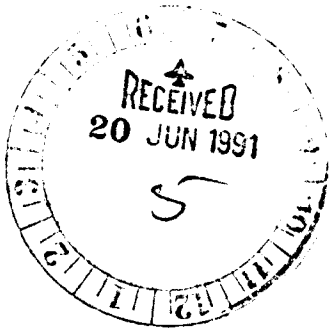
T.O. 1A-7D-3

TECHNICAL MANUAL

STRUCTURAL REPAIR INSTRUCTIONS

A-7D



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Change 8	1 Oct 1986	Change 17	15 Feb 1989		

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1,674 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
Title	.25	1-79 thru 1-192	0	1-300	1	2-25	.21
A	.25	1-193	2	1-301 thru 1-314	0	2-26	0
B	.25	1-194 thru 1-196	0	1-315	.13	2-27	.20
C Blank	.25	1-197	9	1-316 thru 1-321	0	2-28	.20
i	8	1-198	0	1-322	.12	2-29	.21
ii	.20	1-199	0	1-322.1	.12	2-30	.20
iii thru v	8	1-200	9	1-322.2	.12	2-31	.21
vi	0	1-201	0	1-323 thru 1-377	0	2-32	0
vii	9	1-202	9	1-378 Blank	0	2-33	.20
viii	.12	1-203 thru 1-217	0	2-1	.20	2-34	.20
ix	9	1-218	2	2-2	0	2-35	.21
x	.20	1-219 thru 1-225	0	2-3	0	2-36	.21
x.1	8	1-226	.13	2-4	.21	2-37	.20
x.2 Blank	8	1-227	0	2-5	0	2-38	.20
xi	.20	1-228	9	2-6	.20	2-39	0
xii	7	1-228.1	9	2-7	0	2-40	.20
xiii	0	1-228.2	9	2-8	0	2-41	4
xiv	7	1-229	0	2-9	.21	2-42	0
xv thru xvii	0	1-230	.21	2-10	.21	2-43	.20
xviii	8	1-231 thru 1-255	0	2-11 thru 2-13	.20	2-44	.20
xix thru xxiii	0	1-256	4	2-14	.21	2-45 Deleted	.20
xxiv	8	1-257 thru 1-261	0	2-15	.21	2-46 Deleted	.20
xxv	8	1-262	1	2-16	.20	2-47	.20
xxvi thru xlv	0	1-263	0	2-17	.20	2-48	.20
1-0	0	1-264	.11	2-18 thru 2-20	.21	2-49	1
1-1 thru 1-10	0	1-265	.11	2-21	4	2-50 thru 2-52	.20
1-11	3	1-266 thru 1-268	0	2-22	.20	2-53	1
1-12 thru 1-77	0	1-269	4	2-23	.20	2-54	.20
1-78	8	1-270 thru 1-299	0	2-24	.21	2-55	.20

*Zero in this column indicates an original page.

USAF

LIST OF EFFECTIVE PAGES (Continued)

Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
2-56	.21	5-99	4	6-66	8	6-313	1
2-57	8	5-100	0	6-67	8	6-314 thru 6-363	0
2-58	8	5-101	.15	6-68 thru 6-108	0	6-364	.20
2-59	8	5-102	.15	6-108.1	3	6-364.1	.20
2-60 Blank	8	5-102.1	.15	6-108.2 Blank	3	6-364.2 Blank	.20
3-1	0	5-102.2	.15	6-109	7	6-365	.20
3-2	0	5-103 thru 5-110	0	6-110 thru 6-123	0	6-366	0
3-3	.22	5-111	.14	6-124	.10	6-367	0
3-4	.15	5-112	.14	6-125	0	6-368	.20
3-5	.22	5-113 thru 5-132	0	6-126 thru 6-128	.18	6-368.1	.20
3-6	.15	5-133	9	6-128.1	.10	6-368.2 Blank	.20
3-7 thru 3-27	0	5-134 thru 5-142	0	6-128.2	.10	6-369 thru 6-438	0
3-28	1	5-143	9	6-129	.18	7-1 thru 7-22	0
3-29 thru 3-36	0	5-144 thru 5-148	0	6-130	.18	7-23	4
4-1 thru 4-3	0	5-148.1	1	6-131 thru 6-166	0	7-24 thru 7-50	0
4-4	.19	5-148.2	7	6-167 thru 6-170	8	8-1 thru 8-12	0
4-5 thru 4-8	0	5-148.3	7	6-171 thru 6-174	0	8-13 thru 8-15	8
5-1	0	5-148.4 Blank	1	6-175	8	8-16 thru 8-20	0
5-2	4	5-149	7	6-176	8	8-21	.16
5-3	3	5-150 thru 5-159	0	6-177	0	8-22 thru 8-29	0
5-4	3	5-160	8	6-178	0	8-30 Blank	0
5-5	0	5-161	0	6-179	8	9-1 thru 9-11	0
5-6	2	5-162	8	6-180	0	9-12	.23
5-7	0	5-163 thru 5-195	0	6-181	8	9-13 thru 9-17	0
5-8	2	5-196 Blank	0	6-182	8	9-18 Blank	0
5-9 thru 5-19	0	6-1 thru 6-4	0	6-183 thru 6-198	0	10-1 thru 10-12	0
5-20	9	6-4.1	6	6-199 thru 6-202	8	11-1	0
5-20.1	9	6-4.2 Blank	6	6-203	0	11-2	0
5-20.2 Blank	9	6-5 thru 6-10	0	6-204	0	11-3 thru 11-5	.17
5-21 thru 5-44	0	6-11	8	6-205	8	11-6 thru 11-44	0
5-44.1	2	6-12	.12	6-206	8	12-1 thru 12-69	0
5-44.2	7	6-12.1	8	6-207 thru 6-229	0	12-70 Blank	0
5-45	7	6-12.2	8	6-230	8	13-1 thru 13-32	0
5-46	0	6-12.3	.12	6-231	0	14-1 thru 14-3	0
5-47	8	6-12.4	8	6-232	8	14-4	1
5-48	8	6-13	8	6-233	8	14-5 thru 14-31	0
5-48.1	8	6-14 thru 6-20	0	6-234	0	14-32 Blank	0
5-48.2	8	6-21	.22	6-235	8	15-1 thru 15-54	0
5-49	8	6-22	.12	6-236 thru 6-240	0	16-1 thru 16-28	0
5-50 thru 5-56	0	6-23	.12	6-241	.18	17-1 thru 17-24	0
5-56.1	2	6-24	0	6-242	.18	17-25	5
5-56.2	7	6-25	.12	6-242.1	.18	17-26	3
5-57	7	6-26 Blank	.12	6-242.2 Blank	.18	17-27 thru 17-49	0
5-58	0	6-27 Deleted	.12	6-243	.18	17-50 Blank	0
5-58.1	.20	6-28 Deleted	.12	6-244 thru 6-258	0	18-1 thru 18-22	8
5-58.2 Blank	.20	6-29 thru 6-47	0	6-259	9	Glossary-1 thru Glossary-4	0
5-59 thru 5-67	0	6-48	1	6-260 thru 6-296	0	Index-1 thru Index-3	0
5-68	.24	6-49 thru 6-57	0	6-297	.25	Index-4	8
5-69 thru 5-82	0	6-58	.20	6-298	.25	Index-4.1	8
5-82A	.13	6-58.1	.20	6-298.1	1	Index-4.2 Blank	8
5-82B Blank	.13	6-58.2 Blank	.20	6-298.2	7	Index-5 thru Index-20	0
5-83	.13	6-59	.22	6-299	7		
5-84 thru 5-98	0	6-60 thru 6-65	0	6-300 thru 6-312	0		

*Zero in this column indicates an original page.

FOREWORD

THIS MANUAL.

This manual contains instructions for service personnel to maintain the structural integrity of A-7D airplanes. The instructions include procedures for damage evaluation, crash handling, and repair of airframe structure. Proper use of this information should enable repair personnel to return damaged structure to original strength, shape, and alignment. Information in this manual is for repairs peculiar to A-7D airplanes.

Included is repair data on the following:

General	Section I
Airplane Exterior Markings	Section II
Fuel Tank Repair, Sealing, and Testing	Section III
Radome Repair	Section IV
Wing Group	Section V
Fuselage Group	Section VI
Empennage Group	Section VII
Engine Group	Section VIII
Landing Gear Group	Section IX
Damage Due to Landing Gear Failure	Section X
Repair of Structural Life Limiting Areas	Section XI
Typical Repairs for Conventional Metal Structures	Section XII
Typical Repairs for Bonded Metal Structures	Section XIII
Typical Repairs for Reinforced Plastic Structures and Rigid Foam	Section XIV
Extrusions, Metal and Nonstructural	Section XV
Repair Materials	Section XVI
Special Tools and Equipment	Section XVII
Forward Looking Infrared Pod	Section XVIII

A table listing A-7D maintenance manuals and specialized manuals is provided herein. These manuals are not duplicated in this manual, but should be used when they apply.

ARRANGEMENT AND USE OF THIS MANUAL.

The repair information in this manual is divided into sections. Sections I through IV and X through XVIII are typical of other repair manuals and should need no special explanation. Sections V through IX cover the detail breakdown and repair information of the different structural sections of the airplane. Use the following procedures to find the repair information in these sections.

Read Section I for general information concerning type of construction, classification of damage, damage evaluation and evaluation procedures, and other information about the damage condition.

From figure 1-2 find the number of the repair section that covers the damaged part.

Go to the Group Index figure in that section. Find the INDEX FIGURE number for the structural section in which the repair part is located.

Go to that figure and find the INDEX NUMBER of the MAJOR COMPONENT containing the repair part. Look at the MAJOR COMPONENT list and, with the INDEX NO., find the INDEX FIGURE number in the far right column.

Turn to that figure and find the part name in the NOMENCLATURE column. On the far right under REPAIR, SECTION/FIGURE, find the repair action and references.

Go to the alphabetical index and find the paragraph(s) which covers the component and damage being repaired. Read that paragraph and repair information before starting repairs.

Make all repairs using the information and instructions in both the text and the illustrations.

The structural area or component which is damaged or contains the damaged part may also be found in the list of illustrations or table of contents.

REFERENCE PUBLICATIONS.

Publications generally related to subject matter or specifically referenced herein are listed in the table of reference publications.

TIME COMPLIANCE TECHNICAL ORDERS.

Time compliance technical orders for the systems covered in this manual are listed in a table. The listing, in technical order numerical sequence, includes the basic date, title, ECP number, and date of change or revision.

REVISION.

This manual has been revised to issue changes resulting from formalization and to incorporate airplane design changes.

ABBREVIATIONS AND ACRONYMS.

The following is a list of nonstandard abbreviations and acronyms used in this manual.

AR – As Required

BL – Buttock Line

CHEM MILL – Chemical Milled

PVA – Polyvinylalcohol

WCS – Wing Center Section

WOP – Wing Outer Panel

XA – Aileron-Fuselage Station

XCD – Wing Center Section Flap Station

XCR – Spoiler-Fuselage Station

XF – Flap Station

XH – Horizontal Stabilizer-Fuselage Station

XW – Wing-Fuselage Station

YA – Aileron Station

YCD – Wing Center Section Leading Edge Flap Fuselage Station

YCR – Spoiler-Fuselage Station

YF – Flap Station

YOD – Wing Outer Panel Leading Edge Flap Station

YW – Wing Station

List of Time Compliance Technical Orders

T.O. Number	Date	Title	Change/revision date
1A-7-530	15 Mar 1988	Installation of Forward Looking Infrared System on A-7 Aircraft (ECP 622)	1 Oct 1986
1A-7-551		Installation of Starter Battery System in A-7 Aircraft	1 Dec 1989
1A-7-562		Installation of Ring Laser Gyro Inertial Navigation System, A-7D/K Aircraft	15 Aug 1989
1A-7-568		Installation of Video Recording System in A-7D/K Aircraft (ECP 622R4)	15 May 1987

List of Systems Maintenance Manuals

Publication No.	Title
General Maintenance Manuals	
T.O. 00-85-2	USAF Packing Materials Partial Listing
T.O. 00-85-36	Selection and Use of Flexible Barriers and Wrapping Material for Packaging
T.O. 1-1-1	Cleaning of Aerospace Equipment
T.O. 1-1-2	Corrosion Prevention and Control for Aerospace Equipment
T.O. 1-1-3	Preparation, Inspection, and Repair of Aircraft Fuel, Oil, and Water, Alcohol Cells and Integral Tanks
T.O. 1-1-4	Exterior Finishes, Insignia, and Markings, Applicable to Aircraft and Missiles
T.O. 1-1-5	Abrasive Blasting Method, Cleaning and Corrosion Removal
T.O. 1-1-8	Application of Organic Coatings (Paints and Allied Materials)
T.O. 1-1-24	Maintenance, Repair, and Electrical Requirements – Fiber Laminated and Sandwich Constructed Radomes, All Aircraft
T.O. 1-1A-1	Engineering Handbook Series for Aircraft Repair – General Manual for Structural Repair
T.O. 1-1A-8	Engineering Manual Series, Aircraft and Missile Repair, Structural Hardware

List of Systems Maintenance Manuals – CONT

Publication No.	Title
T.O. 1-1A-9	Aerospace Metals, General Data and Usage Factors
T.O. 1-1A-12	Fabrication, Maintenance, and Repair of Transparent Plastics
T.O. 1-1A-14	Installation Practices, Aircraft Electric and Electronic Wiring
T.O. 33B-1-1	Nondestructive Inspection Methods
T.O. 33B2-1-1	Magnetic Particle Inspection
T.O. 33B3-1-1	Inspection of Material (Radiography)
T.O. 35D5-5-3-11	Operational Service and Repair Instructions, Pneumatic Bag, Aircraft, Lifting, 12-Ton Capacity, Type F-1, F-2 (New York Rubber)
T.O. 42B1-1-10	Use of Dye in JP-4 Fuel to Detect Fuel System Leaks
T.O. 44H1-1-13	General Use of Rosan Fasteners
T.O. 44H1-1-117	General Installation of Heli-Coil Inserts
Operation, Service, and Repair Manuals	
T.O. 8D2-3-1	Aircraft Nickel Cadmium Storage Batteries
Organizational Maintenance Manuals	
T.O. 1A-7D-2-1	General Information and Airframe Group
T.O. 1A-7D-2-2	Egress and Survival Systems

List of Systems Maintenance Manuals – CONT

Publication No.	Title
T.O. 1A-7D-2-3	Mechanical Accessories Systems
T.O. 1A-7D-2-4	Pneudraulic Systems
T.O. 1A-7D-2-5	Powerplant Systems
T.O. 1A-7D-2-6	Fuel System
T.O. 1A-7D-2-7	Landing Gear Systems
T.O. 1A-7D-2-8	Flight Control Systems
T.O. 1A-7D-2-9	Automatic Flight Control System
T.O. 1A-7D-2-10	Instrument Systems
T.O. 1A-7D-2-11	Electrical Power and Lighting Systems
T.O. 1A-7D-2-12	Radio Communication and Navigation Systems
T.O. 1A-7D-2-13	Armament Systems
T.O. 1A-7D-2-14	Weapon Control Systems
Specialized Manuals	
T.O. 1A-7D-1	Flight Manual
T.O. 1A-7D-6	Inspection Instructions Aircraft Scheduled Inspection and Maintenance Requirements

List of Systems Maintenance Manuals – CONT

Publication No.	Title
T.O. 1A-7D-33-1-2	Conventional Munitions Loading Procedures
T.O. 1A-7D-4-20	Support Equipment, A-7D
T.O. 1A-7D-23	Corrosion Control, A-7D
T.O. 1A-7D-36	Nondestructive Inspection, A-7D
T.O. 1A-7D-38	Aircraft Structural Integrity Program, A-7D
Depot Maintenance Instructions	
T.O. 16W33-2-3	Arresting Gear, 215-44020

Reference Publications

Publication No.	Title
Department of Defense Handbooks	
H4-1	Federal Supply Code for Manufacturers Cataloging Handbook
H4-2	Federal Supply Code for Manufacturers Cataloging Handbook
Air Force Manuals	
AFR 127-101	Ground Accident Prevention Handbook

TABLE OF CONTENTS

Section		Page
FOREWORD		i
LIST OF ILLUSTRATIONS		vi
LIST OF TABLES		xix
SAFETY SUMMARY		xxi
I.	GENERAL	1-1
II.	AIRPLANE EXTERIOR MARKINGS	2-1
III.	FUEL TANK REPAIR, SEALING, AND TESTING	3-1
IV.	RADOME REPAIR	4-1
V.	WING GROUP	5-1
VI.	FUSELAGE GROUP	6-1
VII.	EMPENNAGE GROUP	7-1
VIII.	ENGINE GROUP	8-1
IX.	LANDING GEAR GROUP	9-1
X.	DAMAGE DUE TO LANDING GEAR FAILURE	10-1
XI.	REPAIR OF STRUCTURAL LIFE LIMITING AREAS	11-1
XII.	TYPICAL REPAIRS FOR CONVENTIONAL METAL STRUCTURES	12-1
XIII.	TYPICAL REPAIRS FOR BONDED METAL STRUCTURES	13-1
XIV.	TYPICAL REPAIRS FOR REINFORCED PLASTIC STRUCTURES AND RIGID FOAM	14-1
XV.	EXTRUSIONS, METAL AND NONSTRUCTURAL	15-1
XVI.	REPAIR MATERIALS	16-1
XVII.	SPECIAL TOOLS AND EQUIPMENT	17-1
XVIII.	FORWARD LOOKING INFRARED POD (Airplanes After T.O. 1A-7-530)	18-1
GLOSSARY		Glossary-1
INDEX		Index-1

LIST OF ILLUSTRATIONS

Number	Title	Page
1-1.	A-7D Airplane	1-0
1-2.	Major Structural Groups and Repair Section Index	1-78
1-3.	Skin Plating Diagram	1-79
1-4.	Principal Dimensions	1-81
1-5.	Airplane Principal Stations and Waterlines	1-83
1-6.	Classification of Damage	1-90
1-7.	Examples of Damage	1-91
1-8.	Hardness Test Readings Showing Typical Fire Damage	1-92
1-9.	Airplane Alignment Check	1-93
1-10.	Wing and Horizontal Stabilizer Symmetry Check	1-95
1-11.	Airplane Optical Leveling	1-96
1-12.	Aerodynamic Discrepancy Repairs	1-99
1-13.	Permissible Wave Heights	1-103
1-14.	Forward Fuselage Aerodynamic Skin Tolerances	1-105
1-15.	Mid-Fuselage Aerodynamic Skin Tolerances	1-109
1-16.	Aft Fuselage Aerodynamic Skin Tolerances	1-112
1-17.	Wing Aerodynamic Skin Tolerances	1-114
1-18.	Pylon Aerodynamic Skin Tolerances	1-121
1-19.	Typical Aerodynamic Fairing Applications	1-124
1-20.	Interchangeable Fasteners	1-125
1-21.	NAS1738 and NAS1739 Blind Rivet Identification, Installation, and Inspection Data	1-126
1-22.	Huck Blind Rivet Identification, Installation, and Inspection Data	1-128
1-23.	Huck and Cherry Lockbolts Identification, Inspection, and Grip Range Data	1-129
1-24.	Cherrymax Rivet Identification, Grip Range, and Hole Data	1-131
1-25.	Huck Blind Lockbolt Identification, Inspection, Grip Range, and Hole Data	1-133
1-26.	Huck Blind Lockbolt Removal	1-135
1-27.	Hi-Shear Blind Bolt and Blind Nut Identification Data	1-136
1-28.	Installation of Hi-Shear Blind Bolts and Blind Nuts Using Power Tools	1-137
1-29.	Installation of Hi-Shear Blind Bolts and Blind Nuts Using Hand Driving Tools	1-139
1-30.	Removal of Hi-Shear Blind Bolt and Blind Nut Assemblies	1-141
1-31.	Jo-Bolt Identification and Grip Range Data	1-142
1-32.	Jo-Bolt Preparation and Inspection Requirements	1-143
1-33.	Riv-O-Seal and Flush Seal Rivet Identification and Size Data	1-144
1-34.	Hi-Lok Fastener Identification and Grip Length Data	1-145
1-35.	Hi-Lok Fastener Hole Preparation, Installation, and Removal	1-146
1-36.	Deutsch Drive Pin Blind Rivet Identification and Grip Range Data	1-148
1-37.	Semi-Tubular Rivet Identification and Installation	1-149
1-38.	Camloc Fastener Identification and Grip Range Data	1-150
1-39.	CVC771 Skin Countersink Conical Washer Identification and Installation Data	1-151
1-40.	Forming Terminology	1-152
1-41.	Minimum Inside Bend Radii	1-153
1-42.	Bend Allowance Chart	1-154
1-43.	Setback Chart	1-155
1-44.	Use of Bend Line	1-156
1-45.	Forming Layout Diagram	1-157
1-46.	Flat Pattern Layout From Charts – Example 1	1-158
1-47.	Flat Pattern Layout From Charts – Example 2	1-159
1-48.	Flat Pattern Layout From Formula	1-161
1-49.	Form Correction Chart	1-162

LIST OF ILLUSTRATIONS - CONT

Number	Title	Page
1-50.	Procedure for Forming Parts	1-163
1-51.	Procedure for Hand Forming Concave Surfaces	1-164
1-52.	Procedure for Hand Forming Convex Surfaces	1-165
1-53.	Procedure for Hand Forming Extruded Shapes	1-166
1-54.	Method for Brake Forming Joggles	1-167
1-55.	Forming Joggle with Joggle Blocks	1-168
1-56.	Forming Joggle with Joggle Clip	1-169
1-57.	Joggle Dimension Chart - Flat Sheet, Joggled Cold	1-170
1-58.	Joggle Dimension Chart - Flanged Sheet, Rubber Formed and Joggled Cold	1-171
1-59.	Joggle Dimension Chart - Extruded or Bent Sheet Sections, Die Joggled	1-172
1-60.	Dimpling of Sheet Metal	1-173
1-61.	Ram Pressure Test and Dwell Time	1-174
1-62.	Hot and Cold Dimpling Inspection	1-175
1-63.	Dimple Pry Test	1-177
1-64.	Wing Attach and Support Structure Hardware Repair Limits	1-178
1-65.	Wing Air Refueling Cavity Hardware Repair Limits	1-184
1-66.	Wing Center Section Leading Edge Flap Hinge and Actuator Supports Hardware Repair Limits	1-193
1-67.	Wing Center Section Leading Edge Flap Hardware Repair Limits	1-195
1-68.	Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits	1-197
1-69.	Wing Trailing Edge Flap Hardware Repair Limits	1-203
1-70.	Wing Trailing Edge Flap Door Hardware Repair Limits	1-205
1-71.	Spoiler Hinge Support Hardware Repair Limits	1-207
1-72.	Deflector Hinge Support Hardware Repair Limits	1-210
1-73.	Wing Center Section Wingfold Rib Hardware Repair Limits	1-212
1-74.	Wing Outer Panel Wingfold Rib Hardware Repair Limits	1-216
1-75.	Wing Outer Panel Leading Edge Flap Hinge and Wingfold Actuator Supports Hardware Repair Limits	1-218
1-76.	Wing Outer Panel Leading Edge Flap Actuator Supports Hardware Repair Limits	1-220
1-77.	Wing Outer Panel Leading Edge Flap Hardware Repair Limits	1-222
1-78.	Aileron Hinge Assemblies Hardware Repair Limits	1-224
1-79.	Aileron Hardware Repair Limits	1-226
1-79A.	Aileron PC Installation Hardware Repair Limits	1-228
1-80.	Pylons Installation Bushing Repair Limits	1-228.2
1-81.	Detector Pod Adapter Fitting Repair Limits	1-231
1-82.	Nose Landing Gear Shock Strut Hardware Repair Limits	1-235
1-83.	Nose Gear Drag Brace Hardware Repair Limits	1-243
1-84.	Nose Landing Gear Door Linkage Repair Limits	1-253
1-85.	Speed Brake Installation Hardware Repair Limits	1-263
1-86.	Main Landing Gear Hardware Repair Limits	1-268
1-87.	Main Landing Gear Door and Uplock Mechanism Repair Limits	1-273
1-88.	Main Landing Gear Upper Forward Door Assembly Hardware Repair Limits	1-282
1-89.	Main Landing Gear Upper Aft Door Assembly Hardware Repair Limits	1-284
1-90.	Main Landing Gear Lower Door Hardware Repair Limits	1-286
1-91.	Partition Installation - Upper Fuselage Station 480.00 to 490.50 - Bushing Repair Limits	1-287
1-92.	Arresting Gear Hardware Repair Limits	1-289

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
1-93.	Engine Mounts Bushing Repair Limits	1-295
1-94.	Skin Installation, Aft Fuselage, Bushing Repair Limits	1-298
1-95.	Aft Bobweight Support Assembly Bushing Repair Limits	1-299
1-96.	Rudder Hinge Fittings and Power Control Valve Support Hardware Repair Limits	1-301
1-97.	Rudder Bushing Repair Limits	1-304
1-98.	Horizontal Stabilizer Bushing Repair Limits	1-306
1-99.	Horizontal Stabilizer Backup Controls Torque Tube Hardware Repair Limits	1-308
1-100.	Canopy Release Mechanism Hardware Repair Limits	1-311
1-100.1.	Ram Air Scoop Assembly Repair Limits	1-322
1-101.	Engine Throttle Control Support Bearing Repair Limits	1-322.2
1-102.	Aft Gun Mount Support Assembly Bushing Repair Limits	1-324
1-103.	Forward Gun Mount Yoke Assembly Dimensions	1-327
1-104.	Typical Contour Data and Dimensions	1-328
1-105.	Hazardous Component Locations	1-329
1-106.	Sandbag and Cribbing Details	1-330
1-107.	Lifting Platform Details	1-332
1-108.	Lifting Damaged Airplane Using Pneumatic Lifting Bags	1-333
1-109.	Towing Airplane Using Arresting Gear Hook	1-334
1-110.	Towing Airplane Out of Soft Ground	1-335
1-111.	Moving Airplane with Damaged Nose Landing Gear	1-336
1-112.	Moving Airplane with Damaged Main Landing Gear	1-337
1-113.	Wing Center Section Assembly (216-70020) Shipping Container	1-338
1-114.	Wing Center Section Leading Edge Flap Assembly (215-70200) Shipping Container	1-345
1-115.	Wing Trailing Edge Flap (215-70310) Shipping Container	1-347
1-116.	Wing Outer Panel Assembly (215-80020) Shipping Container	1-348
1-117.	Wing Outer Panel Leading Edge Flap Assembly (215-80200) Shipping Container	1-351
1-118.	Aileron Assembly (215-80300) Shipping Container	1-352
1-119.	Wing Stations 1 and 8 Pylon Assembly (216-70065) Shipping Container	1-354
1-120.	Wing Stations 2 and 7 Pylon Assembly (216-70067) Shipping Container	1-355
1-121.	Wing Stations 3 and 6 Pylon Assembly (216-70069) Shipping Container	1-357
1-122.	Nose Radome Assembly (216-20175) Shipping Container	1-359
1-123.	Canopy Assembly (215-20079) Shipping Container	1-360
1-124.	Nose Landing Gear Left Door Assembly (215-20100) Shipping Container	1-361
1-125.	Nose Landing Gear Right Door Assembly (215-20100) Shipping Container	1-363
1-126.	Avionics Compartment Access Door Assembly (215-30045) Shipping Container	1-365

LIST OF ILLUSTRATIONS - CONT

Number	Title	Page
1-127.	Speed Brake Assembly (215-30085) Shipping Container	1-366
1-128.	Main Landing Gear Upper Door Assembly (215-30047) Shipping Container	1-368
1-129.	Main Landing Gear Lower Door Assembly (215-30048) Shipping Container	1-369
1-130.	Engine Removal Door (216-40040) Shipping Container	1-370
1-131.	Aft Fuselage Fairing Assembly (215-40060) Shipping Container	1-371
1-132.	Horizontal Stabilizer Assembly (216-60200) Shipping Container	1-372
1-133.	Rudder Assembly (215-60100) Shipping Container	1-375
1-134.	Determining Weight and Center of Balance for Shipping Containers with Component Installed	1-377
2-1.	Wing Exterior Markings	2-4
2-2.	Wing Station No. 1 Pylon Exterior Markings	2-9
2-3.	Wing Station No. 2 Pylon Exterior Markings	2-14
2-4.	Wing Station No. 3 Pylon Exterior Markings	2-19
2-5.	Wing Station No. 6 Pylon Exterior Markings	2-24
2-6.	Wing Station No. 7 Pylon Exterior Markings	2-29
2-7.	Wing Station No. 8 Pylon Exterior Markings	2-34
2-8.	Fuselage Nose Section Exterior Markings	2-39
2-9.	Fuselage Mid Section Exterior Markings	2-44
2-10.	Fuselage Aft Section Exterior Markings	2-47
2-11.	Vertical Stabilizer Exterior Markings	2-54
2-12.	Horizontal Stabilizer Exterior Markings	2-56
2-13.	Forward Looking Infrared Pod Exterior Markings (Airplanes After T.O. 1A-7-530)	2-57
3-1.	Wing Fuel Tank Integral Structure Pressure Test	3-4
3-2.	Stat-O-Seal Washer and O-Ring Sealing of Fasteners	3-9
3-3.	Wing Fastener Torque Values	3-10
3-4.	Blind Fastener Sealing and Installation	3-15
3-5.	Wing Integral Fuel Tank Foam Baffle Locations	3-21
3-6.	Pylon Support and Dome Nut Sealing	3-25
3-7.	Dome Nut and Riv-O-Seal Rivet Installation	3-26
3-8.	Gask-O-Seal Joint Sealing	3-29
3-9.	Wing Tank Injection Sealing Sequence	3-30
3-10.	Sealing Around Hydraulic Fittings and Electrical Receptacles	3-34
4-1.	Radome General Arrangement	4-2
4-2.	Nose Radome Leading Particulars and Damage Evaluation	4-3
4-3.	Doppler Radome Leading Particulars and Damage Evaluation	4-5
5-1.	Wing Group Index	5-10
5-2.	Wing Center Section	5-12
5-2A.	Spoiler Strut Installation Repair Limits and Spacer Installation	5-20
5-3.	Wing Center Section Rear Spar	5-20.1
5-4.	Wing Center Section Trailing Edge Spar Installation	5-21
5-5.	Wing Center Section Trailing Edge Installation	5-23
5-6.	Wing Center Section Wingfold Rib Installation and Fairing Replacement	5-27
5-7.	Wingfold Rib Damage and Repair Limits	5-30

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
5-8.	Wingfold Rib Cylinder Attachment Lug Repair	5-31
5-9.	Wingfold Rib Clip Replacement	5-33
5-10.	Wingfold Rib Hinge Pin Cylinder/ Lock Latch Assembly Bolt Hole Repair	5-34
5-11.	Wingfold Fairing Installation	5-35
5-12.	Wing Center Section Wingfold Fairing	5-37
5-13.	Pylon-to-Wing Fuel Connection Insert Repair	5-39
5-14.	Wing-to-Fuselage Fairing Installation	5-41
5-15.	Wing Forward Hoist Point Access Door	5-43
5-16.	Wing Root Fairing	5-44
5-16.1.	Wing Root Fairing Installation	5-44.2
5-17.	Wing Aft Hoist Point Access Door	5-46
5-18.	Wing Center Section Leading Edge Installation	5-47
5-18.1.	Right Wing Center Section Leading Edge Installation (Airplanes After T.O. 1A-7-530)	5-48.1
5-19.	Wing Center Section Leading Edge Flap Hinge Repair	5-49
5-20.	Wing Center Section Leading Edge Electrical Cable Assembly Repair	5-51
5-21.	Wing Dorsal Installation	5-54
5-21.1.	Wing Dorsal Fairing Installation	5-56.2
5-22.	Wing Upper Access Door Installation	5-58
5-22.1.	Upper Anticollision Light Connector Bracket	5-58.1
5-23.	Wing Air Refueling Cavity	5-59
5-24.	Wing Access Door Installation, FS 373.50 to 428.40	5-61
5-25.	Door Installation, FS 428.40 to 483.25	5-63
5-26.	Wing Outer Panel	5-64
5-27.	Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298	5-69
5-28.	Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246	5-74
5-29.	Wing Outer Panel Trailing Edge Installation	5-79
5-29.1.	Outer Wing Section Aileron Link Repair	5-83
5-30.	Wing Outer Panel Trailing Edge Upper Skin Crack Repair	5-84
5-31.	Wing Outer Panel Wingfold Rib Installation	5-91
5-32.	Wing Outer Panel Tip Installation	5-93
5-33.	Wing Outer Panel Tip Repair	5-94
5-34.	Wing Center Section Leading Edge Flap Assembly Repair	5-96
5-35.	Wing Leading Edge Flap Trailing Edge Repair	5-101
5-36.	Wing Center Section Leading Edge Flap Dent Repair	5-103
5-37.	Wing Leading Edge Flap Repair	5-104
5-38.	Wing Center Section Inboard Leading Edge Flap Actuator Bay Access Skin Repair	5-106
5-39.	Wing Outer Panel Leading Edge Installation	5-109
5-40.	Wing Outer Panel Leading Edge Flap Hinge Repair	5-113

LIST OF ILLUSTRATIONS - CONT

Number	Title	Page
1-127.	Speed Brake Assembly (215-30085) Shipping Container	1-366
1-128.	Main Landing Gear Upper Door Assembly (215-30047) Shipping Container	1-368
1-129.	Main Landing Gear Lower Door Assembly (215-30048) Shipping Container	1-369
1-130.	Engine Removal Door (216-40040) Shipping Container	1-370
1-131.	Aft Fuselage Fairing Assembly (215-40060) Shipping Container	1-371
1-132.	Horizontal Stabilizer Assembly (216-60200) Shipping Container	1-372
1-133.	Rudder Assembly (215-60100) Shipping Container	1-375
1-134.	Determining Weight and Center of Balance for Shipping Containers with Component Installed	1-377
2-1.	Wing Exterior Markings	2-4
2-2.	Wing Station No. 1 Pylon Exterior Markings	2-9
2-3.	Wing Station No. 2 Pylon Exterior Markings	2-14
2-4.	Wing Station No. 3 Pylon Exterior Markings	2-19
2-5.	Wing Station No. 6 Pylon Exterior Markings	2-24
2-6.	Wing Station No. 7 Pylon Exterior Markings	2-29
2-7.	Wing Station No. 8 Pylon Exterior Markings	2-34
2-8.	Fuselage Nose Section Exterior Markings	2-39
2-9.	Fuselage Mid Section Exterior Markings	2-44
2-10.	Fuselage Aft Section Exterior Markings	2-47
2-11.	Vertical Stabilizer Exterior Markings	2-54
2-12.	Horizontal Stabilizer Exterior Markings	2-56
2-13.	Forward Looking Infrared Pod Exterior Markings (Airplanes After T.O. 1A-7-530)	2-57
3-1.	Wing Fuel Tank Integral Structure Pressure Test	3-4
3-2.	Stat-O-Seal Washer and O-Ring Sealing of Fasteners	3-9
3-3.	Wing Fastener Torque Values	3-10
3-4.	Blind Fastener Sealing and Installation	3-15
3-5.	Wing Integral Fuel Tank Foam Baffle Locations	3-21
3-6.	Pylon Support and Dome Nut Sealing	3-25
3-7.	Dome Nut and Riv-O-Seal Rivet Installation	3-26
3-8.	Gask-O-Seal Joint Sealing	3-29
3-9.	Wing Tank Injection Sealing Sequence	3-30
3-10.	Sealing Around Hydraulic Fittings and Electrical Receptacles	3-34
4-1.	Radome General Arrangement	4-2
4-2.	Nose Radome Leading Particulars and Damage Evaluation	4-3
4-3.	Doppler Radome Leading Particulars and Damage Evaluation	4-5
5-1.	Wing Group Index	5-10
5-2.	Wing Center Section	5-12
5-2A.	Spoiler Strut Installation Repair Limits and Spacer Installation	5-20
5-3.	Wing Center Section Rear Spar	5-20.1
5-4.	Wing Center Section Trailing Edge Spar Installation	5-21
5-5.	Wing Center Section Trailing Edge Installation	5-23
5-6.	Wing Center Section Wingfold Rib Installation and Fairing Replacement	5-27
5-7.	Wingfold Rib Damage and Repair Limits	5-30

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
5-8.	Wingfold Rib Cylinder Attachment Lug Repair	5-31
5-9.	Wingfold Rib Clip Replacement	5-33
5-10.	Wingfold Rib Hinge Pin Cylinder/ Lock Latch Assembly Bolt Hole Repair	5-34
5-11.	Wingfold Fairing Installation	5-35
5-12.	Wing Center Section Wingfold Fairing	5-37
5-13.	Pylon-to-Wing Fuel Connection Insert Repair	5-39
5-14.	Wing-to-Fuselage Fairing Installation	5-41
5-15.	Wing Forward Hoist Point Access Door	5-43
5-16.	Wing Root Fairing	5-44
5-16.1.	Wing Root Fairing Installation	5-44.2
5-17.	Wing Aft Hoist Point Access Door	5-46
5-18.	Wing Center Section Leading Edge Installation	5-47
5-18.1.	Right Wing Center Section Leading Edge Installation (Airplanes After T.O. 1A-7-530)	5-48.1
5-19.	Wing Center Section Leading Edge Flap Hinge Repair	5-49
5-20.	Wing Center Section Leading Edge Electrical Cable Assembly Repair	5-51
5-21.	Wing Dorsal Installation	5-54
5-21.1.	Wing Dorsal Fairing Installation	5-56.2
5-22.	Wing Upper Access Door Installation	5-58
5-23.	Wing Air Refueling Cavity	5-59
5-24.	Wing Access Door Installation, FS 373.50 to 428.40	5-61
5-25.	Door Installation, FS 428.40 to 483.25	5-63
5-26.	Wing Outer Panel	5-64
5-27.	Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298	5-69
5-28.	Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246	5-74
5-29.	Wing Outer Panel Trailing Edge Installation	5-79
5-29.1.	Outer Wing Section Aileron Link Repair	5-83
5-30.	Wing Outer Panel Trailing Edge Upper Skin Crack Repair	5-84
5-31.	Wing Outer Panel Wingfold Rib Installation	5-91
5-32.	Wing Outer Panel Tip Installation	5-93
5-33.	Wing Outer Panel Tip Repair	5-94
5-34.	Wing Center Section Leading Edge Flap Assembly Repair	5-96
5-35.	Wing Leading Edge Flap Trailing Edge Repair	5-101
5-36.	Wing Center Section Leading Edge Flap Dent Repair	5-103
5-37.	Wing Leading Edge Flap Repair	5-104
5-38.	Wing Center Section Inboard Leading Edge Flap Actuator Bay Access Skin Repair	5-106
5-39.	Wing Outer Panel Leading Edge Installation	5-109
5-40.	Wing Outer Panel Leading Edge Flap Hinge Repair	5-113

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
5-41.	Wing Outer Panel Leading Edge Fairing Repair	5-117
5-42.	Wing Outer Panel Leading Edge Flap Assembly	5-119
5-43.	Wing Outer Panel Leading Edge Flap Dent Repair	5-124
5-44.	Aileron Assembly	5-125
5-45.	Wing Trailing Edge Flap Installation	5-128
5-46.	Wing Trailing Edge Flap Leading Edge Installation	5-131
5-47.	Wing Trailing Edge Flap Leading Edge Repair	5-134
5-48.	Wing Trailing Edge Flap Lower Leading Edge Skin Repair	5-136
5-49.	Wing Trailing Edge Flap Slot Door Repair	5-138
5-50.	Wing Trailing Edge Flap Slot Door Actuator Lug Repair	5-141
5-51.	Spoiler Assembly	5-144
5-52.	Spoiler Rod End Removal and Skin Cutout Repair	5-146
5-52.1.	Shimming of Spoiler Assembly Hinge Points	5-148.2
5-53.	Deflector Assembly	5-150
5-54.	Wingfold Pylon Fairing Installation	5-152
5-55.	Wing Stations 1 and 8 Pylon Assembly	5-154

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
5-56.	Wing Stations 2 and 7 Pylon Assembly	5-157
5-57.	Wing Stations 3 and 6 Pylon Assembly	5-160
5-58.	Preparation for Removal of Wing Center Section Upper Skin	5-163
5-59.	Wing Dorsal Area Equipment Locations	5-164
5-60.	Wing Center Section Upper Skin Fasteners at Trailing Edge	5-167
5-61.	Wing Center Section Upper Skin Fasteners at Leading Edge	5-168
5-62.	Wing Center Section Upper Skin Fasteners Index	5-170
5-63.	Wing Center Section Centerline Rib Upper Skin Fasteners	5-171
5-64.	Wing Center Section Wing Attach Rib Upper Skin Fasteners	5-173
5-65.	Wing Center Section Station YW 61.2 Rib Upper Skin Fasteners	5-175
5-66.	Wing Center Section Intermediate No. 4 Spar Upper Skin Fasteners	5-176
5-67.	Wing Center Section Intermediate No. 5 Spar Upper Skin Fasteners	5-178
5-68.	Wing Center Section Station YW 97.2 Rib Upper Skin Fasteners	5-180
5-69.	Wing Center Section Rear Spar Upper Skin Fasteners	5-181
5-70.	Wing Center Section Flap Support Rib Upper Skin Fasteners	5-183
5-71.	Wing Center Section Wingfold Rib Upper Skin Fasteners	5-184
5-72.	Wing Center Section Intermediate No. 3 Spar Upper Skin Fasteners	5-187
5-73.	Wing Center Section Intermediate No. 2 Spar Upper Skin Fasteners	5-189
5-74.	Wing Center Section Intermediate No. 1 Spar Upper Skin Fasteners	5-191
5-75.	Wing Center Section Front Spar Upper Skin Fasteners	5-193
5-76.	Wing Center Section Center Front Spar Upper Skin Fasteners	5-194
6-1.	Fuselage Group Index	6-3
6-2.	Pressurized Cockpit Compartment Negligible Hole Damage Repair	6-4
6-2A.	Power Brake Actuating Rod Assembly, Part No. CV15-408042-11, Repair	6-4.1
6-3.	Steel Armorplate Damage Limits	6-5
6-4.	Forward Fuselage Section	6-6
6-5.	Windshield and Cowl Assembly (Airplanes Before T.O. 1A-7-530)	6-11
6-5.1.	Windshield and Cowl Assembly (Airplanes After T.O. 1A-7-530)	6-12.2
6-6.	Windshield Frame Assembly, 216-00650-1, Removal and Replacement	6-14
6-7.	Windshield and Canopy Damage Limits and Repairs	6-21
6-8.	Deleted	
6-9.	Center Windshield Support Corrosion Damage Limits and Repair	6-29
6-10.	Panel and Frame Assembly, FS 204.40 to 221.90	6-30
6-11.	Bulkhead Installation, FS 221.90	6-33
6-12.	Longeron Installation, FS 208.90 to 254.80	6-35
6-13.	Rudder Pedal Access, Upper Step and Panel Installation	6-37
6-14.	Tension Tie Strut Assembly	6-41
6-15.	Duct Lip, Nose, FS 210.90 to 221.80	6-43
6-16.	Duct Lip Upper Antenna Fairings Repair	6-49
6-17.	Duct Lip Lower Antenna Fairing Repair	6-52
6-18.	Engine Air Duct Assembly, FS 221.90 to 260.00	6-54
6-18.1.	Target Identification System Laser Pod Support Fitting Limitations and Repair	6-59
6-19.	Gun Blast Port Assembly	6-60
6-20.	Longeron Installation, FS 216.60 to 260.00	6-62

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
6-21.	Frame Assembly, FS 225.20	6-64
6-22.	Frame Assembly, FS 232.20	6-66
6-23.	Frame Assembly, FS 235.90	6-68
6-24.	Frame Assembly, FS 239.40	6-70
6-25.	Frame Assembly, FS 242.50	6-72
6-26.	Frame Assembly, FS 246.30	6-74
6-27.	Frame Assembly, FS 249.50	6-76
6-28.	Frame Assembly, FS 254.50	6-78
6-29.	Duct Assembly, Ram Air	6-80
6-30.	Longeron Installation, FS 221.90 to 260.00	6-82
6-31.	Pilot Floor Assembly, FS 221.90 to 254.80	6-84
6-32.	Pilot Protection Armorplate, FS 221.90 to 281.00	6-88
6-33.	Longeron Installation, FS 254.80 to 346.50	6-92
6-34.	Step Assembly, Cockpit, Lower	6-95
6-35.	Door Installation, Pilot Access Step	6-97
6-36.	Controls and Equipment Access Door Assembly, FS 308.80	6-98
6-37.	Canopy Assembly	6-99
6-38.	Canopy Seal Repair	6-101
6-39.	Canopy Aft Former Crack Limits and Repair	6-102
6-40.	Canopy Deck Assembly	6-105
6-41.	Canopy Rail Longeron, FS 254.80 to 346.50	6-108
6-41.1.	Canopy Handle Guard Assembly Minimum Clearance Requirements	6-109
6-42.	Bulkhead Installation, FS 254.82	6-110
6-43.	Beam Installation, FS 254.00 to 278.00	6-112
6-44.	Console Access Door, FS 254.00 to 278.00	6-113
6-45.	Static Port Inspection, Repair, Removal, and Replacement	6-116
6-46.	Damage Limits, Pitot-Static Probe	6-119
6-47.	Center Step, Panel Assembly, FS 254.80 to 278.00	6-120
6-48.	Lower Fuselage Skin Installation, FS 254.80 to 278.00	6-123
6-49.	Pilot Seat Bulkhead	6-124
6-50.	Engine Upper Air Duct Assembly, FS 260.00 to 306.80	6-131
6-51.	Centerline Keel Installation, FS 278.00 to 308.80	6-137
6-52.	Keel Installation, FS 268.00 to 280.94	6-139
6-53.	Nose Landing Gear Keels and Bulkhead, FS 275.70 to 346.50	6-141
6-54.	Nose Gear Door Assembly, FS 278.00 to 346.50	6-145
6-55.	Forward Gun Mount Support Installation	6-148
6-56.	Lower Longeron Installation, FS 265.00 to 346.50	6-149
6-57.	Lower Fuselage Skin Installation, FS 278.00 to 290.00	6-150
6-58.	Protective Shield Installation	6-152
6-59.	Bulkhead Installation, FS 281.00	6-153
6-60.	Bulkhead Installation, Forward Gun Mount, FS 290.90	6-155
6-61.	Panel Installation, FS 278.00 to 302.00	6-157
6-62.	Panel Installation, FS 281.00 to 340.00	6-159
6-63.	Air-Conditioning Access Cover, FS 270.00 to 326.80	6-161
6-64.	Air-Conditioning Access Cover, FS 290.00 to 340.00	6-163
6-65.	Canopy Pivot Support, FS 306.00	6-165
6-66.	Bulkhead Installation, FS 308.80	6-167
6-67.	Bulkhead Installation, FS 302.26	6-171
6-68.	Ammunition Drum Access, FS 307.70 to 366.27	6-173
6-69.	Beam Installation, FS 308.80 to 371.80	6-175
6-70.	Centerline Keel Installation, FS 326.50 to 346.50	6-177
6-71.	Floor Installation, FS 308.80 to 346.50	6-179
6-72.	Centerline Keel Installation, FS 308.80 to 326.80	6-183
6-73.	Liquid Oxygen Compartment Floor Assembly, FS 326.80 to 346.50	6-185

