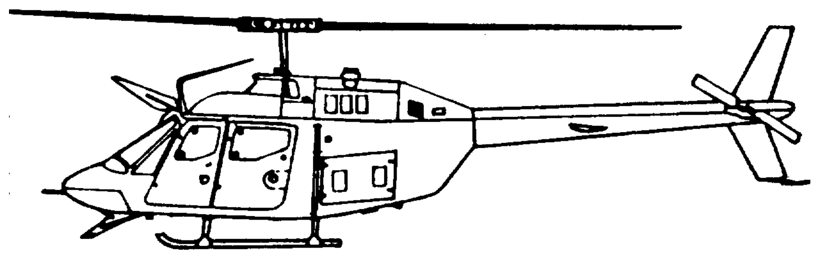
TM 55-1520-228-BD

TECHNICAL MANUAL

OPERATORS, AVIATION UNIT, AND AVIATION INTERMEDIATE MAINTENANCE



BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

HELICOPTER, OBSERVATION OH-58A & OH-58C

ITEM NSN INSIDE FRONT COVER

This publication supersedes TM 55-1520-228-BD dated 17 August 1990.

HEADQUARTERS, DEPARTMENT OF THE ARMY

4 January 1991

BDAR FIXES SHALL BE USED ONLY IN COMBAT
AT THE DISCRETION OF THE COMMANDER
AND SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES
AS SOON AS PRACTICABLE AFTER THE MISSION IS COMPLETED.

BDAR TECHNIQUES IN THIS MANUAL PERTAIN to the following helicopters:

OH-58A	Helicopter, Observation	NSN 1520-00-169-7137
OH-58C	Helicopter, Observation	NSN 1520-01-020-4216

WARNING DATA

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the general following warnings. Disregard of these warnings can cause serious injury or death.

WARNINGS

FLIGHT SAFETY

The standards contained herein allow aircraft to be flown with battle damage substantially in excess of peacetime limits. Under no circumstances shall this manual be used entirely or in part for peacetime maintenance of the aircraft. Assessment of aircraft battle damage requires extreme care and diligence and strict adherence to the instructions and standards contained in this manual. If at any stage of damage assessment the assessor believes that oversights or errors have been made, the assessment shall be stopped at that point and repeated from the beginning. Under no circumstances shall the requirements of this manual be waived or circumvented without the express approval of the commander or his designated representative.

EXPLOSIVES

Battle damaged areas should be inspected for unexploded ordnance before attempting repairs. Disposal of unexploded ordnance should be accomplished by qualified personnel.

ARMAMENT

Loaded weapons or weapons being loaded or unloaded shall be pointed in a direction which offers the least exposure to personnel or property in the event of accidental firing. Personnel shall remain clear of hazardous area.

CLEANING SOLVENTS

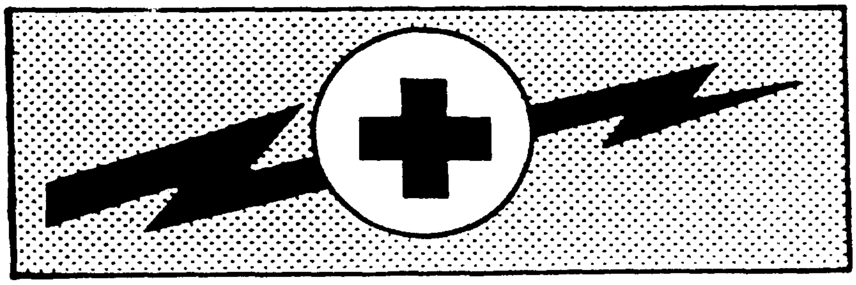
Cleaning solvents may be flammable and toxic. Use only in well-ventilated areas. Avoid inhalation of vapor and skin contact. Do not use solvents near open flame or in areas where very high temperatures prevail. Solvent flash point must not be less than 100°F.

COMPRESSED AIR

Compressed air can blow dust into eyes. Wear eye protection. Do not exceed 30 psig air pressure.

ELECTROLYTE

Battery Electrolyte (Potassium Hydroxide) is corrosive. Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.



HIGH VOLTAGE

is used in this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever the nature of the operation permits, keep one hand away from the equipment as to reduce the hazard of current flowing through vital organs of the body.

Do not be mislead by the term “low voltage.” Potentials as low as 50 volts may cause death under adverse conditions. For Artificial Respiration, refer to FM 21-11.

EXTERNAL STORES

Prior to any helicopter maintenance functions that require external stores be removed, JETTISON cartridge shall be removed. To prevent injury to personnel and damage to equipment, remove jettison cartridges from stores ejection device prior to placing helicopter in a hangar.

All ground safety pins must be removed before flight. Failure to do so will prevent emergency jettison of stores.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF_3BR) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns.

FUELING AND FUEL REPAIRS

When refueling helicopter, the refueling vehicle must be parked a minimum of 20 feet from the helicopter. Before starting the fueling operation, always insert fueling nozzle grounding cable of fuel truck into GROUND HERE receptacle. Refer to FM 10-68. When defueling, turn off all electrical switches and disconnect external power from the helicopter. The helicopter must be electrically grounded prior to defueling.

Fuel line and tank repairs often involve handling of highly flammable material. Mishandling can result in serious injury or death.

GROUNDING HELICOPTER

The helicopter should be electrically grounded when parked to dissipate static electricity. Turn off all power switches before making electrical connections or disconnections.

HIGH PRESSURE

Extremely high pressure can occur during and after operation of certain equipment. If this pressure is not relieved before working on this equipment, serious injury or death may occur. Be sure to open all drains and vents before beginning disassembly.

HYDRAULIC FLUID

Prolonged contact with liquid or mist can irritate eyes and skin. Wear rubber gloves when handling liquid. After contact with skin, inmmediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting, get immediate medical attention. If prolonged exposure with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

LIFTING

Lifting or moving heavy equipment incorrectly can cause serious injury. Do not try to lift or move more than 50 pounds by yourself. Bend legs while lifting. Do not support heavy weight with your back. Always use assistants during lifting operations. Use guide ropes to move hanging assemblies. Lack of attention or being in an improper position during lifting operations can result in serious injury. Pay close attention to movements of assemblies being lifted. Do not stand under lifted assembly or in a position where you could be pinned against another object. Watch your footing.

NOISE

Sound pressure levels in and around this aircraft during operating conditions exceed the Surgeon General's hearing conservation criteria, as defined in TB MED 501. Hearing protection devices such as aviator helmet or ear plugs are required to be worn.

RADIOACTIVE MATERIALS

Self-luminous dials and ignition units may contain radioactive materials. If such an instrument or unit is broken or becomes unsealed, avoid personal contact. Use forceps or gloves made of rubber or polyethylene to pick up contaminated material. Place materials and gloves in a plastic bag. Seal bag and dispose of it as radioactive waste in accordance with AR 708-1 and TM 3-261 (Refer to TB 43-0108). Repair shall conform to requirements in AR 385-11.

SANDING DUST

Sanding on reinforced laminated glass produces fine dust that may cause skin and lung irritations. Observe necessary protective measures.

STARTING HELICOPTER

Starting and operation of the helicopter will be performed only by authorized personnel.

TOXIC POISONS

Turbine fuels, lubricating oils, and adhesives contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary. Wear protective equipment.

CHANGE

NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 September 2005

TECHNICAL MANUAL

OPERATORS, AVIATION UNIT, AND AVIATION INTERMEDIATE MAINTENANCE

BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR HELICOPTER, OBSERVATION OH-58A & OH-58C

DISTRIBUTION STATEMENT A**:** Approved for public release; distribution is unlimited.

TM 55-1520-228-BD, dated 4 January 1991, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove Pages	Insert Pages
------------	A/(B blank)
i and ii	i and ii
1-5 and 1-6	1-5 and 1-6

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

Sandra R. Riley

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0518801

DISTRIBUTION:
To be distributed in accordance with Initial Distribution Number (IDN) 311704, requirements for TM 55-1520-228-BD.

LIST OF EFFECTIVE PAGES

Insert latest changed pages. Dispose of superseded pages in accordance with regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original .... 4 January 1991

Change 1......... 1 September 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 762. CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Cover	0
A through d	0
i	1
ii through ix	0
x blank	0
1-1 through 1-5	0
1-6	1
1-7 through 1-11	0
1-12 blank	0
2-1 through 2-9	0
2-10 blank	0
3-1	0
3-2 blank	0
4-1 through 4-70	0
5-1 through 5-6	0
6-1 through 6-12	0
7-1 through 7-8	0
8-1 through 8-12	0
9-1 through 9-17	0
9-18 blank	0
10-1	0
10-2 blank	0
11-1 through 11-49	0
11-50 blank	0
12-1 through 12-9	0
12-10 blank	0
13-1 through 13-14	0
14-1 and 14-2	0
15-1 through 15-11	0
15-12 blank	0
16-1	0
16-2 blank	0
17-1	0
17-2 blank	0
A-1	0
A-2 blank	0
B-1 and B-2	0
C-1 through C-4	0
D-1 through D-11	0
D-12 blank	0
E-1 and E-2	0
F-1 through F-22	0
Index-1 through index-5	0
Index-6 blank	0
Glos-1 through Glos-8	0

*Zero in this column indicates an original page.

Technical Manual

No. 55-1520-228-BD

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 4 January 1991

TECHNICAL MANUAL
OPERATORS, AVIATION UNIT, AND AVIATION INTERMEDIATE MAINTENANCE
BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR
FOR HELICOPTER, OBSERVATION OH-58A & OH-58C

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 these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

Distribution Statement: Approved for public release; distribution is unlimited.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont)

LIST OF ILLUSTRATIONS (Cont)

LIST OF ILLUSTRATIONS (Cont)

LIST OF TABLES

LIST OF TABLES (Cont)

HOW TO USE THIS MANUAL

This manual is developed to assist the soldier in a battlefield environment to make assessment and repair of damage to the OH-58 helicopter which cannot, due to asset availability or environmental factors, be repaired in the normal prescribed manner. Within this technical manual, the word shall is used to indicate a mandatory requirement. The word should is used to indicate a nonmandatory but preferred method of accomplishment. The word may is used to indicate an acceptable method of accomplishment.

1. Organization of the Manual. This manual contains a general information chapter (chapter 1), a general assessment chapter (chapter 2), and specific repair chapters (chapters 4 thru 19). Chapter 3 is not used. It also contains five appendices. References (Appendix A), special or fabricated tools (Appendix B), expendable/durable supplies and materials list (Appendix C), substitute materials and parts (Appendix D), and BDAR fixes authorized for training (Appendix E).

2. Chapter 2 is used to assess the helicopter in general and references specific chapters for detailed repair procedures of the major functional groups. The major functional groups correspond with the functional groups of the -23 series manuals that are employed in routine repairs to the helicopter.

3. Chapter 3 is not used in this manual. It would normally contain repairs for equipment which does not fall under one of the standard helicopter functional groups.

4. Each functional group chapter is organized as follows:

a. Section I - Introduction.

(1) Scope. Purpose of the chapter.
(2) Assessment procedures. General assessment information for the repairs covered therein.
(3) Repair procedure index.

b. Section II - Repair Item. A subsection is included for each repair item covered in that functional group. It contains the following:

(1) General. About the nature and cause of damage and repair.
(2) Item and trouble statement with:

(a) Limits given.
(b) Personnel and time required to effect repairs.
(c) Materials and tools needed.
(d) Procedural steps to accomplish the repair.

(3) If more than one method of repair can be used, the various options will be included next.

NOTE

The first option is the preferred choice, the second option is the next preferred, etc. Selection of the option should be the most preferred method possible under the circumstances and with the available materials and manpower.

HOW TO USE THIS MANUAL (Cont)

5. Finding Repairs in this Manual.

a. When the damage is obvious and known, find the functional group chapter of which the damaged item is a part. Turn to the repair procedure index, section I, subparagraph c of each chapter to locate the item being repaired. Then turn to the repair section and review each option to ascertain the appropriate fix. Read the entire section for the option, then effect the repairs following the procedures given.

b. When the damage is hidden and/or unknown, follow the overall assessment procedures provided in chapter 2, and follow the procedures and directions provided.

6. Preparation.

a. Each mechanic/technician shall have read chapters 1 and 2 and become familiar with the repairs and layout of the manual prior to attempting to accomplish BDAR repairs.

b. All warnings, cautions, and safety precautions shall be followed, inasmuch as possible, at all times during BDAR procedures so as not to further damage and/or jeopardize either personnel or the equipment during or subsequent to the BDAR action. Ensure all documentation is completed as directed in this manual and by local command.

7. Expendable/Durable Supplies and Materials.

a. Each fix or repair option contains a short listing of materials and tools considered basic to the repair. It is important to note that the expendable materials listed usually cover a wide range for any one item.

Example: **MATERIALS/TOOLS REQUIRED:**

- Drill with Bit
- Sheet Metal (items 131-142, Appx C)
- Rivets (items 98-115, Appx C)

In this example, sheet metal covers the range of items 131 thru 142 in Appendix C. This means that, depending on the circumstances and location of the fix, any one of these metals could be used. Likewise any one of the rivets, items 98 thru 115, may be used to attach the patch plate depending on the application.

b. One of the key points concerning successful BDAR repairs is flexibility. The users of this manual should strive to use the items on hand, provided a safe repair is made. The stringent requirements of normal maintenance may be lifted.

CHAPTER 1

GENERAL INFORMATION

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

1-1. PURPOSE. The purpose of Battle Damage Assessment and Repair (BDAR) is to quickly return the disabled helicopter to the operational commander by expediently fixing, bypassing, or jury-rigging components to restore the minimum essential systems required for the support of the specific combat mission for self-recovery. These repairs will be temporary and may not restore full performance capability. Standard repair will be completed as soon as practical.

1-2. SCOPE.

a. This technical manual (TM) describes BDAR procedures applicable to OH-58 helicopter series, and these procedures are to be used by crew, operators, aviation unit maintenance (AVUM) teams, and aviation intermediate maintenance (AVIM) support teams.

b. Standard repair techniques for the OH-58 helicopter are included in other technical manuals which are referenced in Appendix A of this TM. Details of these procedures are not duplicated in whole in this TM. If the repairs are more than one page in length, the repairs may only be referenced in appropriate chapter.

c. All possible types of combat damage and failure modes cannot be predicted, nor are all effective field expedient repairs known. This TM provides guidelines for assessing and repairing battlefield failures of OH-58 helicopters and is not intended to be a complete catalog of all possible emergency repairs. The repairs described here will serve as guidelines and will stimulate the experienced mechanic/operator to devise repairs as needed to rapidly return equipment to operation in a combat situation.

d. The direct replacement of a piece of equipment by its spare, even under battlefield conditions, is not a BDAR fix and may not be covered is in this TM. A standard procedure should be performed in preference to a BDAR fix when time and spares are available.

1-3. APPLICATION.

a. The procedures in this manual are designed for battlefield environments and should be used in situations where standard maintenance procedures are impractical. These procedures are not meant to replace standard maintenance practices, but rather to supplement them strictly in a battlefield environment. Standard maintenance procedures will provide the most effective means of returning damaged equipment to ready status provided that adequate time, replacement parts, necessary tools, and trained/qualified repair persons are available. BDAR procedures are only authorized for use in an emergency situation in a battlefield environment, and only at the direction of the commander. They are not to be continued after the equipment is out of the battle environment.

b. BDAR techniques are not limited to simple restoration of minimum functional combat capability. If full functional capability can be restored expediently with a limited expenditure of time and assets, it will be accomplished.

c. Some of the special techniques in this manual, if applied, may result in shortened life or in further damage to major components of the helicopter. The commander must decide whether the risk of having one less helicopter available for combat outweighs the risk of applying the potentially destructive expedient repair technique. Each technique gives appropriate warnings, cautions, and lists systems limitations caused by this action.

1-4. DEFINITIONS.

a. Battlefield Damage. Any incident such as combat damage, random failures, operator errors, accidents, and wear-out failures which occur on the battlefield and which prevent the helicopter from accomplishing its mission.

b. Repair or Fix. Any expedient action that returns a damaged part or assembly to a full or an acceptably degraded operating condition, including:

(1) Short cuts in parts removal or installation.

(2) Installation of components from other equipment that can be modified to fit or interchange with components on the damaged equipment.

(3) Repair using parts that serve a noncritical function elsewhere on the same equipment for the purpose of restoring a critical function.

(4) Bypassing of noncritical components in order to restore basic functional capability.

(5) Expeditious cannibalization procedures.

(6) Fabrication of parts from kits or readily available materials.

(7) Jury-rigging.

(8) Use of substitute materials.

c. Damage Assessment. A procedure to rapidly determine what is damaged, whether it is repairable, what assets are required to make the repair, who can do the repair (e.g., crew, maintenance team or maintenance support team), and where the repair should be made. The assessment procedure includes the following steps:

(1) Determine if the repair can be deferred, or if it must be done.

(2) Isolate the damaged areas and components.

(3) Determine which components must be fixed.

(4) Prescribe fixes.

(5) Determine if parts or components, materials, and tools are available.

(6) Estimate the manpower and skill required.

(7) Estimate the total time (clock hours) required to make the repair.

(8) Establish the priority of the fixes.

(9) Decide where the fix shall be performed.

(10) Decide if recovery or evacuation is necessary and to what location.

d. Fully Mission Capable (FMC). The helicopter can perform all its combat missions. To be FMC, the helicopter must be complete and fully operable with no faults listed in the aircraft inspection and maintenance record as prescribed in DA PAM 738-751.

e. Combat Capable. Equipment meets the minimum functional combat capability requirements. (See paragraph 1-8.)

f. Combat Emergency Capable. The equipment meets the needs for specific tactical missions; however, all systems are not functional. Also, additional damage due to the nature of an expedient repair may occur to the equipment if it is used. The commander must decide if these limitations are acceptable for that specific emergency situation.

g. Cannibalization or Controlled Exchange. Throughout this manual, cannibalization and controlled exchange are used interchangeably meaning the removal of an item of materiel from one piece of equipment for immediate use in another. Generally the rules for cannibalization/controlled exchange provided in TM 55-1500-328-25, as modified by local authority, will prevail.

h. Evacuation. A combat service support function which involves the movement of recovered helicopters from a main supply route, maintenance collection point, or maintenance activity to higher categories of maintenance. The materiel may be returned to the user, to the supply system for reissue, or to property disposal activities.

i. Recovery. The retrieval of immobile, inoperative, or abandoned OH-58 helicopter from the battlefield or immediate vicinity, and its movement to a maintenance collection point, the main supply route, or a maintenance activity for disposition, repair, or evacuation.

j. Self-Recovery. The ability of a battle damaged helicopter to retrieve itself (fly out) from a battlefield environment. It usually will involve flying with degraded flight status and with restrictions and limitations placed on performance characteristics such as limitations placed on weight, airspeed, engine torque, and other characteristics. In BDAR repairs, the limitations recommended should be followed. Emergency flight procedure in TM 55-1520-228-10 should further be consulted.

k. Maintenance Collection Point. A point operated by AVIM unit for the collection of equipment for repair.

l. Maintenance Support Team (MST). A team of AVIM mechanics and technical specialists who are trained in assessing battlefield damage and field repair procedures.

m. Maintenance Team (MT). Helicopter crew chief or AVUM mechanics/technicians who are trained in assessing battlefield damage and field repair procedures.

1-5. QUALITY DEFICIENCY REPORT/EQUIPMENT IMPROVEMENT RECOMMENDATION (QDR/EIR). If your helicopter and its equipment need improvement, let us know: Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-QF, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. We'll send you a reply.

Section II. STANDARDS AND PRACTICES

1-6. BDAR CHARACTERISTICS. BDAR capability requires simplicity, speed, and effectiveness. Some BDAR procedures include repair techniques that violate standard peacetime maintenance practices. In a combat emergency situation, greater risks are sometimes necessary and acceptable.

1-7. WAIVER OF PRECAUTIONS. Under combat conditions, BDAR may be performed on helicopters which are in flight or which are under power while on the ground. While some of these BDAR actions may require waiving of safety precautions, the cautions to protect personnel life should not be overlooked. Other similar precautions may be waived at the discretion of the commander. BDAR fixes may be required in a chemically toxic environment or under other adverse battlefield conditions with severe limitations in personnel, facilities, equipment, and materials. Performance of repair tasks may be necessary while wearing protective gear. Decontamination procedures are described in FM 3-5.

1-8 OPERATING CHARACTERISTICS. This manual covers expedient repairs for the OH-58 helicopter and its components. It is entirely possible that in a combat situation, the helicopter having undergone one or more repairs may suffer degradation of its normal operating characteristics (e.g., reduced speed, reduced load capability, reduced range, etc.), and still be able to carry out all or parts of an assigned mission. The minimum functional combat capability (MFCC) criteria for the OH-58 is as follows:

a. Flight Capability for Mission Completion. Helicopter's flight characteristics degraded to a minimum of combat capable (CC).

(1) Sufficient power delivered to main and tail rotor to accommodate lift capability for helicopter crew and cargo.

(2) No fuel leaks which will curtail the intended length of flight.

(3) No degradation of any component/system which will end in failure and curtailment of intended mission.

(4) Communications. Must have intercom communications within aircraft and at least two tactical receiver-transmitter (R-T) units operating at full capability.

NOTE

Criteria may be waived for recovery or if the tactical situation demands otherwise.

b. Flight Capability for Self-Recovery Capability (SRC).

(1) Must have power delivered to main and tail rotor at acceptable limits.

(2) Maximum engine torque:

80% at 0 kts
64% at 16 kts
53% at 32 kts
50% at 50 kts

(3) Lift capability for crew members. Unload unnecessary weight.

(4) Flight controls at minimum function level acceptable for flight.

(5) Instruments/avionics as required to meet mission needs.

(6) Maximum airspeed of 50 kts.

(7) Maximum flight duration of 2 hours. Consideration will be given to minimize flight duration.

(8) Be prepared for emergency procedures. See TM 55-1520-228-10, Chapter 9.

WARNING

Careful consideration shall be given to the operation of the Identify Friend or FOE (IFF), Mode 4, avionics system. Failure of the IFF or failure to properly communicate with area air defense command prior to liftoff could result in an attack from friendly forces due to mistaken identity.

1-9. TRAINING.

a. BDAR by its nature involves fixes, bypasses, and/or jury-rigging, which is outside authorized standard repairs, and may degrade the inherent safety of the helicopter. Therefore, BDAR actions are not intended to supplement, replace standard maintenance practices during peacetime, nor should they be employed indiscriminately to facilitate training.

b. Repairs described in this manual, which can be appropriately accomplished in order to provide training, are listed in Appendix E and are highlighted in each repair chapters repair procedure index. The trainable repair in the index will be blocked in.

Section III. TASKS AND RESPONSIBILITIES

1-10. TAGGING/IDENTIFYING BDAR REPAIRS.

a. All damage will be identified on aircraft inspection and maintenance record, DA Form 2408-13 and DA Form 2408-18, as per DA PAM 738-751. See Figures 1-1, 1-2.

b. Recording of BDAR repairs and the use of status symbols, as defined in DA PAM 738-751, will be completed as soon as practical to indicate any limitations and restrictions or required standard repairs.

c. In addition to recording all damage, the area damaged will be marked on aircraft or component part using damage assessment markings as shown in Figure 1-3.

d. Status Symbols. Status symbols used in aircraft logbooks to record defects are defined below.

(1) Red “X.” A red “X” shows that a defect exists and the aircraft is unsafe for flight.

(2) Circled red “X.” A red “X” inside a red circle indicates a limiting defect. The aircraft may be flown under specific limits as directed by higher authority, or as directed locally until corrective action is taken.

(3) Red horizontal dash (-).

(a) This symbol indicates an inspection, special inspection, component replacement, maintenance operational check, or test flight is needed. The symbol is also used to indicate that a normal modification work order (MWO) is overdue.

(b) This symbol also shows that the condition of the equipment is unknown. A potentially dangerous condition may exist. The condition will be corrected as soon as possible.

(4) Red diagonal (/). This symbol indicates a defect exists that is not serious enough to ground the aircraft.

e. Maintenance of Forms. Instructions for the maintenance of forms, records, and reports are listed in DA PAM 738-751 and TB 55-1500-307-24. When battle damage assessment and repair (BDAR) becomes necessary, the procedures in DA PAM 738-751 will apply. Refer to Figures 1-1 and 1-2 for examples.

(1) In block 17 of DA Form 2408-13, list the fault.

(2) In block 16 of DA Form 2408-13, enter the status symbol.

(3) In block 18 of DA Form 2408-13, enter the corrective action taken.

(4) The individual completing the repair will sign the form in block 19 opposite the first line of the action taken, and will place his last name initial over the status symbol in block 16.

f. Temporary Repair. If the repair is temporary, take the following additional action:

(1) In block 18 of DA Form 2408-13, enter the corrective action and a statement that the repair is temporary. Then make an entry in DA Form 2408-14, block b. The entry will be a duplicate of the entry in block 17 of DA Form 2408-13 to include a statement that a temporary repair has been made.

NOTE

Faults with status symbol of red "x", or circle red "x" will not be entered on DA form 2408-14.

(2) If the temporary repair limits the capability of the aircraft, the following entry will be made on DA Form 2408-13:

(a) Place a circled red “X” in block 16.

(b) State the limitation in block 17.

(3) If the temporary repair requires an inspection at intervals, list the required inspection on DA Form 2408-18.

(a) Enter item to be inspected in block 5.

(b) List the applicable TM in block 6.

(c) State the frequency of the inspection in block 7.

1-11. REPORTS. All written reports required for BDAR fixes are found in DA PAM 738-751. If the helicopter can no longer fly, the aircraft commander should immediately initiate an out-of-action report to his superior. If communications capability is damaged, the aircraft commander should approach the nearest friendly radio and make his report if possible. The report should include these essentials:

a. Aircraft damage (out-of-action or function partially impaired).

b. Location of aircraft.

c. Defense status.

d. Mobility.

e. Personnel report.

f. Current and anticipated hostile action.

g. Anticipated BDAR fixes and repair time.

1. DATE	2 MODEL	3. SERIAL NO.	4 NAME OF CREW CHIEF/MECHANIC	5 STATION	6 PAGE NO.	6a NO. OF PAGES

7 STATUS TODAY						
AIRCRAFT				ELEC-TRONIC	ARMA-MENT	OTHER
1		4				
2		5				
3		6				

8 AIRCRAFT TIME	
TIME TO DATE	
TIME TO-DAY	
TOTAL TIME	

9 NEXT INSPECTION DUE	
INTMED NO.	
P.E. NO.	
OTHER	

	HOT STARTS		LANDINGS	OTHER
	NO.1 ENGINE	NO. 2 ENGINE	*b*	*c*
PREVIOUS				
TODAY				
TOTAL				

11	FUEL (Gals or Lbs)			12 OIL (Quarts)						13	14	15 SERVICED	
SERV-ICE NO.	GRADE	ADDED	TOTAL IN TANKS	GRADE	ADDED NO. 1 ENG	TOTAL IN TANKS	ADDED NO. 2 ENG	TOTAL IN TANKS	APU	OXYGEN	ANTI-*ICING* FLUID (Gals)	BY	STATION
1													
2													
3													
4													
5													
6													
7													
TOTAL													

16 STATUS	17 FAULTS AND/OR REMARKS	18. ACTION TAKEN	19 SIGNATURE

DA FORM 2408-13, 1 DEC 66 REPLACES EDITION OF 1 JAN 64, WHICH WILL BE USED

AIRCRAFT INSPECTION AND MAINTENANCE RECORD
For use of this form see DA PAM 738-751, the proponent army is DCSLOG

Figure 1-1. DA Form 2408-13

1. NOMEN CLATURE	2. MODEL	3. SERIAL NUMBER	4. PAGE NO. NO. OF PAGES

5. ITEM TO BE INSPECTED	6. REEFERENCE	7. FREQUENCY	8. NEXT DUE

DA FORM 2404.18. 1 JAN 64

EQUIPMENT INSPECTION LIST
For use of this form, see TM 38-750; the proponent agency is DCSLOG.

Figure 1-2. DA Form 2408-18

MEANINGS | **MARKINGS**

TO INDICATE DAMAGE HAS BEEN ASSESSED AND EVALUATED:

Draw a circle around the damage.

TO INDICATE NO BDAR REPAIR REQUIRED:

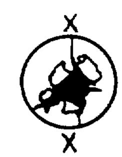
Write "OK" inside the circle.

TO INDICATE STRUCTURAL REPAIRS ARE REQUIRED:

Draw a second line about 1/4 to 1/2 way around the initial circle then draw slashes or crosshatch between the two circular lines.

STRINGER REPAIR: Place an X to the left and right of the circle.

FRAME REPAIR: Place an X above and below the circle.



TO INDICATE DAMAGE TO SYSTEMS REQUIRING REPAIRS:

Draw a series of "curly cue" lines about 1/4 to 1/2 way around the initial circle.

TO INDICATE REPAIR INSTRUCTIONS:

For internal damage - draw a dashed circle around the repair instructions.

REPAIR INSTRUCTIONS

For external damage - write repair instructions but do NOT enclose with a circle.

REPAIR INSTRUCTIONS

PARTIAL

Figure 1-3. Damage Assessment Markings (Sheet 1 of 3)

WRITTEN INSTRUCTIONS	**MEANING**
See me - print name & rank. (Signature)	See assessor or whoever has signed written instructions for additional information.
Names of parts to be repaired, (item, skin, stringer.	Where compound damage occurs, the names or abbreviations of specific items can be written adjacent to the damage to clarify repair instructions.
Full	A full strength repair is required.
Partial	Partial strength repair required in accordance with specific aircraft BDAR manual.
OK	No repairs required - damage is within acceptable limits for battle conditions.
?	Continual assessment or reinspection is required after each sortie.

Instruction markings for system are in two parts:

(1) Repair instruction markings and meanings are shown on this sheet and are used to indicate repair actions required.

(2) System Identification - When known, identify the system using markings shown on sheet 3 of this figure.

MARKINGS	**MEANING**
Fix	Repair the damaged system in accordance with approved standard BDAR techniques for type of system, item, high pressure, low pressure, etc.
Cap	Terminate or block the system to prevent leakage.
Repl	Replace damaged part - repairs not acceptable.
OK	No repairs required.
Tag	Repair instructions are written on tags tied to individual damaged lines/components.

Figure 1-3. Damage Assessment Markings (Sheet 2 of 3)

System identification markings are primarily abbreviations of the system.

MARKINGS	**SYSTEM/MEANING**
Sys	Damage to unknown system.
Fuel	Fuel
Hyd	Hydraulic
HP	High Pressure
LP	Low Pressure
Elect	Electrical
AV	Avionics
Flt Cont	Flight Control
Main Rotor	Main Rotor Group
Tail Rotor	Tail Rotor Group
Air	Pneumatic
Air Cond	Air Conditioning
BL Air	Bleed Air System
BLC	Boundary Layer Control
N_2	Nitrogen
O_2	Oxygen
Eng Contr	Engine Control
Pow Tr	Power Train
EJ	Ejection

NOTE

More than one identification marking may be used to describe the system (e.g., HP, Hyd).

Figure 1-3. Damage Assessment Markings (Sheet 3 of 3)

CHAPTER 2

ASSESSING BATTLEFIELD DAMAGE

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

2-1. SCOPE.

a. This chapter provides guidelines to use in assessing battlefield damage to the OH-58 helicopter. It directs you to an expedient BDAR fix or to the standard system fix of TM 55-1520-228-23-1,2 if an expedient BDAR repair does not exist. General decision logic chart, Table 2-1, assists in BDAR discussions.

b. Each chapter will have a specific fault assessment chart for each functional group and this flow chart will direct you to specific BDAR fixes for and within the functional group.

c. Use the following guidelines to find and fix sustained damage or suspected damage to your helicopter. Keep in mind that damage can be sustained while on the ground or in flight. The helicopter location can have a considerable effect on the assessment. The following appraisal shall be accomplished.

(1) If possible and time permits, inspect and check the helicopter using operator's check list (CL), operator's manual (-10), and other records and forms kept in aircraft log book. At the same time be looking for obvious damage to aircraft.

(2) If applicable and possible, use standard troubleshooting recommendations in TMs.

(3) If you find a problem, determine its effect on helicopter's mobility and capability.

(4) If you cannot fix the problem with standard fixes, apply this TM and use general and specific assessment tables, charts, and BDAR action.

(5) If the damage does not affect aircraft's flying status, the aircraft or flight commander will decide whether to fix or defer fix, and continue or start mission.

(6) If damage does affect flight status, do one of the following:

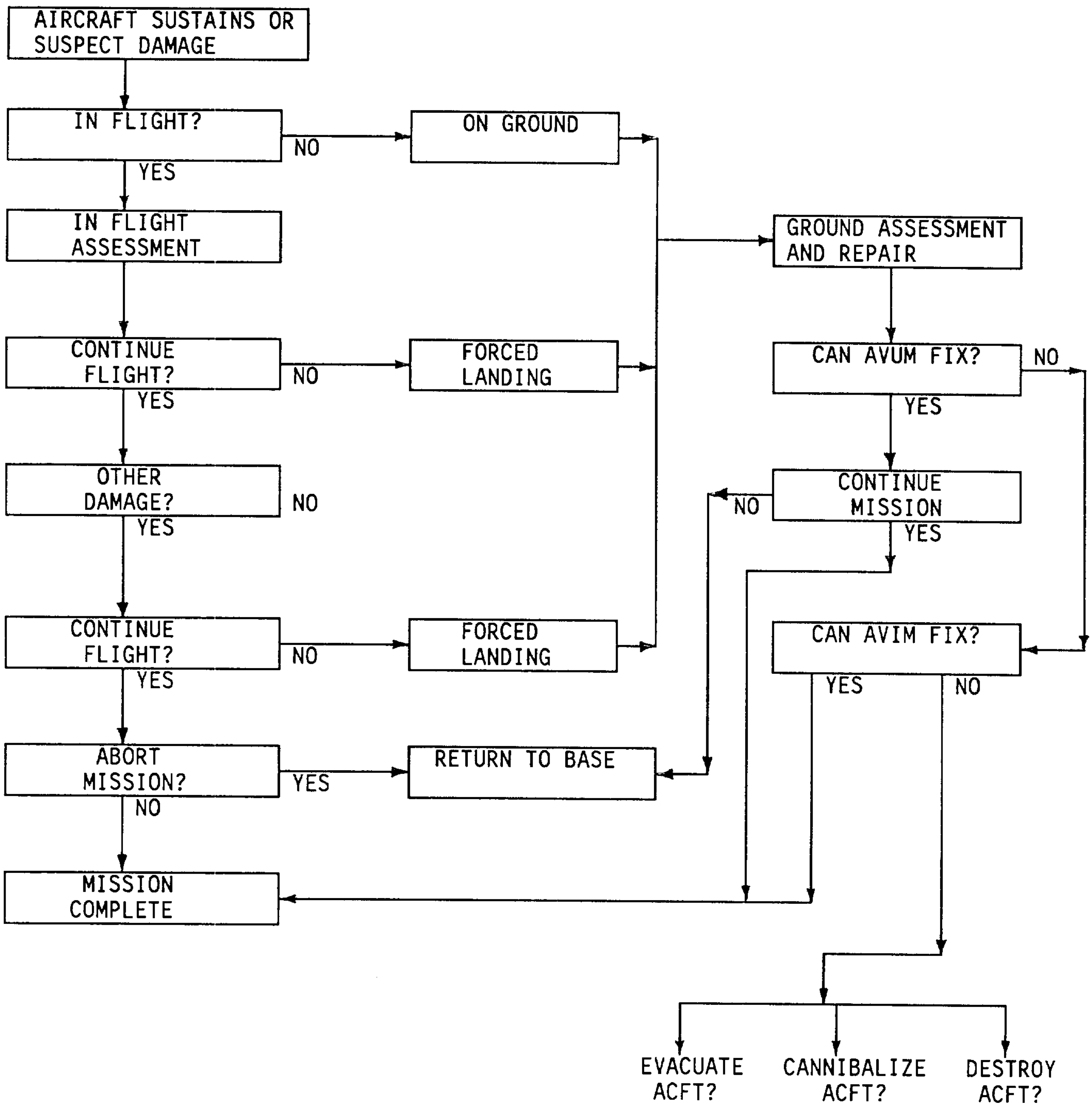
(a) Replace damaged part with a serviceable part.

(b) Replace damaged part with suitable substitute if it exists.

(c) Apply a BDAR fix.

(7) After repairing the damage, replace all lost fluids/lubricants. If one specified by aircraft TM is not available, refer to Appendix D for alternative materials/parts.

Table 2-1. General Decision Logic



SEE TM 55-1520-328-25

d. General aircraft assessment charts, Table 2-1, guide you through the aircraft's capability so that all the necessary capabilities are evaluated. If a fault is found, Table 2-1 directs you to the chapter for the functional group which contains the fault. The BDAR assessment procedure will refer you to a guide fix in this manual, a standard TM 55-1520-228-23 repair if it is feasible, or a higher AVIM level of repair if extent of damage, time constraint, tooling requirements, repair part or material, and any other necessary requirements are only available at a higher level of maintenance.

Section II. GENERAL FAULT ASSESSMENT TABLE

2-2. GENERAL FAULT ASSESSMENT TABLE. Refer to Table 2-2 for assessment logic flow chart.

Table 2-2. General Assessment

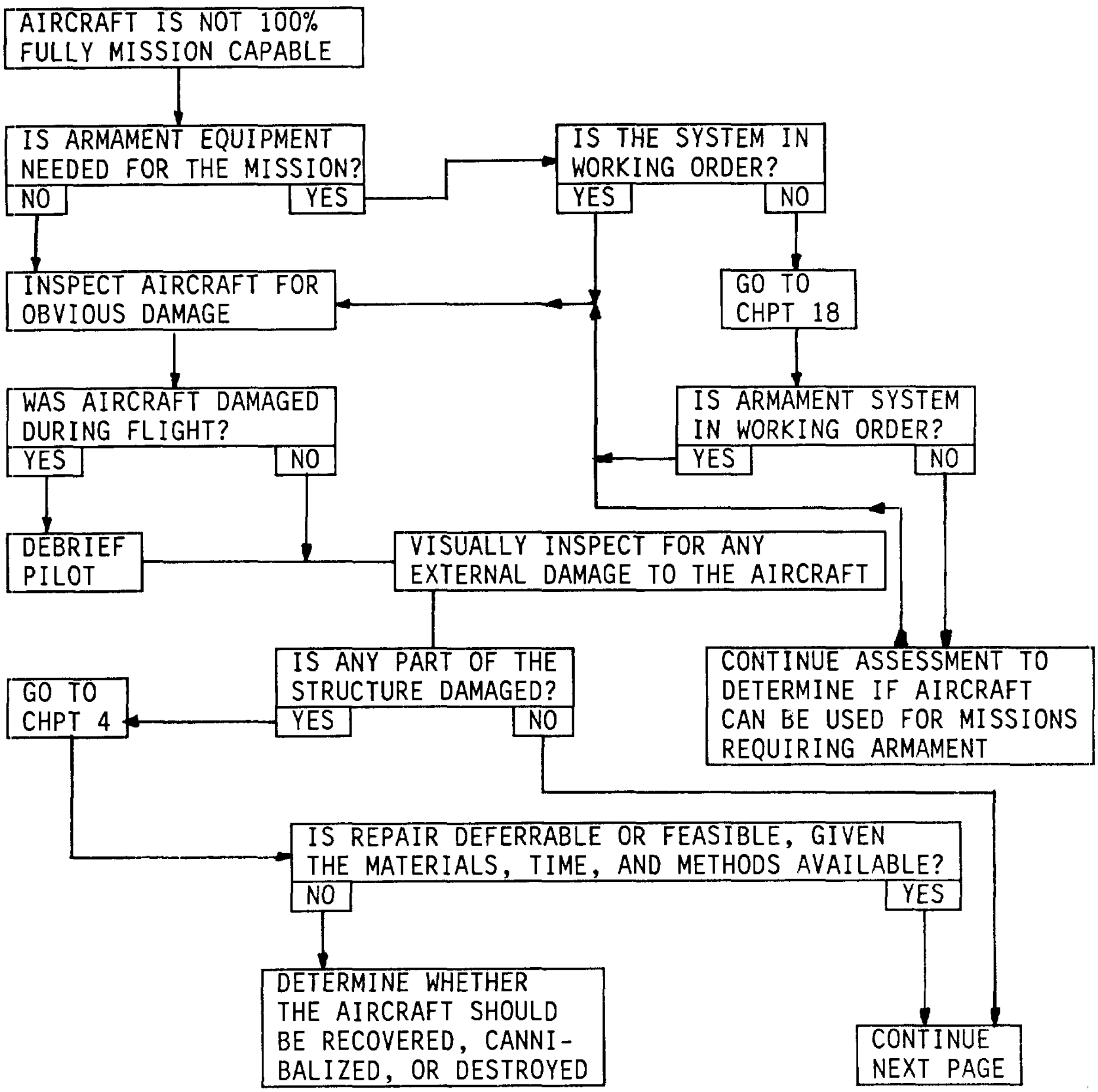


Table 2-2. General Assessment (Cont)

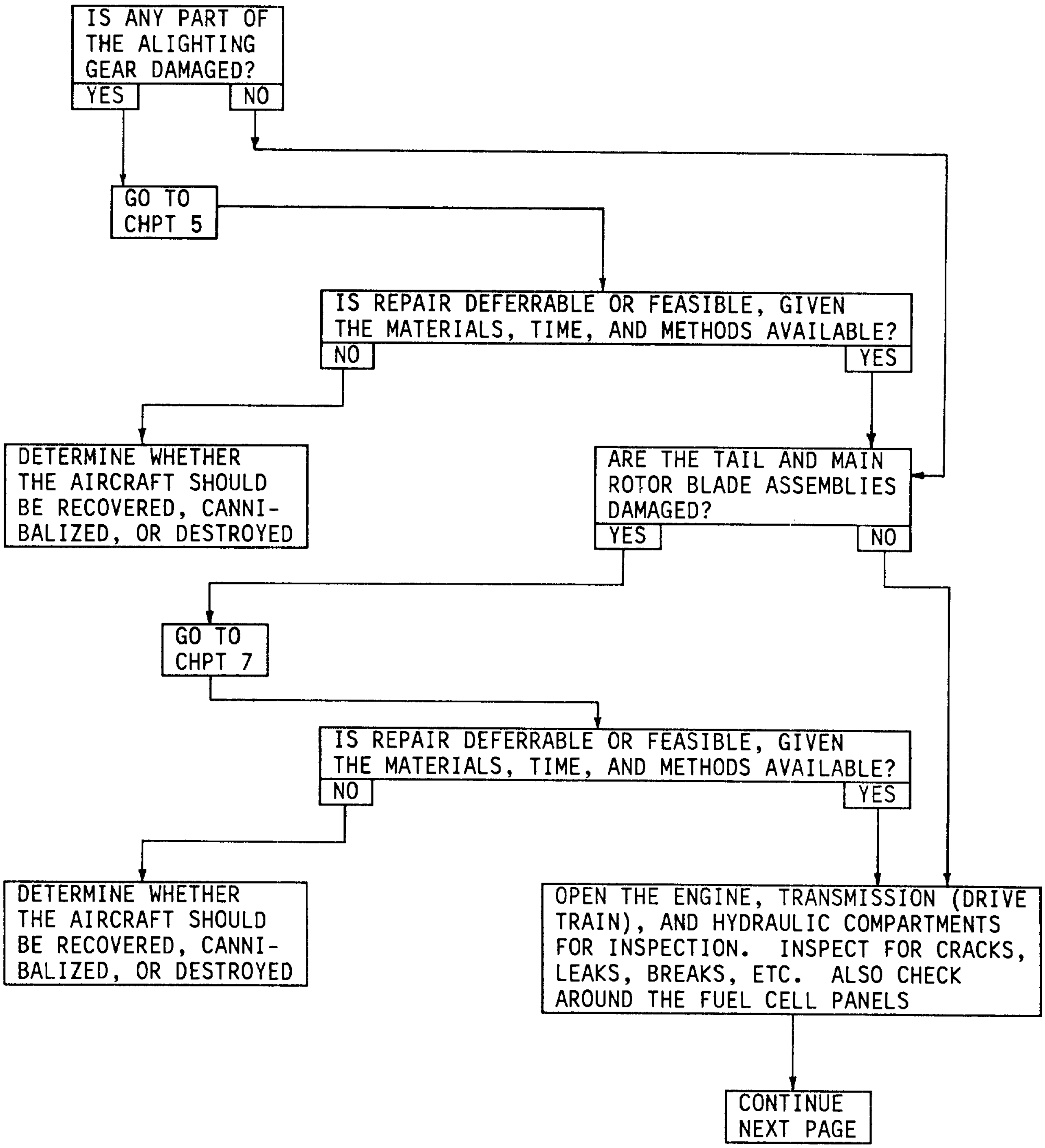


Table 2-2. General Assessment (Cont)

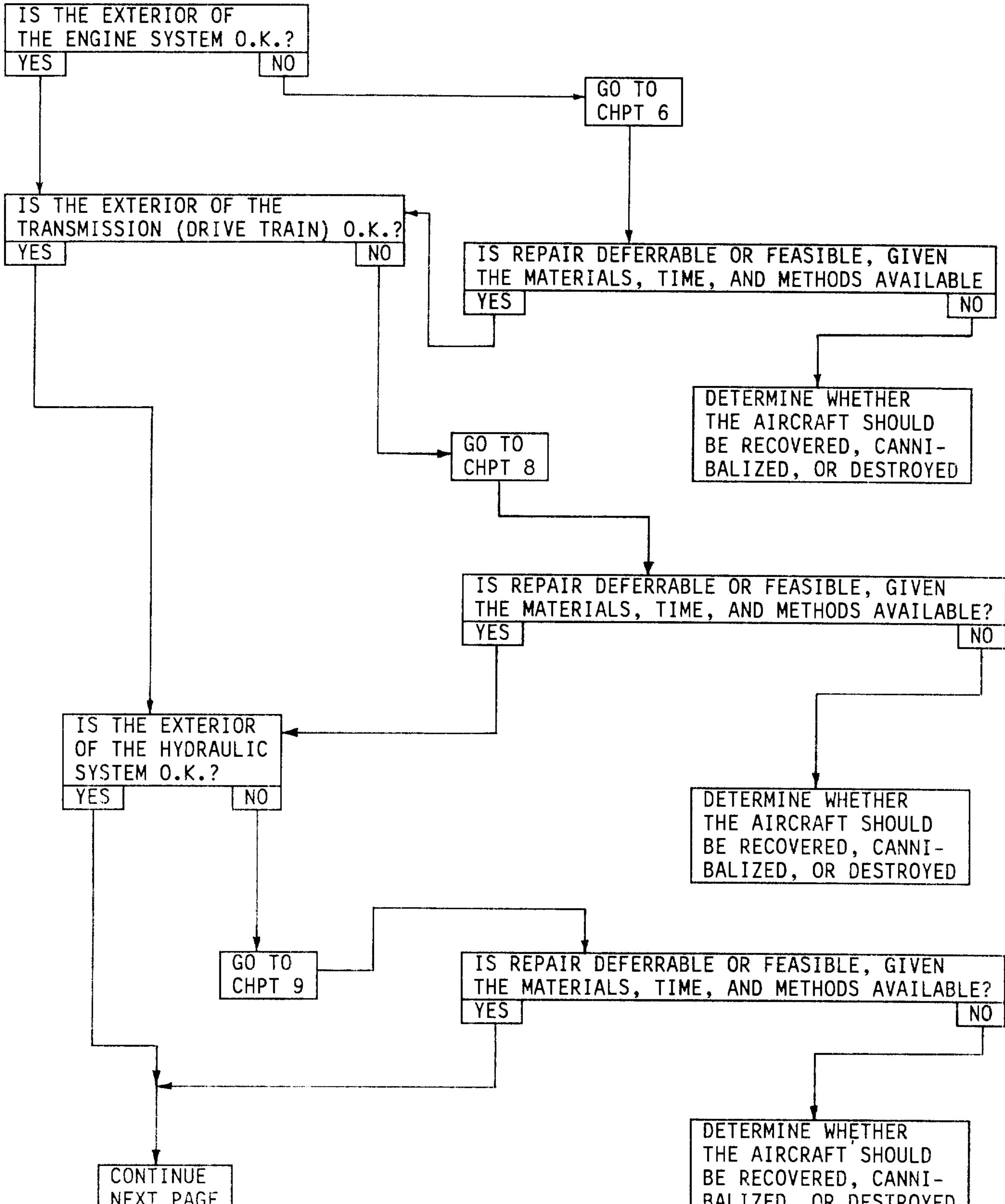


Table 2-2. General Assessment (Cont)

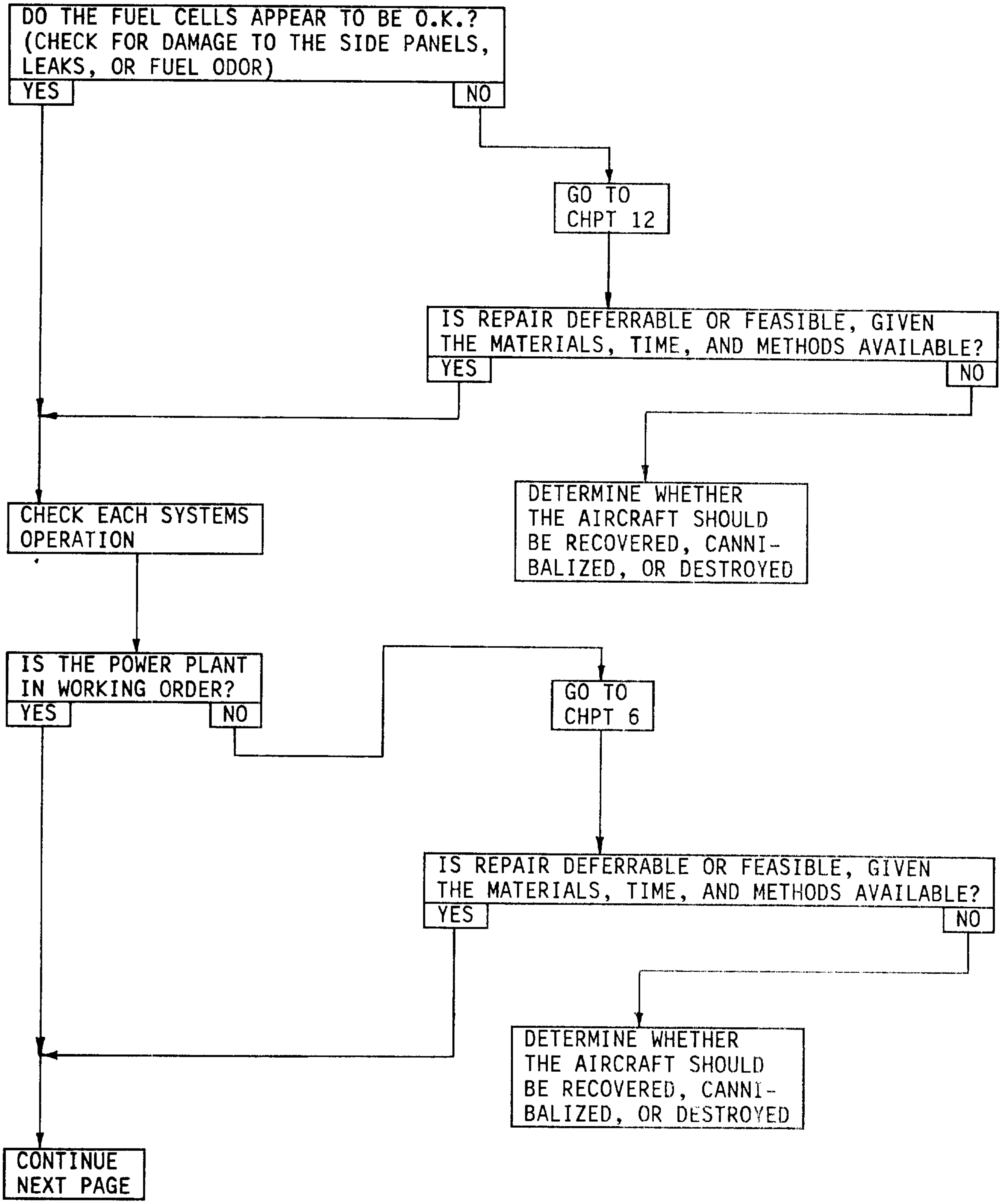


Table 2-2. General Assessment (Cont)

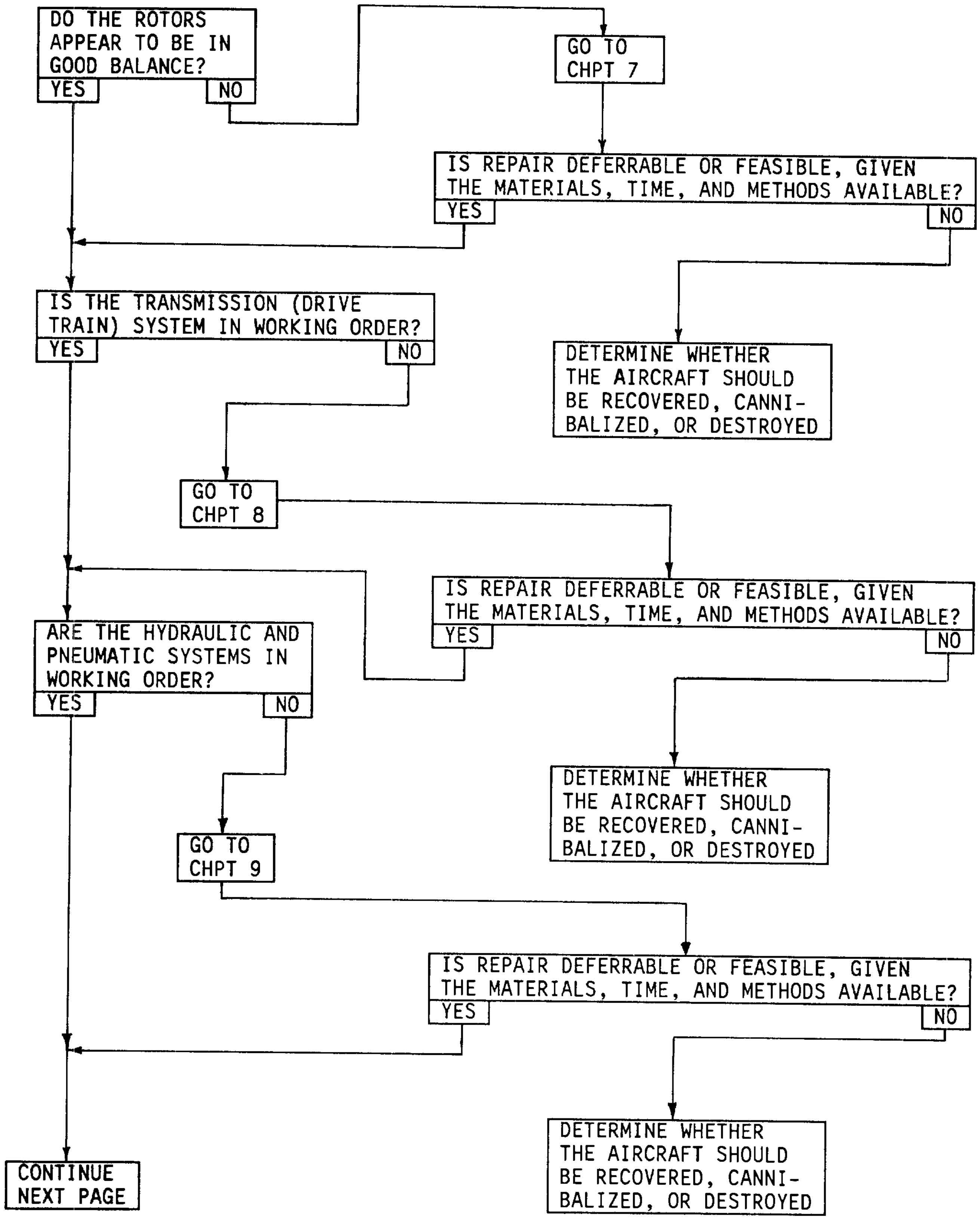


Table 2-2. General Assessment (Cont)

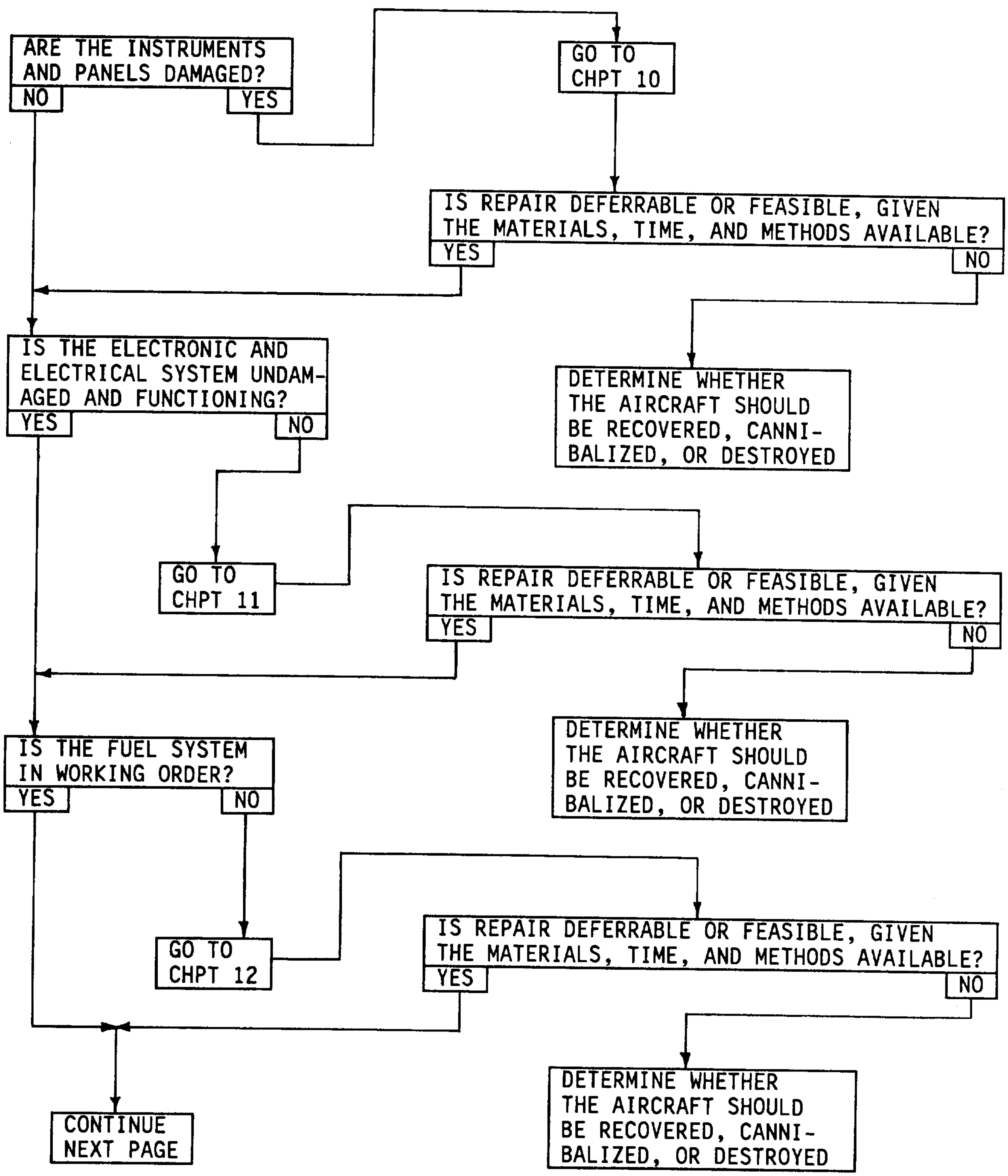
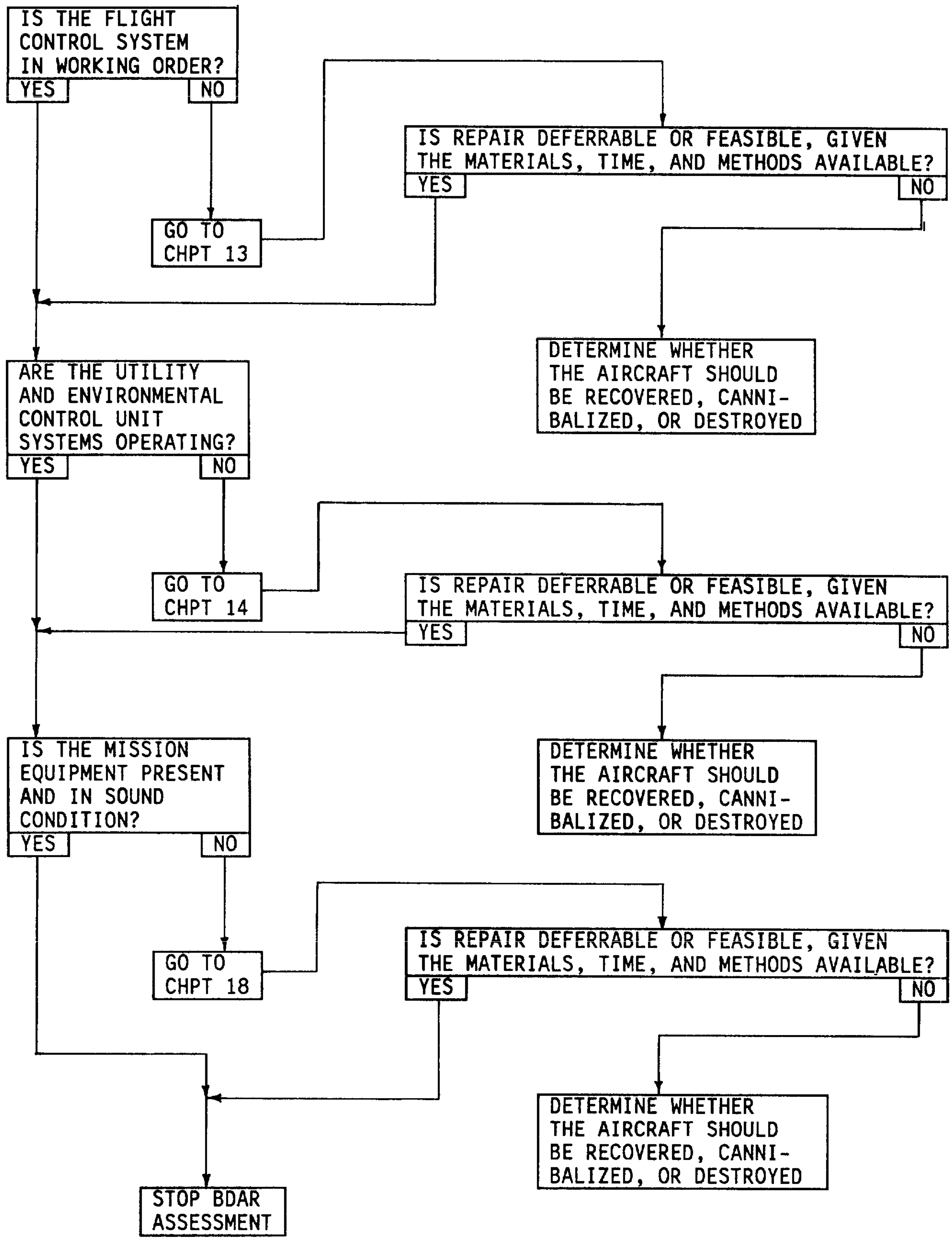


Table 2-2. General Assessment (Cont)



CHAPTER 3

GENERAL REPAIRS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DANAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

No general repairs have been identified for this model helicopter. Proceed to Chapters 4 thru 19 for functional group assessment and repair procedures.

CHAPTER 4

AIRFRAME

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

4-1. SCOPE. This chapter contains information on battle damage assessment and expedient repair procedures for the OH-58 helicopter airframe. The procedures are to be used only during combat operations or during periods of extreme emergency.

a. Section I contains information pertaining to the various structural areas which are suspected of being damaged, and whether the damage is to a primary or secondary element. Logic flow chart tables and damage limit tables are also part of this section.

b. Section II consists of expedient structural repairs and procedures on how to perform these repairs and field fixes.

4-2. ASSESSMENT PROCEDURES. Refer to Table 4-1.

4-3. GENERAL. Aircraft structure is classified as primary and secondary structure.

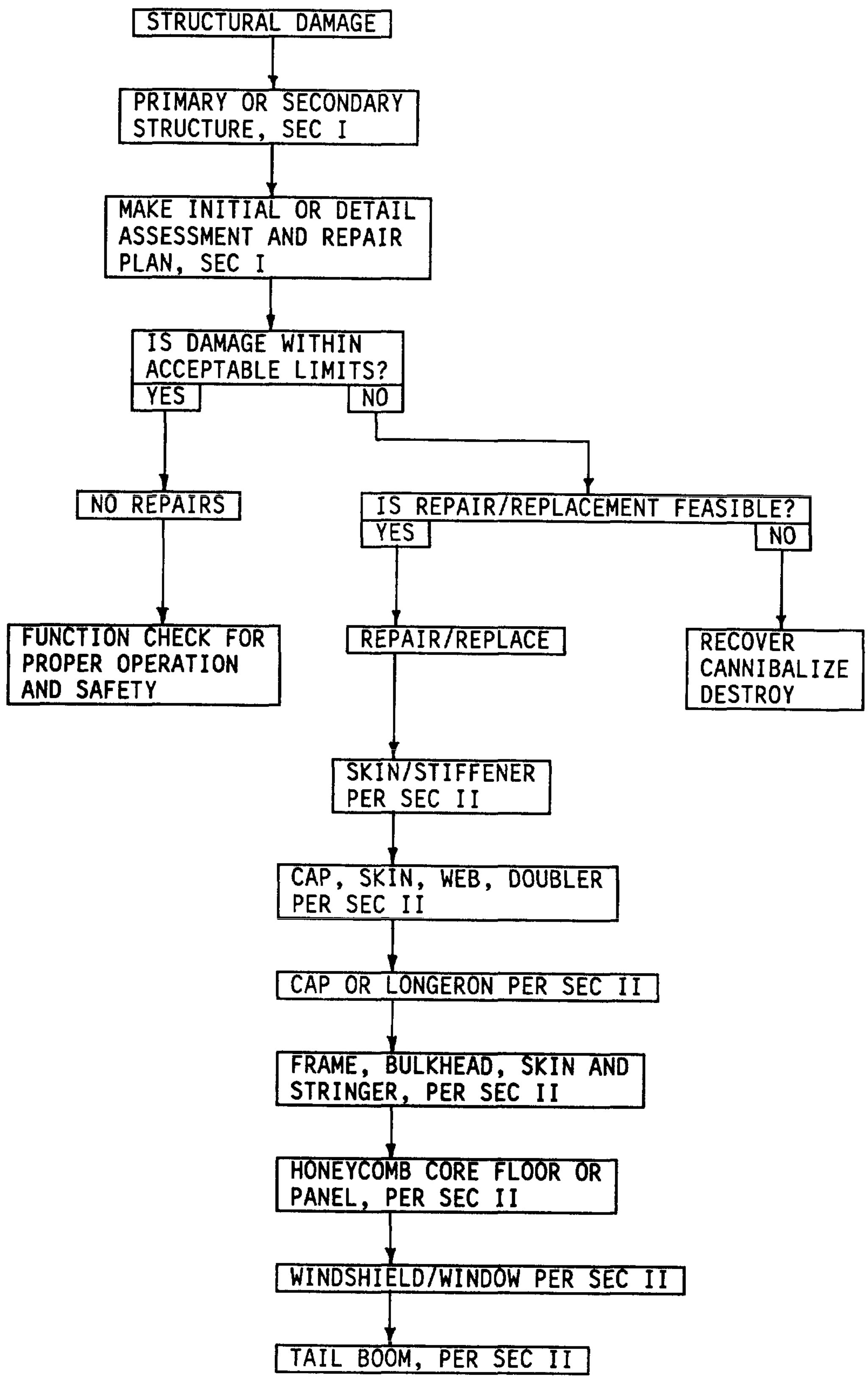
a. The primary structure is the basic structure which holds the aircraft together. Any serious damage to any element of the primary structure will restrict the combat capability of the aircraft. The primary structure for each major airframe subassembly is shown in Figure 4-11, Sheets 1 thru 5.

b. Secondary structures are mounted on the primary structure. No amount of structural damage to secondary structures will restrict combat capability from a structural point of view; however, secondary structure may be required for aerodynamic reasons or to accomplish or support mission functions.

4-4. STRUCTURAL DAMAGE ASSESSMENT AND REPAIR. The battlefield structural damage assessment and repair consists of three steps: an initial assessment, paragraph 4-5; a detail assessment, paragraph 4-6; and a repair plan, paragraph 4-10. The initial assessment is a quick visual assessment to decide whether or not a detail assessment should be made. A detail assessment involves the identification of all damage to primary structural elements, possibly some clean-up and measurement of the damage and of the damaged elements. The procedure is described for various aircraft sections in this chapter. This process requires damage measurement and determination of the corresponding damage limits. The repair plan is based on an analysis of the detail assessment. An overall view of all the aircraft zones is shown in Figure 4-1.

4-5. INITIAL ASSESSMENT. To perform an initial assessment, the assessor must be acquainted with structural damage modes and the primary structure as shown in the figures of this chapter. He shall be capable of differentiating between primary and secondary structure, and he must understand the function of primary structural elements. The initial assessment consists of a visual inspection of primary structure. The assessor determines if any primary caps, webs, or panels are damaged or fractured and decides whether:

Table 4-1. Aircraft Structure Damage Assessment Prodecures



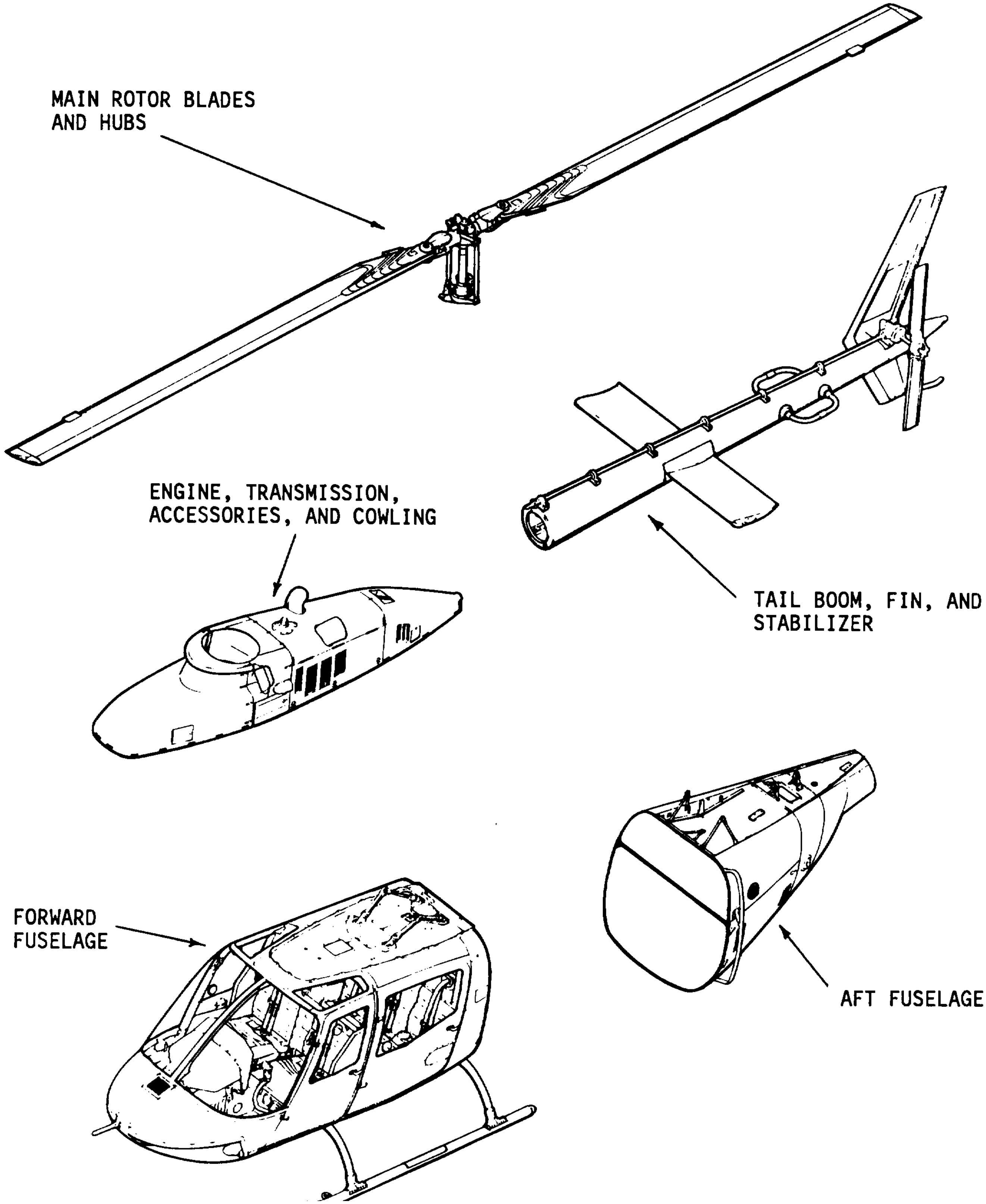


Figure 4-1. Aircraft Sections

a. the damage appears to be deferrable;

b. a detail assessment can be made and the damage can be repaired by BDAR techniques within the time available to return the aircraft to service in the ongoing battle;

c. an adequate assessment can be made and the damage can be repaired by BDAR techniques to enable the aircraft to self-recover;

d. a detail assessment cannot be made and/or the damage cannot be repaired by BDAR techniques within the available time. The aircraft shall be scheduled for standard repair.

e. The aircraft is damaged beyond repair, and he shall arrange for its disposition (i.e., recovery, cannibalization, or destruction).

4-6. DETAIL ASSESSMENT.

a. Access to Damaged Structure. Locate all damage to airframe primary structure. Remove access panels, covers, and fairings in the damaged area. Remove aircraft components as required to inspect the structure. Use the location of entrance and exit wounds and the estimates of projectile paths to determine the areas where damage may be present and access to interior inspection will be needed. If an area of structure suspected of being damaged cannot be reached by other means, cut small inspection holes in the exterior skin. Then inspect internal members with an inspection light and mirror.

b. Inspecting for Cracks.

(1) Inspect for cracks caused by impact or penetration in regions away from the site of primary damage.

(2) Inspect for small and large cracks caused by projectile damage. Small cracks will enlarge under continued loading, particularly when located at the edge of a hole.

(3) Locate cracks in primary structure using magnifying glass or dye penetrant. Check for cracks around fasteners in areas showing signs of overstress.

(4) Inspect for cracks in all areas of an explosion caused by a high explosive incendiary (HEI) strike.

c. Inspecting for Structural Changes.

(1) Inspect damaged area and surrounding undamaged area for evidence of buckling, crippling, and misalignment. Kinks, wrinkles, and sheared, pulled-through or missing fasteners on skin panels are indications of structural changes by an HEI hit.

(2) Inspect structural changes in the form of buckling, crippling, and misalignment caused by overpressure. These structural changes are noticeable in areas where one structural member may have to support the load of another broken member. Check damaged area to see if there is interference with mechanical moving components.

(3) Use a straight edge to examine the component for twisting or bowing.

d. Inspecting for Embedded Projectiles and Fragments.

(1) Inspect for embedded projectiles which can create the same affect as a hole or crack on a tension member.

(2) Inspect for embedded projectiles and fragments in areas which have suffered HEI damage. The inspection will reveal that a solid projectile is embedded or has broken apart, striking internal components.

(3) Inspect all structures using bright light and magnifying glass. Determine the path entry of the projectile to aid in finding structures that may have embedded fragments. Mark embedded objects and record them on DA Form 2404, Figure 4-2.

e. Inspecting for Fire Damage. Inspect for fire damage by checking for discoloration of the structure. Any discoloration will indicate that the member has been exposed to high temperature. Conduct a hardness test to determine if the temperature of the material has changed. If test indicates heat damage, record the information on DA Form 2404 and clearly mark the member.

f. Detecting Structural Damage in Adjoining Areas.

(1) Secondary damage can be the result of severe overstress, explosive blast, or maneuvering loads imposed on damaged structures. Inspect the airframe near the projectile damage for evidence of secondary damage.

(2) Inspect the skin for creases, wrinkles, and dents. Inspect fasteners for chipped or flaked paint, looseness, and serviceability. If these conditions are evident, remove access panels and doors to inspect members for cracks and structural changes.

Inspecting for broken and missing fasteners. Inspect fasteners for security, shear, pull-through, tear-out, and elongated fastener holes. Where possible, inspect fasteners from both sides.

h. Inspecting for Delaminations. Inspect honeycomb structures for voids and delamination using the coin tapping method.

i. Marking and Recording Damage.

(1) Record all detected damage. Refer to Table 4-1 for repair/referral of repair on structural member.

(a) Record name of aircraft section containing the damaged element, Figure 4-1.

(b) Record the name of the damage element such as frame, stringer, or skin panel.

(c) Describe the location of the damaged element such as station, waterline, butt line, or panel location.

(d) Describe the damage to the element using terms such as hole, crack, or buckle.

(e) Continue damage recording for:

1 Other damages to the same element.

2 Other damaged elements in the same subassembly.

3 Other damaged subassemblies in the section of the airframe.

4 Other damage sections of the airframe as required.

(f) After the damage inspection is completed, file the damage report in the aircraft log book and make entries as required.

(2) Damage diagrams. Show the location and extent of damage as shown in the diagrams in Figure 1-3. The damage can be drawn by hand. Accurately locating damage on a diagram will greatly help the damage assessment procedure.

EQUIPMENT INSPECTION AND MAINTENANCE WORKSHEET

For use of this form, see TM 38-750; the proponent agency is the Office of the Deputy Chief of Staff for Logistics.

1. ORGANIZATION	2. NOMENCLATURE AND MODEL

3. REGISTRATION/SERIAL/NSN	4a. MILES	b. HOURS	c. ROUNDS FIRED	d. HOT STARTS	5. DATE	6. TYPE INSPECTION

7. APPLICABLE REFERENCE

TM NUMBER	TM DATE	TM NUMBER	TM DATE

COLUMN a — Enter TM item number.

COLUMN b — Enter the applicable condition status symbol.

COLUMN c — Enter deficiencies and shortcomings.

COLUMN d — Show corrective action for deficiency or shortcoming listed in Column c.

COLUMN e — Individual ascertaining completed corrective action initial in this column.

STATUS SYMBOLS

"X"—Indicates a deficiency in the equipment that places it in an inoperable status.

CIRCLED "X"—Indicates a deficiency, however, the equipment may be operated under specific limitations as directed by higher authority or as prescribed locally, until corrective action can be accomplished.

HORIZONTAL DASH "(-)"—Indicates that a required inspection, component replacement, maintenance operation check, or test flight is due but has not been accomplished, or an overdue MWO has not been accomplished.

DIAGONAL "(/)"—Indicates a materiel defect other than a deficiency which must be corrected to increase deficiency or to make the item completely serviceable.

LAST NAME INITIAL IN BLACK, BLUE-BLACK INK, OR PENCIL-Indicates that a completely satisfactory condition exists.

FOR AIRCRAFT-Status symbols will be recorded in red.

ALL INSPECTIONS AND EQUIPMENT CONDITIONS RECORDED ON THIS FORM HAVE BEEN DETERMINED IN ACCORDANCE WITH DIAGNOSTIC PROCEDURES AND STANDARDS IN THE TM CITED HEREON.

8a. SIGNATURE (Person(s) performing inspection)	8b. TIME	9a. SIGNATURE (Maintenance Supervisor)	9b. TIME	10. MANHOURS REQUIRED

TM ITEM NO. a	STATUS b	DEFICIENCIES AND SHORTCOMINGS c	CORRECTIVE ACTION d	INITIAL WHEN CORRECTED e

DA FORM 2404, 1 APR 79 — Replaces edition of 1 Jan 64, which will be used

Figure 4-2. DA Form 2404

(3) Marking damage. Mark the damaged structure using grease pencil or paint. Use the labeling scheme shown in Figure 1-3.

CAUTION

Use of lead pencil in some areas will cause corrosion.

(a) Use a bright color to outline each area of damage as it is located and recorded on the DA Form 2404. Attempt to make the outline visible from all angles.

(b) Draw arrows on inside skin panels, webs, and bulkheads to point toward areas of damage that are hidden.

4-7. DAMAGE MEASUREMENT. If the assessment indicates that the damage should be repaired by BDAR or standard procedures, no damage measurement is necessary. Damage measurement is required to determine if structural repair (other than cleanup) can be deferred, or if self-recovery of the damaged aircraft is feasible. Damage measurement may also be required if a BDAR repair does not restore original strength. Begin damage measurement with the largest damage.

a. Damage Measurement of Typical Sections.

(1) The parameters involved in measuring damage to typical sections are shown in Figure 4-3. The pertinent values are:

CD = Depth of damage.
CL = Length (width) of damage.
A = CL x CD = area of damage.
D = Distance between damages.

In Figure 4-4, the length of the flattened cross section of the angle is:

$$a + b$$

CD is the depth of the damage into the flattened cross section. The length of the remaining effective cross section is still capable of supporting a load. All dimensions are in inches.

$$CS = (a+b)-CD$$

(2) When measuring damage, use the following procedure:

(a) Clean all damaged areas thoroughly. Use brushes and swabs to remove dirt and film from small crevices where damage may be present.

(b) Smooth all jagged and rough edges and be sure to cut out all radiated cracks. Use largest corner radii possible in the cut-outs; avoid sharp corners.

(c) Measure damage after smoothing, or if measuring before smoothing, make allowance for the material which must be removed during smoothing. See paragraph (d) below.

(d) Use a steel rule graduated in tenths of an inch and measure each damage dimension to the next higher tenth.

(e) Include the size of the hole when measuring damage that extends into a fastener hole or lightening hole.

(f) Record on DA Form 2404.

b. Webs, Panels, and Skins.

(1) Refer to Figures 4-5 and 4-6 for the measurements of “WL” and “D.” "WL" is the largest dimension across the damage, regardless of direction, and must include all radiated cracks. "D" is the distance between damages. Take and record measurements as described in paragraph 4-7.a(2).

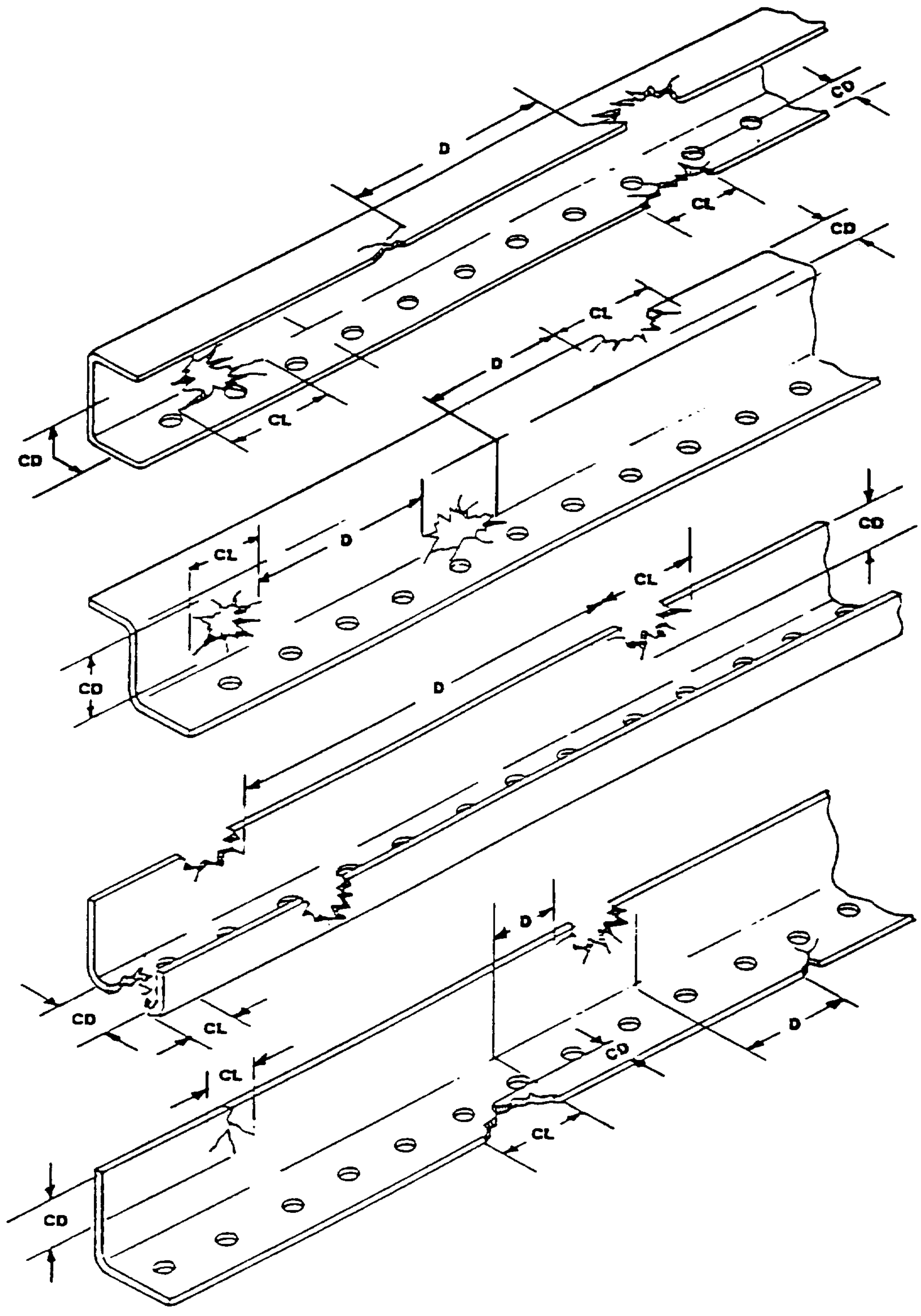


Figure 4-3. Evaluating Damage to Angles, Channels, and Z-Angles

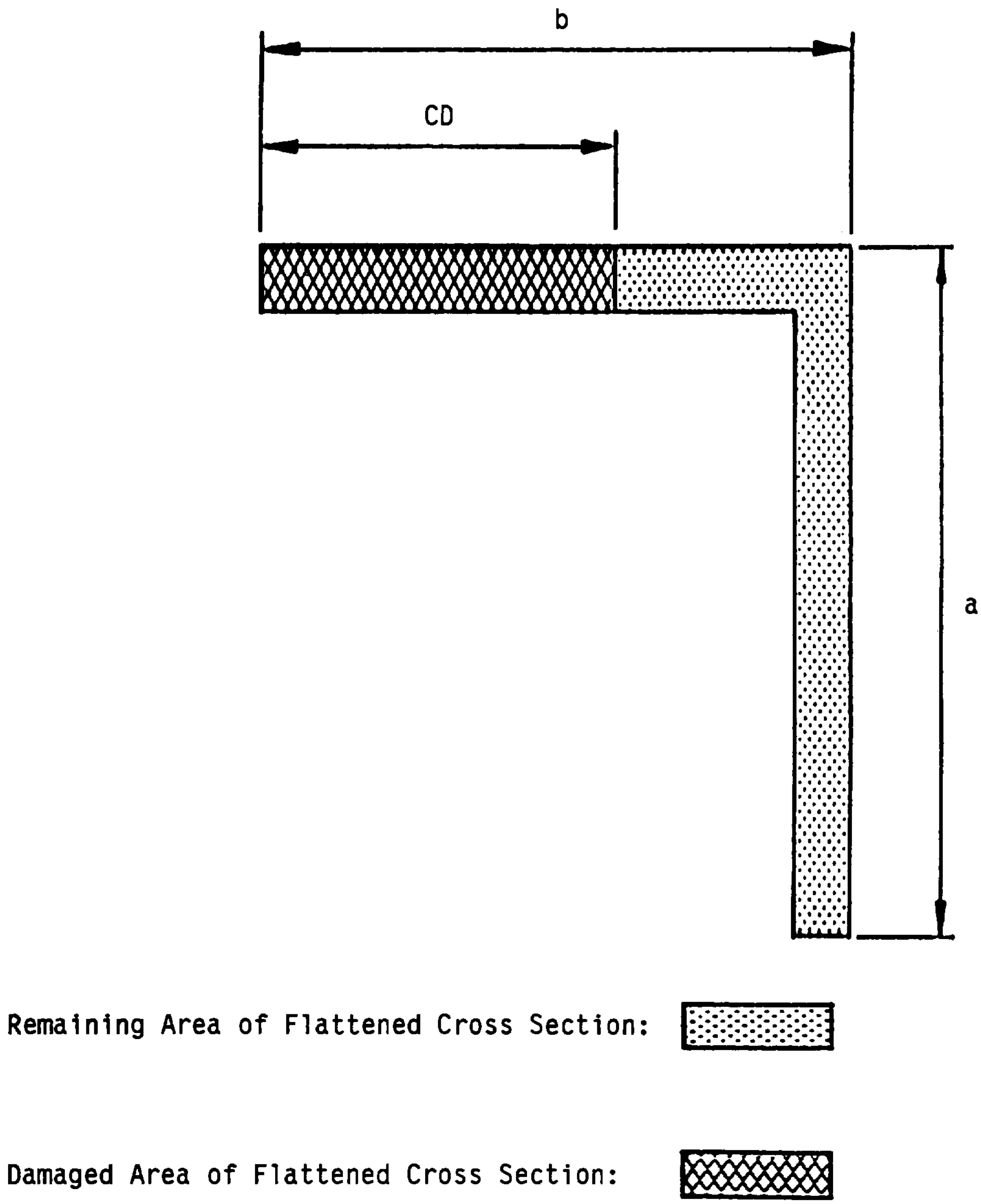
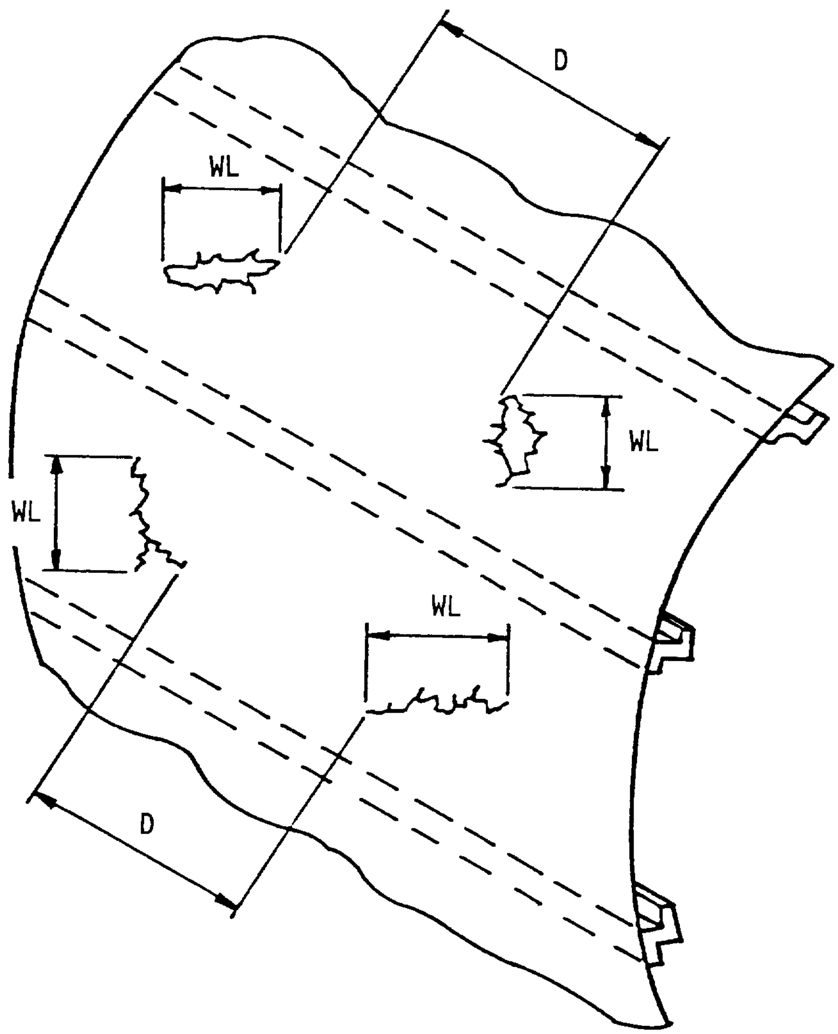


Figure 4-4. Damaged Cross Section



IMPORTANT: MEASURED LATERAL DAMAGE MUST INCLUDE ALL RADIATED CRACKS.

Figure 4-5. Measuring Skin Panel Damage

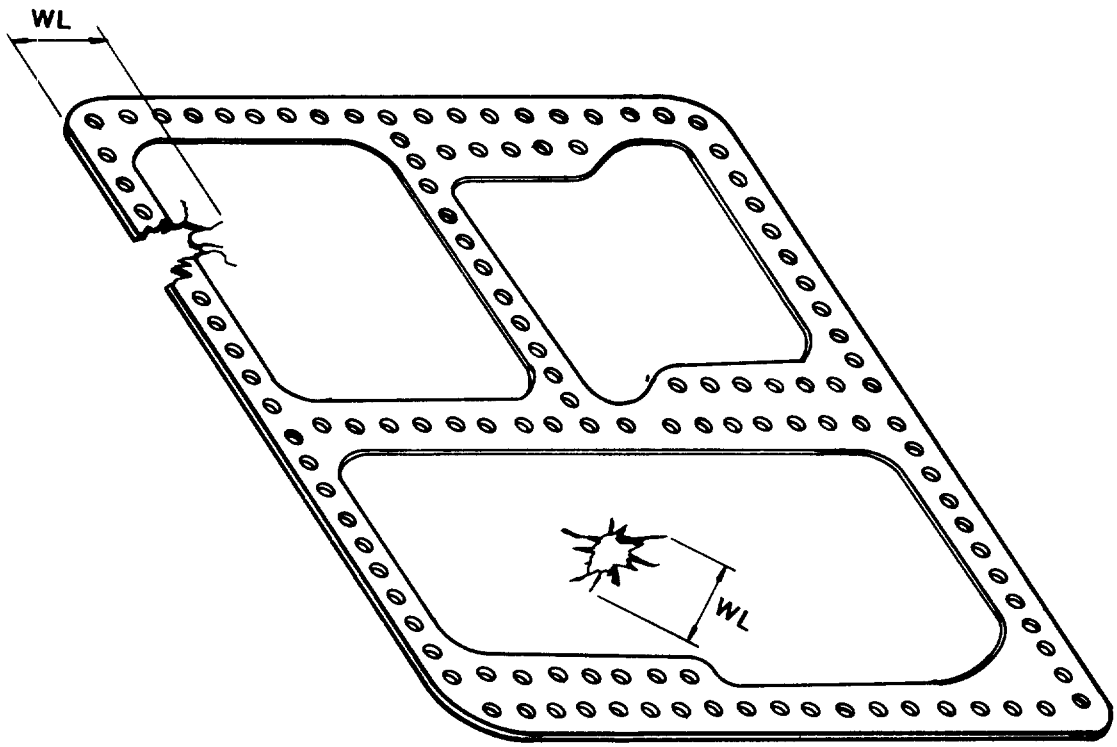


Figure 4-6. Measuring Damage in Webs and Panels

(2) Honeycomb Sandwich Structures. Refer to Figure 4-7 for the measurement of "WL" and "D." If a projectile hits a sandwich panel at an angle, the damages in the two skins may be off-set and of different sizes. Measure the damage on the side with the largest damage (usually the exit side), and make sure that the measurement includes the damaged area on the other side. "WL" is the largest dimension across the damage (both sides), regardless of direction, and must include all radiated cracks. “D” is the distance between damages. Take and record the measurements as described in paragraph 4-7.a(2).

c. Fittings, Attachments, and Splices.

(1) See paragraph 4-12.

