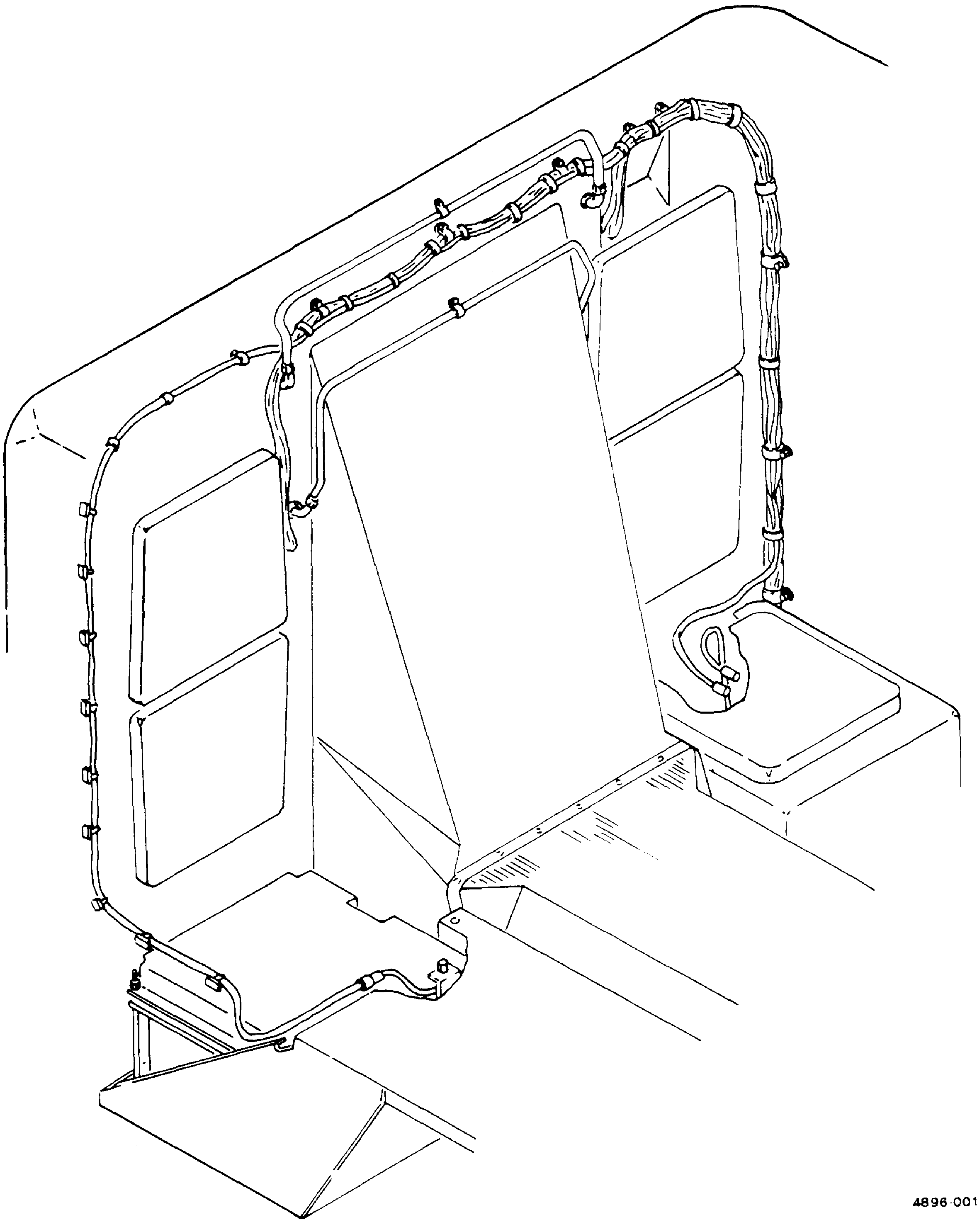


Figure 2-36. Example of Cable Tiedown Installation on SUSV

(c) Inboard bolt goes through the hull and has a locking nut on the inside, This nut can be reached from the inside of the vehicle by removing the engine cover and reaching down to the left, or preferably, accessed from the outside rear of the vehicle next to the muffler to the right.

(d) Remove bolts and seat belt.

(e) Replace two bolts. Tighten bolts.

(f) Fold seat belt, place in a plastic bag, and mark “Seat belt for right rear passenger seat. Use 17-mm open-end wrench.” Tie bag and stow in SUSV toolbox.

(7) **Removal of Engine Compartment Access Panel.** Remove access panel as follows:

(a) Open right front door and unsnap clip to release tension on engine access panel. Remove the lower right acess panel from engine compartment using flat-tip screwdriver to loosen five slotted captive screws. See figure 2-37.

(b) Remove the two bottom screws from the panel by removing the nylon retainers from rear of the panel.

(c) Place retainers in a plastic hug and mark “Front right engine panel screw retainers. ” Tie bag and stow in SUSV toolbox.

(d) Reinstall access panel with two bottom screws. Do not tighten lower two screws.

(8) Removal of Heater Access Cover and Brace- Remove cover and brace as follows:

(a) Using a 10-mm open-end wrench. remove six bolts securing beater access cover and brace located just forwward of the engine access panel (see figure 2-37). Reinstall bolts loosely.

(b) Place cover and brace in a plastic bag and mark “Heater access cover and brace for small opening at bottom right front of engine cover. Use 10-mm open-end wrench to install.” Tie bag and stow in SUSV toolbox.

(9) **Removal of Dash Panel Handle.** Remove as follows:

(a) Using a 13-mm open-end wrench, remove two bolts holding dash panel handleon dash panel on right-hand side of vehicle. See figure 2-37.

(b) Place bolts in a plastic bag and mark “For attaching dash panel handle. Install with 13-mm open-end wrench.” Tie bag and attach to dash panel handle. Set aside for later use.

(10) **Removal of Battery Box Cover.** Remove cover as follows:

(a) Open left rear door, unclip and remove battery box cover which is the bottom part of the rear seat. Set cover aside, to be replaced later.

(b) Disconnect cable to negative terminal (rear end of battery) using 13-mm open-end wrench. See figure 2-38.

(c) Disconnect connector P42 from cable to forward end terminals of the batteries.

(d) Disconnect the negative cable from the heater plate at rear end of batteries, using 13-mm open-end wrench. Pull negative cable forward for later working room clearance.

(11) Removal of Clips. Remove clips as follows

(a) Open left front door. Using a 10-mm open-end wrench, remove two bolts securing clip to driver’s seat support (see figure 2-39).

(b) Remove two bolts securing clip to driver’s backrest support.

(c) Remove the clips and reinstall the four lo-mm bolts loosely in supports to be used later.

(d) Place the two clips in a plastic bag and mark, “Clips to driver’s seat and backrest supports. Reinstall with 10-mm open-end wrench.” Tie bag and stow in Susv toolbox.

(12) **Removal of Upper Engine Access Cover.** Remove cover as follows:

(a) Cover extends half length of front ear.

(b) Unlatch fasteners at locations over its length.

(c) Stow cover in rear car until needed.

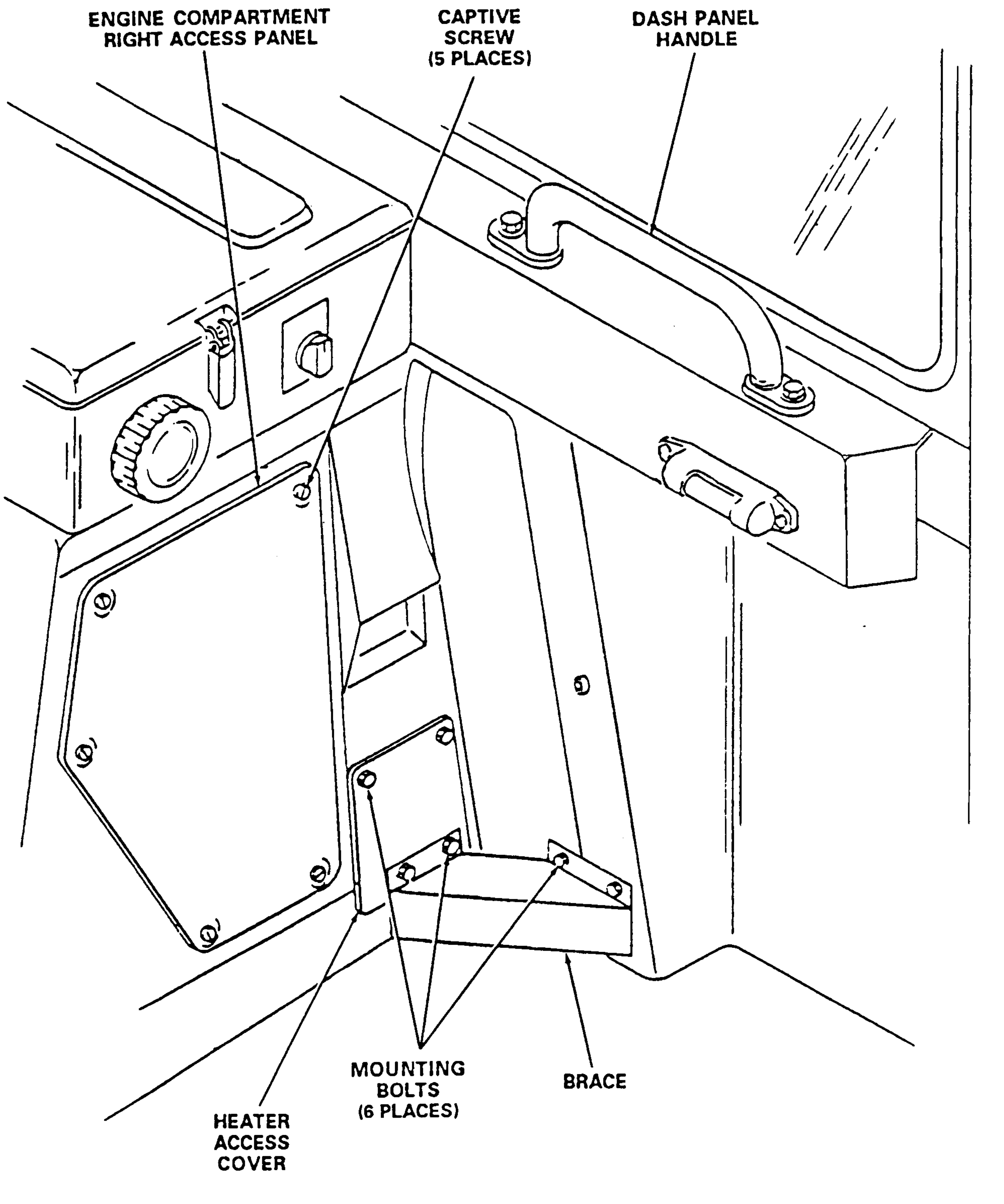


Figure 2-37. Removal of SUSV Engine Compartment Access Panel, Brace and Dash Panel Handle

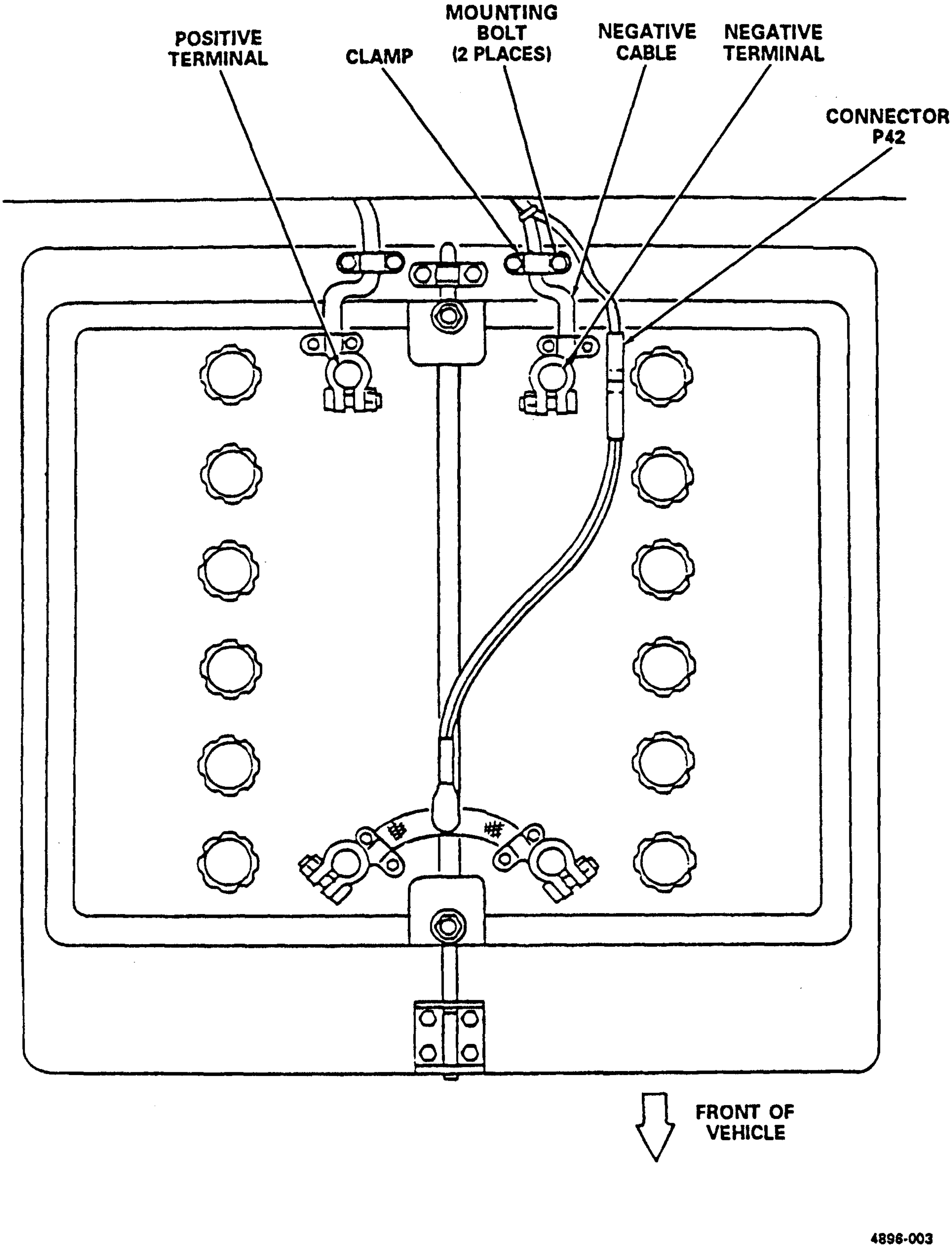


Figure 2-38. SUSV Battery Terminal Connections

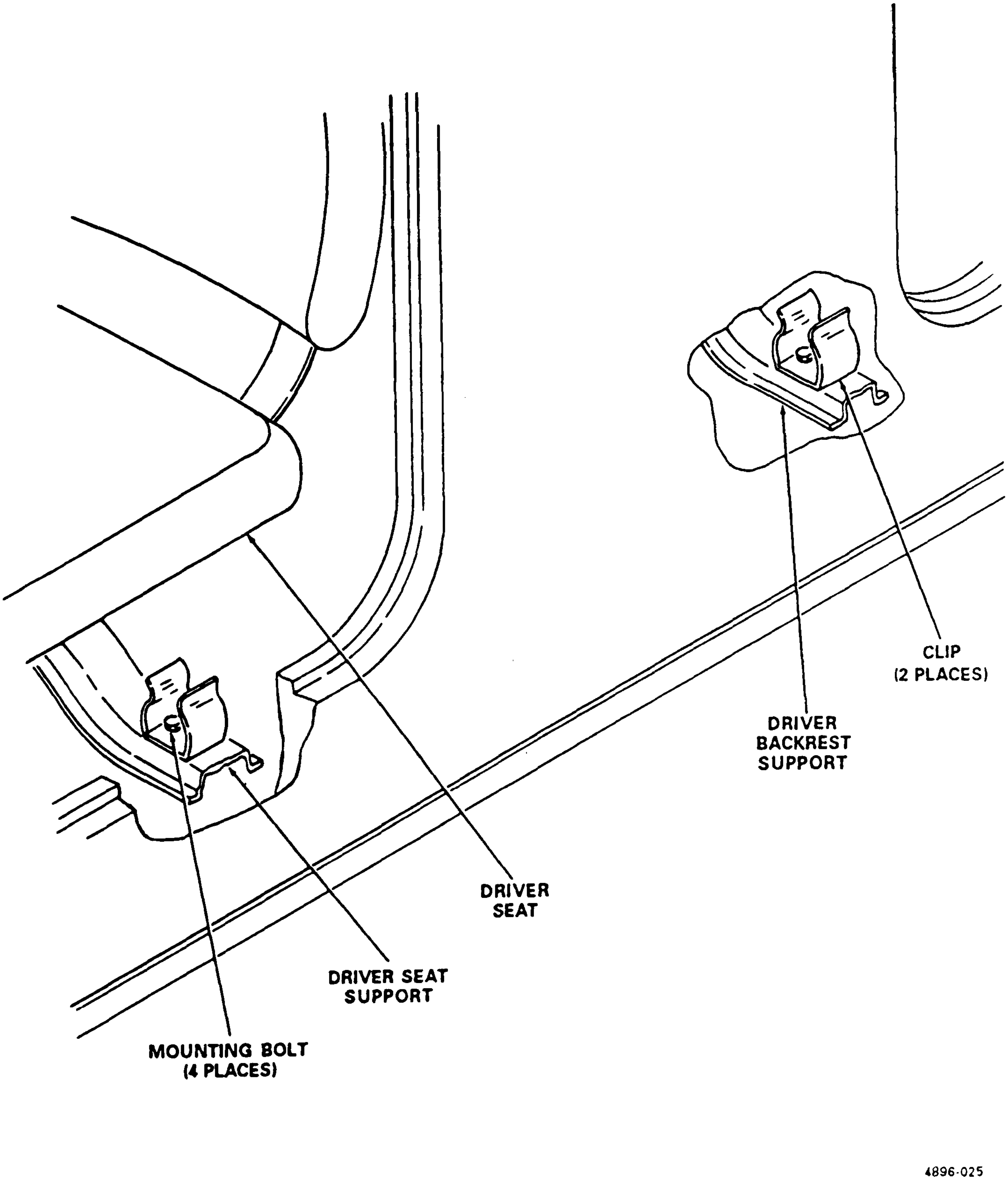


Figure 2-39. *Location of Clips on Driver's Seat* and Backrest *Supports*

b. SUSV PADS Modifications. Before PADS can be installed, the SUSV inner body must be drilled to provide a hole for the battery vent tubing and the vehicle wiring harness must be modified, These operations must be performed by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.

c. SUSV Kit Installation.

(1) **CDU Mount Installation**. Obtain the following items from the SUSV installation kit and proceed as follows: lower bracket (item 19, figure 1-7), upper plate (item 20, figure 1-7), radial washer (item 21, figure 1-7), mount tube (item 22, figure 1-7), clamp (item 23, figure 1-7), CDU mounting bracket (item 24, figure 1-7), quick-release pin (item 25, figure 1-7), chain (item 26, figure 1-7), two O-rings (1.478-1 .490 ID), one .375 -24UNF x 1.75 lg bolt one .375 flat washer, two .312-24UNF x .875 lg bolts, two .312 flat washers, and one no. 6-32UNC-2A x .312 lg screw.

(a) Remove four of the six bolts for the heater access plate and brace from the SUSV (see figure 2-37). Obtain the lower bracket from kit.

(b) Install lower bracket using existing hardware. Hand-tighten, See figure 2-40.

(c) Retrieve dash panel handle and the two bolts and upper plate from kit.

(d) Place dash panel handle on top of upper plate, align holes, insert bolts, and hand-tighten.

(e) Attach tube to lower bracket using radial washer, 3/8 bolt, and flat washer. Hand-tighten.

(f) Fit clamp around tube at the top and attach to upper bracket using two 5/16 belts and flat washers. Hand-tighten.

(g) Check that all hardware is in place without stress. Tighten all bolts and screws.

(h) Attach quick-release pin and the 10-inch long piece of chain using No. 6-32UNC-2A x .312 lg screw on CDU mounting bracket.

(i) Install two O-rings on mount tube in slots provided.

(j) Install CDU mounting bracket on mount tube and secure with quick-release pin.

(2) **Cable W1 Installation** Obtain two cable clamps (item 27, figure 1-7) from installation kit and CDU cable W1. Place the two clamps from the kit around cable W1 near connector WlP1 and 4J1 and, with the screwdriver, install screws in bottom two holes of the engine access panel. The cable should be loose in the clamps so it can slide back and forth.

(3) **Plumb Bob Assembly Installation**. The plumb bob assembly fits just inside the left front of vehicle, beside the driver. Obtain, from the installation kit, the plumb bob assembly (item 28, figure 1-7) (it includes the plumb bob arm and the support). See figure 2-41 and install assembly as follows:

(a) Using a 10-mm open-end wrench, install the plumb bob bracket on the driver’s seat and backrest supports located inside the driver’s door. Use the four bolts loosely installed in the supports.

(b) Install the bracket so that the pin for rotating the plumb bob arm is located to the front of the vehicle as shown in figure 2-41.

(4) **Frame Assembly Installation**. Obtain floor support plate (item 29, figure 1-7), frame assembly (item 30, figure 1-7), and four M8 x 1.25 mm x 50 mm long bolts, flat washers, lockwashers, and nuts from the installation kit. Refer to figure 2-42 and proceed as follows

(a) Insert the four bolts into the tapped holes in the floor of the vehicle from the inside.

(b) Thread bolts by hand or use a 13-mm wrench, full length into the holes to clean threads.

(c) Remove bolts from holes.

(d) Place frame assembly into the vehicle with battery compartment located to the rear.

(e) Align the four holes of the frame (in battery compartment) with threaded holes in the vehicle floor.

(f) Place floor support plate underneath the vehicle, aligning holes with frame assembly, Apply anti-seize compound, from installation kit, to the bolts, and thread from underneath the vehicle through the holes to the inside. Tighten bolts to pull the plate into position flush with the outside of the vehicle. Add washers and nuts and hand-tighten.

(g) Align the forward end of frame assembly with two holes on the passenger seat rails.

(h) Bolt the forward end of frame to seat rails using two 5/16-24 UNF bolts, nuts, and washers from kit. Hand-tighten.

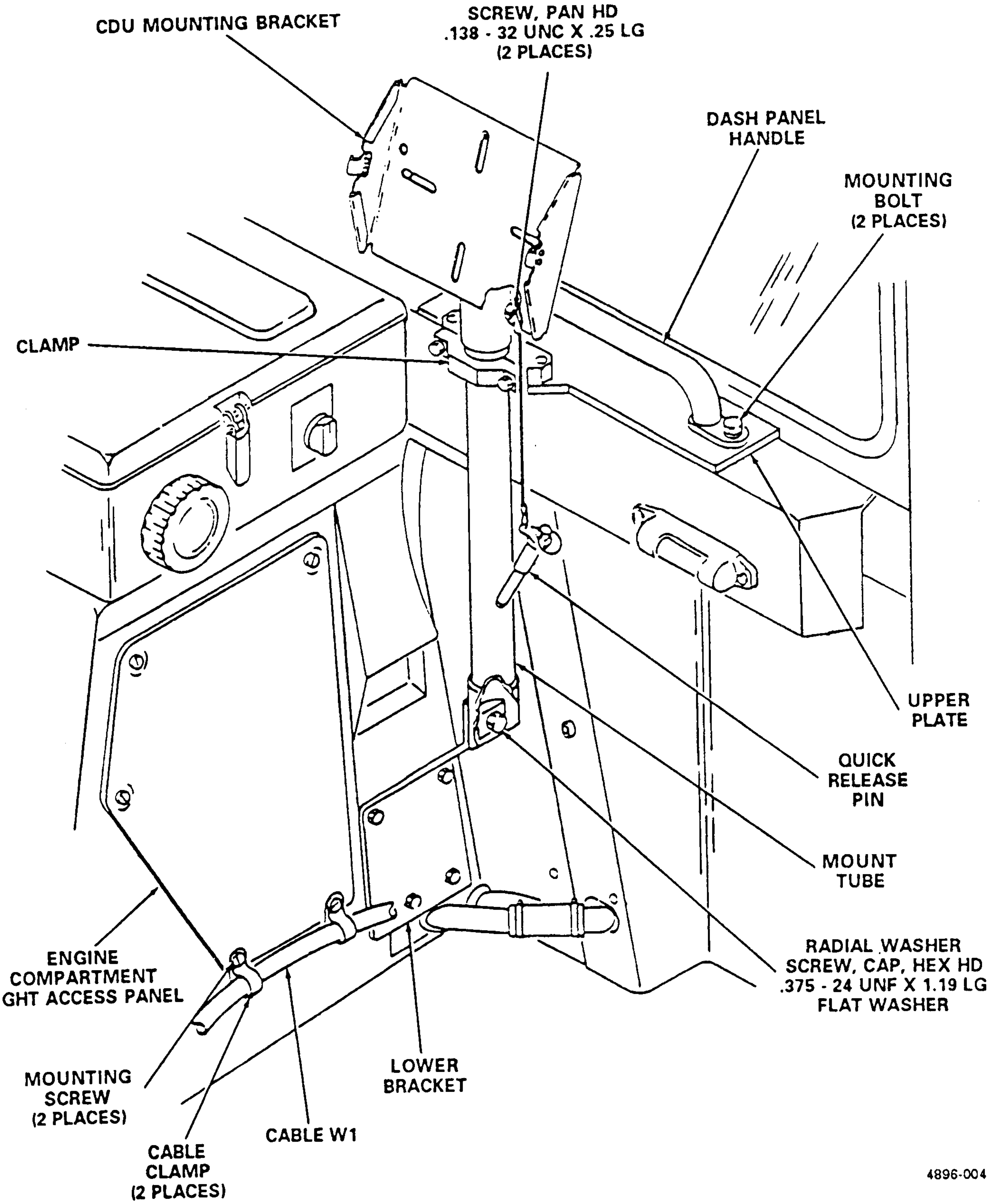


Figure 2-40. CDU Mount Installation

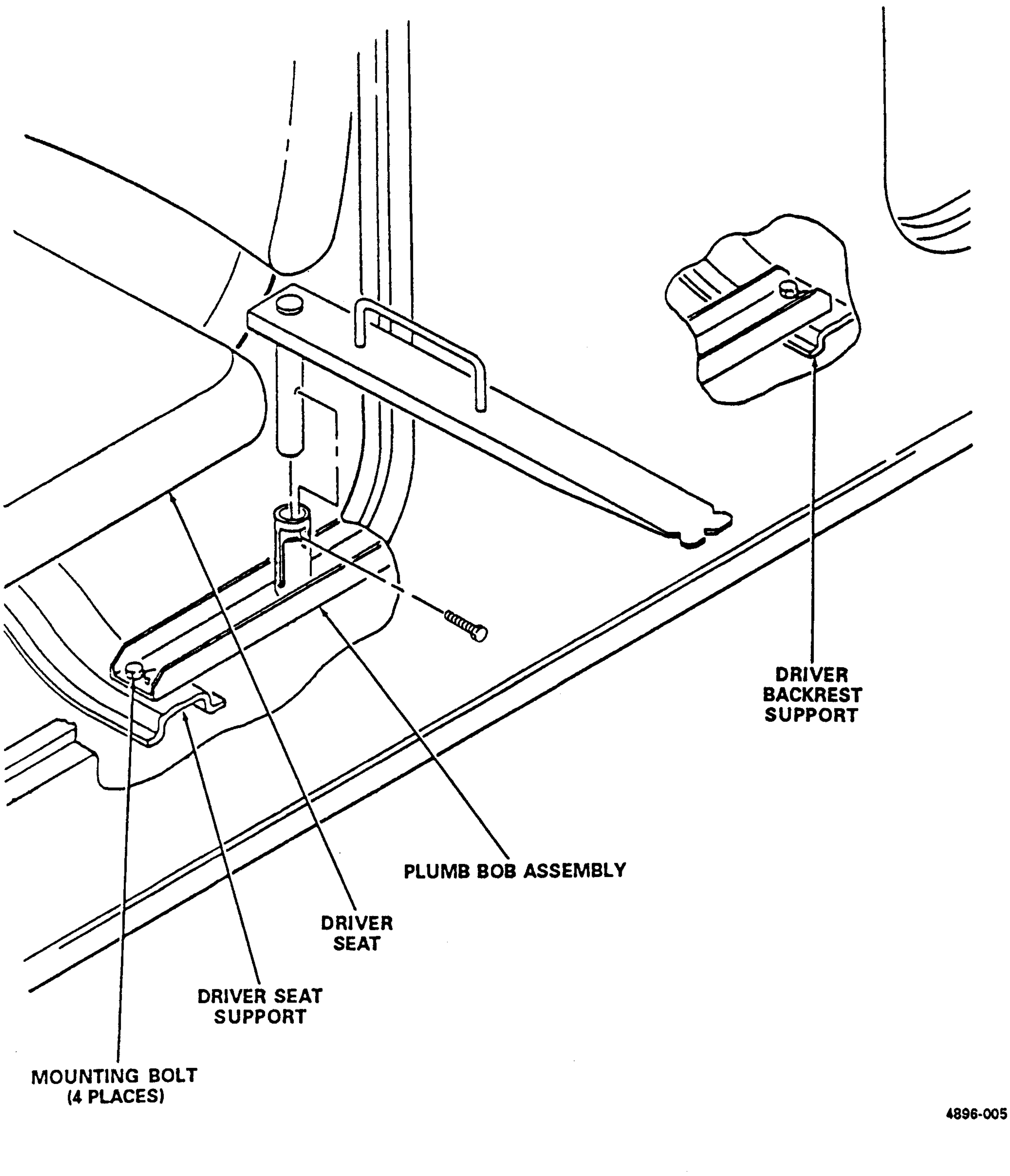


Figure 2-41. Plumb Bob Assembly Installation

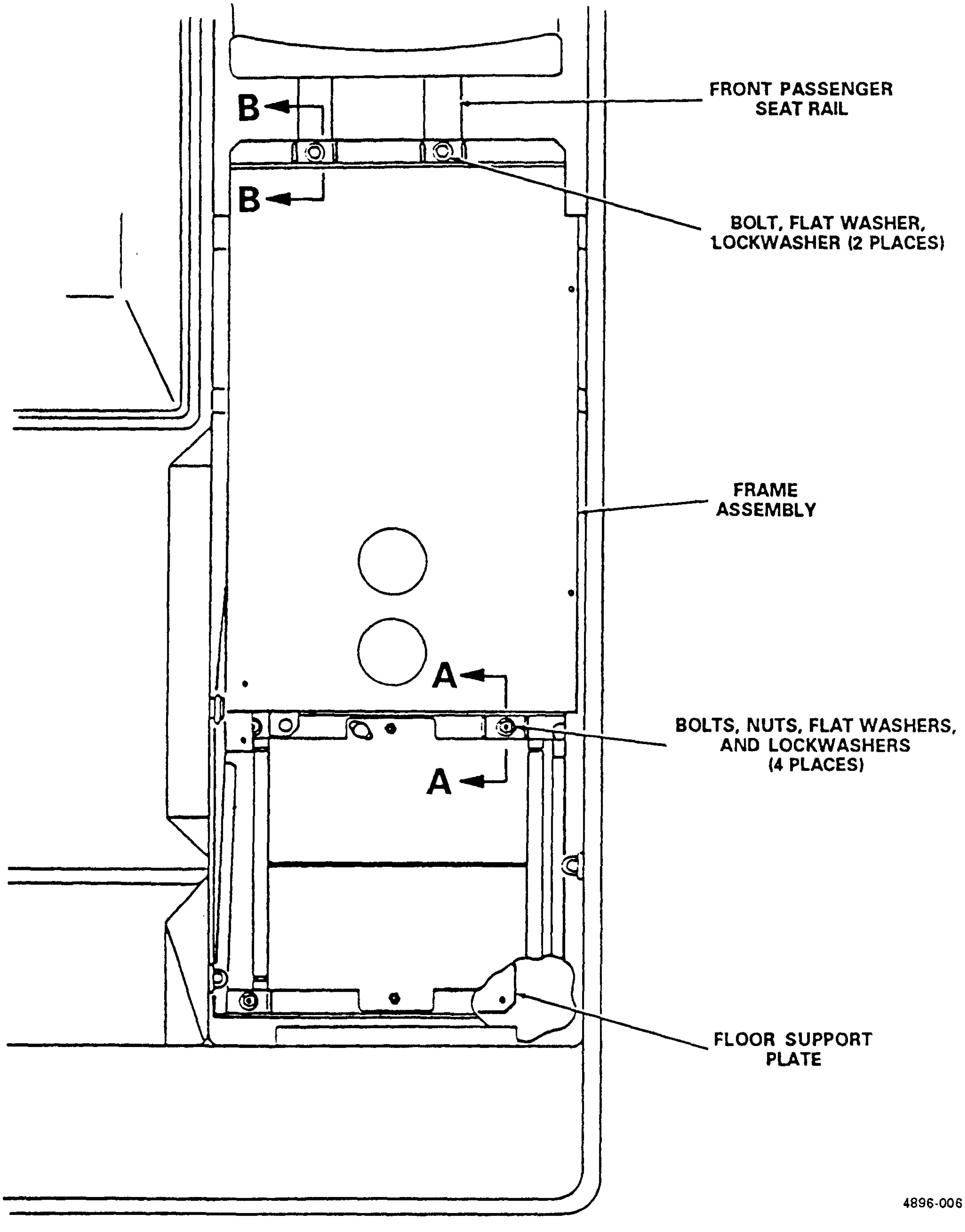
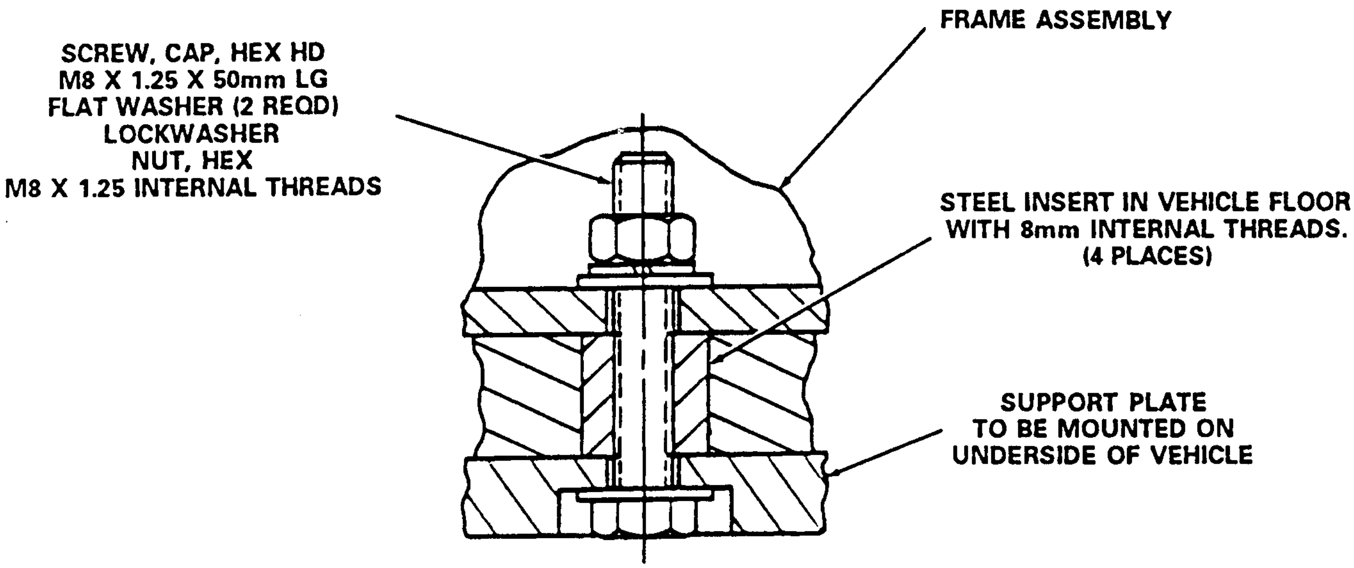
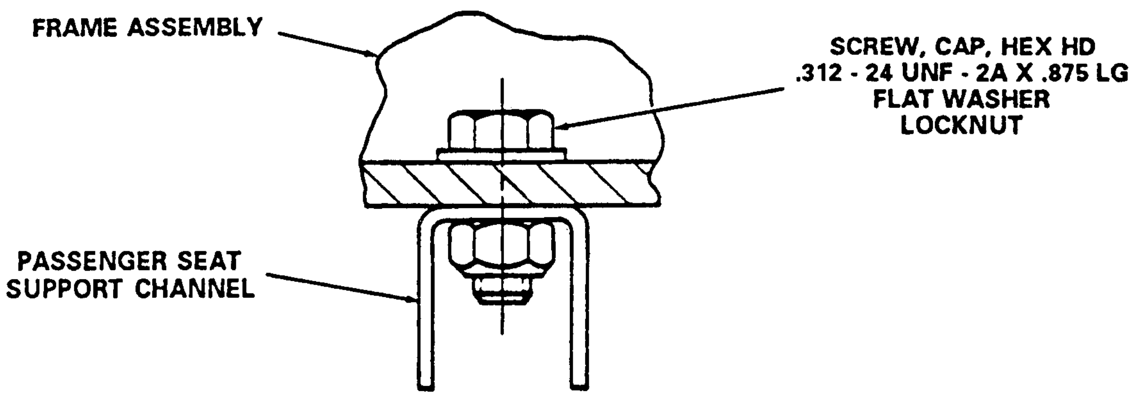


Figure 2-42. Frame Assembly Installation (Sheet 1 of 2)



SECTION A - A
4 PLACES



SECTION B - B
2 PLACES

4896-007

Figure 2-42. Frame Assembly Installation (Sheet 2 of 2)

(i) Force the frame forward and into the vehicle. This provides hole-bolt registration. Tighten all hardware.

(5) **Cable Installation**

(a) Obtain cable W102 and cable ties from the installation kit.

(b) Route the harness loosely with cable connector J103 adjacent to PADS battery area and connector P104 adjacent to the vehicle battery area. Install the cable in the rear area of the vehicle and secure loosely with the cable ties. See figure 2-43.

(c) Connect cable connector P104 to connector J104. Check harness routing to be sure it is not pulled tight in any area.

(d) Connect connector P103 to cable connector J103 and reposition cable so there is equal slack at both ends.

(e) Tighten all cable ties.

(6) Installation of Kit Batteries. Obtain two functional batteries, including vent hose and fittings. Obtain battery retainer frame assembly and four hooks from installation kit. Install as follows:

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc., must be removed.

To prevent injury to personnel or damage to equipment, when disconnecting a battery, remove negative cable from battery post first; when connecting a battery, connect negative cable last.

Batteries are acid-filled batteries which may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water; if it touches the eyes, flush immediately with water for 30 minutes and see a physician without delay.

(a) Install the two batteries in rear, lower portion of frame. Place aft battery with positive terminal inboard and the forward battery with negative terminal inboard. See figure 2-44.

(b) Place the battery retainer over the top of the batteries and secure in place with the four battery retainer J-hooks, washers, and nuts.

NOTE

Before performing step (c), below, verify that vent tubing hole has been drilled in vehicle inner body by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.

(c) Install tubing and fittings to vent the two batteries (figure 2-44).

(d) Obtain W6 and W11 cables from the instllation kit.

(e) Inspect all battery terminal adapters and cable assemblies W6 and W11. Perform maintenance, if required, in accordance with TM 9-6140-200-14.

(f) Clean all pieces with a solution of baking soda and water and bristle brush, or use a wire brush obtained from shop supplies/tools.

(g) Burnish all contact surfaces with a battery burnishing tool or wire brush from shop tools.

(h) Connect battery terminal adapters and covers to both lugs of cable assembly W6 and cable assembly Wl1.

(i) Connect battery terminal adapter of positive branch of cable assembly W6 to positive post of battery as shown in figure 2-44. Secure by tightening nut on battery terminal adapter.

(j) Connect battery terminal adapter of cable assembly W6 negative branch to negative post of other battery as shown in figure 2-44. Secure by tightening nut on battery terminal adapter.

(k) Connect positive battery terminal adapter of cable assembly W11 to positive post of other battery as shown in figure 2-44. Secure by tightening nut on battery terminal adapter.

(1) Connect negative battery terminal adapter of cable assembly W11 to negative post of first battery as shown in figure 2-44. Secure by tightening nut on battery terminal adapter.

(m) Obtain a multimeter from shop tools and measure voltage of W6-P1 with the plus (+) input of the multimeter on P1-A, B or C. Measure 12 volts direct current (VDC) to the outboard terminals. Then with the plus(+) input of the multimeter, measure 24 volts direct current to P1-F, G, or H. If these battery voltages canot be achieved, check the hookup (configuration) or replace batteries.

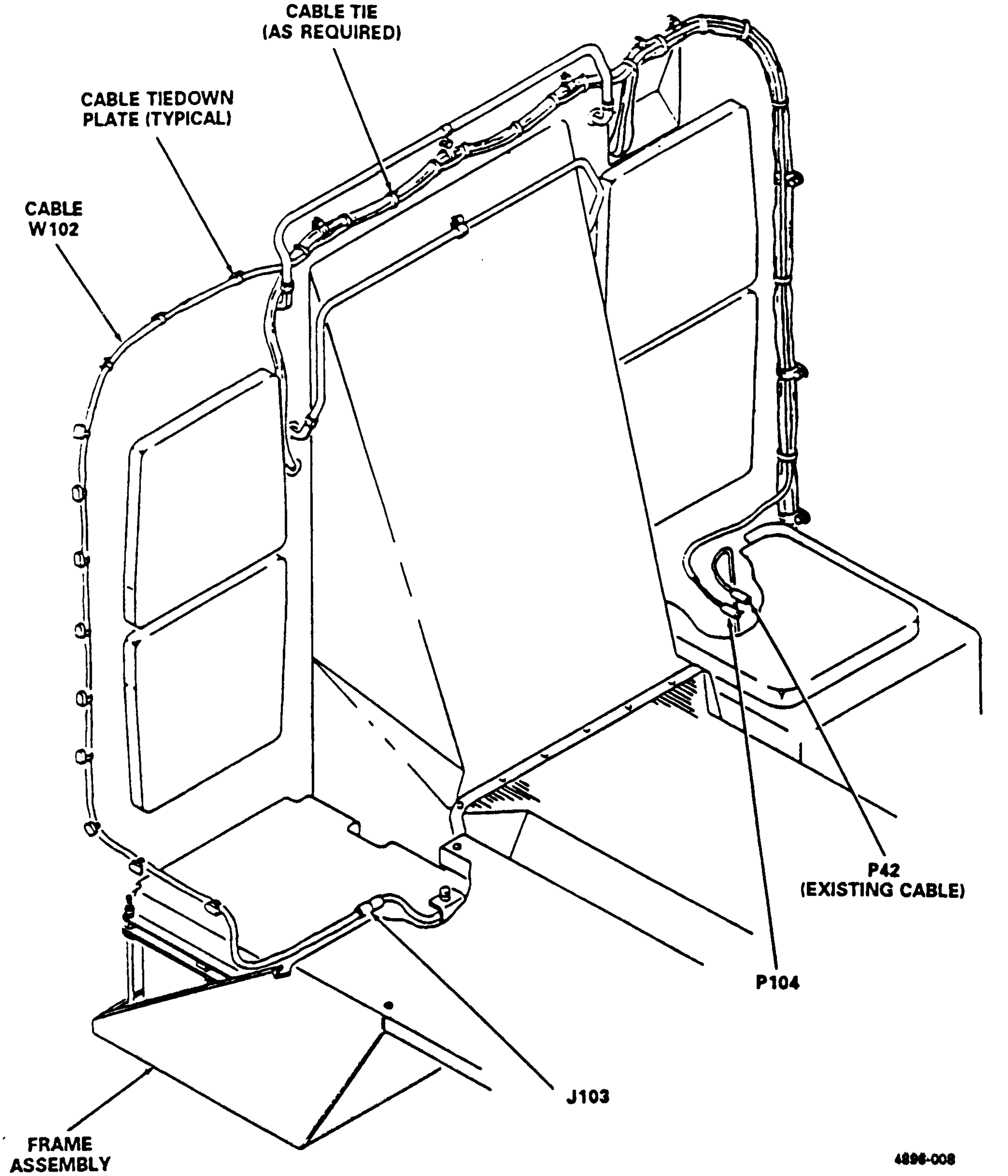


Figure 2-43. Cable Assembly W102 Installation

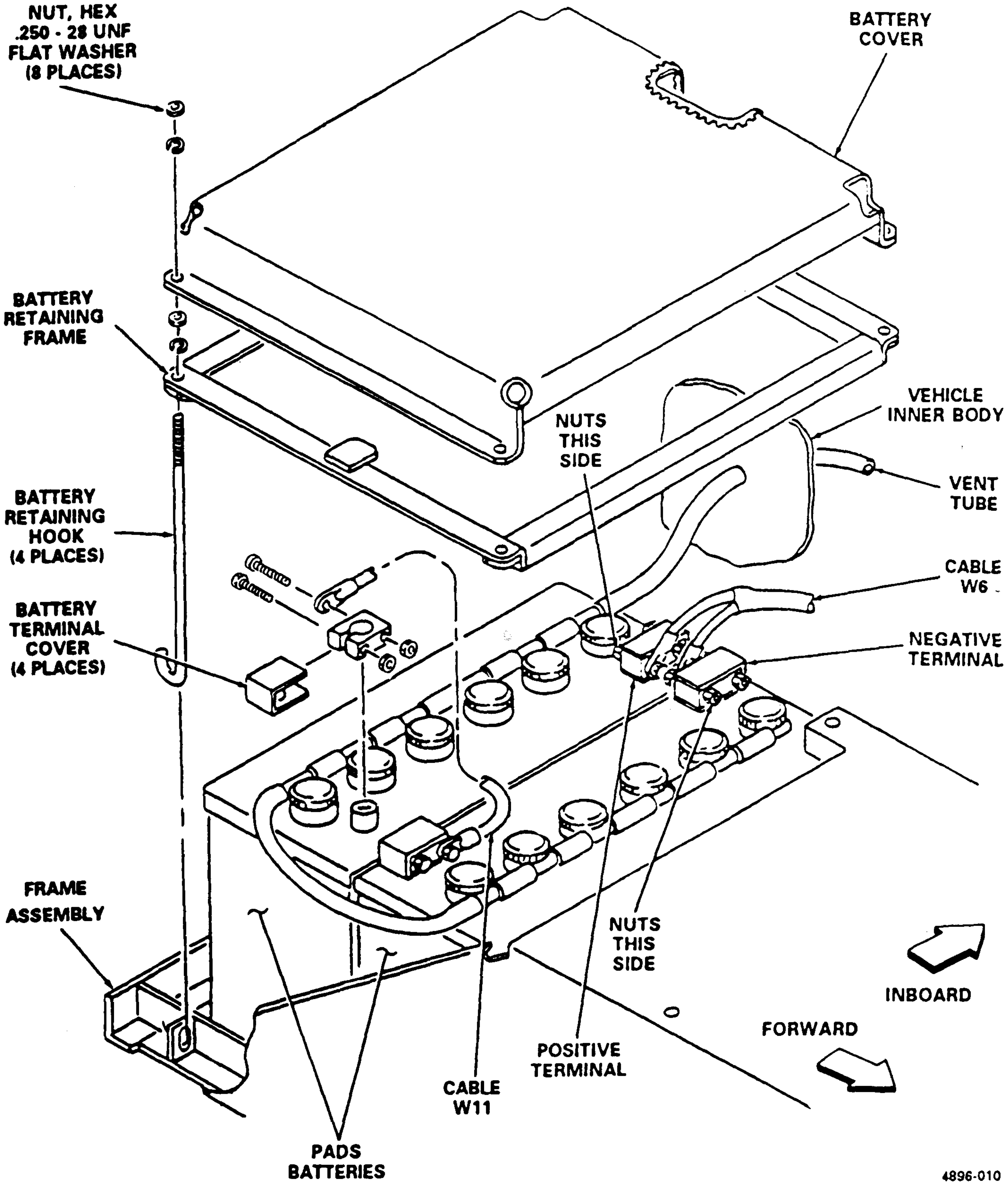


Figure 2-44. SUSV PADS Battery Installation

(7) **Installation of System Cables.** Obtain the following items from installation kit: cable W100, power cable connector assembly, and connector adapter. Obtain cable W7 from the PADS. Using an adjustable wrench and flat-tip or cross-tip screwdriver, install the two lugs of cable W100 and the two lugs of cable assembly W7 to the connector as follows (see figure 2-45):

(a) Remove back of connector, Remove the existing terminal bolts.

(b) Install red-banded lug (wire marked positive) of cable W7 and positive wire of cable W100 to the positive terminal of the connector (center post).

(c) Install black-banded lug (wire marked negative) of cable W7 and negative wire of cable W100 to the negative terminal of the connector.

(d) Tighten hardware to secure lugs, replace back of connector, and tighten all bolts and screws.

(e) The connector shall be identified as J16.

(f) Using approximately eight cable ties, evenly spaced, tie the W7 and W 100 cables together the full length. See figure 2-45.

(g) Install the connector adapter in the auxiliary starting connector P16, beneath the driver's seat. See figure 2-46.

(8) Power Check. To check the power output of the system, refer to figures 2-47 and 2-48 and proceed as follows:

(a) Reconnect SUSV batteries, as follows:

1 Connect negative cable from heater plate to negative terminal (rear end) of batteries. See figure 2-38.

2 Connect connector P42 to positive terminal (forward end of batteries).

3 Connect cable to negative terminal.

(b) Plug connector J16 into connector P16 adapter below driver's seat (see figure 2-46). Use multimeter and check for +24 VDC from J100-1(+) to J100-2(-), and from J100-1 (+) to engine block (-).

(c) Check cable W7 for 24 VDC from W7P1-A(+) to W7P1 -K(-) and W7P1 -A(+) to engine block (-).

(d) Start vehicle engine. Measure 24 VDC from J103-1(+) to the engine block(-). Shutdown the engine.

(e) Connect J100 to P100, J101 to P101, J102 to P102, J103 to P103, and J105 to P105.

(f) Cool thermostat on the PADS battery heater to 40° F.

(g) Start SUSV engine. L100 should light (adjust for individual intensity).

(h) Heat thermostat to above 60°F.

(i) At approximately 60°F, light L100 should go out.

(9) Clean Up.

(a) Reinstall the left rear seat/battery cover and secure.

(b) Remove cable assembly and connector adapter from auxiliary starting connector P16 and put cap in place.

(c) Retrieve top engine access cover from rear car, reinstall, and secure in place.

(d) Place protective cap on W6 cable connector 3J4.

(e) Install battery cover. See figure 2-44.

(f) Cheek all bolts and screws to ensure they are tight.

(10) PADS Preparation. Obtain the PADS and the right bracket and left bracket, four 3/8-24 UNF-2A x 1.75 long bolts, and nuts from the installation kit. Then proceed as follows:

(a) On the PADS, disconnect three interconnecting cables W3, W4, and W5 at the power supply. See figure 2-49.

(b) Remove the power supply from the PADS by loosening the four Allen head screws (using appropriate Allen wrench) holding the power supply in the rack. Refer to TM 5-6675-308-34 if additional instructions are required.

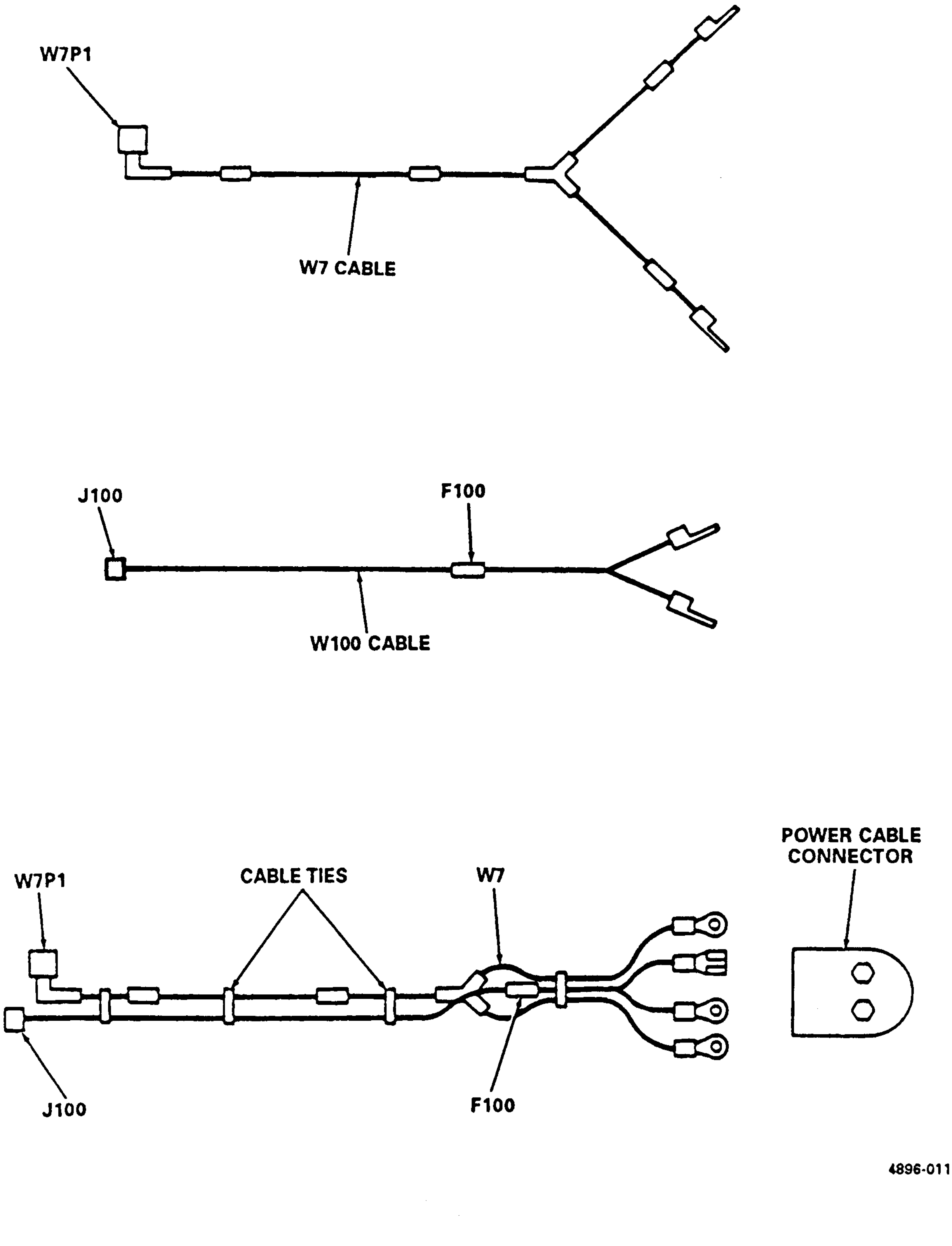


Figure 2-45. Power Cable Assembly and Installation

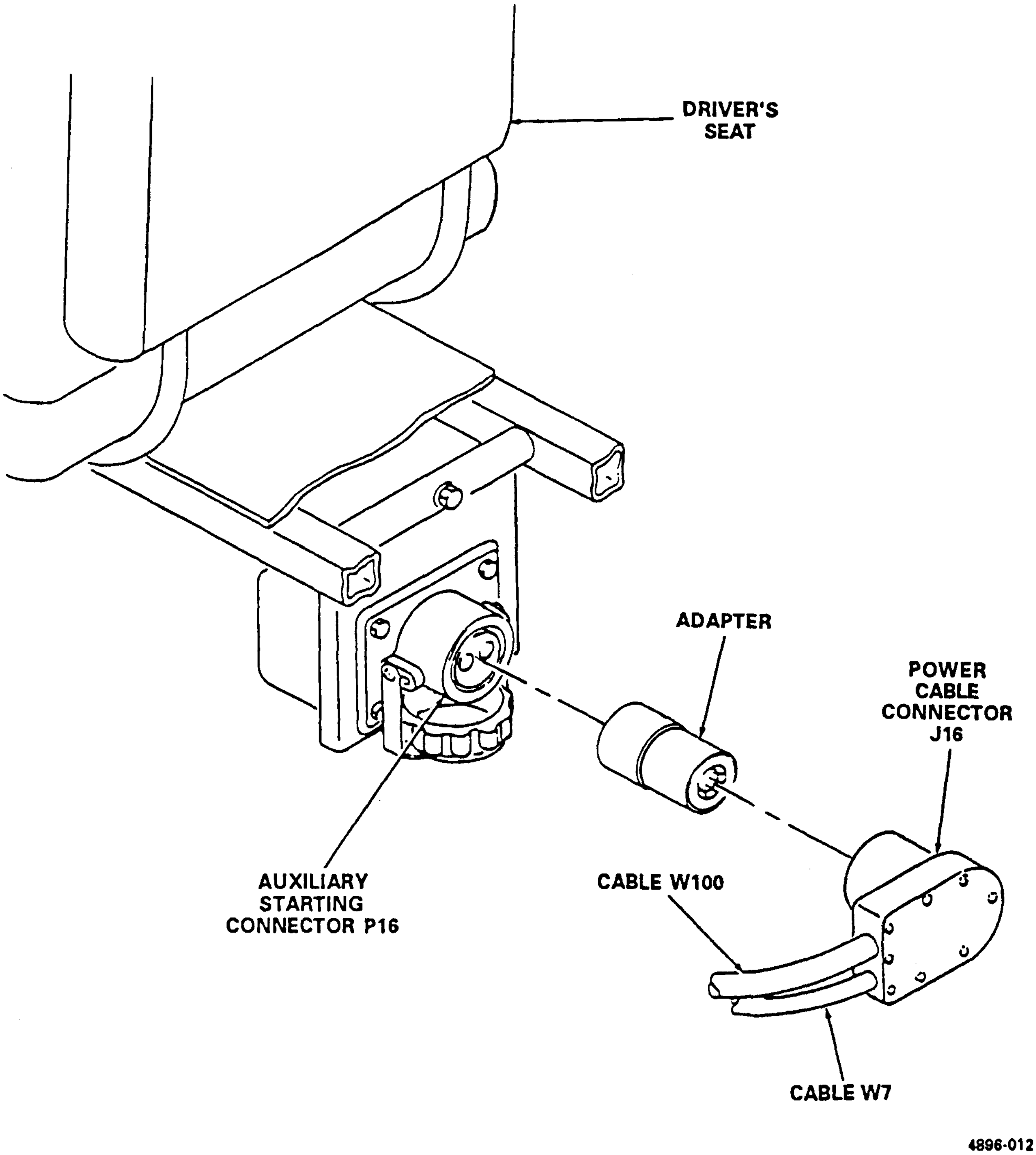


Figure 2-46. SUSV Auxiliary Starting Connector P16

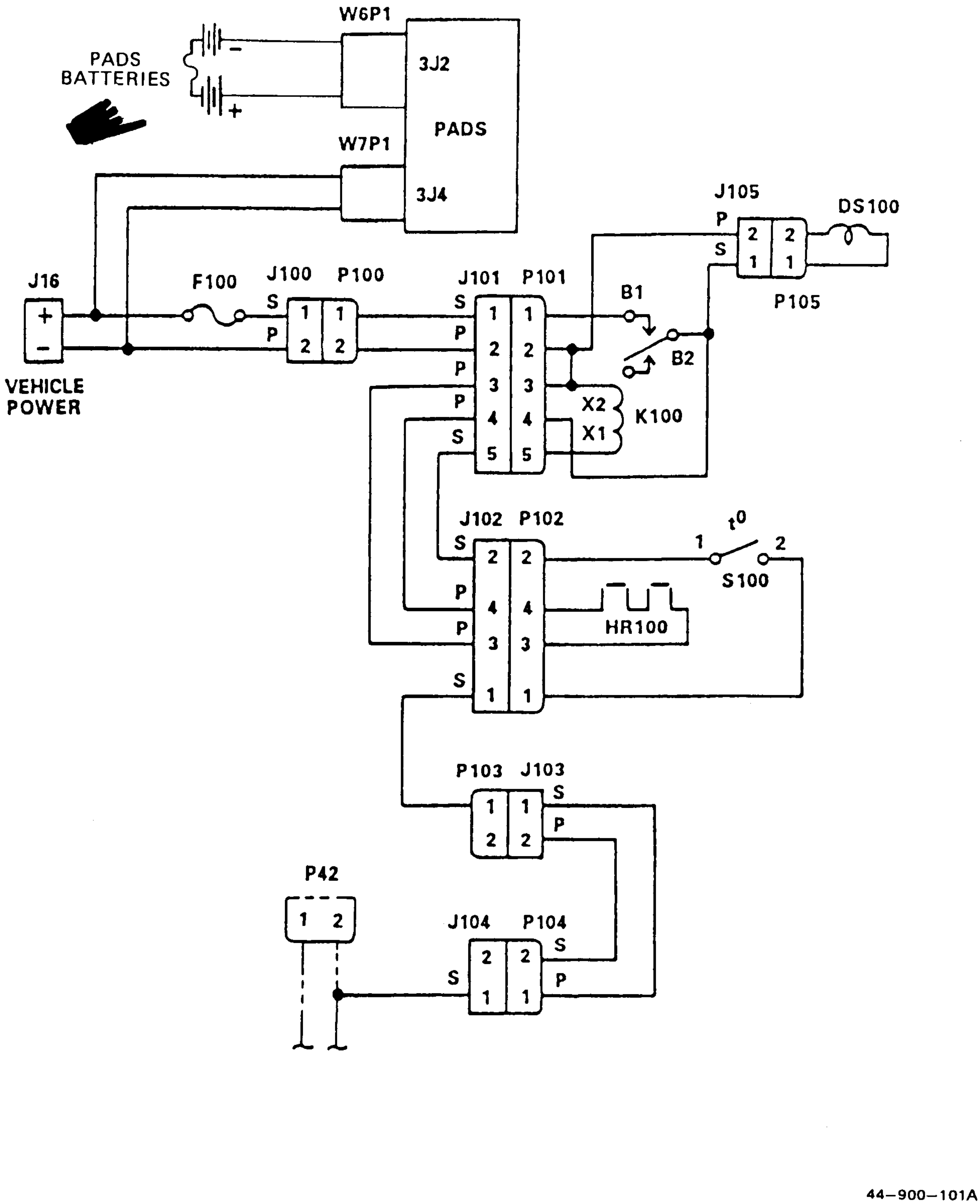


Figure 2-47. PADS Installation Schematic Wiring Diagram

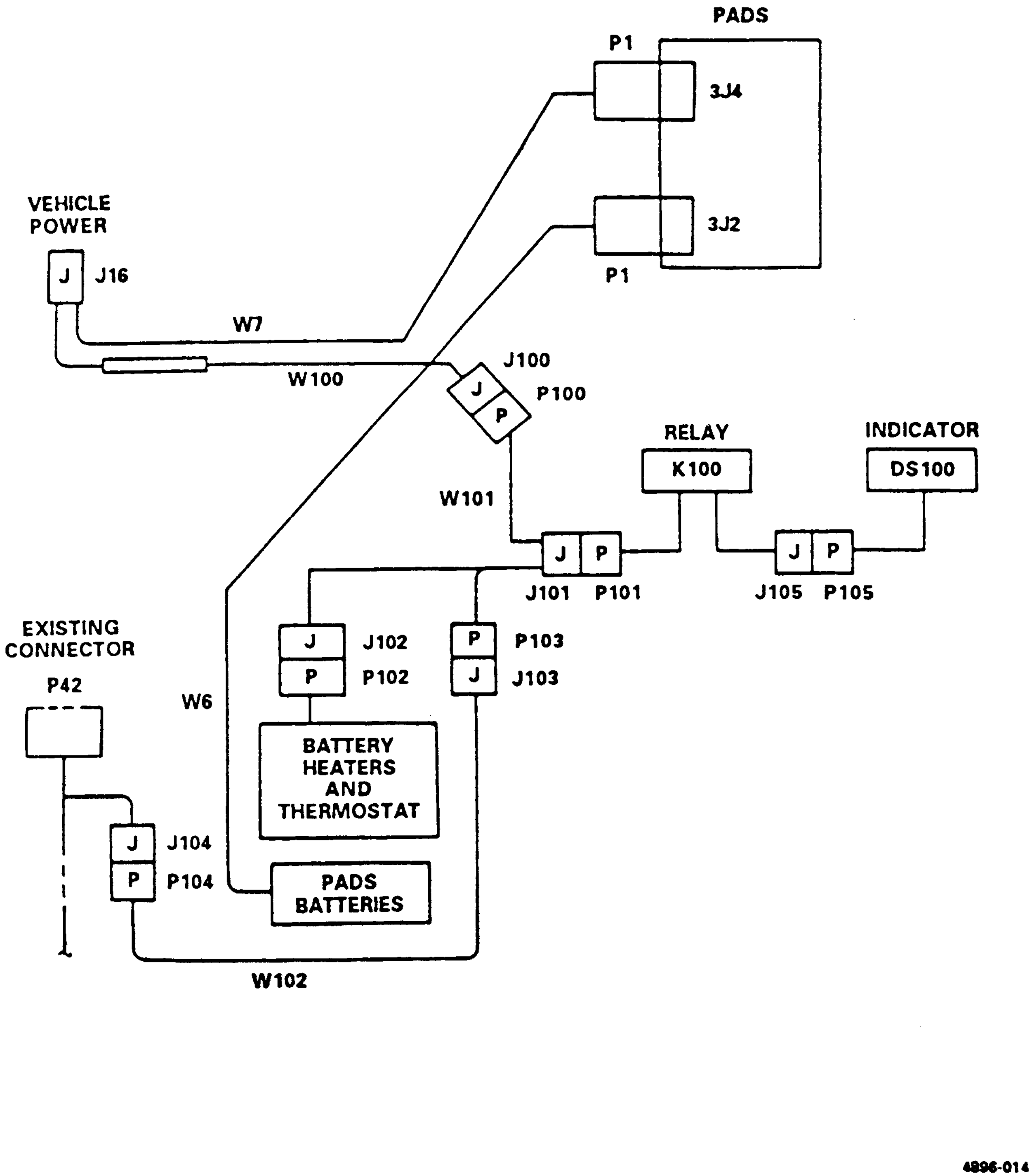


Figure 2-48. PADS installation Power Cabling Diagram

(c) Remove the power supply and stow in a safe location until needed.