LIST OF ILLUSTRATIONS - CONT

Number	Title	Page
6-74.	Emergency Power Package Floor Assembly, FS 326.80 to 346.50	6-187
6-75.	Engine Air Duct Installation, FS 306.80 to 346.50	6-189
6-76.	Bulkhead Installation, FS 326.80	6-193
6-77.	Shroud Installation, FS 308.80 to 316.15	6-196
6-78.	Shroud Installation, FS 308.80 to 361.60	6-198
6-79.	Ammunition Chute Shroud Installation, FS 302.81 to 325.25	6-203
6-80.	Systems Access Cover, FS 308.83 to 352.34	6-205
6-81.	Upper Panel Installation, FS 352.33 to 371.75	6-207
6-82.	Controls and Equipment Access Door Assembly, Left Side, FS 308.80	6-211
6-83.	Fuselage Access Cover, FS 308.80 to 326.80	6-213
6-84.	Center Equipment Access Door Assembly, FS 326.80 to 346.50	6-215
6-85.	Gun Access Cover, FS 302.20 to 326.80	6-216
6-86.	Liquid Oxygen Access Door Assembly, FS 326.50 to 346.50	6-218
6-87.	Adjustment of Access Door Flush Latches	6-220
6-88.	Emergency Power Package Access Door, FS 326.50 to 346.50	6-221
6-89.	Lower Panel Installation, FS 340.00 to 346.50	6-223
6-90.	Fuselage Midsection	6-225
6-91.	Bulkhead Installation, FS 346.50	6-229
6-92.	Upper Partition and Longeron Installation, FS 346.50 to 423.50	6-236
6-93.	Longeron and Partition Installation, FS 346.50 to 423.50	6-239
6-94.	Lower Longeron and Floor Installation, FS 346.50 to 423.50	6-241
6-95.	Longeron (215-30081 and 218-30081) Repair	6-244
6-96.	Keel Installation, FS 346.50 to 404.50	6-250
6-97.	Speed Brake Keel Installation, FS 346.50 to 404.50	6-252
6-98.	Speed Brake Assembly	6-254
6-99.	Bushing Repair, Speed Brake Arm Support	6-258
6-100.	Speed Brake Chine Door Repair	6-259
6-101.	Speed Brake Flap Chine Assembly	6-260
6-102.	Skin and Door Installation, FS 346.50 to 380.50	6-262
6-103.	Side Skin Assembly, FS 346.50 to 423.50	6-268
6-104.	Left Avionic Access Door Installation, FS 346.50 to 404.50	6-270
6-105.	Right Avionic Access Door Installation, FS 346.50 to 404.50	6-272
6-106.	Bulkhead Installation, FS 375.00	6-275
6-107.	Wing Access Cover, FS 372.40 to 480.00	6-277
6-108.	Bulkhead Installation, FS 404.50	6-279
6-109.	Cover and Skin Installation, FS 404.50 to 423.50	6-281
6-110.	Bulkhead Installation, FS 423.50	6-283
6-111.	Side Skin, Roll Control and Hydraulic Access Covers, FS 423.50 to 490.50	6-285
6-112.	Upper Partition Installation, FS 423.50 to 526.50	6-287
6-113.	Longeron and Partition Installation, FS 423.50 to 526.50	6-289
6-114.	Main Landing Gear Upper Door Bellcrank Repair	6-291

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
6-115.	Main Landing Gear Keel, FS 423.50 to 490.50	6-292
6-116.	Main Landing Gear Bumper Support Repair	6-295
6-116.1.	Main Landing Gear Uplock Gusset and Hook Support Damage Limitations and Repair	6-298.2
6-117.	Bottom Longeron and Hinge Installation, FS 423.50 to 526.50	6-300
6-118.	Main Landing Gear Upper Door Assembly	6-303
6-119.	Main Landing Gear Lower Door Assembly	6-306
6-120.	Bulkhead Installation, FS 480.00	6-308
6-121.	Partition Installation, FS 480.00 to 490.50	6-310
6-122.	Dorsal Fairing Installation, FS 483.00 to 526.50	6-312
6-123.	Top Controls Access Door Installation, FS 483.50 to 490.50	6-314
6-124.	Wing Attach Fairing Installation, FS 480.00 to 535.00	6-316
6-125.	Bulkhead Installation, FS 490.50	6-318
6-126.	Aileron Trim Actuator Mount Replacement	6-321
6-127.	Upper Partition Installation, FS 490.50 to 526.50	6-323
6-128.	Floor Installation, FS 490.50 to 526.50	6-325
6-129.	Armorplate Installation, FS 480.00 to 526.50	6-329
6-130.	Upper Skin Installation, FS 490.50 to 526.50	6-331
6-131.	Upper Side Skin Installation, FS 490.50 to 526.50	6-333
6-132.	Lower Side Skin Installation, FS 490.50 to 526.50	6-335
6-133.	Main Landing Gear Drag Strut Door Assembly	6-337
6-134.	Lower Skin Installation, FS 490.50 to 516.50	6-339
6-135.	Fuel Access Cover, FS 490.50 to 526.50	6-341
6-136.	UHF/ADF Antenna Cover Repair	6-343
6-137.	Bulkhead Installation, FS 526.50	6-345
6-138.	Lower Skin Assembly, FS 516.50 to 526.50	6-350
6-139.	Fuselage Aft Section	6-352
6-140.	Dorsal Fin Fairing Installation, FS 526.50 to 590.00	6-354
6-141.	Dorsal Fin Fairing/Vertical Stabilizer Alignment Repair	6-356
6-142.	Upper Skin Installation, FS 526.50 to 590.00	6-360
6-143.	Side Skin Installation, FS 526.50 to 664.60	6-364
6-144.	Camera Cooling Duct Rework and Longeron Repair	6-369
6-145.	Battery Mount, FS 526.50 to 552.70	6-371
6-146.	Lower Longeron Installation, FS 526.30 to 590.00	6-373
6-147.	Engine Side Access Cover, FS 526.50 to 552.70	6-375
6-148.	Lower Skin Assembly, FS 526.50 to 552.70	6-377
6-149.	Engine Lower Access Cover, FS 526.50 to 552.70	6-379
6-150.	UHF/ADF Antenna Aft Fairing Repair	6-381
6-151.	Strike Camera Shroud, FS 531.75 to 550.32	6-383
6-152.	Bulkhead Installation, FS 552.70	6-385
6-153.	Engine Forward Support Installation, FS 552.70 to 590.00	6-388
6-154.	Engine Left Side Access Cover, FS 573.00 to 590.00	6-390
6-155.	Engine Access Door	6-392
6-156.	Arresting Gear Actuator Access Cover, FS 570.83 to 590.00	6-394
6-157.	Lower Skin Assembly, FS 552.70 to 590.00	6-396
6-158.	Bulkhead Installation, FS 590.00	6-398

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
6-159.	Upper Aft Skin Installation, FS 590.00 to 665.67	6-401
6-160.	Engine Removal Door, FS 590.00 to 665.67	6-405
6-161.	Engine Removal Door, Support (215-40040-100) Repair	6-415
6-162.	Fuel Access Door	6-417
6-163.	Bulkhead Installation, FS 624.67	6-419
6-164.	Side Skin Installation, FS 624.67 to 665.67	6-421
6-165.	Horizontal Stabilizer Controls Access Cover, FS 624.70 to 653.50	6-423
6-166.	Bulkhead Installation, FS 664.62	6-425
6-167.	Bulkhead Installation, FS 653.00	6-426
6-168.	Aft Fuselage Fairing Assembly, FS 665.73 to 712.00	6-428
6-169.	Rudder Fairing Assembly	6-430
6-170.	Armorplate for Engine and Horizontal Stabilizer Protection	6-432
6-171.	Engine Bay Armorplate Spall Shield Repair	6-438
7-1.	Empennage Group Major Components	7-2
7-2.	Vertical Stabilizer Assembly	7-3
7-3.	Steel Armorplate Damage Limits	7-5
7-4.	Vertical Stabilizer Cap Repair	7-6
7-5.	Vertical Stabilizer Aft Antenna Cover Repair	7-8
7-6.	ARN-58 Localizer Antenna Assembly Repair	7-10
7-7.	Vertical Stabilizer Upper Leading Edge	7-11
7-8.	Vertical Stabilizer Antenna Isolating Skin Repair	7-13
7-9.	Vertical Stabilizer Lower Leading Edge	7-15
7-10.	Vertical Stabilizer Torque Box Installation	7-20
7-11.	Vertical Stabilizer Trailing Edge	7-23
7-12.	Vertical Stabilizer Upper Trailing Edge and Cap	7-27
7-13.	Vertical Stabilizer Lower Skin and Access Cover	7-29
7-14.	Vertical Stabilizer Midaccess Armored Cover	7-30
7-15.	Vertical Stabilizer Midaccess Cover Beaded Skin Repair	7-31
7-16.	Rudder	7-32
7-17.	Rudder Hinge Assembly (215-60105-2) Rework Tolerances	7-34
7-18.	Horizontal Stabilizer	7-36
7-19.	Horizontal Stabilizer Bearing Housing Removal and Replacement	7-40
7-20.	Horizontal Stabilizer Shaft Removal and Replacement	7-45
7-21.	Horizontal Stabilizer Trailing Edge Repair	7-50
8-1.	Engine Group Major Components Index	8-12
8-2.	Engine Air Duct Installation, FS 346.50 to 423.50	8-13
8-3.	Engine Air Duct Installation, FS 423.50 to 490.50	8-16
8-4.	Engine Air Duct Installation, FS 490.50 to 526.50	8-18
8-5.	Replacement of Engine Inlet Seal Retainer	8-20
8-6.	Engine Exhaust Duct	8-22
8-7.	Jet Fuel Starter Exhaust Duct Damage Evaluation	8-24
8-8.	Engine Exhaust Duct Aft Flange and Stiffener Crack Repair	8-27
8-9.	Engine Inlet Air Duct Negligible Hole Damage Repair	8-28
8-10.	Engine Air Duct Lap Patch Repair	8-29
9-1.	Landing Gear Group Index	9-3
9-2.	Nose Landing Gear Shock Strut Assembly	9-4
9-3.	Landing Gear Axle Damage Guide	9-6

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
9-4.	Nose Landing Gear Steering Bellcrank Repair	9-7
9-5.	Nose Landing Gear Drag Brace and Linkage	9-8
9-6.	Connecting Link Assembly Repair, Part No. 215-24302-1	9-12
9-7.	Main Landing Gear Strut Assembly	9-14
9-8.	Arresting Gear	9-16
10-1.	Nose Gear Up Landing Probable Damage Areas	10-5
10-2.	Main Landing Gears Up Landing Probable Damage Areas	10-6
10-3.	Nose and Main Landing Gears Up Landing Probable Damage Areas	10-8
10-4.	One Main Landing Gear Up Landing Probable Damage Areas	10-11
11-1.	A-7D Life Limiting Locations	11-2
11-2.	Arbor Assembly Modifications	11-6
11-3.	Fabrication of 7936053-01 Pilot Tool for Repair of Critical Area No. 1	11-10
11-4.	Fabrication of 7936054-10 Reaming Tool for Critical Area No. 1	11-11
11-5.	Sizing of Repair Bushings	11-13
11-6.	Fabrication of 7936056-01 Bushing Installation Tool for Critical Area No. 1	11-15
11-7.	Fabrication of 7936057-10 Reaming Tool for Critical Area No. 1	11-16
11-8.	Fabrication of 7936058-01 Pilot Tool for Repair of Critical Area No. 3	11-20
11-9.	Fabrication of 7936059-10 Reaming Tool	11-21
11-10.	Sizing of 7936060 Repair Bushings	11-24
11-11.	Fabrication of 7936056-03 Bushing Installation Tool for Critical Area No. 3	11-25
11-12.	Fabrication of 7936061-10 Reaming Tool	11-26
11-13.	Fabrication of 7936065-01 Oversize Bushing for Critical Area No. 6	11-31
11-14.	7936069-10 Pilot Counterbore Tool Assembly	11-34
11-15.	Fabrication of 7936070-01 Countersink Tool	11-38
11-16.	Fabrication of 7936073 Wingfold Lug Oversize Bushing	11-42
12-1.	Classification and Repair of Negligible Damage	12-2
12-2.	Fastener Calculation Table for Patching and Splicing Repairs	12-7
12-3.	Cracked Bend Relief Cutout	12-16
12-4.	Cracked Dimple	12-17
12-5.	Floor at Bulkhead	12-18
12-6.	Oilcanning	12-19
12-7.	Plate	12-20
12-8.	Cracked Rivet Hole Edge	12-21
12-9.	Cracked Flange	12-22
12-10.	Cracked Short Flange	12-23
12-11.	Cracked Joggled Flange (Patching with Angle)	12-24
12-12.	Cracked Web Flange Lightening Hole	12-25
12-13.	Curved Former	12-26
12-14.	Curved Former End	12-28
12-15.	Joggled Former	12-29
12-16.	Straight Former (Patching)	12-30
12-17.	Straight Former (Short Insertion)	12-31
12-18.	Straight or Curved Former (Insertion)	12-32
12-19.	Channel Section (Insertion)	12-33
12-20.	Channel Section (Short Insertion)	12-34
12-21.	Hat or Z-Section (Patching)	12-35
12-22.	Hat Section (Insertion)	12-36
12-23.	Hat Section (Short Insertion)	12-37
12-24.	Hat Section (Fuel Cell Compartment Repair)	12-38
12-25.	I-Beam (Insertion)	12-39
12-26.	T-Section and Other Structures (Patching with Plate)	12-40
12-27.	T-Section and Other Structures (Patching with Strap)	12-41
12-28.	T-Section and Angle (Insertion)	12-42

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
12-29.	T-Section and Angle (Short Insertion)	12-43
12-30.	Z-Section and Other Structures (Patching)	12-44
12-31.	Z-Section (Insertion)	12-45
12-32.	Z-Section (Short Insertion)	12-46
12-33.	Frame (Insertion)	12-47
12-34.	Skin (Patching)	12-48
12-35.	Skin (Insertion)	12-49
12-36.	Skin at T-Section (Insertion)	12-50
12-37.	Skin at Hat Section Stiffener	12-51
12-38.	Skin and Reinforcing Pan	12-52
12-39.	Skin and Stiffener	12-53
12-40.	Skin at Access Panel	12-54
12-41.	Skin at Small Access Panel	12-55
12-42.	Skin at Former	12-56
12-43.	Skin at Stiffener	12-57
12-44.	Skin Edge with Doubler	12-58
12-45.	Skin (Small Hole)	12-59
12-46.	Skin (Small Blind Holes)	12-60
12-47.	Web	12-61
12-48.	Beaded Web	12-62
12-49.	Web and Angle Section Capstrip	12-63
12-50.	Web and Doubler	12-64
12-51.	Web, Doubler, and Angle Section Capstrip	12-65
12-52.	Web, Doubler, and T-Section Capstrip	12-66
12-53.	Web and Stiffener	12-67
12-54.	Web and T-Section Capstrip	12-68
12-55.	Web and T-Section Capstrip (Alternate)	12-69
13-1.	Metalite Assemblies, Damage Classification and Evaluation	13-2
13-2.	Metalite Repair with Flush Patch	13-5
13-3.	Metalite Repair with Nonflush Patch	13-6
13-4.	Metalite Repair at Undamaged Capstrip	13-7
13-5.	Metalite Repair at Damaged Capstrip	13-8
13-6.	Metalite Repair with Internal Doublers	13-9
13-7.	Metalite with Nonflush Patch at External Doubler	13-10
13-8.	Crack Repairs for Metalite Panel Edge Members	13-11
13-9.	Honeycomb Repair with Flush Patch	13-17
13-10.	Honeycomb Repair with Nonflush Patch	13-19
13-11.	Cutting Metalite	13-21
13-12.	Metalite Repair of Fastener Holes with Excessive Core Cutback	13-24
13-13.	Fastener Installation in Metalite	13-27
14-1.	Details of Repair Procedure D, Stepped Joint Method	14-8
14-2.	Cross-Section of Repair Procedure D, Scarf Method	14-11
14-3.	Details of Repair Procedure E	14-13
14-4.	Details of Repair Procedure F	14-17
14-5.	Details of Repair Procedure H	14-20
14-6.	Details of Repair Procedure J	14-22
14-7.	Details of Repair Procedure K	14-26
15-1.	Extruded Angles	15-6
15-2.	Extruded Tees	15-14
15-3.	Extruded Channels	15-29
15-4.	Extruded H-Sections	15-32
15-5.	Extruded Bars and Hinges	15-34
15-6.	Extruded Zees	15-42
15-7.	Extruded Trailing Edge Sections, Fillers	15-43
15-8.	Extruded Miscellaneous Sections	15-44
15-9.	Nonmetallic Extrusions	15-52
16-1.	Engine Air Inlet Duct Repair Kit (216-00107)	16-20
17-1.	Bearing Staking Tools	17-25
17-2.	Sealant Fairing Tool	17-27
17-3.	Fuel Tank Sealant Injection Gun and Nozzle Set (215-00331-1)	17-28
17-4.	Canopy Pressure Test Stand (SN-312054)	17-30
17-5.	Engine Removal Door Alignment Fixture (216-01910-1)	17-34
17-6.	Fuel Tank Pressure Test Plate Set (215-01456-1)	17-36
17-7.	Landing Gear Door Fixture Set (216-01513-1)	17-40
17-8.	Lower Main Landing Gear Door Fixture Set (216-01514-1)	17-43

LIST OF ILLUSTRATIONS – CONT

Number	Title	Page
17-9.	Wing Center Section Leading Edge Flap Support (216-00905-1, -2)	17-45
17-10.	AN/APQ-126(V) Radar Hinge Alignment Tool (216-01450-1)	17-47
17-11.	Spoiler Strut Holddown Fixture (218-00271-1)	17-48
17-12.	Horizontal Stabilizer Bearing Housing Puller (215-00286-1)	17-49
18-1.	Forward Looking Infrared Pod Major Components	18-2
18-2.	Forward Looking Infrared Pod Nose Fairing	18-3
18-3.	Forward Looking Infrared Pod Forward Body	18-5
18-4.	Forward Looking Infrared Pod Aft Body	18-13
18-5.	Forward Looking Infrared Pod Tail Fairing	18-17
18-6.	Forward Looking Infrared Pod Sealant Application	18-19
18-7.	Forward Looking Infrared Pod Drain Paths and Drain Holes	18-22

LIST OF TABLES

Number	Title	Page
1-1.	Metallic Materials Used in Original Fabrication of A-7D Airplane Structure	1-2
1-2.	Hard Landing Inspection	1-8
1-3.	Excessive Positive G-Load Inspection	1-11
1-4.	Excessive Negative G-Load Inspection	1-14
1-5.	Comparisons of Various Inspection Methods	1-17
1-6.	Rockwell Hardness Scale Readings	1-20
1-7.	Standard Permissible Steps	1-25
1-8.	Standard Permissible Gaps	1-25
1-9.	External Flush Rivet and Rivet Type Fastener Tolerances External Skin and Air Duct	1-26
1-10.	Minimum Acceptable Head Diameter of Flush Head Rivets After Shaving	1-33
1-11.	Minimum Acceptable Head Diameter of Flush Head Aluminum Screws After Shaving	1-33
1-12.	Substituting Blind Rivets for Solid Rivets	1-34
1-13.	Standard Hole Sizes for Rivet Type Fasteners	1-37
1-14.	Hole Preparation Data for Hi-Shear Blind Bolts and Nuts	1-43
1-15.	Material Substitution for Clad Sheet and Plate Aluminum Alloys Based on Ultimate Tensile Strength	1-52
1-16.	Material Substitution for Bare Sheet and Plate Aluminum Alloys Based on Ultimate Tensile Strength	1-53
1-17.	Material Substitution for Specific Usage	1-54
1-18.	Thickness Limitations and Heating Requirements	1-58
1-19.	Recommended Pilot Drill Size for Hot Dimpling	1-60
1-20.	Recommended Pilot Drill Size for Cold Dimpling	1-61
1-21.	Hole and Bushing Diameters for Installation of Press-Fit Bushings	1-63
1-22.	Airplane Component Weights and Support Points	1-66
1-23.	Contour Drawing List	1-67
1-24.	Shipping Containers for Airplane Components	1-76
2-1.	Exterior Stencils	2-1
3-1.	Fuel Leak Criterial Airworthiness Evaluation	3-7
3-2.	Replacement Fastener Selection	3-17
3-3.	Rivet Head Shaving Tolerances	3-27
3-4.	Mixing Proportions for Topcoating Material	3-35
4-1.	RF Absorber Data	4-7
8-1.	Engine Exhaust Duct Inspection and Repair Limits	8-4
8-2.	Engine Exhaust Duct Weld Data, Inert-Arc Process	8-8
8-3.	Current Requirements for Difference Stock Thickness	8-9
11-1.	Inspection/Modification Intervals for Critical Areas (Equivalent Baseline Hours)	11-4
11-2.	Airplanes with Oversized Pylon Aft Attach Hole Diameter (Inches)	11-8
13-1.	Fasteners Used in Metalite Repairs	13-22
14-1.	Resin and Catalyst Mixing Ratios	14-4
14-2.	MMM-A-181 Adhesive Working Life and Assembly Time	14-30
15-1.	Index of Extrusions	15-2
15-2.	Manufacturers Identification Code	15-4
15-3.	Heat-Treat Tensile Strengths	15-5
16-1.	Miscellaneous Materials	16-3
16-2.	Special Fasteners and Sealing Devices	16-6
16-3.	Airframe Refinishing Materials	16-9

LIST OF TABLES – CONT

Number	Title	Page
16-4.	Airframe Sealing and Fairing Materials	16-12
16-5.	Reinforced Plastic Repair Materials	16-14
16-6.	Bonded Metal Structures Repair Materials	16-16
16-7.	Miscellaneous Chemicals	16-17
16-8.	Wing Integral Fuel Tank Repair Materials	16-18
16-9.	Shipping Container Fabrication and Packaging Materials	16-19
17-1.	Miscellaneous Tools and Equipment	17-6
17-2.	Flush Head Fastener Milling and Inspection Tools	17-7
17-3.	NAS1738 and NAS1739 Blind Rivet Tools	17-7
17-4.	Special and Huck Blind Rivet Tools	17-8
17-5.	Huck Lockbolt, Cherry Lockbolt, and Huck Blind Lockbolt Tools	17-8
17-6.	Hi-Shear Blind Bolt and Blind Nut Tools	17-10
17-7.	Jo-Bolt Installation Tools	17-13
17-8.	Hi-Lok Fastener Installation and Removal Tools	17-15
17-9.	Camlock Fastener Tools	17-15
17-10.	Airframe Sealing, Refinishing, and Bonded Structure Repair Tools	17-16
17-11.	Airplane and Major Components Hoisting Equipment	17-17
17-12.	Airframe and Major Components Repair Fixtures	17-18
17-13.	Airplane System Component Alignment Tools	17-19
17-14.	Structure Supports and Dollies	17-20
17-15.	Wing Repair Tools	17-21
17-16.	Horizontal Stabilizer Repair Tools	17-24

SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are precautions that personnel must know and use during many phases of structural repair work. Personnel should also be familiar with and observe all requirements of AFR 127-101.

RESUSCITATION

Personnel working with or near highly toxic chemicals and electrically powered equipment should be familiar with modern methods of resuscitation. Contact Base Medical Services for instructions and information.

WORKING ALONE

Never enter or reach into small compartments and tight spaces to make repairs without another person standing by to give help in case of emergency.

ELECTRICAL SHOCK AND EXPLOSION HAZARD

Use only electrical equipment and tools which are properly grounded. Use nonsparking, explosion-proof electrical equipment when working where fumes and vapors could be ignited.

LIFTING AND MOVING HEAVY OBJECTS

Do not lift or move heavy objects in awkward positions alone. Get help or use equipment such as dollies, hoists, and forklifts.

FIRE HAZARD

Observe all fire prevention regulations. Comply with all local fire regulations issued by the Base Fire Chief. Dispose of flammable materials (rags, used chemicals, etc.) in the proper manner using safety containers.

UNAUTHORIZED PERSONNEL

Do not allow visitors, spectators, or unauthorized personnel to enter the work area.

PROTECTIVE CLOTHING AND EQUIPMENT

Even if not specified in a procedure, always wear protective clothing, goggles, gloves, respirators, hearing protectors, etc. when in doubt about the safety of a job procedure.

TOOLS, EQUIPMENT, AND WORKSTANDS

Always use the correct tools and equipment for the job. Use workstands for climbing and reaching high places.

SAFETY SUMMARY - CONT

LIST OF WARNINGS AND CAUTIONS

The following warnings and cautions appear in the text in this manual, and are repeated here for emphasis.

WARNING

TT-N-95 naptha is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-19 and 6-101).

WARNING

Caustic soda is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation (page 1-22).

WARNING

Chromic acid is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (pages 1-22, 13-28, and 13-29).

WARNING

Shims shall not be used in the following areas:

Rear spar	215-70041
Wingfold rib	215-70050
Centerline rib	215-70053
Pylon attach fittings	215-70098
	215-70422
	215-70094
	215-70054
	215-70035

MIL-C-5541 chemical film is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid all contact. Good general ventilation is normally adequate (page 1-26).

WARNING

Shaving and sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (page 1-27).

SAFETY SUMMARY – CONT

WARNING

Under no circumstances shall high-pressure compressed air be used to clean dirt or debris from airplane, nor shall it ever be directed at a fellow worker or used to clean dirt and dust from clothing or body. Wear goggles when using low-pressure compressed air (page 1-27).

WARNING

Toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-27, 3-2, 3-8, 3-13, 3-19, 3-24, 3-33, 3-35, 4-7, 7-49, 13-25, 14-3, and 17-29).

WARNING

Silicone compound is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (page 1-28).

WARNING

Under no circumstances shall fairing compound be used in the engine air intake duct. Introduction of loose material, however small, into the intake system of a jet engine can result in damage to the engine and possible injury to personnel (page 1-28).

WARNING

Methyl ethyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-29, 1-31, 5-29, 6-13, 6-29, 6-118, 6-438, 14-1, 14-3, 14-6, 14-7, 14-9, 14-10, 14-14, 14-15, 14-18, 14-19, 14-21, 14-25, 14-28, and 14-29).

WARNING

Pro-Seal 777P is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (page 1-29).

SAFETY SUMMARY – CONT

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-29, 1-31, 1-65, 3-18, 3-26, 3-27, 3-28, 5-29, 5-36, 5-52, 5-73, 5-78, 5-102, 5-103, 5-124, 5-138, 5-142, 5-149, 6-29, 6-102, 6-104, 6-118, 7-44, 7-49, 8-6, 8-7, 11-14, 11-28, 11-30, 11-32, 13-32, 14-30, and 18-21).

WARNING

PR 1955 aerodynamic fairing compound is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-30 and 7-49).

WARNING

Silicone coating and catalyst are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 1-30).

WARNING

Epoxy polyamide primer is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation (pages 1-30, 1-50, 11-14, 11-19, and 11-30).

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (pages 1-35, 1-39, 1-41, 1-42, 1-44, 1-45, 1-47, 1-48, 1-49, 3-13, 3-18, 3-20, 3-26, 5-32, 5-40, 5-52, 5-73, 5-78, 5-90, 5-98, 5-101, 5-149, 6-104, 6-117, 6-322, 6-370, 7-47, 9-13, 13-20, 13-28, 13-29, 13-30, 13-31, 14-5, and 14-16).

WARNING

Alodine is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (pages 1-36, 5-149, 11-7, 11-14, 11-19, 11-29, 11-30, 11-32, 11-37, 11-39, 11-40, 11-41, 11-43, 13-26, 13-29, and 13-31).

SAFETY SUMMARY – CONT

WARNING

MIL-M-3171, MIL-C-5541, and MIL-P-23377 are moderately to highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation (pages 1-40, 1-42, 1-45, 8-7, and 18-1).

WARNING

MIL-S-83430 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 1-40 and 1-42).

WARNING

Reaming operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (pages 1-41 and 3-14).

WARNING

Shaving operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (page 1-42).

WARNING

Counterboring operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (pages 1-43 and 3-20).

WARNING

Milling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (page 1-44).

WARNING

MIL-C-5541 is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (pages 1-44 and 8-7).

WARNING

Countersinking operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (pages 1-47 and 1-48).

SAFETY SUMMARY – CONT

WARNING

Zinc chromate primer is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (pages 1-65 and 11-41).

WARNING

Protect each lifting bag by placing a 1/2-inch thick felt pad between top of bag and airplane structure where protruding objects could damage lifting bag. A punctured lifting bag could cause the airplane to fall and possibly endanger personnel (page 1-71).

WARNING

When towing the airplane forward up a slope, closely watch the nose gear strut extension measurement. If the strut begins to gradually extend due to a shift in balance, turn airplane around and tow it backwards up the slope (page 1-74).

WARNING

Observe airplane jacking safety precautions. Refer to T.O. 1A-7D-2-1 (page 1-96).

WARNING

The paint used for markings is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 2-2).

WARNING

TT-T-266 thinner is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 2-2).

WARNING

Trichloroethane is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 2-2, 5-29, 7-42, 11-14, and 11-23).

SAFETY SUMMARY – CONT

WARNING

P-D-680 drycleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Eye and skin protection is required. Use only in a well ventilated area. Keep away from flames or other sources of ignition (pages 3-3, 4-7, 5-104, 7-41, 7-42, 7-48, 9-2, 11-18, and 11-28).

WARNING

Pressure in wing tank must not exceed 21.37 inches of mercury (10.5 psi) (page 3-6).

WARNING

MIL-S-81733 sealant is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (pages 3-18, 5-6, 5-7, 5-33, 5-86, 5-88, 5-90, 5-104, 5-137, 6-370, and 8-6).

WARNING

Before installation, the foam baffles shall be dry of fuel to prevent vapors from creating an explosive hazard or a nauseating environment (page 3-20).

WARNING

TEC No. 901 cleaner is toxic to eyes, skin, and respiratory tract. Eye and skin protection is required. Use only in a well ventilated area (page 3-24).

WARNING

MIL-S-4383 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 3-27, 3-36, 13-25, 13-28, 13-29, 13-30, and 14-31).

WARNING

TT-T-735 alcohol is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 3-28).

SAFETY SUMMARY – CONT

WARNING

Be sure that external hydraulic power is disconnected from airplane. PC No. 1 accumulator must be relieved of system pressure to ensure safety of personnel and equipment (page 3-33).

WARNING

Methyl isobutyl ketone (MIBK) is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation (page 3-35).

WARNING

Since skin weighs about 325 pounds, six to eight men are required to lift and handle it (pages 5-5 and 5-7).

WARNING

Grinding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (pages 5-30, 5-138, 5-142, and 13-26).

WARNING

MIL-S-22473 adhesive is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 5-32 and 5-40).

WARNING

Acetone is flammable and highy toxic to skin, eyes, and respiratory tract. Skin and eye protection required. Avoid all contact. Good general ventilation is normally adequate. Keep away from open flames or other sources or ignition (page 5-40).

WARNING

MIL-R-46082 retaining compound is toxic to skin, eyes, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (page 5-40).

SAFETY SUMMARY - CONT

WARNING

Fiberglass sanding is hazardous to personnel. Protective equipment consists of long sleeve shop coats or coveralls, gloves, goggles, and respirators or vented exhaust hoods are required (page 5-52).

WARNING

Aerodynamic fairing compound is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 5-86).

WARNING

Welding operations produce heat, highly toxic fumes, injurious radiation, metal slag, and airborne particles. Protection equipment consisting of welding goggles with proper tinted lenses, apron or jacket, and welder's boots are required. Good general ventilation is normally adequate (pages 5-98 and 8-8).

WARNING

The following WARNINGS should be observed when repairing small chafed areas on the flaps:

1. O-T-620 trichloroethane is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection required. Use only with adequate ventilation. Avoid smoking or using welding equipment during use. Organic vapor respirator recommended.

2. Sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate. An approved dust mask is recommended.

3. Spraying operations are hazardous to the eyes and respiratory tract. Eye protection and mist/dust respirator required. Good general ventilation is normally adequate (page 5-134).

SAFETY SUMMARY – CONT

WARNING

The following WARNINGS should be observed when repairing small chafed areas on the flaps:

1. O-T-620 trichloroethane is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection required. Use only with adequate ventilation. Avoid smoking or using welding equipment during use. Organic vapor respirator recommended.

2. Sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate. An approved dust mask is recommended.

3. DEVCON F surface filler is toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Use only in a well ventilated area.

4. Spraying operations are hazardous to the eyes and respiratory tract. Eye protection and mist/dust respirator required. Good general ventilation is normally adequate (page 5-135).

WARNING

RTV 1-2/RTV 103 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 6-13 and 6-101).

WARNING

MIL-A-8576 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 6-23).

WARNING

MIL-L-83231 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 6-23).

WARNING

MIL-C-7439 coatings and primers are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 6-52).

SAFETY SUMMARY – CONT

WARNING

TT-T-548 and MIL-S-18718 are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 6-117 and 6-203).

WARNING

TEC No. 901 is toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Use only in a well ventilated area (page 6-117).

WARNING

Urelane 8089 A/B is toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Use only in a well ventilated area (page 6-203).

WARNING

MIL-P-1757 primer is toxic to skin, eyes, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (page 6-220).

WARNING

Spotfacing operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (page 6-357).

WARNING

EC1300 Adhesive is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 6-438).

WARNING

To avoid cracks in shaft, which may result in loss of the horizontal stabilizer, the arm or shaft of a matched set shall not be mixed or interchanged with similar parts. Misaligned taper-pin holes can occur. Misaligned taper-pin holes will cause undue stress in shaft and arm (pages 7-41 and 7-47).

SAFETY SUMMARY - CONT

WARNING

Abrasive blasting operations involve airborne particles which may be hazardous to body and eyes. Hood and gloves with gauntlets required (page 7-42).

WARNING

MIL-C-16173, grade 1, corrosion preventive compound is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 7-44).

WARNING

Structural repairs of any kind involving components of the engine section must be made with extreme care. The soundness of all such repairs is critical. It is imperative that no repair parts (patches, insertions, or attachments) can come loose and drop into the duct system. After any repair in the air inlet duct, carefully inspect the entire repair area to make sure that no loose material, parts, or tools remain. Even a very small piece getting into the intake system of a jet engine can easily destroy the engine and possibly injure personnel (page 8-6).

WARNING

O-T-634 trichloroethylene is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate (page 8-9).

WARNING

O-A-51 acetone is flammable and highly toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid all contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (pages 8-9 and 8-10).

WARNING

Engine performance may be seriously affected by excessive leakage of air from air inlet duct. To reduce possible damage to seal during engine installation, closely observe engine installation procedures in T.O. 1A-7D-2-5 (page 8-19).

SAFETY SUMMARY – CONT

WARNING

Blending operations with power tools are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate (page 9-2).

WARNING

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation (pages 9-2, 13-29, and 13-31).

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure will not exceed 30 psig. Eye protection is required (pages 13-31, 13-32, 14-3, 14-9, 14-10, 14-14, 14-18, and 14-28).

WARNING

Caustic soda solution is harmful to skin. To avoid contact with the skin, rubber gloves shall be worn when handling the caustic soda solution. Add acid and caustic solutions to water (never add water to the solutions) to prevent solutions from splattering or popping on personnel (page 16-1).

WARNING

Chromic acid solution is harmful to skin. To avoid contact with the skin, rubber gloves shall be worn when handling the chromic acid solution. Add acid to water (never add water to the solutions) to prevent solutions from splattering or popping on personnel (page 16-2).

WARNING

Most materials used for fuel tank sealing are toxic and/or flammable. Safety precautions given in wing integral fuel tank repair procedures (Section III) shall be observed when handling these materials (page 16-2).

WARNING

G651 and Q4-2805 sealants are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition (page 17-28).

SAFETY SUMMARY – CONT

WARNING

When heating wing, ensure adequate ventilation in area to alleviate possibility of fire or explosion (page 17-29).

WARNING

Wear approved safety goggles to protect eyes in event of failure of safety equipment during test (page 17-32).

WARNING

Ensure that canopy retaining locks are secure before applying pressure (page 17-33).

WARNING

Cell should be placed in a well ventilated area to remove harmful vapors (page 17-38).

CAUTION

Hardness tests for aluminum alloys are used primarily to tell the difference between annealed and heat-treated conditions. Hardness tests to determine loss of strength due to overheating should be done with caution because hardness is not a positive check of tensile strength in aluminum alloys (page 1-19).

CAUTION

The indenter shall be perpendicular to the surface and care exercised to avoid side thrust on the instrument when applying it to a surface; otherwise, readings may not be accurate enough to determine extent of damage (page 1-19).

CAUTION

To prevent corrosion of metal surfaces, do not remove or score surface finish (page 1-27).

CAUTION

All fasteners shall be installed in all doors and panels in the cockpit pressurized area. Pressurization may be affected if any fastener is missing (page 1-32).

SAFETY SUMMARY – CONT

CAUTION

Back up thin or nonrigid material while driving out pin to prevent damage (page 1-42).

CAUTION

Any Jo-Bolt assembly can be loosened when sufficient force is exerted upon the Jo-Bolt. A Jo-Bolt installation shall not be inspected using any type of tool with which torque can be applied (page 1-45).

CAUTION

Holes shall be completely deburred to prevent damage to seal (page 1-45).

CAUTION

Do not drive Deutsch rivets into tight holes by hammering on pin. This will cause premature expansion of the rivet. Use a hollow drift that will clear pin and locking lip (page 1-47).

CAUTION

If shaving is necessary for flushness, ensure that the locking lip is not cut away to the extent that the lock is damaged (page 1-47).

CAUTION

If high torque is felt during initial clockwise 1/4 turn of the stud, turn stud left (counterclockwise) enough to reset the receptacle insert so the stud will engage in the first 1/4 clockwise turn. Several turns of the unengaged stud may screw the insert inward enough to unseat the receptacle cover. A damaged receptacle cover is indicated if the unengaged stud ejects as the screwdriver is removed. When this happens, the cover on the receptacle should be checked for damage before resetting the insert and installing the airframe cover or door (page 1-49).

CAUTION

To prevent overstress of structures, contour lines for construction of support fixtures and repair jigs shall be plotted at structural points that will provide maximum support to the component to be repaired (page 1-68).

SAFETY SUMMARY – CONT

CAUTION

Excessive impact stresses can cause damage to airplane. During lifting operation, use care to minimize jerking motions and sudden starts or stops. Make sure lines are taut before actual lifting takes place (page 1-70).

CAUTION

When the part will be press formed, use these joggle lengths; otherwise, design must allow for joggle lengths given under extruded and bent sheet sections (page 1-171).

CAUTION

Observe safety precautions (paragraph 2-2) when applying markings and insignias (page 2-2).

CAUTION

Use of any sealant other than G651 or Q4-2805 may require removal of main wing skins and other components to clean unauthorized sealant from sealing grooves (paragraph 3-8) (page 3-2).

CAUTION

Graphite lead pencils or sharp pointed tools shall not be used to mark or sketch on metal surfaces. Graphite or pointed tools have been found to cause severe corrosion. Use MIL-P-83953 airplane marking pencil (pages 3-3, 8-3, and 13-16).

CAUTION

To prevent damage to test stand draft gage, valve A shall be opened prior to opening valve B (page 3-6).

CAUTION

Be sure that leakage does not run into critical areas of the airplane, such as engine bay area, electrical connectors, and that it is not possible for fuel to be blown into the engine area. Electrical connectors or apparatus shall be thoroughly dried and inspected after leak repairs are made. Any of the above conditions must be corrected before flight (page 3-7).

SAFETY SUMMARY – CONT

CAUTION

No lubricants other than paraffin wax or JP fuel are recommended for O-rings. Paraffin is less volatile and is the preferred lubricant to lessen explosion/fire hazard (page 3-13).

CAUTION

Designed voids in the baffle shall be cut to maintain required clearances around fuel components (page 3-20).

CAUTION

Correct positioning and installation of all baffles in fuel tanks is extremely important. Designed voids in the foam shall be positioned to maintain required clearances around fuel components and prevent static charge generation (page 3-20).

CAUTION

Do not use scrapers of material that could scratch the sealing surfaces. Leakage could result (page 3-24).

CAUTION

The Gask-O-Seal assembly is a prematched, two-part set. Parts from one prematched set shall not be mixed with parts from another set.

Gask-O-Seal and splice shall be stored in a protective bag until ready for installation. Be very careful not to damage or contaminate seal assembly.

Hands, tools, and work area shall be free of oil, grease, and foreign materials.

All metal chips and filings shall be removed from part and work area after drilling operations (page 3-28).

CAUTION

Do not apply excessive sealant to the Jig-O-Seal joint, as all excess must be removed. Sealant shall not be allowed to remain on the extreme tip of the Gask-O-Seal rubber crown (page 3-28).

SAFETY SUMMARY – CONT

CAUTION

Missing compensating patch(es) will cause a degrading of radar performance. Radome shall be returned to depot for boresight check (page 4-4).

CAUTION

The fiber glass surface of radome is sealed against moisture penetration; do not sand through sealer (page 4-7).

CAUTION

In subsequent procedures, avoid damage to projecting supports left attached to AR cavity after removal of forward dorsal rib structure. Damage could require replacing cavity support structure and time consuming rework (page 5-4).

CAUTION

The clips are bonded to the rib. The rib is critical aircraft structure which cannot tolerate nicks or scratches. Ensure that the clip is separated from the wingfold rib and the rib is protected against damage from any tools before cutting a slot into the clip (page 5-33).

CAUTION

When removing pin (1) and insert (2) take extreme care not to score or damage inside walls of rib fuel hole cavity (page 5-40).

CAUTION

Do not drill spring pin hole in any other area than specified as wing fuel cavity will be penetrated resulting in additional damage (page 5-40).

CAUTION

Use care to avoid increasing delamination (page 5-52).

CAUTION

Edges of lap patch should have round, smooth edges to prevent damage to mating reinforced plastic fairing (page 5-101).

SAFETY SUMMARY – CONT

CAUTION

Avoid damage to shaft when enlarging access in stiffener lower surface (page 5-148).

CAUTION

Ensure rod end, part No. 215-70429, with roller bearings, is installed at the inboard end of the spoiler door and rod end, part No. 215-70428, with ball bearings, is installed at the outboard end of the spoiler door (page 5-149).

CAUTION

Replace steel armorplate that is damaged beyond limits. No repairs are allowed (page 6-5).

CAUTION

Use care to prevent accidental application of resin on acrylic plastic panel. Optical distortion to windshield may result (page 6-23).

CAUTION

Touchup and patch repairs to finish shall be made using like materials. MIL-C-7439 neoprene and MIL-C-83231 polyurethane coatings are not compatible and one shall not be used on surface finished with the other (page 6-52).

CAUTION

Use care not to deform skin when removing ports. Deformed skin can result in false instrument indications. Skin must be smooth within ± 0.003 inch (page 6-117).

CAUTION

Prevent sealant from entering static port holes. A clean unobstructed port hole is necessary for true sensing of static air pressure (page 6-118).

CAUTION

Apply primer only up to edge of static port surface flowing primer into gap around edge of port to make a smooth contour (detail B). Do not apply lacquer within 0.75 inch of port hole. A clean smooth surface around port hole is necessary to obtain true sensing of static air pressure (page 6-118).

SAFETY SUMMARY – CONT

CAUTION

The avionic compartment cooling fan control microswitch operation may be affected by door adjustment. To prevent intermittent or faulty operation of the system, check switch for proper adjustment and operation. Refer to T.O. 1A-7D-2-3 (page 6-220).

CAUTION

Repair only one longeron at a time (page 6-249).

CAUTION

Control cables are located behind area where cut is made through skin (page 6-356).

CAUTION

To prevent damage to leading edge bulkhead, depth of cut should not exceed 0.25 inch (page 6-357).

CAUTION

To prevent damage to shaft internal threads, use special care when performing steps F and G (page 7-41).

CAUTION

Carefully support arm (10) during removal, to prevent damage to shaft and arm (page 7-41).

CAUTION

To prevent hydrogen embrittlement, use only a MIL-R-25134 paint and lacquer remover (pages 7-42 and 7-48).

CAUTION

The bearing housing is an ultra-high-strength steel forging susceptible to hydrogen embrittlement, use only a MIL-R-25134 paint and lacquer remover (page 7-42).

SAFETY SUMMARY - CONT

CAUTION

To prevent taper-pin hole damage, do not use drift pins, bars, or similar tools in taper-pin holes to align arm (page 7-43).

CAUTION

Lockscrew (2) and ball (3) will not be reused because proper torque can be held only by new parts (page 7-44).

CAUTION

Use proper size drill and exercise care to prevent damage to fastener holes (page 7-47).

CAUTION

To prevent damage to skins, do not drive wedges deeper than necessary to break seal between skins (page 7-47).

CAUTION

Do not use tools that will cause scoring or other damage to skins when removing center skin (page 7-47).

CAUTION

To prevent damage to shaft, do not allow it to fall from stabilizer (page 7-47).

CAUTION

To prevent hydrogen embrittlement only the specified plating will be used (page 7-48).

CAUTION

All negligible damage shall be repaired. Failure to repair crack damage may cause pressure leakage sufficient to collapse the aft fuel tank and tear out of duct skin pieces large enough to cause engine foreign object damage (FOD) (page 8-2).

CAUTION

To prevent possible repair failure, do not use aluminum Cherrylock rivets in duct repairs. Replace overdriven rivets and maintain shop formed rivet heads within limits specified in T.O. 1-1A-8 (page 8-6).

SAFETY SUMMARY - CONT

CAUTION

Do not stop-drill cracks or fuel tank may be damaged (page 8-7).

CAUTION

The flow rate of backup gas should be as much as possible; however, excessive flow could force the molten metal out of a crack which is completely through the sheet metal. If this occurs, oxides may form in the metal being blown out. This oxidized material may then drop back into the material and contaminate the weld (page 8-9).

CAUTION

To prevent damage to fuselage aft fuel tank, the fuel tank must be removed before starting patch repairs in the duct area between FS 490.5 and 526.5 (T.O. 1A-7D-2-6) (page 8-29).

CAUTION

Phenolic or nylon material is required to prevent possible damage to skin during bushing removal (page 11-1).

CAUTION

Use rawhide hammer to prevent possible skin damage during bushing installation (pages 11-18 and 11-28).

CAUTION

Flaw(s) detected in outboard hole (0.3125 inch) is critical for repair because of oversized hole in the rear spar flange. If a flaw is detected in this hole, contact OC-ALC Engineering, MMSRGB for disposition (page 11-32).

CAUTION

Tap lightly to avoid denting or damaging thin outer facing (pages 13-16 and 14-2).

CAUTION

Do not drill through opposite facing (page 13-20).

SAFETY SUMMARY – CONT

CAUTION

Use extreme care when machine or press countersinking Metalite to avoid making the countersink or dimple too deep (page 13-26).

CAUTION

Minimum squeeze pressure shall be used to avoid dimpling the Metalite faces (page 13-28).

CAUTION

When removing rivets, exercise care not to enlarge the hole or tear aluminum face from the core (page 13-28).

CAUTION

Use extreme care in sanding to avoid damage to outer glass fabric ply (page 14-4).

CAUTION

If damage is delamination between plies, do not drill through last ply into the honeycomb core (page 14-5).

CAUTION

Use care to prevent further damage to laminate from force of injection (page 14-5).

CAUTION

Do not apply excessive pressure with rubout tool. Patch shall remain centered over damaged area (pages 14-5, 14-6, 14-9, 14-11, 14-15, and 14-18).

CAUTION

Use care to prevent damaging the next ply when stepcutting and trimming glass fabric plies (page 14-7).

CAUTION

The sanded areas shall be kept clean (page 14-9).

SAFETY SUMMARY – CONT

CAUTION

Be careful to avoid damage to the opposite facing or bond between skin and core (page 14-10).

CAUTION

Do not touch repair area with bare hands or tools (page 14-10).

CAUTION

Be careful to prevent damaging the inner skin when cutting and trimming the damaged area (pages 14-12 and 14-16).

CAUTION

Be careful to prevent damaging the next layer while cutting and trimming glass fabric ply (pages 14-12 and 14-16).

CAUTION

Make sure all cells are full of resin and free of air (page 14-16).

CAUTION

Do not exceed curing temperature when using heating element (page 14-21).

CAUTION

Be careful to prevent cutting into next ply when trimming and stepcutting glass fabric plies (page 14-21).

CAUTION

Keep repair area clean. Avoid touching repair area with hands. Oil from hands has adverse affect on resin adhesion to surfaces (page 14-24).

CAUTION

Do not apply excessive pressure. Keep patches in place (page 14-24).

CAUTION

Apply pressure slowly and uniformly. Do not apply excessive pressure (page 14-25).

SAFETY SUMMARY – CONT

CAUTION

Use care to prevent damage to canopy seal and test stand canopy seal striker (6) during canopy installation (page 17-31).

CAUTION

Monitor air pressure gage (17) during test. In event of pressure relief valve (11) failure during pressurization of canopy, shut off air source and open dump valve (15) immediately (page 17-32).

CAUTION

Door may be positioned horizontally in fixture so that weight is resting on frame or with edges perpendicular and weight against shear pins. Do not perform repairs with door weight against restraining straps alone (page 17-35).

CAUTION

Due to close tolerance involved, the outboard stop assembly (1) must be removed before flap can be attached to support (page 17-46).

CAUTION

To prevent damage to actuator shaft and arm, support arm during bearing removal (page 17-49).