(2) Record all damage on DA Form 2404, Figure 4-2.

d. Damage measurements apply after cleanup and smoothing or after BDAR has been accomplished. However, as a practical matter, measurements must be taken before smoothing to make a decision on deferrability. Hence, when estimating damage limits before cleanup and smoothing, make allowance for the material that will be removed in smoothing. This applies particularly to cracks. The length of the crack must be included in in the depth (CD) and length (CL) measurements.

4-8. ALLOWABLE DAMAGE LIMITS DEFINITION.

a. The allowable damage limits corresponding to the damage measurements of paragraph 4-7 are designated for a given condition as follows:

CD' = Allowable depth of damage.
CL' = Allowable length (width) of damage.
A' = Allowable area of damage.
D' = Minimum allowable distance between damages.
WL' = Allowable largest dimension across web/panel damage.
N = Minimum damage factor.

b. Allowable damage limits for primary structural elements are associated with the conditions of paragraph 4-9. A damage limit for a given condition is a measure of the amount of damage that a structural member can sustain and still support the loads associated with the given condition.

c. For a given condition, all damages must be equal to or less than the corresponding allowable damage limits, and the distance between damages must be equal to or greater than the corresponding minimal allowable limit; that is:

$$CD < CD'$$
$$CL < CL'$$
$$WL < WL'$$
$$D > D'$$

The aircraft may be released for flight in that condition. Repair may be deferred, although some cleanup and smoothing of the damage will be required, as will inspection for damage growth after every flight. Special consideration should be given to damage exposed to the airstream, particularly to the effects of ram air, rain, and petaling. Petals may vibrate in the passing airflow, rapidly creating cracks in the supporting base metal. Large pieces of metal may peel off and damage other parts of the aircraft. The distance D between damage sites for most structures has a minimum required spacing. The spacing requirement is expressed as a multiple factor (N) of the measured area of damage.

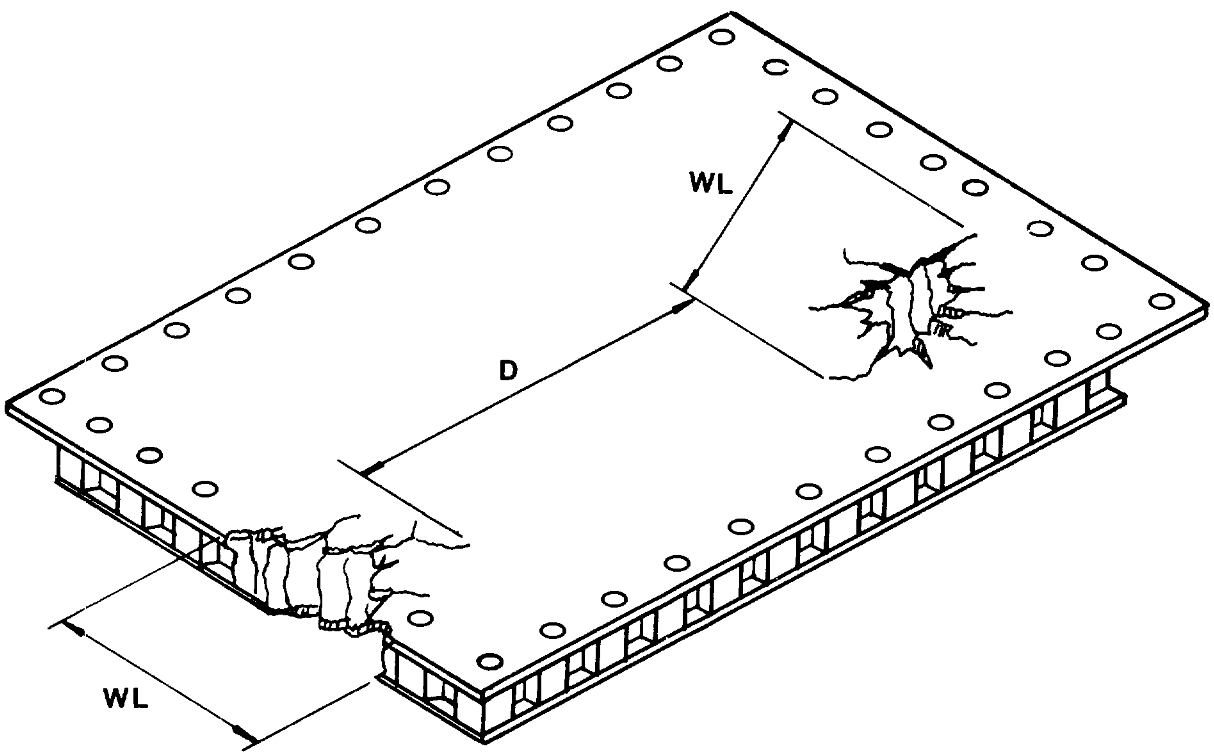


Figure 4-7. Measuring Damage in Honeycomb Sandwich Panels

(1) The factor applies to the damage actually measured not to the maximum damage limit for the structure.

(2) The factor applies to the largest dimension of the largest damage between which separation is being measured.

(3) The factor applies only if the dimensions of both damages, when added together, exceed the single damage limit.

4-9. CONDITION. Condition is an indicator of the residual capacity of a damaged structural element to perform its function. Battlefield damaged structures or BDAR repaired structures are classified in three conditions:

a. Condition 1. Aircraft fully flight capable. No flight restrictions. However, on a battlefield under the pressures of time and tactical situations, the assessment of structural damage may not have found all the damages. Therefore, aircraft with structural damage, whether repaired or repair deferred, should be inspected after every flight. The inspector should look for crack growth, evidence of overstress, growth of allowable deformations, and for the development of new cracks at other locations.

b. Condition 2. Self-recovery capable. Self-recovery may be required to move a damaged aircraft to a repair site or from one site to another when towing is not feasible. Self-recovery is preferable to disassembly and boxing an aircraft for transportation. As time permits, proceed as follows:

(1) Mark all visible cracks and the extent of other structural damage with chalk, grease pencil, paint, tape, or other available means so that any growth in the damage can be quickly recognized.

(2) Perform any feasible on-site BDAR fixes as required for self-recovery.

(3) Unload all ammunition, weapons, stores, and unnecessary equipment.

(4) The following restrictions are imposed on a recovery flight:

(a) Maximum airspeed: 50 kts

(b) Maximum engine torque:

80% at O kts
64% at 16 kts
53% at 32 kts
50% at 50 kts

(c) Maximum flight time: 2 hours.

(d) Use gradual and smooth pedal movements to minimize loads on aircraft.

(e) Land at level attitude; soft touchdown from hover.

c. Condition 3. Structural damage exceeding condition 2 limits generally does not allow self-recovery. The damage may or may not be repairable by BDAR techniques. The airframe may be so extensively damaged that no useful or needed functions can be restored within available time and resources. These aircraft will be:

(1) Recovered or evacuated to a facility with the resources to repair the airframe.

(2) Used as a source of cannibalized components.

(3) Destroyed. This is a last resort. These conditions apply to the primary structure and should not be confused with the mission capability classifications. Mission capability is dependent on equipment condition.

d. The type, extent, and variation of damage under condition 3 does not permit categorization of the many combinations of damage. Self-recovery, if considered, will depend on the extent and type of damage, type of terrain, distance, and urgency of the situation.

If judgment and experience indicate self-recovery is feasible, it should be accomplished at minimum weight, altitude and airspeed with an occasional stop to check on the condition of the aircraft.

4-10. REPAIR PLAN.

a. The damage measurements and initial repair data obtained from the detail assessment must be organized and formulated into a repair plan.

b. Repair requirements including cleanup/smoothing, condition, and repair times should be recorded on DA Form 2404.

c. If the worst case is better than condition 1, repair may be deferred except for cleanup and smoothing of all rough edges. The ends of all cracks must be stop drilled.

d. If the worst case is between condition 1 and 2, a decision must be made to degrade the aircraft to condition 2 or to repair the aircraft and restore it to condition 1.

(1) If the aircraft is degraded to condition 2 and is to perform a recovery flight, severe damage should be cleaned-up, rough edges smoothed, and cracks stop drilled.

(2) If it is decided to restore the aircraft to condition 1,

(a) determine the required repairs for all damaged structural elements that are below condition 1.

(b) Repairs on damaged structural elements that are better than condition 1 may be deferred except for cleanup and smoothing.

e. If the worst case is between condition 2 and 3, a decision must be made to degrade the aircraft to condition 3 or to repair the aircraft and restore it either to condition 1 or 2. An aircraft in this condition is probably so badly damaged that it may not be restored to condition 1 within the available time. However, every effort should be made to restore it to condition 2 or better if at all possible for recovery.

(1) If the aircraft is degraded to condition 3, no repair is required.

(2) If it is decided to restore the aircraft to condition 2,

(a) determine the required repairs for all damaged structured elements that are below condition 2.

(b) Repairs on damaged structural elements that are better than condition 2 may be deferred except for some cleanup and smoothing of the badly damaged areas.

(3) If it is decided to restore the aircraft to condition 1,

(a) determine the required repairs for all structural elements that are below condition 1.

(b) Repairs on damaged structural elements that are better than condition 1 may be deferred except for cleanup and smoothing.

f. Once all decisions are made and a repair plan formulated, complete repairs. Attach DA Form 2404 to DA Form 2408-13 and indicate deferred repairs on DA Form 2408-13.

4-11. GENERAL.

a. The aircraft consists of three main sections. The forward cabin section extends from the cockpit nose at FS1 to the bulkhead aft of the passenger compartment at FS130. The aft cabin section extends from FS130 to FS205 where the tail boom is attached. The third section is the tail boom. Refer to Figure 4-8.

b. The forward section utilizes aluminum honeycomb and sheet metal structures for the major load carrying elements. The forward section provides for pilot and passenger seating, fuel cell enclosure, and pylon support. Honeycomb sandwich is used extensively in this section, including the upper and lower shells, seat panels, and some bulkhead panels. The remainder is of conventional thin sheet metal construction. Primary loads forward of FS73 are taken by the lower console, pedestal, and lower shell. The cabin enclosure section between FS73 and FS130 is a X - Z planar frame consisting of the center post at FS73, roof beam, lower shell, and bulkhead and enclosure at FS114 and FS130. Refer to Figure 4-9.

c. The aft section utilizes an aluminum and honeycomb semimonocoque construction and provides a deck for engine installation and a compartment under the engine deck for electrical equipment. This section utilizes conventional thin sheet metal structure composed of longerons and bulkhead frames as beam elements and decks and skins as shear panels. Some of the fairing and decks are honeycomb panels.

d. The tail boom is a circular section with a horizontal stabilizer, vertical fin, and anti-torque rotor attached. The tail boom is a full monocoque structure utilizing a tapered circular section of aluminum alloy skin. Redistribution in the forward end, which is required to transfer loads from the monocoque structure to the four attachment fittings on the fuselage, is accomplished by the use of intercoastals and two aluminum redistribution bulkheads. The horizontal stabilizer is a standard spar-rib-skin riveted construction. The vertical fin is of standard sandwich construction using aluminum honeycomb core and thin aluminum skins. The upper half of the upper fin is composed of fiberglass skins and honeycomb core.

e. The damage assessment procedure described in paragraph 4-5 consists of damage measurement, determination of the corresponding allowable damage limit and associated condition, and formulating repair instructions. This data is recorded on DA Form 2404.

4-12. DAMAGE MEASUREMENT.

a. Refer to Figures 4-8 thru 4-15 for location and identification of major fuselage and tail boom structural areas.

b. Refer to paragraph 4-8 and for each damaged element, measure the depth “CD” and the length (width) “CL” or “WL” of each damage. Count the number of damages and measure the “D” between damages. Start with the worst damage. Record these values for each damaged element on DA 2404 and compare them with the allowable damage limits given in this section. Select the set of allowable damage limits which are next larger than the measured damage, determine the corresponding condition. Consider whether damage could result in flight failure of other elements. Attempt to visualize what effect large defections of damaged member will have on adjacent structure.

c. Decide on whether repair can be deferred or whether damage should be fixed and what the condition of deferred or repaired damage would be.

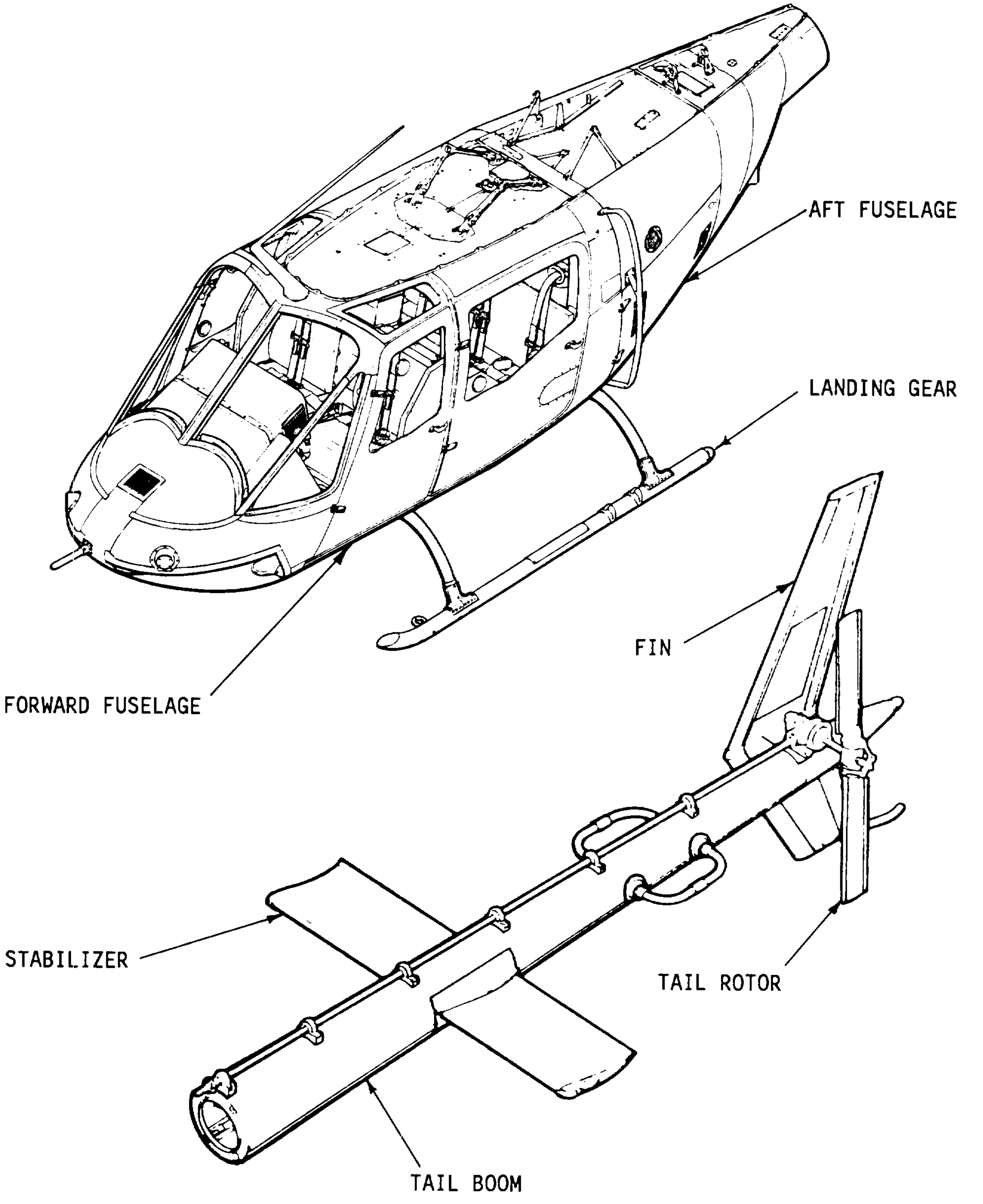
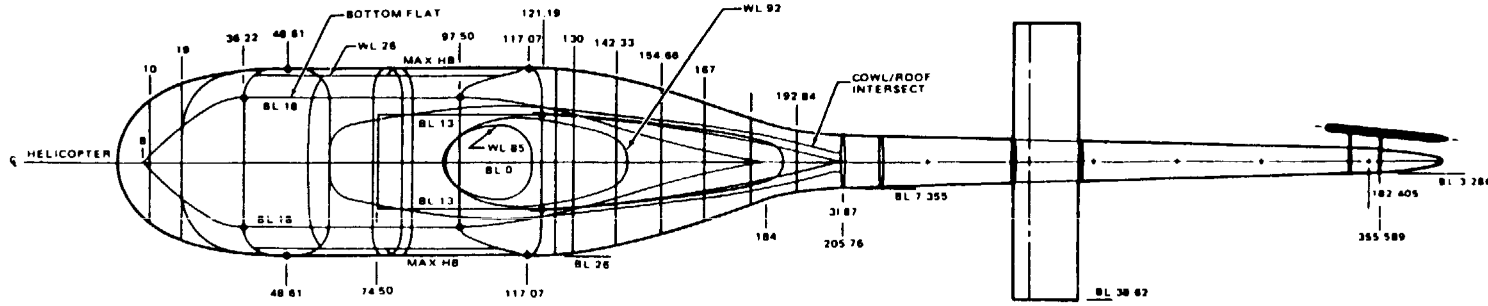
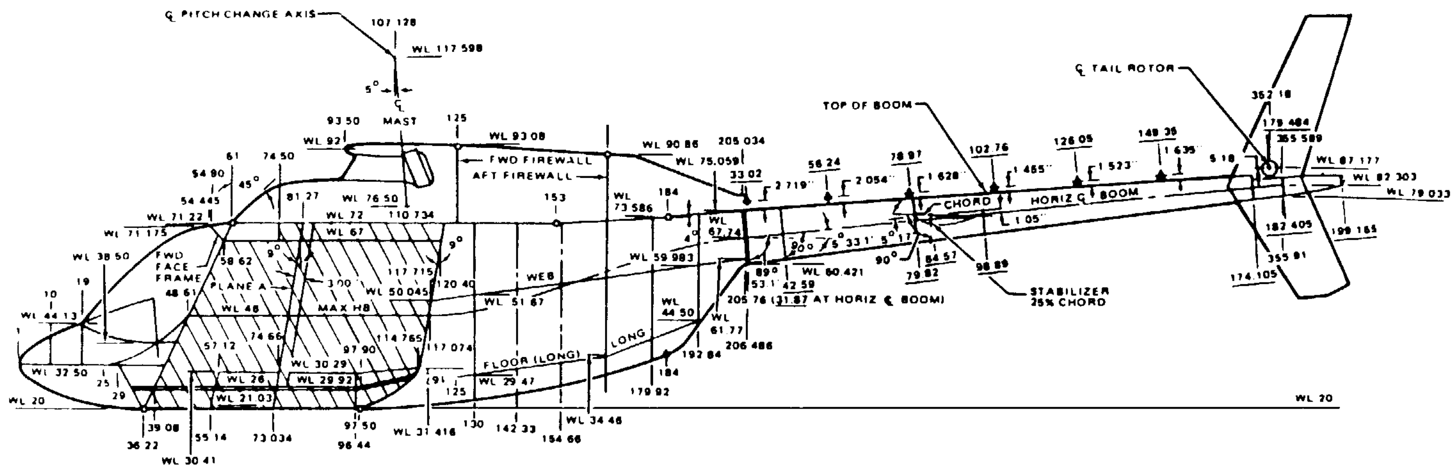


Figure 4-8. OH-58 Helicopter



PLAN



PROFILE

BL - BUTT LINE

FS - FUSELAGE STATION

WL - WATERLINE

<u>BS</u> - BOOM STATION (UNDERLINED)

▲ CENTER TAILROTOR BEARING HANGER.

● TANGENCY POINT.
CONTOURS IN BOOM STATIONS ARE CIRCLES. RADIUS AT <u>31.87</u> IS 7.3555" RADIUS AT <u>182.405</u> IS 3.286". TAPER' OF BOOM IS 0.02703" PER INCH. BOOM STATION IS 90° TO HORIZ C BOOM.

Figure 4-9. Airframe Reference Lines

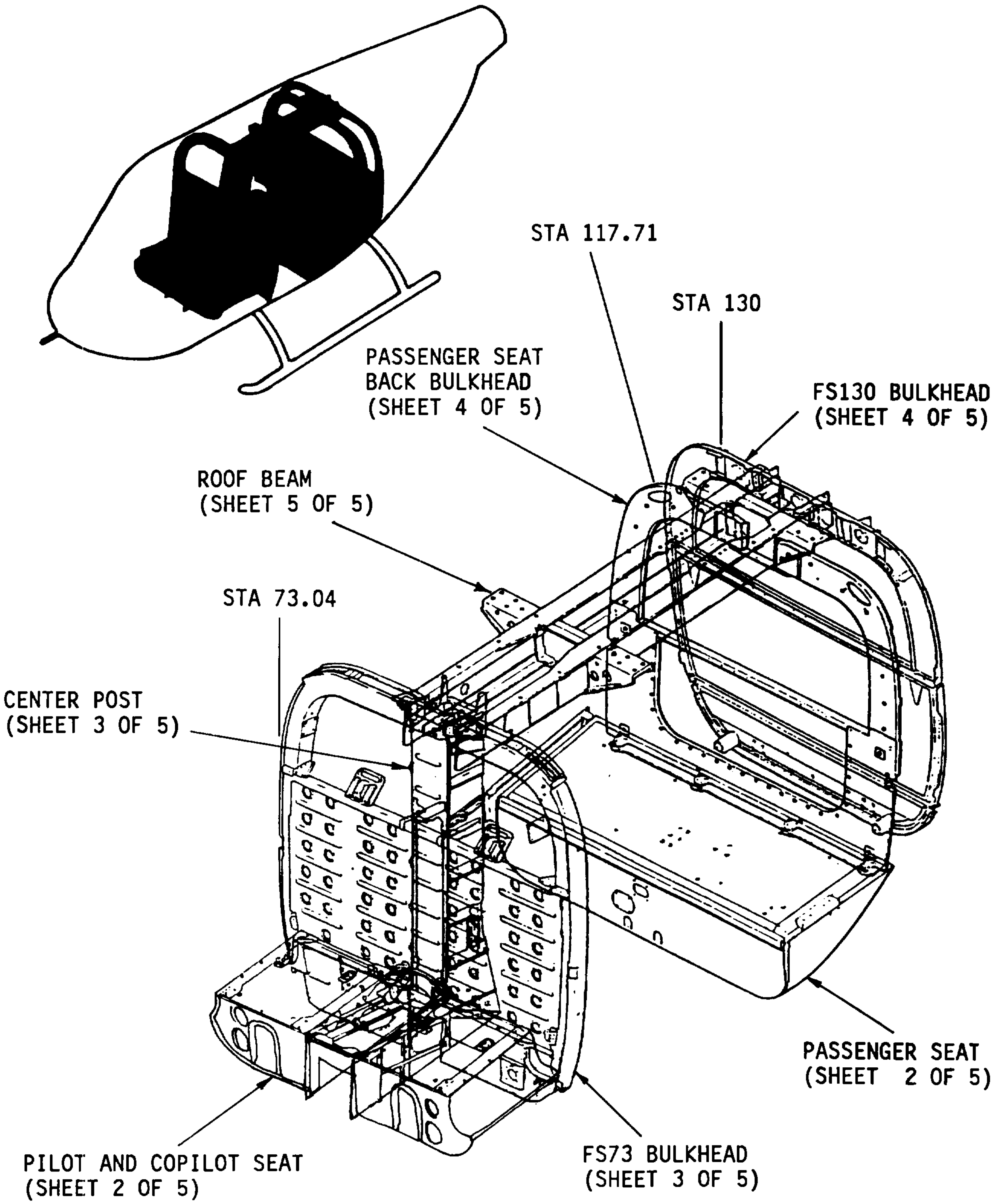


Figure 4-10. Cockpit

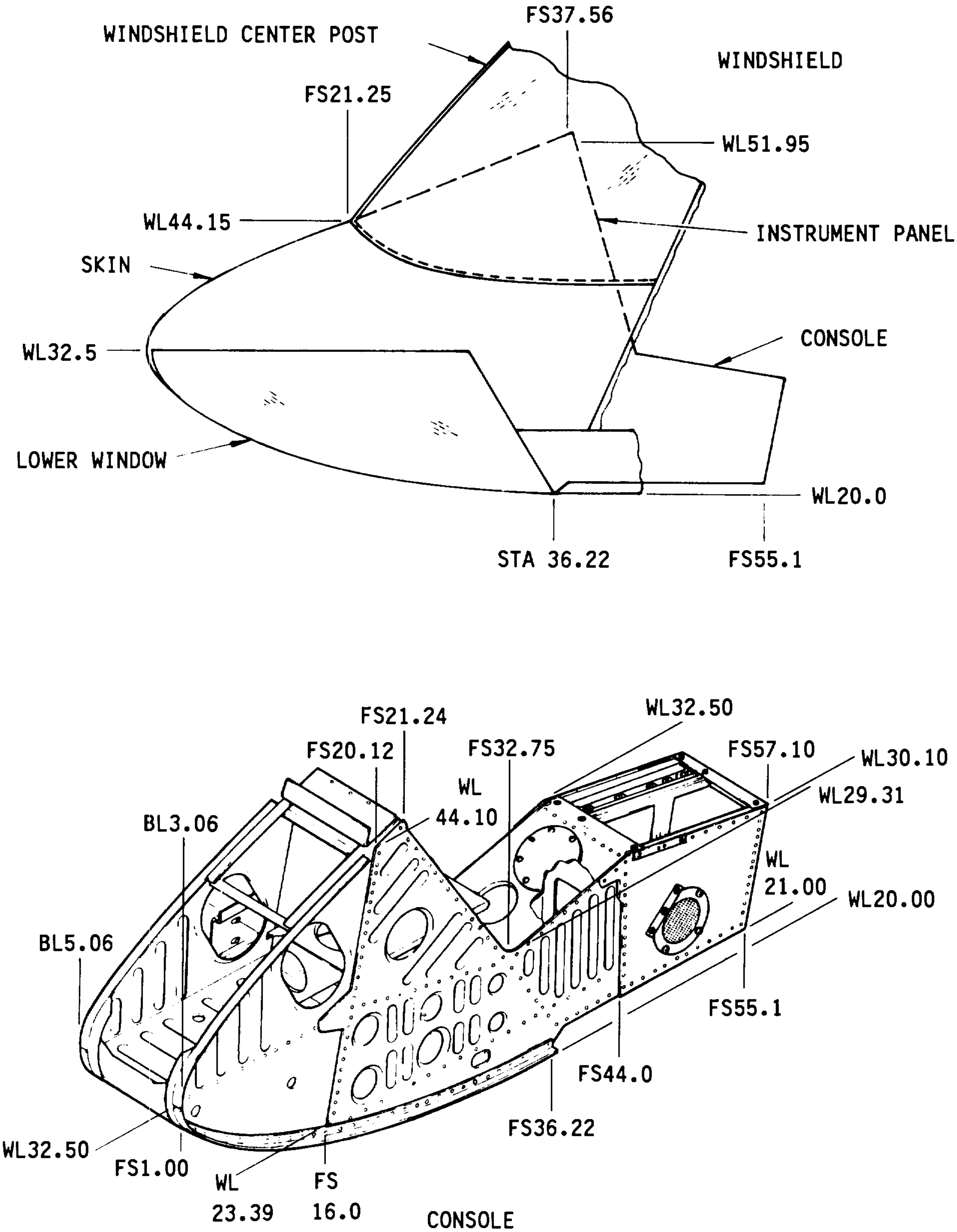
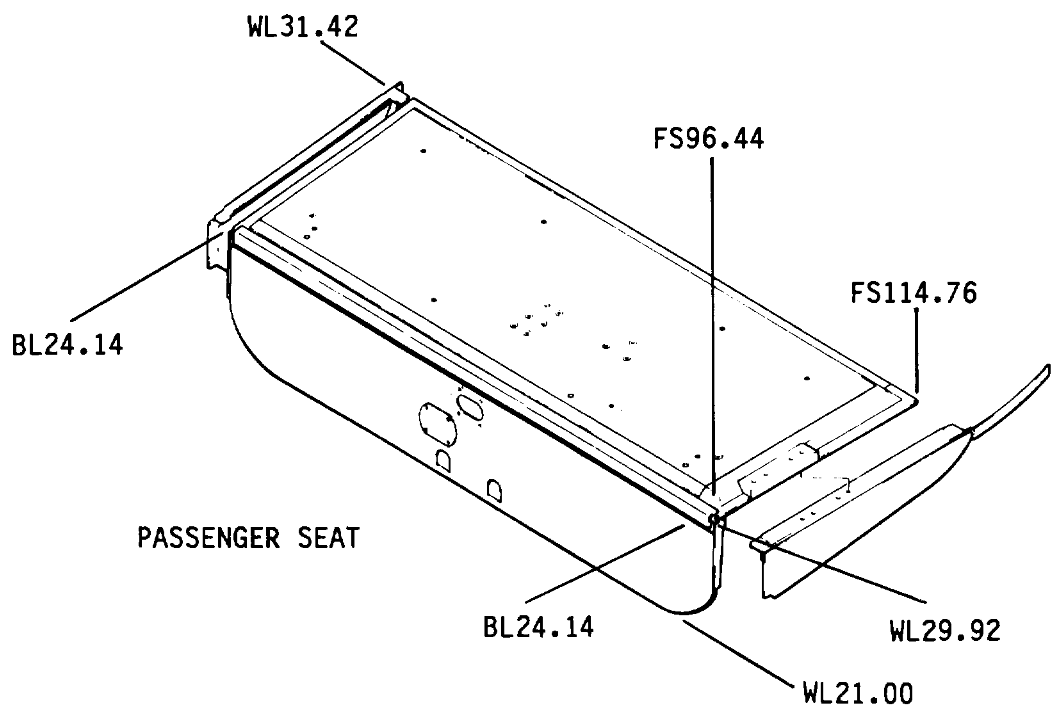


Figure 4-11. Fuselage Pylon Support Structure (Sheet 1 of 5)



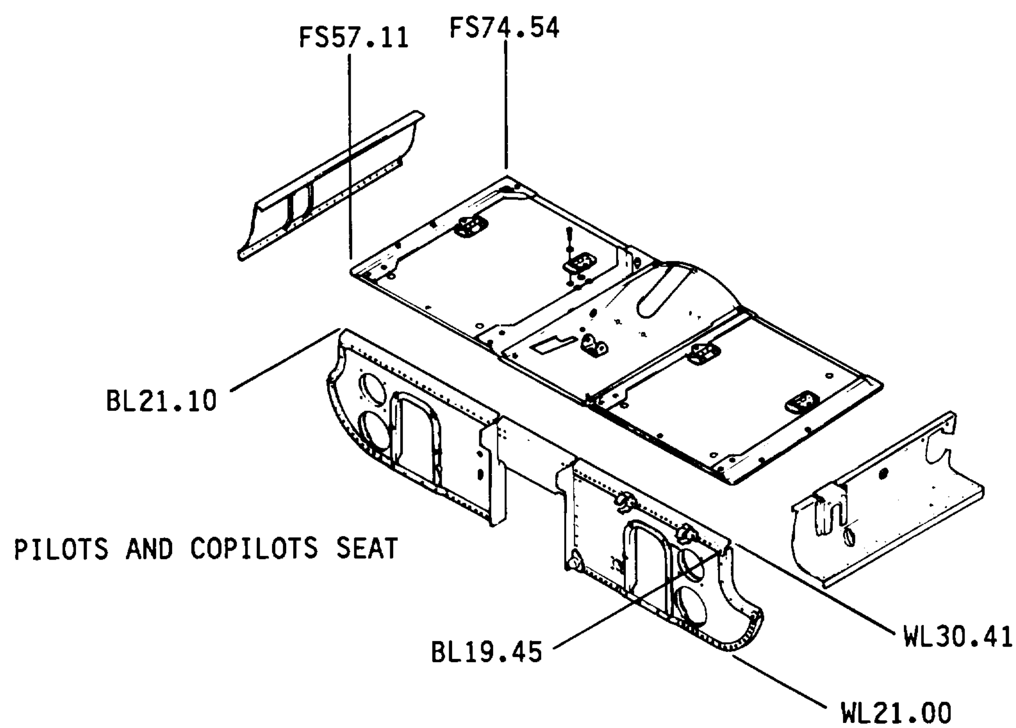


Figure 4-11. Fuselage Pylon Support Structure (Sheet 2 of 5)

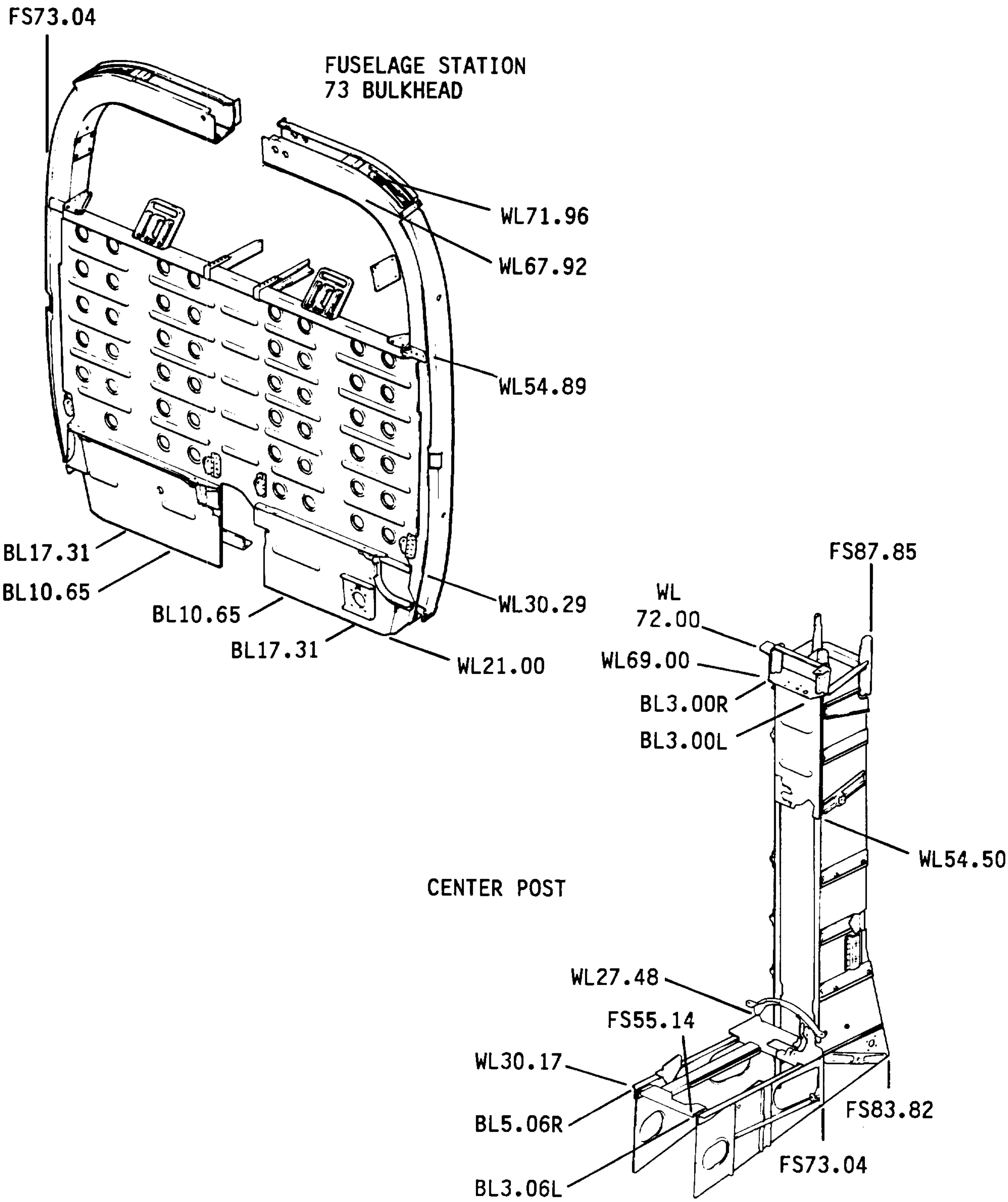


Figure 4-11. Fuselage Pylon Support Structure (Sheet 3 of 5)

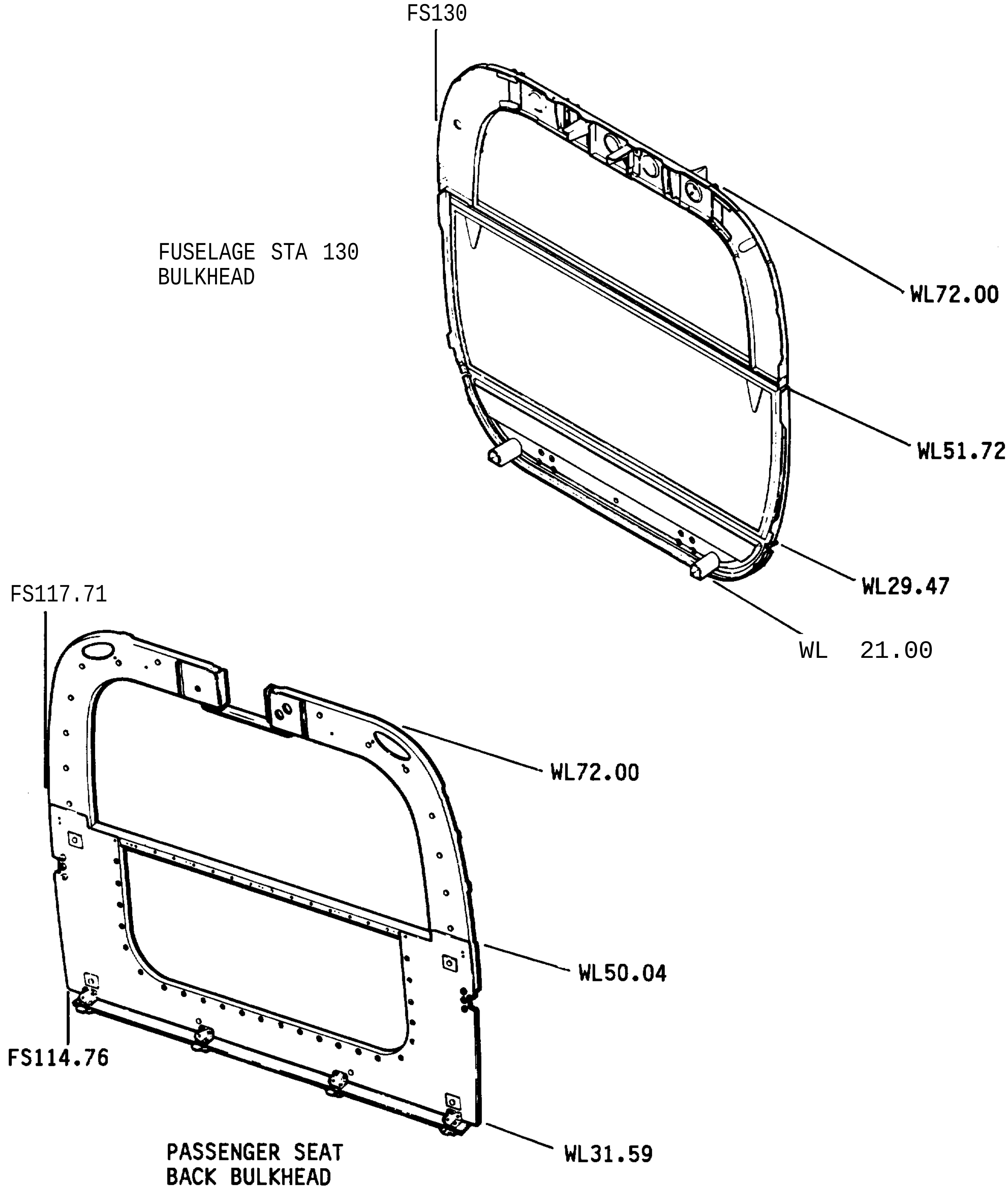


Figure 4-11. Fuselage Pylon Support Structure (Sheet 4 of 5)

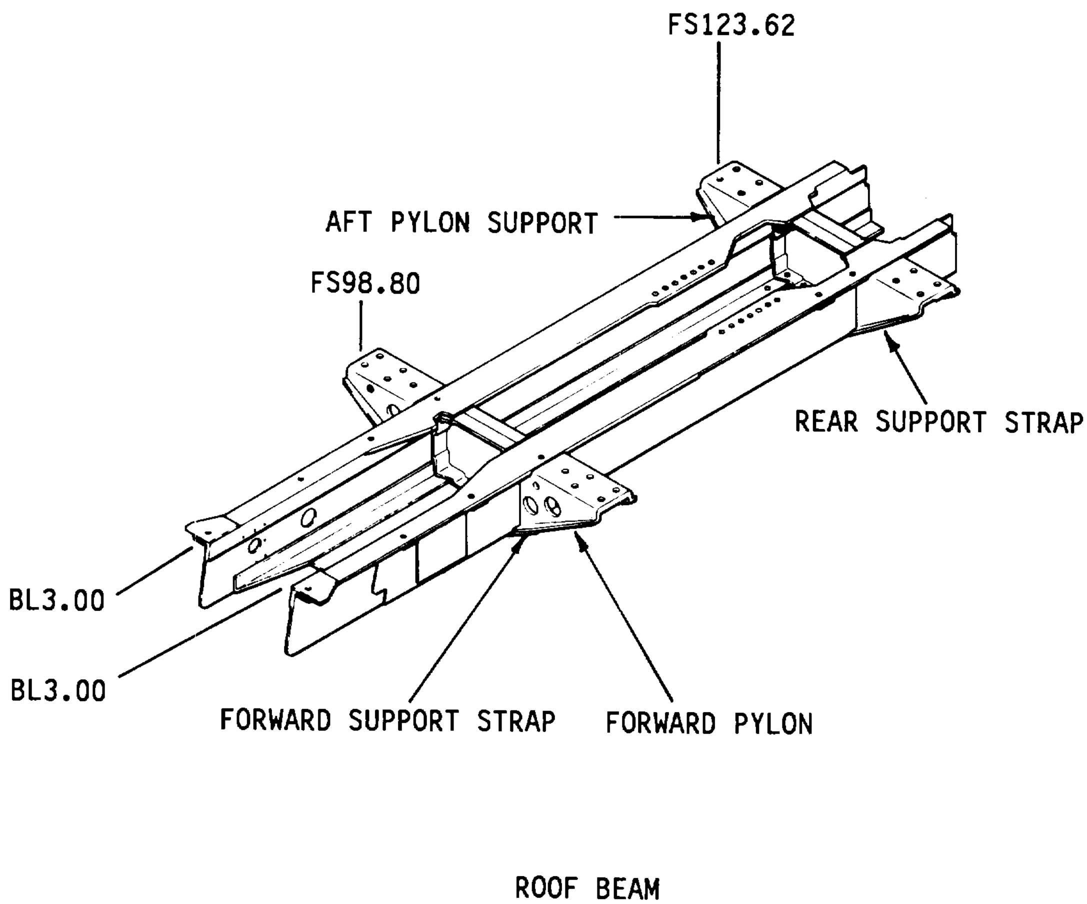


Figure 4-11. Fuselage Pylon Support Structure (Sheet 5 of 5)

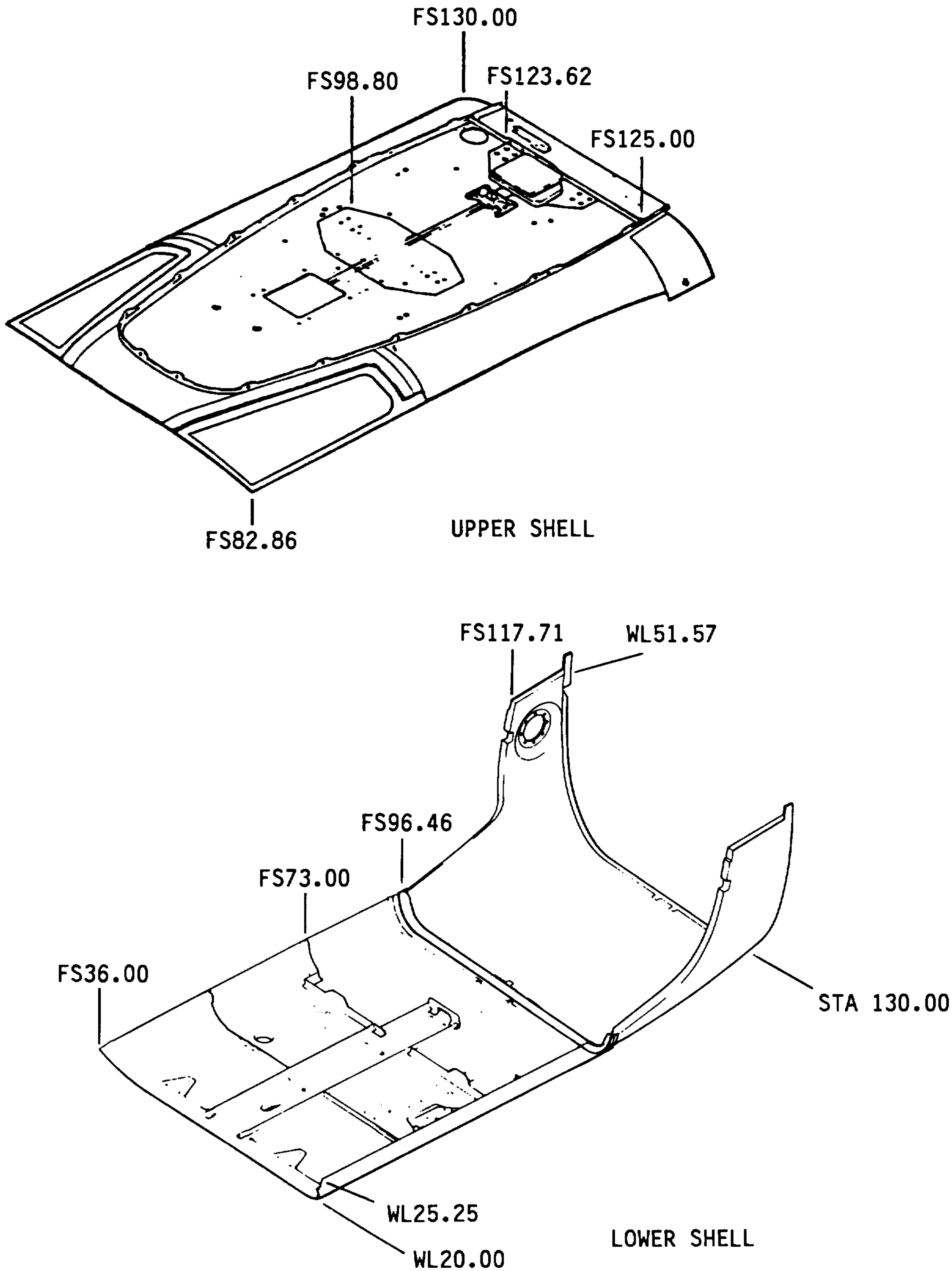


Figure 4-12. Upper and Lower Shell Structure

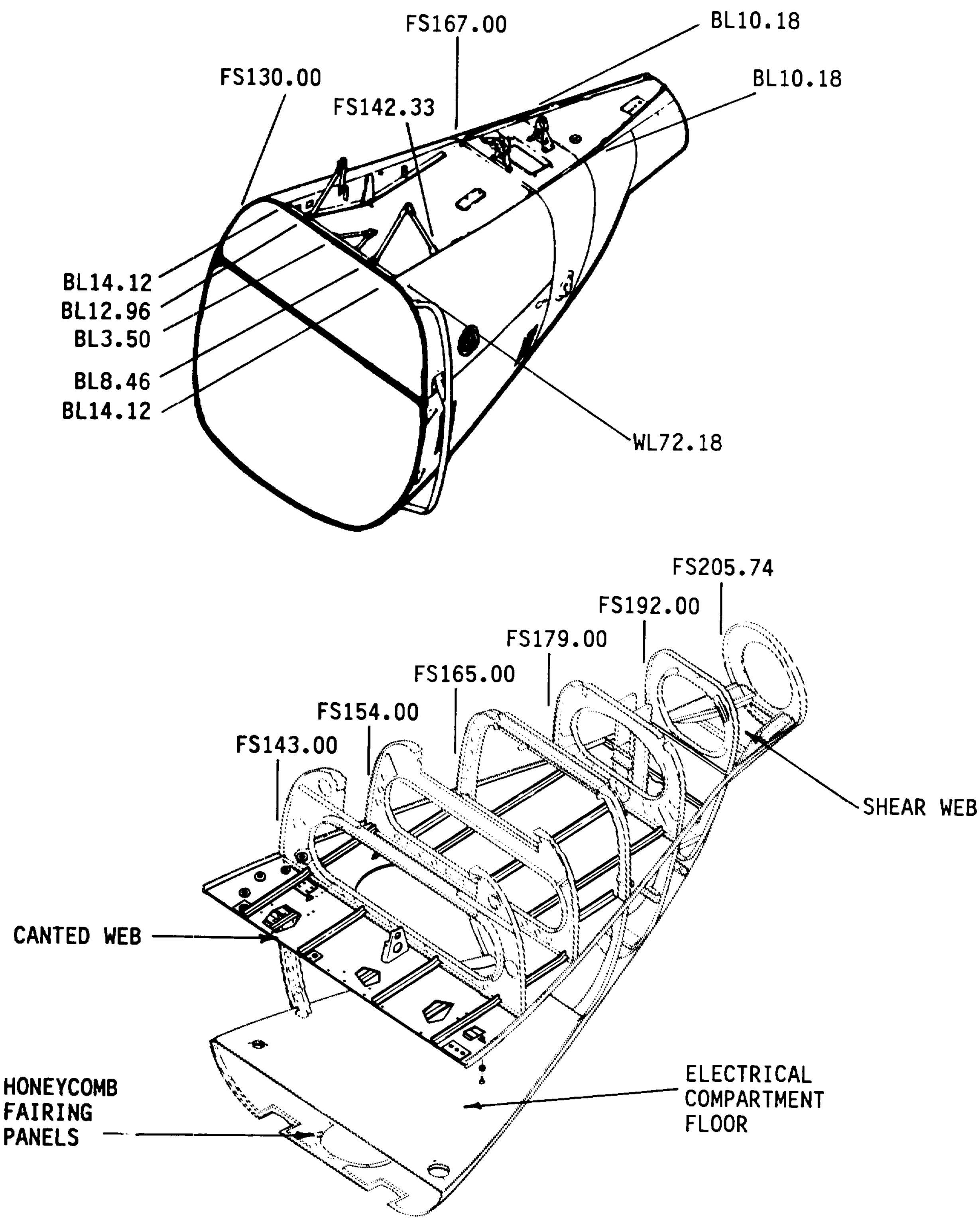
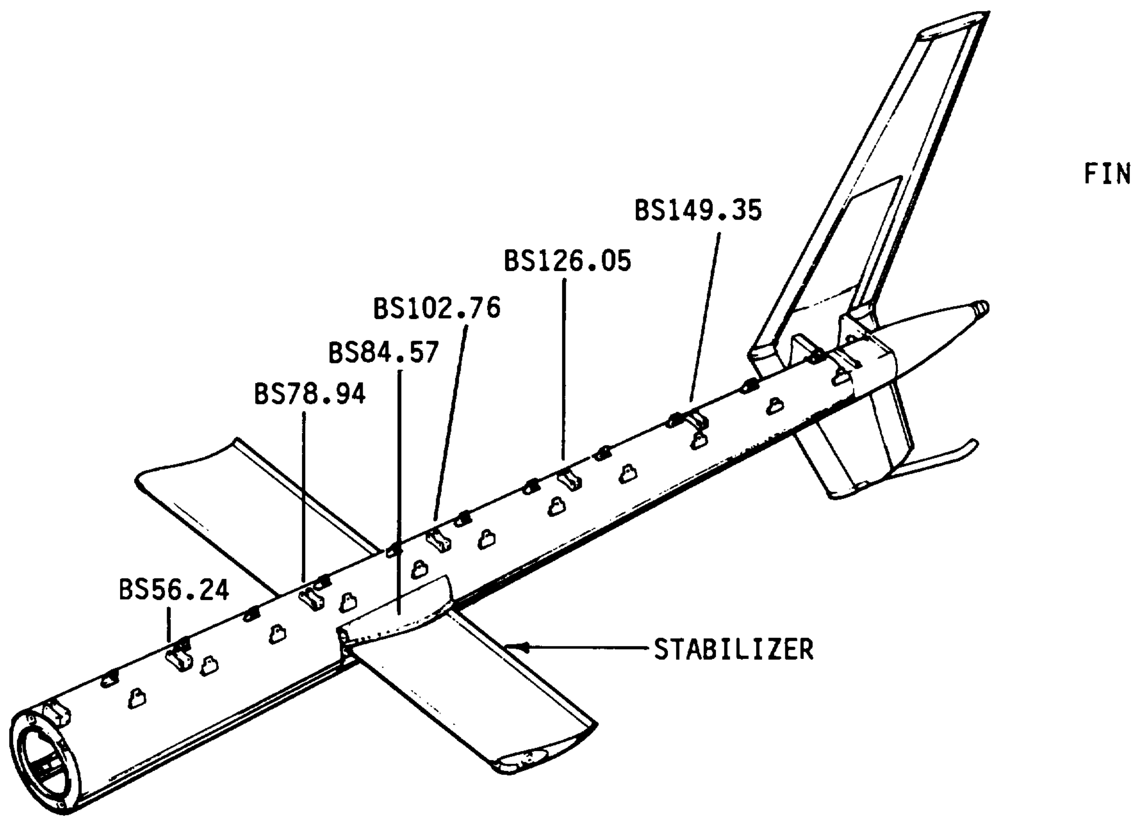


Figure 4-13. Aft Fuselage Structure



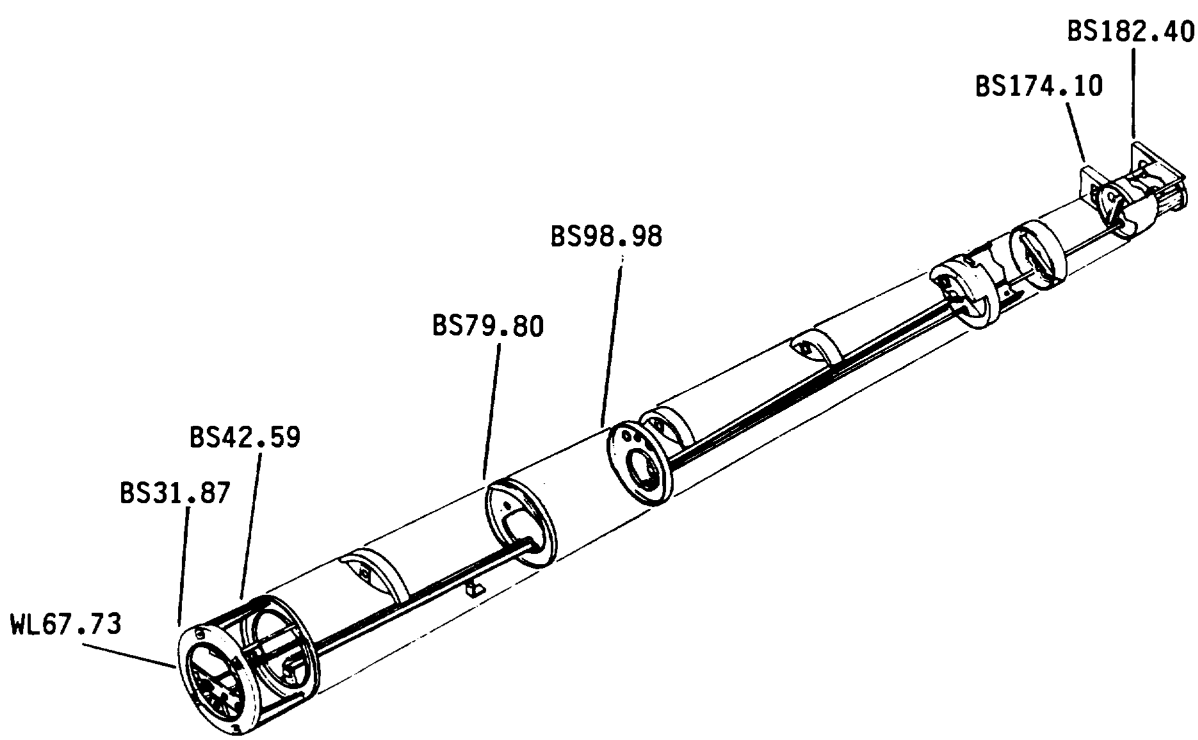


Figure 4-14. Tail Boom

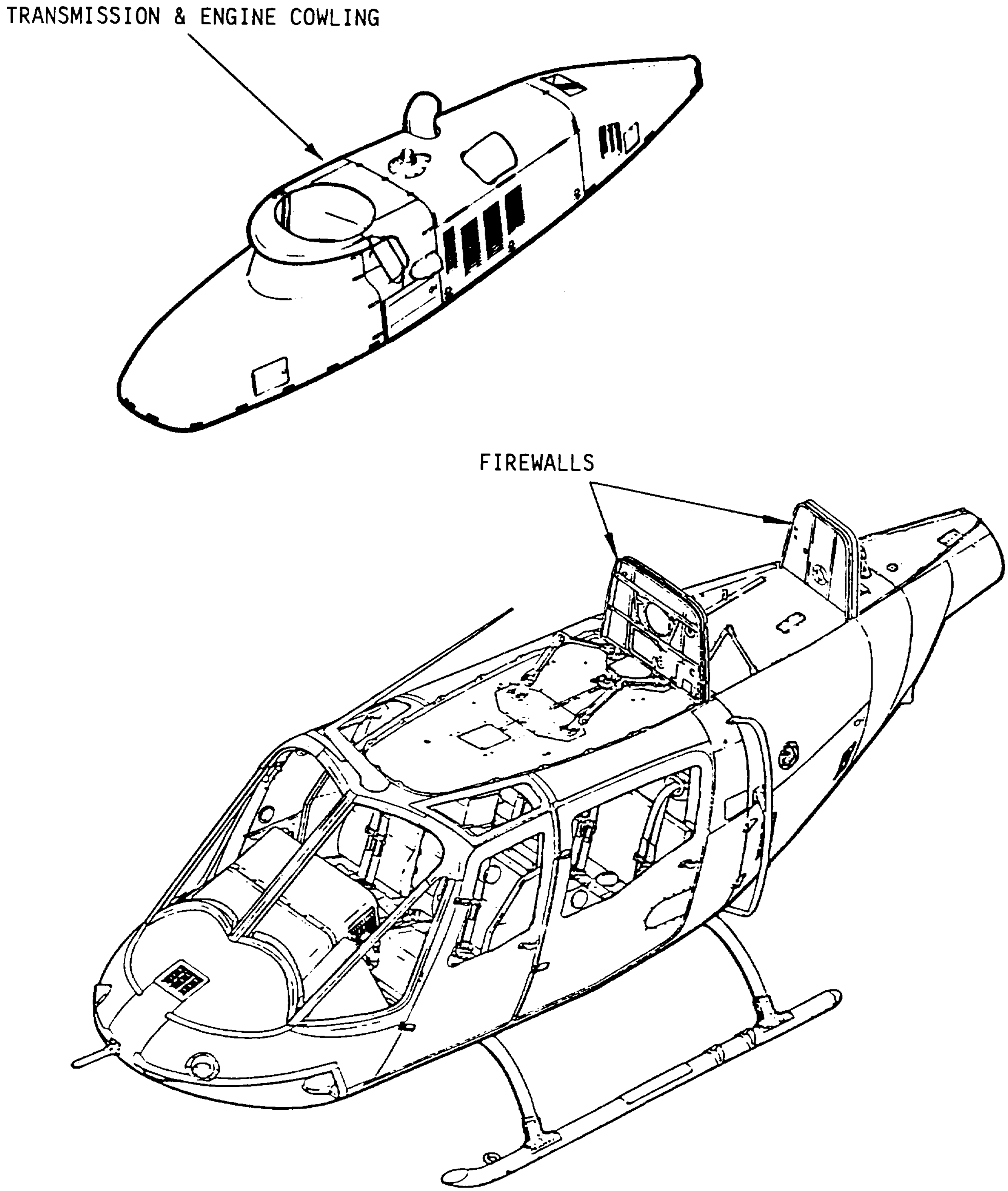


Figure 4-15. Cowling and Firewalls

d. Determine the priority of the various required repairs based on repair time, difficulty of repair, resources available, tactical situation, and need for the aircraft, etc. The longest repair time normally is given the highest priority and is most critical.

4-13. ALLOWABLE DAMAGE LIMITS. Damage limits are calculated on the basis of the OH-58 structural analysis and tend to be conservative. Assessors using damage limits to prepare damage assessments should consider them as guides and balance the damage limits against the judgment resulting from their own experience.

a. Damage limits are tabulated in Tables 4-2 thru 4-7 for most primary structure. If a damaged member is not covered in this manual and the damage appears to exceed authorized limits, classify the member as unserviceable.

b. A component that shows signs of severe overstress such as twisting or buckling or heat damage should be treated as failed.

c. A component should be repaired if the failed component can overstress other systems.

d. Evaluation of Damage to Caps, Longerons, and Stringers. Classify caps,longerons, and stringers as failed if any of-the following conditions exist:

(1) Damage exceeds limits tabulated in Tables 4-2 thru 4-7.

(2) There is damage in four or more locations within a length of three feet.

(3) Fasteners securing the component to other major components are sheared, pulled-through, or missing at one or more locations.

(4) Three or more fasteners next to each other, which join a cap, longeron, and stringer to the web, are sheared, pulled-through or missing.

(5) Twenty percent or more of the component to web fasteners are similarly damaged.

(6) Angles and clips securing the component to another structure are severely damaged or failed.

e. Evaluation of Damage to Machined Fittings. Classify a fitting as failed if any of the following conditions exist:

(1) Damage to the fitting exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 20 percent of the structural section in any one location.

(2) One or more fasteners connecting the fitting to a structure or to an aircraft component are bent, sheared, stripped, or loose.

f. Evaluation of Splices, Straps, Doublers, and Gussets. Damage to a splice, strap, doubler, and gusset will be evaluated as part of the elements to which it attaches. Classify a splice, strap, doubler, or gusset as failed if any of the following conditions exist:

(1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 20 percent of the structural section in any location.

(2) The part has significant damage at the intersection of the two members it connects.

(3) Fasteners securing the part to a structural member(s) are sheared, pulled-through, or missing at two or more adjoining locations.

(4) More than 20 percent of the total number of fasteners are similarly damaged.

g. Evaluation of Damage to Skin and Web Panels. Classify a skin or web panel as failed if any of the following conditions exist:

(1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 25 percent of the panel area.

(2) Damage to one panel is located within 3 inches of damage in an adjoining panel.

(3) The panel is severely deformed or buckled.

(4) Damage to a panel exceeds the damage limit. The damage extends across a stringer, frame, or former in an adjoining panel. Classify that panel as failed even if its damage is within limits.

(5) The panel is on the outside of the aircraft where the damage is exposed to aerodynamic forces that can produce peeling or tearing of the structure in flight.

(6) Fasteners securing the panel are sheared, pulled-through, or missing at three or more adjoining locations.

(7) Twenty percent or more of the total number of fasteners are similarly damaged.

h. Evaluaton of Damage to Honeycomb-Sandwich Panels. Classify a honeycomb-sandwich structure as failed if any of the following conditions exist:

(1) Damage exceeds limits tabulated in Tables 4-2 thru 4-7.

(2) The panel is damaged to the extent that it cannot support the weight of personnel, cargo, or equipment for which it was designed.

(3) The panel is on the outside of the aircraft where it is exposed to aerodynamic forces, and the damage is oriented so as to produce peeling or tearing of the structure in flight.

(4) The panel is secured by mechanical fasteners. Three or more adjoining fasteners are sheared, pulled-through, or missing.

(5) Twenty percent or more of the total number of fasteners are similarly damaged.

i. Evaluation of Damage to Sheet Metal Ribs, Formers, Intercoastals, and Channels. Classify a rib, former, intercostal, or channel as failed if any of the following conditions exist:

(1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 25 percent of the structural section.

(2) Fasteners securing the component are sheared, pulled-through, or missing in three or more adjoining locations.

(3) More than 20 percent of the total number of fasteners are similarly damaged.

j. Evaluation and Damage to Hatches, Doors, and Door Jambs. Classify a damaged hatch, door, or door jamb as failed if any of the following conditions exist:

(1) Damage exceeds limits tabulated Tables 4-2 thru 4-7.

(2) Damage to the hatch, door, or door jamb prevents it from being secured adequately to the airframe.

(3) Hinges and latches are damaged and in danger of becoming unserviceable in flight.

(4) The hatch or door shows signs of severe overstress such as buckling or misalignment.

Table 4-2. Damage Limits Forward Fuselage - Condition I

COMPONENT/ MEMBER	LOCATION FS	WL	BL	ELEMENT	DAMAGE LIMITS CAP/FLANGE CD'	CL' (D'=NxCL)	N	SKIN/WEB WL' (D'=NxWL)	N	NOTES/CAUTIONS
Console, Forward	1.00-32.75	20.00-44.50	5.06R-3.06L	Caps, Stiffeners, Doublers	1.05	2.10	10			
	1.00-32.75	20.00-44.50	5.06R-3.06L	Skins/Webs				2.5	5	
	32.75-55.10	21.00-32.50	5.06R-3.06L	Caps, Stiffeners, Doublers	0.15	0.30	10			
	32.75-44.00	23.39-32.50	5.06R-3.06L	Skins/Webs				2.5	5	
	32.75-44.00	21.00-23.39	5.06R-3.06L	Skin				No Damage Allowed		
Honeycomb Panel	44.00-57.10	21.00-32.50	5.06R-3.06L	Honeycomb Panel				7.50	5	
	44.00-57.10	21.00-32.50	5.06R-3.06L	Panel Edges	0.20	0.40	10			
Instrument Panel Shroud	21.25-37.57	44.15-51.95	5.02R-3.02L	Brace	1.25	2.50	10			
Front Seat Support	57.11	21.00-30.41		Honeycomb Bulkhead				No Damage Allowed		
Pilot's & Copilot's Seat	57.11-74.54	30.41	19.45L-22.15R	Honeycomb Panel				3.5	5	
Center Bulkhead Section	73.04	30.29-54.89		Web				10.0	5	Behind Pilots
Center Bulkhead Section	73.04	21.00-30.29	10.65-17.31L&R	Vertical Stiffeners	2.0	4.0	-			Sum of Damage on All Elements
Pilot's & Copilot's	73.04	30.29		Aft Attachment Angle	No Damage Permitted					
Collective Jackshaft	73.04	21.00-30.29		Support Bracket Channel	0.70	1.50	10			
Pedestal Structure	55.14-73.04	20.00-30.17	5.06R-3.06L	Webs				0.75	5	

Table 4-2. Damage Limits Forward Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Pedestal Structure	55.14-73.04	20.00-30.17	5.06R-3.06L	Caps/Stiffeners	(D’=N x CL)			(D’=N x WL)		
					0.65	1.30	10			
Lower Shell	36.00-73.04	20.00-25.25		Honeycomb Panel				3.50	5	
	36.00-73.04	20.00		Inserts for Cyclic & Pedal Controls	No Damage Within 3” Radius of Insert					
	73.00	20.00	12.16& 14.58L&R	Forward Landing Gear Attachments	One Damaged Insert Permitted					
Center Post	73.00-87.85	20.00-72.00	3.00L-3.00R	Caps	0.25	0.50	10			
	73.00-87.85	27.48-72.00	3.00L-3.00R	Side Webs and Doublers				2.25	5	
	74.52-81.30	54.50-72.00	3.00L-3.00R	Web, Front				0	—	
	80.00-87.85	62.00-72.00	3.00L-3.00R	Splices	0	-	-			
	73.00-87.85	20.00-72.00	3.00L-3.00R	Stiffeners	0.50	1.00	10			
Passenger Seat	96.44-114.76	29.92-31.42	24.14L-24.14R	Honeycomb Seat Panel				4.25	5	No Damage Within 3” of Gun Mounts (If used)
	96.44-114.76	24.70-29.92	23.08L&R	Honeycomb Side Panels				1.5	5	
	96.44	20.00-29.92	23.08L-23.08R	Honeycomb Front Panel				4.0	5	
	96.44-114.76	20.00-29.92	23.08L-23.08R	Angles, Side, Front Top, Bottom	0.25	0.50	10			
Gun Mounts	103.76	30.25	0.00& 23.00L	Fittings and Fasteners	No Damage Permitted (If Used)					
Depression Stop Attachment	104.55	30.25	5.85L	Honeycomb Panel	No Damage Permitted Within 3” Radius of Attachments					

Table 4-2. Damage Limits Forward Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
					(D’=N x CL)			(D’=N x WL)		
Passenger Seat Back Bulkhead	114.79-122.20	31.42-72.00		Flanges, Angles, Caps, Splices, Clips	No Damage Permitted					
	117.90-122.20	48.25-72.00		Web				1.10	5	
	115.10-117.70	35.39-49.98	17.80L 17.80R	Honeycomb Door Assembly				3.00	5	
	114.76-117.70	31.42-49.98		Honeycomb Panel Assembly				1.50 1.50	5 5	
Bulkhead FS130, Upper	130	51.72-72.00		Inboard, Outboard Frame Caps	0.30	0.60	10			
	130	51.72-72.00		Frame Webs				2.40	5	
	130	51.72-72.00		Clips, Splices, Supports, Flanges	0.30	0.60	10			
Bulkhead FS130, Lower	130	29.70-51.52		Honeycomb Panel				8.00	5	
	130	20.00-29.70		Honeycomb Panel				3.00	5	
Aft Cabin Enclosure	120.00-130.00	50.04-69.00	20.55L&R	Inner Skin and Doublers				3.70	5	
	117.71-130.00	50.04-67.20	25.25L	Outer Skin				6.00	5	
	117.71-130.00	50.04-67.20	25.25R	Outer Skin and Door Panel				6.00	5	
	117.71-130.00	50.00-72.00	25.25L&R	Intercoastals Between Inner & Outer Skin				1.50	5	
	117.71-130.00	50.04-72.00	25.25L&R	Angles, Supports, Flanges, Stiffeners	0.50	1.00	10			

Table 4-2. Damage Limits Forward Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Aft Cabin Enclosure	120.00-130.00	63.71	20.00L	Gun Mount Channel	(D'=N x CL)			(D'=N x WL)		
					1.00	2.00	10			
Pylon Support	98.80	73.93	7.52L&R	Forward Support	No Damage Allowed					
	123.62	71.92	6.25L&R	Aft Support	No Damage Allowed					
Cabin Roof Beam	80.46-130.00	67.92-71.96	3.00L&R	Beam, Left and Right	No Damage Allowed					
	101.67& 123.62	67.92-71.96	0	Bulkheads Between Beams	No Damage Allowed					
	120.90	67.92-71.96	3.00L-3.00R	Bulkhead Skin and Doubler				2.00	5	
	80.46-130.00	67.92	3.00L-3.00R	Bottom Skin and Access Cover				0.75	5	
Lower Cabin Shell	73.18-113.00	20.00-25.25	18.40L&R-Outboard	Radius and Edge of Honeycomb Panel				1.00	5	
	73.18-113.00	20.00	18.40L-18.40R	Honeycomb Panel				6.30	5	No Damage Within 3" Radius of Inserts
	113.00-130.00	20.00-54.65		Honeycomb Panel				6.30	5	No Damage Within 3" Radius of Inserts
	96.44	20.00		Splice	0.75	1.50	10			
	36.00-130.00	20.00-54.65		Frames, Angles, Stiffeners	0.50	1.00	10			
Upper Cabin Roof Shell	54.48-82.86			Top Skin				3.00	5	
	82.86-125.00			Honeycomb Panels				3.00	5	
	120.40-130.00		14.12L&R-Outboard	Honeycomb Panels				2.50	5	
	125.00-130.00		14.12L-14.12R	Titanium Panel				2.50	5	

Table 4-2. Damage Limits Forward Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Upper Cabin Roof Shell	54.48-130.00			Flanges, Formers, Stiffeners, Supports	(D’=N x CL)			(D’=N x WL)		
					0.60	1.20	10			
Landing Gear	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Support Fitting Flanges	Damage Allowed on One Flange					
	130.00	20.75	10.25L&R	Cross Tube Aft Strap	0.31	0.62	-			
	73.00	18.30	13.30L&R	Cross Tube Forward Strap	0.10	0.20	-			
	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Back-Up Supports	No Damage Allowed					
	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Attachment Fasteners and Inserts	Damage Allowed On One Fastener & Insert Per Fitting					
Jacking & Tiedown Fittings				Fitting	Damage Limited By Jacking Tiedown Requirements					
Anti-Torque Support	35.66	21.00	5.04L-3.04R	Fitting	No Damage Allowed					
Collective Jackshaft Bearing Support	73.12	28.62	1.50L	Fitting	No Damage Allowed					
Anti-Torque Support Fitting	78.95	23.83	3.06L	Fitting	No Damage Allowed					

Table 4-3. Damage Limits Aft Fuselage — Condition I

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Upper Longeron	130.00-205.00	72.00-72.93	14.12-4.72L&R	Channel	(D'=N x CL)			(D'=N x WL)		
					No Damage Allowed					
	130.00& 167.00			Splice	No Damage Allowed					
	205.00			Tail Boom Attach Fittings	No Damage Allowed					
Center Longeron	130.00-206.35	51.67-61.76	25.5-2.79L&R	Angle and Channel	No Damage Allowed					
	130.00	51.67		Splice	No Damage Allowed					
	206.35	61.76		Tail Boom Attach Fittings	No Damage Allowed					
Lower Longeron	130.00-192.84	29.40-44.50	22.50-1.10L&R	Angle	No Damage Allowed					
	130.00	29.40		Splice	No Damage Allowed					
Aft Fuselage	130.00-206.35	Lower Longeron Upward		Stiffeners	0.52	1.04	10			
	130.00-206.35	Lower Longeron to Upper Longeron		Skin				3.0	5	
	130.00-206.35	Lower Longeron Upward		Doublers				3.0	5	
	130.00-206.35	Lower Longeron Upward		Clips	Same Limits As Attaching Structure					
Tail Boom Access Door	192.84-205.76	73.34-61.76		Skin				8.0	5	
Deck	179.92-205.76	72.00	8.33L-8.33R	skin				3.0	5	
Oil Cooler	167.00-179.92	72.00	10.18L-10.18R	Honeycomb Support Panel				2.0	5	No Damage Within 3” of Inserts
	171.50	72.00	0	Pan & Drain	No Damage Allowed					

Table 4-3. Damage Limits Aft Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Anti-Torque Support	179.92-181.62	58.27-73.37	0.88R	Support and Fittings	(D’=N x CL)			(D’=N x WL)		
					No Damage Allowed					
Engine Pan	130.00-167.00	71.74	14.12L-14.12R	Horizontal Stiffeners	1.00	2.00	10			
	130.00-167.00	71.74	14.12L-14.12R	Web & Drain	No Damage Allowed					
	130.00-167.00	71.74	14.12L-14.12R	Spot Weld Damage	1/3 of Welds May Be Damaged					
	130.00-167.00	71.74	14.12L-14.12R	Doublers, Splices Vertical Stiffeners	0.75	1.50	10			
Canted Web	130.00-192.84	51.67-59.98	25.00L&R-7.00L&R	Stiffeners	1.15	2.30	10			
	130.00-192.84	51.67-59.98	15.00L&R-7.00L&R	Web				4.75	5	
Shear Web	192.84-206.35	60.00	7.00L&R-4.00L&R	Stiffeners	0.15	0.30	10			
	192.84-206.35	60.00	7.00L&R-4.00L&R	Webs				3.00	5	
Electrical Compartment Floor	130.00-167.00	29.47-34.46		Inserts	Damage Allowed to One Insert in Each Group of Four					
	130.00-167.00	29.47-34.46		Honeycomb				10.00	5	No Damage Within 2” of Effective Inserts
Bulkheads	142, 154, 167, 179, 192			Frame Section	0.75	1.50	10			
	142, 154, 167, 179, 192			Stiffeners, Clips Doublers	0.50	1.00	10			
	142, 154, 167, 179, 192			Splices	No Damage Allowed					

Table 4-3. Damage Limits Aft Fuselage — Condition I (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Bulkhead				Frame Section	(D'=N x CL)			(D'=N x WL)		
	205.74				0.40	0.80	10			
	205.74			Angles, Clips	0.50	1.00	10			
Engine Mount Support	130.00		8.465L&R	Back-Up Structure	No Damage Allowed					
	130.00		3.50L&R	Fitting	No Damage Allowed					
	142.33	72.00	12.96L&R	Fitting	No Damage Allowed					

Table 4-4. Damage Limits Tail Boom and Landing Gear — Condition I

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	BS	WL	BL		CD'	CL'	N	WL'	N	
Tail Boom	31.94- 42.59			Intercoastals	(D'=N x CL)			(D'=N x WL)		
					No Damage Allowed					
	31.92			Attachment Fittings	No Damage Allowed					
	31.87- 164.10			Skin				At any Circumference		No Damage Allowed BS164.10-182.40
								3.0	5	
	31.87, 42.59, 79.82, 98.29, 116.84, 150.22			Bulkheads	No Damage Allowed					
	174.10- 182.40			Bulkheads	0.85	1.70	10			
	174.10- 182.40			Fin Supports	0.17	0.34	10			
	174.10- 182.40			Gearbox Mounting Plate	No Damage Allowed					

Table 4-4. Damage Limits Forward Fuselage — Condition I

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Tail Boom	174.10-182.40			Bell Crank Support	(D'=N x CL)			(D'=N x WL)		
					No Damage Allowed					
	31.87-182.40			Driveshaft Support & Hangers	No Damage Allowed					
Stabilizer	84.57			Spar	0.70	1.40	10			
Fin				Honeycomb Panels				2.0	5	

Table 4-5. Damage Limits Forward Fuselage — Condition II

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Fin				Fin to Antenna Attaching Flanges	(D'=N x CL)			(D'=N x WL)		
					1.20	2.40	10			
				Fin to Boom Inserts	No Damage Within 3" of Inserts					
Tail Skid				Tube Fitting	No Damage Restrictions					
Landing Gear				Skid Tube				2.00	5	
				Fwd and Aft Cross Tubes	No Damage Allowed					
Forward Console	1.00-32.75	20.00-44.50	5.06R-3.06L	Caps, Stiffeners, Doublers	1.10	2.20	5			
	1.00-32.75	20.00-44.50	5.06R-3.06L	Skins/Webs				4.50	5	
	32.75-55.10	21.00-32.50	5.06R-3.06L	Caps, Stiffeners, Doublers	0.65	1.30	5			
	32.75-44.00	23.39-32.50	5.06R-3.06L	Skins/Webs				4.50	5	
	32.75-44.00	21.00-23.39	5.06R-3.06L	Skin				1.00	5	
Honeycomb Panel	44.00-57.10	21.00-32.50	5.06R-3.06L	Honeycomb Panel				8.00	5	

Table 4-5. Damage Limits Forward Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Honeycomb Panel	44.00-57.10	21.00-32.50	5.06R-3.06L	Panel Edges	(D’=N x CL)			(D’=N x WL)		
					0.35	0.70	5			
Instrument Panel Shroud	21.25-37.56	44.15-51.95	5.02R-3.02L	Brace	1.50	3.00	5			
Front Seat Support	57.11	21.00-30.41		Honeycomb Bulkhead				1.05	5	Does Not Include Manufacturer’s Holes
Pilot’s & Copilot’s Seat	57.11-74.54	30.41	19.45L-22.15R	Honeycomb Panel				8.50	5	
Center Bulkhead Section	73.04	30.29-54.89		Web				12.00	5	
	73.04	21.00-30.29	10.64-17.31L&R	Vertical Stiffeners	2.20	4.40	-			
Pilot’s & Copilot’s Seat	73.04	30.29		Aft Attachment Angle	0.70	1.40	5			
Collective Jackshaft	73.04	21.00-30.29		Support Bracket Channel	1.00	2.00	5			
Pedestal Structure	55.14-73.04	20.00-30.17	5.06R-3.06L	Webs				1.10	5	
	55.14-73.04	20.00-30.17	5.06R-3.06L	Caps/Stiffeners	0.85	1.70	5			
Lower Shell	36.00-73.00	20.00-25.25		Honeycomb Panel				4.50	5	
	36.00-73.00	20.00		Inserts for cyclic and Pedal Controls	No Damage in One Set of Controls Within 3” Radius of Inserts					
	73.00	20.00	12.16 & 14.58 L&R	Forward Landing Gear Attachments	Two Diagonal Inserts May Be Damage					
Center Post	73.00-85.85	20.00-72.00	3.00L-3.00R	Caps	0.75	1.50	5			

Table 4-5. Damage Limits Forward Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Center Post	73.00-87.85	24.48-72.00	3.00L 3.00R	Side Webs and Doublers	(D’=N x CL)			(D’=N x WL)		
								4.50	5	
	74.52-81.30	54.50-72.00	3.00L 3.00R	Front Web				2.50	5	
	80.00-87.85	62.00-72.00	3.00L-3.00R	Splices	0.75	1.50	5			
	73.00-87.85	20.00-72.00	3.00L-3.00R	Stiffeners	0.75	1.50	5			
Passenger Seat	96.44-114.57	29.92-31.42	24.14L-24.14R	Honeycomb Seat Panel				10.00	5	No Damage Within 3” of Gun Mount (If Used)
	96.44-114.76	24.70-29.92	23.08L&R	Honeycomb Side Panels				2.00	5	
	96.44	20.00-29.92	23.08L-23.08R	Honeycomb Front Panel				4.5	5	
	96.44-114.76	20.00-29.92	23.08L-23.08R	Angles, Side, Front, Top, bottom	0.60	1.20	5			
Gun Mounts	103.76	30.25	0.00 & 23.00L	Fittings and Fasteners	No Damage Permitted (If Used)					
Depression Stop Attachment	104.55	30.25	5.85L	Honeycomb Panel	No Damage Permitted Within 1-1/2” Radius of Attachments					
Passenger Seat Back Bulkhead	114.79-122.20	31.42-72.00		Flanges, Angles, Caps, Splices, Clips	0.50	1.00	5			
	117.90-122.20	48.25-72.00		Web				1.40	5	
	115.10-117.70	35.39-49.98	17.80L-17.80R	Honeycomb Door Assembly				6.00	5	
	114.76-117.70	31.42-49.98		Honeycomb Panel Assembly				2.00	5	

Table 4-5. Damage Limits Forward Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Bulkhead FS130, Upper	130	51.72-72.00		Inboard, Outboard Frames, Webs	(D’=N x CL)			(D’=N x WL)		
					0.60	1.20	5			
	130	51.72-72.00		Frame, Webs				3.00	5	
	130	51.72-72.00		Clips, Splices Supports, Flanges	0.60	1.20	5			
Bulkhead, FS130, Lower	130	29.70-51.52		Honeycomb Panel				12.00	5	
	130	20.00-29.70		Honeycomb Panel				4.00	5	
Aft Cabin Enclosure	120.00-130.00	50.04-69.00	20.55L&R	Inner Skin and Doublers				5.30	5	
	117.71-130.00	50.04-67.20	25.25L	Outer Skin				7.50	5	
	117.71-130.00	50.04-67.20	25.25R	Outer Skin and Door Panel				7.50	5	
	117.71-130.00	50.00 72.00	25.25L&R	Intercoastals Between Inner & Outer Skin				2.00	5	
	117.71-130.00	50.04-72.00	25.25L&R	Angles, Support, Flanges, Stiffeners	0.70	1.40	5			
Aft Cabin Enclosure	120.00-130.00	63.71	20.00L	Gun Mount Channel	1.50	3.00	5			
Pylon Support	98.80	73.93	7.52L&R	Forward Support	No Damage Allowed					
	123.62	71.92	6.25L&R	Aft Support	No Damage Allowed					
Cabin Roof Beam	80.46-130.00	67.92-71.96	3.00L&R	Beam, Left and Right	No Damage Allowed					
	101.67& 123.62	67.92-71.96	0	Bulkheads Between Beams	No Damage Allowed					

Table 4-5. Damage Limits Forward Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Cabin Roof Beam	120.90	67.92-71.96	3.00L-3.00R	Bulkhead Skin and Doublers	(D’=N x CL)			(D’=N x WL)		
								2.75	5	
	80.46-130.00	67.92	3.00L-3.00R	Bottom Skin and Access Cover				1.00	5	
Lower Cabin Shell	73.18-113.00	20.00-25.25	18.40L&R-Outboard	Radius and Edge of Honeycomb Panel				1.50	5	
	73.18-113.00	20.00	18.40L 18.40R	Honeycomb Panel				10.00	5	No Damage Within 3” Radius of Inserts
	113.00-130.00	20.00-54.65		Honeycomb Panel				10.00	5	No Damage Within 3” Radius of Inserts
	96.44	20.00		Splice	1.50	3.00	5			
	36.00-130.00	20.00-54.65		Frames, Angles Stiffeners	0.75	1.50	5			
Upper Cabin Roof Shell	54.48-82.86			Top Skin				4.50	5	
	82.86-125.00			Honeycomb Panels				4.50	5	
	120.40-130.00		14.12L&R-Outboard	Honeycomb Panels				3.00	5	
	125.00-130.00		14.12L-14.12R	Titanium Panel				3.00	5	
	54.48-130.00			Flanges, Formers, Stiffeners, Supports	0.75	1.50	5			
Landing Gear	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Support Fitting Flanges	Damage Allowed on Two Diagonal Tabs					
	130.00	20.75	10.25L&R	Cross Tube Aft Strap	0.63	1.26	5			
	73.00	18.30	13.30L&R	Cross Tube Forward Strap	0.35	0.70	5			
	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Back-Up Support	No Damage Allowed					

Table 4-5. Damage Limits Forward Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Landing Gear	73.00& 130.00	18.30& 20.75	13.30L&R & 10.25L&R	Attachment Fasteners and Inserts	(D'=N x CL)			(D'=N x WL)		
					Damage Allowed on One Fastener and Insert Per Fitting					
Jacking & Tiedown Fittings				Fitting	Damage Limited By Jacking and Tiedown Requirements					
Anti-Torque Support	35.66	21.00	5.04L- 3.04R	Fitting	No Damage Allowed					
Collective Jackshaft Bearing Support	73.12	28.62	1.50L	Fitting	No Damage Allowed					
Anti-Torque Support Fittings	78.95	23.83	3.06L	Fitting	No Damage Allowed					

Table 4-6. Damage Limits Aft Fuselage — Condition II

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD'	CL'	N	WL'	N	
Upper Longeron	130.00- 205.00	72.00- 72.93	14.12- 4.72L&R	Channel	(D'=N x CL)			(D'=N x WL)		
					1.50	3.00	5			
	130.00& 167.00			Splice	No Damage Allowed					
	205.00			Tail Boom Attach Fittings	No Damage Allowed					
Center Longeron	130.00- 206.35	51.67- 61.76	25.50- 2.79L&R	Angle and Channel	0.90	1.80	5			
	130.00	51.67		Splices	No Damage Allowed					
	206.35	61.76		Tail Boom Attach Fittings	No Damage Allowed					
Lower Longeron	130.00- 192.84	29.40- 44.50	22.50- 1.10L&R	Angle	0.85	1.70	5			
	130.00	29.40		Splice	No Damage Allowed					

Table 4-6. Damage Limits Aft Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Aft Fuselage	130.00-206.25	Longeron Upward		Stiffeners	(D’=N x CL)			(D’=N x WL)		
					0.75	1.50	5			
	130.00-206.25	Lower Longeron to Upper Longeron		Skin				3.75	5	
	130.00-206.35	Lower Longeron Upward		Doublers				3.75	5	
	130.00-206.35	Lower Longeron Upward		Clips	Same Limits as Attaching Structure					
Tail Boom Access	192.84-205.76	73.34-61.76		Skin				11.0	5	
Deck	179.92-205.76	72.00	8.33L-8.33R	Skin				3.75	5	
Oil Cooler	167.00-179.92	72.00	10.18L-10.18R	Honeycomb Support Panel				3.00	5	No Damage Within 2” of Inserts
	171.50	72.00	0	Pan & Drain	No Damage Allowed					
Anti-Torque Support	179.92-181.62	58.27-73.37	0.88R	Support & Fittings	No Damage Allowed					
Engine Pan	130.00-167.00	71.74	14.12L 14.12R	Horizontal Stiffeners	1.20	2.40	5			
	130.00-167.00	71.74	14.12L 14.12R	Web & Drain	No Damage Allowed					
	130.00-167.00	71.74	14.12L-14.12R	Spot Weld Damage	1/2 of Welds May Be Damaged					
	130.00-167.00	71.74	14.12L-14.12R	Doublers, Splices Vertical Stiffener	0.85	1.70	5			
Canted Web	130.00-192.84	51.67-59.98	25.00-7.00L&R	Stiffeners	1.50	3.00	5			
	130.00-192.84	51.67-59.98	25.00-7.00L&R	Web				5.40	5	

Table 4-6. Damage Limits Aft Fuselage — Condition II (Cont)

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Shear Web	192.84-206.35	60.00	7.00-4.00L&R	Stiffeners	(D’=N x CL)			(D’=N x WL)		
					0.40	0.80	5			
	192.84-206.35	60.00	7.00-4.00L&R	Webs				3.60	5	
Electrical Compartment Floor	130.00-167.00	29.47-34.46		Inserts	Damage Limited to Two Inserts to Each Group of Four					
	130.00-167.00	29.47-34.46		Honeycomb				15.0	5	No Damage Within 2” of Effective Inserts
Bulkheads	142, 154 167, 179 192			Frame Section	1.10	2.20	5			
	142, 154 167, 179 192			Stiffeners, Clips, Doublers	0.70	1.40	5			
	142, 154 167, 179 192			Splices	No Damage Allowed					
Bulkhead	205.74			Frame Section	1.50	3.00	5			
	205.74			Angles, Clips	0.70	1.40	5			
Engine Mount Support	130.00		8.465L&R	Back-Up Structure	No Damage Allowed					
	130.00		3.50L&R	Fitting	No Damage Allowed					
	142.33	72.00	12.96L&R	Fitting	No Damage Allowed					

Table 4-7. Damage Limits Tail Boom and Landing Gear — Condition II

COMPONENT / MEMBER	LOCATION			ELEMENT	DAMAGE LIMITS					NOTES / CAUTIONS
					CAP / FLANGE			SKIN / WEB		
	FS	WL	BL		CD’	CL’	N	WL’	N	
Tail Boom	31.92-42.59			Intercoastals	(D’=N x CL)			(D’=N x WL)		
					No Damage Allowed					
	31.92			Attachment Fittings	No Damage Allowed					
	31.87-164.10			Skin				At Any Circumference		No Damage Allowed BS164.10-182.40
								6.00	5	
	31.87, 42.59, 79.82, 98.29, 116.84, 150.22			Bulkheads	1.00	2.00	5			
	174.10-182.40			Bulkheads	1.05	2.10	5			
	174.10-182.40			Fin Supports	0.50	1.00	5			
	174.10-182.40			Gearbox Mounting Plate	No Damage Allowed					
	174.10-182.40			Bell Crank Support	No Damage Allowed					
	31.87-182.40			Driveshaft Support and Hangers	No Damage Allowed					
Stabilizer	84.57			Spar	1.50	3.00	5			
Fin				Honeycomb Panels				4.50	5	
				Fin to Antenna Attaching Flanges	2.60	5.20	5			
				Fin to Boom	No Damage Within 3” of Inserts					
Tail Skid				Tube Fitting	No Damage Restrictions					
Landing Gear				Skid Tube				3.50	5	
				Fwd & Aft Cross Tubes				1.50	5	

(5) There are large holes or cracks in an area of the door or hatch exposed to the windstream, and peeling or tearing of the material in flight is probable.

(6) Fasteners holding major components of the hatch, door, or door jamb together are sheared, pulled-through, or missing at three or more adjoining locations.

(7) More than 20 percent of the total number of fasteners are similarly damaged.

k. Evaluation of Damage to Fairings and Cowlings. Classify a damaged fairing or cowling as failed if any of the following conditions exist:

(1) Damage to the fairing and cowling or its attaching structure prevents it from being adequately secured to the airframe.

(2) The fairing and cowling shows signs of severe overstress such as crushing, buckling, or misalignment.

(3) Tracks, rollers, hinges, or latches are damaged in danger of becoming unserviceable in flight.

(4) Fasteners securing the fairing and cowling are sheared, stripped, pulled-through, or missing at three or more adjoining locations.

(5) Twenty percent or more of the total number of fasteners are similarly damaged.

(6) There are large cracks or holes in an area of the fairing and cowling exposed to the windstream, and peeling or tearing of the material in flight is probable.

l. Evaluation of Damage to Firewalls. Classify a damaged firewall as failed if any of the following conditions exist:

(1) The firewall shows sign of severe overstress such as buckling and misalignment.

(2) Fasteners securing the firewall to the upper deck structure are sheared, stripped, pulled-through, or missing at three or more adjoining locations.

(3) Twenty percent or more of the total number of fasteners are similarly damaged.

(4) Damage to the supporting framework causes the firewalls to be loose and subject to collapsing in flight.

(5) There are large holes or cracks in the firewall that would prevent the firewall from containing a fire.

m. Assessing the Effect of Structural Damage on Other Aircraft Systems.

(1) The assessment standards provided basically concern the airworthiness and flight capability of the OH-58 airframe. However, every member of the airframe has a structural and/or functional purpose. Even those members which are unessential to airworthiness may have an important function related to the integrity and performance of other aircraft systems and components. Some of these effects have been considered and are reflected in the assessment standards.

(2) The assessor is responsible for working with other specialists to determine if damage to airframe structures will overstress, damage, or degrade the performance of other system components. All of the system hardware near the damage should be evaluated for these possible effects. Among the types of conditions to consider are as follows:

(a) Structural movement which might change the location or alignment of a component. Controls and drive-shafts will be particularly critical.

(b) Structural damage which could affect the security of wire bundles and fluid lines, causing them to vibrate, chafe, and fatigue during flight.

(c) Damaged structure which might interfere with the free travel or movement of a system component during operation.

(3) If the assessor determines that structural damage will or might create any of the above conditions, classify the structure as failed even if the physical damage is within allowable limits.

4-14. BDAR REPAIR PROCEDURE INDEX.

Section II. EXPEDIENT STRUCTURAL REPAIRS

4-15. GENERAL.

a. Many of these expedient repairs will restore the airframe to condition 1. Inspection for damage growth will generally be required after every flight, and damage should be repaired as soon as practical by standard maintenance procedures.

b. Multiple Damage. Special attention should be given to structural components which have sustained damage in multiple locations. It is essential that damage to an individual structural item not be considered by itself. Suitable repair will often depend on the condition of the adjacent structure. In some cases, undamaged adjacent structure may satisfactorily take the load of the damaged item. Since time is an overriding consideration on the battlefield, BDAR airframe repairs are usually performed on the outside of the aircraft to save the time required to gain access to the interior. If, however, access to the interior damaged structure is already available, inside BDAR repairs may be made.

c. Fasteners. BDAR can be carried out using any form of fastening device, which is available at the time (e.g., nuts, bolts, rivets, etc.), as long as strength requirements are met. Use accepted practices regarding fastener edge distance and spacing. The fasteners used in a single repair should be of the same type.

d. Metal Selection. All repair patches should be manufactured from material of the same or similar specification as the damaged area but at least one gauge or 10 percent thicker. When required repair materials are unavailable, substitutions can often be made to produce a desired strength. Table 4-8 cross lists various types of metal and instructions on how to substitute one type of metal for another. Alternate repair materials can be obtained from scrapped aircraft. It is also permissible to fabricate from thinner gauge material and use multiple thickness.