CAUTION

Do not lift IMU by porro prism cover.

(c.1) Disconnect the four connectors to the IMU. Loosen the two Allen screws holding the IMU to the frame. Remove the IMU from the pallet and stow with power supply.

(d) Using 9/16-in. and 5/8-in. open-end wrenches, secure the left and right brackets (31 and 32, figure 1-7) to the PADS primary pallet. The right bracket is attached to the side of the frame containing the Porro prism. See figure 2-50. Apply sealing compound. MIL-S-22473, Grade C, to the threads after assembly.

(e) Remove the plumb bob bracket by removing four Phillips head screws, using Phillips head screwdriver. See figure 2-50. Place plumb bob bracket and screws in a bag and mark, "PADS plumb bob bracket and hardware." Stow in PADS battery box.

(f) Remove flashlight, flashlight bracket, and T-handles. See figure 2-50. Place in bag and mark, "T-handle and hardware," Tie the bag and stow in PADS battery box.

(g) Remove black shock mounts and replace with two brown ones from installation kit as follows (see figure 2-51):

1 Remove bolt at top of shock mount.

2 Remove four Allen head screws and remove shock mount from PADS frame.

2.1 Invert the black shock mounts and remove the spacers. Reinstall the spacers on the brown shock mounts.

3 Install brown shock mount and secure with four Allen head screws and bolt. Ensure that the air flow restrictors (flat plates) are installed beneath the shock mounts.

(h) Retrieve power supply from safe location and, using screwdriver, remove the lower circuit breaker CB1 cover from the power supply. See figure 2-52. Place circuit breaker cover and screws in a bag and mark. "Circuit breaker cover and hardware." Tie bag closed and stow in PADS battery box.

(i) Reinstall the power supply and IMU in PADS using an Allen head wrench to tighten the screws.

(j) Reconnect all interconnecting cables previously disconnected. Ensure that cable assembly W7 power cable connector J16 is disconnected from vehicle connector P16.

(k) Using three persons, lift PADS and place in mounting frame assembly with the short (right) bracket on the outboard or curb side of the vehicle. See figure 2-53.

(l) Obtain four .312-24 UNC x .875 in. long bolts from installation kit.

(m) Align the four bolt holes in the frame with those in the brackets.

(n) Loosely install the four bolts. Push the PADS into and forward to justify the hole-bolt center, then tighten using 1/2-in. open-end wrench.

(o) Deleted

(p) Connect two cables, W6 and W7, to the two power supply outlets (see figure 2-49).

(q) Connect cable W7 to P16 (beneath driver's seat).

(r) Check all areas of the installation and tighten any loose bolts, screws and connectors.

(11) <u>CDU Installation.</u>

(a) Remove CDU from top of PADS primary pallet.

(b) Secure CDU to CDU bracket using the two clamping catches. Connect CDU cable W1 to the CDU and computer.

(12) <u>Preliminary Checks.</u>

(a) Cables connected as in figures 2-36, 2-40, 2-43, 2-44, 2-45, 2.46, and 2-48; cables properly muted; and connections tight.

(b) Electrical equipment mounting base and battery box secured firmly.

(c) No physical obstructions to fans.

(d) No obstructions to sway space.

(e) Specific gravity and fluid level checked on batteries in accordance with TM 9-6140-200-14.

(f) Start vehicle engine.

(g) Set power supply circuit breakers CB1 and CB2 to ON.

(h) Turn on the system by pressing <u>ON/OFF.</u> CDU lights and display indicates "SPH" or "SS SPH". System fans are operating (temperature dependent).

(i) After 5 minutes, set circuit breaker CB2 to OFF. PADS remains on.

(j) Set circuit breaker CB2 to ON and circuit breaker CB1 to OFF. PADS remains on.

(k) Set circuit breaker CB1 to ON and initialize the PADS system. The system should align in approximately 30 minutes.

(1) Shut down system by pressing ON/OFF.

(m) Set circuit breakers CBl and CB2 to OFF.

(n) Make one last check of installation to ensure that hardware is tight.

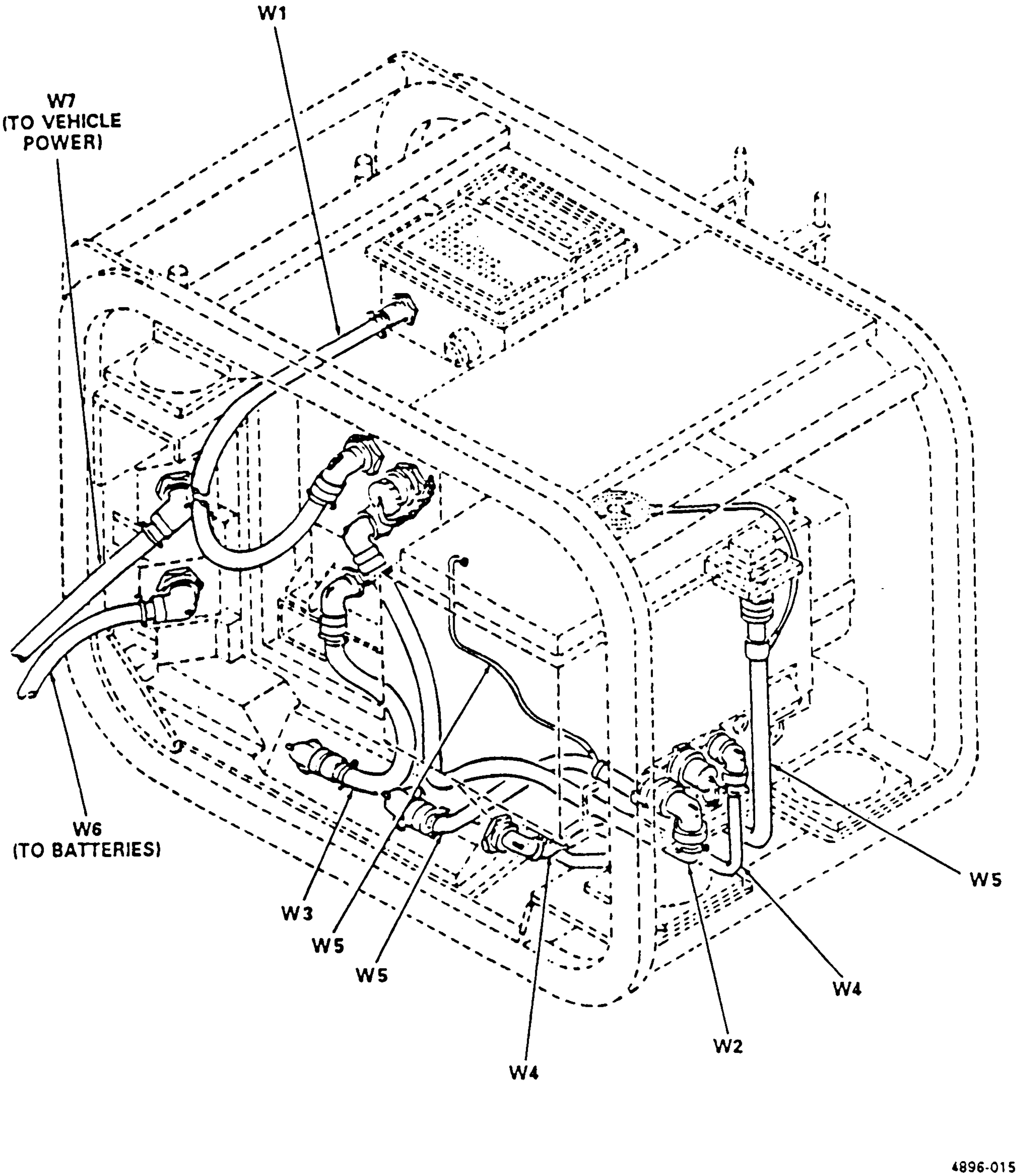


Figure 2-49. Primary Pallet Cable Routing Diagram

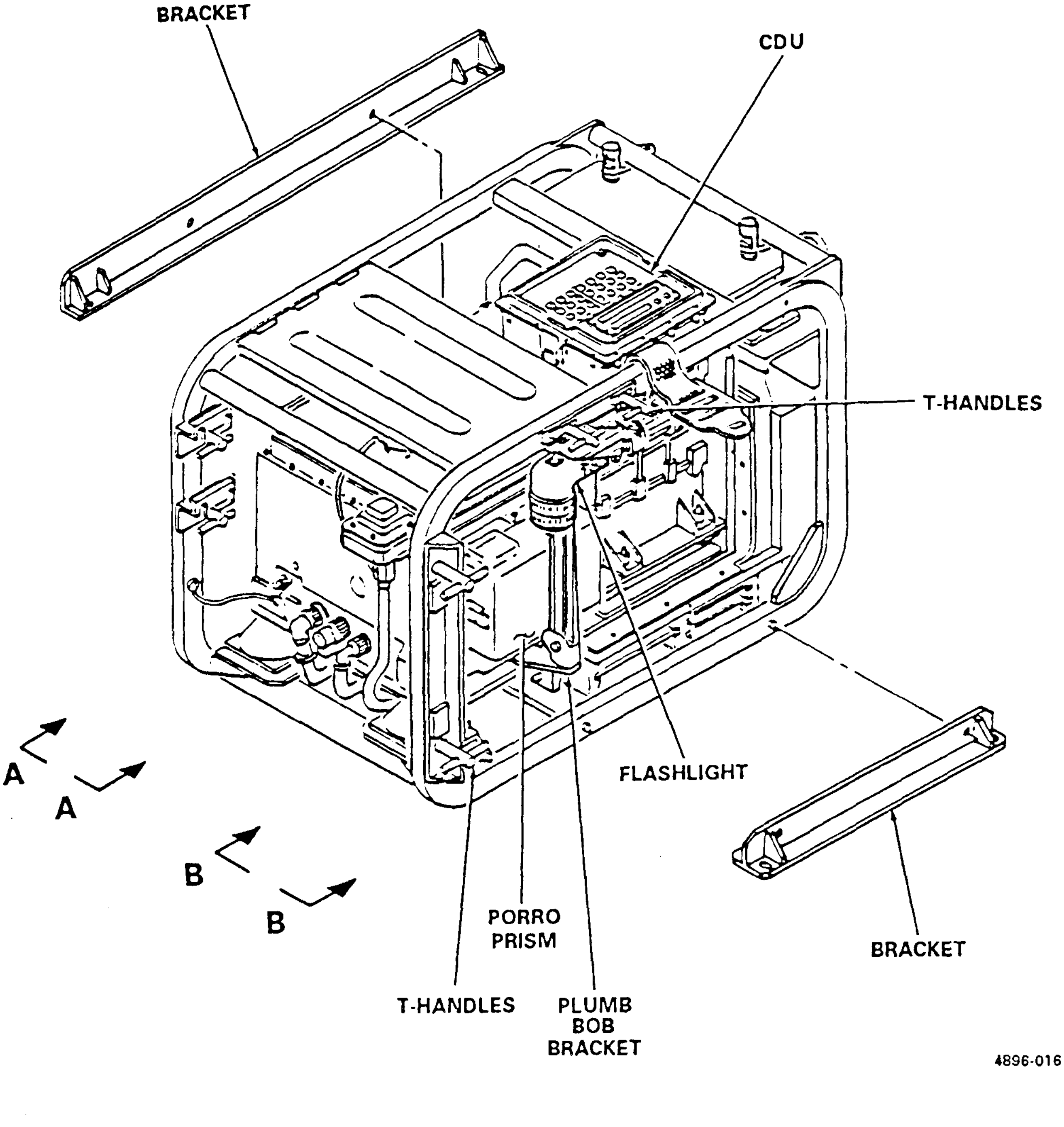
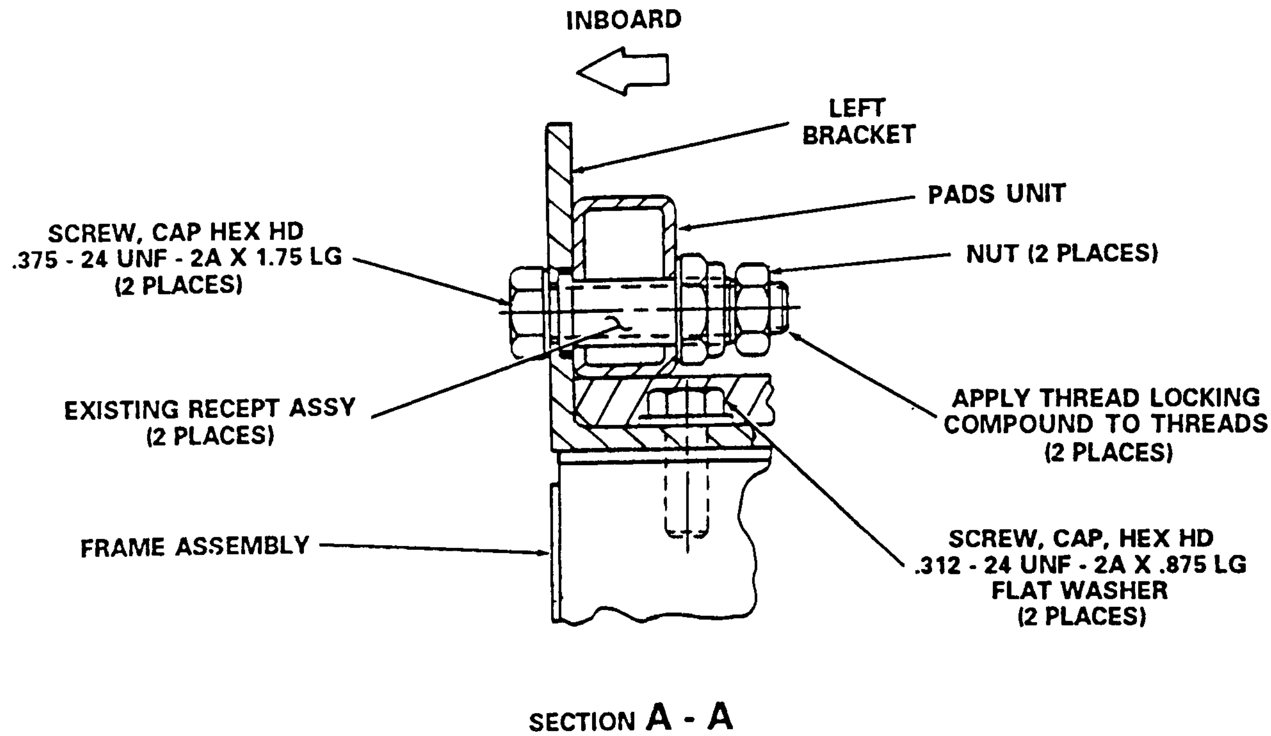


Figure 2-50. PADS Primary Pallet Installation Details (Sheet 1 of 2)



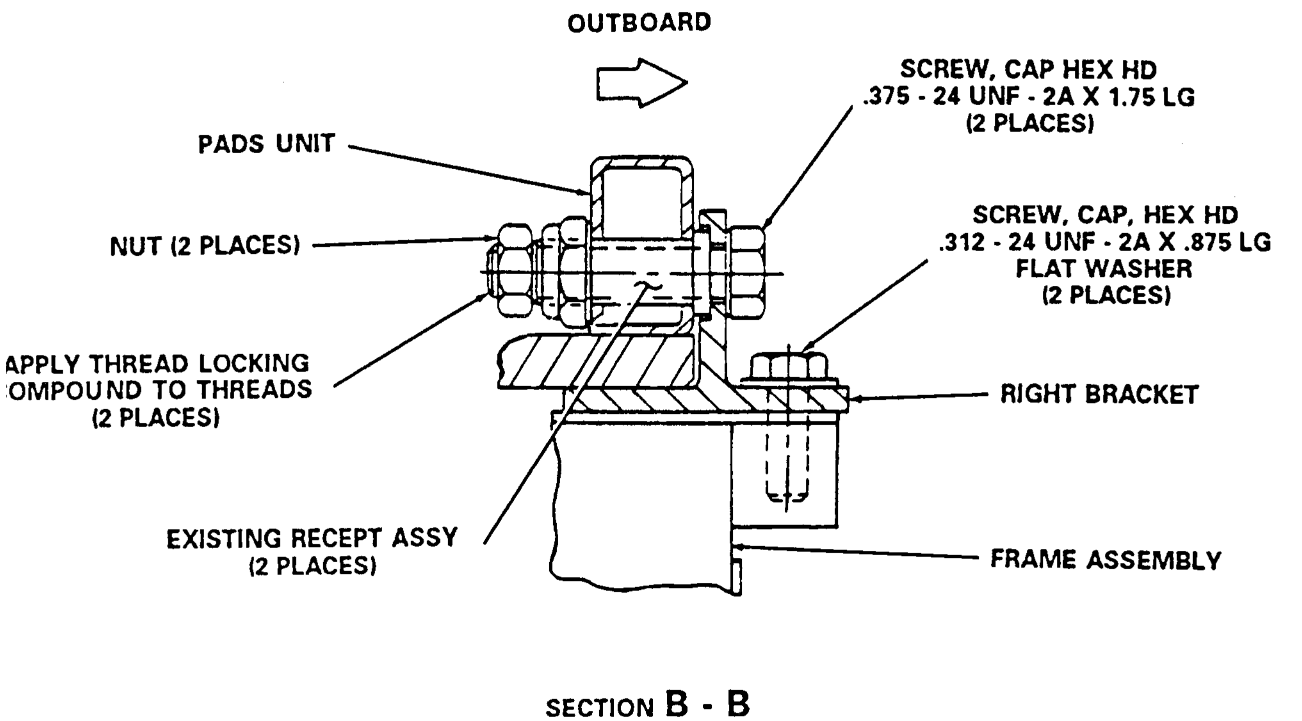


Figure 2-50. PADS Primary Pallet Installation Details (Sheet 2 of 2)

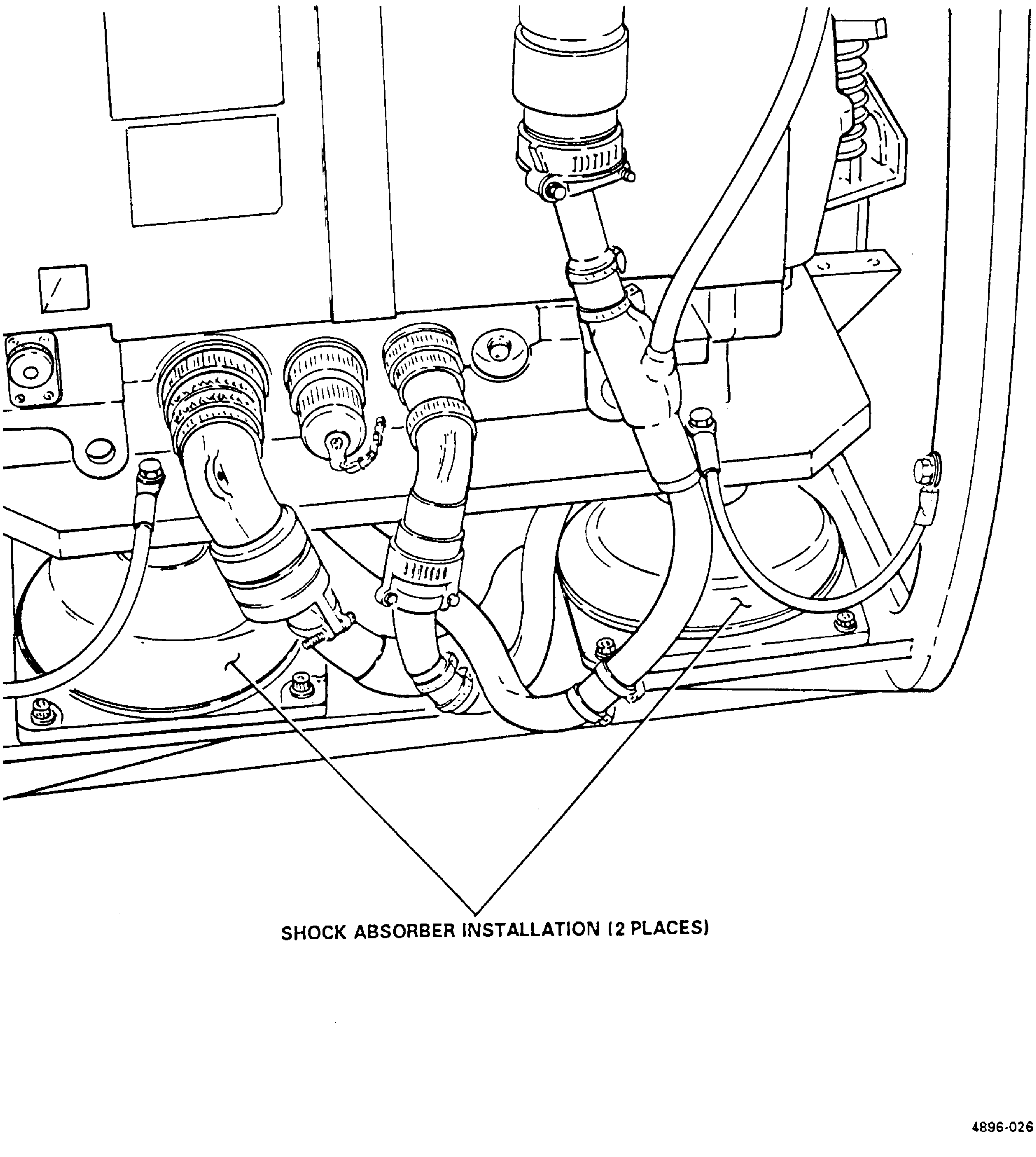


Figure 2-51. *Replacement of Shock Absorbers*

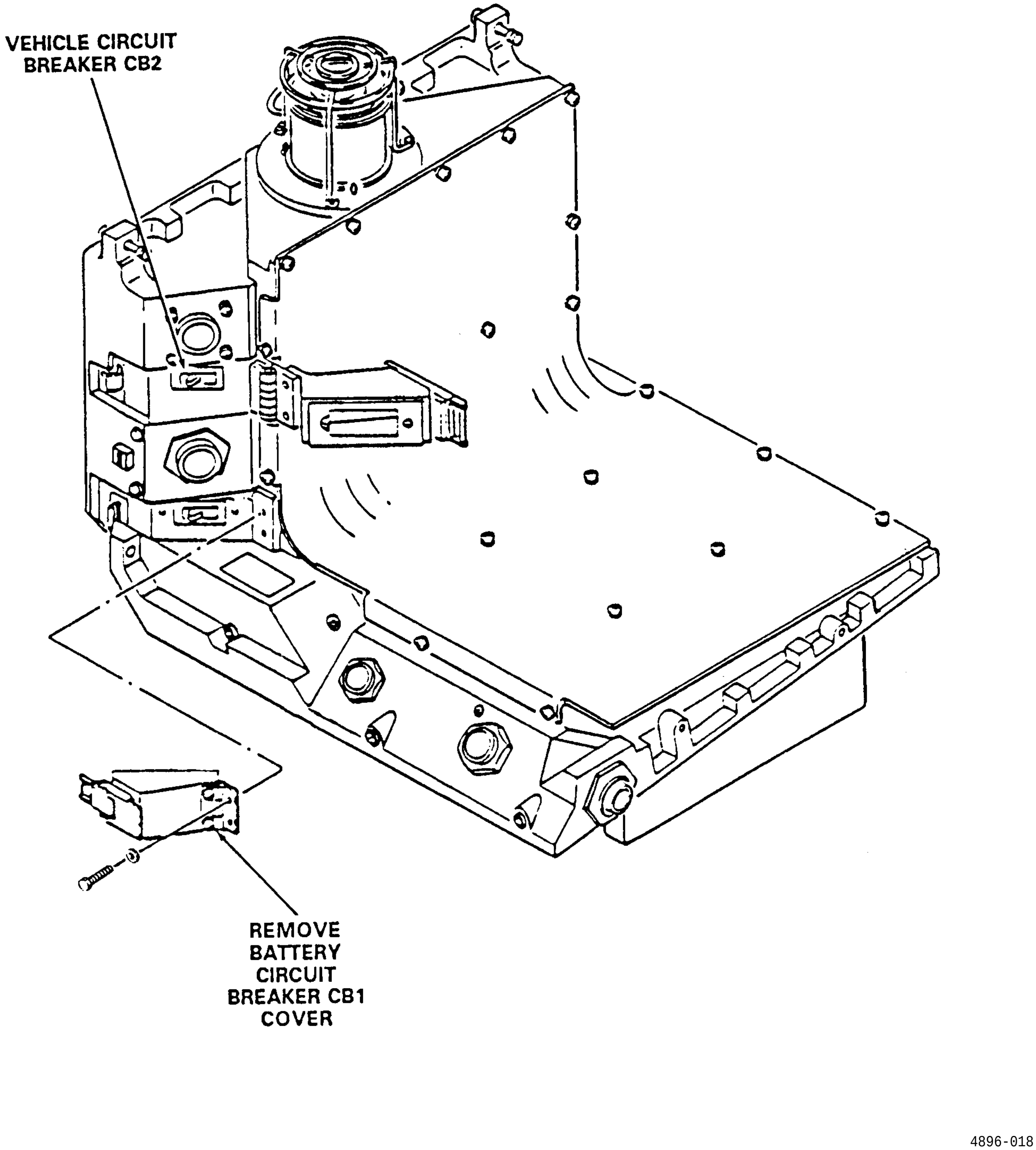


Figure 2-52. PADS Power Supply Subassembly

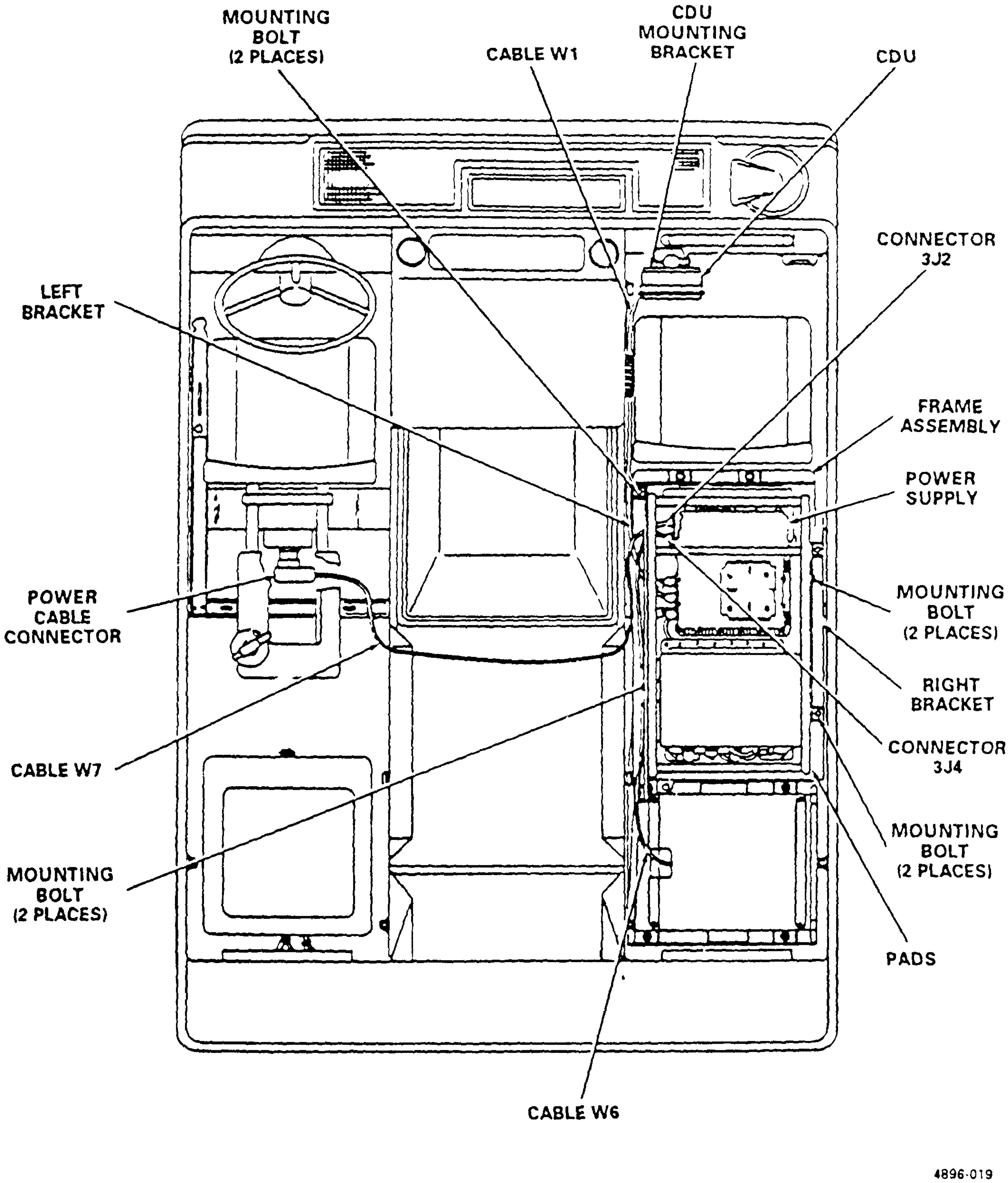


Figure 2-53. SUS V PADS Installation and Power Cable Interconnections

Section III. PRELIMINARY ADJUSTMENT OF EQUIPMENT

2-15. Changing Vehicles

a. The operator must determine the type of vehicle being used with PADS. Each vehicle, within the Army inventory which carries PADS, will have a different set of dimensions associated with the plumb bob suspension point. The operator will be informed after entry of the spheroid by the CDU display of one of seven possible vehicles (predetermined) or three (user defined) vehicles. The last vehicle used (assuming a save turnoff routine had been performed) will be displayed. If this vehicle is acceptable to the operator, CDU ENT is pressed. If the vehicle was not the vehicle desired, +/2 would be pressed to increment or –/8 to decrement until the correct vehicle was found, at which time ENT would be pressed.

b. Review of lever arm information if desired, will be available in monitor ID locations 47, 48, 49, and 50. The data will be in meters to the nearest millimeter.

c. A change of selected vehicle may be effected at any time after the initialization entries have been made by selecting monitor ID 51. Refer to paragraph 3-8.1.

d. Adding a new vehicle point may be accomplished with great care in the measurement techniques, and entered into the system via monitor ID 51 and instructions in paragraph 3-8.1.

2-16. Preliminary Checks and Services. After completing a PADS installation, and with all equipment mounted and connected, make the following checks:

a. Cables connected as in figures 2-9, 2-14, 2-25, 2-35 and 2-53; cables properly routed; and connections tight.

b. Electrical equipment mounting base and battery box secured firmly to subfloor plate.

c. No physical obstructions to fans.

d. No obstructions to sway space.

e. Specific gravity and fluid level checked on batteries in accordance with TM 9-6140-200-14.

f. Plumb bob location from CDU monitor ID 51.

NOTE

Before performing step g., refer to chapter 3, section II, and table 3-1 to become familiar with the PADS controls and indicators.

g. Perform 30-day azimuth-gyro bias calibration in accordance with table 4-1.

The operator at this time must check monitor IDs 47 thru 50 to verify PADS has the following

ID 47M	-2.7
ID 48M	-5.8
ID 49M	-1.0
ID 50M	-3.3

2-16. Preliminary Checks and Services. After completing a PADS installation, and with all equipment mounted and connected, make the following checks:

a. Cables connected as in figures 2-9, 2-14, 2-25, 2-35 and 2-53; cables properly routed; and connections tight.

b. Electrical equipment mounting base and battery box secured firmly to subfloor plate.

c. No physical obstructions to fans.

d. No obstructions to sway space.

e. Specific gravity and fluid level checked on batteries in accordance with TM 9-6140-200-14.

f. Plumb bob location from monitor tables 47 through 50.

NOTE

Before performing step g., refer to chapter 3, section II, and table 3-1 to become familiar with the PADS controls and indicators.

g. Perform 30-day azimuth-gyro bias calibration in accordance with table 4-1.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS AND INSTRUMENTS

3-1. Damage from Improper Setting. No combination of control settings will cause damage to the equipment or create a hazard to personnel.

3-2. Operator/Crew Controls, Indicators, and Connectors. PADS controls, indicators, and connectors are illustrated in figures 3-1 thru 3-5 and listed, with functional descriptions, in table 3-1.

NOTE

If possible, PADS should be positioned so that direct sunlight does not shine on the CDU. Direct sunlight on the CDU makes it difficult to read the display.

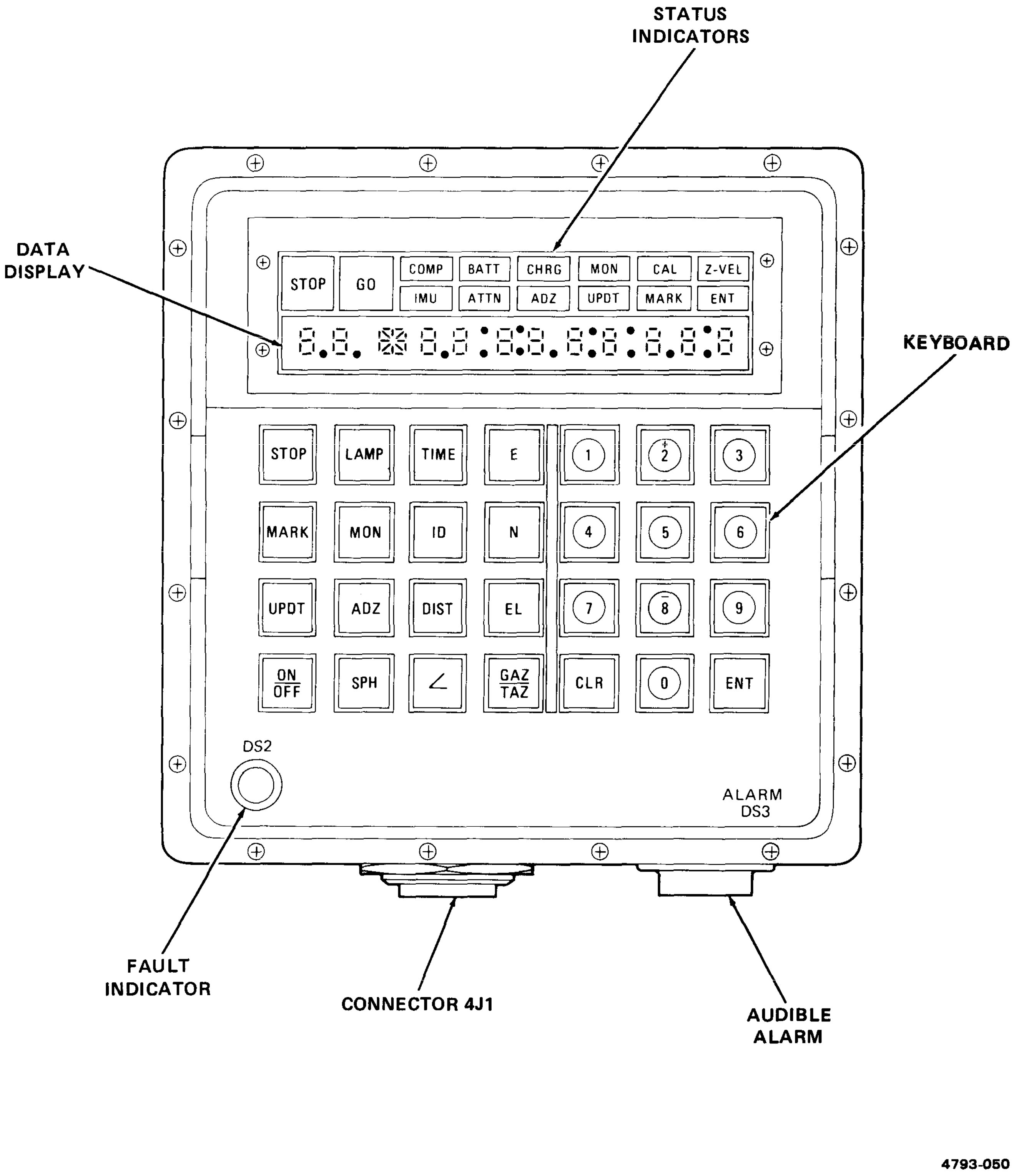


Figure 3-1. CDU Operator/Crew Controls, Indicators, and Connectors

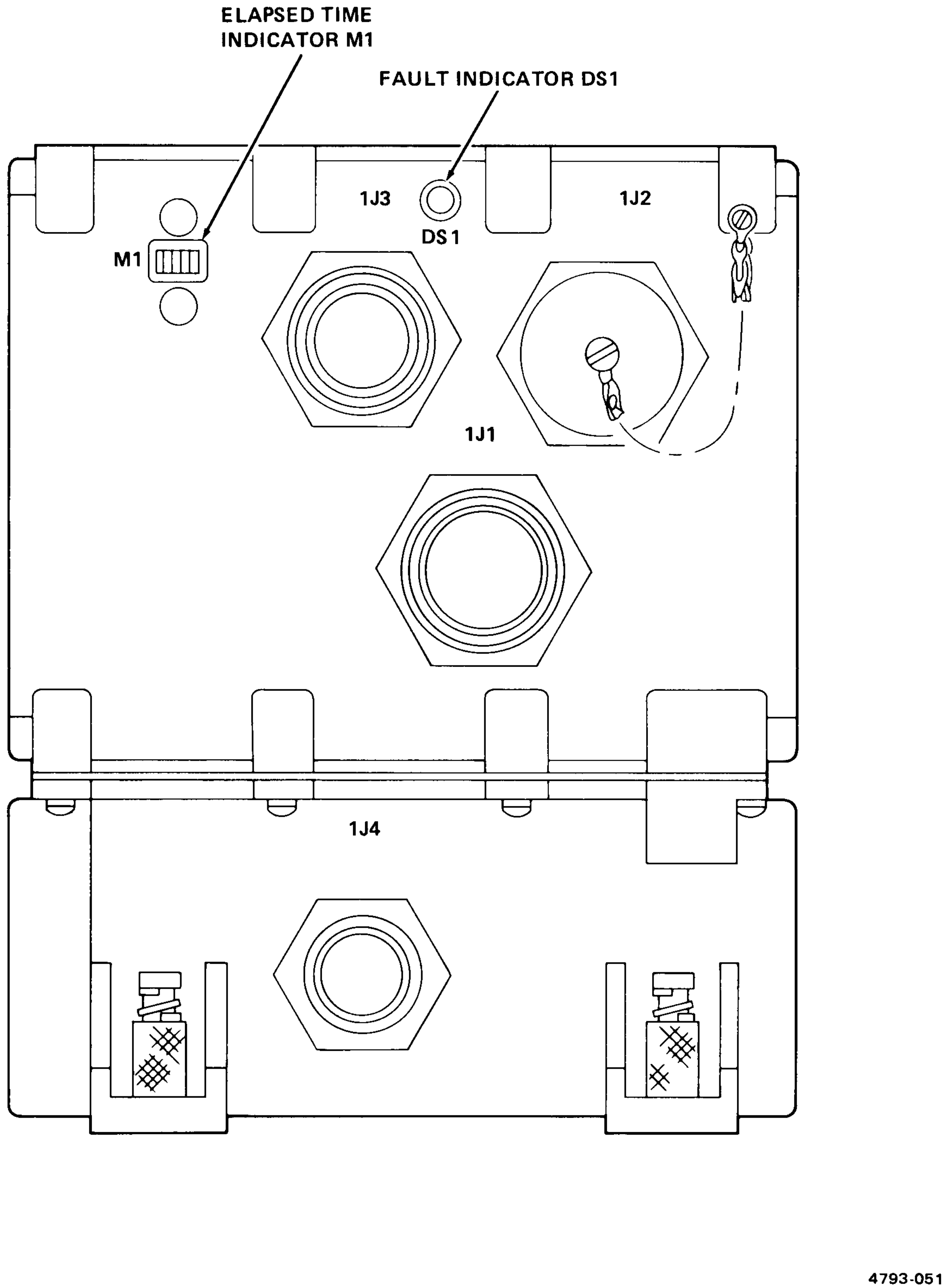


Figure 3-2. Computer Operator/ Crew Indicators and Connectors

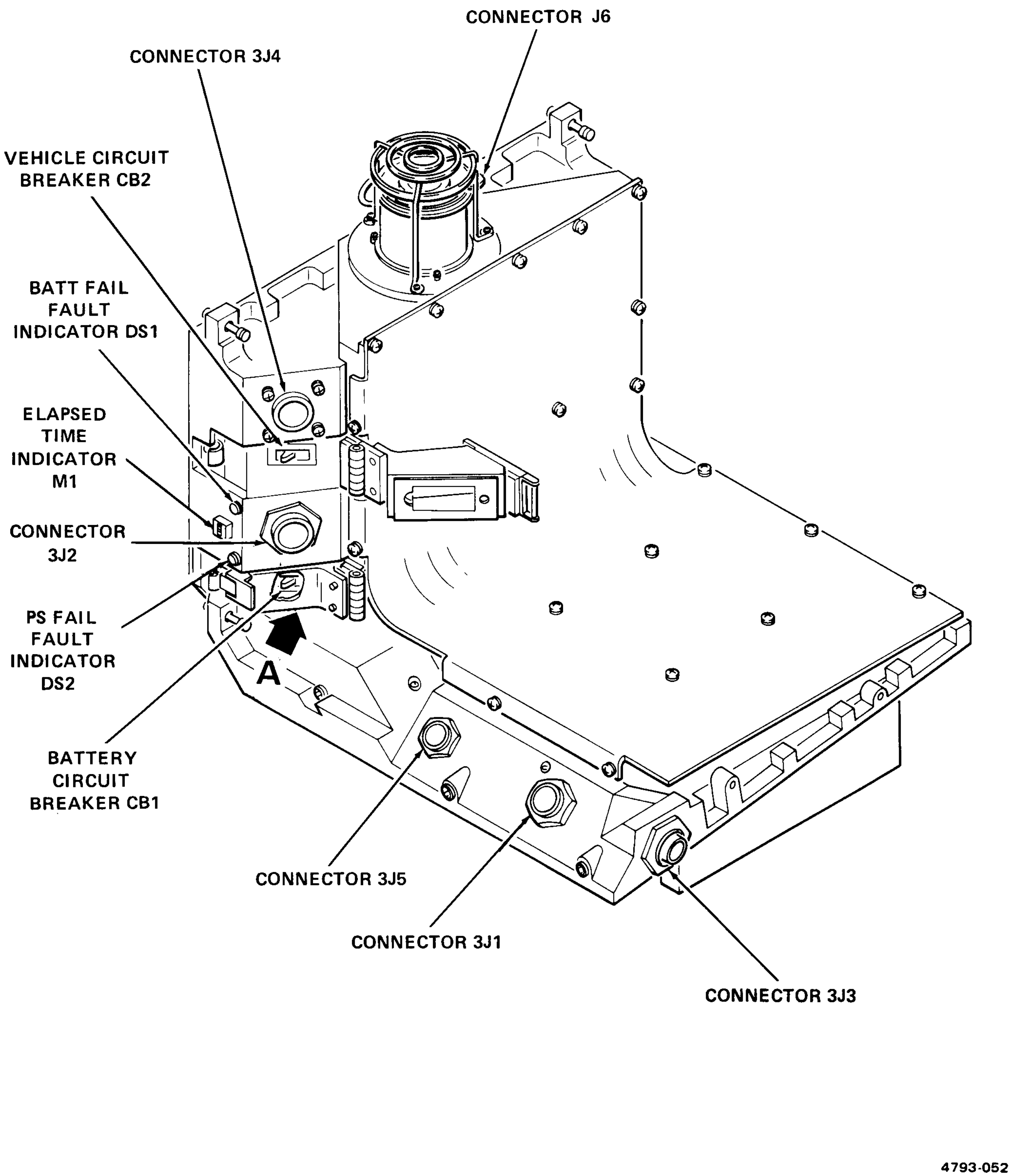
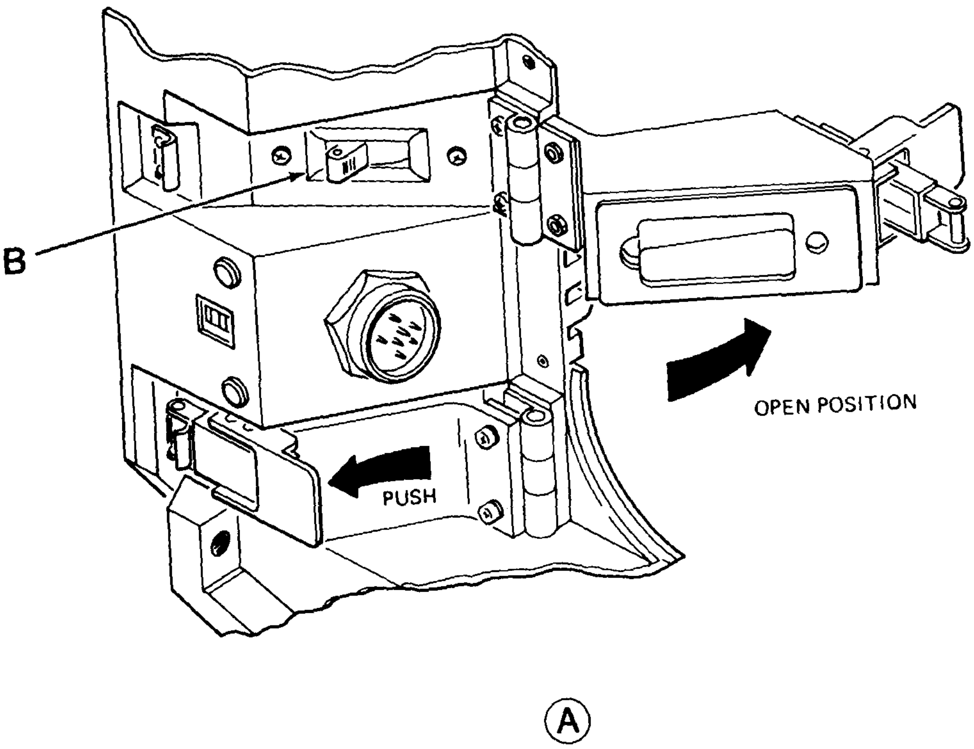


Figure 3-3. Power Supply Operator/Crew Controls, Indicators, and Connectors (Sheet 1 of 2)



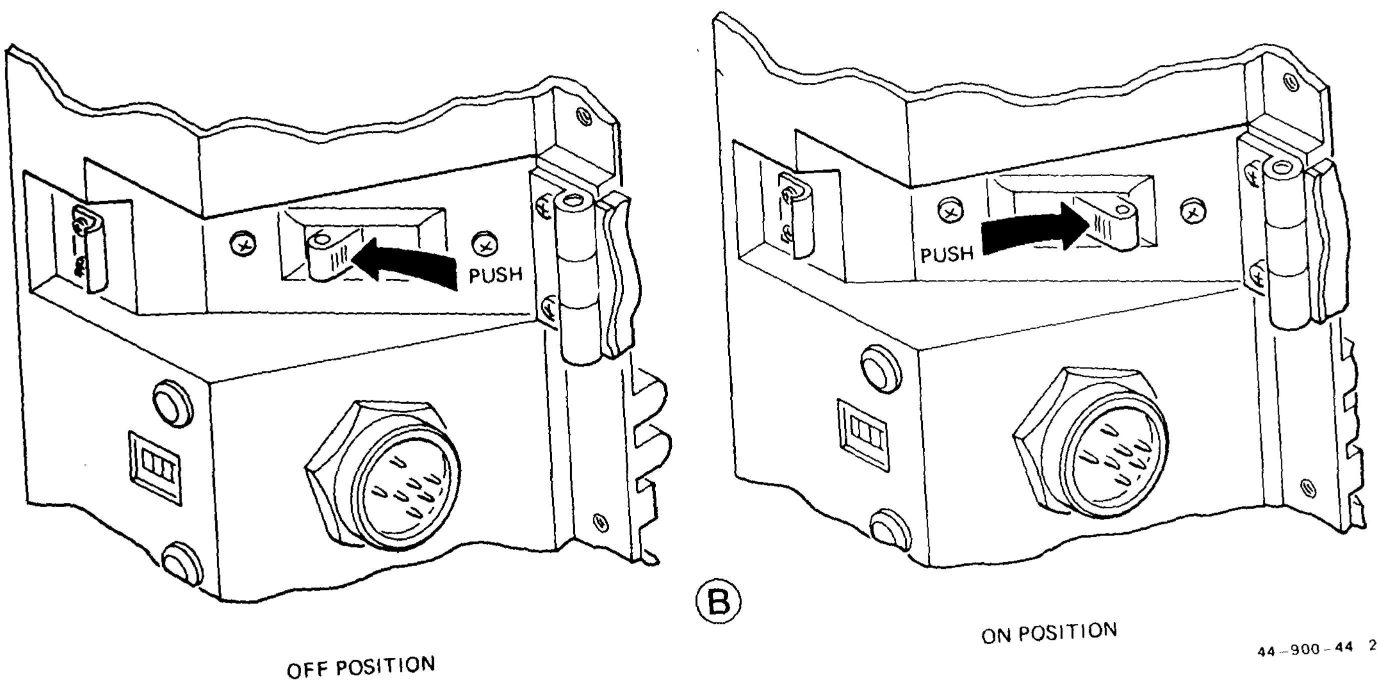


Figure 3-3. Power Supply Operator/Crew Controls,Indicators, and Connectors (Sheet 2 of 2)

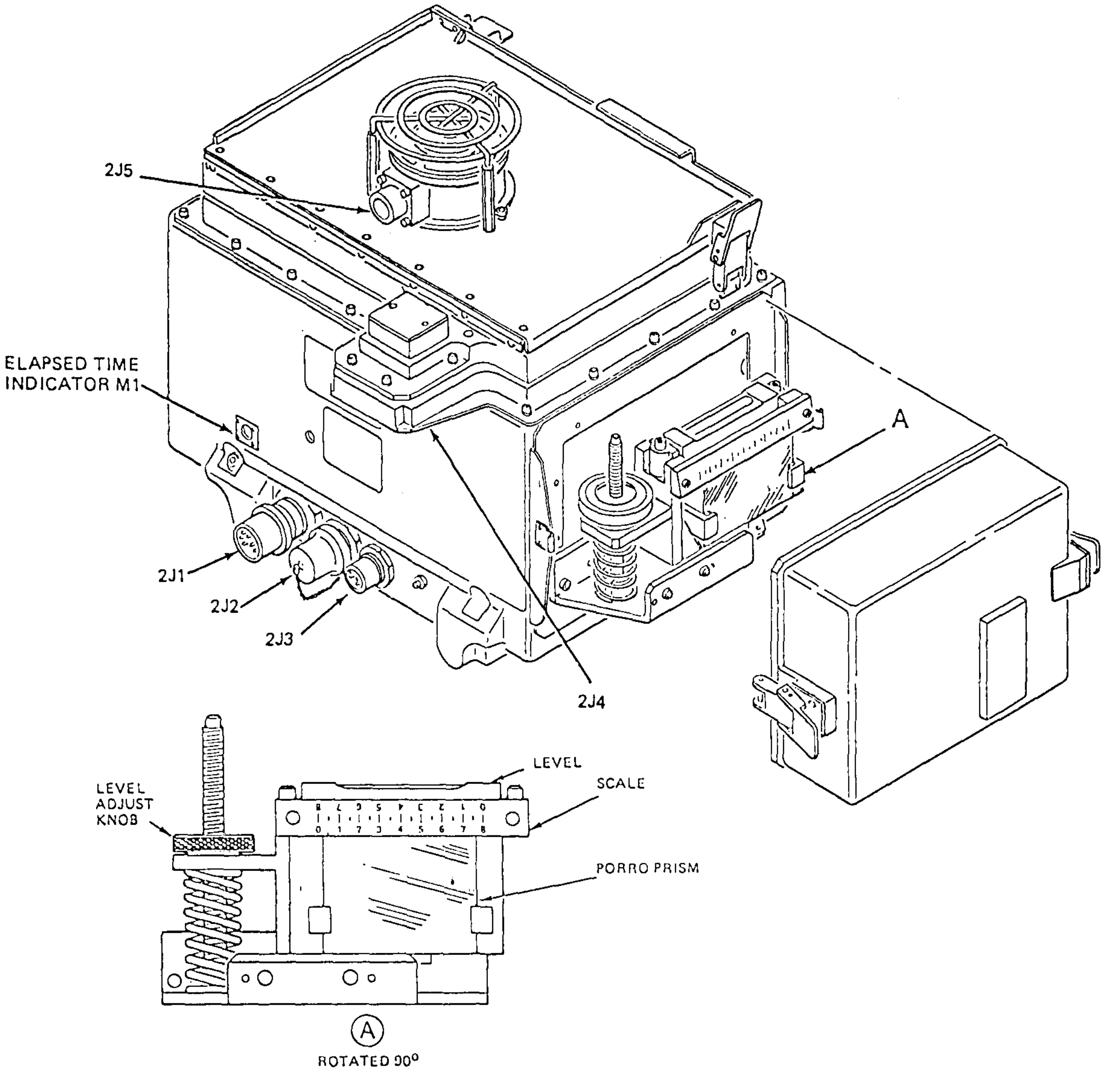


Figure 3-4. IMU Operator/Crew Controls, Indicators, and Connectors

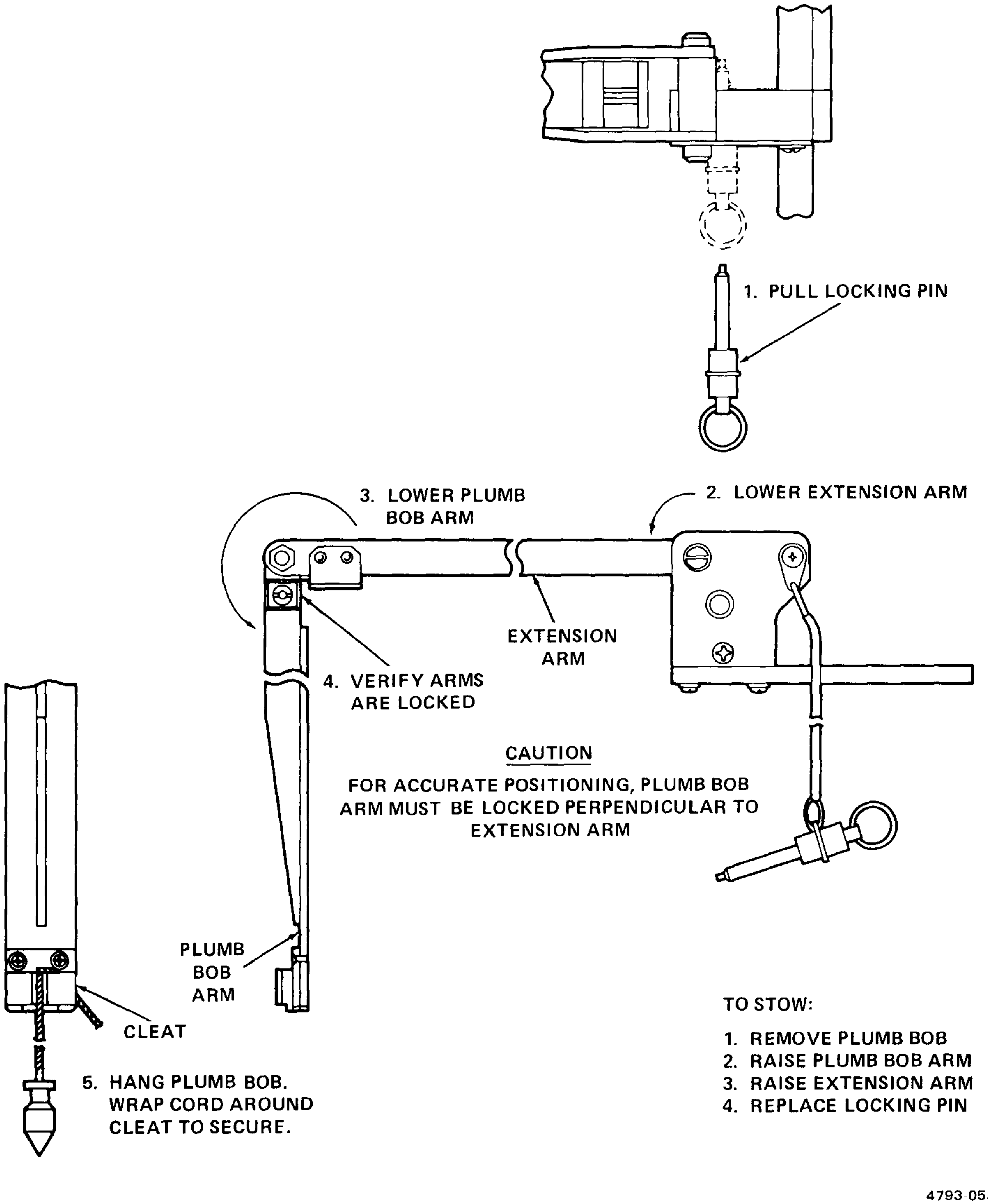


Figure 3-5. Plumb Bob Assembly Operation

Table 3-1. Operator/ Crew Controls, Indicators, and Connectors

NOTE

This table covers only items used by the operator; items used by higher level maintenance personnel are covered in instructions for the appropriate maintenance level.