CORSAIR II

A-7D

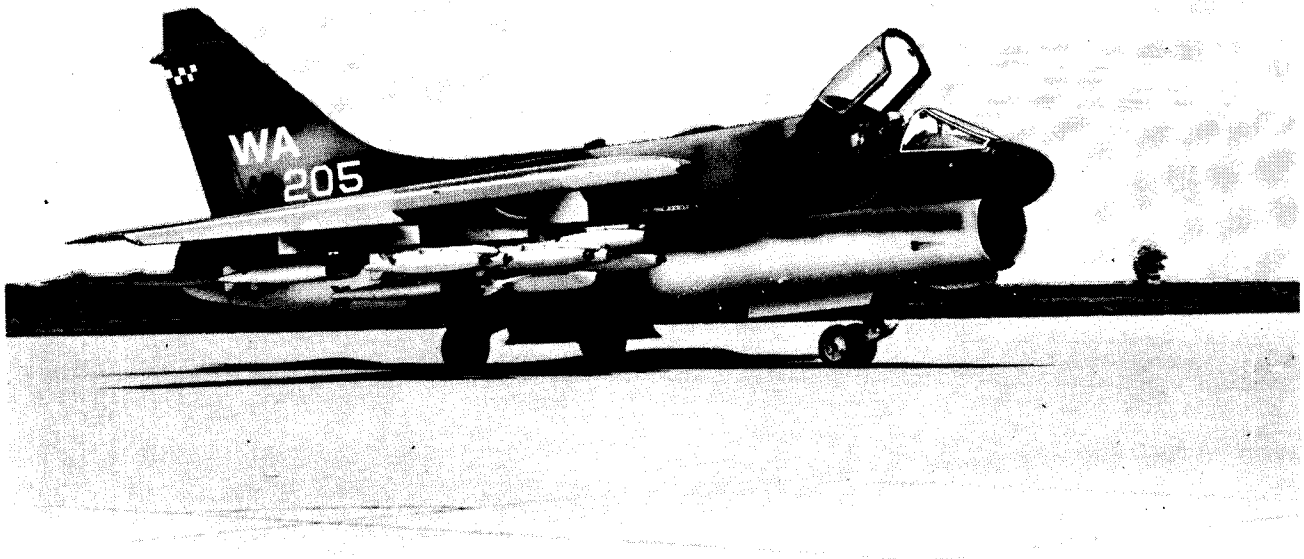


Figure 1-1. A-7D Airplane

Section I

GENERAL

1-1. GENERAL. This section contains general information and procedures pertaining to the A-7D airplane. Included is data on type of construction, materials used, airplane dimensions, damage classification, damage investigation and evaluation, aerodynamic smoothness, fasteners, airframe sealing and pressure testing (nonfuel areas), general shop practices, in-service use criteria, support of structure, and crash handling and shipping of airframe major components.

1-2. DESCRIPTION. (See figure 1-1.) The airplane is single place and powered by a TF41-A-1 nonafterburning turbofan engine mounted in the fuselage aft section. The basic structure consists of a swept-back wing with folding outer panels, a three-section semimonocoque fuselage, and an empennage consisting of a vertical stabilizer and a two-piece horizontal stabilizer. The wing is joined to the fuselage midsection at four points by lug and shearpin arrangement. The fuselage sections are permanently spliced at flanges on bulkheads and longerons. The vertical stabilizer is joined to the fuselage at the horizontal stabilizer support station by splice plates and angles. The horizontal stabilizer sections are joined to the fuselage aft section by taper bolts which secure the torque tubes to housing support assemblies. The landing gear is tricycle type and retracts into the fuselage.

1-3. MAJOR STRUCTURAL GROUPS AND REPAIR SECTION INDEX. (See figure 1-2.) The major structural group and repair section index figure assists in locating the specific repair section for each structural group. Each repair section also contains a figure to give the location of repair information for specific assemblies or installations within the major structural group.

1-4. TYPE OF CONSTRUCTION. Refer to applicable repair section descriptive data for detailed information on the type of construction of each major structural group.

1-4.1. Metallic Construction. Conventional aluminum alloy construction is used in the fabrication of the skeleton and skin plating. Magnesium, titanium, and steel alloys are also used. Magnesium is primarily confined to the vertical stabilizer and castings used in various systems installations. Steel is used primarily in the fuselage aft section.

1-4.2. Metalite and Reinforced Plastic. Metalite and reinforced plastics are used primarily in the areas of the wingtip, structural flooring, antennas, and radomes. Reinforced plastics are used in three forms: Fabrilite, bonded honeycomb sandwich, and solid laminate. Various castings and forgings used are fabricated from aluminum, magnesium, and steel. Bullet-resistant laminated glass and stretched acrylic plastic are used to provide the transparent and protective enclosures for the cockpit.

1-5. MATERIALS. The various materials used in construction of the A-7D airplane were selected for optimum reliability and maintainability. With exception of Metalite and Fabrilite structures, only standard state-of-the-art metallic and nonmetallic materials were used. Some of the determining factors which were used in selection of metallic materials and which apply equally to the design of major structural repairs are as follows:

a. Strength-to-weight properties

b. Stiffness-to-weight properties

c. Elongation (ductility) properties

d. Corrosion resistance

e. Minimum dissimilarity of metal contacts

f. Plate stability-to-weight properties

g. Fatigue resistance

1-5.1. Temperature Impact Considered in Selection of Materials. Thermal expansion, conductivity, and strength at various temperatures may be important for certain applications. The time at maximum and at minimum temperatures must always be considered in the selection of materials. The original material for each structural component of the landing gear and airframe is provided in the applicable repair section. Exterior skin materials are given in figure 1-3. A brief description and primary use of both metallic and nonmetallic materials and Metalite and Fabrilite bonded structures are provided in the following paragraphs.

1-5.2. Metallic Materials. (Refer to table 1-1.) Aluminum alloys in various forms are used as the primary structural materials. Steel, titanium, and magnesium materials are used for specific applications only. The use of alloy steel is generally limited to ultra-high-strength, heat-treated parts (260 ksi tensile strength). Titanium is used only where a significant savings in weight can be attained and corrosion resistant material is required. The use of magnesium is limited to components where weight can be saved and experience has demonstrated that no corrosion problems exist. For a detail description of metallic materials, refer to T.O. 1-1A-9.

Table 1-1. Metallic Materials Used in Original Fabrication of A-7D Airplane Structure

Form	Material	Alloy	Condition	Temperature limit	How used
Clad sheet	Aluminum	7075	T6	225	Exterior and primary structure
		2024	T6	350	General – exterior and secondary structural areas
			T81	350	Moderate forming
Bare sheet	Magnesium	AZ31B	H24	200	Empennage exterior surfaces
	Aluminum	6061	T6	300	General – exterior leading edges and fairings
	Steel	4130	HT-180 max	700	Welded assemblies
	CRES 18-8 type	302	1/4, 1/2 hard	800	Temperature or corrosion areas
		321	Annealed	800	Welded assemblies, formed parts, and temperature areas
	CRES heat treatable	17-7PH	HT-180 max	750	Temperature stressed areas
		PH15-7Mo	HT-200 max	750	Temperature stressed areas
	Nickel	Inconel X	HT-150 max	1200	Extreme temperature or springs
	Titanium	Commercial Pure	Annealed	600	Corrosion or temperature areas
		6A1-4V	Solution treated	600	Temperature and stressed areas

See footnotes at the end of the table.

Table 1-1. Metallic Materials Used in Original Fabrication of A-7D Airplane Structure – CONT

Form	Material	Alloy	Condition	Temperature limit	How used
Plate	Aluminum	6061	T651	300	General – corrosion and secondary structural
		2024	T851	300	Secondary structural areas
		7075	T73	250	Primary structural areas
		7075	T651	250	Primary structure only where 7075-T73 cannot be used
	Steel	4130	HT-180 max	700	Weldments
		4340	HT-200 max[1]	600	Stressed areas thick sections
Bar, rod and Extrusions	Aluminum	6061	T651	300	General – corrosion and low stress
		2024	T351	350	Secondary structure
		7075	T73	250	Corrosion and high stress
		7075	T651	250	Primary structure only where 7075-T73 cannot be used
Bar and rod only	Steel	4130	HT-180 max	700	Small weldments
		4340	HT-200 max[1]	600	Stressed areas
	CRES heat treatable	17-4PH	HT-190 max	750	General – corrosion and stress areas
		440C	Rc58 min	300	Hydraulic – wear resistance, no load
Forgings	Aluminum	6061	T6	300	Misc – corrosion and secondary structural areas
		2014	T652	300	Existing parts common with model A-7 airplanes
		7075	T6	225	General – primary structure
		7075	T652	225	For die forgings only and where 7075-T73 cannot be used
		7075	T73	250	Corrosion and sustained stress areas
	Steel	4340	HT-200 max[1]	600	Primary structure
	CRES heat treatable	17-4PH	HT-190 max	750	General – stressed and corrosion areas
	Titanium	6A1-6V-2Sn	HT-170 max	600	Stressed and corrosion areas
		6A1-4V	HT-160 max	600	Stressed and corrosion areas

See footnotes at the end of the table.

Table 1-1. Metallic Materials Used in Original Fabrication of A-7D Airplane Structure – CONT

Form	Material	Alloy	Condition	Temperature limit	How used
Castings	Magnesium	AZ91	T6	200	Interior castings in noncorrosion areas
	Aluminum	356	T6	250	Corrosion and low stress areas
		A356	T6	250	Corrosion and stressed areas
		357	T6	250	Corrosion and high stressed areas
	Steel, CRES heat treatable	17-4PH	HT-180 max	750	High stressed areas

[1]Maximum heat treat level permitted is 200,000 to 220,000 psi ultimate tensile strength.

1-5.3. Nonmetallic Materials. Nonmetallic materials are used for lightweight structural parts, lightweight nonstructural parts, flexible parts, seals, adhesives, radomes, antenna housings, transparent mediums, and paints. Nonmetallic materials used in the original construction of the airplane were selected from standard state-of-the-arts materials which have a history of outstanding reliability and maintainability qualities. In addition to strength and weight of materials, temperature range and exposure to oil/fuel must be considered when designing repairs which involve nonmetallic materials.

1-5.4. Metalite. Metalite is a sandwich panel made up of a very light balsawood core bonded between two sheets of 7075-T6 aluminum alloy. For high resistance to crushing, the balsawood grain is set 90° to the aluminum sheets. In certain places, internal and external aluminum alloy and phenolic reinforcements are bonded to the panels. Where extra strength is needed around fastener holes, mahogany inserts are bonded in the balsawood core. The advantages of Metalite are strength, stiffness, lightweight, and smooth surfaces. Metalite is used only for internal flat parts where the temperature does not get above 250°F.

1-5.5. Fabrilite. Fabrilite is a sheet assembly of sandwich construction with structure identical to Metalite, except reinforced plastic material is used for facing in place of aluminum alloy. Fabrilite is used in the construction of pylons only.

1-6. PRINCIPAL DIMENSIONS AND STATIONS. (See figures 1-4 and 1-5.)

1-7. TYPICAL REPAIRS AND SPECIFIC REPAIRS.

A repair designed for general use in the structure is called a typical repair. Typical repairs are intended for damage in locations and on parts of the structure which do not have special requirements. Parts and locations which are designed and built to carry unusual stresses and loads, or use special materials, require specific repairs. Typical repairs are covered in Sections XII through XIV. Specific repairs are given in Sections of this T.O. which cover the different areas of the structure. Before using a typical repair, check these sections to find out if a specific repair is required. For certain critical parts and areas, damage repairs must be designed by an aeronautical structures engineer.

1-8. REPAIR MAINTENANCE LEVELS.

Structural repairs are made at three levels of maintenance: organizational, intermediate, and depot. The repairs contained in this manual are not limited to a certain level of maintenance. Normally, repairs are limited by the capabilities of the responsible maintenance activity. The types of repairs normally done by each maintenance level are listed in the following paragraphs.

1-8.1. Organizational Level Repairs. The following types of repairs are considered to be organizational level maintenance:

a. Touchup painting of nicks, scratches, countersunk holes, trimmed edges, and small parts.

b. Replacement of fasteners if extensive painting is not required.

c. Removal of sheet metal dents if extensive painting is not required.

d. Windshield and canopy glass maintenance (cleaning, waxing of shallow scratches).

e. Visual damage inspection.

f. Replacement of parts where drilling or trimming is not required.

1-8.2. Intermediate Level Repairs. The following types of repairs are considered to be intermediate level maintenance:

a. Stripping and refinishing of parts such as ailerons, flap access doors, hinge assemblies, and bellcranks.

b. Hardness testing.

c. Magnetic, fluorescent, and dye penetrant testing.

d. Replacement of parts requiring trimming and drilling.

e. Sheet metal repairs including manufacture of small metal forms, forming and heat treating of repair parts, dimpling, welding, and machining which can be done with light job shop-type equipment.

f. Repairs to honeycomb, glass fiber, and plastic structure that is cracked, dented, crushed, delaminated, or punctured.

1-8.3. Depot Level Repairs. The following types of repairs are considered to be depot level maintenance:

a. Repairs which require design by an aeronautical structures engineer.

b. Major rebuilding and manufacture of structural assemblies.

c. Repair parts that are large and require forming and production type machining operations.

d. Replacement of structural parts that requires the use of production type jigs and fixtures.

e. Stripping and refinishing of entire airframe and associated structures.

1-9. CLASSIFICATION OF DAMAGE.

Damage is divided into four classes: negligible damage, repairable damage, crash damage, and combat damage. Limits for typical structural damage are given in Sections XII through XIV. Damage limits for specific areas or components are given in the repair sections which cover the part or area of the airplane. The definition for each class of damage is provided in the following paragraphs.

1-9.1. Negligible Damage. Negligible damage is damage which can be permitted to exist as is or which can be corrected by a simple procedure without placing flight restrictions on the airplane. Figure 1-6 shows an example of negligible damage. Actual limits are given in sections covering the specific structural areas.

1-9.2. Repairable Damage. Repairable damage is damage which exceeds negligible damage limits and can be classified in one or more of the following subclasses.

1-9.2.1. Damage Repairable By Patching. Damage which can be repaired by bridging the damaged area with splice material is damage repairable by patching. Figure 1-6 shows an example of damage repairable by patching. Actual limits are given in sections covering the specific structural areas.

1-9.2.2. Damage Repairable By Insertion. Damage which can be repaired by cutting away a section of the damaged component, inserting a section into the cutaway area, and securing components with splices at each end of the repair material is damage repairable by insertion. A repair by insertion is not permissible on Metalite. Figure 1-6 shows an example of damage repairable by insertion. Actual limits are given in sections covering the specific structural areas.

1-9.2.3. Damage Requiring Replacement. (See figure 1-6.) Damage requiring replacement is damage which requires replacement of an entire part or structural component because of one or more of the following conditions:

NOTE

Figure 1-6 shows an example of damage requiring replacement. Actual damage limits are given in sections covering the specific structural areas.

a. A complicated part that has been extensively damaged.

b. Location or structure around damage makes other classes of repair too hard to do.

c. Damaged part that is relatively easy or cheaper to replace.

d. Forged or cast parts that are damaged beyond negligible damage limits.

1-9.3. Crash Damage. Crash damage is caused by an accident during takeoff, landing, or because of a midair collision. Usually, the damage requires major repairs which must be designed by an aeronautical structures engineer. It also requires the use of special tools, special holding fixtures, and complicated repair methods.

1-9.4. Combat Area Damage. Combat area damage is caused while operating in combat conditions. It can be quickly repaired using limited tools, equipment, and materials to restore the structural strength of the airplane. Combat area damage repairs are restricted to actual combat areas of operation.

1-10. TYPES OF REPAIR.

There are four types of repair: permanent, temporary, one-time flight, and combat area repairs. The type of repair made will depend on the materials, tools, amount of time available, and the maintenance level. Temporary, one-time flight, and combat area repairs will generally be made only at organizational and intermediate levels of maintenance when it is impractical to make a permanent repair.

1-10.1. Permanent Repair. A permanent repair makes the structure as strong or stronger than it was originally. It also satisfies aerodynamic, thermal, and interchangeability requirements.

1-10.2. Temporary Repair. A temporary repair restores the strength of the structure but is not aerodynamically smooth or able to satisfy interchangeability requirements. This repair should be replaced by a permanent type as soon as practical.

1-10.3. One-Time Flight (Ferry) Repair. The one-time flight repair partly restores the strength of the structure in order to fly the airplane to a depot for a permanent repair. When a one-time flight repair is made, the airplane cockpit should be placarded to limit the performance of the airplane, as required by nature of the repair.

1-10.4. Combat Area Repairs. Combat area repairs are repairs designed to adequately restore functional capability of the airplane. They are simple enough to be done quickly with limited tools, equipment, and materials. This repair should be replaced with a permanent repair as soon as practical.

1-11. DAMAGE INVESTIGATION AND EVALUATION.

When an airplane has sustained damage, the entire external surface shall be inspected and damage evaluated before beginning repairs. The inspection may show damage to the exterior surfaces such as scratches, dents, holes, and buckled or wrinkled skin. Buckled or wrinkled skin is a good indication that adjoining understructure is damaged and a thorough inspection for secondary damage is required. Specific areas of probable damage from hard landings or excessive G-loads and general procedures for inspection and evaluation of all types of damage are presented in the following paragraphs. For inspection and evaluation procedures on a specific part of the airplane, refer to the section of this manual which covers the damaged area of the airplane.

1-11.1. Hard Landing and Excessive G-Load Damage. The impact force that changes a normal landing into a hard landing is difficult to determine. One landing at a certain airplane attitude may be severe enough to cause structural failure. A series of landings with same impact force, but at different attitudes, may occur before any damage results. The same can be true for excessive G-loads. When an airplane has been involved in a hard landing or has exceeded the G-load limits, a visual inspection is

required. Whenever the pilot records a hard landing or the exceeding of G-load limits, a visual inspection of the areas specified in tables 1-2 through 1-4 shall be performed in accordance with paragraph 1-11.2.

1-11.2. Visual Inspection. Visual inspection is the most common method of investigating damage. When necessary and where possible, inspection aids (such as dye penetrant, Magnaflux, hardness test, magnifying glass, etc.) shall be used to evaluate known damage or suspected damage (paragraph 1-13). When external damage is found that indicates possible damage to adjoining structure, a thorough inspection of the understructure shall be made and damage evaluated before beginning repairs. Inspect airplane for evidence of damage as outlined in the following paragraphs.

NOTE

Damaged areas and areas of suspected damage shall be thoroughly cleaned before attempting the inspection. Refer to T.O. 1A-7D-23 for cleaning methods.

1-11.2.1. Access Openings. For a more detailed evaluation of damage, removal of external and/or internal access covers and doors may become necessary. For identification and removal of external accesses, refer to T.O. 1A-7D-2-1. For identification and removal of internal accesses, refer to the applicable organizational maintenance manual for systems equipment located in the area.

1-11.2.2. Attachment Damage. Inspect all riveted and bolted joints in vicinity of damaged area for elongated holes and sheared or damaged attachments. If there is any doubt whether an attachment has failed, remove attachment so damage can be detected. Cracked paint around a rivet head may be an indication the rivet is damaged or has been overloaded.

1-11.2.3. Dents and Wrinkles. Investigate dents and wrinkles in skin sheet, sheet and rib, or beam webs to ensure there are no stress wrinkles caused by failure of vital structural components (figure 1-7).

1-11.2.4. Buckling, Breaks, and Stress Wrinkles. These conditions indicate the possibility of damaged or distorted structure caused by fatigue, high G-loads, hard landings, etc. A thorough inspection of adjoining structure is required to determine extent of damage (figure 1-7).

1-11.2.5. Scratches. Find out if a scratch is over allowable limits in the applicable repair section. Repair or replace damaged parts as required. Refer to paragraph 1-15 for clad penetration check of aluminum components.

1-11.2.6. Critical Points. For damage incurred on doors, check critical points such as the hinge for missing or broken tangs. Check hinge fittings for cracks or misalignment. Check door fasteners and holes. On damaged skin panels, check the supporting structure for cracks or deformed members. Check landing gear supporting structure for cracks and misalignment.

1-11.2.7. Spotweld Shearing. Inspect all spotwelds in vicinity of damaged area for shearing and cracks.

1-11.2.8. Cracks in Nonmagnetic Materials. If a crack is suspected or known to exist in nonmagnetic materials, determine presence and extent of crack by means of a dye penetrant inspection. Refer to paragraph 1-13 and T.O. 33B-1-1 for dye penetrant inspection method.

1-11.2.9. Cracks in Magnetic Materials. If a crack is suspected or known to exist in magnetic materials, determine presence and extent of crack by magnetic particle inspection (Magnaflux). Refer to paragraph 1-13 and T.O. 33B-1-1 for magnetic particle inspection method.

1-11.2.10. Fatigue Failure Cracks. If a fatigue crack is suspected or known to exist in a part, determine presence and extent of crack by eddy current or ultrasonic inspection methods. Fatigue cracks are not detectable by low-power magnification. Refer to paragraph 1-13 and T.O. 33B-1-1 for inspection methods.

1-11.2.11. Corrosion. Inspect for corrosion. For location of corrosion-prone areas, refer to T.O. 1A-7D-23. Refer to T.O. 1-1-2 for corrosion detection.

1-11.2.12. Fire Damage. Fire damage can be detected by comparing zinc chromate primer colors. When subjected to temperatures above 300°F for a short period, the color changes from a pale greenish-yellow to a light tan. Chrome green primer darkens when subjected to high temperatures. When fire damage is detected, hardness tests should be made using a portable hardness tester to determine the extent of damage (figure 1-8). Refer to paragraph 1-14 for hardness test procedures and scale readings.

Table 1-2. Hard Landing Inspection

1. Accomplish the following inspections if a hard landing is suspected.

   a. Visually inspect nose gear keel webs, stiffeners, and trunnions for deformation, loose/missing fasteners, or cracks.

   b. Visually inspect nose gear tires for wheel rim cuts or other damage.

   c. Visually inspect nose strut for obvious damage, evidence of leakage, or improper servicing.

   d. Visually inspect nose gear wheel well area for unusual paint flaking (caused by deflection of sheet metal). Carefully examine all fasteners and immediate surrounding areas for evidence of paint flaking.

   e. Visually inspect nose gear trunnion supports for loose/missing fasteners, evidence of structural fatigue, or cracks.

   f. Visually inspect fuselage skin to nose landing gear aft bulkhead attachment area for evidence of loose/missing fasteners.

   g. Visually inspect tail cone for wrinkles, distortion, or security of attachment.

   h. Visually inspect tailpipe for centering in tail cone, warpage, cracks, or other visible damage.

   i. Visually inspect main landing gear shock strut for leakage, nicks, dents, scratches, and proper servicing. Check for deformation and bulging by placing straightedge along strut cylinder. Check cylinder at several places around circumference. Repeat for exposed portion of piston. Check strut lower attach fitting bearing for protrusion in excess of 0.30 inch beyond vertical surface fitting. Any of the above conditions is cause for strut rejection.

   j. Visually inspect main wheel rim flanges for localized flattening. Also, visually inspect main landing gear tires for wheel rim cuts.

   k. Visually inspect lower right-hand and left-hand FS 590 bulkhead inboard cap strip and adjacent structure at and near point of overlapping splice to upper inboard cap strips for buckling, loose/missing fasteners, or cracks.

   l. Open access panels 5122-4 and 6122-4 and visually inspect area around engine mounts for cracks, distortion, or loose/missing fasteners.

   m. Visually inspect lower longeron and longeron splice in speedbrake area for buckles or loose/missing fasteners.

   n. Visually inspect forward-looking radar mounts for distortion, deformation, or cracks.

   o. If airplane is loaded with stores, visually inspect wing attach points for signs of distortion, cracking, or unusual paint flaking caused by deformation of sheet metal. Visually inspect lower wing skin and pylon skin and pylon/wing junction for deformation, bending, or other signs of damage or failure.

Table 1-2. Hard Landing Inspection – CONT

2. Accomplish the following inspections only if defects were found in previous steps a through o.

a. Perform dye penetrant inspection of nose landing gear trunnion supports and fittings for loose/missing fasteners, evidence of structural fatigue, or cracks in accordance with T.O. 1A-7D-36.

b. Visually inspect nose landing gear and main landing gear axles for distortion, deformation, or evidence of bending.

c. Visually inspect forward and aft gun mounts for loose/missing fasteners or cracks.

d. Verify nose landing gear and main landing gear wheel bearings are not loose and do not restrict wheel rotation.

e. Visually inspect MLG actuating cylinder to tension strut attach bolt for binding or galling.

f. Verify MLG tension strut wheel clearance by measuring distance between surface of wheel and outboard face of shock strut attaching lug while rotating wheel. Maximum allowable deviation shall be 0.25 inch.

g. Visually inspect FS 490 bulkhead tension strut attaching lug bushing for elongation. Additionally, perform ultrasonic inspection of lugs for cracks in accordance with T.O. 1A-7D-36.

h. Visually inspect tension strut attaching lug bushings for elongation. Additionally, perform ultrasonic inspection of lugs for cracks in accordance with T.O. 1A-7D-36.

i. Perform dye penetrant inspection of tension strut trunnions for elongation or cracks in accordance with T.O. 1A-7D-36.

j. Visually inspect FS 490 bulkhead shock strut attaching lug bushings for elongation. Additionally, perform ultrasonic inspection of lugs for cracks in accordance with T.O. 1A-7D-36.

k. Visually inspect shock strut attaching lug bushings for elongation. Additionally, perform ultrasonic inspection of lugs for cracks in accordance with T.O. 1A-7D-36.

l. Perform dye penetrant inspection of shock strut trunnions for elongation or cracks in accordance with T.O. 1A-7D-36.

m. Perform eddy current inspection of drag strut attachment fitting inboard tang for cracks in accordance with T.O. 1A-7D-36.

n. Perform dye penetrant inspection of drag strut trunnions for elongation or cracks in accordance with T.O. 1A-7D-36.

o. Perform magnetic particle inspection of right engine mount trunnion assembly (6866836) bearing, retainer plates and bracket, spherical nut, and trunnion lockring for nicks, scratches, distortion, burrs, damaged serrations, or cracks in accordance with T.O. 1A-7D-36.

Table 1-2. Hard Landing Inspection – CONT

p. Perform magnetic particle inspection of right engine mount trunnion (part No. 216-55464-4) for nicks, scratches, galling, distortion, burrs, damaged serrations, elongated boltholes, or cracks in accordance with T.O. 1A-7D-36.

q. Perform magnetic particle inspection of left engine mount trunnion assembly (6866838) bearing, retainer, plates and bracket for nicks, scratches, distortion, burrs, damaged serrations, elongated boltholes, or cracks in accordance with T.O. 1A-7D-36.

r. Perform magnetic particle inspection of left engine mount trunnion (part No. 216-55464-3) for nicks, scratches, galling, distortion, burrs, elongated boltholes, and cracks in accordance with T.O. 1A-7D-36.

s. Perform dye penetrant inspection of aft engine mount support (part No. 216-40446) for deformation, hole elongation, or cracks in accordance with T.O. 1A-7D-36.

t. Perform magnetic particle inspection of aft engine mount link assembly (6866622) for deformation, hole elongation, or cracks in accordance with T.O. 1A-7D-36.

u. If external stores were installed on pylons:

(1) Visually inspect inboard and center pylon forward support for deformation, damaged bearing surfaces, or cracks.

(2) Visually inspect helicoil inserts in inboard and center pylon aft rib assemblies for distortion or looseness.

(3) Visually inspect outboard pylon attach bolts and lugs for distortion, looseness, deformation, or cracks.

Table 1-3. Excessive Positive G-Load Inspection

1. Accomplish the following inspections if a positive over G condition has been detected by the wheel well counting accelerometers.

   a. Visually inspect external skin and panels for buckles, cracks, and loose/missing fasteners.

   b. Visually inspect ailerons, spoilers, deflectors, leading and trailing edge flaps, and connecting hinges for buckles, cracks, and loose/missing fasteners.

   c. Sight check all flight controls for evidence of warpage. With hydraulic pressure applied, visually inspect aileron and leading and trailing edge flap control linkages, pivot points, and hinges for binding by control surface movement.

   NOTE

   If any warpage, misalignment, or binding is suspected or apparent, install protractors and check for proper travel and smooth operation in accordance with T.O. 1A-7D-2-8.

   d. Visually inspect wingfold ribs for binding at pivot points, interference (rubbing from other components), scratches, or cracks in radius area of lugs, ribs, and flanges.

   e. Visually inspect intake duct for cracks and loose/missing fasteners.

   f. Visually inspect tailpipe for centering in tail cone.

   g. Visually inspect unit horizontal tail (UHT) for cracks in upper/lower skins.

   h. Visually inspect nose landing gear (NLG) and main landing gear (MLG) wheel wells and doors for buckles, cracks, or loose/missing fasteners.

   i. Visually inspect fuselage keel (stations 346.5 to 404.5) webs, flanges, and speedbrake actuator cylinder lug for cracks, buckles, distortion, and loose/missing fasteners. Also, visually inspect longeron and longeron splice in speedbrake area for buckles or loose/missing fasteners.

   j. Open access panels 5122-4 and 6122-4 and visually inspect area around engine mounts for cracks, distortion, or loose/missing fasteners.

   k. Perform magnetic particle inspection of NLG uplock shaft supports, NLG uplock hook, and MLG uplock hooks in accordance with T.O. 1A-7D-36. Additionally, perform dye penetrant inspection of MLG uplock hook support lugs in accordance with T.O. 1A-7D-36.

2. Accomplish the following inspections only if defects were found in previous steps a through j.

   a. Open access panels 1121-7, 2126-6, 3110-10, and 4113-10 and visually inspect wing attach forward links for cracks and distortion. Check surrounding area for cracks, distortion, or loose/missing fasteners.

Table 1-3. Excessive Positive G-Load Inspection – CONT

b. Open access panels 5111-4 and 6111-3 and visually inspect truss links for cracks or distortion. Check upper longeron in area of truss link fitting for cracks or loose/missing fasteners.

c. Open access panel 1222-9 and visually inspect area around aft gun mount for cracks, distortion, or loose/missing fasteners.

d. Perform magnetic particle inspection of right engine mount trunnion assembly (6866836) bearing, retainer plates and bracket, spherical nut, and trunnion lockring for nicks, scratches, distortion, burrs, damaged serration, or cracks in accordance with T.O. 1A-7D-36.

e. Perform magnetic particle inspection of right engine mount trunnion (part No. 216-55464-4) for nicks, scratches, galling, distortion, burrs, damaged serrations, elongated boltholes, or cracks in accordance with T.O. 1A-7D-36.

f. Perform magnetic particle inspection of left engine mount trunnion assembly (6866838) bearing, retainer plates, and bracket for nicks, scratches, distortion, burrs, damaged serration, elongated boltholes, or cracks in accordance with T.O. 1A-7D-36.

g. Perform magnetic particle inspection of left engine mount trunnion (part No. 216-55464-3) for nicks, scratches, galling, distortion, burrs, elongated boltholes, and cracks in accordance with T.O. 1A-7D-36.

h. Perform dye penetrant inspection of aft engine mount support (part No. 216-40446) for deformation, hole elongation, or cracks in accordance with T.O. 1A-7D-36.

i. Perform magnetic particle inspection of aft engine mount link assembly (6866622) for deformation, hole elongation, or cracks in accordance with T.O. 1A-7D-36.

j. If damage was found in MLG wheel wells or doors during part 1, step h inspections, perform dye penetrant inspection of MLG torque tube end fittings.

k. If damage was found in wingfold area during part 1, step d inspections, perform ultrasonic inspection of WCS and WOP locking lugs and eddy current inspection of WCS and WOP locking lug shanks in accordance with T.O. 1A-7D-36.

l. If external stores were installed on pylons:

(1) Visually inspect inboard and center pylon forward support for deformation, damaged bearing surfaces, or cracks.

(2) Visually inspect helicoil inserts in inboard and center pylon aft rib assemblies for distortion or looseness.

(3) Visually inspect outboard pylon attach bolts and lugs for distortion, looseness, deformation, or cracks.

Table 1-3. Excessive Positive G-Load Inspection – CONT

3. Accomplish the following inspections only if defects were found in parts 1 and 2.

   a. Perform eddy current inspection of FS 375 wing attach lugs (wing side).

   b. Perform eddy current inspection of FS 375 forward wing attachment adapter.

   c. Perform magnetic particle inspection of forward wing attach link.

   d. Perform eddy current inspection of FS 480 wing attach lugs (wing side).

   e. Perform eddy current inspection of FS 480 wing attach lugs (fuselage side).

   f. Perform eddy current inspection of FS 480 and 490 truss link lugs.

   g. Perform magnetic particle inspection of truss links.

   h. Perform magnetic particle inspection of FS 480 wing attach bolts and FS 480 and 490 truss link bolts.

Table 1-4. Excessive Negative G-Load Inspection

Accomplish the following inspections if a negative G condition has been detected by the cockpit G meter.

a. Visually inspect external skin and panels for buckles, cracks, and loose/missing fasteners.

b. Visually inspect ailerons, spoilers, deflectors, leading and trailing edge flaps, and connecting hinges for buckles, cracks, and loose/missing fasteners.

c. Sight check all flight controls for evidence of warpage. With hydraulic pressure applied, visually inspect aileron and leading and trailing edge flap control linkages, pivot points, and hinges for binding by control surface movement.

NOTE

If any warpage, misalignment, or binding is suspected or apparent, install protractors and check for proper travel and smooth operation in accordance with T.O. 1A-7D-2-8.

d. Visually inspect wingfold ribs for binding at pivot points, interference (rubbing from other components), scratches, or cracks in radius area of lugs, ribs, and flanges.

NOTE

If damage in the wingfold rib area is suspected or apparent, perform an ultrasonic inspection of the WCS and WOP locking lugs and an eddy current inspection of the WCS and WOP locking lug shanks in accordance with T.O. 1A-7D-36.

e. Visually inspect intake duct for cracks and loose/missing fasteners.

f. Visually inspect tailpipe for centering in tail cone.

g. Visually inspect unit horizontal tail (UHT) for cracks in upper/lower skins.

h. Visually inspect forward-looking radar mounts for distortion, deformation, or cracks.

i. Visually inspect LH and RH avionic bay for security of equipment or cracks in equipment shelves.

j. Visually inspect canopy hooks and rollers for deformation, binding of rollers, or cracks.

k. Remove ejection seat and visually inspect seat actuator attach points for deformation or cracks.

1-11.2.13. Secondary Damage. Secondary damage is a failure removed from the primary damage area and is caused by a transmission of shock loads. In estimating extent of primary damage, make certain no secondary damage escapes detection.

1-11.2.14. Misalignment. If damage is extensive or if airplane has been overstressed because of excessive airloads, perform an alignment check as directed in paragraph 1-17.

1-12. REPAIR OF DAMAGE.

After airplane damage has been investigated and evaluated, the damage shall be classified and a repair plan established. Refer to paragraph 1-9 for damage classification and paragraph 1-11 for damage investigation and evaluation. To facilitate planning and accomplishment of repairs, classify damage and accomplish repairs as follows:

a. Determine if damage is negligible, repairable, or if replacement is required (paragraph 1-9).

b. If damage is found to be negligible, process damage according to Sections XII through XIV, or applicable repair section as appropriate.

c. If damage is greater than negligible, determine if damage is repairable by patching or insertion (paragraphs 1-9.2.1 and 1-9.2.2).

d. If damage is found to be repairable by patching or insertion, make repairs in accordance with the applicable repair section for typical repair or specific repair if required.

e. When repairing by patching and insertion, if possible use material of same type and thickness as used in original structure. If dissimilar metals are involved, refer to T.O. 1A-7D-23 for applicable surface treatment and corrosion protection requirements.

f. If possible, use same type of fasteners for repair that were used in the original structure. Refer to paragraph 1-20 for substitute fasteners if other type of fasteners are required.

g. If damage is found to be greater than negligible or repairable but can be repaired by replacement, remove and replace the affected component.

h. All repairs involving structural strength of the airplane and for which no repairs are provided in this manual shall be designed by a qualified structures engineer.

1-13. NONDESTRUCTIVE INSPECTION.

Nondestructive inspection (NDI) is the examination of structure, structural components, and mechanisms for defects without causing damage to the part. Several NDI methods are available which may be applied to a structure or component to determine the integrity, composition (including physical, electrical, or thermal properties), and dimensions of the material without causing change in any of these characteristics. Refer to T.O. 33B-1-1 for the theory and general procedures for the various methods of NDI. Refer to T.O. 1A-7D-36 for procedures peculiar to A-7D airplane. A brief description and purpose of the NDI methods are outlined in the following paragraphs.

1-13.1. Dye Penetrant. Dye penetrant inspection is used to detect small cracks or discontinuities open to the surface and which may not be evident by normal visual inspection. Penetrant inspection may be used on most airframe parts and assemblies accessible for dye application. The inspection is performed by applying a liquid dye which penetrates into surface defects. Excessive penetrating liquid is removed and suitable developers applied to draw the penetrant from the surface defects so that visual indications are obtained by color contrast or fluorescence of the penetrant under the influence of black light.

1-13.2. Eddy Current. Eddy current inspection is used to detect surface or near surface cracks in most metals and to separate metals or alloys and their heat treat conditions. The method may be applied to airframe parts or assemblies where the defective area is accessible to contact by the eddy current probe. The inspection is performed by inducing eddy currents into a part and electronically observing variations in the induced field. The character of observed field change is interpreted to determine the nature of the defective condition.

1-13.3. Ultrasonic. Ultrasonic inspection is a nondestructive test method suitable for the inspection of most metals for surface or subsurface defects. Ultrasonic inspection requires at least one surface of the part to be accessible in the vicinity of the area in question. The inspection of airframe structure is accomplished by inducing the ultrasound into the part by a contacting probe and picking up reflections of this sound from within the part. The detected ultrasonic reflections are electronically displayed on an oscilloscope and interpreted for indications of defects.

1-13.4. Magnetic Particle. Magnetic particle inspection will indicate surface or near surface defects in ferromagnetic parts. The inspection is a nondestructive test method and may be performed on assembled or disassembled parts. The test is accomplished by inducing a magnetic field in the part and applying a liquid suspension of iron oxide particles. Local magnetic fields formed by defects in the part attract the oxide particles so when viewed may be evaluated by color contrast or fluorescence under black light.

1-13.5. Radiographic (X Ray). Radiographic inspection will show internal and external structural details of all types of parts and materials. The inspection is a nondestructive test method and is used for the inspection of airframe structure inaccessible or unsatisfactory for the application of other nondestructive test methods. The test is accomplished by passing the x rays through the part or assembly being tested to expose a radiographic film. The processed film shows the structural details of the part or assembly by variations in film density. Interpretation of the radiograph will indicate defects or damage.

1-13.6. Selecting the Inspection Method. The method of inspection for the damaged area will depend on several factors: accessibility, portability, type of defect sought, material of part, and degree of sensitivity required. The advantages and disadvantages of each type of NDI are described in table 1-5. These should be studied by personnel who are about to make an inspection of an area not covered in specific inspection instructions or if the inspection equipment called for in the procedure is not available. The information should be used as a guide in choosing the best method, or best alternative method, for the area for equipment available. A typical example of determining which inspection method to use is described as follows:

Example:

A fatigue crack was found radiating from a fastener hole in the wing lower skin. The fastener was removed and a penetrant inspection performed to determine the length of the crack on the surface. A section of the skin containing the hole and crack was cut out (5/8-inch diameter section). A check of the skin around the cutout was necessary to determine that all of the crack had been removed. The following methods were considered: dye penetrant, radiographic, ultrasonic, and eddy current.

Determining Inspection Method:

a. The dye penetrant method was considered unsuitable because of the smeared nature of the saw-cut surface and excessive bleed back from the skin to doubler faying surface.

b. Radiographic was considered in evaluating the test standards, but was not considered suitable for the wing inspection because sensitivity to a small, tight crack is not as good as the ultrasonic or eddy current methods.

c. The ultrasonic method was rejected because the method is less sensitive to small cracks of the type being looked for than is eddy current inspection and requires the preparation of a special transducer holder to obtain maximum sensitivity in any given area.

d. Eddy current was chosen as the best method of inspection because the inspection can be performed quickly with standard equipment and a high degree of sensitivity obtained.

Table 1-5. Comparisons of Various Inspection Methods

Method	Advantages	Disadvantages
Radiographic	1. Ability to inspect for both internal and surface defects	1. Most expensive
	2. Ability to inspect parts covered or hidden by other parts or structure	2. Airplane may have to be defueled
	3. Permanent test record obtained	3. Area must be cleared of other personnel to avoid X-ray exposure
	4. Minimum part preparation required	4. Test method is partially directional, depends on crack X-ray source orientation
		5. High degree of skill required for varied technique, development and radiographic interpretation
Eddy current	1. Portability	1. Essentially a surface inspection
	2. Moderate cost	2. Surface to be inspected must be accessible to contact by eddy current probe
	3. Immediate results obtained	3. Rough surfaces interfere with test sensitivity
	4. Sensitive to small defects	4. Suitable for inspection of metals only, principally nonferrous
	5. Little part preparation required	5. No permanent test record obtained
		6. Considerable skill and familiarity required in handling test equipment
Ultrasonic	1. Suitable for surface and subsurface defects	1. Surface of part to be accessible to sonic probe
	2. Sensitive to small defects	2. Rough surfaces interfere with test results
	3. Immediate results obtained	3. No permanent test record obtained

Table 1-5. Comparisons of Various Inspection Methods – CONT

Method	Advantages	Disadvantages
	4. Little part preparation required	4. Test method is directional depending on sound beam-defect orientation
		5. High degree of skill and experience required to set up and interpret results for various test conditions
Dye penetrant	1. Cheapness	1. Only surface of parts accessible to penetrant application can be inspected
	2. Portability	2. Defects must be open to surface
	3. High sensitivity	3. Part preparation such as removal of finishes and sealant required
	4. Immediate results obtained	4. No permanent test record obtained
	5. Minimum skill required	5. Direct visual detection of results required
Magnetic particle	1. Semi-portable	1. Suitable only for ferromagnetic material
	2. Sensitive to small indications	2. Part must be physically and visually accessible
	3. Detects surface and near surface defects	3. Removal of most surface coatings and sealant required
	4. Sensitive to inclusions as well as cracks	4. Inspection is semidirectional, requiring a general orientation of field to defect
	5. Moderate skill required	5. No permanent test record obtained

1-14. HARDNESS TESTING. Hardness testing is done with the Rockwell method. The test consists of pressing a hardened steel ball or a diamond point into a flat surface of the metal being tested. The hardened steel ball and the diamond point are known as indenters or penetrators. The impression made on the metal by the penetrator is related to the tensile strength of the metal. Through this relationship, determining whether or not the strength characteristics of the metal have been seriously affected is possible. This relationship, however, is only an approximation and should not be used as final judgement as to whether or not the strength of the material is satisfactory. If the strength of the material is in doubt, a damage sample should be sent to a depot laboratory for analysis. Make sure the sample selected is the right size and shape for a tensile strength testing machine. For information on material, consult the sections of this manual which show the portion of the airplane that is damaged.

1-14.1. Rockwell Hardness Test. When the damaged part is off the airplane, make hardness tests according to T.O. 1-1A-9. Use the following procedures when making a hardness test on parts still on the airplane.

CAUTION

Hardness tests for aluminum alloys are used primarily to tell the difference between annealed and heat-treated conditions. Hardness tests to determine loss of strength due to overheating should be done with caution because hardness is not a positive check of tensile strength in aluminum alloys.

NOTE

A surface which has been anodized is harder than the actual base material and requires removal of the anodized coating to get a true reading. A surface which has been clad is softer than the base material and requires removal of the cladding to get a true reading.

a. Remove finish, including anodized coating or clad, if required, from surface to be tested at point where penetrator makes contact.

b. Remove all scratches and variations that might affect readings.

c. Adjust dial to 0 on Ernst portable hardness tester (figure 1-8).

CAUTION

The indenter shall be perpendicular to the surface and care exercised to avoid side thrust on the instrument when applying it to a surface; otherwise, readings may not be accurate enough to determine extent of damage.

d. Apply pressure to tester.

NOTE

For comparison take a reading on structure that has not been damaged by heat.

e. Take readings, starting at center of damaged area and working outward, to determine extent of damage (figure 1-8 and table 1-6).

1-15. PENETRATION CHECK FOR DEFECTS IN ALUMINUM CLAD. When scratch or abrasions are detected in aluminum clad, check for penetration of the clad surface according to the following:

WARNING

TT-N-95 naptha is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

a. Clean area to be checked using clean, lint-free cloth moistened with TT-N-95 aliphatic naptha.

b. Wipe area dry with clean, lint-free cloth.

Table 1-6. Rockwell Hardness Scale Readings

Material	Spec	Condition	Form	Rockwell scale				
				B	C	E	H	15-T

NOTE

Strength/hardness relationship for aluminum and magnesium alloys are not as accurate as for steels; therefore, representive tension test should be performed on doubtful parts before acceptance or rejection.

Refer to T.O. 1-1A-9 for tension tests, composition of metals, and heat treatment.

Aluminum alloy 2014	QQ-A-250	-0	Bar, rod, forging	65-70		80 max	H-95 max	
		-T4		80-90		87-95		
		-T6				103-110		
Aluminum alloy 2024	QQ-A-250	-0	Sheet (bare), plate, bar, rod, extrusions	69-83		70 max	H-95 max	82.5-87.5
		-T3, -T4		76-90		97-106		85-90
		-T36		74.5-83.5		100-110	111-118	84-88
		-T6, -T8		83-90		99-106		87.5-90
		-T86				105-110		
Alclad 2024	QQ-A-250	-T3, -T4	Sheet clad (less than 0.090)	52-71		91-102	109-116	80-84.5
Aluminum 6061		-0	All sheet bar, rod, extrusion, forging			40 max	60-78	
		-T4				60-75	88-100	64-75
		-T4				70-81	82-103	67-78
		-T6				85-97		
Aluminum alloy 7075	QQ-A-250	-0	Sheet (bare), plate, bar, rod, extrusion, forging			70 max	95 max	
		-T6		85-94		106-114		87.5-92
		-T73[1]		76 min				
Alclad 7075	QQ-A-250	-T6	Sheet clad	73-90		102-110		86-90
Aluminum alloy 7079	QQ-A-250	-0	Bar, forging	81-93		104-114		87.5-92
		-T6						
Aluminum alloy 356		-T6	Casting	21 min				
A356		-T6		23 min				
Magnesium AZ31B	QQ-M-44	-0	Sheet			57-68		
		-H24				74 min		
Magnesium AZ91	QQ-M-38	-T6	Casting (die)			77 min	95 min	
CRES steel 17-7 PH		A		92 max				
		TH1050			39-44			
		RH1050			39-44			
		TH1100	Sheet		34-40			

See footnotes at the end of the table.

Table 1-6. Rockwell Hardness Scale Readings – CONT

Material	Spec	Condition	Form	Rockwell scale				
				B	C	E	H	15-T
CRES steel PH15-7Mo		A TH1050		100 max	 41-46			
CRES steel 17-4PH		A H900 (190 KSI) H925 (170 KSI) H1025 (155 KSI) H1075 (145 KSI) H1150 (135 KSI)	Bar, forging, casting		38 max 41-46 38-45 35-41 32-39 29-36			
CRES steel 301	QQ-S-766	A (1/4 hard) (1/2 hard) (3/4 hard) (full hard)	Sheet	94 max	 20-30 28-35 38-40 38 min			
CRES steel 302	QQ-S-763	A (1/4 hard)	Sheet, bar, plate	94 max	 25-35			
CRES steel 321	QQ-S-763	A	Sheet, plate, bar, forging	94 max				
CRES steel 440C	QQ-S-763		Bar		58-62			
Carbon steel 4130	QQ-S-624	125 KSI 150 KSI 165 KSI 180 KSI	Sheet, bar, plate		27-32 33-37 37-40 39-42			
Carbon steel 4340	QQ-S-624	180 KSI 200 KSI 260 KSI	Plate, bar, forging		39-43 43-46 50-53			
Titanium 6A1-4V	MIL-T-9047	A (STA)	Sheet, plate, bar, forging		36 max			
Titanium 6A1-6V-2Sn		A (STA)	Forging		38 max			
70A			Sheet	100 max				
Inconel X-750	MIL-N-7786	A Stress Equalized Age 155 KSI	Sheet, bar, forging	100 max	 32 max 32-42			

[1]In the case of 7075-T73 aluminum, hardness values do not indicate the material was properly heat treated but only that the material is not in the -0 or -T6 condition.

c. Air-dry area for approximately 1 minute.

WARNING

Caustic soda is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

d. Using eye dropper, place a drop of caustic soda solution on defect and allow to react for 5 minutes. Refer to Section XVI for chemical solution.

NOTE

Recessed area of defect shall not be cleaned.

e. Using clean, lint-free cloth moistened with tap water, clean off any caustic soda solution from area surrounding defect.

f. Allow area to dry.

NOTE

If a black residue has formed, clad has been penetrated; if not, clad has not been penetrated. In case of certain alloys, the clad around defect may darken. If clad has been penetrated, bottom of defect will be distinctly blacker.

g. Look for black residue in bottom of defect.

WARNING

Chromic acid is highly toxic to skin, eyes, and respiratory tract. Avoid all contact. Skin and eye protection and exhaust hood are required.

h. Using clean swab and eye dropper, apply chromic acid solution over all areas covered by caustic soda solution. Refer to Section XVI for acid solution.

NOTE

Be sure all areas contacted by caustic soda solution, including sides and bottom of defect, are neutralized by chromic acid solution.

i. Allow chromic acid to neutralize caustic soda solution for approximately 5 minutes.

j. Rinse area with water and wipe dry using clean cheesecloth.

NOTE

The black residue, if any, should be cleaned off. If not, steps h through j shall be repeated.

k. If defect is through clad, repair in accordance with applicable repair section.

1-16. BONDED STRUCTURE DAMAGE TEST.