Table 4-8. Metal Substitution Chart

MATERIAL TO BE REPLACED	ULTIMATE TENSILE STRENGTH PSI	2024			1025	7075 T6		4130 8630 Steel		Titanium				Stainless Steel		
		T3&4 Clad	T4 Extruded	T6 Bare	Steel	Clad	Extruded	90 KSI	125 KSI	99%	8 Mn	6AL -4V	6Al-6V-2Sn	1/4 301	1/2 302	321 347
6061-T6 Extruded	38,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AZ31A-H Magnesium	39,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6061-T6 Clad	42,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T4 Extruded	57,000	1.0	1.0	1.0	1.04	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T4 Clad	58,000	1.0	1.02	1.0	1.05	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T3 Clad	60,000	1.04	1.05	1.0	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T6 Bare	62,000	1.07	1.09	1.0	1.13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T81 Clad	64,000	1.1	1.12	1.03	1.16	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T88 Clad	70,000	1.21	1.23	1.13	1.25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Clad	72,000	1.24	1.27	1.16	1.31	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Bare	78,000	1.35	1.37	1.26	1.42	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Extruded	78,000	1.35	1.37	1.26	1.42	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7178-T6 Bare	84,000	1.45	1.48	1.36	1.53	1.17	1.08	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7178-T6 Extruded	84,000	1.45	1.48	1.36	1.53	1.17	1.08	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium 99%	80,000	1.38	1.40	1.29	1.45	1.11	1.02	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Type 321 & 347 CRES	100,000	1.72	1.75	1.61	1.82	1.38	1.28	1.11	1.0	1.25	1.0	1.0	1.0	1.0	1.0	1.0
Titanium-8Mn	120,000	2.06	2.1	1.93	2.18	1.66	1.53	1.33	1.0	1.50	1.0	1.0	1.0	1.0	1.0	1.20
Type 301 Stainless	125,000	2.15	2.19	2.09	2.27	1.73	1.60	1.38	1.0	1.56	1.04	1.0	1.0	1.0	1.0	1.25
Titanium 6AL-4V	134,000	2.31	2.35	2.16	2.43	1.86	1.71	1.48	1.07	1.67	1.12	1.0	1.0	1.07	1.0	1.34
Titanium 4Al-4Mn	140,000	2.41	2.45	2.25	2.55	1.94	1.79	1.55	1.12	1.75	1.16	1.04	1.00	1.12	1.0	1.40
Type 301 Stainless	150,000	2.58	2.63	2.42	2.73	2.08	1.92	1.66	1.20	1.88	1.25	1.11	1.0	1.2	1.0	1.50
Titanium 6Al-6V-2Sn	155,000	2.67	2.71	2.5	2.81	2.15	1.98	1.72	1.24	1.93	1.29	1.15	1.0	1.24	1.03	1.55

A. LOCATE THE MATERIAL TO BE REPLACED ON THE LINE IN THE LEFT HAND COLUMN.
B. LOCATE THE SUBSTITUTE MATERIAL IN THE VERTICAL COLUMNS.
C. TO OBTAIN THE MINIMUM THICKNESS OF THE SUBSTITUTE MATERIAL, MULTIPLY THE THICKNESS OF THE MATERIAL TO BE REPLACED BY THE FACTOR SHOWN AT THE INTERSECTION OF THE LINE AND COLUMN FOUND IN STEP A & B. SUBSTITUTE STANDARD GAGE EQUAL TO THIS THICKNESS OR NEAREST STANDARD GAGE.

NOTE

- Steel and aluminum are incompatible materials and normally require special precautions. However, for BDAR, this is an acceptable usage.

- Refinements to patch repairs, such as countersunk fasteners, chamfered edges, anti-corrosive treatment, and radius corners of the patches are unnecessary.

e. External patch repairs generally will meet strength criteria for effective BDAR. Sometimes these repairs must take into consideration the clearance of moving parts (e.g., control surfaces, doors, etc). In low stress areas, patches may only be necessary to provide aerodynamic shape to prevent ram air effect or to keep water out. Damage in these areas can be covered with thin gauge metal or Army green tape. In some areas, negligible damage can be ignored. Use environmental protection for external repairs if possible. Where an access hole is large or can be made larger for internal repair, an internal or external repair may be used. External repairs should be aligned within 15° either side of the direction of air flow.

f. General Repair Requirements. Restore structural continuity by restoring original structure or by bridging the damage. Original strength should be restored if possible. Weight and appearance are unimportant in battle damage repair. Structural stiffness should be sufficient to assure loads are properly distributed and to avoid serious vibrations. Use shims to avoid joggles. Avoid hand formed and fitted parts. Where a stringer/stiffener is light (1-1/2 X 1-1/2 X 0.060 inches or less) and the stringers on either side of the damage or fracture are sound, apply a skin patch 2 gauges thicker over the damaged area.

g. Special Repair Techniques. One method to create a complex curve in a normally straight angle or T - Profile member is to place appropriate cuts and stop drill holes to allow bends, as given in Figure 4-16. This field expedient procedure will allow former repair from stray stock.

4-16. SKIN-STIFFENER DAMAGE.

GENERAL INFORMATION: These repairs are applicable to any skin-stiffener/stringer structure such as the fuselage, fairings, and many secondary structures other than sandwich construction.

OPTION 1: Patch Plate and Substitute Stiffener/Stringer.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

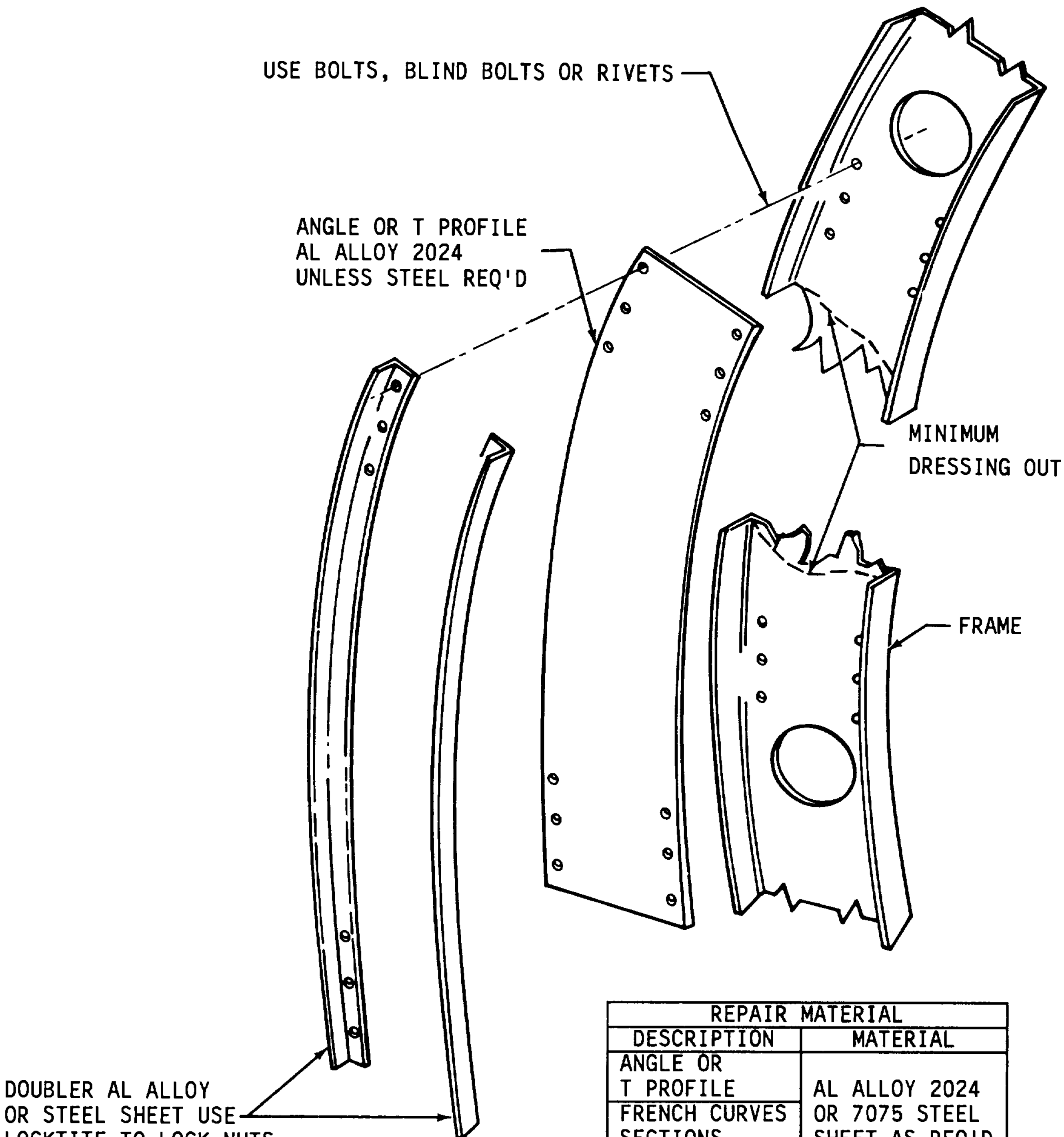
PERSONNEL/TIME REQUIRED:
- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Substitute Stiffener or Stringer
- Section
- Skin Patch
- Cherry Rivets (item 37, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the aircraft skin and stiffener/stringer containing the damage. Smooth and round the cutout. Cleanup ends of the stiffener/stringer. Stop drill any remaining cracks, Figure 4-17.

2. Cut and fit a skin patch one gauge thicker allowing overlap for at least two rows of rivets, Figure 4-18.



REPAIR MATERIAL	
DESCRIPTION	MATERIAL
ANGLE OR T PROFILE	AL ALLOY 2024 OR 7075 STEEL SHEET AS REQ'D
FRENCH CURVES SECTIONS	
DOUBLER	

Figure 4-16. Typical Former Repair (Sheet 1 of 2)

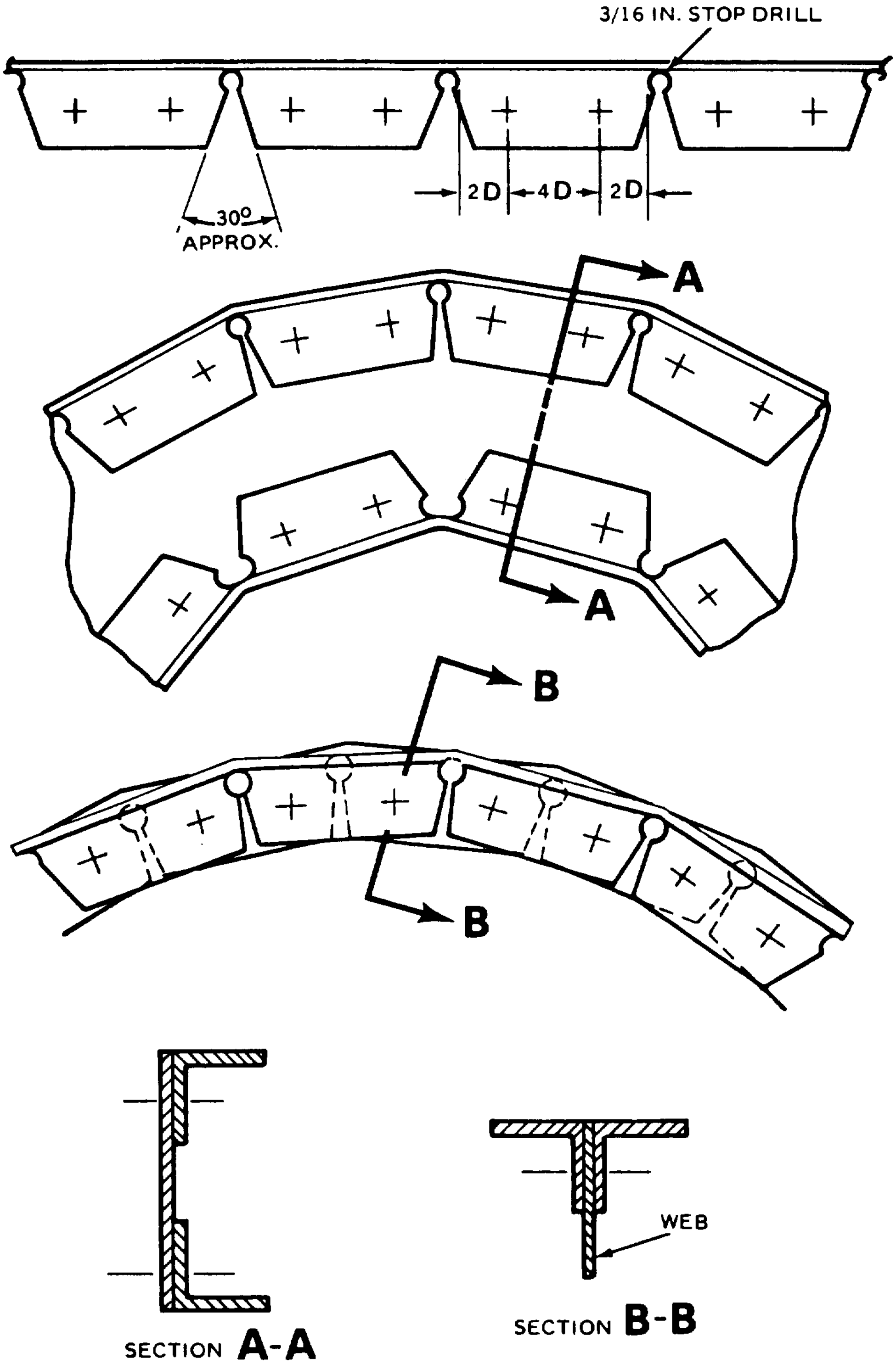


Figure 4-16. Typical Former Repair (Sheet 2 of 2)

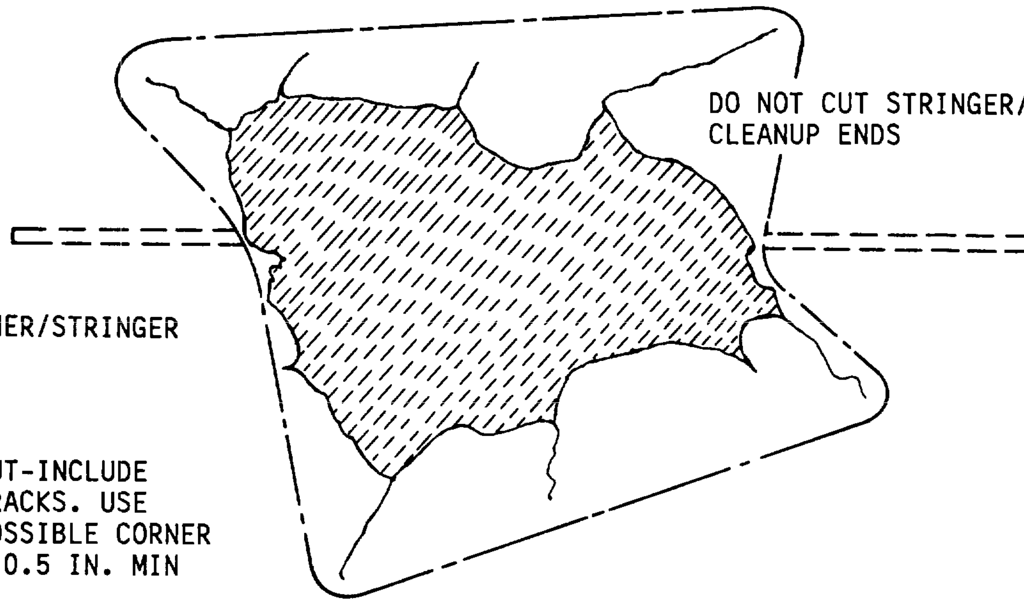


Figure 4-17. Cutout in Damaged Skin

3. Cut a piece of substitute stringer or stiffener to extend a minimum of six fasteners beyond the damage on each end. Use an angle, channel, or z-angle extrusion, if available, with a cross section and strength equal to or larger than the existing stiffener/stringer. Sometimes a single substitute stringer or stiffener can be extended to provide support for several damages. This is better than individual repairs, as it will stiffen the airframe.

4. Remove rivets in the existing stiffener/stringer and back drill rivet holes in the substitute stiffener/stringer to match existing holes. Attempt to interpitch new fasteners within the existing rivet pattern if the area is inaccessible for back-drilling.

5. Rivet the substitute stiffener/stringer in place, Figure 4-18, using the same size or larger rivets as those removed.

6. Rivet patch plate over hole using same size as existing rivets.

NOTE

Stiffener can be placed on outside; however, this configuration is nonpreferred.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Tape Repair.

LIMITATIONS: Repair may only be used on secondary structure to keep moisture out. No damage to stiffener/stringer allowed.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:
- Army Green Tape (item 50, Appx C) or Aluminum Tape

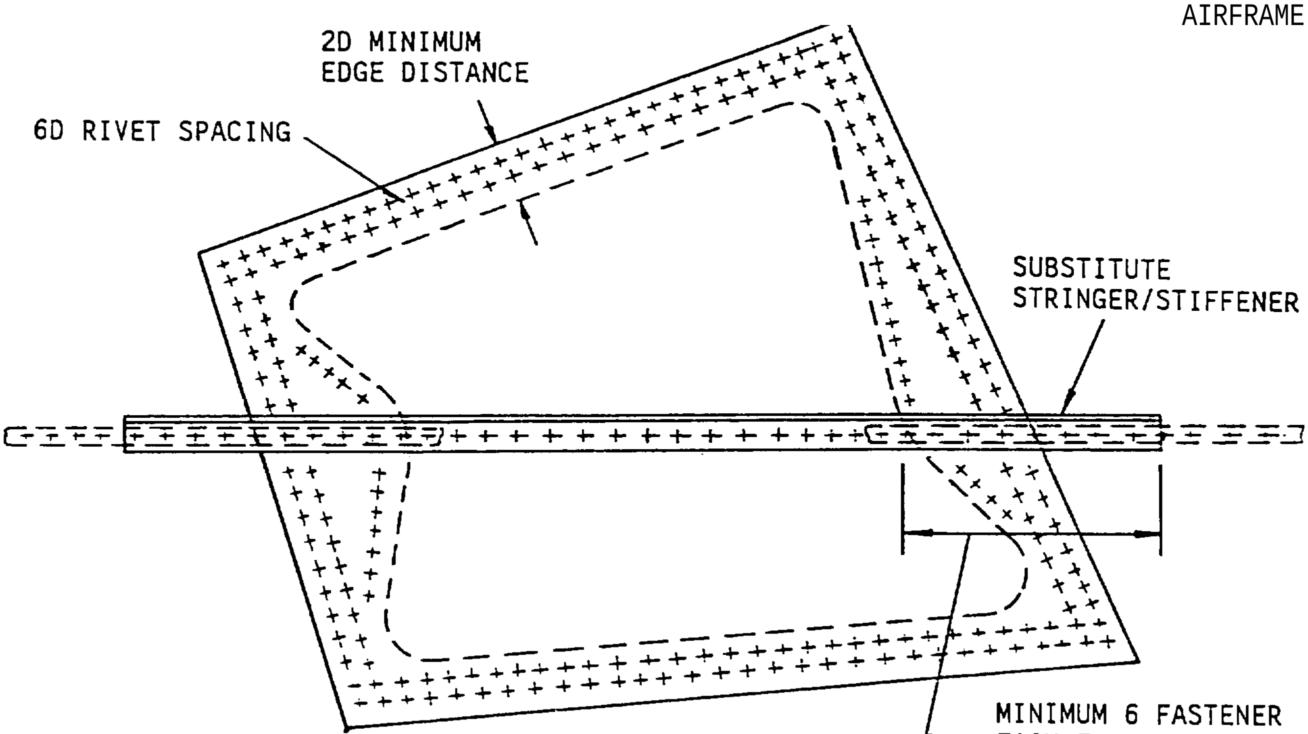


Figure 4-18. Patch Plate

PROCEDURAL STEPS:

1. Smooth off ragged edges on damaged skin.

2. Tape over hole. Use several layers as necessary, and overlap onto skin well beyond damaged area.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-17. CAP, SKIN, WEB, DOUBLER DAMAGE.

GENERAL INFORMATION: Much of the fuselage construction is relatively light built-up structure. Small damage will likely exceed the allowable limits and will require repair. A patch plate can often be used to repair the damage.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:
- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Patch Plate
- Cherry Rivets (item 38, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the aircraft containing the damage. Smooth and round the cutouts. Stop-drill any remaining cracks, Figure 4-19.

2. Cut and fit a patch plate one gauge thicker and of the same material as the damaged structure. The plate thickness should be based on the thickest part of the damaged area. The patch plate should be large enough to allow installation of the required fasteners on all sides. Cut and fit shims to fill gaps.

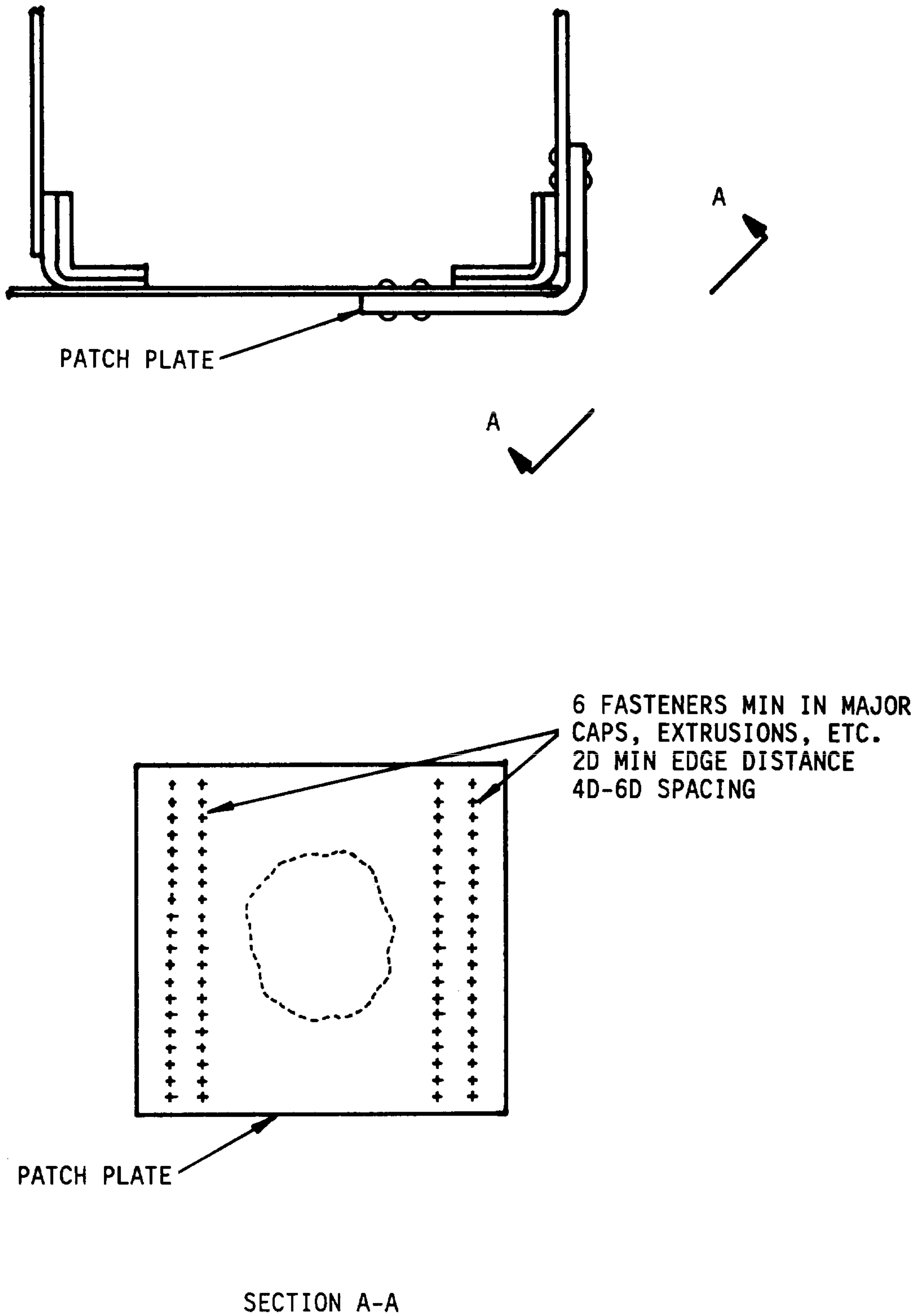


Figure 4-19. Typical Patch Plate Repair

3. Install a minimum of six rivets in each row on each damaged end of major structure such as caps, extrusions, etc. Remove existing rivets and back drill holes in the patch plate if the area is accessible. If back drilling is not practical, it may be possible to interpitch new rivets between existing rivets. Use same size rivets or oversize rivets if necessary.

4. Install two rows of rivets around patch plate in webs and skins using same size as adjacent rivets in webs and skin.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-18. CAP OR LONGERON DAMAGE.

GENERAL INFORMATION: Nondeferrable cap or longeron damage may be substantial, combined with skin damage. It will generally be necessary to repair the cap or longeron first and then the skin. It may not be necessary to repair the skin for structural reasons, but generally skin repair is recommended to make a watertight repair.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:
- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Longeron or Cap - Sections used in outside repairs should be angular or channel shaped. The strength of the new cap or longeron should be at least that of the damaged cap or longeron. Refer to Table 4-8 for substitute materials to use on repair if a longeron or cap section is not available.
- Skin Patch
- Blind Rivets (item 41, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the aircraft skin containing the damage. Do not cut cap or longeron, but cut off ragged ends, Figure 4-20.

2. Make a patch plate. Plate should be as strong or stronger than original skin. Overlap the hole for at least 2 rows of rivets.

3. Cut a piece of substitute cap or longeron to extend at least six fasteners on all rows fore and aft of damaged section. Sometimes a single substitute cap or longeron can be extended to provide support for several damages. This is better than individual repairs, as it will stiffen the airframe.

4. In the areas where the substitute cap or longeron will overlap on the damaged cap or longeron sections, remove rivets which attach the damaged cap or longeron to skin. Back drill rivet holes on the substitute cap or longeron to match existing holes on the damage cap or longeron.

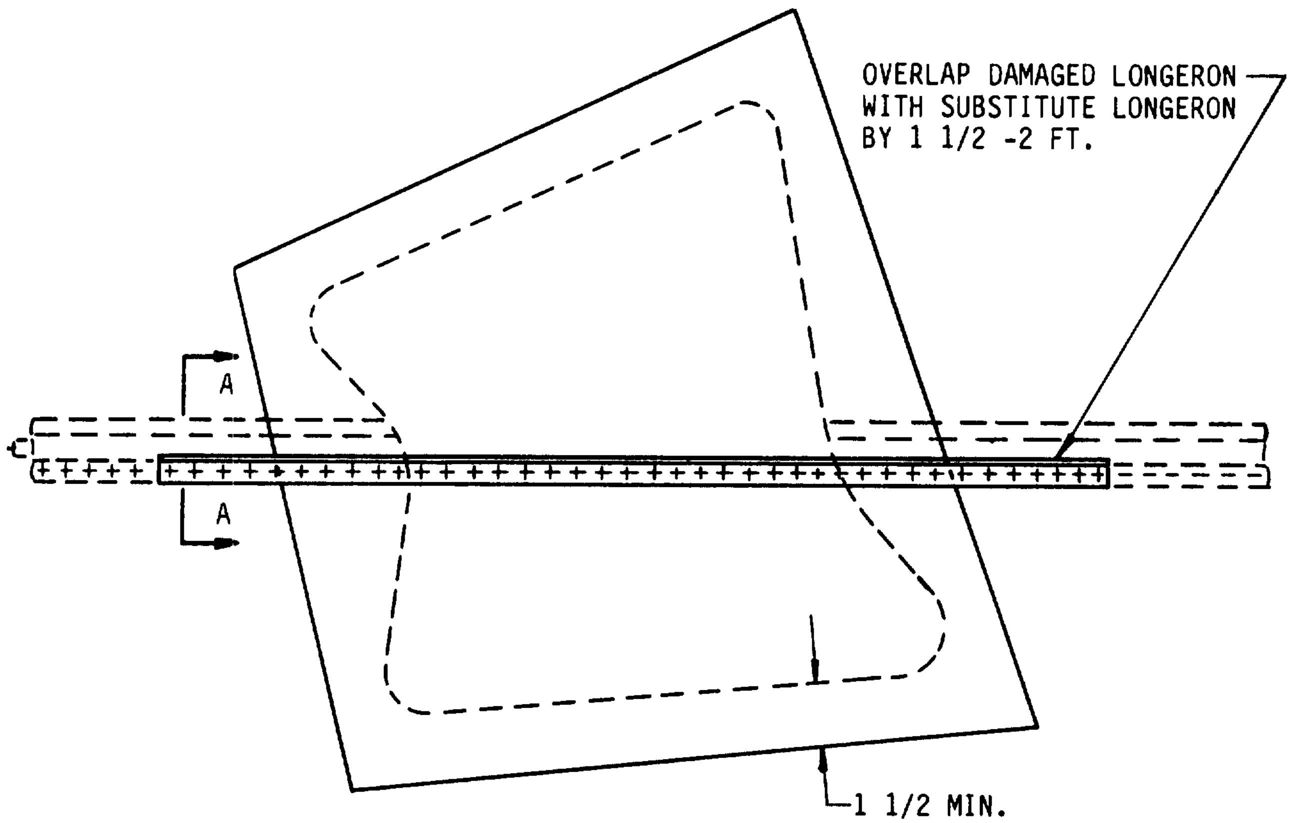
5. Rivet the substitute cap or longeron in place using the same size or larger rivets as those removed in step 4.

6. Rivet patch plate over hole using blind rivets. Use same size rivets as existing rivets.

NOTE

Stiffener can be placed on outside; however, this configuration is nonpreferred.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.



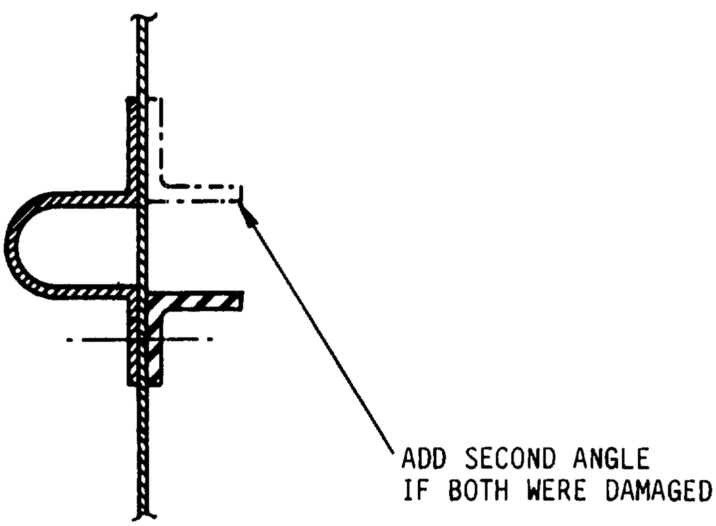


Figure 4-20. Expedient Cap/Longeron Repair

4-19. FRAME, BULKHEAD, SKIN, AND STRINGER DAMAGE.

GENERAL INFORMATION: A damaged flange on a bulkhead or frame could be repaired from the outside in the same way as is a cap or longeron. However, it is not desirable to have a section on the outside of the aircraft sticking out normal to the airstream. Frame flanges are therefore repaired by applying a strap over the damage. If the damage to a highly loaded bulkhead is severe, then treat it like a cap and let the section stick out in the airstream.

OPTION 1: Patch Plate Repair for Small Damage.

LIMITATIONS: None – Condition 1. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Repair Strap
- Cherry Rivets (item 41, Appx C)
- Tape or Skin Patch

PROCEDURAL STEPS:

1. Stop drill all cracks, Figure 4-21.

2. Cover the damage with tape. Be sure to cover the ends of all cracks.

3. Fabricate a repair strap using thick sheet metal. The sheet metal should be 2 X thickness of the original flange material, skin, and stringer. The strap should be wide enough to cover damaged area and to allow at least two rows of rivets on the skin, and a minimum of six rivets in the undamage portion of damaged stringers. The strap should be long enough to overlap both ends of the damaged bulkhead or frame flange by six rivets on each end. In the areas where the repair strap will overlap on the damaged bulkhead flange and stringer, remove rivets and back drill if the area is accessible. If back drilling is not feasible, interpitch new rivets between existing rivets.

4. Rivet the repair strap to the bulkhead or frame flange and stringer using the same size or larger rivets. Rivet the strap to the skin using two rows of rivets around the perimeter using the same size rivets as in adjacent skin-flange structure.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Combination Repair for Major Frame or Bulkhead Damage.

LIMITATIONS: None — Condition 1. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 3 Hours

MATERIALS/TOOLS REQUIRED:

- Filler Patch
- Repair Doubler
- Skin Patch
- Cherry Rivets (item 41, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the skin and frame or bulkhead containing the damage. Smooth and round the cutouts, Figure 4-22.

2. Cut and fit repair doubler for frame or bulkhead. Cut skin patch allowing overlap for at least two rows of rivets. Repair patch and doubler should be the same material and one gauge thicker than original material.

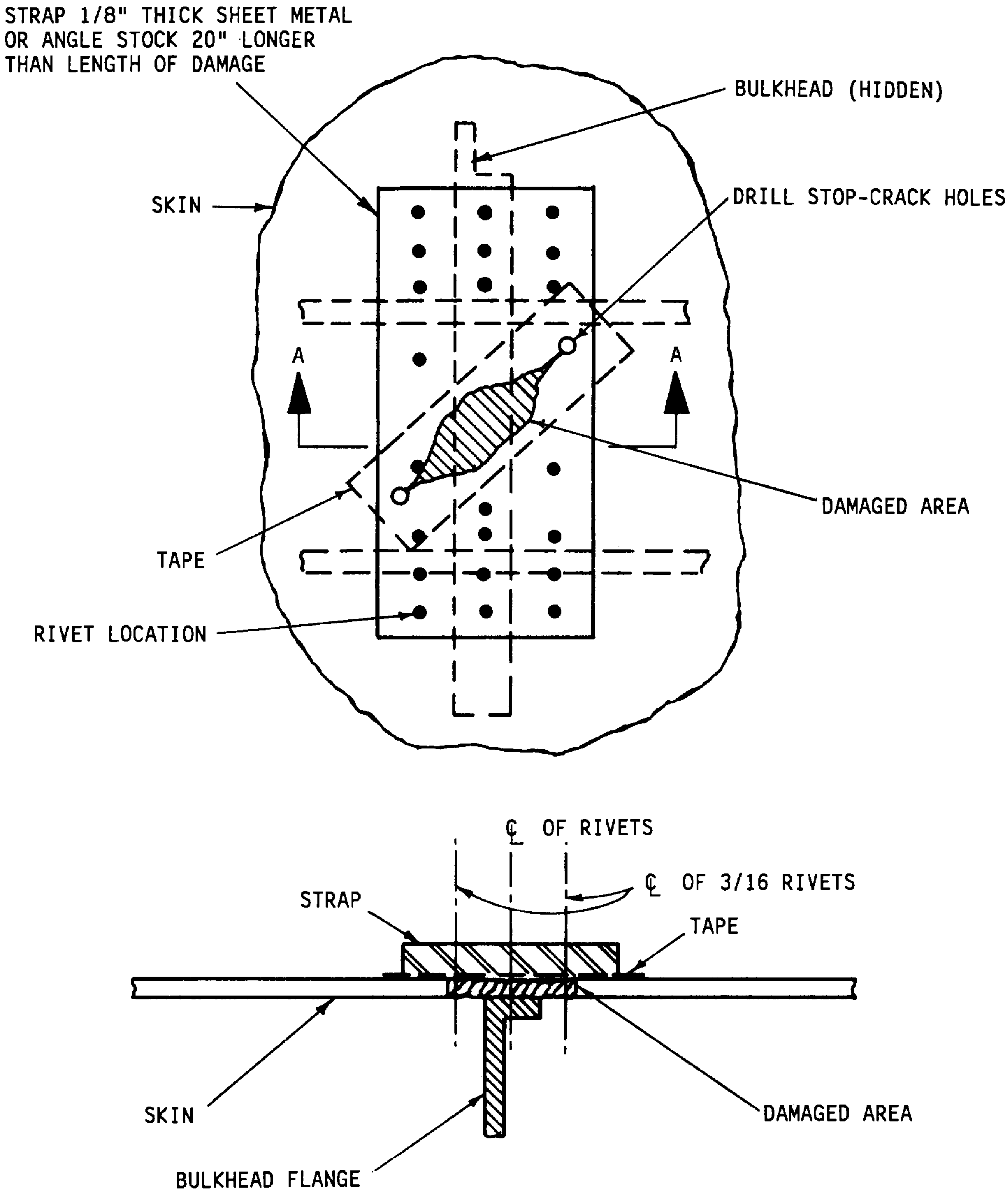


Figure 4-21. Repair of Damaged Bulkhead Flange

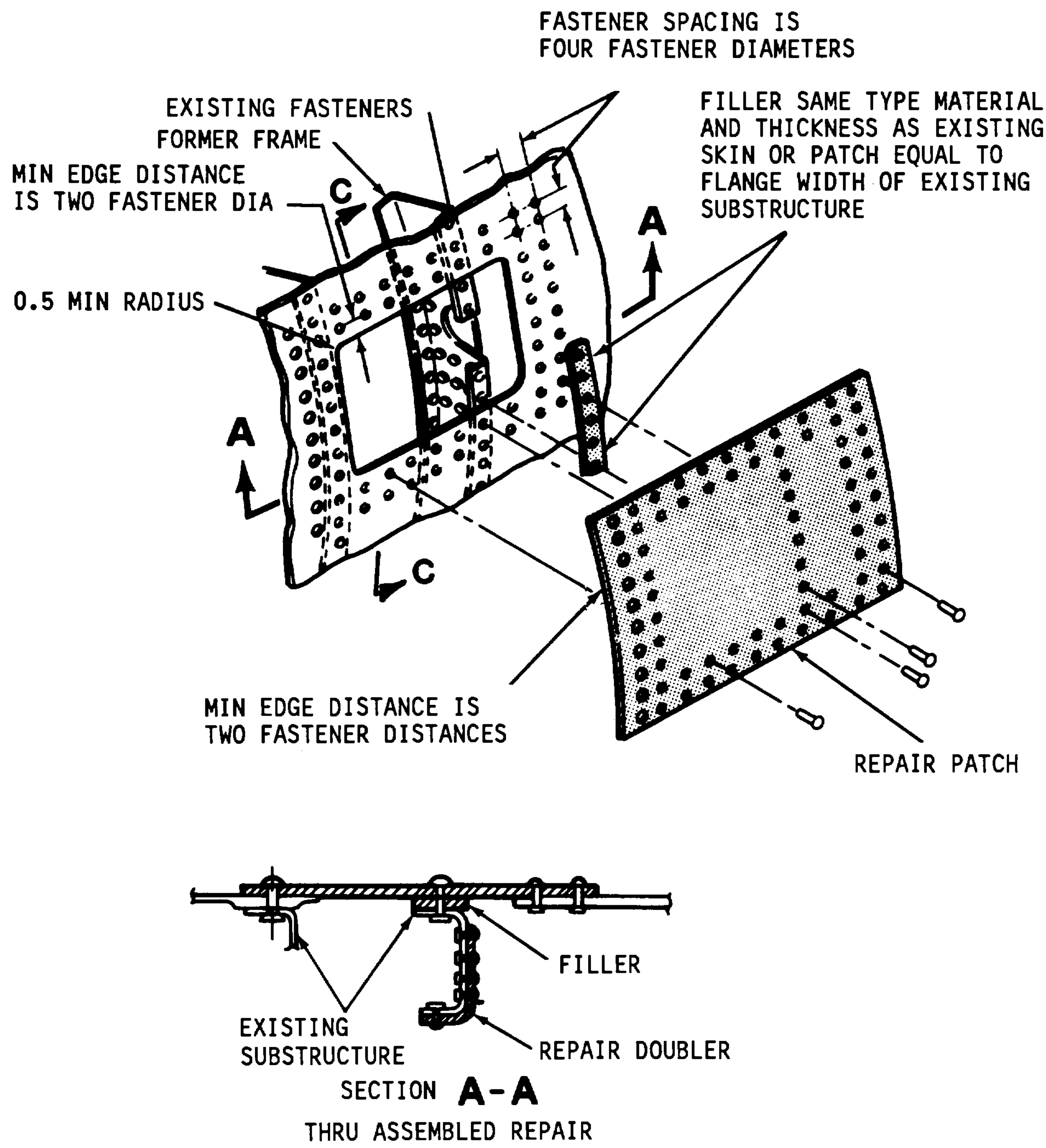


Figure 4-22. Typical Combination Repair (Sheet 1 of 2)

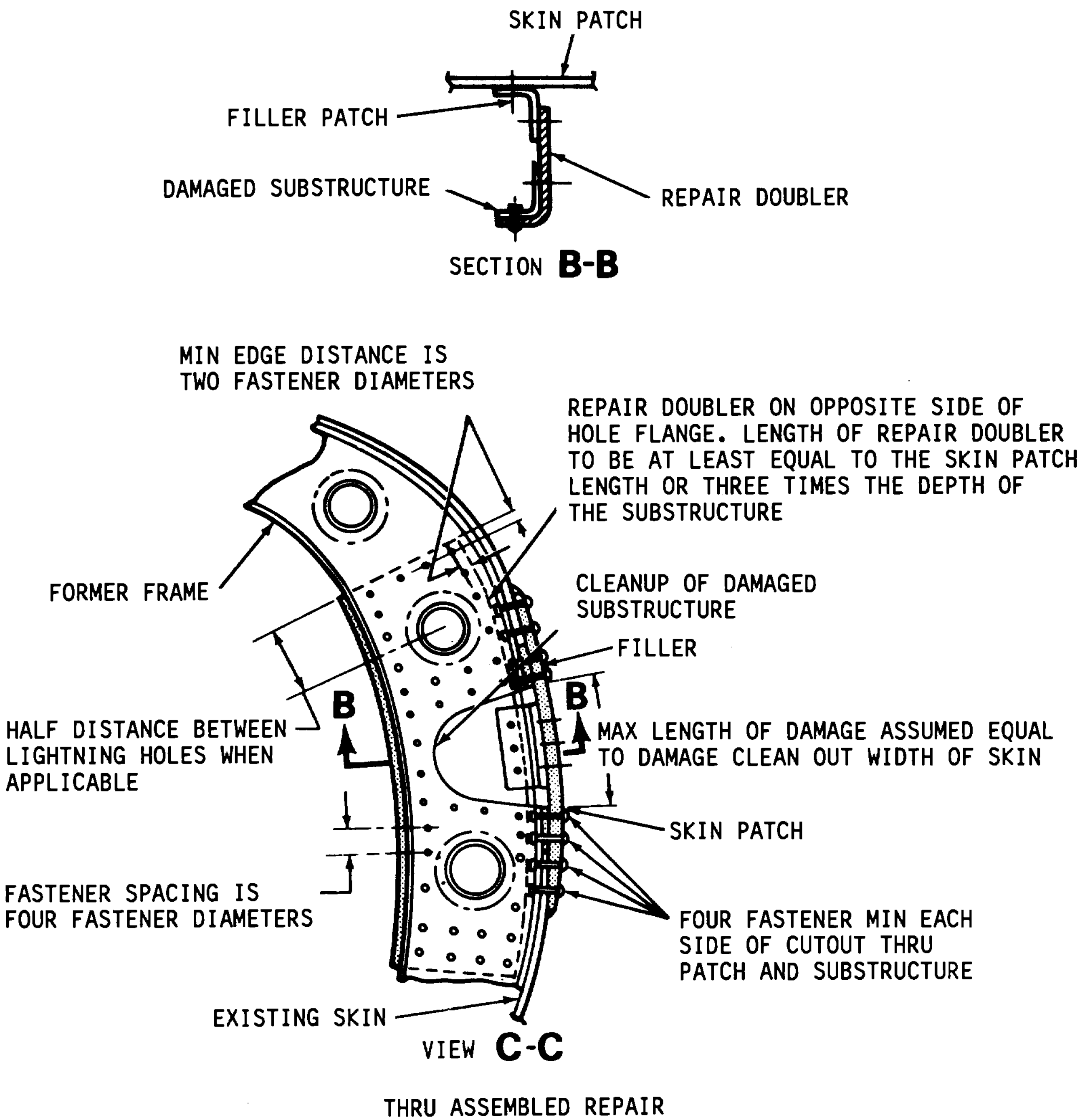


Figure 4-22. Typical Combination Repair (Sheet 2 of 2)

3. Remove existing rivets where the repair parts will overlap existing rivets if the area is accessible for back-drilling holes. If not, install rivets between existing rivets if space permits.

4. Rivet the repair parts in place using original diameter rivets or larger if necessary.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-20. HONEYCOMB CORE FLOOR OR PANEL DAMAGE.

GENERAL INFORMATION:

a. Part of the bottom shell, top deck, shelves, interior panels, and the fin panels are honeycomb core structures.

b. Various repair options are given for a range of damage size.

OPTION 1: Small Damage to One Skin and Core or Both Skins and Core - Less Than 2 Inches Maximum Diameter.

LIMITATIONS: Procedure is designed only to keep moisture out. No additional strength has been added.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Army Green Tape (item 47, Appx C) or Aluminized Tape

PROCEDURAL STEPS:

1. Remove ragged edges, Figure 4-23.

2. Apply tape over repair to keep out moisture.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: 2 to 8 Inch Damage, One Skin and Core.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 90 Minutes

MATERIALS/TOOLS REQUIRED:
- Metal Set or Equivalent Filler Compound (item 2, Appx C)
- Patch Plate
- Cherry Rivets (item 38, Appx C)
- Solvent Cleaner; Naptha (item 5, Appx C) or Equivalent

PROCEDURAL STEPS:

1. Remove damaged skin and core, Figure 4-24. Clean surface 6 inches around holes with cleaner. The maximum damaged area that may be cut out is 8 inches.

2. Make a patch plate as shown in Figure 4-25. Make plate 2 inches larger than cutout. Lay out and drill rivet pattern.

3. Completely fill void with metal set fill compound. Add slight excess to allow for shrinkage.

4. Apply metal set to area between the patch plate and panel. Assemble to panel with 1/8 blind rivets.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Damage to Both Skins and Core, 2-8 Inch, Only One Side of Panel is Accessible.

LIMITATIONS: None.

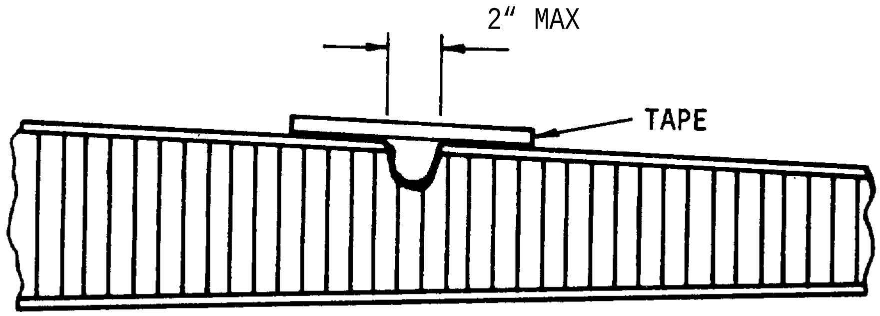


Figure 4-23. Damaged Honeycomb Core Panel,
Small Damage to One Skin and Core

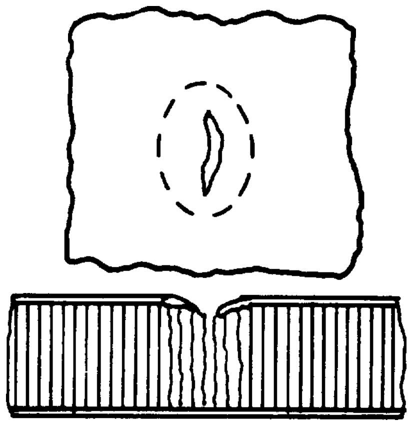


Figure 4-24. Damaged Honeycomb Core Panel,
2-8 Inch Damage - One Skin and Core

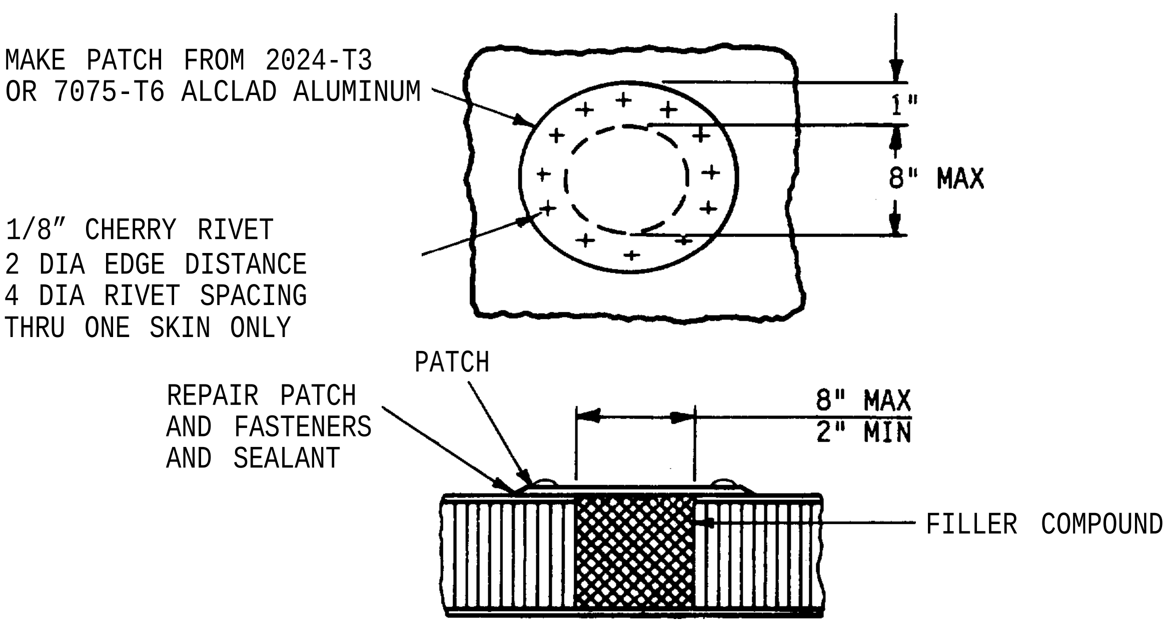


Figure 4-25. Repaired Honeycomb Core Panel,
2-8 Inch Damage - One Skin and Core

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Drill with No. 30 Bit
- Router
- Metal Set (item 2, Appx C) or Equivalent Filler Compound
- 2 Patch Plates
- Cherry Rivets (item 38, Appx C)
- Rivet Gun
- Solvent (item 47, Appx C)

PROCEDURAL STEPS:

1. Remove damaged skin and core using a router to route all damage on outer and inner skins. Enlarge the hole on the outer skin and honeycomb so that a 1 Inch rim surface of the inner skin is exposed, as shown in Figure 4-26.

2. Make two patch plates. One patch plate is for inner skin; the other for the outer skin, Figure 4-27.

3. Apply sealant to exposed surface of inner skin. Assemble patch plate to the inner skin with cherry rivets.

4. Completely fill void with metal set fill compound. Add slight excess to allow for shrinkage.

5. Let harden. Sand smooth. Apply sealant to the area between the outer patch and skin. Assemble patch to outer skin with 1/8 cherry rivets.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Damage Over 8 Inches to Both Skins and Core.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- 2 Patch Plates
- Cherry Rivets

PROCEDURAL STEPS:

1. Remove damaged skin and core, Figure 4-28. Clean top and bottom skins 6 inches around holes with cleaner. The maximum damaged area that may be cut out is 12 inches.

2. Make two patch plates, 0.04 inch or thicker, as shown in Figure 4-28. (If damage is in an area where installing an interior patch is not possible or where sharp edges from rivets on an interior patch might cause damage, a single exterior patch plate, 0.05 inch thick, may be used.) Make plates 2 inches larger than the cutout. Lay out and drill a rivet pattern, two rows, as shown.

3. Assemble with 2 rows of cherry rivets.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 5: Secondary Structure Repair.

LIMITATIONS: This option is recommended for secondary structural areas, which have a honeycomb core between the walls, where repair is required for aerodynamic reasons or to keep water out of aircraft.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIAL/TOOLS REQUIRED:
- Patch Plate, 0.020 Inch (Minimum) Aluminum or Steel
- Cherry Rivets (item 38, Appx C)
- Sealant (item 5, Appx C)
- Rivet Gun
- Solvent (item 7, Appx C)
- Drill and Bit

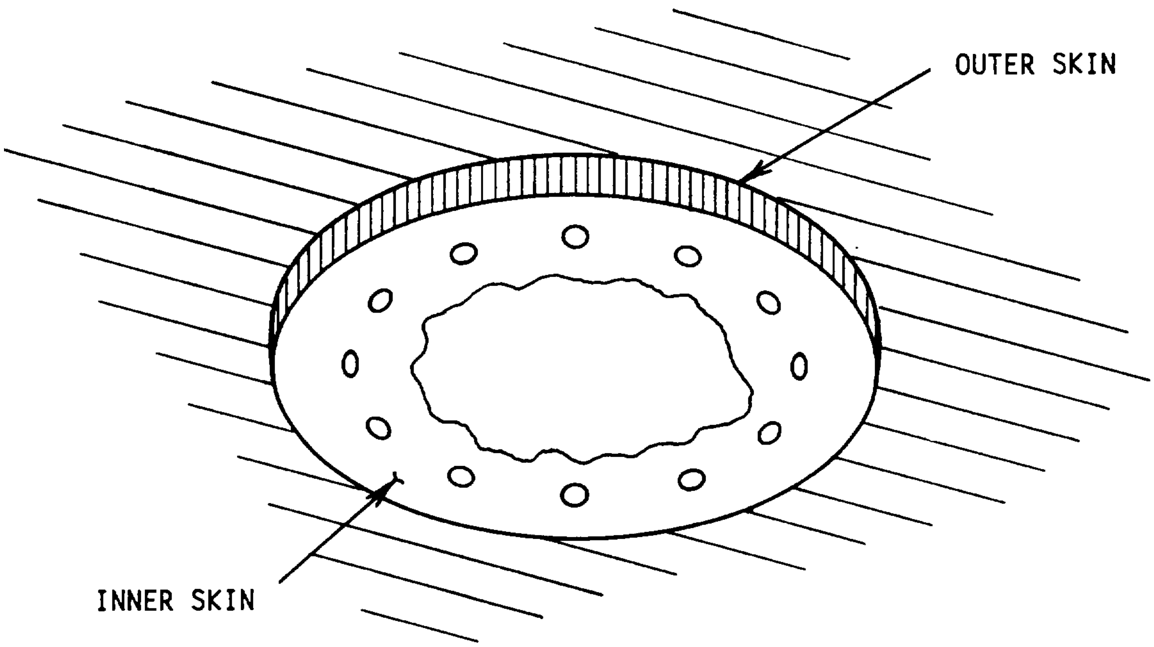


Figure 4-26. Damage Repair, Accessible One Side Only

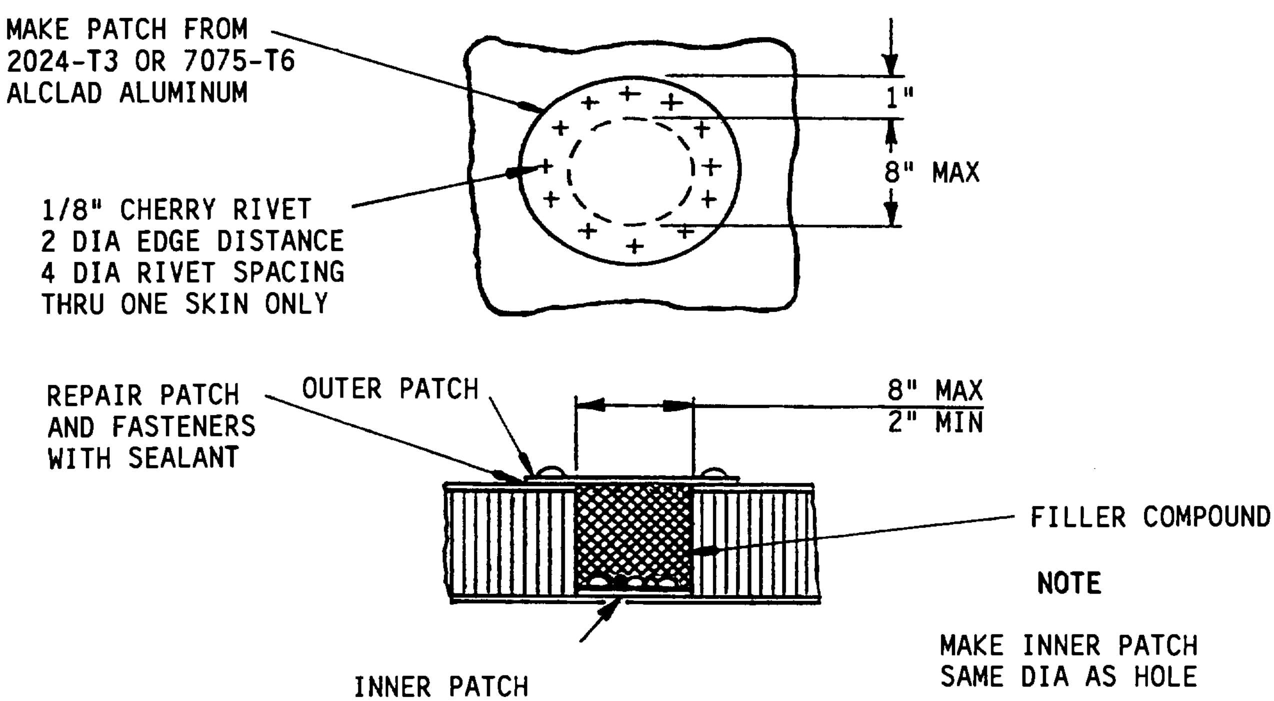


Figure 4-27. Patch Plates, One Side Accessible Repair

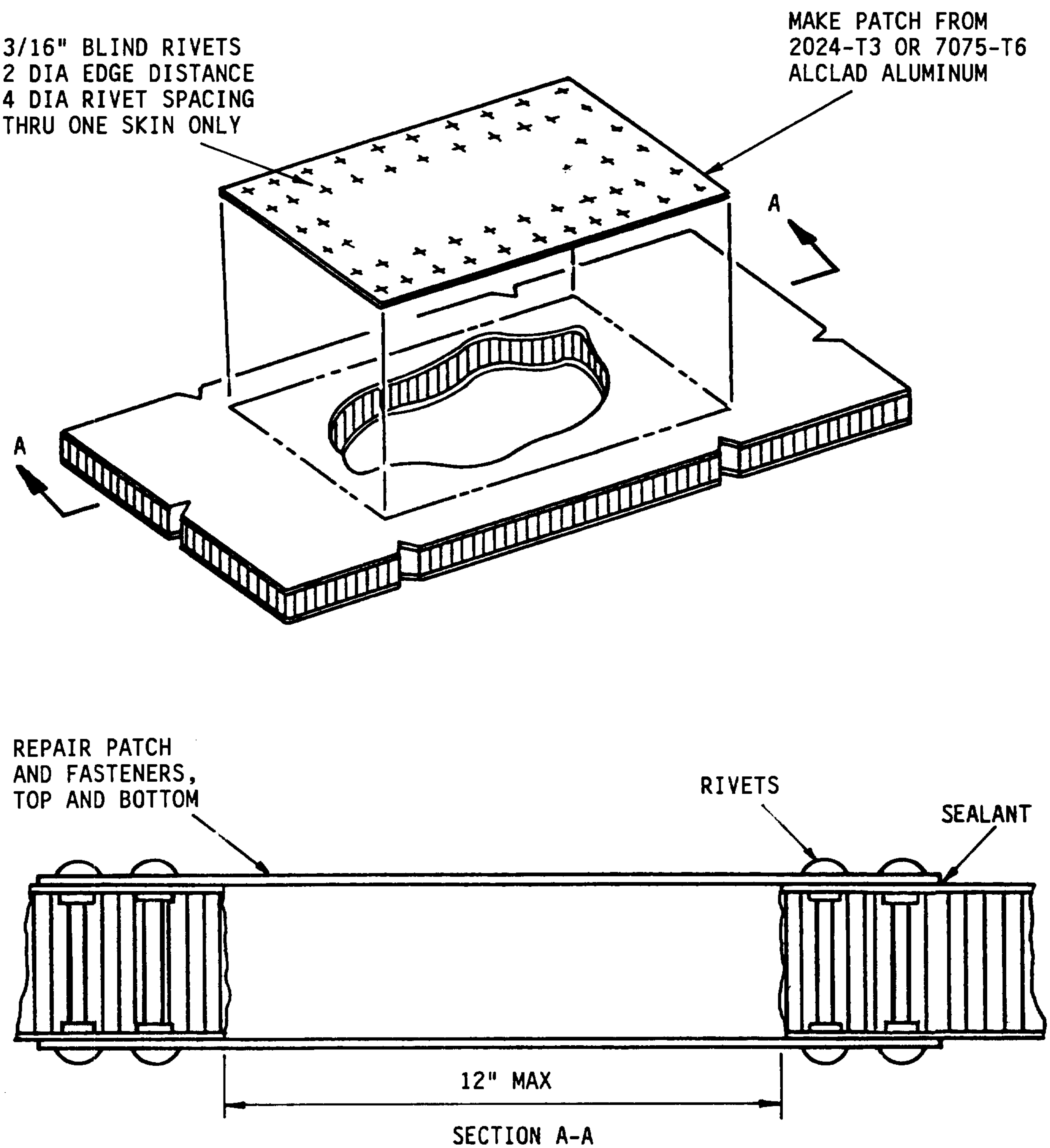


Figure 4-28. Repair of Honeycomb Core Panel,
Damage Over 8 Inches - Both Skins and Core

PROCEDURAL STEPS:

1. Remove protruding sections of damaged skins and core. Clean area with solvent.

2. Cut patch plate to fit over hole, allowing 1 inch overlap on all sides.

3. Lay out and drill rivet pattern on overlapping area.

4. Apply sealant to underside of patch plate on overlapping area.

5. Assemble patch plate to panel with rivets.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-21. WINDOW SHIELD/WINDOW DAMAGE.

GENERAL INFORMATION: In general, repairs to transparencies are at best make-shift and usually result in serious impairment of clear vision characteristics. Damaged sections should be replaced as soon as possible.

LIMITATIONS: Restricted vision. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- Safety Wire (item 25, Appx C)
- Sealant (item 4, Appx C)
- Tape (item 50, Appx C)

PROCEDURAL STEPS:

1. Stop drill a hole at the end of each crack, Figure 4-29. If tolerable, cut out a hole to include the ends of all cracks. This will restrict vision further. Smooth ragged edges.

2. Drill small holes 1/2 to 3/4 inch spacing, 3/8 inch edge distance along both sides of any crack and along the sides of the hole.

3. Lace safety-wire with needle nose pliers through holes and across cracks and over hole, forming a web with 1/2 to 3/4 inch spacing between wires. Pull wires tight.

4. Brush epoxy sealant over safety wire and crack to make a water tight seal.

NOTE

Holes too large to be closed with safety-wire and epoxy may be sealed temporarily with Army green tape.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-22. TAIL BOOM SKIN DAMAGE.

GENERAL INFORMATION: The tail boom is a basic monocoque structure with no longitudinal skin stiffeners or longerons. The tail boom is unserviceable if damage is extensive enough to cause misalignment. Damage which does not exceed 10 percent of tail boom circumference in height and 30 percent of tail boom circumference in length may be repaired by patching. (Circumference to measured at aft end of damage.) A maximum of TWO damaged areas per stress section of the tail boom is permitted. Example, a line drawn around the circumference of the tail boom must not touch more than TWO damaged areas. Damaged areas must be a minimum of 8 inches apart. Total damage to tail boom is not to exceed 5 percent of the tail boom area (approx. 160 square inches).

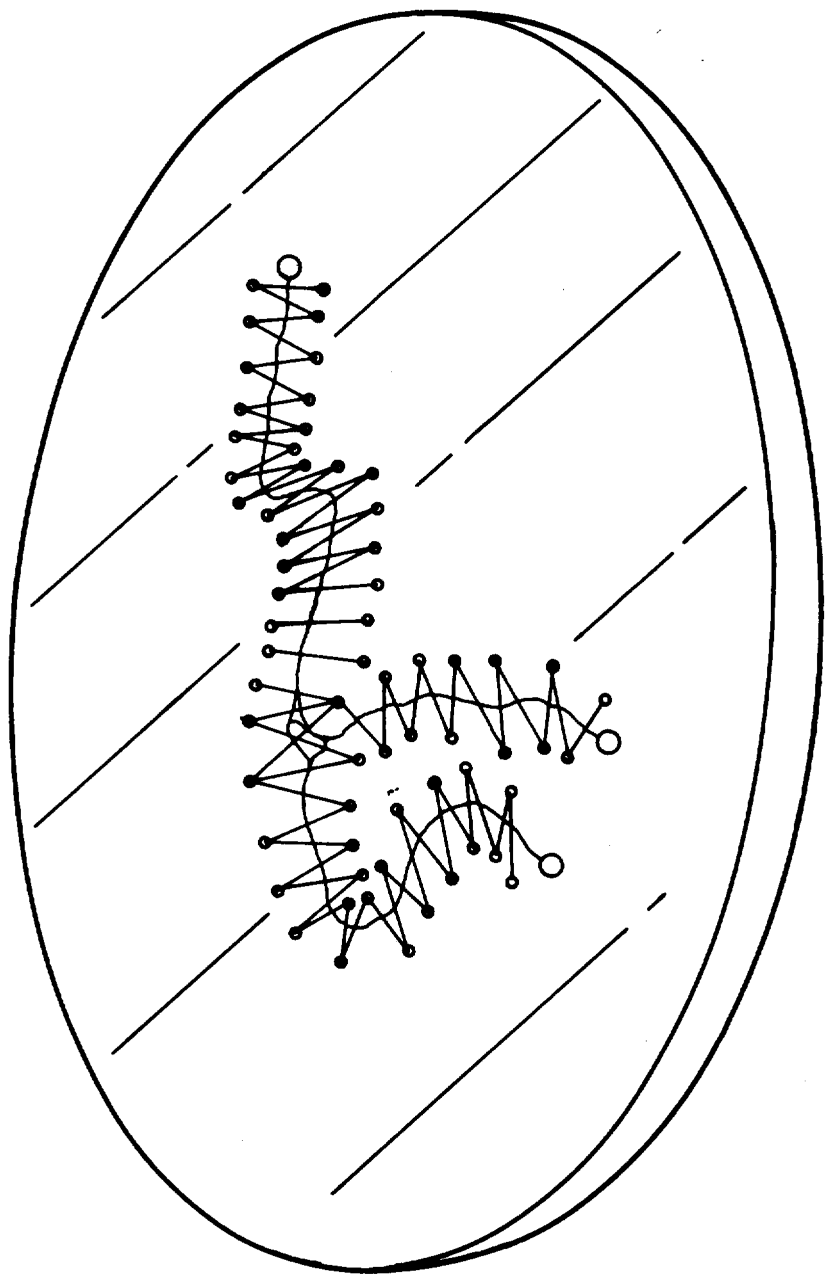


Figure 4-29. Fracture Lacing With Safety Wire

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Skin Patch
- Cherry Rivets (item 37, Appx C)
- EA93NA Adhesive (item 6, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the tail boom skin containing the damage. Stop drill remaining cracks. Clean up damaged skin using a minimum 0.125 inch radius.

2. Prepare a patch of 2024-T3 aluminum 0.050 thick and shape to contour of tail boom. The patch must extend a minimum of 3 inches forward and aft, and 1 inch above and below the damaged area, Figure 4-30.

3. Sand surfaces lightly to remove all surface finish. Clean areas with cleaner. Bond patch to surface with EA934NA adhesive.

4. Install a minimum of three rows of rivets running circumferentially on each end and a minimum of one row of rivets top and bottom running longitudinally in the patch. Rivet size to be the same as skin lap joints, Figure 4-30.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

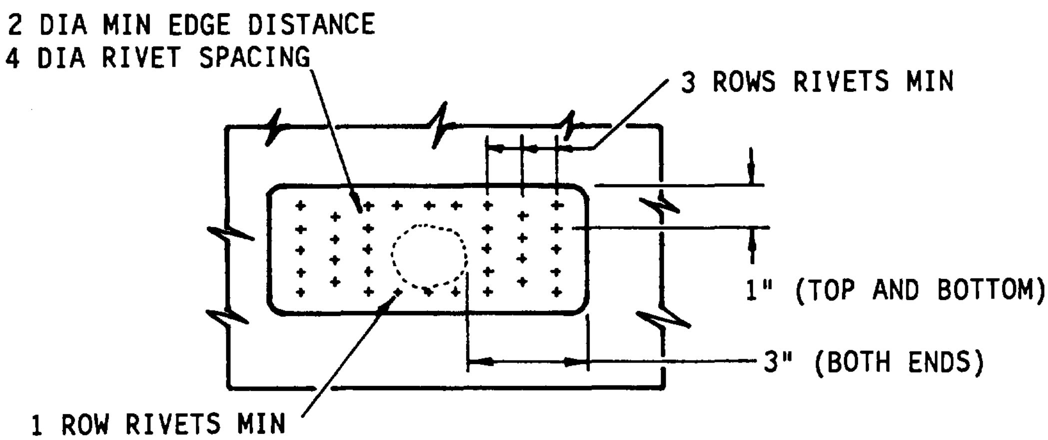


Figure 4-30. Tail Boom Skin Damage

CHAPTER 5

ALIGHTING GEAR

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

5-1. SCOPE. This chapter contains information for deferring repair and expedient field fixes of battle damaged alighting gear assembly. The repairs or field fixes can only be applied to the skid tubes.

5-2. DESCRIPTION. The alighting gear assembly, Figure 5-1, consists of two tubes (1) and two arched crosstubes (2) and (3) fastened together with skid saddles (4), and attaching hardware. The assembly is attached to the lower structure with support assemblies (5 and 6) at four points. Replaceable steel skid shoes (7) are attached to the bottom of the skid tubes to prevent damage from contact with the ground.

5-3. ASSESSMENT PROCEDURES. Refer to Table 5-1.

5-4. REPAIR PROCEDURE INDEX.

Section II. SKID TUBE

5-5. GENERAL INFORMATION.

a. In battle conditions, part of the skid tube may sustain various amounts of damage which may be deferred.

NOTE

The conditions in this paragraph apply only to damage to the skid tube (1, Figure 5-l).

b. Deferrable skid tube damage:

(1) Damage to Sections A and E, Figure 5-2, may include up to complete rupture.

(2) Damage to the junction of the crosstubes and skid tube, Sections B and D, Figure 5-2, may include up to one-half of the cross section of the skid tube as long as alighting gear is not too badly deformed.

(3) Damage to Section C, Figure 5-2, may be deferred unless skid tube is so deformed that alighting gear is not functional.

5-6. HARD LANDINGS, SUDDEN STOPS.

GENERAL INFORMATION.

a. Any hard landings which permanently deform the crosstubes, so that the spread of the skid tubes is in excess of 74 inches, may cause damage to the structure, transmission, or rotor.

b. Binding or unusual noises in the transmission may require replacement of rotor and the transmission. This is not BDAR.

NOTE

Aircraft grounded until assessed flight worthy.

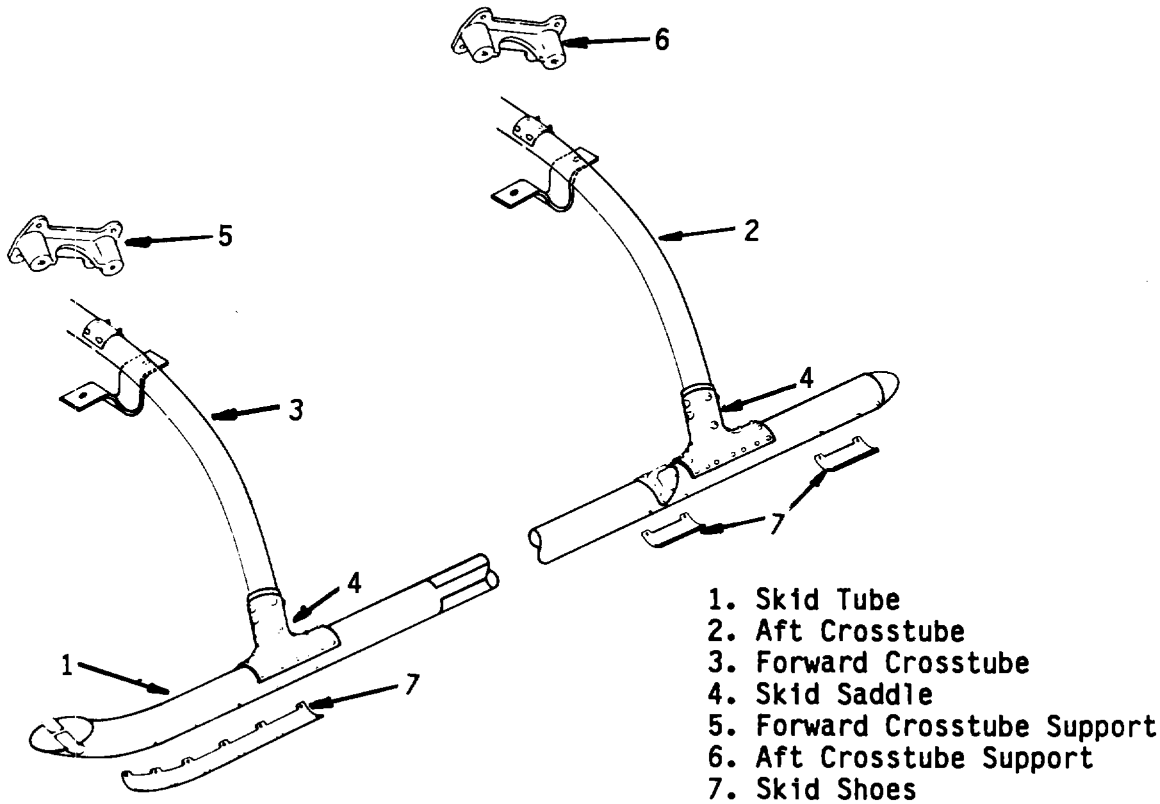


Figure 5-1. Landing Gear and Support Installation

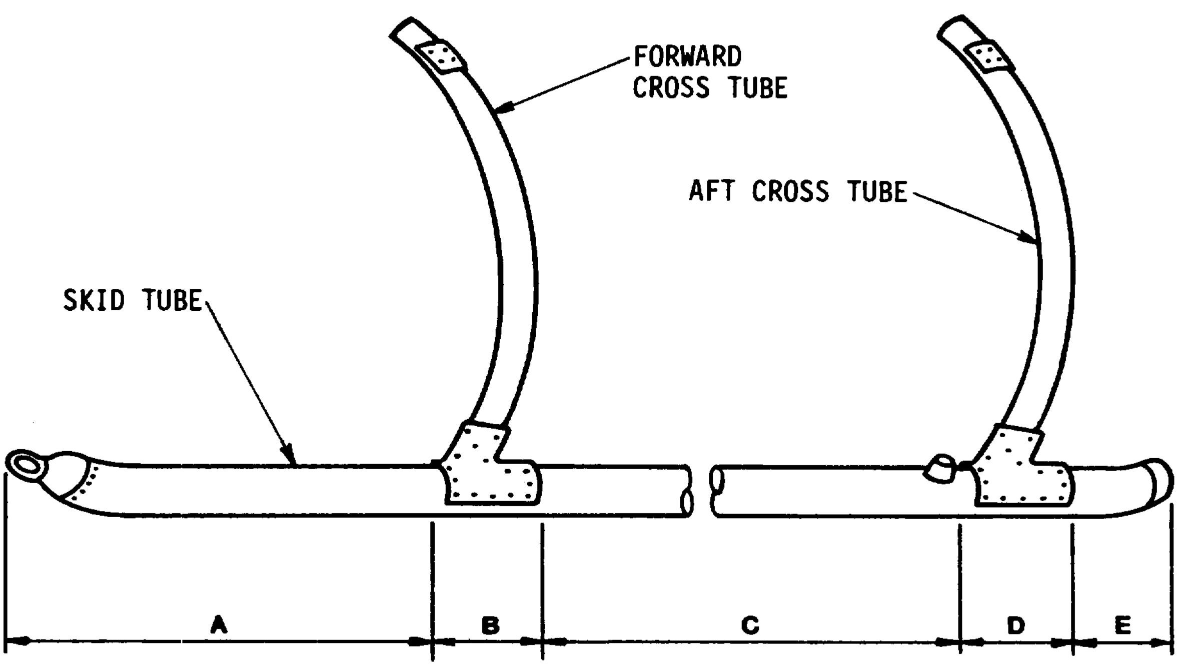
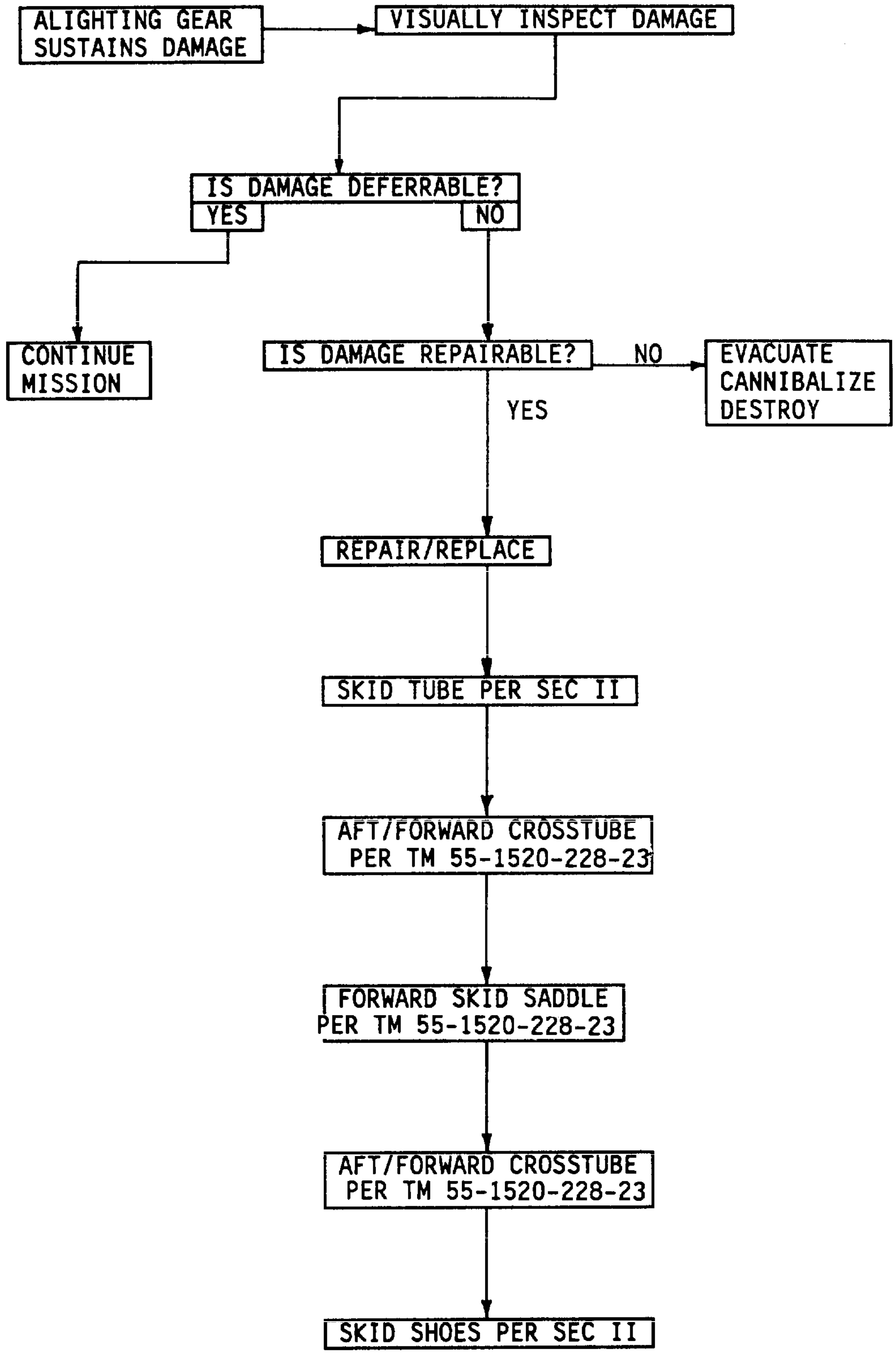


Figure 5-2. Skid Tube Damage Zones

Table 5-1. Assessment Procedure Logic



c. Visually inspect structures supporting alighting gear attachment points and transmission attachment points for any signs of structural distress such as buckling, cracks, rupture, deformation, popped rivets, or elongated rivet holes. If no such damage is found, replacement of alighting gear may be deferred if it is still functional, and aircraft may be released for fully mission capable flight. Watch for any unusual vibrations in flight. Inspect after every flight until alighting gear can be replaced.

d. If alighting gear supporting structure is damaged but still functional and the transmission supporting structure shows no damage, release for flight. Watch for any unusual vibrations in flight. Inspect after every flight until structure and alighting gear can be replaced.

e. If alighting gear or its supporting structure is not functional or the transmission or its supporting structure show any sign of damage, aircraft will be grounded until problem is corrected. This will most likely go beyond scope of BDAR.

Section III. SKID DAMAGE

5-7. SKID DAMAGE.

GENERAL INFORMATION: Landing skids may be damaged by wear or enemy fire. If time is available, repair can be performed to prevent further damage to landing skids.

LIMITATIONS: Use care in landing.

PERSONNEL/TIME REQUIRED:
- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- 0.032 In. Sheet Metal
- Blind Fasteners (item 36, Appx C)
- Drill Bit and Motor

PROCEDURAL STEPS:

1. Form plate to fit snug around skid. Drill oversize holes along each edge to match attachment holes in skid tube. Plate should extend one foot on each side of damaged area. Locate center of plate at center of skid tube, Figure 5-3. If there are no impediments, the new plate may be installed over the old shoes; otherwise remove shoes. Install plate using 1/4 inch cherry rivets or steel clamps, Figure 5-4. Clamps may be fabricated if not available, Figure 5-5.

NOTE

The aft end of the skid tube is bent up, and a steel plate cannot be formed to follow this contour. Do not extend steel plate beyond start of curvature.

2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

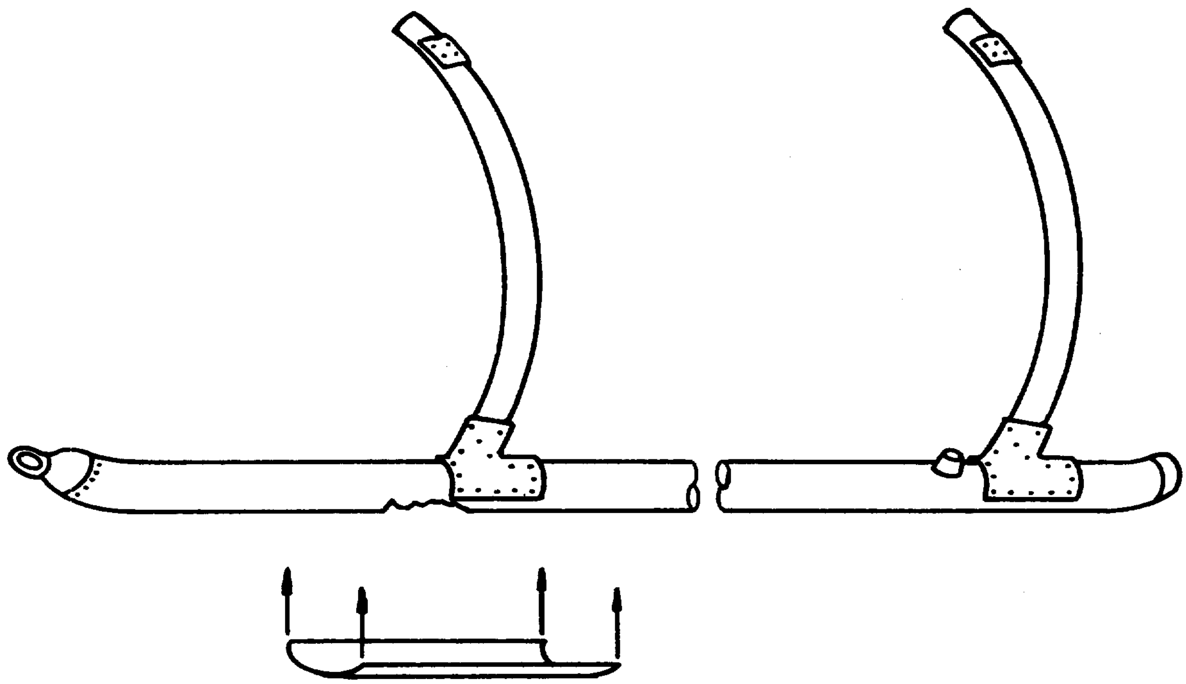


Figure 5-3. Skid Repair

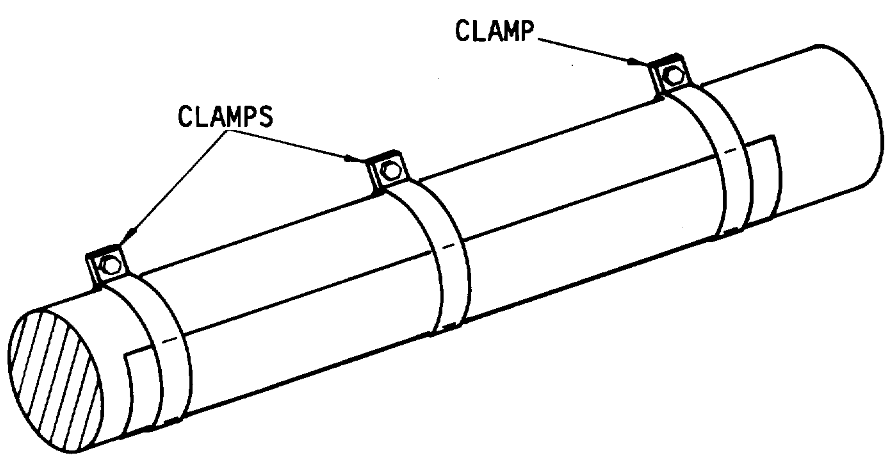


Figure 5-4. Clamp Repair

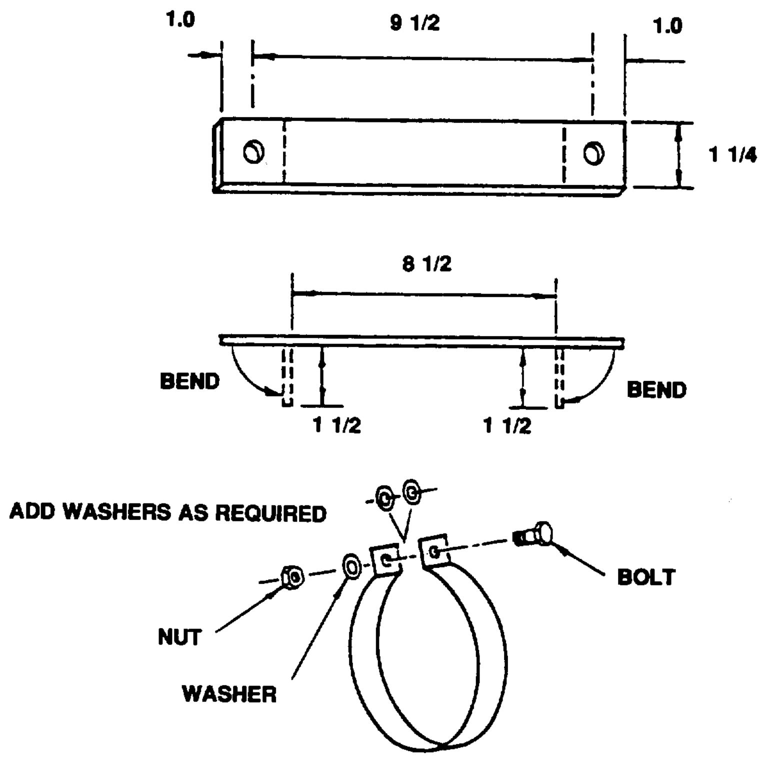


Figure 5-5. Fabricated Clamp

CHAPTER 6

POWER PLANT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

6-1. DESCRIPTION, POWER PLANT. The power plant consists of a T63-A-700 on the OH-58A and a T63-A-720 on the OH-58C mounted between FS120.O and FS206.0, Figure 6-1. Engine connections are provided for fuel, oil, electrical, instrument, and engine control systems. Major sections of the engine are the air-inlet, compressor, combuster, turbine, and power and accessory gearbox. All BDAR repairs discussed in this chapter are applicable to both engine models.

6-2. ASSESSMENT PROCEDURES. Combat damage to the engine usually requires engine replacement. The logic diagram, Table 6-1, refers to BDAR repair procedures which have been developed.

6-3. REPAIR PROCEDURE INDEX.

Section II. COMPONENT EXPEDIENT FIXES

6-4. GENERAL. This section has various expedient fixes which can restore the helicopter's mobility in the event of engine failure. Engine malfunctions can be detected from the following observations:

a. Abnormal oil pressure, temperature readings, or warning lights.

b. Abnormal noises or high frequency vibrations.

c. Sudden loss of power.

6-5. AIR BLEED VALVE INOPERATIVE.

GENERAL INFORMATION: During engine start-up (or part-speed operation), the compressor is susceptible to surge due to high pressure build-up in the rear stages. An air bleed valve is employed to discharge the high-pressure air in order to alleviate the stall condition. The bleed valve is initially in the open position and senses pressures between the fifth stage and the scroll. Once the stall region is overcome (usually between 65 percent to 75 percent N1) and scroll pressure is reached, the valve is closed. Should the valve not close correctly, excess air will be dumped at the compressor and the required burner pressure will not be obtained resulting in engine abort.

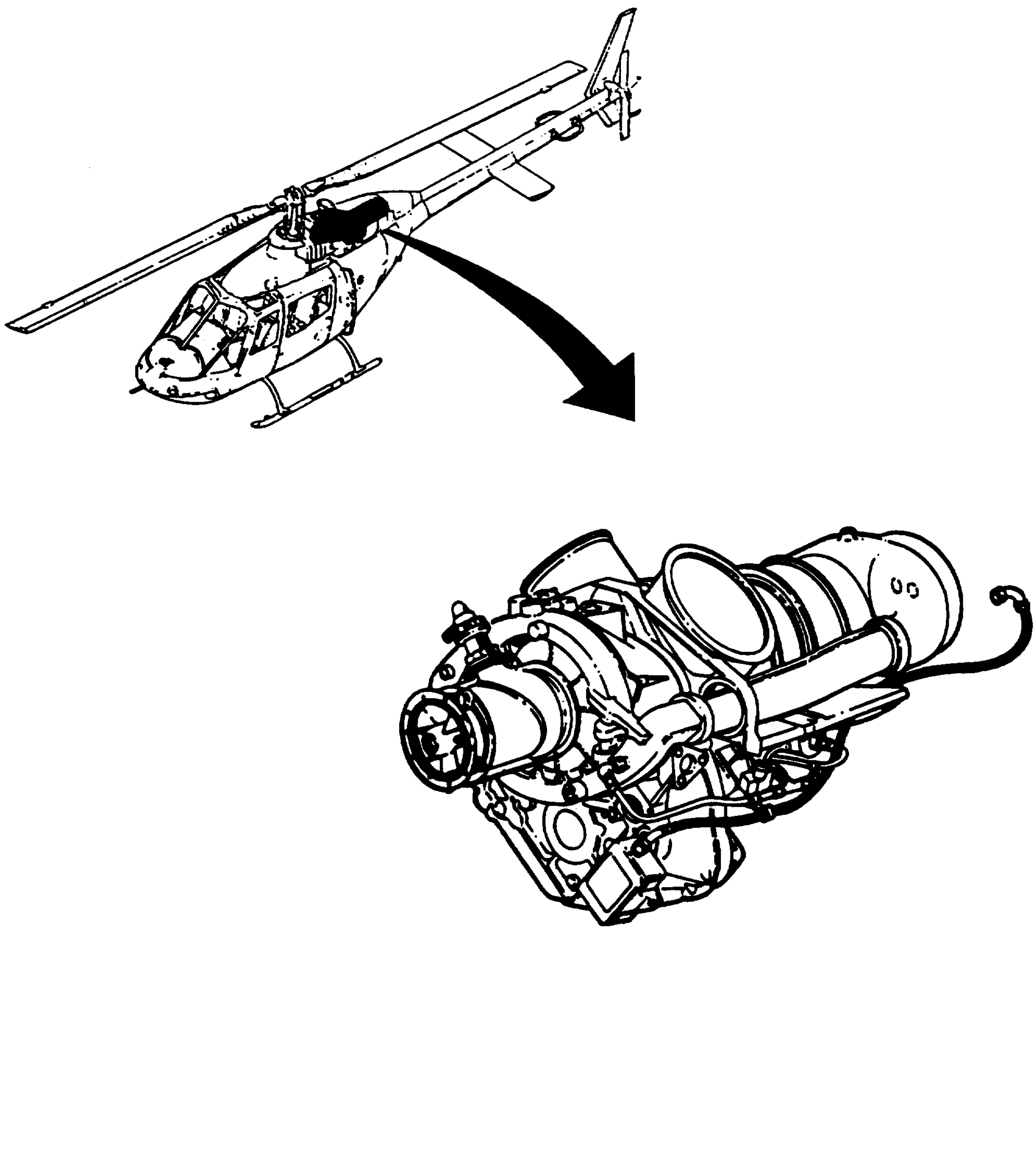
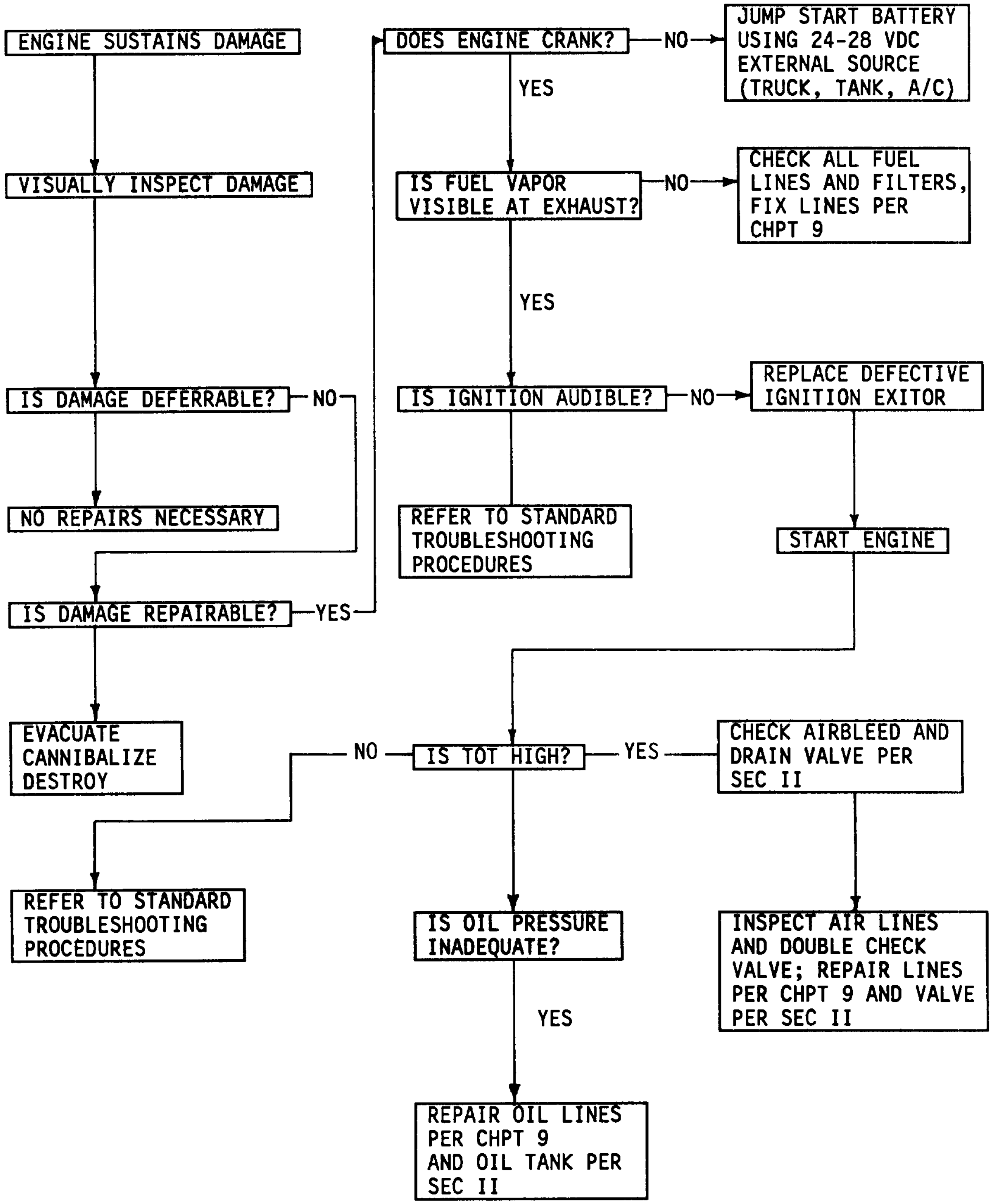


Figure 6-1. T63 Series Engine

Table 6-1. Engine BDAR Assessment Logic



LIMITATIONS: Revised engine start procedure.