Control, indicator, or connector	Function
CDU (figure 3-1)	
Status indicators	Display system status and operating modes as follows:
STOP	Flashing STOP alerts operator to stop for zero-velocity correction. Steady STOP alerts operator to remain stopped. Operator may move PADS system with STOP indicator illuminated prior to entering spheroid data. PADS must not be moved for at least one minute after turn on.
GO	Flashing GO advises operator the vehicle may be moved. Steady GO indicates the vehicle has moved since the last zero-velocity correction
COMP	Indicates possible computer failure
IMU	Indicates possible IMU failure
BATT	Steady BATT indicates: vehicles or PADS battery is not connected, PADS battery is being discharged, or either PS circuit breaker is OFF. Flashing BATT indicates input voltage is too low and PADS will soon turn off unless the problem is corrected
ATTN	Indicates operator error
CHRG	Indicates PADS batteries are charging
ADZ	Indicates entry and display of position data are in the adjacent universal transverse mercator (UTM) grid zones
MON	CDU displays requested data being monitored
UPDT	Indicates system is ready to accept position or elevation update data
CAL	Lights during initialization. Lighting during a position or elevation update indicates the operator has entered incorrect data or the system is out of calibration
MARK	Indicates the system is recording marked survey data
Z-VEL	Indicates zero-velocity correction is being made
ENT	Indicates computer is ready to accept data from the keyboard
Data display	Displays alphanumeric data and commands
Keyboard	Used to enter data and commands as follows:
STOP	When pressed with vehicle stopped starts zero-velocity correction. Lights STOP indicator and turns off audible alarm, if on. If pressed while vehicle is moving, ATTN indicator will illuminate
MARK	Initiates position mark procedure. Lights MARK indicator. Pressing MARK twice cancels a position-mark procedure

Table 3-1. Operator/Crew Controls, Indicators, and Connectors — Continued

Control, indicator, or connector	Function
UPDT	Initiates position and/or elevation update procedure. Lights UPDT indicator. Pressing UPDT twice cancels a position and/or elevation update procedure
ON/OFF	If system is off, pressing ON/OFF applies power. If system is on, pressing ON/OFF causes display to read OFF C-E. Pressing ENT turns system off. Pressing CLR continues operation
LAMP	Tests all CDU status indicators, alphanumeric data display lamps, and system fault indicators. When held down, varies lamp intensities and when at full brilliance, sounds ALARM DS3
MON	Selects monitor mode; lights MON indicator
ADZ	Directs system to enter or display adjacent UTM grid zones; lights ADZ indicator
SPH	Allows entry and display of earth spheroid number used in data reduction
TIME	During initialization and zero-velocity correction, displays elapsed time since turn on. When vehicle is in motion displays time-to-go to the next zero-velocity correction. Silences ALARM DS3 for 30 seconds
ID	When pressed, followed by an ID number, followed by ENT, cues PADS to provide requested mark data identified by that ID number. ID, O, ENT indicates current data display. Pressing ID twice selects display of position, azimuth and elevation (PAE) display
DIST	Allows entry and display of distance between porro prism and theodolite for an optical position mark. Displays distance between the points on a two-position azimuth mark
∠	Allows entry (at an optical position and azimuth mark) and display of horizontal angle measured by theodolite
E	Allows entry and display of UTM grid zone and casting
N	Allows entry and display of northing; when pressed twice, indicates southern hemisphere by displaying S. Only during the initial entry of data (before entering northing) may the change in selection of hemisphere from northern to southern be made
EL	Allows entry and display of elevation
GAZ/TAZ	Displays grid azimuth. When pressed twice, displays true azimuth, clear or enter (TA C-E). Operator may display true (geodetic) azimuth by pressing ENT. If CLR is pressed, grid azimuth is displayed
1, 2, 3, 4, 5, 6, 7, 8, 9, 0	Enters numerical data as selected
+2, –8	When elevation has been selected for entry of data, the first pressing of the 2 or 8 will enter a + or –, respectively; thereafter, the 2 and 8 revert to normal number functions. Advances (+) and decreases (–) ID and monitor numbers

Table 3-1. Operator/Crew Controls, Indicators, and Connectors — Continued

Control, indicator, or connector	Function
ENT	Causes displayed data (or function) to be entered into computer (or executed)
CLR	Clears display and mode selection
ALARM DS3	Warns operator to stop for zero-velocity correction or may sound if there is excessive motion during initialization
Fault indicator DS2	Indicates CDU is functioning (black) or malfunctioning (white)
Connector 4J1	Connects CDU to computer through cable assembly W1
Computer (figure 3-2)	
Elapsed time indicator M1	Displays total computer operating time
Fault indicator DS1	Indicates computer is functioning (black) or malfunctioning (white)
Connectors	
1J1	Connects computer to IMU through cable assembly W2
1J3	Connects computer to CDU through cable assembly W1
1J4	Connects computer to power supply through cable assembly W3
Power supply (figure 3-3)	
BATTERY circuit breaker CB1	Controls PADS battery power
VEHICLE circuit breaker CB2	Controls vehicle power to PADS
BATT FAIL fault indicator DS1	Turns from black to white when PADS batteries have insufficient power available to sustain system operation
PS FAIL fault indicator DS2	Indicates PS is functioning (black) or malfunctioning (white)
Elapsed time indicator M1	Displays total PS operating time
Connectors	
3J1	Connects PS to IMU through cable assembly W5
3J2	Connects PS to PADS batteries through cable assembly W6
3J3	Connects PS to IMU through cable assembly W4
3J4	Connects PS to land vehicle through cable assembly W7 (or cable assemblies W7 and W8), or to helicopter through cable assemblies W8 and W9
3J5	Connects PS to computer through cable assembly W3
J6	Connects PS to PS fan
IMU (figure 3-4)	
Elapsed time indicator M1	Displays IMU total operating time
Connectors	
2J1	Connects IMU to computer through cable assembly W2
2J3	Connects IMU to PS through cable assembly W4
2J4	Connects IMU to PS through cable assembly W5
2J5	Connects IMU fan to PS through cable assembly W5

Table 3-1. Operator/ Crew Controls, Indicators, and Connectors — Continued

Control, indicator, or connector	Function
Porro prism	Used to align the theodolite to the IMU during all optical measurements
Level adjust knob	Used to level the porro prism
Level	Indicates level of the porro prism
Scale	Used with theodolite stadia lines to measure distance between porro prism and theodolite to 0.1 meter
Plumb-bob arm assembly (figure 3-5)	Used in conjunction with plumb bob for plumb-bob marks and for updating for certain vehicle applications.

Section II. OPERATION UNDER USUAL CONDITIONS

3-3. General. PADS normally is operated from a land vehicle. Helicopters are used in special situations, e.g., great distances between survey points, survey points inaccessible to a land vehicle, or when speed is of paramount concern. Because operations in a land vehicle or helicopter are nearly the same, complete procedures are given only for a land vehicle mounted PADS. Transfer between vehicle and helicopter is described. Special helicopter operating considerations are covered.

3-4. PADS Mission Procedure. Normal operating procedures are summarized in table 3-2. The mission begins with pre-turnon checks and services, followed by initialization. Next, PADS is updated, using the position and elevation update procedure. PADS then performs a series of marks, where position, elevation, and azimuth are recorded. Update, data recall, and shutdown completes the mission. Table 3-2 references paragraphs, tables, and figures where mission phases are explained in detail. If a malfunction occurs, refer to table 4-2, Troubleshooting.

3-5. Initialization.

CAUTION

PADS must not be moved for at least one minute after turn on. Failure to do this may result in severe damage to the equipment.

PADS must be initialized on a firm, level surface. Alignment failure can result from vehicle movement on soft surfaces such as mud, snow, or ice, and shocks caused by operator movement or wind gusts. The operator should stand clear of the vehicle during alignment. The vehicle should be facing into high winds with the wheels blocked.

To prevent damage, do not move PADS for at least 2 minutes following shutdown. Defer shutdown if it is not possible to wait.

NOTE

To speed warm-up and improve alignment accuracy, PADS may be turned on before leaving for the initialization point with the understanding that total mission time is decreased. Do not enter spheroid data until vehicle is parked at the initialization point. Alignment starts when spheroid is entered.

PADS may be initialized on slopes greater than 5 degrees with decreased alignment accuracy.

a. PADS must be initialized before it can survey. The operator enters the approximate PADS position. Then PADS automatically aligns.

b. The initialization site must have a firm surface level to ±5 degrees. The site horizontal position coordinates should be known to ±100 meters and the elevation known to ±10 meters. Initialization takes 30 to 45 minutes, depending upon ambient temperature.

c. Vehicle movement and shocks must be avoided during alignment. The parking brake must be firmly set and the front wheels pointed straight. The vehicle should face into high winds with the wheels blocked. After entering the site coordinates, the operator should leave and remain clear of tile vehicle until alignment is completed. The initialization sequence is shown in step 2 of table 3-2.

d. If excessive vehicle movement is experienced during alignment, the ATTN indicator will light and the CAL indicator will go off, the ALARM DS3 may sound, or the STOP and GO indicators may flash alternately. If this occurs, turn PADS off, wait 2 minutes, then restart the initialization procedures.

e. If the vehicle is not level within ±5 degrees, the display will show LEVEL starting in monitor MODE 3. The LEVEL display locks out the monitor mode unless a malfunction occurs. Turn PADS off, wait 2 minutes, and move vehicle to a more level area and reinitialize. If this is not possible, PADS will continue to align with possible degraded accuracy. The LEVEL display will go off at MODE 8. Remember, initialization coordinates must be known only to ±100 meters. The system does not have to be initialized directly over a survey control point (SCP). Thus, it usually will be possible to find a level area for initialization. Updates must be done over a known SCP.

3-6. Turn on/Turn off.

NOTE

The following conventions are used in Chapters 3 and 4 of this manual.

1. CDU pushbuttons are underlined, e.g., <u>STOP</u>.

2. A lighted status indicator remains lighted until extinguished, e.g., GO.

3. An extinguished status indicator is boxed in, e.g., $\boxed{\text{STOP}}$.

4. Flashing displays are enclosed in quotation marks, e.g., "GO".

NOTE

There are two types of memory modules available for the PADS computer: a core memory or a solid state memory. The determination of memory type can be made at PADS turnon per step a, and is important as the turnoff procedure will be different for each memory.

a. **Turnon Sequence.** Power is applied to PADS by setting PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to ON. Turn on the system by pressing ON/OFF. Observe the CDU display response.

(1) For core memory, the CDU display will indicate "SPH" (last spheroid used).

(2) For solid state memory, the CDU display will indicate "SS SPH" (last spheroid used).

(3) For solid state memory, the CDU display will indicate GPS C–E, thus indicating the newer program. The newer program contains global positioning satellite (GPS) information and can only be used with the solid state memory. The operator must go to paragraph 3–22.1.

b. **Core Memory Turnoff Sequence.** If PADS is on, pressing ON/OFF initiates shutdown. OFF C–E is displayed. To turn off, press ENT and set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to OFF. To continue operation, press CLR.

c. **Solid State Memory Turnoff Sequence.** The solid state memory requires some internal computer information to be transferred from one operational section of memory to another and is required before actual system shutdown occurs. Perform the following steps and observe the CDU display cues:

(1) Press ON/OFF. Display indicates SAVE C–E.

(2) Press ENT. Display indicates PAUSE.

(3) When "OFF" E appears, press ON/OFF. Display indicates OFF "E".

(4) Press ENT. System will turn off.

(5) Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to OFF.

d. **Solid State Memory Accidental Turnoff.** In the event the ON/OFF key was accidentally pressed and system turnoff is desired perform the following:

(1) ON/OFF pressed. Display indicates SAVE C-E.

(2) Press CLR. Display indicates "OFF" C-E.

(3) Press ON/OFF. Display indicates OFF "C-E".

(4) Press CLR. Display reverts to previous state.

e. **Security Turnoff.** If for security reasons the operator does not want to save previously worked data, the following shutdown sequence should be followed:

(1) Press ON/OFF. Display indicates SAVE C-E.

(2) Press CLR. Display indicates "OFF" C-E.

(3) Press ON/OFF. Display indicates OFF "C-E".

(4) Press ENT. System will turn off.

(5) Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to OFF.

3–7. Intensity Setting/Lamp Test.

a. **Dim.** Press and hold LAMP to dim CDU lights. All lamps light and the intensity slowly decreases. At full dark, no further change will occur. Release LAMP when desired intensity is reached. The display returns to normal at the new intensity.

b. **Brighten.** To brighten the display: press LAMP; release for 2 to 6 seconds; press and hold LAMP. All lamps light and the intensity slowly increases. At full brilliance, ALARM DS3 sounds. Release LAMP when desired intensity is reached. The display returns to normal at the new intensity.

c. **Lamp Test.** Set display to full brilliance and hold LAMP key. Observe that all status indicators, all data-display segments, and all punctuation marks light; ALARM DS 3 sounds, and computer, power supply, and CDU fault indicators DS1 and DS2 turn white. Release LAMP key and note that display returns to normal, ALARM DS3 turns off, and fault indicators DS1 and DS2 turn black. Lamp tests maybe performed periodically during the survey mission, but must always be performed prior to initialization and prior to recalling adjusted survey data.

3-8. Entering Spheroid. PADS is programmed to survey in any of the following spheroids:

SPH1 . . . . Clarke 1866

SPH2 . . . Clarke 1880

SPH3 . . . . International

SPH4 . . . . Bessel

SPH5 . . . . Everest

SPH6 . . . . Malayan

SPH7 . . . . Australian National

Figure FO–1 contains index to spheroids. At tumon, PADS displays "SPH" followed by the number of the spheroid used last. Enter the desired spheroid by pressing SPH, the number of the desired spheroid, and ENT (e.g., Spheroid 3, press SPH, 3, ENT). The display then indicates PAUSE for about 10 seconds then cues for vehicle. If a wrong spheroid is entered, the system must be turned off and initialization restarted.

3-8.1. Entering Vehicle Selection. The PADS program contains seven standard U.S. Army vehicles and has the capability of having the operator add lever arm information for up to three nondefined vehicles. Reference the specific vehicle installation for sight/plumb bob location. The standard vehicles in the order of selection and CDU displays follow. The program will display the last vehicle entered during the initialization, i.e., if the OH-58 had been selected before the system was turned off, the CDU at turnon would indicate OH-58 5.

CDU	QUE	Vehicle	Plumb Bob or Sight Location
1. HUM	1	HMMWV	Left side driver sight/plumb bob
2. CUV	2	CUCV	Pintle mounted plumb bob
3. SUV	3	SUSV	Left side driver sight/plumb bob
4. M151	4	Jeep	Pintle mounted plumb bob
5. OH-58	5	OH-58 Helicopter	PADS mounted plumb bob arm
6. UH-1	6	UH-1 Helicopter	PADS mounted plumb bob arm
7. PLMB	7	M151 Jeep	PADS mounted plumb bob arm

a. The operator presses CDU +/2 or -/8 advance or decrement the vehicle selection until the correct vehicle has been displayed, then presses ENT. The vehicle selection may be changed at any time during operation, which allows vehicle to vehicle transfer while the system is operational.

b. If the system has been installed in a vehicle which is not defined as one of the seven standard vehicles, or has not had the lever arm previously entered, the operator must enter any choice of vehicles, in order to proceed with the initialization. The procedure for selecting and inserting data for the nondefined vehicle is as follows:

(1) While PADS is aligning or preferably after alignment is complete, the operator may insert up to three nonstandard vehicle selections after determining the X, Y, Z, and V lever arm dimensions using figure 3-5.1 as an example. All lever arm entries and displays must be in meters to the nearest millimeter.

OPERATOR ACTION	DATA DISPLAY
Press MON, ID, 5, 1, ENT	Vehicle initially entered
Press CLR	51E “8-10”
Press 8, ENT	51X .
Press +, 7, 6, 2	51+ .762
Press ENT	51Y .
Press -, 1, 6, 5, 8, ENT	51Z .
Press -, 6, 1, 0, ENT	51V .
Press -, 4, 9, 5, ENT	SEL 1 8

Press - to scan ID’s 50, 49, 48, and 47 to verify the entered values are correct. Above operator action must be repeated if a change is to be made.

(2) In the event more than one nonstandard vehicle is to be entered into memory, repeat above operator action making sure that when performing third step, a number other than the one previously entered is used, i.e., 9 or 10. If the number 8 were entered again, X, Y, Z, and V dimensions previously entered would be cleared from memory. A save routine at shutdown will store all nonstandard vehicle selections which have been entered.

(3) In the event a vehicle selection change is necessary during a mission, the new vehicle lever arms may be selected by returning to the monitor table and proceeding as follows:

OPERATOR ACTION	DATA DISPLAY	
Press ID, 5, 1, ENT	Vehicle previously selected	
	When number of selected vehicle is displayed, press ENT.	
Press MON, 1	HUM 1	
Press MON, 2	CUV 2	
Press MON, 3	SUV 3	
Press MON, 4	M151 4	
Press MON, 5	OH-58 5	
Press MON, 6	UH-1 6	
Press MON, 7	PLMB 7	
Press MON, 8	SEL 1 8	Only displayed if entered per non-standard vehicle procedure
Press MON, 9	SEL 2 9	
Press MON, 10	SEL 3 10	

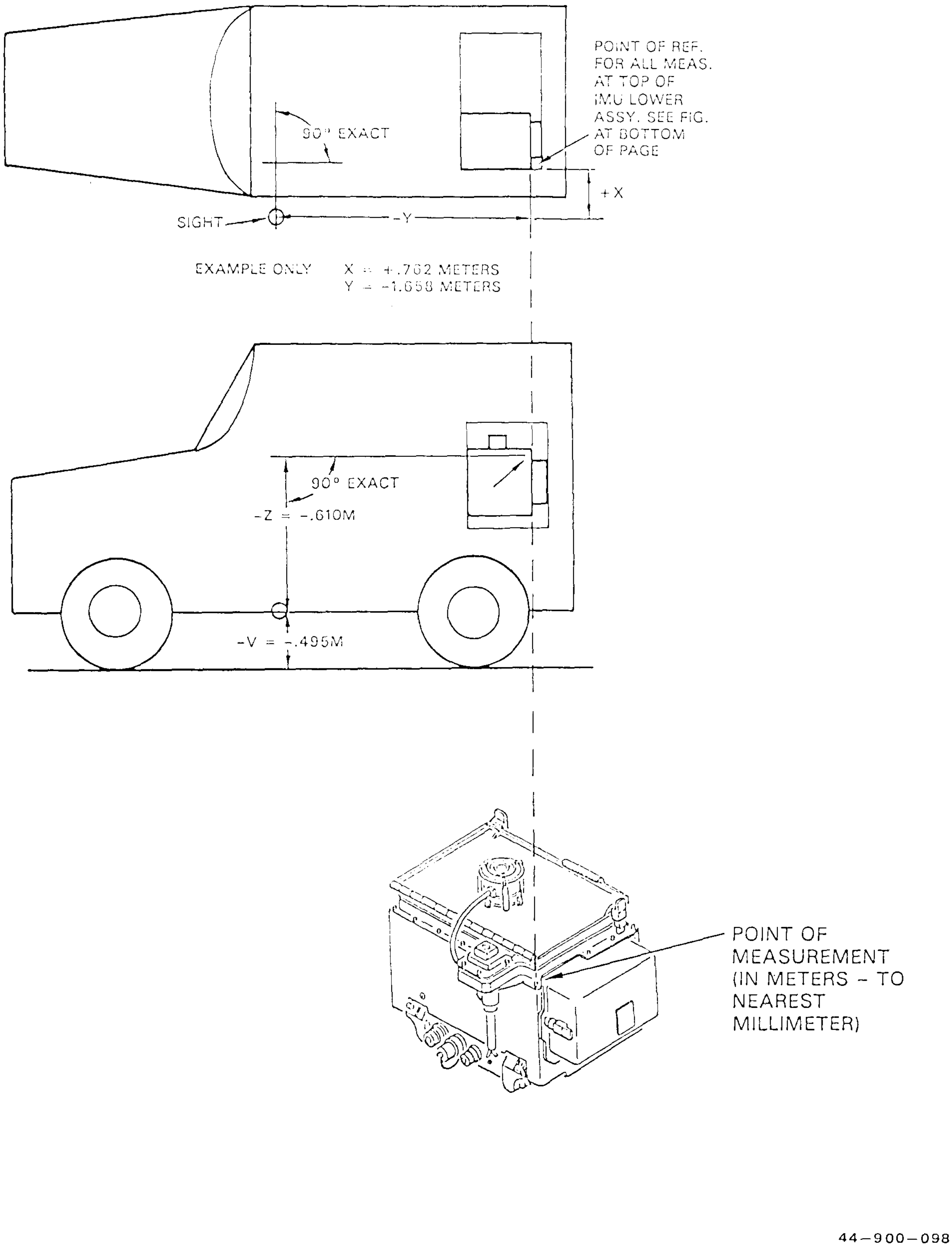


Figure 3-5.1. Nonstandard Vehicle Example

3-9. Entering UTM Grid Zone, Easting, Northing, Elevation, Distance, or Horizontal Angle. When PADS wants data, the CDU data display cues the operator by flashing a symbol. The data format is indicated by decimal points, colons, and zeros.

a. The operator recognizes a cue by pressing the pushbutton corresponding to the flashing symbol. The displayed symbol stops flashing and the zero(s) goes blank. Enter data with the numeric pushbuttons. Each numeral enters the display at the extreme right and moves one space to the left when a new digit is entered.

b. If a wrong number is entered, press CLR to clear the display. When all numerals are entered, check that the data is entered correctly. If possible, use a second person to check the entry. Press ENT to enter the data into the system. The display will show a new message.

c. A display showing "E"0: .0, means PADS wants the UTM grid zone and casting coordinates entered. UTM grid zone is entered first and will eventually appear to the left of the colon. The coordinate must have 7 digits and be entered to the nearest tenth of a meter.

Example: Enter an casting value of 246789.7 for UTM grid zone 12.

OPERATOR ACTION	DATA DISPLAY
(PADS cue)	"E"0: .0
Press E.	E :
Press 1.	E : .1
Press 2.	E : 1.2
Press 2.	E : 12.2
Press 4.	E : 122.4
Press 6.	E : 1224.6
Press 7.	E : 12246.7
Press 8.	E :122467.8
Press 9.	E 1:224678.9
Press 7.	E12:246789.7

Check that data is correct before entering.

Press ENT	"N" : .0

The cues for the other parameters are:

"N"	.0	UTM northing – entered to nearest tenth of a meter. For southern hemisphere, press N twice. Display will change from N to S.
"EL"	.0	Elevation – entered to nearest tenth of a meter. When EL is pressed, PADS will display ±EL. For an elevation above mean sea level, press +2. For an elevation below mean sea level, press -8. Then enter the numerical value.
"D"	.0	Distance between theodolite and porro prism — entered to nearest tenth of a meter.
"∠"	.0	Mean horizontal angle between PADS and azimuth line – entered to nearest hundredth of a mil.

3-9.1 Entering Latitude, Longitude, and Elevation for Operation in the Geographic Coordinate System. When PADS requests data, the CDU data display cues the operator by flashing a symbol. The data format is indicated by decimal points, colons, and zeros. Refer to examples below:

Example: Entering longitude value of -118° 25' 36.63'"

OPERATOR ACTION	DATA DISPLAY	
(PADS cue)	"LO"	: : .00
PRESS E	LO "-"	: : .
PRESS -	LO -	: : .
PRESS 1	LO -	: : . 1
PRESS 1	LO -	: : .11
PRESS 8	LO -	: 1.18
PRESS 2	LO -	:11.82
PRESS 5	LO -	: 1:18.25
PRESS 3	LO -	:11:82.53
PRESS 6	LO -	1:18:23.36
PRESS 6	LO -	11:82:53.66
PRESS 3	LO -	118:25:36.63

Check that data is correct before pressing ENT.

PRESS ENT	"LA"	: : .00

Example: Enter a latitude value of +34° 10' 19.27"

OPERATOR ACTION	DATA DISPLAY	
(PADS cue)	"LA"	: : .00
PRESS N	LA "-"	: : .
PRESS +	LA	: : .
PRESS 3	LA	: : . 3
PRESS 4	LA	: : .34
PRESS 1	LA	: 3.41
PRESS 0	LA	:34.10
PRESS 1	LA	: 3:41.01
PRESS 9	LA	:34:10.19
PRESS 2	LA	3:41:01.92
PRESS 7	LA	34:10:19.27

Check that the data is correct before pressing ENT.

PRESS ENT	"EL"	. 0

NOTE

The remainder of the cueing and entry is identical to operation in the UTM grid coordinate system. Refer to paragraph 3-9.

a. The operator recognizes a cue by pressing the pushbutton corresponding to the flashing symbol. The displayed symbol stops flashing and the zero(s) goes blank. Enter data with the numeric pushbuttons. Each numeral enters the display at the extreme right and moves one space to the left when a new digit is entered.

h. If a wrong number is entered, press CLR to clear the display. When all numerals are entered, check that the data is entered correctly. If possible, use a second person to check the entry. Press ENT to enter the data into the system. The display will show a new message.

c. To operate in the geographic coordinate system, the flashing "SPH"' must he responded to by adding 100 to the selected survey spheroid. Therefore:

SPH 101 = Clarke 1866 Spheroid, Geographic Coordinate System

SPH 102 = Clarke 1880 Spheroid. Geographic Coordinate System

SPH 103 = International Spheroid, Geographic Coordinate System

SPH 10-1 = Bessel Spheroid, Geographic Coordinaite System

SPH 105 = Everest Spheroid, Geographic Coordinate System

SPH 106 = Malayan Spheroid, Geographic Coordinate System

SPH 107 = Australian National Spheroid, Geographic Coordinate System

d. After the proper spheroid is selected, the display will indicate the last vehicle in use. Refer to paragraph 3-8.1. Upon entry of a vehicle, the display will cue for longitude position with a flashing "LO". East of Greenwich is is defined as positive (eastern hemisphere) and west of Greenwhich is defined as negative (western hemisphere). Only the negative (-) sign will be displayed for western hemisphere operation. If no convention sign is displayed in geographic coordinate position, it will be assumed to be positive.

NOTE

Since operation in the geographic coordinate system is for survey missions only, the two position azimuth mark (paragraph 3-17) and distance traveled displays are not activated. The CDU will display dashes (--) when DIST is pressed by the operator.

When operating in the geographic coordinate system, the CDU azimuth displays are in degrees, minutes, and seconds. Paragraphs 3-18 through 3-20 must, therefore, be performed using the theodolite with entry in degrees, minutes, and seconds. (Mils must be converted to degrees, minutes, and seconds before entry.)

3-10. Zero-velocity Correction.

CAUTION

Failure to perform zero-velocity corrections when requested may cause survey mission failures.

NOTE

Zero-velocity correction should be performed whenever the vehicle is stopped. Frequent (corrections improve survey accuracy.

Helicopters must land for zero-velocity corrections.

a. Zero-velocity corrections are needed for accurate surveying. One begins automatically during initialization Thereafter, PADS requests zero-velocity correction stops at 10-minute intervals. PADS automatically performs a zero-velocity correction at all mark and update procedures.

b. PADS requests a zero-velocity correction by flashing the GO and STOP indicators and beeping ALARM DS3 30 seconds before the next required correction. The operator has 30 seconds to stop the vehicle and press STOP. If he does not, the GO indicator extinguishes, STOP indicator continues to flash, ALARM DS3 sounds steadily, and data display reads STOP. Press TIME to disable ALARM DS3 for 30 seconds. The sequence of operations is:

OPERATION	STATUS INDICATOR
(1) Stop vehicle and set brake.	"STOP" "GO", or "STOP" $\boxed{\text{GO}}$
(2) Press STOP.	Stop $\boxed{\text{GO}}$
(3) After a few seconds.	Z-VEL
(4) Correction completed.	$\boxed{\text{STOP}}$ "GO"
(5) Vehicle moves.	GO $\boxed{\text{Z-VEL}}$

c. If the vehicle moves before a zero-velocity correction is completed, the time automatically reverts back to the prior zero-velocity countdown time.

d. In order to obtain the PADS specified accuracies for battalion survey, the operator must perform 10-minute zero-velocity corrections. For division artillery survey, the operator must perform 5–minute zero velocity corrections.

CAUTION

Do not set the Z–VEL interval to exceed 10 minutes as PADS accuracies will degrade.

NOTE

The Z–VEL interval may be changed by the operator, i.e. if a 5–minute interval is required for the fourth order survey, the operator should perform the following sequence: Press MON, ID, 4, 6, ENT, MON, 5, 0, ENT. The CDU display will display 5.0 as the Z-VEL interval and will remain this value throughout this and subsequent missions until reset in the same manner. To change Z-VEL back to 10 minutes press MON, ID, 4, 6, ENT, MON 1, 0, 0, ENT. This can be performed at any time during the mission.

e. The ATTN indicator lights if system errors are too large during a zero-velocity correction. This can be caused by: pressing STOP while vehicle is moving; not stopping when requested; or a PADS malfunction. Make sure the vehicle is stopped; press and hold STOP to override the ATTN indicator. Release STOP when ATTN indicator extinguishes and STOP indicator lights. Troubleshoot in accordance with table 4–2 for repeated failure indications not induced by the operator.

3–11. Updating.

NOTE

An update may be cancelled any time before completion by pressing UPDT a second time. A completed update cannot be eliminated.

Position and elevation updates may be performed independently.

a. Inserting accurate position and/or elevation data into PADS is called updating. All updates are per–formed over known survey control points. PADS must he updated after initialization before it can provide accurate survey data. The first update after initialization is called the initial update. The survey mission starts after the initial update. It is essential to update PADS at the end of a survey mission. At the end of an update, PADS automatically adjusts all data recorded since the previous update. The adjusted data replaces the unadjusted data stored in the systems computer.

b. After the operator has entered the known trig list position and/or elevation data of the survey control point into the PADS, the system automatically tests the difference between the update coordinates (trig list data), and his actual PADS position coordinates. If the difference (error) is within the built in calibrated tolerance parameters, the update is accepted and the CDU will display ID° PAE U-U.

c. When PADS accepts an update and displays ID° PAE U-U, the system has told the operator that PADS has met the required specified accuracies needed for that update and all surveyed stations established back to the previous update. The order of accuracy is based upon the time interval of zero-velocity correction performed during the mission. To obtain prescribed accuracies, the required zero-velocity correction intervals are shown below:

REQUIRED ACCURACY	REQUIRED TIME INTERVAL
Battalion Survey Accuracy	10 minute zero-velocity corrections
Division Artillery Accuracy	5 minute zero-velocity corrections

d. Procedures used to update position and/or elevation with plumb bob or theodolite are listed in steps 3, 4, 5, and 6 of table 3-2.

3-12. Update Rejection.

a. While updating the system, PADS tests the difference between the update coordinates (trig list data), and the actual PADS position coordinates.

b. If the difference (error) is within a built-in tolerance, the update is accepted and the display will read ID° PAE U-U.

c. If the difference (error) is outside the built-in tolerance, PADS recues for the data by flashing “E” on the CDU followed by the data the operator entered.

d. The flashing “E” indicates an update rejection. The operators will check the probable reason and take the appropriate corrective action(s) as outlined in the update rejection troubleshooting table 3-3.

3-13. PAE Display. At the completion of an update or mark, PADS summarizes the results by displaying the following:

X(ID) PAE X X X

(X means the value does not matter for this illustration)

The symbols used in the summary are:

SYMBOL	MEANING
X(ID)	A numeric display identifying the mark table-data location of a completed mark or update. The mark table cart store 30 positions
PAE	Stands for Position Azimuth, Elevation. PAE display with no numeric summary indicates a mark or update was not completed
U	Indicates that an update of position and/or elevation is complete
1	Indicates that a theodolite was used to mark position azimuth and/or elevation
2	Indicates that the PADS plumb bob was used to mark position, azimuth and/or elevation.
E	Indicates that a probable error is in the numeric location of the PAE display
–	Indicates that either position, azimuth and/or elevation was not marked or updated

Shown below are examples of the displays.

1	PAE U-U	You have updated position and elevation using either plumb bob or theodolite
2	PAE 1-1	You have marked position and elevation using a theodolite
3	PAE 111	You have marked position, azimuth, and elevation using a theodolite
4	PAE 2-2	You have marked position and elevation using a plumb bob
5	PAE 222	You have marked position, azimuth, and elevation using a plumb bob

6 PAE 2E2	You have marked position, azimuth, and elevation using a plumb bob, but there is a probable error in azimuth. In this event, you have to repeat the measurement. An E in azimuth of a 2-position azimuth mark indicates that the distance between points was not at least 100 meters or the travel time between points was too long

3-14. ID Number/Data Recall.

a. PADS assigns an ID number to identify the data when a mark or update is completed. The ID number appears in the two left digits of the data display. E, N, EL, AZ, DIST, ∠, TIME, and PAE for any previous mark or update may be recalled at any time except during a mark or update. The time of each mark or update may also be recalled. The recall procedure is:

OPERATION	DATA DISPLAY
(Present display)	12 N3835482.5
Press ID	N3835482.5
Enter desired ID number, e.g., 7	7 N3835482.5
Press ENT	7 N3835961.5
Press key(s) for desired parameter(s), e.g., EL	7 + EL 359.5

b. An alternate procedure is to press +2 to increase the ID number by one or press -8 to decrease.

c. The PAE display is recalled by pressing ID twice.

d. The time of a mark or update is recalled by pressing TIME.

3-15. Marking.

NOTE

PADS measures elevation at ground level under the plumb bob. If the survey marker is at a different height, adjust the elevation for the difference.

a. The establishment of survey coordinates and azimuth with PADS is called "marking". PADS has the ability to store data up to 30 positions, but is unlimited in the amount of positions which may be established in a mission. These stored positions are assigned an identification number along with a PAE display and are stored in the mark table of the computer as discussed in paragraphs 3-13 and 3-14. Identification numbers (IDs) are assigned in numeric sequence for each mark or update. The PADS system does not assign an ID number or PAE display for the initialization data. The first update SCP after initialization always has the ID number 1. After 30 ID numbers have been stored, another mark or update will erase the first ID data stored in the computer, and replace it with the new mark or update data. Thereafter, each subsequent mark or update will erase the next ID in sequence.

b. Positions can be established using the plumb bob as reference or can be offset from the PADS system using a theodolite (optical position mark, no azimuth). Azimuths to distant landmarks can be established using a theodolite (optical position and azimuth mark). An azimuth of a short line (100 to 1000 meters) can be established by marking both ends of the required azimuth line with PADS (2-position azimuth mark using plumb bob) or using theodolite and performing an optical position and azimuth mark.

c. An optical position and azimuth mark requires the operator to autoreflect, measure a horizontal angle, and measure the offset distance with a theodolite as described in paragraph 3-18. Marking procedures are described in paragraphs 3-16, 3-17, 3-19, and 3-20.

CAUTION

If the wrong vehicle has been selected for the vehicle in use, the effective position of the PADS to the sight or new plumb bob extension point will be incorrect, and will provide incorrect mark/update information. To verify the correct configuration is being used, the operator must verify the correct vehicle is in use by pressing MON, ID, 5, 1, and ENT. Refer to paragraph 3-8.1.

3-16. Marking Position and Elevation Using Plumb Bob. Used to establish position and elevation coordinates of a point or the first point of a 2-position azimuth mark.

a. Maneuver vehicle to place plumb bob over point to be established.

b. Deleted

c. Stop the vehicle, set hand brake, and exit vehicle.

d. Press STOP.

e. Press MARK

f. If display reads 2-POS C-E, press CLR.

g. Display will read ⊼ C-E.

h. Press CLR. Display will show PAE.

i. The mark is completed when MARK, ENT, and STOP indicators extinguish, GO indicator flashes, and display shows ID° PAE 2-2. PADS has automatically assigned the next ID number and stored the position and elevation coordinates. No azimuth will be stored.

j. Press E, N, EL, and record the unadjusted data.

k. Mark the surveyed point with witness stake, stow plumb bob and other equipment.

l. Ensure that the CDU has a flashing "CO" and proceed to next point.

3-17. Marking 2-Position Azimuth Mark Using Plumb Bob. (Not Functional in Geographic Coordinate System Operations.)

NOTE

The vehicle must be able to travel to quickly between both ends of the azimuth line, 100 to 1000 meters long. If the distance between the points is less than 100 meters or the travel time is too long, the accuracy of the computed azimuth may be degraded and the PAE display will show E in the azimuth location, meaning there is a probable error in azimuth.

Time begins when flashing green "GO" goes solid and ends when the "MARK" is pushed at the second position.

The Distance/Time parameters are
100 meters/76 seconds
150 meters/85 seconds
200 meters/93 seconds
300 meters/109 seconds.

a. Mark one end of the azimuth line in accordance with paragraph 3-16.

b. proceed immediately without delay to the second point.

c. As soon as vehicle is in motion, press ID 0 ENT DIST. Distance in meters from the marked point to the present vehicle position will be displayed. Make certain the azimuth line is 100 to 1000 meters long.

d. Upon arrival at second point, maneuver vehicle to plumb over point in accordance with paragraph 3-16, steps a through c.

e. Press MARK. and ENT indicators light. Display shows 2 POS C-E.

f. Press ENT. Display shows PAUSE.

g. The mark is completed when MARK, ENT, and STOP indicators extinguish, GO indicator flashes and display shows ID PAE 222. PADS has automatically assigned the next ID number and stored position, azimuth, and elevation. The azimuth is from the second point to the first. The azimuth from the first point to the second is added to the data stored for the first point.

h. Press E, N, EL, DIST. GAZ, and record the unadjusted data.

i. Mark the surveyed point with witness stake. Stow plumb bob and other equipment.

j. Make certain the CDU has a flashing “GO” and proceed to the next point.

3-18. Theodolite Measurements. Optical measurements may be performed any time throughout the survey mission, but must always be performed when the update SCP is inaccessible to the PADS vehicle, when a position to be established is inaccessible to the PADS vehicle, or when an azimuth line of less that 100 meters is required.

NOTE

To increase visibility, color the theodolite sight white with typewriter correctionfluid. At night, illuminate the sight with the theodolite handlamp. If possible, PADS should be positioned so that the direct sunlight does not shine on the porro prism. If the sun is reflected by the porro prism, the operator will have difficulty in performing autoreflection.

a. Autoreflection. Prior to making any optical measurements, the PADS operator must achieve autoreflection. To achieve autoreflection, perform the following:

(1) Stop vehicle close to SCP or point to be established, exit vehicle, and perform a zero-velocity correction by pressing STOP in the CDU.

(2) Set up theodolite over SCP or point to be established. If an azimuth is required, set up range pole over azimuth marker.

(3) Uncover and roughly level the porro prism.

(4) The vehicle operator makes certain that the CDU has a flashing "GO" light and maneuvers the vehicle so that the porro prism is visible from the theodolite and is within 16 meters. The PADS operator, standing behind the theodolite, instructs the vehicle operator to slowly maneuver the vehicle until the theodolite is reflected in the porro prism and autoreflection is obtained. An alternate procedure, especially useful for helicopter operations, is to keep the vehicle stationary and move the theodolite until autoreflection is achieved.

(5) Vehicle operator exits the vehicle, presses the STOP key, and fine-level the porro prism.

(6) The PADS operator then checks to sce if autoreflection can still be achieved. If not, repeat steps (1) through (5) if necessary.

(7) Focus the theodolite so the reflected image of the theodolite front sight is centered on the vertical crosshair see figure 3-6, view A). The theodolite line-of-sight is now perpendicular to the porro prism.

b. Mean Horizontal Angle Measurement. See figure 3-6, view B.

(1) Autoreflection porro prism

(2) Measure direct angle (in mils) from porro prism clockwise to azimuth target.

(3)*Plunge theodolite telescope and measure reverse angle (in mils) from azimuth target to porro prism (autoreflect).

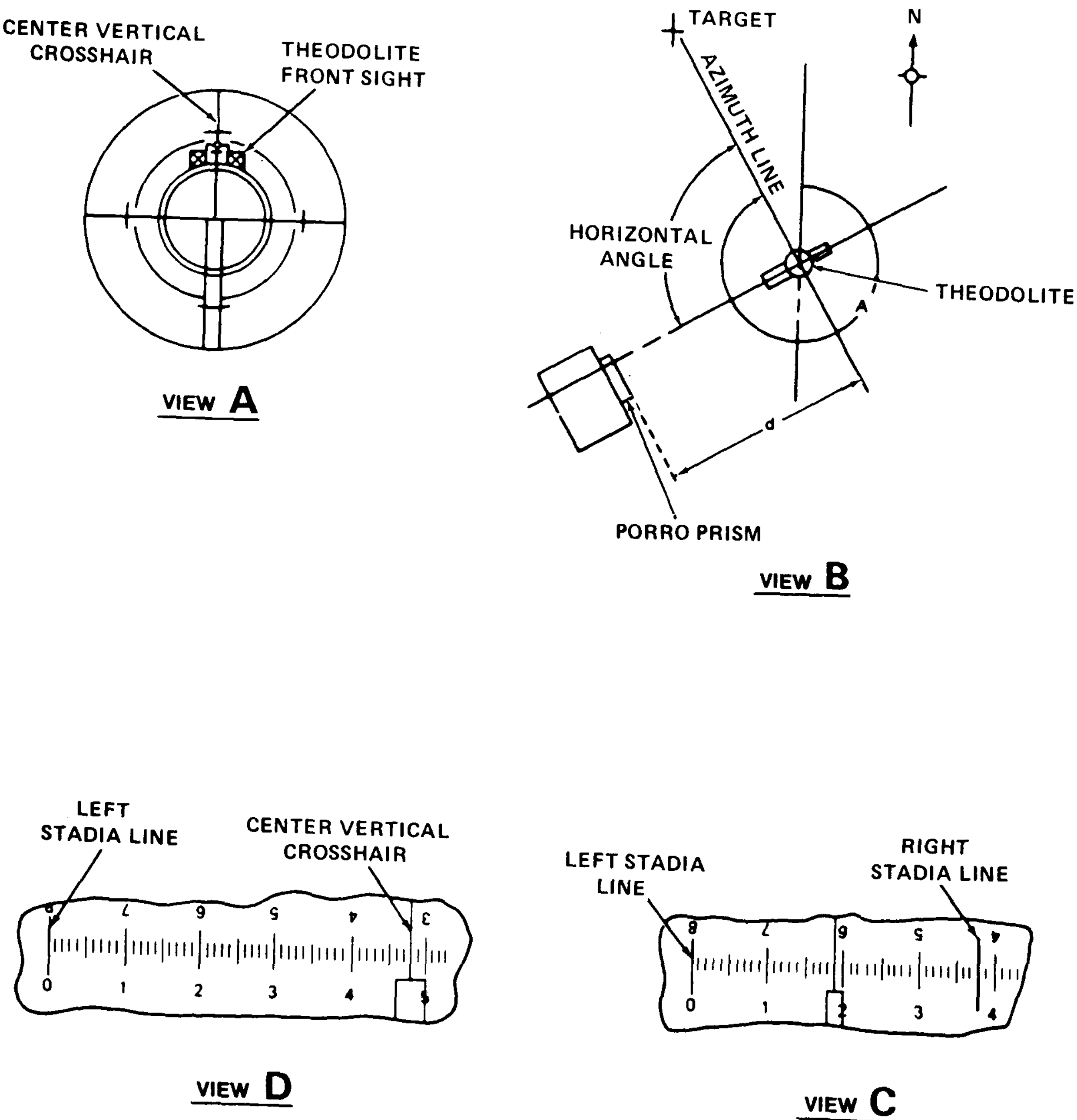


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Figure 3-6. Optical Measurement Details

(4) If the difference between direct and reverse pointings is greater than 0.2 mil, repeat the measurements.

(5) Mean the direct and reverse pointings to obtain the mean horizontal angle.

c. **Offset Distance Measurement.**

NOTE

At night, illuminate porro prism scale with PADS mounted flashlight. Porro prism has two scales for inverting and noninverting instruments.

(1) If distance between porro prism scale and theodolite is less than 8 meters, locate left vertical stadia line on porro prism scale zero mark. Read the scale where the right stadia line intersects the scale. Example: See figure 3-6, view C.) Stadia lines on 0 and 3.8 on scale. Offset distance is 3.8 meters.

(2) If offset distance is between 8 and 16 meters, locate left stadia line on zero mark and read the distance to the center vertical crosshair where it intersects the scale; then, multiply it by two. Example, figure 3-6, view D: left stadia line is at zero, vertical crosshair is on 4.8 of scale, offset distance equals 4.8 x 2 or 9.6 meters.

3-19. Marking - Position, Azimuth, and Elevation Using Theodolite.

NOTE

At the completion of an update, PADS will not adjust the azimuth obtained in a position, azimuth, and elevation mark using a theodolite.

a. Stop vehicle close to SCP or point to be established. Exit vehicle and perform a zero-velocity correction by pressing STOP key on CDU.

b. Set up theodolite over SCP or point to be established and achieve autoreflection as described in paragraph 3-18a.

c. Once autoreflection is achieved, the PADS operator instructs the assistant PADS operator to press MARK. If display shows 2 POS C-E, press CLR. Display now shows ⊼ C-E.

d. Press ENT. Display alternates between "⊼" and "READ" for 64 seconds and then displays a flashing "∠" .00. The alternating "⊼ "/" "READ" for 64 seconds is a motion test. During the motion test, the vehicle must not be moved or disturbed. The assistant PADS operator now becomes the recorder for the PADS operator.

e. Measure and record the mean horizontal angle and offset distance in accordance with paragraph 3-18, subparagraphs b and c.

f. The time between steps d and i must be at least 64 seconds, so do not press ∠ until display shows a flashing " ∠ " 00. Without disturbing the vehicle, press ∠

g. After pressing ∠, the display will show PAUSE while PADS checks for excessive motion. If the vehicle was disturbed or moved, the display will show ⊼ C-E and the operator must repeat steps d through g.

h. PADS displays ∠.

i. Enter mean-horizontal angle to the nearest 0.01 mil. PADS cues for distance by flashing "D'" on display.

j. Press DIST. Display shows D. Enter offset distance to nearest 0.1 meter. Press ENT; PADS displays PAUSE.

k. When MARK, ENT, and STOP indicators extinguish and "GO" indicator flashes, display indicates ID° PAE 111. PADS has assigned the next ID number and stored the position and azimuth data.

l. Press E, N, EL, and GAZ and record the unadjusted survey data.

m. Mark the surveyed points with witness stakes and stow all equipment.

n. Make certain the CDU has a flashing "GO", and proceed to next point.

3-20. Marking - Position and Elevation Using Theodolite.

a. Perform steps a through d of paragraph 3-19.

b. Display alternates between "⊼" and "READ".

c. Press CLR to bypass the 64-second motion test and mean-horizontal angle entry. PADS will cue for distance by flashing "D".

d. Press DIST and enter distance to the nearest 0.1 meter. Display shows PAUSE.

e. MARK, ENT, arsd STOP indicators extinguish; "GO" indicator flashes and display reads ID° PAE 1-1. PADS has assigned the next ID number and stored the position data.

f. Press E, N, EL, and record the unadjusted data.

g. Mark the surveyed point with witness stake and stow equipment.

h. Make certain the CDU has a flashing "GO"' and proceed to the next point.

3-21. Adjacent Grid Zone. (Not Functional in Geographic Coordinate System Operation.)

a. PADS automatically computes coordinates in the correct UTM grid zone. If you are within approximately 80 kilometers of a zone boundary, and wish to enter or recall northing and easting in terms of the adjacent zone, press ADZ. The ADZ indicator will light. Enter or recall the desired data.

b. The ADZ indicator will extinguish if PADS is further than 80 kilometers from a zone boundary or a function other than northing or casting is selected.

c. If REJ is displayed on the data display window, PADS is not within the 80 kilometer zone boundary.

3-22. Recording PADS Data.

a. **Mark.** Record station, ID number, PAE display, zone, easting, northing, elevation, grid azimuth (if measured), and distance for each position marked. Record all mean-horizontal angles and offset distances measured. Also record all malfunctions which occur during the survey mission.

b. **Update.** After any update except the initial one, recall an record all adjusted data stored since the last update. The assistant operator should check all data. PADS does not adjust distances or azimuths obtained using a theodolite.

c. For examples of recording PADS data, refer to FM 6-2, chapter 8.

Table 3-2. Mission Procedures

Step no.	Operator action	CDU data display	Status indicators	Reference
	NOTE This table summarizes PADS operational sequences. More detailed descriptions are in the paragraphs and tables listed in the reference column.			
1.	DAILY CHECKS AND SERVICES			
a.	Check that primary pallet, battery box, and CDU are securely mounted			Para 2-11 2-12 and 2-13
b.	Inspect fluid level of vehicle and PADS batteries. Replenish as necessary			**Table 4-1**
c.	Check that primary pallet is properly connected to vehicle power, battery box, and CDU			Para 2-11, 2-12, 2-13 and 2-14
d.	Check for proper operation of flashlight			**Table 4-1**
e.	Clean porro prism			**Table 4-1**
f.	Check that all equipment is properly stowed and does not block air-flow to PADS or interfere with vibration isolated units			Para 2-11, 2-12, 2-13 and 2-14
g.	Check that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are OFF			Figure 3-3
h.	Start vehicle engine and verify proper operation of vehicle electrical system			
2.	INITIALIZATION			
a.	Check that PS is connected to vehicle power using cable assembly W7			Para 2-11, 2-12 and 2-13
b.	Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to ON			**Para 3-6 and fig. 3-3**
	CAUTION PADS must not be moved for at least one minute after turn on. Failure to do this may result in severe damage to the equipment.			

Table 3-2. Mission Procedures-Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
c.	Press ON/OFF	"SPH" 1 or "SS SPH" 1 (or last used spheroid)	STOP. ENT	Note below
	NOTE			
	BATT may light for a few minutes. If it stays lighted, verify connections to vehicle power and battery box and that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are ON. CHRG may light throughout the mission.			
	If computer and/or CDU fault indicators set white at turnon, press LAMP and observe that they set to black.			
	If malfunctions are encountered now or during mission operations, refer to table 4-2.			Para 3-6
d.	Drive vehicle to initialization point and park			Para 3-5
e.	Adjust vehicle hand throttle so batteries charge and engine idle is smooth			
f.	Perform lamp test, replace faulty lamp modules	(All lamps light)	(All lamps light)	Para 3-7
	NOTE			
	Fault indicators set white then reset black when **LAMP** is released.			
g.	Set lamp intensity; Press **SPH**	"SPH" 1 or "SS SPH" 1	STOP. ENT	Para 3-7
h.	Enter spheroid: PADS accepts spheroid	PAUSE		Para 3-8
i.	PADS cues for vehicle type	HUM 1 (or last vehicle used)		Para 3-8.1
	NOTE			
	PADS will display last vehicle in which it was used. When selecting vehicle, press the + or – key until desired vehicle appears.			

Table 3-2. Mission Procedures-Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
j.	Press + or – key until desired vehicle appears			
k.	Press <u>*ENT;*</u> PADS cues for casting	"E" 0.	.0	Para 3-9
l.	Enter zone and casting PADS cues for northing	"N"	.0	Para 3-9
m.	Enter northing; PADS cues for elevation	"EL"	.0	Para 3-9
	NOTE When entering elevation, first press <u>+ 2</u> or <u>– 8</u> depending on whether PADS is above or below sea level.			
n.	Enter elevation: alignment continues; operator leaves vehicle	MODE MODE MODE	0 $\boxed{\text{ENT}}$ CAL MON 1 2 Z-VEL	

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
		MODE 3		
		MODE 4		Note 2 (below)
		MODE 5		
		MODE 6		
		MODE 7		
o.	Alignment ends; system ready to move	MODE 8	$\boxed{\text{CAL}}$ $\boxed{\text{STOP}}$ "GO"	
	NOTE 1. The data display will initially show MODE, 0, 1, 2, or 3 depending on the speed of coordinate entry. Time since turn on may be displayed by pressing <u>TIME</u>. The mode may be recalled by pressing <u>MON.</u>			
	NOTE 2. MON will extinguish when any other function is selected.			
p.	Move system to known survey control point (SCP) to perform an update; perform zero-velocity corrections as necessary		$\boxed{\text{Z-VEL}}$ GO	Para 3-10
3.	<u>UPDATE - POSITION AND ELEVATION - PLUMB BOB</u>			
a.	Maneuver vehicle to place plumb bob over SCP			Para 3-11
b.	Stop vehicle: press <u>STOP</u>		STOP $\boxed{\text{GO}}$ Z-VEL	
c.	Press <u>UPDT</u>	⊼ C-E	UPDT ENT	
d.	Press <u>CLR;</u> PADS cues for casting	"E"0: .0		Para 3-9
e.	Enter zone and casting; PADS cues for northing	"N" .0		Para 3-9
f.	Enter northing; PADS accepts position data	PAUSE		Para 3-9
g.	PADS cues for elevation	"EL" .0		

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
h.	Enter elevation; PADS accepts elevation data	PAUSE		Para 3-9
i.	PADS shows update results and is ready to move after indicator has flashing "GO"	ID°PAE U-U	STOP UPDT ENT "GO"	Para 3-13
4.	<u>UPDATE - POSITION AND ELEVATION - THEODOLITE</u>			
a.	Stop vehicle; press <u>STOP</u>		STOP GO Z-VEL	
b.	Set up theodolite over SCP			
c.	When ready to move, ("GO"), maneuver vehicle for autoreflection		STOP GO Z-VEL	Para 3-18
d.	Press <u>STOP</u>		STOP GO Z-VEL	
e.	Measure and record offset distance			Para 3-18
f.	Press <u>UPDT</u>	⊼ C-E	UPDT, ENT	
g.	Press <u>ENT</u>			
h.	PADS cues for easting	"E"O: .0		Para 3-9
i.	Enter zone and easting; PADS cues for northing	"N" .0		Para 3-9
j.	Enter northing; PADS cues for offset distance	"D" .0		Para 3-9
k.	Press <u>DIST</u> and enter distance; PADS accepts update data	PAUSE		
l.	PADS cues for elevation	"EL" .0		Para 3-9
m.	Enter elevation; PADS accepts elevation data	PAUSE		
n.	PADS shows update results and is ready to move after indicator has flashing "GO"	ID° PAE U-U	STOP UPDT ENT "GO"	Para 3-13
5.	<u>UPDATE - POSITION ONLY</u>			
a.	Perform steps 3a thru 3g or 4a thru 41	"EL" .0	STOP GO ENT Z-VEL UPDT	Para 3-11

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
	b. Press CLR; PADS shows update results and is ready to move after indicator has flashing "GO"	ID° PAE U --	STOP "GO" ENT UPDT	Para 3-13
8.	UPDATE - ELEVATION ONLY			Para 3-11
	a Maneuver vehicle to place plumb bob over SCP			
	b. Stop vehicle; press STOP		STOP GO Z-VEL	
	c. Press UPDT	⊼ C-E	UPDT ENT	
	d Press CLR; PADS cues for easting	"E"0: .0		
	e. Press CLR	"'EL" .0		
	f. Enter elevation; PADS accepts elevation data	PAUSE		Para 3-9
	g. PADS shows update results and is ready to move after indicator has flashing "GO"	ID" PAE - -U	STOP "GO" UPDT ENT	Para 3-13
7.	CURRENT DATA DISPLAY			
	a. Press ID	--(Last display)	ENT	Para 3-17 and table 3-1 (ID)
	b. Press 0	--0 (Last display)		
	c. Press ENT	(Last display)	ENT	
	d. Press symbol for desired parameter; e.g., easting; press E	EXX:XXXXXX.X		
8.	MARKING - POSITION AND ELEVATION (Using plumb bob)			Para 3-16
	a. Stop vehicle; press STOP		STOP GO Z-VEL	
	b. Hang plumb bob from suspension point			
	c. Set survey marker directly under plumb bob			
	d. Stow equipment			
OR:				
	a. Hang plumb bob from suspension point			

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
b.	Maneuver vehicle so plumb bob is directly above pre-established survey marker		$\boxed{\text{STOP}}$ GO $\boxed{\text{Z-VEL}}$	
c.	Stow equipment			
d.	Press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
e.	Press MARK (if 2 POS C-E appears on display, press CLR)	⊼ C-E	MARK ENT	
f.	Press CLR PADS marks position	PAUSE		
g.	PADS records position and shows results of mark and is ready to move after indicator has flashing "GO"	ID° PAE 2-2	$\boxed{\text{MARK}}$ $\boxed{\text{ENT}}$ $\boxed{\text{STOP}}$ "GO"	
9.	MARKING - 2-POSITION AZIMUTH MARK (Using plumb bob. Not functional in geographiccoordinate system operation)			
a.	Stop vehicle; press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	Para 3-17
b.	Hang plumb bob from suspension point			
c.	Set survey marker directly under plumb bob			
d.	Stow equipment			
OR:				
a.	Hang plumb bob from suspension point			
b.	Maneuver vehicle so plumb bob is directly above a pre-established survey marker		$\boxed{\text{STOP}}$ GO $\boxed{\text{Z-VEL}}$	
c.	Stow equipment			
d.	Press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
e.	Press MARK (if 2 POS C-E appears on display, press CLR)	⊼ C-E	MARK ENT	
f.	Press CLR; PADS marks position	PAUSE		
g.	PADS records position and shows results of the first position of a 2-position azimuth mark and is ready to move after indicator has flashing "GO"	ID° PAE 2-2	$\boxed{\text{MARK}}$ $\boxed{\text{ENT}}$ $\boxed{\text{STOP}}$ "GO"	

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
h.	Drive vehicle toward second point requiring survey; press ID, 0, ENT, DIST	(Radial distance from first point)	$\boxed{\text{Z-VEL}}$ GO	
i.	Maneuver vehicle so plumb bob is directly over second point to be established and press STOP. (Distance must be at least 100 meters from the first point.		STOP $\boxed{\text{GO}}$ Z-VEL	
j.	Press MARK	2 POS C-E	MARK, ENT	
k.	Press ENT; PADS marks position	PAUSE		
l.	PADS records position, azimuth, elevation, and shows result of mark	ID° PAE 222	$\boxed{\text{MARK}}$ $\boxed{\text{STOP}}$ $\boxed{\text{ENT}}$ "GO"	
m.	Drive to next position, performing zero-velocity corrections as necessary		$\boxed{\text{Z-VEL}}$ GO	
10.	MARKING - POSITION AND ELEVATION (Using theodolite) **NOTE** If azimuth appears after update. disregard.			Note a, Para 3-9.1
a.	Stop vehicle, press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	Para 3-20
b.	Set up theodolite over point to be established			
c.	When ready to move ("GO"), maneuver vehicle and achieve autoreflection		$\boxed{\text{STOP}}$ GO $\boxed{\text{Z-VEL}}$	Para 3-18
d.	Press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
e.	Press MARK (if 2 POS C-E appears on display, press CLR)	⊼ C-E	MARK, ENT Z-VEL	
f.	Press ENT	"⊼", "READ" alternate for 64 seconds		
g.	Press CLR (to bypass 64-second motion test). PADS will cue for distance	"D"		

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
h.	Measure and record offset distance			Para 3-18
i.	Press <u>DIST</u>	D		Note a, Para 3-9.1
j.	Enter distance	PAUSE		
k.	PADS shows mark results	ID° PAE 1-1	$\boxed{\text{MARK}}$ $\boxed{\text{ENT}}$ $\boxed{\text{STOP}}$ "GO"	
l.	Stow equipment, and proceed with mission after indicator has flashing "GO"		GO $\boxed{\text{Z-VEL}}$	
11.	<u>MARKING - POSITION, AZIMUTH, AND ELEVATION (Using theodolite)</u>			Note b, Para 3-9.1
a.	Stop vehicle; press <u>STOP</u>		STOP $\boxed{\text{GO}}$ Z-VEL	Para 3-19
b.	Set up theodolite over point to be established			
c.	When ready to move, ("GO"), maneuver vehicle and achieve autoreflection		$\boxed{\text{STOP}}$ GO $\boxed{\text{Z-VEL}}$	Para 3-18
d.	Press <u>STOP</u>		STOP $\boxed{\text{GO}}$ Z-VEL	
e.	Press <u>MARK</u>	⊼ C-E	MARK, ENT Z-VEL	
f.	Press <u>ENT</u>	"⊼", "READ" alternate for 64 seconds then "∠"	.00	
g.	Measure and record horizontal angle and offset distance			Para 3-18
h.	Without disturbing vehicle, press ∠. PADS will automatically check for azimuthal motion. Display must be "∠" before this step will be accepted	PAUSE		
i.	Azimuth motion within limits (if motion is excessive, display will revert back to ⊼ C-E and steps f and h must be repeated)	∠		

Table 3-2. Mission Procedures - Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
j.	Enter horizontal angle. PADS cues for distance	"D" .0		Note a, Para 3-9.1
k.	Press DIST	D		
l.	Enter distance	PAUSE		
m.	PADS shows mark results	ID° PAE 111	MARK ENT STOP "GO"	
n.	Load survey equipment and proceed on mission when indicator has flashing "GO"		GO Z-VEL	
12.	DATA RECALL			Para 3-14
a.	Press ID	--(Last display)		
b.	Enter ID number of desired data. (Example: ID10)	10(Last display)		
c.	Press ENT	10(New display)		
d.	Press for data desired. (Example: for easting, press E.) Azimuth information will only be available for those ID's where an azimuth was marked. Refer to note preceding step 10a. Dashes will be displayed for grid or true azimuth in those ID's where only position and elevation are marked	10EXX:XXXXXX.X		
e.	An alternate procedure to recall data is to press +2 to increase the ID number by one or press -8 to decrease the ID number by one			
13.	SHUTDOWN			Para 3-6

CAUTION

To prevent damage, do not move or restart PADS for at least 2 minutes after shutdown.

Table 3-2. Mission Procedures-Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
	NOTE The following steps check the PADS battery operation under load. While it may be performed at any time during a mission, it is suggested that it be performed at the beginning of the mission to minimize impact if a defective battery is found.			
a.	While PADS is operating, note CHRG indicator is not lighted continuously			
b.	Disconnect vehicle power by setting PS VEHICLE circuit breaker CB2 to OFF. PADS should remain operating		BATT	
c.	After 30 seconds of battery operation, set VEHICLE circuit breaker CB2 to ON		CHRG	
	NOTE Steps d thru g are performed if system has a solid state memory and steps h and i are performed if system has a core memory.			
d.	Press *ON/OFF*	SAVE C-E		
	CAUTION Do not attempt to remove power or force a system shutdown during the PAUSE command. Memory data is being transferred during this time.			
e.	Press *ENT*	PAUSE		
f.	When display indicates “OFF” E, press *ON/OFF*	OFF “E”		
g.	Press *ENT*	(All displays darken)		
	OR:			
h.	Press *ON/OFF*	OFF C-E		
i.	Press *ENT*	(All displays darken)		

Table 3-2. Mission Procedures-Continued

Step no.	Operator action	CDU data display	Status indicators	Reference
	NOTE Steps j thru m apply to the solid state memory only. If, for security reasons, the operator does not want to store previously worked data, the following shutdown sequence should be followed.			
	j. Press <u>*ON/OFF*</u>	SAVE C-E		
	k. Press <u>*CLR*</u>	"OFF" C-E		
	l. Press <u>*ON/OFF*</u>	OFF “C-E“		
	m. Press <u>*ENT*</u>	(All displays darken)		
	n. Turn off PS BATTERY and VEHICLE circuit breakers CB1 and CB2			
	o. Turn off vehicle engine			
14.	**<u>AFTER-OPERATION CHECKS AND SERVICES</u>**			
	a. Inspect for excessive accumulation of dirt and debris. Clean as necessary.			Table 4-1
	b. Inspect for damage to primary pallet, battery box, CDU, and cables			Table 4-1

Table 3-3. Update Rejection Troubleshooting

NOTE

Update rejection may occur at the initial SCP or at SCP's during the survey mission. This table is divided into two parts. Part I pertains to rejection at the initial update SCP. Part II comprises all other update rejections occurring during the survey mission, or when closing the survey mission.

PART I
Update Rejections at Initial Update SCP

Reason for flashing E	Operator corrective action
1. Operator entered coordinates incorrectly	a. If displayed data is incorrect, enter the correct data. Press E, re-enter correct data. Press N, re-enter correct data
	b. If displayed data is correct, see reason 2, part I
2. Accuracy of initialization coordinates are questionable	a. Check map spot/or coordinates used to initialize system. Accuracy not within 100 meters, shut down and reinitialize using correct data. If accuracy of coordinates were correct, see reason 3, part I
3. Accuracy of initial update SCP is questionable	a. Cancel update. Press UPDT, proceed to another SCP and update system

PART II
Update Rejections During or Closing Survey Mission

Reason for flashing E	Operator corrective action
1. Operator entered coordinates incorrectly	a. If displayed data is incorrect, re-enter the correct data. Press E, re-enter correct data. Press N, re-enter correct data
	b. If displayed data is correct, see reason 2, part II
2. Accuracy of present SCP is questionable	a. Cancel update. Press UPDT, proceed to another SCP and update system
	b. If update is accepted, continue with mission. The accuracy of the last SCP where update was rejected is questionable
	c. If update is rejected, the accuracy of the initial update SCP or the initialization data is questionable. See reason 3, part II
3. Accuracy of initial update is questionable, or initialization; data was incorrect	a. Troubleshoot all data. Shut down, reinitialize using correct data. Update over known accurate SCP

NOTE

Illumination of the CAL indicator anytime during an update means that the update coordinates are wrong, the initial update coordinates were wrong, or there is a possibility that the system is out of calibration. If the update coordinates were wrong and the system accepted the update with the CAL indicator on, use the unadjusted rather than the adjusted PADS data. If the initial update coordinates were wrong, rerun the survey mission. If illumination of the CAL indicator cannot be traced to incorrect survey mission data, troubleshoot in accordance with table 4-2.