Several types of bonded structures such as Metalite, Fabrilite, and reinforced plastic honeycomb sandwich are used on the A-7D airplane. These structures may sustain damage which may not always be visible. Voids are common defects that are not visible but may result from structural damage to the airplane or occur as a result of excessive heat in the area. A simple and effective method of detecting voids with a tap hammer has been developed. Refer to Section XII or XIII, as applicable.

1-17. ALIGNMENT AND SYMMETRY CHECK OF AIRPLANE AND MAJOR COMPONENTS.

The alignment and symmetry (dihedral) checks consist of measuring the distance between predetermined points on the wings, landing gears, horizontal and vertical stabilizers, and fuselage to determine if the fuselage or a major structural component has become asymmetrically aligned. An alignment and/or symmetry check is required for one or more of the following reasons:

a. Airplane has sustained known or suspected damage that could affect alignment and symmetry.

b. After major structural repair.

c. After removal, replacement, or re-installation of major structural component.

d. When change in airplane flight characteristics occur.

e. When routine inspection reveals possible damage to major structure.

1-17.1. Alignment Check. (See figure 1-9.) Perform alignment check of each wing, each horizontal stabilizer, main and nose landing gear, vertical stabilizer, and fuselage as follows:

a. Position airplane in closed hangar or protect from wind.

b. Check airplane for symmetrical wing loads.

c. Perform alignment check according to figure 1-9.

1-17.2. Symmetry Check. (See figure 1-10.) Prepare airplane and perform symmetry (dihedral) check of each wing and each horizontal stabilizer as outlined in the following paragraphs.

1-17.2.1. Airplane Preparation. Prepare airplane as follows:

a. Defuel airplane (T.O. 1A-7D-2-1).

b. Position airplane in closed hangar on smooth and level surface.

c. Check that outer wing panels are spread and locked, flaps retracted, and horizontal stabilizer in neutral position.

NOTE

Symmetry check shall be accomplished with engine installed, airplane defueled, and leveled without use of jacks.

d. Level airplane by deflating and inflating nose and main landing gear shock struts as required (T.O. 1A-7D-2-1).

e. Tape plumb lines at checkpoints A through E located on lower surface of each wing and horizontal stabilizer.

f. Position engineer's transit in front of airplane so that all plumb lines (left and right sides of airplane) are visible through transit.

1-17.2.2. Wing Symmetry (Dihedral) Check. (See figure 1-10.) Perform check as follows:

a. Adjust transit to establish level line-of-sight that passes through all plumb lines on wings.

b. Begin measurements at either outboard checkpoint.

NOTE

Transit shall be perfectly level when sighting from one checkpoint to another. If transit becomes unlevel, the measurements shall be repeated.

c. With vernier scale held adjacent to plumb line and contacting checkpoint, sight through transit. Read and record distance from lower wing surface to level line-of-sight established in step a.

d. Repeat step c at each wing checkpoint. Distances shall be as follows:

(1) Distance at checkpoint D shall equal distance at checkpoint E plus 4 9/16 ($\pm$ 1/2) inches.

(2) Distance at checkpoint C shall equal distance at checkpoint D plus 7 13/16 ($\pm$ 1/2) inches.

(3) Distance at checkpoint C shall equal distance at checkpoint E plus 11 3/4 ($\pm$ 1) inches.

e. Check airplane for damage if measurements do not fall within specified tolerances.

1-17.2.3. Horizontal Stabilizer Symmetry (Dihedral) Check. (See figure 1-10.) Perform check as follows:

a. Adjust transit to establish level line-of-sight that passes through all plumb lines on horizontal stabilizer.

b. Begin measurements at either outboard checkpoint.

NOTE

Transit shall be perfectly level when sighting from one checkpoint to another. If transit becomes unlevel, the measurements shall be repeated.

c. With vernier scale held adjacent to plumb line and contacting checkpoint, sight through transit. Read and record distance from lower stabilizer surface to level line-of-sight established in step a.

d. Repeat step c at each checkpoint.

e. Distance at checkpoint A shall be equal to checkpoint B plus 8 25/32 ($\pm$ 1/2) inches.

f. Check airplane for damage if measurements do not fall within specified tolerances.

g. Remove all plumb lines, tape, and transit.

h. Service main and nose gear shock struts and fuel airplane (T.O. 1A-7D-2-1).

1-18. OPTICAL LEVELING OF AIRPLANE. (See figure 1-11.)

1-19. AERODYNAMIC SMOOTHNESS.

Aerodynamic smoothness is the exterior surface condition of an airplane that approximates the design contour necessary for maximum airplane performance. Common surface flaws that affect aerodynamic smoothness include waves, steps, gaps, and nonflushness of external fasteners. The following paragraphs present wave, step, and gap definitions, aerodynamic smoothness inspection instructions, aerodynamic tolerances, and applicable repair instructions including aerodynamic fairing compound application.

1-19.1. Wave, Step, and Gap Definitions. Common aerodynamic surface flaws (waves, steps, and gaps) are defined in the following paragraphs.

1-19.1.1. Wave Definition. (See figure 1-12.) A wave is a gradual change from and return to the design contour of a surface. Waves may be negative (dipping below design contour) or positive (rising above design contour). The length of any individual wave is measured from the point of departure from contour to the point of return, and the height (or depth) of the wave is measured at the maximum deviation from the design contour. Waves are most critical when they occur in the wing leading edges, empennage leading edges, and in the engine air duct between fuselage stations 181.9 and 257.

1-19.1.2. Step Definition. (See figure 1-12.) A step is a sharp change from the design contour. A step may result from mismatched edges at adjacent skin panels, poorly fitted access panels or doors, or improperly rigged control surfaces riding above or below the intended airfoil contour. Steps may be positive (airflow stepping up) or negative (airflow stepping down). Steps of any size disturb the airflow and are usually more critical on the wing leading edges, empennage leading edges, and in the engine air duct.

1-19.1.3. Gap Definition. (See figure 1-12.) Gaps are spaces between the edges of adjacent skin panels, between the edge of a door or removable panel and the opening which it closes, and between two surfaces intended to be part of the same aerodynamic surface.

1-19.2. Inspection of Aerodynamic Surfaces. Inspect surfaces for aerodynamic smoothness tolerances as specified in the following paragraphs.

1-19.2.1. Wave Inspection. (See figure 1-13.) Perform a chordwise contour inspection on fuselage, wing, or empennage surfaces as follows:

a. Stretch steel wire (0.020 to 0.040 inch diameter) taut over surface in chordwise direction (direction of airflow). Clearance between skin surface and wire should be within wave tolerance specified in figure 1-13.

b. Repeat step a at several points along span of wing or empennage surface being inspected.

c. Repair surfaces where out-of-tolerance waves exist (paragraph 1-19.4).

1-19.2.2. Step and Gap Inspection. (See figures 1-14 through 1-18.) Inspect fuselage, wing, and horizontal and vertical stabilizers aerodynamic surfaces for permissible step, gap, and flush rivet tolerances as follows:

a. Using micrometer or equivalent tool, measure step, gap, and height of rivet head above or below repaired or questionable skin surfaces. See figures 1-14 through 1-18 and refer to paragraph 1-19.3 for permissible tolerances.

b. Repair surfaces where out-of-tolerance discrepancies exist in accordance with paragraph 1-19.4.

1-19.2.3. Engine Air Intake Duct Inspection. (See figure 1-13.) Inspect engine air intake duct for aerodynamic smoothness by feel and with templates, if available. Repair out-of-tolerance discrepancies in accordance with applicable procedures in paragraph 1-19.4 and Section VIII.

NOTE

The tolerances given are intended for use as a guide during major repair and/or replacement of components and are not intended to restrict the structural acceptability of the airplane.

1-19.3. Standard Aerodynamic Tolerances. Tables 1-7 through 1-9 list all standard permissible steps, gaps, and external flush rivet tolerances. Wave tolerances are given in figure 1-13. Nonstandard fuselage tolerances are given in figures 1-14 through 1-18.

Table 1-7. Standard Permissible Steps

Surface	Max step (inches)
(Fwd) FS 204.4 to FS 346.5	0.03
(Mid) FS 346.5 to FS 526.5	0.05
(Aft) Aft of FS 526.5	0.08

Table 1-8. Standard Permissible Gaps

Surface	Not involving magnesium	One or both members magnesium
	Max gap (inches)	Max gap (inches)
Fixed panels	0.03[1]	0.06[1]
Access doors and panels	0.06[1]	0.09[1]
Power operated doors	0.125[1]	0.16[1]

NOTE

Gaps 0.03 in excess of specified maximum are acceptable provided 90% of the periphery is within the maximum tolerance.

[1]Unless otherwise noted (figures 1-14 through 1-18)

Table 1-9. External Flush Rivet and Rivet Type Fastener Tolerances External Skin and Air Duct

Surface	Height of rivet head	
	Above skin	Below skin
Wing and tail, leading edge to 25% chord	0.002	0.005
Engine air duct, station 346.5 forward	0.002	0.005
Wing and tail, 25% chord to trailing edge	0.005	0.008
Engine air duct, station 346.5 aft	0.005	0.008
Fuselage, all locations	0.005	0.008
Pylons, all stations	0.005	0.008

1-19.4. Repair. Aerodynamic smoothness discrepancies may be corrected according to the following paragraphs.

1-19.4.1. Waves. Waves which are out of tolerance as specified in figure 1-13 should be repaired by blending out, where possible, to longer waves which are within tolerance. Where this is not possible, additional internal supports may be necessary. Minor waves may be repaired using aerodynamic fairing compound (figure 1-12). Refer to paragraph 1-19.5 for application.

WARNING

Shims shall not be used in the following areas:

Rear spar	215-70041
Wingfold rib	215-70050
Centerline rib	215-70053
Pylon attach fittings	215-70098
	215-70422
	215-70094
	215-70054
	215-70035

MIL-C-5541 chemical film is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated ventilation is normally adequate.

1-19.4.2. Steps. Steps which exceed tolerances specified in table 1-7 and figures 1-14 through 1-18 may be smoothed by shimming, scarfing, and fairing with aerodynamic fairing compound. Shimming for smoothness may be attained by installing tapered 2024 aluminum shims between the skin and substructure. Shims may be 0.020 inch maximum thickness with 0.003 inch maximum step at each end. Treat shim surfaces with MIL-C-5541 chemical film before installation (T.O. 1-1-2). Waves produced by shimming are subject to wave tolerances (figure 1-13). When shimming is not practical, scarfing and/or fairing with compound are approved methods (figure 1-12). Use aerodynamic fairing compound only when other methods fail to attain required smoothness (paragraph 1-19.5).

1-19.4.3. Gaps. Gap tolerances are given in table 1-8 and figures 1-14 through 1-18. Out-of-tolerance gaps at fixed panels may be faired with aerodynamic fairing compound (paragraph 1-19.5).

Out-of-tolerance gaps at wing center section and outer panel leading edge flaps may be faired by building up thickness at aft edge of flap with glass fabric and epoxy resin as formulated in Section V.

1-19.5. Aerodynamic Fairing Compound Application. Aerodynamic fairing compounds are used to produce aerodynamically smooth surfaces and for corrosion protection. Determine the type of compound required and application. Refer to airframe sealing (nonfuel areas) in T.O. 1A-7D-23. See figures 1-13 and 1-18 for critical aerodynamic tolerances. Apply chemical treatment and compound to surfaces to be faired in accordance with the applicable procedures contained in the following paragraphs.

1-19.5.1. Precautions. To prevent injury to personnel and damage to airplane, observe the precautions in the safety summary of this T.O. Also, carefully observe the following safety precautions.

a. Wear clean rubber or plastic coated gloves when working with fairing compound materials. Skin oils will keep compound from sticking.

b. If fairing application is performed in closed area, forced air ventilation shall be provided and suitable respirator shall be worn by personnel involved.

c. Do not allow dust or fine particles to blow into sensitive instruments.

d. Store and transport mild acid cleaner in plastic container.

1-19.5.2. Surface Preparation. Prepare surface for fairing compound application as follows:

a. Observe safety precautions (paragraph 1-19.5.1).

WARNING

Shaving and sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

CAUTION

To prevent corrosion of metal surfaces, do not remove or score surface finish.

b. Remove old compound by shaving and sanding. If new compound is to be installed over old compound, recondition old compound by sanding.

WARNING

Under no circumstances shall high-pressure compressed air be used to clean dirt or debris from airplane, nor shall it ever be directed at a fellow worker or used to clean dirt and dust from clothing or body. Wear goggles when using low-pressure compressed air.

c. Clean dirt, chips, and other debris from surface, holes, crevices, and slots using vacuum cleaner or low-pressure compressed air (10 to 15 psi).

WARNING

Toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

d. Wipe dirt, oil, and grit from surfaces with clean cloth wet with TT-T-548 toluene. Wipe surface dry with clean cloth before cleaner dries.

e. Air-dry minimum of 15 minutes before applying compound.

f. If compound is not applied immediately, cover cleaned surfaces with clean, dry cloth or paper to prevent contamination.

g. If surface finish was damaged or removed during cleaning operation, refinish exposed areas of bare metal after sealant application with original finish materials (T.O. 1A-7D-23).

1-19.5.3. Silicone Compound (207-9-420). Prepare LTV Specification 207-9-420 (PR 1955) compound for application as follows:

a. Observe safety precautions in safety summary of this T.O.

WARNING

Silicone compound is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

b. Stir base compound and accelerator in separate containers until homogeneous consistencies are obtained.

c. Mix 20 parts by weight of silicone base compound with 1 part by weight of accelerator.

d. Add accelerator to base compound and mix thoroughly. Stir until homogeneous mixture is obtained. Keep as much air as possible from mixing into compound.

NOTE

Use LTV Specification 207-9-419 primer and 150-W-7 silicone coating with silicone compound.

e. Apply silicone compound within 30 minutes after mixing (paragraph 1-19.5.5, step d).

f. Apply thin coat of 207-9-419 primer over silicone compound within 30 minutes after application.

g. Allow compound to cure 18 hours at room temperature before handling.

1-19.5.4. Surface Treatment. Prepare surfaces for aerodynamic fairing compound application as follows:

WARNING

Under no circumstances shall fairing compound be used in the engine air intake duct. Introduction of loose material, however small, into the intake system of a jet engine can result in damage to the engine and possible injury to personnel.

NOTE

Fairing compound should not be installed in head slots of screws, quick action fasteners, etc, that are used to attach readily removable items.

The maximum amount of compound to be used shall be limited to 1 pound for 2,500 square feet. No area of depression greater than 1 square foot shall be faired.

a. Observe safety precautions (paragraph 1-19.5.1).

b. Prepare surfaces before sealant application (paragraph 1-19.5.2).

c. Protect treated surfaces with clean cloth or paper to prevent contamination. Retreat surfaces if more than 8 hours elapse before applying compound.

d. If metal surfaces have been previously coated with polyurethane enamel, prime

surface edges before compound application as follows:

WARNING

Methyl ethyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

(1) Clean polyurethane enamel by wiping with cloth wet with TT-M-261 methyl ethyl ketone. Immediately wipe dry with clean, dry cloth.

WARNING

Pro-Seal 777P is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

(2) Brush thin coat of Pro-Seal 777P primer over polyurethane enamel surface to receive fairing compound.

(3) Allow to air-dry for 30 minutes before compound application.

1-19.5.5. Fairing of Butt Joints Involving Magnesium-to-Magnesium or Similar Metals. (See figure 1-19.) This type of compound application is used for corrosion protection as well as for aerodynamic smoothness. Apply compound as follows:

a. Prepare surface for compound application (paragraph 1-19.5.4).

b. To obtain neat uniform joint, outline areas to receive compound with parallel strips of masking tape. Provide fairing area equal in width to widest part of butt joint groove.

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

NOTE

Apply all compounds according to step c, except PR 1955 silicone compound which shall be applied according to step d.

Wooden tongue depressors, nonmetallic spatulas, or plastic putty knife may be used in place of a sealant fillet gun in small and inaccessible areas.

c. Apply MIL-S-8802 (sealant) fairing compound as follows using sealant fillet gun (figure 1-19 and Section XVII).

(1) Immediately before use, add accelerator and mix according to instructions with container.

NOTE

Pot life of mixed B-2 1/2 compound is 2 1/2 hours.

(2) Apply mixed compound as shown for butt joints involving magnesium-to-magnesium and before expiration of pot life (figure 1-19).

NOTE

The compound should fill the butt joint gaps level with adjacent surfaces.

(3) Fair, feather, and smooth compound to dimensions shown using locally fabricated fairing tools (Section XVII).

(4) Remove masking tape immediately to prevent lifting.

(5) Cure compound 72 hours at room temperature or 4 hours at 160°(±10°)F.

(6) Use fairing tool or sand edges to obtain correct contour and feather (figure 1-19).

WARNING

PR 1955 is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

d. Apply PR 1955 silicone compound (paragraph 1-19.5.3) as follows using tongue depressor, plastic putty knife, or nonmetallic spatula.

(1) Brush 0.4 to 0.5 mil coating of PR 1902 primer in seam and on edges of abutting skins.

(2) Allow primer to air-dry for 30 minutes minimum to 8 hours maximum before application of fairing compound.

(3) Apply silicone fairing compound shown for magnesium-to-magnesium butt joints (figure 1-19).

WARNING

Silicone coating and catalyst are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

(4) Mix by volume 3 parts of 150-W-7 silicone coating with 2 parts of 75-C-414 thinner-catalyst. Apply thin brush coat over compound within 30 minutes after compound application.

WARNING

Epoxy-polyamide primer is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

(5) Allow silicone compound to cure 1 hour minimum to 2 hours maximum; then, brush on coating of MIL-P-23377 epoxy-polyamide primer (T.O. 1A-7D-23).

(6) After compound has cured 18 hours minimum, remove masking tape and sand edges to obtain correct contour.

1-19.5.6. Fairing of Butt Joints Involving Metalite or Dissimilar Metal Involving Magnesium. (See figure 1-19.) This type of compound application is used at butt joints for corrosion protection as well as for aerodynamic smoothness fairing when dissimilar metals are involved. Apply compound as follows:

a. Prepare surfaces for compound application (paragraph 1-19.5.4).

b. To obtain neat, uniform joint and straight fairing, outline areas to receive compound with parallel strips of masking tape. See figure 1-19 for dimensions.

c. Prepare fairing compound for application. Refer to airframe sealing requirements for nonfuel areas (T.O. 1A-7D-23).

NOTE

Wooden tongue depressors, nonmetallic spatula, or plastic putty knife may be used in place of a sealant fillet gun in small and inaccessible areas.

d. Using sealant fillet gun, apply layer of fairing compound 0.007 to 0.012 inch thick (figure 1-19 and Section XVII).

e. Fair, feather, and smooth compound to correct dimensions using locally fabricated fairing tools. See figure 1-19 for application in critical or noncritical aerodynamic areas, as applicable.

f. Cure compound as required.

g. Remove masking tape.

h. Fair edges as required to obtain correct contour using sandpaper or fairing tool (figure 1-19 and Section XVII).

1-19.5.7. Fairing of Fasteners in Corrosion Prone Areas. (Refer to table 1-9; see figure 1-19). This type of compound application is used for fastener corrosion protection and aerodynamic smoothness in critical and noncritical aerodynamic areas. Apply compound as follows:

a. Prepare surfaces for compound application (paragraph 1-19.5.4).

b. Fill slots in screwheads with EC 1184 smoothing compound.

WARNING

Methyl ethyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

c. Wipe off excess smoothing compound flush with screwhead using TT-M-261 methyl ethyl ketone.

d. Allow smoothing compound to dry 12 hours before fairing compound application.

e. Apply parallel strips of tape (0.004 inch maximum thickness) on each side of fasteners. Maintain distance from edge of countersink (figure 1-19).

WARNING

MIL-S-8802 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

f. Prepare MIL-S-8802 Type B-2 1/2 fairing compound for application (T.O. 1A-7D-23). Add 25 parts by weight of TT-P-320, Type I, Class A aluminum powder to 100 parts by weight of mixed sealant.

NOTE

Pot life of MIL-S-8802 mixture is 2 hours.

g. Using sealant fillet gun, apply compound in countersink and over fasteners (Section XVII).

h. Smooth compound to correct thickness using suitable fairing tool (figure 1-19 and Section XVII).

i. Remove tape and cure compound for 12 hours at room temperature.

j. If compound is applied in critical aerodynamic areas, fair edges using sandpaper or fairing tool (figure 1-19).

1-20. FASTENERS. Various types of fastening devices are used in the construction and repair of the airframe and airframe component parts. These devices include conventional rivets, special rivet type fasteners, and quick-release (Camloc type) fasteners. The most common fasteners used are the countersunk and protruding head solid shank conventional rivets. A large variety of both countersunk and protruding head special rivet type mechanical fasteners are used. The special fasteners include blind rivets, Hi-Shear rivets, Hi-Shear blind bolts and nuts, Huck lockbolts, Jo-Bolts, Hi-Kor blind bolts, Riv-O-Seal (Flush Seal) rivets, and Hi-Lok fasteners. Information is provided in this section for identification, hole preparation, removal, and installation of special fasteners which are not covered in T.O. 1-1A-1 or T.O. 1-1A-8. For lists of fasteners and required tools, refer to Sections XVI and XVII, respectively.

1-20.1. Fastener Smoothness Requirements. All permanently installed rivets, screws, and rivet type fasteners installed in exterior skins shall not exceed the flushness requirements specified for particular airframe areas in table 1-9. Check flushness with an aircraft surface flushness gage, Model B5M or B3K or equivalent.

1-20.1.1. Rivets and Screws. Conventional rivets, Riv-O-Seal rivets, and aluminum alloy screws may be shaved to obtain required flushness, except when the fastener head protrudes beyond the limit established for before shaving (tables 1-10 and 1-11). Rivets and aluminum alloy screws exceeding the maximum protrusion limits before shaving shall be replaced since the reduced head diameter after shaving will not be structurally satisfactory. All shaving of Riv-O-Seal rivets shall be accomplished before pressure testing of the pressure tight area. The head diameter after shaving shall be within the limits established in tables 1-10 and 1-11 for rivets and aluminum screws respectively. Shaving of rivets and screws shall be held to a minimum. The head of any shaved fastener shall be flush to within 0.001 inch above the skin surface.

1-20.1.2. Threaded and Pull Rivet Type Fasteners. Threaded and pull rivet type blind fasteners are not generally shaved; instead, the countersink shall be adjusted to provide a flush installation. Rivet type fasteners, except Hi-Shear rivets and plated steel fasteners, may be shaved if countersink adjustment is not possible. Under no circumstances shall the head be shaved to the extent of weakening the fastener locking device. Any shaved fastener shall be flush to within 0.001 inch above the skin surface. Refer to Section XVII for required tools.

1-20.2. Interchangeable Fasteners. If at all possible, use the same type of fasteners used in the original installation when making repairs. In the event original type fasteners are not available or can not be used, see figure 1-20 for interchangeable fasteners.

1-20.3. Rivet Substitution. When accomplishing repairs in blind or limited access areas, the use of blind rivets in place of solid rivets may become necessary. Substitution of blind rivets for solid rivets shall be in accordance with table 1-12 unless otherwise specified.

1-20.4. Limit for Missing Fasteners. The airplane may be cleared for flight with fasteners missing from access doors and panels provided the following restrictions are observed.

CAUTION

All fasteners shall be installed in all doors and panels in the cockpit pressurized area. Pressurization may be affected if any fastener is missing.

a. A maximum of 10% of total fasteners in any row on any door or panel may be missing; two fasteners in one row of 20 or more fasteners may be missing only when two missing fasteners are separated by two installed fasteners.

b. First and last fastener in any row shall be installed. All corner fasteners shall be installed. Maximum allowable unfastened gap on leading edge of any door and panel shall not exceed 5 inches in length.

c. All fasteners which perform secondary function of supporting a bracket or other equipment shall be installed.

1-20.5. Solid Shank Conventional Rivets. (Refer to T.O. 1-1A-1 and T.O. 1-1A-8.)

1-20.6. Military Standard (MS) Mechanically Expanded Blind Rivets. (Refer to T.O. 1-1A-8.)

1-20.7. NAS1738 and NAS1739 Blind Rivets. NAS1738 and NAS1739 protruding head and flush head blind rivets are used in applications when access for installation can be gained from one side only (figure 1-21). These rivets are intended for use in structural locations where temperatures will not exceed 400°F.

Table 1-10. Minimum Acceptable Head Diameter of Flush Head Rivets After Shaving

Dash number	Fastener shank diameter	Minimum acceptable head diameter after shaving	Maximum theoretical protuberance before shaving
-2	1/16	0.097	0.007
-3	3/32	0.190[3] 0.150[2]	0.004[3] 0.012[2]
-4	1/8	0.260[3] 0.203[2]	0.004[3] 0.009[2]
-5	5/32	0.257	0.012
-6	3/16	0.380[1] 0.310[2]	0.009[1] 0.018[2]
-8	1/4	0.470[1] 0.415[2]	0.010[1] 0.026[2]

[1]Applies to Riv-O-Seal rivets only.
[2]Applies to rivets other than Riv-O-Seal.
[3]Applies to Riv-O-Seal rivets, plate nuts, dome nuts, gang channels, and bolt retainers (non-structural only).

Table 1-11. Minimum Acceptable Head Diameter of Flush Head Aluminum Screws After Shaving

Dash number	Fastener shank diameter	Minimum acceptable head diameter after shaving	Maximum theoretical protuberance before shaving	Type of screw
-3	0.1890 0.1860	0.376 0.373	0.07 0.06	LTV SPEC CVC148
-4	0.2490 0.2460	0.501 0.498	0.08 0.07	LTV SPEC CVC148
-5	0.3115 0.3085	0.627 0.623	0.10 0.09	LTV SPEC CVC148
-6	0.3740 0.3710	0.752 0.748	0.12 0.11	LTV SPEC CVC148
-8	0.1610	0.283	0.015	NAS517
-10	0.1860	0.327	0.016	NAS517
-416	0.2460	0.447	0.018	NAS517
-516	0.3085	0.569	0.020	NAS517
-616	0.3710	0.686	0.023	NAS517

Table 1-12. Substituting Blind Rivets for Solid Rivets

Material gage	Original rivet diameter	Blind rivet diameter	Ratio of number of blind rivets to solid rivets	
			Brazier head	Flush head
	NOTE			
	When available, the oversize blind rivet should be used when replacing original design rivets. This is especially true if the rivet hole has become oversize due to the swelling of the original rivet. If the oversize rivets are not available, the next size larger blind rivet may be substituted on a 1-for-1 basis. Refer to AND10387 for blind rivet hole size.			
0.016	3/32	1/8	4 for 3	1 for 1
0.020	3/32	1/8	4 for 3	1 for 1
	1/8	1/8	2 for 1	3 for 2
0.025	3/32	1/8	1 for 1	1 for 1
	1/8	1/8	2 for 1	3 for 2
	5/32	5/32	5 for 3	3 for 2
0.032	1/8	1/8	5 for 3	4 for 3
	5/32	5/32	5 for 3	7 for 5
	3/16	3/16	5 for 3	7 for 5
0.040	5/32	5/32	5 for 3	4 for 3
	3/16	3/16	7 for 4	7 for 5
0.050	5/32	5/32	3 for 2	4 for 3
	3/16	3/16	3 for 2	4 for 3
0.063	5/32	5/32	4 for 3	5 for 4
	3/16	3/16	4 for 3	4 for 3
0.071	3/16	3/16	5 for 4	5 for 4
0.080	3/16	3/16	5 for 4	5 for 4
0.090	3/16	3/16	5 for 4	5 for 4
	1/4	1/4	5 for 4	5 for 4
0.100	3/16	3/16	5 for 4	5 for 4
	1/4	1/4	5 for 4	5 for 4
0.125	3/16	3/16	5 for 4	5 for 4
	1/4	1/4	5 for 4	5 for 4

1-20.7.1. Installation. Install NAS1738 and NAS1739 rivets as follows:

a. Remove dirt and burrs from rivet holes.

b. Using 269C3 Cherry selector gage, select rivet of correct size and insert rivet into hole. Rivet must go into hole without forcing.

c. Install H681 pulling head of correct size on G684A Cherry hydraulic riveting gun.

d. Position riveting gun pulling head over stem of rivet and press until in contact with rivet head.

NOTE

Application of excessive pressure or preventing rivet gun from freely aligning itself as trigger is pulled may result in improperly installed rivet with gaps between head and structural metal. Maximum allowable gaps are shown in figure 1-21.

e. Using only enough pressure to maintain rivet head contact, hold gun line with axis of rivet and pull trigger. As trigger is pulled, allow gun to freely align itself with rivet.

f. When rivet is installed, release trigger to allow pulling head to eject portion of rivet stem.

g. Inspect rivets for proper installation (figure 1-21). Inspection for proper installation may be made by looking at pulled side of work only. If criteria for pulled side of work are met and correct grip length rivet was used, blind head should be considered satisfactory.

h. If required for aerodynamic smoothness, shave rivets (paragraph 1-20.1).

1-20.7.2. Removal. Remove installed NAS1738 and NAS1739 rivets as follows:

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Drill pilot hole in top of rivet stem using drill smaller than stem diameter.

b. Using drill no greater in diameter than rivet shank, drill out rivet stem and shank.

c. Remove any remaining parts of locking collar by prying out with drift pin.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

When drilling through rivet head, do not drill through rivet sleeve or rivet hole may become enlarged.

d. Drill rivet head nearly through using drill same size as rivet shank.

e. Snap off rivet head by prying with drift pin.

f. Drive out remainder of rivet shank with drift same diameter as shank.

1-20.8. Huck Blind Rivets. (See figure 1-22.) The Huck blind rivet is made up of a hollow sleeve and a pin. The sleeve is made of 5056S 1/4-hard aluminum alloy and has either a brazier or a countersunk head with a conical recess and locking collar. The pin, made of 2024-T36 aluminum alloy, is pressed into the sleeve. The pin is provided with pull grooves which fit the jaws of the rivet gun and has an extruding angle and land, a breakneck groove, a locking groove, and a head. Huck rivets are available in diameters of 1/8, 5/32, and 3/16 inch and in the grip lengths shown in figure 1-22.

1-20.8.1. Code Identification. (See figure 1-22.) Typical code identification of the Huck rivets (HKM-P4A, HKM-100V4A, and HKM-HC-100V4A) is as follows:

a. Code symbol HKM designates manufacturer.

b. Letters HC designate special high collars for countersunk-head rivets for areas where aerodynamic smoothness of finished rivet is required.

c. First letter of part number indicates head type: P represents brazier head and 100V indicates 100° countersunk head.

d. Figure following head identification number indicates nominal rivet diameter in thirty-seconds of an inch.

e. Last letter is grip range code letter.

1-20.8.2. Installation. (See figure 1-22.) Huck rivets should be installed in clean, round holes carefully drilled at 90° to the surface. Refer to Section XVII for tools required.

a. Unless otherwise specified, prepare holes according to table 1-13.

b. Remove dirt and burrs from drilled hole.

c. As applicable, dimple or machine countersink drilled hole before installing countersunk-head rivets.

d. Insert rivet into hole.

e. Apply blind rivet gun to rivet so that rivet head contacts outer anvil of gun.

f. Hold head of gun steady and at right angles to work. Press gun hard enough to hold head of rivet firmly against work. Check gun shift valve pressure.

g. Squeeze trigger of gun and hold until rivet pin breaks; then release trigger. Next rivet should not be driven until return action has caused gun to latch, as evidenced by distinct click.

h. If necessary for aerodynamically smooth surfaces, shave countersunk-head rivets in accordance with tolerances given in table 1-10.

i. Inspect rivets for proper installation (figure 1-22).

WARNING

Alodine is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

j. Apply surface treatment touchup and MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2 to brazier-head. Apply appropriate surface treatment and paint to shaved head flush rivets if located in paint area (T.O. 1A-7D-23).

1-20.8.3. Removal. Huck rivets may be removed from sheet metal by the following procedure.

NOTE

To weaken the locking action of the rivet, the rivet head may first be filed down to be partially removed with a rivet shaver. Alternate method: file a small flat surface on the pin end, center punch the flat surface, and carefully drill away the tapered part of the pin forming the lock.

Removal of Huck blind rivets from Metalite may be accomplished by carefully drilling the entire rivet shank and following the steps below as necessary.

a. Shear-lock by driving cut rivet pin with tapered steel drift pin not over 3/32 inch in diameter at small end. Back up thin or nonrigid sheets to avoid damage to parts.

b. Pry remainder of locking collar out of rivet head with drift pin. Removal of locking collar is necessary or collar will rotate with drill in next step.

Table 1-13. Standard Hole Sizes for Rivet Type Fasteners

Type of fastener	Basic part No.	Operation	Drill size and final hole size data								
			-2	-3	-4	-5	-6	-8	-10	-12	-16
Riv-O-Seal rivets	860-015 860-065	Final drill[1]		3/32 0.0938	1/8 0.125	5/32 0.1562	3/16 0.1875	1/4 0.250	5/16 0.3125	3/8 0.375	
Hi-Shear rivets	NAS1055 NAS1054 HS67 HS68	3 or less in a pattern: ream +0.002, –0.001			0.125	0.157	0.190	0.250	0.3125	0.375	
		3 or more in a pattern drill[1]			1/8 0.125	No. 22 0.157	No. 11 0.191	1/4 0.250	5/16 0.3125	3/8 0.375	
Hi-Shear blind bolts	BB351PB BB352PB	Ream +0.002, –0.001				0.171	0.198	0.259	0.340	0.392	0.532
Deutsch blind rivets	6950S 6951S	Final drill[1]			1/8 0.125	5/32 0.1562	No. 11 0.191	G 0.261	O 0.316	W 0.386	
Huck lock-bolts	NAS1516 Series NAS1525 Series NAS1456 Series	3 or less in a pattern: ream +0.002, –0.001				0.165	0.190	0.250	0.3125	0.375	
	NAS1465 Series NAS1436 Series NAS1446 Series	3 or more in a pattern: drill[1]				No. 19 0.166	No. 11 0.191	1/4 0.250	5/16 0.3125	3/8 0.375	
Huck steel blind bolts	MS90353 B100T MS90354 BPT	Ream +0.002, –0.001				0.165	0.200	0.261	0.3125	0.375	
Huck and MS blind rivets	MS20600 MS20601 MS20604 MS20605	Final drill[1]	No. 51 0.067	No. 40 0.098	No. 30 0.1285	No. 20 0.161	No. 10 0.1935	F 0.257	P 0.323	W 0.386	
	Huck P/100V										
Semi-tubular rivets	CVC1389-C-D, -C-B, -D-D, and -D-B	Final drill[1]	No. 51 0.067	No. 40 0.098	No. 30 0.1285	No. 20 0.161	No. 10 0.1935	F 0.257	P 0.323	W 0.386	

See footnotes at the end of the table.

Table 1-13. Standard Hole Sizes for Rivet Type Fasteners – CONT

Type of fastener	Basic part No.	Operation	Drill size and final hole size data								
			-2	-3	-4	-5	-6	-8	-10	-12	-16
Blind rivets	NAS1738 NAS1739	Final drill[1]			No. 27 0.143 to 0.146	No. 16 0.176 to 0.180	No. 5 0.205 to 0.209				
Hi-Lok pins	HL18PB (202- 17000) HL19PB (202- 17001)	3 or less in a pattern: ream +0.002, –0.001 3 or more in a pattern: drill[1]				0.164 No. 19 0.166	0.191 No. 11 0.191	0.250 E 0.250	0.3125 5/16 0.3125		

[1]Drill tolerances unless otherwise specified shall be as follows:

Nominal drill diameter	Hole tolerance	Nominal drill diameter	Hole tolerance
0.0135 to 0.125	+0.004, –0.001	0.501 to 0.750	+0.008, –0.001
0.126 to 0.250	+0.005, –0.001	0.751 to 1.000	+0.010, –0.001
0.251 to 0.500	+0.006, –0.001	1.001 to 2.000	+0.012, –0.001

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

c. Drill almost through rivet head using No. 31 drill for 1/8-inch diameter rivet, No. 24 drill for 5/32-inch diameter rivet, and No. 15 drill for 3/16-inch diameter rivet.

d. Break off head using drift pin as pry.

e. Drive out remainder of rivet with pin or new rivet having diameter equal to or only slightly less than nominal rivet diameter.

1-20.9. Huck and Cherry Lockbolts. (See figure 1-23.) Huck and Cherry lockbolts are identical in use and part number and are completely interchangeable, regardless of manufacturing source or standard name. Most lockbolts made for airplane use have been standardized under National Aerospace Standards (NAS). A cross-reference of both manufacturer's part number and NAS number are provided in figure 1-23. For additional information not contained in this manual, refer to T.O. 1-1A-8.

1-20.9.1. Code Identification of Pin. (See figure 1-23.) Code identification of Huck and Cherry lockbolts, using part number NAS1526-8 as an example, is as follows:

a. NAS designates National Aerospace Standard.

b. The 1526 designates lockbolt type and diameter. Last digit in number designates nominal diameter of lockbolt in 1/32-inch increments.

c. The 8 designates grip range.

1-20.9.2. Code Identification of Collar. (See figure 1-23.) Code identification of NAS1080P8 collar is as follows:

a. NAS designates National Aerospace Standard.

b. The 1080 designates type of collar, locking swage for pull or stump type lockbolts.

c. P designates material.

d. The 8 designates nominal inside diameter of collar in 1/32-inch increments.

1-20.9.3. Installation. Huck and Cherry lockbolts should be installed in clean, round holes carefully drilled at 90° to the surface.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

When using nonhole filling style lockbolts, ream 0.190 (+0.002, –0.000) inch for 3/16-inch diameter lockbolts and 0.250 (+0.002, –0.000) inch for 1/4-inch diameter lockbolts.

a. Predrill, dimple, or countersink and drill holes to final size (table 1-13).

b. Remove dirt and burrs from drilled holes.

NOTE

When installing lockbolts in Metalite, use special blue collar (HKM-3BLC).

c. Insert pin in drilled hole and slip collar onto pin.

d. Position lockbolt gun. Gun jaws automatically engage pull grooves of pin. Refer to Section XVII for required tools.

e. Pull gun. The fastener is installed in the following stages:

(1) Initial pull of gun draws pin into hole and squeezes material together between collar and head of pin, equivalent to bolting.

(2) Increased pull on pin then forces gun anvil over collar, swaging collar into locking grooves of pin.

(3) A further increase in pull causes the pin to break off at breakneck groove, approximately flush with collar. Extension of gun jaw collet advances to push anvil off collar.

f. If necessary for aerodynamically smooth surfaces, shave countersunk-head lockbolts as required (paragraph 1-20.1).

WARNING

MIL-M-3171, MIL-C-5541, and MIL-P-23377 are moderately to highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

g. Treat exposed heads, broken pin ends of brazier-head lockbolts, and lockbolt shaved heads as follows:

(1) Apply MIL-M-3171 surface treatment per T.O. 1-1-2.

(2) Apply two coats of MIL-C-5541 conversion coat per T.O. 1-1-2.

NOTE

Epoxy primer is not required on lockbolt ends which are sealed against exposure to fuel.

(3) Apply MIL-P-23377 epoxy primer per T.O. 1-1-2.

WARNING

MIL-S-83430 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

(4) Apply brush coat of MIL-S-83430 sealant to lockbolt ends which are exposed to fuel.

h. Touch up repair work with paint as necessary per T.O. 1A-7D-23.

1-20.9.4. Removal. Remove Huck and Cherry lockbolt as follows:

a. Remove collar by cutting through locking collar with nippers held along axis of pin so that collar will be split into two equal parts. Collar can also be removed by filing small flat surface on broken pin end, center-punching flat surface, and carefully drilling through collar. Collar can then be broken off using drift pin as pry.

b. Drive pin, now freed of collar, out of hole with drift pin or end of undriven lockbolt pin. Back up thin or nonrigid parts to avoid damage.

NOTE

When visual inspection of the parts reveals no damage from the removal of a Huck lockbolt, a new lockbolt of the same diameter as the original may be installed. A 2024-T4 aluminum alloy bolt shall not be used in place of a 7075-T6 aluminum alloy lockbolt.

1-20.10. Cherrymax Rivet. (See figure 1-24.) The Cherrymax rivet is a complete blind fastener consisting of: a fastener stem with break notch, shear ring and plug section, locking collar, fastener sleeve, and a driving anvil to ensure flush stem break and flush installed collar. During installation, the stem pulls into the rivet sleeve and forms a large bulbed, blind head. A shoulder on the stem forces the locking collar upward against the driving anvil and forms the collar into the collar recess, holding the stem and sleeve together. Features of the Cherrymax rivet include a driving anvil which eliminates the problem of nose assembly wear and allows a single tool to install different rivet diameters without changing the nose piece. The Cherrymax assembly also includes a shorter pull stem for greater accessibility.

1-20.10.1. Code Identification. (See figure 1-24.)

1-20.10.2. Installation.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

Cherrymax rivets should be installed in clean, round holes carefully drilled at 90° to the surface.

a. Predrill, dimple, or countersink and drill holes to final size (figure 1-24).

b. Remove dirt and burrs from drilled holes.

c. Insert rivet in drilled hole.

d. Press riveter firmly against head of rivet to minimize head gapping and sheet gap. Refer to T.O. 1-1A-8 for required tools.

e. Apply steady, firm pressure and pull trigger. Rivet clamping action will pull sheets together, seat rivet head, and break stem flush with head of rivet.

1-20.10.3. Inspection. Refer to T.O. 1-1A-8 for inspection procedures.

1-20.10.4. Removal. Remove Cherrymax rivets as follows:

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Drill away upper portion of rivet stem to destroy lock.

b. Drive out rivet stem using tapered steel drift pin or spent stem.

c. Drill nearly through head of rivet using drill same size as rivet shank.

d. Break off rivet head using drift pin as pry.

e. Drive out remaining rivet shank with pin having diameter equal to rivet shank.

1-20.11. Huck Blind Lockbolts. (See figure 1-25.) The Huck blind lockbolt is furnished as a complete unit or assembly. The assembly consists of a sleeve, locking collar, and a pull-pin with locking groove. During driving operation, the pull-pin head upsets the sleeve to form a bulbed head on the blind side. As the blind head is being formed, the installation tool automatically forces the locking collar into a conical space between a recess in the sleeve head and the locking groove in the pull-pin. This arrangement provides a positive mechanical lock permanently locking the parts together.

1-20.11.1. Code Identification. The Huck blind lockbolts have been standardized under Military Standards (MS). For clarification the manufacturer's basic part numbers and corresponding MS numbers are listed in figure 1-25.

1-20.11.2. Installation. (See figure 1-25.) Install Huck blind lockbolts in clean, round holes carefully drilled at 90° to surface.

WARNING

Reaming operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

Prepare a test installation using scrap material to ensure proper adjustment of equipment and ability to meet installation requirements.

a. Ream holes to size as specified unless otherwise noted.

b. Machine countersink or form countersink (dimple) if required.

c. Remove dirt and burrs from drilled holes.

d. Install bolts using pneumatic pull gun, adjusted and equipped to install required size fastener.

e. Inspect bolts for proper installation.

WARNING

Shaving operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

f. Shave countersunk head as required for aerodynamically smooth surfaces (paragraph 1-20.1).

WARNING

MIL-M-3171, MIL-C-5541, and MIL-P-23377 are moderately to highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

g. Treat exposed heads, broken pin ends of brazier-head lockbolts, and lockbolt shaved heads as follows:

(1) Apply MIL-M-3171 surface treatment per T.O. 1-1-2.

(2) Apply two coats of MIL-C-5541 conversion coat per T.O. 1-1-2.

NOTE

Epoxy primer is not required on lockbolt ends which are sealed against exposure to fuel.

(3) Apply MIL-P-23377 epoxy primer per T.O. 1-1-2.

WARNING

MIL-S-83430 is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

(4) Apply brush coat of MIL-S-83430 sealant to lockbolt ends which are exposed to fuel.

h. Touch up repair work with paint as necessary per T.O. 1A-7D-23.

1-20.11.3. Removal. (See figure 1-26.) The technique of removing Huck blind lockbolts is different from technique used for blind rivets because of hardness of lockbolt pin. A special removal kit is available to remove Huck blind lockbolts. See figure 1-26 for tools required and method of use. Remove blind lockbolts as follows:

a. Place drill bushing over pin so bushing rests squarely on lock collar.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

b. Drill to lock collar depth using drill with 1,250 rpm maximum.

CAUTION

Back up thin or nonrigid material while driving out pin to prevent damage.

c. Position pin punch on fastener pin and drive pin out of fastener.

d. Remove remaining portion of pin and lock collar with suitable tool.

WARNING

Counterboring operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

e. Using Micro-Limit tool and cutter, adjust tool to within 0.005 to 0.015 inch less than head height (dimension X, figure 1-26).

f. Place antirotation cap firmly against head of fastener.

g. Counterbore to desired depth.

h. Using proper size sleeve punch, drive out lower portion of sleeve.

i. Tilt sleeve punch slightly and lift out head of fastener.

1-20.12. Hi-Shear Rivets. (Refer to T.O. 1-1A-8.)

1-20.13. Hi-Shear Blind Bolt and Blind Nut. (See figure 1-27.) Standard Hi-Shear blind bolts (BB351 and BB352) are all-metal assemblies consisting of a sleeve, a threaded expander nut, and a core bolt. The BB351 and BB352 bolts are provided in countersunk and flat head configurations, respectively. A special Hi-Shear blind bolt assembly (BB362), consisting of the three parts plus two rubber O-rings, is available for sealing purposes. The BB362 bolt is made in the countersunk style only. Hi-Shear blind nuts are essentially standard type blind bolt assemblies without the core bolt. Since there are a few small differences, the nuts are part numbered and listed as distinct parts. The standard BN359 and BN360 blind nuts are two-piece, countersunk fastener assemblies consisting of a type 302 stainless steel sleeve and a type 431 stainless steel expander nut. The standard BN356 blind nut is a similar two-piece, flat head fastener assembly made of the same type steel materials.

1-20.13.1. Installation. (See figures 1-28 and 1-29.) Install Hi-Shear blind bolts and nuts as follows:

a. Unless otherwise specified, prepare hole according to table 1-14.

b. Determine type and size of blind bolt or nut to be used.

Table 1-14. Hole Preparation Data for Hi-Shear Blind Bolts and Nuts

Part No.		Final hole size	
BB351, BB352[1]	Nominal diameter	Minimum	Maximum
-5	5/32	0.170	0.173
-6	3/16	0.197	0.200
-8	1/4	0.258	0.261
-10	5/16	0.339	0.342
-12	3/8	0.391	0.394
-14	7/16	0.469	0.475
-16	1/2	0.531	0.539

[1]The first dash number of the blind nut assembly number indicates size of bolt to be used. Select corresponding nominal diameter (figure 1-27).

c. Select applicable tooling (Section XVII).

NOTE

Hi-Shear blind bolts and nuts may be installed using power driving tools (standard, extender standard, and offset) and hand-driving tools.

d. Install bolts and nuts.

1-20.13.2. Removal. Remove Hi-Shear blind bolt and nut assemblies according to figure 1-30.

1-20.14. Jo-Bolt. (See figure 1-31.) The Jo-Bolt is a special three-piece internally threaded, blind rivet-type fastener assembly used in various areas of the airplane to join structural members and attach parts to substructure. The Jo-Bolt consists of a long tapered shank nut (with hex head or recessed vanes in head), an expansion sleeve, and a bolt (with a shear stem and milled drive flats). The sleeve is positioned on the bolt between the bolthead and nut shank, and the bolt is threaded into the nut to form a complete three-piece fastener assembly. During installation, the Jo-Bolt installation tool holds the nut stationary and drives the bolt counterclockwise to draw sleeve upon tapered shank of the nut. The installation tool continues to drive until sleeve is seated against understructure. When proper torque is obtained, the bolt stem shears off.

1-20.14.1. Installation. (See figures 1-31 and 1-32.) The Jo-Bolt is installed with either a pneumatic or hand-operated tool. Each type of tool is available as either a complete unit designed to drive Jo-Bolt of one specific type and diameter or as individual components which can be assembled to drive Jo-Bolts of several sizes (Section XVII). When installing a Jo-Bolt in an original hole, omit steps a, b, and c and proceed with step d. If hole is elongated, the hole shall be redrilled to receive a fastener of next larger diameter; proceed with step a.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Predrill hole prior to final drilling or reaming to size (figure 1-32).

b. Remove all burrs from holes and all chips from between parts to be fastened.

c. Securely clamp the parts together using Cleco (or equivalent) fasteners.

d. Using Jo-Bolt grip scale or Cherry rivet gage, measure material thickness for proper grip length of Jo-Bolt (figure 1-31).

e. Select correct type and size Jo-Bolt and insert in hole with sleeve and bolthead on inner or blind side (figure 1-32).

f. Select proper installation tool and attach driving tool over bolt stem (Section XVII).

g. Drive bolt until bolt stem breaks off. If stem breakoff is not within tolerances, grip length was probably too long or too short (figure 1-32).