WARNING

Blocking of the air bleed valve will render the engine highly susceptible to surge which could result in catastrophic damage to the engine.

PERSONNEL/TIME REQUIRED:
1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
Sheet Metal, 2 X 3 In., Thickness 0.032
Sheet Metal Snips

PROCEDURAL STEPS:

1. Manufacture a blocking plate, Figure 6-2.

2. Loosen three bolts which secure bleed valve to compressor manifold.

3. Slide blocking plate between bleed valve and mounting flange.

4. Retighten three bolts which secure bleed valve to compressor manifold.

WARNING

Blocking of air bleed valve could result in catastrophic damage to the engine. The following revisions must be incorporated.

5. Complete normal engine start procedure except for the following:

NOTE

Bring engine up to 60 percent N1 and hold for a minimum of two minutes. A gradual acceleration is required to avoid a stall condition.

a. When increasing fuel to the engine, grasp the throttle firmly with both hands and accelerate engine slowly.

b. Monitor TOT and N1 gauges for possible stall readings.

NOTE

Stall usually occurs between 65 percent and 75 percent N1.

c. If stall is present, TOT will rise rapidly and N1 RPMs will fluctuate between 65 percent and 75 percent.

WARNING

If gauges indicate a stall is present, do not overreact. A quick shutdown of engine will decrease N1 RPMs reducing pressure at the inlet causing the fire to come forward through the engine.

d. If gauges indicate stall, hold the throttle firmly. If N1 does not pickup RPM, slowly decrease throttle fuel demand.

WARNING

If stall condition is overcome, engine must now be run in full power operation.

6. If engine start is achieved, N1 must be maintained above 80 percent. Reduction to part-speed operation could introduce possible stall implications resulting in engine flameout without auto-relight capability.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

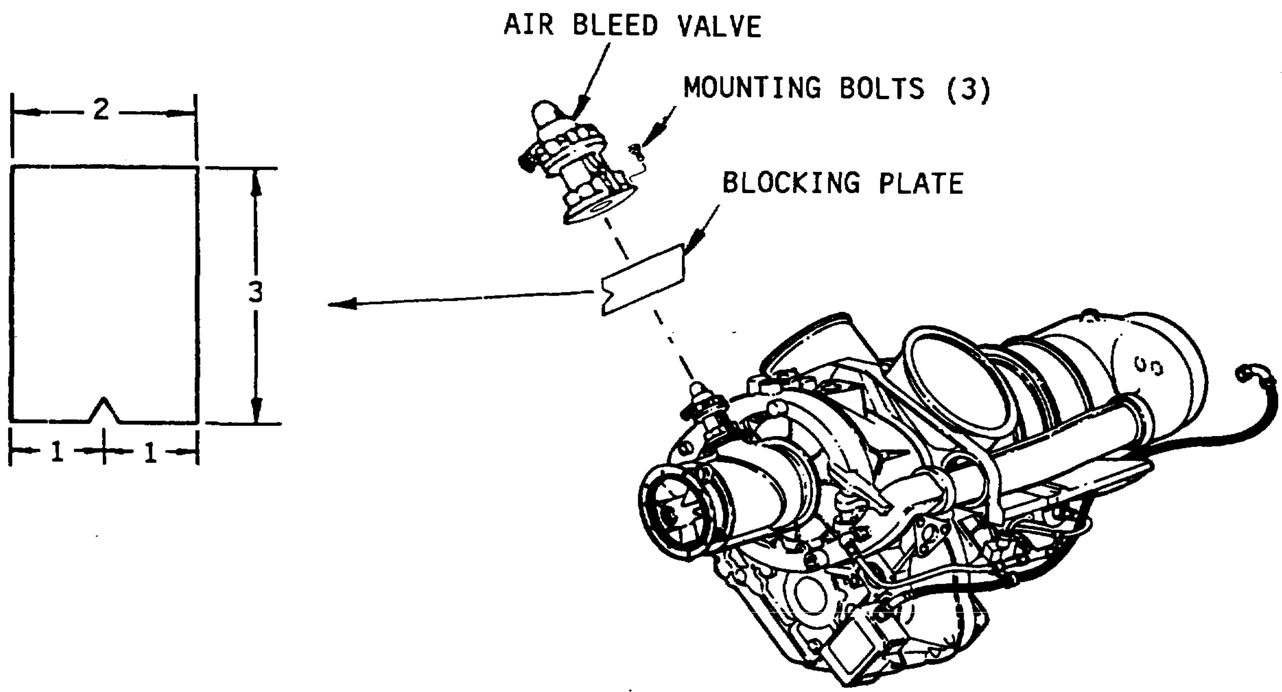


Figure 6-2. Blocking Plate Installation

6-6. DOUBLE-CHECK VALVE INOPERATIVE.

GENERAL INFORMATION: The double-check valve, along with both accumulators, is situated in-line between the power turbine governor and the fuel control, and acts as a dampener for surge control. This system feeds into the fuel control to insure a steady stream of secondary fuel should the compressor flow become inconsistent. It also decelerates a quick reaction from pilot input. With these factors in mind, the pilot must be made aware that if any component of the system is removed or bypassed, any input will result in erratic engine response. At all times, the integrity of all fuel control lines must be maintained. No lines may be deleted or plugged.

NOTE

Should any of the three components sustain damage or otherwise be rendered inoperable, the remaining functional items should be reconnected. In emergency situations, when time is of the essence, the complete system may be bypassed (option 2). This option results in the most unstable condition for the pilot and is therefore least desirable.

OPTION 1: Remove Defective Component.

LIMITATIONS: Erratic engine response.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
. Flex Line Tubing (ID 0.25 in., Length 12 in. min)
. No. 4 Fittings

PROCEDURAL STEPS:

1. All connections and fittings throughout the system incorporate the same thread pattern and therefore a variety of configurations may be achieved. Should the system be inoperable, remove only the defective component(s) and reconstruct the system. Refer to Figure 6-3 to determine possible alternatives.

2. Reuse existing o-rings when possible. If o-rings are severely damaged, scavenge off removed component.

CAUTION

All fuel control lines must be maintained. No lines may be deleted or plugged.

3. Insure the lines between the fuel control and the governor are intact and not leaking.

4. If any leakage is incurred due to the above procedure and cannot be corrected or if time constraints take precedent, the system may be bypassed as a last resort, refer to option 2.

OPTION 2: Bypass Entire System.

LIMITATIONS: Erratic flight control.

NOTE

The pilot must be made aware that any fuel demand he places on the engine will be reacted upon immediately leading to quick engine response and erratic flight control.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 15 Minutes

MATERIALS/TOOLS REQUIRED:
. Flex Line Tubing (ID 0.25 in., Length 12 in. rein)
. No. 4 Fittings

1. Refer to Figure 6-3(b) to establish bypass configuration.

2. Disconnect clamp from flexible hose and extend flexible hose to rigid hose.

3. Use fitting from either hose and connect the two hoses.

4. Insure both o-rings are reusable and no leakage exists. If either o-ring is damaged, scavenge from bypassed components.

6-7. OIL TANK PUNCTURED.

GENERAL INFORMATION: The engine will seize in a matter of minutes if run without oil. This procedure lists six methods to fix a leaking oil tank, depending on the size of the leak and the materials available. If fuel cell repair kit is available, utilize its contents.

LIMITATIONS: None.

NOTE

Some repairs may come loose due to heat and vibration.

OPTION 1: Wood Plug (for Smooth Round Holes).

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
. Plug, Wooden
. Hose or Tubing

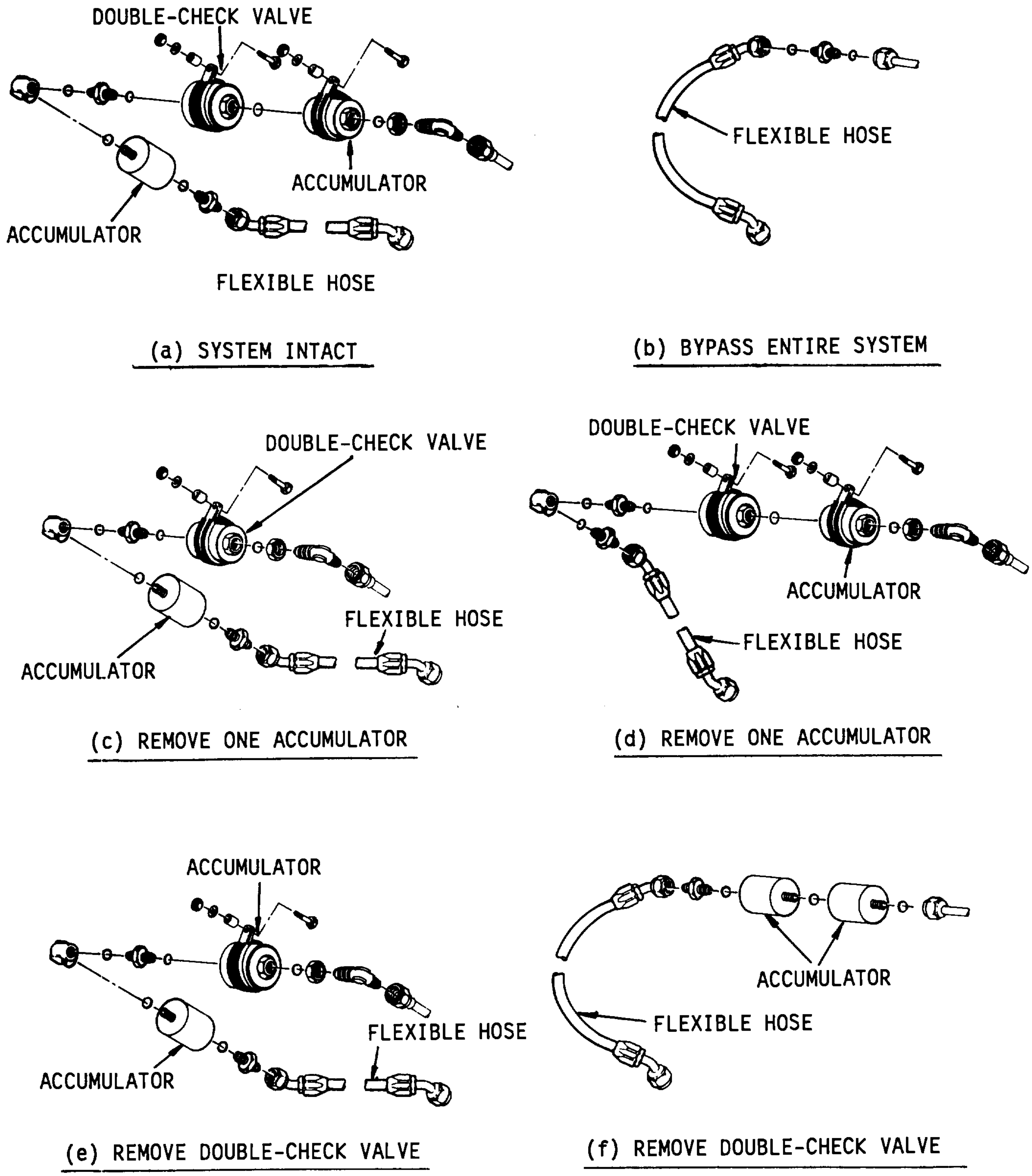


Figure 6-3. Double-Check Valve System, Possible Alternatives

PROCEDURAL STEPS:

1. Obtain a small piece of hose or tubing and insert the piece into the hole on the oil tank, Figure 6-4.

2. Insert a tapered wooden plug inside the hose or tubing (wooden plug should be checked periodically and retightened if necessary).

3. Replenish oil supply.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

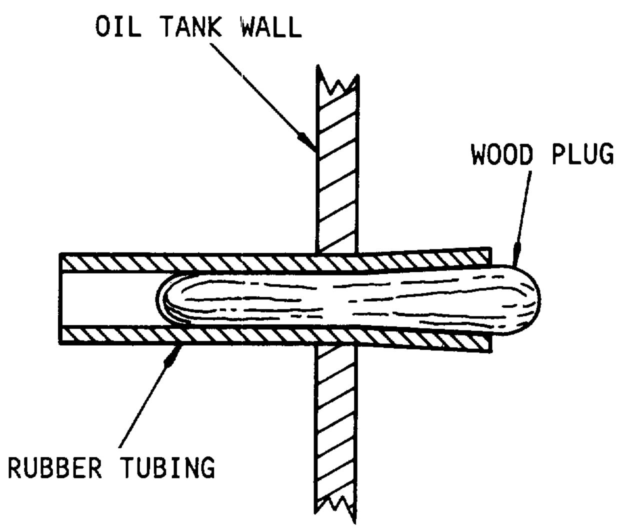


Figure 6-4. Wood Plug

OPTION 2: Duct Tape (for thin cracks).

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
. Tape, Fiberglass or Duct (item 51, Appx C)
. Solvent, Naptha (item 7, Appx C) or Equivalent

PROCEDURAL STEPS:

1. Clean area around crack with solvent to remove the oil.

2. Seal crack with tape.

3. Replenish oil supply.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Sealant (for small holes)

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 1 Hour

MATERIALS/TOOLS REQUIRED:
. Solvent, Naptha (item 7, Appx C) or Equivalent
. Sealant, Silicon (item 4, Appx C) or Equivalent
. Wood Plug

PROCEDURAL STEPS:

1. Clean area around hole with solvent to remove all traces of oil so sealant will stick.

2. Fill hole and surrounding area with sealant.

3. If hole is large enough, use wood plug as a filler while filling hole with sealant, Figure 6-5.

4. After sealant has dried, replenish oil supply.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

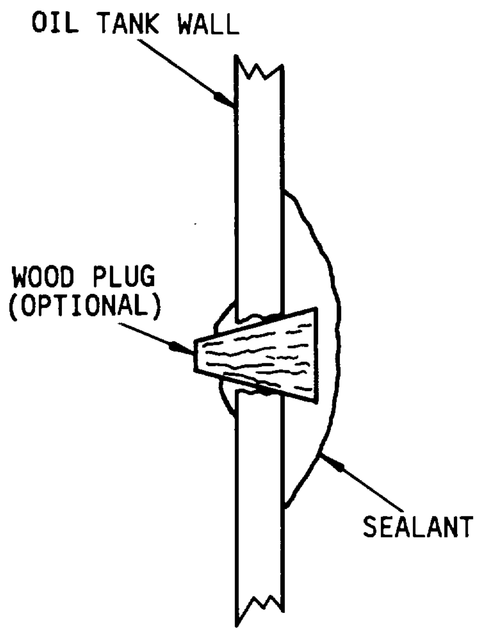


Figure 6-5. Sealant for Small Holes

OPTION 4: Screw, Washer, and Gasket (for small holes)

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
. Screw, Sheet Metal
. Gasket Material (item 20, Appx C)
. Washer

PROCEDURAL STEPS:

1. Cut a piece of gasket material that will overlap the hole by about 1 inch from the center of the hole.

2. Pierce a small hole in the center of the gasket material.

3. Using the sheet metal screw and washer, screw the gasket material through the pierced hole and through the small hole on the oil tank onto the oil tank wall to stop the leak, Figure 6-6.

4. Replenish oil supply.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures

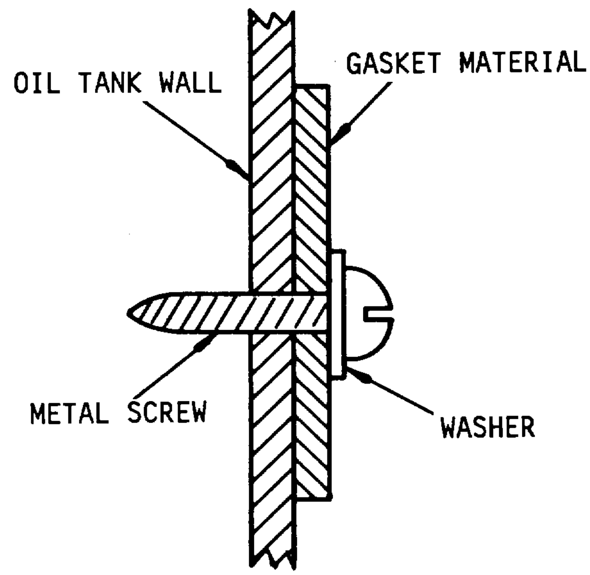


Figure 6-6. Repair Using Screw, Washer and Gasket

OPTION 5: Hose Assembly, Sealant, Nut and Bolt.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 2 Hours

MATERIALS/TOOLS REQUIRED:
. Nut, Bolt, and Washer
. Sealant, Silicon (item 4, Appx C) or Equivalent
. Hose or Tubing
. Solvent, Naptha (item 7, Appx C) or Equivalent

PROCEDURAL STEPS:

1. Clean area around hole with solvent to remove all traces of oil so sealant will stick.

2. Use a piece of hose/tubing about the same diameter of the hole. Assemble bolt, hose/tubing, washer, and nut, Figure 6-7. Apply sealant to all edges. Start nut on bolt and tubing until assembly is snug.

3. File edge of hole until round and smooth. Push hose assembly about half-way through hole. Tighten-nut on bolt expand hose to seal hole. If necessary, remove oil tank plate to allow a wrench or pliers inside of oil tank to hold nut while turning bolt.

4. If oil tank plate was removed, reinstall.

5. After sealant has dried, replenish oil supply.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

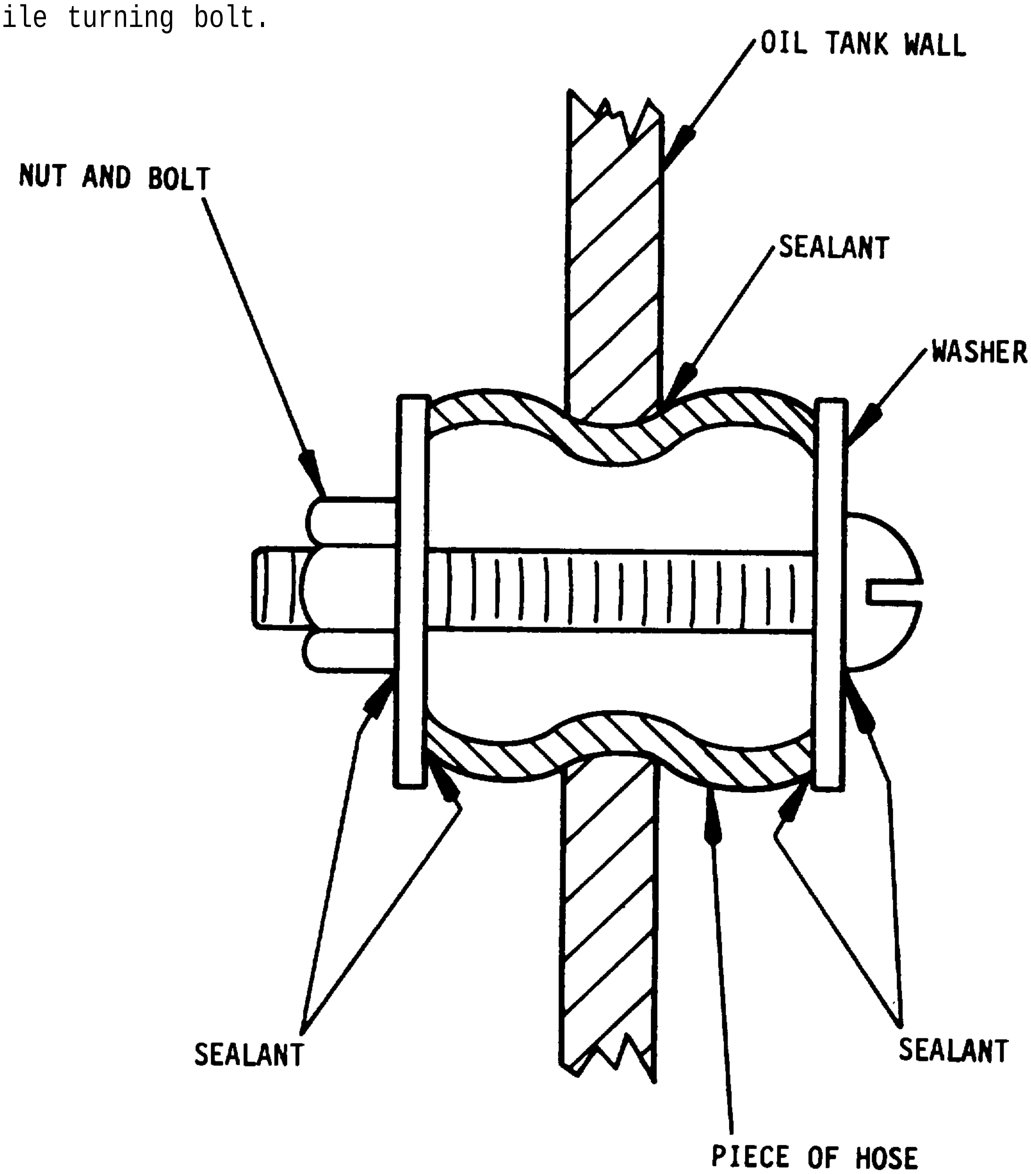


Figure 6-7. Hose Assembly, Sealant, Nut, and Bolt

OPTION 6: Sheet Metal with Sealant and/or Blind Rivets (for large holes).

PERSONNEL/TIME REQUIRED:
. 2 Soldiers
. 3 Hours

MATERIALS/TOOLS REQUIRED:
. Sheet Metal
. Sealant, Silicon (item 4, Appx C) or Equivalent
. Blind Rivets or Sheet Metal Screws (item 39, Appx C)
. Solvent, Naptha (item 7, Appx C) or Equivalent
. Gasket Material (item 20, Appx C)

PROCEDURAL STEPS:

1. Cut a piece of sheet metal that will overlap the hole by 1-1/2 inches at all points, Figure 6-8.

2. If sealant is to be used, clean area around hole with solvent so sealant will stick.

3. Put sealant or gasket material over hole. Put sheet metal plate over hole and secure with sheet metal screws or blind rivets.

4. After sealant has dried, replenish oil supply.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

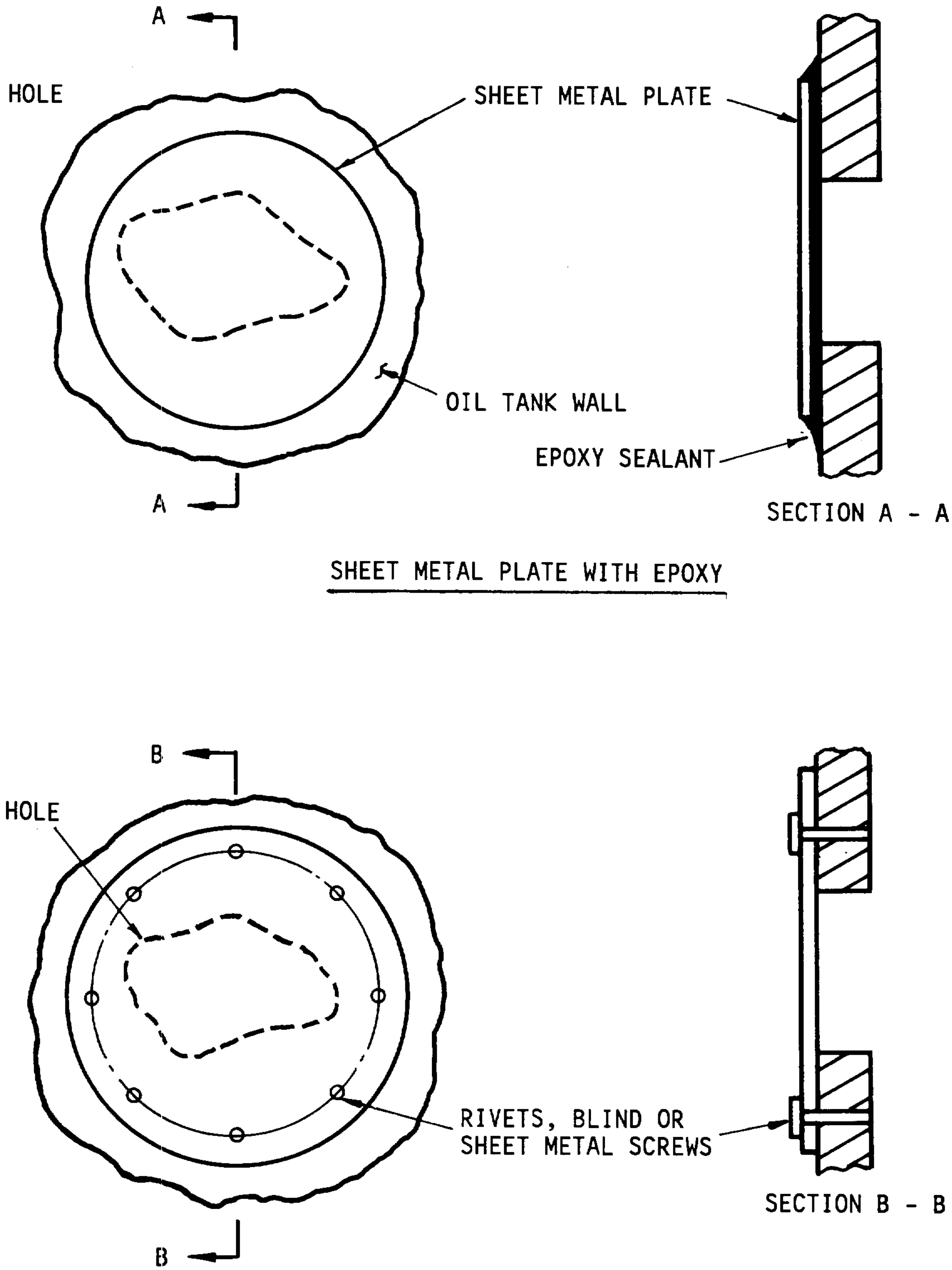


Figure 6-8. Sheet Metal Plate with Sealant and/or Cherry Rivets

CHAPTER 7

ROTORS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section 1. INTRODUCTION

7-1. SCOPE. This chapter contains the fault assessment and expedient repair procedures available to find and fix battlefield damage to the main and tail rotor blades.

7-2. GENERAL. The system consisting of two blade assemblies, each with two blades, a central hub, and a control mechanism. The main rotor is driven by the mast which is connected to the transmission and provides for fore, aft, lateral, and vertical flight modes. The tail rotor is driven by the tail rotor gearbox and provides for directional control. See Figures 7-1 and 7-2 for system configuration. Assessment procedures are found in Table 7-1.

7-3. ASSESSMENT PROCEDURES. Refer to Table 7-1.

7-4. REPAIR PROCEDURE INDEX.

Section II. REPAIRS

7-5. GENERAL. The rotor system does not lend itself well to limited repairs. In most instances, the only repair options for a faulty component will be to replace or repair by normal procedures. Those limited repairs which have been developed are listed in this section.

7-6. ROTOR BLADE, HOLE 1 INCH DIAMETER OR LESS.

GENERAL INFORMATION: A small hole passing through the honeycomb core area, Figure 7-3, on either a main or tail rotor blade can be repaired with duct tape. Removal of blade is not necessary.

LIMITATIONS: Adjustment of blade balance may be required after repair. Inspection of repaired area after each flight would be required.

PERSONNEL/TIME REQUIRED:
. 2 Soldiers
. 15 Minutes

MATERIALS/TOOLS REQUIRED:
. Army Green 3 Inch Tape or Aluminized Tape (item 50, Appx C)
. Cleaning Solvent (item 7, Appx C)

PROCEDURAL STEPS:

1. Position blades for access to damaged area. Support blades to prevent movement and droop.

1. Pitch Link
2. Lever
3. Idler Link
4. Swashplate Assy
5. Link
6. Collective Lever
7. Inner Ring
8. Outer Ring
9. Collar
10. Blade Latch
11. Blade Assy
12. Retaining Bolt
13. Grip
14. Mast Nut
15. Hub Assy (Oil Lubricated shown)
16. Pitch Horn
17. Mast

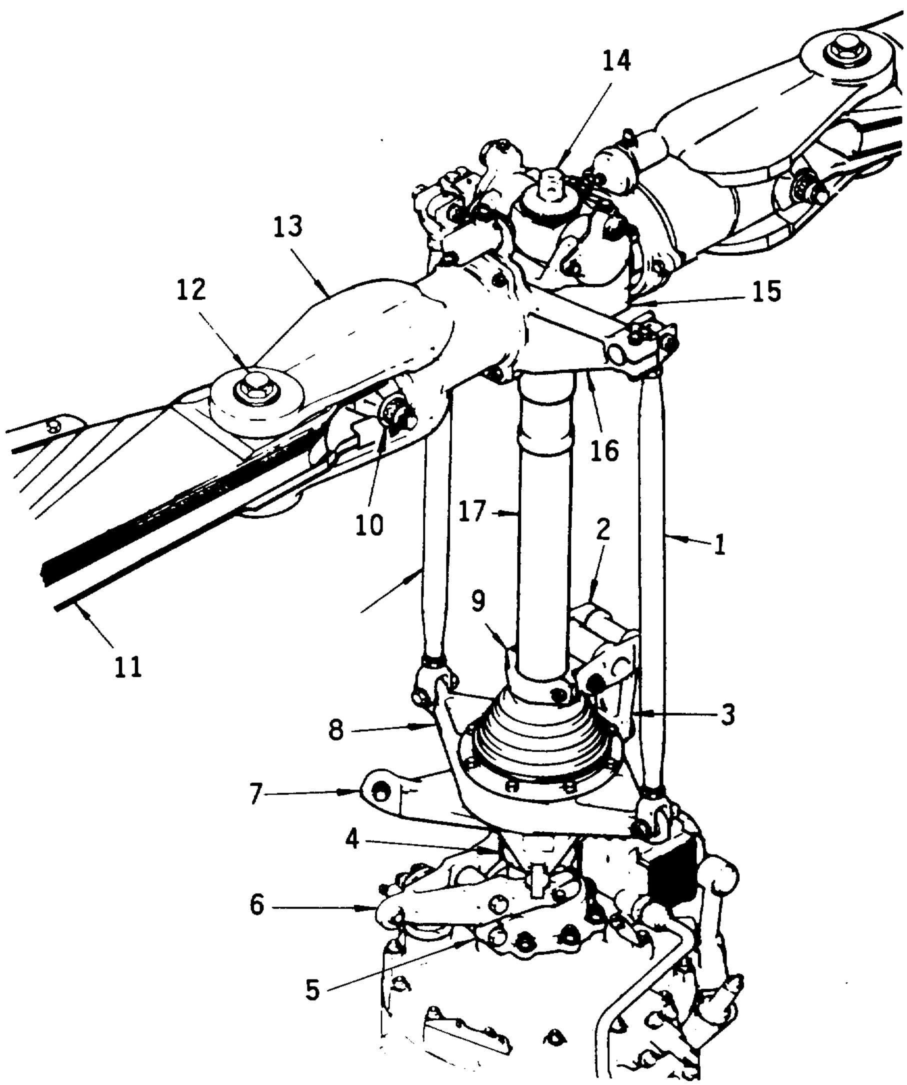
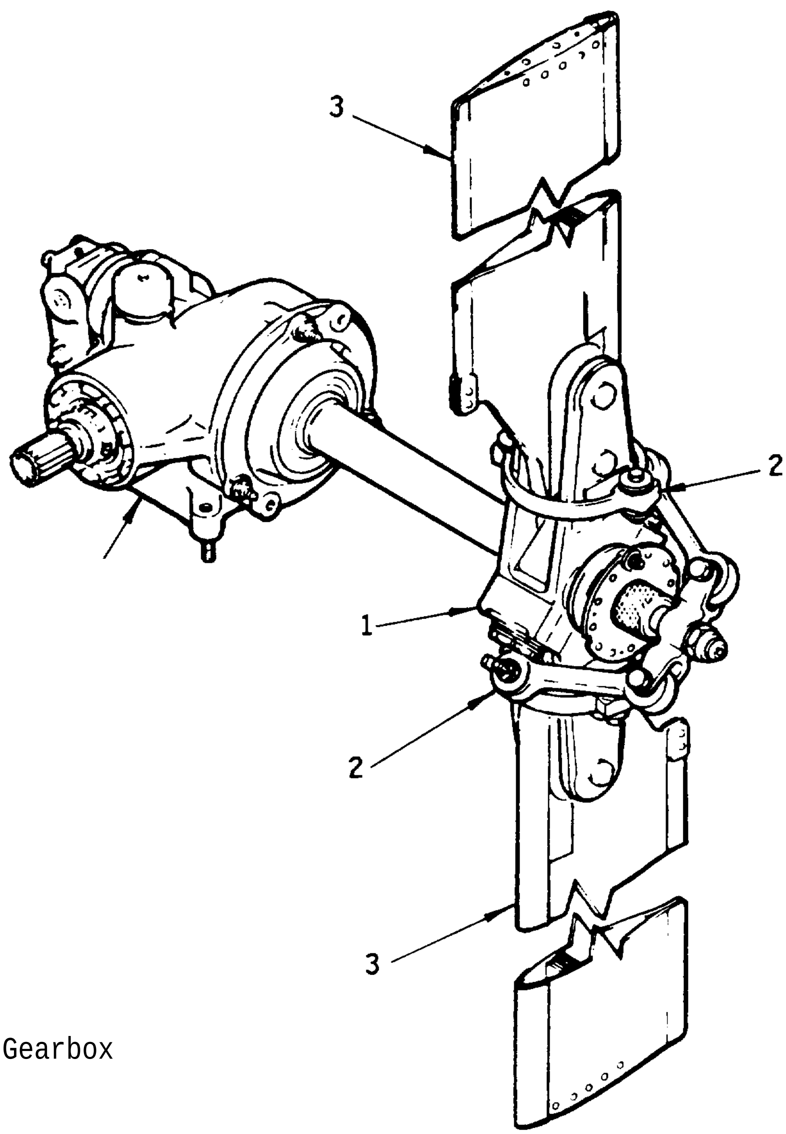


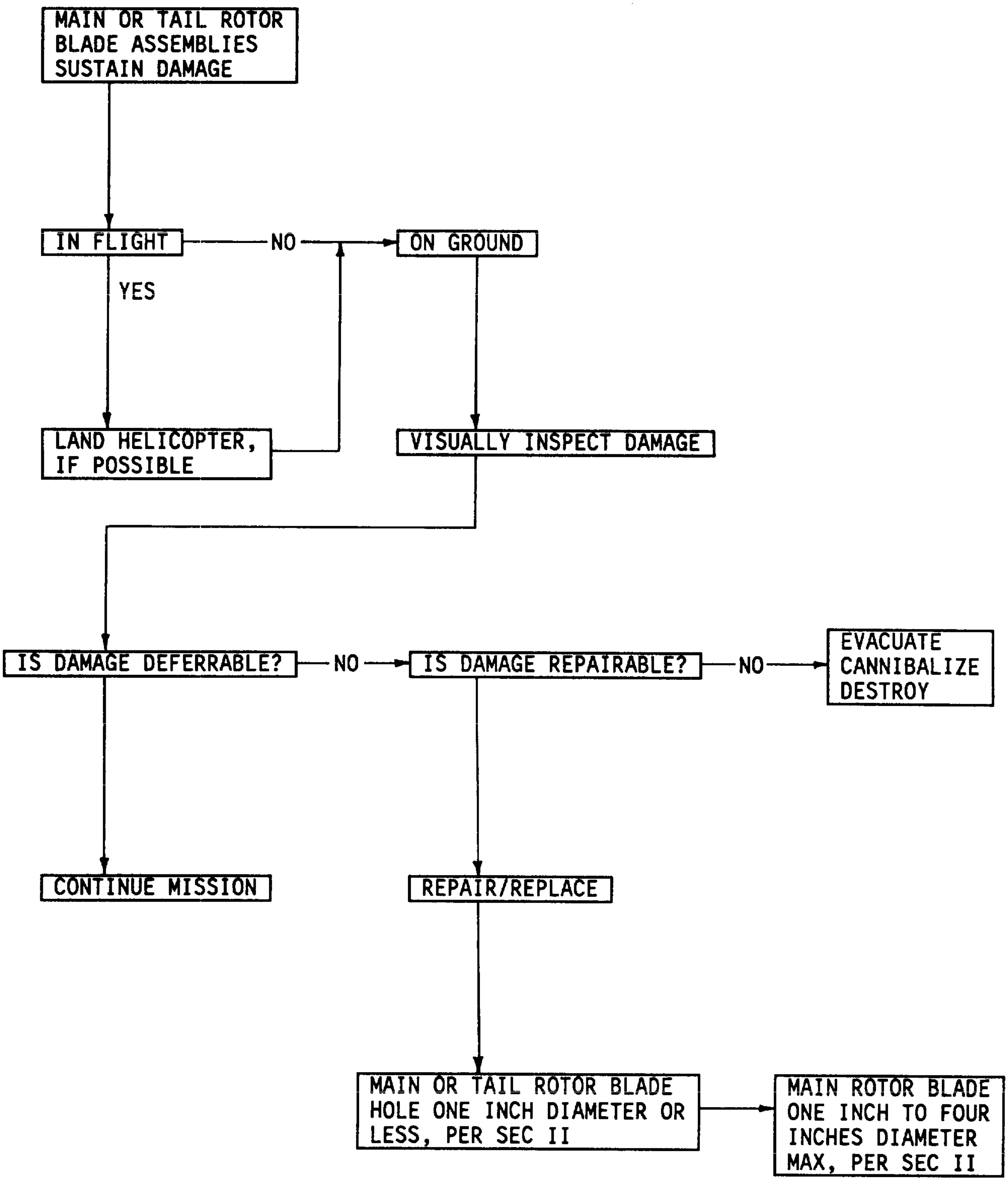
Figure 7-1. Main Rotor System



1. Hub
2. Pitch Horn
3. Blade
4. Tail Rotor Gearbox

Figure 7-2. Tail Rotor System

Table 7-1. Assessment Procedures



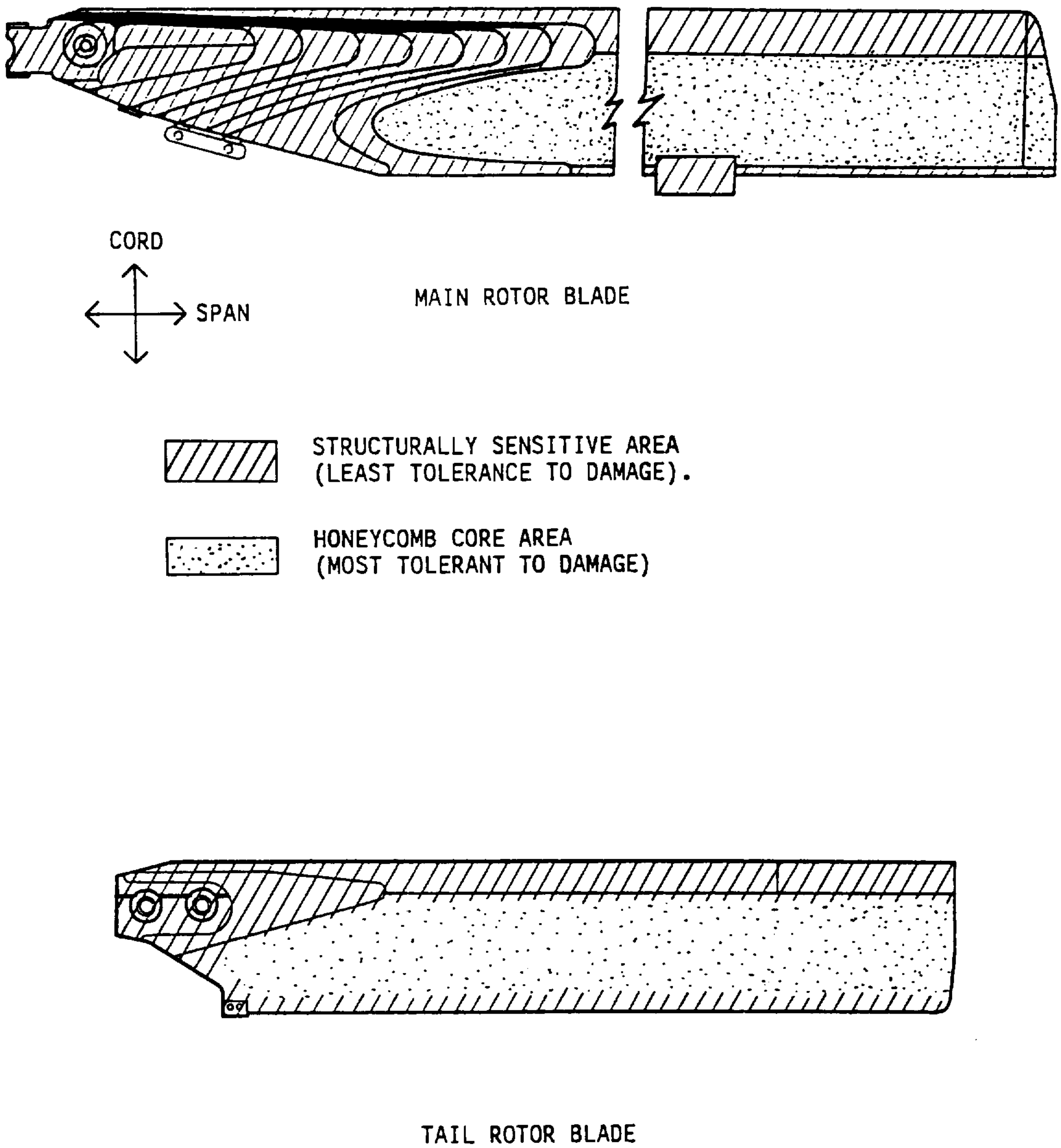


Figure 7-3. Rotor Blades, Damage Sensitive Areas

2. Smooth damage; remove all rough edges.

3. Clean area around damage and completely around blade where tape is to be applied.

4. Cover hole with a chordwise layer of tape, top and bottom of blade. Extend ends of tape 2 inches beyond area of damage, Figure 7-4.

5. Wrap a second layer of tape chordwise over the first layer and around the entire blade. Overlap ends by 3 inches with outside edge of top toward trailing edge.

6. Wrap exact number of tape wraps on opposite side at approximately same span location.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

7-7. MAIN ROTOR BLADE, HOLE 1 T0 4 INCHES DIAMETER MAXIMUM.

GENERAL INFORMATION: A medium size hole in the honeycomb core area, Figure 7-3, of a main rotor blade can be temporarily repaired by fashioning a patch using aluminum foil as a plugging material. Removal of blade is not necessary. This repair is limited to certain areas of the blade as shown in Figure 7-5.

LIMITATIONS: Adjustment of blade balance may be required after repair. Inspection of repaired area after each flight would be required.

PERSONNEL/TIME REQUIRED:
. 2 Soldiers
. 1 Hour

MATERIALS/TOOLS REQUIRED:
. Army Green Tape, Maximum Width Available; 3 Inches Minimum or Aluminized Tape (item 50, Appx C)
. Fiberglass or Aluminum Wafers
. Aluminum Foil or Other Filler Material (item 18, Appx C)
. Adhesive Package

PROCEDURAL STEPS:

1. Position blades for access to damage area. Support blades to prevent movement and droop.

2. Smooth damage; remove all rough edges.

3. Clean area around damage and completely around blade where tape is to be applied.

4. Make a plug of crushed aluminum foil or other filler material shaped to fit in the hole. Do not make the plug too dense; voids should be about 1/4 inch. Apply spots of adhesive to the aluminum sheet before crushing so plug will have some strength. Apply adhesive sparsely to the finished plug in the area where it will come in contact with the blade sandwich material.

5. Insert plug in hole. Hole should be well packed,

6. Cut out a fiberglass or aluminum wafer so it just fits over the hole without overlapping the external blade skin. Apply adhesive to the bottom of the wafer where it comes in contact with the aluminum plug, and close the hole.

7. Cover hole with Army green tape. Tape should extend 2 inches beyond edge of the hole, Figure 7-4.

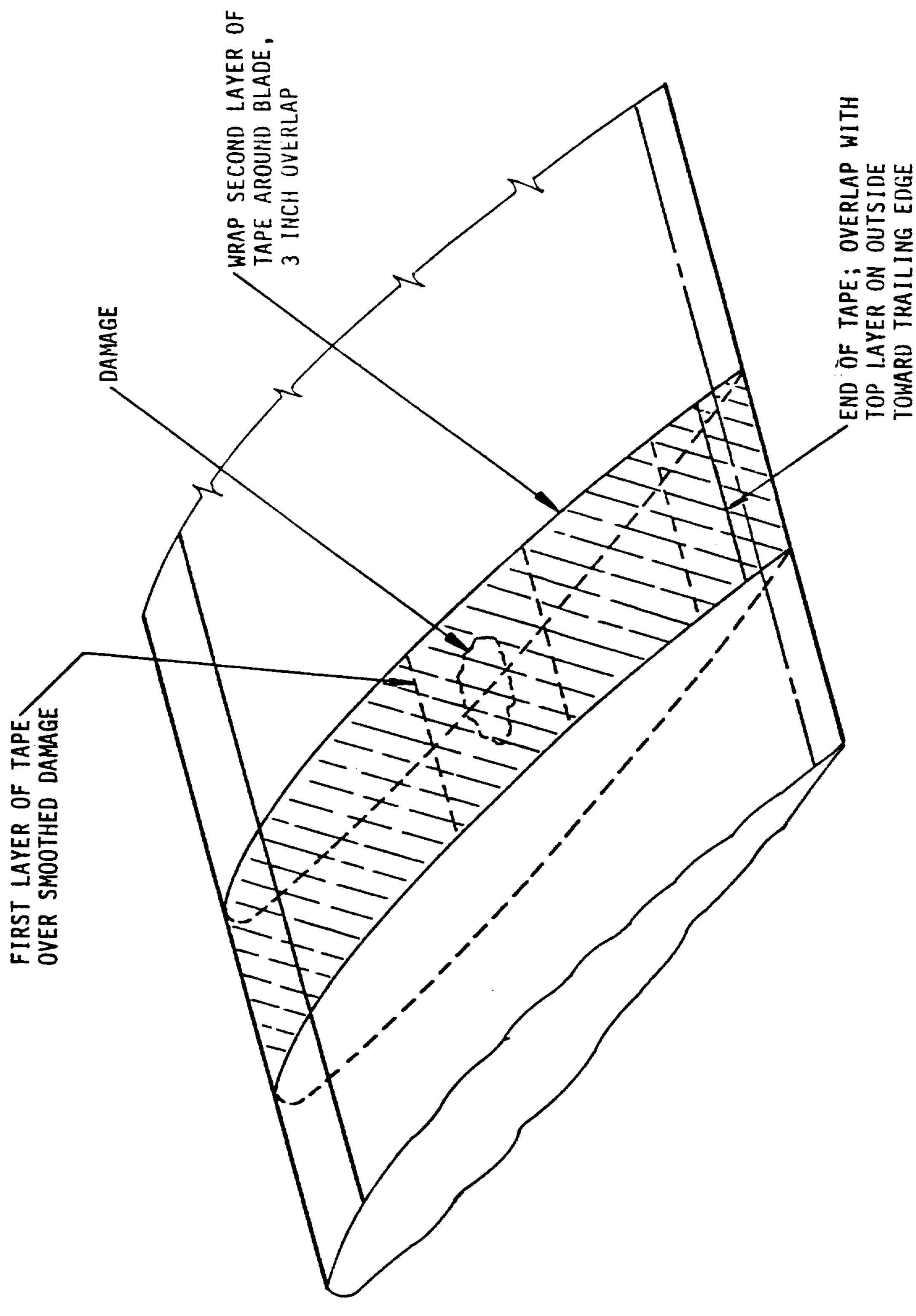


Figure 7-4. Rotor Blade Repair, Application of Tape

8. Wrap a layer of tape around the entire blade and over the repaired area.

9. Wrap exact number of tape wraps on opposite side at approximately same span location.

10. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

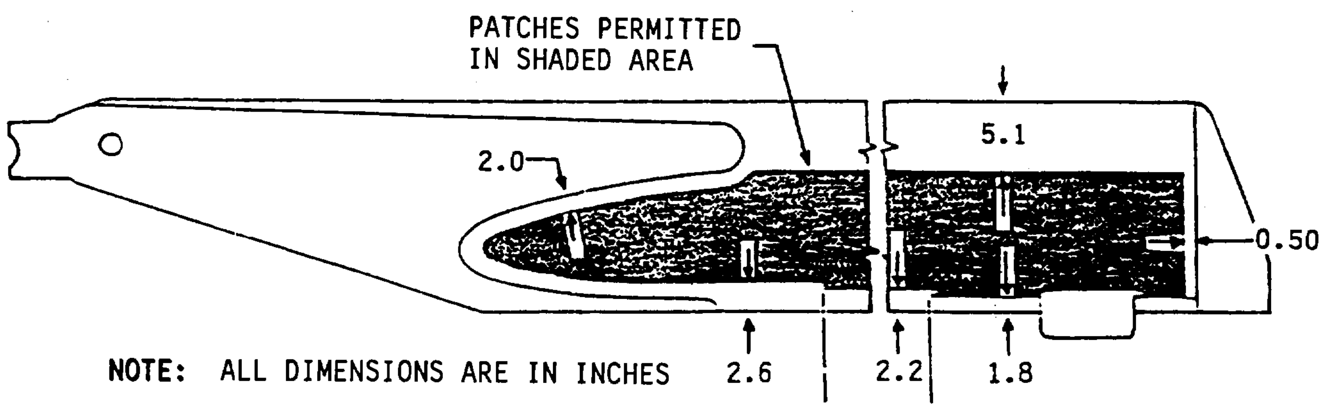


Figure 7-5. Repair Areas - Main Rotor Blades

CHAPTER 8

DRIVE TRAIN SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

8-1. GENERAL. The drive train is a system of shafts and gearboxes through which the engine drives the main rotor, tail rotor, and such accessories as rotor tachometer generator and hydraulic pump. (See Figure 8-1 for drive train system configuration.)

8-2. DRIVE TRAIN DAMAGE. The drive train system does not lend itself well to limited repairs. In most instances, the only repair options for a faulty component will be to replace or repair by normal procedures. Those limited repairs which have been developed are listed in this section.

8-3. ASSESSMENT PROCEDURES. Refer to Table 8-1.

8-4. REPAIR PROCEDURES INDEX.

Section 11. REPAIR

8-5. SENSITIVITY OF DRIVE TRAIN SYSTEM TO BATTLEFIELD DAMAGE. The drive train system includes a number of components which, if damaged or deformed (bent) in any way or fail internally, will render the system inoperable or severely degrade flight characteristics or safety. The system is particularly sensitive to any damage which adversely affects any of the following:

a. Internal operation of transmission, freewheeling assembly, or tail rotor gearbox.

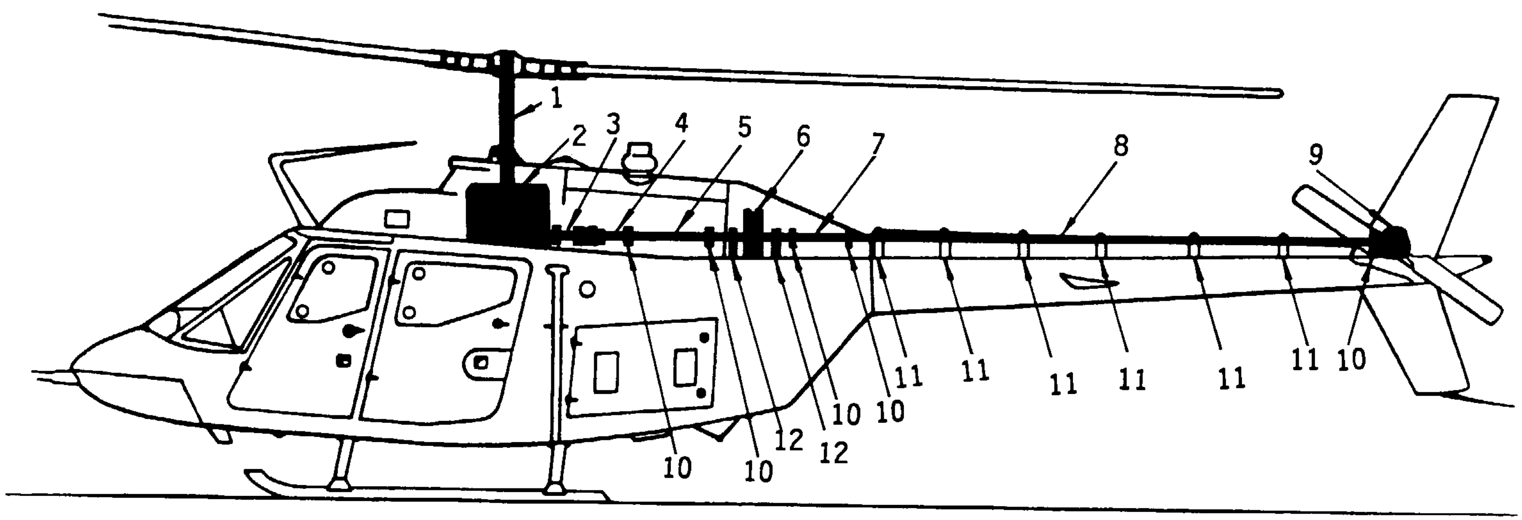
b. Operation of the transmission oil system.

c. Straightness, original shape, or integrity of either the mast, drive-shafts, or output shaft at tail rotor gearbox.

8-6. AIR DUCT HOSE DAMAGE.

GENERAL INFORMATION: Holes, tears, or distortions in air duct hose (16, Figure 8-2) can result in less than the required amount of cooling air reaching the oil cooler (2, Figure 8-2). This condition may cause the transmission oil system to operate at above normal temperature. Several repairs can be applied depending on accessibility and the nature and extent of damage incurred. Various repairs are shown at Figure 8-3.

1. Mast
2. Transmission Assy
3. Main Driveshaft
4. Freewheeling Assy
5. Forward Short Tail Rotor Driveshaft
6. Oil Cooling Blower and Shaft Assy
7. Aft Short Tail Rotor Driveshaft
8. Long Tail Rotor Driveshaft
9. Tail Rotor Gearbox Assy
10. Disc Assy
11. Bearing Hangar and Support Bracket
12. Hangar (Blower Assy)
13. Oil Cooler
14. Coupling (Main Driveshaft)
15. Splined Adapter
16. Oil Filter Assy
17. Tail Rotor Driveshaft Segment



SEE DETAIL A

(PRIOR TO COMPLIANCE WITH MWO 55-1520-228-50-25!

Figure 8-1. Drive Train System (Sheet 1 of 4)

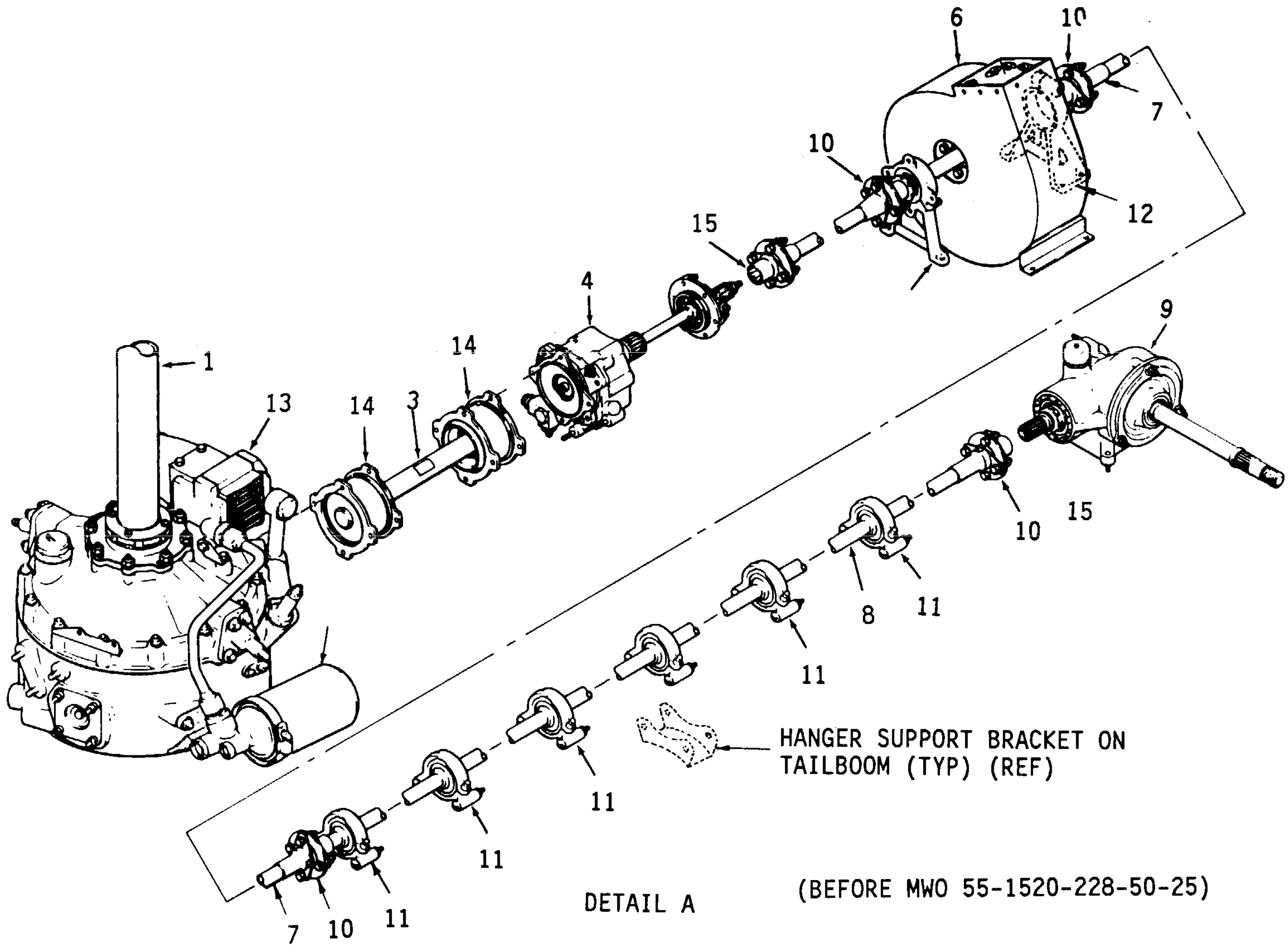
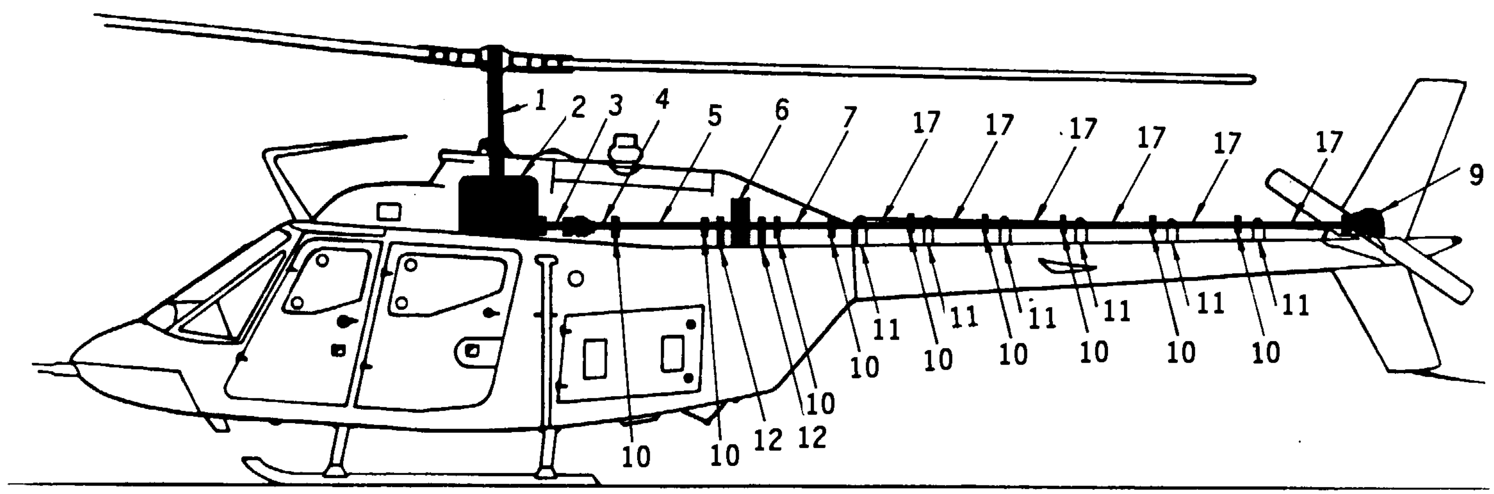


Figure 8-1. Drive Train System (Sheet 2 of 4)



(AFTER COMPLIANCE WITH MWO 55-1520-228-50-25)

Figure 8-1. Drive Train System (Sheet 3 of 4)

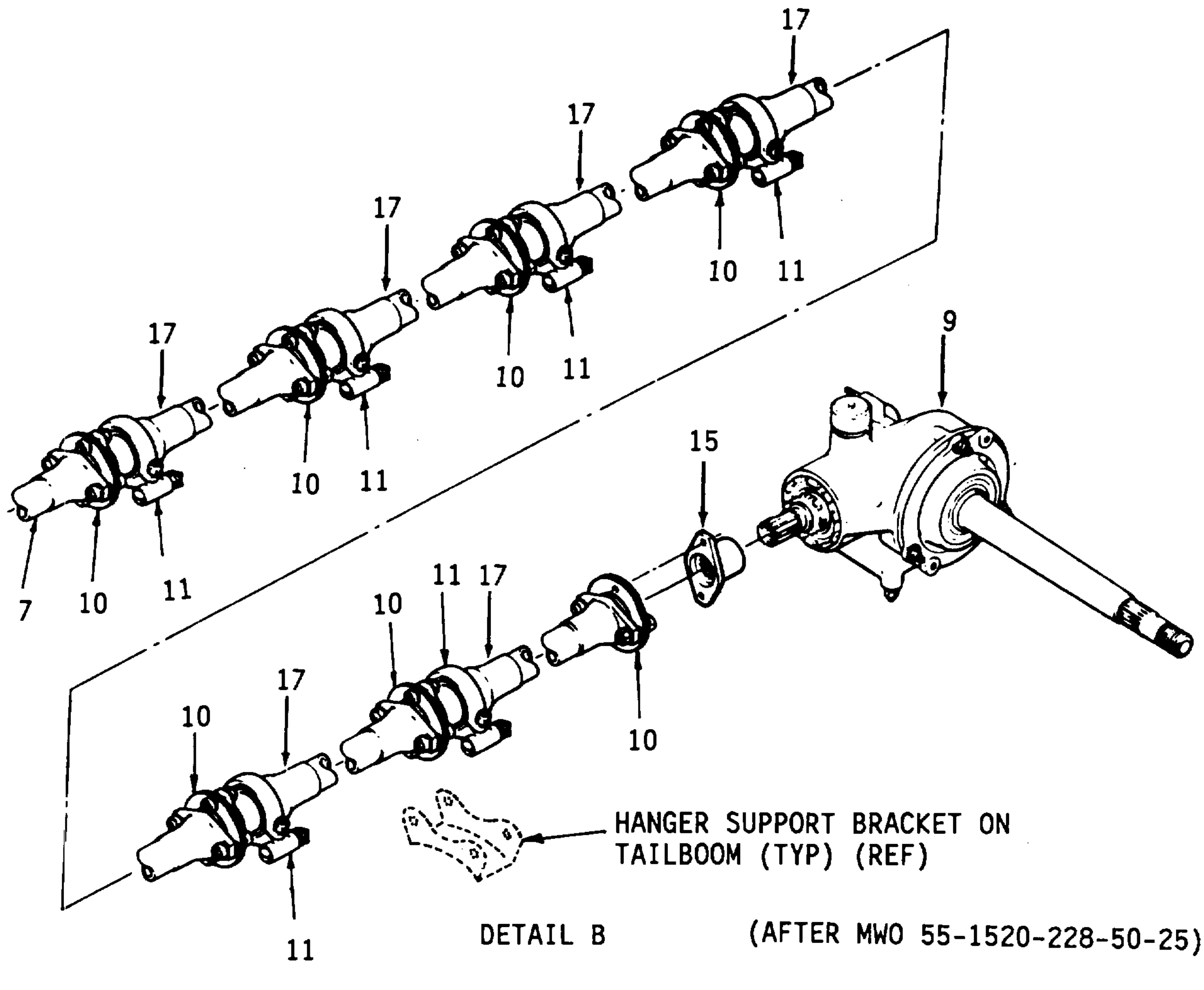
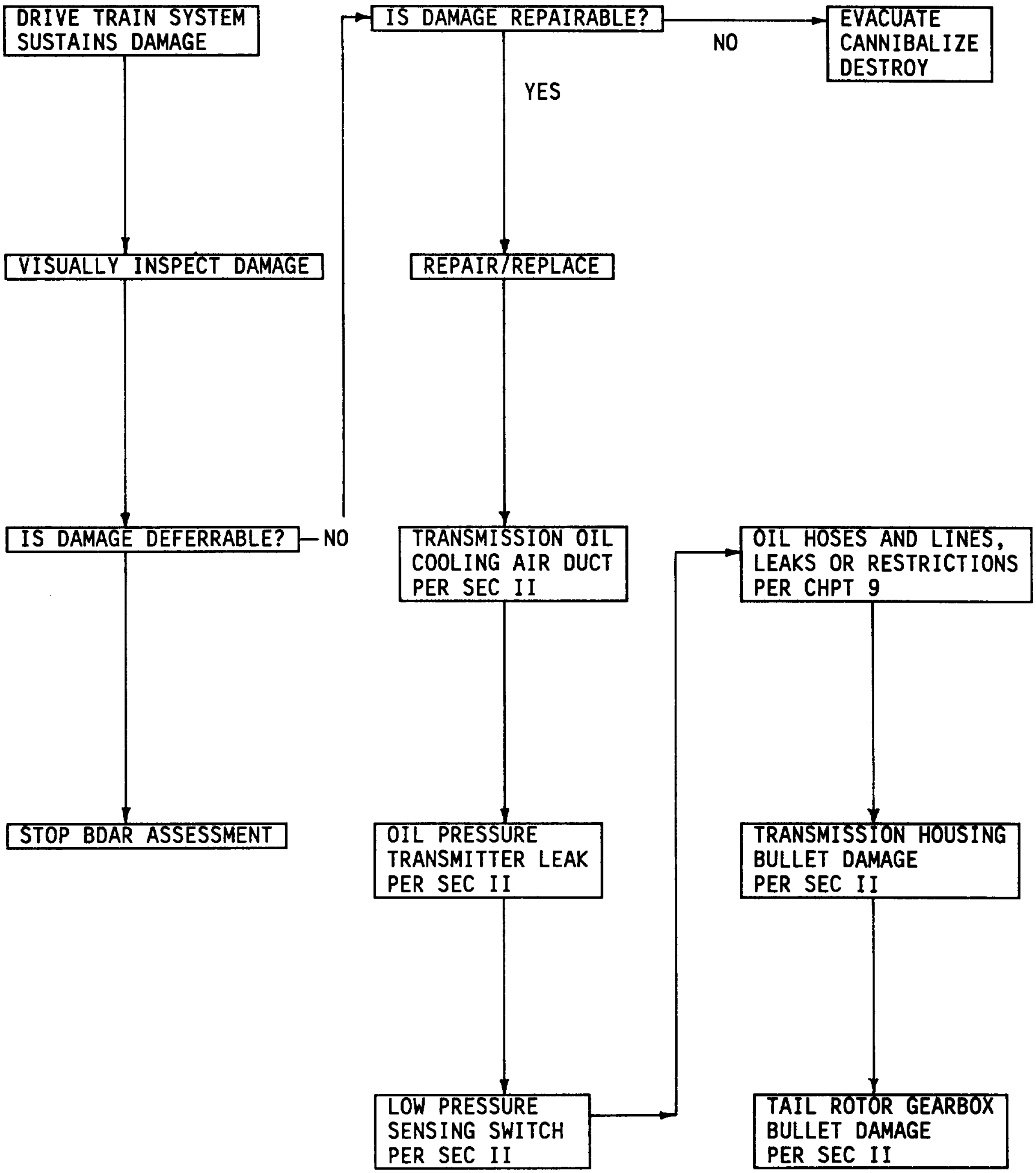


Figure 8-1. Drive Train System (Sheet 4 of 4)

Table 8-1. Drive Train System BDAR Assessment Procedures



LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 20 Minutes

MATERIALS/TOOLS REQUIRED:
. Pliers
. Duct Tape (item 51, Appx C)
. Wire Cutters
. Thin Pliable Material

PROCEDURAL STEPS: (Refer to Figure 8-3, Repairs A, B, C, D.)

1. Hole or tear in fabric. Wrap several turns around duct to cover hole or tear. Tape should extend beyond damaged area 1 to 2 inches in each direction. Refer to repair A.

2. Distorted duct.

a. Using pliers and wire cutters, reshape or cut away the portion of duct which would create an air flow restriction or which is badly distorted. Note: If wire frame work below fabric is cut through, refer to step 3, severed duct.

b. If repair area is not at a bend portion of duct routing, a repair can be applied as shown at either repair B or C. If repair area is located at a bend portion of duct routing, a repair can be applied as shown at repair B.

c. Tape should extend beyond damaged area 1 to 2 inches in either direction.

3. Severed duct.

a. Using pliers and wire cutters, reshape or cut away any portion of duct which would create an air flow restriction or which is badly distorted.

b. If area to be repaired is not in a bend portion of duct routing, a repair can be applied as shown at either repair B, C, or D. If area to be repaired is in a bend portion of duct routing, a repair can be applied as shown at either repair B or D.

c. Tape should extend beyond damaged area 1 to 2 inches in either direction.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

8-7. OIL PRESSURE TRANSMITTER C LEAK.

CAUTION

If 8-7 and 8-8 repairs are accomplished, there will be no Oil Pressure Monitoring System.

GENERAL INFORMATION: If oil is being lost due to damage at oil pressure transmitter (7, Figure 8-2), the transmitter can be removed and replaced with a threaded plug provided XMSN OIL PRESS warning light is operable and considered reliable.

LIMITATIONS: Early warning of high oil pressure conditions would be eliminated since the transmission oil gauge would be rendered inoperable. XSMN OIL PRESS warning light would give early warning but for low pressure conditions only.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 15 Minutes

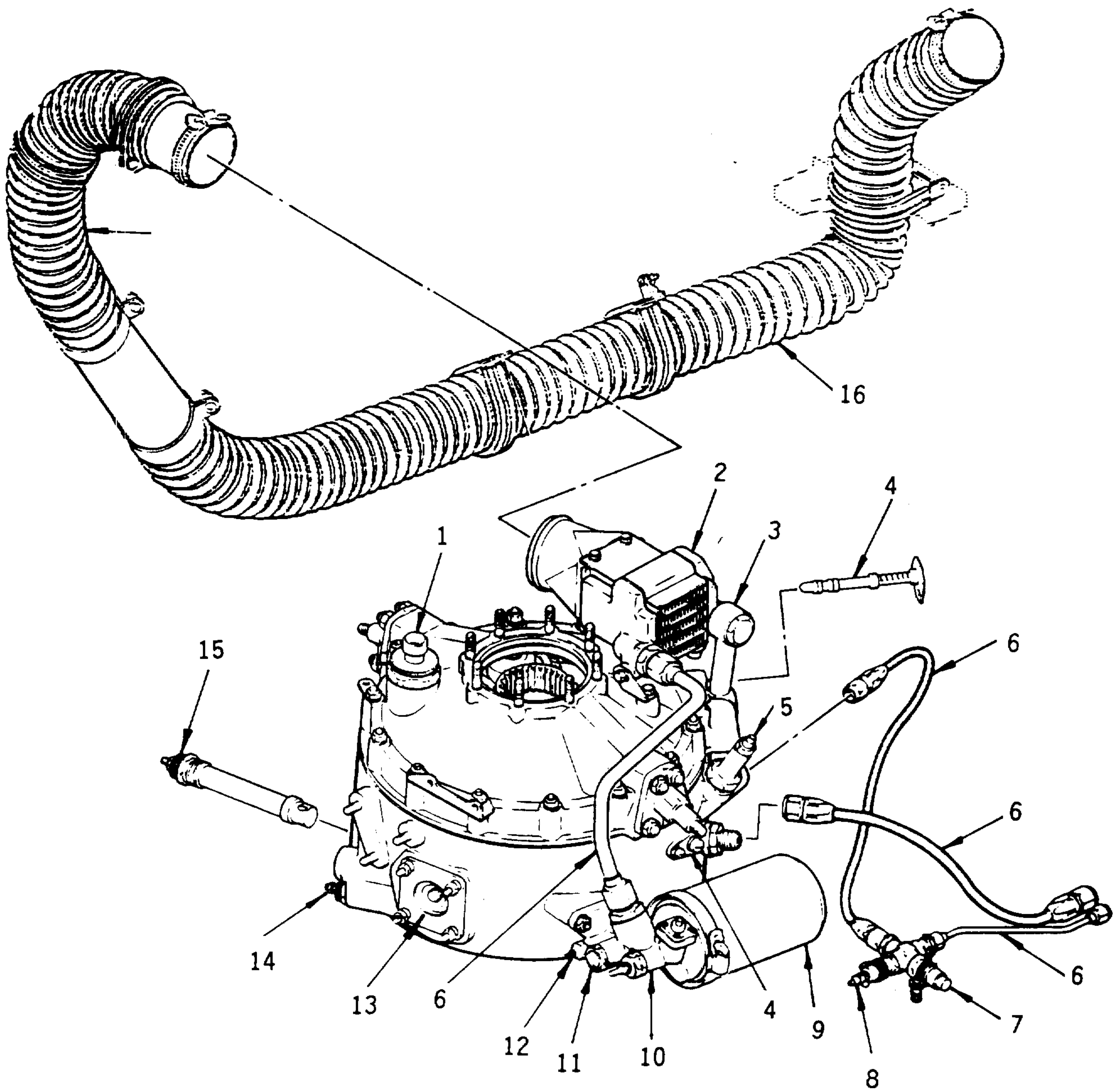
MATERIALS/TOOLS REQUIRED:
. Pliers
. Open End Wrench
. Tie Wraps
. Plug, MS24391D4L (same as 7, Figure 8-2 A)

PROCEDURAL STEPS: (Refer to Figure 6-2.)

1. Cut lock wire at transmitter (7).

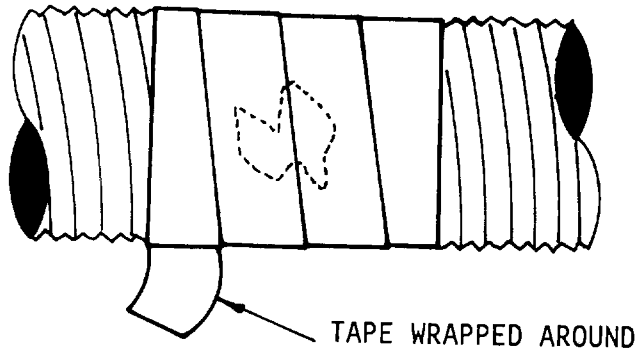
2. Remove electrical connector from transmitter (7).

3. Remove transmitter (7) and packing. Retain packing.

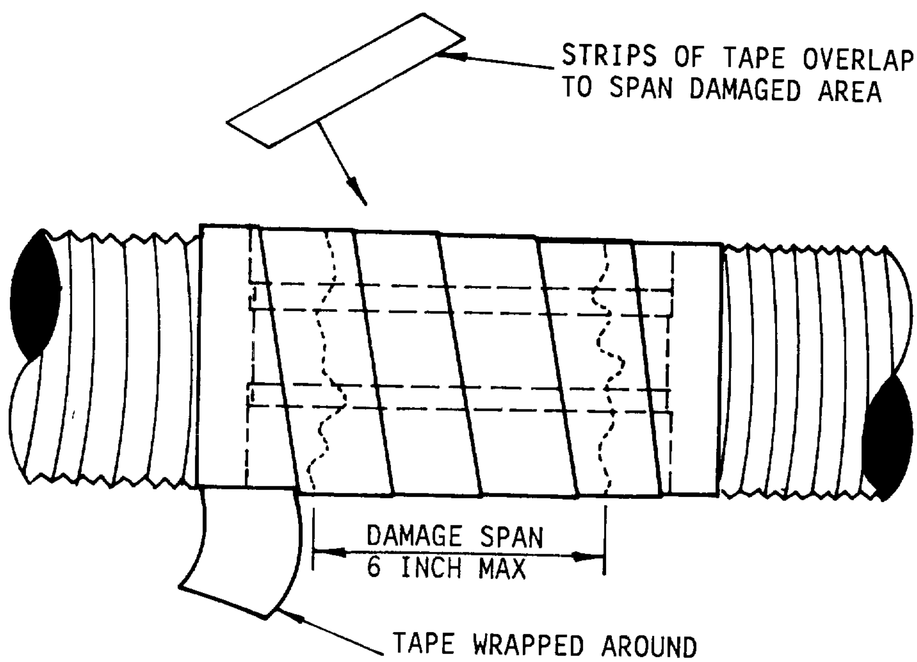


1. Filler Cap
2. Oil Cooler
3. Transfer Tube
4. Nozzle (Jet)
5. Pressure Regulating Valve
6. Hoses and Lines
7. Oil Pressure Transmitter $\boxed{C}$ Plug $\boxed{A}$
8. Low Pressure Sensing Switch
9. Oil Filter
10. Oil Filter Head Assy
11. Filter Bypass Valve
12. Oil Temperature Switch
13. Oil Pump
14. Chip Detector
15. Chip Detector
16. Air Duct Hoses

Figure 8-2. External Components - Transmission Oil System

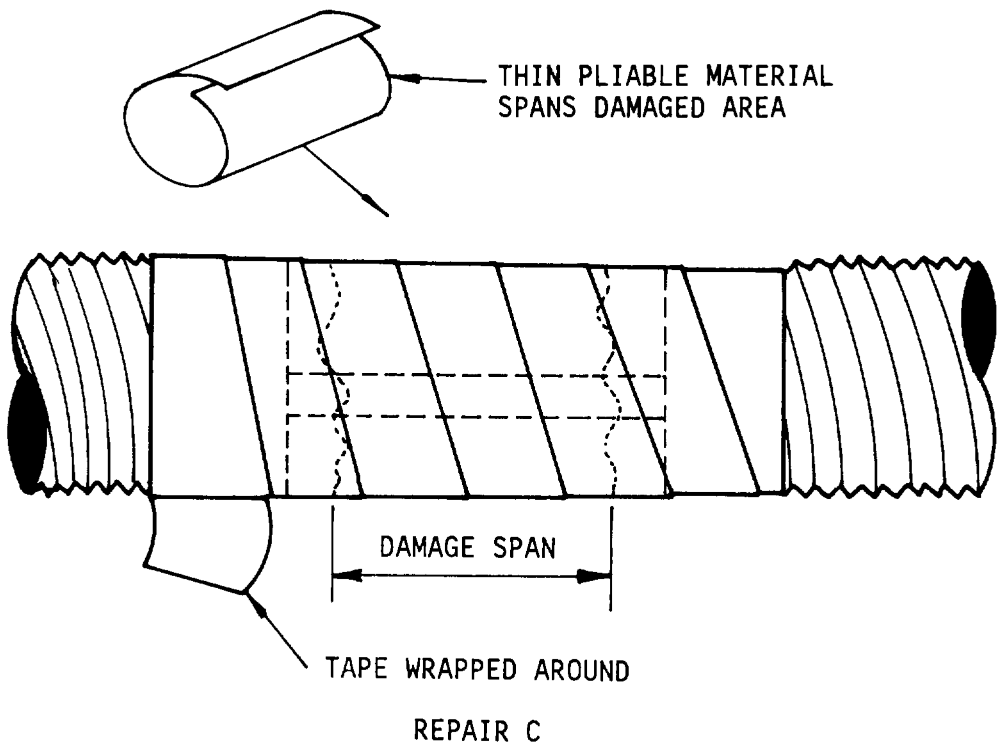


REPAIR A



REPAIR B

Figure 8-3. Flex Duct Repair (Sheet 1 of 2)



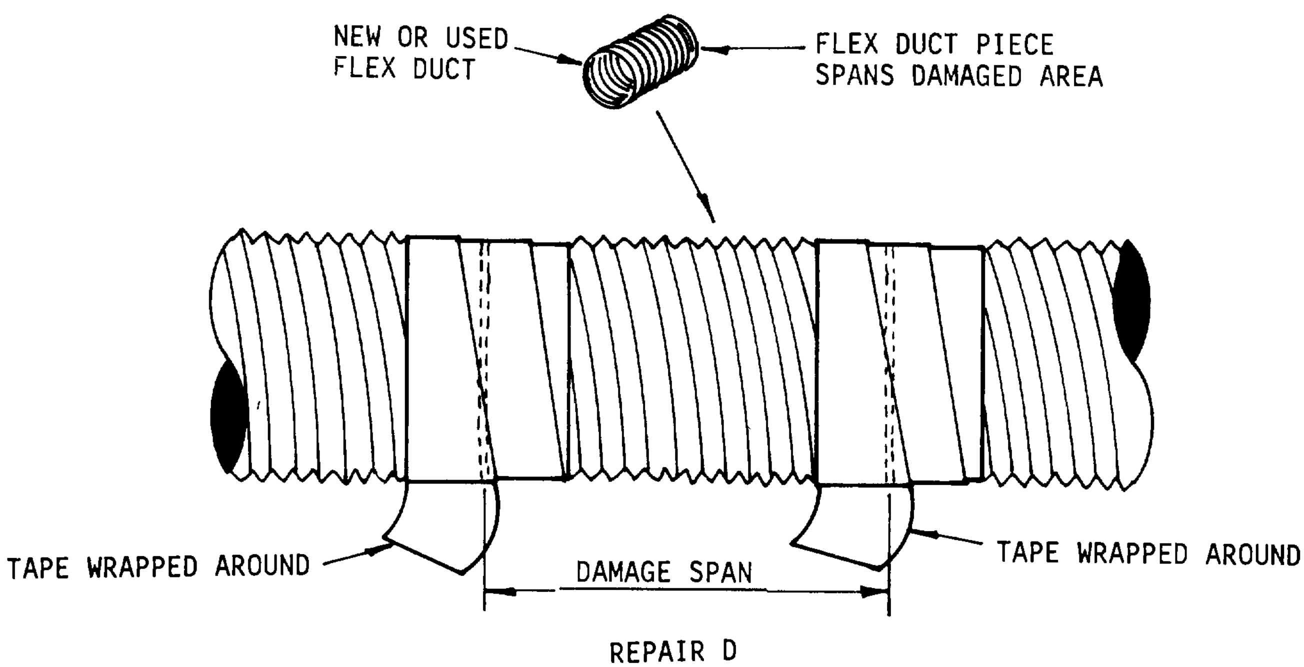


Figure 8-3. Flex Duct Repair (Sheet 2 of 2)

4. Install plug and packing where transmitter (7) was previously installed.

5. Secure loose electrical connector and cable with tie wraps.

6. Check for leaks.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

8-8. LOW PRESSURE SENSING SWITCH [C] LEAK.

GENERAL INFORMATION: If oil is being lost due to damage at low pressure sensing switch (8, Figure 8-2), the switch can be removed and replaced with a threaded plug, provided the transmission oil pressure gauge is operable and reliable.

LIMITATIONS: XMSN OIL PRESS warning light would be inoperable. Only the transmission oil pressure gauge would monitor transmission oil pressure.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 15 Minutes

MATERIALS/TOOLS REQUIRED:
. Pliers
. Tie Wraps
. Open End Wrench
. Plug, MS 24391D4L (same as 7, Figure 8-2 [A])

PROCEDURAL STEPS: (Refer to Figure 8-2.)

1. Cut lock wire.

2. Remove electrical connector from switch (8).

3. Remove switch (8) and packing. Retain packing.

4. Install plug and packing where switch (8) was previously installed.

5. Secure loose electrical connector and cable with tie wraps.

6. Check for leaks.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

8-9. OIL HOSES AND LINES, LEAK OR RESTRICTION (CRIMP).

GENERAL INFORMATION: Damaged oil hoses and lines (6, Figure 8-2) of the transmission oil system may be repaired by manufacturing a new hose or line or by installing a replacement section for the damaged section. Similar repairs are outlined at Chapter 9, Section II, and may be utilized for the transmission oil system.

8-10. TRANSMISSION-BULLET DAMAGE.

GENERAL INFORMATION: If the transmission is hit by a bullet which exits on the opposite side, the transmission does not bind and there is no oil loss, repair may be deferred. Aircraft is fully flight capable. Other repairs that may be utilized for the transmission can be found in Chapter 6, Section II.

LIMITATIONS: Small oil loss can be tolerated. Inspect after every flight.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 15 Minutes

MATERIALS/TOOLS REQUIRED:
. Solvent, Cleaner (item 7, Appx C)
. Tape, Army Green (item 50, Appx C) or Equivalent
. Plug
. Safety Wire (item 26, Appx C)

PROCEDURAL STEPS:

1. Clean damaged area with solvent.

2. Close bullet hole with a plug and hold in place with tape.

3. Secure plug in place with safety wire.

NOTE

Because transmission is pressurized, try to center safety wire over plug.

4. Fill transmission with oil.

5. Inspect after every flight.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

8-11. TAIL ROTOR GEARBOX, BULLET DAMAGE.

GENERAL INFORMATION: If a bullet strikes the gearbox and exits and the gears do not jam, bind, or lose lubricant, repair may be deferred.

LIMITATIONS: Small oil loss can be tolerated. If aircraft is run for an extended period of time with little or no oil, gearbox will jam.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Solvent, Cleaner (item 7, Appx C)
- Rubber Sheet
- Tape, Army Green (item 50, Appx C) or Equivalent
- Sealant (item 4, Appx C)

PROCEDURAL STEPS:

1. Clean damaged area with solvent if available. Place a rubber sheet 1/2 inch to 3/4 inch larger than hole under green tape. Alternatively, if rubber sheet not available, place sealant under tape.

2. Close bullet hole with green Army tape.

3. Inspect after every flight.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

CHAPTER 9

HYDRAULIC

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

9-1. SCOPE. The OH-58 hydraulic system operates at pressures of 575 to 625 psi. This pressure is produced by the hydraulic pump (9, Figure 9-1). The hydraulic fluid is routed to the flight control servo actuators by means of flex hoses, tubes, mechanical valves, and an electrically controlled solenoid.

9-2. GENERAL. This chapter contains field fixes applicable only to the hoses and tubing which the hydraulic system utilizes. Refer to Figure 9-2 for system fluid distribution.

9-3. ASSESSMENT PROCEDURES. No assessment procedures are needed to locate leaks and ruptured hoses and lines. The location of a leak can only be determined by visual examination. Refer to Table 9-1 for assessment logic of the hydraulic system.

9-4. REPAIR PROCEDURE INDEX.

	PARA.
Lines and Hose Replacement	9-5
Tube Cutting	9-6
Aluminum Tubing Damage	9-7
Hydraulic Hose Damage.	9-8
O-Ring, Packing, and Gasket Application..	9-10
Hydraulic Fluid Substitutions.	9-11

Section II. LINES AND HOSES

9-5. GENERAL.

a. Replacement lines may be manufactured in the field if materials and tools are available.

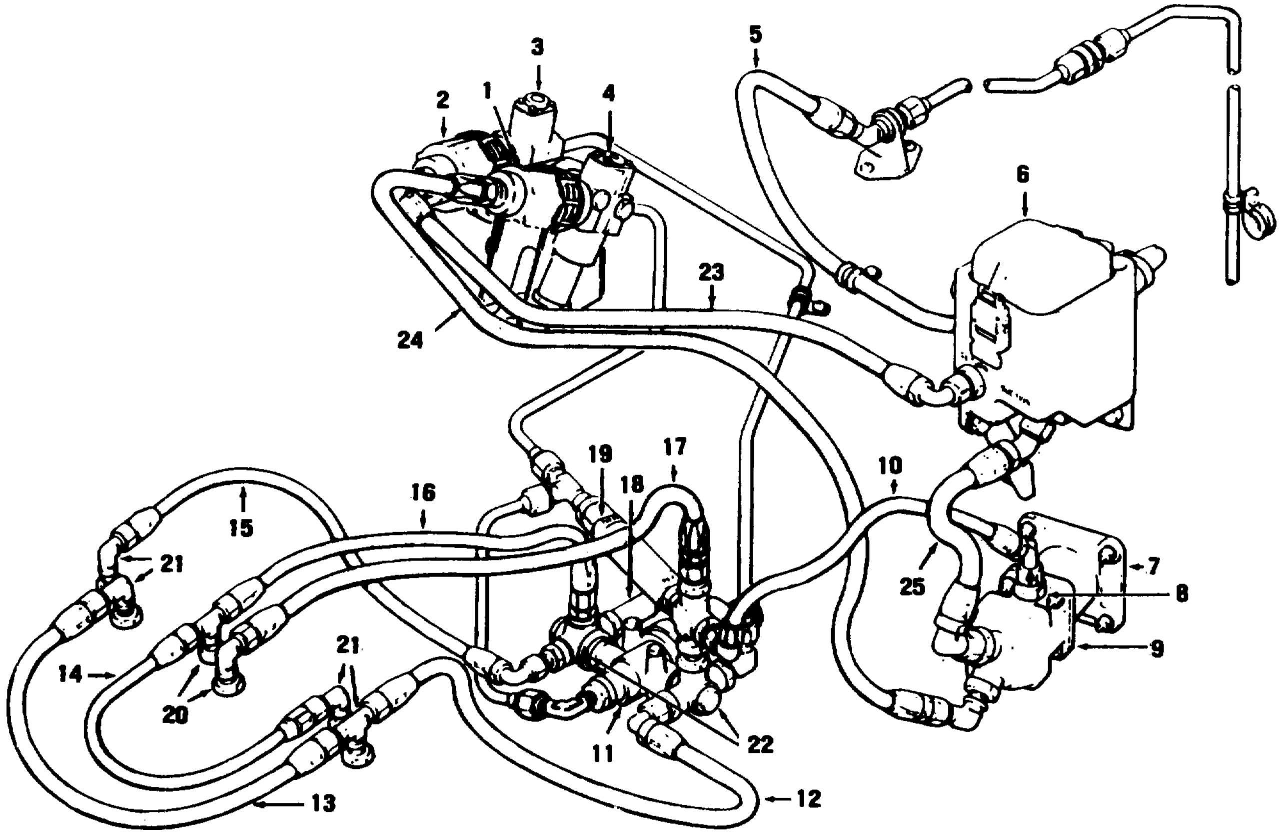
NOTE

Never discard MS fittings, they are reusable. The MS21922 sleeve is not reusable.

b. Replacement lines and hoses need not be routed along the path of the original installation. They may be routed along any convenient path as long as they do not interfere with personnel or with operating equipment. Long lines and hoses should be clamped to hard supports at convenient intervals not exceeding 24 inches.

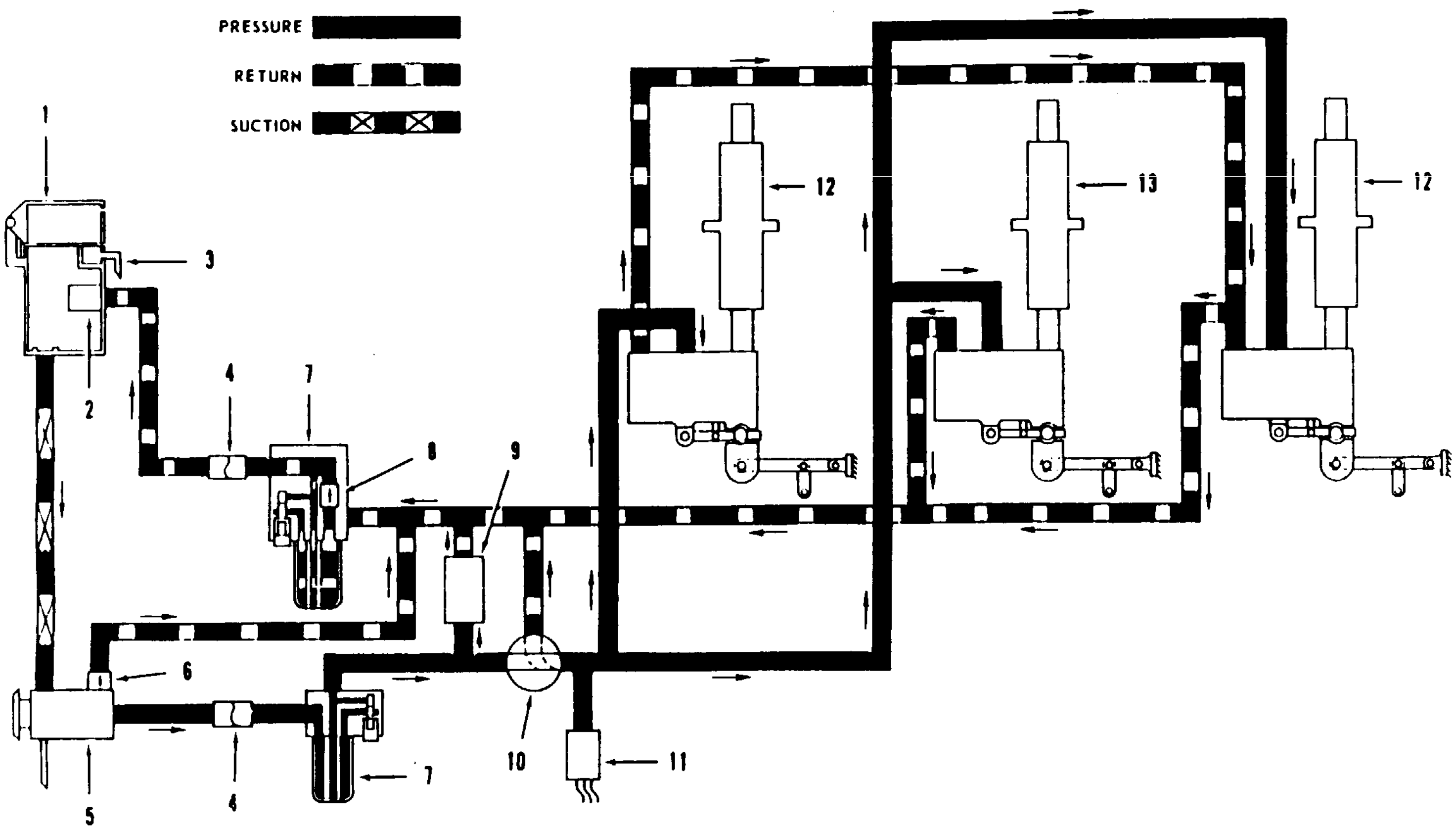
c. It is considered quicker to make a replacement hose, using the old fitting if serviceable, than to repair a damaged hose. Flexible hose of braided stainless steel with rubber center is used. There are two types of fittings used. One fitting is a socket and nipple assembly, Figure 9-3. The other type is a nipple, o-ring, sleeve and socket, Figure 9-4.

9-6. TUBE CUTTING. When cutting tubing, it is of utmost importance to produce a squared end free of burrs. Tubing may be cut with a tube cutter or a hacksaw. The tube cutter is adaptable for use with any metal tubing such as steel, titanium, or aluminum alloy. Place tubing in the cutting tool with the cutting wheel at the point where the cut is to be made, Figure 9-5.