NOTE

Paragraphs 3-22.1 through 3-22.24 apply only to the solid state memory using the newer program containing GPS.

3-22.1. General. PADS normally is operated from a land vehicle. Helicopters are used in special situations, e.g., great distances between survey points, survey points inaccessible to a land vehicle, or when speed is of paramount concern. Because operations in a land vehicle or helicopter are nearly the same, complete procedures are given only for a land vehicle mounted PADS. Transfer between a vehicle and helicopter is described.

a. PADS requires horizontal and vertical position information to enable it to determine accurate position, azimuth and elevation. Initialization data can vary from update data. This was designed into the software to allow system alignment to be performed in an area, using less accurate data (map spot, etc.) than the data used to update the system. The update data should be the exact coordinates and elevation relative to the grid or map being used for the survey. Any position or elevation error entered during the update will be carried by the PADS throughout the mission.

b. Small position errors will not affect the azimuth determination accuracies as long as the target is on the same map or grid. If two grids or maps are used, position errors may have a greater impact on the target solution.

c. The initial position data typically has been obtained from local survey control, DMA maps, local road maps among a few, aided by local landmarks such as mountains, streams, etc. Ocean and desert locations, lacking in obvious landmarks or other defining marks present a difficult, if not impossible situation in determining, rough present position. Currently, another means of obtaining relatively accurate three dimensional position is available. This is known as Global Positioning Satellite NAV STAR (GPS). Accuracies are currently ±25 meters spherically. Eventually 24 hours coverage will become available providing the user with uninterrupted coverages. The user is cautioned when using GPS data. The various agencies controlling GPS can misdirect through various techniques and cause positioning errors up to 200 meters and perhaps even more. Some receivers have embedded cryptology to decode the selected errors, some do not. Reference the receiver manual for the receiver in use to determine applicability in those matters. The PADS software has been enabled to accept manual entries of GPS data with corresponding changes to accommodate the possible random errors associated with GPS. The operator will be informed via the mark table whether GPS, differential GPS or survey control was associated with the survey mission, and of those marks/updates uniquely associated.

d. If known survey control is unavailable or is suspect of being in error, PADS should use GPS data to update.

e. PADS update is performed in two distinct phases and is isolated from one another. The first in sequence is horizontal position. When this has been accepted, the elevation phase initiated automatically for convenience. These have been combined to follow one another, but can be performed individually if one control data is suspect. Therefore, the operator can be performing two consecutive (if desired) updates, using GPS/DIFF GPS and/or SCP.

3-22.2. PADS Mission Procedure. Normal operating procedures are summarized in table 3-3.2. The mission begins with pro-tumon checks and services, followed by initialization. Next, PADS is updated, using the position and elevation update procedure. PADS then performs a series of marks, where position, elevation, and azimuth are recorded. Update, data recall, and shutdown completes the mission. Table 3-3.2 references paragraphs, tables, and figures where mission phases are explained in detail. If a malfunction occurs, refer to table 4-2, Troubleshooting.

3-22.3. Initialization.

CAUTION

PADS must not be moved for at least one minute after turn on. Failure to do this may result in severe damage to the equipment.

PADS should be initialized on a firm, level surface. Alignment failure can result from vehicle movement on soft surfaces such as mud, snow, or ice, and shocks caused by operator movement or wind gusts. The operator should stand clear of the vehicle during alignment. The vehicle should be facing into high winds.

To prevent damage, do not move PADS for at least 2 minutes following shutdown. Defer shutdown if it is not possible to wait.

NOTE

To speed warm-up and improve alignment accuracy, PADS may be turned on before leaving for the initialization point. Do not enter spheroid data until vehicle is parked at the initialization point. Alignment starts when spheroid is entered.

PADS may be initialized on slopes greater than 5 degrees with a possible decreased alignment accuracy.

a. PADS must be initialized before it can survey. The operator enters the approximate PADS position. Then PADS automatically aligns.

b. The initialization site should have a firm surface level to ±5 degrees. The site horizontal position coordinates should be known to ±100 meters and the elevation known to ±10 meters from the actual position. Initialization takes 30 to 45 minutes, depending upon ambient temperature.

c. After entering the site coordinates, the operator should leave and remain clear of the vehicle until alignment is completed. The initialization sequence is shown in step 2 of table 3-3.2.

d. If excessive vehicle movement is experienced during alignment, the ATTN indicator will light and the CAL indicator will go off, the ALARM DS3 may sound, or the STOP and GO indicators may flash alternately. If this occurs, turn PADS off, wait 2 minutes, then restart the initialization procedures.

e. If the vehicle is not level within ±5 degrees, the display will show LEVEL starting in monitor MODE 3. The LEVEL display locks out the monitor mode unless a malfunction occurs. Turn PADS off, wait 2 minutes, and move vehicle to a more level area and reinitialize. If this is not possible, PADS will continue to align with possible degraded accuracy. The LEVEL display will go off at MODE 8.

3-22.4. Turn on/Turn off.

NOTE

The following conventions are used in Chapters 3 and 4 of this manual.

1. CDU pushbuttons are underlined, e.g., <u>STOP.</u>
2. A lighted status indicator remains lighted until extinguished, e.g., GO.
3. An extinguished status indicator is boxed in, e.g., [STOP].
4. Flashing displays are enclosed in quotation marks, e.g., "GO".

a. **<u>Turnon Sequence.</u>** Power is applied to PADS by setting PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to ON. Turn on the system by pressing <u>ON/OFF</u>. Observe the CDU display response. The CDU display will indicate "GPS C-E".

b. **<u>Turnoff Sequence</u>.** Mission data and automatic bias data may be stored into memory at turnoff. Data is transferred from high speed memory to storage (low speed) and requires a specific write time. Time is dependent upon quantity of data being written. Perform the following steps and observe the CDU display cues:

(1) Press <u>ON/OFF</u>. Display indicates SAVE C-E.

(2) Press <u>ENT.</u> Display indicates PAUSE.

(3) When “OFF” E appears, press <u>ON/OFF.</u> Display indicates OFF "E".

(4) Press ENT. System will turn off.

(5) Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to OFF.

c. **Accidental Turnoff.** In the event the ON/OFF key was accidentally pressed and system turnoff is not desired, perform the following:

(1) ON/OFF pressed. Display indicates SAVE C-E.

(2) Press CLR. Display indicates “OFF” C-E.

(3) Press ON/OFF. Display indicates OFF “C-E”.

(4) Press CLR. Display reverts to previous state.

d. **Security Turnoff.** If for security reasons the operator does not want to save mission data, perform the following shutdown sequence:

(1) Press ON/OFF. Display indicates SAVE C-E.

(2) Press CLR. Display indicates “OFF” C-E.

(3) Press ON/OFF. Display indicates OFF “C-E”.

(4) Press ENT. System will turn off. All mark data will be zeroed.

(5) Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to OFF.

3-22.5. Intensity Setting/Lamp Test.

a. **Dim.** Press and hold LAMP to dim CDU lights. All lamps light and the intensity slowly decreases. At full dark, no further change will occur. Release LAMP when desired intensity is reached. The display returns to normal at the new intensity.

b. **Brighten.** To brighten the display: press LAMP; release for 2 to 6 seconds; press and hold LAMP. All lamps light and the intensity slowly increases. At full brilliance, ALARM DS3 sounds. Release LAMP when sired intensity is reached. The display returns to normal at the new intensity.

c. **Lamp Test.** Set display to full brilliance and hold LAMP key. Observe that all status indicators, all data-display segments and all punctuation marks light; ALARM DS3 sounds, and computer, power supply, and CDU fault indicators DS1 and DS2 turn white. Release LAMP key and note that display returns to normal, ALARM DS3 turns off, and fault indicators DS1 and DS2 turn black. Lamp tests may be performed periodically during the survey mission, but must always be performed prior to initialization and prior to recalling adjusted survey data.

3-22.6. System Initialization. At power on, the CDU indicates GPS C-E. The operator may choose either clear CLR or enter ENT path at this time. The preferred path would be enter, whether or not GPS data will be used. This will allow the operator to ensure that the GPS vehicle lever arms have been entered. If the lever arms have not been entered, the ATTN status indicator will flash after entry of spheroid, cueing the operator to enter those values. The critical entry of GPS occurs only at the update request.

a. Operator selects CLR. The CDU cues the operator for spheroid by flashing "SPH", bypassing all further GPS related entries during initialization.

b. Operator selects ENT. The program requests additional GPS related data for entry.

(1) FOM 1-9 (figure of merit). If the operator has no receiver, any number 1 through 9 may be entered. If the operator has a receiver, it is recommended that a receiver mark be made, thus freezing position and elevation data, and recording the FOM. The following table defines two unique receiver displays of FOM and the corresponding estimated accuracies. Refer to specific GPS receiver operators manual for proper receiver operation and determination of data.

FOM RCVR No. 1	RCVR No. 2	PADS Entry	Receiver Estimated 3 Dimensional Accuracy
A	1	1	±25 meters
B	2	2	±50 meters
	3	N/A*	±75 meters
C	4	N/A*	±100 meters
D	5	N/A*	±200 meters
	6	N/A*	±500 meters
	7	N/A*	±1000 meters
	8	N/A*	<5000 meters
	9	N/A*	>5000 meters

*Not applicable (N/A). Possible error too large. During initialization, any entry will be accepted. During update, only 1 and 2 will be accepted, with a reject of 3 and up.

(2) After FOM number has been selected, press ENT.

c. At completion of FOM entry, the CDU displays AOV C-E (antenna on vehicle). The operator has the option of using the plumb bob suspension point of the vehicle in use, or the GPS lever arms with the GPS receiver attached to the vehicle.

(1) The operator presses CLR. This indicates that the GPS receiver is/was remote to the vehicle and the PADS defaults to the plumb bob suspension point of the vehicle in use. This allows previously determined data derived by GPS to be inputted to the PADS, using the plumb bob on the theodolite.

(2) The operator presses ENT. This indicates that there is an operational GPS receiver mounted on the vehicle carrying the PADS. If the GPS receiver antenna lever arms have not been entered into the PADS system, the ATTN status indicator will flash, notifying the operator that lever arm information is required. If the operator does not know the lever arms, or elects not to enter the lever arms, the PADS will default lever arm information to that of the porro prism. If the ATTN status indicator does not flash, the operator will know that GPS lever arm information has been entered into PADS.

(3) Once the AOV selection has been made, the CDU will cue the operator for spheroid by flashing “SPH".

3-22.7. Entering Spheroid. PADS is programmed to survey in any of the following spheroids:

SPH 1 . . . . Clarke 1866

SPH 2 . . . . International

SPH 3 . . . . Clarke 1880

SPH 4 . . . . Everest

SPH 5 . . . . Bessel

SPH 6 . . . . Spare

SPH 7 . . . . Spare

SPH 8 . . . . Australian GRS 67

SPH 9 . . . . GRS 1980 WGS 84

SPH 10. . . Airy

SPH 11 . . . Modified Airy

SPH 12 . . . Modified Everest

SPH 13 . . . WGS 72

SPH 14 . . . Hough

SPH 15 . . . User defined*

SPH 16 . . . User defined*

*Refer to paragraph 3-30 for operation/entry into user defined spheroid.

Figure FO-2 contains index to spheroids. When PADS displays "SPH" followed by the number of the spheroid used last, enter the desired spheroid by pressing SPH, the number of the desired spheroid, and ENT (e.g., Spheroid 3, press SPH, 3, ENT). The display then indicates PAUSE for about 15 seconds, then cues for vehicle. If a wrong spheroid is entered, the system must be turned off and initialization restarted. Refer to table 3-3.1 for a list of GPS datums and associated ellipsoids (spheroids). If the operator utilizes GPS during a PADS mission, the data and its associated spheroid used must agree with the spheroid entered into PADS. If there is any question and local maps are not to be referred to, the operator should select WGS 84 or WGS 72 for both PADS and GPS use. It is recommended that once the datums/spheroid have been selected, they not be changed on the GPS receivers for the duration of the mission.

3-22.8. Entering Vehicle Selection. The PADS program contains seven standard U.S. Army vehicles and has the capability of having the operator add lever arm information for up to three nondefined vehicles and lever arms for a vehicle mounted GPS receiver. Reference the specific vehicle installation for sight/plumb bob location. The standard vehicles in the order of selection and CDU displays follow. The program will display the last vehicle entered during the initialization, i.e., if the OH-58 had been selected before the system was turned off, the CDU at turnon would indicate OH-58 5.

	CDU	QUE	Vehicle	Plumb Bob or Sight Location
1.	HUM	1	HMMWV	Left side driver sight/plumb bob
2.	CUV	2	CUCV	Pintle mounted plumb bob
3.	SUV	3	SUSV	Left side driver sight/plumb bob
4.	M151	4	Jeep	Pintle mounted plumb bob
5.	OH-58	5	OH-58 Helicopter	PADS mounted plumb bob arm

Table 3-3.1. GPS Datums and Associated Spheroids

Receiver B Datum Code	Receiver A Map Datum	PADS Spheroid No.	Associated Spheroid
01	ADINDAN	3	CLARKE 1880
02	ARC 1950	3	CLARKE 1880
03	AUSTRALIAN GEODETIC 1966	8	AUSTRALIAN NATIONAL
04	BUKIT RIMPAH	5	BESSEL 1841
05	CAMP AREA ASTRO	2	INTERNATIONAL
06	DJAKARTA	5	BESSEL 1841
07	EUROPEAN 1950	2	INTERNATIONAL
08	GEODETIC DATUM 1949	2	INTERNATIONAL
09	GHANA	9	WGS 84
10	GUAM 1963	1	CLARKE 1866
11	G. SEGARA	5	BESSEL 1841
12	G. SERINDUNG	5	BESSEL 1841
13	HERAT NORTH	2	INTERNATIONAL
14	HJORSEY 1955	2	INTERNATIONAL
15	HU-TZU-SHAN	2	INTERNATIONAL
16	INDIAN	4	EVEREST
17	IRELAND 1965	11	MODIFIED AIRY
18	KERTAU (MALAYAN REVISED TRIANGULATION)	12	MODIFIED EVEREST
19	LIBERIA 1964	3	CLARKE 1880
20	USER ENTERED		USER DEFINED
21	LUZON	1	CLARKE 1866
22	MERCHICH	3	CLARKE 1880
23	MONTJONG LOWE	5	BESSEL 1841
24	NIGERIA (MINNA)	3	CLARKE 1880
	NORTH-AMERICA-1927:		
25	CONUS	1	CLARKE 1866
26	ALASKA AND CANADA	1	CLARKE 1866

Table 3-3.1. GPS Datums and Associated Spheroids - Continued

Receiver B	Receiver A		
Datum Code	Map Datum	PADS Spheroid No.	Associated Spheroid
	OLD HAWAIIAN:		
27	MAUI	2	INTERNATIONAL
28	OAHU	2	INTERNATIONAL
29	KAUAI	2	INTERNATIONAL
30	ORDINANCE SURVEY OF GREAT BRITAIN 1936	10	AIRY
31	QORNOQ	2	INTERNATIONAL
32	SIERRA LEONE 1960	3	CLARKE 1880
	SOUTH AMERICA:		
33	PROVISIONAL SOUTH AMERICA 1956	2	INTERNATIONAL
34	CORREGO ALEGRE	2	INTERNATIONAL
35	CAMPO INCHAUSPE	2	INTERNATIONAL
36	CHUA ASTRO	2	INTERNATIONAL
37	YACARE	2	INTERNATIONAL
38	TANANARIVE OBSERVATORY 1925	2	INTERNATIONAL
39	TIMBALAI	4	EVEREST
40	TOKYO	5	BESSEL 1841
41	VOIROL	3	CLARKE 1880
	SPECIAL DATUM (SD) MGRS RELATED:		
42	SD, INDIAN SPECIAL	4	EVEREST
43	SD, LUZON SPECIAL	1	CLARKE 1866
44	SD, TOKYO SPECIAL	5	BESSEL 1841
45	SD, WGS 84 SPECIAL	9	WGS 84
46	WGS 72	13	WGS 72
47	WGS 84	9	WGS 84
N/A	N/A	14	HOUGH

6.	UH-1	6	UH-1 Helicopter	PADS mounted plumb bob arm
7.	PLMB	7	M151 Jeep	PADS mounted plumb bob arm

a. The operator presses CDU +/2 or -/8 to change the vehicle selection until the connector vehicle has been displayed, then presses ENT. The vehicle selection may be changed at any time during operation, which allows vehicle to vehicle transfer while the system is operational.

b. If the system has been installed in a vehicle which is not defined as one of the seven standard vehicles, or has not had the lever arm previously entered, the operator must enter any choice of vehicles, in order to proceed with the initialization. The procedure for selecting and inserting data for the nondefined vehicle is as follows:

(1) While PADS is aligning or preferably after alignment is complete, the operator may insert up to three nonstandard vehicle selections and/or GPS lever arms after determining the X, Y, Z, and V lever arm dimensions using figure 3-5.1 and 3-6.1 as examples. All lever arm entries and displays must be in meters to the nearest millimeter.

OPERATOR ACTION	DATA DISPLAY	
Press MON, ID, 5, 1, ENT	Vehicle initially entered	
Press CLR	51E	"8-10"
Press 8, ENT	51X	.
Press +, 7, 6, 2	51+	.762
Press ENT	51Y	.
Press -, 1, 6, 5, 8, ENT	51Z	.
Press -, 6, 1, 0, ENT	51V	.
Press -, 4, 9, 5, ENT	SEL 1	8

Press - to scan IDs 50, 49, 48, and 47 to verify the entered values are correct. Above operator action must be repeated if a change is to be made.

(2) In the event more than one nonstandard vehicle is to be entered into memory, repeat above operator action making sure that when performing third step, a number other than the one previously entered is used, i.e., 9 or 10. If the number 8 were entered again, X, Y, Z, and V dimensions previously entered would be cleared from memory, A save routine at shutdown will store all nonstandard vehicle selections which have been entered.

(3) In the event a vehicle selection change is necessary during a mission, the new vehicle lever arms may be selected by returning to the monitor table and proceeding as follows:

OPERATOR ACTION	DATA DISPLAY	
Press ID, 5, 1, ENT	Vehicle previously selected	
When number of selected vehicle is displayed, press ENT.		
Press MON, 1	HUM 1	
Press MON, 2	CUV 2	
Press MON, 3	SUV 3	
Press MON, 4	M1514	
Press MON, 5	OH-58 5	
Press MON, 6	UH-16	
Press MON, 7	PLMB 7	
Press MON, 8	SEL 1 8	Only displayed if entered per nonstandard vehicle procedure
Press MON, 9	SEL 2 9	
Press MON, 10	SEL 3 10	
Press MON, 11	Vehicle previously selected	

The GPS lever arm data is not available for review once data has been input to the computer.

(4) The CDU will flash the "ATTN" status indicator in the special case of GPS lever arm entries, if the operator has cued the system to GPS mode with the antenna mounted on the vehicle and if there is no lever arm data entered into the computer. The special case allows GPS lever arm data review only after the data has been entered (via MON ID 51). If there is ever any question related to the validity of GPS lever arm data, the operator must reenter that data.

(5) After GPS lever arm data has been entered, the operator must reselect the vehicle that is in use. This will allow the program to correctly compute PAE data from the suspension point of the vehicle in use during normal marks and SCP updates.

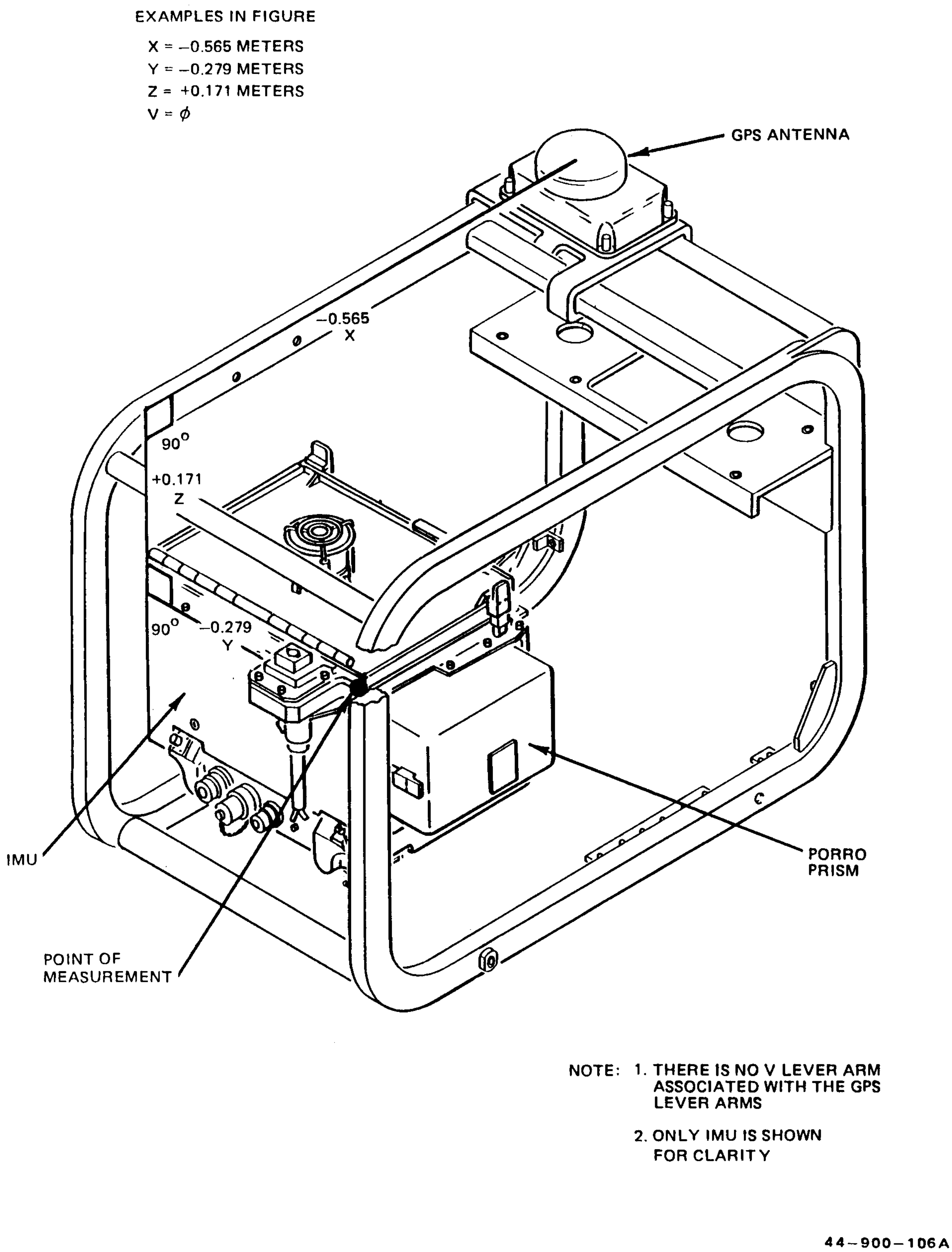


Figure 3-6.1. GPS Antenna Lever Arm Example

3-22.9. Entering UTM Grid Zone, Easting, Northing, Elevation, Distance, or Horizontal Angle. When PADS wants data, the CDU data display cues the operator by flashing a symbol. The data format is indicated by decimal points, colons, and zeros.

a. The operator recognizes a cue by pressing the pushbutton corresponding to the flashing symbol. The displayed symbol stops flashing and the zero(s) goes blank. Enter data with the numeric pushbuttons. Each numeral enters the display at the extreme right and moves one space to the left when a new digit is entered.

b. If a wrong number is entered, press CLR to clear the display. When all numerals are entered, check that the data is entered correctly. If possible, use a second person to check the entry. Press ENT to enter the data into the system. The display will show a new message.

c. A display showing "E"0: .0, means PADS wants the UTM grid zone and easting coordinates entered. UTM grid zone is entered first and will eventually appear to the left of the colon. The coordinate must have 7 digits and be entered to the nearest tenth of a meter.

3-22.10. Entering Spheroid, Latitude, Longitude, and Elevation for Operation in the Geographic Coordinate System.

a. To operate in the geographic coordinate system, the flashing "SPH" must be responded to by adding 100 to the selected survey spheroid. Therefore:

SPH 101 = Clarke 1866 Spheroid, Geographic Coordinate System

SPH 102 = International Spheroid, Geographic Coordinate System

SPH 103 = Clarke 1880 Spheroid, Geographic Coordinate System

SPH 104 = Everest Spheroid, Geographic Coordinate System

SPH 105 = Bessel Spheroid, Geographic Coordinate System

SPH 108 = Australian GRS 67 Spheroid, Geographic Coordinate System

SPH 109 = GRS 1980 WGS 84 Spheroid, Geographic Coordinate System

SPH 110 = Airy Spheroid, Geographic Coordinate System

SPH 111 = Modified Airy Spheroid, Geographic Coordinate System

SPH 112 = Modified Everest Spheroid, Geographic Coordinate System

SPH 113 = WGS 72 Spheroid, Geographic Coordinate System

SPH 114 = Hough Spheroid, Geographic Coordinate System

b. After the proper spheroid and vehicle is selected, the display will cue for longitude position with a flashing “LO". East of Greenwich is defined as positive (eastern hemisphere) and west of Greenwich is defined as negative (western hemisphere). Only the negative (–) sign will be displayed for western hemisphere operation. If no convention sign is displayed in geographic coordinate position, it will be assumed to be positive.

NOTE

Since operation in the geographic coordinate system is for survey missions only, the 2-position azimuth mark (paragraph 3-22.19) and distance traveled displays are not activated. The CDU will display dashes (--) when DIST is pressed by the operator.

When operating in the geographic coordinate system, the CDU azimuth displays are in degrees, minutes, and seconds. Paragraphs 3-22.20 through 3-22.22 must, therefore, be performed using the theodolite with entry in degrees, minutes, and seconds. (Mils must be converted to degrees, minutes, and seconds before entry.)

c. When PADS requests data, the CDU data display cues the operator by flashing a symbol. The data format is indicated by decimal points, colons, and zeros. Refer to examples below:

NOTE

If a wrong number is entered, press CLR to clear the display. When all numerals are entered, check that the data is entered correctly. If possible use a second person to check the entry. Press ENT to enter the data into the system. The display will show a new message.

Example: Entering longitude value of -118°25’36.63”

OPERATOR ACTION	DATA DISPLAY
(PADS cue)	"LO" : : .00
Press E	LO : . “_”
Press –	LO – : : .
Press 1	LO – : : . 1
Press 1	LO- : : .11
Press 8	LO- : : 1.18
Press 2	LO- : :11.82
Press 5	LO - : 1:18.25
Press 3	LO - :11:82.53
Press 6	LO - 1:18:25.36
Press 6	LO - 11:82:53.66
Press 3	LO - 118:25:36.63

Check that data is correct before pressing ENT.

Press ENT	“LA” : : .00

Example: Enter a latitude value of +34°10’19.27”

OPERATOR ACTION	DATA DISPLAY
(PADS cue)	"LA" : .00
Press N	LA : : . “_”
Press +	LA . . .
Press 3	LA : : . 3
Press 4	LA : : .34
Press 1	LA : 3.41
Press 0	LA : :34.10
Press 1	LA : 3:41.01
Press 9	LA :34:10.19
Press 2	LA 3:41:01.92
Press 7	LA 34:10:19.27

Check that the data is correct before pressing ENT.

Press ENT	"EL" . 0

NOTE

The remainder of the cueing and entry is identical to operation in the UTM grid coordinate system. Refer to paragraph 3-22.9.

3-22.11. Premission/Mission Troubleshooting. Fault indicators, installed on the computer, CDU, and PS provide automatic and continuous fault isolation to the major unit level during PADS operation. A fault indicator appears black when its unit is functioning correctly, and changes to white when a failure is detected. To provide the operator with immediate notification of failure, a fault in the IMU or computer is indicated by lighting the IMU or COMP status indicator. PADS shuts down for a PS failure. The PS has two fault indicators. If PS BATT FAIL fault indicator DS1 turns white, the vehicle electrical system is not supplying enough power and PADS batteries are too weak. If PS FAIL fault indicator DS2 turns white, the PS unit has failed.

NOTE

When PADS is operating, but with a fault indicator showing white or a malfunction status indicator is illuminated, the operator must enter the malfunction table in order to attempt to clear the malfunction. The PADS operator is responsible for monitoring and reporting 1 MAL through 5 MAL of the malfunction table. The step-by-step procedures follow:

a. Press MON, ID, I, ENT. Display should show 1 MAL 000000. Record complete display of non zero.

b. Press + key. Display should show 2 MAL 000000. Record complete display if non zero.

c. Repeat step b and monitor 3 MAL through 5 MAL. Pressing + key will advance the MAL number. Record complete display if non zero in 3 MAL through 5 MAL.

d. Return the MAL number which had a non zero content. Pressing + or – key will sequence the MAL number up or down.

e. Attempt to clear the malfunction by pressing and holding CLR until the display zeros.

f. Attempt to clear the status indicator by pressing LAMP.

g. If display zeros and the status indicator goes out, the malfunction is cleared. Continue with mission.

h. If the malfunction does not clear, turn system off and reinitialize.

i. If the malfunction does not repeat, continue with mission.

j. If the malfunction still exists, locate and record the malfunction per steps a, b, and c. Discontinue the mission and return system to support maintenance.

Whenever the PADS is turned in, the non zero display recorded in steps a through c should be furnished to the support maintenance personnel.

3-22.12. Zero-Velocity Correction.

CAUTION

Failure to perform zero-velocity corrections when requested may cause survey mission failures.

NOTE

Zero-velocity correction should be performed whenever the vehicle is stopped. Frequent corrections improve survey accuracy.

Helicopters must land for zero-velocity corrections.

a. Zero-velocity corrections are needed for accurate surveying. One begins automatically during initialization. Thereafter, PADS requests zero-velocity correction stops at 10-minute intervals. PADS automatically performs a zero-velocity correction at all mark and update procedures.

b. PADS requests a zero-velocity correction by flashing the GO and STOP indicators and beeping ALARM DS3 30 seconds before the next required correction. The operator has 30 seconds to stop the vehicle and press STOP. If he does not, the GO indicator extinguishes, STOP indicator continues to flash, ALARM DS3 sounds steadily, and data display reads STOP. Press TIME to disable ALARM DS3 for 30 seconds. The sequence of operations is:

OPERATION	STATUS INDICATOR
(1) Stop vehicle and set brake.	"STOP" "GO", or "STOP" [GO]
(2) Press STOP.	Stop [GO]
(3) After a few seconds.	Z-VEL
(4) Correction completed.	[STOP] "GO"
(5) Vehicle moves.	GO [Z–VEL]

c. If the vehicle moves before a zero-velocity correction is completed, the time automatically reverts back to the prior zero-velocity countdown time.

d. In order to obtain the PADS specified accuracies for battalion survey, the operator must perform 10-minute zero-velocity corrections. For division artillery survey, the operator must perform 5-minute zero-velocity corrections.

CAUTION

Do not set the Z-VEL interval to exceed 10 minutes as PADS accuracies will degrade.

NOTE

The Z-VEL interval may be changed by the operator, i.e., if a 5-minute interval is required for the fourth order survey, the operator should perform the following sequence: Press MON, ID, 4, 6, ENT, MON, 5, 0, ENT. The CDU display will display 5.0 as the Z-VEL interval and will remain this value throughout this and subsequent missions until reset in the same manner. To change Z-VEL back to 10 minutes press MON, ID, 4, 6, ENT, MON, 1, 0, 0, ENT.

e. The ATTN indicator lights if system errors are too large during a zero-velocity correction. This can be caused by: pressing STOP while a vehicle is moving; not stopping when requested; or a PADS malfunction. Make sure the vehicle is stopped; press and hold STOP to override the ATTN indicator. Release STOP when ATTN indicator extinguishes and STOP indicator lights. Troubleshoot in accordance with table 4-2 for repeated failure indications not induced by the operator.

3-22.13. Updating.

NOTE

An update may be cancelled any time before completion by pressing UPDT a second time. A completed update cannot be eliminated.

Position and elevation updates may be performed independently.

a. PADS must be updated after initialization before it can supply survey data. The accuracy of the survey data is dependent upon the accuracy of the update data. This is required, assuming the mission will be assessing local map coordinate data. Control data can be obtained by astronomic, conventional survey, local map, etc. with generally a bench mark embedded in concrete defining the point. A relatively new method of determining position, as indicated in paragraph 3-22.1, is GPS. The GPS receiver accuracies, with the best figure of merit (FOM) and low (four or better) geometric dilution of precision (GDOP), is ±25 meters spherically. Typically, however, they are generally much better. For increased GPS accuracy, another method utilizing two receivers has been devised. One receiver travels with the surveying group and a second receiver remains at a stationary base. The two receivers are initially compared at the first station with receiver differences recorded. When the survey team desires a secondary update, radio communication with the base station is made and any changes from the station position as determined by the stationary receiver is given to the mobile receiver for adjustment of the mobile receiver data. This is commonly known as differential GPS operation. PADS update inputs includes survey control, differential GPS, and GPS in the descending order of accuracy.

b. After an update is requested, the PADS will cue for the following: GPS C-E, where C means known survey control data will be entered. The data entered will be referenced to the plumb bob suspension point and the expected data will be trig list data obtained from known control.

c. Assuming the surveyor decides to use GPS data, he should generate a mark with the GPS receiver, noting the FOM. It is recommended that a FOM of less than 25 meters (PADS entry of 1) always be used and 50 meters (PADS entry of 2) only in emergency situations. Greater than 50 meters should never be used due to the inaccuracy associated with the data.

d. E will enable the software to accept GPS related data. The next cue will be for the differential mode. The very first update will ignore the differential mode whether or not it is entered because it is meaningless at that time. The surveyor should observe and maintain correct system inputs. The operator should clear the differential input request. The next cue should be for FOM. 1 through 9 is flashed, but the system will accept 1 or 2, rejecting 3 and up (refer to paragraph 3-22.6b(1) for accuracies). If the system rejects the entry, the cueing will restart with GPS C-E.

e. After the correct FOM has been entered, the system will cue for antenna on vehicle (AOV C-E). C means the antenna is remote to the vehicle, or the GPS data may have been placed previously, with a marker locating the point. The system will revert to the vehicle's standard lever arms for the plumb bob or the porro prism.

f. An E means the GPS receiver antenna is hard mounted to the vehicle, the lever arms of the antenna to the IMU are in place, and current GPS data is planned on being entered into PADS. The cue will be for casting data. The operator surveyor must be sure the GPS receiver datum and associated reference ellipsoid (spheroid) agrees with the spheroid (ellipsoid) that had been entered into PADS during initialization. If there is any question as to the PADS entered spheroid, the operator must press SPH to identify the spheroid PADS is operating within. Refer to table 3-3.1 to determine that the GPS receiver and PADS are utilizing the same reference ellipsoid (spheroid). If a change is required, the GPS receiver may be changed without reinitializing. To change the PADS spheroid, a shutdown and reinitialization is required.

g. Horizontal position updates are completed separately from elevation, therefore making it possible to mix updates if necessary, i.e., a known horizontal control may be available with no, or questionable, vertical control. The operator should proceed with updating the horizontal position with the known control by rejecting GPS and entering the known control coordinates, then rejecting the elevation entry. A second update would start with GPS, reject of the horizontal, and update of the vertical using the GPS data. The surveyor should always use known good survey control over GPS derived data when available.

h. After the operator has entered the position and/or elevation data into the PADS, the system automatically tests the difference between the update coordinates, and his actual PADS position coordinates. If the difference (error) is within the built-in calibrated tolerance parameters, the update is accepted and the CDU will display the update symbology.

i. When PADS accepts an update and displays such, the system has told the operator that PADS has met the required specified accuracies needed for that update and all surveyed stations established back to the previous update. The order of accuracy is based upon the time interval of zero-velocity corrections performed during the mission and type of update. To obtain prescribed accuracies, using known control bench marks for updates, the required zero velocity correction intervals are shown below:

REQUIRED ACCURACY	REQUIRED TIME INTERVAL
Battalion Survey Accuracy	10-minute zero-velocity corrections
Division Artillery Accuracy	5-minute zero-velocity corrections

j. A comprehensive example of a mixed first update and a differential secondary update is as follows:

(1) PADS is initialized and confined to operation in NAD 27 CONUS datum (Clarke 1866 spheroid), unless cycled off and reinitialized. The PADS operator has a GPS receiver which has been setup to operate in NAD 27 CONUS datum. Several kilometers away, a known survey control station is available, with good horizontal control, but no vertical (elevation) control. At the known control, a second GPS receiver is available.

(2) The operator initializes PADS using SPH 1 (Clarke 1866) and enters the GPS determined easting, northing, and elevation. On completion of alignment, PADS should be driven to the known control point to be updated prior to attempting to survey.

(3) PADS should be located over the known control point and a non GPS horizontal position update performed. When elevation is cued, the operator should exit the update.

(4) The GPS receivcr (A) should then be located over the SCP. The operator should mark or freeze the GPS at the SCP and record the FOM, casting, northing, elevation, and any other data he may wish to review at a later time. This may be recorded as FOMA, EA1, NA1, and ELA1. He should then initiate another PADS update, using GPS this time, bypassing the horizontal input, and entering the elevation GPS data recorded previously.

(5) The second GPS receiver (B) located at this station does not have to be coincident with the first receiver, but somewhere nearby and setup to operate in the NAD 27 CONUS datum. The FOM, easting, northing, and elevation should be recorded by an assistant in his notebook. This will be FOMB, EB1, NB 1, and ELB1. The value of FOMB should be recorded in the PADS operator’s notebook also.

(6) The PADS and the surveying team have now been properly prepared and documented to advance on a survey mission. The PADS operator decides to perform a differential GPS update. He would then radio the assistant with receiver B, determine that receiver B had not been moved and the receiver operation was still in the same datum as receiver A. He would then instruct his operator to perform a mark on receiver B, noting the FOM, and he would do the same on his receiver A.

(7) Assume that the assistant operator notifies the PADS operator that the latest set of GPS readings from receiver B are higher than the first set of readings by ΔE, ΔN, and ΔEL. The PADS operator would then log these values along with the FOM. The PADS operator would also log his present position mark data (EA2, NA2, and ELA2) and FOM data from receiver A. The PADS operator would then perform a differential GPS update for position and elevation. The casting data to be entered would be EA2 - ΔE - (EA1 - ESCP). The northing data would be corrected by the delta offset at the stationary receiver B and difference of SCP

to mobile receiver A. The elevation input would be ELA2 - ΔE1. FOM input should be the largest of the FOM values recorded.

k. Procedures used to update position and/or elevation are listed in table 3-3.2.

3-22.14. Update Rejection.

a. While updating the system, PADS tests the difference between the update coordinates and the actual PADS position coordinates.

b. If the difference (error) is within a built-in tolerance, the update is accepted and the display will read ID PAE (type of update).

c. If the difference (error) is outside the built-in tolerance, PADS recues for the data by flashing "E" on the CDU followed by the data the operator entered.

d. The flashing "E' indicates an update rejection for horizontal position, either casting or northing. A flashing "EL" with data indicates an elevation update rejection. The operators will check the probable reason and take the appropriate corrective action(s) as outlined in the update rejection troubleshooting table 3-3.3.

3-22.15. PAE Display. At the completion of an update or mark, PADS summarizes the results by displaying the following:

X(ID) * PAEXXX

(X means the value does not matter for this illustration)

The symbols used in the summary are:

SYMBOL	MEANING
X(ID)	A numeric display identifying the mark table-data location of a completed mark or update. The mark table can store 50 positions
PAE	Stands for Position, Azimuth, Elevation. PAE display with no numeric summary indicates a mark or update was not completed
U	Indicates that an update of position and/or elevation is complete
d	Indicates that differential GPS position/ elevation mark/update was completed
g.	Indicates that a GPS position/elevation mark/update was completed
1	Indicates that a theodolite was used to mark position, azimuth and/or elevation
2	Indicates that the PADS plumb bob was used to mark position, azimuth, and/or elevation
E	Indicates that a probable error is in the numeric location of the PAE display
-	Indicates that either position, azimuth, and/or elevation was not marked or updated

Shown below are examples of the displays.

1	* PAE U-U	You have updated position and elevation using either plumb bob or theodolite
2	* PAE 1-1	You have marked position and elevation using a theodolite
3	* PAE 111	You have marked position, azimuth, and elevation using a theodolite
4	* PAE 2-2	You have marked position and elevation using a plumb bob
5	* PAE 222	You have marked position, azimuth, and elevation using a plumb bob
6	* PAE 2E2	You have marked position, azimuth, and elevation using a plumb bob, but there is a probable error in azimuth. In this event, you have to repeat the measurement. An E in azimuth of a 2-position azimuth mark indicates that the distance between points was not at least 100 meters or the travel time between points was too long
7	* PAE g-g	Position and elevation were updated using GPS only
8	* PAE d-d	Position and elevation were updated using differential GPS
9	* PAE g--	GPS position only update
10	* PAE --g	GPS elevation only update
11	* PAE U--	Trig position only update
12	* PAE --U	Trig elevation only update
13	* PAE d--	GPS differential position only update

14 * PAE--d	GPS differential elevation only update
15 * PAE g1-1	GPS influenced theodolite position mark, standard control elevation and smoothed

A g or d associated with numbers 1 or 2 indicate the mark data has been affected by using a GPS or differential GPS update on either end, remembering that in the order of accuracy, the update is the most accurate using known trig data, differential GPS data, then GPS data, in that order. d1, g1, 1d, or 1g differential or GPS in conjunction with a theodolite mark. d2, g2, 2d, or 2g differential or GPS in conjunction with a plumb bob mark.

3-22.16. ID Number/Data Recall.

a. PADS assigns an ID number to identify the data when a mark or update is completed. The ID number appears in the two left digits of the data display. E, N, EL, AZ, DIST, ∠, TIME, and PAE for any previous mark or update may be recalled at any time except during a mark or update. The time of each mark or update may also be recalled. The recall procedure is:

OPERATION	DATA DISPLAY
(Present display)	12 N3835482.5
Press ID	N3835482.5
Enter desired ID number, e.g., 7	7 N3835482.5
Press ENT	7 N3835961.5
Press key(s) for desired parameter(s), e.g., EL	7 + EL 359.5

b. An alternate procedure is to press +/2 to increase the ID number by one or press –/8 to decrease.

c. The PAE display is recalled by pressing ID twice.

d. The time of a mark or update is recalled by pressing TIME.

3-22.17. Marking.

NOTE

PADS measures elevation at ground level under the plumb bob. If the survey marker is at a different height, adjust the elevation for the difference.

a. The establishment of survey coordinates and azimuth with PADS is called “marking”. PADS has the ability to store data up to 50 positions, but is unlimited in the amount of positions which may be established in a mission. These stored positions are assigned an identification number along with a PAE display and are stored in the mark table of the computer as discussed in paragraphs 3-22.14 and 3-22.15. Identification numbers (IDs) are assigned in numeric sequence for each mark or update. The PADS system does not assign an ID number or PAE display for the initialization data. The first update SCP after initialization always has the ID number 1. After 50 ID numbers have been stored, another mark or update will overwrite the first ID data stored in the computer with the new mark or update data. Thereafter, each subsequent mark or update will overwrite the next ID in sequence.

b. Positions can be established using the plumb bob as reference or can be offset from the PADS system using a theodolite (optical position mark, no azimuth). Azimuths to distant landmarks can be established using a theodolite (optical position and azimuth mark). An azimuth of a short line (100 to 1000 meters) can be established by marking both ends of the required azimuth line with PADS (2-position azimuth mark using plumb bob) or using theodolite and performing an optical position and azimuth mark.

c. An optical position and azimuth mark requires the operator to autoreflect, measure a horizontal angle, and measure the offset distance with a theodolite as described in paragraph 3-22.20. Marking procedures are described in paragraphs 3-22.18, 3-22.19, 3-22.21, and 3-22.22.

CAUTION

If the wrong vehicle has been selected from the vehicle in use, the effective position of the PADS to the sight or new plumb bob extension point will be incorrect, and will provide incorrect mark/update information. To verify the correct configuration is being used, the operator must verify the correct vehicle is in use by pressing MON, ID, 5, 1, and ENT. Refer to paragraph 3-22.8.

3-22.18. Marking Position and Elevation Using Plumb Bob. Used to establish position and elevation coordinates of a point or the first point of a 2-position azimuth mark.

a. If required, maneuver vehicle to place plumb bob over point to be established.

b. Stop the vehicle

c. Press STOP.

d. Press MARK.

e. If display reads 2-POS C-E, press CLR.

f. Display will read ⊼ C-E.

g. Press CLR. Display will show PAUSE.

h. The mark is completed when MARK, ENT, and STOP indicators extinguish, GO indicator flashes, and display shows ID PAE 2-2. PADS has automatically assigned the next ID number and stored the position and elevation coordinates. No azimuth will be stored.

i. Press E, N, EL and record the unadjusted data.

j. Mark the survey point very carefully by ensuring that the hub is driven flush with the ground and the plumb bob point is directly over the indent in the marker. Drive in the witness stake and stow the equipment.

k. Ensure that the CDU has a flashing “GO” and proceed to the next point.

3-22.19. Marking 2-Position Azimuth Mark Using Plumb Bob. (Not Functional in Geographic Coordinate System Operations.)

NOTE

The vehicle must be able to travel quickly between both ends of the azimuth line, 100 to 1000 meters long. If the distance between the points is less than 100 meters or the travel time is too long, the accuracy of the computed azimuth maybe degraded and the PAE display will show E in the azimuth location, meaning there is a probable error in azimuth.

a. Mark one end of the azimuth line in accordance with paragraph 3-22.18.

b. Proceed immediately without delay to the second point.

c. As soon as vehicle is in motion, press ID, O, ENT, DIST. Distance in meters from the marked point to the present vehicle position will be displayed. Make certain the azimuth line is 100 to 1000 meters long.

d. Upon arrival at second point, plumb over point in accordance with paragraph 3-22. 18, steps a through d.

e. Press MARK. MARK and ENT indicators light. Display shows 2 POS C-E.

f. Press ENT. Display shows PAUSE.

g. The mark is completed when MARK, ENT, and STOP indicators extinguish, GO indicator flashes and displays shows ID* PAE 222. PADS has automatically assigned the next ID number and stored position, azimuth, and elevation. The azimuth is from the second point to the first. The azimuth from the first point to the second is added to the data stored for the first point.

h. Press E, N, EL, DIST, GAZ, and record the unadjusted data.

i. Mark the survey point very carefully by ensuring that the hub is driven flush with the ground and the plumb bob point is directly over the indent in the marker. Drive in the witness stake and stow the equipment.

j. Make certain the CDU has a flashing “GO" and proceed to the next point.

3-22.20. Theodolite Measurements. Optical measurements may be performed any time throughout the survey mission, but must always be performed when the update point is inaccessible to the PADS vehicle, when a position to be established is inaccessible to the PADS vehicle, or when an azimuth line of less than 100 meters is required.

NOTE

To increase visibility, color the theodolite sight white. At night, illuminate the sight with the theodolite handlamp.

a. **Autoreflection.** Prior to making any optical measurements, the PADS operator must achieve autoreflection. To achieve autoreflection, perform the following:

(1) Stop vehicle close to SCP, GPS update point or point to be established, exit vehicle, and perform a zero-velocity correction by pressing CDU STOP.

(2) Set up theodolite over SCP, GPS update point or point to be established. If an azimuth is required, set up a range pole over azimuth marker.

(3) Uncover and roughly level the porro prism.

(4) The vehicle operator makes certain that the CDU has a flashing “GO” light and maneuvers the vehicle so that the porro prism is visible from the theodolite and is within 16 meters. The PADS operator, standing behind the theodolite, instructs the vehicle operator to slowly maneuver the vehicle until the theodolite is reflected in the porro prism and autoreflection is obtained. An alternate procedure, especially useful for helicopter operations, is to keep the vehicle stationary and move the theodolite until autoreflection is achieved.

(5) Vehicle operator exits the vehicle, presses the STOP key, and fine-levels the porro prism.

(6) The PADS operator then checks to see if autoreflection can still be achieved. If not, repeat steps(1) through (5) as necessary.

(7) Focus the theodolite so the reflected image of the theodolite front sight is centered on the vertical crosshair (see figure 3-6, view A). The theodolite line-of-sight is now perpendicular to the porro prism.

b. **Mean Horizontal Angle Measurement.** See figure 3-6, view B.

(1) Autoreflect on porro prism.

(2) Measure direct angle (in mils) from porro prism clockwise to azimuth target.

(3) Plunge theodolite telescope and measure reverse angle (in mils) from azimuth target to porro prism (autoreflect).

(4) If the difference between direct and reverse pointings is greater than 0.2 mil, repeat the measurements.

(5) Determine the mean of the direct and reverse pointings to obtain the mean horizontal angle.

c. **Offset Distance Measurement.**

NOTE

At night, illuminate porro prism scale with PADS mounted flashlight. Porro prism has two scales for inverting and noninverting instruments.

(1) If distance between porro prism scale and theodolite is less than 8 meters, locate left vertical stadia line on porro prism scale zero mark. Read the scale where the right stadia line intersects the scale. Example, figure 3-6, view C: stadia lines on 0 and 3.8 on scale. Offset distance is 3.8 meters.

(2) If offset distance is between 8 and 16 meters, locate left stadia line on zero mark and read the distance to the center vertical crosshair where it intersects the scale; then, multiply it by two. Example, figure 3-6, view D: left stadia line is at zero, vertical crosshair is on 4.8 of scale, offset distance equals 4.8 x 2 or 9.6 meters.

3-22.21. Marking - Position, Azimuth, and Elevation Using Theodolite.

NOTE

At the completion of an update, PADS will not adjust the azimuth obtained in a position, azimuth and elevation mark using a theodolite.

a. Stop vehicle close to SCP, GPS update point or point to be established. Exit vehicle and perform a zero-velocity correction by pressing STOP key on CDU.

b. Set up theodolite over point to be used and achieve autoreflection as described in paragraph 3-22.20a.

c. Once autoreflection is achieved, the PADS operator instructs the assistant PADS operator to press MARK. If display shows 2 POS C-E, press CLR. Display now shows $\overline{\wedge}$ C-E.

d. Press ENT. Display alternates between "$\overline{\wedge}$" and "READ" for 64 seconds and then displays a flashing "<" .00. The alternating "$\overline{\wedge}$" and "READ" for 64 seconds is a motion test. During the motion test, the vehicle must not be moved or disturbed. The assistant PADS operator now becomes the recorder for the PADS operator.

e. Measure and record the mean horizontal angle and offset distance in accordance with paragraph 3-22.20b and c.

f. The time between steps d and i must be at least 64 seconds, so do not press ≤ until display shows a flashing "<" 00. Without disturbing the vehicle, press ≤.

g. After pressing <, the display will show PAUSE while PADS checks for excessive motion. If the vehicle was disturbed or moved, the display will show $\overline{\wedge}$ C-E and the operator must repeat steps d through g.

h. PADS displays <.

i. Enter mean horizontal angle to the nearest 0.01 mil or nearest second of arc for geographic operation. PADS cues for distance by flashing "D" on display.

j. Press DIST. Display shows D. Enter offset distance to nearest 0.1 meter. Press ENT; PADS displays PAUSE.

k. When MARK, ENT, and STOP indicators extinguish and "GO" indicator flashes, display indicates ID* PAE 111. PADS has assigned the next ID number and stored the position and azimuth data.

l. Press E, N, EL, and GAZ and record the unadjusted survey data.

m. Mark the surveyed points with witness and hub stakes. Stow all equipment.

n. Make certain the CDU has a flashing "GO", and proceed to next point.

3-22.22. Marking - Position and Elevation Using Theodolite.

a. Perform steps a through d of paragraph 3-22.21.

b. Display alternates between "$\overline{\wedge}$" and "READ".

c. Press CLR to bypass the 64-second motion test and mean horizontal angle entry. PADS will cue for distance by flashing "D".

d. Press DIST and enter distance to the nearest 0.1 meter. Display shows PAUSE.

e. MARK, ENT, and STOP indicators extinguish. "GO" indicator flashes and display reads ID* PAE 1-1. PADS has assigned the next ID number and stored the position data.

f. Press E, N, EL, and record the unadjusted data.

g. Mark the surveyed point with witness and hub stake. Stow equipment.

h. Make certain the CDU has a flashing "GO" and proceed to the next point.

3-22.23. Adjacent Grid Zone. (Not Functional in Geographic Coordinate System Operation.)

a. PADS automatically computes coordinates in the correct UTM grid zone. If you are within approximately 80 kilometers of a zone boundary, and wish to enter or recall northing and casting in terms of the adjacent zone, press ADZ. The ADZ indicator will light. Enter or recall the desired data.

b. The ADZ indicator will extinguish if PADS is further than 80 kilometers from a zone boundary or a function other than northing or casting is selected.

c. If REJ is displayed on the data display window, PADS is not within the 80 kilometer zone boundary.

3-22.24. Recording PADS Data.

a. **Mark.** Record station, ID number, PAE display, zone, casting, northing, elevation, grid azimuth (if measured), and distance for each position marked. Record all mean horizontal angles and offset distances measured. Also record all malfunctions which occur during the survey mission.

b. **Update.** After any update except the initial one, recall and record all adjusted data stored since the last update. The assistant operator should check all data. PADS does not adjust distances or azimuths obtained using a theodolite.

c. For examples of recording PADS data, refer to FM 6-2, chapter 8, or for general data recording, FM6-2, chapter 4.

Table 3-3.2. Mission Procedures (GPS)

Step no.	Operation action	CDU data display	Status indicators	Reference
	NOTE This table summarizes PADS operational sequences in the UTM coordinate system only. More detailed descriptions are in the paragraphs and tables listed in the reference column.			
1.	<u>DAILY CHECKS AND SERVICES</u>			
a.	Check that primary pallet, battery box, and CDU are securely mounted			Para 2-11, 2-12, 2-13
b.	Inspect fluid level of vehicle and PADS batteries. Replenish as necessary			Table 4-1
c.	Check that primary pallet is properly connected to vehicle power, battery box, and CDU			Para 2-11, 2-12, 2-13, 2-14
d.	Check for proper operation of flashlight			Table 4-1
e.	Clean porro prism			Table 4-1
f.	Check that all equipment is properly stowed and does not block airflow to PADS or interfere with vibration isolated units			Para 2-11, 2-12, 2-13, 2-14
g.	Check that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are OFF			Figure 3-3
h.	Start vehicle engine and verify proper operation of vehicle electrical system			
2.	<u>INITIALIZATION</u>			
a.	Check that PS is connected to vehicle power using cable assembly W7			Para 2-11, 2-12, 2-13, 2-14
b.	Set PS BATTERY and VEHICLE circuit breakers CB1 and CB2 to ON			Para 3-22.4, Figure 3-3
	CAUTION PADS must not be moved for at least one minute after tumon. Failure to do this may result in severe damage to the equipment.			
c.	Press ON/OFF	GPS C-E	STOP. ENT	Note below

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
	NOTE BATT may light for a few minutes. If it stays lighted, verify connections to vehicle power and battery box and that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are ON. CHRG may light throughout the mission.			
	If computer and/or CDU fault indicators set white at tumon, press LAMP and observe that they set to black.			
	If malfunctions are encountered now or during mission operations, refer to table 4-2.			Para 3-22.4
d.	Set PS VEHICLE circuit breaker CB2 to OFF for approximately 30 seconds		BATT	
e.	Set PS VEHICLE circuit breaker CB2 to ON		$\boxed{\text{BATT}}$ ' CHRG (within 10) seconds)	
f.	If system shuts down when CB2 is switched OFF, check cables first, and if good, replace battery so mission can continue			
g.	If required, drive vehicle to initialization point and park			Para 3-22.3
h.	Adjust vehicle hand throttle so batteries charge and engine idle is smooth, without racing engine			
i.	Perform lamp test, replace faulty lamp modules. Set lamp intensity	(All lamps light)	(All lamps light)	Para 3-22.5
	NOTE Fault indicators set white then reset black when LAMP is released.			
j.	Observe CDU data display	GPS C-E		Para 3-22.7
	NOTE It is preferable to enter the GPS mode at this time to ensure that the GPS receiver lever arms have been entered into the computer, even if GPS is not intended for use.			
k.	Press ENT	FOM "1-9"		Para 3-22.7

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
l.	Press the indicated FOM value of 1 through 9, then press <u>ENT.</u> For FOM A, enter 1, B, enter 2, etc.	AOV C-E		Para 3-22.7
	NOTE Antenna on vehicle (AOV). The operator must know the location of the antenna mount on the vehicle and know the lever arm values. If the entry is made and there are no lever arm values in the computer, the ATTN status indicator will flash until the lever arms are added or until the first mark or update is made. If receiver lever arms have been entered, the ATTN status indicator will remain off. The following example includes initialization with no GPS receiver lever arm.			
m.	Press <u>ENT</u>	“SS” "SPH" X	STOP “ATTN” ENT	Para 3-22.6, 3-22.7
n.	Enter spheroid: PADS accepts spheroid	PAUSE		Para 3-22.7
o.	PADS cues for vehicle type	HUM 1 (or last vehicle used)		Para 3-22.8
	NOTE PADS will display last vehicle in which it was used. When selecting vehicle, press the + or – key until desired vehicle appears.			
p.	Press + or – key until desired vehicle appears			
q.	Press ENT; PADS cues for easting	“E”0: .0	STOP Z-VEL “ATTN” ENT	Para 3-22.9
r.	Enter zone and casting, PADS cues for northing	"N" .0		Para 3-22.9
s.	Enter northing; PADS cues for elevation	“EL” .0		Para 3-22.9
	NOTE When entering elevation, first press <u>+/2</u> or <u>–/8</u> depending on whether PADS is above below sea level.			

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
t.	Enter elevation: alignment continues; operator leaves vehicle	MODE MODE MODE MODE MODE MODE MODE MODE	0 $\boxed{\text{ENT}}$ MON CAL 1 "ATTN" 2 Z-VEL 3 4 5 6 7	Notes 1 and 2 (below)
u.	Alignment ends; system ready to move	MODE	8 $\boxed{\text{STOP}}$ $\boxed{\text{CAL}}$ "GO"	

NOTE

1. The data display will initially show MODE, 0, 1, 2, or 3 depending on the speed of coordinate entry. Time since turnon maybe displayed by pressing TIME. The mode may be recalled by pressing MON.
2. MON will extinguish when any other function is selected.

The operator may enter GPS lever arms at any time after the last initialization entry has been made. By removing the CDU from the vehicle mount and placing in either front seat, the operator may make CDU entry without disturbing the vehicle while PADS is aligning.