WARNING

Milling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

h. Mill FFA series (millable type) Jo-Bolt head flush with surface.

i. Inspect Jo-Bolt installation in accordance with paragraph 1-20.14.2.

WARNING

MIL-C-5541 is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

j. Apply MIL-C-5541 conversion coating to milled head per T.O. 1-1-2.

WARNING

MIL-P-23377 is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

k. Prime milled head with MIL-P-23377 epoxy primer per T.O. 1-1-2.

l. Touch up repair area with finish coat of paint as required per T.O. 1A-7D-23.

1-20.14.2. Inspection. Inspect Jo-Bolt for proper installation.

NOTE

A Jo-Bolt installation shall be inspected as a conventional rivet installation.

a. Visually inspect Jo-Bolt installation.

CAUTION

Any Jo-Bolt assembly can be loosened when sufficient force is exerted upon the Jo-Bolt. A Jo-Bolt installation shall not be inspected using any type of tool with which torque can be applied.

b. Examine Jo-Bolt installation by finger pressure for looseness of material being joined and looseness of Jo-Bolt.

c. Inspect flush head Jo-Bolt for aerodynamic smoothness (paragraph 1-20.1).

d. Inspect for specified stem breakoff limits.

e. Remove and replace any improperly installed Jo-Bolt.

1-20.14.3. Removal. Remove Jo-Bolt as follows:

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Using No. 40 drill, drill center of bolt stem to depth slightly below nut head.

b. Redrill hole using drill slightly smaller than nut shank.

c. Pry off nut head using drift punch or similar tool.

d. Drive shank from hole using punch and lightly tapping with hammer.

1-20.15. Riv-O-Seal and Flush Seal Rivets. (See figure 1-33.) Riv-O-Seal and Flush Seal are trade names for flush head sealing type rivets. The rivets consist of two parts, a conventional type solid shank rivet and a rubber O-ring seal. Regardless of manufacturing source, the rivets are identical in use, part number, and are completely interchangeable. Both parts are procured as an assembly. The seal type rivets are designed for installation in areas which require fluid-tight seals.

1-20.15.1. Installation. Install Riv-O-Seal and Flush Seal rivets as follows:

a. Unless otherwise specified, prepare holes according to table 1-13.

NOTE

Countersink depth for seal type rivets is determined by using an identical rivet without the O-ring. The head of the rivet shall meet flushness requirements (paragraph 1-20.1).

b. Machine countersink rivet holes as required.

CAUTION

Holes shall be completely deburred to prevent damage to seal.

c. Deburr rivet holes.

d. Using rivet gun and bucking bar, install seal type rivets in same manner as conventional rivets (T.O. 1-1A-8).

e. Inspect rivet for proper installation and for aerodynamic smoothness (paragraph 1-20.1).

1-20.15.2. Removal. Riv-O-Seal and Flush Seal rivets are removed in same manner as conventional rivets (T.O. 1-1A-8).

1-20.16. Hi-Lok Fasteners. (See figure 1-34.) The Hi-Lok fastener combines the features of a rivet and a bolt and is used for high-strength, interference fit of primary structures. The fastener consists of a threaded pin and threaded locking collar. The pins are made of cadmium-plated alloy steel with protruding or 100° flush heads. Collars for the pins are made of anodized 2024-T6 aluminum. The threaded end of the pin is recessed with a hexagon socket to allow installation from one side. The major diameter of the threaded part of the pin has been truncated to accommodate a 0.004-inch maximum interference fit. One end of the collar is internally recessed with a 1/16-inch, built-in variation which automatically provides for variable material thickness without the use of washers and without preload changes. The other end of the collar has torque-off wrenching device which controls a predetermined residual tension of preload ($\pm 10°$) in the fastener.

1-20.16.1. Code Identification of Pin. Code identification of the Hi-Lok pin (HL18-8-10) is as follows:

a. Code symbol HL designates Hi-Lok fastener.

b. Number 18 designates basic pin number.

c. First dash number (-8) designates nominal diameter of pin in thirty-seconds of an inch.

d. Second dash number (-10) indicates maximum grip in sixteenths of an inch.

1-20.16.2. Code Identification of Collar. Code identification of the collar (HL70-8) is as follows:

a. Code symbol HL designates Hi-Lok fastener.

b. Number 70 designates basic collar number.

c. Dash number (-8) indicates nominal thread size in thirty-seconds of an inch.

d. Red collar indicates standard collar.

e. Blue collar indicates salvage collar.

1-20.16.3. Installation. (See figure 1-35.) Hi-Lok fasteners should be installed as follows:

a. Unless otherwise specified, prepare holes for installation of Hi-Lok fasteners in accordance with table 1-13 and figure 1-35.

b. Remove all chips and burrs between faying surfaces.

c. Insert pin into prepared hole and manually screw collar onto pin minimum of two threads.

d. Insert power-driven Allen wrench tip into hex recess of pin and press against collar. Operate power driver until torque limit of collar wrenching device has been exceeded and collar removed. If power driver is not available, insert Allen wrench into hex recess of pin and, using box-end, open-end, or ratchet wrench, rotate collar clockwise until torque limit of collar wrenching device has been exceeded and collar removed. Refer to Section XVII for tools required.

1-20.16.4. Removal. (See figure 1-35.) Removal of Hi-Lok fasteners is similar to removing a nut and bolt. Remove the fastener as follows:

a. Insert Allen wrench in hex recess of pin.

b. Hold Allen wrench firm and, using pair of channel-lock or vise-grip pliers, rotate collar counterclockwise until removed.

c. Remove pin.

1-20.17. Deutsch Drive Pin Blind Rivet. (See figure 1-36.) The Deutsch drive pin blind rivet is a positive expansion, locking-type blind fastener consisting of a factory preassembled sleeve and drive pin. Pins used in A-7D airplanes are made of No. 416 alloy stainless steel and the sleeves are made of No. 303 alloy stainless steel. Deutsch rivets are available in both countersunk and protruding head configurations. The rivet is installed using a common flat faced hammer or using a flush rivet set and a conventional rivet gun.

1-20.17.1. Code Identification. (See figure 1-36.)

1-20.17.2. Installation. Install Deutsch drive pin rivets as follows:

a. Unless otherwise specified, prepare hole according to table 1-13.

WARNING

Countersinking operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

b. Machine countersink hole as required. Use new drive pin rivet, identical to type and size of rivets to be installed, as gage.

c. Clean and deburr hole.

d. Determine grip range requirement for rivet. Use Cherry rivet gage or equivalent to determine thickness of material to be joined.

e. Select rivet of proper grip length.

CAUTION

Do not drive Deutsch rivets into tight holes by hammering on pin. This will cause premature expansion of the rivet. Use a hollow drift that will clear pin and locking lip.

f. Insert and seat rivet in drilled hole.

g. Strike pin section of rivet with hand held hammer or light air hammer with flat set.

NOTE

As the pin is driven into the rivet sleeve, the sleeve is expanded to form a large blind head.

h. Drive pin until it is seated in head of sleeve.

i. Peen lip section of sleeve to lock pin in place.

CAUTION

If shaving is necessary for flushness, ensure that the locking lip is not cut away to the extent that the lock is damaged.

j. Inspect rivet head for aerodynamic smoothness requirements (paragraph 1-20.1).

k. Inspect for looseness and replace improperly installed rivets.

1-20.17.3. Removal. Remove Deutsch drive pin blind rivets as follows:

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Drill head from pin using drill of same size as rivet pin.

b. Drive remaining portion of pin from rivet sleeve using drift one size smaller than pin diameter.

c. Drill head from rivet sleeve using drill one size smaller than rivet.

d. Drive remaining portion of rivet sleeve from hole using drift one size smaller than rivet.

1-20.18. Semi-Tubular Rivets. (See figure 1-37). Semi-tubular rivets resemble conventional solid shank rivets in size and shape, except a portion of the shank is hollow. The rivets are designed for use in materials that would be damaged if a solid shank or any other expanding or high driving force type rivet is used. Semi-tubular rivets are used primarily in Metalite construction. The rivets are available in 100-degree countersunk and protruding head configurations in either 2017 or 5056 aluminum alloy materials. A special washer is used on the expanded end (shop head) of the rivet. Removal and installation of semi-tubular rivets is the same as conventional solid shank rivets, except a special shank upsetting tool is used for installation instead of a bucking bar.

1-20.18.1. Code Identification. (See figure 1-37.)

1-20.18.2. Installation. (See figure 1-37.) Install semi-tubular rivets as follows:

a. Unless otherwise specified, prepare hole according to table 1-13.

WARNING

Countersinking operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

b. Machine countersink drilled hole as required. Use new rivet of identical size and type required as gage for installation.

c. Clean and deburr hole.

d. Determine length and select proper size rivet.

e. Insert rivet in prepared hole and install CVC754 washer.

f. Using standard riveting tools and AKJ-31 shank upsetting tool, install rivet (Section XVII).

g. Inspect expanded (shop) head for minimum dimension specified.

h. Inspect flush head rivets for aerodynamic smoothness (paragraph 1-20.1).

i. Remove and replace improperly installed rivets.

1-20.18.3. Removal. Remove semi-tubular rivets in the same manner as conventional solid shank rivets (T.O. 1-1A-8).

1-20.19. Camloc Stressed Panel Fasteners. (See figure 1-38.) Camloc stressed panel fasteners are high-strength, quick-release, rotary-type fasteners. A complete fastener unit consists of a stud assembly, receptacle assembly, and retainer ring. The stud assembly includes a latching stud, with Phillips recessed head, ejection spring, and bushing. The receptacle assembly includes a receptacle housing, threaded insert providing an adjustable locking device, and a cover. The stud assembly is inserted into the prepared hole in the removable panel and retained in place with the retainer ring. Flat and cone-shaped retainer rings are available for protruding and flush head installations, respectively. The receptacle assembly is attached to the understructure with rivets. Refer to Section XVI for procurement source. Refer to T.O. 1-1A-1 for information pertaining to 4002, 2600, and 2700 type Camloc fasteners.

1-20.19.1. Code Identification. For identification of part number codes for Camloc stud assembly, receptacle assembly, and retainer ring, see figure 1-38.

1-20.19.2. Installation of Stud Assembly. Install stud assembly in door or removal panel as follows:

WARNING

Countersinking operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Prepare hole for type and size stud to be installed. Machine countersink or dimple if required.

b. Insert stud assembly in prepared hole.

c. Using retainer ring tool, lock stud assembly in place with retainer ring (Section XVII).

1-20.19.3. Installation of Receptacle Assembly. Install Camloc receptacle assembly on understructure as follows:

a. Prepare hole to mate with stud hole in door or cover.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

b. Drill rivet holes for attaching receptacle to understructure. Use receptacle for location of rivet holes.

c. Hold receptacle in position with Cleco fasteners and install receptacle mounting rivets.

1-20.19.4. Fastener Locking and Inspection. Lock and inspect fastener as follows:

a. Position airframe cover or door in place for installation with Camloc fasteners installed.

CAUTION

If high torque is felt during initial clockwise 1/4 turn of the stud, turn stud left (counterclockwise) enough to reset the receptacle insert so the stud will engage in the first 1/4 clockwise turn. Several turns of the unengaged stud may screw the insert inward enough to unseat the receptacle cover. A damaged receptacle cover is indicated if the unengaged stud ejects as the screwdriver is removed. When this happens, the cover on the receptacle should be checked for damage before resetting the insert and installing the airframe cover or door.

b. Using proper size Phillips screwdriver, push stud into receptacle until it bottoms.

c. Turn stud counterclockwise 1/2 turn (approximately 180°) to reset insert. Then turn stud 1/4 turn clockwise (approximately 90°) to engage stud.

d. Tighten stud as required.

e. Inspect Camloc installation for the following conditions:

(1) Stud heads of flush head fasteners that are installed on exterior or interior surfaces, when in locked position, shall be flush with outer surface of cover or door within +0.020, −0.015 inch.

(2) Stud heads of protruding head fasteners installed on interior surfaces, when in locked position, shall not protrude more than 0.188 inch above outer surface of cover or door.

f. Replace stud assemblies not within tolerances specified in step e with stud assembly of shorter or longer grip length to obtain correct locking and stud head height.

1-20.19.5. Fastener Unlocking and Removal. Unlock and remove Camloc fastener as follows:

a. Using Phillips screwdriver, turn stud counterclockwise 1/4 turn (approximately 90°).

b. Using retainer ring tool, remove retainer ring from stud assembly and lift out stud assembly.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

c. Drill attaching rivets from receptacle attaching structure and remove receptacle.

1-20.20. Heli-Coil Inserts. (Refer to T.O. 1-1A-8 and 44H1-1-117.)

1-20.21. Rosan Inserts. (Refer to T.O. 44H-1-13.)

1-20.22. CVC771 Skin Countersink Conical Washers. (See figure 1-39.) CVC771 skin countersink conical washers are used to fill countersink voids where existing flush fastener patterns are picked up to attach repair doublers, or additional structure, to external skin or internal structure where flush fasteners are encountered.

1-20.23. Standard Screws, Nuts, and Bolts. The procedures of T.O. 1-1A-8 apply, except for the thread protrusion through self-locking nuts requirement. Thread protrusion through self-locking nuts is specified as follows: Round or chamfered end bolts, studs, or screws must extend at least the full round or chamfer through the nut; flat end bolts, studs, or screws must extend at least 1/32 inch through the nut.

WARNING

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

1-20.24. Fastener Installation Using Epoxy Primer (MIL-P-23377). Install fasteners wet with MIL-P-23377 epoxy primer to prevent corrosion around the fasteners. The wet installation of fasteners can be accomplished by either dipping the fastener in primer then installing the fastener or by swabbing the primer on the fastener with a cotton swab. Certain areas have fasteners installed with wet sealant. Primer should not be substituted for sealant. Wet installation of fasteners is required, especially in the following areas: wheel wells and landing gear doors, around urinal areas, leading edges, flaps, and all other corrosion prone areas.

1-21. AIRFRAME SEALING (NONFUEL AREAS).

(Refer to T.O. 1A-7D-23).

1-22. CONTROL SURFACE REBALANCING.

Because all flight control surfaces on the airplane are hydraulically power operated instead of being moved mechanically by the pilot, static rebalancing following structural repair is not required. Operational testing of an affected flight control system after structural repair is required. Refer to T.O. 1A-7D-2-8 for system rigging and testing procedures.

1-23. GENERAL SHOP PRACTICES.

Shop practices, as presented in the following paragraphs, consist of a brief general discussion of the various operations required to accomplish the structural repairs outlined in the repair sections of this manual. Before a structural repair part is attached to the airplane, the part has to be shaped to fit into place. The shaping processes are called forming and dimpling. Forming may be a very simple operation (such as making a single bend or curve) or may be very complex requiring several different shapes. In most cases the type, thickness, and temper of the material will determine how much and what kind of forming and dimpling operations can be performed. Before attempting to shape a part, consideration shall be given to the complexity of bends, size of the part, and the type, thickness, and temper of materials required. In certain cases, the repair materials must be worked in the annealed condition and heat treated after forming. Other factors which affect the repair processes and shall be considered when planning a repair are as follows:

a. Type of repair required, such as patch, repair by insertion, part replacement, etc (paragraph 1-23.2).

b. Combined strength of repair parts (paragraph 1-23.2.1).

c. Substitution of materials and fasteners if original materials or fasteners are not available or cannot be used (paragraphs 1-23.3 and 1-23.4).

d. Type, thickness, and temper of materials to be used.

e. Development of repair flat pattern for shaping repair parts (paragraphs 1-23.5 and 1-23.6).

f. Required shapes, bends, and/or curves of repair parts (paragraph 1-23.7).

g. Physical and mechanical properties and tempering methods of repair materials (T.O. 1-1A-9).

h. Type of equipment and tools available for shaping and tempering repair parts (paragraphs 1-23.7, 1-23.9, and 1-23.10).

1-23.1. Precautions. To prevent injury to personnel and damage to airplane, comply with the precautions in the safety summary of this technical order. Also, carefully observe the following safety precautions.

a. Follow operating instructions when using shop equipment.

b. Ensure that forming blocks, tools, and other equipment are in good repair.

c. Use proper tools and equipment for job.

d. Keep work area clean and free of unnecessary tools.

e. Adjust forming machines using scrap stock material of same type and gage as repair parts.

1-23.2. General Repair Requirements. Repairs procedures contained in the repair sections apply to the specific repairs covered, unless otherwise specified. The typical repair illustrations and procedures contained in Sections XII, XIII, and XIV are applicable to similar components throughout the airplane, regardless of location. Faying surfaces, formed by patches and adjoining structure, shall be coated with MIL-S-8802 sealant (before assembly) as specified in T.O. 1A-7D-23 for protection against corrosion, unless otherwise specified. The following paragraphs contain important conditions which shall be remembered when developing and performing structural repairs. For general repair procedures, refer to paragraph 1-12.

1-23.2.1. Static Strength. The purpose in making repairs is to restore the structure to its original strength. When metal is removed from a sheet, extrusion, or formed member because of damage, the repair must make the structure as strong as it was originally. Spacing of the attachments must be even to ensure proper distribution of strength over the repair area.

1-23.2.2. Fatigue Strength. Fatigue failures are most likely to start at sharp damaged areas. In the repair of these areas, all sharp edges in the parent material and in the repair material must be removed. This applies to damage classified as negligible and damage repairable by patching or insertion. Replacement of materials restores the damaged area to the original condition.

1-23.3. Material Substitution. (Refer to tables 1-15 through 1-17.) Repair materials shall normally be identical to the original materials unless otherwise specified. If certain types of materials are not available, a substitute material may be used if listed in the material substitution tables. When the type, thickness, or temper of repair materials prevents use of materials of the original temper, repair parts may be formed in the annealed condition and then heat-treated to proper temper (T.O. 1-1A-9). If magnesium alloy is not available for repair, 2024-T3 aluminum clad sheet may be substituted without any increase in material gage. When dissimilar metals are used as a substitute repair material, the contacting surfaces shall be treated according to T.O. 1A-7D-23 for protection against corrosion.

1-23.4. Fastener Substitution. (Refer to paragraph 1-20.)

1-23.5. Technical Forming Terms. Terminology normally used in the development of flat pattern layouts for repair parts is given in figure 1-40.

1-23.6. Flat Pattern Development. Construction of interchangeable structural and nonstructural airplane parts is achieved by the forming of flat sheet stock to make channel, angle, zee, and hat section members. Before a sheet metal part is formed, make a flat pattern to show how much material is required in the bend areas, to what point the sheet must be inserted into the forming tool, or to indicate the bend lines. Bend radii, bend allowances, setback dimensions, and bend lines must be determined to develop a flat pattern for sheet metal forming. Operations associated with this type of repair are outlined in the following paragraphs.

1-23.6.1. Bend Radius. (See figure 1-41.) When developing a flat pattern for forming sheet stock, the bend radius must be known. The type, temper, and thickness of material being formed will determine the minimum bend radius permitted without damage to the material (figure 1-41).

1-23.6.2. Bend Allowance. (See figure 1-42.) Aluminum alloy and sheet steel require a definite length of material to make a bend, depending on the thickness of the material and the bend radius used. The main difficulty in flat pattern layout is determining the amount of material in the bend area. Such allowance can be calculated by using the following aids:

a. The bend allowance chart gives amount of material needed for each degree of bend when material thickness and bend radius are known. To determine amount of material needed to make bend, bend allowance for each degree is multiplied by number of degrees in bend.

Table 1-15. Material Substitution for Clad Sheet and Plate Aluminum Alloys Based on Ultimate Tensile Strength

Original material	Substitute material							
	2024						7075	
	T3	T42	T62	T81	T851	T86	T6	T651
	NOTE							
	Determine gage and type of original material. Locate type of material in table under original material. Read across from original material and select substitute material. Number at intersection is factor by which original gage must be multiplied to determine required gage of substitute material. When original gage multiplied by factor lies between two standard gages, the next highest gage shall be used for substitute material. Factors listed in this table are based on ultimate tensile strength only. For shear panels and stability application, use table 1-17.							
2024-T3	1.00	1.04	0.98	0.95		0.89	0.84	
2024-T42	0.96	1.00	0.95	0.92		0.86	0.79	
2024-T62	1.01	1.05	1.00	0.96		0.91	0.83	
2024-T81	1.05	1.09	1.05	1.00		0.94	0.87	
2024-T851					1.00	0.94		
2024-T86	1.13	1.17	1.13	1.08	1.08	1.00	1.09	1.10
7075-T6	1.22	1.26	1.21	1.16		1.09	1.00	
7075-T651					1.19	1.10		1.00
7079-T6	1.14	1.17	1.13	1.08		1.02	0.93	

Table 1-16. Material Substitution for Bare Sheet and Plate Aluminum Alloys Based on Ultimate Tensile Strength

Original material	Substitute material										
	6061		2024						7075		
	T6	T651	T3	T4	T62	T81	T851	T86	T6	T651	T73
	NOTE Determine gage and type of original material. Locate type of material in table under original material. Read across from original material and select substitute material. Number at intersection is factor by which original gage must be multiplied to determine required gage of substitute material. When original gage multiplied by factor lies between two standard gages, the next highest gage shall be used for substitute material. Factors listed in this table are based on ultimate tensile strength only. For shear panels and stability application, use table 1-17. 6061 is the only weldable material shown.										
6061-T6	1.00		0.66	0.68	0.66	0.63		0.59	0.55		0.63
6061-T651		1.00			0.66	0.63	0.63	0.59		0.55	
2024-T3	1.52		1.00	1.03	1.02	0.96		0.89	0.83		0.96
2024-T4	1.48		0.97	1.00	0.97	0.93		0.86	0.81		0.93
2024-T62	1.52	1.52	0.99	1.03	1.00	0.96	0.96	0.89	0.83	0.83	0.94
2024-T81	1.60	1.60	1.05	1.08	1.05	1.00	1.00	0.93	0.87	0.88	1.00
2024-T851		1.00			1.05	1.00	1.00	0.94		0.87	
2024-T86	1.72	1.69	1.13	1.16	1.13	1.08	1.06	1.00	0.94	0.93	1.08
7075-T6	1.83		1.20	1.24	1.20	1.15		1.07	1.00		1.17
7075-T651		1.81			1.20	1.13	1.15	1.07		1.00	
7075-T73	1.60		1.05	1.08	1.06	1.00		0.93	0.86		1.00
7079-T6	1.72		1.13	1.16	1.14	1.08		1.00	0.94		1.08
7079-T651		1.69			1.14	1.06	1.08	1.00	0.94	0.93	

Table 1-17. Material Substitution for Specific Usage

Original material 7075-T6	2024-T4 Substitute		
	Tension-brackets angles clips	Shear panels	Compressive panels inter-rivet buckling
0.012	0.016	0.020	0.020
0.016	0.025	0.032	0.025
0.020	0.032	0.040	0.032
0.025	0.032	0.051	0.040
0.032	0.040	0.064	0.051
0.040	0.051	0.072	0.064
0.051	0.064	0.091	0.081
0.064	0.081	0.128	0.091
0.072	0.091	0.128	0.128
0.081	0.102	0.156	0.128
0.091	0.128	0.188	0.156
0.102	0.128	0.188	0.188
0.128	0.188	0.250	0.250
0.156	0.250	0.313	0.250
0.188	0.250		0.313

b. In place of bend allowance chart, the following formula can be used:

BA = (0.01745R + 0.0087T)

BA = Material required to make a bend

R = Inside radius of the bend or bend radius

T = Thickness of material

N = Number of degrees that material will be bent

NOTE

This is a tried and proven formula for aluminum alloy and steel sheet and applies whether or not the material has been heat-treated.

1-23.6.3. Setback. (See figure 1-43.) To accurately lay out a flat pattern, not only must the bend allowance for each bend be known but also the length of the legs, flanges, and the flat portions between the bends. If the lengths of the flat portions of the part are known or can be measured, no further calculations are necessary. If these measurements are not known, a calculation for these lengths must be made. In order to determine the length of the flat portions, the setback for each bend must be found and subtracted from the mold line measurement. The setback can be calculated by taking the bend radius plus the thickness of the material and multiplying it by the setback or K value. The K value is obtained from the chart shown in figure 1-43.

1-23.6.4. Bend Line. (See figure 1-44.) After the flat pattern has been cut to shape with the bend tangent lines indicated, to accurately form the part is still not possible unless it is known where the bend tangent lines should lie in relation to the bend radius over which the part is to be bent. This requires the use of a bend line. The bend line is marked on the flat pattern with pencil or other convenient means (but never with a scriber) to indicate where the edge of the forming tool must line up in order to make the bend. The bend line must be at a distance equal to the bend radius away from one of the bend tangent lines, depending upon the direction in which the part is to be bent. This rule holds regardless of the angle of bend. The procedure for lining up the material in the bending tool is shown in figure 1-44. Line up the bend line with the nose of the bending tool by using a combination square. If the bend is made with form blocks, the bend line must line up with the edge of the form blocks.

NOTE

The radius of the part over which the metal is to be bent must be exactly the same as that used as the bend radius in the flat pattern calculations.

1-23.6.5. Flat Pattern Layout Operations. (See figure 1-45.) To illustrate the operation involved in laying out flat patterns, three examples have been developed. Examples 1 and 2 develop the flat pattern when the bend allowance and the setback charts are available (figures 1-46 and 1-47). Example 3 is a practical solution when bend allowance and setback tables are not available (figure 1-48). Figure 1-45 shows a simple sheet metal part having two sides at 90° to each other. The leg and flange are indicated as well as the unbent portions, the neutral axis, the radius of the neutral axis, and the thickness of the metal. Examples 1 and 3 will be developed from figure 1-45.

1-23.7. Sheet Metal Forming. Forming is the operation which tends to change the shape or contour of a flat sheet or extruded shape. The change in shape or contour is accomplished by either stretching or shrinking the material in a particular area to produce curves, flanges, and various irregular shapes. Since the forming operation involves altering the shape of the stock material, the amount of stretching and shrinking depends almost entirely on the type of material used. Fully annealed material can withstand considerably more stretching, shrinking, and smaller bend radii than material in the tempered conditions. The forming of aluminum alloy sheet shall be done in the tempered condition when possible. When not possible, material in the −0 or annealed condition shall be used and heat treated after forming. In no case shall 2024, 7075, or 6061 in the −0 or annealed condition be used on the airplane. When forming a repair or replacement part, the bend radius shall be the same as the part being repaired or replaced. If measuring the radius of the damaged part is not possible, the bend radius specified in figure 1-41 shall be used. For physical and mechanical properties and heat treating of repair materials, refer to T.O. 1-1A-9.

1-23.7.1. Hand Forming. (See figures 1-49 through 1-53.) All hand forming involves the process of stretching and shrinking material. Hand forming includes straight line bends and either concave or convex curved flange parts.

1-23.7.1.1. Straight Line Bends. Straight line bends of comparatively short sections can be made by hand with the aid of wooden or metal bending blocks. After the part has been laid out and cut to size, clamp the part rigidly along the bend line between two forming blocks held in a vise. The forming blocks shall have one edge rounded to give the desired bend radius. Bend the metal protruding beyond the bending block to the desired angle by tapping lightly with a rubber, plastic, or rawhide mallet. Start tapping at one end and work back and forth along the edge, making the bend gradually and evenly. Continue this process until the protruding metal is bent to the desired angle. If a large amount of metal extends beyond the bending blocks, maintain enough hand pressure against the protruding sheet to prevent the metal from bouncing. Remove any irregularity in the flange by holding a straight block of hardwood edgewise against the bend and striking it with heavy blows of a hammer or mallet. If the amount of metal protruding beyond the bending blocks is small, make the entire bend by using the hardwood block and hammer.

1-23.7.1.2. Curved Flanged Parts. Curved flanged parts have mold lines that are either concave or convex. The concave flange is formed by stretching while the convex flange is formed by shrinking. Such parts are shaped with the aid of hardwood or metal form blocks. These blocks must be made in pairs and specifically for the shape of the part being formed. Each pair must fit exactly and conform to the actual dimension and contour of the finished article. The mating blocks may be equipped with small aligning pins to aid in lining up the blocks and to hold the material in place. The blocks may be held together by C-clamps or a vise. The edges of the form blocks must be rounded to give the correct radius of bend to the part and undercut approximately 5° to allow for the springback of the metal. This undercut is especially important if the material is hard or if the bend must be accurate. To accurately lay out and cut the form blocks to the proper size when only the mold line dimensions of the chart are known, use the form correction chart shown in figure 1-49 for locating the edge of the form block. The chart gives correction C which is the amount to be subtracted from the mold line dimension of the part to be formed. This corrected measurement is the size to which the form block shall be cut. The major steps in forming a curved flange are shown in figure 1-50. Cut the material to size, allowing about one-quarter inch excess material for trim, and drill holes for alignment pins. File and sand the edges of the material to remove all nicks caused by the cutting tools. This reduces the possibility of the material cracking at the edges during the forming operation. Place the material between the form blocks and clamp tightly in a vise so that the material will not move or shift. Clamp the work as closely as possible to the particular area being formed to prevent strain on the form block and to keep the material from slipping.

1-23.7.1.3. Concave Surfaces. Concave surfaces are formed by stretching the material over a form block (figure 1-51). Using a plastic or rawhide mallet with a smooth, slightly rounded face, start hammering at the extreme ends of the part and continue toward the center of the bend. This procedure permits some of the material at the ends of the part to be worked into the center of the curve where the material will be needed. Continue hammering until the metal is gradually worked down over the entire flange and is flush with the form block. After the flange is formed, trim off the excess material and check the part for accuracy.

1-23.7.1.4. Convex Surfaces. Convex surfaces are formed by shrinking the material over a form block (figure 1-52). Using a wooden or plastic shrinking mallet and a backup or wedge block, start at the center of the curve and work toward both ends. Hammer the flange down over the form, striking the metal with glancing blows at an angle of approximately 45° and with a motion that will tend to pull the part away from the radius of the form block. The wedge block is used to keep the edge of the flange as nearly perpendicular to the form block as possible. The wedge block also lessens the possibility of buckles and splitting or cracking the metal. Another method of hand-forming flanges is using a lead bar or strap. The material, while secured in the form block, is struck by the lead strap which takes the shape of the part being formed and forces it down against the form block. One advantage in using this method is that the metal is formed without marring or wrinkling and is not thinned out as much as it would be by other methods of hand-forming.

1-23.7.1.5. Formed and Extruded Angles. Formed and extruded angles can be curved, not bent

sharply, by stretching or shrinking one of the flanges. In this forming process, place the flange to be stretched in the groove of a V-block as shown in figure 1-53. If the flange is to be shrunk, place the flange across the V-block. Using a stretching mallet, strike the flange directly over the V-portion with light, even blows and gradually force flange down into the V-cutout. A blow too heavy will buckle the angle strip. Keep moving the angle strip across the V-block but always strike the spot directly above the V. Form the curve gradually and evenly by moving the strip slowly back and forth, distributing the hammer blows at equal spaces on the flange. Lay out a full-sized, accurate pattern on a sheet of paper and periodically check the accuracy of the curve by comparing the part with the pattern. This check helps to determine exactly how the curve is progressing and just where the curve needs to be increased or decreased. Form the part roughly to the desired shape before attempting to finish any one portion because the finishing or smoothing of the angle may cause some other portion of the angle to change shape. If any section of the part is curved too much, reduce the curve by reversing the part on the V-block and striking lightly with a mallet. Form the curve with a minimum amount of hammering because excessive hammering will work-harden the metal. Work-hardening can be recognized by a lack of bending or by springiness in the metal. In some cases the part may have to be annealed before the forming can continue.

1-23.7.2. Machine Forming. The easiest and most accurate method of making straight line bends or curves is by machine forming. Straight line bends can easily be formed with either a cornice or pan box brake. Curves may be formed using a slip-roll-former.

NOTE

Before bending any work demanding an accurate bend radius and definite leg length, the settings of the brake should be checked with a piece of scrap metal.

1-23.7.2.1. Cornice or Pan Box Brake. When using a cornice or pan box brake, place the sheet to be bent on the bench so that the bend line is directly under the upper jaw or clamping bar; then pull down the clamping bar handle. This brings the clamping bar down to hold the sheet firmly in place. Set the stop for the proper angle or amount of bend, and make the bend by raising the bending leaf until it strikes the stop. If more than one bend is to be made, bring the next bend line under the clamping bar and repeat the bending procedure.

1-23.7.2.2. Slip-Roll-Former. With the exception of the brake, the slip-roll-former is probably used more than any other machine in the shop. This machine is for forming sheets into cylinders or other straight curved surfaces. The former consists of right and left end frames with three solid rolls mounted in between. The two gripping rolls are connected by gears operated by either a handcrank or a power drive. These rolls can be adjusted to the thickness of the metal by two adjusting screws located on the bottom of each frame. When the metal is started into the machine, the rolls grip the metal and carry it to the rear roll which curves it. The desired radius of a bend is obtained by the rear roll. The bend radius of the part can be checked as the forming operation progresses by using a circle board or radius gage. The gages can be made by cutting a piece of material to the required finished radius and comparing it to the radius being formed by the rolling operation. On some material the forming operation must be performed by passing the material through the rolls several times with progressive settings on the forming roll. On most machines the top roll can be released on one end, permitting the formed sheet to be removed from the machine without distortion.

1-23.7.3. Joggling. (See figures 1-54 through 1-56.) A joggle is an offset formed on a part to allow clearance for a sheet or another mating part. Joggle dimensions, depending upon type of material, depth of joggle, and the thickness of the material being joggled are shown in figures 1-57 through 1-59. There are a number of different methods for forming joggles. If the joggle is to be made on a straight flange or flat piece of metal, it can be formed on a cornice brake (figure 1-54). To form the joggle, lay out the boundary lines of the joggle where the bends are to occur on the sheet. Insert the sheet in the brake and bend the metal up approximately 20° to 30°. Release the brake and remove the part. Turn the part over and clamp it in the brake at the second bend line. Bend the part up until the correct height of the joggle is attained. Remove the part from the brake and check the joggle for correct dimensions and clearance. When a joggle is necessary in a curved part or on a part having a flange, joggle blocks made of hardwood, steel, or aluminum may be used. The forming procedure consists of placing the part to be joggled between the two joggle blocks and squeezing them in a vise or some other suitable clamping device. After the joggle is formed, the

joggle blocks are turned over in the vise and the bulge on the opposite flange is flattened with a wooden or rawhide mallet (figure 1-55).

1-23.7.3.1. Joggling Using Joggle Chips. On small parts or parts having a relatively short width joggle, the fastest and easiest method of forming the joggle is by using a joggling clip as shown in figure 1-56. The joggle clip can be made easily and quickly for any size joggle required. For best results, make the joggle clips from material that is as hard or harder than the material being joggled and one gauge thicker than the required depth of the finished joggle. The width of the slot to be cut in clip shall be the dimension taken from figure 1-56 minus the thickness of the joggle clip. The procedure for using the joggling clip is as follows:

a. Lay out bend line of joggle on part to be formed.

b. Insert part into joggling clip.

c. Clamp clip and material in vise or other pressure-applying device.

NOTE

To prevent scratching the material during the forming operation the jaws of the vise used for clamping the clip and material shall be machined smooth or covered with a soft metal such as brass.

1-23.8. Dimpling. (See figure 1-60.) Dimpling may be accomplished by either the ram coin dimpling or modified radius dimpling process with the material heated or cold. Ram coin dimples are formed between a punch and a coining ram and die with a machine capable of furnishing sufficient pressure to force the metal into shape between the punch and die with or without heat. The coining ram assists in forcing metal against the surface of the male die. This results in a form countersink resembling a machine countersink in definition yet giving a stronger joint, particularly in thin sheets. Modified radius dimpling is done with equipment similar to that used for ram coin dimpling but with a shouldered die not having the coining ram feature. The resulting dimple lacks the sharp definition characteristic of ram coin dimpling and is therefore less desirable in airplane work. Modified radius tools will be used only for understructure and for those applications where access with ram coin tools is impossible. External use of modified radius tools shall also be restricted to those areas where access with ram coin tools is impossible. Refer to table 1-18 for type of materials and thickness limitations for hot or cold dimpling.

Table 1-18. Thickness Limitations and Heating Requirements

Material	Thickness (maximum)	Alloy	Condition	Dimpling temperature
Aluminum alloy	0.080		T3, and T4	Cold[1]
		2024	T6, T651, T81, T86	Hot
		6061	0, T4	Cold[1]
			T6	Hot
		7075	All	Hot
Magnesium alloy	0.080	Any	A or H	Hot
Corrosion resistant steel	0.063	Any	Annealed, 1/4H, 1/2H	Cold
Titanium	0.063	Any	All	Hot

[1]May be dimpled hot when heat will prevent cracking.

1-23.8.1. Preparation of Materials. Pilot holes must be drilled and the surface treated before being dimpled. The size of the pilot holes may vary, provided the holes meet all requirements after dimpling for the specific fastener. Pilot drill sizes which will normally produce these results are given in tables 1-19 and 1-20. Pilot holes shall not be punched. Parts to be dimpled shall be clean and free from grease, dirt, chips, and other foreign matter. Unless burrs are excessive, the drilled holes shall not be deburred. When deburring is required, care shall be exercised to remove as little of the material as possible. After cleaning and after surface treatment, as specified in T.O. 1A-7D-23 for the particular type of material being worked, the material may be dimpled.

1-23.8.2. Hot Dimpling. The application of heat increases the elongation of metal, resulting in a lowered tendency to crack while dimpling. Heat for hot dimpling is supplied by electrical heating elements on one or both coin dimpling dies. The heat is regulated by controls and thermocouples which are a part of the dimpling machine. The heating element shall be properly attached to the dimpling tools (punch and dies). The tools shall protrude through the heating elements sufficiently to prevent the heater from contacting the work. Check air line pressure to the dimpling machine. The time or dwell that heated dies are in contact with the materials before the dimple is formed is automatically regulated. Therefore, the machine setup for the dwell timer and dwell pressure must be in accordance with dimpling machine operating procedures. A machine setup test strip shall be run to assure proper machine setup. The test strip shall be of the same material and gage as the repair or replacement part. Redimpling to obtain better dimple configuration is permissible but the sheet shall be allowed to cool before redimpling. Redimpling to reverse a dimple is not permissible. Dimpling of tapered sheet having a maximum taper of 0.001 inch per inch is permissible. Ram coin tools shall be used for all dimpling operations where access permits. Dwell time and temperature for hot dimpling aluminum, magnesium, and titanium alloys shall be as follows:

1-23.8.2.1. Aluminum and Magnesium Alloys. Hot dimpling of aluminum alloys shall be in accordance with figure 1-61 with a dwell time of 1/2 to 5 seconds. The dwell time for aluminum of any thickness may be increased to 5 seconds if necessary to prevent cracking. The dwell time for magnesium alloys shall be 2 to 3 seconds. For both alloys, use two heater blocks heated to 600° (±25°)F. If only one die can be heated, the temperature shall be the same, but the dwell time may be increased to a maximum of 5 seconds. An increase in dwell time up to 5 seconds may be used when dimpling magnesium parts which have been primed and/or hydrolube resistant lacquered. There is a lag in testing through the dies to the sheet, whereby, the dimple only reaches a temperature of about 300°F. This temperature is usually sufficient to improve the workability of the sheet and to prevent cracking.

1-23.8.2.2. Titanium Alloys. The dwell time for single sheet titanium alloys shall be 5 to 15 seconds. Normally double dimpling is not permitted; however, when two sheets are spotwelded together, double dimpling may be performed. In this case, the dimples shall be prechecked by dimpling two loose test pieces together, then separating and checking each dimple separately. Both dies shall be heated to 800° (±25°)F. When dimpling with only one heated die, the temperature shall be the same, but the dwell time may be increased to a maximum of 30 seconds. Double dimpling shall always be accomplished with both dies heated. Finished dimples shall meet the requirements of paragraph 1-23.8.4.

1-23.8.3. Cold Dimpling. All corrosion resistant steel in the annealed condition, 1/4 or 1/2 hard, and 2024 and 6061 aluminum, except as noted in table 1-18, shall be dimpled cold using standard dies. For fasteners larger than 1/4 inch, a test strip shall be used to set the correct ram pressure and dimpling pressure. The test strip shall be of the same alloy and gage as the repair or replacement part. Redimpling to obtain better dimple configuration is permissible. Redimpling to reverse a dimple is not permissible. Dimpling of extruded material is not permissible. Ram coin tools shall be used for all cold dimpling where access with these tools is possible. Modified radius tools shall be used only for understructure and for those applications where access with ram coin tools is impossible. Dimples made with ram coin or standard tools may be used interchangeably and also may be nested into modified radius tools dimples. Those made with modified radius tools may only be nested into a countersunk substructure. Finished dimples shall meet the requirements of paragraph 1-23.8.4.

Table 1-19. Recommended Pilot Drill Size for Hot Dimpling

Fastener	Size	Recommended pilot size +0.007 −0.000	
Hi-Shear rivets undersize pilot dimpling	1/8	#40	(0.098)
	3/16	#17	(0.173)
	1/4	#1	(0.228)
	5/16	L	(0.290)
Lockbolts undersize pilot dimpling	3/16	#23	(0.152)
	1/4	#5	(0.205)
	5/16	1/4	(0.250)
	3/8	5/16	(0.312)
Standard screws standard pilot dimpling	#6	#27	(0.144)
	#8	#18	(0.169)
	#10	#10	(0.193)
	1/4	F	(0.257)
Airloc fasteners	#5 (1.00)	9/32	(0.281)
	#7 (1.38)	11/32	(0.343)
Standard MS20426 rivets	3/32	#40	(0.098)
	1/8	#30	(0.128)
	5/32	#21	(0.159)
	1/4	F	(0.257)
DuPont blind rivets	1/8	#30	(0.128)
	5/32	#22	(0.157)
	3/16	#12	(0.189)
Huck and Cherry blind rivets undersize pilot dimpling	1/8	#40	(0.098)
	5/32	#30	(0.128)
	3/16	#21	(0.159)
	1/4	#10	(0.193)
	5/32	#30	(0.128)

Table 1-20. Recommended Pilot Drill Size for Cold Dimpling

Fastener	Size	Recommended pilot size +0.007 −0.000	
Standard MS20426 and MS20427 rivets	3/32	#40	(0.098)
	1/8	#30	(0.128)
	5/32	#21	(0.159)
	3/16	#11	(0.191)
	1/4	F	(0.257)
DuPont blind rivets	1/8	#30	(0.128)
	5/32	#22	(0.157)
	3/16	#12	(0.189)
Huck and Cherry blind rivets undersize pilot dimpling	1/8	#40	(0.098)
	5/32	#30	(0.128)
	3/16	#21	(0.159)
	1/4	#10	(0.193)
Hi-Shear rivets undersize pilot dimpling	1/8	#40	(0.098)
	5/32	#30	(0.128)
	3/16	#17	(0.173)
	1/4	#1	(0.2280)
	5/16	L	(0.290)
Lockbolts undersize pilot dimpling	3/16	#24	(0.152)
	1/4	#5	(0.205)
	5/16	1/4	(0.250)
	3/8	5/16	(0.312)
Standard screws undersize pilot dimpling	#10	#24	(0.152)
	1/4	#5	(0.205)
	5/16	1/4	(0.250)
	3/8	5/16	(0.312)
Standard screws standard pilot dimpling	#6	#27	(0.144)
	#8	#18	(0.169)
	#10	#10	(0.193)
	1/4	F	(0.257)
Airloc fasteners	#5 (1.00)	9/32	(0.281)
	#7 (1.38)	11/32	(0.343)

1-23.8.4. Inspection of Dimples. Finished dimples shall meet the requirements as shown in figure 1-62. Dimensional requirements shall be governed by the requirements for the fasteners involved. A pry test for completed dimples shall be performed according to figure 1-63.

1-23.9. Working Metallic Materials. (Refer to T.O. 1-1A-1 and 1-1A-8.)

1-23.10. Working Nonmetallic Materials. For working nonmetallic materials, refer to the applicable typical repair appendix and/or general repair manual as follows:

a. For rigid foam, refer to Section XIV.

b. For reinforced plastic materials, refer to Section XIV and/or T.O. 1-1-24.

c. For acrylic plastic, refer to T.O. 1-1A-12.

1-24. IN-SERVICE USE CRITERIA.

In-service use criteria includes permissible wear allowances, reaming and bushing limits, critical external surface contour tolerances, and allowable clearances for structural components, movable structural joints, and mechanical linkages. Criteria for repair, replacement, or continued use of in-service parts; repair of external surface contours, allowable clearances, and corrosion prevention; and sealing of affected parts is provided in the following paragraphs.

1-24.1. Permissible Wear Allowances. The maximum permissible wear allowance for movable structural joints and mechanical linkages is given in the applicable permissible wear allowance chart (figures 1-64 through 1-103). Disposition of these parts shall be as follows:

a. If specified wear allowance is not exceeded, part may remain in-service.

b. If wear allowance is exceeded, part shall be repaired by rebushing, provided permissible reaming and bushing limits are not exceeded.

c. Replace parts if:

(1) Permissible wear allowance is exceeded and part can not be bushed.

(2) Replacement bushing outside diameter would have to be increased beyond maximum allowable ream diameter specified in applicable permissible reaming and bushing limits chart (figures 1-64 through 1-103).

d. Replace part if replacement is specified in applicable repair section or applicable permissible wear, reaming, and bushing limits (figures 1-64 through 1-103).

1-24.2. Reaming and Bushing Data. Bushing removal and installation and reaming operations, when applicable, shall be in accordance with T.O. 1-1A-8 and as follows:

a. Unless otherwise specified, holes to be bushed and outside wall surfaces of bushings shall have surface finish of 125 microinches.

b. Diametrical limits for reaming holes prior to bushing installation shall be in accordance with applicable permissible reaming and bushing limits chart (figures 1-64 through 1-103).

c. Installation of oversize bushings and installation of bushings in holes not originally bushed shall not be permitted unless specifically authorized in this manual or by qualified structural engineer.

d. Outside diameter of bushing shall be machined to fit original hole as specified in table 1-21, unless otherwise specified.

e. Edges of holes to be bushed may be chamfered slightly to facilitate bushing installation.

f. Bushing material and heat-treat requirements specified in applicable permissible reaming and bushing limits chart shall be strictly observed (figures 1-64 through 1-103).

g. Shoulders and lubrication grooves provided in original bushings shall be duplicated in replacement bushings.

Table 1-21. Hole and Bushing Diameters for Installation of Press-Fit Bushings

Hole diameter (inches)	Bushing outside diameter[1] (inches)	Interference (inches)	
		Minimum	Maximum
0.2500 (+0.0005, −0.0004)	0.2511 (+0.0000, −0.0005)	0.0001	0.0015
0.3125 (+0.0005, −0.0004)	0.3136 (+0.0000, −0.0005)	0.0001	0.0015
0.3750 (+0.0005, −0.0004)	0.3761 (+0.0000, −0.0005)	0.0001	0.0015
0.4375 (+0.0005, −0.0004)	0.4386 (+0.0000, −0.0005)	0.0001	0.0015
0.5000 (+0.0005, −0.0005)	0.5013 (+0.0000, −0.0007)	0.0001	0.0018
0.5625 (+0.0005, −0.0005)	0.5638 (+0.0000, −0.0007)	0.0001	0.0018
0.6250 (+0.0005, −0.0005)	0.6265 (+0.0000, −0.0008)	0.0002	0.0020
0.6875 (+0.0005, −0.0005)	0.6892 (+0.0000, −0.0010)	0.0002	0.0022
0.7500 (+0.0005, −0.0005)	0.7517 (+0.0000, −0.0010)	0.0002	0.0022
0.8125 (+0.0005, −0.0005)	0.8142 (+0.0000, −0.0010)	0.0002	0.0022
0.8750 (+0.0005, −0.0005)	0.8767 (+0.0000, −0.0010)	0.0002	0.0022
0.9375 (+0.0005, −0.0005)	0.9393 (+0.0000, −0.0010)	0.0003	0.0023
1.0000 (+0.0005, −0.0005)	1.0018 (+0.0000, −0.0010)	0.0003	0.0023
1.0625 (+0.0010, −0.0005)	1.0648 (+0.0000, −0.0010)	0.0003	0.0028
1.1250 (+0.0010, −0.0005)	1.1273 (+0.0000, −0.0010)	0.0003	0.0028
1.1875 (+0.0010, −0.0005)	1.1898 (+0.0000, −0.0010)	0.0003	0.0028
1.2500 (+0.0010, −0.0005)	1.2523 (+0.0000, −0.0010)	0.0003	0.0028
1.3125 (+0.0010, −0.0005)	1.3148 (+0.0000, −0.0010)	0.0003	0.0028
1.3750 (+0.0010, −0.0005)	1.3773 (+0.0000, −0.0010)	0.0003	0.0028
1.4375 (+0.0010, −0.0005)	1.4399 (+0.0000, −0.0010)	0.0004	0.0029

See footnotes at the end of the table.