1. Quick Disconnect (Pressure)
2. Quick Disconnect (Return)
3. Filter (Return)
4. Filter (Pressure)
5. Vent Line
6. Reservoir
7. Tachometer Generator
8. Check Valve
9. Hydraulic Pump
10. Case Drain Hose
11. Solenoid Valve
12. Hose (Return)
13. Hose (Return)
14. Hose (Pressure)
15. Hose (Pressure
16. Hose (Pressure)
17. Hose (Return]
18. pressure Switch
19. Relief Valve
20. To Servo Actuator (Collective)
21. To Servo Actuator (Cycilc)
22. Solenoid Valve Tee Fitting
23. Hose Filter (Return)
24. Hose Filter (Pressure)
25. Hose, Pump inlet

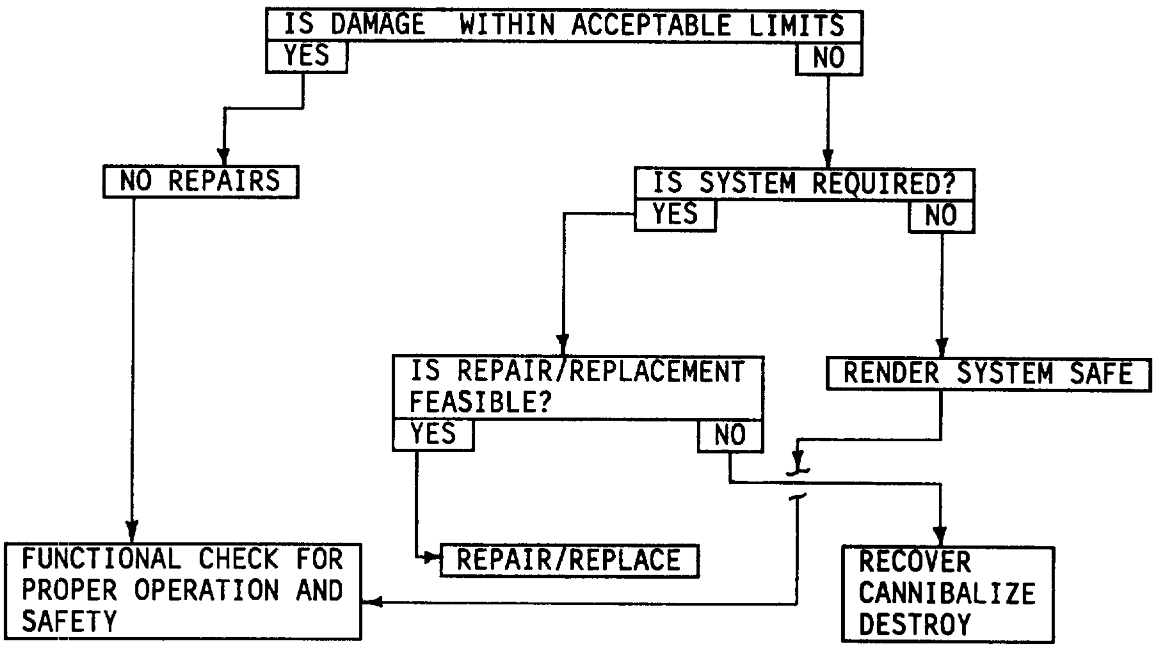
Figure 9-1. Hydraulic System



1. Reservoir
2. Baffle
3. Scupper Drain
4. Quick Disconnects
5. Pump
6. Check Valve
7. Filter
8. Filter Bypass Valve
9. Relief Valve
10. Solenoid Valve
11. Pressure Switch
12. Servo Actuator, Cyclic
13. Servo Actuator, Collective

Figure 9-2. Hydraulic System Schematic

Table 9-1. Assessment Logic



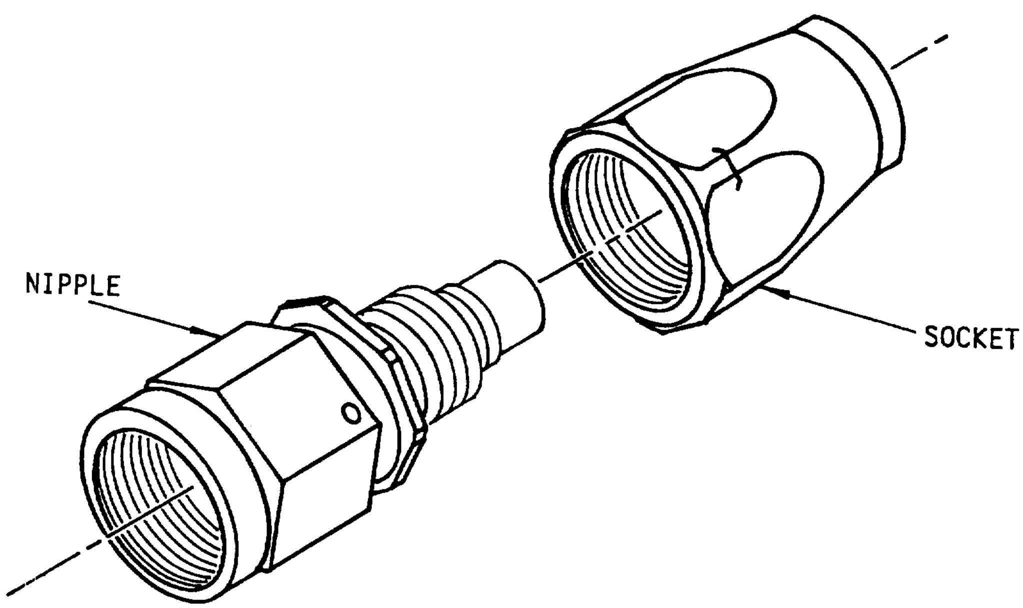


Figure 9-3. Two-Part Fitting

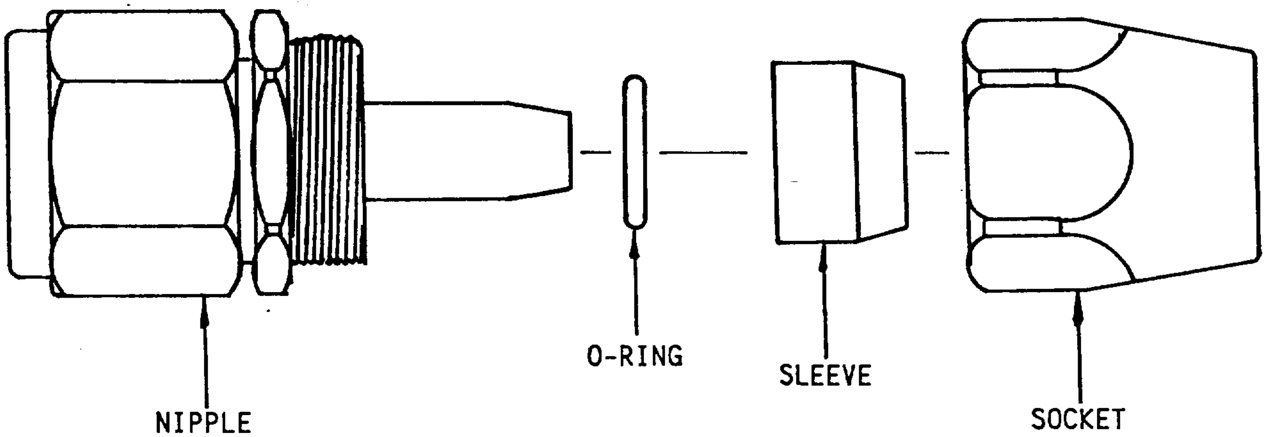


Figure 9-4. Four-Part Fitting

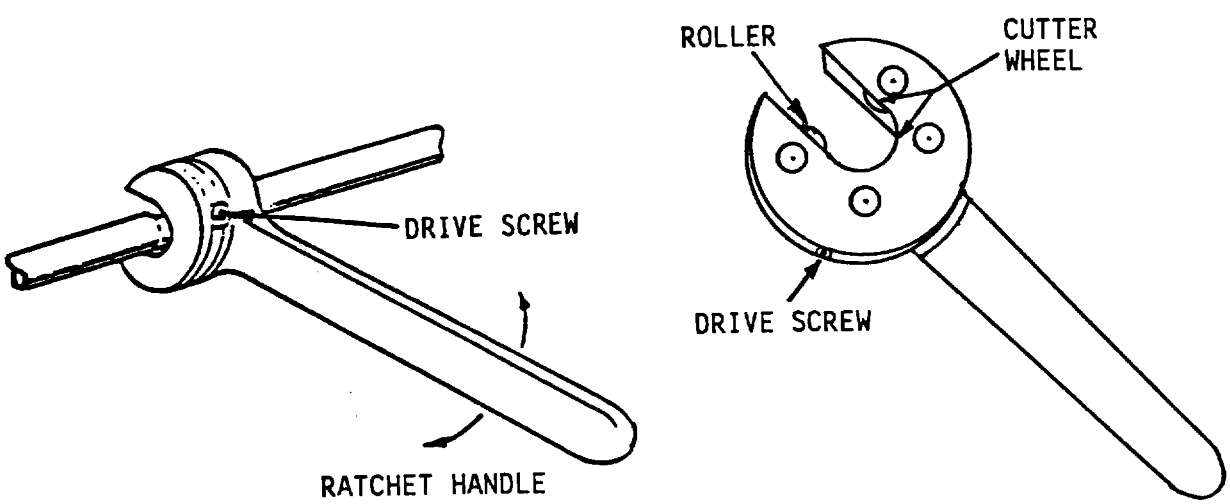


Figure 9-5. Using Tube Cutter

Ratchet the cutter around the tubing applying a light pressure to the cutting wheel by intermittently twisting the setscrew. Too much pressure on the cutting wheel could deform the tubing or cause excessive burring. After cutting the tubing, carefully remove any burrs from inside and outside of the tube. If a tube cutter is not available or if tubing of hard material is to be cut, use a fine toothed hacksaw, preferably one having 32 teeth per inch. After sawing, file the end of the tube square and smooth and remove all burrs. Be sure all filings and cuttings are removed from the tubing. Inspect the tubing end to verify its roundness, its being cut square, and that it is clean and free from marks and scratches. Figure 9-6 illustrates properly burred tubing.

NOTE

After tubing has been cut, all efforts should be made to flush any residue from the tube end. Flush with any available fluid or if end connections are inaccessible, momentary activation of the system will suffice.

9-7. ALUMINUM TUBING DAMAGE.

GENERAL INFORMATION: Aluminum tubing is subject to damage by projectiles and fragments. Replacement with original replacement parts is desirable, but not essential. In BDAR, tubing and hose, AN and MS fittings, and other similar components can be substituted one for the other. Available time, tools, skills, and materials will determine which repair option to use. Whenever an aluminum line has complex bends, replacement of the damaged section with hose, option 3, is probably the quickest fix.

OPTION 1: In Line Repair.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:
- 2 MS Unions
- Splice Tube
- Tubing Cutter
- Knife or File
- 4 MS Fittings

PROCEDURAL STEPS:

1. Cut and remove damaged section of tubing, Figure 9-7. Tube ends must be square.

2. Clean ends of undamaged tubing with knife or file.

3. Measure the distance between the two undamaged ends and prepare a tube splice replacement section of this size. Clean ends of splice section as done in step 2.

4. Install an MS fitting on each end of the splice tube, Figure 9-8.

5. Insert the splice tube and tighten all fittings, Figure 9-9.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

Figure 9-6. Properly Burred Tubing

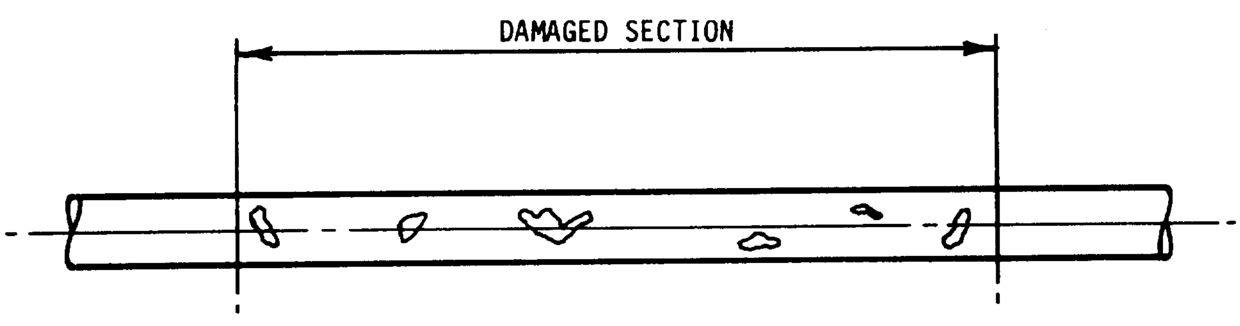


Figure 9-7. Damaged Tube Section

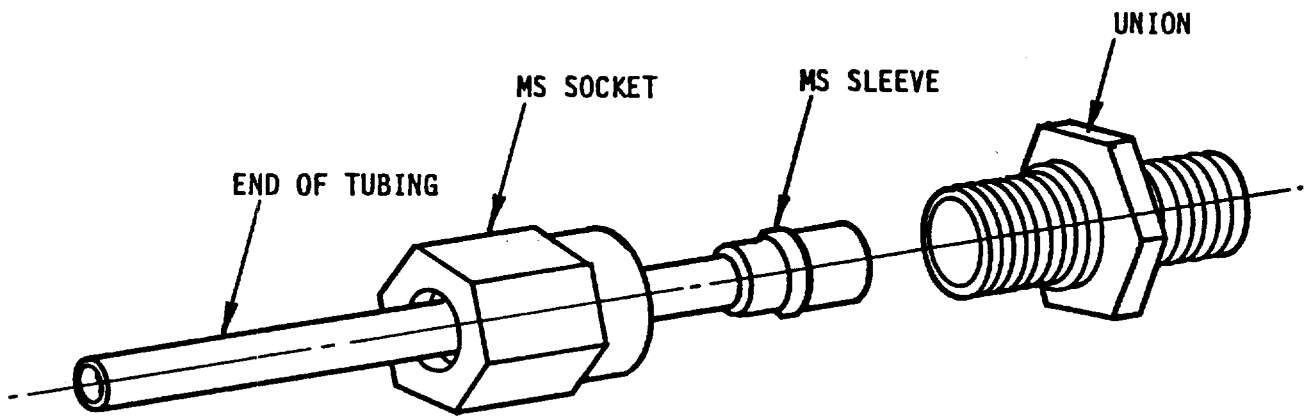


Figure 9-8. Splice Repair Assembly

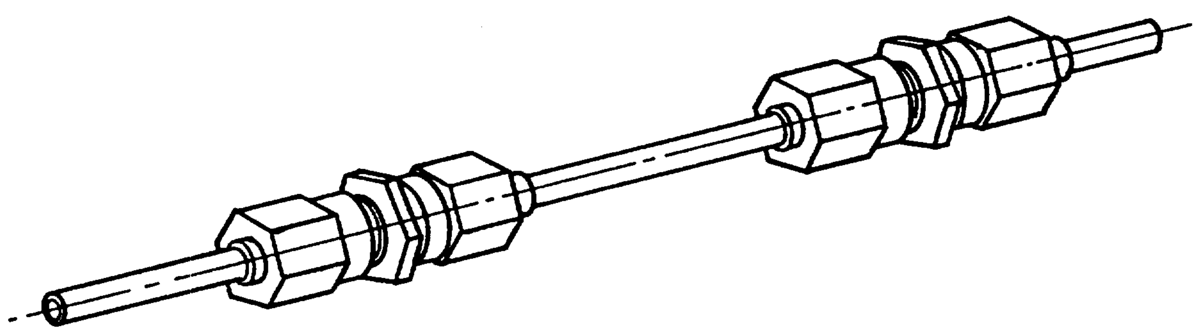


Figure 9-9. Repair Fitting and Tube Installation

OPTION 2: Substitute with High Pressure Hose (damage to section of tubing with bends).

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:
- Hydraulic Hose Assembly Complete with End Fittings
- 2 MS Unions
- 2 MS Fittings
- Tube Cutter
- Knife or File

PROCEDURAL STEPS:

1. Cut and remove damaged section of tubing, Figure 9-10. Tube ends must be square.

2. Clean ends of undamaged tubing with knife or file.

3. Install MS fittings as shown in Figure 9-8.

4. Connect MS unions to both MS fittings and complete the repair by connecting a hydraulic hose assembly from one union to the other, Figure 9-11. If the damaged length of tubing is long and more than one hose assembly is required, hose assemblies may be spliced together with unions. No harm will be done if the replacement hose is too long.

5. Clamp at convenient intervals (not exceeding 2 feet) to rigid supports to secure the line.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

9-8. HYDRAULIC HOSE DAMAGE.

GENERAL INFORMATION: The hydraulic hoses on the OH-58 are braided wire covered rubber hose. Repair of damage or wear to the wire braids is deferrable for one more flight, provided the rubber inner hose is not leaking under pressure. Inspect after every flight. If the inner rubber hose is leaking and a replacement assembly is not available, manufacture a new hose assembly. If an elbow fitting is not available, make a new hose with a large gentle loop so the hose will not kink. MS detachable fittings from a damaged hose may be reused in the manufacture of a new assembly as long as the threads and the seat are not damaged. Swaged fittings cannot be reused.

OPTION 1: Install New Hose Assembly-BDAR Kit.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 20 Minutes

MATERIALS/TOOLS REQUIRED:
- Hydrualic Hose Assembly

PROCEDURAL STEPS:

1. Remove damaged hose assembly.

2. Install new hose assembly (BDAR kit). It may be necessary to splice two or more hose assemblies together using MS unions to replace the damaged hose assembly. No harm will be done if the replacement hose is too long.

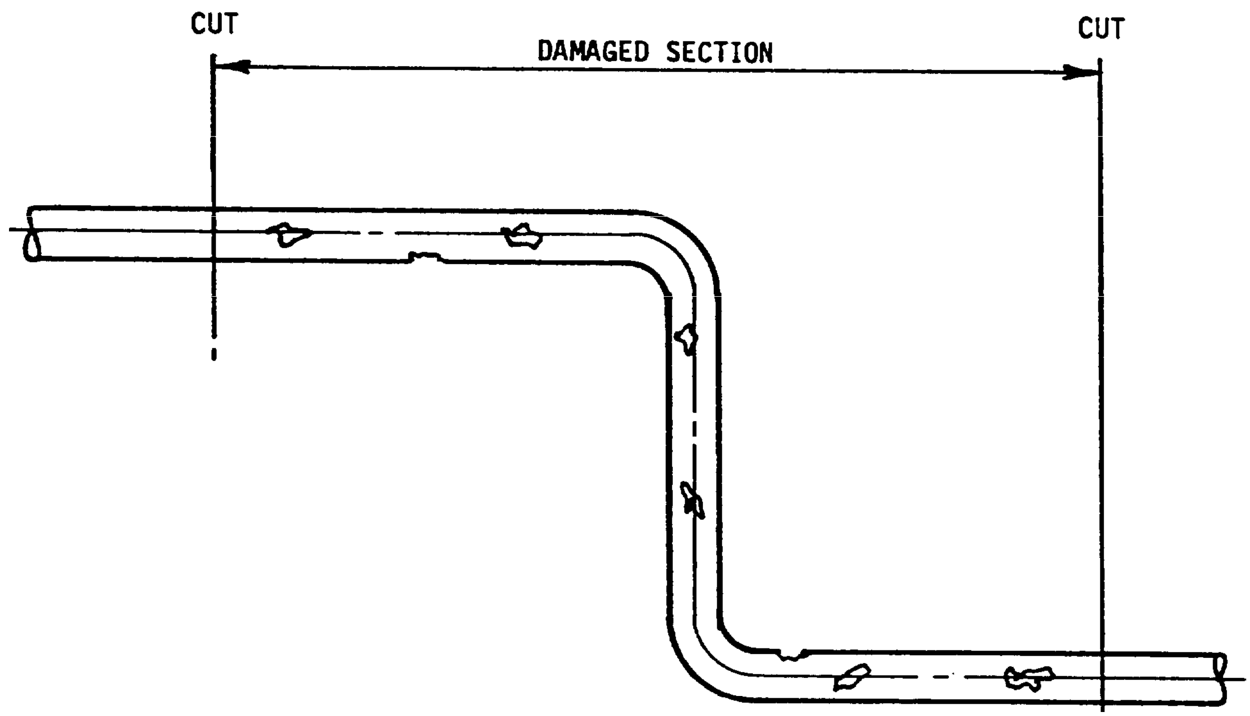


Figure 9-10. Damaged Tube Section-Complex Bends

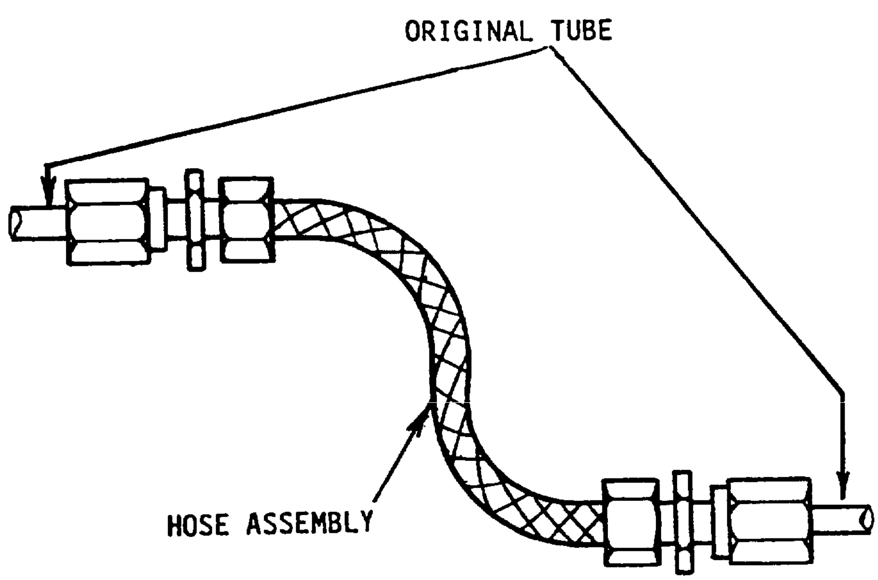


Figure 9-11. Splice Adapter Assembly Installation

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Replace Hose Section with MS Fittings (no BDAR hose assemblies available). For Teflon and rubber hose.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:
- Replacement Section of Hose or Tube (if needed)
- Masking Tape (item 52, Appx C)
- Fine Toothed Hacksaw
- MS Fittings (socket, sleeve, and female fitting, 4 ea.)
- MS Union (2 ea.)

PROCEDURAL STEPS:

1. Cut out damaged hose section. Wrap masking tape (or other available tape) around hose over the areas where cuts are to be made to contain the braided wires from unraveling. Mark on tape where the cuts are to be made. Hold in a vice and cut with a fine-toothed hacksaw. Take care to make square cut. Do not remove tape.

NOTE

If the damage is small, the length of a single union may be sufficient to provide a repair. However, if the damage is longer, a replacement section will be required.

2. Obtain the proper sized MS fitting and unions.

3. Slip the MS socket over one of the undamaged ends of the hose, Figure 9-12. Use care not to unravel the wire braids.

4. Insert the MS sleeve between the wire braid cover and the inner rubber hose. Force onto hose until the edge of the sleeve is even with the end of the rubber hose.

5. Reem inside end of Teflon hose with a square tool or a wooden plug so that edge is smooth and flared to facilitate insertion of the nipple of the MS female fitting.

6. Slide the MS socket over end of hose as far as it will go and hold in vise. Insert nipple of MS female fitting into rubber inner tube, Figure 9-13. Force all the way until threads in socket and female fitting together and tighten until the gap between the edge of the socket and the base of the female fitting is approximately 0-1/32 inch for rubber and 0.025 to 0.045 inch for Teflon.

7. Prepare the other damaged end of the hose in the same manner.

8. If no replacement section is necessary, connect the MS fittings on the undamaged ends with an MS union, Figure 9-14.

9. If a replacement section is needed, obtain replacement section and cut to desired length. Refer to step 1 for procedure for cutting hose. No harm will be done if replacement section is too long. Attach MS fittings to both sides of the replacement section.

10. Place replacement section between the undamaged ends and connect the MS fittings on the undamaged ends to the fittings on the replacement section using MS unions.

11. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

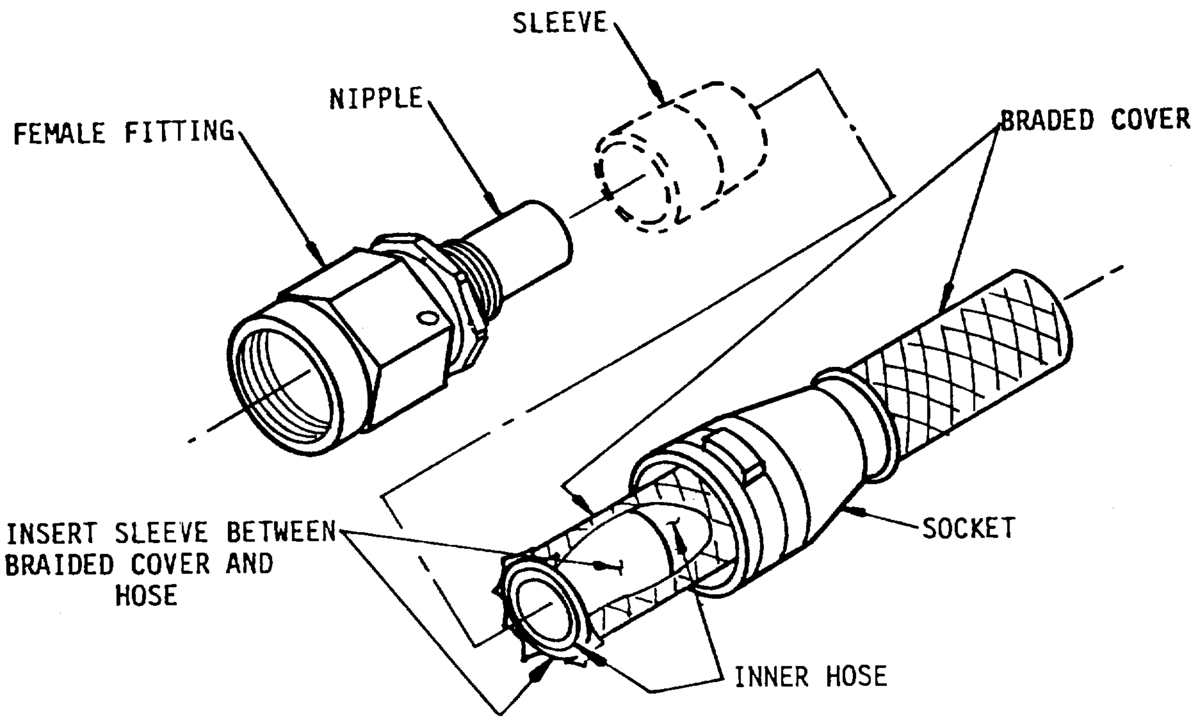


Figure 9-12. Installation of Socket and Sleeve

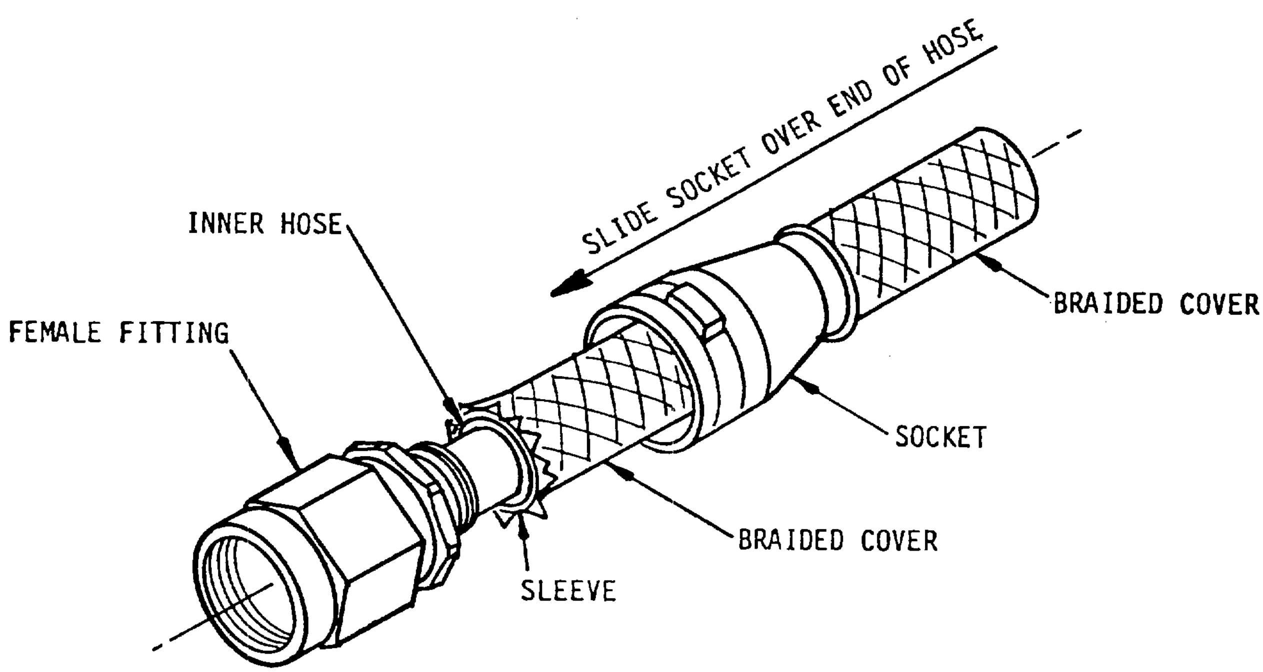


Figure 9-13. Assembly of MS Fitting

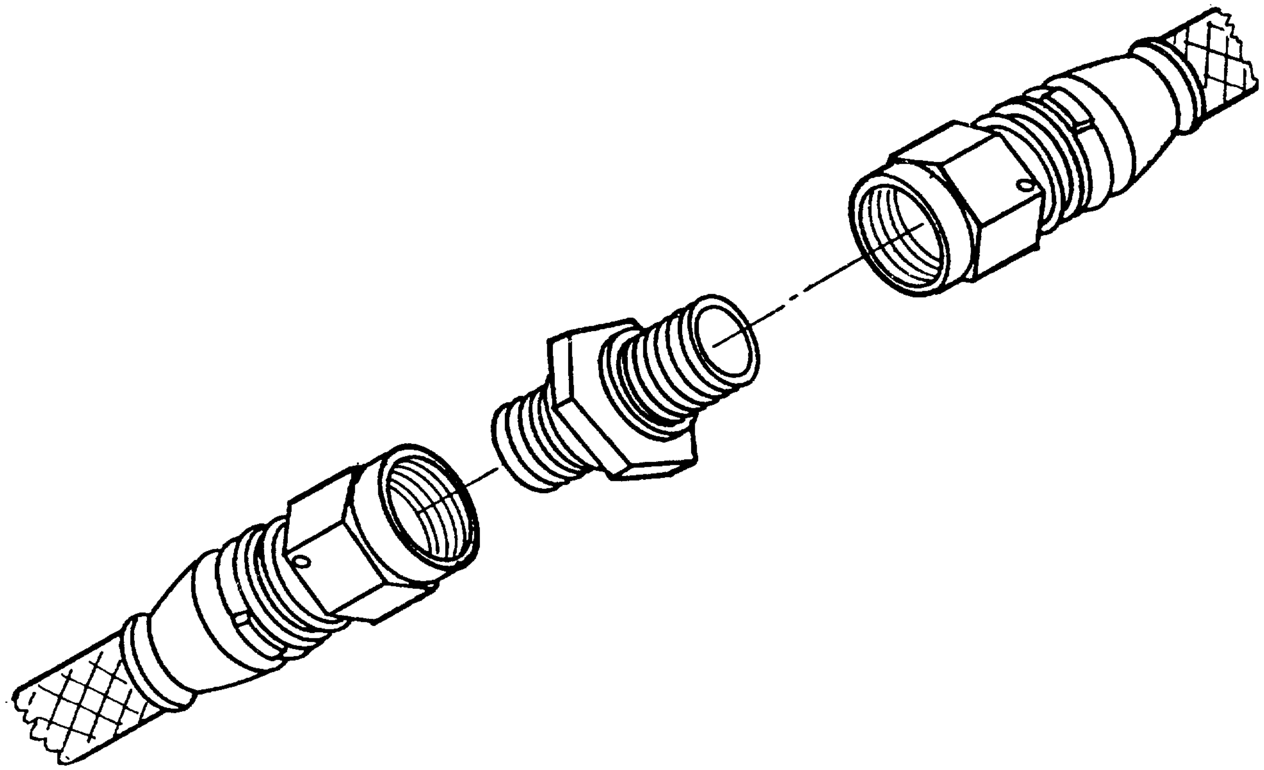


Figure 9-14. Union Connection

Section III. SEALS, PACKINGS, AND GASKETS

9-9. O-RING, PACKING, AND GASKET APPLICATIONS.

a. O-rings are used in static and dynamic applications.

(1) In static applications, the o-ring serves as a gasket when it is compressed within a recess. Leakage is not normally acceptable.

(2) In dynamic applications, the sealing action is dependent primarily on the resilience of the o-rings. When moving parts are involved, minor seepage may be normal and acceptable. A moist surface found on moving parts of a hydraulic unit (piston shaft) is an indication that the seal is being properly lubricated.

(3) Seal replacement is required when:

(a) The amount of fluid being lost will cause system failure.

(b) The leak creates a hazard.

(c) The leak will not permit the system to function safely for one more flight.

NOTE

Packings and gaskets are identified by part number on packages. Do not remove from package until ready for use.

b. Selection of Proper Packing or Gasket. Selection of proper packing or gasket for a particular application is of the utmost importance. The exact size, shape, and material composition must be properly determined in order for various systems to function correctly. Packings, gaskets, or seals like fittings are made to an AN, MS, or NAS standard. While gaskets may look alike in general construction features and may be of the same size, they are not necessarily interchangeable (Table 9-2).

c. The dimensional relationship between AN6227, AN6230, and MS28775 series o-ring packings and gaskets in the various sizes are as follows:

- AN6227-B1 through B7 are equivalent to MS28775-006 through -012.
- AN6227-B8 through B14 are equivalent to MS28775-11O through -116.
- AN6227-B15 through B27 are equivalent to MS28775-21O through -222.
- AN6227-B28 through B52 are equivalent to MS28775-325 through -349.
- AN6227-B53 through B87 are equivalent to MS28775-426 through -460.
- AN6227B88 is equivalent to MS28775-425
- AN6230-B1 through B25 are equivalent to MS28775-223 through -247.

9-10. HYDRAULIC FLUID SUBSTITUTIONS.

a. If the original specified fluid is lost and standard replacement is not available, a substitute fluid must be used. Check Appendix D for a compatible fluid. If a compatible fluid is not available, any available nonflammable lubricant can be used in a BDAR action as a last resort.

CAUTION

O-rings, wipers, gaskets, or other plastic or rubber parts of the hydraulic system may swell or shrink, and for that reason continued operability of the system cannot be guaranteed. Following such a substitution, instructions for bringing the system back to normal should include checking all moving parts of the hydraulic system and all hydraulic activated devices for proper operation and leaks. Where feasible, plastic and rubber parts should be inspected for swelling, deformation, and other damage.

b. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

Table 9-2. Seals Reference and Temperature Guides Chart

SERIES	MILITARY SPECIFICATION	PARKER COMPOUND	BASE POLYMER	TEMP GUIDE CONT SERV	DURO-METER	SERVICE
AN6227B AN67230B	MIL-P-5516 Class B	PS-01-30-5	NITRILE (BUNA N)	-65°F to +180°F	70	Air Force and Navy hydraulic fluid MIL-H-5606, MIL-H-83282
MS28775	MIL-P-25732	N304-7	NITRILE (BUNA N)	-65°F to +250°F	70	
MS29512 MS29513 2-, 3-	MIL-P-5315	N602-7	NITRILE (BUNA N)	-65°F to +180°F	60	Air Force & Navy aircraft fuel JP-4, JP-5
MS29561 NAS617	MIL-R-7362 Comp.A, Type 1	47-071	NITRILE (BUNA N)	-65°F to +250°F	70	Synthetic lubricants MIL-L-7808
AN6290 MS28778 2-, 3-	MIL-P-5510	N507-9	NITRILE (BUNA N)	-65°F to +180°F	90	Hydrualic oil, MIL-H-5606 MIL-H-83282
NAS1593 NAS1595	MIL-R-25897 CL 1	77-545	Fluoro-1 Elastomer	-20°F to +400°F	70	High temperature, fluid resistant.
NAS1594 NAS1596	MIL-R-25897 CL 2	V-377-9	Fluoro-1 Elastomer	-20°F to +400°F	90	High temperature, fluid resistant.

SERIES	DESIGNATION ASTMID735-58T	PARKER COMPOUND	BASE POLYMER	TEMP GUIDE CONT SERV	DURO-METER	SERVICE AND SPECIFICATIONS
2-, 3-	SC720BCE1 E3 F2	C147-7	NEOPRENE	-65°F to +300°F	70	Freon 12, weather & salt water resistant. AMS3209
2-, 3-	SC712BE1 E3 F2	C526-7	NEOPRENE	-65°F to +300°F	70	General purpose industrial Neoprene. AMS3209
2-, 3-	R810 B F2	F515-8	ETHYLENE PROPYLENE	-65°F to +300°F	80	Skydrol, Cellulube, & other phosphate esters, steam, water, air, dilute acids & alkalis.

Table 9-2. Seals Reference and Temperature Guides Chart (Cont)

SERIES	DESIGNATION ASTMID735-58T	PARKER COMPOUND	BASE POLYMER	TEMP GUIDE CONT SERV	DURO-METER	SERVICE AND SPECIFICATIONS
2-, 3-	SB620 B E1 E3 F1	N525-6	NITRILE (BUNA N)	-40°F to +250°F	60	Mineral oil & hydraulic fluid, water, steam, coolants, pneumatic service.
MS9021 MS9020 2-, 3-	SB712BE1 F2	N506-7	NITRILE (BUNA N)	-65°F to +225°F	65	Petroleum base fuel & low temperature resistance. AMS7271
2-, 3-	SB715BE1 E3 F2	N103-7	NITRILE (BUNA N)	-65°F to +225°F	70	Commercial gasoline, mineral oils & hydraulic fluids, pneumatic service.
2-, 3-	SB715BE1 E3 F1	N109-7	NITRILE (BUNA N)	-30°F to +250°F	70	Mineral oil & hydraulic fluids, alkalies, gasolines, diesel oils, pneumatics.
AN1239XX AN1240XX 2-, 3-	SB715B E1 E3 F2	N179-7	NITRILE (BUNA N)	-40°F to +250°F	70	Petroleum base fuel resistant. AMS7270
AN1238XX AN1239XX 2-, 3-	SB720B E1 F2	N180-7	NITRILE (BUNA N)	-20°F to +250°F	70	Petroleum base lubricating oil resistant. AMS7274
2-, 3-	SB715E1 E3 F1	N214-7	NITRILE (BUNA N)	-40°F to +250°F	70	Listed by Underwriter Laboratories for fuels, oils, and gasolines.
2-, 3-	SB715BE1 E3 F1	N219-7	NITRILE (BUNA N)	-40°F to +250°F	70	Mineral oils & hydraulic fluids, gasolines, pneumatics, SAE 120R Class 1, UL Listed.

Table 9-2. Seals Reference and Temperature Guides Chart (Cont)

SERIES	DESIGNATION ASTMID735-58T	PARKER COMPOUND	BASE POLYMER	TEMP GUIDE CONT SERV	DURO-METER	SERVICE AND SPECIFICATIONS
2-, 3-	SB710 B E1 E3 F1	N398-7	NITRILE (BUNA N)	-40°F to +250°F	70	Water service. Low swell, extremely stable. Oil resistance.
2-, 3-	SB820B E1 E3 F1	N256-8	NITRILE (BUNA N)	-20°F to +225°F	80	For rotary seals. Do not use with stainless steel.
2-, 3-	SB815BE1 E3 F1	N532-8	NITRILE (BUNA N)	-20°F to +250°F	80	Mineral oils & hydraulic fluids, gasoline, pneumatics.
2-, 3-	SB915B E1 E3	N183-9	NITRILE (BUNA N)	-30°F to +250°F	90	Mineral oil & hy fluids, pneu-matics. High extru-sion resistance.
2-, 3-	SB915B E1 E3	N552-9	NITRILE (BUNA N)	-30°F to +250°F	90	Mineral oil & hydraulic fluids pneumatics.
2-, 3-	TA-605B E1 E3 F2	S418-6	SILICONE	-80°F to +450°F	60	Air & gases. Static seal only. AMS3303
2-, 3-	TA705B E1 E3 LF2	S417-7	SILICONE	-80°F to +450°F	70	Air & gases. Static seal only.
MS9068 2-, 3-	TA-705BE1 E3 F2	S604-7	SILICONE	-80°F to +450°F	70	Air & gases. Static seal only. AMS3304
2-, 3-	None	77-545	Fluoro-1 Elastomer	-20°F to +400°F	70	High temperature oils, aromatic solvents, chemical service. AMS7278
2-, 3-	None	V377-9	Fluoro-1 Elastomer	-20°F to +400°F	90	High temperature oils, aromatic solvents, chemical service. AMS7278

CHAPTER 10

INSTRUMENTS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.
(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the instrument systems.

CHAPTER 11

ELECTRICAL AND AVIONICS SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section 1. INTRODUCTION

11-1. SCOPE. This chapter provides methods for assessing battle damage, deferring damage repair, and repairing electrical and avionics systems. Extensive repairs to complicated components or line replaceable units (LRUs) are not expected to be made in the field. Therefore, more emphasis is placed on common repairs to interconnecting cables and simple electrical and avionic components.

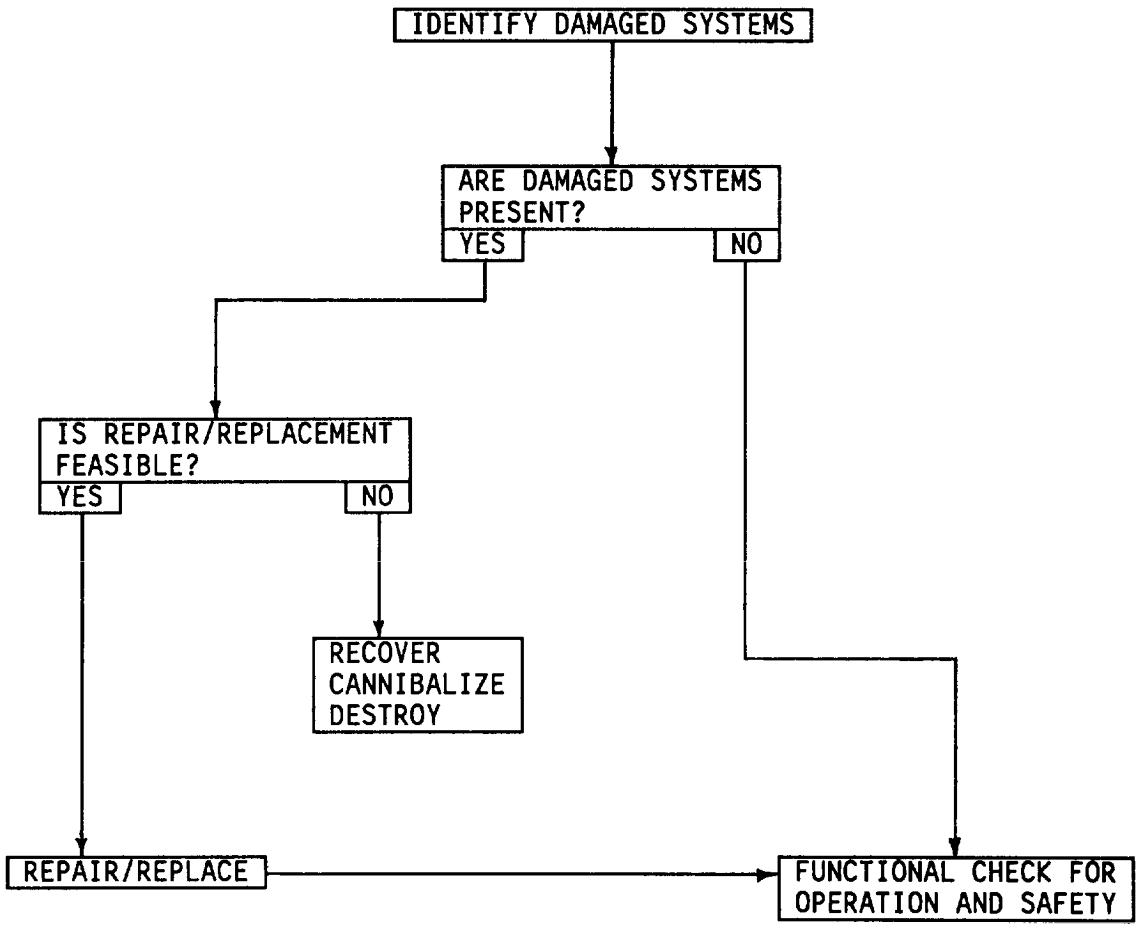
11-2. ASSESSMENT PROCEDURES. (See Table 11-1 for assessment logic.)

a. Wire Identification. The most difficult and time consuming part of electrical and avionics battle damage assessment is wire identification. Added and repaired wiring should be identified to aid in troubleshooting. If time permits, tape or sleeving at each end of added wiring of a material suitable for the ambient temperature range may be used. Typical wire and circuit identification schemes are shown in Figure 11-1 and Table 11-2. Appendix F lists and depicts the major components, cable routes, and wiring terminations for the more complex avionics systems.

b. Circuit Function. The unit number and circuit designation letter identify the type of circuits. The wire number consists of one or more digits. It is used to distinguish between wires in the same circuit. The wire segment letter is used to distinguish between conductor segments (a wire segment between two terminals or connections). The wire size number is used to identify the gage of the wire or cable. The ground, phase, or thermocouple letter(s) are used as suffixes to the wire identification code to further identify certain wires. Ground wires are identified with an N suffix. Phase letters A, B, or C are added to identify the phase of wires that are in the three-phase wiring of alternating current (AC) systems. For thermocouple wire, the following suffixes are added to the identification code: AL (Alumel), CR (Chromel), FE (Iron), CN (Constantan), and CU (Copper).

c. Deferral. Repair of systems and subsystems, which have adequate redundancy or are not critical to mission accomplishment, may be deferred if safety of flight is not significantly degraded. Requirements must be examined to determine if relaxed criteria for repair and aircraft performance can be accepted. The commander may defer combat maintenance and battle damage repair, even if doing so places operational limitations on the aircraft.

Table 11-1. Electrical and Avionics Assessment Logic



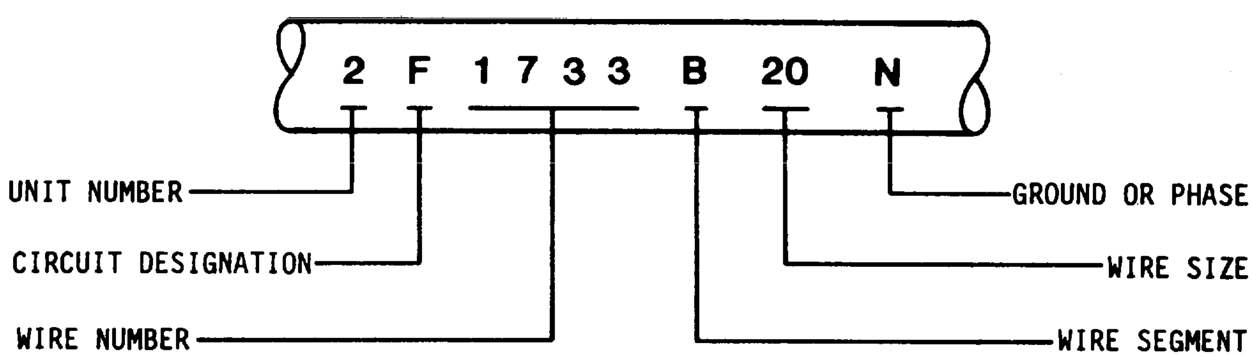


Figure 11-1. Circuit Identification

Table 11-2. Function and Designation Letters

CIRCUIT DESIGNATION LETTER	CIRCUITS
A	ARMAMENT: Bomb suspension & release Guns Chemical Rocket Sight Turret Warning External pylons & stores Jettison fuel tanks Mine dispenser
B	PHOTOGRAPHIC: Gun camera Mapping camera Reconnaissance camera Camera intervalometer Camera doors Camera heaters Warning
C	CONTROL SURFACE: Horizontal stabilizer Warning
D	INSTRUMENT (other than flight or engine instruments): Ammeter Air pressure Free air temperature Hydraulic pressure Horizontal position stabilizer Voltmeter Clock Warning
E	ENGINE INSTRUMENT: Tailpipe temperature Fuel flow Fuel quantity Fuel capacity Oil temperature Oil pressure Manifold pressure Fuel pressure Engine oil quantity Tachometer Warning
F	FLIGHT INSTRUMENT: Bank and turn Rate of climb Directional gyro Air position Ground position Compass (including flux gate and other stabilized compasses) Gyro horizon Attitude gyro Driftmeter Altimeter Airspeed Accelerometer Pitot-static tube meter Warning
H	HEATING, VENTILATING, AND DE-ICING: Anti-icing (general) Battery heater Cabin heater Cigarette lighter De-icing (general) Windshield defroster Windshield defogger Windshield de-icer Heater blanket Oil immersion heater Refrigeration Ventilation Warning
I	In order to avoid confusion with the numeral one, the letter "I" shall not be used for circuit or cable identification.
J	IGNITION: Booster Vibrator Distributor Electronic Warning

Table 11-2. Function and Designation Letters (Cont)

CIRCUIT DESIGNATION LETTER	CIRCUITS	CIRCUIT DESIGNATION LETTER	CIRCUITS
K	ENGINE CONTROL: Blower ratio Starter Warning	Q	FUEL AND OIL: Fuel valves Fuel booster-pump motor Moisture control Oil dilution Engine primer Fuel-transfer-pump motor and control Fuel-loading-pump motor 0il transfer-pump motor and control Oil booster pump Oil scavenge pump Throttle control Fuel-pump motor Oil diverter Oil valves Warning
L	LIGHTING: Approach Flasher-coder Cockpit Drift Cabin Formation Cargo Interior Instrument Section (fuselage) Landing Exterior Running, position, navigation Passing Search Taxi Warning	R	RADIO (Navigation and communication): RA-Instrument landing RC-Command RD-Radio direction finding RF-VHF liaison RH-Homing RL-Liaison RM-Marker beacon RN-Navigation RP-Special systems RS-SHF command RT-Radio teletype RU-UHF command RV-VHF command RX-Recorder RZ-Interphone, headphone
M	MISCELLANEOUS ELECTRIC: Windshield spray Windshield wiper Hoist Enclosure operation Positioner; seat, pedal Special test equipment		
N	UNASSIGNED		
O	In order to avoid confusion with the numeral zero, the letter "O" shall not be used for circuit or cable identification.		
P	DC POWER		

Table 11-2. Function and Designation Letters (Cont)

CIRCUIT DESIGNATION LETTER	CIRCUITS	CIRCUIT DESIGNATION LETTER	CIRCUITS
S	RADAR: SA-Altimeter SF-Intercept SG-Gunlaying SM-Mapping SN-Navigation SQ-Bombing SR-Recorder SS-Search SV-Special systems SW-Warning SX-Recognition (IFF)	U	MISCELLANEOUS ELECTRONIC: Electronic wiring for which no "R", "S", or "T" designation has been assigned by the procuring activity shall have the circuit function letter "U" assigned. Examples of wiring for which the circuit function letter "U" will be assigned are common leads to electronic equipments and systems interconnection wiring such as antenna or power circuits common to more than one equipment or system.
T	SPECIAL ELECTRONIC: TA-Adapter TB-Radar control TC-Radio control TD-Airborne announcing TE-Electronic countermeasure TF-Repeat back TG-GM homing TH-Infrared TK-Telemetering TL-Attitude indicator TM-Chaff dispenser TN-Navigation TP-Beacon (crash and locator) TQ-Transmitters and receivers TR-Receivers TT-Transmitters TU-Reconnaissance TW-Weather devices TZ-Bombing devices	V	DC POWER and DC control cables for AC systems shall be identified by the circuit function letter "V."
		W	WARNING AND EMERGENCY Enclosure release and locks Fire extinguishers Flare release Fire detector Intercrew buzzer or light
		X	AC POWER: Wiring in the AC power system shall be identified by the circuit function letter "X."
		Y	ARMAMENT SPECIAL SYSTEMS: Y*A-Air to air Y*B-Air to surface Y*C-Multimode Y*M-Missile-guidance Y*T-Turret * Armament special system number
		Z	UNASSIGNED

11-3. REPAIR PROCEDURE INDEX.

Section II. ELECTRICAL AND AVIONICS WIRING DAMAGE

11-4. GENERAL. The objective of electrical and avionics system battle damage repair is to restore damaged circuits which are mission essential. It is also used to make nonessential circuits safe. The repair procedures in this section are designated to quickly return an aircraft to a flyable condition.

a. Electrical and Avionics Repairs. Electrical and avionics equipment receiving significant battle damage will usually not be repairable. The equipment may require replacement to meet mission requirements. When replacement for nonessential system units are not available, the technician should, when possible, make the necessary repairs or adjustments on the unit for one more combat sortie. Avionics wiring, coaxial cables, and general aircraft wiring can be repaired using a variety of procedures and materials. Most of these techniques are considered standard for temporary repairs. Appendix F lists and depicts the major components, cable routes, and wiring terminations for the more complex avionics systems.

b. Isolation of Nonessential Systems. To isolate damaged nonessential system wiring use crimp-on end caps, tape, or other insulating method. Secure wires to structure.

c. BDAR Electrical Wiring System Repair Definitions and Capabilities. The BDAR wiring repair set provides for two types of aircraft electrical wiring repairs classified as "PERMANENT," or "TEMPORARY."

(1) A permanent repair returns the electrical wiring system to full capability as manufactured with no degradation of any system operating characteristics. No periodic inspection or replacement is required with a permanent repair.

(2) A temporary repair returns the electrical wiring system to a reduced level of capacity with a possible slight reduction of system operational capability. Temporary repairs must be reinspected at 100 flight hours. At this time, a permanent repair will be performed or an extension of use for the temporary repair will be granted.

NOTE

Temporary repairs established in the TM will only be applied in time of war. The commander or his designated representatives may authorize deviations necessary to accomplish wartime requirements.

d. Repair Techniques.

(1) In battle, situations may arise that will require the assessor and repair personnel to develop innovative repair techniques. This section describes and illustrates some repair capabilities to broken and/or damaged wires, shielded or coaxial cables, electrical connectors, and associated electrical components in the combat environment.

(2) Prior to performing any of the listed repairs, the repair technician must be knowledgeable in the application of the basic repair procedures and proficient in the use of wiring repair tools and materials.

11-5. SPLICING UNSHIELDED WIRES.

GENERAL INFORMATION: This procedure provides for repairing damaged unshielded wires.

WARNING

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

CAUTION

Make sure aircraft power is off. Disconnect battery before touching any wires.

OPTION 1: Crimp Splicing.

LIMITATIONS: Only to be used for wire sizes 12-26. Where no more than one splice is made per 10 feet of wire, it is a permanent repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Appropriate Size Splice (item 10, Appx B)
- Appropriate Size Sealing Sleeve (item 10, Appx B)
- Crimping Tool (item 10, Appx B)
- Strippers (item 10, Appx B)
- Heat Gun (item 10, Appx B)
- Reflector (item 10, Appx B)

PROCEDURAL STEPS:

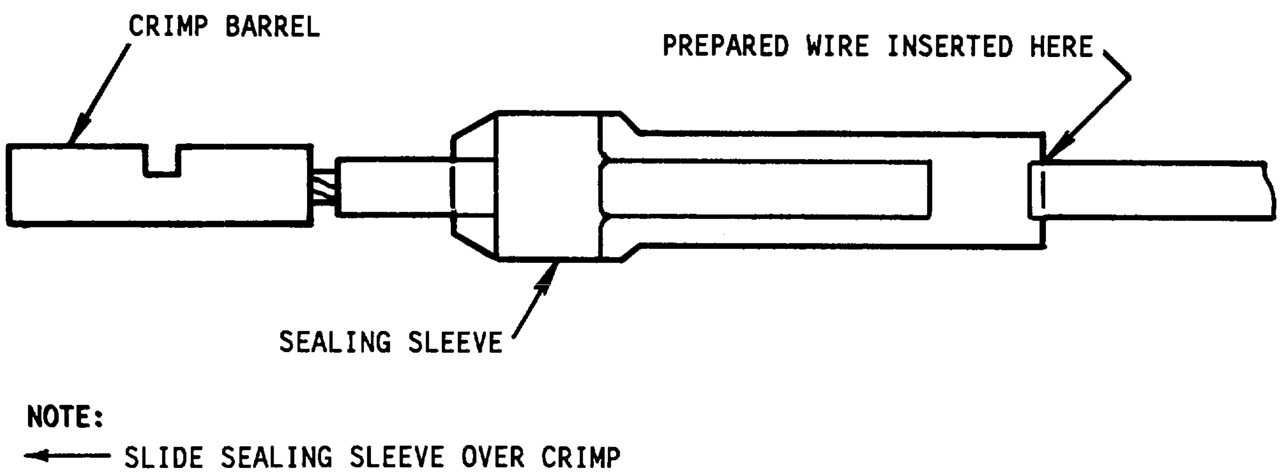
1. Strip wires, refer to Table 11-3.

Table 11-3. Unshielded Crimp Splice Application

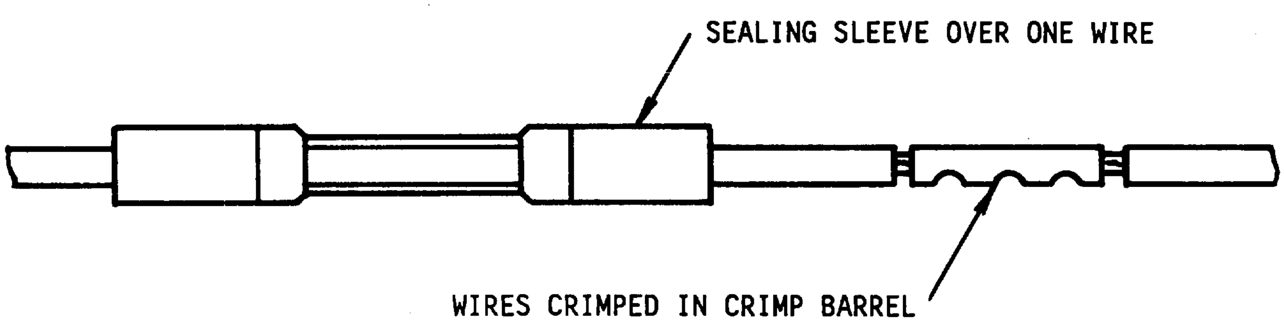
WIRE SIZE	STRIPPING LENGTH , INCHES	TEMP. RATING DEG. C
20-26	.25-.30	>125
16-18	.30-.35	>125
12-14	.30-.35	>125
20-26	.25-.30	<105
16-18	.30-.35	<105
12-14	.30-.35	<105

2. Slide sealing sleeve onto one of the wires, Figure 11-2. On wire rated at 125°C or above, insert one prepared wire into small end of sealing sleeve and push crimp barrel out.

3. Crimp wires with crimp tool.



FOR WIRES 125°C OR ABOVE



FOR WIRES RATED 105°C OR BELOW

Figure 11-2. Crimp Splice

4. Shrink sealing sleeve over crimp with heat gun. Use reflector, temperature set at 900°F.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Terminal Lug Splicing.

LIMITATIONS: Only to be used on wire sizes AWG No. 10 and smaller. This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minues Per Splice

MATERIALS/TOOLS REQUIRED:
- Terminal Lug Barrel
- Insulating Sleeve and Tie Wraps or Heat-Shrinkable Insulation
- Crimp Tool

PROCEDURAL STEPS:

1. Select a terminal with a barrel large enough to accommodate both wires.

2. Cut off terminal lug tongue.

3. Prepare wire ends.

4. Slip an insulating sleeve 1 inch longer than terminal lug barrel over the end of one of the wires, and insert wire end into the barrel as shown in Figure 11-3.

5. Crimp barrel in center.

6. Slide insulating sleeve over the terminal lug barrel splice, and secure in place by using tie wraps or heating if heat-shrink sleeve is used.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Split Bolt Splice Connectors.

LIMITATIONS: Only to be used on wire sizes AWG No. 4 through No. 10. Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Strippers or Knife (item 10, Appx B)
- Heat–Shrinkable Tubing (item 10, Appx B)
- Split Bolt Splice Connector (item 10, Appx B)
- Heat–Shrinkable Tape (item 10, Appx B)
- Reflector (item 3, Appx B)

PROCEDURAL STEPS:

1. Slide a 3 inch length of large diameter, heat-shrinkable tubing over one of the wires to be spliced.

2. Strip wires and insert into the connector from opposite sides.

NOTE

Conductors may be folded back one or more times to fill the connector opening and provide firm clamping.
- Strip wires 1/2 inch if folding back is not required.
- Strip wires 1-1/4 inch if single folding back is required.
- Strip wires 2-1/2 inch if double folding back is required.

3. Tighten nut securely.

4. Wrap the splice with heat-shrinkable tape. Cover all metal parts and overlap onto insulation.

5. Heat the end of the tape to soften the adhesive layer and press it into position while warm. Use reflector (located in A5 of wiring kit), temperature set at 900°F.

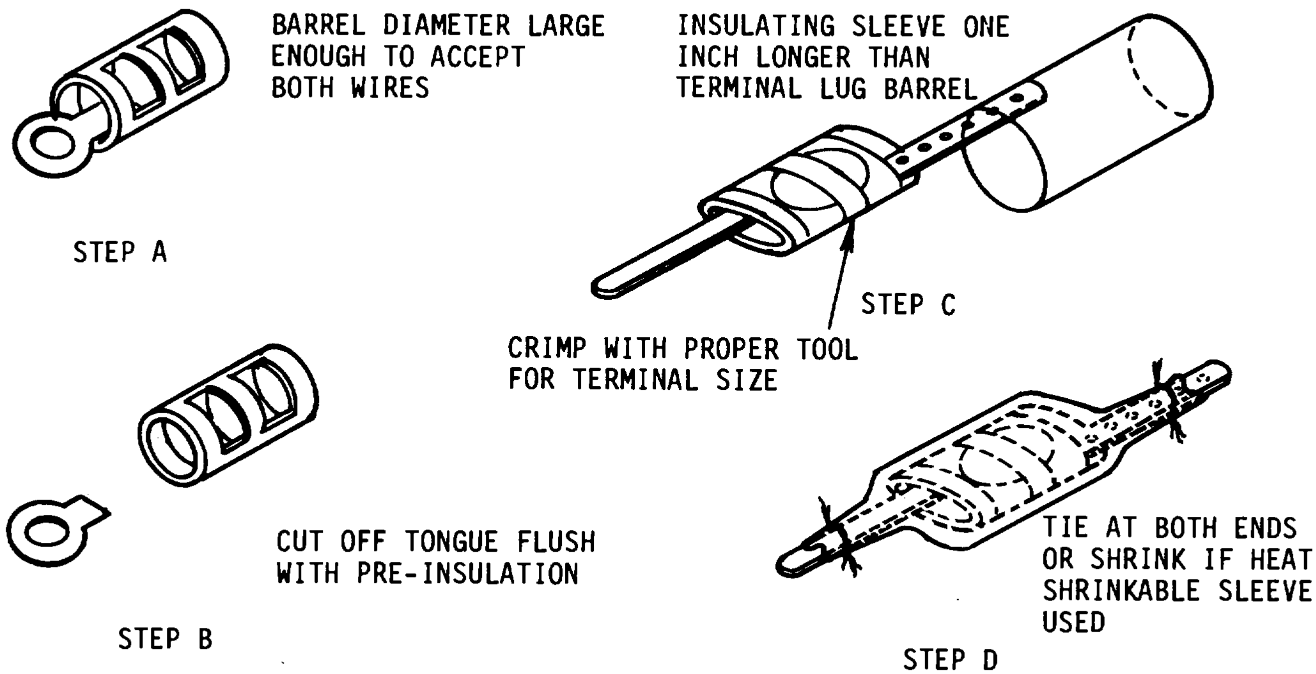


Figure 11-3. Splicing with Terminal Lug Barrel

6. Heat the tape to shrink it onto the splice and soften the adhesive layer. Use reflector (located in A29 of wiring kit), temperature set at 900°F.

7. Center the heat-shrinkable tubing over the splice.

8. Heat the tubing to shrink it onto the splice. Use reflector (A29), temperature set at 900°F. Begin in the middle and work toward the ends. Tubing may not shrink completely onto the wire insulation, this is normal.

9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Twist Wire.

LIMITATIONS: This is a temporary type repair.

PERSONNEL/TIME
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Tape, Electrical (item 46, Appx C)
- Strippers or Knife

PROCEDURAL STEPS:

1. Cut ties and work broken wire to the outside of the bundle.

2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.

3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 trichloroethane, alcohol, or equivalent.

4. Trim broken ends of the wire.

5. Split all the wire ends.

6. Split the strands of wire apart and twist the matching wires together as shown in Figure 11-4.

7. Cover each individual splice with electrical tape. Insure no metal contact between adjacent splices.

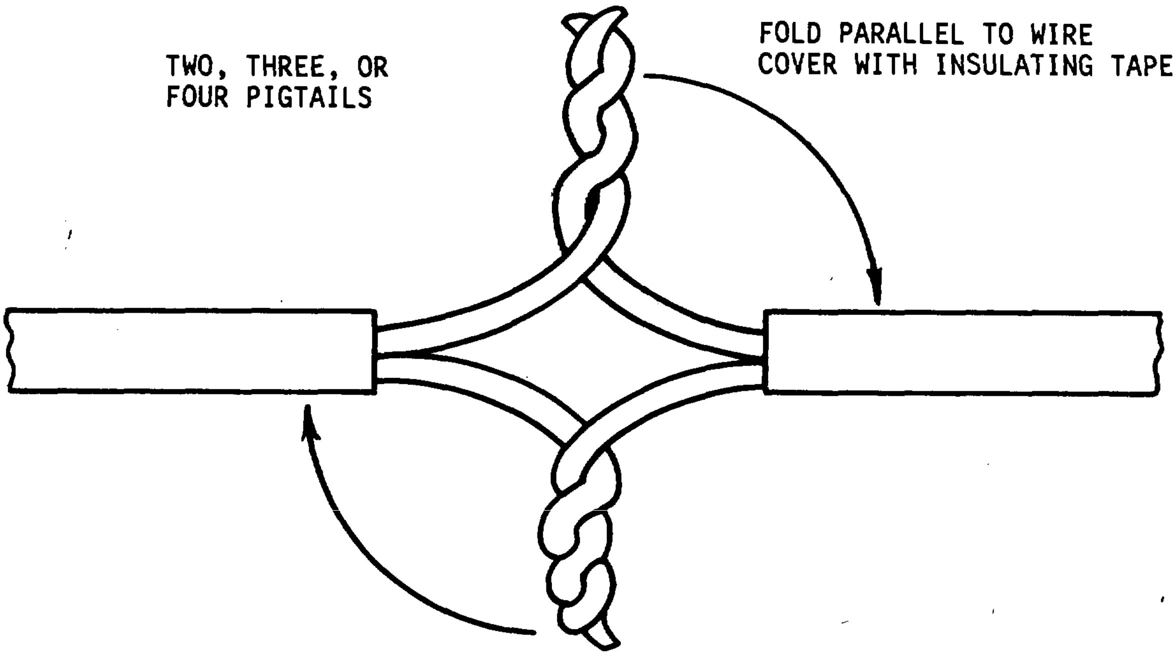


Figure 11-4. Twist Wire Repair

8. Cover splice area with electrical tape.

9. If a section of wire needs to be replaced, a double repair can be made, Figure 11-5.

10. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 5: Casing Splice Method.

LIMITATIONS: This is an emergency type repair for one time flight only.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Cylindrical metal casing such as ball point pen refills, expended cartridges, etc.
- Insulation Sleeve or Tape (item 10, Appx B)
- Crimp Tool (hammer, pliers, etc.)
- Wire (item 10, Appx B)

PROCEDURAL STEPS:

1. Fabricate splices approximately 1 to 2 inches long from small metal casing.

NOTE

Ball point refills or expended cartridge shell casings, when cut to length, make excellent splices, Figure 11-6.

2. Strip 1/2 to 1 inch insulation from both ends of wire to be spliced.

3. Insert wires into casing splice and crimp tightly with pliers or a hammer and small iron bar.

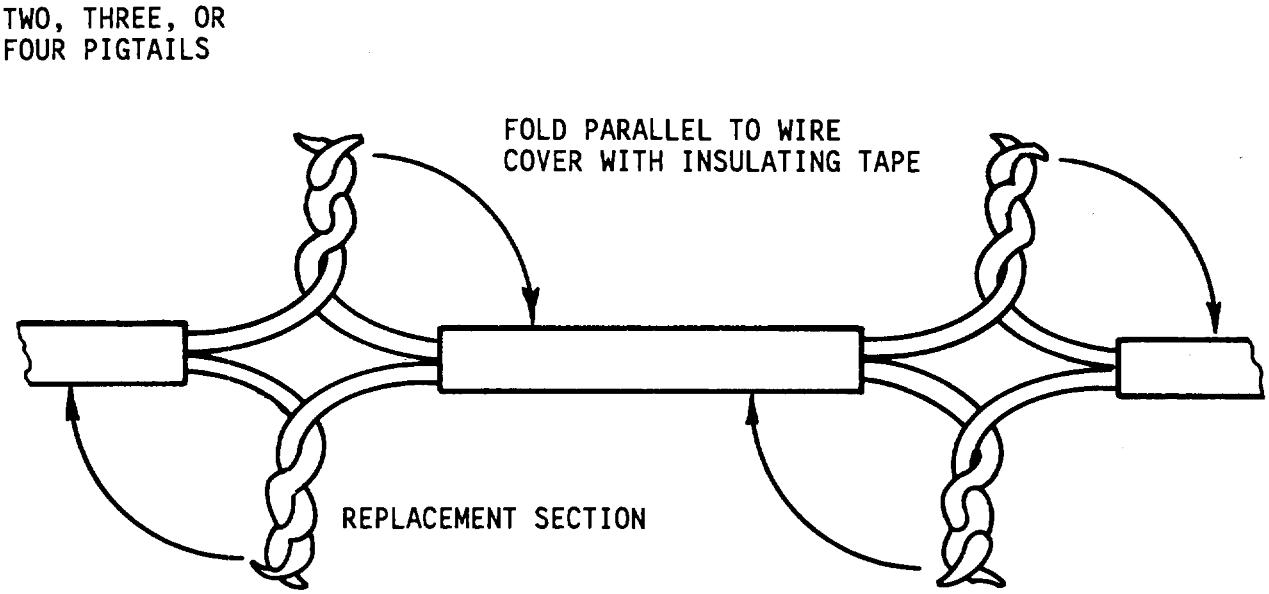


Figure 11-5. Replacement Section; Twist Wire Repair

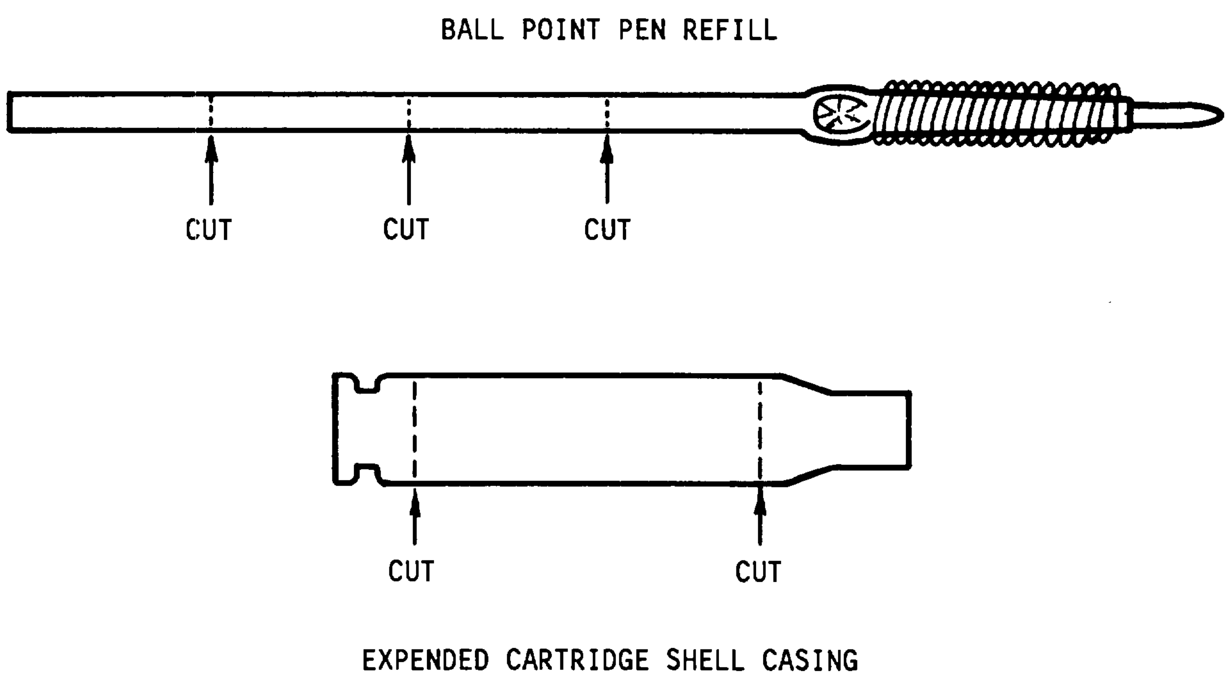


Figure 11-6. Metal Casing Splice Repair

4. Insulate with tape or use plastic and string. Tie in place.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 6: Bolted Terminal Lug.

LIMITATIONS: This is a temporary type repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Appropriate Size Terminal Lugs, 2 ea. (items 54, 55, 56, 57, 58, Appx C)
- Screw or Bolt
- Nut
- Washer
- Lockwasher
- Insulating Sleeve or Tape (item 52, Appx C)

PROCEDURAL STEPS:

1. Cut ties and work broken wire to the outside of the bundle.

2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.

3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 trichloroethane, alcohol, or equivalent.

4. Trim broken ends of wire, and install an insulating sleeve over one end of the wire and slide back and out of the way for now.

5. Strip both wire ends and crimp an insulated terminal lug of the proper size to each wire end.

6. Bolt terminal lugs together as shown in Figure 11-7.

7. Slide the insulating sleeve over the splice so that the ends of the insulating sleeve extend at least 3/4 of an inch beyond the ends of each terminal lug. Secure both ends of the insulation with tie wraps or string ties as shown in Figure 11-7.

8. If a section of wire needs to be replaced, a double repair can be made to bridge the ends of the original wire back together, Figure 11-8.

9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 7: Metal Clamp Method.

LIMITATIONS: This is an emergency type repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Screw Clamp, Control Cable Clamp, or Safety Wire (item 26, Appx C)
- Insulating Sleeve or Electrical Tape (item 49, Appx C)
- Knife
- Cable Ties (item 10, Appx B)

PROCEDURAL STEPS:

1. Cut ties and work broken wire to the outside of the bundle.

2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.

3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 trichloroethane, alcohol, or equivalent.

4. Trim broken ends of wire.

5. Remove 2 inches of wire insulation from each end of the damaged wire.

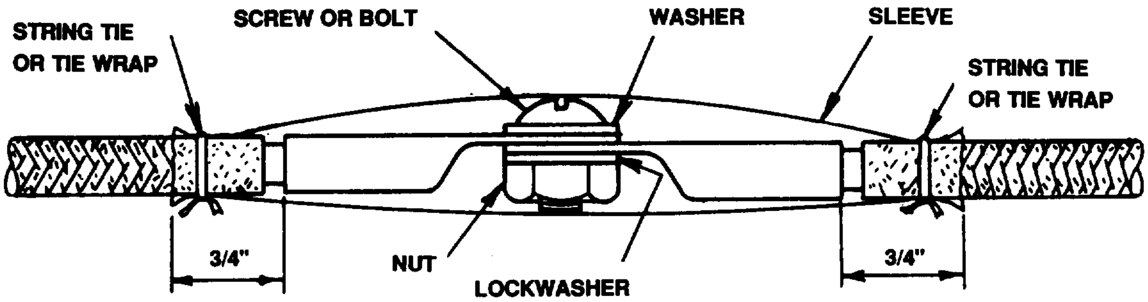


Figure 11-7. Bolted Terminal Lug Repair of Large Wires

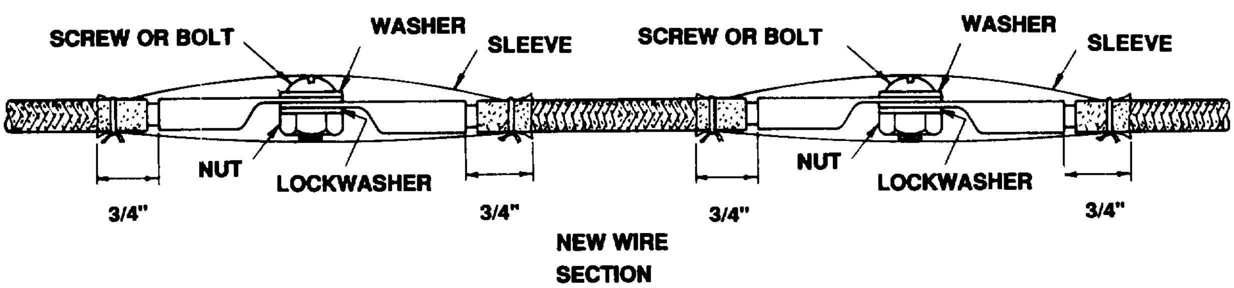


Figure 11-8. Replacement Section; Terminal Lug Repair

6. Ram or push the two wire ends together so that the strands interlink.

7. Secure with screw clamp, control cable clamp, safety wire, or other suitable means, Figure 11-9.

8. Insulate with tape or insulation sleeve.

9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

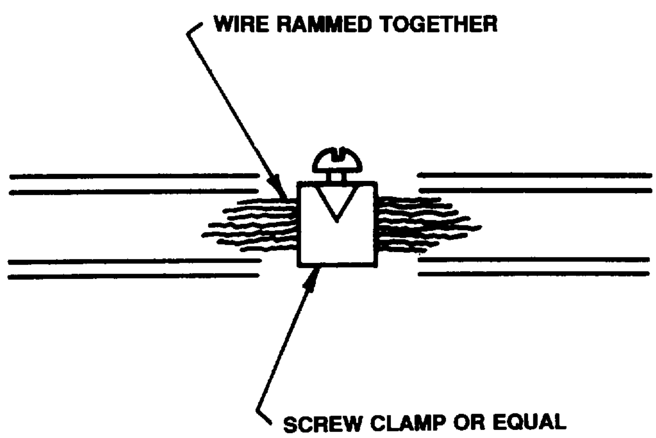


Figure 11-9. Ram Wire Repair Method

11-6. WIRE REPAIR SEGMENTS, UNSHIELDED WIRES.

GENERAL INFORMATION. The BDAR electrical wiring kit has wire replacement segments for replacement sections up to 9 inches in length. The replacement sections are located in the wire repair kit. Refer to Table 11-4.

CAUTION

Make sure aircraft power is off. Disconnect battery before touching any wires.

LIMITATIONS: Dependent on splice method used to connect replacement segment.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 20 Minutes

MATERIALS/TOOLS REQUIRED:
- Replacement Segment (Refer to Table Table 11-4)
- Splice (item 10, Appx B)
- Insulation Sleeve or Tape (item 49, Appx C)
- Crimp Tool (item 10, Appx B)

PROCEDURAL STEPS:

1. Cut out damaged wire (up to 9 inches in length).

2. Strip wires, refer to Table 11-4.

3. Splice replacement segment onto damaged wire using one of the options in paragraph 11-9.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-7. DAMAGED WIRE INSULATION.

GENERAL INFORMATION: If the wire insulation is damaged but the wire itself is not, repair of the insulation may be accomplished by installing heat-shrinkable tape, a transparent sleeve of flexible tubing, and securing with nylon braid or some other means.

CAUTION

Make sure aircraft power is off. Disconnect battery before touching wires.

OPTION 1: Heat-Shrinkable Repair Tape.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Heat-Shrinkable Tape (item 10, Appx B)
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

PROCEDURAL STEPS:

1. Start wrapping tape at one end of area to be covered.

2. Overlap each turn about one-third of tape width. Overlap of more than 50 percent or multiple wraps are not recommended. Excess thickness prevents heat transfer to the inner layer. Refer to Figure 11-10.

3. Apply heat to end of last lap to soften the meltable adhesive, and press it into position while warm. Use reflector (A5), temperature set at 900°F.

4. Heat the tape to shrink it and melt the adhesive layer. Use reflector (A29), temperature set at 900°F.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

Table 11-4. Wire Repair Segments

WIRE SIZE	ITEM LOCATION ELECTRICAL WIRING KIT	CRIMP COLOR GUIDE	WIRE STRIP LENGTH (IN)
26,24, 22,20	B12-1	RED	.25-.30
18,16	B12-2	BLUE	.30-.35
14,12	B12-3	YELLOW	.30-.35

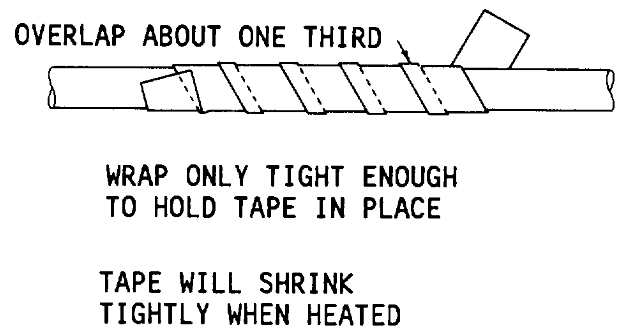


Figure 11-10. Heat-Shrinkable Tape

OPTION 2: Insulation Sleeve.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:
- Insulation Sleeving (item 10, Appx B)
- Knife
- String, Nylon Braid, or Tie-Wraps. (item 10, Appx B)

PROCEDURAL STEPS:

1. Remove damaged insulation and examine to insure center conductor is not damaged.

2. Prepare a transparent sleeve of flexible tubing 1-1/2 times the outside diameter of the wire and 2 inches longer than the damaged portion of the insulation.

3. Split lengthwise and wrap 1-1/2 times around the wire at the damaged section.

4. Tie with string or other suitable material at each end and at 1 inch intervals over the entire length, Figure 11-11.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

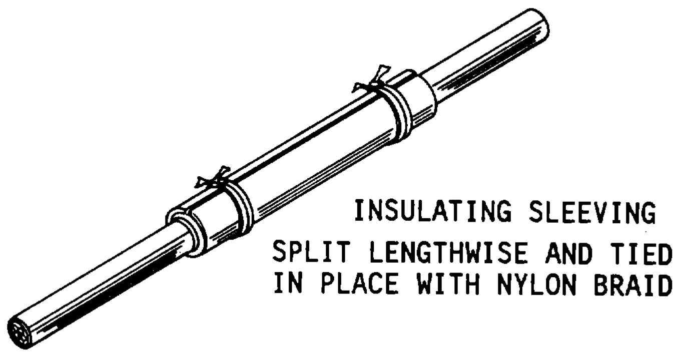


Figure 11-11. Insulation Repair with Sleeving

OPTION 3: Tape Insulation.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 5 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:
- Tape, Electrical (item 49, Appx C)
- Knife

PROCEDURAL STEPS:

1. Remove damaged insulation and examine to insure center conductor is not damaged.

2. Wrap tape over exposed center conductor of wire. Tape should extend 2 inches over the wire insulation at each end of the area to be covered.

3. Record BDAR action taken. When mission is completed or as soon as feasible, repair using standard maintenance procedures.

OPTION 4: Potting Compound Insulation.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1-3 Hours Per Wire (Depending on which potting compound is used.)

MATERIALS/TOOLS REQUIRED:
- Potting Compound Insulation (RTV-730, MIL-S-8516, synthetic rubber, or equivalent)
- Knife

PROCEDURAL STEPS:

1. Remove damaged insulation and examine to insure center conductor is not damaged.

2. Apply a thin coat of potting compound over the exposed center conductor.

3. Allow time to dry. If compound coating does not seem to be sufficient, apply additional layers as needed.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-8. SHIELDED CABLE REPAIR.

GENERAL INFORMATION: The following procedures may be used to repair severed shielded cables.

OPTION 1: Shielded Cable Splice.

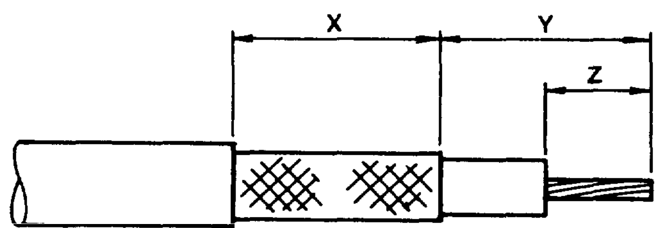
LIMITATIONS: Repair is good for cables rated at 125°C or above.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Appropriate Size Splice (item 10, Appx B)
- Appropriate Size Sealing Sleeve (item 10, Appx B)
- Crimping Tool (item 10, Appx B)
- Strippers (item 10, Appx B)
- Heat Gun (item 10, Appx B)
- Reflector (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for splice. Refer to Figure 11-12 and Table 11-5.



NOTE

Refer to Table 11-5. for X, Y, and Z

Figure 11-12. Shielded Cable Repair Preparation

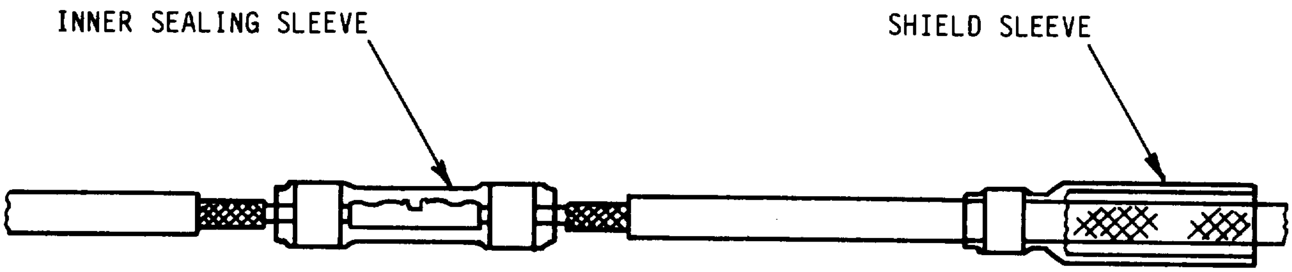


Figure 11-13. Shielded Cable Splice Preparation

Table 11-5. Shielded Cable Repair

WIRE SIZE)	X (IN.)	Y (IN.)	Z (IN.)
26,24			
22,20	.50-.55	.65-.75	.30-.35
18,16	.50-.55	.65-.75	.30-.35
14,12	.50-.55	.65-.75	.30-.35

2. Slide the shield sleeve onto one of the cables.

3. Slide the inner sealing sleeve onto the primary wires of one of the cables, then insert the other primary wire onto the other end of the inner sealing sleeve and crimp with AD-1377 crimp tool, located in electrical wiring kit. Refer to Figure 11-13.

4. Shrink the inner sleeve of the splice with temperature set at 900°F. Keep hot air away from shield sleeve.

5. Center and shrink the shield over the splice area so that the solder melts and flows. Shield sleeve braid must overlap cable braid at both ends. Refer to Figure 11-14.

OPTION 2: Sheath Connector and Grounding Sheath.

LIMITATIONS: This is a temporary repair until heat shrink is installed, then it is a permanent repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1/2 Hour Per Wire

MATERIALS/TOOLS REQUIRED:
- Insulating Sleeving, Heat Shrink, or Tape (item 49, Appx C)
- Knife
- String, Nylon Braid, or Tie Wrap (to be used if insulating sleeve is used)
- 2 Sheath Connectors (item 10, Appx B)
- Grounding Sheath (item 10, Appx B)
- Center Conductor Splice (item 10, Appx B)

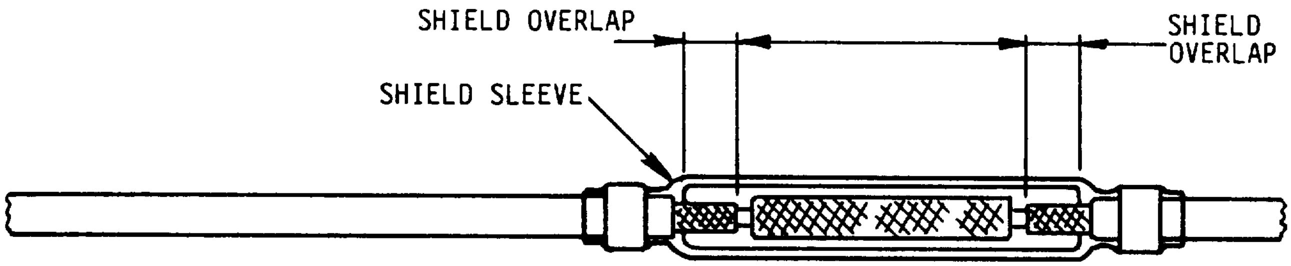


Figure 11-14. Shielded Cable Spliced

PROCEDURAL STEPS:

1. Select a grounding sheath.

2. Prepare the severed ends of the cable for application of a grounding sheath connector, Figure 11-15, step a.

3. Position sheath connector and grounding sheath as shown in Figure 11-15, step b. (NOTE: Crimp sheath connector and grounding sheath only at one side at this time.)

4. Slide insulating sleeve over uncrimped sheath connector as shown in Figure 11-15, step b. (NOTE: If insulating sleeve is not available, use heat shrink or alternate insulation such as electrical tape.)

5. Splice center conductor using a permanent splice or by using one of the splicing procedures in paragraph 11-9.

6. Push the free end of the grounding wire into the uncrimped grounding sheath connector. Crimp securely, Figure 11-15, step c.

7. If an insulating sleeve is used, slide into place and tie both ends Figure 11-15, step d. If heat shrink is used, slide into place and shrink into position. If tape is used, use it to cover repair.

8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Pigtailed Sheath Method.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1/2 Hour Per Wire

MATERIALS/TOOLS REQUIRED:
- Knife
- Insulating Sleeving or Tape (item 49, Appx C)
- String, Nylon Braid, or Tie Wrap (to be used if insulating sleeve is used)
- Center Conductor Splice (item 10, Appx B)

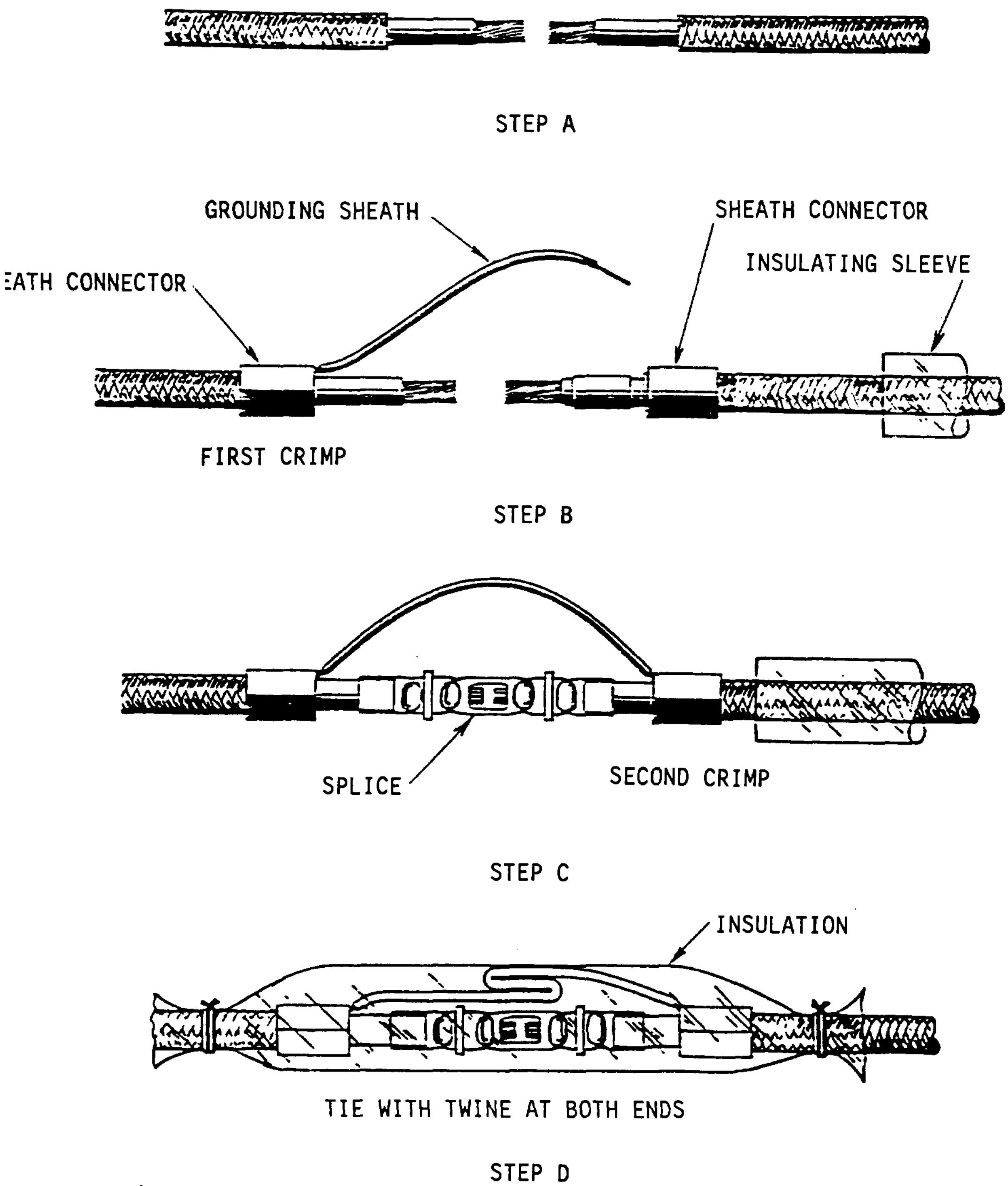


Figure 11-15. Shielded Cable Repair

PROCEDURAL STEPS:

1. Prepare severed ends of cable for pigtail method of shield terminations, Figure 11-16, step a.

2. Splice center conductor, Figure 11-16, step b, using a permanent splice or by using one of the splicing procedures in paragraph 11-9.

3. Use two splice connectors to add short length of insulated wire as extension to complete shield connection, Figure 11-16, step b.

4. Insulate repair, Figure 11-16, step c.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Substitute Shielded Braid.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1/2 Hour Per Wire

MATERIALS/TOOLS REQUIRED:
- Substitute Shielded Braid (item 10, Appx B)
- Knife
- Center Conductor Splice (Item 10, Appx B)
- Metal Screw Clamp, Sheath Connector, or Equivalent

PROCEDURAL STEPS:

1. Prepare severed ends of cable for application of repair splice and shielding, Figure 11-17, step a.

2. Select suitable shielding material and slide over one end of severed cable. Shielding must be long enough to overlap the shielding on both sides of the cable being repaired after the center conductor is repaired. Shielding material can be obtained from another shield cable or ground cable material.

NOTE

It is essential that the shielding, as well as the inner conductor, be repaired properly to prevent electromagnetic interference (EMI) problems.

3. Splice center conductor using a permanent splice or by using one of the splicing procedures in paragraph 11-9, Figure 11-17, step b. Insure center conductor is insulated from shield.