Step no.	Operation action	CDU data display	Status indicators	Reference
v.	Press MON, ID, 5, 1, ENT	HUM 1 or current vehicle selected	STOP MON CAL Z-VEL "ATTN"	Para 3-22.8
w.	Press CLR	51E "8-11"		
x.	Press 1, 1, ENT	51X .		
y.	Press +/2 or -/8 and value of lever arm for X to the nearest millimeter, then press ENT	51Y		
z.	Enter polarity and value of Y lever arm, then press ENT	5 1 Z .		
aa.	Enter polarity and value of Z lever arm, then press ENT	51V .		
ab.	There is no GPS V lever arm. Enter any polarity and zero, then press ENT	51GPS4 11	STOP MON CAL Z-VEL ATTN	

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
ac.	To verify lever arm entries areas desired, press –/8 which will yield lever arm data located in MON ID locations 47 through 50	(Example)		
	Press -/8	50V 0.000		
	Press -/8	49Z 0.432		
	Press -/8	48Y -1.014		
	Press -/8	47X 0.660		
ad.	If the operator is or is not satisfied with the entries, he must again access MON ID 51. If not satisfied, he must reenter the lever arms per the preceding steps	51GPS4 11		
ae.	If he is satisfied, press MON, ID, 5, 1, then ENT. Press MON and number of vehicle that is in use, i.e., 6 for UH-1 helicopter, then press ENT	UH-1 6		Para 3-22.8
af.	To return to the MODE status, press ID, ENT	MODE X		
ag.	If required, move system to known survey control point (SCP) to perform an update; perform zero-velocity corrections as necessary		GO $\boxed{\text{Z–VEL}}$	Para 3-22.12
3.	SCP UPDATE - POSITION AND ELEVATION - PLUMB BOB			
a.	Maneuver vehicle to place plumb bob over SCP			Para 3-22.13
b.	Stop vehicle; press STOP		STOP $\boxed{\text{GO}}$ Z–VEL	
c.	To ensure that the correct vehicle lever arms are in use, press MON, ID, 5, 1, ENT. The display should indicate the vehicle in use. If not, select the correct vehicle	CUCV 2 (example)		Para 3-22.8
d.	Press UPDT	GPS C-E	UPDT ENT	
e.	Press CLR	⊼ C-E		
f.	Press CLR; PADS cues for casting	"E"0: .0		Para 3-22.9
g.	Enter zone and easting; PADS cues for northing	"N" .0		Para 3-22.9
h.	Enter northing; PADS accepts position data	PAUSE		Para 3-22.9
i.	PADS cues for elevation	"EL" .0		

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
j.	Enter elevation; PADS accepts elevation data	PAUSE		Para 3-22.9
k.	PADS shows update results and is ready to move after indicator has flashing "GO"	ID*PAE U-U	$\boxed{\text{STOP}}$ $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$ "GO"	Para 3-22.15
4.	SCP UPDATE - POSITION AND ELEVATION - THEODOLITE			
a.	Stop vehicle; press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
b.	Set up theodolite over SCP			
c.	When ready to move ("GO"), maneuver vehicle for autoreflection		$\boxed{\text{STOP}}$ GO $\boxed{\text{Z-VEL}}$	Para 3-22.20
d.	Press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
e.	Measure and record offset distance			Para 3-22.20
f.	Press UPDT	GPS C-E	UPDT ENT	
g.	Press CLR	⊼ C-E		
h.	Press ENT			
i.	PADS cues for easting	"E"0: .0		Para 3-22.9
j.	Enter zone and easting; PADS cues for northing	"N" .0		Para 3-22.9
k.	Enter northing; PADS cues for offset distance	"D" .0		Para 3-22.9
l.	Press DIST and enter distance; PADS accepts update data	PAUSE		
m.	PADS cues for elevation	"EL" .0		Para 3-22.9
n.	Enter elevation; PADS accepts elevation data	PAUSE		
o.	PADS shows update results and is ready to move after indicator has flashing "GO"	ID*PAE U-U	$\boxed{\text{STOP}}$ $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$ "GO"	
5.	SCP UPDATE - POSITION ONLY			
a.	Perform steps 3a through 3i or 4a through 4m	"EL" .0	STOP $\boxed{\text{GO}}$ ENT Z-VEL UPDT	Para 3-22.13
b.	Press CLR; PADS shows update results and is ready to move after indicator has flashing "GO"	ID*PAE U--	$\boxed{\text{STOP}}$ "GO" $\boxed{\text{ENT}}$ $\boxed{\text{UPDT}}$	Para 3-22.15
6.	SCP UPDATE - ELEVATION ONLY			Para 3-22.13
a.	Maneuver vehicle to place plumb bob over SCP			

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
b.	Stop vehicle; press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
c.	Press UPDT	GPS C-E		
d.	Press CLR	⊼ C-E	UPDT ENT	
e.	Press CLR; PADS cues for easting	"E"0: .0		
f.	Press CLR	"EL" .0		Para 3-22.9
g.	Enter elevation; PADS accepts elevation data	PAUSE	Z-VEL	Para 3-22.9
h.	PADS shows update results and is ready to move after indicator has flashing "GO"	ID*PAE --U	$\boxed{\text{STOP}}$ "GO" $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$	Para 3-22.15
7.	GPS UPDATE POSITION AND ELEVATION - ANTENNA ON VEHICLE (AOV)			Para 3-22.13
	NOTE PADS can be updated at its present position.			
a.	If the vehicle had been moving, bring to a halt and press STOP		STOP $\boxed{\text{GO}}$ Z-VEL	
	NOTE Ensure that the GPS receiver is being operated in the same datum (and reference ellipsoid) as PADS. If not, reselect the GPS datum to match PADS.			
b.	Press UPDT	GPS C-E	STOP Z-VEL UPDT ENT	
c.	Press ENT	DIFF C-E		
d.	Press CLR if not a differential GPS update	FOM "1-9"		
e.	Record data from GPS receiver by making a GPS mark or freezing the data. Note the FOM value			
f.	Enter the FOM value 1 = less than 25 meters 2 = less than 50 meters			
g.	Press ENT	AOV C-E		
	NOTE The GPS receiver must be mounted on the vehicle for this example.			
h.	Press ENT	PAUSE "E"0: .0		

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
i.	Enter the zone number and casting value from the frozen or marked GPS receiver, then press ENT	"N" .0		
j.	Enter the northing value from the GPS receiver, then press ENT	PAUSE “EL” .0	STOP Z-VEL UPDT ENT	
k.	Enter the elevation mean sea level (MSL) information from the GPS receiver, then press ENT	PAUSE ID*PAE g-g	$\boxed{\text{STOP}}$ “GO” Z–VEL $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$	
	NOTE Steps 1 through u apply to GPS update position only, using plumb bob (antenna is not on vehicle).			
l.	Move the vehicle to position plumb bob over location previously determined, using GPS. (Must have prerecorded position, FOM, and spheroid (datum) data)			
m.	Press STOP, UPDT	GPS C-E	STOP $\boxed{\text{GO}}$ Z–VEL UPDT ENT	
n.	Press ENT	DIFF C-E		
o.	Press CLR	FOM “1-9”		
p.	Enter prerecorded FOM, then press ENT	AOV C-E		
q.	Press CLR	$\overline{\wedge}$ C-E		
r.	Press CLR	"E"0: .0		
s.	Enter prerecorded zone and casting value, then press ENT	"N" .0		
t.	Enter prerecorded northing value, then press ENT	PAUSE “EL” .0		
u.	Press CLR	ID*PAE g--	$\boxed{\text{STOP}}$ “GO” Z–VEL $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$	
	NOTE Steps v through ad apply to differential GPS update elevation only, using plumb bob (antenna is not on vehicle).			
v.	Move vehicle to position plumb bob over location previously determined, using GPS. (Must have prerecorded elevation, FOM, and spheroid (datum) data)		GO	
w.	Press STOP, UPDT	GPS C-E	STOP $\boxed{\text{GO}}$ Z–VEL UPDT ENT	

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
x.	Press ENT	DIFF C-E		
y.	Press ENT	FOM "1-9"		
z.	Enter prerecorded FOM, then press ENT	AOV C-E		
aa.	Press CLR	⊼ C-E		
ab.	Press CLR	"E"0: .0		
ac.	Press CLR	"EL" .0		
ad.	Enter prerecorded elevation value, then press ENT	PAUSE ID*PAE --d	$\boxed{\text{STOP}}$ "GO" Z–VEL $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$	
	NOTE Steps ae through ao apply to GPS position and elevation update, using theodolite (antenna not on vehicle).			
ae.	Set up theodolite over previously determined GPS. Maneuver vehicle to obtain autoreflection		GO	
af.	Press STOP, UPDT. Exit vehicle and level porro prism	GPS C-E	STOP $\boxed{\text{GO}}$ Z–VEL UPDT ENT	
ag.	Press ENT	DIFF C-E		
ah.	Press CLR	FOM "1-9"		
ai.	Enter prerecorded FOM, then press ENT	AOV C-E		
aj.	Press CLR	⊼ C-E		
ak.	Press ENT	"E"0: .0		
al.	Enter prerecorded zone number and casting value, then press ENT	"N" .0		
am.	Enter prerecorded northing value, then press ENT	"D" .0		
an.	Enter distance derived from theodolite to PADS, then press ENT	PAUSE "EL" .0		
ao.	Enter prerecorded elevation value, then press ENT	PAUSE ID*PAE g-g	$\boxed{\text{STOP}}$ "GO" Z–VEL $\boxed{\text{UPDT}}$ $\boxed{\text{ENT}}$	
8.	CURRENT DATA DISPLAY			
a.	Press ID	--(Last display)		Para 3-22.19, Table 3-1 (ID)
b.	Press 0	-O(Last display)		
c.	Press ENT	(Last display)		
d.	Press symbol for desired parameter; e.g., easting; press E	EXX:XXXXXX.X		

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
	NOTE All mission survey is accomplished using either the plumb bob or theodolite and will have no CDU reference to GPS. If GPS mark data is required, the individual receivers must be accessed to log mark data. Standard survey accounting techniques should reference PADS mark numbers with GPS derived mark numbers.			
9.	MARKING - POSITION AND ELEVATION (using plumb bob)			Para 3-22.18
a.	Stop vehicle; press STOP		STOP [GO] Z-VEL	
b.	Hang plumb bob from suspension point			
c.	Set survey marker directly under plumb bob flush with the ground. Set locator stake nearby			
d.	Stow equipment			
OR:				
a.	Hang plumb bob from suspension point			
b.	Maneuver vehicle so plumb bob is directly above pre-established survey marker		[STOP] GO [Z-VEL]	
c.	Stow equipment			
d.	Press STOP		STOP [GO] Z-VEL	
e.	Press MARK (if 2 POS C-E appears on ⊼ C-E display, press CLR)		MARK ENT	
f.	Press CLR; PADS marks position	PAUSE		
g.	PADS records position and shows results of mark and is ready to move after indicator has flashing "GO"	ID*PAE 2-2	[MARK] [ENT] [STOP] "GO"	
10.	MARKING - 2-POSITION AZIMUTH MARK (using plumb bob. Not functional in geographic coordinate system operation.)			
a.	Stop vehicle; press STOP		STOP [GO] Z-VEL	Para 3-22.19
b.	Hang plumb bob from suspension point			
c.	With care, set survey marker directly under plumb bob			Para 3-22.18, 3-22.19

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
d.	Stow equipment			
OR:				
a.	Hang plumb bob from suspension point			
b.	Maneuver vehicle so plumb bob is directly above a pre-established survey marker		STOP GO Z-VEL	
c.	Stow equipment			
d.	Press STOP		STOP GO Z-VEL	
e.	Press MARK (if 2 POS C-E appears on display, press CLR)	⊼ C-E	MARK ENT	
f.	Press CLR; PADS marks position	PAUSE		
g.	PADS records position and shows results of the first position of a 2-position azimuth mark and is ready to move after indicator has flashing "GO"	ID*PAE 2-2	MARK ENT STOP "GO"	
h.	Drive vehicle toward second point requiring survey; press ID, 0, ENT, DIST	(Radial distance from first point)	Z-VEL GO	
i.	Maneuver vehicle so plumb bob is directly over second point to be established and press STOP. (Distance must beat least 100 meters from the first point.)		STOP GO Z-VEL	Para 3-22.18, 3-22.19
j.	Press MARK	2 POS C-E	MARK, ENT	
k.	Press ENT; PADS marks position	PAUSE		
l.	PADS records position, azimuth, elevation, and shows result of mark	ID*PAE 222	MARK STOP ENT "GO"	
m.	Set witness and hub stakes, taking care to locate hub indent exactly beneath the plumb bob			
n.	Stow all equipment			
o.	Drive to next position, performing zero-velocity corrections as necessary		Z-VEL GO	
11.	MARKING - POSITION AND ELEVATION (using theodolite)			Para 3-22.10
a.	Stop vehicle, press STOP		STOP GO Z-VEL	Para 3-22.22
b.	Set up theodolite over point to be established			
c.	When ready to move ("GO"), maneuver vehicle and achieve autoreflection		STOP GO Z-VEL	Para 3-22.20

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
d.	Press STOP		STOP [GO]	
e.	Press MARK (if 2 POS C-E appears on display, press CLR)	⊼ C-E	MARK, ENT Z-VEL	
f.	Press ENT	"⊼", "READ" alternate for 64 seconds		
g.	Press CLR (to bypass 64-second motion test). PADS will cue for distance	"D"		
h.	Measure and record offset distance			Para 3-22.20
i.	Press DIST	D		Para 3-22.10
j.	Enter distance	PAUSE		
k.	PADS shows mark results	ID*PAE 1-1	[MARK] [ENT] [STOP] "GO"	
l.	Stow equipment, and proceed with mission after indicator has flashing "GO"		GO [Z–VEL]	
12.	MARKING - POSITION, AZIMUTH, AND ELEVATION (using theodolite)			Para 3-22.10
a.	Stop vehicle; press STOP		STOP [GO] Z–VEL	Para 3-22.21
b.	Set up theodolite over point to be established			
c.	When ready to move ("GO"), maneuver vehicle and achieve autoreflection		[STOP] GO [Z–VEL]	Para 3-22.20
d.	Press STOP		STOP [GO] Z–VEL	
e.	Press MARK	⊼ C-E	MARK, ENT	
f.	Press ENT	"⊼", "READ" alternate for 64 seconds then "<" .00		
g.	Measure and record horizontal angle and offset distance			Para 3-22.20
h.	Without disturbing vehicle, press <. PADS will automatically check for azimuth motion. Display must be "<" before this step will be accepted	PAUSE		
i.	Azimuth motion within limits (if motion is excessive, display will revert back to ⊼ C-E and steps f and h must be repeated)	<		

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
k.	Press DIST	D		
l.	Enter distance	PAUSE		
m.	PADS shows mark results	ID*PAE 111	MARK ENT STOP "GO"	
n.	Load survey equipment and proceed on mission when indicator has flashing "GO"		GO Z–VEL	
13.	DATA RECALL			Para 3-22.16
a.	Perform lamp test to verify proper lamp operation. Set lamp intensity to desired brightness			
b.	Press ID	--(Last display)		
c.	Enter ID number of desired data. (Example: ID10)	10(Last display)		
d.	Press ENT	10(New display)		
e.	Press for data desired. (Example: for easting, press E.) Azimuth information will only be available for those IDs where an azimuth was marked. Dashes will be displayed for grid or true azimuth in those IDs where only position and elevation are marked	10EXX:XXXXXX.X		
f.	An alternate procedure to recall data is to press +/2 to increase the ID number by one one press -/8 to decrease the ID number by one			
14.	SHUTDOWN **CAUTION** To prevent damage, do not move or restart PADS for at least 2 minutes after shutdown. **NOTE** The following steps check the PADS battery operation under load. While it may be performed at any time during a mission, it is suggested that it be performed at the beginning of the mission to minimize impact if a defective battery is found.			Para 3-6
a.	While PADS is operating, note CHRG indicator is not lighted continuously			

Table 3-3.2. Mission Procedures (GPS) - Continued

Step no.	Operation action	CDU data display	Status indicators	Reference
b.	Disconnect vehicle power by setting PS VEHICLE circuit breaker CB2 to OFF. PADS should remain operating.		BATT	
c.	After 30 seconds of battery operation, set PS VEHICLE circuit breaker CB2 to ON		CHRG	
d.	Press ON/OFF	SAVE C-E		
	CAUTION Do not attempt to remove power or force a system shutdown during the PAUSE command. Memory data is being transferred during this time.			
e.	Press ENT	PAUSE (approx 40 seconds)		
f.	When display indicates "OFF" E, press ON/OFF	OFF "E"		
g.	Press ENT	(All displays darken)		
	NOTE If, for security reasons, the operator does not want to store the mission data, the following shutdown sequence should be followed.			
h.	Press ON/OFF	SAVE C-E		
i.	Press CLR	"OFF" C-E		
j.	Press ON/OFF	OFF "C-E"		
k.	Press ENT	(All displays darken)		
l.	Turn off PS BATTERY and VEHICLE circuit breakers CB1 and CB2			
m.	Turn off vehicle engine			
15.	AFTER-OPERATION CHECKS AND SERVICES			
a.	Inspect for excessive accumulation of dirt and debris. Clear as necessary			Table 4-1
b.	Inspect for damage to primary pallet, battery box, CDU, and cables			Table 4-1

Table 3-3.3. Update Rejection Troubleshooting (GPS)

NOTE

Update rejection may occur at the initial update attempt or secondary update attempts during the survey mission. This table is divided into two parts. Part I pertains to rejection at the initial update. Part II comprises all other update rejections occurring during the survey mission, or when closing the survey mission.

PART I. Update Rejections at Initial Update

Reason for Flashing E	Operator Corrective Action
1. Operator entered coordinates incorrectly	a. If displayed data is incorrect, enter the correct data. Press E, reenter correct data. Press N, reenter correct data.
	b. If displayed data is correct, see reason 2, part I.
2. Accuracy of initialization coordinates is questionable	a. Check map spot/or coordinates used to initialize system. If using GPS, check that the GPS datum/reference ellipsoid is the same as the spheroid chosen for PADS. If not, establish the spheroids desired, then reselect the GPS receiver spheroid/datum. If PADS spheroid is incorrect, shut down PADS and reinitialize using the desired spheroid.
	b. Accuracy not within 100 meters, shut down and reinitialize using correct data. If accuracy of coordinates were correct, see reason 3, part I.
3. Accuracy of initial update coordinates is questionable	a. Cancel update by pressing UPDT. If using GPS data, ensure that the value of the indicated FOM is less than 25 meters. Ensure that the GPS receiver and PADS are operating in the same datum/spheroid configuration. Mark the position with the GPS receiver and attempt a new update. If rejection continues, cancel update and proceed to a known SCP or a new location to receive GPS.

Part II. Update Rejections During or Closing Survey Mission

Reason for Flashing E	Operator Corrective Action
1. Operator entered coordinates incorrectly	a. If displayed data is incorrect, reenter the correct data. Press E, reenter correct data. Press N, reenter correct data.
	b. If displayed data is correct, see reason 2, part II.
2. Accuracy of present coordinates is questionable	a. Cancel update by pressing UPDT. If using GPS data, ensure that the value of the indicated FOM is less than 25 meters. Ensure that the GPS receiver and PADS are operating in the same datum/spheroid configuration. Mark the position with the GPS receiver and attempt a new update. If rejection continues, cancel update and proceed to a known SCP or a new location to receive GPS.
	b. If update is accepted, on second entry, continue with mission. The accuracy of the entered coordinates where update was rejected is questionable.
	c. If update is rejected, the accuracy of the initial update or the initialization data is questionable. See reason 3, part II.
3. Accuracy of initial update is questionable, or initialization data was incorrect	a. Troubleshoot all data. Shut down, reinitialize using correct data. Update over known accurate SCP, or if using GPS, use another receiver.

NOTE

Illumination of the CAL indicator anytime during an update means that the update coordinates are wrong, the initial update coordinates were wrong, or there is a possibility that the system is out of calibration. If the update coordinates were wrong and the system accepted the update with the CAL indicator on, use the unadjusted rather than the adjusted PADS data. If the initial update coordinates were wrong, rerun the survey mission. If illumination of the CAL indicator cannot be traced to incorrect survey mission data, troubleshoot in accordance with table 4-2.

3-23. Transfer to an Army OH-58 Series Helicopter with Rotor Stopped.

WARNING

Use extreme care when working under helicopter blades.

Make sure blades are secured when helicopter engine is off.

Make sure rotor swath is clear before starting helicopter.

To prevent injury, use at least three persons to transfer primary pallet.

With a heavy crew and total PADS equipment installed, the Army OH-58 may easily exceed its forward center of gravity limits, which could result in mast bumping. The helicopter pilot shall perform a weight and balance calculation before each flight (Class 2 aircraft) to guarantee that the aircraft remains within its center of gravity limits for both takeoff and landing. The weight of the PADS equipment is 334 lbs. To calculate the moment/100, refer to the center of gravity limit chart in TM 55-1520-228-10 for the OH-58A, or in TM 55-1520-235-10 for the OH-58C. Should load adjustments be required, take the actions listed in order of preference:

a. Limit pilot and operator weight.

b. Leave behind unnecessary personal gear.

c. Remove chest armor.

d. Remove seat armor.

e. Remove PADS battery box.

f. Reduce fuel load.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to avoid becoming a missile hazard during a crash.

Refueling of the aircraft should not be performed while either land vehicle or helicopter is running; start-up of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

CAUTION

To prevent damage to the equipment when the PADS operator is on the aircraft, the copilot's cyclic stick shall be in a stowed position.

In the event of aircraft generator failure, the PADS equipment shall be immediately shut down.

NOTE

Transfer system to helicopter power quickly to minimize discharge of batteries.

Initiate a zero velocity correction whenever the system is stationary.

To install PADS in an Army OH-58C, the helicopter cargo pallets must be modified by direct support personnel.

PADS may be transferred between the land vehicle and helicopter while operating. The procedure for transfer with the helicopter rotor stopped is given below.

NOTE

Before initializing for such a mission, connect transfer cable W8, located in the battery box top, between PS connector 3J4 and connector W7P1 on power cable W7. Stow the cable so it can be extended without tangling. (See figure 3-7).

a. Position vehicle so PADS is within 5 feet of the helicopter left cargo door. Remove left cargo door or secure it in the fully open position.

b. Clear canvas from vehicle and remove radio, spare tire, and gas can, if present. Remove theodolite, tripods, and other gear from vehicle and set aside.

c. Without disconnecting cable assembly W1, unsnap CDU from vehicle CDU bracket and secure to computer bracket. Wrap cable around CDU to keep it out of the way.

d. If transfer cable W8 is not connected:

(1) Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights.

(2) Connect transfer cable W8, located in battery box top, between PS connector 3J4 and power cable W7 connector W7P1. (See figure 3-7).

(3) Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator goes off. (CHRG indicator may light.)

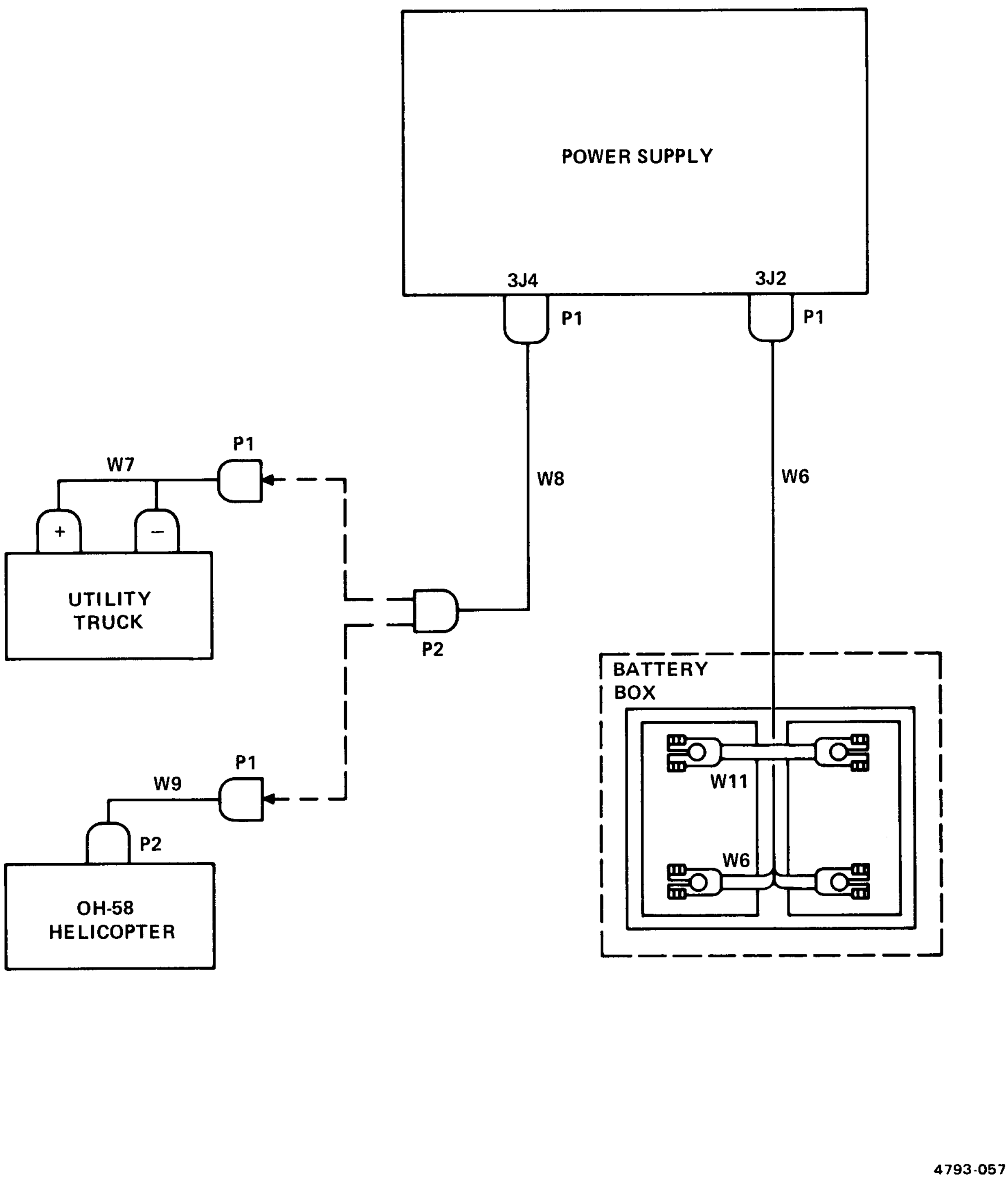


Figure 3-7. Transferring Electrical Connections from Utility Truck to Helicopter

e. Remove two forward T-handles securing clamping brackets to subfloor or mounting base and store in battery box top. Retain clamping brackets for later use.

f. Slide primary pallet forward a few inches to disengage alignment pins. Remove two rear T-handles securing alignment pin bracket and store in battery box top. Retain bracket for later use.

g. Remove D-rings from helicopter cargo platforms as shown in figure 3-8.

NOTE

Save five D-rings for later use. Store the rest in the battery box top.

h. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator lights. Disconnect battery cable W6 from PS connector 3J2.

i. Raise IMU end of primary pallet so it rests on left fender. Rotate the pallet so the IMU end hangs over the rear panel. Using three persons, transfer the primary pallet to the helicopter left cargo platform. The porro prism faces out the door. (See figure 3-9 or 3-10.)

j. Mate alignment pin bracket to right bottom rail (side opposite porro prism) of primary pallet. Adjust alignment pins as necessary.

k. Secure alignment pin bracket to cargo platform with two D- rings. Secure left side (porro prism side) of primary pallet with two clamping brackets and D-rings.

l. Transfer the battery box to the right cargo platform. Connect battery cable W6 to PS connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator goes out.

m. Position battery box locating bracket over center rear tiedown receptacle. Secure with a D-ring. Fasten and secure battery-box belt to D-rings on both sides of the battery box.

n. Strap auxiliary gear to cargo platforms.

o. Without disconnecting cable W1, remove CDU from computer bracket and secure to helicopter leg mount (located in battery box top). Route to passenger's seat.

p. Check that helicopter armament power circuit breaker is out.

q. Connect W9P2 of helicopter cable W9 (located in battery box top) to helicopter armament power connector under left cargo platform. Route between the cargo platforms.

r. Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights. Disconnect cable W8

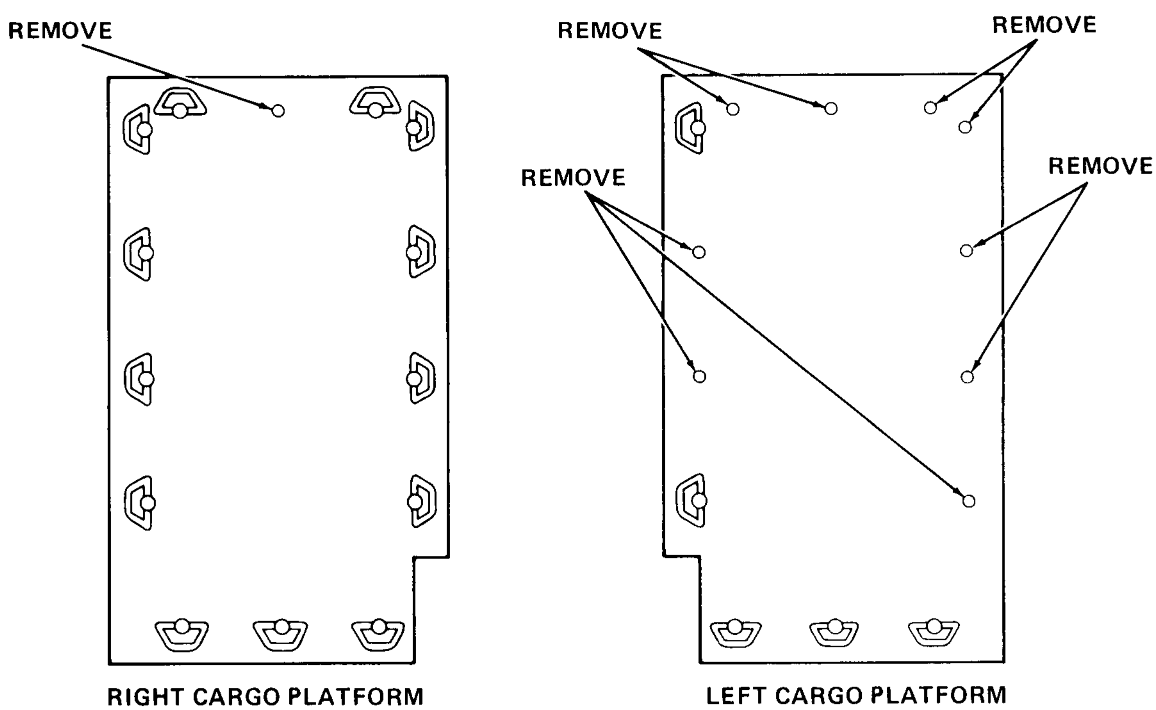


Figure 3-8. Army OH-58A Helicopter Cargo Platforms

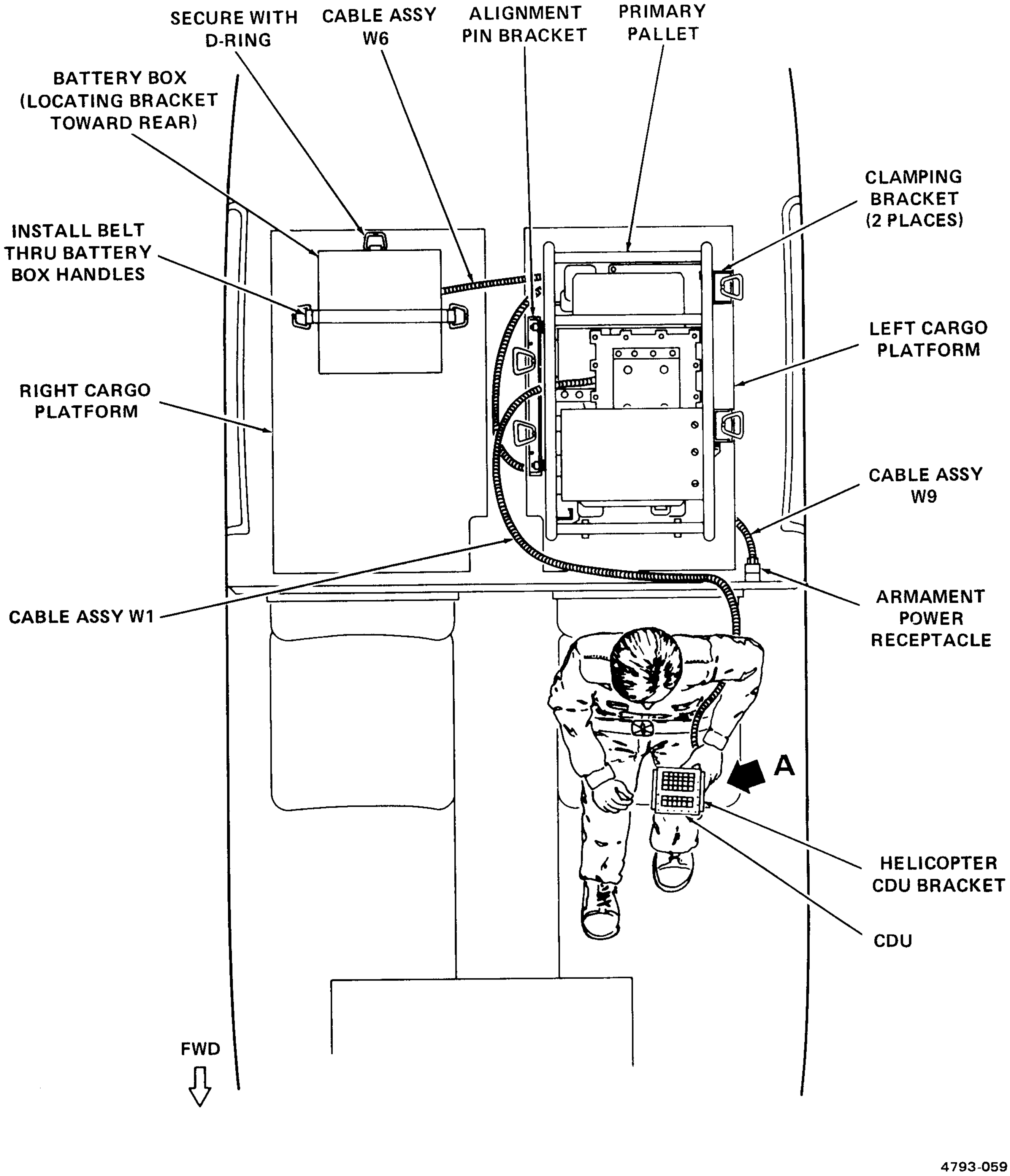


Figure 3-9. Installation in Army OH-58A Helicopter (Sheet 1 of 2)

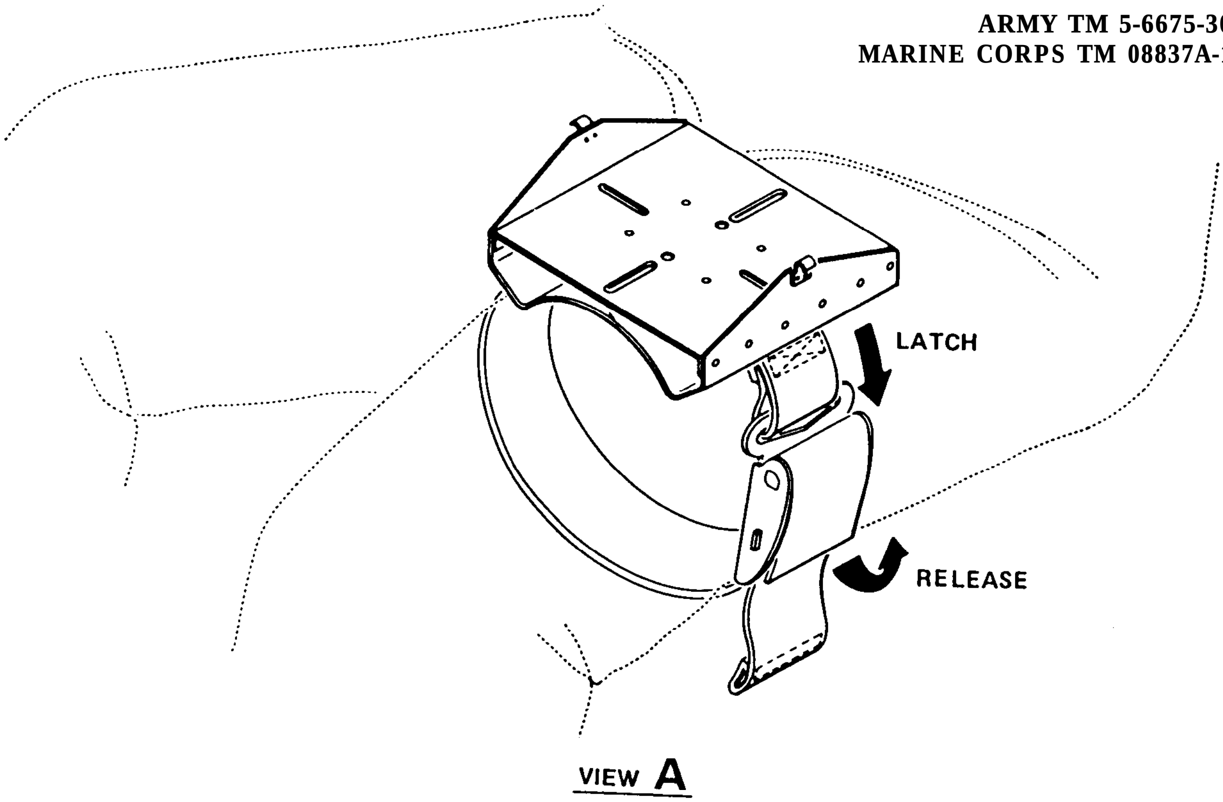


Figure 3-9. Installation in Army OH-58A Helicopter (Sheet 2 of 2)

connector W8P2 from power cable W7 connector W7P1. Drive utility truck clear of helicopter.

s. Connect helicopter cable W9 connector W9P1 to transfer cable W8 connector W8P2. Set PS VEHICLE circuit breaker CB2 to ON. Slide excess transfer cable W8 between the cargo platforms to the helicopter floor.

t. Start helicopter. When helicopter power demand is less than 45 amps, close armament power circuit breaker. BATT indicator goes out. CHRG indicator may light.

u. Select the new lever arms for the helicopter. Refer to paragraph 3-8.1b(3).

v. Secure helicopter doors. Reinstall radio, spare tire, and gas can on vehicle, if removed. Load survey and personal gear, which will not be used during the helicopter mission, onto the vehicle.

w. During flight, the CDU is strapped to the operator's left leg. (See figure 3-9, sheet 2.)

3-24. Transfer to Army OH-58 Series Helicopter with Rotor Turning.

NOTE

Use extreme care when working under helicopter blades. To prevent injury, use at least three persons to transfer primary pallet.

With a heavy crew and total PADS equipment installed, the OH-58 may easily exceed its forward center of gravity limits, which could result in mast bumping. The helicopter pilot shall perform a weight and balance calculation before each flight (Class 2 aircraft) to guarantee that the aircraft remains within its center of gravity limits for both takeoff and landing. The weight of the PADS equipment is 334 lbs. To calculate the moment/100, refer to the center of gravity limit chart in TM 55-1520-228-10 for the Army OH-58A, or in TM 55-1520-235-10 for the Army OH-58C. Should load adjustments be required, take the actions listed in order of preference:

a. Limit pilot and operator weight.

b. Leave behind unnecessary personal gear.

c. Remove chest armor.

d. Remove seat armor.

e. Remove PADS battery box.

f. Reduce fuel load.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to

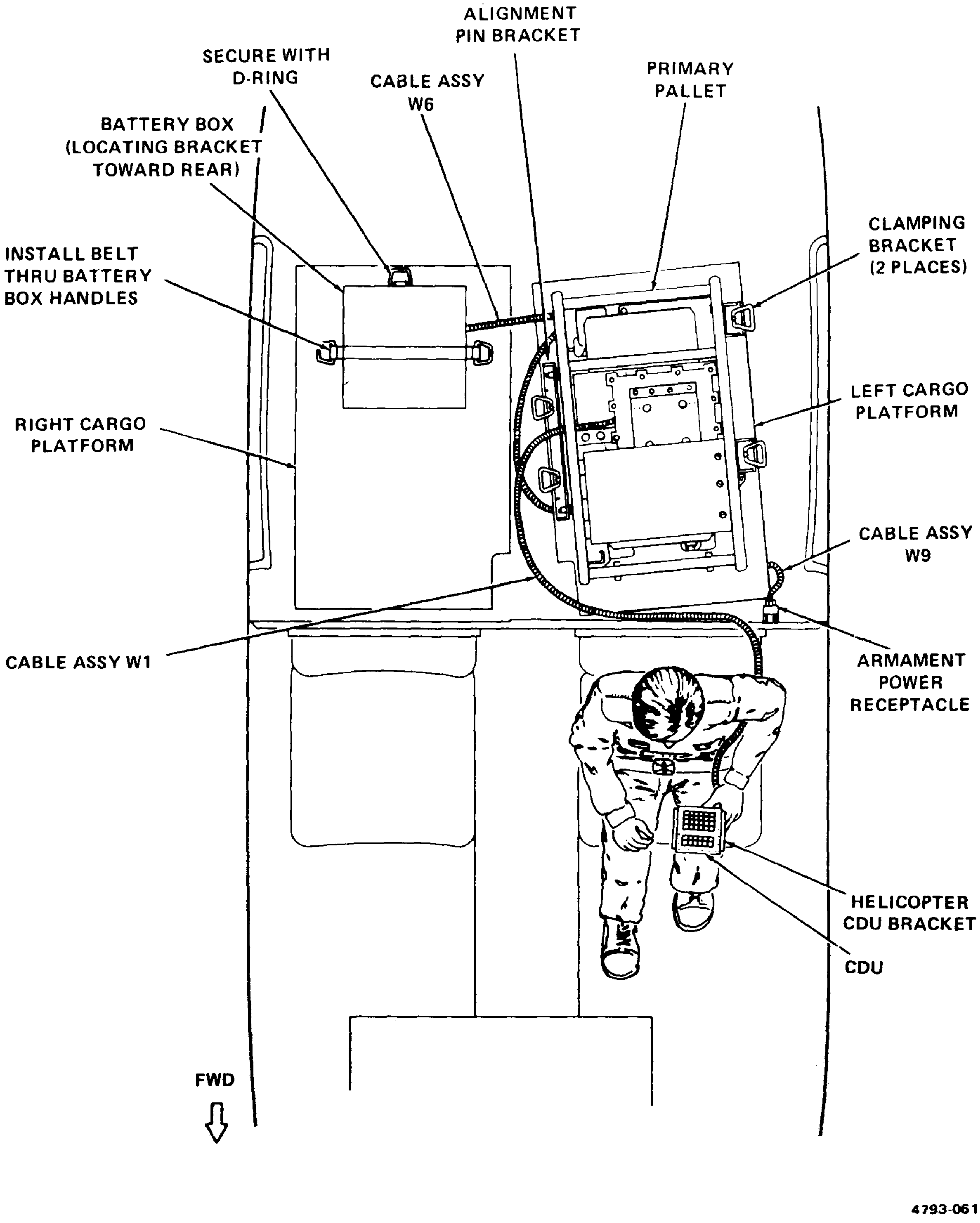


Figure 3-10. Installation on Army OH-58C Helicopter

avoid becoming a missile hazard during a crash.

WARNING

Refueling of the aircraft should not be performed while either vehicle or helicopter is running; start-up of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

CAUTION

To prevent damage to the equipment when the PADS operator is on the aircraft, the copilot's cyclic stick shall be in the stowed position. In the event of aircraft generator failure, the PADS equipment shall be immediately shut down.

NOTE

Transfer system to helicopter power quickly to minimize discharge of batteries. Initiate a zero velocity correction whenever the system is stationary.

To install PADS in an Army OH-58C. the helicopter cargo pallets must be modified by direct support personnel.

PADS may be transferred between the land vehicle and helicopter while operating. The procedure for transfer with the helicopter rotor turning is given below.

NOTE

Before initializing for such a mission, connect transfer cable W8, located in the battery-box top, between PS connector 3J4 and connector W7P1 on power cable W7. Stow the cable so it can be extended without tangling.

a. Clear canvas from vehicle and remove radio, spare tire, and gas can if they are obstructing access to PADS. Remove theodolite, tripod, and other gear from vehicle and set aside.

b. Without disconnecting cable assembly W1, unsnap CDU from vehicle CDU bracket and secure to computer bracket. Wrap cable around CDU to keep it out of the way.

c. If transfer cable W8 is not connected:

(1) Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights.

(2) Connect transfer cable W8, located in battery box top, between PS connector 3J4 and power cable W7 connector W7P1.

(3) Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator goes out. (CHRG indicator may light.)

d. Remove two forward T-handles securing clamping brackets to subfloor or mounting plate and store in battery box top. Retain clamping brackets for later use.

e. Slide primary pallet forward a few inches to disengage alignment pins. Remove two rear T-handles securing alignment pin bracket and store in battery box top. Retain bracket for later use.

f. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator lights. Disconnect battery cable W6 from PS connector 3J2.

g. If the host vehicle is a Jeep, raise IMU end of primary pallet so it rests on left fender. Rotate the pallet so the IMU end hangers over the rear panel. Lift the pallet out of vehicle and move about 5 feet behind the vehicle.

h. Place battery box on ground near the primary pallet. Connect battery cable W6 connector W6P1 to PS connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator goes out.

i. When the helicopter approaches, set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights. Disconnect transfer cable W8 connector W8P2 from power cable W7 connector W7P1. Drive the vehicle outside the landing area.

j. Connect helicopter cable W9 (located in battery box top) connector W9P1 to transfer cable W8 connector W8P2.

k. Pilot lands the helicopter so the left cargo door is as close to the primary pallet as possible. Check that helicopter armament power circuit breaker is out. Remove left cargo door or secure it in a fully open position.

l. Route cable assemblies W8 and W9 so connector W9P2 passes between the cargo platforms into the space below. Connect W9P2 to armament power receptacle beneath cargo platforms. Close armament power circuit breaker. Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator goes off.

m. Remove D-rings from helicopter cargo platforms as shown in figure 3-8.

NOTE

Save five D-rings for later use. Store the rest in the battery box top.

n. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator lights. Disconnect battery cable W6 from PS connector 3J2.

o. Lift primary pallet into helicopter and locate in on left cargo platform with porro prism facing outward.

p. Mate alignment pin bracket to right bottom rail (side opposite porro prism) of primary pallet. Adjust alignment pins as necessary.

q. Secure alignment pin bracket to cargo platform with two D-rings. Secure left side (porro prism side) of primary pallet with two clamping brackets and D-rings.

r. Transfer the battery box to the right cargo platform. Connect battery cable W6 to PS connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator goes out.

s. Position battery-box-locating bracket over center rear-tiedown receptacle. Secure with a D-ring. Fasten and secure battery-box belt to D-rings on both sides of the battery box.

t. Strap auxiliary gear to cargo platforms. Slide excess transfer cable W8 between the cargo platforms to the helicopter floor.

u. Without disconnecting cable W1, remove CDU from computer bracket and secure to helicopter leg mount (located in battery box top). Route to passenger's seat.

v. Select the new lever arms for the helicopter. Refer to paragraph 3-8.1b(3).

w. Secure helicopter doors. Reinstall radio, spare tire, and gas can on vehicle, if removed. Load survey and personal gear, which will not he used during the helicopter mission, onto the vehicle.

x. During flight. the CDU is strapped to the operator's left leg. (See figure 3-9, sheet 2.)

3-25. Transfer to UH-1 Helicopter with Rotor Stopped.

WARNING

PADS is to be installed *only* in a Medivac model of the UH-1.

PADS may be transferred from a land vehicle to a UH-1 helicopter while operating. The procedure for transfer with the helicopter rotor stopped is given below.

WARNING

Use extreme care when working under helicopter blades.

Make sure blades are secured when helicopter engine is off.

Make sure rotor swath is clear before starting helicopter.

To prevent injury use at least three persons to transfer primary pallet.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to avoid becoming a missile hazard during a crash.

Refueling of the aircraft should not be performed while either the land vehicle or the helicopter is running; start-up of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

CAUTION

In the event of aircraft generator failure, the PADS equipment shall be shut down immediately.

NOTE

Ensure helicopter has J119 connector installed.

Transfer system to helicopter power quickly to minimize discharge of batteries.

Initiate a zero velocity correction whenever the system is stationary.

Before initializing for a helicopter mission, connect transfer cable W8, located in top of battery box, between Power Supply connector 3J4 and power cable W7 connector W7P1 (see figure 3-7). Stow the cable so it can be extended without tangling.

a. Prepare helicopter for PADS as follows:

(1) Remove end seat section on starboard side and stow (see figures 3-11 and 3-12).

(2) Disconnect seat legs from floor of rear starboard seat, fold seat against wall and lock in position with self-contained fasteners (see figures 3-11 and 3-13).

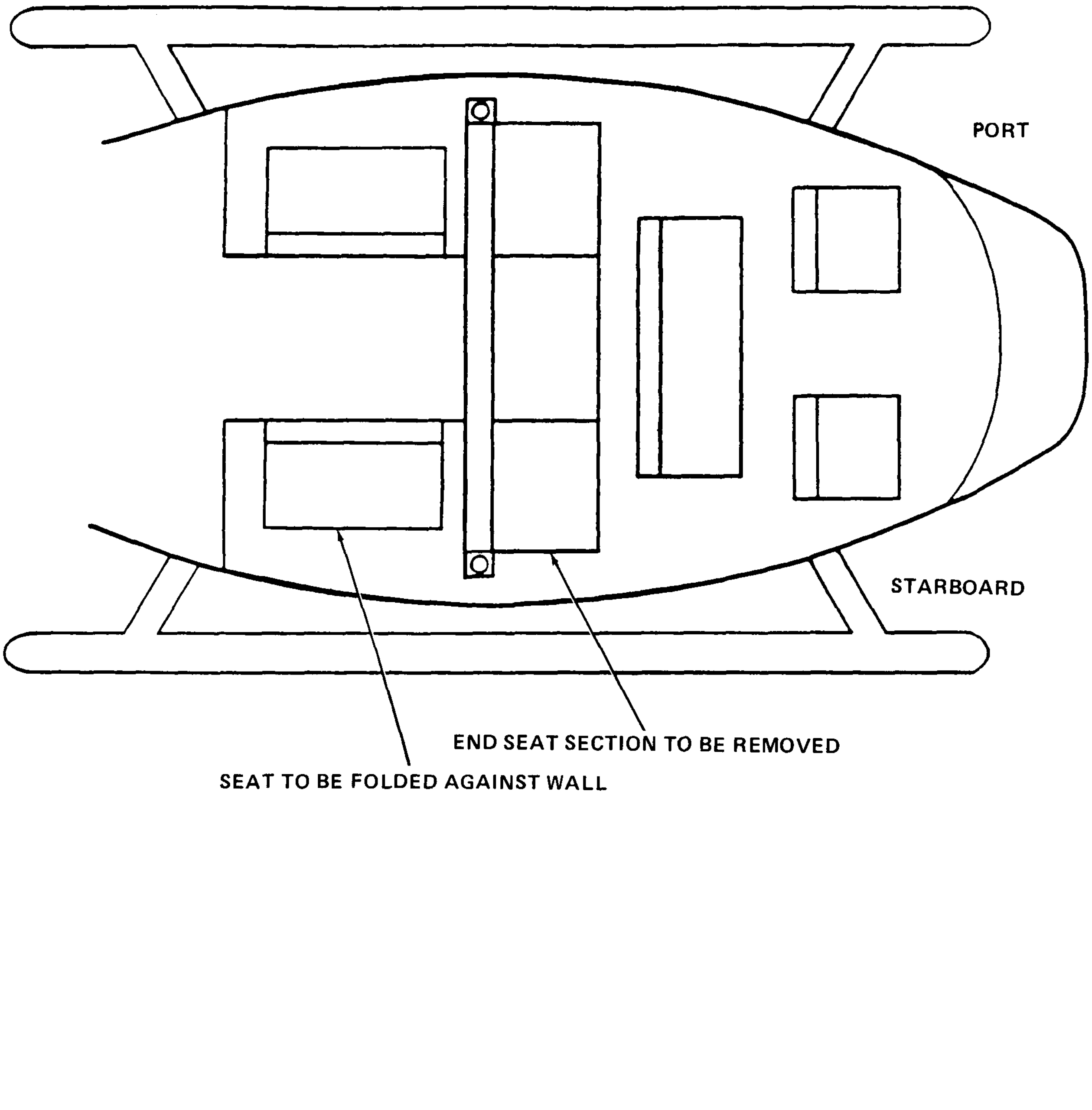


Figure 3-11. Cockpit Arrangement of UH-1 Helicopter

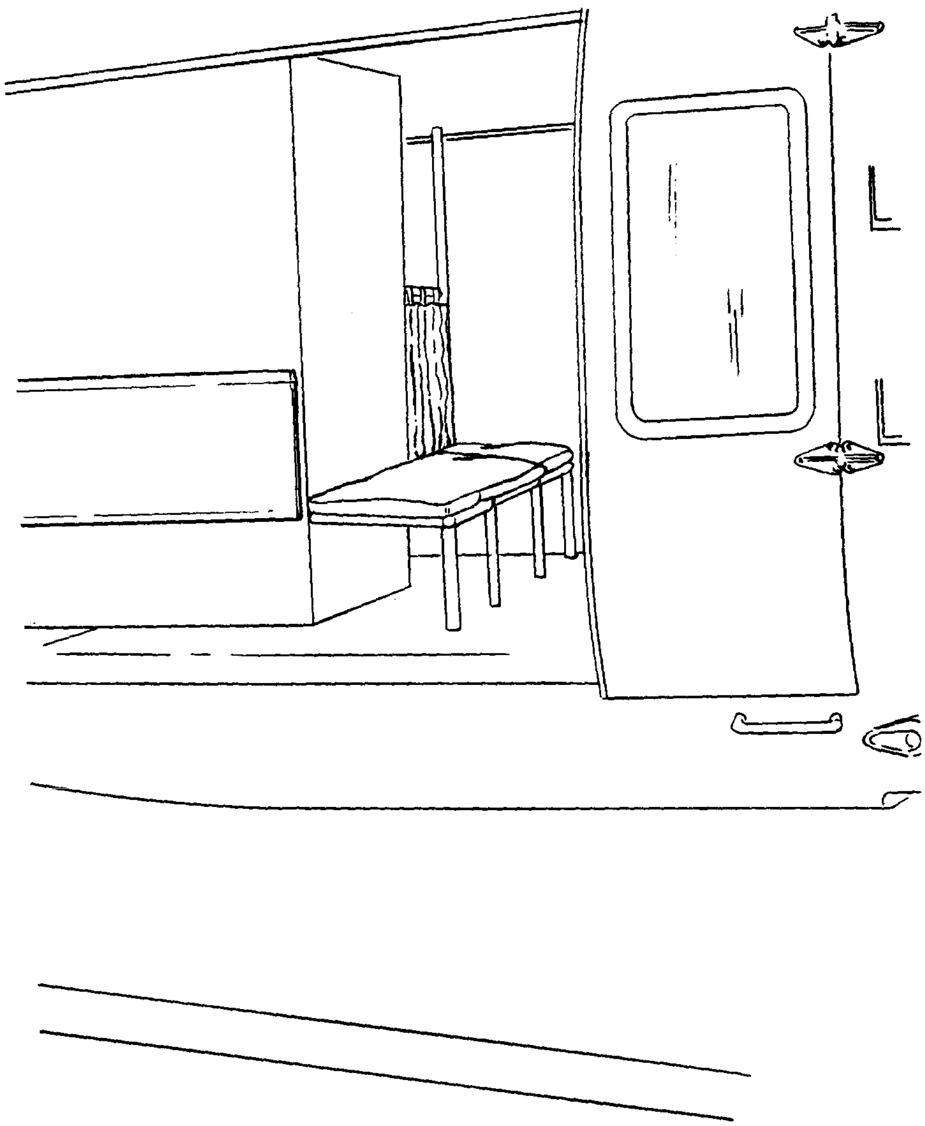


Figure 3-12. End Seat Section Removed

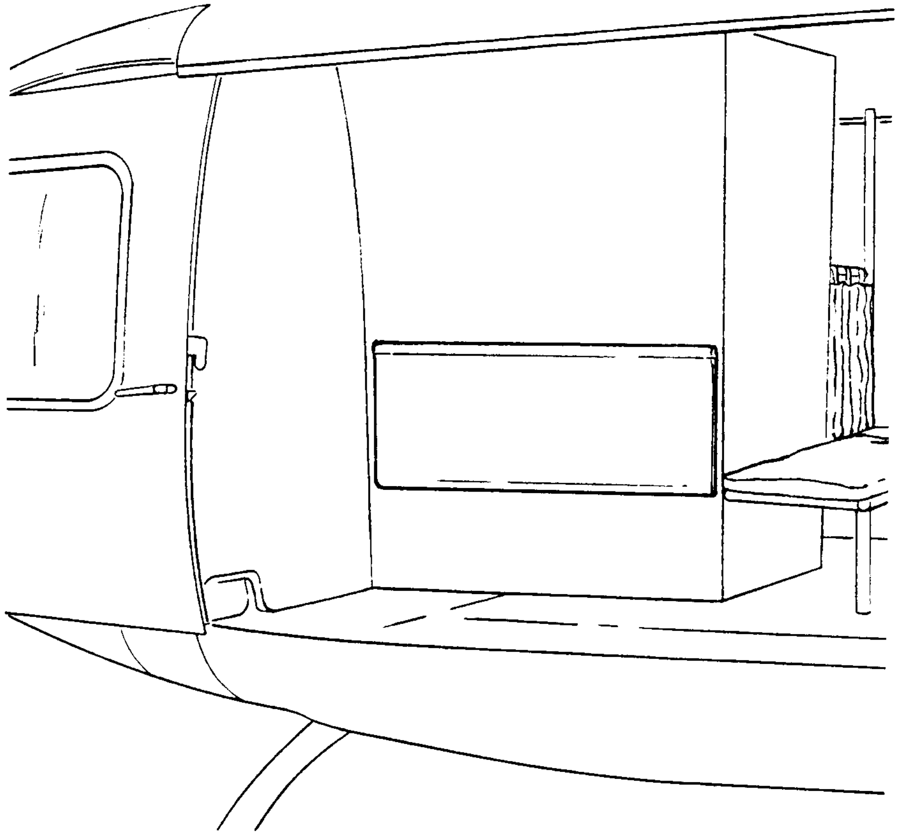


Figure 3-13. Rear Seat Folded

b. Position vehicle so PADS is within 5 feet of the helicopter starboard cargo door. Secure the starboard cargo door in the fully open position.

c. If necessary, clear canvas from vehicle and remove radio, spare tire, and gas can. Remove theodolite, tripods and other gear from vehicle and set aside.

d. Without disconnecting cable assembly, W1, unsnap CDU from instrument panel bracket and secure to computer bracket. Wrap cable around CDU to keep it out of the way.

e. If transfer cable, W8, is not connected, proceed as follows:

(1) Set PS VEHICLE circuit breaker, CB2 to OFF. BATT indicator will light. (CHRG indicator may light.)

(2) Connect transfer cable W8, located in top of battery box, between power supply connector 3J4 and power cable W7 connector W7P1. (See figure 3-7.)

(3) Set PS VEHICLE circuit breaker, CB2, to ON. BATT indicator will go out. (CHRG indicator may light.)

f. Remove two forward T-handles securing clamping brackets to vehicle's subfloor or mounting base and store on PADS primary pallet.

g. Slide primary pallet forward several inches to disengage alignment pins. Remove two rear T-handles securing alignment pin bracket and store the T-handles on PADS primary pallet.

h. Set PS BATTERY circuit breaker, CB1, to OFF. BATT indicator will light. Disconnect battery cable W6 from power supply connector 3J2.

i. Using three persons, remove the primary pallet from the vehicle and transfer to the helicopter. The porro prism must face out the door.

j. Adjust pallet until PADS is positioned approximately as shown in figure 3-14, so that forward alinement pin hole in PADS lower frame plate is alined with armament mount bracket below helicopter door opening, and plumb bob can hang down between helicopter fuselage and landing skid. (See figure 3-15.)

k. Open primary pallet top panel marked "NO SEAT" and, using two belt assemblies, tie down primary pallet to floor rings as shown in figures 3-14 and 3-16.

l. Tighten belt assemblies using ratchet handles.