Table 1-21. Hole and Bushing Diameters for Installation of Press-Fit Bushings – CONT

Hole diameter (inches)	Bushing outside diameter[1] (inches)	Interference (inches)	
		Minimum	Maximum
1.5000 (+0.0010, −0.0005)	1.5024 (+0.0000, −0.0010)	0.0004	0.0029
1.5625 (+0.0010, −0.0005)	1.5659 (+0.0000, −0.0010)	0.0004	0.0029
1.6250 (+0.0010, −0.0005)	1.6274 (+0.0000, −0.0010)	0.0004	0.0029
1.6875 (+0.0010, −0.0010)	1.6899 (+0.0000, −0.0010)	0.0004	0.0034
1.7500 (+0.0010, −0.0010)	1.7524 (+0.0000, −0.0010)	0.0004	0.0034
1.8125 (+0.0020, −0.0010)	1.8150 (+0.0000, −0.0010)	0.0005	0.0035
1.8750 (+0.0010, −0.0010)	1.8775 (+0.0000, −0.0010)	0.0005	0.0035
1.9375 (+0.0010, −0.0010)	1.9400 (+0.0000, −0.0010)	0.0005	0.0035
2.0000 (+0.0010, −0.0010)	2.0025 (+0.0000, −0.0010)	0.0005	0.0035
2.0625 (+0.0010, −0.0010)	2.0650 (+0.0000, −0.0010)	0.0005	0.0035
2.1250 (+0.0010, −0.0010)	2.1275 (+0.0000, −0.0010)	0.0005	0.0035
2.1875 (+0.0010, −0.0010)	2.1900 (+0.0000, −0.0010)	0.0005	0.0035
2.2500 (+0.0010, −0.0010)	2.2526 (+0.0000, −0.0010)	0.0006	0.0036

[1]If required bushing outside diameter is not listed, use tolerance and interference data for nearest nominal diameter listed.

h. Bushing ends shall not extend beyond surface of receiving part, unless otherwise specified.

i. No end thrust on bushing is permissible.

WARNING

Zinc chromate primer is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

j. Unless otherwise specified in applicable permissible reaming and bushing limits chart, install bushing with wet, unthinned MIL-P-8585 zinc chromate primer. Exercise care to prevent obstruction of lubrication passages during installation (T.O. 1A-7D-23).

k. Remove bushings, ream bushing holes, and install bushings according to T.O. 1-1A-8.

l. After bushing installation, carefully wipe excess primer to form fillet seal between bushing and receiving part.

WARNING

Sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

m. When specified in applicable permissible reaming and bushing limits chart, apply fillet of MIL-S-8802 sealant around perimeters of bushing and receiving contacting surfaces (T.O. 1A-7D-23).

1-24.3. Bearing Data. Bearing removal, installation, and staking operations shall be in accordance with T.O. 44B-1-2. Related dimensions and wear allowances for bearings are given in figures 1-64 through 1-103.

1-24.4. Critical External Surface Contour Tolerances. Refer to aerodynamic smoothness (paragraph 1-19) for surface contour tolerances and methods of repair.

1-24.5. Allowable Clearances. Refer to aerodynamic smoothness (paragraph 1-19) and applicable permissible reaming and bushing limits chart for external structural surfaces and bushing allowable clearances, respectively (figures 1-64 through 1-103). Refer to the applicable organization maintenance manual for other allowable clearances.

1-25. SUPPORT OF STRUCTURE DURING REPAIR.

When major structural components are removed from the airplane, damaged, or disassembled, support is required to hold structural alignment and prevent overstressing of structural members. Special Support Equipment (SE) is provided for this purpose and is listed in Section XVII and T.O. 1A-7D-4-20. When structural damage or excessive skin removal prevents use of available supports, suitable supports may be fabricated to accomodate the damaged components. Suggested support points and approximate weight of major structural components are given in table 1-22.

1-26. SUPPORT EQUIPMENT FABRICATION.

Information necessary to establish contour lines and dimensions for fabrication of support equipment is as follows:

a. A typical example of plotting contour lines and dimensions is shown in figure 1-104.

b. Data and dimensions required to plot contour lines for construction of contour templates for support fixtures and repair templates and jigs may be derived from data contained in table 1-23 or from an airplane or like component known to be sound.

Table 1-22. Airplane Component Weights and Support Points

Nomenclature	Weight[1]	Support points
Wing center section (WCS)	2,886	Attach points
Leading edge flap (WCS)	38 (1)	Leading edge, top or bottom
Trailing edge flap (WCS)	62 (1)	Leading edge, top or bottom
Wing outer panel (WOP)	316 (1)	Leading edge, top or bottom
Leading edge flap (WOP)	41 (1)	Leading edge, top or bottom
Aileron	23 (1)	Leading edge, top or bottom
Fuselage nose section	4,340	FS 254.8 and 346.5 (nose gear trunnion mounts, when nose gear is removed)
Fuselage midsection	4,904	FS 346.5 and 526.5
Fuselage aft section	1,683	FS 552.7, arresting gear attach points, and FS 664.6[2]
Horizontal stabilizer	185 (1)	Leading edge, top or bottom
Vertical stabilizer	495	Leading edge, left or right side
Rudder	31	Leading edge, left or right side
Powerplant (removable)	2,931	
Total airplane weight (empty)	18,600	

[1]Weights are based on an empty airplane, all fluids drained and without stores. Weights may vary slightly between individual airplanes.

[2]This support point is accessible only with engine removal access removed.

Table 1-23. Contour Drawing List

Drawing No.	Location	Intervals (inches)
215-10901-1	Fuselage station 177 to 200 Fuselage station 200 to 275	1 5
215-10901-2	Fuselage station 280 to 340	20
215-10901-3	Fuselage station 285 to 345	20
215-10901-4	Fuselage station 290 to 350	20
215-10901-15	Fuselage station 295 to 335	20
215-10901-6	Fuselage station 355 to 480	25
215-10901-7	Fuselage station 360 to 485	25
215-10901-8	Fuselage station 365 to 490	25
215-10901-9	Fuselage station 370 to 495	25
215-10901-10	Fuselage station 500 to 625	25
215-10901-11	Fuselage station 505 to 630	25
215-10901-12	Fuselage station 510 to 635	25
215-10901-13	Fuselage station 515 to 640	25
215-10901-14	Fuselage station 520 to 645	25
215-10901-15	Fuselage station 295 to 335	20
215-10901-16	Fuselage station 650 to 700	5
215-10902-1, -4	Engine air duct inlet lip	
215-10902-2	Engine air duct, fuselage station 210 to 330	
215-10902-3	Engine air duct, fuselage station 335 to 470	
215-10903	Dorsal fairing	
215-10904	Fuselage, horizontal stabilizer	

Table 1-23. Contour Drawing List – CONT

Drawing No.	Location	Intervals (inches)
215-10907	Vertical stabilizer tip	
215-10908	Rudder	
215-10909-1, -2	Vertical stabilizer-dorsal intersection	
215-10910-1, -2, -3	Wing tip	
215-10911	Wing airfoil, 100-inch chord percent basis	
215-10912	Wingfold fairing	
215-10913	Wingfold droop trims	
215-10914-1, -2	Gun fairing	
215-10921	Doppler antenna fairing	
216-10922	Inflight refuel fairing	

CAUTION

To prevent overstress of structures, contour lines for construction of support fixtures and repair jigs shall be plotted at structural points that will provide maximum support to the component to be repaired.

c. Templates for construction of support equipment, repair templates, and jigs may be plotted on template material for cutting and forming of contour templates.

d. Supports, jigs, and repair templates may be fabricated as required using contour template prepared as outlined in steps a through c and using materials suitable for specific operation.

1-27. CRASH HANDLING. The following paragraphs contain instructions for recovery of a crashed or damaged airplane. Instructions include safety precautions to be observed before and during crash handling, methods and steps for lifting and moving airplane from a crash site, and for use of correct equipment.

1-27.1. Safety Precautions. Adherence to safety precautions is required to prevent damage to equipment and possible injury to personnel. Removal of hazardous parts or condition should be performed to comply with instructions in the correct maintenance manual when possible.

a. Remove fire hazards when possible. Remove or check that hazardous components are in safe condition (figure 1-105).

b. Ensure that fire fighting and medical aid are present at crash site.

c. Rope off area and post guards if quick removal of airplane is not possible.

d. Disarm ejection seat (qualified egress system personnel only).

e. Install safety pins in ejector bomb racks and remove bombs, missiles, rockets, and ejector rack cartridges (qualified armament personnel only).

f. Remove ammunition from guns and airplane (qualified armament personnel only).

g. Defuel all internal tanks if possible (T.O. 1A-7D-2-1).

h. Defuel external tanks (if applicable) and remove tanks from airplane.

i. Remove LOX converter from airplane or drain oxygen system.

j. Install landing gear lockpins if gear is extended (T.O. 1A-7D-2-1).

k. Approach overheated landing gear wheels from front or rear only.

l. Depressurize all hydraulic accumulators except emergency landing gear (T.O. 1A-7D-2-1).

m. Do not walk under airplane being salvaged.

n. Provide adequate security for classified equipment.

o. Clean areas where chemical fire extinguishing agents were used if airplane is to be moved to storage area.

1-27.2. Recovery of Airplane. Several methods for lifting and moving (recovery) of a crashed or damaged airplane are presented in this manual. Lifting of the airplane can be done by hoisting (using a sling and crane), use of pneumatic lifting bags, or use of a combination of jacks, cribbing, and sandbags. Moving can be done by towing or transporting the airplane by tractor and trailer. In some cases, disassembly of the airplane may be required at the crash site to permit safe recovery and prevent possible further damage during movement to repair facilities. The method of recovery to be used will depend on various conditions. Because of the different conditions that can be encountered, no one procedure can be given that will suit every case. One procedure or a combination of procedures may be used. A preliminary survey to be taken in any type of ground incident is as follows:

a. Survey damage to determine structural condition of airplane. This is important from standpoint of personnel safety, to prevent additional damage to airplane, to determine equipment required for recovery, and to find out limitations of equipment available.

b. Check access to crash site so that passage of recovery vehicles can be planned.

c. Take into consideration wind and weather conditions which could create unstable condition during airplane lifting and moving operation.

d. Determine that airplane weight is within structural load limits of lift points, hoist points, and operating limits of equipment available. If possible, airplane should be defueled and dearmed before lifting or towing operation to reduce weight and minimize hazards.

e. Before attempting any lifting or towing operation, several recovery methods should be analyzed and judged by foregoing survey. Refer to applicable procedures or combination of procedures contained in this section that best meet requirements for recovery of crashed or damaged airplane.

1-27.3. Lifting Crashed or Damaged Airplane. Lifting a crashed or damaged airplane may be accomplished by using either of the following methods, or a combination of these methods. The method used should be the fastest and most efficient method possible with maximum safety and minimum additional damage to the airplane. Refer to a survey of conditions to be considered when choosing a lifting method (paragraph 1-27.2).

1-27.3.1. Lifting Airplane Using Airplane Hoisting Sling Assembly. The complete airplane may be lifted using the MB-1A semitractor crane (or equivalent) and the 216-00210-28 sling assembly. The wing attach points must not be damaged if this method is to be used. Lift airplane as follows:

a. Install sling assembly and attach guy lines according to airplane hoisting procedure (T.O. 1A-7D-2-1).

b. Make sure all maintenance stands and obstructions will clear airplane.

c. Station personnel at guy lines and at strategic points around airplane to watch lifting operation and to signal recovery team chief in case anything dangerous happens as airplane rises.

d. Anchor guy lines to stable objects (vehicles, post, etc.) in a manner that will permit slacking of lines as airplane moves upward and will allow cinching of lines to control lateral movement of airplane as dictated by team chief.

e. Recovery team chief shall be positioned in view of crane operator and airplane monitors. Team chief shall direct crane operator and all other personnel as airplane is lifted.

CAUTION

Excessive impact stresses can cause damage to airplane. During lifting operation, use care to minimize jerking motions and sudden starts or stops. Make sure lines are taut before actual lifting takes place.

f. Make sure lifting and lowering operations are performed slowly and carefully.

g. Slowly lift airplane, using crane, to sufficient height to lower landing gear. Necessary ground clearance to lower landing gear is 57 inches at FS 300.76 and 42 inches at FS 487.70.

h. Using maintenance stand, type B-4 or equivalent, reach into cockpit and actuate emergency landing gear extension system to lower landing gear. This will lower and lock nose gear and partially lower main gear. Complete main gear lowering by pushing aft on main gear with 2-inch by 4-inch by 12-foot timbers or equivalent until it locks, being careful to stay out from under airplane. If emergency lowering of landing gear cannot be accomplished, use two 40-foot flatbed trailers and trucks with mattresses on them to protect airplane under forward and aft sections. Place one just forward of nose gear doors, and one at FS 593.5 to crib airplane. Pry open left main gear door and charge normal hydraulic system using hand pump. Lower gear normally.

i. Install landing gear downlocks and inspect landing gear and supporting structures for damage.

NOTE

If landing gear or supporting structures are damaged beyond safe support of airplane, airplane can be supported with jacks or cribbing and sandbags, depending upon recovery conditions. If it is necessary to move the airplane to a hard surface by crane, a method must be utilized which minimizes swinging and swaying of the airplane during movement.

j. Lower airplane slowly and carefully until it rests on landing gear or supporting equipment as applicable. See figure 1-106 for support of airplane using cribbing, sandbags, and timbers.

k. Secure airplane with chocks or guy lines as necessary.

l. Statically ground airplane.

1-27.3.2. Lifting Airplane Using F-2 Lifting Bags. (See figures 1-107 and 1-108.) The type F-2 airplane pneumatic lifting bags provide a fast means of lifting a complete airplane that has made a gear-up landing or has landed on soft or irregular terrain where the use of mechanical lifting equipment is impractical or impossible. Each bag is 6-1/2 feet wide by 7-1/2 feet long and is capable of lifting 12 tons to a height of 6 feet when inflated to 3.5 psi maximum. The bags will collapse to a height

of 6 inches when deflated. When more than 6 feet of height is required, two bags may be stacked and laced together to provide a total lift of 12 feet. When bags are used in this manner, additional guy lines and precautionary measures are required to prevent shifting of the airplane. Cribbing built around the bags is another method often used to prevent shifting as the airplane is lifted. The airplane can usually be raised high enough for landing gear extension using two stacked bags under each wing and two under the aft fuselage, depending on the slope of the recovery site. One bag will be required under the nose section to provide stability. Type MC-2A air compressors or type A-1 blowers, or equivalent, can be used as an air source for inflating the bags. When a type MC-2A air compressor is used, precautions shall be taken to prevent overpressurization (3.5 psi maximum) of the lifting bags. Refer to T.O. 35D5-5-3-11 for additional information about F-2 lifting bags. Prepare airplane and equipment for lifting as follows:

NOTE

Wing pylons 1, 2, 7, and 8 must be installed to lift airplane (T.O. 1A-7D-13).

a. Build platforms to be placed on wing lifting bags so that lifting loads will be transmitted into pylons (figure 1-107).

b. Stack and lace together two sets of two bags each. Position one set of bags lengthwise and centered under outer two pylons on each wing.

c. Position platforms on top of bags under each wing, selecting proper platform so that 4 by 4 timbers slant inboard and forward.

WARNING

Protect each lifting bag by placing a 1/2-inch thick felt pad between top of bag and airplane structure where protruding objects could damage lifting bag. A punctured lifting bag could cause the airplane to fall and possibly endanger personnel.

d. Position lifting bag under nose section with longest sides of bag perpendicular to airplane centerline, and extending no farther aft than FS 275.00.

e. Attach guy lines to airplane (figure 1-106, note 2).

NOTE

Connections are 1-inch pipe-threaded fittings. The inlet connection of the bag has the word INLET stenciled directly above it.

f. Position and connect air source to bottom bags under each wing, to bag under nose section, and to bottom bag under aft fuselage.

NOTE

Securing guy lines in the wide open spaces can be a problem. Trees or other natural objects may be utilized as anchor points. If lines are tied to vehicle, wheels of vehicle should be securely chocked and the brakes set so that airplane guidance will be as stable as possible. If airplane weight shifts and shifting becomes uncontrollable, the airplane can drag a large tractor. On sloping ground, the change in balance during lifting must be taken into consideration.

g. Secure guy lines to objects capable of holding airplane in position as it is lifted. Attach guy lines in a manner that will allow slack and will also allow lines to be quickly cinched, as required, during lifting operation.

NOTE

The word OUTLET is stenciled directly below each of the sleeves. Two fabric straps with buckles are provided.

h. Fold up and securely fasten two outlet assemblies on both sides of each lifting bag.

i. Make sure all maintenance stands and obstructions will clear airplane.

1-27.3.2.1. Lifting Airplane. Lift airplane as follows:

a. Station personnel at guy lines, at air blowers (compressors), and at strategic points around airplane to watch lifting operation and to signal recovery team chief in case anything dangerous happens as airplane rises.

b. Recovery team chief shall be positioned in view of airplane monitors and direct all personnel as the airplane is lifted.

c. Start blowers.

d. Fully inflate bottom bags under wings. When bottom bags are inflated, stop lifting operation, connect blowers to upper bags, and install inlet-air port cap on bottom bags.

e. Position another bag under fuselage aft section so that it extends farther forward than FS 550.00.

f. Slowly lift airplane by first inflating bags necessary to raise airplane to level position, and then slowly inflate all bags at same time until airplane is high enough to lower landing gear. Slacken or tighten guy lines as necessary to prevent shifting of airplane during lifting operation.

g. Shut off blowers, disconnect air hoses, and install inlet-air port cap to upper bags.

h. Perform necessary repairs on airplane and remove lifting equipment.

1-27.4. Moving Crashed or Damaged Airplane. Moving a crashed or damaged airplane to a repair facility is one of the major tasks involved in an airplane recovery operation. Any one of several methods or a combination of methods may be required. The airplane may be towed, transported by tractor and trailer, hoisted and carried by MB-1A crane, or partially supported by a special dolly or flatbed trailer and towed. The method used will depend on conditions surrounding the recovery operation. Because of the different conditions that can be encountered, no one way will work in every case. The procedures provided in this manual for moving a crashed or damaged airplane consist of general recommendations, except where special equipment is provided for this purpose. For other recovery methods, specific procedures for moving the airplane must be developed at the site to fit the individual conditions. In any event, the safety precautions contained in this section shall apply.

1-27.4.1. Conditions To Be Considered. When deciding the best method for moving a damaged airplane to a repair facility, consider the following:

a. Condition of airplane:

(1) Can it be safely towed if all conditions are favorable?

(2) Can necessary repairs be accomplished at recovery site that will allow safe towing?

(3) Is airplane structurally safe to hoist and carry by crane, or is it better to remove wing and vertical stabilizer and transport airplane by tractor and trailer?

b. Equipment available:

(1) Is MB-1A crane or equivalent available?

(2) Is adequate landing gear dolly available?

(3) Is low bed trailer (capable of hauling airplane) available?

(4) Are required handling fixtures available?

c. Accessibility of recovery site:

(1) Is ground soft or muddy?

(2) Is rough terrain enroute?

(3) Is hard surface route nearby? Can steel planking or timbers be used to improve recovery route enough to allow towing or hauling airplane?

(4) Is recovery site near repair facility?

(5) Are there bridges, underpasses, or other obstructions along recovery route?

d. Possible use of more than one method: Is route to repair facility suitable for only one method of airplane movement or will combination of methods be needed?

1-27.4.2. Towing Crashed or Damaged Airplane. For normal towing procedures, refer to T.O. 1A-7D-2-1. Abnormal towing shall be done according to the following procedures.

1-27.4.2.1. Prepare Airplane for Towing. Prepare airplane for towing operation as follows:

a. Make sure all personnel involved in towing operation are thoroughly familiar with and comply with safety precautions (paragraph 1-27.1).

b. Check that landing gear downlocks are installed.

c. Remove as much weight from airplane as possible.

d. If necessary to obtain horizontal clearance, remove wing (T.O. 1A-7D-2-1). Airplane width with wing removed is 18.14 feet.

e. If necessary to obtain horizontal clearance, remove horizontal stabilizer (T.O. 1A-7D-2-8). Airplane width with wing and horizontal stabilizer removed is approximately 10 feet.

f. If necessary or desirable to reduce weight and improve balance for towing, remove engine from airplane (T.O. 1A-7D-2-5).

g. If it is necessary to tow airplane backward, arresting hook may be used (figure 1-109).

h. If wheels have sunk into soft ground no farther than up to rim, airplane may be towed without prior preparation of ground.

i. If wheels are sunk deeply in soft ground or are in rut, ground around landing gear must be prepared for towing (figure 1-110) or wing jacks or pneumatic lifting bags may be used to raise gear above ground to position pierced steel planking or wooden planking directly under wheels.

j. If necessary, airplane can be lifted with crane and sling to prepare ground under wheels.

k. Form smooth pathway from landing gear wheels to firm surfaced area. If practical, cover pathway with coarse crushed stone extending at least 12 inches on each side of landing gear to support airplane.

l. If necessary, position pierced steel planking (PSP) or wooden planking as close to tires as possible.

NOTE

Existing conditions will determine if PSP or wooden planking will be needed to permit towing airplane to a firm surfaced area. Use extreme caution to avoid upending of PSP or planking as the airplane is moved onto the prepared pathway.

1-27.4.2.2. Towing Airplane. Tow airplane as follows:

a. Recovery team chief shall brief all personnel involved in towing operation of airplane movement plans and their specific duties.

b. Personnel shall be stationed as follows:

(1) Two on nose gear tow bar to steer airplane if airplane is towed backward.

(2) One in cockpit to operate brakes.

(3) One on each wingtip to check wing clearance, tail clearance, and to chock wheels in event of brake failure.

c. Recovery team chief shall be positioned in view of vehicle operator, wingtip walkers, and brake operator. Team chief shall direct movement of airplane during towing operation.

d. Steady pulling action shall be maintained to prevent jerking airplane.

WARNING

When towing the airplane forward up a slope, closely watch the nose gear strut extension measurement. If the strut begins to gradually extend due to a shift in balance, turn airplane around and tow it backwards up the slope.

e. Make sure adequate clearance exists between airplane and obstructions along towing route.

f. After towing is finished, perform following steps:

(1) Place chocks in front and rear of each main landing gear wheel.

(2) Disconnect tow bar from nose gear.

(3) Install static ground wire and secure airplane.

1-27.4.3. Moving Crashed or Damaged Airplane Using MB-1A Crane. Where recovery conditions permit, the type MB-1A semitractor crane provides a fast and efficient means of moving a crashed or damaged airplane for short distances. When used in conjunction with the airplane hoisting sling assembly, the MB-1A crane is capable of lifting and safely carrying a complete airplane without causing additional damage to the airplane.

1-27.4.3.1. Prepare Airplane for Moving. Prepare airplane for movement as follows:

a. Make sure all personnel involved in moving airplane are thoroughly familiar with and comply with safety precautions (paragraph 1-27.1).

b. Remove as much weight from airplane as practical.

c. If necessary, by digging and/or filling, form smooth roadway from airplane to firm surfaced area. Cover roadway with enough coarse, crushed stone to support combined weight of crane and airplane.

NOTE

If necessary, position pierced steel planking or equivalent to form a roadway from airplane recovery site to a firm, surfaced area.

d. Lift airplane high enough to permit safe movement of airplane using sling assembly (paragraph 1-27.3).

e. Secure airplane with guy lines to prevent swinging and turning of airplane as it is moved.

1-27.4.3.2. Moving Airplane. Move airplane as follows:

a. Recovery team chief shall brief all personnel involved in airplane movement operation on movement plan and on their specific duties.

b. Station personnel at strategic points to watch airplane as it is for and moved and to notify the recovery team chief if anything dangerous happens.

c. Recovery team chief shall be positioned in view of operation observers and crane operator and shall direct movement of airplane.

d. Make smooth and slow start, and then continue airplane movement at slow steady pace.

e. Make sure that adequate clearance exists between airplane and obstructions along recovery route.

f. After airplane has been moved, slowly lower airplane until it is supported by landing gear, cribbing and sandbags, or jacks as applicable.

g. Moor airplane.

h. Remove hoist and sling assemblies from airplane.

i. Install static ground wire and secure airplane.

1-27.4.4. Moving Airplane with Damaged Nose Landing Gear. (See figure 1-111.) When an airplane nose landing gear or nose landing gear supporting structure is damaged too much for safe towing and temporary repair is not practical at the recovery site, a low-bed trailer may be used to support and move the airplane. Because of the different conditions that must be considered when moving a damaged airplane in this case, no single procedure is ideal for all cases. If the recovery method shown in figure 1-111 is selected as the most practical, the recovery team chief must establish a detailed recovery plan that will prevent any new damage to the airplane. Refer to paragraph 1-27.1 for applicable safe practices to be observed. If this recovery method is not practical, one of the preceding methods of airplane recovery may provide the solution.

1-27.4.5. Moving Airplane with Damaged Main Landing Gear. (See figure 1-112.) When an airplane main landing gear or main landing gear supporting structure is damaged too much for safe towing and needed repairs are not possible at the recovery site, a low-bed trailer may be used to support and move the airplane. Because of the different conditions that must be considered when moving a damaged airplane in this case, a standard procedure is not practical to establish. If the recovery method shown in figure 1-112 is selected as the most practical, the recovery team chief must establish a detailed recovery plan that will prevent minimum of additional damage to the airplane. Refer to paragraph 1-27.1 for applicable safe practices to be observed. If this recovery method is not practical, one of the preceding methods of airplane recovery may provide the solution.

1-28. SHIPPING CONTAINERS.

Proper protection from damage by the elements and by handling is required for all airplane components during shipment. Protection is normally provided by using shipping containers constructed to specific requirements for an individual component or to a general shipping container specification. The following paragraphs provide instructions for preservation of components for shipment and construction of Level A (export), Level B (domestic), and Level C (air) containers required for shipping major airplane components.

1-28.1. Fabrication. Shipping containers are made mostly of wood with contoured blocking and bracing which secure the components inside the container. The blocking and bracing may be fabricated from lumber and plywood, with padding between load bearing surfaces, or from polystyrene foam. Instructions for fabrication of required blocking and bracing, and shipping container dimensions are provided for each major component. Fabrication instructions and material requirements for all shipping containers are to be in accordance with the applicable Federal Specification PPP-B-601, PPP-B-576, PPP-B-636, or MIL-C-104 as specified in the appropriate shipping container fabrication figure. Refer to table 1-24 for a list of airplane components and container fabrication figure number for which shipping container fabrication instructions are provided. For fabrication of shipping containers for components not listed in table 1-24, refer to Federal Specifications PPP-B-636 and PPP-B-601. For a list of materials used in fabrication of containers and for protection of components, refer to Section XVI. For additional packaging materials and instructions, refer to T.O. 00-85-2 and T.O. 00-85-36.

1-28.2. Shipping Container Marking. Shipping container markings shall be in accordance with MIL-STD-129, as specified in the specific packaging instructions, and as follows:

a. Establish center of balance for each container with component installed in container (figure 1-134).

b. Stencil arrow at balance point.

c. Stencil words CENTER OF BALANCE above arrow.

d. Determine gross weight of container with component installed (figure 1-134), unless gross weight is listed in container fabrication instructions. For basic weight of major airplane components, refer to table 1-22.

e. Determine cubic foot volume of container, unless cube is given in fabrication instructions.

f. Identify each shipping container by stenciling component nomenclature, part number, serial number, container cube, and gross weight on side of container.

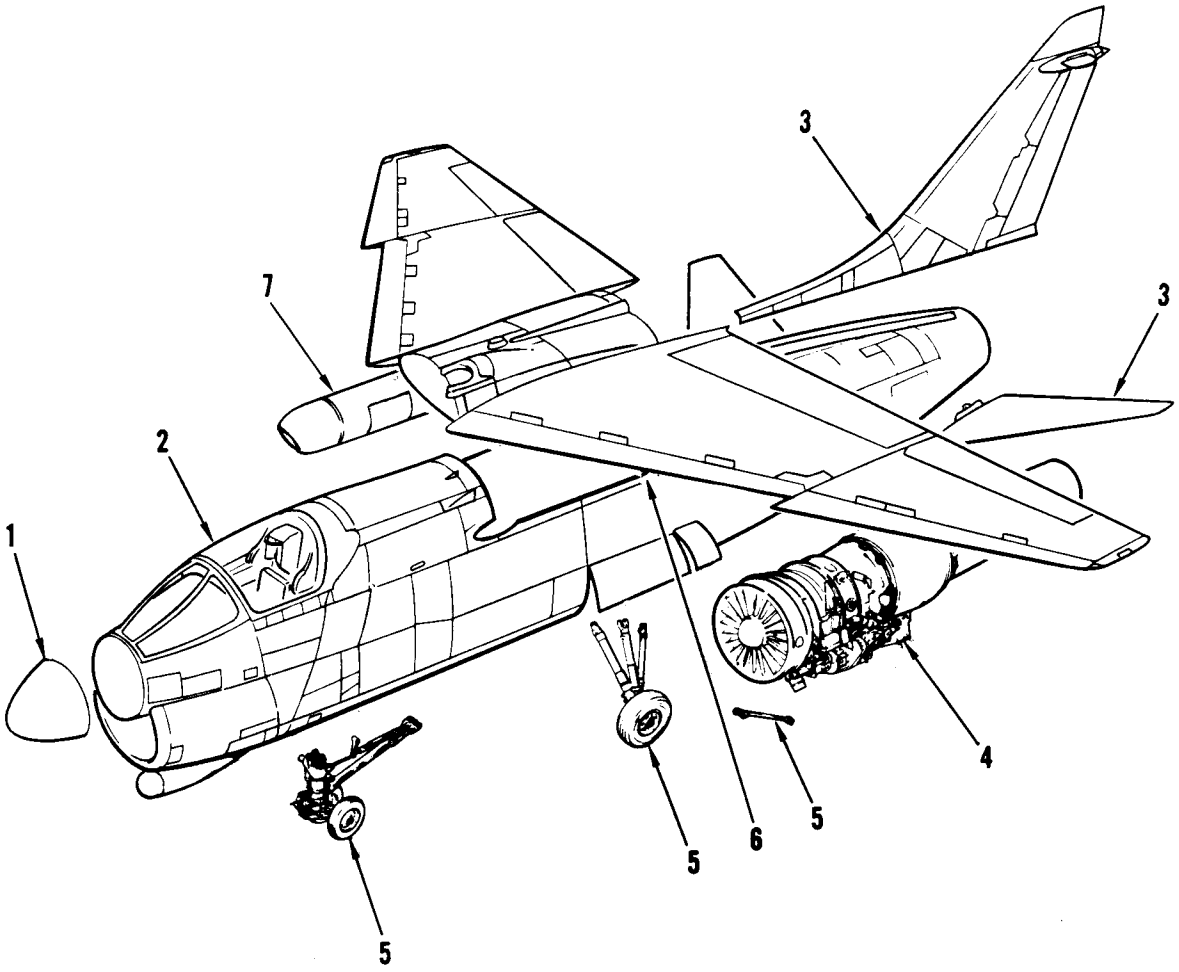
1-28.3. Installation of Components in Containers. Before installing a component in the shipping container, clean the component in accordance with T.O. 1-1-1. Preserve the bare areas. Wrap and protect the component as specified in the container fabrication instructions and MIL-P-116. Ensure that the component is held tight in the container and that all load bearing areas are adequately padded to prevent damage during handling. Refer to Section XVI for a list of component packaging materials. For additional packaging instructions, refer to MIL-STD-726 and T.O. 00-85-2.

Table 1-24. Shipping Containers for Airplane Components

Component part No.	Nomenclature	Fabrication figure No.
216-70020	Wing Center Section	1-113
215-70200	Wing Center Section Leading Edge Flap Assembly	1-114
215-70310	Trailing Edge Flap	1-115
215-80020	Wing Outer Panel Assembly	1-116
215-80200	Wing Outer Panel Leading Edge Flap Assembly	1-117
215-80300	Aileron Assembly	1-118
216-70065	Wing Stations 1 and 8 Pylon Assembly	1-119
216-70067	Wing Stations 2 and 7 Pylon Assembly	1-120
216-70069	Wing Stations 3 and 6 Pylon Assembly	1-121
216-20357	Nose Radome Assembly	1-122
215-20079	Canopy Assembly	1-123
215-20100	Nose Gear Left Door Assembly Nose Gear Right Door Assembly	1-124 1-125
215-30045	Avionics Compartment Access Door Assembly	1-126
215-30085	Speed Brake Assembly	1-127
215-30047	Main Landing Gear Upper Door Assembly	1-128

Table 1-24. Shipping Containers for Airplane Components – CONT

Component part No.	Nomenclature	Fabrication figure No.
215-30048	Main Landing Gear Lower Door Assembly	1-129
216-40040	Engine Removal Door	1-130
215-40060	Aft Fuselage Fairing Assembly	1-131
216-60200	Horizontal Stabilizer Assembly	1-132
215-60100	Rudder Assembly	1-133



INDEX NO.	MAJOR STRUCTURAL GROUP	REPAIR SECTION
1	Radome Repairs (All Radomes)	IV
2	Fuselage Group	VI
3	Empennage Group	VII
4	Engine Group	VIII
5	Landing Gear Group	IX
6	Wing Group	V
7	Forward Looking Infrared Pod (Airplanes after T.O. 1A-7-530)	XVIII

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Figure 1-2. Major Structural Groups and Repair Section Index

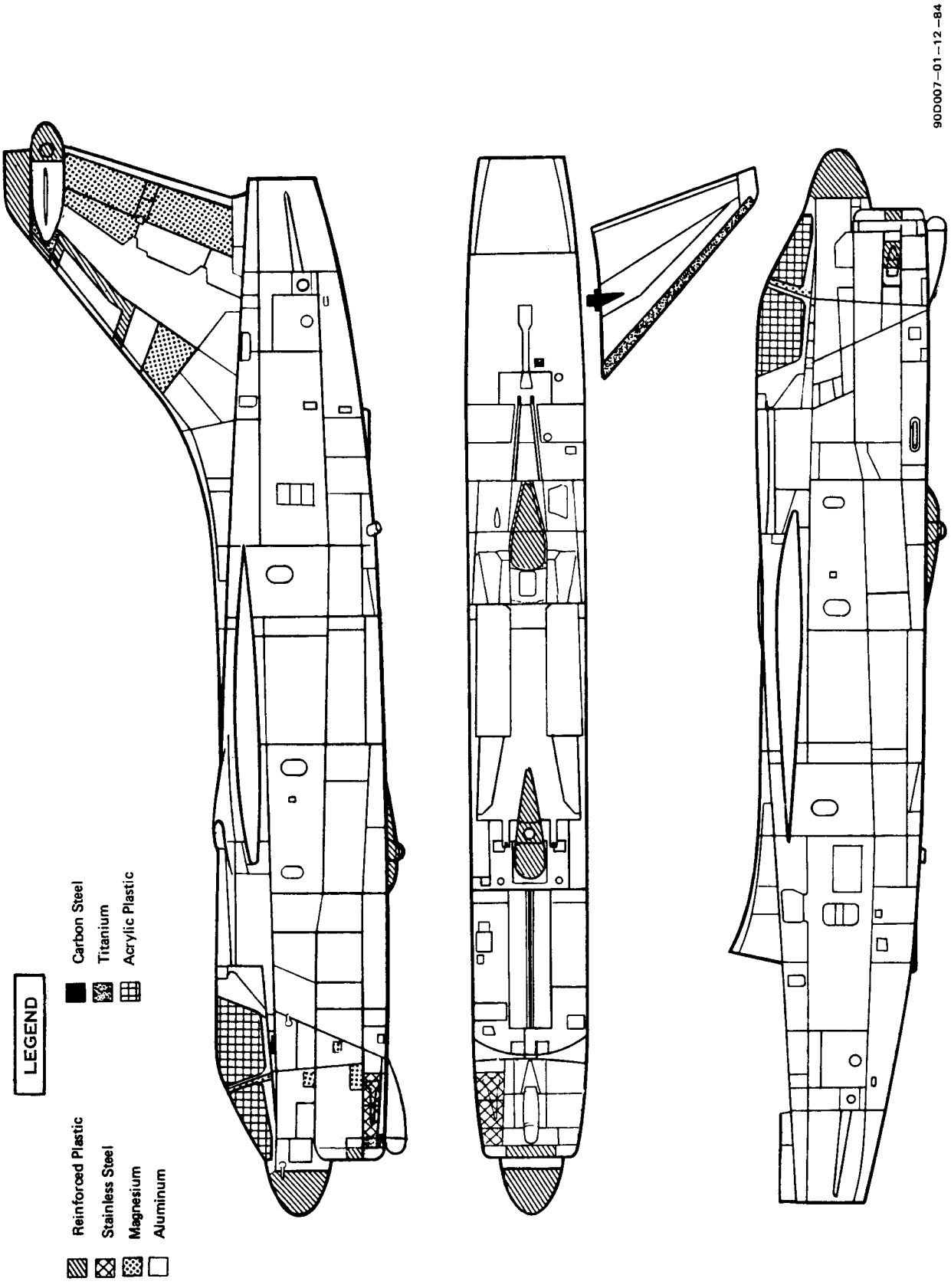


Figure 1-3. Skin Plating Diagram (Sheet 1 of 2)

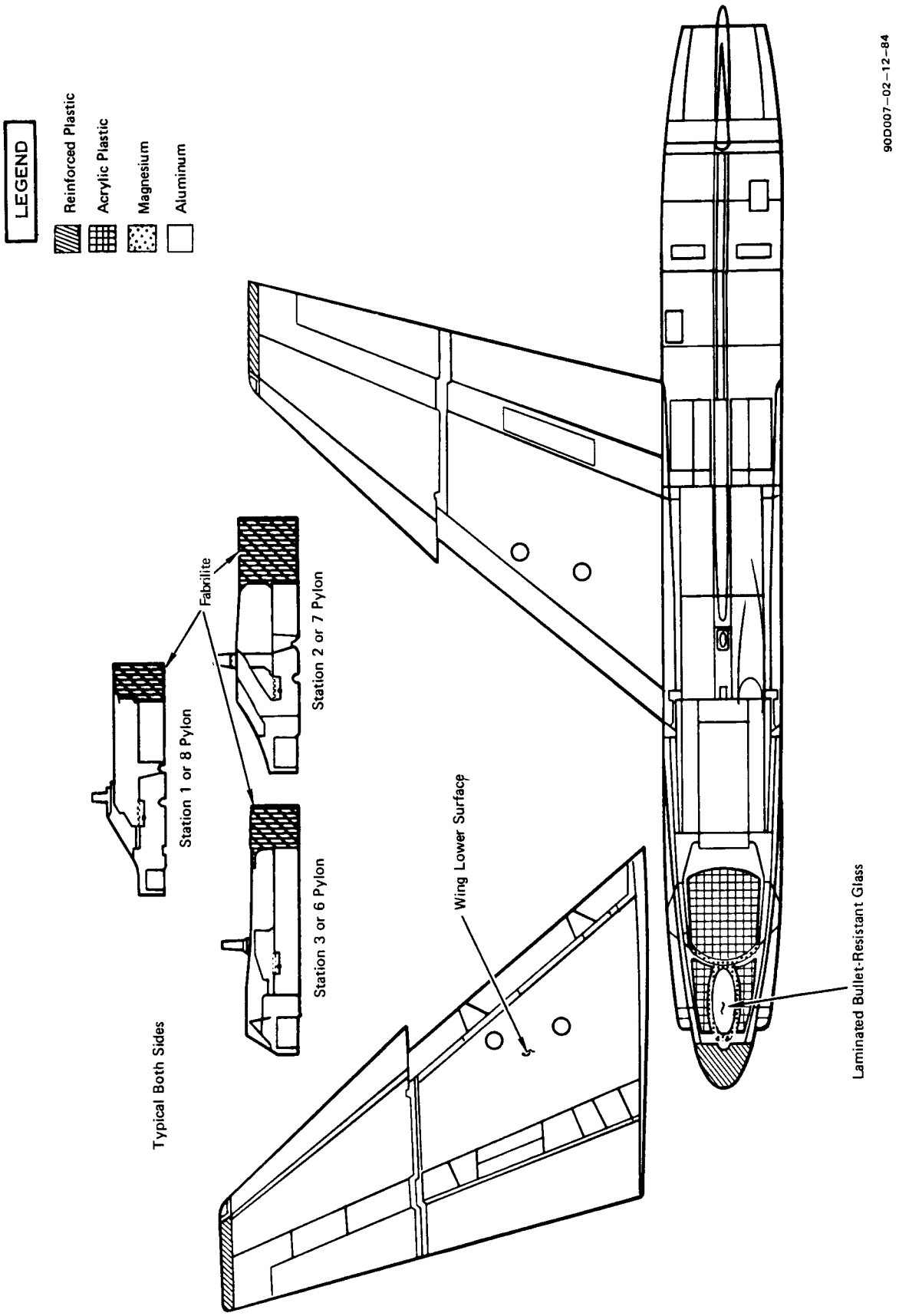
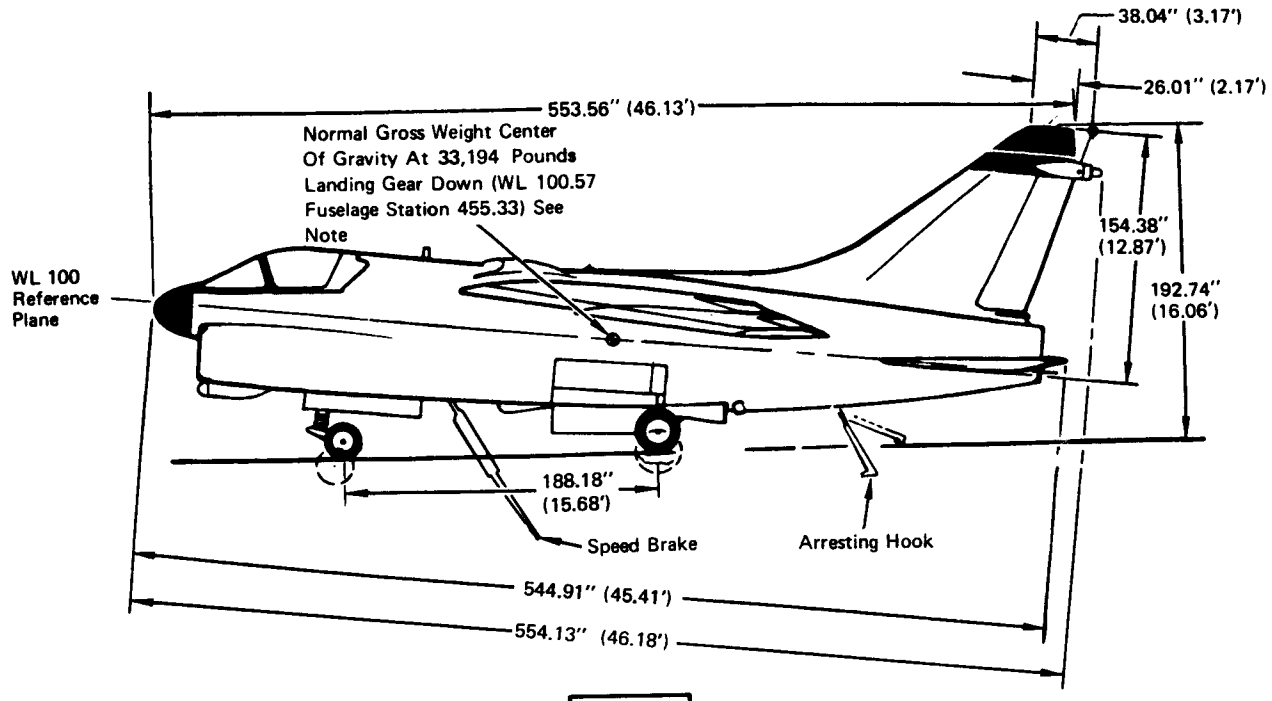


Figure 1-3. Skin Plating Diagram (Sheet 2)



NOTE

Includes fuel, oil, oxygen, pilot, guns, ammunition, and pylon replacement fairings.