4. Slide shielding material over repaired inner conductor and clamp at shielding overlap areas, Figure 11-17, step c.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-9. SHIELDED CABLE REPAIR SEGMENTS.

GENERAL INFORMATION: The electrical wiring kit has wire replacement segments to replace segments up to 9 inches in length.

<u>CAUTION</u>

Make sure aircraft power is off. Disconnect battery before touching any wires.

LIMITATIONS: Dependent on splice method used to connect replacement segment.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

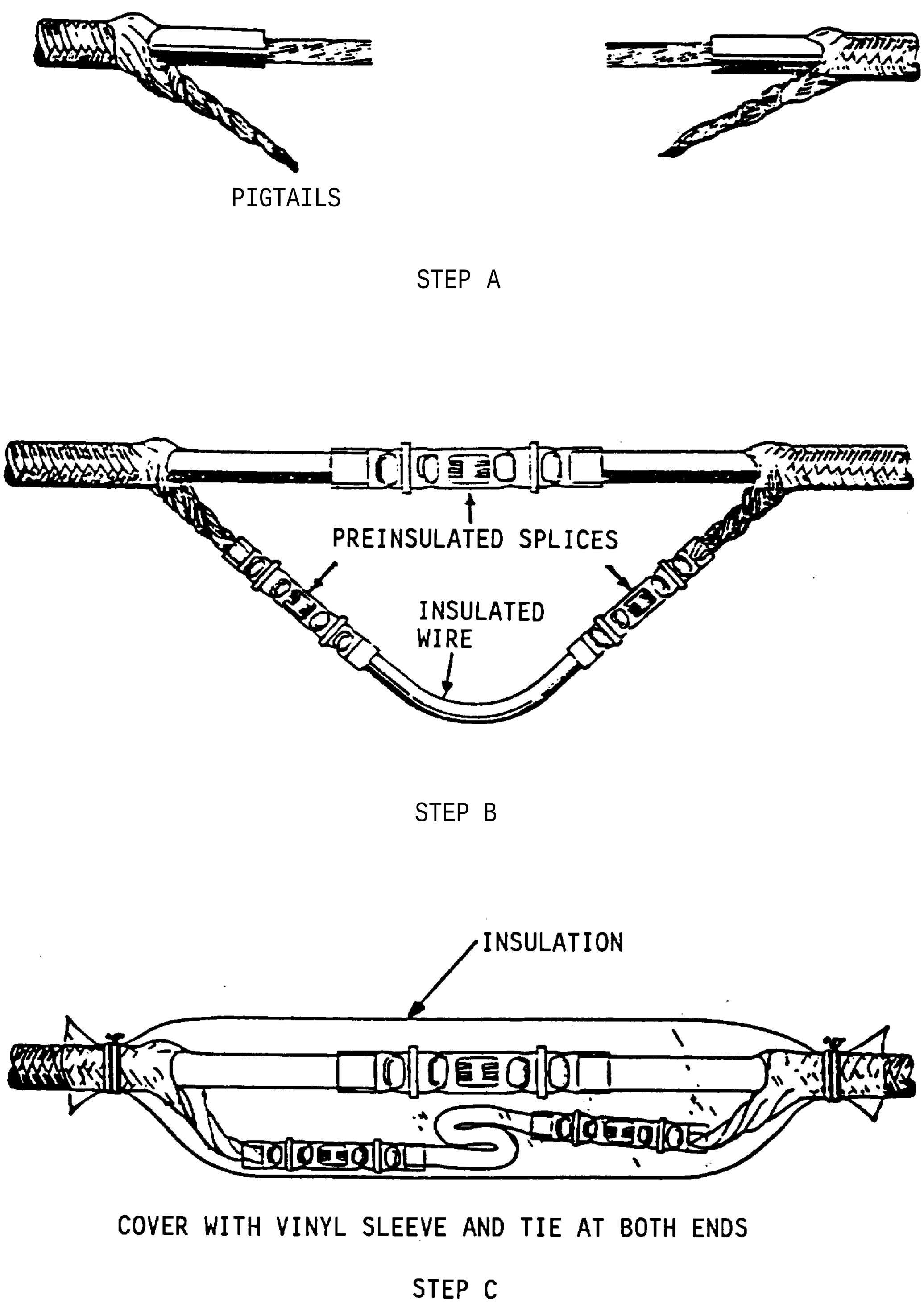


Figure 11-16. Pigtail Method Repair

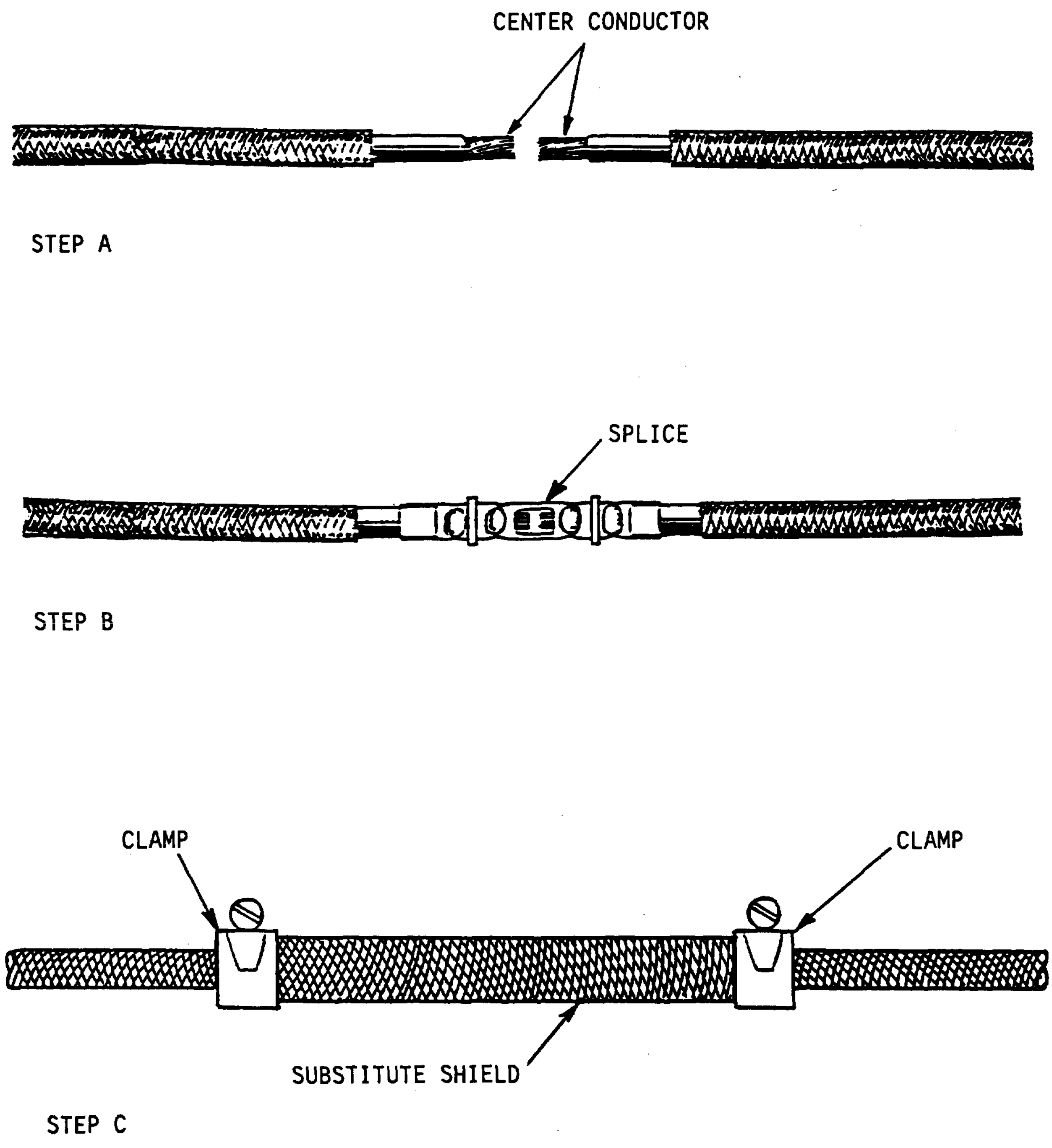


Figure 11-17. Substitute Shielded Braid Repair

MATERIALS/TOOLS REQUIRED:
- Replacement Segment (item 10, Appx B)
- Stripper or Knife
- Splice (item 10, Appx B)
- Insulation Sleeve (item 10, Appx B)
- Crimp Tool

PROCEDURAL STEPS:

1. Cut out damaged cable (up to 9 inches in length).

2. Prepare cable for splice. Refer to Figure 11-12 and Table 11-5.

3. Use one of the options of paragraph 11-5 to splice the ends of the replacement segment onto the damaged cable.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-10. SHIELD TERMINATORS.

GENERAL INFORMATION: The kit contains various types of shield terminators for shielded cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Shield Terminator (item 10, Appx B)
- Reflector
- Heat Gun/Heat Source
- Stripper or Knife
- Insulating Sleeve (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for repair. Refer to Figure 11-18.

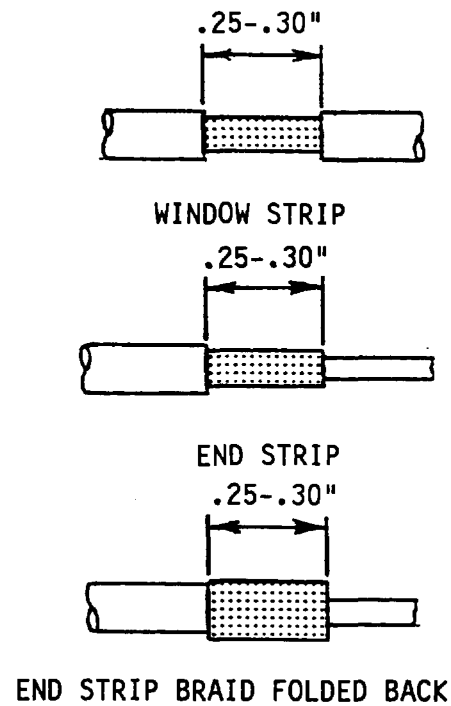


Figure 11-18. Shield Terminator Repair Preparation

2. Position shield terminator on cable as shown in Figure 11-19. (Select the smallest terminator that slides easily over the prepared cable.)

3. Heat shield terminator until solder melts and flows into wire strands, red color disappears, and seals melt and flow at both ends. Use reflector with shield terminator of wire repair kit with temperature set at 900°F.

4. Terminate the ground lead as directed in aircraft wiring manual.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

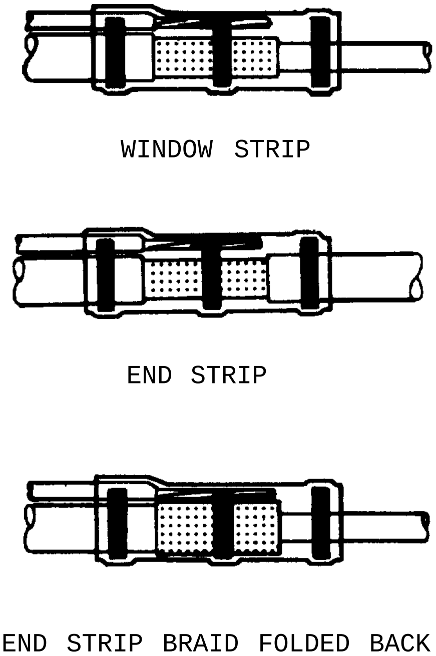


Figure 11-19. Shield Terminator Repair

11-11. TERMINATORS FOR NICKEL-PLATED SHIELDS (INCLUDING VERMILLION).

GENERAL INFORMATION: The kit contains shield terminators for nickel-plated shields, including vermillion.

LIMITATIONS: This is a permanent repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Shield Terminator (item 10, Appx B)
- Reflector (A3) (item 10, Appx B)
- Heat Gun/Heat Source
- Stripper or Knife
- Insulating Sleeve (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for repair. Refer to Figure 11-20.

2. Position ground lead and shield terminator as shown in Figure 11-21.

3. Heat shield terminator until solder ring melts; then, continue heating for an additional 15 seconds or until sleeve starts to turn brown. Use reflector with temperature set at 900°F.

4. Terminate the ground lead as directed in the aircraft wiring manual.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

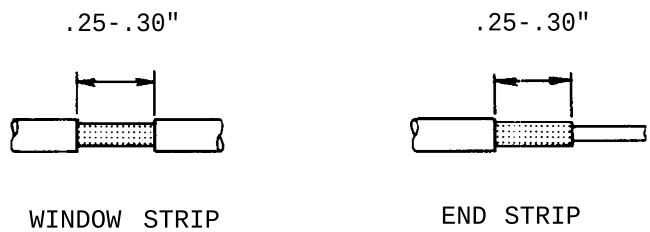


Figure 11-20. Nickel-Plated Shield Terminator Preparation

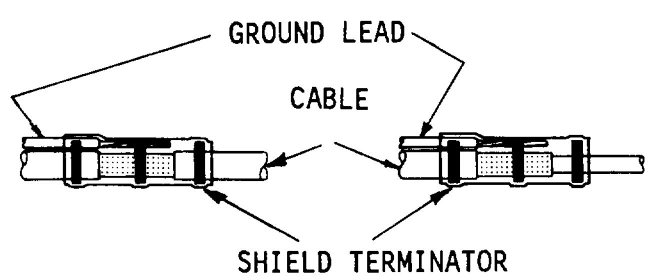


Figure 11-21. Nickel-Plated Shield Terminator Repair

11-12. TERMINAL BOARDS.

GENERAL INFORMATION: The terminal boards provided are all 5 inches in length. They are located in the wiring kit. They can be cut to shorter lengths using a hacksaw. The general procedure is as follows:

LIMITATIONS: Permanent repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- Time will depend on the number of wires on the terminal board in question.

MATERIALS/TOOLS REQUIRED:
- Replacement Terminal Board (item 10, Appx B)

PROCEDURAL STEPS:

1. Tag and disconnect wires one at a time.

2. Remove terminal board.

3. Install replacement terminal board.

4. Connect wires to duplicate the original installation.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-13. TERMINAL LUGS.

GENERAL INFORMATION: Terminal lugs are provided in the wiring kit, Table 11-6. The general procedure for installing terminal lugs is as follows:

LIMITATIONS: None

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:
- Strippers or Knife
- Replacement Terminal Lug (Table 11-6)
- Crimp Tool (item 10, Appx B)

PROCEDURAL STEPS:

1. Select a terminal to fit both the wire and the terminal stud, Table 11-6.

2. Strip the wire to the length specified in Table 11-6.

3. Open the dies of the crimp tool. Refer to Figure 11-22.

4. Place terminal in proper cavity of crimp tool dies (see Detail A of Figure 11-22). Sizes are stamped below each cavity on side of die.

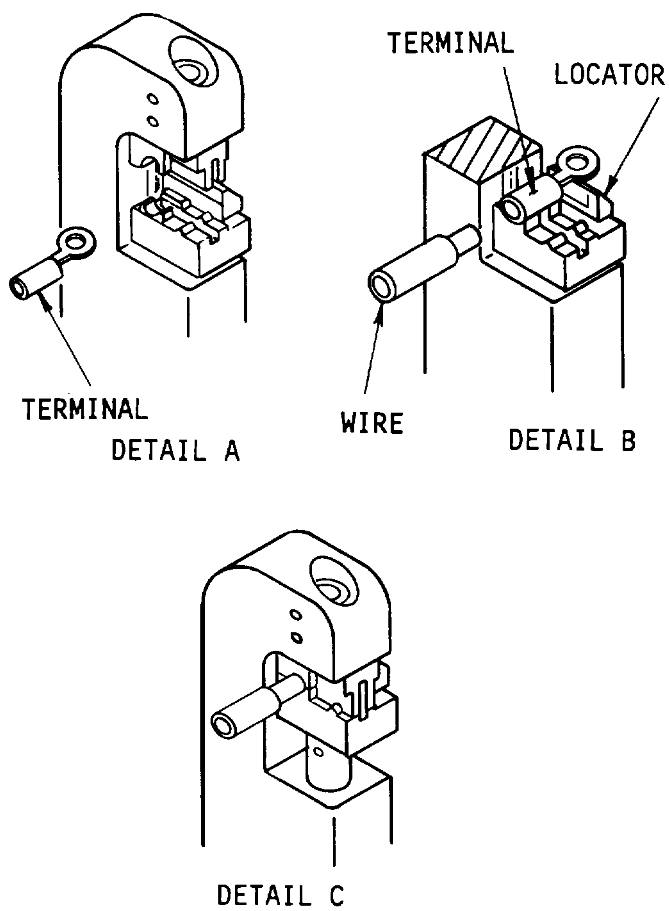


Figure 11-22. Terminal Lug Repair

WIRE SIZE	ITEM	STUD SIZE	P/N	WIRE STRIP LENGTH (IN)
24	B30	4	M7928/1-7	.15
		6	M7928/1-8	
		8	M7928/1-9	
		10	M7928/1-10	
22	B31	8	M7928/1-14	
		10	M7928/1-15	
		1/4 In.	M7928/1-16	.19
20	B32	6	M7928/1-21	
		8	M7928/1-23	
		10	M7928/1-24	
		1/4 In.	M7928/1-25	
18	B33	6	M7928/1-30	
		8	M7928/1-32	
		10	M7928/1-33	
		1/4 In	M7928/1-34	
16	B34	6	M7928/1-39	.25
		8	M7928/1-41	
		10	M7928/1-42	
		1/4 In.	M7928/1-43	
14	B35	6	M7928/1-48	
		8	M7928/1-50	
		10	M7928/1-51	
		1/4 In.	M7928/1-52	

5. Locate terminal with locator (detail B). Terminal should locate with flange over the top of the locator.

6. Insert wire to proper depth.

7. Close handle of tool until dies are closed and ratchet releases. The crimp is now complete (see detail C).

8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-14. WIRE BUNDLE TIE WRAPS.

GENERAL INFORMATION: After wire damage repairs are made, insure minimum essential cable clamps, lugged bundle ties, and unlugged wire bundle ties are replaced.

OPTION 1: Self-Clinching Cable Straps.

LIMITATIONS: These straps are not to be used under the following conditions:

- In temperature environments which exceed 85°C (185°F).

- On coaxial cables or bundles containing coaxial cables which do not have hard dielectrics.

- In areas where excess material from strap cuttings or failure of the mounted strap would allow plastic to fall into moving mechanical parts.

- On the outside of cables or bundles that will be dragged through tight or unreachable spaces during final aircraft installation.

- Where failure of the strap would permit movement of the wiring against parts which could damage the insulation or allow wiring to foul mechanical linkages.

- In high vibration areas.

- In areas of severe wind or moisture problems.

When use of these straps is prevented by these restrictions, use tie tape for secondary ties between clamps.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Minute

MATERIALS/TOOLS REQUIRED:
- Self-Clinching Cable Strap (item 10, Appx B)
- Cable Strap Tool (item 10, Appx B)

PROCEDURAL STEPS:

1. Position the strap around the bundle with the flat side of the large end against the bundle.

2. Thread tip through eye then hand pull strap tight against the bundle. Refer to Figure 11-23.

3. Adjust the tool tension setting to 7.

4. Pass the free end of the cable tie through the slot in the end of the tool then push tool snugly against the strap, Figure 11-24.

5. While holding strap firmly against side of tool and tool faces squarely against large end of strap, pump handle several times without fully activating the tool's cutting knife. Once the strap has been stretched to its maximum, squeeze handle slowly and firmly until strap is cut.

WARNING

The strap must be cut flush with the surface in order to eliminate painful cuts and scratches from protruding strap ends.

6. If strap end is not cut flush, remove the strap and install a new strap in its place.

7. Pick up for appropriate disposal all broken straps and strap ends that were cut off.

8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

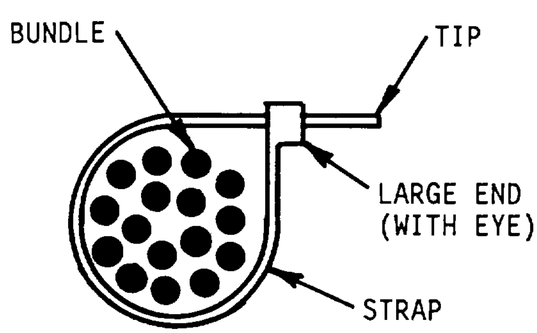


Figure 11-23. Self-Clinching Cable Strap

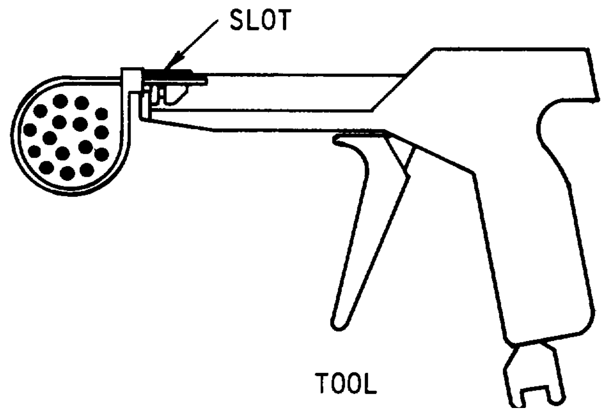


Figure 11-24. Self-Clinching Cable Strap and Tool

OPTION 2: Tie Tape.

LIMITATIONS:

1. Do not use ties on that part of a wire group or bundle located inside a conduit.

2. When tying wire bundles behind connectors, start ties far enough back from the connector to avoid splaying of contacts.

PERSONNEL/TIME REQUIRED:
• 1 Soldier
• 1 Minute Per Tie

MATERIALS/TOOLS REQUIRED:
• Tie Tape (item 10, Appx B)

PROCEDURAL STEPS:

1. Tie bundles tightly enough to prevent slipping, but not so tightly that the tape cuts into or deforms the insulation. Be especially careful when tying coaxial cable which has a soft dielectric insulation between the inner and outer conductors.

2. Use knot shown in Figure 11-25.

3. Tie all wire groups of bundles where supports are more than 12 inches apart. Space ties 12 inches or less.

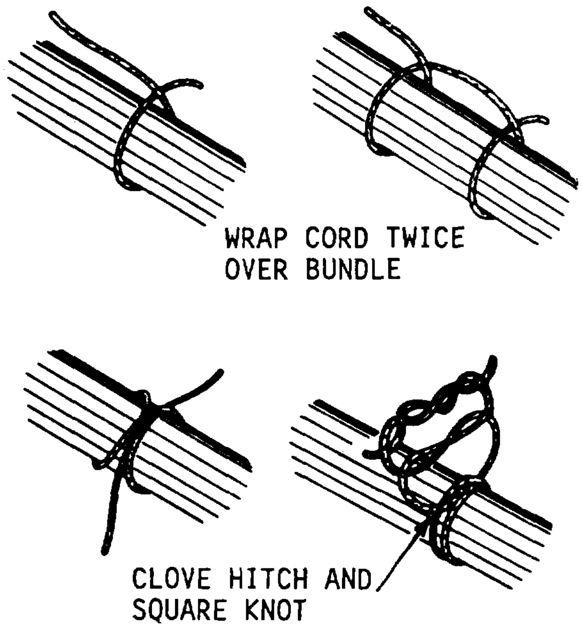


Figure 11-25. Tie Tape Repair Procedure

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

NOTE

Harness branches can be secured by tying.

OPTION 3: String or Wire Repair.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Minute

MATERIALS/TOOLS REQUIRED:
- Wire or String

PROCEDURAL STEPS:

1. Tie wires or groups using type knot shown in Figure 11-25.

CAUTION

Do not tighten wire or string too much, as wire or string can cut into or deform insulation.

2. Space ties at 12 inches or less.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-15. COAX SPLICE FOR RG-136/U AND RG-179B/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Crimp Tool, AD-1377 (item 10, Appx B)
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.

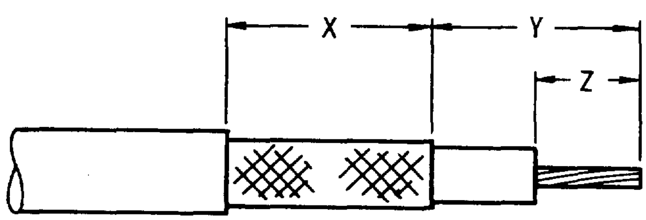


Figure 11-26. Coax Splice Preparation

2. Slide the shield sleeve and inner sleeve onto one of the coaxial cables in the order given.

3. Splice the center conductor. Use the red cavity of the crimp tool.

4. Shrink the inner sleeve over the splice, Figure 11-27. Use reflector, temperature set at 900°F. Keep the hot air away from shield sleeve.

5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-28. Shield sleeve braid must overlap coax braid at both ends. Use reflector, temperature set at 900°F.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-16. COAX SPLICE FOR RG-180B/U, RG-124/U, RG-142B/U, RG-302/U, RG-303/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coaxial cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Crimp Tool, AD-1377 (item 10, Appx B)
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.

2. Slide shield sleeve, inner sleeve, and filler sleeve onto one of the coaxial cables in the given order.

3. Splice the center conductor. Use the red cavity of the crimp tool.

4. Shrink the filler sleeve over the splice. Use reflector, temperature set at 900°F. Keep hot air away from inner and shield sleeves.

5. Shrink the inner sleeve over the splice, Figure 11-27. Use same reflector and temperature. Keep hot air away from shield sleeve.

6. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-28. Shield sleeve braid must overlap coax braid at both ends. Use same reflector and temperature.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-17. COAX SPLICE FOR RG-9B/U, RG-214/U, RG-225/U, RG-393/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Crimp Tool (item 10, Appx B)
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

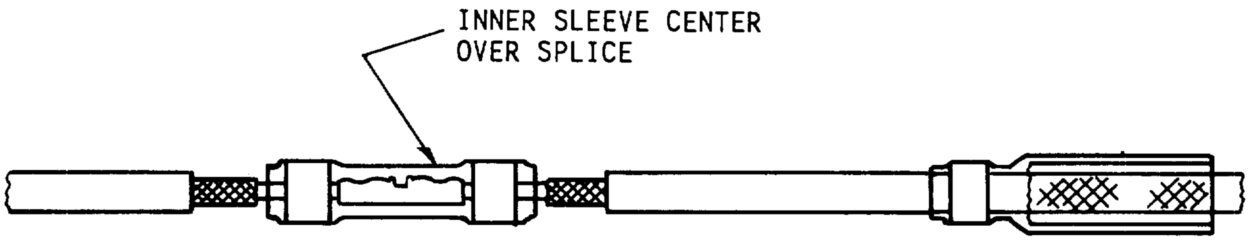


Figure 11-27. Coax Splice Inner Sleeve

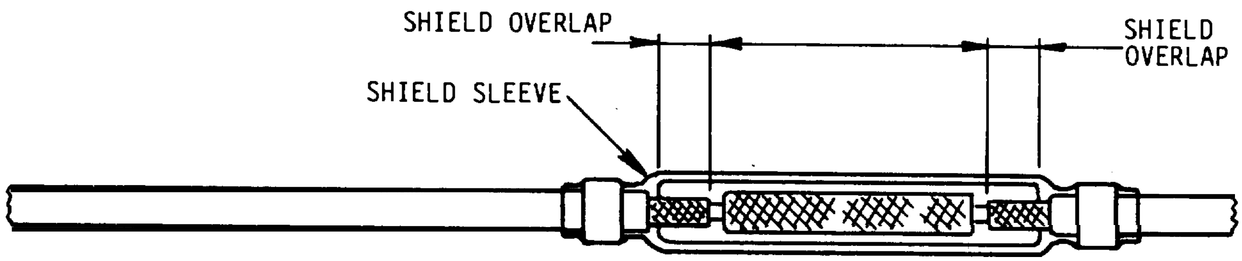


Figure 11-28. Coax Splice Shield Sleeve

PROCEDURAL STEPS:

1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.

2. Slide the tubing, inner sleeve, and filler sleeve onto one of the coax cables in the order given.

3. Splice the center conductor. Use the red cavity of the crimp tool.

4. Shrink the filler sleeve over the splice. Use reflector, temperature set at 900°F. Keep hot air away from shield sleeve and tubing.

5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-29. Shield sleeve must overlap coax braid at both ends. Use same reflector and temperature. Keep hot air away from tubing.

6. Center and shrink the tubing over the splice area. Use reflector with temperature set at 900°F.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

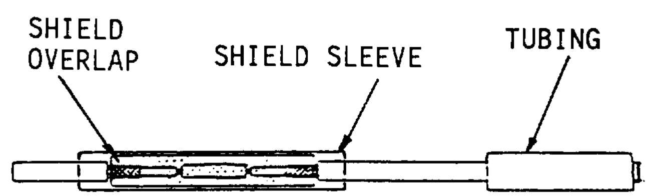


Figure 11-29. Coax Splice with Tubing Sleeve

11-18. COAX SPLICE FOR RG-58C/U, RG-233/U, RG-59B/U, AND RG-71B/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.

2. Slide the shield sleeve and filler sleeve onto one of the coax cables in the order given.

3. Insert center conductors to overlap in center conductor splice. Barrier sleeves of center conductor splice fit under cable braids, Figure 11-30. Heat using reflector, temperature set at 900°F.

4. Shrink the filler sleeve over the splice. Use same reflector and temperature. Keep hot air away from shield sleeve.

5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows. Shield sleeve braid must overlap coax braid at both ends. Refer to Figure 11-31. Use same reflector and temperature.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

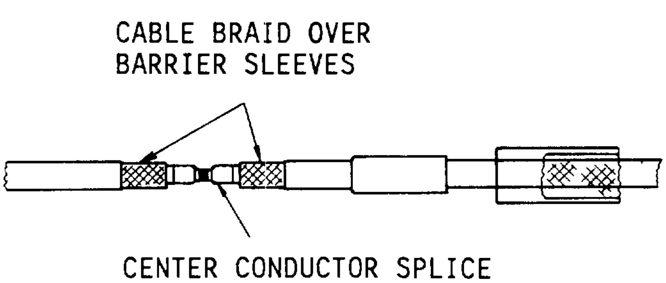


Figure 11-30. Coax Splice with Cable Braid over Barrier Sleeves

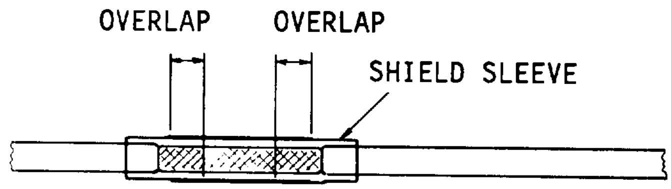


Figure 11-31. Coax Repair with Cable Braid over Barrier Sleeve

11-19. COMPONENT BRIDGING.

GENERAL INFORMATION: In most cases, it will be quicker not to replace bulkhead connectors, junction boxes, or terminal strips. These circuits can be repaired by "bridging" the damaged area with jumper wires spliced in to eliminate the damaged area or component, Figure 11-32.

LIMITATIONS: Will be dependent on the type of splice used. Typically, temporary repair.

PERSONNEL/TIME REQUIRED:
- Will be dependent on the type of splice used. Typically 1 soldier, 15-30 minutes per splice.

MATERIALS/TOOLS REQUIRED:
- Will be dependent on the type of splice used.

PROCEDURAL STEPS:

1. Identify wires to be bridged together.

2. Splice wires and jumper wires together using one of the splicing techniques of this chapter.

3. Secure jumper wires after repair is made.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

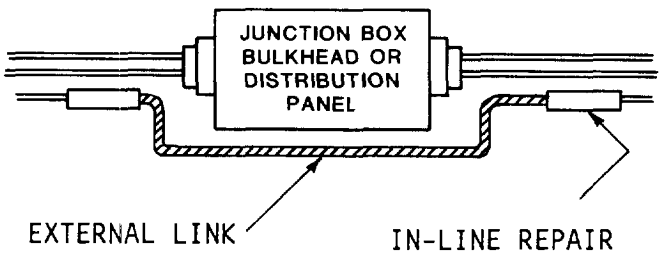


Figure 11-32. Component Bypass

11-20. CONNECTOR REPAIR.

GENERAL INFORMATION: Deformed, crushed, missing, or otherwise damaged connectors can be replaced or repaired. If a replacement connector is not available to replace a crushed connector, clean up fragments of the connector and use jumper wires to bridge wire ends together. If only part of the connector has been damaged and there are unused pins/sockets on the connector which are undamaged, wires on both sides of the connectors can be moved to the unused good pins/sockets. Also, any available undamaged pigtails on the connector may be used.

OPTION 1: Damaged Pins or Sockets; No Damage to Connector.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:
- Replacement Pins/Sockets (item 2, Appx B)
- Insertion/Extraction Tool (item 2, Appx B)
- Knife

PROCEDURAL STEPS:

1. Solder or crimp wires to pin/sockets, Figure 11-33.

2. Insert the pins/sockets into the connector.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

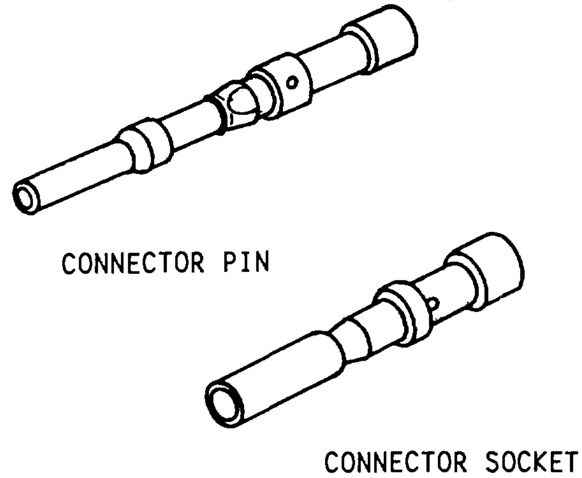


Figure 11-33. Connector Pin and Socket

NOTE

Superglue or epoxy may be used to secure the original or replacement pin back into place. Avoid getting glue or epoxy on contact surface of pin.

OPTION 2: Bridge Across Partially or Fully Damaged Connector.

LIMITATIONS: Temporary repair.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:
- Wire Splice (item 10, Appx B)
- Wire (items 61, 62, Appx C)

PROCEDURAL STEPS:

1. Locate the damaged wire ends that go into connector.

2. Splice the appropriate wires together. The splice will bypass the connector.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Cannibalizing Connector from Other Aircraft.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:
- Replacement Connector with Pigtail
- Splices or Tape (item 10, Appx B)
- Knife

PROCEDURAL STEPS:

1. Obtain a replacement connector with a pigtail. (Replacement may be obtained from a crash damaged aircraft.) Cut pigtail so that splices can be staggered, Figure 11-34.

2. Remove damaged connector; stagger the wires being cut to remove the damaged connector. The staggered wires should match the staggered pigtail of the replacement connector of step 1, Figure 11-34.

3. Splice the appropriate wires together. Insulate properly.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

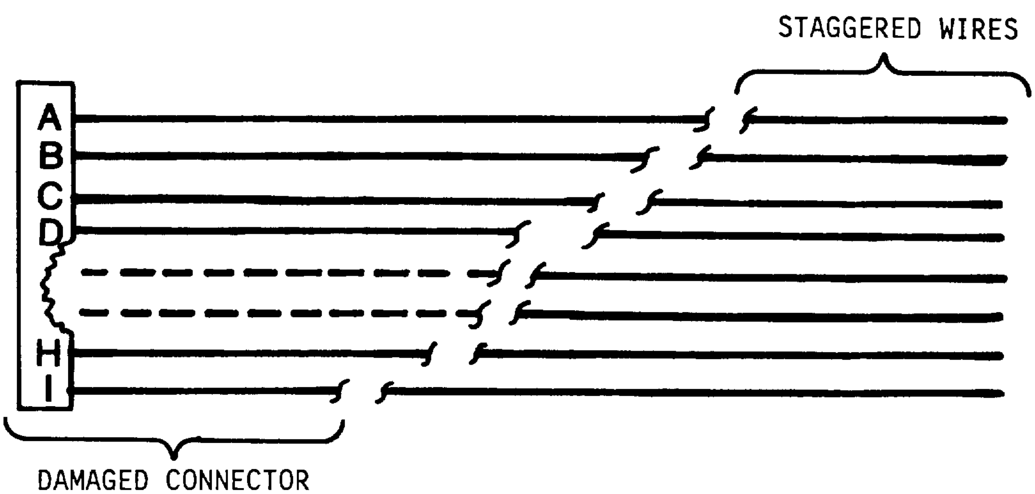


Figure 11-34. Damaged Connector and Pigtail

11-21. CIRCUIT PROTECTION DEVICE REPAIR.

GENERAL INFORMATION: Attempt to maintain a fused system at all times. Circuits with damage circuit breakers can be repaired by:

a. Circuit breakers of the same rating salvaged from other non-flyable aircraft, or removed from other non-essential circuits in the aircraft.

b. Replacing circuit breakers with a specified number of individual strands of No. 38 AWG wire from No. 26 AWG wire.

OPTION 1: Salvaged Circuit Breaker Replacement.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 20 Minutes

MATERIALS/TOOLS REQUIRED:
. Salvaged Circuit Breaker
. Electrical Tape (item 49, Appx C)

PROCEDURAL STEPS:

1. Gain access to area behind circuit breaker panel, Figure 11-35, by turning duze fasteners counterclockwise.

2. Remove screws holding plastic face plate on circuit breaker panel.

3. Use pliers to remove nut and inside star lock washer from damaged circuit breaker.

4. Use phillips screw driver to remove the two screws from the back of the circuit breaker.

5. Replace bad circuit breaker with the salvaged circuit breaker.

6. Connect back of circuit breaker to line and bus bar by reinstalling the two phillips screws.

7. Place inside star washer and nut on front of circuit breaker and tighten with pliers.

8. Replace plastic face plate on front of circuit breaker panel with screws previously removed.

9. Clean and remove any debris from inside circuit breaker panel and close panel. Secure by turning duze fasteners clockwise.

OPTION 2: Individual Strands of No. 38 AWG as Circuit Breaker BDAR Repair.

LIMITATIONS: Emergency repair.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 20 Minutes

MATERIALS/TOOLS REQUIRED:
. 1 Foot of No. 38 AWG Wire

PROCEDURAL STEPS:

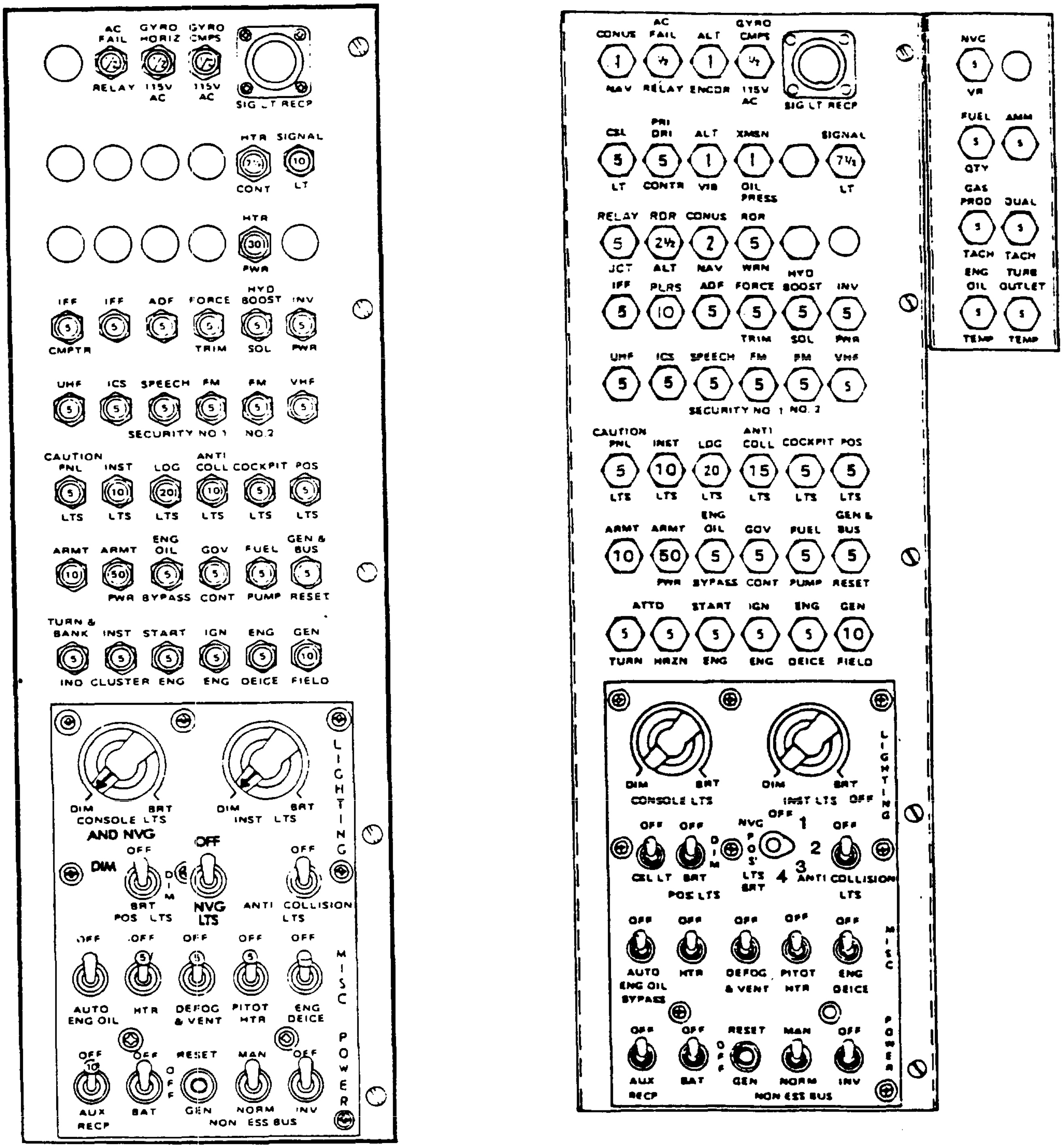
1. Perform steps 1 thru 4 of option 1.

2. Identify the wires hooked to each circuit breaker. Typical circuit breaker is shown in Figure 11-36.

3. Determine amperage of damaged circuit breaker(s) to be replaced. (Amperage is printed on the end of reset button.)

4. Use Table 11-7 to determine number of strands of No. 38 AWG wire needed to replace damaged circuit breaker.

5. Select strands of No. 38 AWG wire to be used. Strands should be 6 to 8 inches long.



OH-58 A

OH-58 C

Figure 11-35. Circuit Breakers

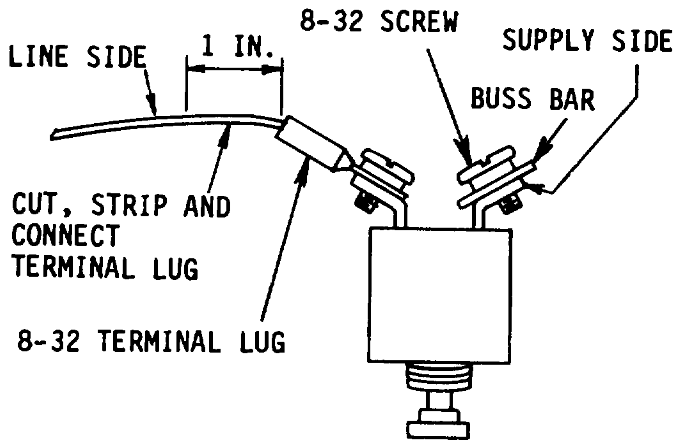


Figure 11-36. Typical Circuit Breaker Connection

Table 11-7. Fuse Link Strands

CIRCUIT BREAKER AMPERAGE	AWG SIZE WIRE	NO. OF STRANDS
1/2A	N0. 38	1
1A	N0. 38	1
2A	N0. 38	1
3A	N0. 38	1
4A	N0. 38	2
5A	N0. 38	2
10A	N0. 38	5
15A	N0. 38	7
20A	N0. 38	10

NOTE

Try to use inner strands of wire that are not cut or nicked by knife used to remove insulation.

6. Remove line side, Figure 11-37, by unscrewing 8-32 screw. Repeat for supply side.

7. Twist the No. 38 AWG strands of wire from step 5 together and insert the end of line side of terminal lug; wrap and twist as shown in Figure 11-37. Slip 1 inch piece of insulation over No. 38 AWG strands of wire. Insert the other end of No. 38 AWG strands of wire into the other terminal lug (supply side). Pull tight against the piece of insulation and twist tight. Insulate bare end of terminal lugs on both sides of 1 inch piece of insulation with tape. Use 8-32 screw to connect other terminal lug to bus side of bus bar.

8. Use this procedure to replace damaged circuit breaker.

9. Secure fuse link to other wiring with tape to avoid pinching wire when circuit breaker panel is closed.

10. Clean up damaged area behind circuit breaker panel to remove debris, and use tape to insulate any damaged parts that might cause electrical shorts.

11. Carefully close circuit breaker panel and secure by turning duze fasteners clockwise.

12. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

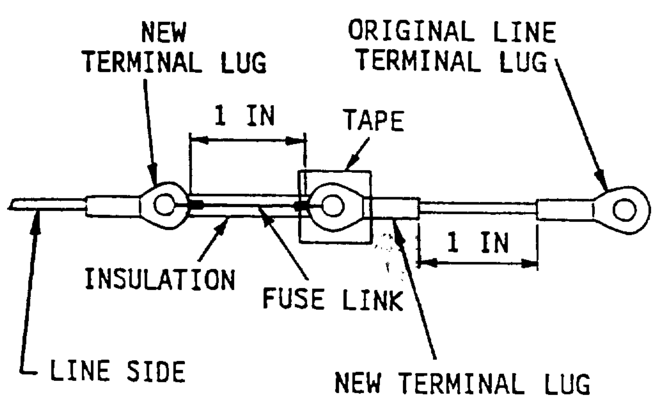


Figure 11-37. Construction of Fuse Link

11-22. BUS BARS.

GENERAL INFORMATION: Rigid bus bars are used in the power distribution circuits of the aircraft. Replace damaged bus bars with copper or brass strips of wire of the same or higher cross-sectional area. Use aluminum only when replacing aluminum bus bars since it makes unrealizable contact with other metals.

LIMITATIONS: Repaired bus bars will have a somewhat higher resistance than the original circuit and a higher than normal voltage drop may occur. Temporary repair.

PERSONNEL/TIME REQUIRED:
. 2 Soldiers
. 2 Hours

MATERIALS/TOOLS REQUIRED:
. Drill and Bit
. Nuts, Bolts, Flat Washers, Lock Washers
. Tape (item 49, Appx C)
. Brush, Wire
. File
. Hacksaw

PROCEDURAL STEPS:

1. Cut a section of another bus bar to use for splice.

2. Drill matching holes in bus bar sections and splice, Figure 11-38.

3. Remove insulation from bus bar only where needed. Insure contact surfaces of cracked bus bar and splice are smooth, and clean to reduce resistance. If necessary, use tile and wire brush to dress and prepare contact surfaces.

4. Install bolts and washers and tighten. Insure no contact of bolts with aircraft structure.

5. Insulate repair with tape or slit a piece of insulating tubing, and wrap around the repair and tie with string.

6. Same repair procedure can be used to lengthen bus bars, Figure 11-39.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-23. BATTERY REPAIR, BB-476/A.

GENERAL INFORMATION: Nickel-Cadmium (Ni-Cad) batteries consist of a number of cells connected in series. Damage to a cell which does not result in short circuiting and destroying the battery. The following procedure gives instructions for locating and removing bad Ni-Cad battery cells and creating a jumper around the bad cell.

WARNING

. Ni-Cad batteries use potassium hydroxide, a strong caustic alkali, as the electrolyte. Do not get this electrolyte on your skin or in your eyes. Use rubber gloves, rubber apron, and protective goggles when handling the electrolyte. If accidental contact with the electrolyte is made, use ONLY clean water and immediately (seconds count) flush contaminated areas. Continue flushing with large quantities of clean water and get medical attention as soon as possible.

. If steam or spewing electrolyte is observed or the battery is hot to the touch, DO NOT ATTEMPT TO remove from the aircraft immediately.

CAUTION

Penetration of battery case by small arms fire or shrapnel will cause thermal runaway. The battery cells will overheat and rupture, melt, or explode. Exercise extreme caution when repairing the battery.

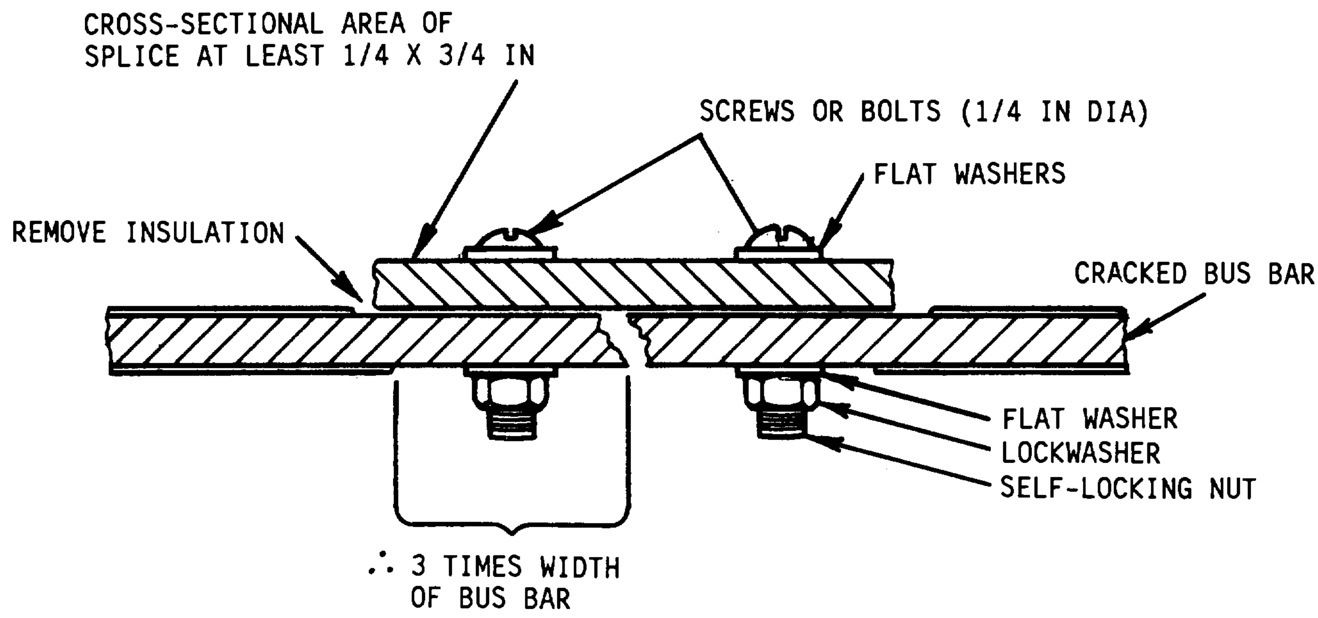


Figure 11-38. Splicing Bus Bars

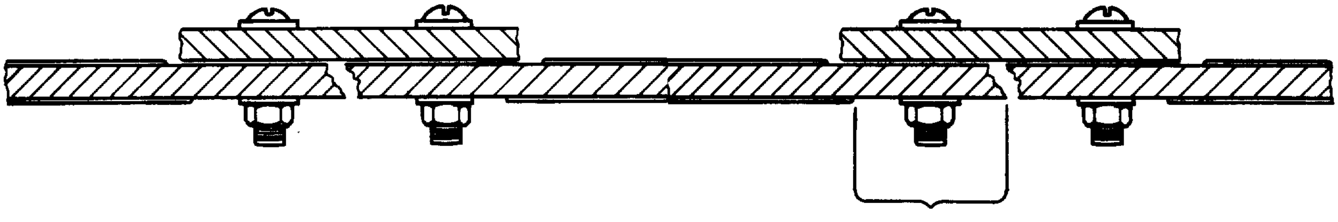


Figure 11-39. Lengthening Bus Bars

LIMITATIONS: Some loss of battery voltage (1.25 to 1.50 V dc per cell removed) and amperage capacity.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:
- 1 Multimeter with Leads (item 9, Appx B)
- Rubber Gloves
- Protective Goggles
- Rubber Apron
- Torque Wrench
- One Foot No. 4 AWG Wire or Equivalent

PROCEDURAL STEPS:

1. Disconnect battery and remove from aircraft if necessary.

2. Release snap fasteners and remove cover.

3. Use a multimeter to measure voltage across each cell. Normal readings should be 1.25 to 1.5 V dc per cell. Remove cells that are dead. For engine cranking loads, cell voltages as low as 0.6 V dc are acceptable. Also, remove any damaged, cracked, or extremely hot cells leaking or spewing electrolyte.

WARNING

Be extremely careful when removing or installing battery cells. Bodily injury and equipment damage may result if any metal tools or parts accidentally cause a short circuit.

4. To remove bad cells, use a 3/8 inch socket or equivalent to loosen and remove terminal screws. Remove washers and terminal links. To remove individual cells, screw terminal screws back into each cell terminal, grasp these screws with pliers and lift the cell straight up.

5. After removing bad cells, prepare jumper from 1 foot of No. 4 AWG and two terminal lugs. Remove 1/2 inch of insulation from one end of wire and crimp terminal lug on stripped end of wire. Measure and cut wire to needed length, strip 1/2 inch of insulation, and crimp terminal lug to other end of wire.

6. Install jumper across removed cells in place of terminal links. Cells are connected in series (positive to negative), Figure 11-40.

7. Torque terminal screws to between 35 and 50 inch-pounds. If torque wrench is not available, tighten firmly with wrench or pliers.

8. Replace cover and install battery in aircraft.

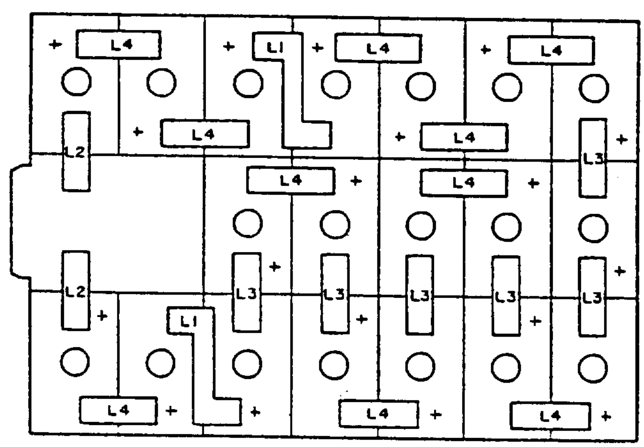


Figure 11-40. Battery, Storage BB-476/A, Cell Layout

11-24. DAMAGED OR DEFECTIVE POWER RELAYS.

GENERAL INFORMATION: A power relay is an electrically operated switch between the main bus and other electrical components in the aircraft. The relays are normally controlled by a switch in the cockpit. Damage incurred to power relays may be temporarily fixed by one of two options.

a. First option: Replace with good relay salvaged from non-flyable aircraft or a nonessential circuit.

b. Second option: Jumper across power terminal and bus bar terminal studs located on relay case. To check power relay for malfunction, locate terminals X1 and X2 on the relay. With a multimeter set on the 0-50 V dc scale, check the voltage from terminals Xl and X2 to the aircraft fuselage (ground), Figure 11-41. One of the two terminals should have 24-28 V dc on it when the power relay control circuit is energized. No dc voltage indicates damage to the control circuit wiring. Repair control circuit wiring. With 24-28 V dc applied to terminals X1 or X2 of the power relay, check the voltage between terminals A1, A2, and the aircraft fuselage (ground), Figure 11-41. The voltage on terminals A1 and A2 should be identical. If there is no voltage on either one of the two terminals A1 or A2 with the relay energized, the relay should be considered defective and replaced.

OPTION 1: Salvaged Power Relay Replacement.

NOTE

Identical part number (Figures 11-42) denotes interchangeability. If damage is extensive, salvaged relays may be difficult to attach to bulkheads.

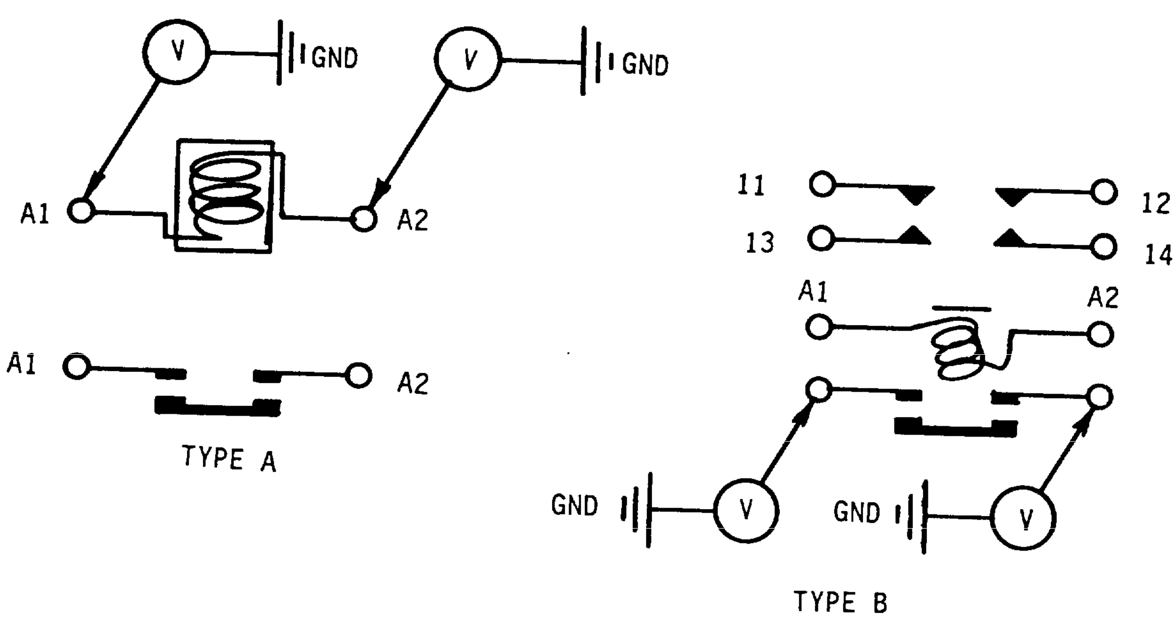


Figure 11-41. Block Diagram Power Relay, Check and Test

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED:
. Salvaged Power Relay

PROCEDURAL STEPS:

1. Obtain salvaged power relay.

2. Disconnect battery.

3. Remove damaged power relay as follows:

NOTE

Note the position of wires/bus bar and what terminals they are connected to.

a. Remove attaching hardware, wires, and bus bar.

b. Remove attachment bolt, and lift relay free from compartment.

4. Position salvaged power relay, and install mounting hardware.

5. Install wires and bus bar on correct terminals, and secure with hardware.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Creating a Jumper for Damaged Power Relays.

CAUTION

. Do not jumper battery relay on an aircraft.

. This procedure is to be used only for one time emergency evacuation and recovery of OH-58 A/C.

LIMITATIONS: Emergency repair. No control over jumpered power relays, circuit cannot be turned on or off.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 20 Minutes

MATERIALS/TOOLS REQUIRED:
. Appropriate Size Aircraft Type Wire
. Appropriate Size Terminal Lugs

PROCEDURAL STEPS:

1. Disconnect battery.

2. Figure 11-43, Type A and B, shows two typical power relay configurations with jumper. This may be used as an aid in performing steps 3 thru 7.

NOTE

Use wire with the same gage or larger than the one being replaced.

3. Prepare a jumper wire, Figure 11-44. (A 1/2 to 1 foot length of appropriate size aircraft wire with appropriate size terminal lugs crimped on each end.)

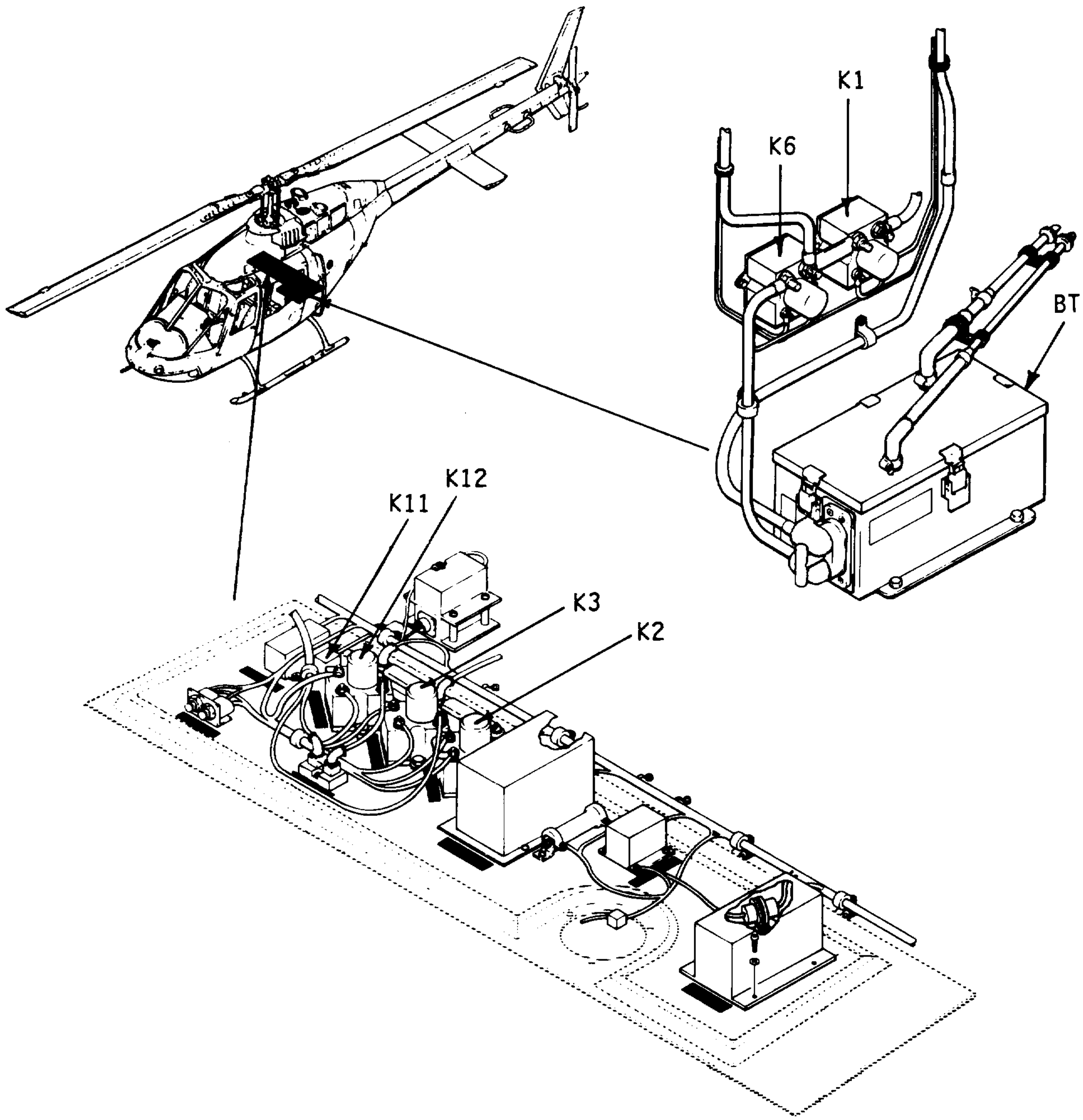
4. Locate terminals marked A1 and A2 on power relay. Power relay terminals should be marked on case of relay. If markings are illegible, A1 and A2 terminals will be the ones with the largest diameter terminal studs.

5. Remove hardware from terminals A1 and A2.

6. Install jumper from terminal A1 to terminal A2. Reference Figure 11-45, Type A and B.

7. Install hardware on terminals A1 and A2. Tighten hardware to hold jumper in place.

8. Remove jumper as soon as emergency evacuation flight is completed.



DRAWING DESIGNATION	PART NUMBER	FUNCTION
K6	MS24183D1	Relay, BATTERY
K1	MS24183D1	Relay, External Pwr
K11	3S2791G200F-9	Relay, Gen Fail
K12	MS24183D1	Relay, Line Cont
K3	MS24183D1	Relay, Non-Ess Bus
BT1	BB-4761A	Battery

Figure 11-42. Location of Power Relays

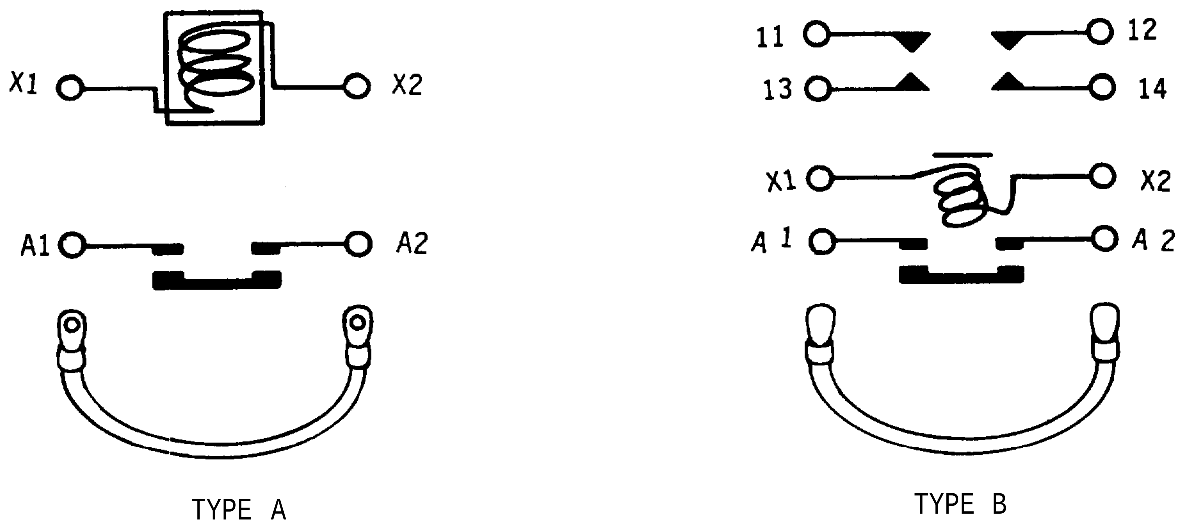


Figure 11-43. Block Diagram, Typical Power Relays

Figure 11-44. Jumper Wire Fabrication

9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-25. SUBSTITUTE EMERGENCY ANTENNA, FIELD EXPEDIENT. This section contains expedient repair procedures to restore radio communication needed to complete the mission.

GENERAL INFORMATION: These procedures give instructions for use of substitute and/or construction of replacement antennas that can be used to transmit and receive radio messages.

WARNING

Do not touch bare wires on expedient antennas with the radio keyed. You could get burned and/or shocked.

OPTION 1: Use of Substitute Antennas.

LIMITATIONS: Some loss of antenna gain and radio transmitter power.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 Minutes

MATERIALS/TOOLS REQUIRED: None

PROCEDURAL STEPS:

1. Be sure that FM No. 1 (1 AN/ARC-114) circuit breaker and BAT switches on the overhead console are off.

2. Remove vent screen from left side of horizontal console to obtain access to No. 1 FM radio connectors.

CAUTION

Do not pull on cables when disconnecting cable connectors. Be careful to avoid any unnecessary strain on the cables.

NOTE

If No. 2 FM radio and secure-voice control indicator are not installed, blank panels may be removed to obtain additional access to connectors.

3. Disconnect cable connectors from J1, J2, J3, and J4.

4. With a screwdriver, turn the six fasteners that secure the unit to the mounting panel one-quarter turn counterclockwise.

5. Slide the No. 1 FM radio out of the mounting panel.

6. Locate coax cable (2 ARC 114-101A) stored in console and use it to replace coax cable (1 ARC 114-101A). Connect it to J2.

NOTE

Both left and right-hand homing antennas may also be used as emergency transmitting antennas by using either coax cable (1 ARC 114-102A) or (1 ARC 114-103A) connected to J2.

7. To replace No. 1 FM radio, be sure that FM 1 circuit breaker and BAT switches on the overhead console are off.

8. Slide the No. 1 FM radio into the mounting panel and turn the six fasteners one-quarter turn clockwise to secure the unit.

9. Connect the coax cables to the rear of the No. 1 FM radio.

10. Attach vent screen to left side of horizontal console.

NOTE

The above procedures apply to the No. 1 FM radio and to the No. 2 FM radio when it is installed, except that J3 and J4 are not used on the second radio.

OPTION 2: Construction of Replacement Antenna.

LIMITATIONS: Some loss of antenna gain and radio transmitter power.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- Cable, Coax RG-58U or Other Available Coax
- Tape, Electrical (item 46, Appx C) or Equivalent
- Resistor, Carbon, 1 Watt 52 Ω ±5 percent.

PROCEDURAL STEPS:

1. Determine length of wire needed for the radiating element by using Figure 11-45. Example:

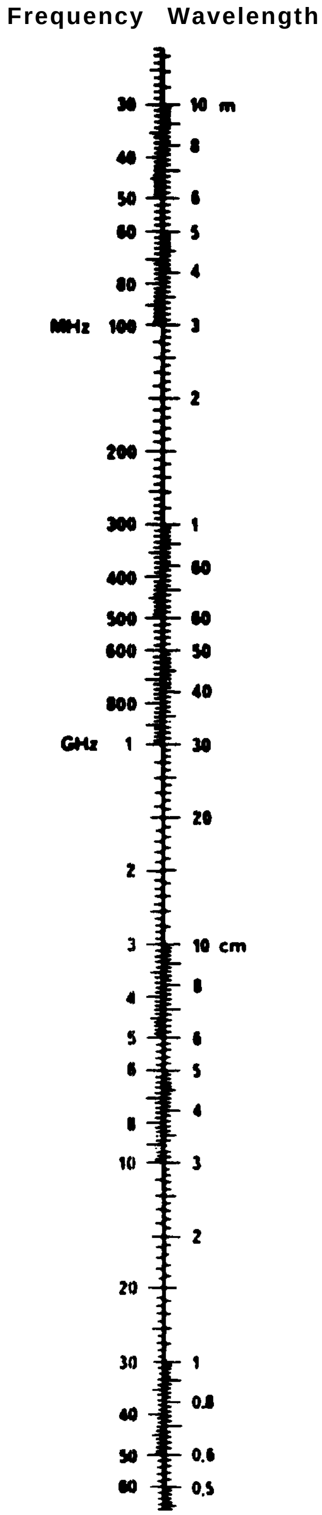


Figure 11-45. Frequency vs. Wave Length

TO CHANGE		MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280

- FM radio with frequency range of 30 to 69.95 MHZ.
- Center of frequency range is 50 MHZ.
- Using Figure 11-45, look under frequency column for 50 MHZ on the wave length side of the Table, 6 M is shown.
- Use Figure 11-45 to convert meters to feet. Six meters multiplied by 3.280 = 19.68 feet for one wave length.
- Divide the one wave length by 8, for a 1/8 wave length antenna, $\frac{19.68}{8}$ = 2.46 feet. Multiply the 1/8 wave length by a .95 correction factor: 2.46 ft. X .95 = 2.34 feet. This is the length of the radiating element.

2. Cut the coax cable to the length of the required radiating element. Remove the outer insulation and shield from the piece of coax cable and then strip a 1 inch piece of insulation from each end exposing the center conductor, Figure 11-46A.

3. Wrap and solder the 52 Ω resistor to one end of the radiating element as per Figure 11-46B. This completes the fabrication of the radiating element of the antenna.

4. Next, remove the structural panel on the right-hand side just forward of the tail boom, Figure 11-47, by removing twenty-seven screws.

5. At the tail boom quick disconnect, locate coax cable marked 1 ARC 114-101B and disconnect it. Remove the coax connector and prepare a 4 inch pigtail termination on the end of the coax cable as shown in Figure 11-46C.

6. Stick the radiating element of the antenna from step three with the resistor end down into the drain hole in the bottom of the tail boom where it joins the fuselage, Figure 11-47.

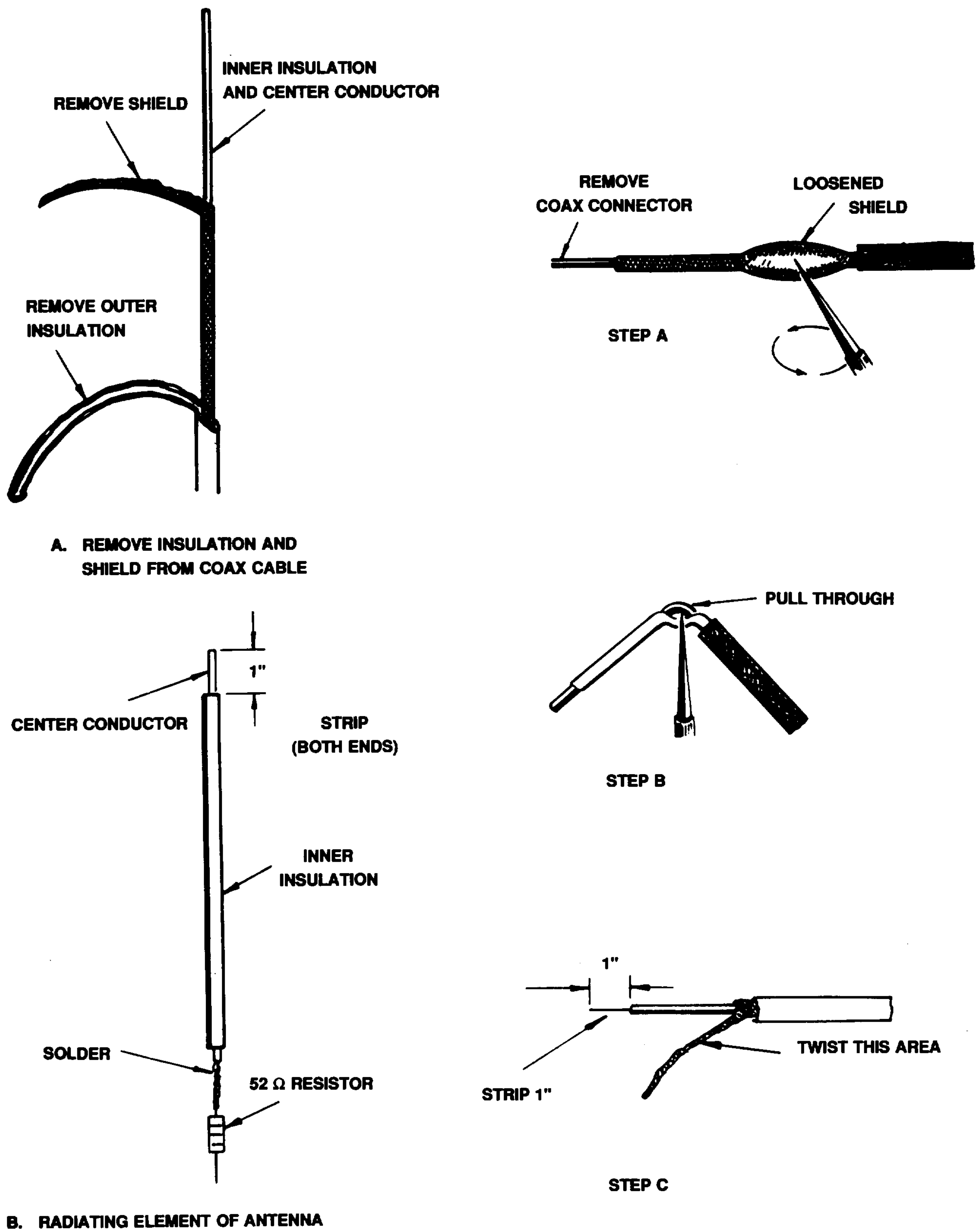


Figure 11-45. Preparation of Coax

7. Twist the center conductor from the radiating element of the antenna to the center conductor of the coax. Make a good mechanical joint and insulate with tape.

8. Ground the pigtail from the coax antenna by wrapping and twisting it around the plug where the coax was disconnected.

9. Secure with tape to hold the antenna and coax in place inside the tail boom. Replace the structural panel and secure with screws.

NOTE

Antenna must be at right angle (90°) to aircraft skin to radiate R.F. energy. Do not tape antenna to skin of aircraft.

10. Using tape, tape a one to two ounce weight below the 52 Ω resistor as shown in Figure 11-47.

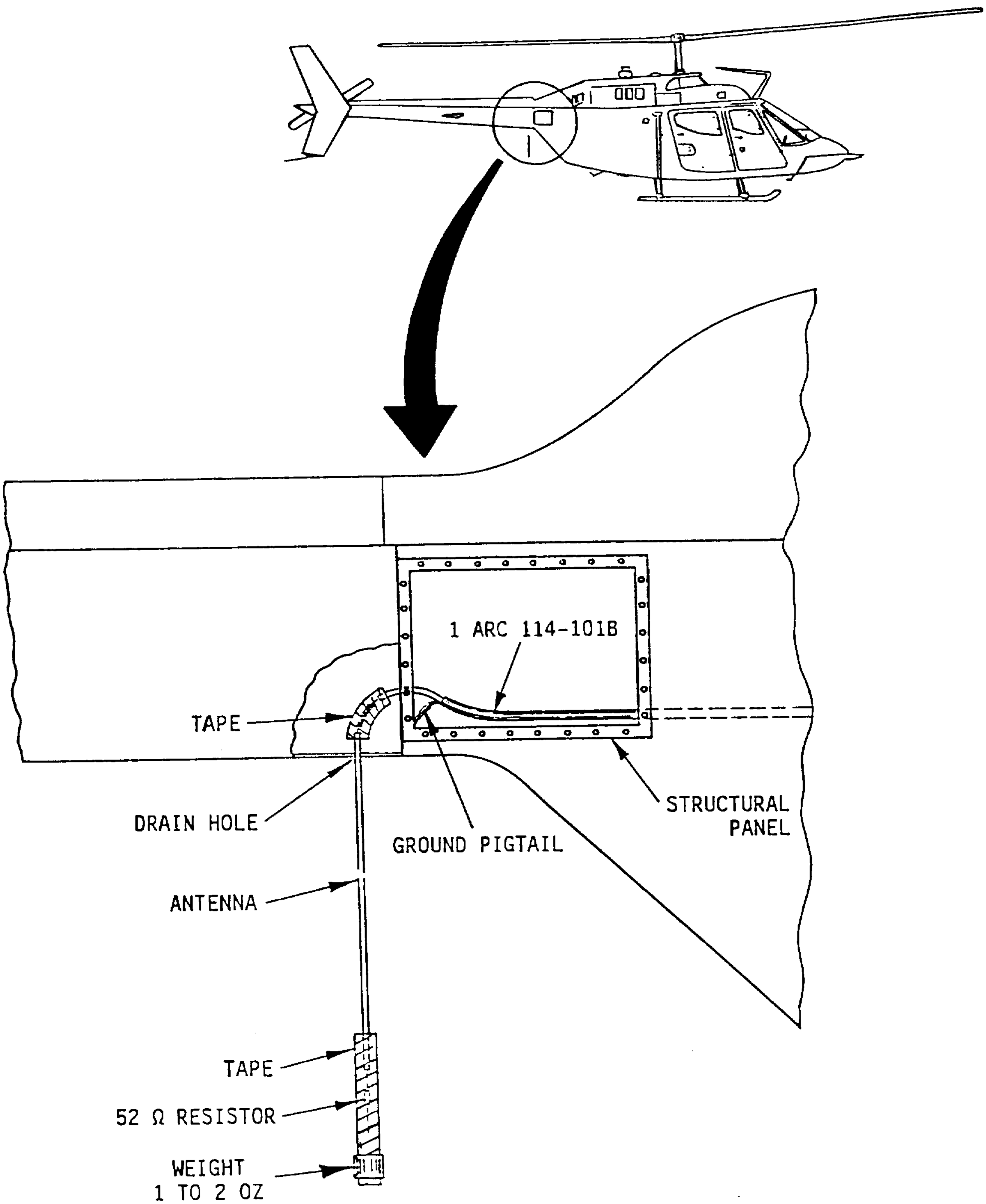


Figure 11-47. Installation of Field Expedient Antenna

CHAPTER 12

FUEL SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

12-1. GENERAL.

a. The fuel supply system, Figure 12-1, consists of a crashworthy bladder type, self-sealing cell. The fuel cell is designed to fit under the passenger seat, in the floor cavity of the fuselage. The system's fuel flow lines are self-sealing. The rigid lines are used for fuel flow or as vent lines. The fuel boost pump is the cartridge type which can be replaced without defueling.

b. The fuel tank will self-seal when damaged by small arms projectiles up to 50 caliber. Damage to the tank and the fuel system must be evaluated very carefully to determine damage which requires immediate repair and that which does not constitute a flight hazard.

12-2. ASSESSMENT PROCEDURES. Refer to Table 12-1.

12-3. REPAIR PROCEDURE INDEX.

	PARA.
Hose and Line Replacement. . .	9-7
O-Ring Damage.	9-10
Fuel Substitution.	12-6
Fuel Cell Repair	12-7

Section II. LINES AND HOSES

12-4. GENERAL.

a. Replacement lines and hoses need not be routed along the path of the original installation. They may be routed along any convenient path as long as they do not interfere with personnel or with operating equipment. Long lines and hoses should be clamped to hard supports at convenient intervals not exceeding 24 inches.

b. Tubing in the OH-58 fuel system is limited to the fuel vent line. When damage occurs to any of the lines (tubes or hoses), they may be substituted with a flexible type hose from the kit.

c. If hose assemblies from the kit are not available, damage may be cut out and replaced with a small section (refer to repair procedures), or a replacement hose may be manufactured if a long enough hose section and MS fittings are available (refer to repair procedures).

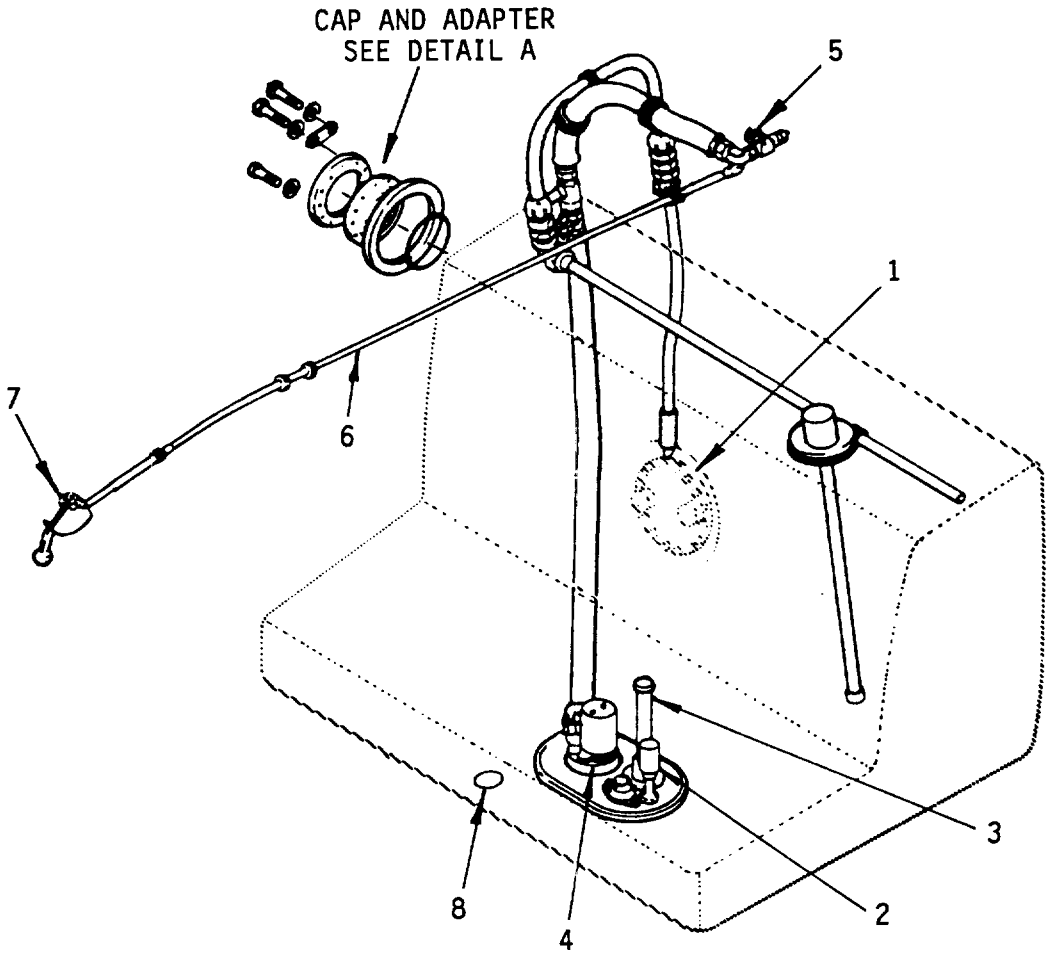
d. Never discard MS fittings, they are reusable. The MS21922 sleeve is not reusable.

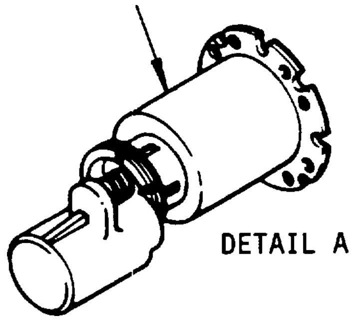
12-5. O-RING DAMAGE. Refer to Chapter 9, paragraph 9-10. The same criteria that applies to hydraulic o-rings also applies to o-rings in the fuel system.

12-6. FUEL SUBSTITUTIONS.

a. If the standard fuel is not available, a substitute fuel must be used. Check Appendix D for a compatible fuel.

b. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.





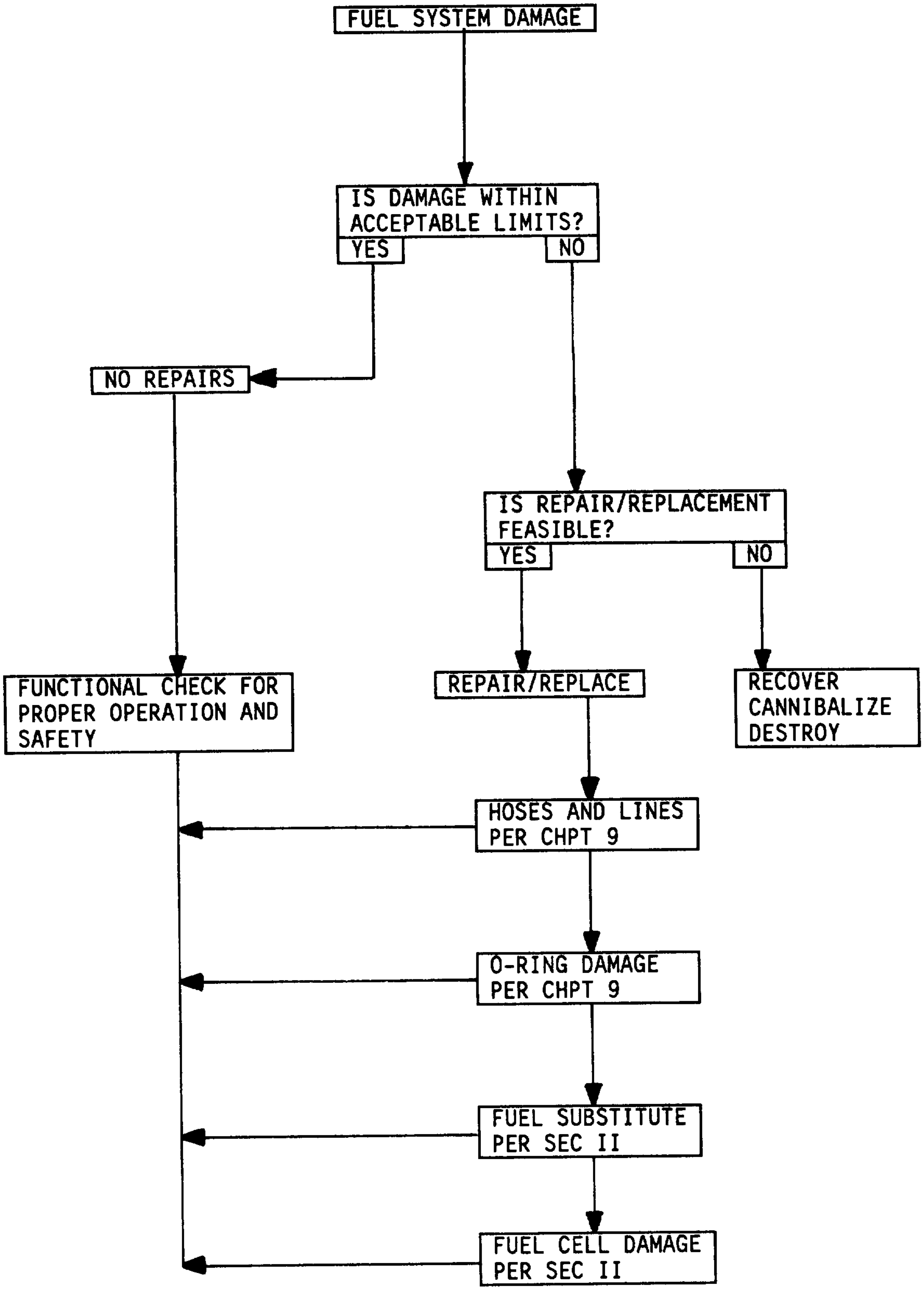
1. Cover Assembly
2. Low Level Switch
3. Lower Transmitter
4. Fuel Pump
5. Fuel Shut-Off Valve
6. Fuel Shut-Off Cable
7. Fuel Shut-Off Lever
8. Auxiliary Fuel
   Cell Fitting

NOTE

RECEIVER REPLACES CAP AND ADAPTER ON HELICOPTERS EQUIPPED WITH CLOSED CIRCUIT REFUELING PROVISIONS.

Figure 12-1. OH-58 Fuel System

Table 12-1. Fuel System Assessment Procedures



Section III. FUEL CELL DAMAGE

12-7. FUEL CELL DAMAGE.

GENERAL INFORMATION: The fuel cells restrict the catastrophic loss of fuel in survivable crashes. The repairs specified in this section, however, will not necessarily return the cells to their original crash resistant level. Fuel cell damage can be categorized as follows:

a. Nonrepairable:

(1) Damage to metal plate of fittings on tank which causes leakage.

(2) Damage to tank wall which exceeds 3 inches.

(3) Damage within 2 inches of metal fitting.

b. One-Time or Emergency Flight Capability Repair:

Mechanical Clamp Repair (option 1).

c. 100 Flight Hour Capability Repair:

(1) Adhesive repair (option 2).

(2) Flat panel repair, one plane (option 3).

(3) Two plane repair (option 4).

(4) Three plane repair (option 5).

OPTION 1: Mechanical Clamp Repair.

LIMITATIONS: Emergency flight repair.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 30 minutes

MATERIALS/TOOLS REQUIRED:
. Mechanical Repair Sealing Clamp (3 or 5 inch)
. Knife

PROCEDURAL STEPS:

1. Defuel the fuel cell by the following procedure:

a. Remove the fuel drain cover panel.

b. Push or twist drain valve located under aircraft where fuel pump is located.

c. Place a bucket or any type receptacle under the aircraft to catch the fuel.

2. Locate the damage (e.g., hole or tear) on the cell.

NOTE

For holes less than 2 inches across, use the 3 inch clamp. For holes greater than 2 inches across but less than 3 inches across, use the 5 inch clamp. Holes larger than 3 inches are nonrepairable.

3. Use the knife to enlarge the hole to 3/4 inch to 2 inches maximum for a 3 inch clamp and 1 inch to 3 inch maximum for the 5 inch clamp.

4. Insert the bottom plate of the clamp through the hole and pull up using the cord. Position the plate so the hole is entirely within the gasket area. Slip the top plate over the threaded stud and hand tighten the wing nut, Figure 12-2.

CAUTION

Excessive mechanical tightening of the wing nut can result in failure of the clamp. The wing nut shall be finger tightened, and the maximum torque on the wing nut shall not exceed 10 to 12 inch-pounds.

5. Tighten drain valve and install cover plate.

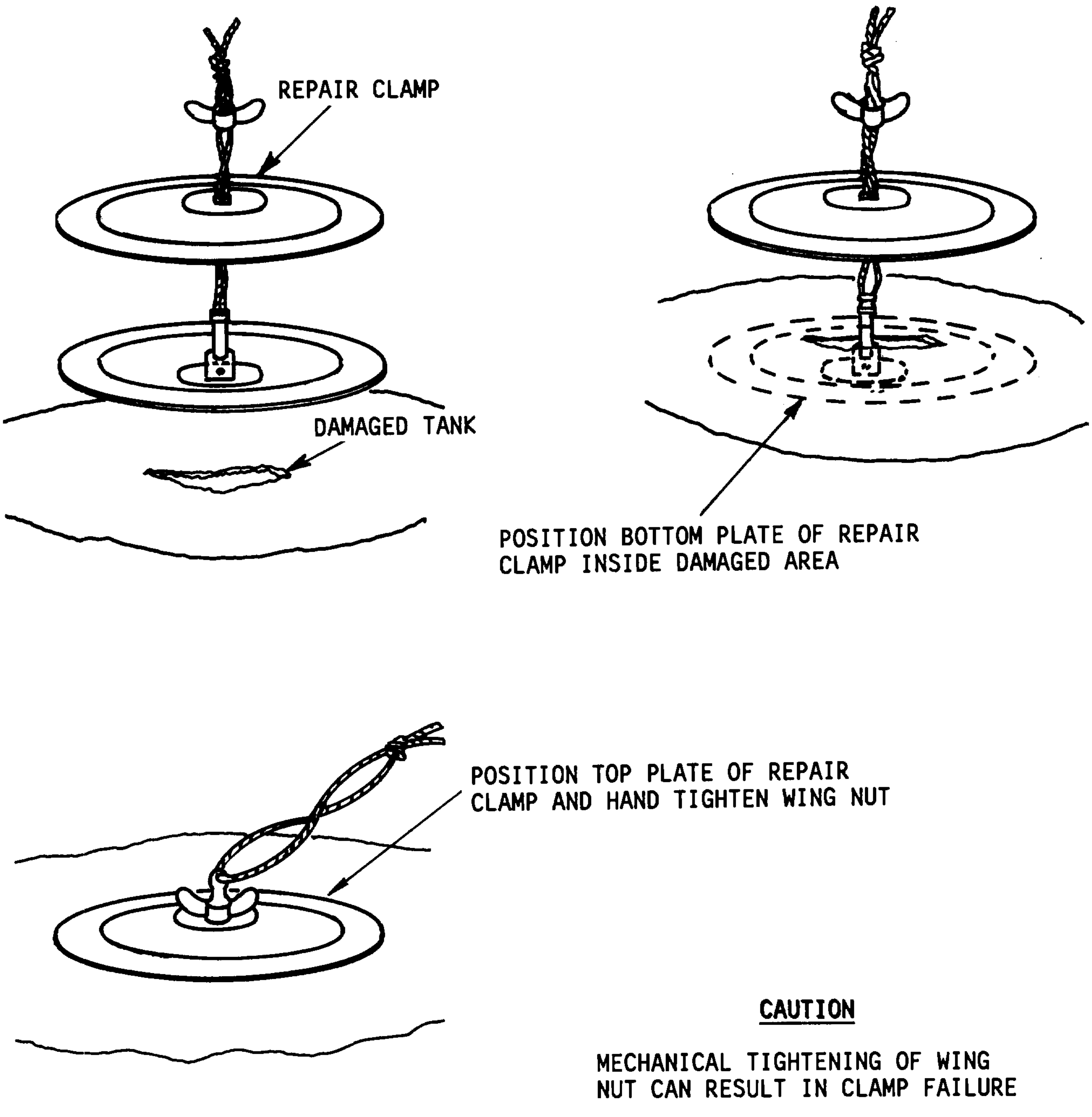


Figure 12-2. Emergency Mechanical Clamp Repair

6. Refuel the aircraft.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Adhesive Repair.

LIMITATIONS: Temporary repair, 100 flight hour capability. Inspect after every flight.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 3 Hours

MATERIALS/TOOLS REQUIRED:
. Knife
. Solvent, 1-1-1 Trichloroethane or Equivalent (item 59, Appx C)
. Repair Fabric
. Abrasive Cloth (item 1, Appx C)
. Adhesive (item 3, Appx C)
. Plastic Container/Cup
. Wooden Tongue Depressor (item 60, Appx C)

PROCEDURAL STEPS:

1. Defuel the aircraft. Refer to option 1, step 1.

2. Once step 1 (above) has been completed, locate the damage. Trim only the outer exposed damage area to provide a reasonably smooth exterior surface. DO NOT ENLARGE HOLE.