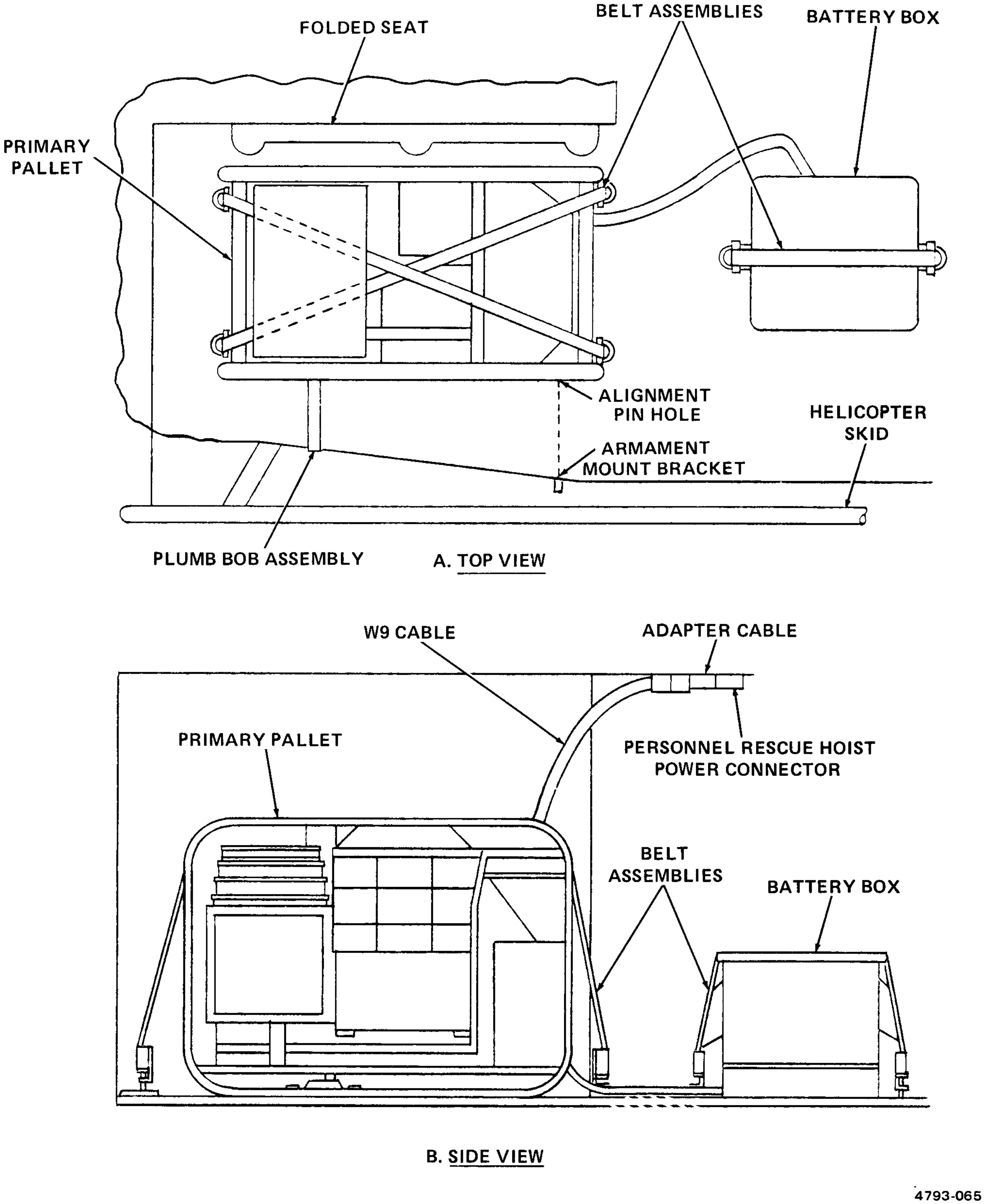


Figure 3-14. Overhead and Side Views, Starboard Side, Showing Primary Pallet, Battery Box and Belt Assemblies in Position

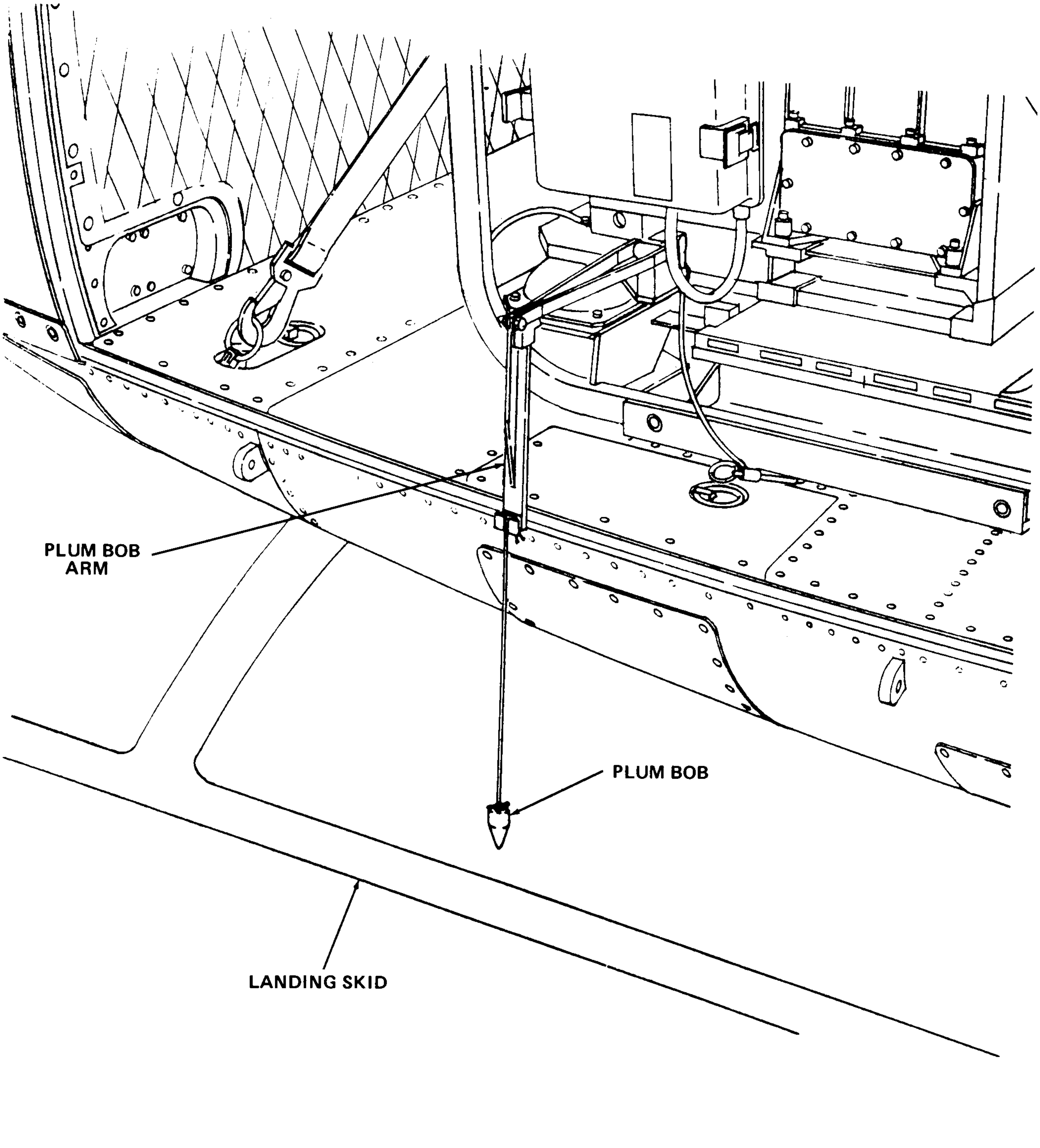


Figure 3-15. Plumb Bob Suspended Between Helicopter Fuselage and Landing Skid

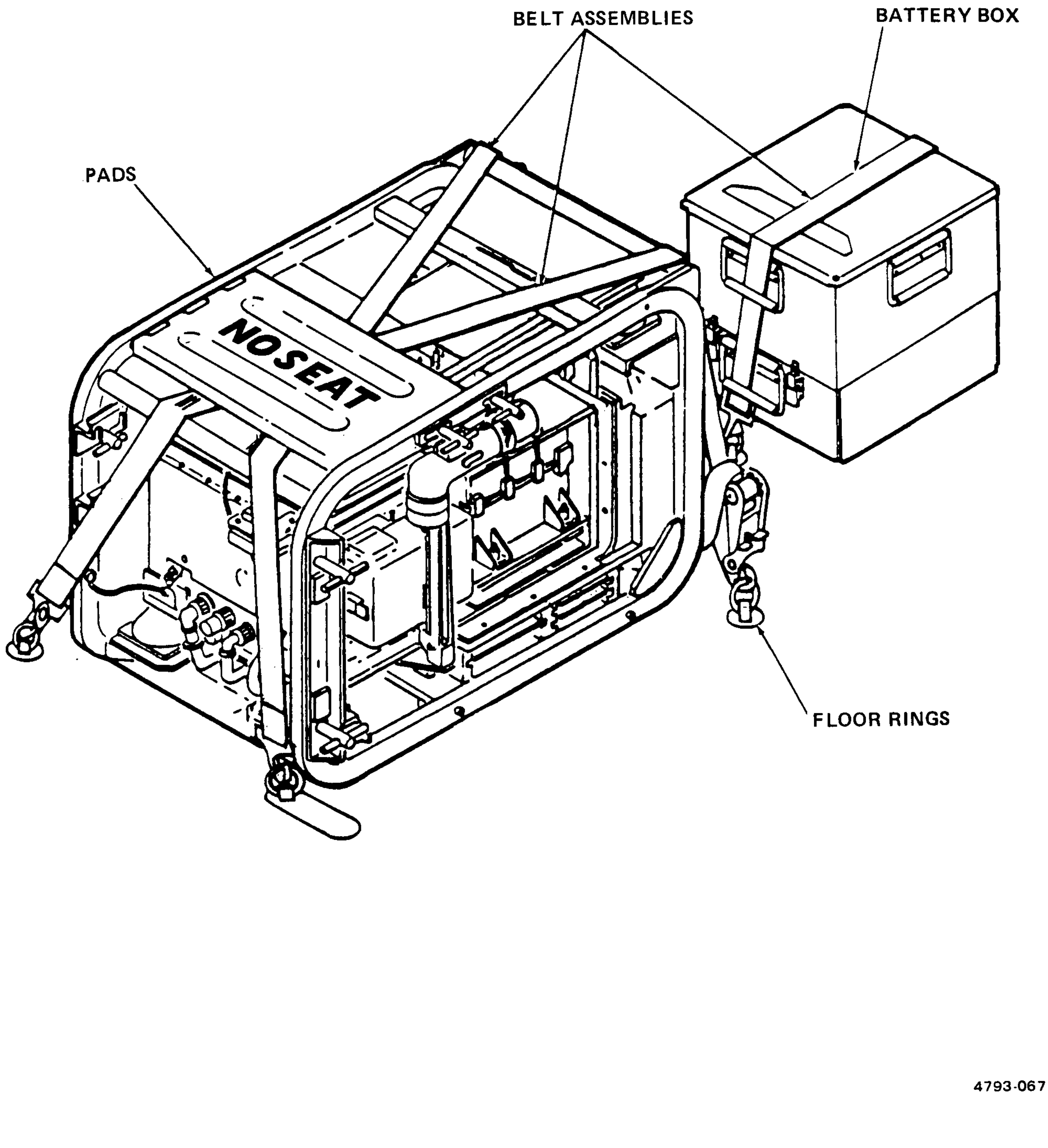


Figure 3-16. Primary Pallet and Battery Box in Tiedown Configuration

m. Close "NO SEAT" top panel.

n. Transfer battery box to the helicopter and position approximately as shown in figure 14. Install battery box belt assembly through handles and fasten to floor rings on both sides of box.

o. Connect battery cable W6 to power supply connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator will go out.

p. Without disconnecting cable W1, remove CDU from computer bracket and secure to helicopter leg mount (located in top of battery box). Route to passenger's seat.

q. Check that helicopter personnel rescue hoist power circuit breaker is OFF.

r. Pull down headliner panel, locatcd over PADS mounting area, to expose personnel rescue hoist power connector, J119.

s. Connect P2 connector of cable W9 (located in top of battery box) to P1 connector of adapter cable.

t. Connect P2 connector of adapter cable to personnel rescue hoist power connector, J119. (See View B, figure 3-14.)

u. Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicators will light. Disconnect cable W8 connector W8P2 from power cable W7 connector W7P1 and from power supply connector 3J4. Stow W8 cable in top of battery box. Drive vehicle clear of helicopter.

v. Connect cable W9 connector W9P1 to power supply connector 3J4. Set PS VEHICLE circuit breaker CB2 to ON.

w. Start helicopter. When helicopter power demand is less than 45 amps, set personnel hoist power circuit breaker to ON. BATT indicator will go out. CHRG indicator may light.

x. Installation is complete, start preflight procedures. Select the new vehicle lever arms. Refer to paragraph 3-8.1 b (3).

y. Secure helicopter doors. Reinstall radio, spare tire, and gas can on vehicle, if removed. Load onto vehicle survey and personal gear that will not be used during the helicopter mission.

z. During flight, the CDU is strapped to the operator's left leg. (See figure 3-9, sheet 2.)

3-26. Transfer to UH-1 Helicopter with Rotor Turning

PADS may be transferred from land vehicle to helicopter while in operation. The procedure for transfer with the helicopter rotor turning is given below.

WARNING

Use extreme care when working under helicopter blades. To prevent injury, use at least three persons to transfer primary pallet.

The PADS CDU must be secured to the operator, primary pallet or aircraft to avoid it becoming a missile hazard during a crash.

Refueling of the aircraft should not be performed while either the vehicle or helicopter is running; startup of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

CAUTION

In the event of aircraft generator failure, the PADS equipment shall be immediately shut down.

NOTE

Transfer system to helicopter power quickly to minimize discharge of batteries.

Initiate a zero velocity correction whenever the system is stationary.

Before initializing for a helicopter mission, connect transfer cable W8 and cable adapter, located in top of battery box, between power supply connector 3J4 and connector W7P1 on power cable W7. Stow the cable so it can be extended without tangling. (See figure 3-7.)

a. If required, clear canvas from vehicle and remove radio, spare tire, and gas can. Remove theodolite, tripod, and other gear from vehicle and set aside.

b. Without disconnecting cable assembly W1, unsnap CDU from instrument panel bracket and secure to computer bracket. Wrap cable around CDU to keep it out of the way.

c. If transfer cable W8 is not connected, proceed as follows:

(1) Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator will light.

(2) Connect. Transfer cable W8, located in top of battery box, between power supply connector 3J4 and power cable W7 connector W7P1.

(3) Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator will go out. (CHRG indicator may light.)

d. Remove two forward T-handles securing clamping brackets to vehicle's subfloor or mounting base and store on PADS primary pallet.

e. Slide primary pallet forward several inches to disengage alignment pins. Remove two rear T-handles securing alignment pins bracket and store the T-handles on PADS primary pallet.

f. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator will light. Disconnect battery cable W6 from power supply connector 3J2.

g. Position the primary pallet so it can be safely lifted out of the vehicle by three persons. Lift the pallet out and move it about 5 feet behind the vehicle.

h. Place battery box on the ground near the primary pallet. Connect battery cable W6 connector W6P1 to power supply connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator will go out.

i. When the helicopter approaches, set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator will light. Disconnect transfer cable W8 connector W8P2 from power cable W7 connector W7P1 and power supply connector 3J4. Drive the vehicle outside the landing area. Stow transfer cable W8 in top of battery box.

j. Connect cable W9 (located in top of battery box) connector W9P1 to power supply connector 3J4.

k. Pilot is to land the helicopter so the starboard cargo door is as close to the primary pallet as possible. Check that helicopter personnel rescue hoist power circuit breaker is OFF. Secure the starboard cargo door in the fully-open position.

l. Prepare helicopter for PADS transfer as described in paragraph 3-25a.

m. Pull down headliner panel located over PADS mounting area to expose personnel rescue hoist connector, J119.

n. Connect cable W9 connector W9P2 to connector P1 of adapter cable.

o. Connect adapter cable connector P2 to personnel rescuc hoist connector, J119. (See view B, figure 3-14.)

p. Set personnel rescue hoist power circuit breaker to ON. Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator will go out.

q. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator will light. Disconnect battery cable W6 from power supply connector 3J2.

r. Lift primary pallet into helicopter and locate it on cargo platform with porro prism facing outward.

s. Adjust pallet until PADS is positioned approximately as shown in figure 3-14, so that plumb bob can hang down between helicopter fuselage and landing skid. (see figure 3-15.)

t. Open PADS top panel marked “NO SEAT” and, using the two belt assemblies from the helicopter's tool kit, tie down primary pallet attaching belts to floor rings as shown in figures 3-14 and 3-16.

u. Tighten belt assemblies, using ratchet handles, and close “NO SEAT” top panel.

v. Transfer the battery box to the cargo platform and position approximately as shown in figure 3-14. Install battery belt assembly through handles and fasten to floor rings on both sides of the box.

w. Connect battery cable W6 to power supply connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator will go out.

x. Without disconnecting cable W1, remove CDU from computer bracket and secure to helicopter leg mount (located in battery box top). Route to passenger seat.

y. Select the new lever arms for the helicopter. Refer to paragraph 3-8.1 b (3).

z. Secure helicopter doors. If removed previously, reinstall radio, spare tire, and gas can on vehicle. Load survey and personal gear that will not be used during the helicopter mission onto the vehicle.

aa. During flight, strap the CDU to the operator's left leg. (See figure 3-9, sheet 2.)

3-27. Initialization in Helicopter.

WARNING

Use extreme care when working under helicopter blades. To prevent injury, use at least three persons to transfer primary pallet.

With a heavy crew and total PADS equipment installed, the OH-58 helicopter may easily exceed its fonvard center of gravity limits, which could result in mast bumping. The helicopter pilot shall perform a weight and balance calculation before eaeh flight (Class 2 aircraft) to guarantee that the aircraft remains within its center of gravity limits for both takeoff and landing. The weight of the PADS equipment is 334 lbs. To calculate the moment/100, refer to the center of gravity limit chart in TM 55-1520-228-10 for the OH-58A, or in TM 55-1520-235-10 for the OH-58C. Should load adjustments be required, take the actions listed in order of preference:

a. Limit pilot and operator weight

b. Leave behind unnecessary personal gear.

c. Remove chest armor.

d. Remove seat armor.

e. Remove PADS battery box.

f. Reduce fuel load.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to avoid becoming a missile hazard during a crash.

Refueling of the aircraft should not be performed while either land vehicle or helicopter is running; start-up of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

PADS normally is initialized in the land vehicle and then transferred to the helicopter during the mission. However, PADS may be installed and initialized in a helicopter in a nonoperating condition (engine shutdown) as follows:

a. Install PADS and auxiliary equipment in the helicopter in a manner similar to paragraphs 3-23, 3-24, 3-25, 3-26, or 3-29. However, battery cable W6 and transfer cable W8 do not have to be connected during transfer.

b. Connect battery cable W6 connector to PS connector 3J2.

c. Connect transfer cable W8 connector W8P1 to PS connector 3J4.

d. Connect transfer cable W8 connector W8P2 to vehicle power cable W7 connector W7P1.

e. Start Vehicle engine and set circuit breakers CB1 and CB2 to ON.

f. Turn on and initialize PADS.

g. When initialization is complete, verify helicopter armament power circuit breaker is out.

h. For the OH-58, connect helicopter cable W9 (located in battery box top) connector W9P2 to helicopter armament power connector located under left cargo platform. Route between the cargo platforms.

i. For the UH-1, pull down headliner panel, located over PADS mounting area, to expose personnel rescue hoist connector, J119. Connect W9P2 to P1 connector of adapter cable. Connect P2 of adapter cable to connector J119.

j. Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights. Disconnect cable W8 connector W8P2 from power cable W7 connector W7P1. Drive vehicle clear of helicopter.

k. Connect helicopter cable W9 connector W9P1 to transfer cable W8 connector W8P2. Set PS VEHICLE circuit breaker CB2 to ON. Slide excess transfer cable W8 between the cargo platforms to the helicopter floor.

l. Start helicopter. When helicopter power demand is less than 45 amps, close armament power circuit breaker. BATT indicator goes off. (CHRG indicator may light.)

m. PADS is ready for the initial update and the survey mission.

n. During flight, the CDU is strapped to the operator's left leg. (See figure 3-9, sheet 2.)

3-28. Transfer to Land Vehicle.

WARNING

Use extreme care when working under helicopter blades.

Make sure blades are secured when helicopter engine is off.

To prevent injury, use at least three persons to transfer primary pallet.

Refueling of the aircraft should not be performed while either vehicle or helicopter is running; start-up of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

NOTE

Transfer system to vehicle power quickly to minimize discharge of batteries. Initiate a zero-velocity correction whenever the system is stationary.

a. Remove spare tire, gas can, radio, and other auxiliary gear, if present, from vehicle. Clear canvas as necessary. Verify vehicle power cable W7 is properly connected to vehicle batteries.

b. Helicopter lands clear of the vehicle. Initiate a zero-velocity correction.

c. Release the CDU from the leg mount and secure it to the computer CDU bracket. Wrap the cable around the CDU to keep it out of the way. Stow the CDU leg mount in the battery box top.

d. Remove or secure the helicopter left cargo door in the fully open position.

e. Unload auxiliary gear from helicopter.

f. Remove two D-rings and clamping brackets which secure primary pallet to cargo platform. Remove two D-rings which secure alignment pin bracket to cargo platform. Remove alignment pin bracket.

g. Set PS VEHICLE circuit breaker CB2 to OFF. BATT indicator lights.

h. Pilot opens helicopter armament power circuit breaker and shuts down helicopter engine. Secure rotor.

i. Position vehicle so its rear panel faces helicopter's left cargo door and is within 1 1/2 feet of it.

j. Disconnect transfer cable W8 connector W8P2 from helicopter cable W9 connector W9P1. Connect W8P2 to vehicle power cable W7 connector W7P1.

k. Ensure vehicle engine is running. Set PS VEHICLE circuit breaker CB2 to ON. BATT indicator goes out. Stow helicopter cable W9 in battery box top.

l. Release belt assembly and remove D-ring securing battery box to cargo platform.

m. Set PS BATTERY circuit breaker CB1 to OFF. BATT indicator lights. Disconnect battery cable W6 connector W6P1 from PS connector 3J2. Move battery box to vehicle and secure with belt assembly.

n. Bring primary pallet out of helicopter left cargo doorway and rotate it so PS end points to vehicle.

o. Position primary pallet on subfloor plate or mounting base in accordance with paragraph 2-11d, 2-12d, or 2-13b, depending on host vehicle. Porro prism will generally be facing rearward.

p. Connect PADS battery cable W6 connector W6P1 to PS connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator goes out.

q. Secure alignment-pin bracket to subfloor plate or mounting base with two T-handles. Slide primary pallet to mate with alignment pins. If necessary, adjust pins in accordance with paragraph 4-15b.

r. Secure primary pallet frame to subfloor plate or mounting base with two clamping brackets and two T-handles.

s. Without disconnecting CDU cable W1, remove CDU from computer bracket and secure to the vehicle CDU bracket.

t. Replace D-rings in cargo platforms. Secure helicopter doors. Neatly stow excess transfer cable W8 so it won't get tangled with other equipment. Stow survey gear in vehicle. Reinstall spare tire, gas can, radio, and canvas, if removed.

u. Select new vehicle lever arms. Refer to paragraph 3-8.1b (3).

v. PADS is ready to continue the mission.

3-29. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped. PADS may be transferred from a land vehicle to a UH-60 helicopter while operating. The procedure for transfer with the helicopter rotor stopped is given below. Table 3-4 lists the components required to transfer PADS to the helicopter.

WARNING

PADS crew must wear hearing protection at all times when working around aircraft.

Use extreme care when working under helicopter blades.

Make sure rotor swath is clear before starting helicopter.

To prevent injury, use at least three persons to transfer primary pallet.

The PADS CDU must be secured to the operator, primary pallet, or aircraft to avoid becoming a missile hazard during a crash.

Refueling of the aircraft should not be performed while either vehicle or helicopter is running; startup of the vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

NOTE

In the event of aircraft generator failure, the PADS will operate on the PADS batteries.

NOTE

Transfer system to helicopter power quickly to minimize discharge of batteries.

Initiate a zero velocity correction whenever the system is stationary.

Before initializing for a helicopter mission, connect transfer cable W8, located in top of battery box, between PS connector 3J4 and connector W7P1 on power cable W7. Stow the cable so it ean be extended without tangling. (See figure 3-7.)

Table 3-4. Parts Required for Transfer to UH-60 Helicopter

Item	Purpose	Quantity	Part Number
Converter, Power	To convert helicopter power to PADS power (24 Vdc).	1	70550-02025-102 (Cage 78286)
Enclosure, Power Converter	To protect converter.	1	13222E2399
Screw, Hex Hd. .250-28 UNF-2A x .75 1g	To secure converter to enclosure.	4	MS35308-306
Washer, Flat 1/4 in.	To secure converter to enclosure.	4	MS15795-810
Washer, Lock, 1/4 in.	To secure converter to enclosure.	4	MS35338-139
Cable Assembly, W15	To connect helicopter power to power converter.	1	13222E2283
Cable Assembly, W7	To connect power converter to PADS.	1	13222E1624
Belt Assembly	To secure battery box to aircraft	1	13222E1654*
Belt Assembly	To secure PADS primary pallet and power converter to aircraft	8	P/O UH-60 inventory
Bracket, CDU	To attach CDU to operator.	1	13222E1641**

*Supplied with PADS
** To be ordered separately if not supplied with PADS

a. With the rotor stopped, prepare helicopter for PADS transfer as follows:

(1) Remove seat sections indicated in figure 3-17 and stow.

(2) Turn on helicopter Aircraft Power Unit, APU. The actuator/backup pumps must be charged and off, requiring approximately 180 seconds.

(3) Turn off power to plug P276 by turning off aircraft circuit breaker designated "60 Hz AC converter, 15 amps" on No. 1 AC PRI BUS located over and behind the copilot's seat.

(4) Assemble power converter in its enclosure with hardware supplied. Connect cable W7 (supplied with converter) terminal ends to the positive (+) and negative (-) terminals of the power converter.

NOTE

When the PADS is mounted in the helicopter, the plumb bob location must be changed within the monitor table of the computer if PADS has been transferred from another vehicle. This can be accomplished before or after transferring the PADS to the helicopter. See paragraph 3-8.1 for this procedure.

b. Transfer of PADS from Vehicle to the Helicopter. PADS, while in operation, may be transferred from a vehicle to helicoper with or without the rotor stopped. Use the following procedure:

(1) Position vehicle so PADS is within 5 feet of the helicopter right side cargo door. Secure the cargo door in the fully open position.

WARNING

If the helicopter rotors are turning, the canvas and top bows must be removed from the vehicle.

(2) Verify that helicopter has been prepared for PADS transfer as described in a., above.

(3) Remove theodolite, tripods, and other gear from vehicle and set aside, if necessary.

(4) Without disconnecting cable assembly W1, unsnap CDU from vehicle mounting bracket and secure to CDU bracket on primary pallet. Stow cable between the computer and the power supply to keep it out of the way.

(5) If transfer cable W8 is not connected:

(a) Set PADS power supply (PS) circuit breaker CB2 to OFF. BATT indicator will light.

(b) Connect transfer cable W8, located in top of battery box, between PS connector 3J4 and power cable W7 connector W7P1. (See figure 3-7.)

(c) Set PS circuit breaker CB2 to ON. BATT indicator will go out (CHRG indicator may light.)

(6) Remove two T-handles securing clamping brackets to vehicle mount and store on PADS primary pallet or in top of battery box.

(7) Move primary pallet a few inches to disengage alignment pins.

(8) Set PS circuit breaker CB1 to OFF. BATT indicator will light. Disconnect battery cable W6 from PS connector 3J2.

(9) Transfer the battery box to the helicopter and position it approximately as illustrated in figure 3-18.

(10) Remove CDU leg mount bracket from battery box before strapping down the battery box.

(11) Install battery box belt assembly through handles and over top of battery box. Fasten belt assembly to aircraft floor cargo rings on each side.

(12) Install power converter in its enclosure, with W7 cable attached, on top of battery box. See figure 3-18. Install belt assembly over power converter enclosure and through enclosure handles. Attach belt assembly to aircraft floor cargo rings on each side.

(13) Connect cable W15 connector P1 to the power converter and connect P2 to the helicopter power connector P276. Remove safety wire securing P276 if necessary.

(14) Position the pallet so the IMU end hangs over the rear panel of the vehicle. Using three persons, transfer the primary pallet to the helicopter.

(15) Adjust location of primary pallet until PADS is positioned approximately as illustrated in figure 3-18. The plumb bob arm must swing clear of the fuselage.

(16) Connect battery cable W6 to PS connector 3J2. Set PS BATTERY circuit breaker CB1 to ON. BATT indicator will go out.

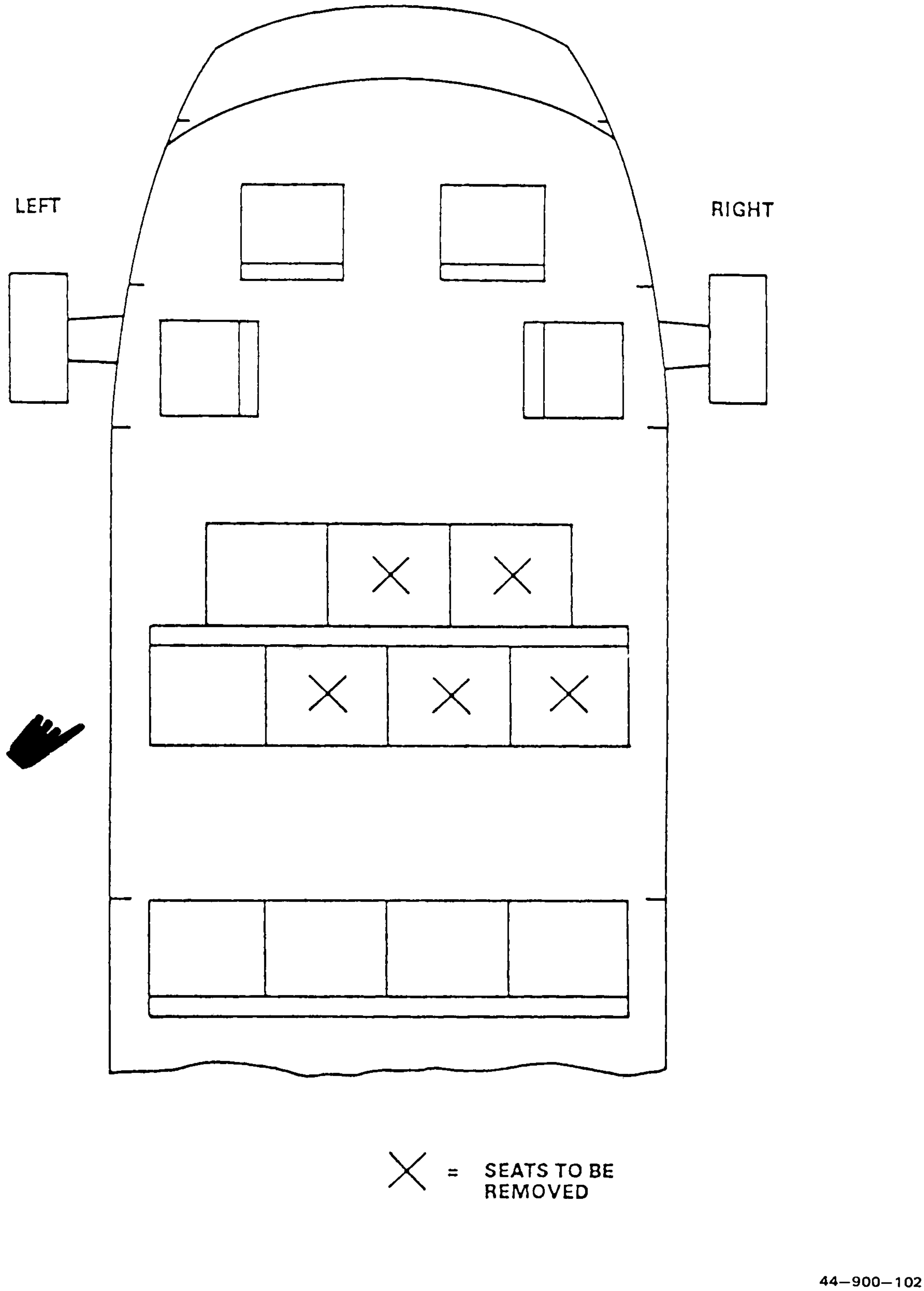


Figure 3-17. Cockpit and Cargo Compartment Arrangement of UH-60 Helicopter

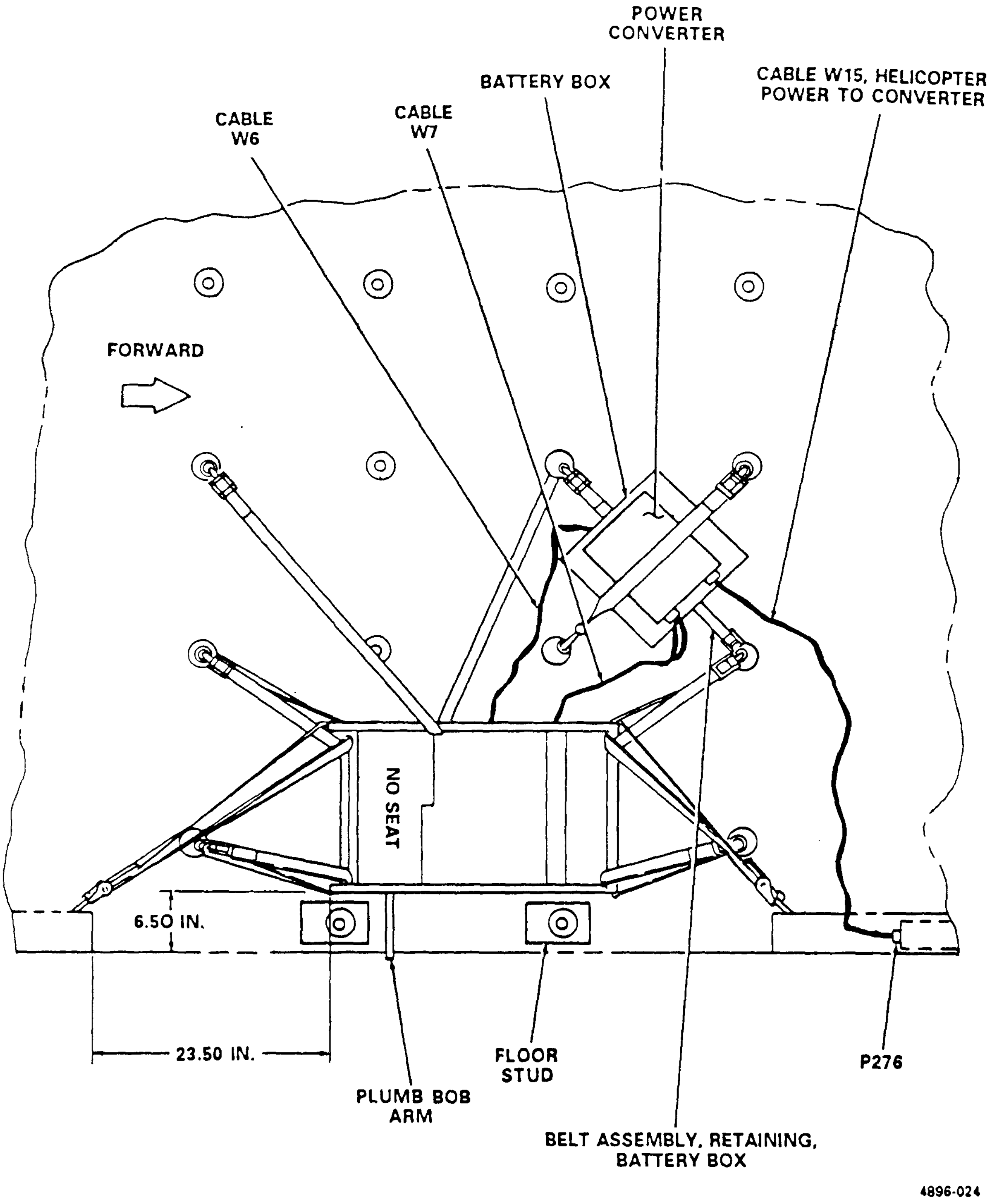


Figure 3-18. PADS and Power Converter Installation

(17) Without disconnecting cable W1, remove CDU from computer bracket and secure to helicopter leg mount. Route cable to passenger's seat.

(18) Set PS circuit breaker CB2 to OFF. BATT indicator will light. Disconnect cable W8 connector P1 from PS connector 3J4. Cable W8 will stay with the vehicle.

(19) Connect cable W7 connector P1 from power converter to PS connector 3J4.

(20) Turn on power to plug P276 by turning on aircraft circuit breaker designated "60 Hz AC Converter, 15 Amps" located over and behind copilot's seat.

(21) Set PS circuit breaker CB2 to ON. The CDU battery light will go out.

(22) Using belt assemblies provided with the aircraft, tie down PADS by attaching belt assemblies to aircraft floor cargo rings as illustrated in figure 3-18.

(23) Tighten belt assemblies using ratchet handles. Do not overtighten and bend PADS frame.

(24) Installation is complete. Start preflight procedures. Select plumb bob location from monitor table (use UH-1 selection, see paragraph 3-8.1). As part of the preflight checkout procedure, PADS operator will sound PADS alarm DS3, to acquaint air crew with its sound.

(25) Secure helicopter doors. Load vehicle with survey and personal gear which will not be used during the helicopter mission.

NOTE

During flight the CDU is strapped to the PADS operator's leg. PADS operator must use aircraft intercommunication system to communicate with flight crew.

Paragraphs 3-30 through 3-33 apply to user defined spheroid entry using GPS.

3-30. User Defined Spheroid. Monitor ID 60 contains the entered spheroid constants for spheroid 15. ID 61 is the tabulated constants for spheroid 16. ID 60 and 61 displays the newly entered constants prior to a save routine. If an entry abort is made, the table values will revert to previously stored constants, if any. If the table in ID 60, ID 61 is exited prior to completion, reentry into the table will be at the beginning.

a. To have the capability of using the user defined spheroid, the data must be saved. To permanently save the spheroid constants, the system must be cycled off with a save.

b. The system must have been initialized with one of the valid spheroids and up to the alignment mode. Monitor ID 52 is the entry ID for the defined spheroid constants. Spheroid 15 and spheroid 16 may be entered with the following conditions.

(1) Each entry may be cleared prior to entering. Once entry has been made, the value may not be changed unless the entire table is changed. Once the spheroid entry has commenced, the parameters must all be entered. To exit the spheroid entry routine prior to completion, CDU STOP must be pressed and all previous entries will be lost.

(2) If a value is zero, the entry may be bypassed by pressing ENT.

(3) The program has a goodness or credibility test where possible to prevent grossly incorrect entries. These will be limited to the first word of a two word group. If credibility fails, the display will revert back to the blank display and the leading number 1A, etc., etc.

(4) All references to feet are to be as follows: 1 foot= 0.3048 meters exactly.

(5) All distance measurements must be entered in meters.

(6) The parameters must be entered to the full value stipulated for the word. Leading or trailing zeroes may be required.

(7) Semi major axis (refer to (a) below) parameter is required for a valid spheroid entry. If this is not entered and/or has not passed the credibility test,

the program will not advance the table and STOP must be pressed to exit. Eccentricity (e^2) will be computed in all cases. The following chart defines required versus not-required parameters:

MAJOR AXIS	MINOR AXIS	FLATTENING	ECCENTRICITY
(a)	(b)	1/f	e^2
Required	Not available	Required	Compute
Required	Required	Not available	Compute
Required	Available	Available	Compute
Not available	Don't care	Don't care	Don't care (abort)

(8) Call up or entry of spheroids 6, 7, 15 and 16 reverts or defaults to the initial flashing spheroid routine, until such time as data has been added to the locations allocated for those spheroids. The spare spheroids 6 and 7 will not be accessible via CDU entry.

(9) Invalid entries even though technically correct will be rejected; i.e., central meridian in degrees, minutes and seconds to the nearest hundredth.

Correct entry	29°14'7.19"
Reject entry	28°73'67.19"

Refer to table 3-5 for word information.

3-31. Entering User Defined Spheroid.

a. Initialize system.

b. Callup monitor ID 52

Operator Action	Data Display
Press MON, ID, 5, 2, ENT	52 add SPH E
Press ENT	SPH "15-16"
Press 1, 5, ENT	1A

c. Enter the semi major axis (refer to paragraph 3-30b(7)) in meters. The first word will contain the whole number value and the second word will contain the fractional (decimal) portion of the value. The entry will be limited to seven digits. Credibility will be checked at the entry. Credibility 6378XXX to 6377XXX. Once the word is checked by the operator for the validity, ENT should be pressed to accept the value or CLR to reject if an error is detected. At enter

Table 3-5. Numerical Data for Spheroid Parameters

CDU Word	Parameter	Maximum Value	Units	Typical Value
1A	Semi Major Axis (a)	9999999	Meters	6378XXX-6377XXX
1B	Decimal Value (a)	.999	Meters	
2A	Semi Minor Axis (b)	9999999	Meters	6357XXX-6355XXX
2B	Decimal Value (b)	.999	Meters	
3A	Flattening (1/f)	999	None	290-305
3B	Decimal Value (1f)	.999999999*	None	
4	Scale Factor (Ko)	9.99999	None	1.01XXX-0.98XXX
5	Zone Width (Zo)	99.9	Degrees	6.0
6	False Northing (Northern Hemisphere)	16777215	Meters	0
7	False Northing (Southern Hemisphere)	16777215	Meters	1000000
8	False Easting	2097151	Meters	500000
9	Northing Origin (from equator)	9999999.99	Meters	Latitude dependent
10	Central Meridian	3595959.99	Deg, Min, See, .01 Sec	0
11	Spare Word	NA	NA	0

*Decimal not shown on CDU

the display indicates 1B. Three digits will be the maximum entry. A decimal will be illuminated on the CDU. If the value is to be zero, ENT may be used as a default to, in effect, enter all zeroes. If, however, the value is known to one or two places only, the second or third zero must be entered. To avoid confusion, all three digits must be entered. EXAMPLE .001 - enter 0, 0, 1; .1 -enter 1, 0, 0; .01 -enter 0, 1, 0.

d. Once ENT is pressed, the display indicates 2A. If known, enter the semi minor axis (refer to paragraph 3-30b(7)), most significant portion of value (7 digits maximum), then the decimal portion in the same manner as in paragraph 3–31c. The display will advance to 2B for the decimal value. Credibility is 6357XXX to 6355XXX. If the semi major axis is unknown, the operator should press ENT. The display will advance to 3A.

e. **Flattening.** Enter the reciprocal of flattening or (1/f). This is a two word entry. The whole number is entered in 3A and the decimal value in 3B. 3A will be 3 digits - credibility 290 to 305. 3B requires a full nine digit number, unless it is zero in which case ENT may be pressed.

NOTE

At this point in the entries, the software will ascertain whether sufficient data has been entered. Refer to paragraph 3-30b(7).

f. **Scale Factor (Ko) - CDU Word 4.** Six digits maximum with a decimal. One whole numeral and five fractional numerals. Credibility 1.01XXX to 0.98XXX. Leading zero need not be entered in this case.

g. **Zone Width (Zo) - CDU Word 5.** Three digits maximum with a decimal. Entry in degrees and tenths of degrees. No credibility.

h. **False Northing - (Northern Hemisphere) - CDU Word 6.** Eight digits maximum, no decimal, in meters. No credibility.

i. **False Northing - (Southern Hemisphere) - CDU Word 7.** Eight digits maximum, no decimal, in meters. No credibility.

j. **False Easting - CDU Word 8.** Seven digits maximum, no decimal, in meters. No credibility.

k. **Northing Origin from Equator – CDU Word 9.** Nine digits maximum with decimal, in meters to the nearest one hundredth of a meter. No credibility.

l. **Central Meridian - CDU Word 10.** Nine digits maximum with decimal, in degrees, minutes, seconds, and hundredths of seconds. Zero is the international dateline. The center of the United States of America would be approximately 72 degrees, Greenwich England 180 degrees, and mid Russia 270 degrees.

m. **Spare Word - CDU Word 11.** This will be unused at this time; however, the operator will be required to press ENT to complete the table.

3-32. Spheroid Data Review. ID 60 is accessed for spheroid 15 and ID 61 for spheroid 16. Once ID 60/61 is accessed, a table for each of the spheroids (external to the ID table) will be accessed by CLR, ENT, and STOP inputs from the CDU.

CLR = Decrement table
STOP = Exit table (to ID 60 or ID 61)
ENT = Increment table

See figure 3-19.

3-33. Example of User Defined Spheroids.

a. Use spheroid Clarke 1866 position data.

N 34°10’01.01”
W 118°35’30.00”
UTM = E 11:353290.87; N 3781616.63
Elevation - immaterial

Refer to TM 5-241-1, Grids and Grid References

Clarke 1886 a = 6,378,206.4 meters
b = 6,356,583.8 meters

$$f = \frac{a - b}{a} \text{ and } 1/f = \frac{a}{a - b} = 294.9786982$$

Now -118° is = 62° from international dateline or zone 11. To determine central meridian for this example (to agree with known data).

62/6 = 10.53. Zone 10 = 60°, zone 11 = 66°, therefore, 63° is center and use this as the central meridian.

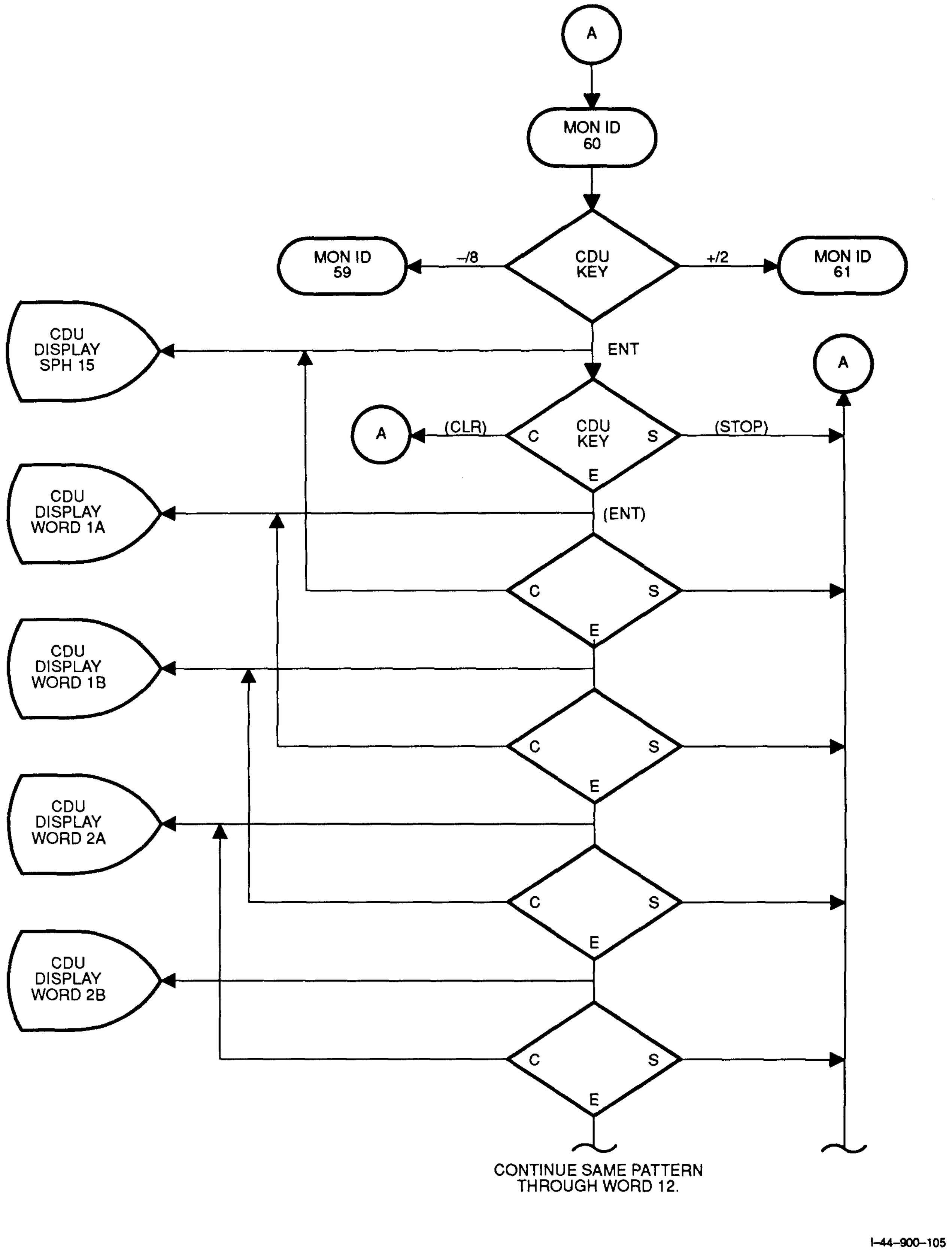


Figure 3-19. Spheroid Entry Data Review Flow

b. Enter data as follows:

Operator Action	Data Display
Press MON, ID, 5, 2, ENT	52 add SPH E
Press ENT	SPH "15-16"
Press 1, 5, ENT	1A
Press 6, 3, 7, 8, 2, 0, 6, ENT	1b .
Press 4, 0, 0, ENT	2A
Press 6, 3, 5, 6, 5, 8, 3, ENT	2b .
Press 8, 0, 0, ENT	3A
Press ENT	4 .
Press 9, 9, 9, 6, 0, ENT	5 .
Press ENT	6
Press ENT	7
Press 1, 0, 0, 0, 0, 0, 0, 0	8
Press 5, 0, 0, 0, 0, 0, ENT	9 .
Press ENT	1 0 : : .
Press 6, 3, 0, 0, 0, 0, 0, 0 ENT	11
Press ENT	52 add SPH E

c. Recall the data to ensure values are the ones desired as follows:

Operator Action	Data Display
Press MON, ID, 6, 0, ENT	60M SPH 15
Press ENT	1A 6378206
Press ENT	1b .400
Press ENT	2A 6356583
Press ENT	2b .800
Press ENT	3A 000
Press ENT	3b 000
Press ENT	4 .99960
Press ENT	5 0.0
Press ENT	6 0
Press ENT	7 10000000
Press ENT	8 500000
Press ENT	9 0.0
Press ENT	10 63:00:00.00
Press STOP	60 M SPH 15

d. Turn system off with a save.

e. To use the user defined spheroid, turn system on and select spheroid 15 as follows:

Operator Action	Data Display
System turnon	GPS C-E
Press CLR	"SPH" X
Press SPH, 1, 5, ENT	PAUSE (15 sec) HUM 1
Press ENT	"E": .0
Press E, 3, 5, 3, 2, 9, 0, 9, ENT	"N": .0
Press N, 3, 7, 8, 1, 6, 1, 6, 6, ENT	"EL" .0
Press EL, +/2, 2, ENT	MODE X
Press MON, ID, 3, 0, ENT	LA +34.10.01.009
Press +/2, ENT	LO -118.35.29.978

NOTE

The difference is software roundoff.

Lat error = 01.010 arc sec-01.009 arc sec = 0.001 arc sec, approximately 1 inch or 25.4 millimeters.

Long error = 30.000 arc sec-29.978 arc sec = 0.022 arc sec, approximately 2.2 feet or 0.67 meter.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3-34. Operation in Extremely Rough Terrain.

a. PADS will operate overall terrain within host vehicle limits. When operating over rough terrain at excessive speeds, PADS may request the operator to slow down. Under these conditions, PADS will display SLO on the CDU data display.

b. If the operator does not slow down, time to next zero-velocity correction will be reduced and the accuracy of the survey could be affected.

c. When SLO is displayed on CDU data display, the operator will perform a zero-velocity correction as outlined in paragraph 3-10 or 3-22.12.

3-35. Operation at Temperature Extremes.

WARNING

Contact with power supply fins may cause skin burns at high ambient temperatures.

At extremely low temperatures, lead-acid batteries which are not fully charged may freeze and burst. Handle batteries in accordance with TM 9-6140-200-14.

a. PADS operates without degradation in performance between -45°C (-50°F) and +52°C (+125°F). It may be stored, without damage, between -45°C (-50°F) and +71°C (+160°F). Initialization, which normally takes about 30 minutes, will be extended at temperatures below -20°C (-5°F) or when wind blows into the IMU heat exchanger. A vehicle enclosure, parking behind a wind break, or placing a blanket or article of clothing over the heat exchanger exhaust will improve reaction time.

b. At temperatures below -29°C (-20°F), keep the batteries warm. Use the vehicle heater during operation. Store batteries in a warmer environment during periods of nonoperation. (Refer to TM 9-6140-200-14.)

c. When wearing arctic gloves or chemical protective clothing, the eraser end of a pencil maybe used to operate the CDU keyboard and PS circuit breakers.

3-36. Operation Under Emergency Conditions. PADS may be operated under blackout conditions, provided the CDU panel can be read with the lamps dimmed. For measurements using a theodolite, the flashlight must shine on the porro prism for leveling and distance measurement.

CHAPTER 4

OPERATOR/CREW MAINTENANCE INSTRUCTIONS

Section I. TOOLS AND EQUIPMENT

4-1. General. Tools required for most operator/crew maintenance are contained in a kit located in the battery box top (figures 1-3 and 1-4) and are listed in the Basic Issue Items List, Section III, Appendix B of this manual.

a. Use MIL-E-52798, alkyd enamel camouflage paint (forest green color) and a small brush for touchup painting.

b. Assistance in troubleshooting battery problems may be obtained from the motor pool.

Section II. LUBRICATING INSTRUCTIONS

4-2. General. There are no lubrication orders for PADS. The following lubrication is required on PADS:

a. Use Lubricating Oil, General Purpose (0-196), to lubricate clamping catches.

b. Use Lubricating Oil, General Purpose (0-196), to apply a thin coat to receptacles in PS that mate with pins in primary pallet to prevent rust.

Section III. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-3. General. To ensure that PADS is always ready for operation, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in table 4-1. Item numbers in the tables indicate sequence of minimum inspection requirements. Note defects discovered during operation for correction after operation. Stop operation immediately if a deficiency is noted which would damage the equipment. When performing table 4-1, observe the following:

a. Before you operate always keep in mind the CAUTIONS and WARNINGS. Perform your before (B) preventive maintenance checks and services.

b. While you operate always keep in mind the CAUTIONS and WARNINGS. Perform your during (D) preventive maintenance checks and services.

c. After you operate be sure to perform your after (A) preventive maintenance checks and services.

d. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750, The Army Maintenance Management System (TAMMS). Marine Corps users shall refer to TM 4700-15/1.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services

NOTE

WITHIN DESIGNATED INTERVAL, THESE CHECKS ARE TO BE PERFORMED IN THE ORDER LISTED

B – Before
D – During
A – After
W – Weekly
M – Monthly
C – Combat Operability Check

Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
								CAUTION Cable connectors can be damaged by improper operation. Release connectors by turning locking ring counterclockwise. Never turn the backshell. Align keyways before mating connectors. Secure connectors by turning locking ring clockwise until it locks. (See figure 4-1.)	
1	●							<u>Pre-Turn-on Checks and Services</u>	
							Primary pallet	a. Check that primary pallet is securely mounted	Primary pallet not securely mounted
							PADS batteries	b. Check PADS batteries and battery box in accordance with TM 9-6140-200-14	Batteries do not pass instructions contained in reference TM
							Primary pallet, vehicle power, battery box, CDU	c. Check that cables W7 (Vehicle power), W6 (battery box power), and W1 (CDU) are connected to primary pallet	Equipment not connected to vehicle power

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
1 Cont								d. Check operation of flashlight	
							Porro prism	e. Clean porro prism	
							Airflow	f. Check that airflow is not blocked to IMU, computer, and power supply	Airflow blocked
							Electrical equipment mounting base	g. Check that electrical equipment mounting base is not blocked	Electrical equipment mounting base blocked
							Circuit breakers	h. Check that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are in the OFF position	
							DS fault indicators	i. Check for fault indicator being set	A fault indicator is set
2		●						<u>Initialization Inspection</u> Perform immediately after turn-on for each mission	
							Lamps	a. Perform lamp test in accordance with paragraph 3-7	Defective lamp module
							Fault indicators	b. Check that no fault indicators are set or that COMP, IMU, BATT, or ATTN status indicator is set or illuminated	A fault indicator is set or status indicator illuminated

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval					C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
	B	D	A	W	M				
2 Cont							Fans	c. Check fans for operation. Fan in IMU and computer operate only if ambient temperature is between 17° to 23°C (63° to 73°F) If a malfunction is encountered, troubleshoot in accordance with table 4-2	
3		●						Postinitialization Check	
							CAL status indicator	Check that CAL status indicator is not illuminated	CAL status indicator is illuminated
4		●						Battery Test NOTE This test provides a check of PADS battery operation under load. A battery test will be performed at the end of a survey mission to minimize the impact of a defective battery and PADS shutdown. a. While PADS is operating, note CHRG indicator is not illuminated. If CHRG has been illuminated for several hours, refer to step 15 of table 4-2	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services — Continued

Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
4 Cont								b. Disconnect vehicle power by setting PS VEHICLE circuit breaker CB2 to OFF. PADS should remain operating with BATT status indicator illuminated. If BATT indicator flashes or system shuts down, refer to step 13 of table 4-2	
								c. After 30 seconds of battery operation, either: set PS VEHICLE circuit breaker CB2 to ON to continue operation; or turn PADS off	
5			●					<u>Postmission Checks</u>	
							Equipment in general	Inspect for excessive accumulation of dirt and debris	
6					●			<u>Cleaning – Primary Pallet and CDU</u> **CAUTION** All connectors must be covered with a mating connector or cap and PS circuit breaker covers secured before cleaning the primary pallet and CDU.	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval					C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
	B	D	A	W	M				
6 Cont								a. Secure CDU to bracket on computer. Remove primary pallet from vehicle in accordance with paragraph 4-9a	
								b. Clean exposed surfaces using brush, low pressure air, or damp cloth. Wipe dry	
								c. Release clamping catch and raise protective cover of primary pallet	
								d. Release two clamping catches and raise IMU cover on its hinge	
								e. Clean finned plate under IMU cover and IMU fan using brush and low-pressure air	
								f. Secure IMU cover and protective cover	
								NOTE Perform the following steps only if dirt was built up in the IMU finned plate, there is an apparent overheating problem, or airflow through the computer or power supply	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
6 Cont								appears to be restricted. See figure 4-2 for an exploded view of the primary pallet. See figure 2-9 for a primary pallet interconnection diagram.	
								g. Disconnect cable assembly W1 connector W1P2 from computer connector 1J3. Remove CDU from computer bracket	
								h. Disconnect cable assembly W2 connector W2P2 from computer connector 1J1	
								i. Disconnect cable assembly W3 connector W3P2 from computer connector 1J4 and W3 connector W3P1 from PS connector 3J5. Remove cable	
							Computer	j. Loosen four captive screws securing computer to primary pallet; remove computer	
								k. Remove two air deflectors by removing six screws and washers	
								l. Clean computer cooling fins using brush and low-pressure air	
								m. Install two air deflectors and secure each with six screws and washers; if damaged, replace	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval					C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
	B	D	A	W	M				
6 Cont							Computer captive mounting screws	n. Inspect computer captive mounting screws	
								o. Clean computer fan chamber using brush and low-pressure air	
								p. Disconnect cable assembly W5 connector W5P2 from PS connector 3J1	
								q. Disconnect cable assembly W4 connector W4P2 from PS connector 3J3	
								r. Loosen four captive screws securing PS to primary pallet; remove PS	
							Power supply	s. Remove 20 screws and washers securing air deflector to PS; remove air deflector	
								t. Disconnect fan cable from PS connector J6	
								u. Remove three screws and washers and one terminal lug securing fan guard to PS; remove fan guard	
								v. Loosen three screws, washers, and clamps securing fan to PS; remove fan by turning	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services — Continued

Item no.	Interval B	D	A	W	M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
6 Cont								w. Clean PS cooling surfaces under air deflector and chamber under fan using brush or low-pressure air	
								x. Install fan and secure with three screws, washers, and clamps. Orient fan so that airflow arrow is pointing down and fan cable will connect to PS connector J6	
								y. Install fan guard and secure with three screws and washers and one terminal lug	
								z. Connect fan cable to PS connector J6	
								aa. Install air deflector and secure with 20 screws and washers; if damaged, replace	
							Primary pallet	ab. Inspect PS slide strips and rear retainers on primary pallet	
								ac. Install PS in primary pallet and secure with four captive screws	
							Connectors	ad. Inspect connectors for bent or damaged pins and connect cable assembly W4 connector W4P2 to PS connector 3J3	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

Item no.	Interval					C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
	B	D	A	W	M				
6 Cont							Connectors	ae. Inspect connectors for bent or damaged pins and connect cable assembly W5 connector W5P2 to PS connector 3J1	
							Connectors	af. Inspect connectors for bent or damaged pins and connect cable assembly W3 connector W3P1 to PS connector 3J5	
								ag. Install computer and secure to mounting base with four captive screws	
							Connectors	ah. Inspect connectors for bent or damaged pins and connect cable assembly W3 connector W3P2 to computer connector 1J4	
							Connectors	ai. Inspect connectors for bent or damaged pins and connect cable assembly W2 connector W2P2 to computer connector 1J1	
							Connectors	aj. Replace CDU on computer bracket. Inspect connectors for bent or damaged pins and connect cable assembly W1 connector W1P2 to computer connector 1J3	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services – Continued

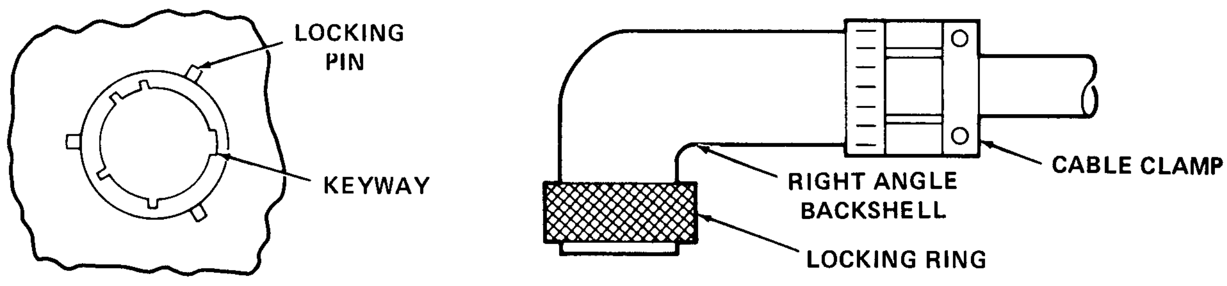
Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
7					●			<u>Inspection – Primary Pallet and CDU</u>	
							Cable assemblies	a. Check all cable assemblies for cuts or torn sheathing and broken connectors or that the connector backshell turns no more than ±10 degrees. (See figure 4-1.) Check connectors for bent or damaged pins NOTE If PADS operates with a defective cable, replacement may be deferred until a more convenient time	
							Vibration isolators	b. Inspect vibration isolators for cracks, deterioration, and/or separation between rubber and metal insert by firmly pressing down near the top of the isolator, report discrepancies to direct support level maintenance (see figure 4-1)	
8					●			<u>30-Day Azimuth-Gyro Bias</u> a. Reinstall PADS in vehicle b. Perform Pre-Turnon Inspection and Service (item no. 1 of table 4-1)	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services-Continued

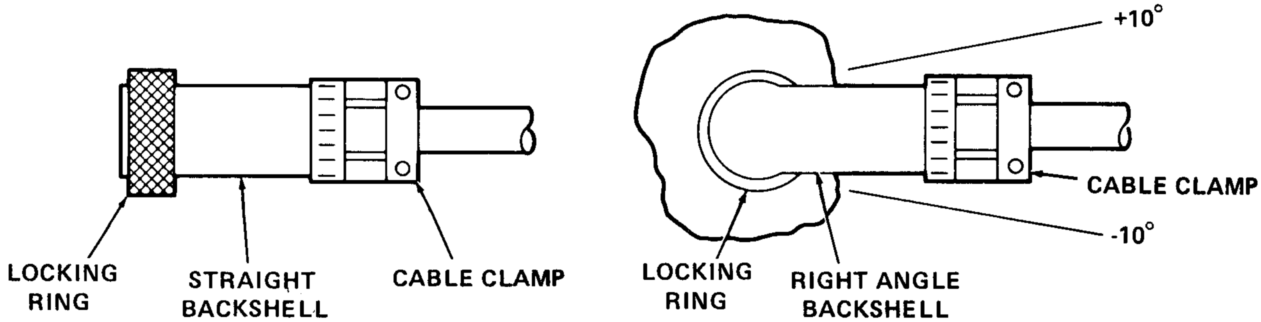
Item no.	Interval B	Interval D	Interval A	Interval W	Interval M	C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
8 cont								c. Turn on PADS plumbed over a fourth order or higher SCP by setting PS CB1 and CB2 to ON positions and pressing ON/OFF switch. The SCP site must be level to ±5 degrees and have a firm surface. d. When PADS cues for spheroid, press SPH, then add 200 to desired spheroid number, then press ENT. If this spheroid is rejected (flashing SPH 1), then press SPH, then add 90 to desired spheroid number, then press ENT. **NOTE** Step d.1 applies to GPS. d.1 When PADS cues for spheroid, press SPH, add 200 to desired spheroid number, then press ENT. e. Perform rest of initialization procedure (refer to steps 2i thru 2k of table 3-2). The mode displays will have a 1 preceding the normal mode number (e.g., MODE 12). **CAUTION** The 30-day azimuth-gyro bias will take from 2 1/2 to 3 hours. The vehicle must not be disturbed during this procedure. When MODE 18 appears and GO indicator flashes, the azimuth-gyro bias has been completed. PADS may proceed on a mission without reinitialization.	

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services—Continued

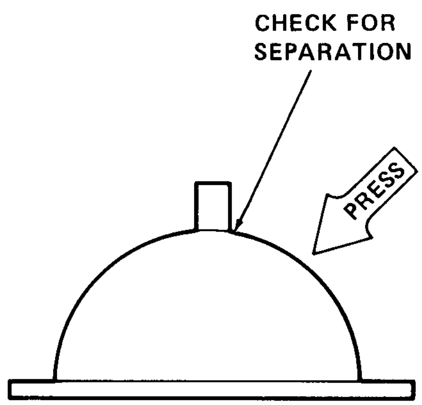
Item no.	Interval					C	Item to be inspected	Procedure	Equipment will be reported not ready (red) if:
	B	D	A	W	M				
9					•		Porro prism alignment	a. Update PADS over 4th order or higher SCP which has a known accurate azimuth mark. b. Maneuver vehicle if required to achieve autoreflection with theodolite plumbed over SCP (paragraph 3-18). c. With theodolite sighted on porro prism and instrument initial circle reading set, measure and record a horizontal angle to azimuth mark. Measure and record horizontal distance. d. Repeat step c: mean the two horizontal angles and horizontal distances. e. Perform a position, azimuth and elevation mark using a theodolite. Use the mean horizontal angle and distance. f. If the azimuth determined in step e differs more than 0.40 mils with the known azimuth, record difference. When PADS next goes to general support maintenance, report discrepancies for possible porro prism alignment checks.	