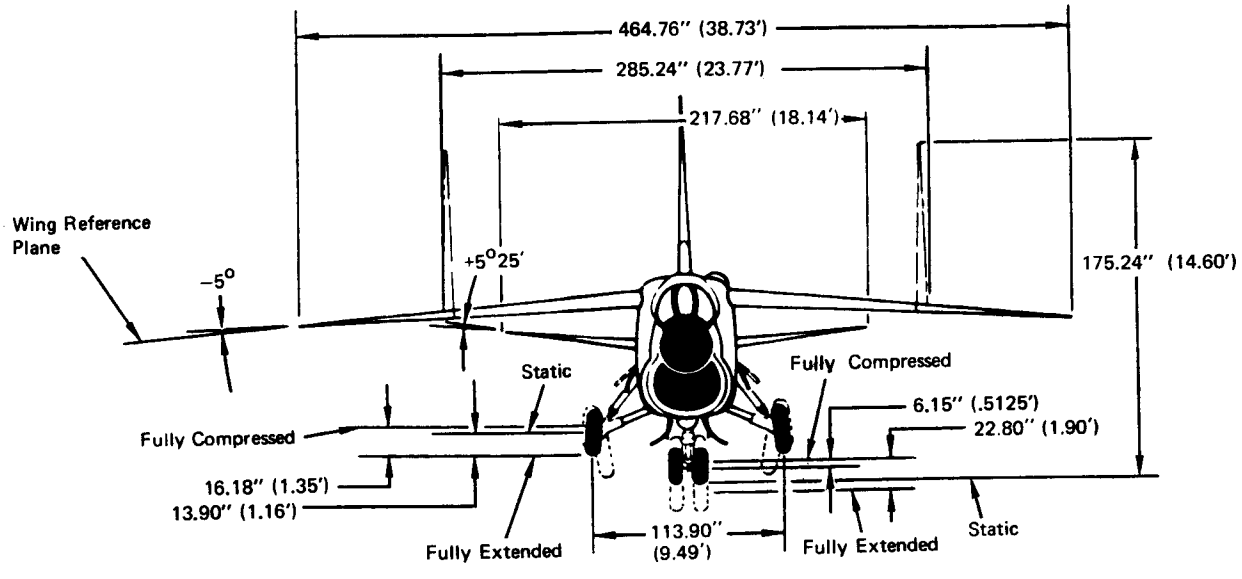


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Figure 1-4. Principal Dimensions (Sheet 1 of 2)

GENERAL

Wingspan	38.73 Ft.
Wingspan, folded	23.77 Ft.
Length, overall	46.18 Ft.
Main wheel tread	9.49 Ft
Airplane gross weight	33,194*
Tire size	
Main wheels	28 X 9 – 12
Nose wheels	22 X 5.5

*Includes fuel, oil, oxygen, pilot, guns, ammunition, and pylon replacement fairings

FUSELAGE

Height, basic outside	7.20 Ft
Width, basic outside	4.88 Ft
Length	44.18 Ft

WING

Type	High
Airfoil section at root	NACA 65A007
Airfoil section at tip	NACA 65A007
Chord at root	15.49 Ft
Chord at tip	3.86 Ft.
Incidence	-1°
Dihedral	-5°
Aspect ratio 0.25	4.0
Sweepback of 0.25 chord line	35°

AILERONS

Type	Plain, sealed
Span	6.24 Ft
Chord, percent wing chord/Ft	
Inboard end	25/2.14
Outboard end	25/1.26
Maximum deflection	±25°

HORIZONTAL STABILIZER

Span	18.14 Ft
Chord (MGC) at 3.40 Ft from Centerline	6.12 Ft
Airfoil section	
Root	NACA 65A006
Tip	NACA 65A004
Maximum deflection	
Leading edge up	7.5°
Leading edge down	28°
Sweepback of 0.25 chord line	45°
Dihedral	5° 25′

VERTICAL STABILIZER

Span	12.86 Ft
Chord (MGC)	10.20 Ft
Airfoil section	
Root	NACA 65A005.2 (Mod)
Tip	NACA 65A004 (Mod)
Sweepback of 0.25 chord line	44.28°

RUDDER

Type	Plain, sealed
Chord, average	2.12 Ft
Maximum deflection	
Takeoff	24.5°
Landing	6.0°

HIGH LIFT AND DRAG INCREASING DEVICES

Wing trailing edge flap	
Type	Single, slotted
Span	9.20 Ft
Chord, percent of wing chord	22.55
Maximum deflection	40°

LEADING EDGE FLAP

Span	
Inboard	11.99 Ft
Outboard	10.55 Ft
Chord, percent of wing chord	
Inboard	12
Outboard	12
Maximum deflection	35°

SPOILER–DEFLECTOR

Location, Percent of semispan	
Inboard end	28.94
Outboard end	43.46
Spoiler chord, percent of Wing chord	
Inboard end	6.92
Outboard end	7.71
Maximum deflection	60°
Deflector, percent of wing Chord	
Inboard end	5.07
Outboard end	5.88
Maximum deflection	30°

SPEED BRAKE

Maximum deflection	60°

AREAS

Wing	375 Sq Ft
Wing, trailing edge flap, each	21.74 Sq Ft
Leading edge flap	
Inboard section	24.11 Sq Ft
Outboard section	24.63 Sq Ft
Ailerons	19.94 Sq Ft
Spoiler	4.60 Sq Ft
Deflector	3.44 Sq Ft
Vertical stabilizer	111.20 Sq Ft
Rudder	15.04 Sq Ft
Horizontal stabilizer, Exposed	56.39 Sq Ft
Speed brake	25.00 Sq Ft

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Figure 1-4. Principal Dimensions (Sheet 2)

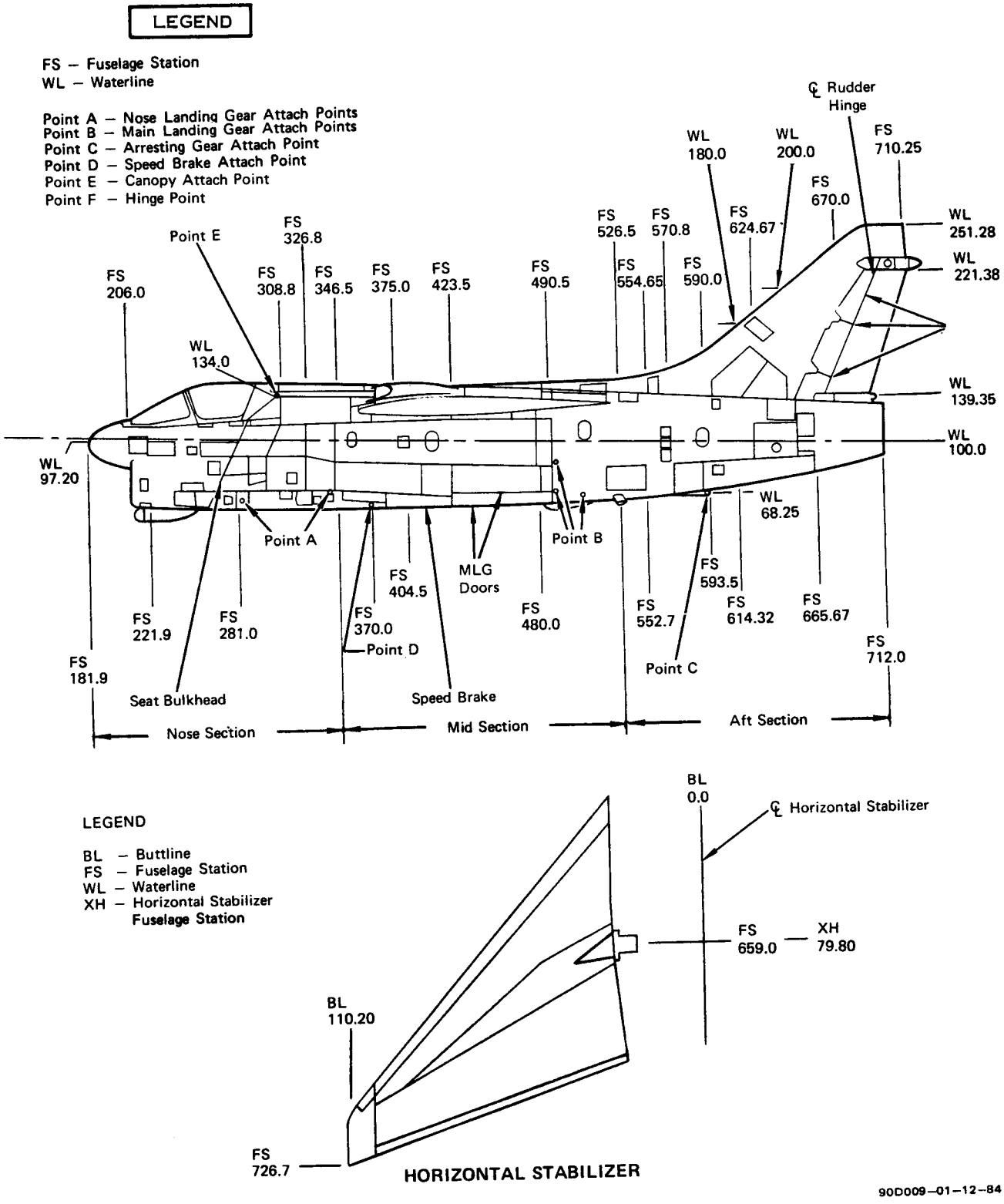
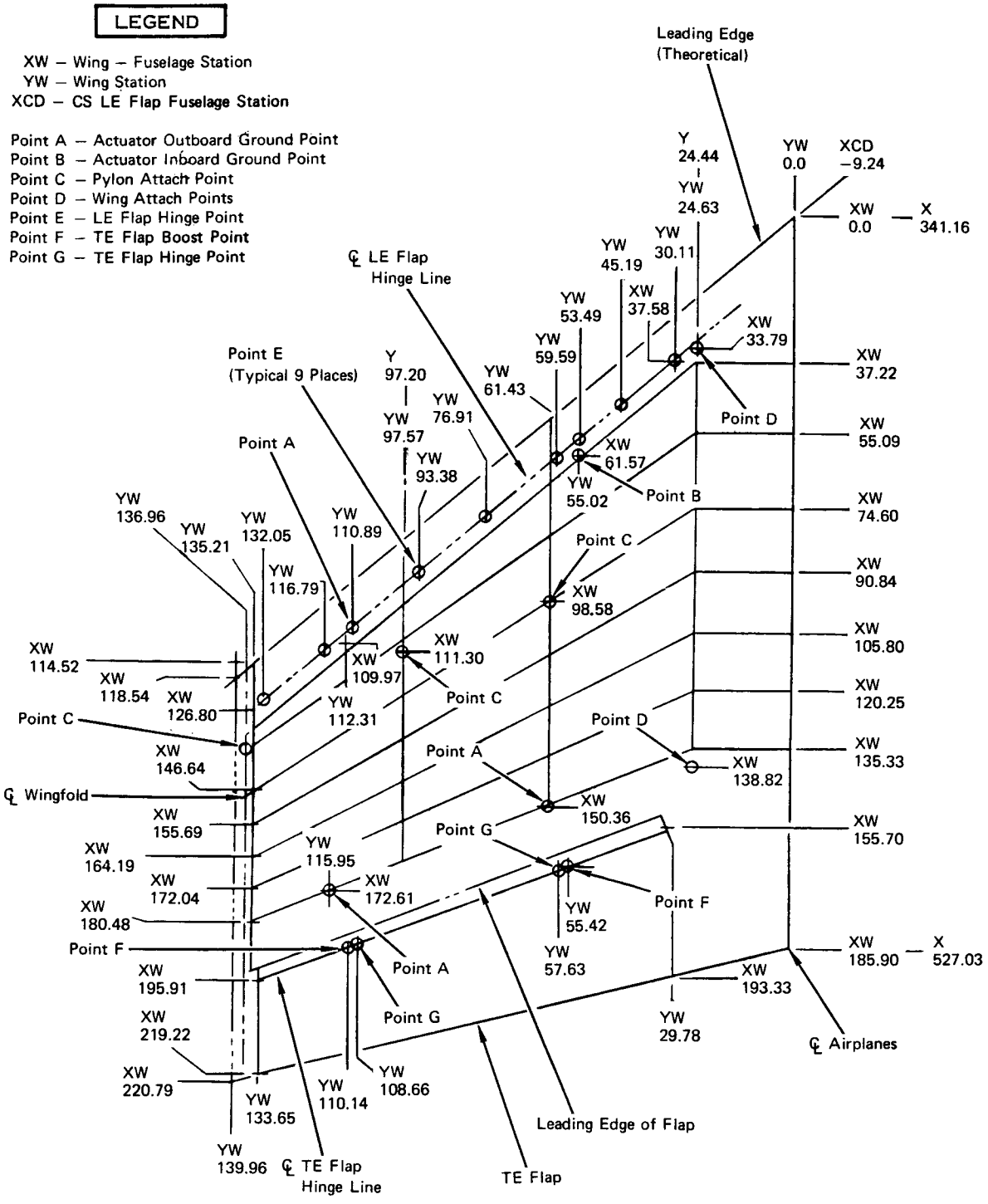


Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 1 of 7)



WING CENTER SECTION

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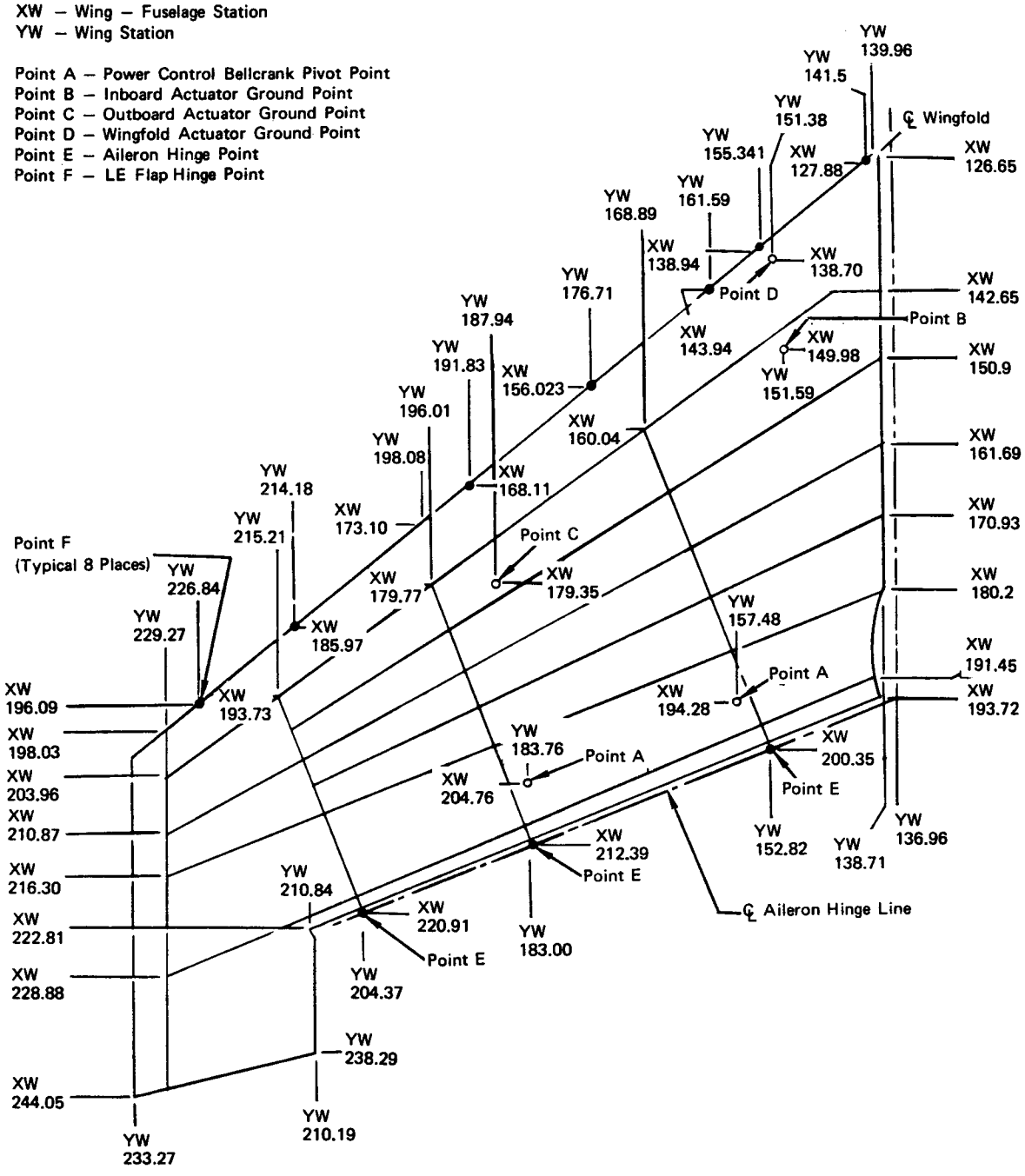
Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 2)



WING OUTER PANEL

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Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 3)

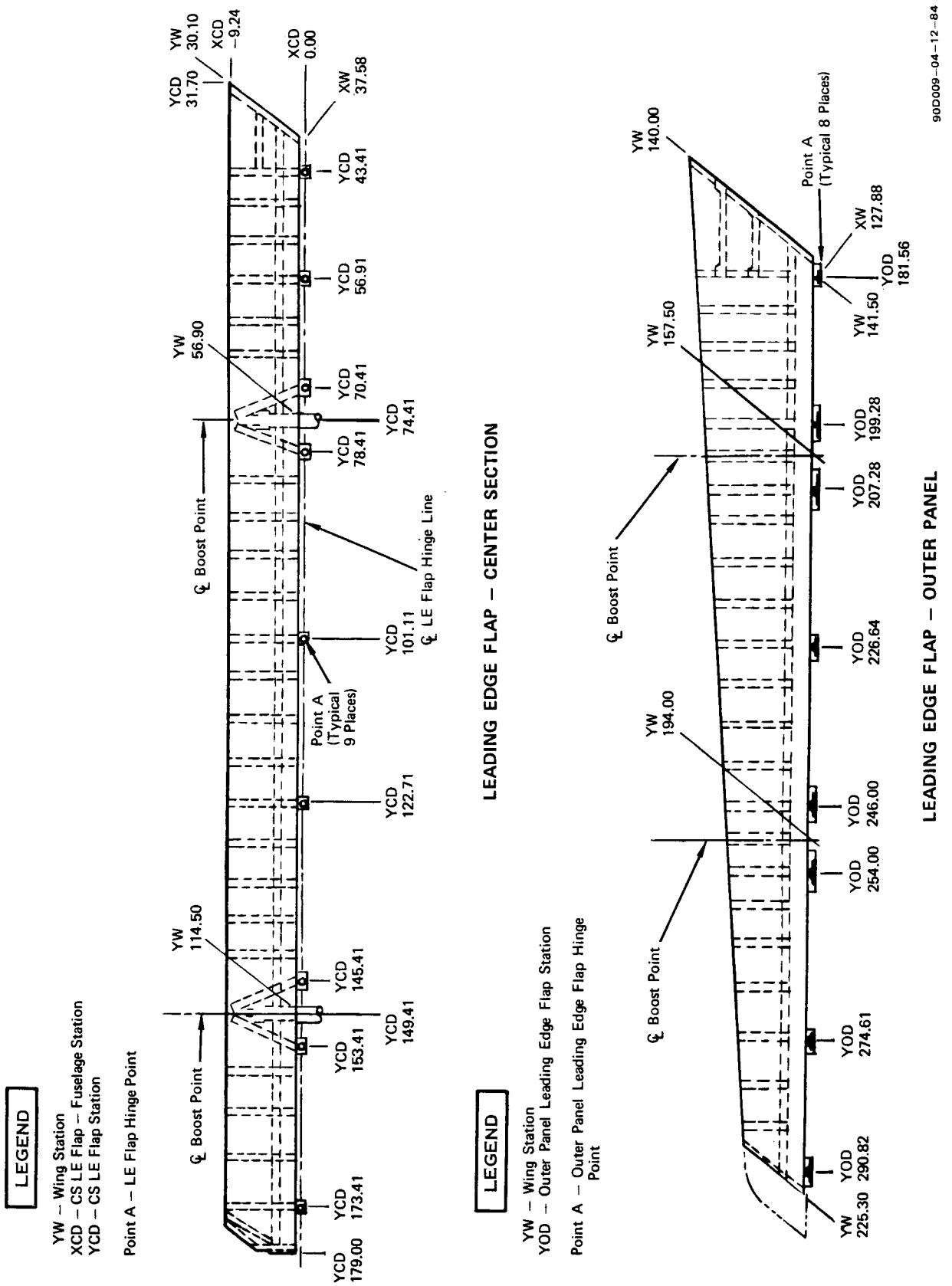

Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 4)

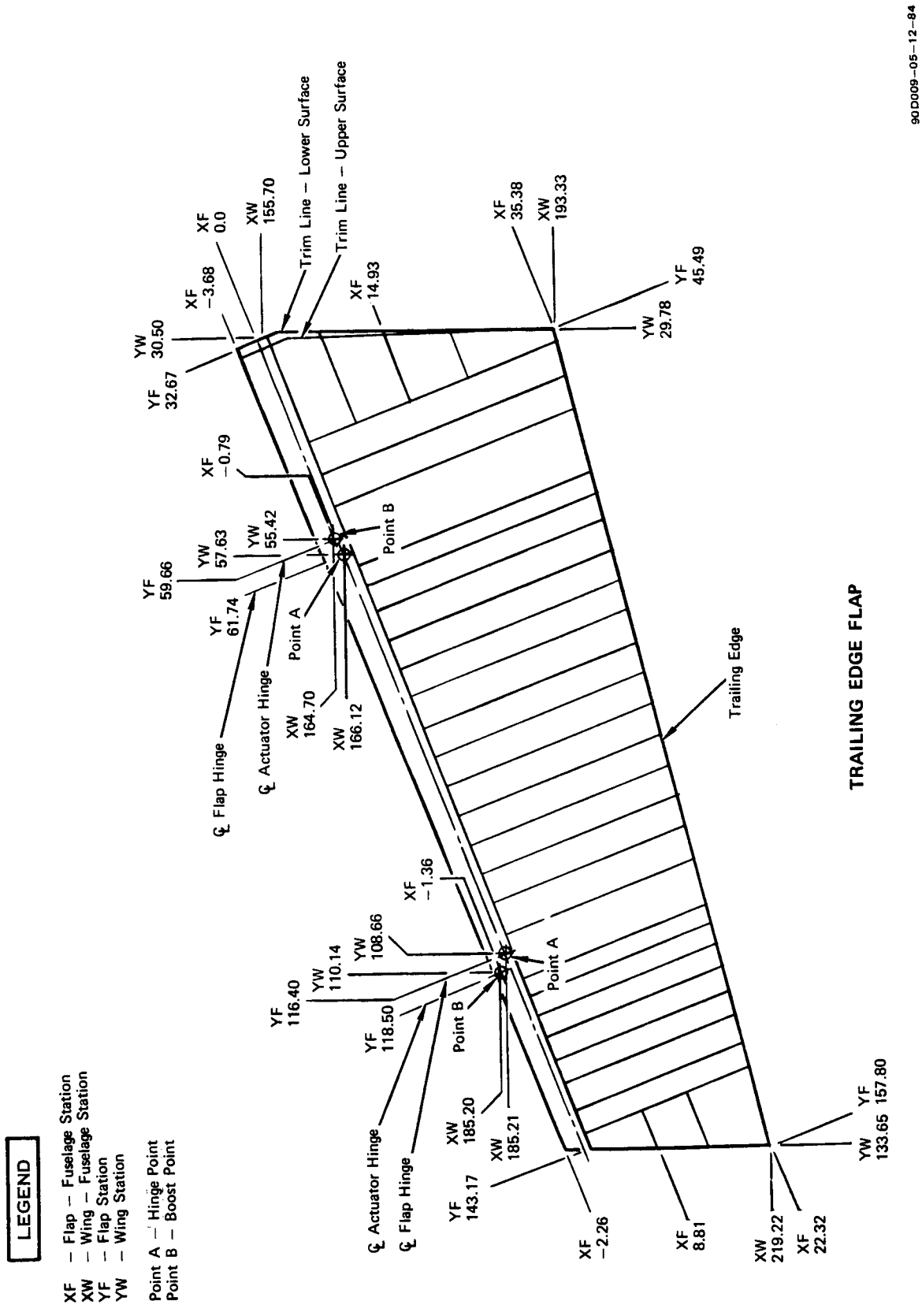

Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 5)

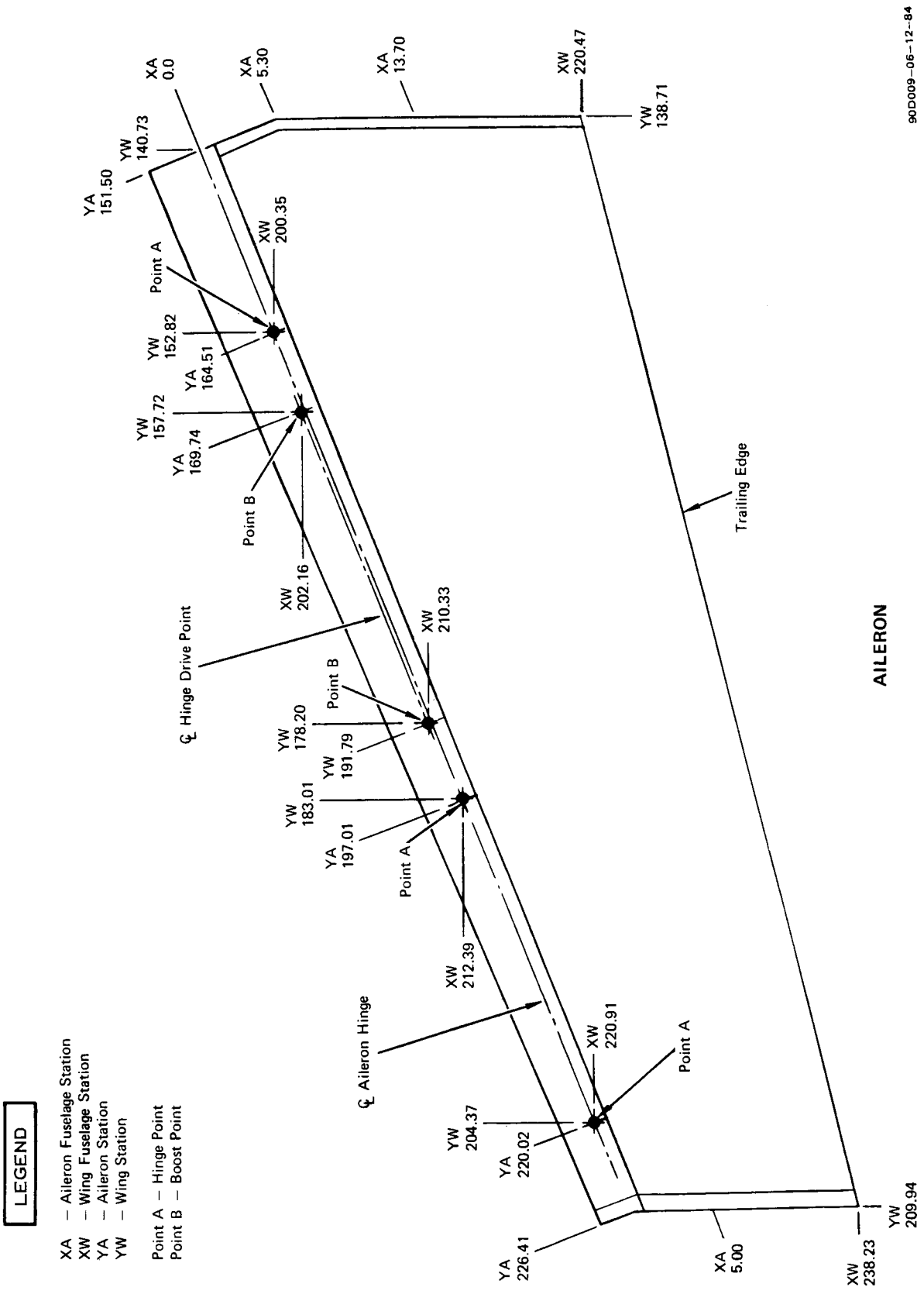

Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 6)

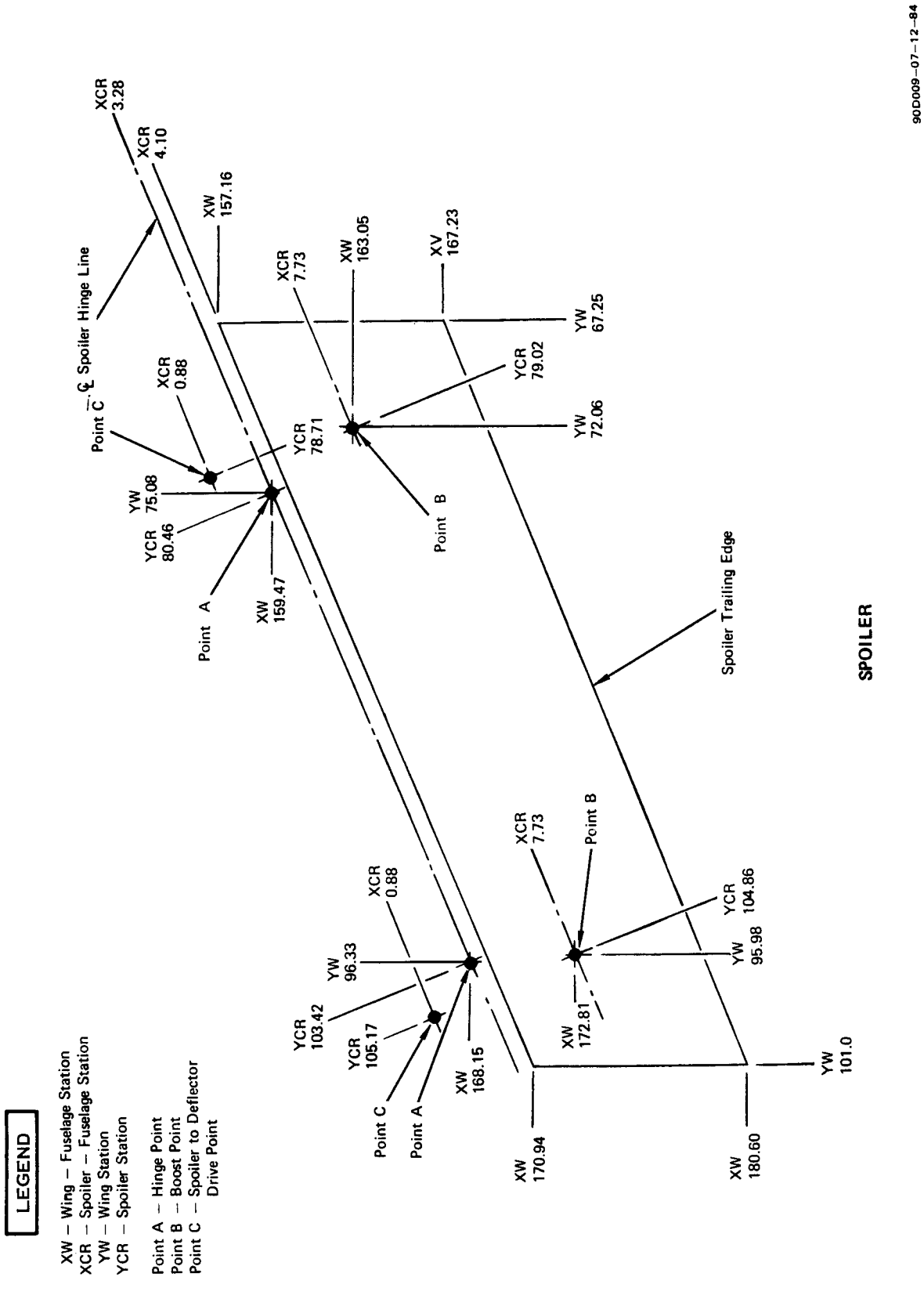

Figure 1-5. Airplane Principal Stations and Waterlines (Sheet 7)

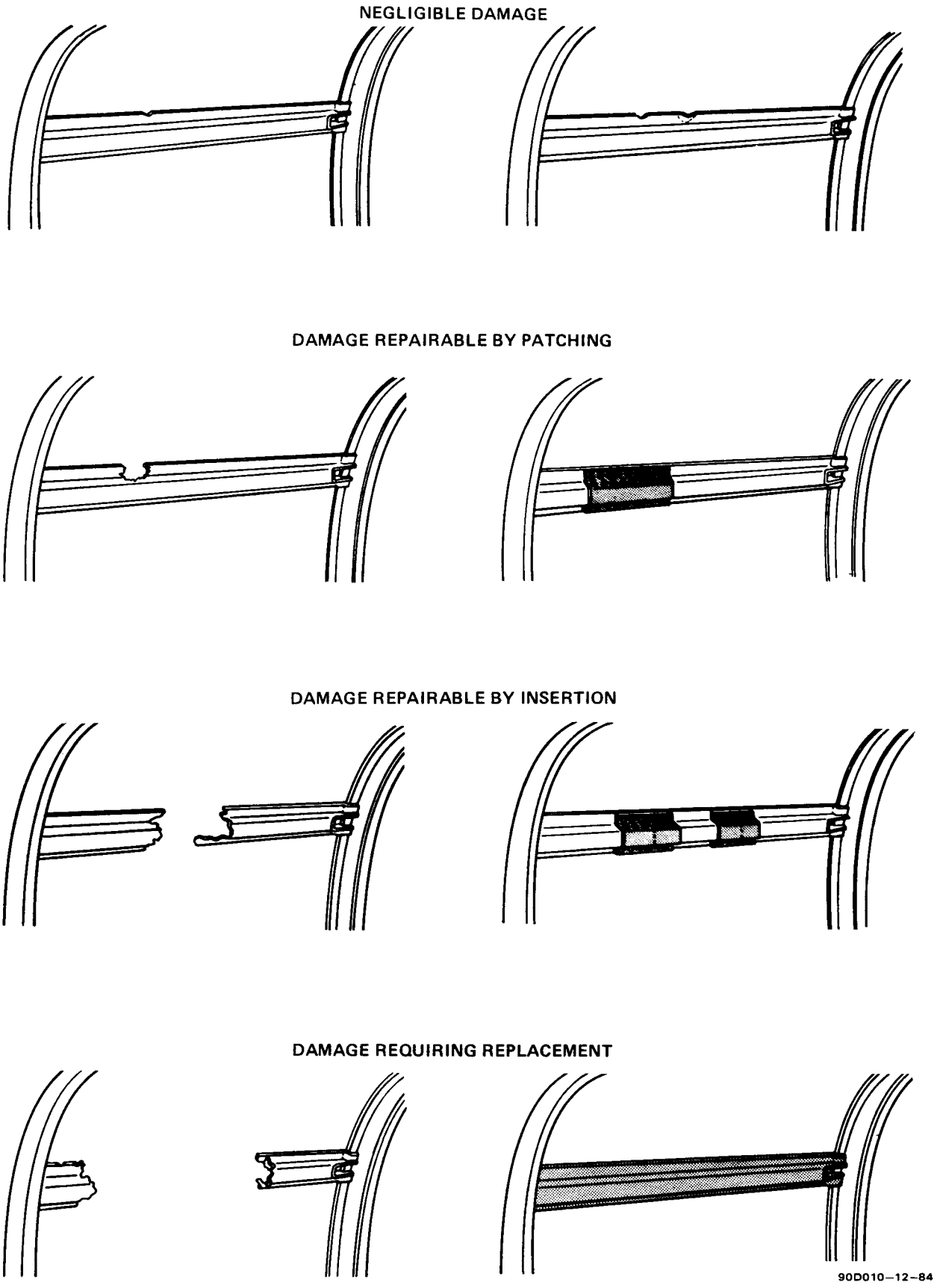

Figure 1-6. Classification of Damage

NOTE

1. Shear buckles run uniformly at approximate 45° angles, normally do not cross fastener rows, and generally do not require repair. If buckles cross fastener rows, internal damage is indicated and requires repair.

2. Compression buckling is not uniform, may cross fastener rows, is usually associated with internal damage and must be repaired.

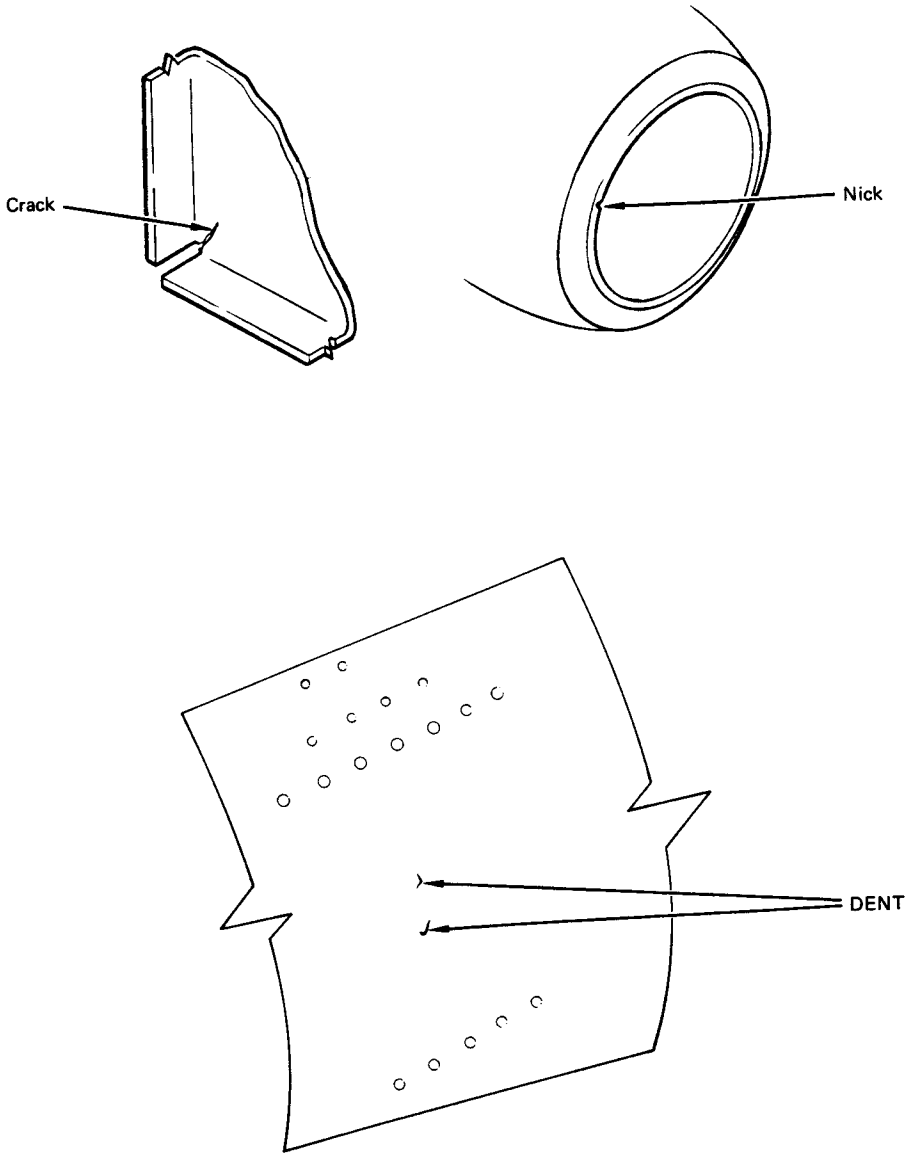

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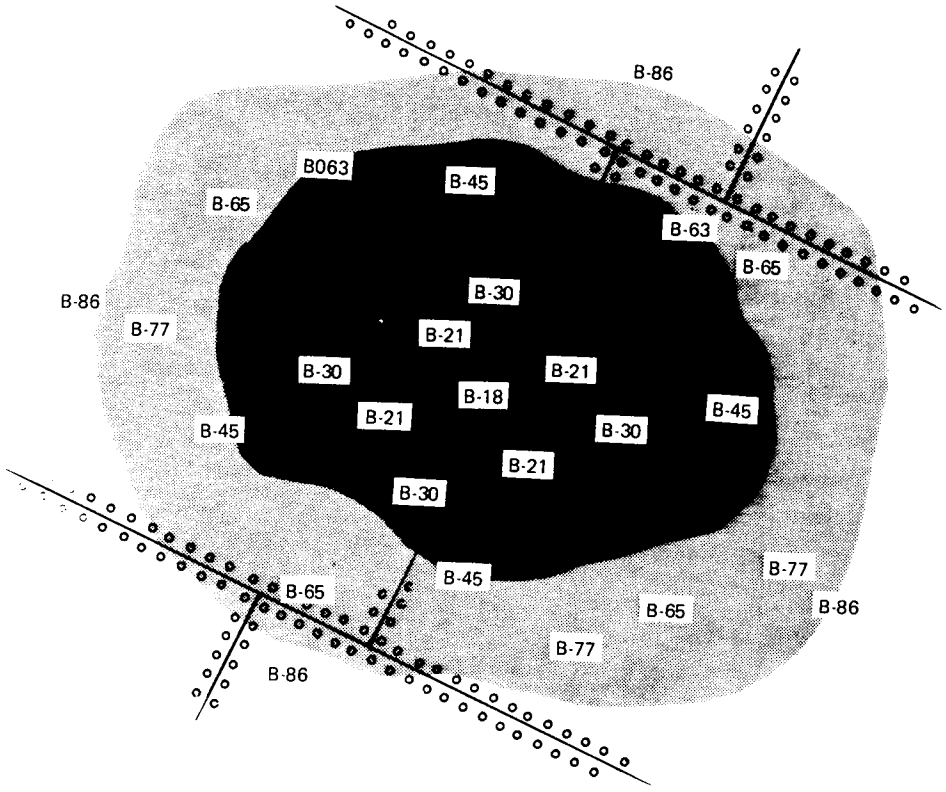
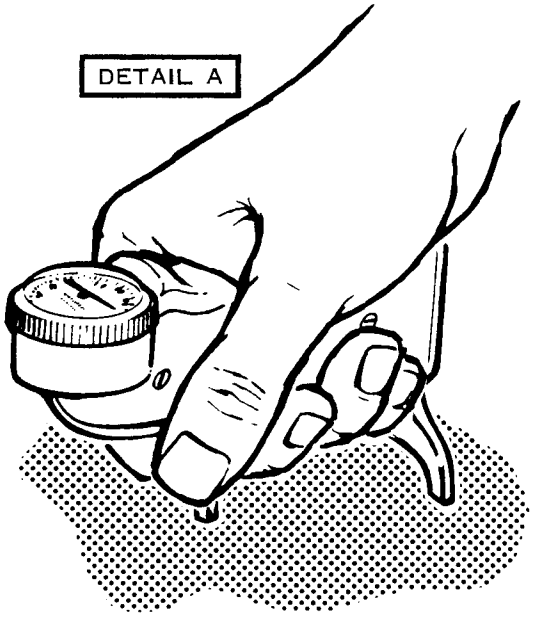
Figure 1-7. Examples of Damage



7075-T6 ALUMINUM ALLOY SKIN PANEL



ERNST PORTABLE
HARDNESS TESTER

PROCEDURE

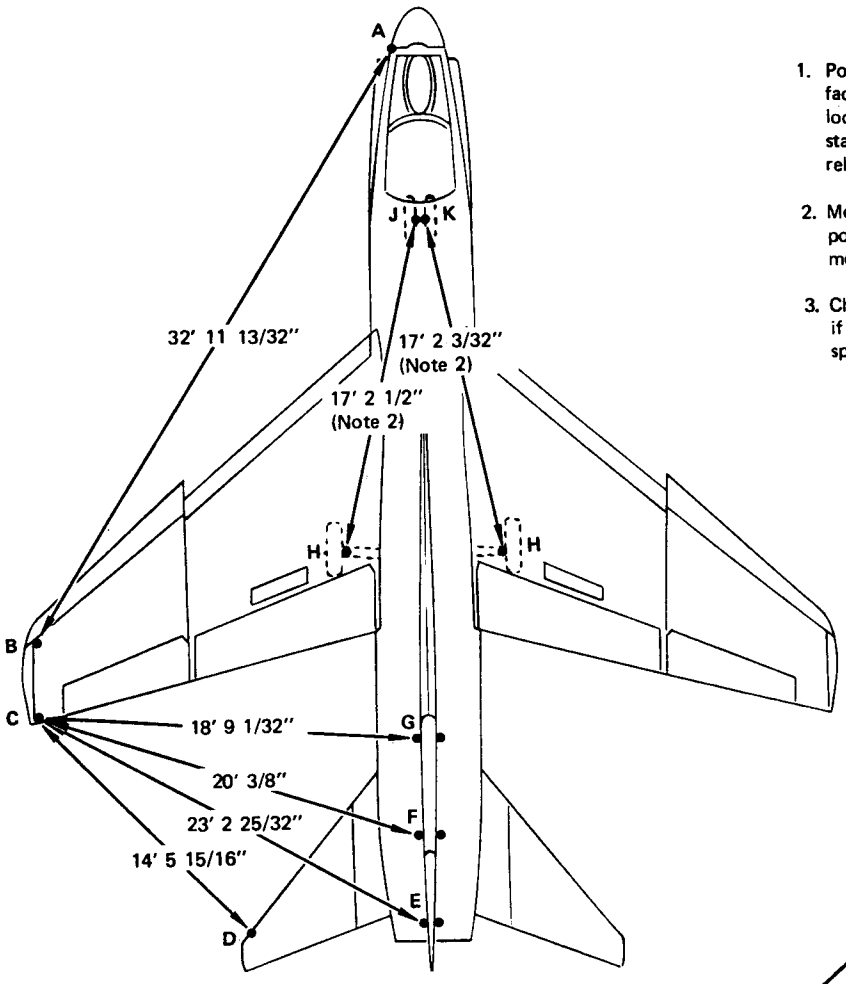
1. When using portable hardness tester, as shown in detail A, an even and constant pressure must be applied until reading is obtained.
2. Take readings beginning at center of damage and work outward.
3. Take readings until minimum acceptable Rockwell readings are obtained.
4. The area bounded by the minimum acceptable readings has been weakened and should be subjected to a more thorough strength test.

NOTE

1. Acceptable Rockwell reading for 7075-T6 aluminum alloy skin is B73 to B90.
2. See text for further information on hardness testing.

90D012-12-84

Figure 1-8. Hardness Test Readings Showing Typical Fire Damage



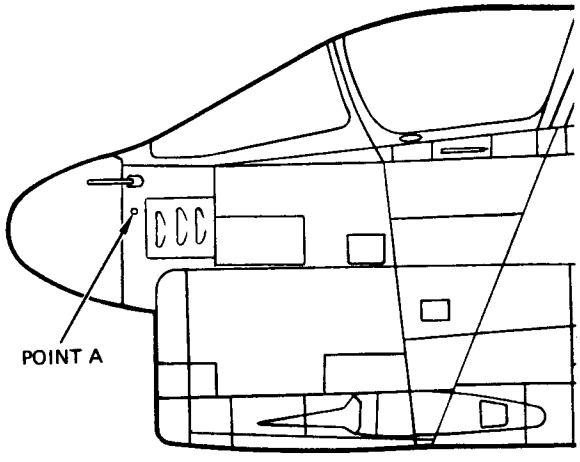
MEASURING POINT LOCATIONS

ALIGNMENT CHECK

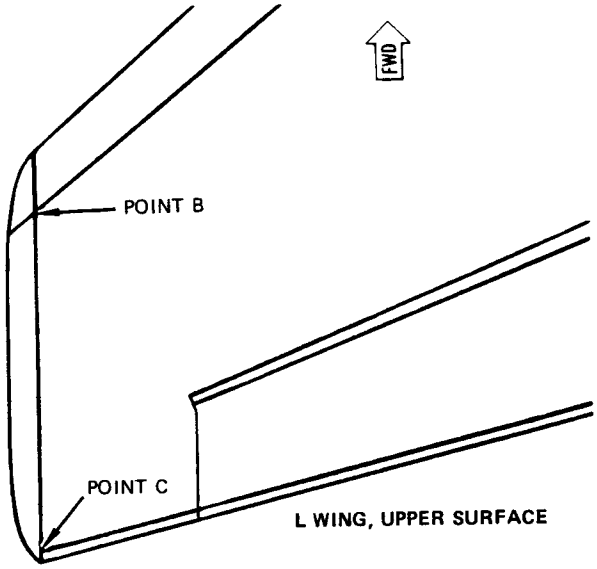
1. Position airplane on a smooth level surface with the outer panels spread and locked, flaps retracted, and horizontal stabilizer at 3° trailing edge up with relation to water line (Z axis).
2. Measure distances between indicated points. Use a 50-foot metallic tape measure.
3. Check the airplane for structural damage if measurements are not within tolerance specified.

NOTE

1. When comparing dimensions between like points on L and R side of the airplane (symmetrical dimensions), the tolerance should be ±1.0 inch. When comparing dimensions to the calculated values shown, the tolerance should be ±2.0 inches.
2. These two landing gear dimensions should be taken on a fully equipped airplane with full internal fuel with the airplane sitting on it's gear. If the airplane weight varies greatly from 32,000 pounds and CG of approximately 27.7% MAC, these dimensions may vary considerably. Weight and balance determination required (T.O. 1A-7D-5 and T.O. 1A-7D-1).



L SIDE, FUSELAGE



L WING, UPPER SURFACE

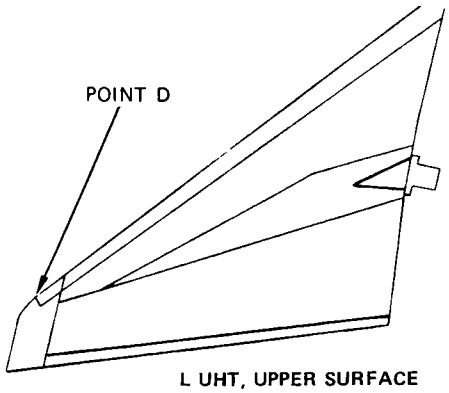
A Located at aft edge of inlet duct screen attaching holes.

B Located at outboard leading edge of upper milled skin on wing outer panel.

C Located at the intersection of trailing edge skin and wing tip.

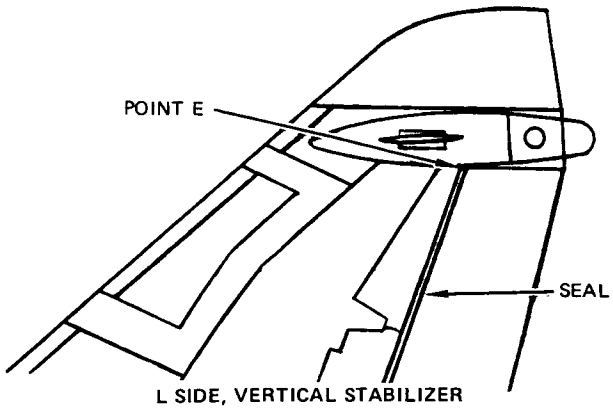
90D013-01-12-84

Figure 1-9. Airplane Alignment Check (Sheet 1 of 2)



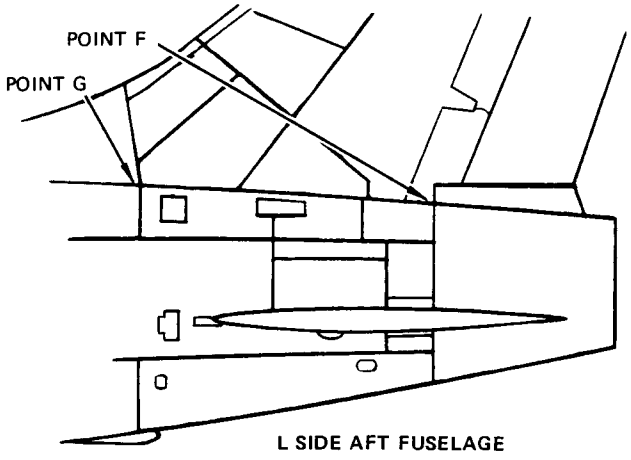
L UHT, UPPER SURFACE

D Located at joint between end cap and UHT leading edge.



L SIDE, VERTICAL STABILIZER

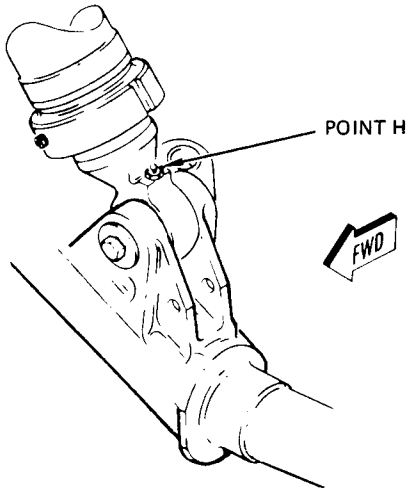
E Located at aft edge of tail fin skin. Do not measure from any point on the attached seal.



L SIDE AFT FUSELAGE

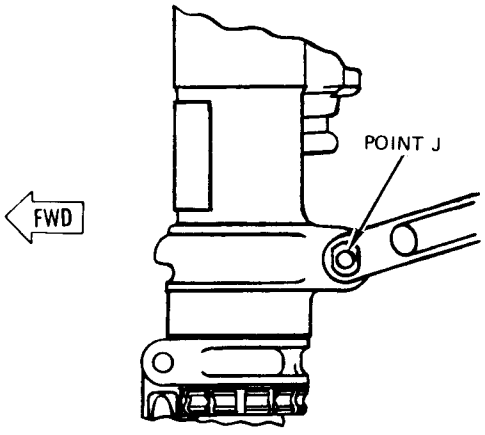
F Located at aft edge of milled skin at intersection between vertical stabilizer and fuselage (Station 665.75).

G Located at dorsal joint where vertical stabilizer and fuselage intersect (Station 590.3125).