3. Abrade and solvent wash the area surrounding the damage. Clean at least 4 inches beyond the damage.

4. Cut a fabric patch to overlap the damaged area by a minimum of 1 inch all the way around. Soak the patch in solvent. (NOTE: No hole is required in the center of the patch.)

5. Mix the adhesive as described below in steps 5a thru 5h, refer to Figure 12-3.

CAUTION

Wear goggles or other eye protection during all operations.

a. Remove the tape band from Semkit cartridge and pull the mixing rod straight up toward the top of the cartridge.

b. Squeeze cartridge slightly in area of the removed tape band to deform foil barrier.

c. To mix dry filler to base compound, push mixing rod to bottom of cartridge and begin stroking in spiral clockwise motion from top to bottom of cartridge, rotating mixing rod approximately 90° with each stroke. Mix for the total number of strokes indicated on the instruction card accompanying each Semkit (40 strokes). A stroke is one complete in and out cycle. On last stroke, mixing rod should be fully extended.

d. Pull mixing rod out approximately one-third of way.

e. Insert ram rod into hole in top of mixing rod and inject about one-third of curing agent into the cartridge.

CAUTION

Use firm but even pressure. Do not force, tap, or jolt ram rod.

f. Repeat steps a and b until all of the contents of the rod are emptied into the cartridge.

g. Mix curing agent into cartridge by repeating step c.

h. Grasp cartridge firmly at neck and unscrew mixing rod by turning counterclockwise approximately three turns. Remove mixing rod and discard.

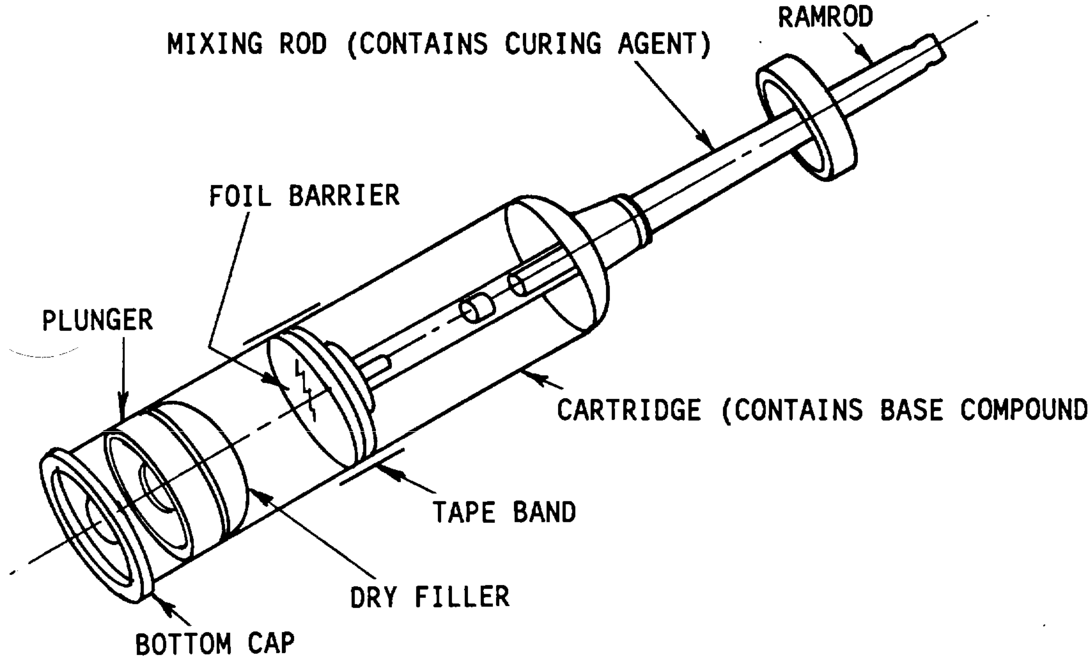


Figure 12-3. Mixing Instruction for Sealant Cartridges

6. Apply adhesive to the wound opening for a least 1-1/2 inches around the damaged area or enough to accept the patch cut in step 4 (above).

7. Apply and smooth out in the applied adhesive a solvent soaked fabric patch to the damaged area. Apply adhesive if required to seal the patch to the tank, and smooth out the surface.

CAUTION

The patch will tend to slip when applying additional adhesive and smoothing. Be sure to recenter the patch.

8. Maintain the patch position until the adhesive sufficiently sets (approx. 30 min). (NOTE: Allow the adhesive to cure for two hours before refueling.)

9. Tighten drain valve and install cover plate.

10. Refuel the aircraft.

11. Record BDAR action taken. When . mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Flat Panel Repair (One Plane).

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
. 1 Soldier
. 3 Hours

MATERIALS/TOOLS REQUIRED:
. Knife or Scissors
. Solvent, 1-1-1 Trichloroethane or Equivalent (item 59, Appx C)
. Abrasive Cloth (item 1, Appx C)
. Repair Fabric
. Adhesive (item 3. Appx C)
. Plastic Cup or Other Small Container
. Rubber Plug Kit

PROCEDURAL STEPS:

1. Defuel the aircraft. Refer to option 1, step 1.

2. Once step 1 of this section has been completed, locate the damage; enlarge the wound in the tank to no more than 3 inches in diameter by using a knife or scissors. Remove all frayed fabric and damaged inner lines.

3. Abrade the inner lines or inner surface at least 1/2 inch beyond the enlarged hole, preferably more if conditions permit. Abrade the outer surface to a minimum of 4 inches from the enlarged area. (NOTE: If the fraying fibers are too numerous, trim the fiber with scissors.)

4. Clean the abraded areas using towels soaked in solvent.

5. Cut a fabric patch 4 inches in diameter or large enough to extend at least 1 inch beyond the damaged area and add a 1/2 inch hole in the center. Soak the patch in solvent.

6. Mix the adhesive per option 2 instructions, step 5, and extrude into a plastic cup. (NOTE: Adhesive can be used between 20° through -120°, but must be warmed to room temperature prior to mixing and be mixed at room temperature. Pot life of adhesive is approximately 25 minutes at 70°F.)

7. Apply adhesive to inner liner using finger to swab cement around the wound. Apply adhesive to concave surface of the rubber plug (this is the surface the cord is attached to). Refer to Figure 12-4 for rubber plug assembly.

NOTE

Use adhesive as required, retain some for finishing the outside of the cell repair.

8. Fold the rubber plug and insert it through the hole in the cell. (NOTE: Retain cord to prevent loss of plug in the cell.)

9. Pull the plug into position and rotate it in position to smooth out the adhesive interface. Center the plug on the wound.

10. Apply a layer of adhesive 4 inches in diameter around the wound on the outside and fill in the wound with adhesive. (NOTE: There must be a minimum of a 1/2 inch bond.)

11. Apply the solvent soaked fabric patch to the outside surface by passing the cord through the hole in the patch and position the patch over the wound. Smooth the patch into the adhesive.

12. Pull the cord and tape to the structure keeping a slight tension.

13. Do not disturb the repair for a minimum of 30 minutes, and let cure two hours before refueling. Cut the string and plug stem without disturbing the repair.

14. Tighten drain valve and install cover plate.

15. Refuel the aircraft.

16. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4. Two Plane Repair. Damage to a two plane area will be repaired in the same manner described in option 3, except the hole should not be enlarged to more than 1/2 X 2-1/2 inches.

OPTION 5. Three Plane Repair. Damage to a three plane area will be repaired in the same manner as described in option 3, except the hole should not be enlarged to more than 1/2 X 2-1/2 inches and the rubber plug will be cut as shown in Figure 12-5. This will allow the plug to assume the contour of the tank when pulled into place.

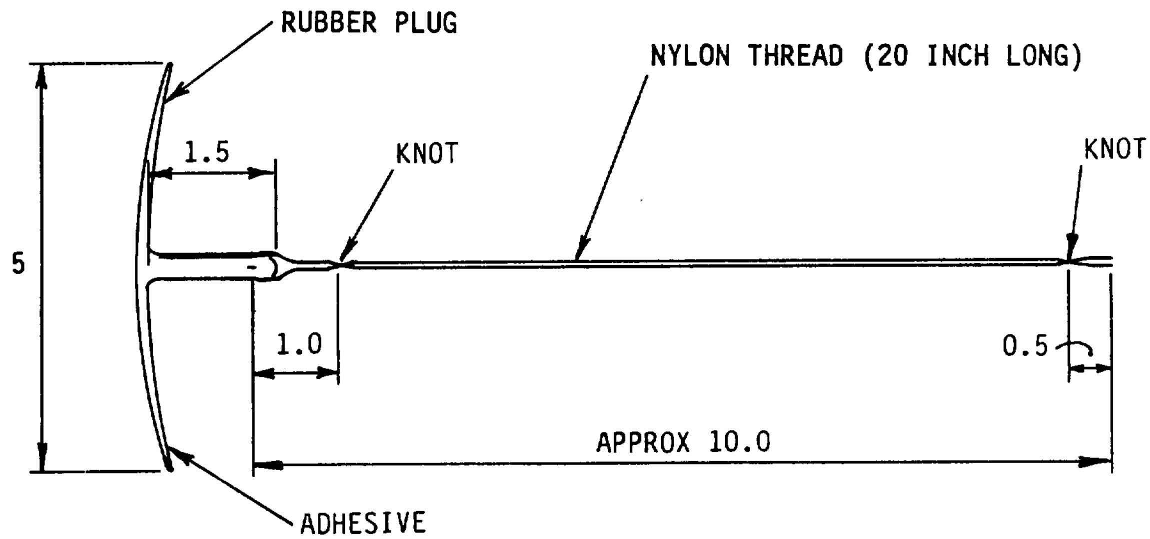


Figure 12-4. Rubber Repair Plug Assembly

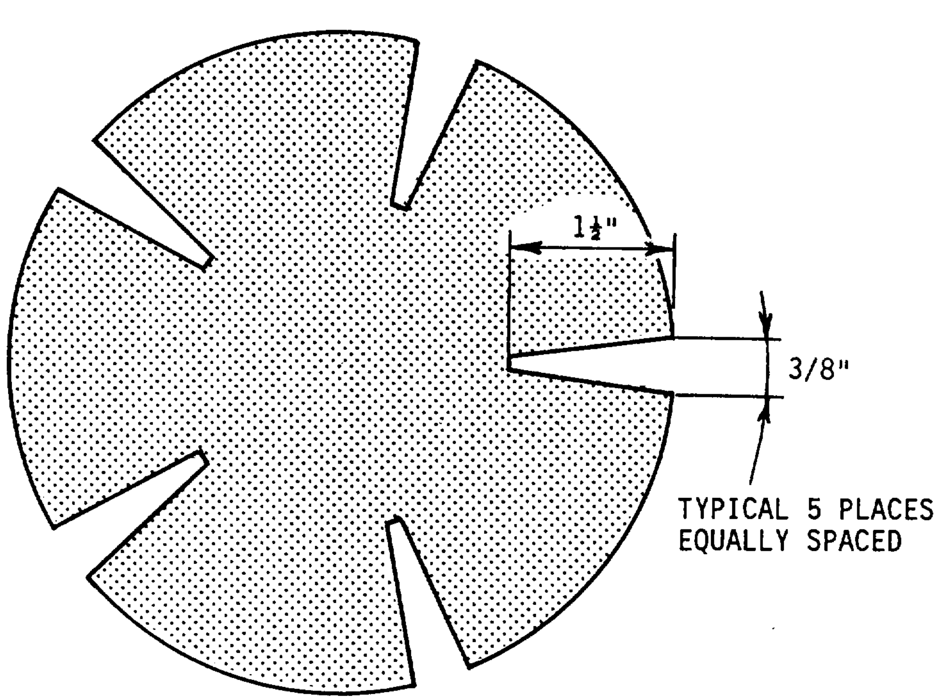


Figure 12-5. Plug Modification for Three Plane Repair

CHAPTER 13

FLIGHT CONTROLS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

13-1. GENERAL.

a. The flight control system is made up of the main rotor collective controls, cyclic controls, and the tail rotor controls. The tail rotor pedals are connected to the tail rotor assembly.

b. This chapter contains some BDAR procedures which may be used to accomplish repairs to the flight control tubes. Flight control tubes connect the copilot's and pilot's cyclic, collective, and tail rotor controls to the aft flight control components. Refer to Figure 13-1 for a schematic of the system.

13-2. ASSESSMENT PROCEDURES. Refer to Table 13-1.

13-3. REPAIR PROCEDURE INDEX.

Section II. TUBES, FLIGHT CONTROL

13-4. SUBSYSTEMS AND ASSEMBLIES. There are various subsystems and assemblies within the flight control system that are vital for combat aircraft maneuverability and control but are not necessarily essential for basic flight capabilities. Refer to Table 13-1 for assessment procedures.

a. Force Trim System. If the force trim system is malfunctioning, the aircraft is still fully mission capable with no limitations presented.

b. Control Rods.

(1) Copilot to Pilot. If any control rods, bell-cranks, or linkages connecting the copilot controls to the pilot controls break or otherwise become inoperable, the pilot may assume full control for the particular function which has been damaged, provided that the damaged part does not become jammed in the surrounding aircraft structure. Once the aircraft is on the ground, if no replacement parts are available, the control tube may be splice-repaired (refer to paragraph 13-4) or removed to avoid any possibility of the control tube getting jammed. If the tube is removed, the pilot assumes full control of the function that has been lost to the copilot.

(2) If any flight control systems, including control rods, bell-cranks, linkages, hydraulic cylinders, etc., which lie between the pilot and the main rotor blade or tail rotor blade sustain damage during flight, the aircraft will be uncontrollable and forced to crash land.

13-5. TUBES, FLIGHT CONTROL.

GENERAL INFORMATION: The following repair procedures may be used to accomplish repairs to flight control tubes. Flight control tubes connect the

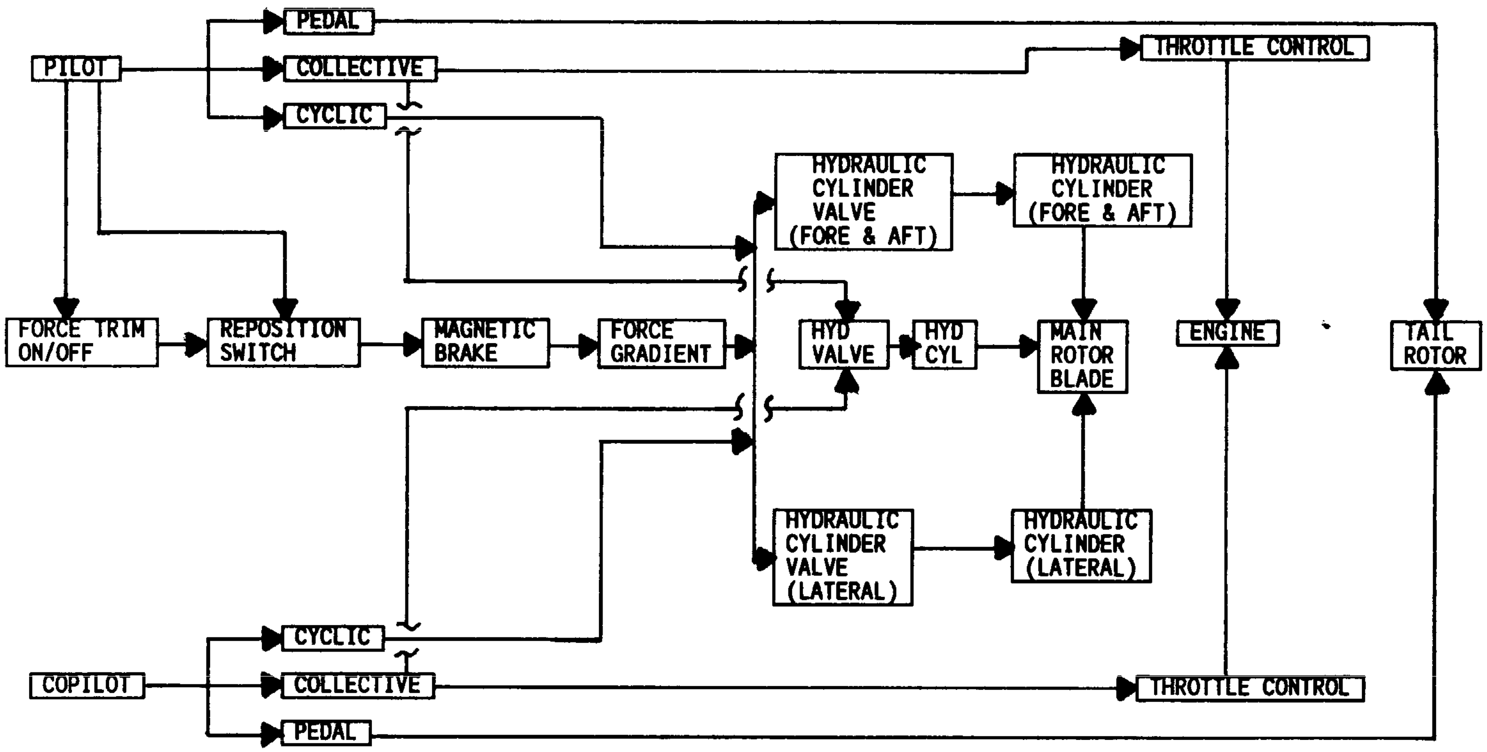
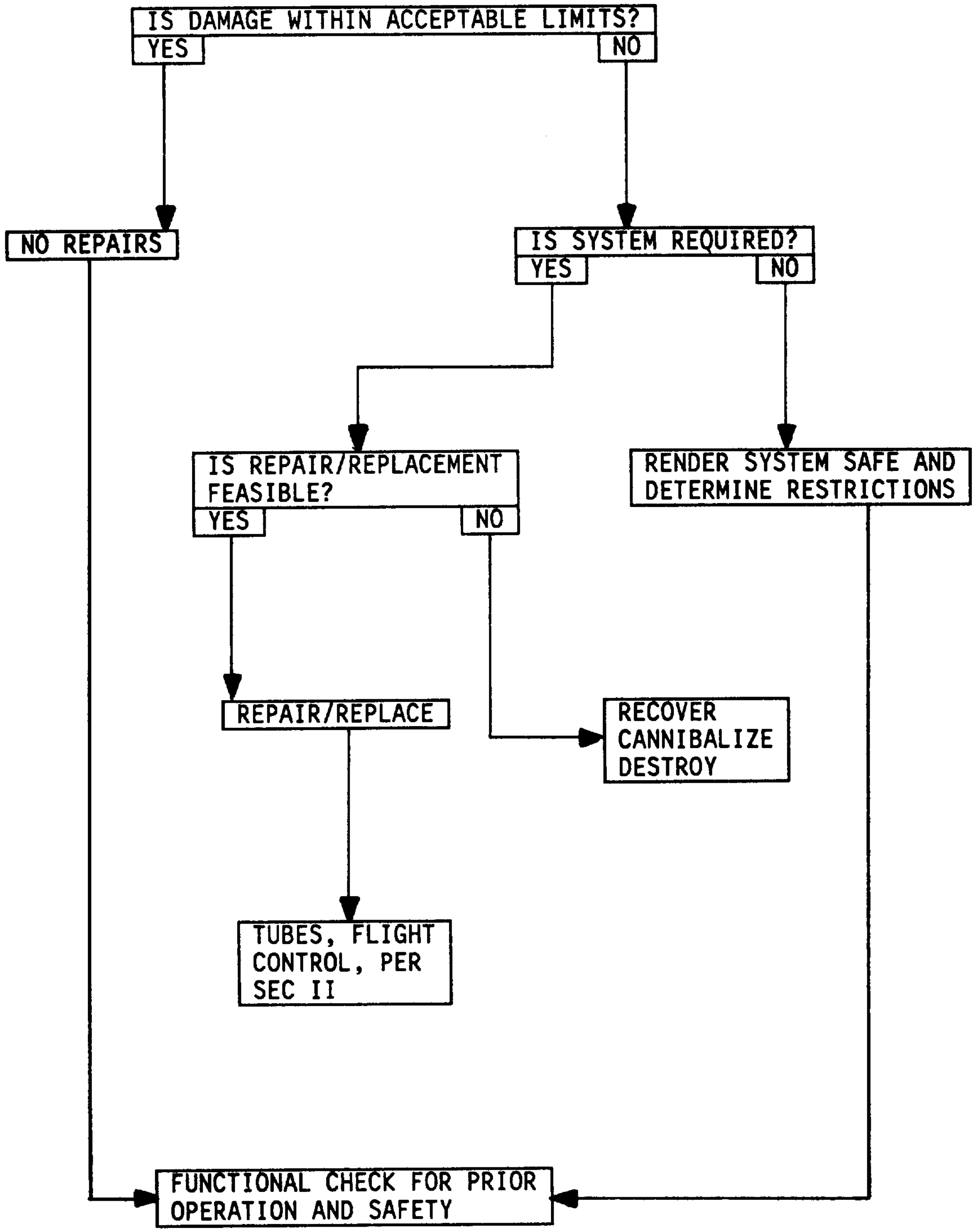


Figure 13-1. OH-58 Flight Controls Schematic

Table 13-1. Flight Control System Assessment Procedures



copilot's and pilot's cyclic, collective, and tail rotor controls to the aft flight control components. See Figure 13-1 for a schematic of the system, and refer to Figures 13-2 thru 13-5 for a complete detail on each individual system and Figure 13-6, Table 13-2, for dimensions of tubes. Make all necessary repairs on all flight control tubes using one of the two options provided in this section. Insure that splice repairs, option 1, do not cause any interference at bulkhead lighting holes or adjacent components.

OPTION 1: Splicing, Tubes, Flight Control.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Metal Sleeve
- Angle Stock
- Bolts

PROCEDURAL STEPS:

1. Put aircraft flight control system into neutral rig.

2. Disconnect and remove damaged control tube from aircraft.

3. Trim damaged area.

4. Using Table 13-2 and Figures 13-2 thru 13-5, select a metal splice, either inner or outer whichever is more suitable, and drill at least two bolt/rivet holes on each end of the tube. Refer to Table 13-3 for bolt/drill sizes to use on different size tubes. Holes should go through the splicer and the damaged tube, and should be positioned in a cross pattern, Figure 13-7. Make sure that the original center to center, length b, Figure 13-6, is maintained.

5. Reinstall tube after repair is accomplished, and check for binding or interference by manually moving the appropriate controls: cyclic, collective, or pedals.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Fabricating, Tubes, Flight Control.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 3 Hours

MATERIALS/TOOLS REQUIRED:
- Tube Stock (about same dia. as original tube, 0.032 in. min. wall thickness)
- Drill and Bit

PROCEDURAL STEPS:

1. Put aircraft flight control system into neutral rig.

2. Remove damaged flight control tube, Figure 13-8.

3. On the end that fits into the clevis bolt, mash the tube so that it fits into the arms of the clevis. A small amount of clearance between the clevis arms should be allowed, Figure 13-9. Round off the end of the mashed tube, Figure 13-10. Drill a hole through the tube and install the bolt.

4. On the end where the clevis bolt would normally fit, mash the tube only enough to fit over the bearing assembly with some clearance. Round off the end of the tube, Figure 13-11.

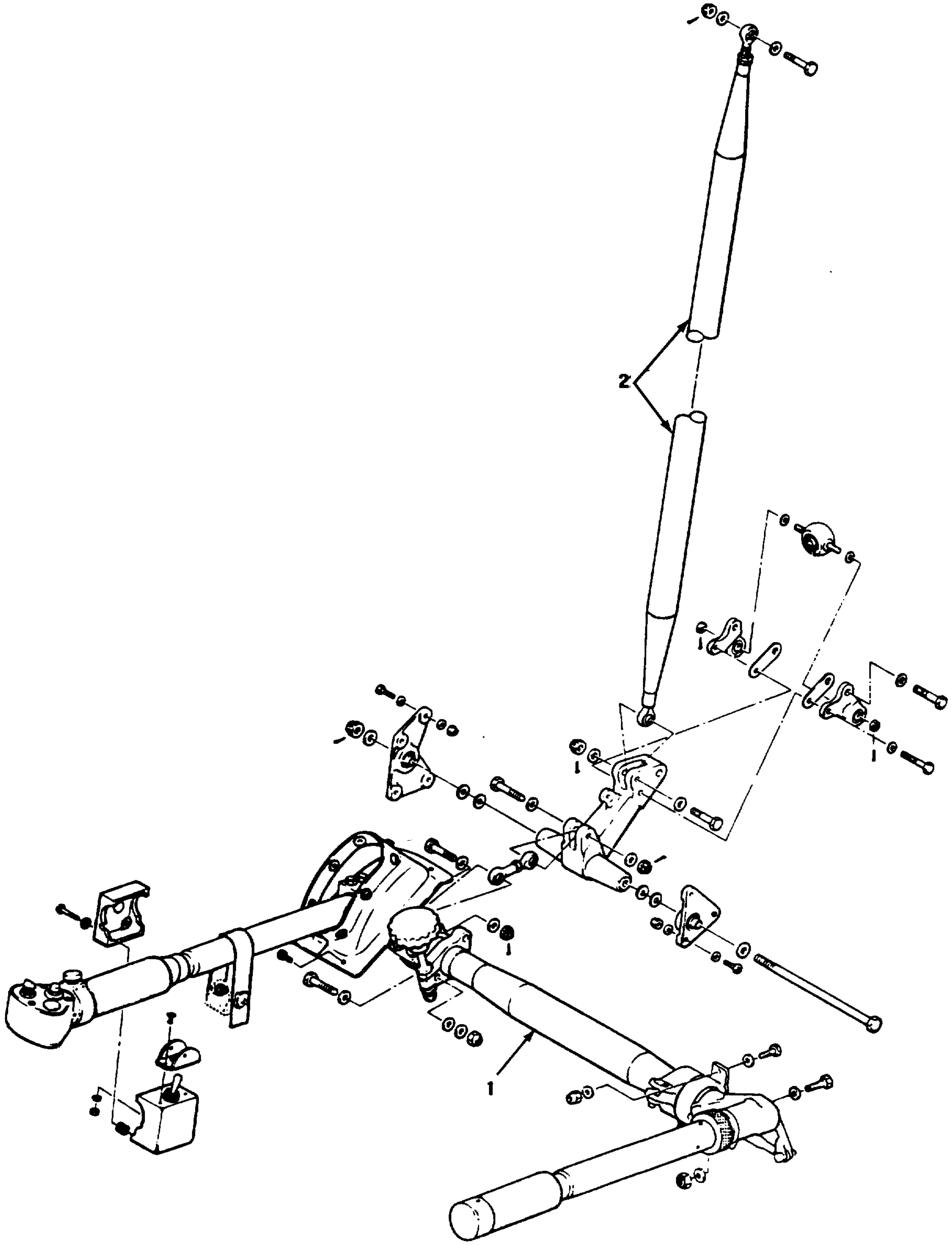


Figure 13-2. Collective Flight Control

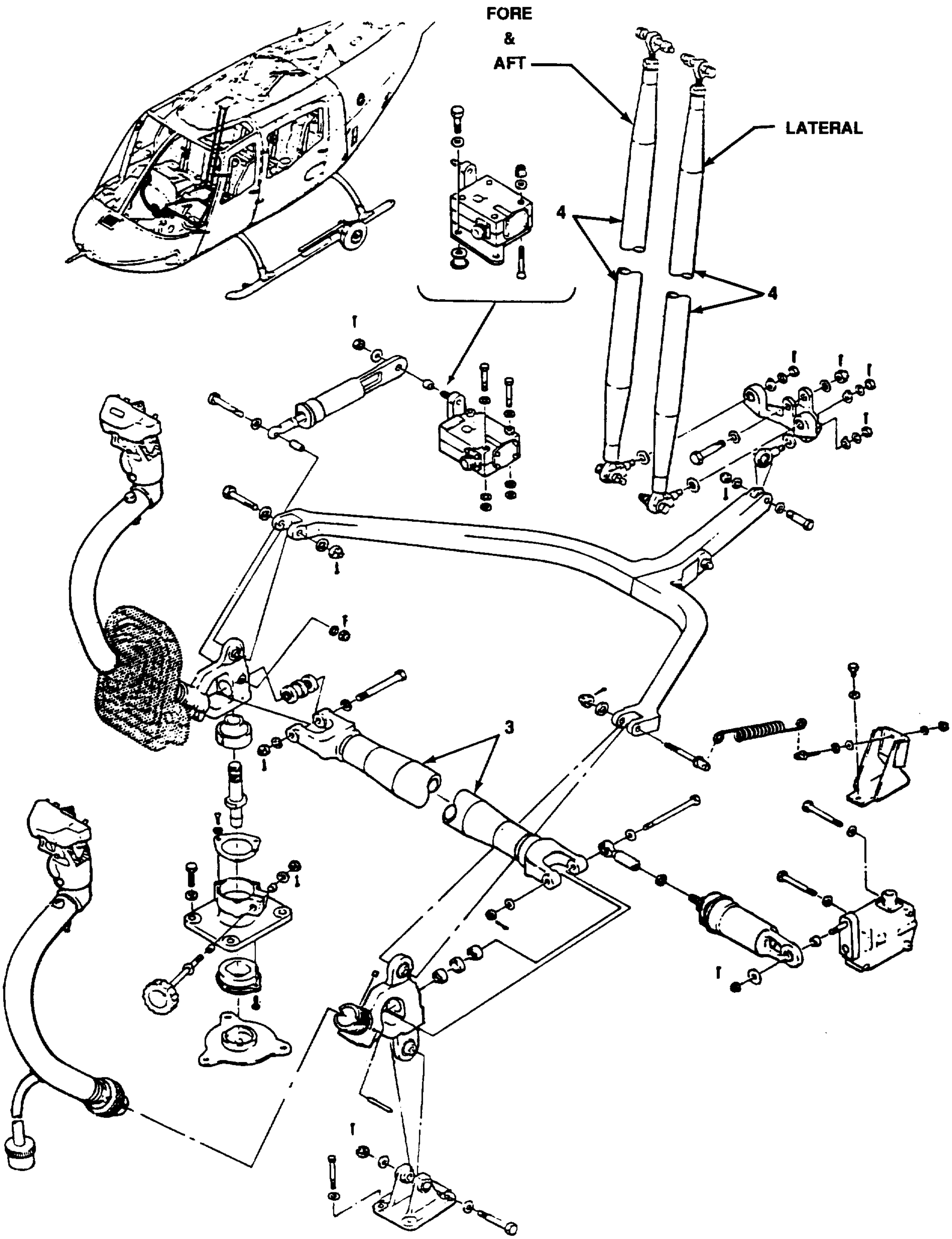


Figure 13-3. Cyclic Flight Control

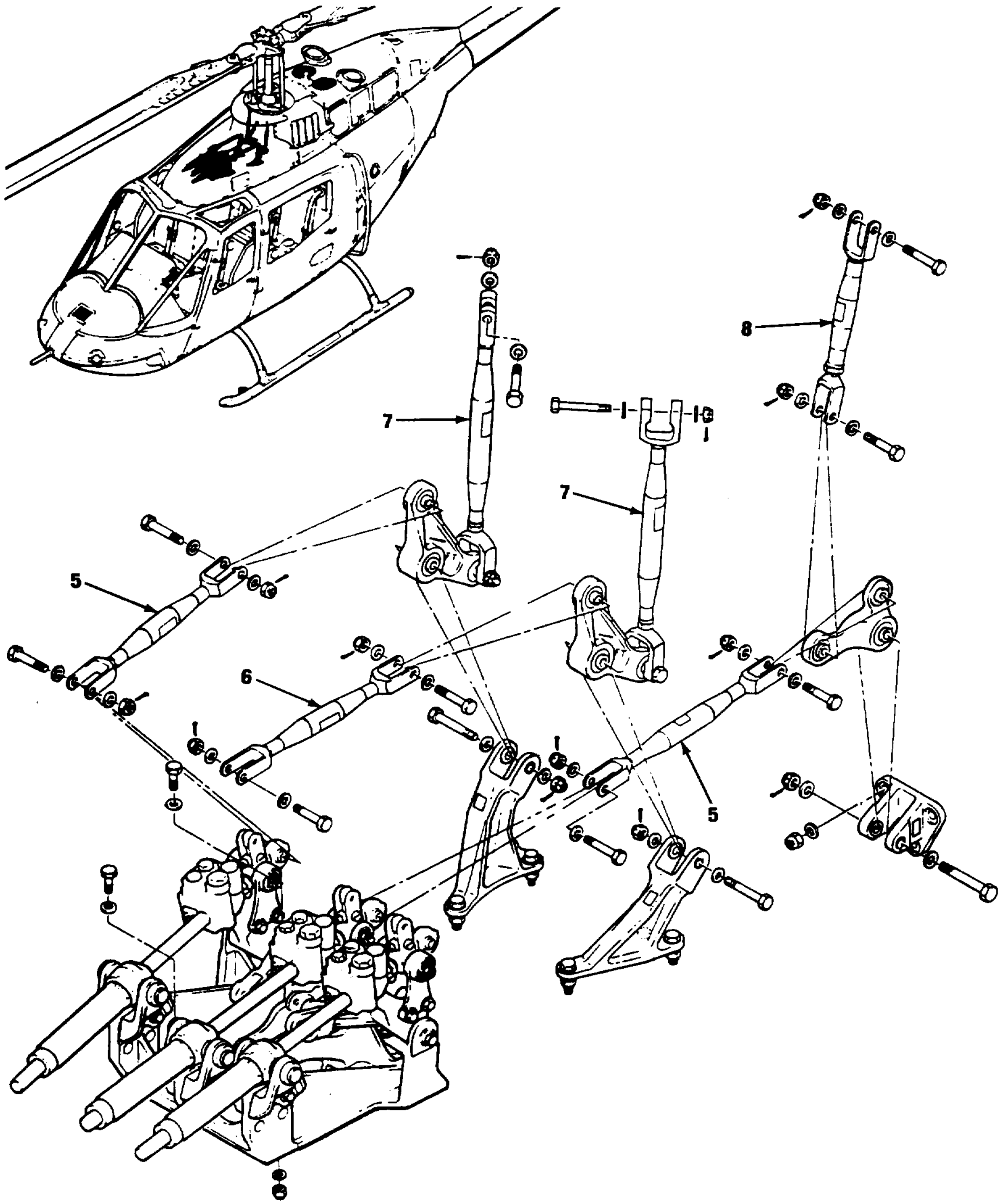
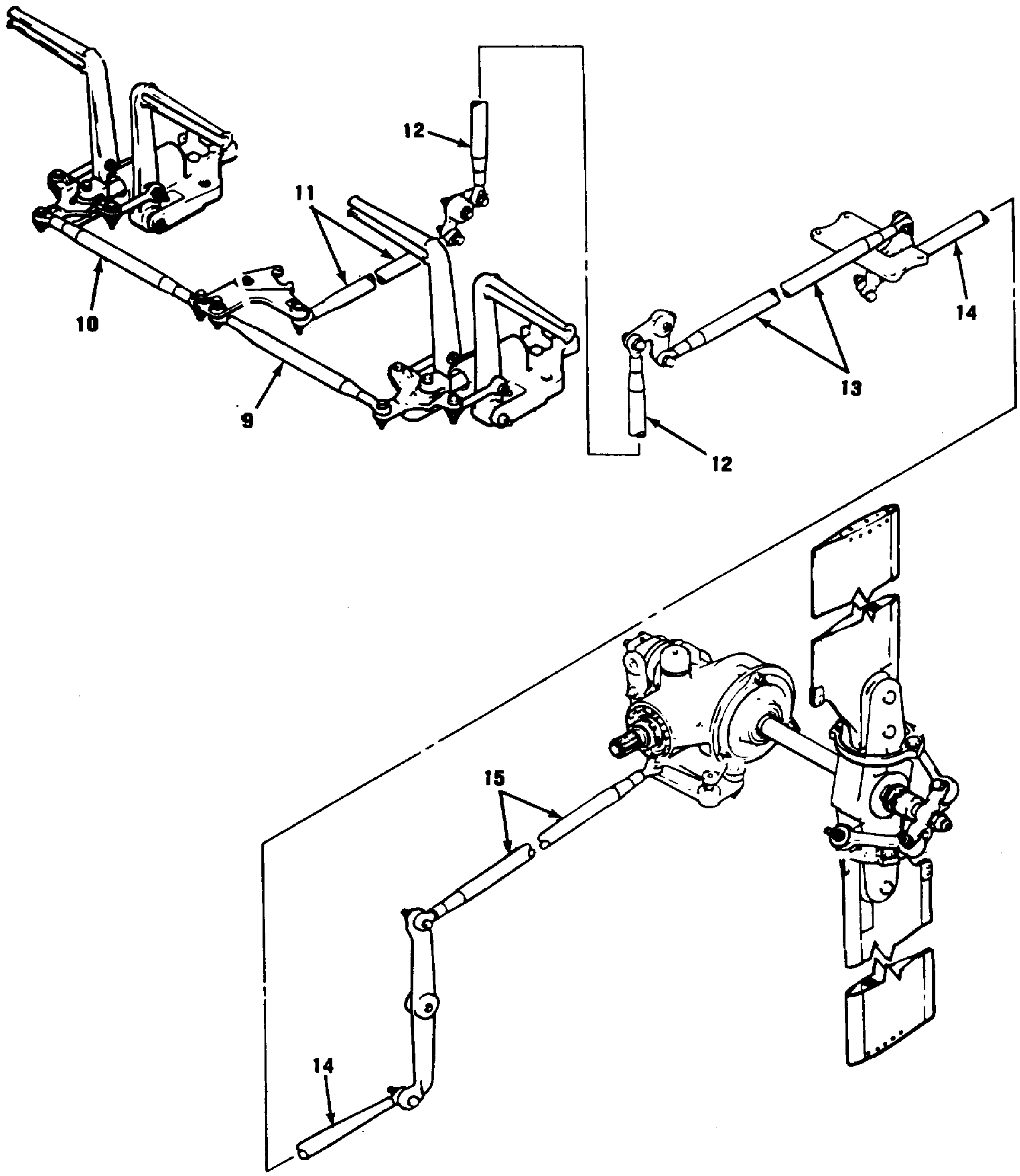


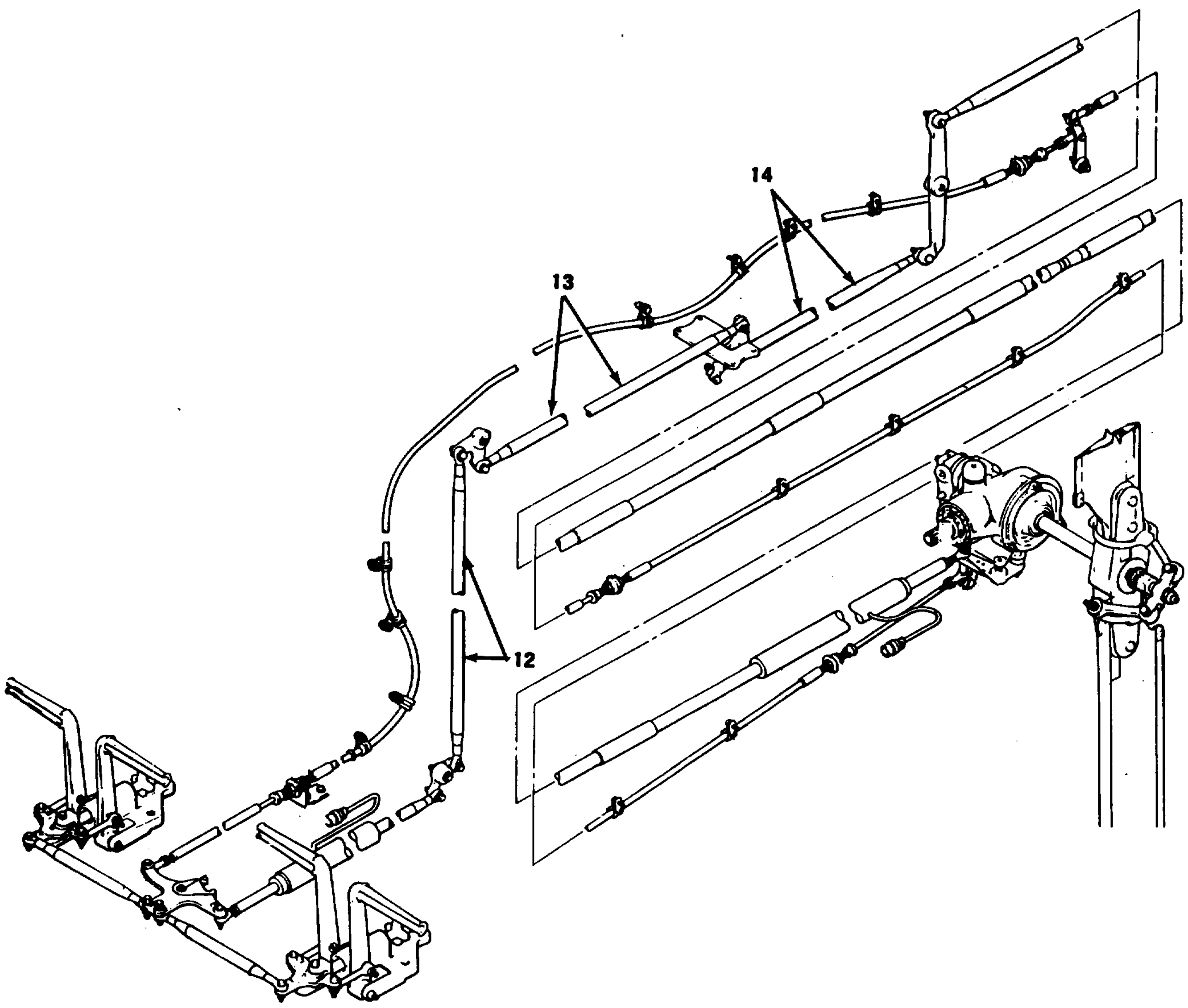
Figure 13-4. Flight Control Actuators



NOTE

THIS IS A CONFIGURATION OF THE OH-58A SERIES HELICOPTER.

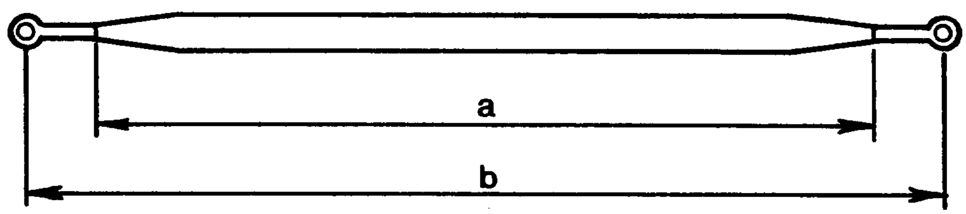
Figure 13-5. Anti-Torque Controls (Sheet 1 of 2)



NOTE

THIS IS A CONFIGURATION OF THE OH-58C SERIES HELICOPTER.

Figure 13-5. Anti-Torque Controls (Sheet 2 of 2)



(Refer to Figures 13-2 thru 13-5)

Figure 13-6. Control Tube Dimensions

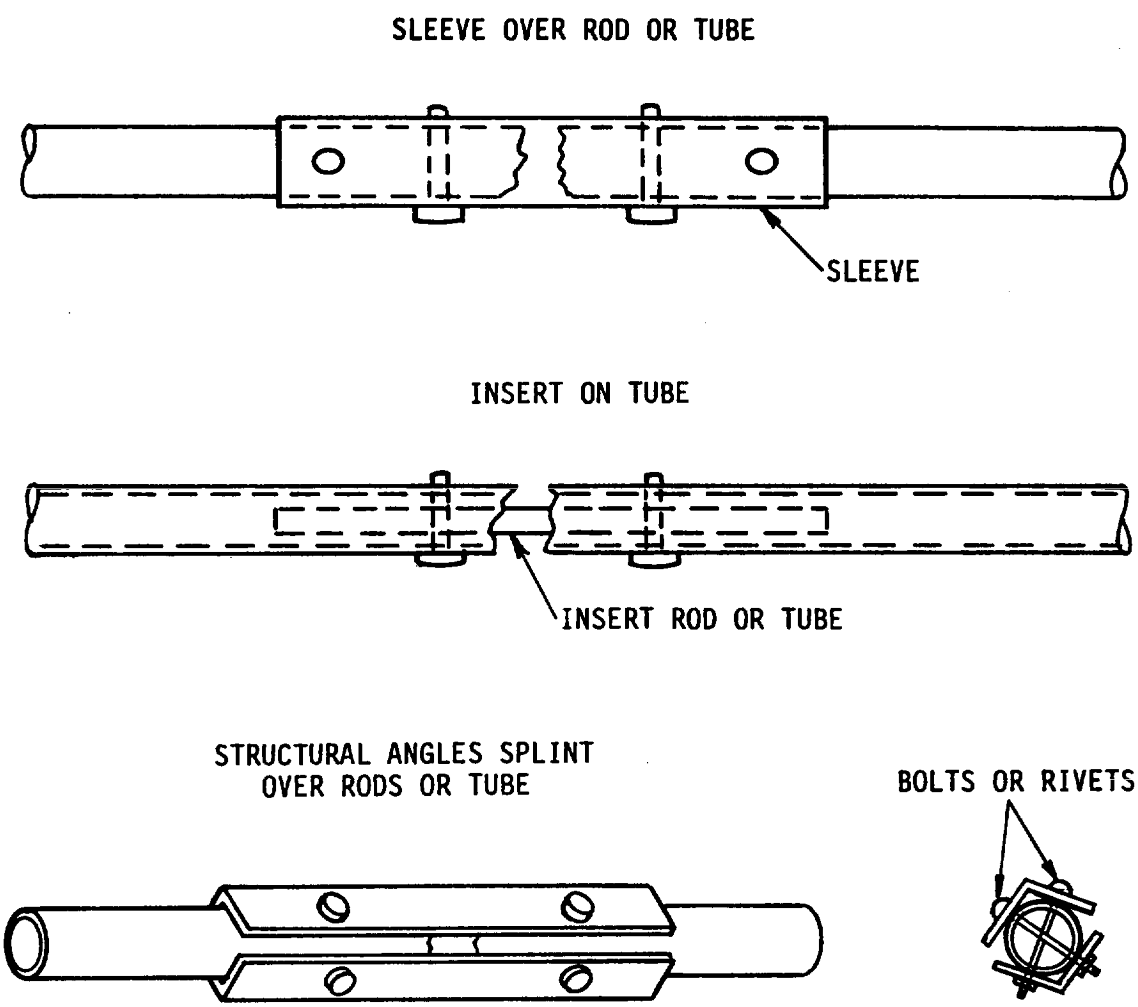


Figure 13-7. Suggested Repair for Control Rods or Tubes

Table 13-2. Nominal Tube Splice Sizes

NO.	FIG	NSN	PART NUMBER	SIZE O.D.	SIZE I.D.	WALL	LENGTH (IN) a	LENGTH (IN) b
1	13-2	1680-00-125-8871	206-001-174-3	1	15/16	.065	22	-
2	13-2	3040-01-010-6779	206-001-096-7	1 3/8	-	-	41.9	-
3	13-3	3040-00-179-6880	206-001-306-11	2	1 15/16	.049	19.7	25.2
4	13-3	3040-01-012-5969	206-001-096-1	1 3/8	-	-	46.1	48.4
5	13-4	3040-01-017-7587	206-001-194-5	3/4	-	-	6.5	10.5
6	13-4	3040-01-007-5514	206-001 -194-1	-	-	-	7.2	11.4
7	13-4	3040-01-018-9710	206-001 -099-1	3/4	-	-	9.1	13.9
8	13-4		206-001-189-5	3/4	-	-	5.25	10.25
9	13-5	3040-00-483-8616	206-001-020-67	5/8	9/16	.035	11.2	12.65
10	13-5	3040-00-024-4146	206-001-020-69	5/8	9/16	.035	9.5	11.0
11	13-5	3040-00-129-6163	206-001-020-59	1 1/8	1 1/16	.035	45.4	46.8
12	13-5	3040-00-129-6137	206-001-020-29	1 1/8	1 1/16	.035	46.6	48.0
13	13-5	3040-00-129-6142	206-001-020-33	1	15/16	.035	38.8	40.2
14	13-5	3040-01-006-4907	206-001-096-25	7/8	13/16	-	51.4	-
15	13-5	3040-00-129-6135	206-001-021-13	7/8	13/16	.035	167.3	168.65

NOTE: ALL DIMENSIONS ARE IN INCHES

Table 13-3. Recommended Bolts and Drill Hole Sizes for Splice Repair

LINK NOMINAL O.D.	MINIMUM BOLT SIZE FOR BOLT	MINIMUM BOLT SIZE DRILL HOLE	MAXIMUM BOLT SIZE FOR BOLT	MAXIMUM BOLT SIZE DRILL HOLE
5/8	No. 6	5/32	No. 8	3/16
3/4	8	3/16	10	7/32
7/8	10	7/32	1/4	9/32
1	10	7/32	1/4	9/32
1/8	10	7/32	1/4	9/32
1-1/4	1/4	9/32	5/16	11/32
1-3/8	1/4	9/32	5/16	11/32
1-1/2	5/16	11/32	3/8	13/32

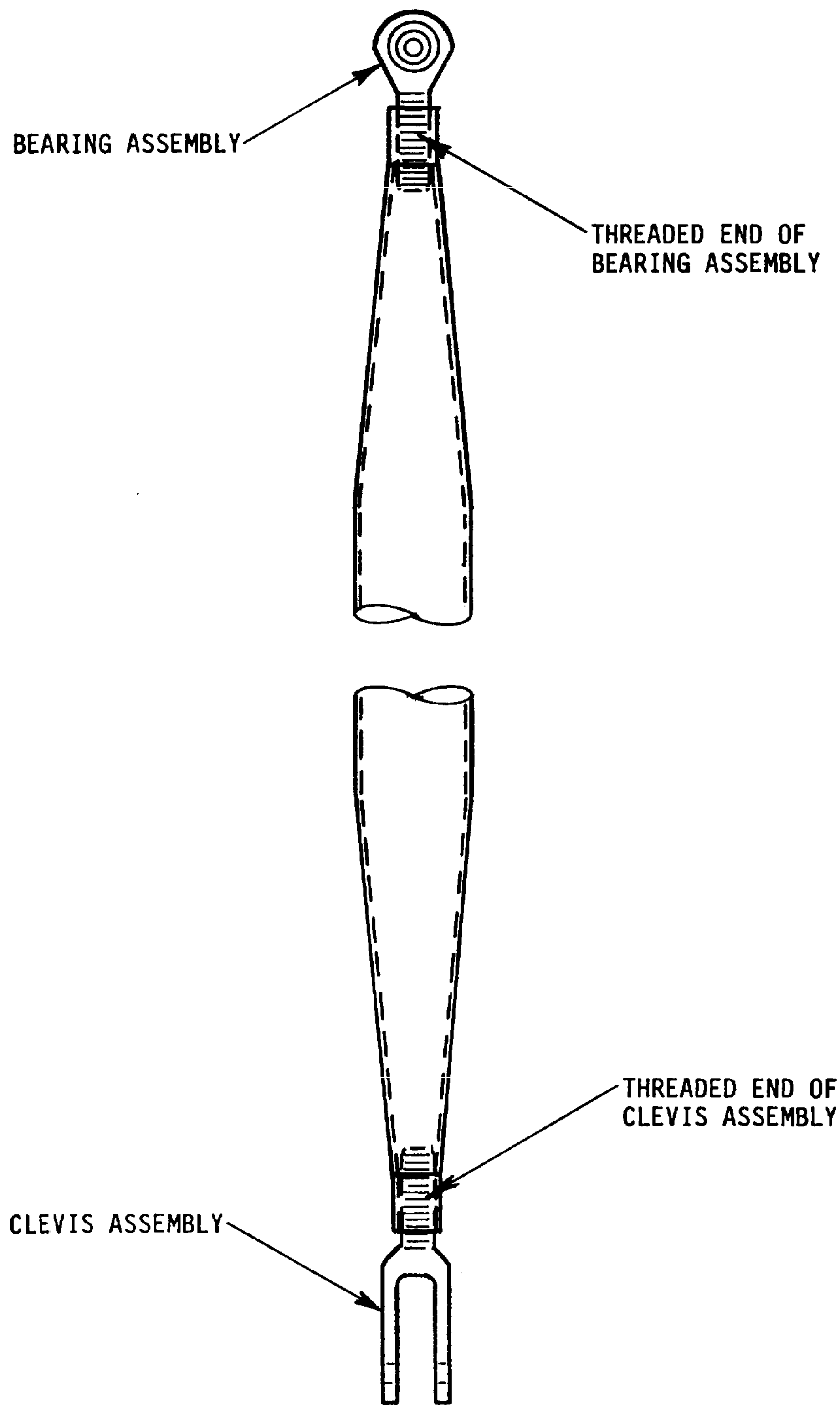


Figure 13-8. Control Rod with Bearing and Clevis Assemblies

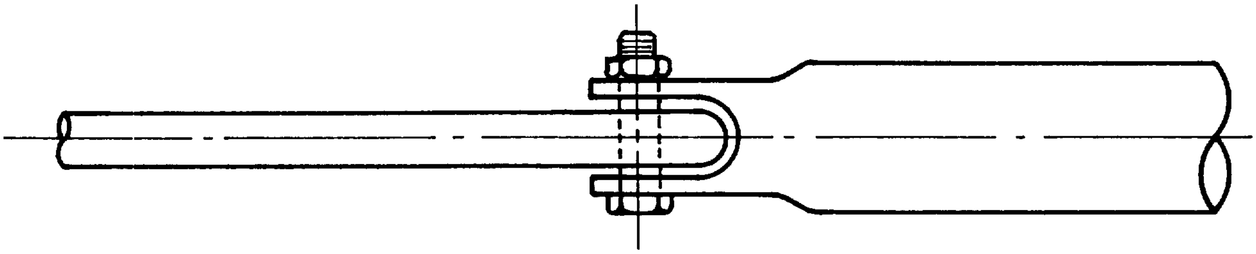


Figure 13-9. Flattened End of Fabricated Flight Control

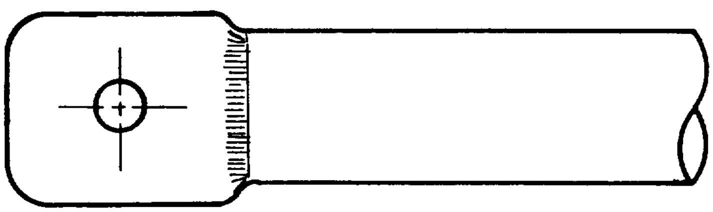


Figure 13-10. Corner Rounding on Fabricated Flight Control

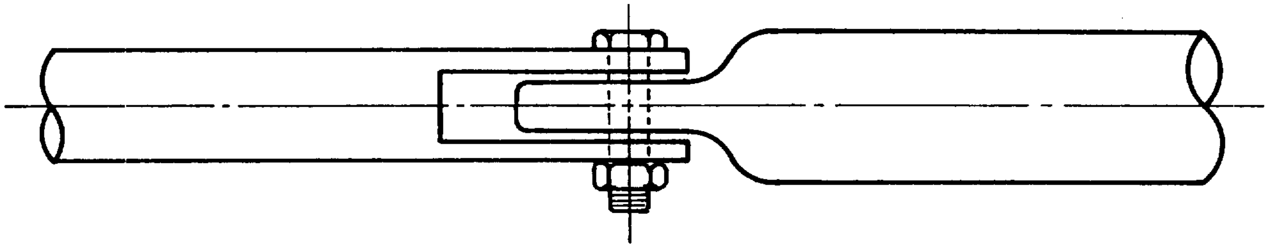


Figure 13-11. Bearing Assembly Connection of Fabricated Flight Control

5. From Table 13-2, determine the correct distance between holes of the flight tube. Mark this distance. Drill the hole and install the bolt.

6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

CHAPTER 14

UTILITY SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.
(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

14-1. SCOPE.

a. The de-icing system is the means by which the engine is kept from an icing condition. The system consists of a de-ice switch and a de-ice control actuator protected by a 5 amp circuit breaker. Refer to Figure 14-1.

b. This chapter consists of two BDAR fixes which can be applied for repair of the de-icing system components.

14-2. ASSESSMENT PROCEDURES. Visually inspect the damaged de-icing components to determine the extent of damage and the repair required.

14-3. REPAIR PROCEDURE INDEX.

Section II. DE-ICE VALVE OR CONTROL

14-4. GENERAL INFORMATION: Damage to control rod may be repaired by using one of the following repair options.

OPTION 1: Splice Repair.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:
- Flat or Round Piece of Material (Example: engine cowl hold open rod)
- Drill with Bit
- No. 8 screws or bolts

PROCEDURAL STEPS:

1. Drill hole on end of control rod. Insure that original length of damaged rod is known. Cut substitute tube to proper length and drill hole on other end. Install substitute tube and secure with screw or bolts and nuts.

2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Manual Control of Valve.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- 0.041 or 0.032 Safety Wire

PROCEDURAL STEPS:

1. Remove damaged control rod from de-ice valve and control actuator. If extremely cold weather, secure de-ice valve control lever in open position by tying the lever to an adjacent part of the engine nose area. If hot weather, secure valve in closed position with safety wire.

2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

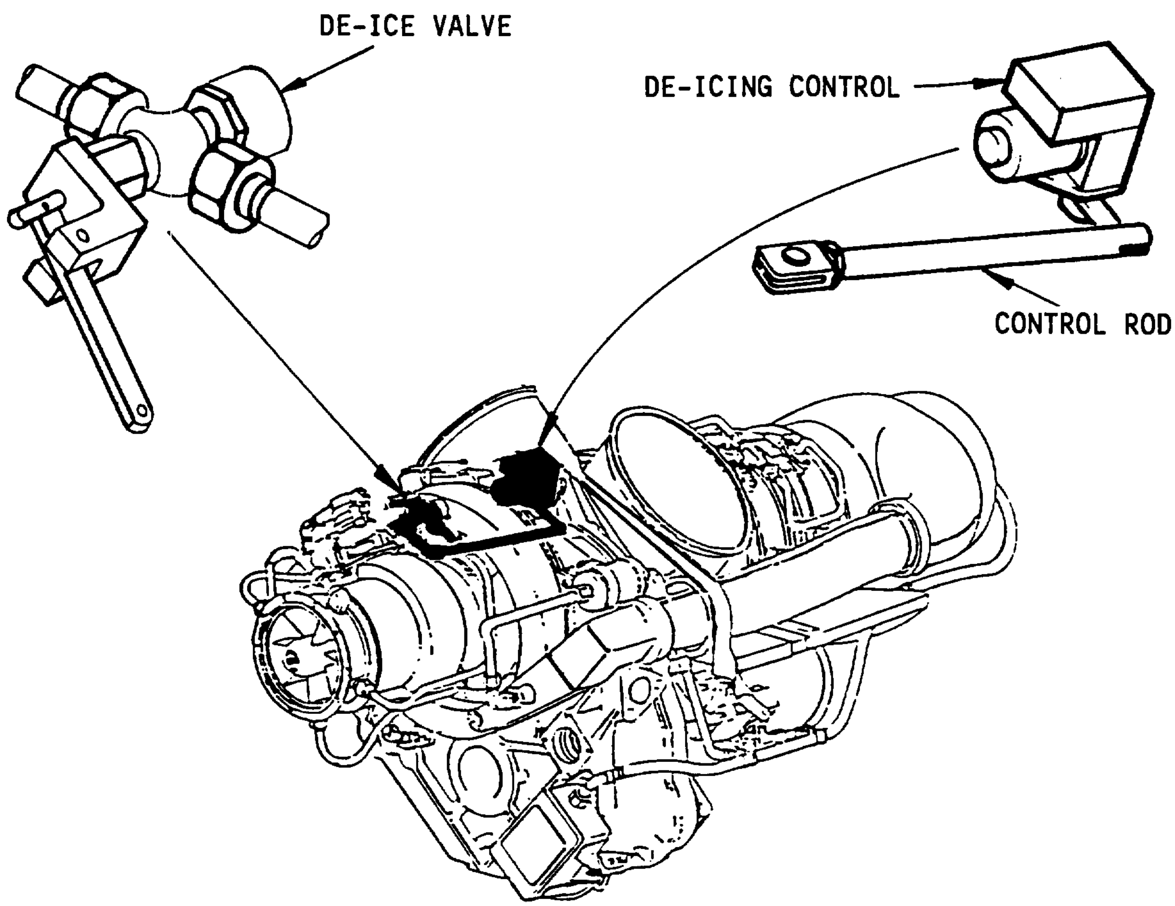


Figure 14-1. Engine De-Ice System

CHAPTER 15

ENVIRONMENTAL CONTROL SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

15-1. SCOPE. This chapter contains BDAR procedures for the heat and vent, bleed air, and defogging systems. The OH-58A/C has one of three types of heat systems: bleed air, Figures 15-1 thru 15-3; combustion heater, Figure 15-4; or shroud heater system, Figure 15-5.

15-2. GENERAL.

a. The three systems consists of air mixing valve, air distribution ducts, defroster nozzles, and control switches to operate system.

b. The heat and vent system is provided for crew comfort. This aids the mission proficiency; however, the aircraft capability is not contingent on system operation. The aircraft is fully flight capable without the system being operable.

c. The shroud heater system utilizes a carbon monoxide (CO) indicator located at the instrument panel in full view of the pilot.

WARNING

If CO indicator is noted to be dark, turn off heater, pull firewall shut-off open vents, and land as soon as practicable.

15-3. ASSESSMENT PROCEDURES. Refer to Table 15-1.

15-4. REPAIR PROCEDURE INDEX.

Section II. RIGID PLASTIC VENTILATION DUCT

15-5. GENERAL INFORMATION: Some damage to plastic ducts is repairable provided the time required to gain access to the damaged duct is feasible.

OPTION 1: Hole or Crack in Duct, Rigid Plastic.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- Sheet Metal Patch, 0.016 inch Thickness Minimum
- Tape, Army Green or Aluminum (item 50, Appx C)

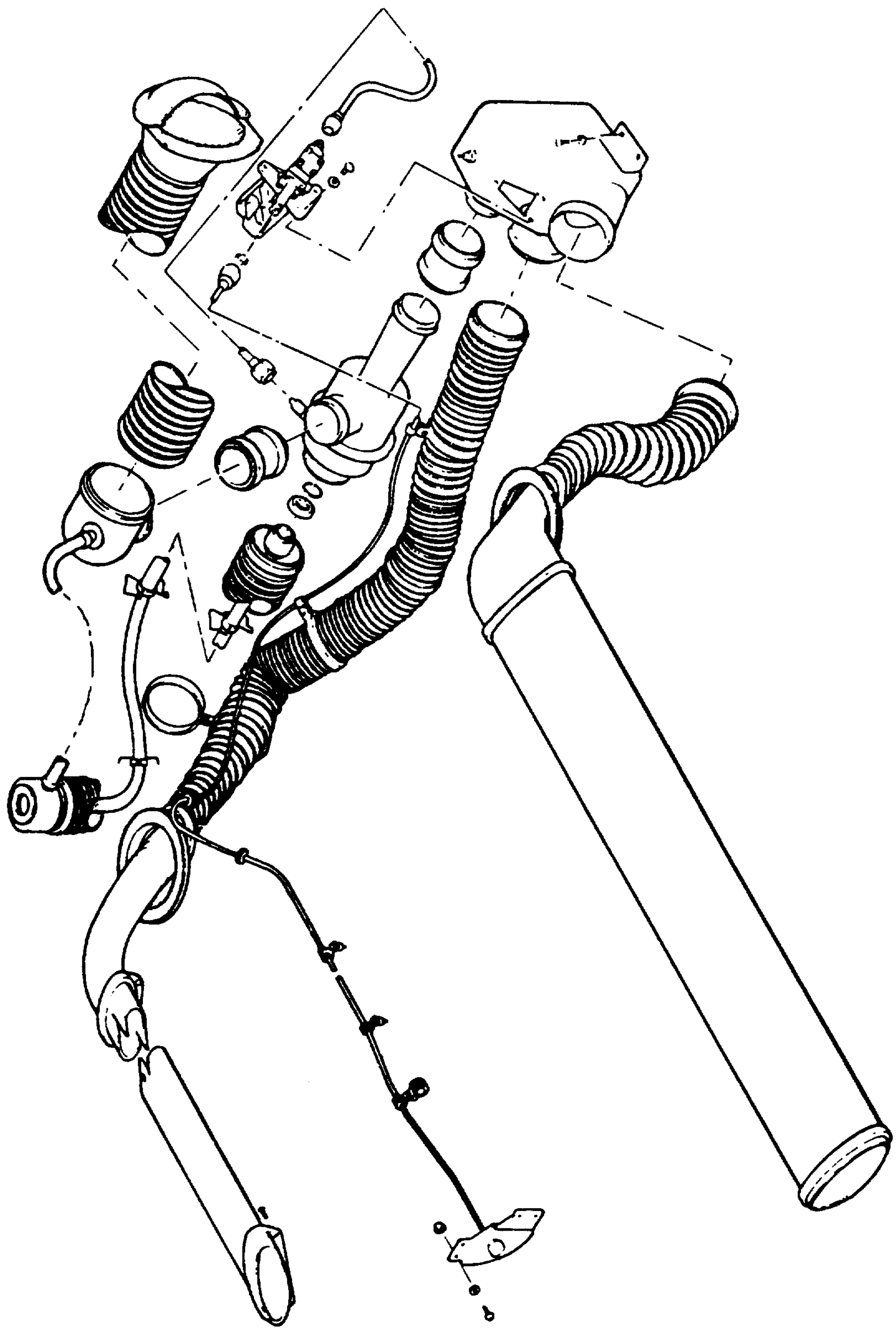
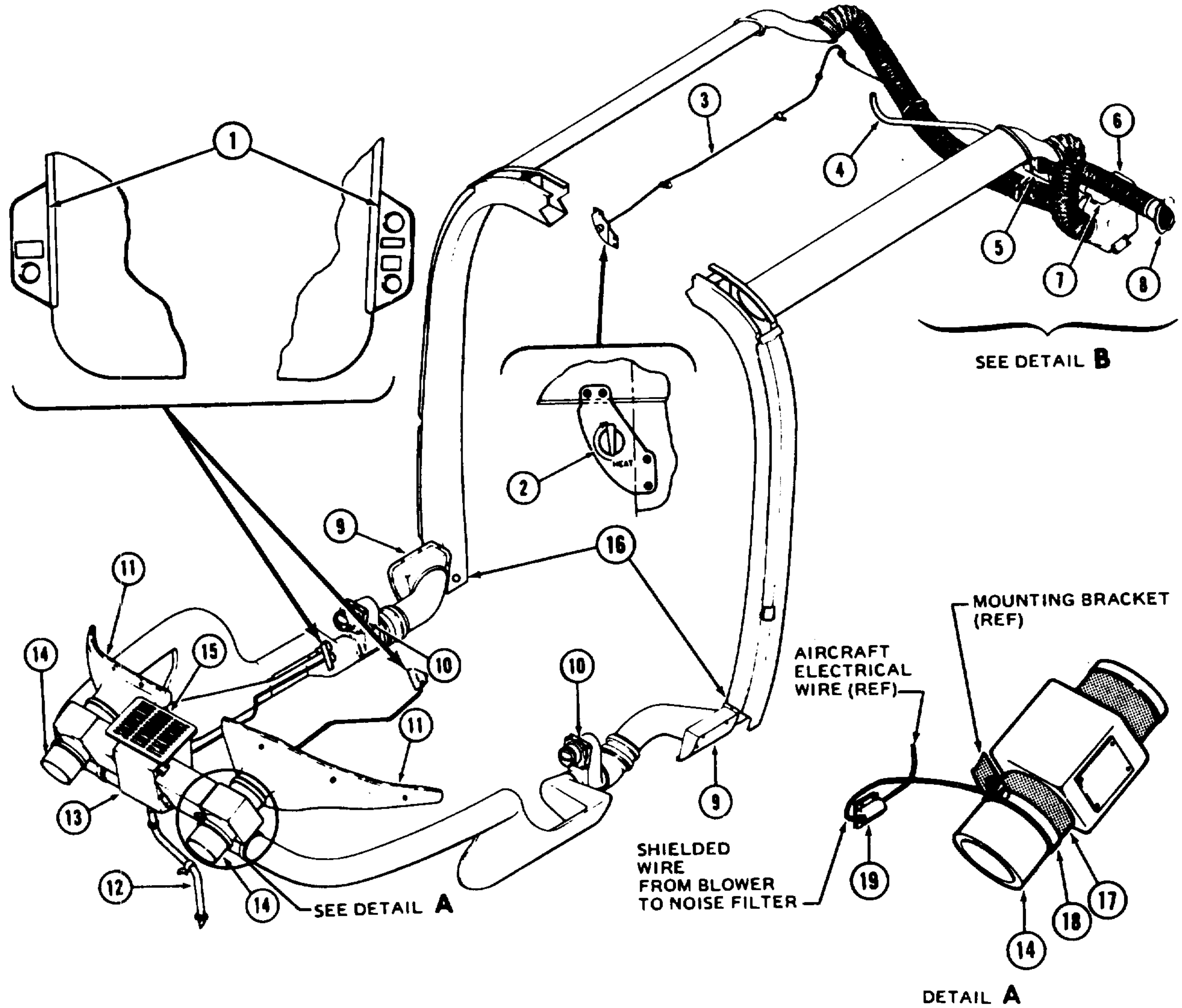
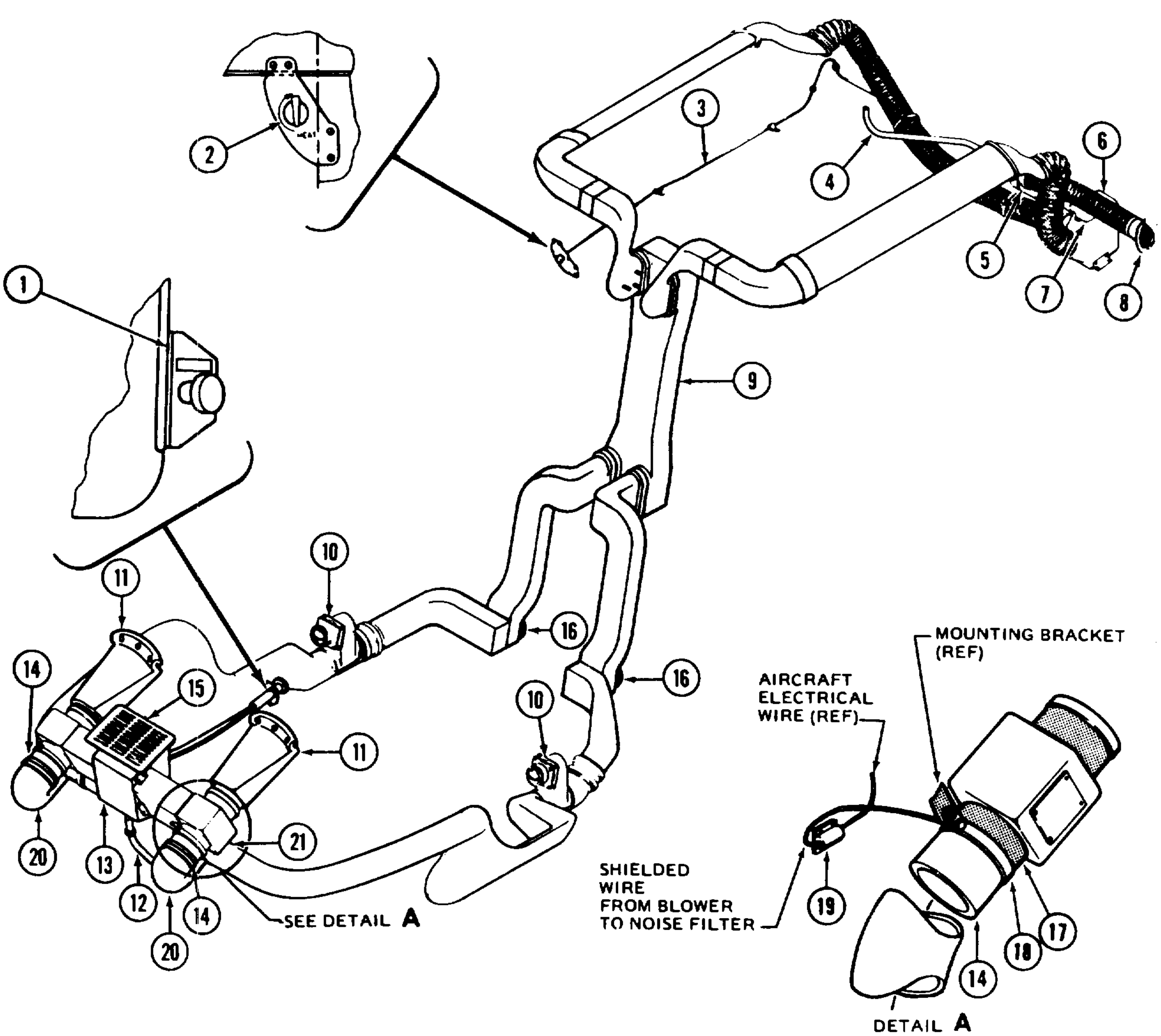


Figure 15-1. Bleed Air Heating and Ventilating System A & C



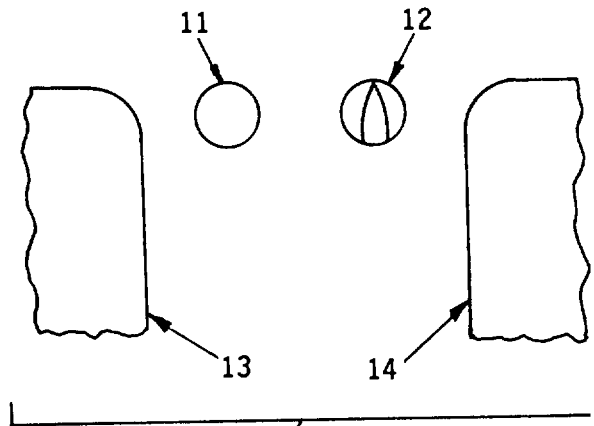
1. Vent and Defog Control
2. Heat Control
3. Heat Control Cable
4. Bleed Air Tube
5. Mixing Valve
6. Plenum
7. Remote Sensor
8. Fresh Air Inlet
9. Post Plenum
10. Air Distribution Valves
11. Windshield Defog Nozzle
12. Plenum Drain
13. Plenum Valve Assembly
14. Ventilating and Defogging Blower
15. Ram Air Intake Grill
16. Air Distribution Vents
17. Coupling
18. Clamp
19. Noise Filter
20. Tube

Figure 15-2. Heating and Ventilating System (Bleed Air) A Model



1. Vent Control
2. Heat Control
3. Heat Control Cable
4. Bleed Air Tube
5. Mixing Valve
6. Plenum
7. Remote Sensor
8. Fresh Air Inlet
9. Center Post Duct
10. Air Distribution
11. Windshield Defog Nozzle
12. Plenum Drain
13. Plenum Valve Assembly
14. Ventilating and Defogging Blower
15. Ram Air Intake Grill
16. Air Distribution Valves Cargo/Passenger Area
17. Coupling
18. Clamp
19. Noise Filter
20. Blower Inlet Duct
21. Tee Valve

Figure 15-3. Heating and Ventilating System (Bleed Air) C Model



1. Combustion Heater Plenum
2. Fuel Shut-Off Valve
3. Fuel Pump
4. Fuel Pressure Relief Valve
5. Fuel Filter
6. Heater
7. Combustion Blower
8. Air Scoop
9. Igniter Plug
10. Duct
11. Firewall Shut-Off Control
12. Temperature Control
13. Pilot Seat Back
14. Copilot Seat Back

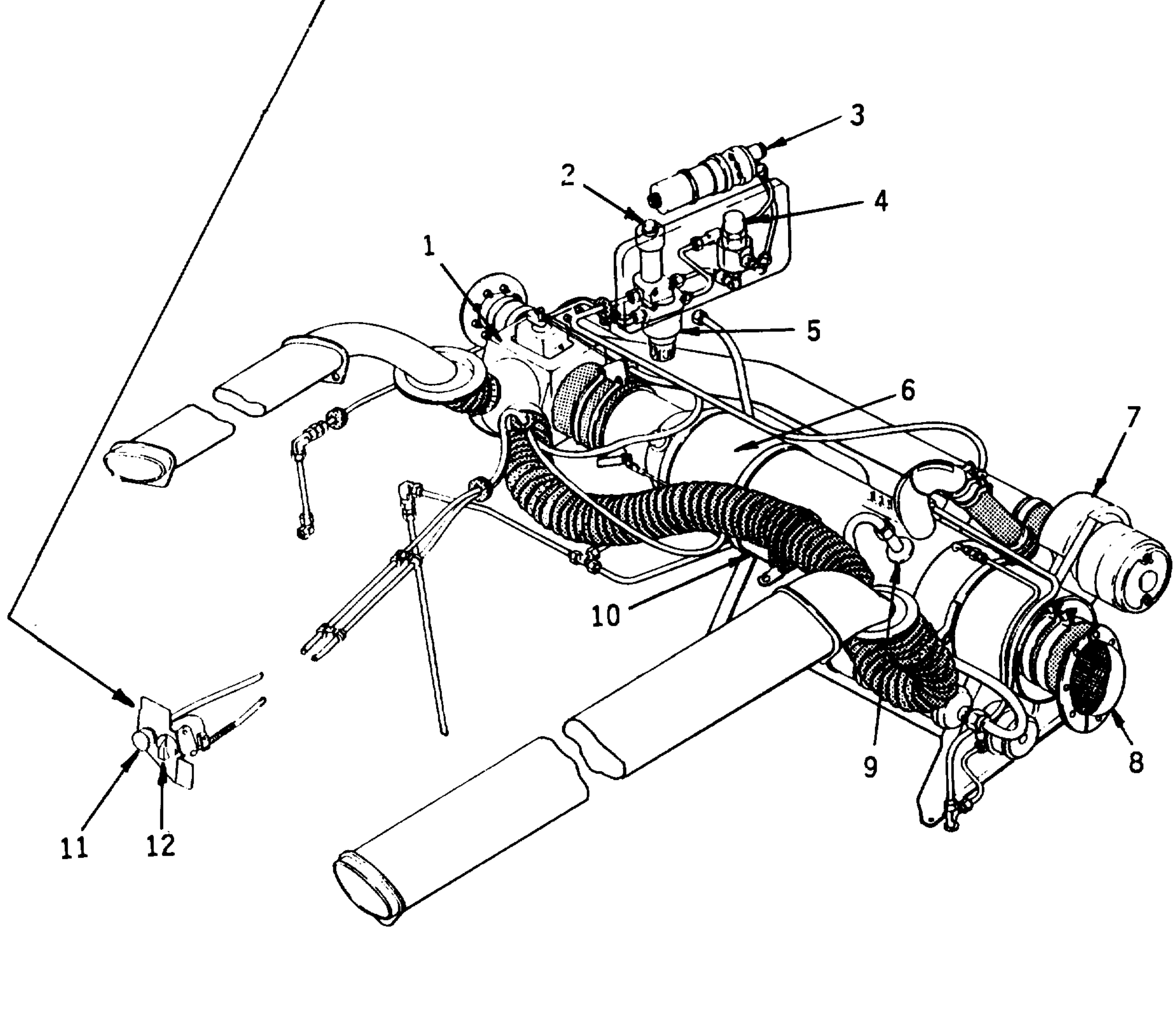
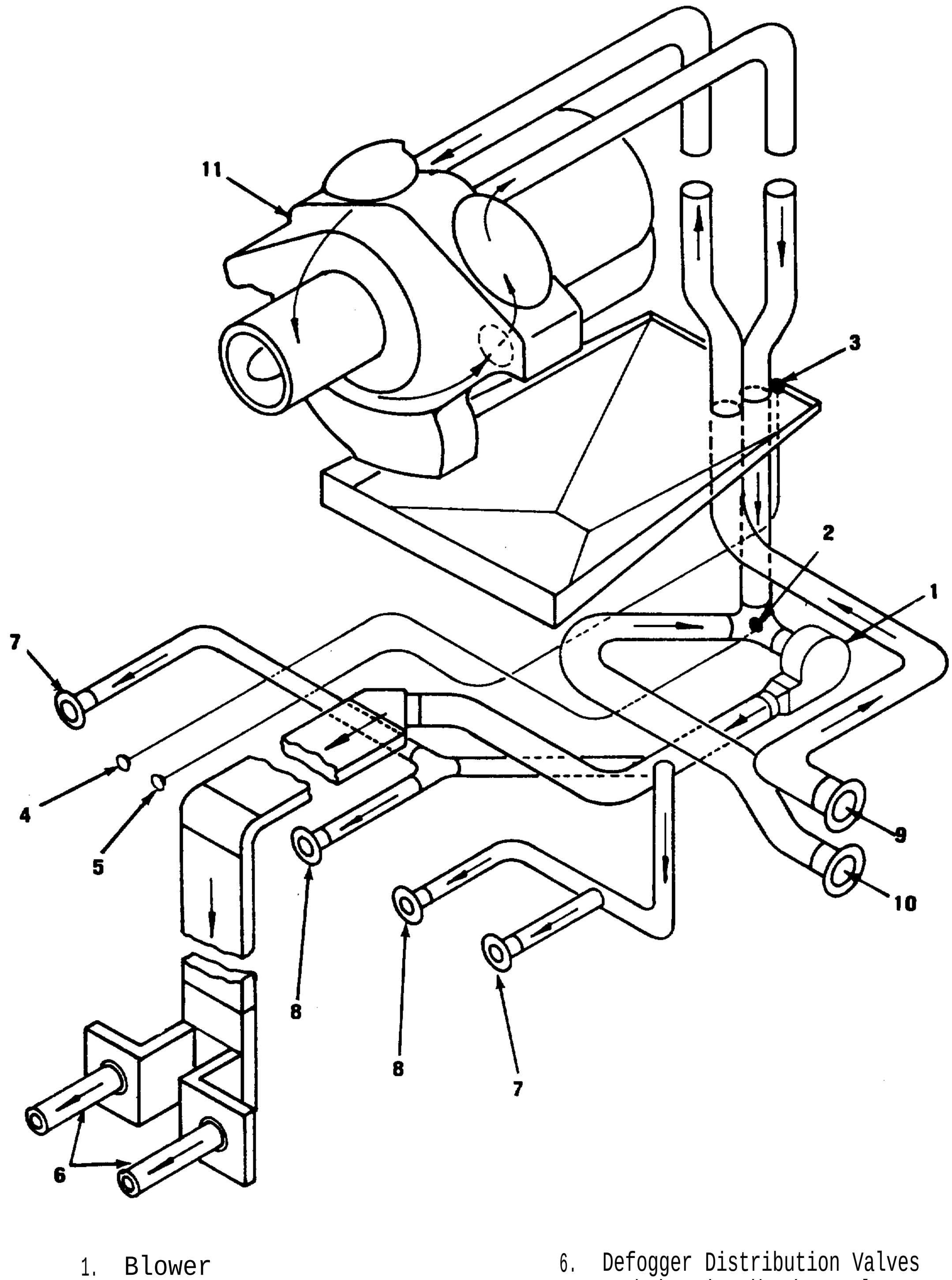


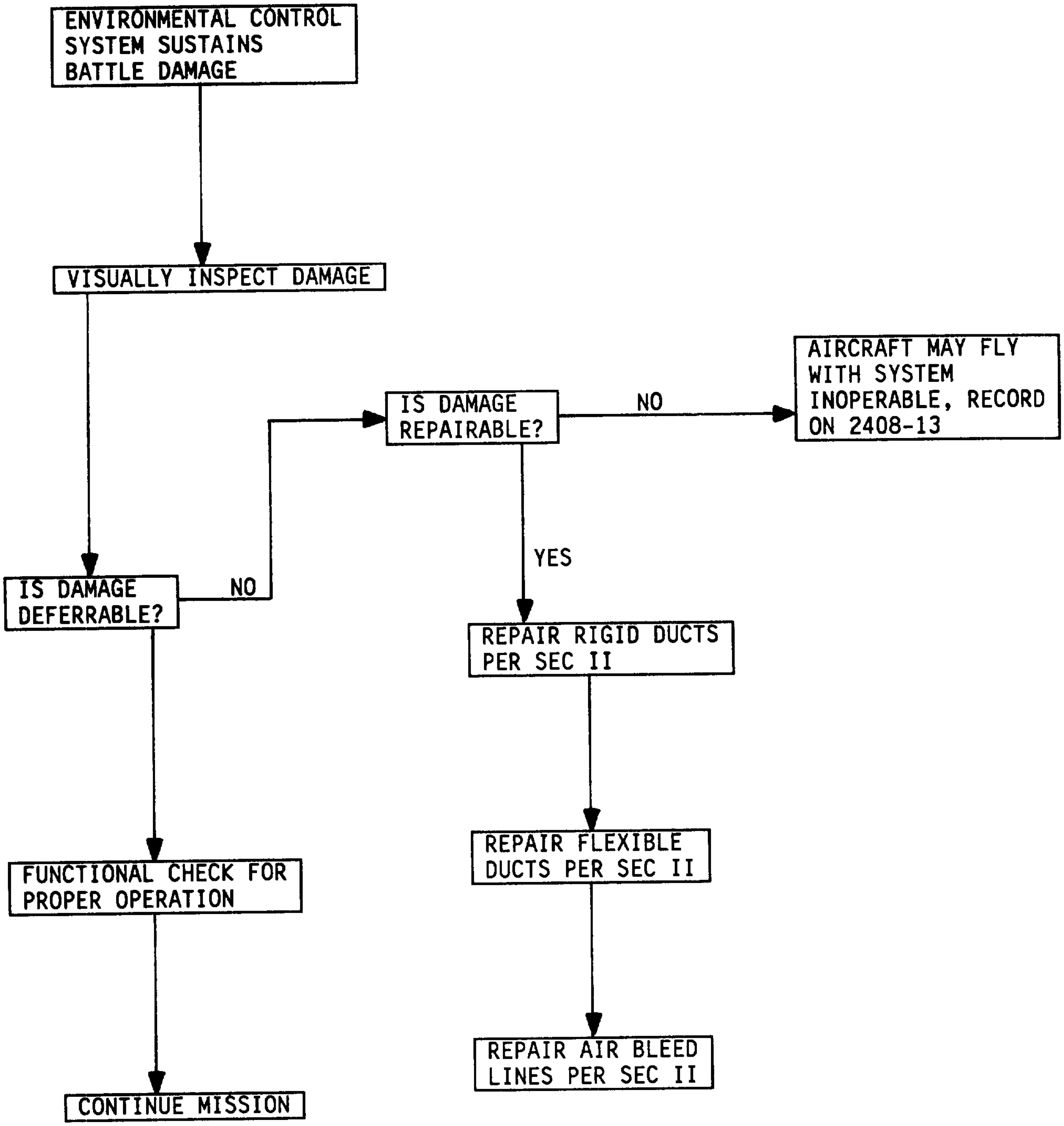
Figure 15-4. Combustion Heater



1. Blower
2. Air Mixing Valve
3. Firewall Shut-Off Valve
4. Air Mixing Valve Control
5. Firewall Shut-Off Valve Control
6. Defogger Distribution Valves
7. Cockpit Distribution Valves
8. Cabin Distribution Valves
9. Fan Air Intake
10. Cold Air Intake
11. Shroud Assembly

Figure 15-5. Shroud Heater System Schematic

Table 15-1. Assessment Procedures



PROCEDURAL STEPS:

1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of rigid plastic ducts.

2. Cut a patch out of sheet stock.

3. Tape into place.

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Hole or Crack in Duct, Rigid Plastic.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- 0.016 inch Sheet Metal Minimum
- Sealant (item 4, Appx C)
- 400 Grit Sand Paper (item 45, Appx C)
- Cleaner Naptha or Equivalent (item 7, Appx C)
- Glass Tape or Aluminum Tape (item 60, Appx C)

PROCEDURAL STEPS:

1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of rigid plastic ducts.

2. Cut a patch out of sheet stock. Patch should extend 1-1/2 inches from the edge of the hole at all points.

3. Stop drill any cracks which might be extending from hole.

4. Sand both the bottom surface of the patch and the surface area around the hole to be covered by the patch.

5. Clean surface with solvent.

6. Apply sealant to patch and on the surface area that will be covered by the patch.

7. Press patch in place, and wrap glass tape around patch and duct to hold the repair in position.

8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

15-6. FLEXIBLE DUCT DAMAGE.

GENERAL INFORMATION: The flexible ducts are composed of special wire covered fabric with impregnated rubber.

LIMITATIONS: These repairs are temporary and the damaged hoses should be replaced as soon as possible. Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:
- Glass Tape or Equivalent

PROCEDURAL STEPS:

1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of flexible plastic ducts.

2. Wrap glass tape several turns around duct to cover hole or tear. Tape should extend beyond damaged area 3 to 4 inches in each direction.

3. Record BDAR action taken. When mission is completed or as soon as feasible, replace duct using standard maintenance procedures.

Section III. BLEED AIR LINE DAMAGE

15-7. GENERAL INFORMATION. Damage to some bleed air lines may be repairable.

SYMPTOM: Loss of Engine Torque and/or High Engine Oil Temperature.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:
- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:
- Sheet Metal Patch - 0.016 in. Min.
- Sealing Compound (item 4, Appx C)
- Aluminum Tape (item 60, Appx C)
- Clamps 0.032 inch or Safety Wire 0.042 inch (item 27, Appx C)

PROCEDURAL STEPS:

1. Locate damaged area and remove panels and other items as necessary to gain access to the line to be repaired. Refer to Figure 15-6 for locations of bleed air lines.

2. Cut patch from aluminum sheet metal to cover hole or other damage. Patch should extend approximately 1 inch from the edge of the hole or damage at all points if possible.

3. Apply sealant around the hole area to be covered by the patch.

4. Place patch in position, and make sure patch fills the contour of the line.

5. Secure metal patch in place using hose clamp, Figure 15-7. If hose clamps are not available, secure in place with safety wire. Turn pigtail to line.

6. Wrap aluminum tape around the repair. Tape should cover at least 2 inches beyond the edge of repair.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

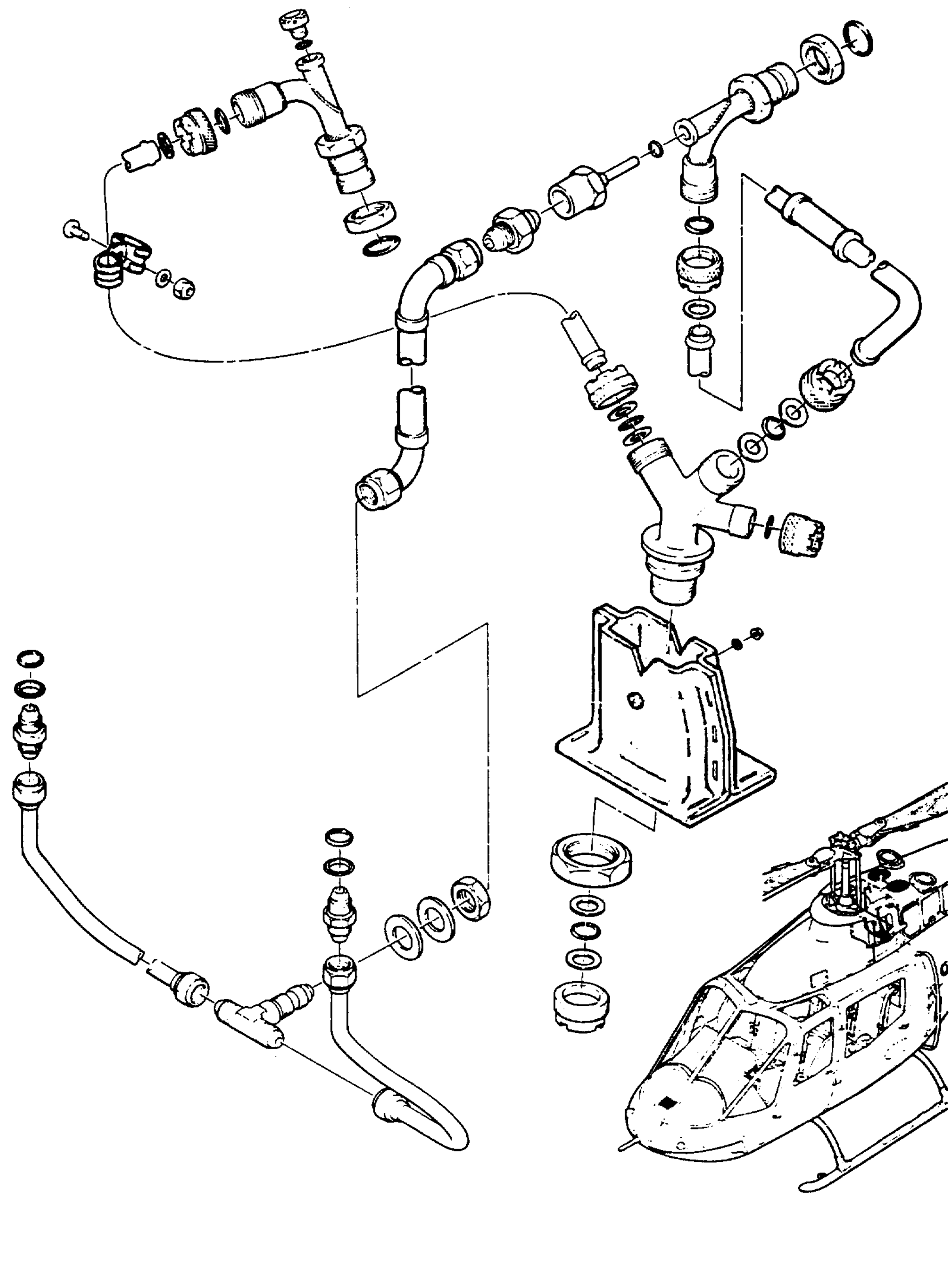
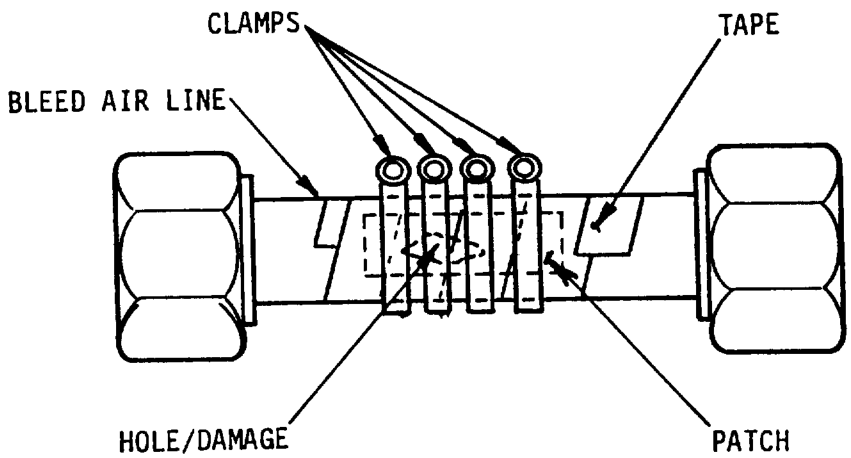
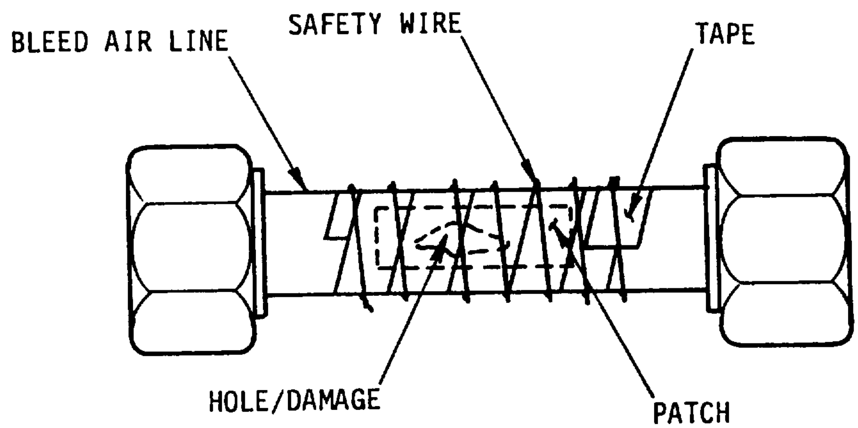


Figure 15-6. Bleed Air Line Installation



REPAIR USING CLAMPS



REPAIR USING SAFETY WIRE

Figure 15-7. Bleed Line Patch Repair

CHAPTER 16

MISSION EQUIPMENT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.
(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the mission equipment.