CABLE CONNECTOR REMOVAL AND REPLACEMENT



CABLE CONNECTOR INSPECTION



VIBRATION ISOLATOR INSPECTION

4793-068

Figure 4-1. Preventive Maintenance Checks and Services

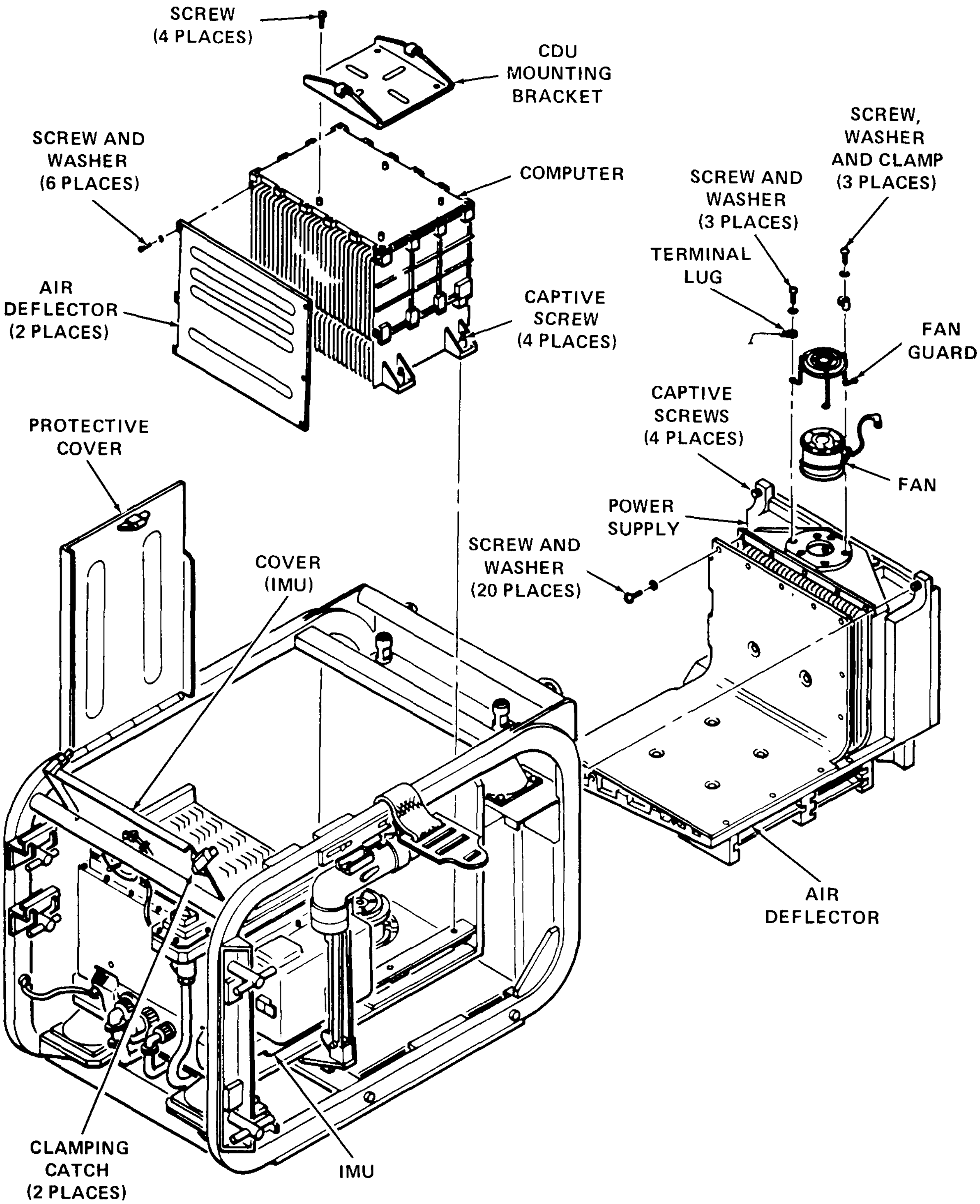


Figure 4-2. Primary Pallet Exploded View

Section IV. OPERATOR/CREW TROUBLESHOOTING

4-4. General. Steps for operator/crew troubleshooting are listed in table 4-2. Any trouble that is beyond the scope of operator/crew shall be referred to direct support maintenance. Fault indicators, installed on the computer, CDU, and PS provide automatic and continuous fault isolation to the major unit level during PADS operation. A fault indicator appears black when its unit is functioning correctly, and changes to white when a failure is detected by the built-in test equipment (BITE). Once a fault indicator has turned white, it will remain white after system shutdown. To provide the operator with immediate notification of failure, a fault in the IMU or computer is indicated by lighting the IMU or COMP status indicator. PADS shuts down for a PS failure. The PS has two fault indicators. If PS BATT FAIL fault indicator DS1 turns white, the vehicle electrical system is not supplying enough power and PADS batteries are too weak. If PS FAIL fault indicator DS2 turns white, the PS unit has failed. Refer to table 4-3 for a list of PADS monitor functions.

Table 4-2. Troubleshooting

NOTE

When PADS is operating, but with a fault indicator showing white or a malfunction status indicator is illuminated, the operator must enter the malfunction table in order to clear the malfunction. The PADS operator is responsible for monitoring 1 MAL through 5 MAL of the malfunction table. The operator will enter the MAL table and attempt to clear the problem by performing the step-by-step procedures listed below.

a. PRESS MON, ID, 1, ENT. Display should show 1 MAL 000000. Record complete display if non zero.

b. PRESS ± KEY. Display should show 2 MAL 000000. Record complete display if non zero.

c. Repeat step b and monitor 3 MAL through 5 MAL. Pressing ± key will advance the MAL number. Record complete display if non zero in 3 MAL through 5 MAL.

d. Return to the MAL number which had a non zero content. Pressing + OR - key will sequence the MAL number up or down.

e. Attempt to clear the malfunction by pressing and holding CLR until the display zeros.

f. Attempt to clear the status indicator by performing a lamp test.

g. If display zeros and the status indicator goes out, the malfunction is cleared. Continue with mission.

h. If the malfunction does not clear, turn system off and re-initialize.

i. If the malfunction does not repeat, continue with mission.

j. If the malfunction still exists, locate the malfunction on the following pages and take the corrective action described.

Whenever the PADS is turned in, the non zero display recorded in steps a through c will be furnished to the Support Maintenance personnel.

Table 4-2. Troubleshooting – Continued

Malfunction	Probable cause	Corrective action	Reference
1. PADS shuts down with no fault indicators showing white and no malfunction status indicator illuminates just prior to shut down	Overheating	a. Let system cool	
		b. Check for obstructed cooling system. Clean as required	Table 4-1 item 6
		c. Check that IMU, computer, and PS fans are connected	
		d. When system is cool, turn it on. If system shuts down within a few seconds, replace primary pallet and CDU	Para 4-7 Para 4-9
		e. Check that PS fan operates. If not, replace fan	Para 4-13a
		f. If ambient temperature is above 23°C (73°F), verify IMU fan and computer fan both operate. If only one fan operates, replace the defective fan. If neither fan operates, replace primary pallet	Para 4-12a Para 4-15f Para 4-9
		g. If system continues to shut down, replace primary pallet and CDU	Para 4-7 Para 4-9
2. System shuts down with PS fault indicator DS2 white	PS failure	Replace primary pallet	Para 4-9

Table 4-2. *Troubleshooting — Continued*

Malfunction	Probable cause	Corrective action	Reference
3. Computer fault indicator shows white and/or COMP indicator illuminates but PADS does not shut down	Computer failure	Replace primary pallet	Para 4-9
4. Computer fault indicator shows white and PADS shuts down	Computer power supply failure	Replace primary pallet	Para 4-9
5. IMU status indicator illuminates	IMU failure	a. Perform 30-day azimuth-gyro bias	Table 4-1 item 8
		b. Replace primary pallet	Para 4-9
6. CDU fault indicator DS2 shows white	CDU failure	Replace CDU	Para 4-7
7. CDU display not completely illuminated when LAMP pressed	Burned-out lamp(s)	Replace and repair defective lamp module(s)	Para 4-10
8. Entire CDU will not illuminate but PADS is running and LAMP sets/resets fault indicators	a. Lamp illumination set to minimum	Set lamp intensity to full	Para 3-7b
	b. Computer power supply failure	Replace primary pallet and CDU	Para 4-7, 4-9
9. CDU ALARM DS3 fails to sound during LAMP test	ALARM DS3 failure	Not mission critical; record failure for correction when PADS or CDU next goes to direct support maintenance	

Table 4-2. Troubleshooting – Continued

Malfunction	Probable cause	Corrective action	Reference
10. PS BATT FAIL fault indicator DS1 shows white. PADS may shut down NOTE This failure can be caused by extended operation from PADS batteries.		a. Check that vehicle power system is working properly	
		b. Check that PS BATTERY and VEHICLE circuit breakers CB1 and CB2 are on	
		c. Check connections to cable assemblies W6 and W11 and vehicle power cable(s)	
		d. Test batteries and perform battery maintenance in accordance with TM 9-6140-200-14	
		e. Replace vehicle cable(s)	
		f. Replace cable assembly W6	
		g. Replace cable assembly W11	
11. CDU CAL indicator illuminates after initialization or during update	a. Entered survey parameters incorrect	a. After initialization, reinitialize with correct survey data	
		b. During update: refer to table 3-2	Table 3-2
	b. System out of calibration	a. Perform 30-day azimuth-gyro bias	Table 4-1 item 8
		b. Replace primary pallet	Para 4-9
12. BATT status indicator illuminates	a. PADS batteries not properly connected	a. Check that battery cable W6P1 is securely connected to PS connector 3J2	

Table 4-2. Troubleshooting -- Continued

Malfunction	Probable cause	Corrective action	Reference
NOTE This indication may be normal during the first few minutes of initialization or during live transfer between vehicles		b. Check that PS VEHICLE and BATTERY circuit breakers CB1 and CB2 are ON	
		c. Check connections to cable assemblies W6 and W11	
		d. Test batteries in accordance with TM 9-6140-200-14. Replace batteries as required	
		e. Replace cable assembly W11	
		f. Replace cable assembly W6	
	b. Vehicle power not properly connected	a. Check that vehicle electrical system is properly functioning and helicopter circuit breaker is on	
		b. Check that power cable assembly is securely connected to PS connector 3J4	
		c. Check that PS VEHICLE and BATTERY circuit breakers CB1 and CB2 are ON	
		d. Check that power cables are properly connected to vehicle electrical system	
		e. Replace power cable(s)	
	c. Power supply failure	Replace primary pallet	Para 4-9

Table 4-2. Troubleshooting – Continued

Malfunction	Probable cause	Corrective action	Reference
13. BATT status indicator flashes. System may shut down with no fault indicators white, or PS BATT FAIL fault indicator DS1 white	Insufficient power available to sustain system operation		
	a. Vehicle power not properly connected	Refer to table 4-2, item 12	
	b. Battery box not properly connected	Refer to table 4-2, item 12	
	c. Power supply failure	Replace primary pallet	Para 4-9
14. ATTN status indicator illuminates	a. STOP button pressed while system is moving	Stop vehicle, press and hold STOP until ATTN status indicator extinguishes and STOP indicator illuminates. Complete zero-velocity correction	Para 3-10
	b. System does not accept zero-velocity correction. (May be caused by not stopping when requested)	a. Make sure vehicle is completely stopped. Press and hold STOP until ATTN indicator extinguishes and STOP status indicator illuminates. Complete zero-velocity correction	Para 3-10
		b. If failure indication repeats several times and is not operator induced:	
		(1) Turn off and reinitialize system	Para 3-5
		(2) Perform 30-day azimuth-gyro bias	Table 4-1 item 8
		(3) Replace primary pallet	Para 4-9

Table 4-2. Troubleshooting – Continued

Malfunction	Probable cause	Corrective action	Reference
	c. Update rejection	Refer to table 4-2, item 11	
	d. Excessive motion during alignment. (CAL indicator extinguishes)	Turn off system and reinitialize	Para 3-5
	e. Excessive vibration (SLO shows in data display when TIME is pressed)	Perform zero-velocity correction	Para 3-27
	f. System not level during alignment. (LEVEL shows in data display)	If possible, shut down and reinitialize on a more level surface	Para 3-5
15. CHRG status indicator illuminates continuously for several hours	NOTE This indication implies PADS batteries are weak. Missions may be continued but avoid extended operation from batteries.		
	a. PADS batteries extremely discharged	Continue to allow batteries to charge. Use external charger overnight if possible	
	b. Weak or defective battery	Test batteries in accordance with TM 9-6140-200-14. Replace as required	
	c. Defective power supply	Replace primary pallet	Para 4-9
16. STOP and GO status indicators flash alternately during alignment	Excessive motion during alignment or wrong initialization survey coordinates	Turn off system and reinitialize using correct survey parameters	Para 3-5

Table 4-3. PADS Monitor Functions

ID No.	Description
00	Mode
01	Computer malfunction word
02	System/IMU malfunction word
03 thru 11	Detail malfunction words
12	Mission history of CDU-ID 1
13	Mission history of CDU-ID 2
14	Program checksum
15	Subroutine checksum
16	Calibration checksum
17	Year/day
18	IMU serial number
19	Binary scale for ID's 22 and 23. The following are predetermined conversions entered in ID 19: -90 = B-12 rad/sec to deg/hr -91 = B0 ft/sec^2 to micro G's -92 = B2 radians to deg -93 = B2 radians to sec -94 = B-7 radians to deg -96 = B-7 radians to sec
20	Memory location
21	Octal display of memory location
22	Scientific decimal display of memory location as single precision
23	Scientific decimal display of memory location as double precision
24	Scientific decimal display of memory location as floated data
25	Degree, minute, and second display of memory location as single precision
26	Degree, minute, and second display of memory location as double precision
27	Pitch in degree, minute, and second displayed 0 to 360
28	Roll in degree, minute, and second displayed 0 to 360
29	Azimuth in degree, minute, and second displayed 0 to 360
30	Latitude in degree, minute, and second display ±90
31	Longitude in degree, minute, and second displayed ± 180
32	Elevation in feet
33	V_x in feet/second
34	V_Y in feet/second
35	V_Z in feet/second
36	X-gyro bias in degrees/hour
37	Y-gyro bias in degrees/hour
38	Z-gyro bias in degrees/hour
39	X-accelerometer bias in micro g's
40	Y-accelerometer bias in micro g's
41	Z-accelerometer bias in micro g's
42	X-quant bias in micro g's
43	Y-quant bias in micro g's
44	Z-quant bias in micro g's
45	Not used
46	Z-VEL interval (XX.X minutes). Refer to para 3-10d NOTE: Refer to caution following para 3-15c.
47	DLXPB } X.XXX meters
48	DLYPB } X.XXX meters
49	DLZPB } X.XXX meters
50	DLVPB } X.XXX meters
51	Vehicle selection. Refer to para 3-8.1b(3)

Table 4-4. PADS Monitor Functions (GPS)

ID No.	Description
00	Mode
01	Computer malfunction word
02	System/IMU malfunction word
03 thru 11	Detail malfunction words
12	Mission history of CDU-ID 1
13	Mission history of CDU-ID 2
14	Program checksum
15	Subroutine checksum
16	Calibration checksum
17	Calibration year/day
18	IMU serial number
19	Binary scale for IDs 22 and 23
	The following are predetermined conversions entered in ID 19: -90 = B-12 rad/sec to deg/hr -91 = B0 ft/sec^2 to micro Gs -92 = B2 radians to deg -93 = B2 radians to sec -94 = B-7 radians to deg -96 = B-7 radians to sec
20	Memory location
21	Octal display of memory location
22	Scientific decimal display of memory location as single precision
23	Scientific decimal display of memory location as double precision
24	Scientific decimal display of memory location as floated data
25	Degree, minute, and second display of memory location as single precision
26	Degree, minute, and second display of memory location as double precision
27	Pitch in degree, minute, and second displayed 0 to 360
28	Roll in degree, minute, and second displayed 0 to 360
29	Azimuth in degree, minute, and second displayed 0 to 360
30	Latitude in degree, minute, and second display ±90
31	Longitude in degree, minute, and second displayed ±180
32	Elevation in feet
33	V_x in feet/second
34	V_Y in feet/second
35	V_z in feet/second
36	X-gyro bias in degrees/hour
37	Y-gyro bias in degrees/hour
38	Z-gyro bias in degrees/hour
39	X-accelerometer bias in micro g's
40	Y-accelerometer bias in micro g's
41	Z-accelerometer bias in micro g's
42	X-quant bias in micro g's
43	Y-quant bias in micro g's
44	Z-quant bias in micro g's
45	Not used
46	Z-VEL interval (XX.X minutes). Refer to para 3-10d NOTE: Refer to caution following para 3-15c.
47	DLXPB } X.XXX meters
48	DLYPB } X.XXX meters
49	DLZPB } X.XXX meters
50	DLVPB } X.XXX meters
51	Vehicle selection. Vehicle change, new vehicle, and lever arm data entry. Refer to para 3-22.8b(3)
52	User defined spheroid entry
53 thru 59	Unused
60	Saved user defined spheroid 15 constants
61	Saved user defined spheroid 16 constants

Section V. MAINTENANCE OF PADS

4-5. General. Operator/crew maintenance consists of cleaning and spot-painting, CDU replacement, primary pallet replacement, battery box replacement, mounting hardware replacement, and specified repairs and services of these major units.

4-6. Cleaning and Spot-Painting. Perform cleaning and spot-painting instructions as follows:

CAUTION

Do not paint over unpainted areas. These areas are EMI bonding surfaces which must remain unpainted for maximum conductance.

Do not paint if temperature is below 4°C (40°F).

a. Cleaning and spot-painting is limited to touchup of scratched, scraped or otherwise marred surfaces.

WARNING

Isopropyl alcohol is flammable and gives off harmful vapors. Use only in well-ventilated area away from open flames and sparks. Avoid prolonged or repeated inhalation of vapors.

b. The area to be painted must be thorougly cleaned, dry, and free from oil or grease. Clean rust from steel surfaces on the alignment pin bracket, clamping bracket, battery box, and subfloor with steel wool or fine sandpaper. Do not sand any other items as they are made from aluminum or plastic. Use isopropyl alcohol as a cleaning solvent. Do not use soap and water because soap reacts with aluminum to produce a waxy film. Cover connectors and unpainted areas with masking tape before painting, near them. The system probably will not work if connector contacts get painted. Make sure moving parts, such as clamping catches, are not immobilized by paint.

c. Carefully apply alkyd camouflage enamel conforming to MIL-E-52798 (color, forest green) with a small paint brush. Brush out any runs or drips. Allow paint to air dry at least 24 hours before subjecting it to wear.

4-7. CDU Replacement.

a. Removal.

(1) Disconnect cable assembly W1 connector WlP1 from CDU connector 4J1.

(2) Release two clamping catches and remove CDU from bracket.

b. **Replacement.**

(1) Install CDU on bracket and secure with two clamping catches.

(2) Connect cable assembly W1 connector W1P1 to CDU connector 4J1.

4-8. Battery Box Replacement.

a. **Removal.**

(1) Remove right front seat.

(2) Disconnect cable assembly W6 connector W6P1 from PS connector 3J2.

(3) Unlatch belt assembly from subfloor (figure 2-13).

(4) Lift battery box clear of subfloor and remove through right door of vehicle.

b. **Replacement.**

(1) Set battery box in plate on subfloor.

(2) Latch belt assembly to subfloor and tighten (figure 2-13).

(3) Connect cable assembly W6 connector W6P1 to PS connector 3J2.

(4) Replace right front seat.

4-9. Primary Pallet (less CDU) Replacement.

a. Removal.

WARNING

Use three or more persons to lift primary pallet.

NOTE

Step (1) does not refer to a winterized utility truck.

(1) Remove spare tire, gas can, and radio from vehicle, clear canvas as required.

(2) Remove loose equipment from cargo area.

(3) Disconnect cable assembly W6 connector W6P1 from PS connector 3J2.

(4) Disconnect cable assembly W1 connector W1P2 from computer connector 1J3.

(5) Disconnect cable W7 connector W7P1 from PS connector 3J4.

(6) Remove battery box in accordance with paragraph 4-8a.

(7) Remove front two T-handles and clamping brackets securing pallet to subfloor.

(8) Carefully slide primary pallet forward to disengage alignment pins.

(9) Lift IMU end of pallet up over fender and rotate pallet so IMU end sits on rear panel.

(10) Carefully lift pallet out of the vehicle.

(11) Store mounting hardware on primary pallet.

b. **Replacement.**

(1) Load primary pallet in vehicle in accordance with paragraph 2-11, 2-12 or 2-13.

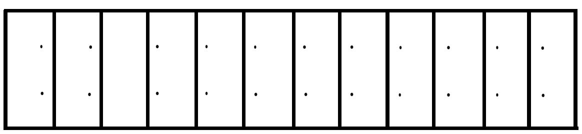
(2) Replace battery box in accordance with paragraph 4-8b.

4-10. CDU Repair.

a. **Lamp Module Replacement.** See figure 4-3 and replace lamp module as follows:

CAUTION

To prevent damage to lamp module pins by attempting to install a numeric module upside down, note orientation of punctuation marks. Modules occupying the two leftmost positions of the display are installed with punctuation marks to the right. All others are inverted so that punctuation marks are to the left.



Inspect CDU bezel. Replace it if there is damage, such as a torn gasket or cracked windows, which might allow water to enter.

Make sure bezel is firmly seated against CDU front panel.

NOTE

CDU lamp module replacement can be performed at any time during the PADS mission.

Tools, spare lamp modules, and spare lamps are in battery box top.

(1) **Removal.**

(a) Using cross tip screwdriver, loosen four screws and remove bezel from CDU.

(b) Grip lamp module with fingers and pull out.

(2) Replacement.

(a) Install lamp module by carefully pressing into place.

(b) Using cross tip screwdriver, install bezel and secure to CDU with four screws.

b. **Lamp Module Repair.** See figure 4-4 and repair lamp module as follows:

(1) When a lamp module is installed in the CDU, perform lamp test and note which segment(s) or bulb(s) is not lighted. The CDU bezel should be removed for this test. See lamp module diagrams in figure 4-4 to determine which lamp is burned out.

(2) An alternate method for determining a burned out lamp is to use a multimeter and check lamps for open filaments between lamp common and lamp pins. Note locations of failed lamps.

(3) Loosen two screws and remove retaining block.

(4) Replace failed lamp(s).

(5) Install retaining block and secure with two screws.

(6) Repair of lamp modules may be verified by installing the module(s) in the CDU and performing a lamp test.

c. **Clamping Catch Replacement.** See figure 4-3 and replace clamping catch as follows:

(1) **Removal.** Remove two screws and washers securing clamping catch to CDU. Remove catch.

(2) **Replacement.** Secure clamping catch to CDU with two screws and washers.

4-11. Primary Pallet Repair. Primary pallet repair consists of IMU repair, PS repair, computer repair, and mounting base subassembly repair. Except where otherwise noted, remove primary pallet from vehicle as described in paragraph 4-9a prior to performing the indicated repair or replacement. Upon completion of the repair or replacement, return primary pallet to vehicle as described in paragraphs 2-11, 2-12 and 2-13.

4-12. IMU Repair. IMU repairs may be accomplished while primary pallet is in the vehicle, and IMU is on primary pallet. (See figure 4-5.)

a. **IMU Fan Replacement.**

(1) **Removal.**

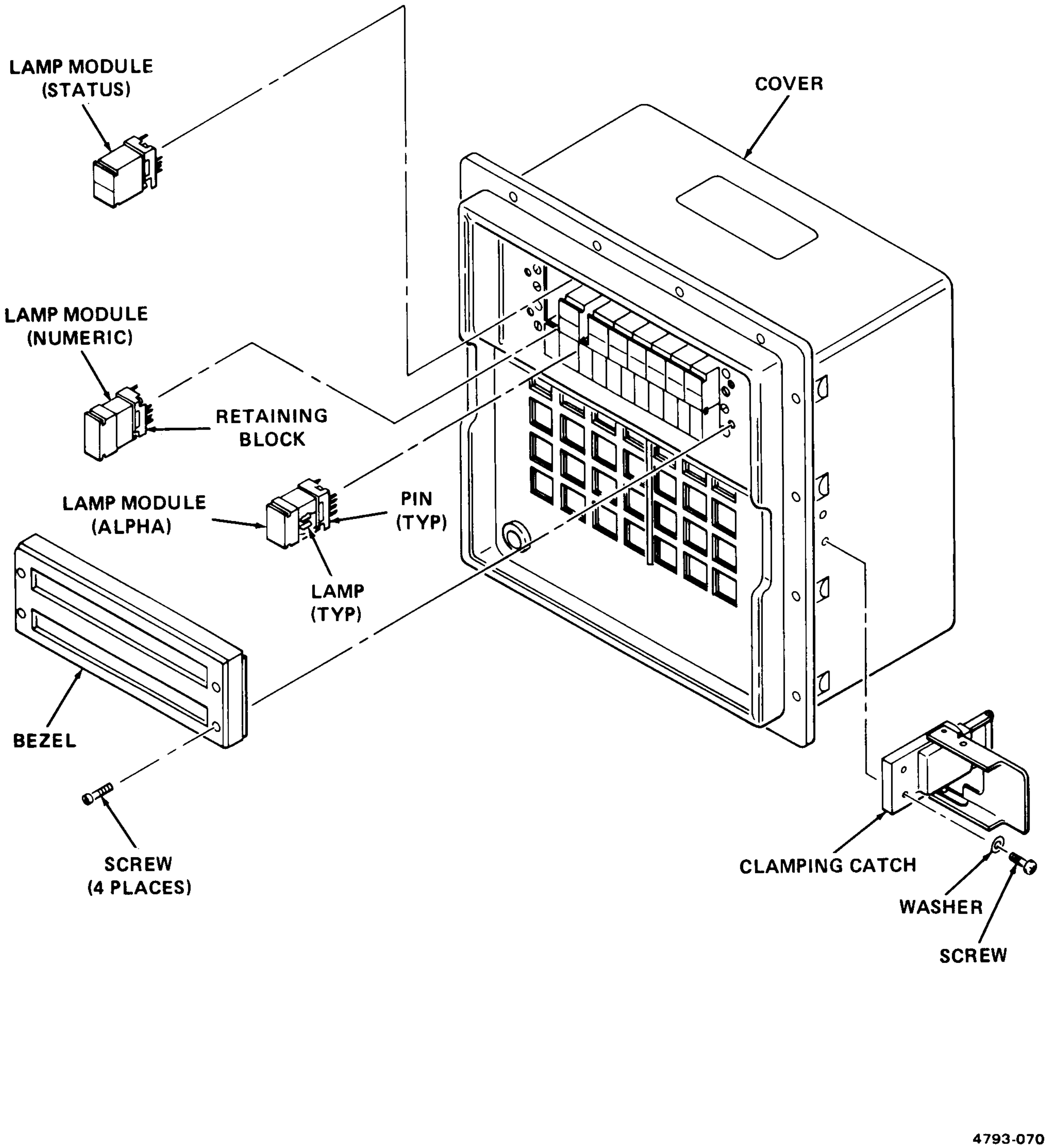


Figure 4-3. CDU Lamp Module and Clamping Catch Replacement

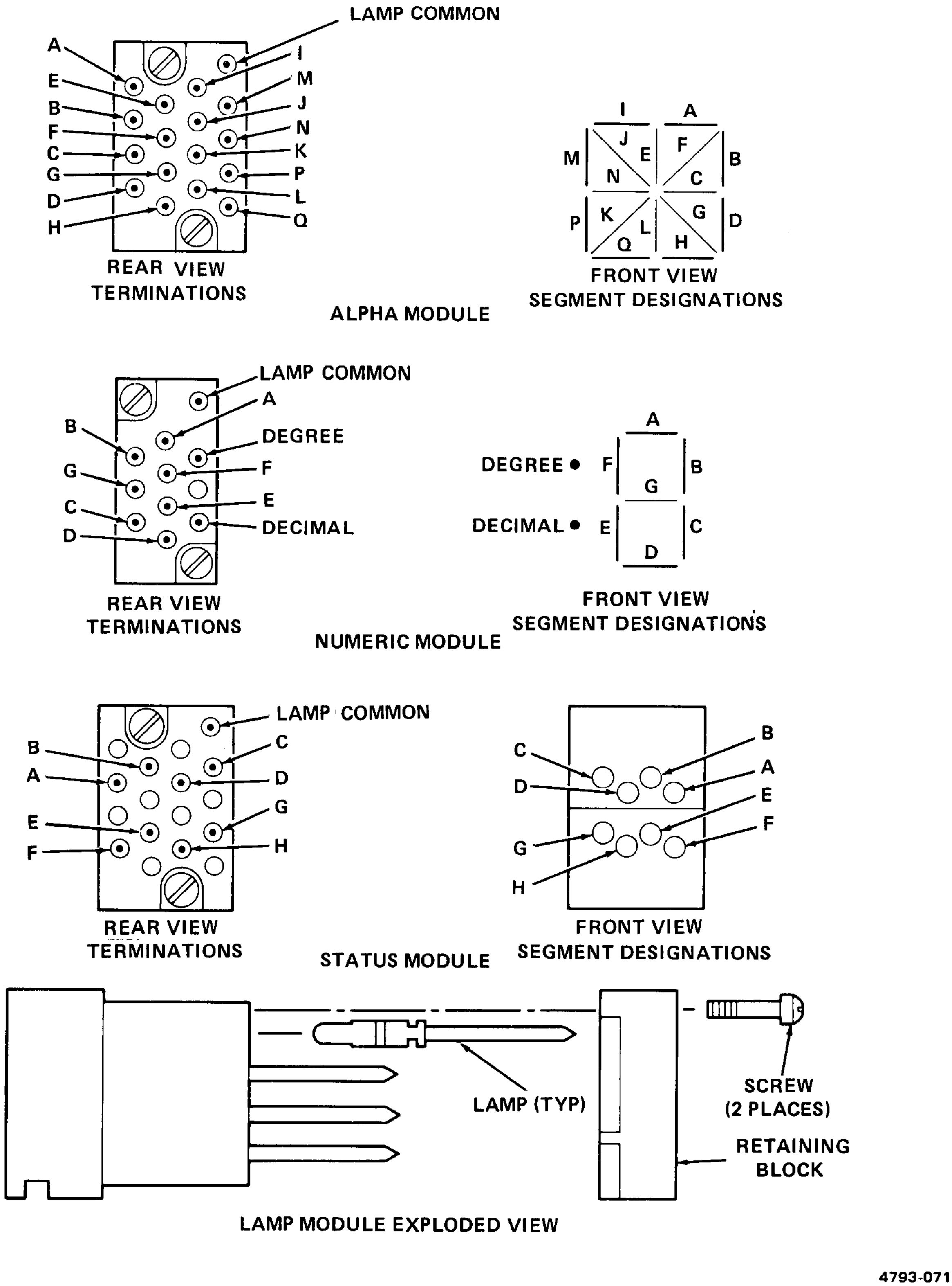


Figure 4-4. Lamp Module Repair

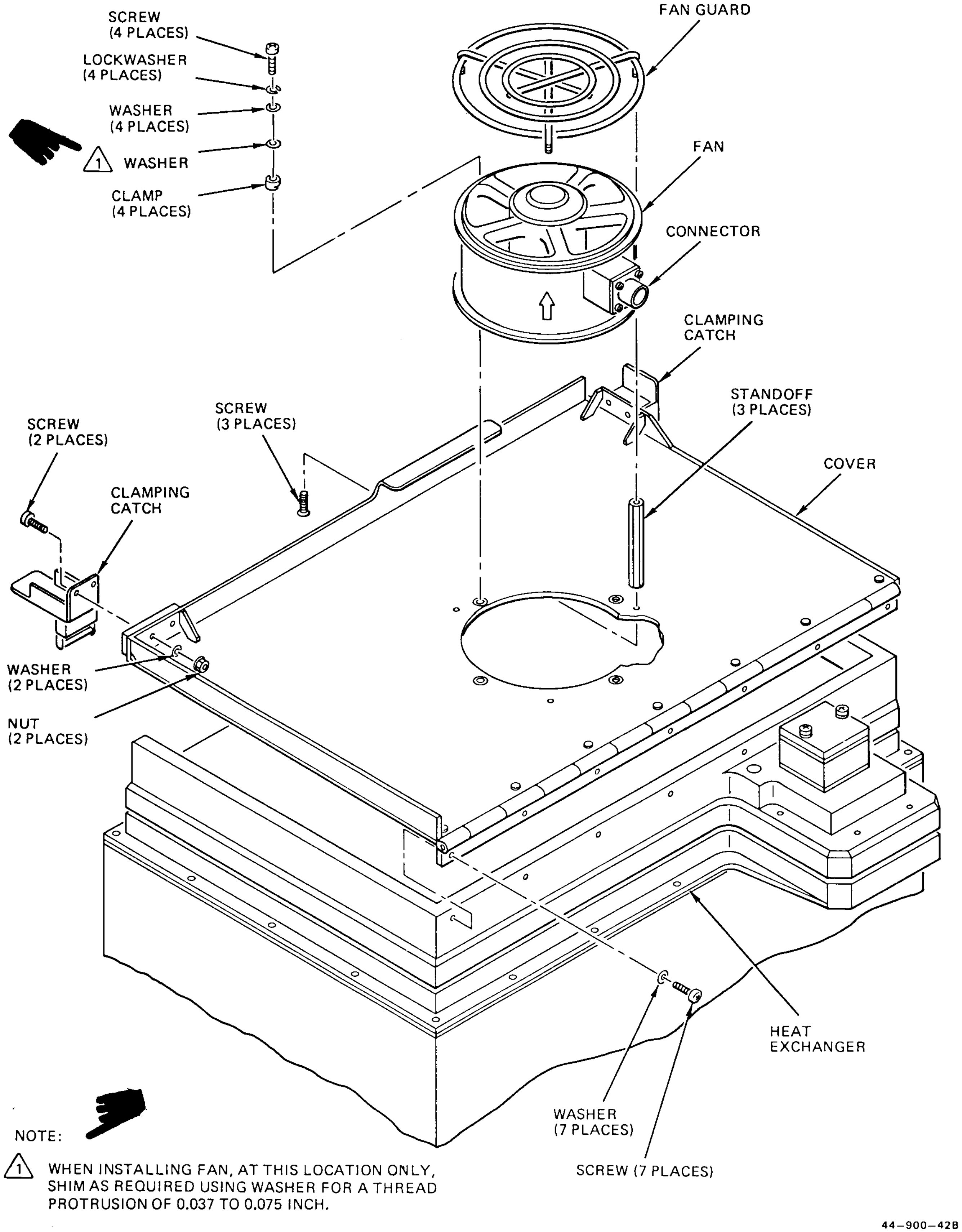


Figure 4-5. IMU Fan, Fan Guard, Cover, and Clamping Catch Replacement

(a) Disconnect cable assembly W5 connector W5P3 from I MU fan connector 2J5.

(b) Raise IMU cover.

(c) Remove three screws securing fan guard standofFs to IMU cover. Remove fan guard assembly.

(d) Loosen four screws securing fan clamps. Rotate clamps to free fan. Remove fan.

(2) Replacement.

(a) Set fan on IMU cover with connector pointed as shown. Ensure that airflow arrow on fan points upward.

(b) Rotate four clamps to secure fan and tighten screws.

(c) Replace fan guard assembly and secure with three screws.

(d) Secure cover.

(e) Connect cable assembly W5 connector W5P3 to IMU fan connector 2J5.

b. IMU Fan Guard Replacement.

(1) Removal.

(a) Raise IMU cover.

(b) Remove three screws securing fan guard standoffs to IMU cover. Remove fan guard assembly.

(c) Unscrew three standoffs from fan guard.

(2) Replacement.

(a) Screw three standoffs onto fan guard.

(b) Replace fan guard assembly and secure with three screws.

(c) Secure IMU cover.

c. IMU Cover Replacement.

(1) Removal.

(a) Remove fan and fan guard assembly in accordance with paragraph 4-12a(1).

(b) Remove seven screws and washers securing cover hinge to IMU. Remove cover.

(c) Remove four screws, washers, nuts and two clamping catches from cover.

(2) Replacement.

(a) Secure two clamping catches to IMU cover with four screws, washers, and nuts.

(b) Secure cover hinge to IMU with seven screws and washers.

(c) Replace fan and fan guard assembly in accordance with paragraph 4-12a(2).

d. IMU Cover Clamping Catch Replacement.

(1) Removal.

(a) Raise IMU cover.

(b) Remove two screws, washers, and nuts securing clamping catch. Remove catch.

(2) Replacement.

(a) Secure clamping catch to IMU cover with two screws, washers, and nuts.

(b) Secure IMU cover.

e. Porro Prism Cover and Chain Replacement. See figure 4-6 and replace porro prism cover as follows:

(1) Removal.

(a) Release two clamping catches and remove porro prism cover from IMU.

(b) Remove screw and two washers securing chain to porro prism cover.

(c) Remove screw, lockwasher, and washer securing chain to IMU; remove chain.

(2) Replacement.

(a) Secure chain to porro prism cover with screw and two washers.

(b) Fit porro prism cover to IMU and secure with two clamping catches.

(c) Secure chain to IMU with screw, lockwasher, and washer.

4-13. Power Supply Repair. See figure 4-2.

a. Fan Replacement.

(1) Removal.

(a) Disconnect cable assembly W3 connector W3P1 from PS connector 3J5.

(b) Disconnect cable assembly W5 connector W5P2 from PS connector 3J1.

(c) Disconnect cable assembly W4 connector W4P2 from PS connector 3J3.

(d) Loosen four captive screws securing PS to primary pallet, remove PS.

(e) Remove three screws and washers and one terminal lug securing fan guard to PS; remove fan guard.

(f) Disconnect fan cable from PS connector J6.

(g) Loosen three screws, washers, and clamps securing fan to PS; remove fan,

(2) Replacement.

(a) Install fan on PS and secure with three screws, washers, and clamps. Orient fan so that airflow arrow is pointing down.

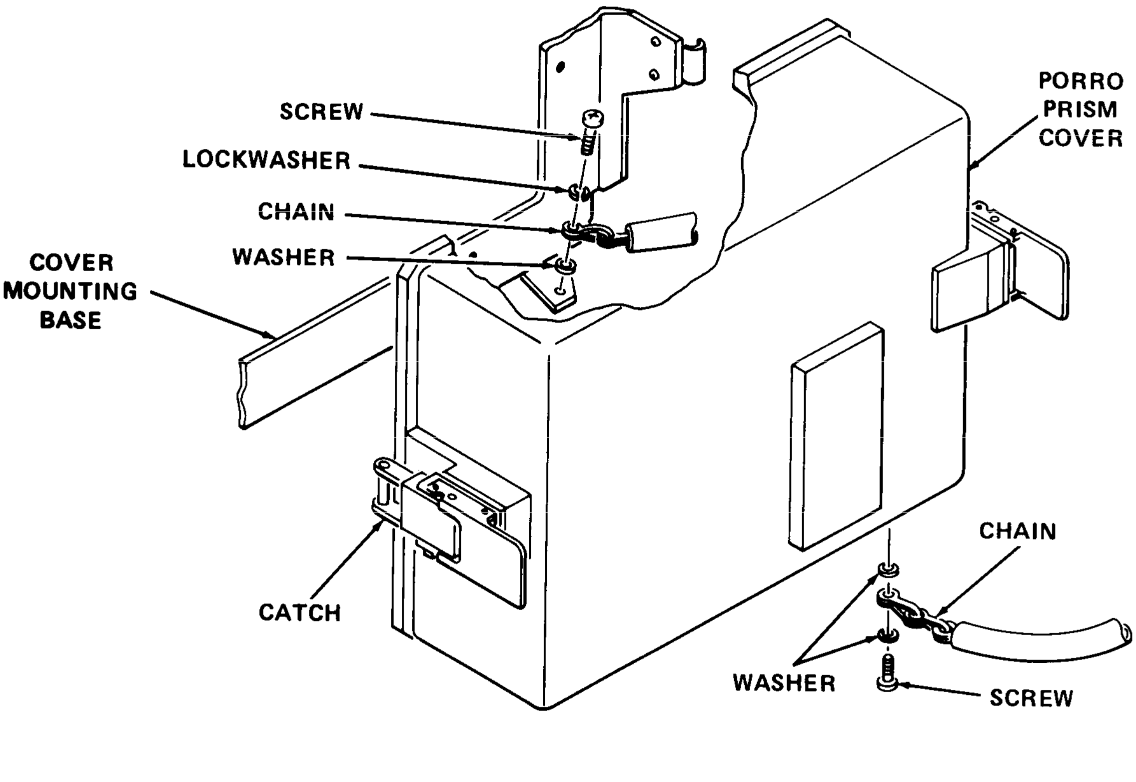


Figure 4-6. Porro Prism Cover Removal

(b) Install fan guard on PS and secure with three screws and washers and one terminal lug.

(c) Connect fan cable to PS connector J6.

(d) Install PS in primary pallet and secure with four captive screws.

(e) Connect cable assembly W4 connector W4P2 to PS connector 3J3.

(f) Connect cable assembly W5 connector W5P2 to PS connector 3J1.

(g) Connect cable assembly W3 connector W3P1 to PS connector 3J5.

b. Fan Guard Replacement.

(1) Removal.

(a) Disconnect cable assembly W3 connector W3P1 from PS connector 3J5.

(b) Disconnect cable assembly W5 connector W5P2 from PS connector 3J1.

(c) Disconnect cable assembly W4 connector W4P2 from PS connector 3J3.

(d) Loosen four captive screws securing PS to primary pallet; remove PS.

(e) Remove three screws and washers and one terminal lug securing fan guard to PS; remove fan guard.

(2) Replacement.

(a) Install fan guard on PS and secure with three screws and washers and one terminal lug.

(b) Install PS in primary pallet and secure with four captive screws.

(c) Connect cable assembly W4 connector W4P2 to PS connector 3J3.

(d) Connect cable assembly W5 connector W5P2 to PS connector 3J1.

(e) Connect cable assembly W3 connector W3P1 to PS connector 3J5.

c. Air Deflector Replacement.

(1) Removal.

(a) Disconnect cable assembly W3 connector W3P1 from PS connector 3J5.

(b) Disconnect cable assembly W5 connector W5P2 from PS connector 3J1.

(c) Disconnect cable assembly W4 connector W4P2 from PS connector 3J3.

(d) Loosen four captive screws securing PS to primary pallet; remove PS.

(e) Remove 20 screws and washers securing air deflector to PS; remove air deflector.

(2) Replacement.

(a) Install air deflector and secure with 20 screws and washers.

(b) Install PS in primary pallet and secure with four captive screws.

(c) Connect cable assembly W4 connector W4P2 to PS connector 3J3.

(d) Connect cable assembly W5 connector W5P2 to PS connector 3J1.

(e) Connect cable assembly W3 connector W3P1 to PS connector 3J5.

4-14. Computer Repair. See figure 4-2.

a. Air Deflector(s).

(1) Removal.

(a) Disconnect cable assembly W2 connector W2P2 from computer connector 1J1.

(b) Disconnect cable assembly W3 connector W3P2 from computer connector 1J4.

(c) Disconnect cable assembly W1 connector W1P2 from computer connector 1J3.

(d) Loosen four captive screws securing computer to primary pallet; remove computer.

(e) Remove six screws and washers securing air deflector to computer; remove air deflector.

(2) Replacement.

(a) Secure air deflector to computer with six screws and washers.

(b) Install computer in primary pallet and secure with four captive, screws.

(c) Connect cable assembly W3 connector W3P2 to computer connector 1J4.

(d) Connect cable assembly W2 connector W2P2 to computer connector 1J1.

(e) Connect cable assembly W1 connector W1P2 to computer connector 1J3.

b. CDU Mounting Bracket.

(1) Removal. Remove four screws securing CDU mounting bracket to computer cover; remove CDU mounting bracket.

(2) Replacement. Install CDU mounting bracket on computer cover and secure with four screws.

4-15. Electrical Equipment Mounting Base Repair. Electrical equipment mounting base repair consists of adjustment of the alignment pins and removal and replacement of the following items:

Alignment pin bracket

Alignment pin receptacle assembly

Computer fan and guard

Protective cover

Flashlight

Flashlight holder

Plumb bob assembly

All of the above items can be replaced with the primary pallet in the vehicle. It may be necessary to move the pallet slightly to gain access to items. Except where specifically noted, the IMU, computer, and PS may remain in the primary pallet during repair. See figure 4-7 and repair electrical equipment mounting base as follows:

a. Alignment Pin Bracket Replacement. See figure 4-7 and replace alignment pin bracket as follows:

(1) Removal. Remove two T-handles securing alignment pin bracket to frame; remove alignment pin bracket.

(2) Replacement. Secure alignment pin bracket to frame with two T-handles.

b. Alignment-Pin Adjustment. See figure 4-8 and adjust alignment pin as follows:

NOTE

The alignment pin bracket must be installed on the vehicle subfloor or helicopter cargo pallet before adjustment.

(1) Hold alignment pin with socket-head key.

(2) Loosen locking nut.

(3) Rotate alignment pin until it mates freely with alignment pin receptacle in the frame.

(4) Holding that position of the alignment pin, tighten locking nut.

(5) Repeat steps (1) thru (4) for the other alignment pin, as necessary.

c. Alignment Pin Bracket Repair. See figure 4-8 and repair alignment-pin bracket as follows:

(1) Remove alignment pin bracket.

(2) Hold alignment pin and remove locking nut. Remove nut securing bushing to bracket. Remove pin and bushing.

(3) Replace pin and bushing and secure with nut. Screw locking nut onto pin.

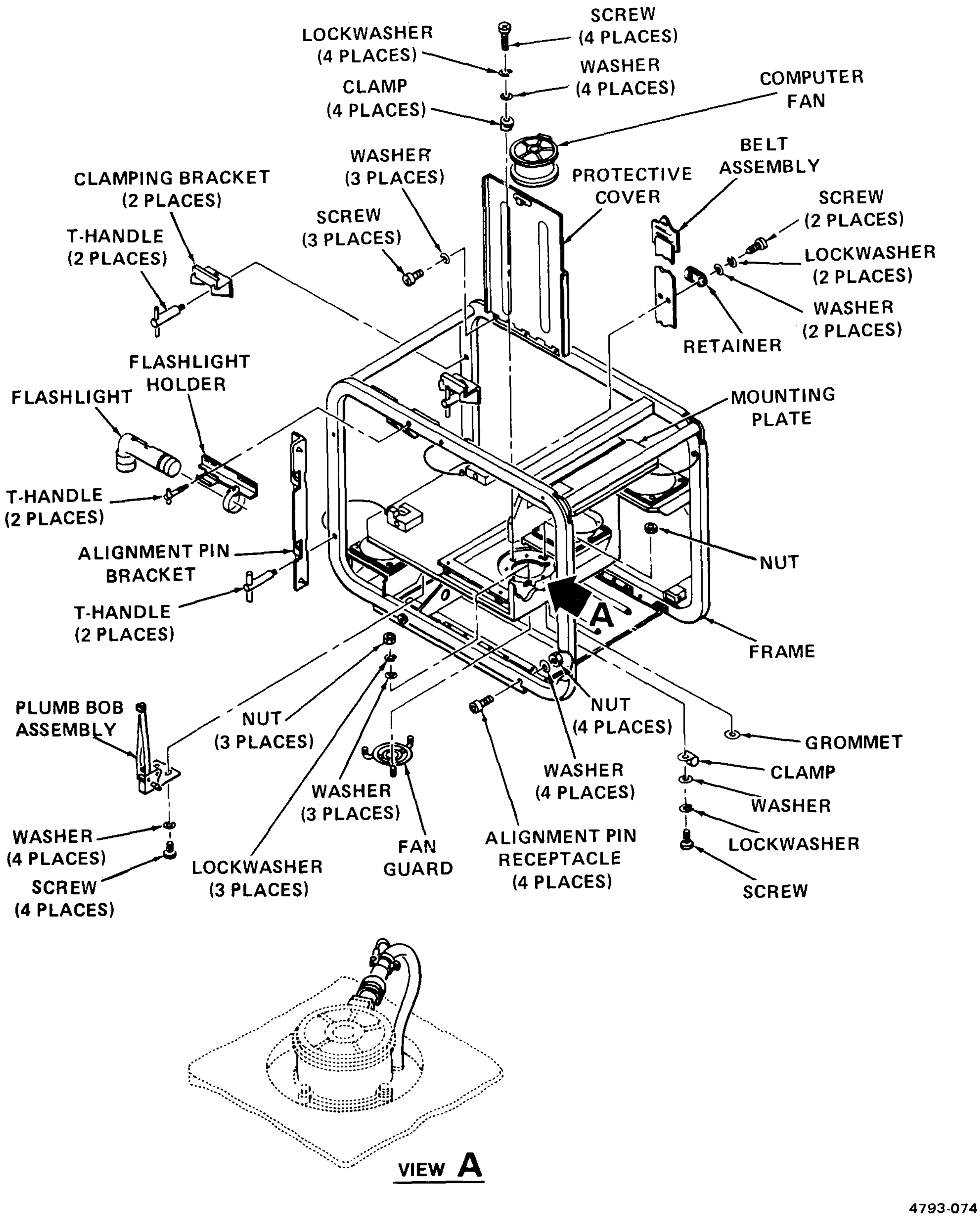


Figure 4-7. Electrical Equipment Mounting Base Exploded View

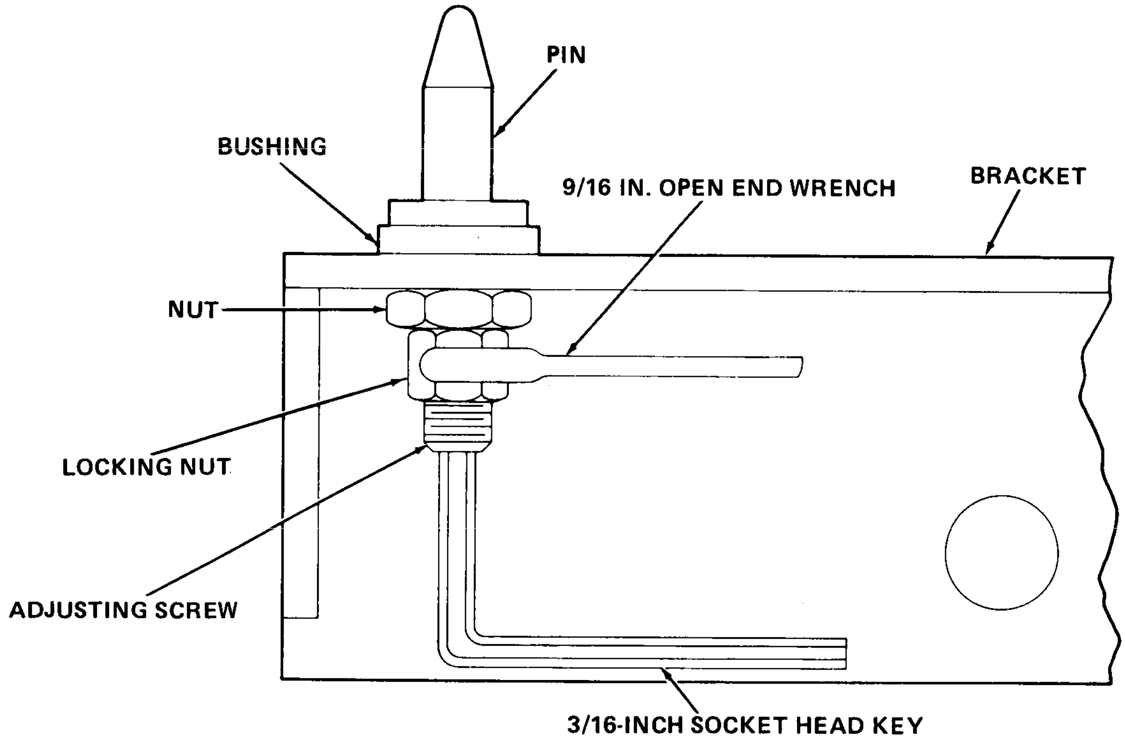


Figure 4-8. Alignment Pin Adjustment

(4) Install alignment-pin bracket and adjust pin(s) in accordance with paragraph 4-15b.

d. Clamping Bracket Replacement. See figure 4-7 and replace clamping bracket as follows:

(1) Removal. Remove T-handle securing clamping bracket to frame; remove clamping bracket.

(2) Replacement. Secure clamping bracket to frame with T-handle.

e. Alignment-Pin Receptacle Replacement. See figure 4-7 and replace alignment pin receptacle as follows:

(1) Removal.

(a) Remove PS in accordance with paragraph 4-13a(1).

(b) Remove nut and washer securing alignment pin receptacle to frame; remove alignment pin receptacle. Inside nut requires 3/4-inch wrench and locking nut requires 1/2-inch wrench.

(2) Replacement.

(a) Secure alignment pin receptacle to frame with nut and washer.

(b) Replace PS in accordance with paragraph 4-13a(2).

f. Computer Fan Replacement. See figures 2-9, 4-2, and 4-7 and replace computer fan as follows:

(1) Removal.

(a) Disconnect cable assembly W2 connector W2P2 from computer connector lJ1 (See figure 2-9.)

(b) Disconnect cable assembly W3 connector W3P2 from computer connector 1J4.

(c) Disconnect cable assembly W1 connector W1P2 from computer connector 1J3.

(d) Loosen four captive screws securing computer to primary pallet; remove computer. (See figure 4-2.)

(e) Disconnect cable assembly W5 connector W5P4 from computer fan connector 5J1.

(f) Loosen four screws, washers, and clamps securing computer fan to mounting plate; remove fan. (See figure 4-7.)

(2) Replacement.

(a) Connect cable assembly W5 connector W5P4 to computer fan connector 5J1. (See figure 2-9.)

(b) Install computer fan on mounting plate, oriented with airflow arrow pointing up, and secure with four clamps, washers, and screws. (See figure 4-7.)

(c) Install computer in primary pallet and secure with four captive screws. (See figure 4-2.)

(d) Connect cable assembly W3 connector W3P2 to computer connector 1J4. (See figure 2-9.)

(e) Connect cable assembly W2 connector W2P2 to computer connector 1J1.

(f) Connect cable assembly W1 connector W1P2 to computer connector 1J3.

g. Protective Cover Replacement. See figure 4-7 and replace protective cover as follows:

(1) Removal.

(a) Release catch and lift up protective cover.

(b) Remove three screws and washers securing protective cover to frame; remove protective cover.

(2) Replacement.

(a) Secure protective cover to frame with three screws and washers.

(b) Close protective cover and secure with catch.

h. Flashlight Replacement. See figure 4-7 and replace flashlight as follows:

(1) Removal. Loosen clamp and slide flashlight away from flashlight holder; remove flashlight.

(2) Replacement. Install flashlight so that it is snapped to flashlight holder and encircled by clamp; tighten clamp.

i. Flashlight Holder Replacement. See figure 4-7 and replace flashlight holder as follows:

(1) Removal. Remove two T-handles securing flashlight holder to frame; remove flashlight holder. Remove flashlight.

(2) Replacement. Install flashlight holder and lightly secure to frame with two T-handles. With flashlight installed, slide flashlight holder until flashlight beam is centered on porro prism; tighten two T-handles.

j. Computer Fan Guard Replacement. See figures 2-9, 4-2, and 4-7 and replace computer fan guard as follows:

(1) Removal.

(a) Disconnect cable assembly W2 connector W2P2 from computer connector 1J1. (See figure 2-9.)

(b) Disconnect cable assembly W3 connector W3P2 from computer connector 1J4.

(c) Disconnect cable assembly W1 connector W1P2 from computer connector 1J3.

(d) Loosen four captive screws securing comuter to primary pallet; remove computer. (See figure 4-2.)

(e) Disconnect cable assembly W5 connector W5P4 from computer fan connector 5J1.

(f) Loosen four screws, washers, and clamps securing computer fan to mounting plate; remove fan.

(g) Remove three nuts, lockwashers, and washers securing fan guard to mounting plate; remove fan guard. (See figure 4-7.)

(2). Replacement.

(a) Secure fan guard to mounting plate with three nuts, lockwashers, and washers.

(b) Connect cable assembly W5 connector W5P4 to computer fan connector 5J1. (See figure 2-9.)

(c) Install computer fan on mounting plate, oriented with airflow arrow pointing up, and secure with four clamps, washers, and screws. (See figure 4-7.)

(d) Install computer in primary pallet and secure with four captive screws. (See figure 4-2.)

(e) Connect cable assembly W3 connector W3P2 to computer connector 1J4. (See figure 2-9.)

(f) Connect cable assembly W2 connector W2P2 to computer connector 1J1.

(g) Connect cable assembly W1 connector W1P2 to computer connector 1J3.

k. Belt Assembly Replacement. See figure 4-7 and replace belt assembly as follows:

(1) Removal. Remove two screws, lockwashers, and washers and one retainer securing belt assembly to frame; remove belt assembly.

(2) Replacement. Secure belt assembly to frame with two screws, washers, and lockwashers and one retainer.

l. Plumb Bob Assembly Replacement. See figure 4-7 and replace plumb bob assembly as follows:

(1) Removal. Remove four screws and washers securing plumb bob assembly to mounting plate; remove plumb bob assembly.

(2) Replacement. Secure plumb bob assembly to mounting plate with four screws and washers.

With plumb bob assembly in the stowed position, adjust so that assembly is against pad.

m. Plumb Bob Arm Maintenance.

(1) Pivot block detent adjustment. See figure 4-9 and perform pivot block detent adjustment as follows:

(a) Hold extension arms in the stowed (vertical) position. If arm will not move to the vertical position, loosen (turn counterclockwise) the detent screw.

(b) Tighten (turn clockwise) detent screw until it is just snug. Do not overtighten.

(c) Loosen the detent screw 1/8 turn.

(2) Extension arm detent adjustment. See figure 4-9 and perform extension arm detent adjustment as follows:

(a) Hold extension arms in the operational position. If arm will not move to this position, loosen (turn counterclockwise) the detent screw.

(b) Tighten (turn clockwise) detent screw until it is just snug. Do not overtighten.

(c) Loosen the detent screw 1/8 turn.

4-16. Cable Replacement.

a. Replace Cable Assemblies W1, W2, W3, and W4. Remove cables by disconnecting both ends. Replace by connecting both ends. Align keyways before mating connectors. Do not force connectors. See figure 4-10 for a cable routing diagram.

b. Cable Assembly W5 Replacement. See figure 2-9, 4-2, and 4-7 and replace cable assembly W5 as follows:

(1) Removal.

(a) Disconnect cable assembly W2 connector W2P2 from computer connector lJ1. (See figure 2-9.)

(b) Disconnect cable assembly W3 connector W3P2 from computer connector 1J4.

(c) Disconnect cable assembly W1 connector W1P2 from computer connector 1J3.

(d) Loosen four captive screws securing comuter to primary pallet; remove computer. (See figure 4-2.)

(e) Disconnect cable assembly W5 connector W5P4 from computer fan connector 5JI.

(f) Loosen four screws, washers, and clamps securing computer fan to mounting plate; remove fan. (See figure 4-7.)

(g) Slide grommet securing connector W5P4 end of cable assembly W5 out of retaining slot.

(h) Remove nut, lockwasher, washer, and screw securing clamp on cable assembly W5 to mounting plate; remove clamp and grommet from cable.

(i) Disconnect cable assembly W5 connectors W5P1, W5P2, and W5P3; remove cable.

(2) Replacement.

(a) Slip clamp over connector W5P5 end of cable assembly W5. Secure clamp to mounting plate with screw, washer, lockwasher, and nut. Slip grommet over connector W5P4 end of cable assembly W5 and slide grommet into retaining slot to secure cable.

(b) Connect cable assembly W5 connector W5P4 to computer fan connector 5J1. (See figure 2-9.)

(c) Install computer fan on mounting plate, oriented with airflow arrow pointing up, and secure with four clamps, washers, and screws. (See figure 4-7.)

(d) Install computer in primary pallet and secure with four captive screws. (See figure 4-2.)

(e) Connect cable assembly W3 connector W3P2 to computer connector 1J4. (See figure 2-9.)

(f) Connect cable assembly W2 connector W2P2 to computer connector lJ1.

(g) Connect cable assembly W1 connector W1P2 to computer connector 1J3.

4-17. Battery Box Assembly.

a. Replacement of Batteries and Auxiliary Components.

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

To prevent injury to personnel or damage to equipment, when disconnecting a battery, remove negative cable from battery post first; when connecting a battery, connect negative cable last.

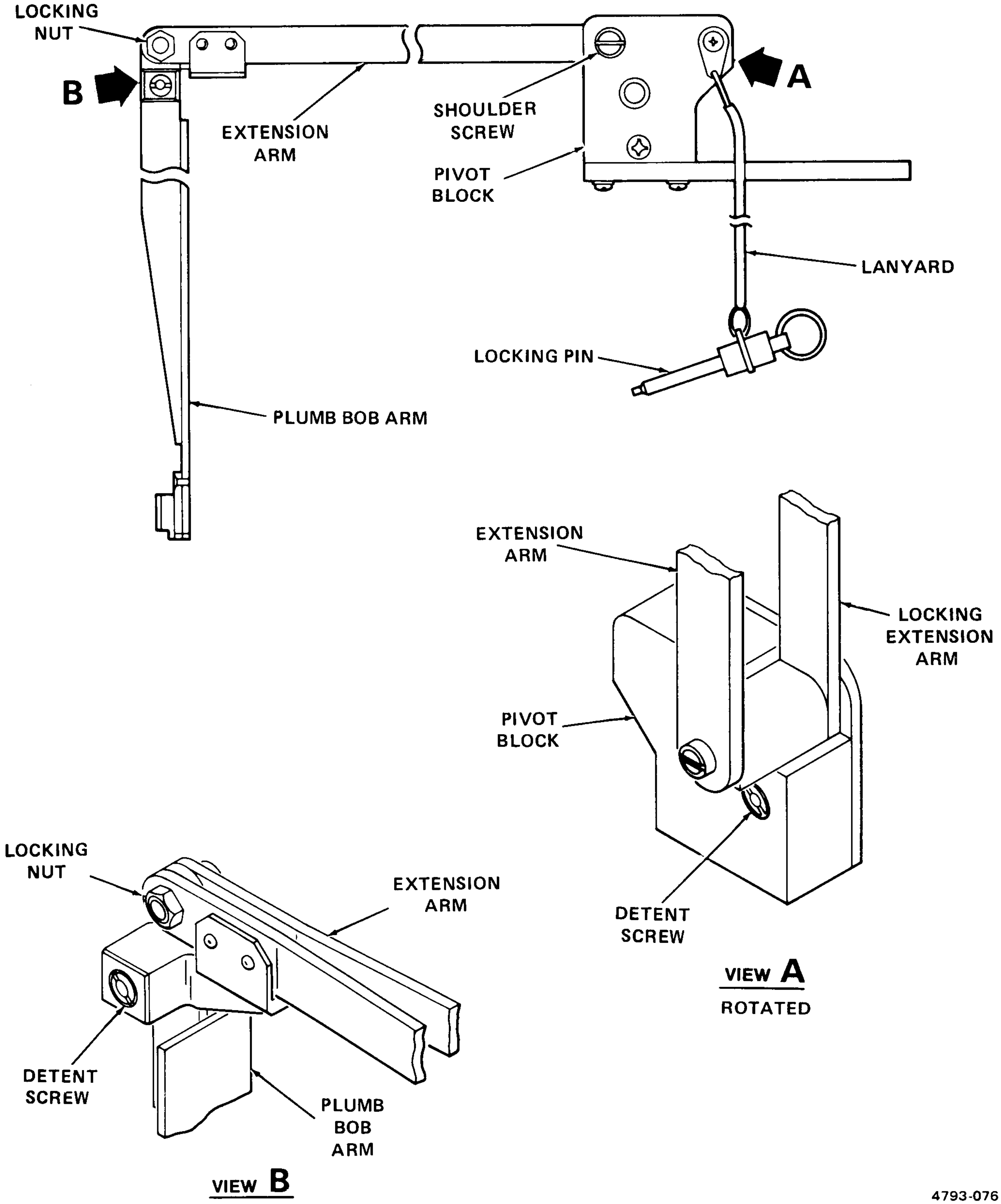
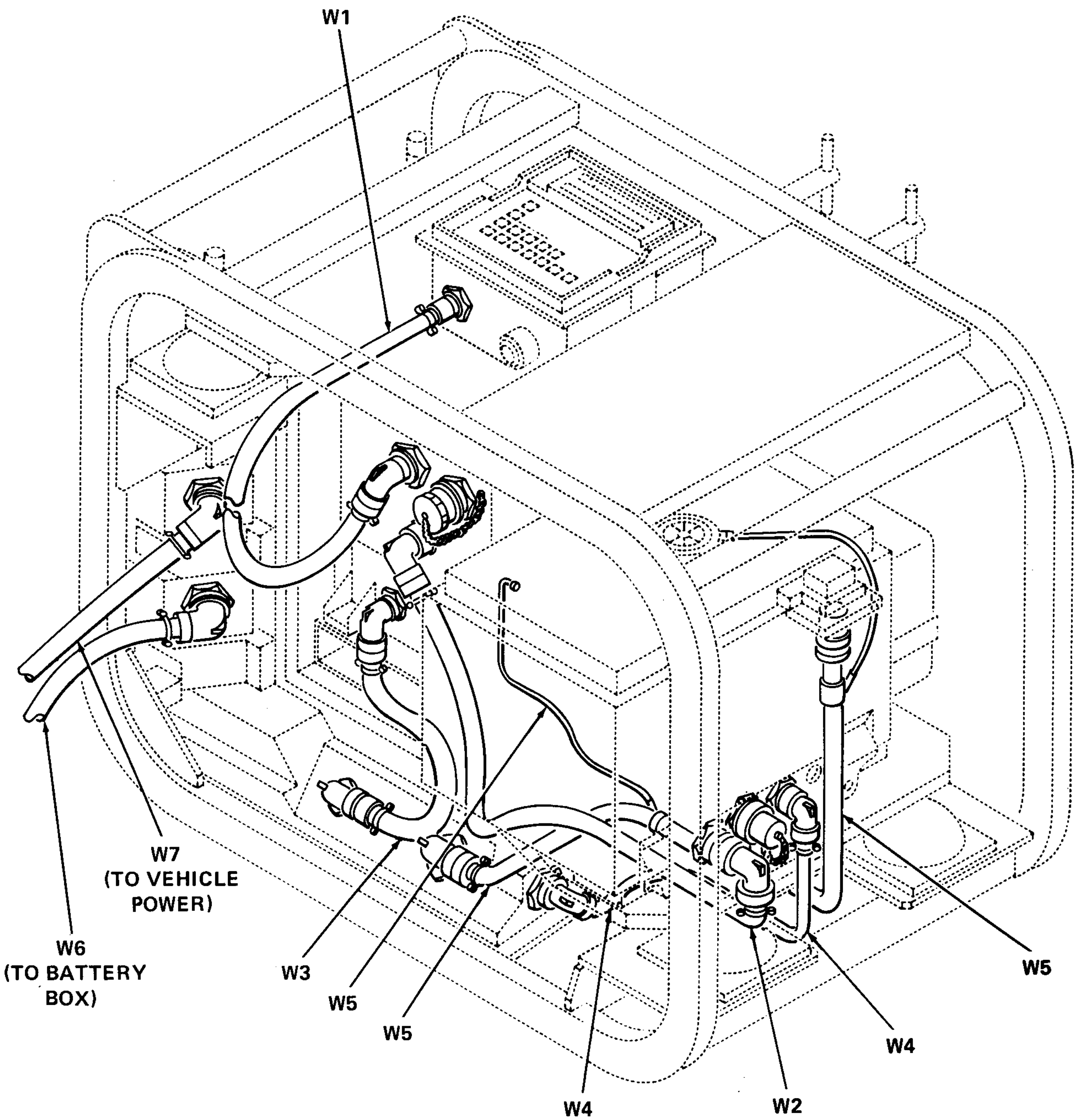


Figure 4-9. Plumb Bob Arm Detent Adjustments



NOTE:

1. CABLE W5 IS ROUTED OVER THE ISOLATION SUPPORT BRACKET
2. CABLES W2 AND W4 ARE ROUTED UNDER THE ISOLATION SUPPORT BRACKET

4793-077

Figure 4-10. Primary Pallet Cable Routing Diagram

Battery box contains acid-filled batteries which may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water; if it touches the eyes, flush immediately with water for 30 minutes and see a physician without delay.

(1) Removal.

(a) Remove battery box top. (See figure 2-8.)

(b) Loosen nut securing cable assembly W11 negative battery terminal adapter to negative battery post; remove cable assembly W11 negative battery terminal adapter from negative battery post.

(c) Disconnect battery terminal adapter on cable assembly W6 from negative terminal of battery.

(d) Disconnect battery terminal adapter on cable assembly W11 from positive terminal of battery; remove cable assembly W11 from battery box.

(e) Disconnect battery terminal adapter on cable assembly W6 from positive terminal of battery; remove cable assembly W6 from battery box. Remove battery terminal cover from battery terminals.

(f) Inspect all battery terminal adapters and cable assemblies W6 and W11. If serviceable, perform maintenance in accordance with TM 9-6140-200-14. If unserviceable, discard and install new equipment in (2) following.

(g) Remove nuts, washers, hook bolts, and battery retainers. Inspect and, if serviceable, perform maintenance in accordance with TM 9-6140-200-14. If unserviceable, discard and install new equipment in (2) following.

(h) Remove batteries with battery carrier. Clean battery box chassis in accordance with TM 9-6140-200-14.

(2) Replacement. Install batteries in accordance with paragraph 2-10.

4-18. M151 Series Vehicle Kit Repair.

a. Subfloor Plate Removal.

(1) Remove battery box, primary pallet, and other equipment. (See figure 2-4.)

(2) Remove two bolts, nuts, and washers which secure subfloor plate and seat belt hardware (if installed) to utility truck bed; retain all serviceable hardware.

(3) Remove four bolts and washers which secure subfloor plate to subfloor mounting bracket. Remove subfloor plate.

(4) Reinstall or retain hardware as appropriate.

b. Subfloor Plate Replacement.

(1) Install subfloor plate as described in paragraph 2-8a.

(2) Install primary pallet, battery box, and other equipment.

c. Subfloor Mounting Bracket Removal.

(1) Remove battery box, primary pallet, and other equipment.

(2) Remove four bolts and washers which secure subfloor mounting bracket to subfloor plate.

(3) Remove two nuts and washers from pintle bolts which secure subfloor mounting bracket to utility truck. Remove subfloor mounting bracket.

(4) Reinstall or retain hardware as appropriate. If a new subfloor mounting bracket is not being installed, replace pintle bolt nuts and washers.

d. Subfloor Mounting Bracket Replacement.

(1) Install subfloor mounting bracket as described in paragraph 2-8a.

(2) Install primary pallet, battery box, and other equipment.

e. Utility Truck CDU Bracket Removal.

(1) Release two clamping catches and remove CDU from vehicle CDU bracket. (See figure 2-15).

(2) Remove two screws and lockwashers and bolt, lockwasher, and nut securing vehicle CDU bracket in place; retain hardware. If a new CDU bracket is not being installed, replace screws and lockwashers in instrument cluster and handle.

f. Utility Truck CDU Bracket Replacement. Install utility truck CDU bracket as described in paragraph 2-8b or 2-9b as applicable.

g. Cable Assembly W7 Removal.

(1) Remove right front seat of utility truck and remove battery compartment cover. (See figure 2-6.)

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

To prevent injury to personnel or damage to equipment when disconnecting a battery, remove negative (ground) cable from battery post first; when connecting a battery, connect negative (ground) cable last.

(2) In battery compartment, disconnect negative battery terminal adapter from negative post of right battery.

(3) Disconnect negative branch of cable assembly W7 from negative battery terminal adapter disconnected in step (2).

(4) Disconnect positive branch of cable assembly W7 from terminal adapter connected at positive terminal of left battery.

(5) Remove bolt, flat washer, lockwasher, and nut securing cable clamp to utility truck. Remove cable clamp.

(6) Remove grommets from cable assembly W7 and remove cable from battery and tool compartments.

(7) Disconnect cable assembly W7 connector W7P1 from PS connector 3J4. Inspect cable assembly W7; if cable is serviceable, perform maintenance on lug ends in accordance with TM 9-6140-200-14. If unserviceable, replace.

(8) Connect positive battery terminal adapter to positive terminal at left battery.

(9) Connect negative battery terminal adapter to negative terminal at right battery.

(10) Install battery compartment cover and right front seat in utility truck.

h. Cable Assembly W7 Replacement. Install cable assembly W7 as described in paragraph 2-8c.

4-19. M1009 Series Vehicle Kit Repair

a. Mounting Base Removal.

(1) Remove battery box, primary pallet and other equipment. (See figure 2-21.)

(2) Remove four bolts, two J-bolts, nuts, washers and spacers which secure mounting base to vehicle cargo bed. Retain all serviceable hardware.

b. Mounting Base Replacement.

(1) Install mounting base as described in paragraph 2-12b.

(2) Install primary pallet, battery box and other equipment.

c. CDU Bracket Removal.

(1) Release two clamping catches and remove CDU from vehicle CDU bracket. (See figure 2-15.)

(2) Remove five screws, nut plate and lockwashers securing CDU bracket to vehicle dash panel. Retain all serviceable hardware.

d. CDU Bracket Replacement. Install CDU bracket as described in paragraph 2-12c and install CDU on CDU bracket (see figure 2-15).

e. Cable Assembly W7 Removal.

WARNING

To prevent injury to personnel or damage to equipment, all rings, watches, and bracelets must be removed. Disconnect ground cable first before working with, or around batteries. Protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

(1) Open vehicle hood and remove battery cover.

(2) Remove ground cable clamp from negative post of battery and protect from accidental contact with other cables or battery posts.

(3) On vehicles where terminal boxes are located on the curbside wall under the radio mount, remove protective cover from positive (+) and negative (–) terminal boxes.

(4) Disconnect the (+) end lug of cable W7 from the positive terminal strip and the (-) end lug of cable W7 from the negative terminal strip.

(5) Replace protective covers on terminal boxes.

(6) On vehicles where terminal boxes are located in the engine compartment, remove protective covers from positive (+) and negative (–) terminal boxes.

(7) Remove (+) end lug of cable W7 from the positive terminal strip and (–) end lug from the negative terminal strip.

(8) Remove protective covers on terminal boxes.

(9) Reinstall negative terminal on battery, replace battery cover and close vehicle hood.

(10) Disconnect cable W7 from cable W8 in passenger compartment.

f. **Cable Assembly W7 Replacement.** Install cable assembly W7 as described in paragraph 2-12e.

4-20. M998 Series Vehicle Kit Repair

a. **Subfloor Plate Removal.**

(1) Remove battery box, primary pallet and other equipment (see figure 2-31).

(2) Remove four screws and washers securing subfloor plate to adapter frame. Retain all serviceable hardware.

b. **Subfloor Plate Replacement.**

(1) Install PADS modified subfloor plate as described in paragraph 2-13a.

(2) Install primary pallet, battery box and other equipment.

c. **Adapter Frame Removal.**

(1) Remove subfloor plate as described in a., above.

(2) Remove five screws and washers securing adapter frame to vehicle cargo bed. Retain all serviceable hardware.

d. **Adapter Frame Replacement.** Install adapter frame as described in paragraph 2-13a.

e. **CDU Bracket Removal.**

(1) Release two clamping catches and remove CDU from vehicle CDU bracket (see figure 2-15).

(2) Remove locking pin securing CDU bracket to bracket mounting post on adapter frame. Lift bracket up and off post.

f. **CDU Bracket Replacement.** Replace CDU bracket as described in paragraph 2-13a.

g. **Cable Assembly W7 Removal.**

WARNING

To prevent injury to personnel or damage to equipment, all rings, watches, and bracelets must be removed. Disconnect ground cable first before working with, or around batteries. Protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

(1) Remove the front commander's seat by opening latch and lifting seat out of vehicle.

(2) Disconnect ground connection of battery.

(3) Remove the cable interconnecting the positive post of one battery and the negative post of the other battery.

(4) Disconnect the negative branch of the W7 cable from the negative post of the rear battery.

(5) Disconnect the positive branch of the W7 cable from the positive post of the front battery.

(6) Replace the interconnect cable between the positive post of the rear battery and the negative post of the front battery.

(7) Replace the battery ground cable.

(8) Replace commander's seat and latch in place.

h. **Cable Assembly W7 Replacement.** Replace cable assembly as described in paragraph 2-13b.

CHAPTER 5

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

PADS has no organizational maintenance apart from operator/crew. See Chapter 4.

CHAPTER 6

MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

SECTION I. INTRODUCTION

6-1. General. This chapter lists auxiliary equipment items that are used by operator/crew to transfer position and azimuth in peforming the PADS mission as described in chapter 3.

Section Il. MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

6-2. Following is a list of material used in conjunction with major item.

a. Theodolite: (with sight painted white to aid in autoreflection).

(1) W07701 Theodolite Survey: direct 0.002 mil 30 ±5 pwr detch tribrach, or:

(2) W07838 Theodolite Survey: direct 0.2 mil with tripod and carrying case.

b. Surveying Set, Supplementary Equipment for Position and Azimuth Determining System, NSN 6675-01-073-3832.

APPENDIX A
REFERENCES

A-1. Shipment and Storage

TB 740-97-2	Preservation of USATROSCOM Mechanical Equipment for Shipment and Storage
TM 740-90-1 or MCO 4450.7	Administrative Storage of Equipment: MC Warehousing Manual

A-2. Maintenance

DA PAM 738-750	The Army Maintenance Management System (TAMMS)
TM 4700-15/1	Equipment Record Procedures
TM 5-6675-308-24P TM 08837A-24P/3	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tools List, Position and Azimuth Determining System AN/USQ-70.
TM 55-1520-228-10	Operator's Manual: Army Model OH-58A Helicopter
TM 55-1520-235-10	Operator's Manual: Army Model OH-58C Helicopter
TM 9-2320-218-20	Organizational Maintenance Manual for 1/4-Ton 4X4 Utility Truck
TM 9-2320-218-20P	Organizational Maintenance Repair Parts and Special Tools List for Truck, Utility
TM 5-6675-238-14 TM 08839A-14/1	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Test Set, Position and Azimuth Determining System AN/USM-427
TM 5-6675-238-24P TM 08839A-24P/2	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tools List for Test Set, Position and Azimuth Determining System AN/USM-427
TM 5-6675-309-14 TM 08840A-14/1	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Test Set Power Supply, PADS, AN/USM-428
TM 5-6675-309-24P TM 08840A-24P/2	Organizational, Direct Support, General Support, and Depot Maintenance Repair Parts and Special Tools List for Test Set, Power Supply AN/USM-428

A-3. Demolition

TM 750-244-2	Destruction of Equipment to Prevent Enemy Use

A-4. Storage Batteries

TM 9-6140-200-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Lead-Acid Storage Batteries: 4HN, 24V; 2HN, 12V; 6TN, 12V

A-5. Forms

NAVMC Form 10772	Rccommcndcd Changes to Technical Publications
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2028-2	Recommcndcd Changes to Equipment Technical Publications
DD Form 6	Packaging Improvement Report
SF 361	Discrepancy in Shipment Report (DISREP)
SF 368	Quality Deficiency Report

A-6. Miscellaneous

CTA 50-970	Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items)
MCO 1650.17	Marine Corps Military Incentive Awards Program
MCO 4430.3	Report of Item and Packaging Discrepancies (ROD)
MCO P4610.19C	Transportation and Travel Report of Transportation Discrepancies and Shipment
MCO 4855.10	Quality Deficiency Report
DA Pam 750-10 SL 1-2/SL 1-3	U.S. Army Equipment Index of Modification Work Orders
SB700-20	Army Adapter/Other Items Selected for Authorization List of Portable Items

APPENDIX B
COMPONENTS OF END ITEM LIST

Section I. INTRODUCTION

B-1. Scope. This appendix lists integral components of and basic issue items for the PADS to help you inventory items required for safe and efficient operation.

B-2. General. The Components of End Item List is divided into the following sections.

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the PADS and must accompany it whenever it is transferred or turned in. These illustrations will help you identify these items.

b. Section III, Basic Issue Items. These are minimum essential items required to place the PADS in operation, to operate it, and to perform emergency repairs. Although shipped separately packed, they must accompany the PADS during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on Table(s) of Organization and Equipment (TOE)/Modification Table of Organization and Equipment (MTOE) authorization of the end item.

B-3. Explanation of Columns.

a. Illustration. This column is divided as follows:

(1) Figure number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

Code	Used on
DEB	AN/USQ-70

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the Rcvd column, list the quantity you actually receive on your major item. The Date columns are for use when you inventory the major item at a later date, such as for shipment to another site.

Section II. INTEGRAL COMPONENTS OF END ITEM

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure no.	(b) Item no.	National stock number	Part no. & FSCM	Description	Location	Usable on code	Qty reqd	Rcvd	Date	Date	Date
1-1	2	6675-01-124-5844	880561-2 (06481)	Cable Assembly, Special Purpose, Electrical, 120 inches, W1		DEB	1				
1-1	5	6675-01-117-1223	880800-2 (06481)	Control and Display Unit C-10164/USQ-70		DEB	1				
1-4	1		880570-6 (06481)	Base, Mounting, Electrical Equipment MT-4877/USQ-70		DEB	1				
1-4	4	7022-01-216-1908	880700-8 (06481)	Computer CP-1283/USQ-70		DEB	1				
1-4	5	6230-00-264-8261	926258-1 (06481)	Flashlight		DEB	1				
1-4	7	5340-01-140-7850	875556-2 (06481)	T-Handle		DEB	4				
1-4	8		880516-1 (06481)	Bracket, Alignment Pin		DEB	1				
1-4	9	6675-01-122-6313	880900-6 (06481)	Inertial Measurement Unit MX-9832/USQ-70		DEB	1				
1-4	10	6675-01-125-0029	880565-3 (06481)	Cable Assembly, Special Purpose, Electrical, 33 inches, W5		DEB	1				

Section II. INTEGRAL COMPONENTS OF END ITEM – Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8)			
								Quantity			
(a) Figure no.	(b) Item no.	National stock number	Part no. & FSCM	Description	Location	Usable on code	Qty reqd	Rcvd	Date	Date	Date
1-4	11	6675-01-124-5847	880564-4 (06481)	Cable Assembly, Special Purpose, Electrical, 21 inches, W4		DEB	1				
1-4	12	6675-01-124-5845	880562-2 (06481)	Cable Assembly, Special Purpose, Electrical, 38 inches, W2		DEB	1				
1-4	13		875522-4 (06481)	Bracket, Clamping		DEB	2				
1-4	14	6675-01-124-5846	880563-2 (06481)	Cable Assembly, Special Purpose, Electrical, 13 inches, W3		DEB	1				
1-4	16	6675-01-117-4053	880600-3 (06481)	Power Supply PP-7352/USQ-70		DEB	1				
1-4		6675-01-118-9514	880530-9 (06481)	Battery Box CY-7560/USQ-70		DEB	1				
1-4	4	6675-01-124-5848	880532-3 (06481)	Cable Assembly, Special Purpose, Electrical, 120 inches, W8		DEB	1				

Section II. INTEGRAL COMPONENTS OF END ITEM – Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8)			
								Quantity			
(a) Figure no.	(b) Item no.	National stock number	Part no. & FSCM	Description	Location	Usable on code	Qty reqd	Rcvd	Date	Date	Date
1-5	6	6675-01-125-0030	880531-8 (06481)	Cable Assembly, Special Purpose, Electrical, 52 inches, W6		DEB	1				
1-5	7	6675-01-124-8039	880534-4 (06481)	Cable Assembly, Special Purpose, Electrical, 11 inches, W11		DEB	1				
1-5	9	6675-01-124-5849	880533-3 (06481)	Cable Assembly, Special Purpose, Electrical, 72 inches, W9		DEB	1				
1-5	11	6675-01-118-5544	880535-1 (06481)	Bracket, CDU Mounting, Helicopter		DEB	1				
1-7	1	6675-01-125-0028	880515-6 (06481)	Cable Assembly, Special Purpose, Electrical, 92 inches, W7		DEB	1				
1-7	2		880512-1 (06481)	Bracket, Mounting, Subfloor		DEB	1				
1-7	3		880511-4 (06481)	Plate, Subfloor		DEB	1				
1-7	5		880513-2 (06481)	Bracket, CDU Mounting, Vehicle		DEB	1				

Section III. BASIC ISSUE ITEMS

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure no.	(b) Item no.	National stock number	Part no. & FSCM	Description	Location	Usable on code	Qty reqd	Rcvd	Date	Date	Date
1-5	1			Operator and Organizational Maintenance Manual for Position and Azimuth Determining System AN/USQ-70, TM 5-6675-308-12/ TM 08837A-12/1A		DEB	1				
1-6	1	5120-00 529-4142		Carrier, Battery		DEB	1				
1-6	2	5120-00-260-4837		Screwdriver, Flat-Tip, 1/4 inch, 6-inch		DEB	1				
1-6	3	5120-00-236-2127		Screwdriver, Flat-Tip, 3/16 inch, 3-inch		DEB	1				
1-6	4	5120-00-234-8913		Screwdriver, Cross-Tip, No. 2, 4-inch		DEB	1				
1-6	5	5120-00-240-8716		Screwdriver, Cross-Tip, No. 1, 3-inch		DEB	1				
1-6	6	5120-00-228-9510		Wrench, Combination, 3/4-inch		DEB	1				
1-6	7	5120-00-264-3795		Wrench, Adjustable, 6-inch		DEB	1				
1-6	8	5120-00-247-5177		Pliers, Long-Nose, 6-inch		DEB	1				

Section III. BASIC ISSUE ITEMS — Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure no.	(b) Item no.	National stock number	Part no. & FSCM	Description	Location	Usable on code	Qty reqd	Rcvd	Date	Date	Date
1-6	9			Brush, 2-inch		DEB	1				
1-6	10			Wrench, Combination, 5/8-inch		DEB	1				
1-6	11	5120-00-228-9707		Wrench, Combination, 9/16-inch		DEB	1				
1-6	12	5120-00-187-7123		Wrench, Open End, 1/1-inch and 7/16-inch		DEB	1				
1-6	13	5120-00-720-4969		Screwdriver, Flat-Tip 3/32-inch, 2-inch		DEB	1				
1-6	14	5120-00-892-5931		Screwdriver, Cross-Tip, No. 1 and 2, Double Offset		DEB	1				
1-6	15	5120-00-240-5300		Key, Socket-Head, L-Type Handle, 3/16-inch		DEB	1				
1-6	16			Key, Socket-Head, L-Type Handle, 1/4-inch		DEB	1				
1-6	17			Pouch, Tool		DEB	1				

APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

C-1. Scope. This appendix lists additional items you are authorized for the suppport of the PADS.

C-2. General. This list identifies items that do not have to accompany the PADS and that do not have to be turned in with it. These items are authorized to you by (CTA, MTOE, TDA, or JTA.

C-3. Explanation of Listing. National stock number, description and quantities are provided to help you identify and request the additional items you require to support this equipment. Usable on codes are identified as follows:

Code	Used on
DEB	AN/USQ-70

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National stock number	Part number and CAGE	(2) Description	Usable on code	(3) U/M	(4) Qty auth
	BA30 (81349)	Battery, Dry, 1/5 Volts	DEB	E A	4
6140-00-057-2553	MS35000-1 (96906)	Battery, Storage, Lead Acid, Charged, Dry, 2HN, 12 Volts, BB-249/U	DEB	E A	2
2920-00-143-4388	11630593 (19207)	Generator/Alternator, 60-Ampere (NOTE: To be installed on truck, 1/4-ton with less than 25-ampere generator/ alternator.)	DEB	E A	1
	880520-1 (06481)	Installation Kit, Winterization, MK-1822/ USQ-70 (NOTE: Used with utility truck equipped with hardtop or gasoline heater.)	DEB	E A	1
2540-00-051-3839	8712420 (19207)	Kit, Winterization for Truck Utility, 1/4-Ton (NOTE: For operation below -30°C(-25°F).)	DEB	EA	1
	D13222E2450 (97403)	Installation Kit, SUSV, Electronic Equipment, MK-1799/USQ-70 (NOTE: Used to install PADS on small utility support vehicle M973 series	DEB	EA	1
	351-32300-003 (96182)	Lamp, Module, Alpha	DEB	EA	1
	351-32300-004 (96182)	Lamp, Module, Numeric	DEB	EA	2
	351-32300-005 (96182)	Lamp, Module, Status	DEB	EA	1
	351-32300-007 (96182)	Lamp, Spare	DEB	EA	50

APPENDIX D
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

D-1. General.

a. This appendix lists the maintenance operations for the Position and Azimuth Determining System (PADS), AN/USQ-70, LIN P21220, SSN M757, NSN 6675-01-071-5552. It authorizes categories of maintenance functions for specific maintenance functions on repairable items and components, and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

b. The Maintenance Allocation Chart (MAC) in Section II designates the overall responsibility for the performance of maintenance functions on each item or component. Implementation of the maintenance formations will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced in Section II.

d. Section IV contains supplemental instructions and explanatory notes for particular maintenance functions.

D-2. Maintenance Functions. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate); to preserve; to drain; to paint; or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of replacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly or module (component or subassembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards, i.e., DMWR, in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/ miles etc.) considered in classifying Army equipments/components.

D-3. Maintenance Allocation Chart Column Entries, Section II.

a. Column 1: Group Number. Column 1 lists the group numbers which identify components, assemblies. subassemblies, and modules with the next higher assembly.

b. Column 2: Component/Assembly. Column 2 lists the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3: Maintenance Functions. Column 3 lists the functions to be performed on the items listed in column 2.

d. Column 4: Maintenance Category. Column 4 specifies, by listing of a work-time figure in the appropriate column(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work-time figures will be shown for each category. The number of manhours specified by the work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. Subcolumns of the maintenance category are as follows:

C	Operator/Crew
O	Organizational
F	Direct Support
H	General Support
D	Depot

e. Column 5: Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6: Remarks. Column 6 contains an alphabetic code referring to Section IV, Remarks, which is pertinent to the item opposite the particular code.

D-4. Took and Test Equipment Requirements, Section III.

a. Column 1: Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the Maintenance Allocation Chart.

b. Column 2: Maintenance Category. The codes in this column indicate the maintenance categories allocated.

c. Column 3: Nomenclature. This column lists tools, tests, and maintenance equipment required to perform the maintenance functions.

d. Column 4: National/NATO Stock Number. This column lists the National/NATO Stock Number of the specific tool or test equipment.

e. Column 5: Tool Number. This column lists manufacturing part number and Federal Supply Code for Manufacturers (FSCM).

Section II. MAINTENANCE ALLOCATION CHART

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
01	Installation Kit (Vehicle)								
0101	Plate, Subfloor	Inspect	0.1						
		Replace	0.6					38, 39, 40, 43 39, 40, 43	
		Repair			0.5			5, 21, 46, 47, 66, 67, 69 67, 69	
0102	Bracket, CDU (Vehicle)	Inspect	0.1						
		Replace	0.1					29, 40 40	
		Repair			0.2			5, 21, 39, 46, 21, 39, 46, 47	
02	Frame, Mounting, Base								
	Bracket, Flashlight	Inspect	0.1						
		Replace	0.1						
	Receptacle Assembly, Alignment-Pin	Inspect	0.1						
		Replace	0.2					9, 40, 43 40, 43	
	Strip, Slide	Inspect	0.1						
		Replace			0.1			22	
	Bracket Clamping	Inspect	0.1						
		Replace	0.1						
	Retainer, Rear (Power Supply)	Inspect	0.1						
		Replace			0.1			14	
	Alignment-Pin Bracket	Inspect	0.1						
		Adjust	0.1						
		Replace	0.2					40, 43 43	
	Mount, Vibration	Inspect	0.1						
		Replace			0.3			13, 39 39	
	Belt Assembly	Inspect	0.1						
		Replace	0.1					52	
	Cover, Protective	Inspect	0.1						
		Replace	0.2					23	
		Repair			0.2				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
02 (cont)	Catch	Inspect							
		Replace	0.2					22	
	Platform, Vibration-Isolator	Inspect	0.1						
		Replace			1.0			13, 39 39	
	Arm Assembly, Plumb Bob	Inspect	0.1						
		Adjust	0.1					27	
		Replace	0.1					24, 29 29	
		Repair			0.5			24, 29 29	
	Fan, Computer	Inspect	0.1						
		Replace	0.2					22	
	Guard Fan	Inspect	0.1						
		Replace	0.2					40	
03	IMU Assembly	Inspect	0.1						B
		Test	0.1		1.0			1, 32, 62, 65 32, 62, 65	C
		Align				2.0		1, 17, 31, 34, 17, 31, 34, 45	E
		Overhaul			0.3		**	9	D, G
0301	Mounting Attachment	Inspect			0.1				
		Replace			0.2			8, 9, 36, 56, 9, 36, 56, 58, 60 60	
	Mounting Bolts	Inspect	0.1						
		Replace			0.1			9, 36, 56, 58, 36, 56, 58, 60	
	External Components								
	Fan	Test	0.1						
		Replace	0.2					22	
	Fan Guard	Inspect	0.1						
		Replace	0.2					23	

**Worktime is included in DMWR.

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
0302 (cont)	Thermostat Switch	Test			0.1			16	
		Replace			0.3			20, 23, 30	
	Cover, Heat Exchange	Inspect	0.1						
		Replace	0.2					22	
		Repair			0.2				
0303	Porro Prism Cover	Inspect	0.1						
		Replace	0.1					22	
		Repair			0.2				
0304	Porro Prism Assembly	Inspect	0.1						
		Service	0.1						
		Replace	0.1			0.1		13	
		Align				1.0		31, 34	E, F
		Repair					**		
04	Computer Assembly	Inspect	0.1						
		Test	0.2		0.3	0.3		9, 16, 18, 23, 32, 45, 65	C, K
		Remove/ Install							
		Replace			0.1			9	D, G, K
		Repair			0.3	0.4		16	
		Overhaul					**		
	Indicator, Fault	Test				0.1		16	
		Replace				0.2		3, 20, 28, 30, 35, 55	
	Switch, Thermostat	Test			0.3			16	
		Replace				0.3		3, 30	
	Indicator, Elapsed Time	Test				0.1		16	
		Replace				1.3		20, 22, 26, 30	
	Connector, Extender	Inspect	0.1						
		Test			0.1			16	
		Replace			0.2			3, 20	
0401	Cover, Computer	Inspect			0.1				
		Replace			0.4			7	
	Deflector, Air	Inspect	0.1						
		Replace	0.1					52	

**Work ne is included in DMW

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
0401 (cont)	Bracket, CDU	Inspect	0.1						
		Replace	0.1					23	
		Repair	0.1		0.2			5, 46, 47	
0402	Circuit Card Memory	Test	0.1		0.2	0.3			C
		Replace			0.2	0.3		7, 11, 26, 56, 58, 59	D, G
		Repair					**		
	Circuit Card	Test			0.2	0.3		32	C
		Replace			0.1	0.1		1, 26, 32	
		Repair					**		
0403	Power Supply	Test	0.1		0.1	0.8		17, 18, 33	C
		Replace			0.4			7	
		Repair				1.0		7, 9, 23, 56, 57, 58, 59	
	Pin, Guide	Inspect			0.1				
		Replace			0.2			20	
	Screw, Cap Live	Inspect			0.1				
		Replace			0.1			7	
	Circuit Card	Test				0.1			
		Replace				0.3		12, 26, 26A, 29	
		Repair					**		
	Interconnect Assembly	Test				0.2		16	
		Replace				0.5			
		Repair				2.0		19, 23	
0404	Wiring Harness	Test				0.1		16	
		Replace				0.1			
		Repair					**		
05	Power Supply	Test	0.1		0.3	0.8		1, 16, 17, 18, 33, 44, 65	C
		Replace			0.1			14	
		Repair				0.3		28, 58, 61	
		Overhaul					**		
	Deflector, Air	Inspect	0.1						
		Replace	0.2					22	
	ıe is included in DMW								

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
0501	Circuit Card	Test				0.1		33	
		Replace				0.2		10, 12, 25, 28	
		Repair					**		
	Modules	Test			0.3			33	
		Replace			0.5			10, 28	
		Repair			2.0			23, 24, 25	
	Power, Inverter Assembly	Test			0.3			33	
		Replace			0.5			10, 28	
		Repair			2.0			23, 24, 25	
0502	Screw, Captive Cover	Inspect			0.1				
		Replace			0.1			10	
0503	Power Supply Chassis								
	Filters	Test				0.1		16	
		Replace				0.4		3, 20, 23, 24, 30, 37, 52, 58	
	Relays	Test				0.1		16	
		Replace				0.2		3, 20, 23, 24, 30, 37, 52, 58	
	Resistors	Test				0.1		16	
		Replace				0.2		3, 20, 23, 24, 30, 55	
	Capacitors	Test				0.1		16	
		Replace				0.3		3, 11, 19, 20, 23, 24, 25, 28, 30, 41, 53, 54, 55	
	Semi-Conductor	Test				0.1		16	
		Replace				0.4		3, 20, 22, 23, 30, 37, 42	
	Indicator, Elapsed Time	Test				0.1		16	
		Replace				0.2		13, 22, 30	
	ne is included in DMW								

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
0503 (cont)	Indicator, Fault	Test				0.1		16	
		Replace				0.2		3, 20, 28, 30, 55	
	Reactors	Test				0.1		16	
		Replace				0.6		3, 20, 23, 25, 30, 55	
	Switch, Thermostat	Test				0.1		16	
		Replace				0.3		3, 19, 20, 30	
0504	Fan and Guard								
	Fan	Test	0.1					16	
		Replace	0.2					22	
	Guard	Inspect	0.1						
		Replace	0.2					23	
0505	Circuit Breaker	Inspect	0.1		0.1				
		Test			0.1			16	
		Replace			0.2			3, 20, 23, 55, 54, 30	
06	Control and Display Unit	Test	0.1			0.1		1, 16, 32, 45	C
		Replace	0.1						
		Repair				0.2		1, 16, 32, 45	
		Overhaul					**		
0601	Lamp Modules	Test	0.1						
		Replace	0.1					27	
		Repair	0.1					20, 22	
0602	Display Panel Assembly	Test			0.1			16	
		Replace				0.5		6, 11, 12, 20, 22, 23, 30, 36, 56, 58, 59	
		Repair				1.0		6, 11, 20, 22, 23, 30, 36, 56 58, 59	

**Work ne is included in DMW .

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
0603	Audible Alarm	Test	0.1			0.1		16	
		Replace				0.2		6, 19, 20, 30, 56, 58, 59	
0604	Cover, Housing	Inspect	0.1			0.3		6, 19, 20, 22, 30, 58, 59	
		Repair				0.3		6, 19, 20, 22, 30, 58, 59	
0605	Circuit Card	Test			0.1			6, 26, 56	
		Replace			0.1			6, 26, 26A, 56, 58, 59	
		Repair					**		
0607	Indicator, Fault	Test			0.1				
		Replace				0.2		22	
07	Battery Box Assembly								
0701	Battery Box	Inspect	0.1						
		Replace	0.3					5, 38, 39, 63	
		Repair	0.3		0.5				
0702	Battery	Inspect	0.1						
		Service	0.1						
		Test	0.2						
		Replace	0.5					38, 39, 40, 63	
0703	Strap, Tie-Down	Inspect	0.1						
		Replace	0.3					28, 40	
08	Cables	Inspect	0.1						
		Test			0.1			16	
		Adjust			0.2			3, 20, 71	
		Replace	0.2						
		Repair				1.0		2, 3, 28, 29, 38, 39, 40, 48, 50, 51, 55, 68	
09	Winterization Kit	Install			2.0			21, 23, 37, 46, 47, 50, 51	J
		Replace			0.2				
		Repair			0.5				

**Work ne is included in DMW

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
10	Cases								
	Cases, Transit, Electrical, Standardized Components	Inspect	0.1						
		Replace	0.5						
		Repair			0.5				
	CDU	Inspect			0.1				
		Replace			0.5				
		Repair				0.2			
	IMU	Inspect			0.1				
		Replace			0.5				
		Repair				0.2			
	Computer	Inspect			0.1				
		Replace			0.5				
		Repair				0.2			
	Computer PS	Inspect			0.1				
		Replace			0.5				
		Repair				0.2			
	Power Supply	Inspect			0.1				
		Replace			0.5				
		Repair				0.2			
11	Installation Kit (CUCV)	Install		1.0				37, 39, 43, 72	
		Repair		0.6					
12	Installation Kit (HMMWV)	Install		1.0				38, 39, 40, 43	
		Repair		0.6					
13	Installation Kit (SUSV)	Install		2.0				16, 25, 28, 39, 40, 64	
		Repair		0.6					

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

Ref. code	Maint. cat.	Nomenclature	National/NATO stock number	Tool number
		NOTE US Marine Corps users may use equivalent electronic test equipment, if necessary.		
1	H	Power supply, 28 VDC	6130-00-504-0372	MH-28-200RS
2	F, H	Crimping tool, battery terminal	5120-00-293-0463	
3	F, H	Pliers, diagonal cutting, 4½-inch	5110-00-240-6209	
4	H	Wrench, single socket spinner, 5/32-inch	5120-00-585-2149	
5	F, H	Hammer, ball peen, 4-oz	5120-00-243-2985	
6	F, H	Key, sockethead, L-type handle, 0.05-inch	5120-00-198-5401	
7	F, H	Key, sockethead, L-type handle, 7/64-inch	5120-00-889-2162	
8	F, H	Key, sockethead, L-type handle, 1/16-inch	5120-00-198-5398	
9	C, F, H	Key, sockethead, L-type handle, 3/16-inch	5120-00-240-5300	
10	H	Key, sockethead, L-type handle, 5/64-inch	5120-00-224-2504	
11	F, H	Key, sockethead, L-type handle, 3/32-inch	5120-00-242-7410	
12	H	Key, sockethead, L-type handle, 3/32-inch	5120-00-892-5999	
13	F, H	Key, sockethead, L-type handle, 5/32-inch	5120-00-198-5392	
14	F	Key, sockethead, L-type handle, 9/64-inch	5120-00-889-2163	
15	F, H	Knife, pocket	5110-00-240-5943	
16	F, H	Multimeter	6625-01-139-2512	AN/PSM-45
17	H	Oscilloscope	6625-00-106-2512	AN/USM-281C
			6625-00-930-6637	AN/USM-273
18	F, H	Voltmeter, Digital	6625-01-124-0834	AN/GSM-64C
19	F, H	Pliers, slip joint, 6-inch	5120-00-224-1567	
20	C, F, H	Pliers, long-nose, 6½ inch	5120-00-293-3481	
21	F, H	Punch, center	5120-00-293-3512	
22	F, H	Screwdriver, cross-tip no. 0, 4-inch	5120-00-060-2004	
23	C, F, H	Screwdriver, cross-tip no. 1, 3-inch	5120-00-240-8716	
24	H	Screwdriver, cross-tip offset nos. 1 and 2	5120-00-892-5931	
25	C, F, H	Screwdriver, cross-tip no. 2, 4-inch	5120-00-234-8913	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS — Continued

Ref. code	Maint. cat.	Nomenclature	National/NATO stock number	Tool number
26	F, H	Extractor, circuit card		875435-1 (06481)
26A	F, H	Extractor, circuit card		877490-1 (06481)
27	C	Screwdriver, flat-tip, 3/32-inch, 3-inch	5120-00-720-4969	
28	C, F, H	Screwdriver, flat-tip, 1/4 inch, 4-inch	5120-00-222-8852	
29	C, F, H	Screwdriver, flat-tip, 3/16-inch, 8-, 5-, or 2-1/2-inch	5120-00-260-4837 5120-00-278-1270 5120-00-287-2504	
30	F, H	Soldering/desoldering set	3439-00-460-7198	
31	H	Target set	6675-00-065-7502	
32	H	Test Set, PADS AN/USM-427	6675-01-081-9198	
33	H	Test Set, Power Supply AN/	6675-01-075-4033	
34	H	Theodolite, surveying, 0.002 mil	6675-99-684-5171	
35	H	Tweezers, 6-1	5120-00-293-0149	
36	F, H	Wrench, open end, fixed 3/8 and 7/16-inch	5120-00-277-2342	
37	F, H	Wrench, combination, 7/16-inch	5120-00-228-9505	
38	C, F, H	Wrench, combination, 9/	5120-00-228-9507	
39	C, F	Wrench, open end, fixed, 1/2- and 7/	5120-00-187-7123	
40	C	Wrench, adjustable, 6-inch	5120-00-264-3795	
41	H	Wrench, open end, fixed, 3/16- and 1/4-inch	5120-00-228-9527	
42	H	Wrench, combination, 5/	5120-00-228-9503	
43	C, F	Wrench, combination, 3/4-inch	5120-00-228-9510	
44	H	Power supply, 0 to 40 VDC	6625-00-249-2748	HP Model 6268A (28480)
45	H	Teletypewriter	5815-00-503-2763	
46	F, H	Drill, electric, 1/4-inch	5130-00-889-8994	
47	F, H	Drill set, twist, range 60 to 1	5130-00-449-6775	
48	H	Crimping tool, connector pins	5120-00-165-3912	MS3191-4
		Crimping tool, connector pins	5120-00-165-3910	MS3198-1
		Insertion tool	5120-00-018-0529	MS27495A16
		Insertion tool	5120-00-137-9140	MS27495A22

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS - Continued

Ref. code	Maint. cat.	Nomenclature	National/NATO stock number	Tool number
		Insertion tool	5120-00-018-0531	MS27495A12
		Insertion tool	5120-00-171-6967	MS27495A20
		Extraction tool	5120-00-409-5206	MS27495R16
		Extraction tool	5120-00-146-6557	MS27495R22
		Extraction tool	5120-00-103-9708	MS27495R12
		Extraction tool	5120-00-177-6966	MS27495R20
		Positioner for MS3191 crimping tool	5120-00-016-7582	MS3191-9T
		Positioner for MS31 crimping tool	5120-00-017-3809	MS31
49	F, H	Wrench, open end, fixed, 3/4- and 7/8-inch	5120-00-240-5609	
50	F, H	Frame, hand hacksaw	5110-00-289-9657	
51	F, H	Blade, hand hacksaw	5110-00-277-4589	
52	C, H	Screwdriver, cross-tip no. 1, 8-inch	5120-00-529-3101	
53	H	Wrench, single socket spinner 1	5120-00-241-3188	
54	H	Wrench, combination, 5/32-inch	5120-00-132-0492	
55	F, H	Wire stripper	5120-00-278-2423	
56	H	Socket, nut, 1/4-inch for 1/4-inch drive	5120-00-236-2264	
57	F, H	Key, sockethead, L-type handle, 7/64-inch	5120-00-951-6589	
58	F, H	Wrench, torque screwdriver, 1/4-inch sq. drive	5120-00-890-7816	
59	F, H	Hex head driver, 7/64-inch, 1/4-inch drive	5120-00-761-2015	
60	F, H	Hex head driver, 3/1 1/4-inch drive	5120-00-935-4612	
61	F, H	Screwdriver, blade, 1/4 x 0.032 inch for 1/4-inch drive	5120-00-316-9228	
62	F, H	Mirror, inspection	5120-00-596-1098	
63	C, F, H	Carrier. battery	5120-00-529-4124/ 5120-00-223-8455	
64	C, F	Wrench, open end, fixed, 5/8-inch and 9/1	5120-00-187-7126	
65	F,H	Magnet	5120-00-545-4268	
66	F	Installation tool, insert		

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS - Continued

Ref. code	Maint. cat.	Nomenclature	National/NATO stock number	Tool number
67	F	Drill, twist, 11/32-inch dia.	5133-00-227-9664	
68	F, H	Wrench, strap		TG-70
69	F	Extractor, screw no. 5	Part of set 5120-00-610-1888	
70	H	Cable assembly, power (W211)		
71	F, H	Watch, stop		
72	C, F, H	Key, sockethead, 1/4-inch		

Section IV. REMARKS

Maintenance Allocation Chart

Reference code	Remarks
A	Replacing shock mounts also replaces the restraining straps
B	Servicing the IMU involves patching the outer thermal insulation
C	Testing by crew is accomplished by using PADS built-in test capabilities. Testing by Direct Support is accomplished by use of PADS built-in test capabilities, multimeter, and digital voltmeter. Testing by General Support is accomplished by use of STE equipment, multimeter, digital voltmeter, and oscilloscope
D	Replacement of failed IMUs must be accomplished by its matched memory
E	Alignment of the IMU at General Support requires a theodolite and target set in conjunction with a matched memory. Actual time of test and alignment does not include 8-hour calibration run which requires no operator intervention
F	Any repair action on the porro prism assembly must include realignment
G	Replacement of failed memory must be programmed to the IMU
H	Inspection of the circuit breaker by crew pertains only to the cover
I	Testing by crew is accomplished by operating equipment. It is not essential to replace until other failures are to be corrected by Direct Support
J	The PADS winterization kit consists of framing and installing a porro prism door in an already installed M151 1/4-ton utility truck winterization kit
K	For cleaning and replacement of fan guard assemblies, crew can remove computer and PADS power supply

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APPENDIX E
REPAIR PARTS AND SPECIAL TOOLS LIST

Refer to TM 5-6675-308-24P, or to TM 08837A-24P/3, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List for Position and Azimuth Determining System AN/USQ-70.

APPENDIX F
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

F-1. Scope. This appendix lists expendable supplies and materials required to operate and maintain the PADS. These items are authorized by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items.)

F-2. Explanation of Columns.

a. Column 1. Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., use cleaning compound, Item 5, App. F).

b. Column 2. Level. This column identifies the lowest level of maintenance that requires the listed item. (Enter as applicable):

C – Operator/Crew

O – Organizational Maintenance

F – Direct Support Maintenance

H – General Support Maintenance

c. Column 3. National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4. Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5. Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two- character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item number	(2) Level	(3) National stock number	(4) Description	(5) U/M
1	F, H		Adhesive, Silicone, Room Tem Curing RTV 156 (72799) or 30-079 (71984	TB
2	F, H		Adhesive, Rubber Base, General Purpose, MMM-A-1617, Type II	TB
3	F, H		Adhesive, Urethane, 724-14C (21109)	TB
4	C, F, H	6810-00-753-4993	Alcohol, Isopropyl TT-I-735	GL
5	C, F, H		Cloth, Lint-free	As required
6	C, F, H	8010-00-111-7937	Enamel, Alkyd, Camouflage, MIL-E-52798, color, forest green	GL
7	H		Insulation Sleeving, Electrical, Heat-Shrinkable, Polyolefin, Flexible, Cross-linked, MIL-I-23053/5A	As required
8	C, F, H		Lubricating Oil, General Purpose (0-196)	QT
9	F, H		Primer, Thread Sealant, MIL-S-22473	QT
10	H		Sealing Compound, Heat Conductive 340 (79184) or G641 (01139)	QT
11	F, H		Sealing Compound, Thread, MIL-S-22473, Grade C	QT
12	F, H		Sealing Compound, Thread, MIL-S-22473, Grade H	QT
13	C, F, H	6640-00-597-6745	Tissue, Lens (81448), NNNP40, Type I, Class 1	PKG
14	F, H		Wire: Gauges 12, 16, 20, 22, and 28	SP
15	F, H		Wire: Safety MS20995C20	SP
17	C	7510-01-020-2806	Correction Fluid, Type II	BT
18	F, H	3439-00-555-4629	Solder, rosin core	SP
19	F, H		Sealing Compound, Thread MIL-S-22473, Grade A	QT
20	C	6810-00-264 6618	Sodium Bicarbonate (Baking Soda)	BX
21	C, F, H		Lubricant, Solid Film, Air Drying, Corrosion Inhibiting, NATO Code Number S-749; MIL-L-23398C, Type II	CN
22	H		Adhesive, Epoxy 163-4LVFF (21	TB
23	H		Adhesive, Epoxy EC 2216 B/A (21	TB
24	H		Insulation Sleeving MIL-I-22 Size 22 NAT	As required

GLOSSARY

Section I. Definitions OF SPECIAL TERMS

A

ACCELEROMETER - A device which measures acceleration. The output is double integrated to determine change in distance.

AZIMUTH -Horizontal angle measured clockwise from true north (true azimuth), or from grid north (grid azimuth), to a line through an observed or designated point.

AUTOREFLECTION -A method of creating a perpendicular line by projecting an image of a theodolite sight to a reflecting porro prism, then back to the telescope.

B

BIT - Built-in test; normally, a test for proper functioning.

BITE - Built-in test equipment; components within an equipment which are used to conduct built-in tests.

E

EASTING - The east-west position (UTM grid).

F

FAULT INDICATOR - An indicator which allows an observer to see that the system concerned is functioning properly (black color), or malfunctioning (white color).

G

GYROSCOPE - A spinning wheel which tends to keep a fixed orientation in space. Used to sense rotation.

GYROCOMPASSING - A method used to find true north by sensing earth rotation.

H

HUB - A temporary traverse-station marker, usually of wood. The stake is driven flush with the ground with a tack or small nail on top to mark the exact point of reference for angular and linear measurements.

L

LOCAL VERTICAL - Coincident with gravity vertical.

M

MARK - The process of establishing the horizontal position and elevation of a point and/or azimuth of an orienting line using plumb bob or theodolite.

MIL - A unit of angular measurement equal to 1/6400 of 360°, or approximately 0°03.4’ of arc approximately equal to 1/1000 of the range.

N

NORTHING - The north-south position (UTM grid).

O

ORIENTING LINE - Line of known direction materialized on the ground.

P

PORRO PRISM - A prism which has two reflecting surfaces at right angles to each other.

S

SPHEROID - An earth spheroid model used for computing geodetic positions. Different models are used in various parts of the world. PADS can accommodate:

Clarke 1866
International
Clarke 1880
Everest
Bessel
Australian GRS 67
GRS 1980 WGS 84
Airy
Modified Airy
Modified Everest
WGS 72
Hough

U

UPDATE - Correction of PADS position by inputting known survey coordinates.

UTM -Universal Transverse Mercator -A rectangular coordinate system used for military mapping.

W

WITNESS STAKE — A stake driven into the ground at an angle usually with a piece of highly visible cloth attached. Used as an aid in recovery of a survey station or hub.

Z

ZERO-VELOCITY CORRECTION - A method to minimize PADS navigating errors. When the vehicle is stopped, PADS measures its velocity errors and the computer applies appropriate corrections to the accelerometer data.

ZONE NUMBER -The number which identifies each of the 60 UTM zones (each 6° of longitude). Zones are numbered consecutively eastward from the 180th meridian.

Section II. NONSTANDARD ABBREVIATIONS

ADZ	–	Adjacent Zone
AOV	–	Antenna on Vehicle
BATT	–	Battery
BIT	–	Built-in Test
C-E	–	Clear or Enter
CDU	–	Control and Display Unit
CEP	–	Circular Error Probable
CHRG	–	Charging
COMP	–	Computer
CUCV	–	Commercial Utility Cargo Vehicle
CUV	–	Commercial Utility Cargo Vehicle
DS	–	Fault Indicator
E	–	Easting
ENT	–	Enter
ESC	–	Equipment Serviceability Criteria
FOM	–	Figure of Merit
GAZ	–	Grid Azimuth
GPS	–	Global Positioning Satellite
HMMWV	–	High-Mobility Multipurpose Wheeled Vehicle
HUM	–	High-Mobility Multipurpose Wheeled Vehicle
ID	–	Identification Number
M151	–	Standard U.S. Army Jeep with Pintle Mount
N	–	Northing
OH-58	–	Helicopter
PADS	–	Position and Azimuth Determining System
PAE	–	Position, Azimuth, Elevation
PE	–	Probable Error
PLMB	–	Standard U.S. Army Jeep with PADS Plumb Bob Arm
PS	–	Power Supply
SCP	–	Survey Control Point
SEL	–	User Selected Data
SPH	–	Spheroid
SUSV	–	Small Unit Support Vehicle
SUV	–	Small Unit Support Vehicle
TAZ	–	True Azimuth
UH-1	–	Helicopter
UH-60	–	Helicopter
UPDT	–	Update
UTM	–	Universal Transverse Mercator
Z-VEL	–	Zero-Velocity Correction

Section III. SYMBOLS

∠ - Horizontal Angle

⊼ - Theodolite

INDEX

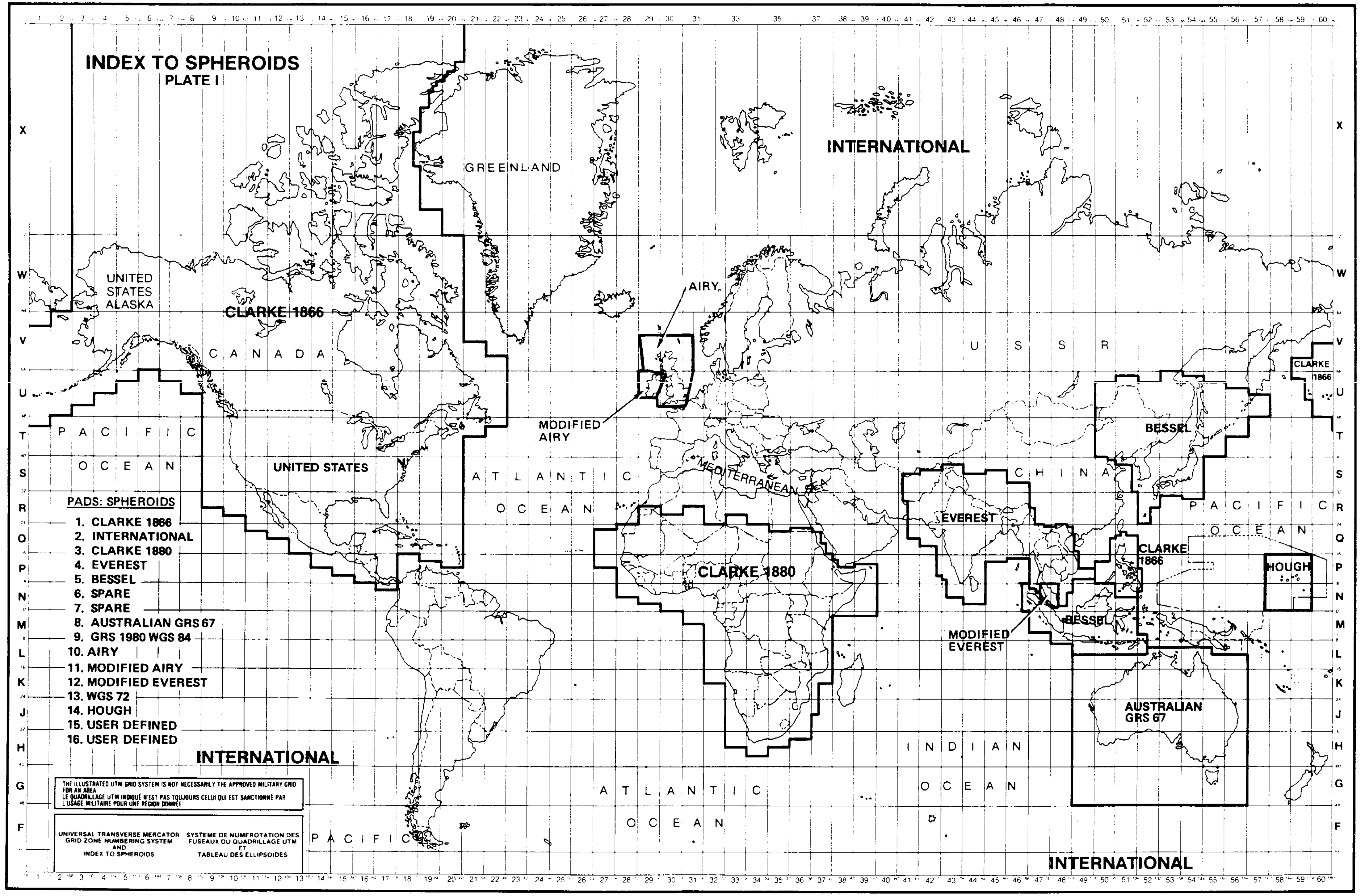
INDEX - Continued

INDEX - Continued

INDEX - *Continued*

INDEX - Continued

INDEX - Continued



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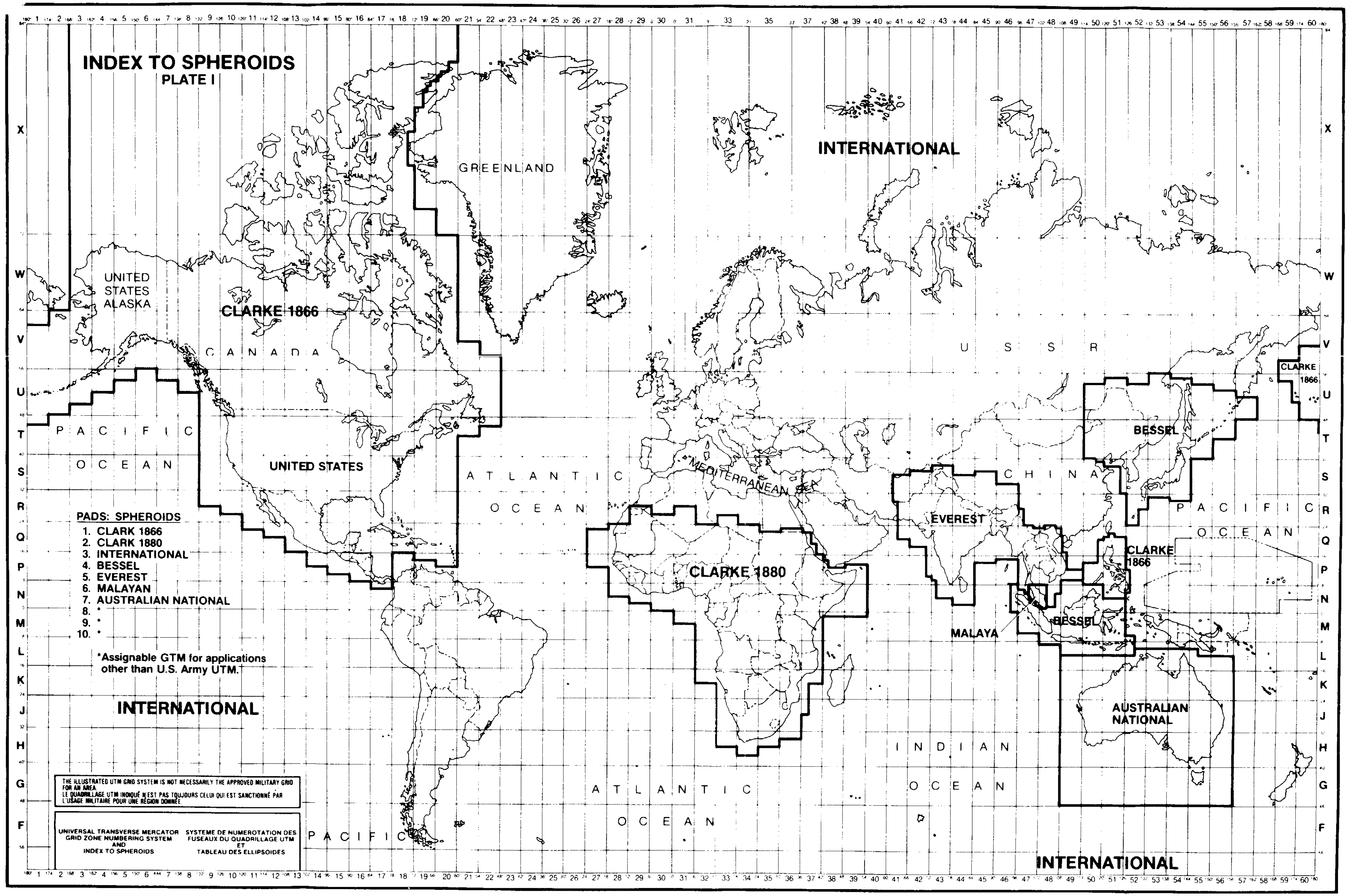

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General, United States Army
Chief of Staff

Official:

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Brigadier General, United States Army
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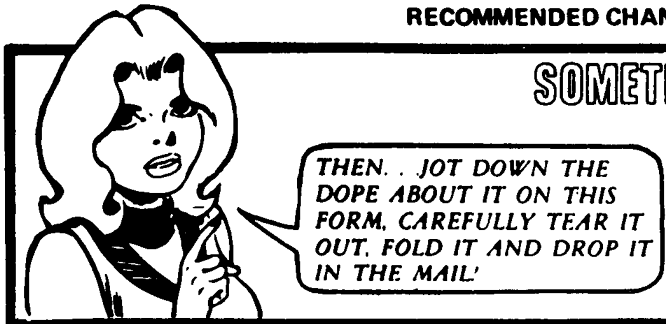

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket bit it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
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SIGN HERE John Doe
JOHN DOE

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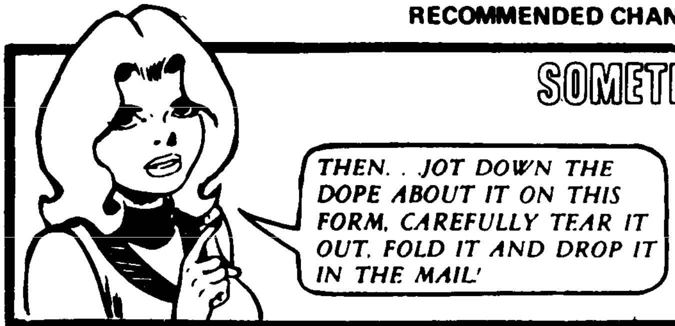

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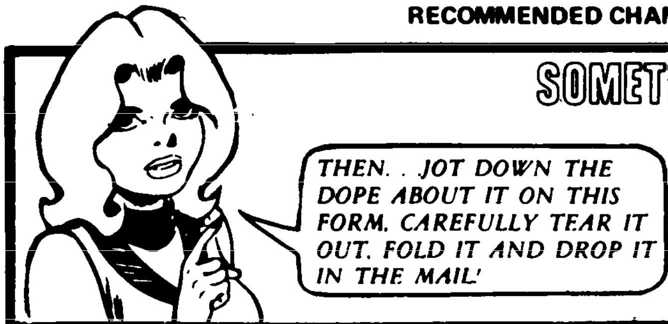

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 050147-000