CHAPTER 17

EMERGENCY EQUIPMENT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the emergency equipment.

APPENDIX A

REFERENCES

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.
(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

The following references of the issue in effect are required for use by repair personnel to accomplish the instructions set forth in this TM.

PUBLICATION NUMBER	TITLE
DA PAM 738-751	Functional User's Manual for the Army Maintenance Management Systems Aviation (TAMMS-A)
FM 3-5	NBC Decontamination
TM 55-1500-328-25	Aeronautical Equipment Maintenance Management Policies and Procedures
TM 55-1520-228-10	Operator's Manual Army Model OH-58A/C Helicopter
TM 55-1520-228-1,2	Aviation Unit and Intermediate Maintenance Manual
TM 55-1520-228-CL	Operator's and Crewmember's Checklist

APPENDIX B

SPECIAL OR FABRICATED TOOLS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. GENERAL

B-1. SCOPE. This appendix lists special tools and test equipment. Several special tools are contained in the BDAR kits listed on the next page. The kits also contain small quantities of parts and durable supplies not listed in other appendices. Each kit contains its own inventory list and tool usage instructions. There are no fabricated tools associated with this BDAR manual.

Section II. TOOLS

B-2. SPECIAL TOOL LISTINGS. The items listed in this appendix will enhance crew members and mechanics at all levels to accomplish battlefield damage assessment and repairs.

SPECIAL OR FABRICATED TOOLS

ITEM NO.	NSN	DESCRIPTION
1	Not Assigned	Composite Structures Repair Kit
2	5935-01-161-5883 (11851) DMC658	Connector Repair Kit (Special Tools for Electrical Connector Repair)
3	4920-01-266-7535 (11851) DMC895	Emergency Repair Kit (Special and Common Tools for Electrical Repair, including Repair Parts)
4	4920-01-266-7534 (78286) 70700-20900-041	Fluid Line Repair Kit (Special and Common Tools for Tubing and Hose Repair, Including Repair Parts)
5	Not Assigned	Fuel Cell Repair Kit
6	Not Assigned	High Energy Laser Damage Analysis Test Kit
7	Not Assigned	Optical Component Repair Kit
8	Not Assigned	Standard Structures Repair Kit
9	4920-01-266-7536 (78286) 70700-20638-041	Test Equipment Repair Kit (Electrical Test Equipment)
10	5935-01-254-1688 (06090) MK-0015-1	Wire Repair Kit (Special Tools Used for Electrical Wiring Repair, Including Repair Parts)

APPENDIX C

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists expendable supplies and materials needed to make BDAR fixes on the OH-58 helicopter. Items are listed alphabetically by the item shown in the description column. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) or CTA 8-100.

C-2. EXPLANATION OF COLUMNS.

a. 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, Appendix C").

b. National Stock Number. This is the National stock number assiqned to the item; use it to request or requisition the item.

c. Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.

d. Unit of Issue (U/I). Is the abbreviation of the types of units under which material is issued.

APPENDIX C

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

ITEM NUMBER	NSN	DESCRIPTION	UNIT OF ISSUE
1	5330-00-192-5051	Abrasive Cloth (Grit 180) P-C-451	PG
2	8040-00-932-1945	Adhesive, ENA934 NA B/A Type II, Class 3 (81348)	CN
3	8040-00-944-7292	Adhesive, Epoxy Metal Set A4 (33564) EA9340	KT
4	8030-00-723-4599	Adhesive, EX1675-B2 Pro Seal 890-B2	KT
5	8040-00-514-1880	Adhesive, General Purpose (81348) EC1300121	KT
6	8040-00-941-9984	Adhesive, Silicone Rubber (80244) MIL-A-46106	TU
7	6810-00-238-8119	Aliphatic Naphtha (81348) TTN95	GL
8	7920-00-514-2417	Brush, Stiff Fiber Bristle (80244) H-B-643	EA
9	5940-00-280-3499	Cap, Electrical Crimp (96906) MS25274-2	EA
10	8030-00-057-2354	Chemical Conversion Coating (Alodine) (80244) MIL-C-81706	GL
11	4730-00-289-5909	Clamp, Hose, 3/8 to 1 in. (70403) MIL-C-11569	EA
12	4730-00-908-3193	Clamp, Hose, 1-1/16 to 2 in. (01944) MS35842-12	EA
13	8030-00-231-2345	Corrosion Preventive Compound (80244) MIL-C-16173	CN
14	5310-00-297-3751	Cotter Pin Assortment (81348)	KT
15	5940-00-296-5326	Ferrul, Electrical, 22-14 Wire Gage size (10 ea) (59730)	EA
16	8305-00-530-0109	Fiberglass Cloth (81349) MIL-C-9084	RO
17	8305-00-530-0111	Fiberglass Resin (81349) MIL-C-9084	CN
18	8135-00-982-0884	Foil, Aluminum QQ-A-1876	BX
19	5330-00-291-1605	Gasket, Cork 1/32 in.	SH
20	5330-00-467-3615	Gasket, Material 1/32 in. (81348) HH-P-96	SH
21	9150-00-944-8953	Grease, Aircraft MIL-G-81322 (54527)	CN
22	9150-00-985-7246	Grease, Aircraft Aero Shell Grease (54527)	CN
23	9150-00-506-8497	Grease, Aircraft Driveshaft Coupling	TU
24	9150-00-237-2388	Jet Engine Lubricating Oil (Grade 1010) (98308)	QT

APPENDIX C

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (Cont)

ITEM NUMBER	NSN	DESCRIPTION	UNIT OF ISSUE
25	9505-00-596-5101	Lockwire, Steel 0.020 (81348) QQ-W-423	RO
26	9505-00-293-4208	Lockwire, Steel 0.032 (81348) QQ-W-423	RO
27	9505-00-331-3275	Lockwire, Steel 0.041 (81348) QQ-W-423	RO
28	9150-00-186-6681	Lubricating Oil MIL-L-2104 (Grade 30) (15958)	QT
29	9150-00-180-6266	Lubricating Oil, MIL-L-23699 (81349)	QT
30	9150-00-782-2627	Lubricating Oil, MIL-L-7808 (81349)	QT
31	5310-00-297-3751	Nut Assortment (81348) FFN836	PG
32	5330-00-966-8657	Packing, Preformed Assortment (51808) MAOK311	PG
33	9250-00-250-0926	Petroleum, Technical USP, White VV-P-236	CN
34	8010-00-082-2450	Primer, Epoxy Polyamide MIL-P-23377	KT
35	8030-00-664-4968	Putty, Chromate (81349) MIL-P-8116	RO
36	5320-00-006-4912	Rivet, Blind (92215) RV1100-4-3	BX
37	5320-00-117-6826	Rivet, Blind (96906) MS2040AD4-4	BX
38	5320-01-033-8179	Rivet, Blind (81349) MIL-R-7885/6	BX
39	5320-01-839-2146	Rivet, B1ind (80205) NAS1738M4-3	BX
40	5320-01-937-5448	Rivet, Blind (11818) 3/16 in. CR2249-5-5	BX
41	5320-00-721-5211	Rivet, Solid Aluminum A470 A4-6 (88044)	BX
42	5330-00-060-8212	Sandpaper, 600 Grit	SH
43	5330-00-244-7201	Sandpaper, 400 Grit, A-A-1200 (58536)	SH
44	5330-00-721-8117	Sandpaper, 180 Grit, A-A-1200 (80244)	SH
45	5350-00-224-7203	Sandpaper, 320 Grit, A-A-1047 (58536)	SH
46	5350-00-619-9167	Sandpaper, 80 Grit, PP101 (81368)	SH
47	6850-00-264-9038	Solvent, Cleaning, P-D-680 (81348)	BBL
48	5940-00-500-8723	Splice, Conductor, Crimp Style Wire Size 10, MS25181-3 (96906)	EA
49	5970-00-419-8723	Tape, Electrical, Black Insulation	RO
50	7510-00-074-5124	Tape, Green (58536) A-A-1586	RO
51	5970-00-812-7387	Tape, Teflon (82577)	RO
52	7510-00-266-6712	Tape, A-A-883 (58536)	RO
53	7510-00-754-2522	Tape, A-A-113 (58536)	RO

APPENDIX C

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (Cont)

ITEM NUMBER	NSN	DESCRIPTION	UNIT OF ISSUE
54	5940-00-283-5380	Terminal, Lug Crimp Style Stud, Size 6, Wire Gage 16-14	BX
55	5940-00-143-4780	Terminal, Lug, Crimp Style Stud, Size 10, Wire Gage 16-14	BX
56	5940-00-143-4777	Terminal, Lug (81349) MIL-T-7928	BX
57	5940-00-804-9184	Terminal, Quick Disconnect Wire Gage 16-14, MS27429-2 (96906)	BX
58	5940-00-804-9185	Terminal, Quick Disconnect, Size 18, MS27429-1 (96906)	BX
59	6810-00-664-0387	Trichloroethane, 1-1-1, T-620 (81348)	CN
60	6515-00-324-5500	Tongue Depressor, LLL-S-007,20 (81348)	BX
61	61409-00-252-6499	Wire, Insulated, Size 14, BB74-50072 (46522)	RL
62	6145-00-435-8613	Wire, Insulated, Size 18, M81044/12-18-9 (81349)	RL

NOTE

- For expedient repair of flex hoses and metal tubes, refer to tables listed in Chapter 9.
- AMC/BDR kits contain all necessary tools, materials, and test equipment for electrical repairs.

APPENDIX D

SUBSTITUTE MATERIALS/PARTS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

D-1. SCOPE. This appendix contains lists and tables of substitute materials and parts which can be used on the OH-58 aircraft for BDAR fixes.

D-2. GENERAL. The lists and tables for Appendix D are made up of the following:

a. Essential spare parts, Table D-1.

b. Spare and repair parts, Table D-2. thru D-3.

c. Fuels, Table D-4 thru D-7.

d. Lubricants and hydraulic fluids, Table D-8.

e. This appendix contains general information concerning types, uses, and effects of POL substitutes, and methods of purging and flushing systems.

f. Some products are made up of chemical ingredients which are not compatible with products used on an OH-58 aircraft. Some fuels, oils, and hydraulic fluids can have an adverse effect on systems and components with the OH-58 systems; therefore, it is advisable to properly identify the product by specification number and name from cross-reference with primary and expedient products available.

g. National stock numbers are used in conjunction with specification numbers to distinguish them from foreign products. The identification of (NATO) product numbers relate directly to U.S. Military Specification numbers and thus are considered direct replacements.

h. In some situations, petroleum, oil, lubricant (POL) substitute products of friendly or enemy nations can be used; however, CAUTION should be exercised due to the possibility of sabotage. If there is no other alternative but to use enemy products, check for signs of contamination, discoloration, smell and thickness.

i. Once a product under consideration is identified as described above, it will fall in one of three categories. These categories are defined as follows:

(1) Primary products. These are basic products for which the system was designed. The system will function without limitation.

(2) Alternate Product. These are products that closely match the primary product and may result in some reduced performance with no effect on system durability. There are no limitations on duration of use.

(3) Emergency/Expedient Products.

(a) These are products that can be used for only short periods of time. These products are to be used as a last resort. These products will cause poor performance and system damage after prolonged use.

(b) It is important that the distinction between these categories is understood. Since the choice between products could mean the difference between completing the mission and limping home.

APPENDIX D

Table D-1. Essential Spare Parts

ITEM NO.	NATIONAL STOCK NUMBER	DESCRIPTION
1	2995-00-134-4543	Actuator, Electro-Mech
2	• • •	Ammunition Gage Block
3	1005-06-938-8226	Ammunition Chute 7.62
4	6140-00-228-8447	Battery, Storage
5	5306-00-616-6472	Bolt
6	5306-00-655-7443	Bolt, NAD 1304-8
7	5306-00-616-6471	Bolt
8	5306-00-806-7697	Bolt
9	5306-00-774-8915	Bolt
10	5306-00-582-5723	Bolt, NAS 1305-8
11	5306-00-816-0948	Bolt
12	5306-00-292-8284	Bolt
13	5306-00-150-9083	Bolt
14	5306-00-156-2533	Bolt
15	5306-00-206-4911	Bolt
16	5306-00-141-4511	Bolt
17	1005-00-832-4549	Drive Motor
18	1005-00-921-6241	Feeder, Delinker Mau-56/A
19	2925-00-444-1186	Igniter Exciter
20	5310-00-807-1474	Nut
21	5310-00-844-4872	Nut
22	5310-00-807-1467	Nut
23	5310-00-807-1475	Nut
24	5310-00-807-1469	Nut
25	5340-00-921-5135	Pin, Quick Release
26	5305-00-X86-3011	Screws, Metal
27	5305-00-206-2036	Screws, Wood
28	• • •	Time Delay Relays (TDR's)
29	5310-O0-167-0766	Washer, Flat
30	5310-00-167-0765	Washer, Flat

Table D-2. Spare and Repair Parts

NOUN/NSN	UH58	UH6A	AH1E	AH1S	AH1F	AH1P	AH1T	UH1H	EH1H	HH1H	UH1V	UH1M	UH1E	UH1K	UH1L	UH1F	UH1P	UH1N	UH1O	AH64	CH47
PUMP SUBMERGED 2915-01-124-5222	X		X	X	X	X		X										X			
LINEAR ACTUATOR 2995-00-134-4543	X																				
FORCE GRADIENT CYL. 1680-00-126-4350	X																				
IGNITER EXCITER 2925-00-444-1186	X																				
PRESSURE ALTIMETER 6610-00-179-5254	X		X	X	X	X		X													
ATTITUDE INDICATOR 6610-00-150-6583	X							X													
COURSE INDICATOR 5826-00-505-3094	X		X	X	X	X		X													
PRESSURE ALTIMETER 6610-00-179-5242	X		X	X	X	X															
VERTICAL SPEED IND. 6610-00-935-4278	X		X	X	X	X		X													
VOLTMETER INDICATOR 6625-00-003-8745	X		X	X	X	X															
PRESSURE ALTIMETER 6610-00-110-3368	X	X	X	X	X	X		X													X
VERTICAL SPEED INDICATOR 6610-00-029-6703	X		X	X	X	X															
TRANSPONDER 5895-00-160-2198	X		X	X	X	X		X				X						X			
MOUNT 5895-00-063-9498	X		X	X	X	X		X				X	X					X			
CONTROL 5895-00-089-4403	X	X	X	X	X	X		X					X					X			
MOUNT 5895-00-919-9513	X	X	X	X	X	X		X				X	X					X			
ANTENNA 5895-00-935-4975	X		X	X	X	X		X							X			X			

Table D-2. Spare and Repair Parts (Cont)

NOUN/NSN	OH58	OH6A	AH1E	AH1S	AH1F	AH1P	AH1T	UH1H	EH1H	HH1H	UH1V	UH1M	UH1E	UH1K	UH1L	UH1F	UH1P	UH1N	UH60	AH64	CH47
MOUNT 5895-00-935-9582	X	X	X	X	X	X		X										X			
UHF RADIO SET 5821-00-138-7990	X		X	X	X	X		X													X
COMPENSATOR 6605-00-487-4773	X	X	X	X	X	X		X									X	X			X
DIRECTIONAL GYRO 6615-00-167-9757	X		X	X	X	X		X										X			
COMPASS TRANSMITTER 6605-00-531-2992	X	X	X	X	X	X		X									X	X			X
AN/ARC-114 5821-00-935-5071	X	X						X				X						X			
RADIO SET AN/ARC-115 5821-00-935-5072	X	X						X				X						X			
INVERTER 5841-01-140-0941																					
ELECTRICAL INDICATOR 6620-01-065-3740	X		X	X	X	X	X														
HOT AIR MIXING VALVE 4810-01-089-4105	X																				
N^1 INDICATOR, GAS PRODUCER 6620-01-032-3937	X																				
INDICATOR TURN & BANK 6610-00-169-1627	X		X	X	X	X		X													
MAGNETIC BRAKE 1680-00-909-8098	X		X	X	X	X		X	X	X	X	X	X		X	X	X	X			
PRESSURE ALTIMETER 6610-00-935-4323	X		X	X	X	X			X												X
ATTITUDE INDICATOR 6610-01-029-6702	X		X	X	X	X															
ICS 5895-00-895-4175	X	X	X	X	X	X		X				X						X	X		

Table D-2. Spare and Repair Parts (Cont)

NOUN/NSN	OH58	OH6A	AH1E	AH1S	AH1F	AH1P	AH1T	UH1H	EH1H	HH1H	UH1V	UH1M	UH1E	UH1K	UH1L	UH1F	UH1P	UH1N	UH60	AH64	CH47
AN/ARC-114(A) 5821-00-165-2970	X		X	X	X	X		X										X			
ANTENNA 5985-00-892-0895			X	X	X	X				X		X				X		X			X
BATTERY 6140-01-068-8572	X		X	X	X	X															
BATTERY 6140-00-228-8447	X																				
IGNITER EXCITER 2935-00-064-9435	X		X	X	X	X	X	X	X	X		X	X	X	X	X					

Table D-3. Weapons

NOUN/NSN	OH58	OH6A	AH1E	AH1S	AH1F	AH1P	AH1T	UH1H	EH1H	HH1H	UH1V	UH1M	UH1E	UH1K	UH1L	UH1F	UH1P	UH1N	UH60	AH64	CH47
MACHINE GUN 7.62MM 1005-00-903-0751	X	X		X		X						X									
AMMO-CHUTE FLEX 7.62 1005-00-027-4217	X	X		X		X						X									
DRIVE MOTOR 1005-00-832-4549	X			X		X						X									
FEEDER, DELINKING 1005-00-921-6241	X	X		X		X						X									

NOTE 1: Components marked X are 100% interchangeable and have the same NSN.

NOTE 2: All subcomponents of the major components may be removed and substituted; however, the level of disassembly must be consistent wlth the field tools and skill levels available.

Section II. FUELS

B-3. SCOPE. This section explains the use of substitute fuels to be used on the OH-58 helicopter. Table D-4 lists some possible U.S. fuels in proper priority that may be used. Table D-5 lists primary or standard fuel sources and alternate fuel sources for various countries. Table D-6 lists some commercial fuel sources that may be substituted for the primary or standard JP-4 fuel and also some alternate fuel sources which are similar to JP-5 and JP-8.

B-4. GENERAL. When fuel is pumped into a combustion chamber with the correct air mixture, it can be ignited and will burn in a controlled manner. The special additives the fuel contains prevents carbon deposits and corrosion build up which in turn helps engine performance.

B-5. MANNER OF BLENDING FUELS.

a. The fuel to be used on an OH-58 helicopter has to meet certain characteristics so that starting and performance will be satisfactory. These criteria are viscosity, pour point, and cloud point.

b. Some substitute fuels which alone cannot be used on the OH-58 helicopter can be blended with a primary fuel and can then be utilized for engine operation.

c. When using substitute fuels, it is preferable to premix the fuels in a container for better blending before pouring into tank. This method of mixing the primary fuel with a substitute fuel insures that the fuels mix completely. The best expedient fueling method is to add both fuels at the same time from two separate fuel lines. Table D-7 lists alternate and expedient fuel blends.

d. There is no special limitation on the use of Army standard fuel or alternate fuel. When using an emergency fuel, a fuel mixture which contains over 10 percent leaded gasoline is considered to be all leaded fuel. When using an emergency fuel, an entry on the faults and remarks column of DA Form 2408-13, Inspection Record, should be made. The entry should annotate the type of fuel, additives, and duration of operation.

e. Fuels having the same NATO code number are interchangeable, and fuels conforming to ASTM-D-1655 specification may be used when standard fuel MIL-T-5624-JP4 is not available. Refer to Table D-4.

Table D-4. Substitute Fuels for JP-4 Fuel

PRIMARY FUEL	ALTERNATE FUEL	EXPEDIENT FUEL	MILITARY SPECIFI-CATION	COMMERCIAL SPECIFI-CATION
Aviation Turbine: MIL-T-5624(JP4) NATO-F-40			X	
	MIL-T-5624(JP-5) NATO-F-44		X	
	Aviation Turbine: ASTM-D-1655 (Jet B)			X
	Aviation Turbine: MIL-T-83133 (JP-8) NATO-F-34		X	
	Aviation Turbine: ASTM-D-1655 (Jet A-1)		X	
		Kerosene: ASTM-D-3699		X
		Kerosene: NATO-F-5B	X	
		MIL-G-5572 (Any AVGAS) NATO-F-12, F-18, F-22	X	

Table D-5. Fuels for The OH-58 Helicopter

Source	Primary or Standard Fuel	Alternate Fuels	
U.S. Military Fuel NATO Code No.	JP-4(MIL-T-5624)	JP-5(MIL-T-5624)	JP-8(MIL-T-83133)
FOREIGN FUEL	NATO F-40	NATO-44	NATO-34
PRODUCT DESCRIPTION	TURBINE FUEL, AVIATION TYPE: Wide cut type +(S-748)	TURBINE FUEL, AVIATION: High Flash Type	TURBINE FUEL, AVIATION: Kerosene Type +(S-748)
BELGIUM	BA-PF-2B AMD.2 a/AF	BA-PF-6 n/AF	BA-PF-7 (AF)
CANADA	3-GP-22F n/AF	3-GP-24h n/(AF)	
DENMARK	MIL-T-5624 Grade JP-4 a/AF		D.Eng.RD.2453 Iss.3Amd.2 n/a/(AF)
FRANCE	AIR 3407/B AF		AIR 3405/C n/a/AF
FEDERAL REPUBLIC OF GERMANY	TL 9130-006 Iss.4 n/a/AF	TL 9130-007 Iss.4 n/(AF)	
GREECE	MIL-T-5624 Grade JP-4 n/AF		
ITALY	AA-M-C.142p n/a/AF	AA-M-C.143b n/(AF)	AA-M-C.141d Amd.1 (AF)
LUXEMBOURG			
NETHERLANDS	MIL-T-5624 Grade JP-4 a/AF	D.Eng.RD.2498 Iss.6Amd.2 n/(AF)	D.Eng.RD.2453 Iss.3Amd.2 a/AF
NORWAY	MIL-T-5624 Grade JP-4 AF		
PORTUGAL	MIL-T -5624 Grade JP-4 AF		AIR 3405/C AF
TURKEY	MIL-T-5624 Grade JP-4 a/AF		
UNITED KINGDOM	D.Eng.RD.2454 Iss.3Amd.2 n/a/AF	D.Eng.RD.2498 Iss.6Amd.2 n/a/(AF)	D.Eng.RD.2453 Iss.3Amd.2 a/AF
UNITED STATES	MIL-T-5624 Grade JP-4 n/alAF	MIL-T-5624 Grade JP-5 n/(AF)	MIL-T-83133 JP-8
USSR	GOST 1842-52 GOST 10227-62 T-1, TS-1		GOST 9145-59

Table D-6. Substitute Commercial Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUELS	
U.S. MILITARY FUEL NATO CODE NO.	JP-4(MIL-T-5624) F-40	JP-5(MIL-T-2624) F-44	JP-8(MIL-T-83133) F-34
COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield Richfield Div	Arcojet B	Arcojet A Richfield A	Arcojet A-1 Richfield A-1
B.P. Trading	B.P.A.T.G		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
City Service Co.		CITCO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Exxon Co. U.S.A.	Exxon Turbo Fuel B	Exxon A	Exxon A-1
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	

Table D-7. Alternate and Expedient Fuel Blends

BASE FUEL	EXTENDER (50% MAXIMUM)

NOTE

Fuel may be extended on an alternate basis with the following blends up to a half and half mixture.

Any Primary Fuel	Any Alternate Fuel
Any Primary Fuel	Any Alternate Fuel
Any Primary or Alternate Fuel	MIL-F-815 Distillate
Any Primary or Alternate Fuel	NATO-F-76 Navy Distillate
Any Alternate or Primary Fuel	Dry Cleaning Solution: P-D-680 (Type I and II)
	Dry Cleaning Solution: AMSTM-D-484 (K, I, II, III, IV)
	Petroleum Spirits: ASTM-D-235 (I, II, III, IV)

CAUTION

The helicopter shall not be flown when emergency fuel has been used for a total cumulative time of 50 hours.

Section III. LUBRICANTS AND HYDRAULIC FLUIDS

D-6. SCOPE. This section lists primary, alternate, and expedient lubricants and hydraulic fluids.

D-7. GENERAL.

a. The lubricants and hydraulic fluids used in OH-58 systems and components must have a compatible base composition, as well as good additive level. Being that the purpose of lubricants and hydraulic fluids is to reduce wear, support bearing loads, and provide cooling, their chemical composition must be compatible. In addition to lubricating, hydraulic fluids must transmit power and motion. If two incompatible hydraulic fluids are mixed, there is a tendency of a gel substance forming within the system and ruining it.

b. Some lubricants will not withstand OH-58 temperatures or loads for extended periods of time. These type of lubricants do not contain the necessary base properties for withstanding long term performance; therefore, they are recommended only as a last resort.

c. Expedient lubricants can cause one of three problems.

(1) They may not allow proper efficient operations because of improper viscosity.

(2) They may allow an increase in wear because of improper viscosity.

(3) They may cause seals to swell or create deposits because of improper composition.

D-8. LUBRICANTS AND HYDRAULIC FLUIDS. Table D-8 lists the primary lubricants and hydraulic fluids which are used as primary, alternate, and expedient uses on the OH-58 helicopter.

CAUTION

Lubricating oil MIL-L-23699 shall not be used in ambient temperatures below minus 32°C/25°F.

NOTE

It is not advisable to mix MIL-L-7808 and MIL-L-23699 oils, except during an emergency. If oils are mixed, the system should be flushed within six hours. An entry on DA Form 2408-13 is required when the oils are mixed. Hydraulic oils MIL-L-83282 and MIL-L-5606 should not be mixed except during an emergency. When these oils are mixed with each other or any other oil, a DA Form 2408-13 entry is required.

APPENDIX E

BDAR FIXES AUTHORIZED FOR TRAINING

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

REPAIR PROCEDURE	PARA NO.
AIRFRAME	
Honeycomb Core Floor or Panel Damage	4-22
DRIVE TRAIN SYSTEM	
Air Duct Hose Damage	8-6
HYDRAULIC SYSTEM	
Lines and Hoses.	9-5
Aluminum Tube Damage	9-7
Hydraulic Hose Damage	9-8
ELECTRICAL AND AVIONICS SYSTEM	
Splicing Unshielded Wires	11-5
Damaged Wire Insulation	11-7
Shielded Cable Repair	11-8
Shielded Cable Repair Segments	11-9
Shielded Terminators	11-10
Terminators for Nickel-Plated Shields (including vermillion).	11-11
Terminal Boards.	11-12
Terminal Lugs.	11-13
Wire Bundle Tie Wraps....	11-14
Coax Splice for RG-136/U and RG-179 R/U.	11-15
Bus Bars.	11-22
Battery Repair BB-476/A.	11-23
Substitute Emergency Antenna, Field Expedient.	11-25

BDAR FIXES AUTHORIZED FOR TRAINING (Cont)

APPENDIX F

AVIONICS CONFIGURATIONS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

F-1. SCOPE. This appendix lists and depicts the major components, cable routes, and wiring terminations pertaining to the OH-58 series helicopter avionics. This information is furnished as an aid to expedient repair techniques described in Chapter 11.

F-2. GENERAL. The actual configurations may vary depending on particular requirements or changes incorporated through modification work order (MWO) action and special purpose alterations. The Figures F-1 thru F-10 show typical location of avionics and their associated components in relation to the helicopter, and lists the component part number. Each figure also has a table associated with the avionics system which contains a complete wire listing to be used as an aid in rapid wire splicing. This includes the wire number, type (shielded, not shielded, or pair twisted with shield), end connectors, and the pin numbers on each connector.

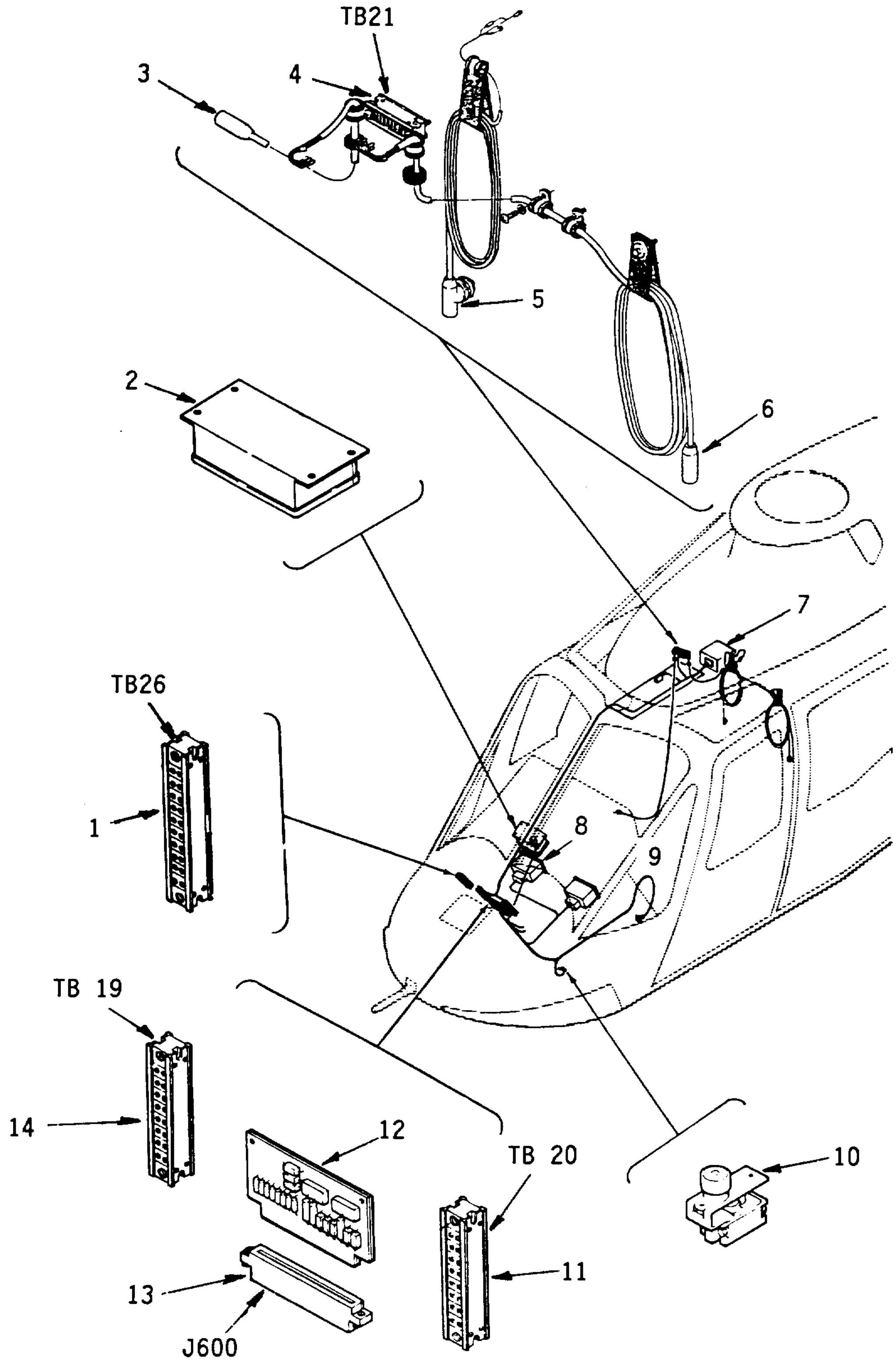


Figure F-1. Intercom System (Sheet 1 of 2)

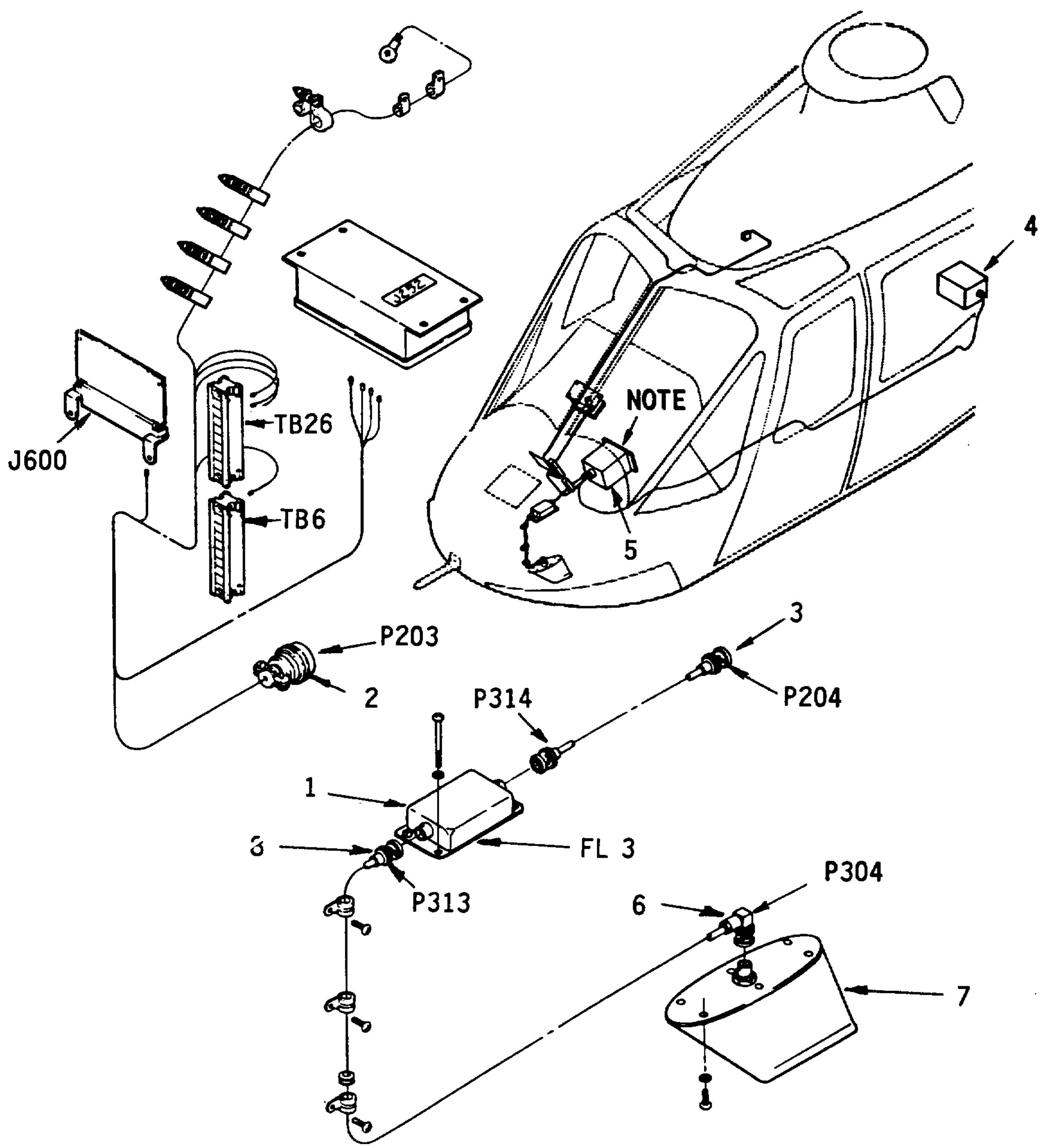
DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	TJ11E-02-01	Module, Terminal Junction
2	1021-DOO1	Audio Threshold
3	U92AU	Jack, Telephone
4	JF13E01-02	Frame, Electronic
5	U94A/U	Plug, Connector
6	U92AU	Jack, Telephone
7	C-6533/ARC	Control, Intercom
8	C-6533/ARC	Control, Intercom
9	C-6533/ARC	Control, Intercom
10	MS25039-1	Switch, Push
11	JF13E01-04	Rack, Electronic
12	206-075-483-1	Network, Impedance Matching
13	PC4D2D22-4	Connector, Recepticle
14	TJ11E02-02	Terminal Board

Figure F-1. Intercom System (Sheet 2 of 2)

Table F-1. Wiring Table, Intercom System

WIRE NUMBER	TYPE [1]	END 1	PIN	END 2	PIN
C6533A-3A22 (RED)	PR/S	P214	C	TB21	AZ
-1A22 (GRN)	PR/S	P214	A	TB21	C1
-45A22	SHIELD	P214	P	TB19	C1
-1OA22	SHIELD	P214	L	TB19	A3
-14A22	SHIELD	P214	R	TB19	C3
-18A22	SHIELD	P214	V	TB19	A1
C6533B-3A22 (RED)	PR/S	P215	C	TB21	A7
-1A22 (GRN)	PR/S	P215	A	TB21	A8
-45A22	SHIELD	P215	P	TB19	D1
-1OA22	SHIELD	P215	L	TB19	B3
-14A22	SHIELD	P215	K	TB19	D3
-18A22	SHIELD	P215	V	TB19	B1
C6533C-3A22 (RED)	PR/S	P213	C	J309	
-1A22 (GRN)	PR/S	P213	A	J309	
-45A22	SHIELD	P213	P	TB19	D2
-1OA22	SHIELD	P213	L	TB19	B4
-14A22	SHIELD	P213	K	TB19	D4
-18A22	SHIELD	P213	V	TB19	B2

1 Denotes: PR/S--Pair, Twisted, with Shield



NOTE
THIS UNIT IS A CONTROL PANEL
ONLY IN AIRCRAFT USING
AN/ARC-51BX TRANSMITTER

Figure F-2. UHF/AM Communication System (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	HPF40-O1T	Filter, High Pass
2		Connector, Electric
3	KD-59-04	Connector, Plug
4	AN/ARC-51BX	Transceiver, UHF, RT-742()
5	C-6287/ARC-51BX AN/ARC-116 AN/ARC-164	Control, Panel
6	KO-59-04	Connector, Plug
7	AS2487	Antenna, UHF
8	KA-59-119	Connector, Plug Electric

Figure F-2. UHF/AM Communication System (Sheet 2 of 2)

Table F-2. Wiring Table UHF/AM Communication System

WIRE NUMBER	TYPE [2]	END 1	PIN	END 2	PIN [1]
OH-58A					
ARC51-124A20	SHIELD	P403	R	P401	E
-125A20	SHIELD	P401	F	J405	d
-128A20 (RED)	PR/S	P403	V	J405	K
-129A20 (BLK)	PR/S	P403	E	J405	L
-131A20	SHIELD	P403	U	J405	e
-140A	COAX	P404		J406	
*ARC116-10A22	SHIELD	P203	K	TB19	C4
-101A	COAX	P204		P314	
-101B	COAX	P313		P304	
*SAME WIRING USED FOR AN/ARC-164.					
OH-58C					
ARC116-10B22 (RED)	PR/S	P203	K	J252	D6
-11B22 (BLK)	PR/S	P203	L	J252	B6
-101A	COAX	P204		P314	
-101B	COAX	J313		P304	

1 Underlined Pin Numbers Denote Lower Case.

2 PR/S---Pair, Twisted, with Shield

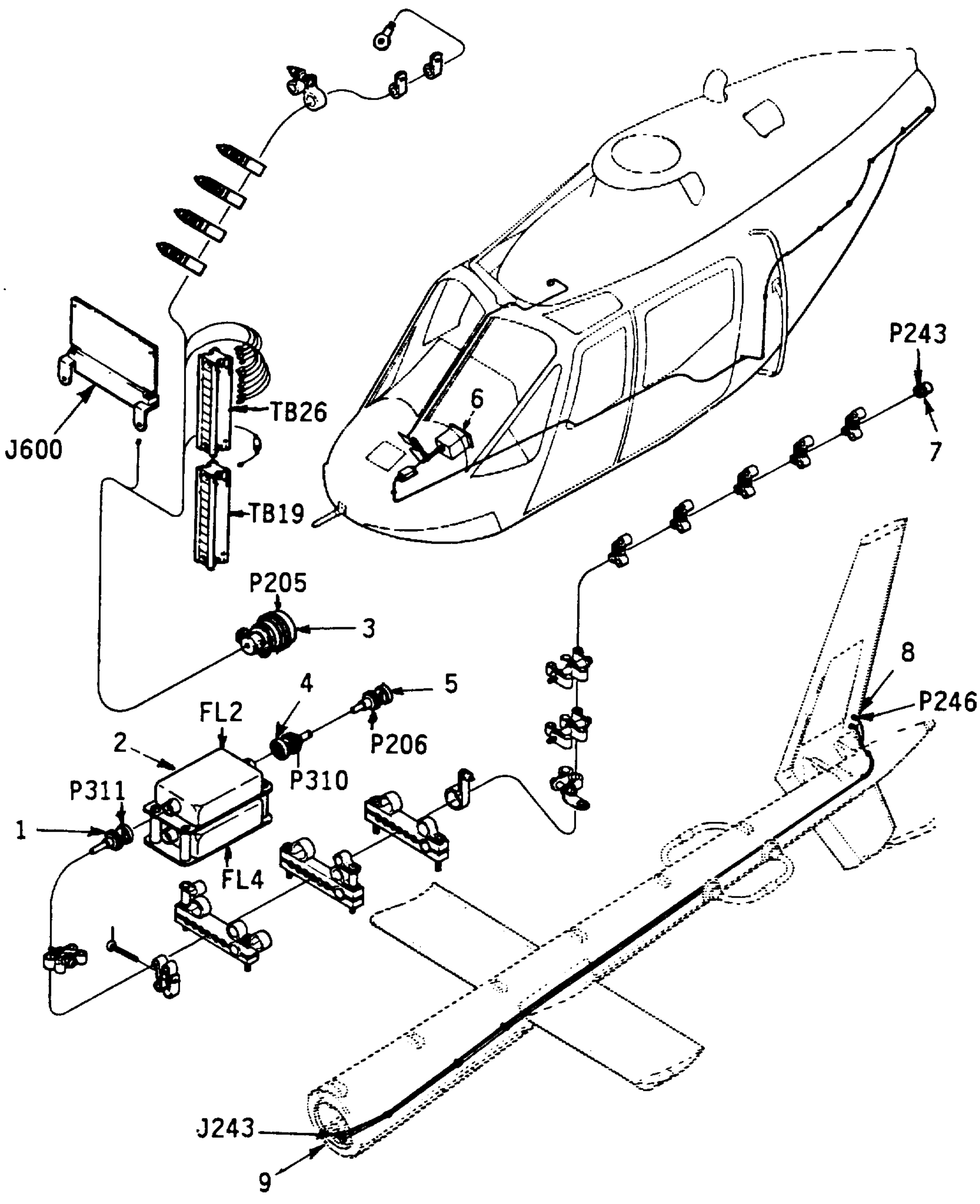


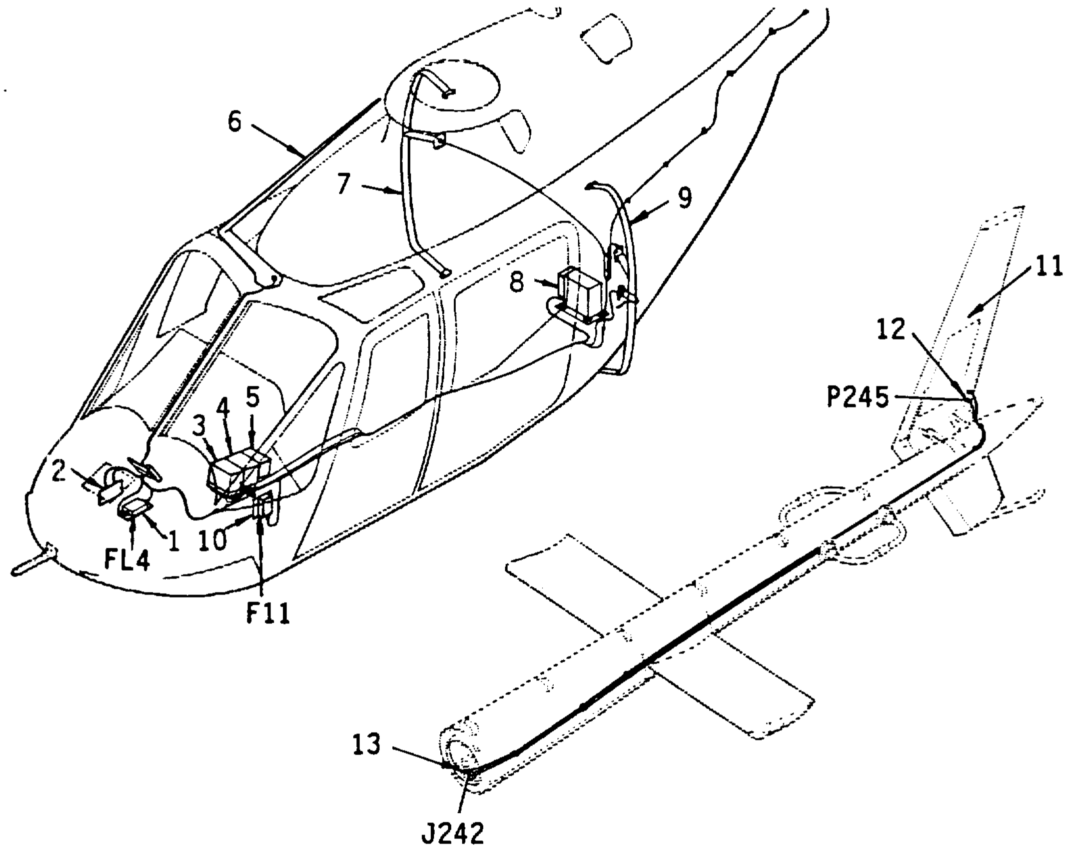
Figure F-3. VHF/AM Communication System and Connecting Cables (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	KC-59-212	Connector, Plug
2	BPF40-03P	Filter, Band Pass
3	JT06RE18-32S	Connector, Plug
4	KC-59-212	Connector, Plug
5	KD-59-04	Connector, Plug
6	AN/ARC-115	Connector, Plug
7	KC-59-196	Connector, Plug
8	KC-59-198	Connector, Electric
9	KC-19-120	Connector, Electric

Figure F-3. VHF/AM Communication System and Connecting Cables (Sheet 2 of 2)

Table F-3. Wiring Table, VHF/AM Communication System

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
OH-58A					
ARC115-1OA22	SHIELD	P205	K	TB19	A4
-101A	COAX	P206		P310	
-101B	COAX	P311		P243	
ARC115-101C	COAX	J243		P246	
OH-58C					
ARC115-1OB22 (RED)		P205	K	J252	D5
-11B22 (BLK)		P205	L	J252	D6
-101A	COAX	P206		P310	
-101B	COAX	P311		P243	
ARC115-101C	COAX	J243		P246	



DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	LPF-40-028	Filter, Low Pass
2	204-075-850-9	Board, Capacitor, A3
3	AN/ARC-114	Radio Set, No. 1 FM
4	AN/ARC-114	Radio Set, No. 2 FM
5	C-8157/ARC	Control, Indicator TSEC/KY-28
6	AS-2485	Antenna, No. 2 FM
7	AS-2670/ARC	Antenna, R/H, No. 1 FM
8	TSEC/KY-28	Com Security Set
	TSECIKY-58	Com Security Set
9	AS-2486/ARC	Antenna, L/H, No. 1 FM
10	LPF40-028	Filter, Low Pass
11	206-022-114-1	Antenna, No. 1 FM, USBL on 68-16687 thru 72-21454
	206-022-114-3	USBL on 72-21455 and Subq.
12	KC-59-212	Connector, Plug
13	KC-19-120	Connector, Electrical

Figure F-4. VHF/FM Communication System

Table F-4. Wiring Table, VHF/FM Communication System

WIRE NUMBER	TYPE [2]	END 1	PIN [1]	END 2	PIN
OH-58A					
1ARC114-2A22	SHIELD	P209	B	P201	V
-9A22	SHIELD	P209	J	P249	P
-10A22	SHIELD	P209	K	P249	V
-11A22	SHIELD	P209	L	P250	H
-17A22	SHIELD	P209	T	A3	2
-18A22	SHIELD	P209	U	A3	1
-19A22	SHIELD	P209	V	P201	W
-26A22	SHIELD	P209	c	P249	D
-27A22	SHIELD	P209	d	P249	G
-28A22	SHIELD	P209	e	P250	K
-101A	COAX	P210		P237	
-101B	COAX	P239		P242	
-101C	COAX	J242		P245	
-102A	COAX	P211		P241	
-103A	COAX	P212		P240	
2ARC114-10A22	SHIELD	P207	K	TB19	C2
-101A	COAX	P208		P316	
-101B	COAX	P315		P238	
OH-58C					
1ARC114-2A22	SHIELD	P209	B	P201	V
-9A22	SHIELD	P209	J	P249	P
-10A22	SHIELD	P209	K	P249	V
-11A22	SHIELD	P209	L	P250	H
-17A22	SHIELD	P209	T	A3	2
-18A22	SHIELD	P209	u	A3	1
-19A22	SHIELD	P209	V	P201	K
-26A22	SHIELD	P209	c	P249	D
-27A22	SHIELD	P209	d	P251	C2
-28A22	SHIELD	P209	e	P250	K
-101A	COAX	P210		P237	
-101B	COAX	P239		P242	
-101C	COAX	P242		P245	
-102A	COAX	P211		P241	
-103A	COAX	P212		P240	
2ARC114-11B22 (BLK)	PR/S	P207	L	J252	D4
-20B22 (RED)	PR/S	P207	K	J252	C5
-101A	COAX	P208		P316	
-101B	COAX	P315		P238	

1 Underlined Pin Numbers Denote Lower Case.

2 Denotes: PR/S---Pair, Twisted, with Shield

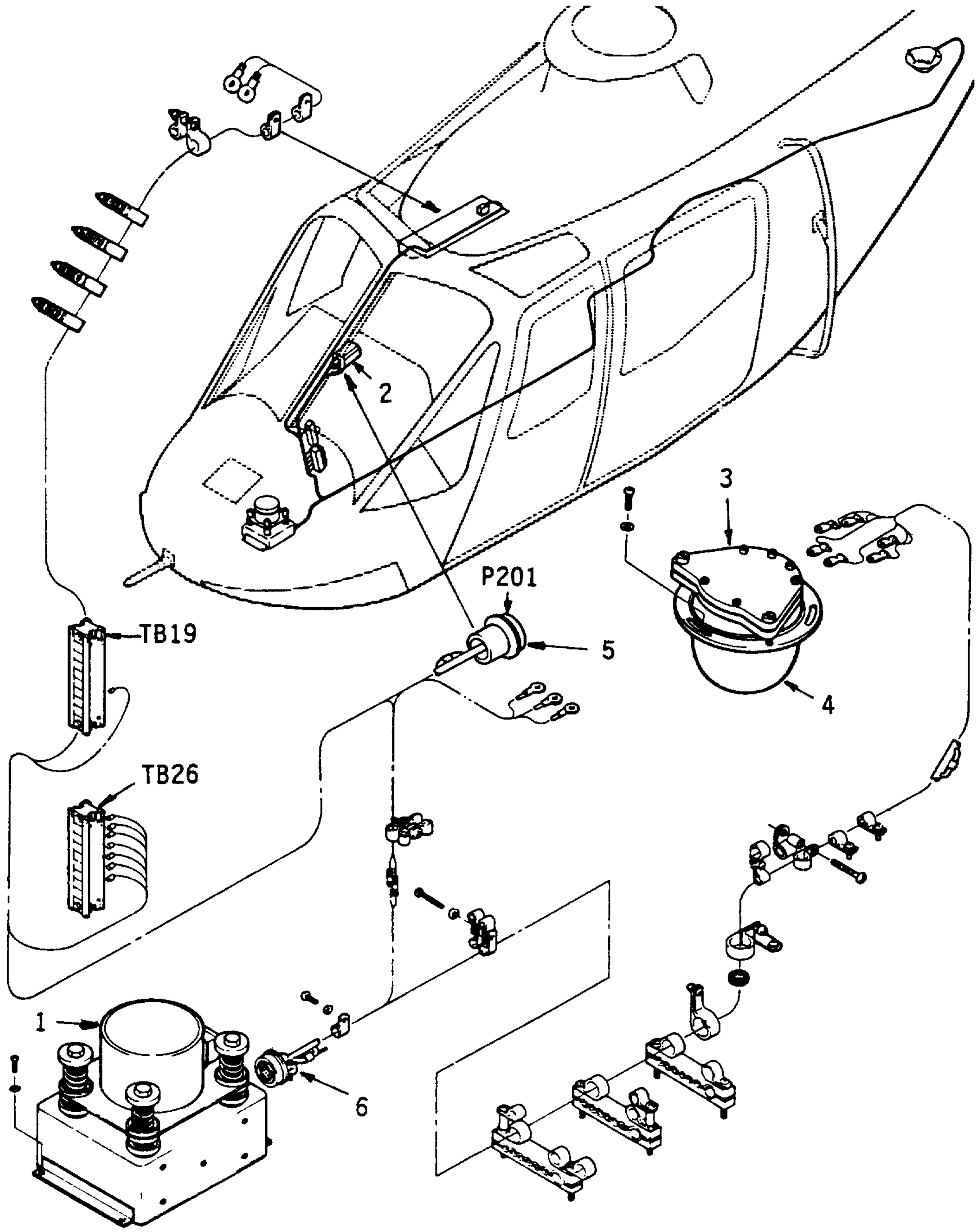


Figure F-5. Gyromagnetic Compass Set AN/ASN-43
and Connecting Cables (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	CN-998()/ASN-43	Gyroscope, Displacement
2	ID-1351()/A	Indicator, Heading Bearing
3	CN-405/ASN	Compensator, Transmitter
4	T-611A/ASN	Transmitter, Induction
5	MS3126E18-32S	Connector, Plug
6	MS3126E16-26S	Connector, Plug

Figure F-5. Gyromagnetic Compass Set AN/ASN-43 and Connecting Cables (Sheet 2 of 2)

Table F-5. Wiring Table, Gyromagnetic Compass Set

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
TN1705D22	SHIELD	P202	V	P202	T
10A22 (BLU)	TWT/S	P202	W	P201	J
11A22 (GRN)	TWT/S	P202	X	P201	K
12A22 (YEL)	TWT/S	P202	Y	P201	L
13A22	SHIELD	P202	H	P201	C
14A22	SHIELD	P202	J	P201	D
15A22	SHIELD	P202	G	P201	E
20A22 (BLU)	TWT/S	P201	F	TR101	B
21A22 (GRN)	TWT/S	P201	G	TR101	C
22A22 (YEL)	TWT/S	P201	H	TR101	A

1 Denotes: TWT/S---Three Wire Twisted, with Shield

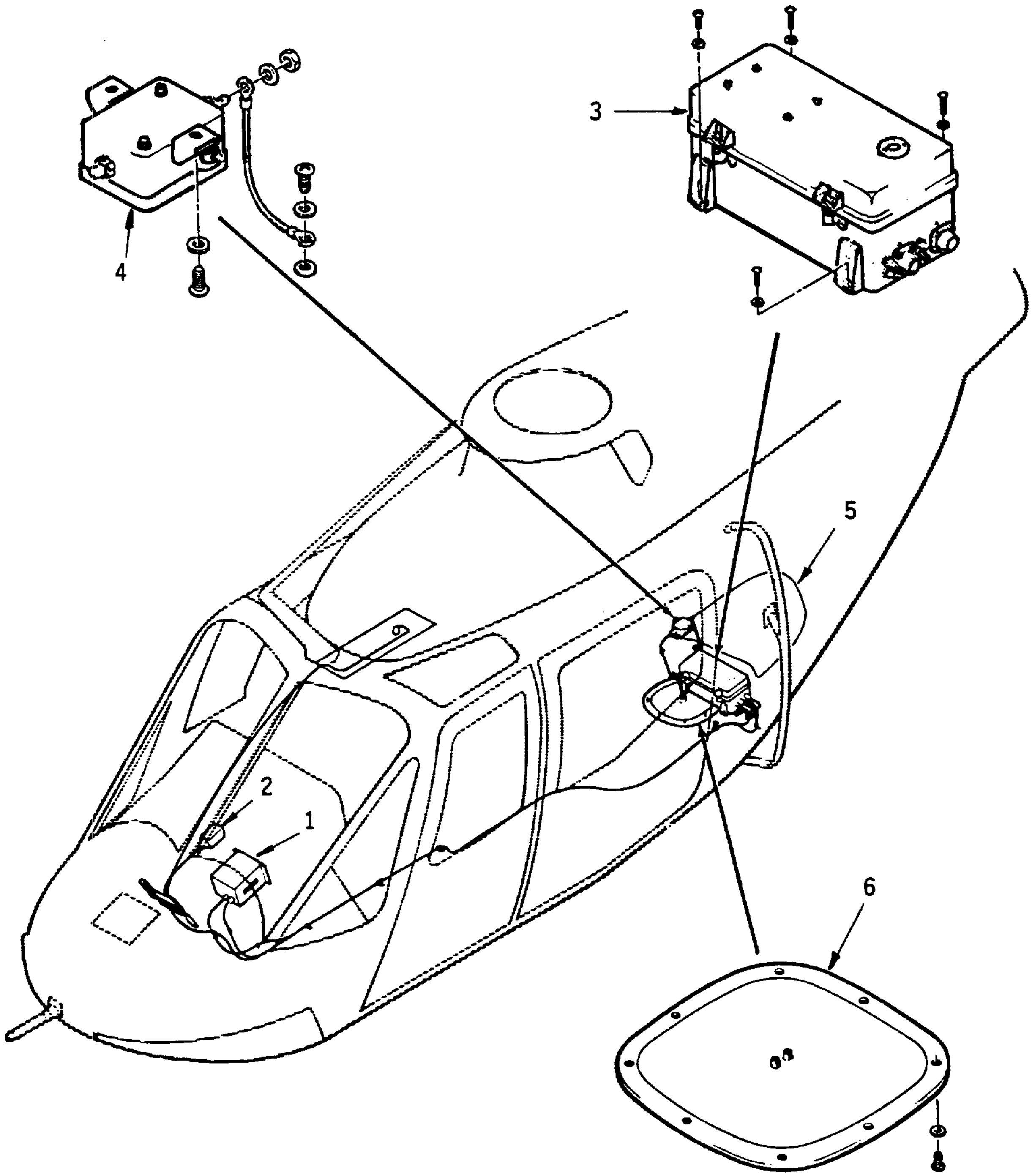


Figure F-6. Direction Finder Set AN/ARN-89 (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	C-7392()/ARN-89	Control, Radio Set
2	ID-1351()/A	Indicator, Heading Bearing
3	R-1496()/ARN-89	Receiver, Radio
4	AM-4859()/ARN-89	Amplifier, Impedance Matching
5	206-032-310-3	Antenna, Sense
6	AS-2108()/ARN-89	Antenna, Loop

Figure F-6. Direction Finder Set AN/ARN-89 (Sheet 2 of 2)

Table F-6. Wiring Table, ADF AN/ARN-89

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
OH-58A					
ARN89-6C22	SHIELD	P227	F	SPLICE	
-6B22	SHIELD	P227	D	SPLICE	
-6A22	SHIELD	SPLICE		P201	N
CG-3492/U() *	COAX	P223		P225	
-3493/U() *	COAX	P222		P224	
-3494/U() *	COAX	P220		P217	
-3495/U() *	COAX	P221		P226	
CX-10960/U()	SHIELD	P219		P218	
OH-58C					
ARN89-6C22	SHIELD	P227	F	SPLICE	
-6B22	SHIELD	P227	D	SPLICE	
-6A22	SHIELD	P227		3405S1	10
CG-3492/U() *	COAX	P223		P225	
CG-3493/U() *	COAX	P222		P224	
CG-3494/U() *	COAX	P220		P217	
CG-3495/U() *	COAX	P221		P226	
CX-10960/U()	SHIELD	P219		P218	

*NOTE: Center Conductor of Coax Cable Has 28.0 V dc.
Disconnect Before Using TDR.

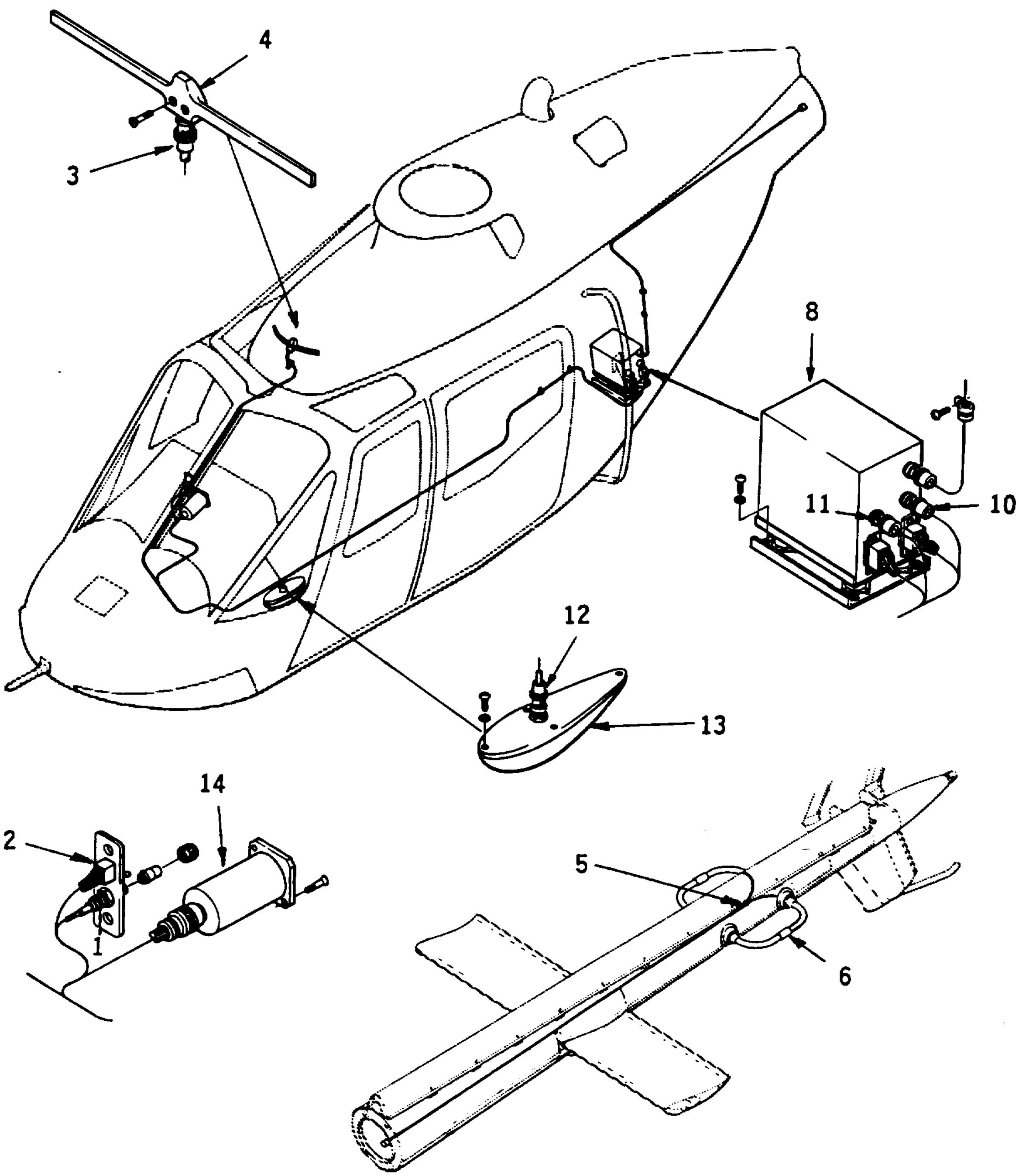


Figure F-7. Radio Receiving Set AN/ARN-123(V)1 (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	MS25041-4	Light, Indicator
2	MS27786-23	Switch, Toggle, Four Pole
3	M39012/16-0004	Connector, Plug
4	AS-3188/ARN	Antenna, Glideslope
5	5955-00-858-6552	Spider, Coax Assembly (05211)
6	AS-3104()/ARN	Antenna
7	M39012/16-0004	Connector, Plug
8	R-2023/ARN-123(V)1	Receiver
9	M39012/16-0004	Connector, Plug
10	M39012/16-0004	Connector, Plug
11	M39012/16-0004	Connector, Plug
12	M39012/16-0004	Connector, Plug
13	AT-640/ARN	Antenna, Marker Beacon
14	ID-1347C/ARN	Indicator, Course

NOTE

IF ID-1347C/ARN-82 IS USED WITH THE AN/ARN-123(V), THE SWITCH ON THE BACK OF THE INDICATOR MUST BE SET TO THE R-1388A/ARN-82 POSITION.

Figure F-7. Radio Receiving Set AN/ARN-123(V)1 (Sheet 2 of 2)

Table F-7. Radio Receiving Set AN/ARN 123(V)1 OH-58C

WIRE NUMBER	TYPE [1]	END 1	PIN	END 2	PIN
ARN123-20A22 (WHT)	TWT/S	3405RE1P11001	12	3405S1	3
-20A22 (BLU)	TWT/S	3405RE1P11001	13	3405S1	6
-20A22 (ORN)	TWT/S	3405RE1P11001	25	3405S1	9
-33A22 (WHT)	TWT/S	3405RE1P12002	9	3405DS1P1	B
-33B22	SHIELD	3405RE1P12002	32	SPLICE	
-33A22 (BLU)	TWT/S	SPLICE		SPLICE	
-34A22 (BLU)	SHIELD	SPLICE		SPLICE	
-33C22		SPLICE		3405DS1P1	C
-34A22 (WHT)	TWT/S	3405RE1P12002	23	3405DS1P1	H
-35A22 (WHT)	PR/S	3405RE1P12002	8	3405DS1P1	D
-35A22 (BLU)	PR/S	3405RE1P12002	33	3405DS1P1	E
-36A22 (WHT)	PR/S	3405RE1P12002	36	3405DS1P1	G
-36A22 (BLU)	PR/S	3405RE1P12002	34	3405DS1P1	F
-38A22 (WHT)	PR/S	3405RE1P12002	15	3405CP1P1	3
-38A22 (BLU)	PR/S	3405RE1P12002	11	3405CP1P1	1
-38B22		SPLICE		3405CP1P1	1
-39A22 (WHT)	PR/S	3405RE1P12002	4	3405CP1P1	19
-39A22 (BLU)	PR/S	3405RE1P12002	2	3405CP1P1	17
-40A22 (WHT)	TWT/S	3405RE1P12002	7	P201	P
-40A22 (BLU)	TWT/S	3405RE1P12002	6	P201	R
-40A22 (ORN)	TWT/S	3405RE1P12002	10	GND	
-41A20 (WHT)	PR/S	3405RE1P12002	18	3405T1	
-41A20 (BLU)	PR/S	3405RE1P12002	19	GROUND	

1 Denotes: PR/S----Pair, Twisted, with Shield
TWT/S---Three Wire Twisted, with Shield

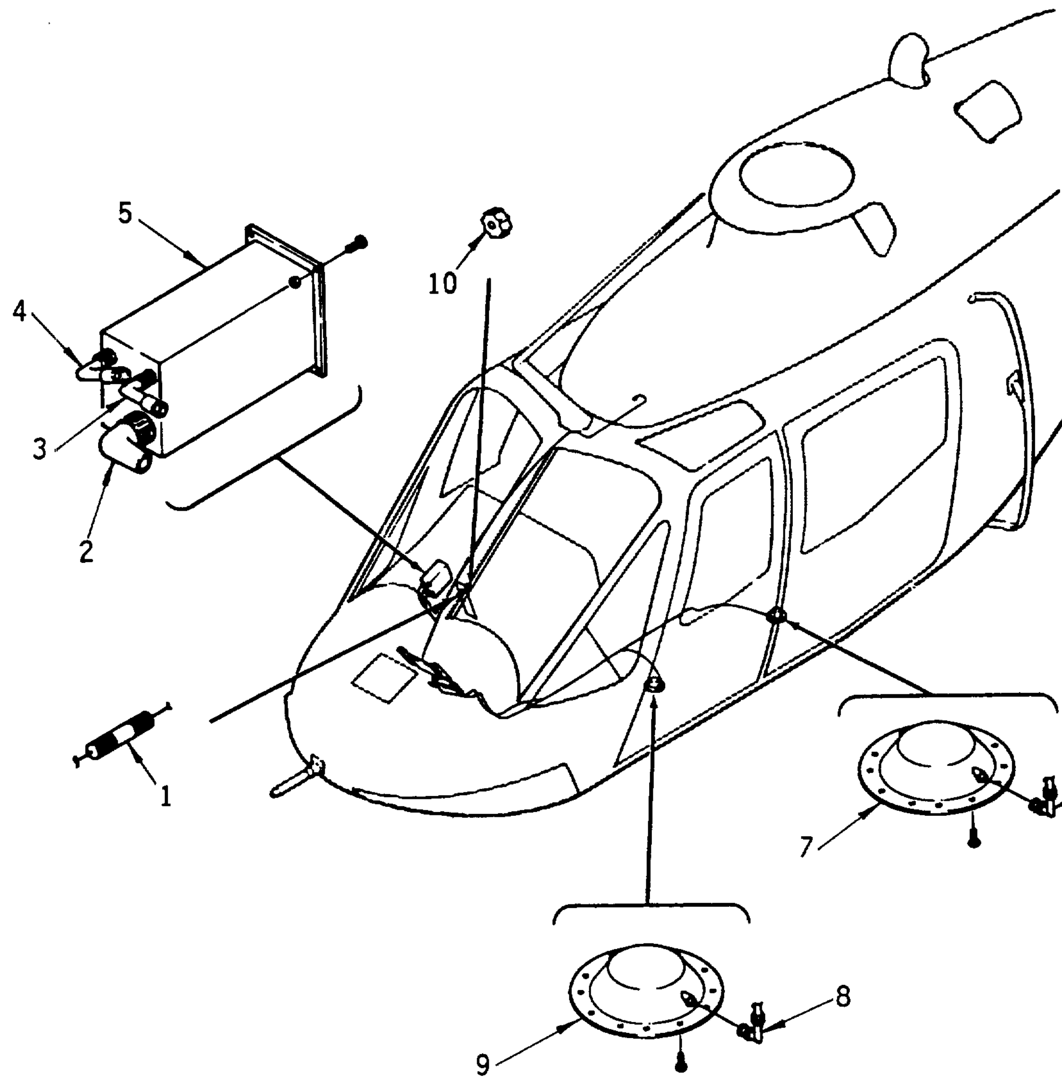


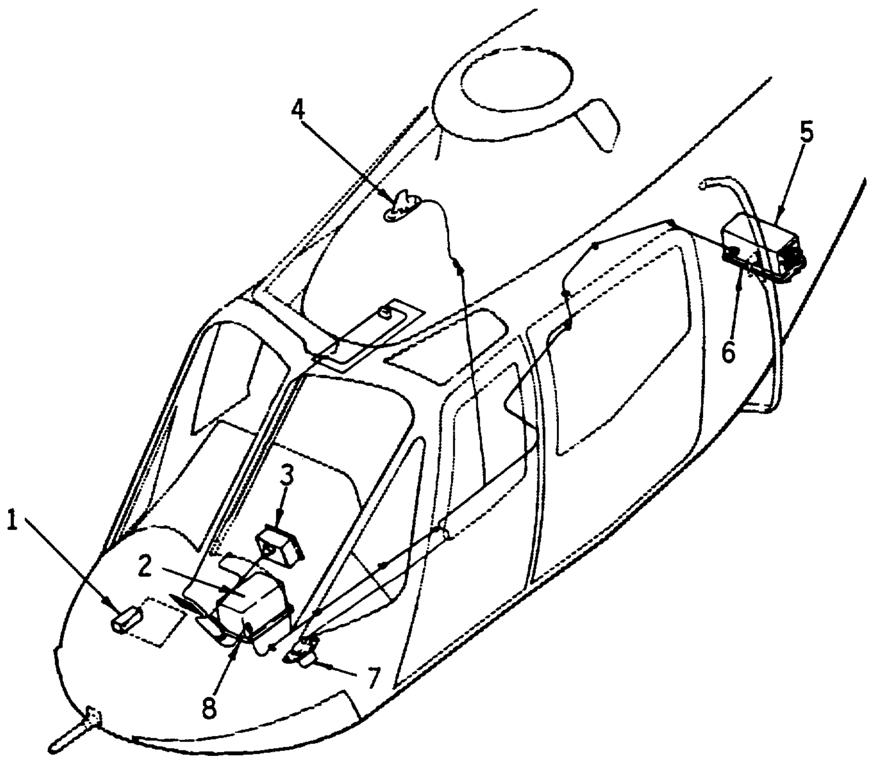
Figure F-8. Radar Altimeter System AN/APN-209 (Sheet 1 of 2)

DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	M39002/01-0072	Resistor, Fixed
2	MS27473T10835S	Connector, Plug, Electric
3	KA-59-96	Connector, Plug
4	KA-59-96	Connector, Plug
5	RT-1115/APN-209	IND., RCVR, Transmitter
6	KA-59-96	Connector, Plug
7	AS-2595/APN-194	Antenna
8	KA-59-96	Connector, Plug
9	AS-2595/APN-194	Antenna
10	MS91528-0N18	Knob, Control

Figure F-8. Radar Altimeter System AN/APN-209 (Sheet 2 of 2)

Table F-8. Wiring Table, Radar Altimeter AN/APN-209 OH-58C

WIRE NUMBER	TYPE 1	END 1	PIN	END 2	PIN
APN209-21A	COAX	2408DS1P4	J4	3408E1P1	J1
APN209-22A	COAX	2408DS1P3	J3	3408E2P1	J1



DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	TS-1843()/APX	Test Set, Transponder
2	RT-859()/APX-72	Receiver-Transponder
3	C-6280A(P)/APX	Control, Transponder
	RT-1285/APX-100(V)	APX Transponder: The APX-100(V), Used On The OH-58C Does Not Require The TS-1843()/APX
4	206-077-109-1	Antenna: Used Only On OH-58C With APX-100
5	KIT-1A/TSEC	Computer
6	MT-3513/APX	Mount
7	AT-884()/APX	Antenna
8	MT-3809/APX-72	Mount

Figure F-9. Transponder (IFF) System AN/APX-72, AN/APX-100

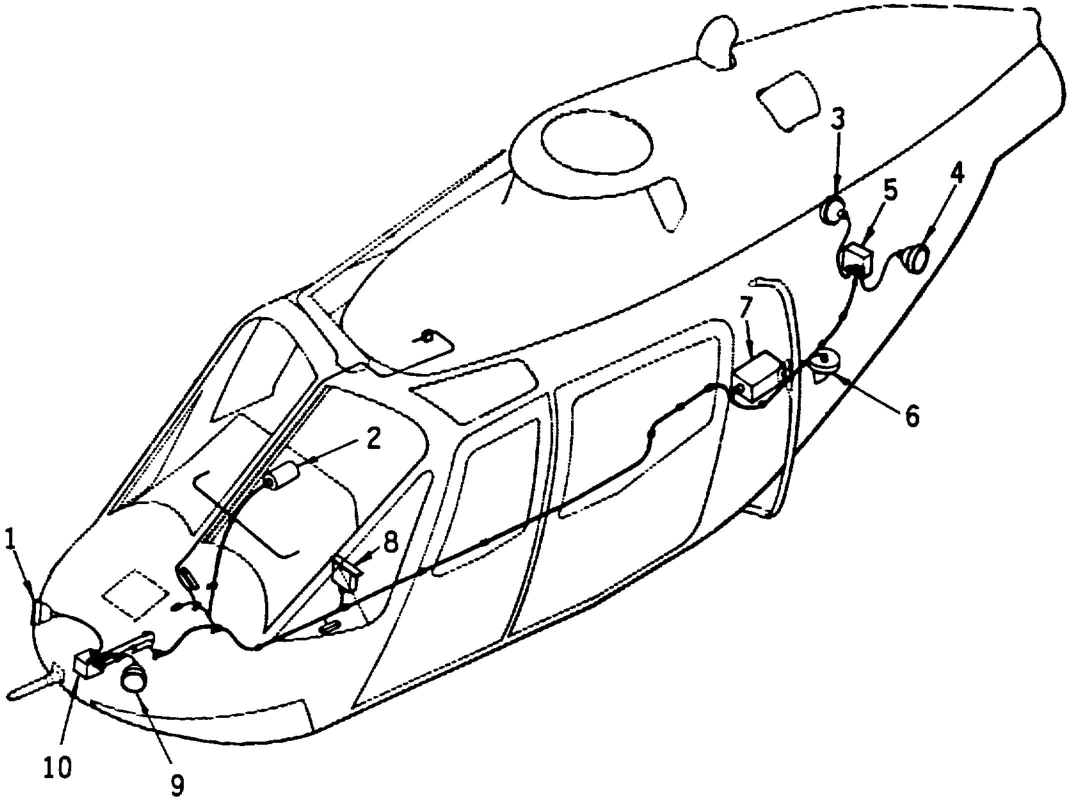
Table F-9. Wiring Table, IFF, APX-72 OH-58A

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
SX706A18	SHIELD	P234	2	SPLICE	
SX706B18	SHIELD	SPLICE		CB2	
SX707A22	SHIELD	P234	4	P232	24
SX712A22	SHIELD	P234	21	P232	2
SX714A22	SHIELD	P234	20	P232	11
SX716A22	SHIELD	P234	19	P232	5
SX717A22	SHIELD	P234	18	P232	6
SX719A22	SHIELD	P234	16	P232	8
SX720A22	SHIELD	P234	15	P232	9
SX721A22	SHIELD	P234	14	P232	10
SX743A22	SHIELD	P234	6	P233	31
SX754A22	SHIELD	P234	40	P232	26
SX755A22	SHIELD	P234	39	P232	27
SX756A22	SHIELD	P234	38	P232	28
SX757A22	SHIELD	P234	37	P232	29
SX758A22	SHIELD	P234	36	P232	30
SX761A22	SHIELD	P234	29	P232	32
SX762A22	SHIELD	P234	28	P232	33
SX763A22	SHIELD	P234	27	P232	35
SX764A22	SHIELD	P234	26	P232	36
SX765A22	SHIELD	P234	25	P232	37
SX766A22	SHIELD	P234	24	P232	38
SX768A22	SHIELD	P232	12	TB6	C3
SX803A22	SHIELD	P234	9	J600	29
SX804A22	SHIELD	P234	10	TB26	B2
SX817A22	SHIELD	P234	59	P232	4
SX818A22	SHIELD	P234	43	P232	15
SX819A22	SHIELD	P234	44	P232	16
SX820A20	SHIELD	P234	50	P232	17
SX821A22	SHIELD	P234	56	P232	18
SX822A22	SHIELD	P234	57	P232	19
SX823A22	SHIELD	P234	58	P232	20
SX824A22	SHIELD	P234	22	P232	25
SX825A20	SHIELD	P234	34	P232	42
SX826A22	SHIELD	P234	51	P232	55
SX834A20	SHIELD	P232	51	SPLICE	
SX849A22	SHIELD	P233	19	P232	3
SX701A	COAX	P233		P236	
SX701B	COAX	P230		P235	
SX828A	COAX	P234	45	P233	2
SX829A	COAX	P234	46	P233	3
SX830A	COAX	P234	47	P233	1
SX831A	COAX	P234	48	P233	4

Table F-10. Wiring Table, IFF, APX-100, OH-58C

WIRE NUMBER	TYPE [1]	END 1	PIN	END 2	PIN
APX100-5048A22(WHT	PR/S	3410TR1P1	21	J600	29
-5048A22(BLU	PR/S	3410TR1P1	23	J600	28
-5001A	COAX	3410TR5P1		3410E1P2	
APX100-5002A	COAX	3410TR4P1		3410E1P1	
APR39-31A	SHIELD	3410TR1P1	19	3422Z1P1	22
APX100-5017A	COAX	3410TR1P1	43	3410U1P1	4
-5018A	COAX	3410TR1P1	45	3410U1P1	2
-5019A	COAX	3410TR1P1	47	3410U1P1	3
APX100-5020A	COAX	3410TR1P1	49	3410U1P1	1

1 Denotes: PR/S---Pair, Twisted, with Shield



DRAWING DESIGNATION	PART NUMBER	FUNCTION
1	AS-2892/APR-39(V)	Antenna, Left Spiral
2	IP-1150()/APR-39	Indicator, Radar Signal
3	AS-2891/APR-39(V)	Antenna, Right Spiral
4	AS-2892/APR-39(V)	Antenna, Left Spiral
5	R-1838()/APR-39	Receiver, Radar
6	AS-2890/APR-39(V)	Antenna
7	CM-440/APR-39(V)	Comparator
8	C-9326/APR-39(V)	Control, Detecting Signal
9	AS-2891/APR-39(V)	Antenna, Right Spiral
10	R-1838()/APR-39(V)	Receiver, Radar

Figure F-10. Radar Warning System AN/APR-39

Table F-11. Wiring Table, AN/APR-39

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
OH-58A					
APR39-1A	COAX	3422Z1P1	8	3422RE1P3	
-2A	COAX	3422Z1P1	18	3422RE2P3	
-3A	COAX	3422Z1P1	19	3422RE2P4	
-4A	COAX	3422Z1P1	9	3422RE1P4	
-9A	COAX	3422Z1P2		3422E1P1	
-15A	COAX	3422DS1P1	5	3422Z1P1	5
-17A	COAX	3422Z1P1	7	3422RE1P5	
-23A	COAX	3422Z1P1	9	3422RE1P4	
-30A22	SHIELD	3422A1P1	14	TB20	C15
-30B22	SHIELD	TB20	C16	P214	LL
-30C22	SHIELD	TB20	D16	P215	LL
APR39-31A	COAX	3422Z1P1	21	P234	11
OH-58C					
APR39-lA	COAX	3422RE1P3	J3	3422Z1P1	8
-2A	COAX	3422RE2P3	J3	3422Z1P1	18
-3A	COAX	3422RE2P4	J4	3422Z1P1	19
-4A	COAX	3422RE1P4	J4	3422Z1P1	9
-9A	COAX	3422Z1P2	J2	3422E1P1	J1
-15A	COAX	3422Z1P1	5	3422DS1P1	5
-17A	COAX	3422RE1P5	J5	3422Z1P1	7
-23A	COAX	3422RE2P5	J5	3422Z1P1	17
-30A22	SHIELD	3422A1P1	14	TB20	C15
-30B22	SHIELD	TB20	C16	P214	LL
-30C22	SHIELD	TB20	D16	P215	LL
APR39-31A	COAX	3422Z1P1	22	3410TR1P1	19

INDEX

INDEX (Cont)

INDEX (Cont)

INDEX (Cont)

INDEX (Cont)

GLOSSARY

NOTE

- The terms and acronyms listed herein are defined in relation to BDAR and accordingly may not be used in the same manner in other manuals.
- Additional definitions of terms, markings, and acronyms used during BDAR assessment procedures will be found under chapter 1, paragraph 1-10, Tagging and Identifying BDAR Repairs.

ABRASION	Roughened surface, varying from light to severe.
ALLOWANCE	A prescribed difference between the maximum condition of mating parts. The minimum clearance or maximum interference between such parts.
API	Armor piercing incendary armament round.
ASSEMBLY	A group of two or more physically connected and related parts, capable of disassembly, and when combined with other assemblies and parts, creates a component.
ASSEMBLY CLEARANCE	The actual fit between two or more mating parts with respect to the amount of clearance or interference between them.
ASSESSMENT	A procedure to rapidly determine what is damaged, whether it is repairable, what assets are required, who can perform the repair, and where the repair can made.
ASSOCIATED PARTS	A group of parts which could contain one or more unrelated parts of a subassembly, one or more subassemblies, and attaching hardware.
AXIAL	Related to an axis. Describes the linear distance a shaft or gear moves.
BATTLEFIELD DAMAGE	Any incident such as combat damage, random failures, operator errors, accidents, and wear-out failures which occur on the battlefield and which prevent the equipment/end item from accomplishing its mission.
BEAM	A primary structural element designed to carry heavy loads by resisting bending in one direction. Usually constructed with a channel, tee, or “I” cross section.
BEND	Any change in an intended configuration.
BORE	Inside measurement of the interior diameter of a hole or tube. Also used to describe the hole itself.

GLOSSARY (Cont)

BOWED	Curved or gradual deviation from original line or plane.
BOX BEAM	A primary structural element designed to carry heavy loads by resisting bending in at least two directions characterized by a square or rectangular hollow cross section.
BRAID	Machine woven wire strands.
BREAK	Separation of a part or substance from itself.
BRIDGING	Jumping or bypassing of a part or component.
BRINELLED	Circular indentations on bearing surfaces.
BULKHEAD	The primary vertical structural element. Often called frames or walls.
BUCKLE	Wrinkle or crease damage to sheet metal structural elements.
BURN	Loss of metal resulting from overheating.
BURNISHING	The smoothing of a metal surface by mechanical action without loss of material. Generally found on plain bearing surfaces. Surface discoloration is sometimes present around outer edges of a burnished area.
BURR	A rough edge or sharp projection.
CANNIBALIZATION	The removal of needed parts or assemblies from other aircraft, equipment, or from non-essential systems on the helicopter undergoing repair.
CAP	A continuous structural element (angle, tee, or channel shape) fastened to the top and bottom of a beam or web.
CATASTROPHIC	A sudden and disastrous event caused by equipment failure which endangers human life.
CHAFED	Functional wear. A rubbing action between two parts having relative motion.
CHECK	An examination for verifying.
CHIPPING	Breaking away of small metallic particles.
CHORDLINE	An imaginary line running perpendicular to the leading or trailing edge of a rotor blade.

GLOSSARY (Cont)

CLOCKWISE	A circular motion in the direction the hands of a clock rotate when viewed from the front.
COATING, PROTECTIVE	An external surface treatment, such as paint, anodizing, electroplating or chemical film, used to delay the effects of corrosive or atmospheric elements upon metals.
COMBAT CAPABLE	The ability of the helicopter to perform the MINIMUM combat mission assignments.
COMBAT EMERGENCY CAPABLE	The ability of the helicopter to perform LIMITED specific tactical mission assignments.
COMPONENT	A group of physically connected assemblies or parts.
CONSUMABLE ITEMS	Parts or materials which are consumed by usage or which have a one-time usage in depot maintenance activity.
CORE	The inner layer of material used to construct honeycomb structural panels.
CORROSION	Surface chemical action which results in surface discoloration, a layer of oxide, rust, or removal of surface metal.
COUNTER-CLOCKWISE	The direction opposite to the direction the hands of a clock rotate, when viewed from the front.
CRACK	A break in some type of material.
CRIPPLE	Damage to a load carrying structural member which would cause degradation of the helicopters full mission capability.
CRITERIA	Standards or rules used to judge.
DATA	A group of facts.
DECONTAMINATION	To make an item safe for unprotected personnel by removing, neutralizing, or destroying any harmful substance. A function of Nuclear, Biological, and Chemical (NBC) Warfare.
DENT	Indentation in metal surface produced by an object striking with force.
DISASSEMBLY	The operations necessary to reduce an assembly to its separate components and parts.

GLOSSARY (Cont)

DISTORTION	A change from an original shape.
EROSION	Wearing away of metal.
EVACUATION	A combat service support function which involves the movement of recovered helicopters from a main supply route, maintenance collection point, or maintenance activity to higher categories of maintenance.
EXPEDIENT	A rapid and often non-standard method of repairing an item (repair technique).
FAILURE MODE	The specific cause of failure, relating to categories such as cracks, corrosion, ballistic impact, etc.
FATIGUE FAILURE	Sharp indentations, cracks, tool marks, or inclusions that result in progressive yielding of one or more local areas of material.
FIX	Any rapid action that returns a damaged part or assembly to full or an acceptably degraded operating condition (repair technique).
FLANGE	A broad ridge or pair of ridges projecting from the edge of a structural element, providing additional strength or a place for attachment.
FLAKING	Loose particles of metal or evidence of separation of a surface covering material.
FLUORESCENT PENETRANT	A test for locating cracks and fissures in non-magnetic material, making use of radiation properties of fluorescent particles when exposed to ultraviolet light.
FORMER	A curved structural element which gives the fuselage its even aerodynamic shape. Normally longerons and stringers are attached and the skin is fitted tightly over all these elements.
FRACTURE	Separation of a part or piece of material from itself.
FRAYING	Loose or raveled threads and fibers.
FULLY MISSION CAPABLE (FMC)	The ability of the helicopter to perform ALL its combat mission assignments.
FUNCTIONAL GROUP	Major helicopter subsystems identified in and corresponding to functional groups in TM 55-1520-236-23.
FUSELAGE	The central main body of the helicopter.

GLOSSARY (Cont)

GALLING	Aggravated condition of wear, generally caused by a rubbing action with little or no lubrication.
GAP	Clearance between faying surfaces, measurement of which is used to determine thickness of shims.
GOUGING	Removal of surface metal because of mechanical contact with foreign material.
HEAT DISCOLORATION	A change in color or appearance of a part, caused by excessive temperature.
HEI	High explosive incendiary armament round.
HOUSING	A frame support or cover, used to hold parts of machinery in place. Also used as a protective cover.
INDENTATION	A cavity with smooth bottom or sides, which can occur on rolling contact surfaces.
INSPECTION	A critical examination of parts to determine their usefulness or condition.
INTERFACE	The joining point of two flat surfaces.
JURY-RIGGING	A rapid non-standard method of repairing an item (repair technique).
LIMIT	An established point or boundary, in time, speed, or space, beyond which something may not go or is not permitted to go.
LOAD PATH	The route taken by a mechanical force traveling through an airframe structure.
LONGERON	A principle longitudinal (fore and aft), structural element (angle or tee shape) continuous across several points of support.
LRU	Line replaceable unit (electronic circuit board).
MAINTENANCE COLLECTION POINT	A point operated by AVIM units for the collection of equipment for repair.
MAINTENANCE SUPPORT TEAM (MST)	A team consisting of AVUM and AVIM mechanics and technical specialist who are trained in assessing battle damage in addition to their routine speciality.

GLOSSARY (Cont)

MAINTENANCE TEAM (MT)	A team consisting of organizational mechanics who may be trained in assessing battle damage and field repair procedures.
MISSION FUNCTION COMBAT CAPABLE (MFCC)	The ability of the helicopter to perform the MINIMUM combat mission assignments.
MODIFICATION	An alteration and/or integral change affecting the configuration of equipment or its respective parts, components, subassemblies, or assemblies.
NATIONAL STOCK NUMBER (NSN)	The assigned identifying number for an item of supply, consisting of the four-digit Federal Supply Class (FSC), and the nine-digit National Stock Identification Number (NIIN).
NICK	A local break or notch in the edge of material.
OPERATION	Performance of a practical, functional action.
OPTION	A specific BDAR repair technique often non-standard in nature.
OVERHAUL	The process of repairing or adjusting a machine to restore, improve, or lengthen its useful life.
PEELING	A breaking away of surface finishes such as coatings or platings, or flaking of large pieces of such material.
PIGTAIL	A group of electrical wire strands twisted together.
PITTING	Small holes or indentations, generally caused by rust, corrosion, high compressive stresses, or metal-to-metal pounding.
PRACTICE	A repeated or customary action.
PRIMARY STRUCTURE	The major structural load carrying elements of an airframe without which helicopter flight safety would be compromised.
PROCEDURE	A particular course of action.
PROCESS	A series of actions conducive to an end.
PYLON	The box shaped structural area surrounding the helicopter main transmission. This area carries several primary structural loads.

GLOSSARY (Cont)

REASSEMBLY	The assembling and aligning of all subassemblies and parts into a complete assembly to affect a serviceable item of equipment.
RECOVERY	The retrival of immobile, inoperative, or abandoned helicopters from the battlefield or immediate vicinity and its movement to a maintenance collection point, main supply route, or a maintenance activity for disposition, repair, or evacuation.
REMOVE	To move by lifting, pulling or pushing.
REPAIR	To restore a defective part, component, subassembly, or assembly to a usable condition in accordance with the instructions contained in this manual.
REPLACE	To supply an equivalent for.
REWORK	To work over again.
RUPTURE	The breaking of an airframe structural element or skin due to overstress/hostile fire.
SCORING	Very deep scratches caused by foreign particles between surfaces that are moving, or between one moving and one stationary surface. Scores follow the travel direction of the part.
SCRATCHING	Narrow, shallow lines resulting from movement of foreign particles across a surface.
SECONDARY STRUCTURE	The non-flight safety structural elements of an airframe.
SELF-RECOVERY	The ability of the helicopter to fly at reduced airspeed and altitude from the battlefield or immediate vicinity to a maintenance collection point, the main supply route, or maintenance activity for disposition, repair or evacuation.
SEMIMONOCOQUE	A structural design which relies on strength of the skin to carry a large portion of the load. The skin is normally reinforced by longerons and vertical bulkheads (walls), but has no diagonal bracing, leaving the interior basicly hollow.
SERVICING	The lubrication, treating, cleaning, or preservation necessary to maintain the equipment and other respective parts in serviceable condition.
SKIN	The aerodynamic exterior covering of the helicopter.

GLOSSARY (Cont)

SPALLING	Chipped or flaked surface caused by the breaking away of the hardened metal and separation of the case from the core.
SPANWISE	The location of a point or direction of movement parallel to the leading or trailing edge of a rotor blade.
SPAR	A primary structural element designed to carry weight and resist bending loads in wings and rotor blades. Spars typically extend the full length of the wing, and taper down to a smaller cross section toward the tip of the wing.
STIFFENER	A longitudinal (fore and aft) structural element use in semimonocoque design which stiffens the skin. Often called a stringer.
STOP HOLE	A hole intentionally drilled at the end of a crack, or saw cut which normally will prevent further propagation of the crack.
STRINGER	A longitudinal (fore and aft) structural element used in semimonocoque design which stiffens the skin. Often called a stiffener.
TEST	As used herein, the checking or operation of equipment to determine that the unit functions properly within the limits set forth in this manual.
TOLERANCE	The difference between two limiting sizes as a means of specifying the degree of accuracy.
TOXIC	A poisonous substance.
TWIST	The damage of a structural element by turning or torque forces causing permanent deformation.
VISCOSITY	The property of a fluid that tends to resist the force trying to make it flow such as gravity or applied pressure.
WARPAGE	The bending or twisting damage causing a structural element to weaken and permanently loose its original shape.
WEB	The sheet metal membrain connecting the upper and lower flanges of a beam or spar. Provides overall rigidity to the airframe structure.
WHIP	The tendency of a bent shaft to rotate away from its original center as the shaft RPM is increased, thus causing severe vibration.

By Order of the Secretary of the Army

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, AVUM and AVIM Maintenance requirements for OH-58A and OH-58C Helicopter Observation.

*U.S.GOVERNMENT PRINTING OFFICE: 1991554-122/21097

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: “Whomever” <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19–OCT–93
8. ***Pub no:*** 55–2840–229–23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04–JUL–85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123–123–1234
17. ***Problem:* 1**
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse*) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL. 35898	FROM: (*Activity and location)(Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9–1005–433–24	16 Sep 2002	Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

EXAMPLE

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

TO: (*Forward direct to addressee listed in publication*)	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL. 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE

TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL. 35898	FROM: (*Activity and location)(Include ZIP Code)*

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 55-2840-228-BD	4 Jan 1991	Technical Manual Operators, Aviation and Intermediate Maintenance Battlefield Damage Assessment and Repair for Helicopter, Observation OH-58A & OH-58C

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication*) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-2840-228-BD	4 Jan 1991	Technical Manual Operators, Aviation and Inter-mediate Maintenance Battlefield Damage Assessment and Repair for Helicopter, Obsevation OH-58A & OH-58C

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeter = 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 hectolitas = 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

P/N:066635-000