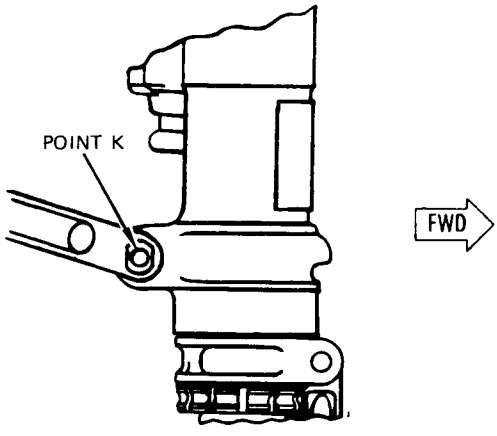
MAIN LANDING GEAR (TYPICAL)

H Located at centerline of zerk fitting 0.98 inch up from main landing gear lower strut attachment.



L SIDE, NOSE LANDING GEAR

J Located at center line of zerk fitting for drag link to nose gear strut attachment.

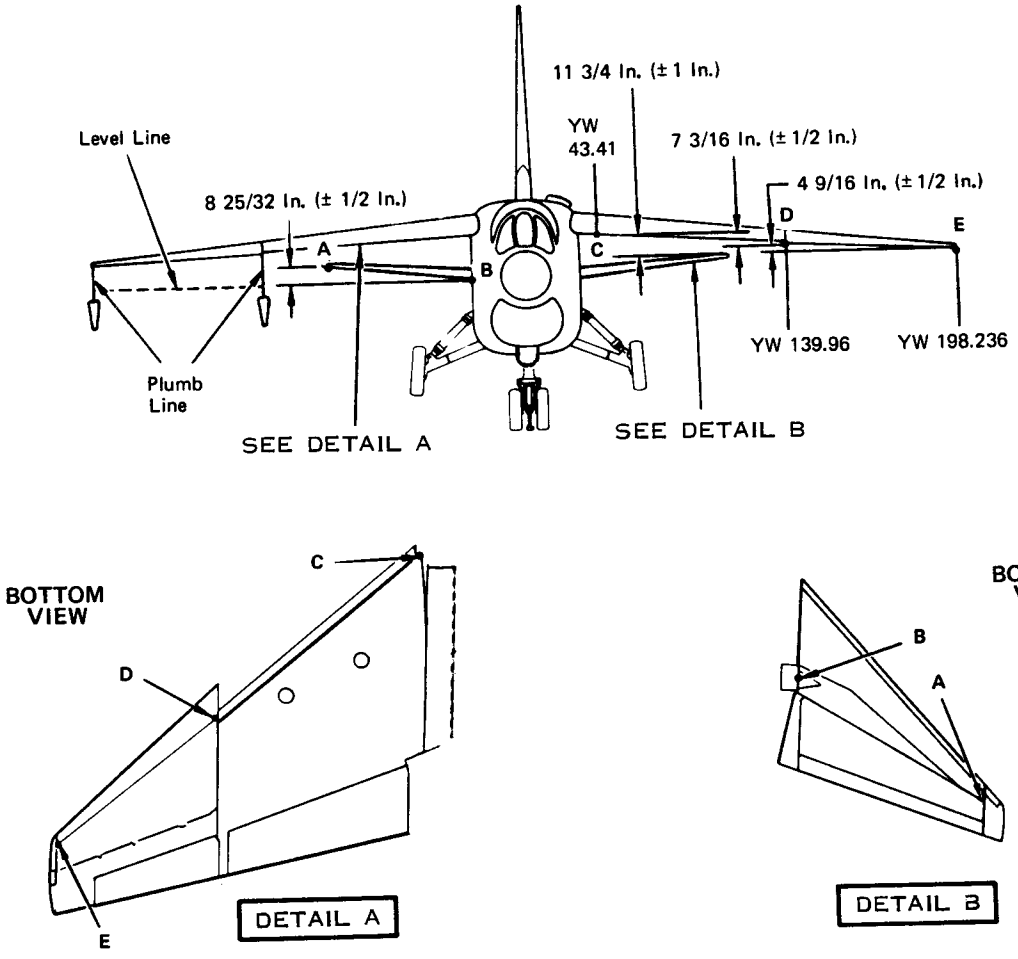


R SIDE, NOSE LANDING GEAR

K Located at centerline of pin attaching drag link to nose gear strut.

90D013-02-12-84

Figure 1-9. Airplane Alignment Check (Sheet 2)



CHECK POINT LOCATIONS

POINT

A Located at the joint between the cap and spar on the centerline of the lower surface of the horizontal stabilizer.

B Located at the centerline of the lower surface of the torque tube shaft fitting below the horizontal stabilizer.

C Located at the forward, inboard corner of the lower milled skin on the wing center section.

D Located at the forward, inboard corner of the lower milled skin on the wing outer panel.

E Located at the forward, outboard corner of the lower milled skin on the wing outer panel.

90D014-12-84

Figure 1-10. Wing and Horizontal Stabilizer Symmetry Check

SE REQUIRED

Engineers transit with tripod

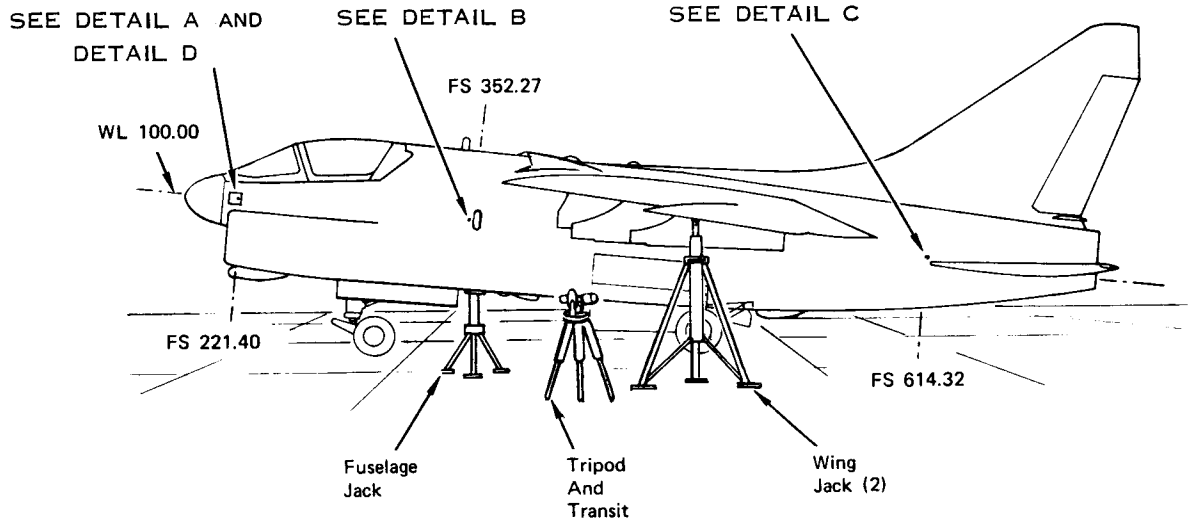
2 precision steel scales (calibrated in 1/32–inch or smaller increments).

OPTICAL LEVELING PROCEDURE

WARNING

Observe airplane jacking safety precautions
Refer to T. O. 1A-7D-2-1

A. Jack entire airplane. Refer to T. O. 1A-7D-2-1



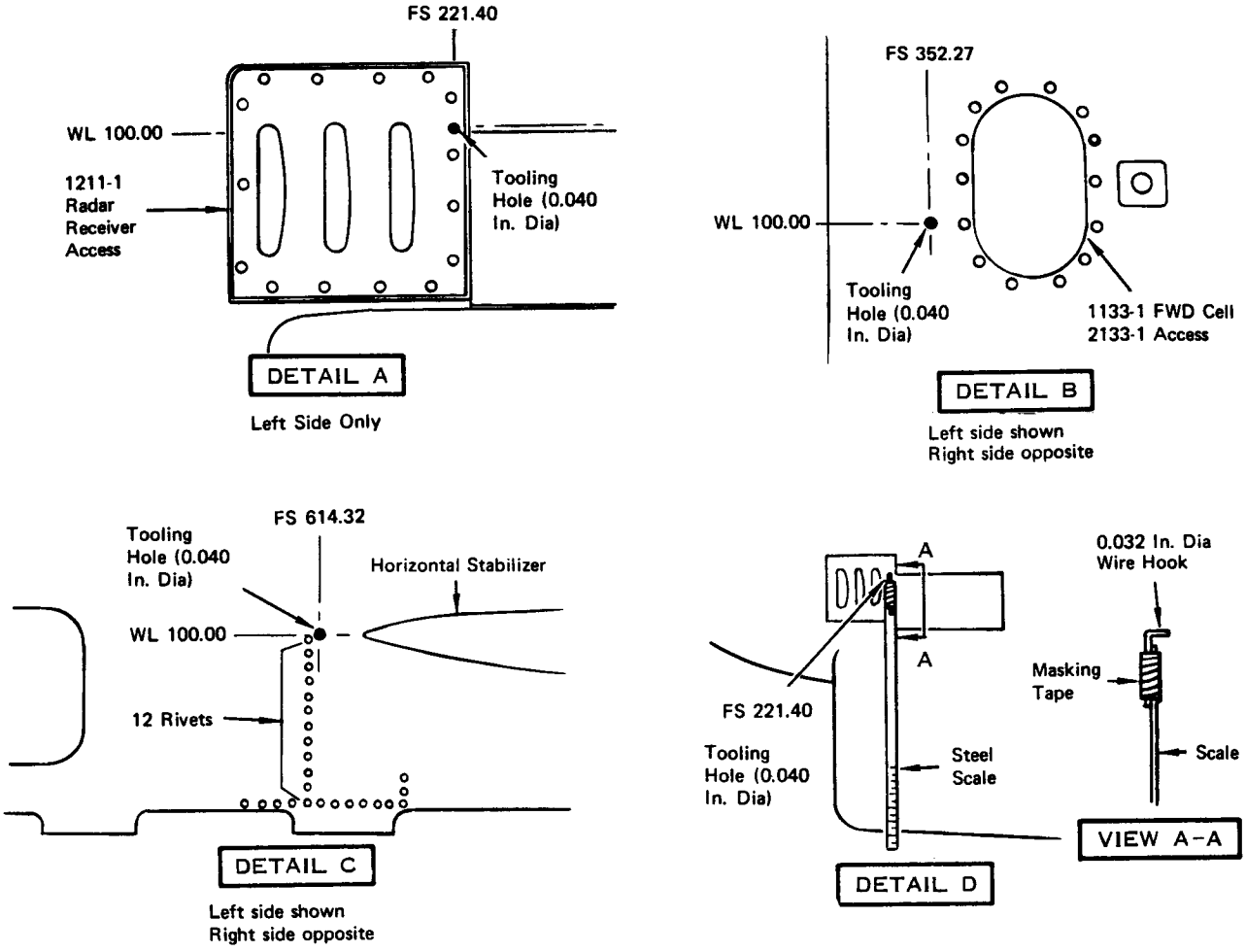
B. Set up tripod and transit at a position near left or right wingtip leading edge.

C. Adjust tripod height to project transit line-of-sight on a horizontal plane below airplane fuselage.

D. Locate tooling alignment holes along WL 100.00 on left and right side of fuselage at FS 221.40 (Detail A, left side only), FS 352.27 (Detail B, and FS 614.32 (Detail C).

90D015–01–12–84

Figure 1-11. Airplane Optical Leveling (Sheet 1 of 3)



NOTE

Remove radar receiver access 1211-1 and locate FS 221.40 tooling hole in bulkhead if hole has not been drilled in access cover.

E. Tape A length of 0.032–inch diameter wire to each steel scale. Leave approximately 1/2 inch of wire extending beyond end of scale. Bend end of wire over end edge of scale to form a right angle to scale. (See Detail D.)

NOTE

Make sure overall length and measuring increments of both scales are identical with wire hooks attached.

F. Attach one scale to left side of fuselage at FS 221.40 and one at FS 614.32 (See Details A and C.)

NOTE

Make sure scales extend at least 6 inches below transit line-of-sight. Do not change transit elevation after first reading.

90D015–02–12–84

Figure 1-11. Airplane Optical Leveling (Sheet 2)

G. Check level of transit, Transit must be in perfect horizontal plane. Sight transit on forward scale (FS 221.40) and record reading.

H. Swing transit to aft scale and record reading.

I. Compare readings obtained in steps G and H. If readings do not coincide, adjust fuselage jack to equalize forward and aft scale readings.

NOTE

When the two scale readings coincide, the airplane is longitudinally level.

J. Remove scales from forward and aft tooling holes. Attach scales to tooling holes on left and right side of fuselage at FS 352.27. (See Detail B.)

K. Check level of transit. Sight transit on left scale and record reading. Sight transit on right scale and record reading.

L. Compare readings obtained in step K. If readings do not coincide, raise low wing jack until left and right scale readings are equal.

NOTE

When the two scale readings coincide the airplane is laterally level.

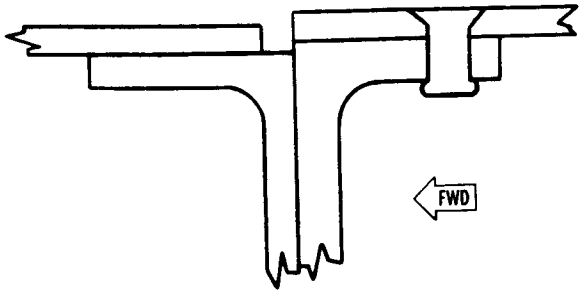
M. Recheck both longitudinal and lateral level indications by repeating steps F, G, H, J and K. All readings shall be equal or within 1/16—inch maximum difference between highest and lowest readings.

N. Repeat steps F through M if readings are not within limits specified in step M.

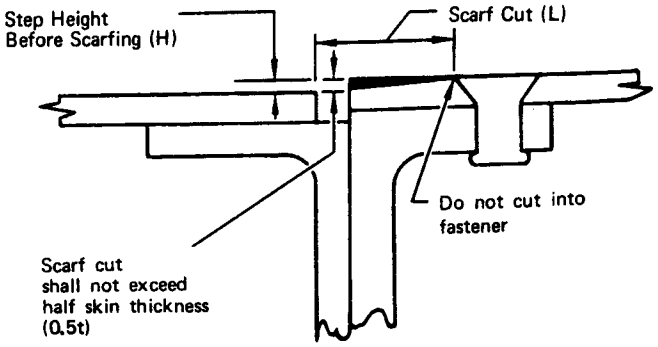
O. Lower airplane from jacks and secure when required work is completed. Refer to T.O. 1A-7D-2-1.

90D015-03-12-84

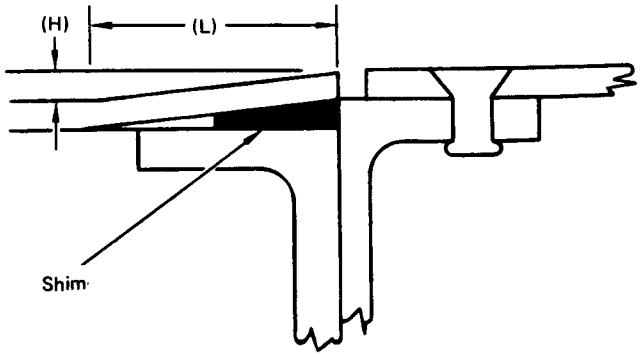
Figure 1-11. Airplane Optical Leveling (Sheet 3)



Positive Step



Positive Step Reworking By Scarfing. Refer to step correction formula.



Positive Step Rework by Shimming. Wave produced by this repair should be within wave tolerance given in Figure 1-13.

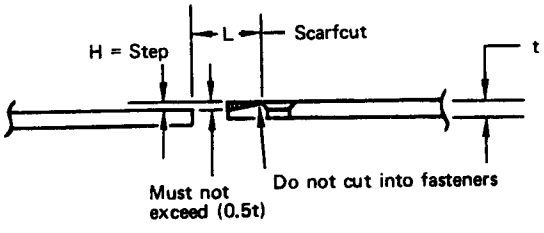
STEP CORRECTION FORMULA

This formula is typical for positive and negative steps exceeding maximum tolerances (figures 1-14 through 1-18). Applicable to steps reworked by scarfing and fairing compound.

NOTE

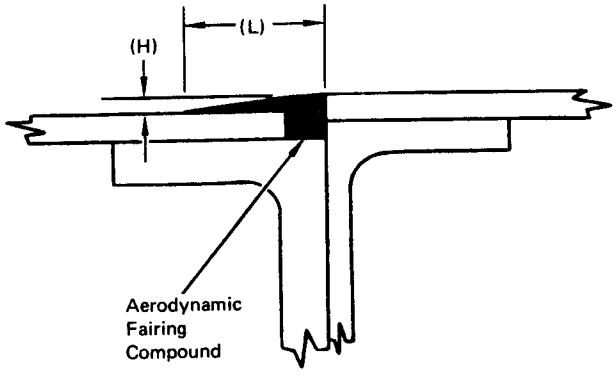
Scarf cut or fairing compound dimension (L) shall not exceed 10% of joint length.

Example:



Wing, vertical stabilizer and horizontal stabilizer:
Maximum ratio H/L = 0.02 inch

Fuselage:
Maximum H/L = 0.04 inch



Positive Step Reworked With Aerodynamic Fairing Compound. Refer to step correction formula.

90D016-01-12-84

Figure 1-12. Aerodynamic Discrepancy Repairs (Sheet 1 of 4)

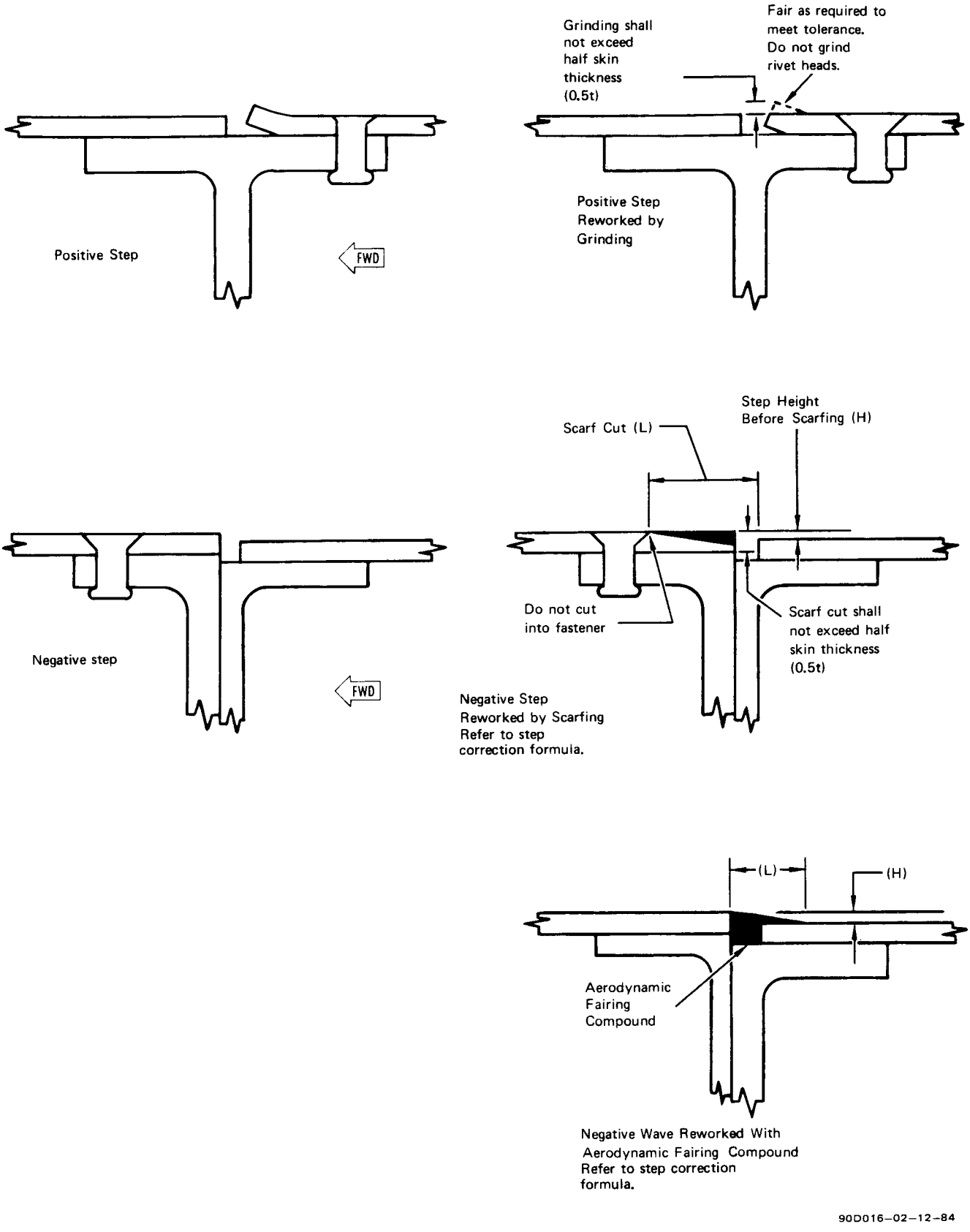
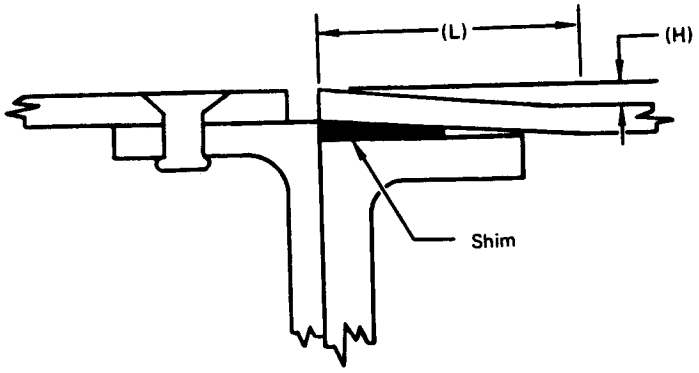
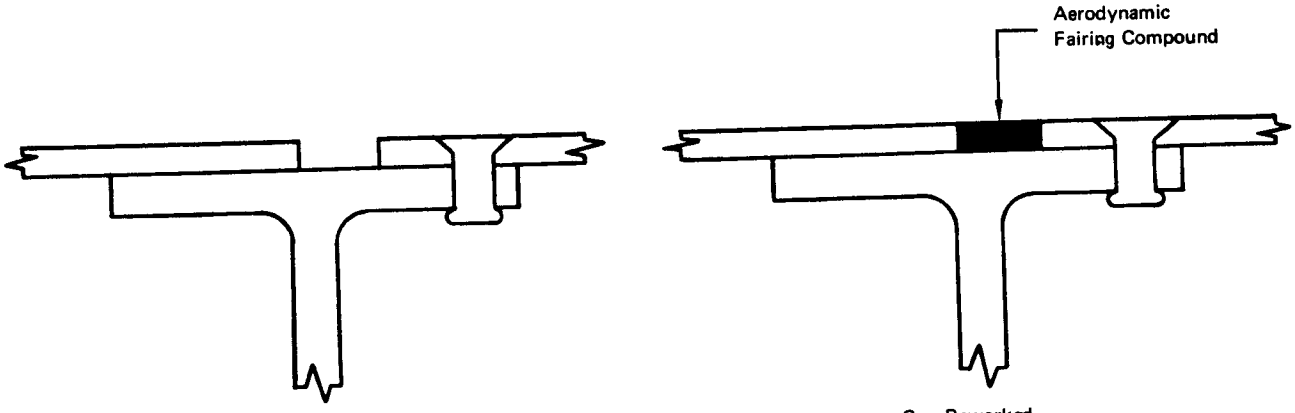


Figure 1-12. Aerodynamic Discrepancy Repairs (Sheet 2)

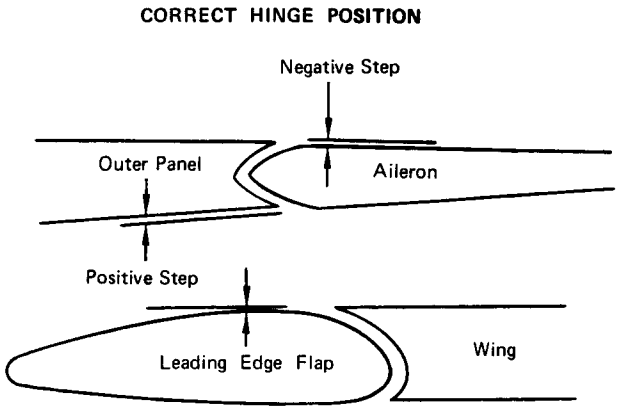


Negative Step Reworked By Shimming Wave produced by this repair should be within wave tolerance given in figure 1-13.



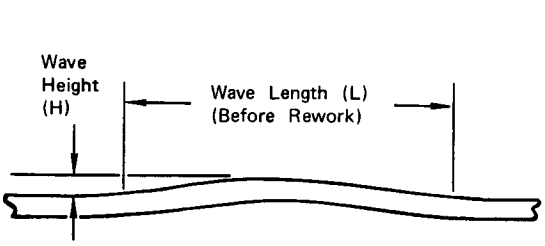
90D016-03-12-84

Figure 1-12. Aerodynamic Discrepancy Repairs (Sheet 3)

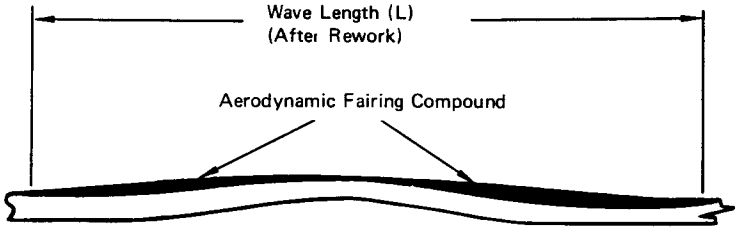


Positive and Negative Step

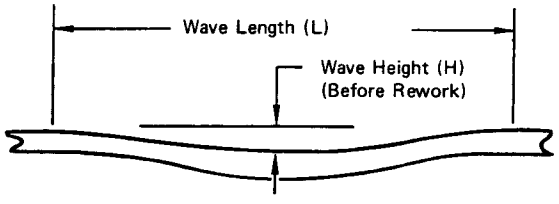
Step correction is made by adjusting hinge (T.O. 1A-7D-2-8). See Figures 1-14 through 1-18 for tolerances.



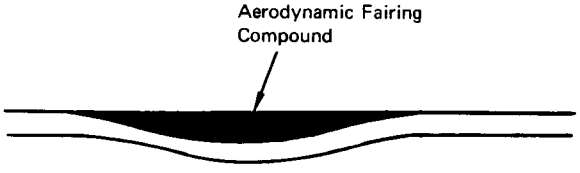
Positive Wave



Positive Wave Reworked With Aerodynamic Fairing Compound. See Figure 1-13 for wave tolerances.



Negative Wave

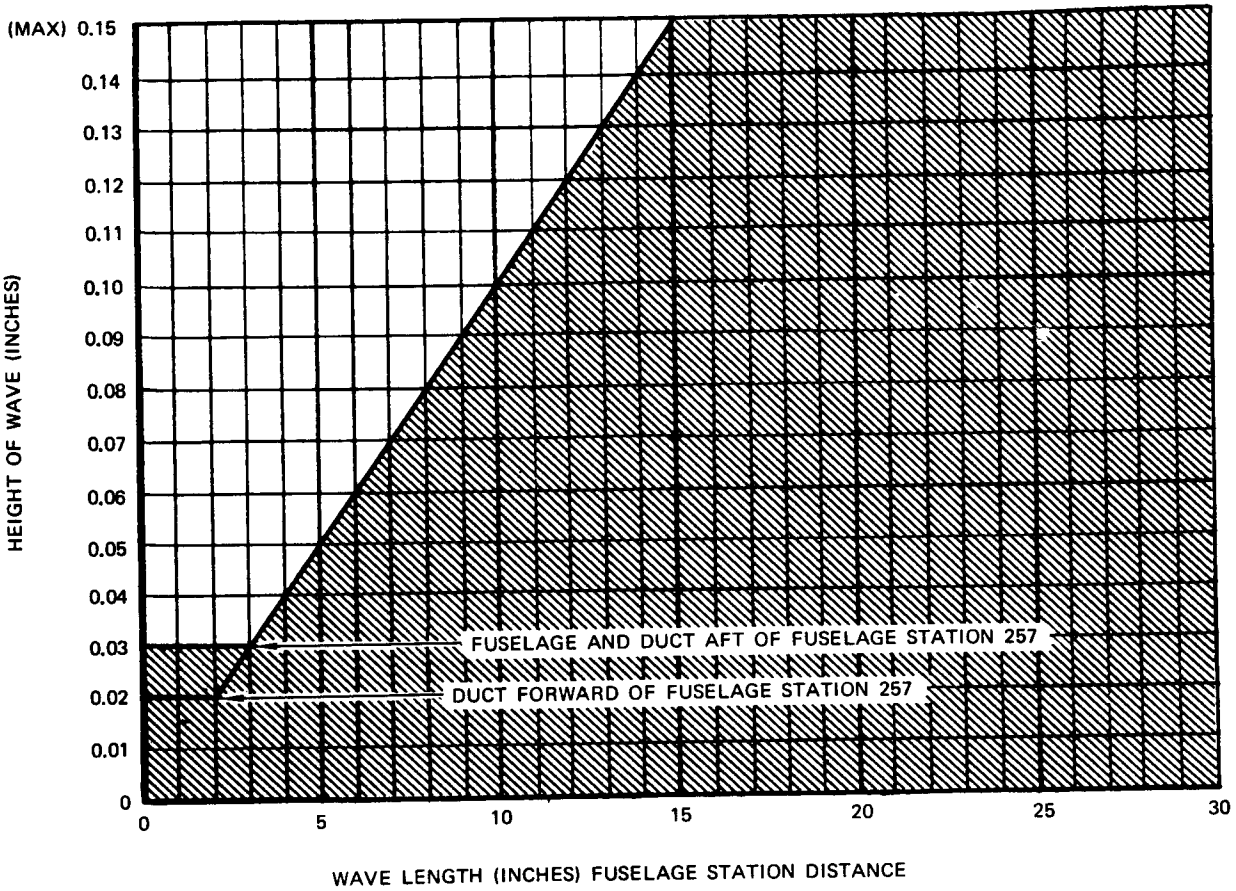


Negative Wave Reworked With Aerodynamic Fairing Compound. See Figure 1-13 for wave tolerances.

90D016-04-12-84

Figure 1-12. Aerodynamic Discrepancy Repairs (Sheet 4)

FUSELAGE, WINDSHIELD, CANOPY, AND ENGINE AIR DUCT

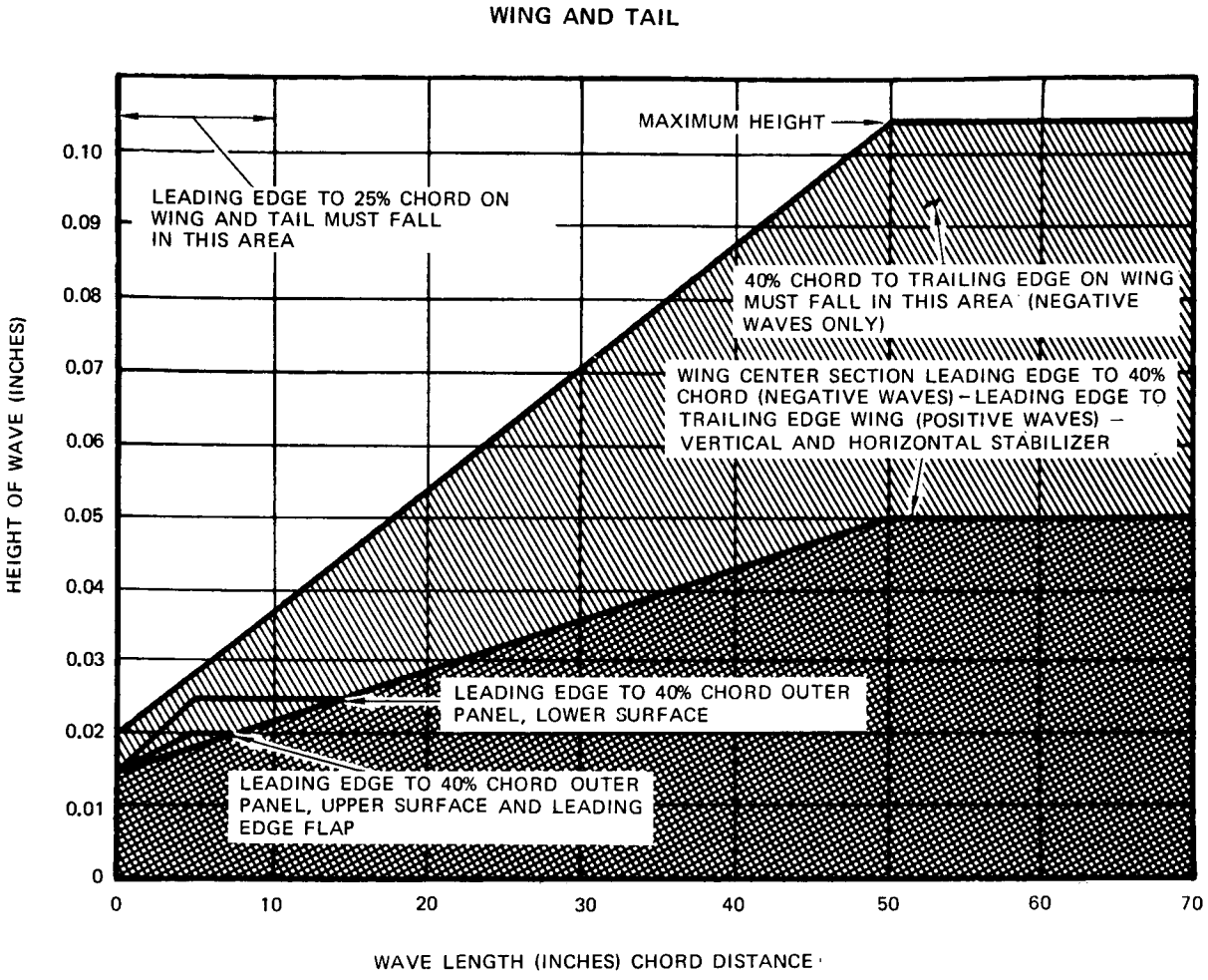


NOTE

1. Wave dimensions are aerodynamic tolerances only and are not intended to restrict the structural acceptability of the airplane.
2. Height of wave must be within shaded area for all values of wave length.

90D017-01-12-84

Figure 1-13. Permissible Wave Heights (Sheet 1 of 2)



NOTE

1. Compound direction waves revealed by an element wise check indicates a flat or concavity in contour which shall be repaired.
2. Wave heights between 0.02 inch and 0.04 inch may be filled with MIL-S-8802 fairing compound.
3. Wave dimensions are aerodynamic tolerances only and are not intended to restrict the structural acceptability of the airplane.
4. Height of wave must be within shaded area for all values of wave length.

90D017-02-12-84

Figure 1-13. Permissible Wave Heights (Sheet 2)

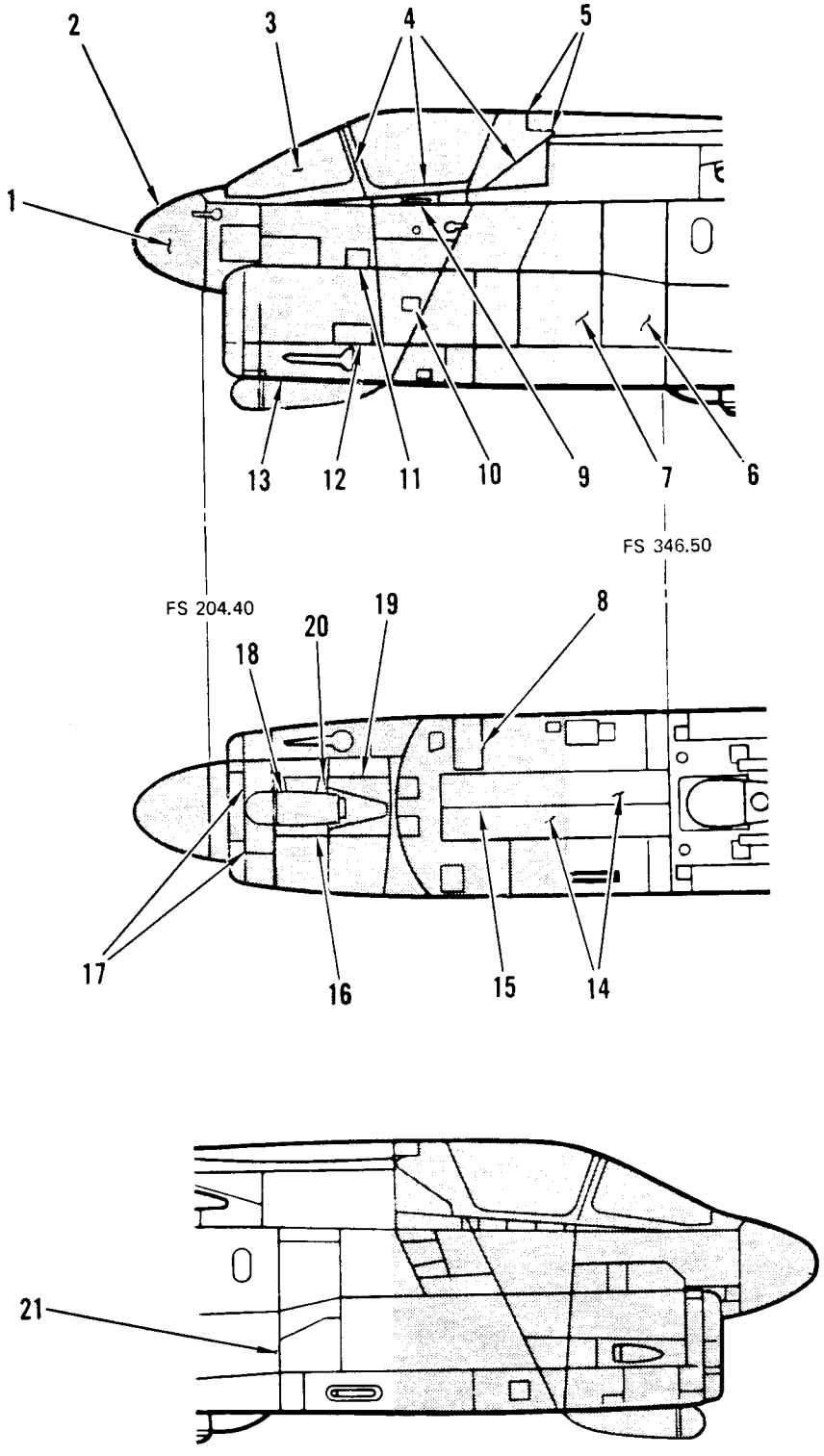
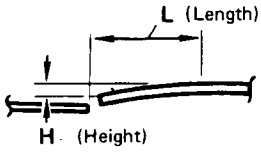
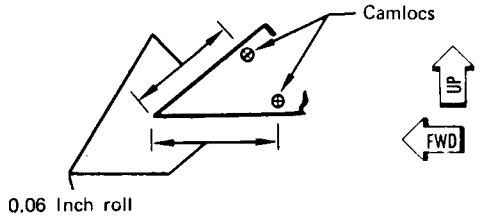


Figure 1-14. Forward Fuselage Aerodynamic Skin Tolerances (Sheet 1 of 4)



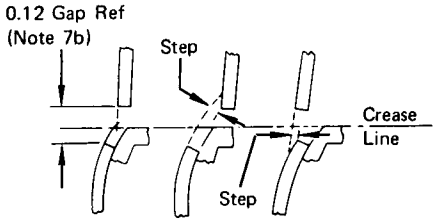
A Roll Defined As Shown, Above

DETAIL A



Gun Access Door

DETAIL B



Canopy

DETAIL C

AERODYNAMIC SMOOTHNESS TOLERANCES (NOTES 1 AND 2)

Index No.	Area	Max Step (Inches)	Max Gap (Inches)
	Fuselage Forward Section		
1	Forward of FS 204.4	0.03	
2	Nose cone to fuselage:		
	A. Above hinge line		0.09
	B. Below hinge line		0.06
3	Windshield to adjacent surfaces: (Note 2)	0.025	0.06
4	Canopy to adjacent surfaces: (Note 7) (Detail C)		
	A. Forward and lower edge		0.12
	B. Aft edge		0.21
	C. Aft facing and longitudinal edges (cockpit unpressurized)	0.06	
	D. Forward facing edges (cockpit unpressurized)	0.04	
	E. All edges (cockpit pressurized)	0.15	
5	Canopy aft edge along aft facing arc	0.06	0.21
6	Lox door		
	A. Entire periphery (except 0.06 step is permissible for 25% of periphery excluding leading edge).		
	B. Roll (defined in Detail A): 0.03 inch roll height is permissible up to 25% of periphery to obtain step limits.		

90D018-02-12-84

Figure 1-14. Forward Fuselage Aerodynamic Skin Tolerances (Sheet 2)

Index No.	Area	Max Step (Inches)	Max Gap (Inches)
7	Gun access door (see Detail B)		
8	Gun access door forward edge	0.06 (Note 5)	
9	Canopy access latch		0.06
10	Pilot's center step		
	A. Side and upper edges		0.09
	B. Lower edge		0.020
11	Pilot's upper step:		
	A. Side and upper edges		0.06
	B. Lower edge		0.20
12	Pilot's lower step		0.06
13	Engine air duct (inside surface):		
	A. Lip surface (forward 10 inches). All nicks and irregularities shall be blended out.	0.10 (Note 3)	
	B. Forward of FS 346.5 except longitudinal skin joint between FS 306.8 and 346.5	0.010	0.03
	C. Longitudinal skin joint between FS 221.8 and 306.8 for 40% of length		0.05
	D. Longitudinal skin joint between FS 306.8 and 346.5	0.010	0.09
	E. Skin joint at FS 346.5 and aft	0.03	0.09
14	Nose gear door		
	A. Entire periphery (except 0.06 step is permissible for 25% of periphery excluding leading edge)	0.03	0.18
	B. Roll (defined in Detail A): 0.03 inch roll height is permissible for 25% of periphery to obtain step limits		
15	Between nose gear doors (Note 8)		0.125
16	Door assembly (right)		
	A. Forward edge		0.12
	B. Aft edge		0.06
17	Door assembly (left and right) forward, aft, and outboard edges		0.09
18	Detector pod. Between left forward support and left access door		0.06
19	Cover assembly		
	A. Left and right forward edges		0.06
	B. Aft and longitudinal edges		0.12
20	Door assembly (left)		
	A. Forward edge	0.05	0.12
	B. Aft edge	0.05	0.06
21	Ram air turbine door		
	A. Up to 75% of periphery	0.03	
	B. Up to 25% of periphery	0.06	

90D018-03-12-84

Figure 1-14. Forward Fuselage Aerodynamic Skin Tolerances (Sheet 3)

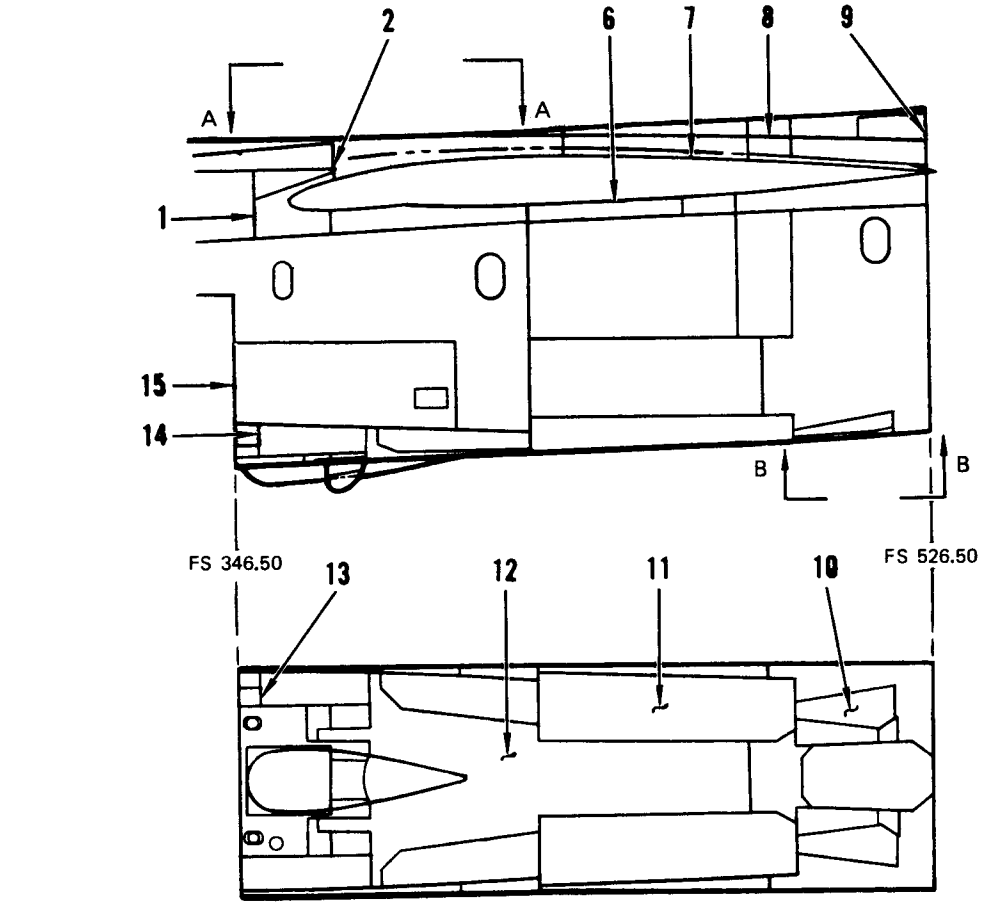
NOTE

Fuselage Forward Section

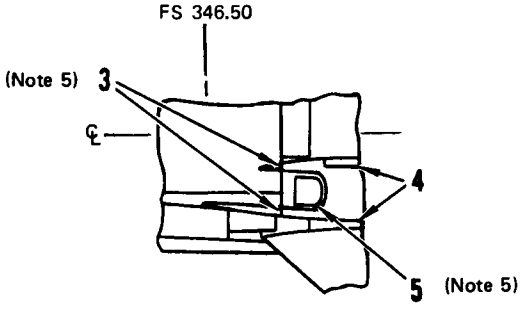
1. All dimensions are in inches and include final finish unless otherwise noted.
2. Maximum wave tolerances are given in permissible wave heights charts (Figure 1-13).
3. Maximum step before finishing. After finishing, contour shall be smooth to feel and have maximum of 0.01 aft facing step.
4. Gaps up to +0.03 over tolerance are permissible if length does not exceed 10 percent of total length of abutting edges.
5. Tolerance dimension in combined height of step and wave.
6. Minimum gap shall be 0.002 unless otherwise noted.
7. a. Along longitudinal crease line, measure steps at intersection of canopy and fuselage by extending contour (Detail C).
   b. No step exists when intersection of contours fall in gap area. Wider retainer strips may be installed on the canopy in order to meet the canopy-to-adjacent surface gap tolerances.
8. New doors shall be trimmed to gap requirement 0.120; however, reworked/salvaged doors which exceed these requirements are satisfactory as long as seal makes contact.

90D018-04-12-84

Figure 1-14. Forward Fuselage Aerodynamic Skin Tolerances (Sheet 4)

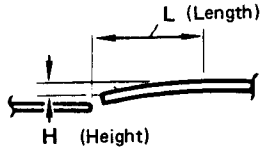


MID—FUSELAGE SECTION



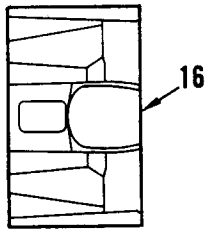
VIEW A-A

Air Refueling Cavity



A Roll Defined As Shown, Above

DETAIL A



VIEW B-B

90D019-01-12-84

Figure 1-15. Mid-Fuselage Aerodynamic Skin Tolerances (Sheet 1 of 3)

AERODYNAMIC SMOOTHNESS TOLERANCES (NOTES 1 AND 2)

Index No.	Area		Max Step (Inches)	Max Gap (Inches) Note 4
1	Wing leading edge fairing to fuselage			0.31
2	Forward edge of wing root fairing			0.18
	A. Forward facing edge		0.06	
	B. Aft facing edge		0.12	
3	IFR slip-way area wing to fuselage	Positive Negative	0.12 0.12	0.22 0.10 (min)
4	Air refueling cavity side panels			0.09
5	Air refueling cavity door			0.16
6	Lower wing center section to fuselage			0.37
7	Upper wing center section to fuselage			0.19
8	Aft edge of wing root fairing			0.28
9	Dorsal skin to mid fuselage, FS 326.5			0.11
10	MLG actuating cylinder (drag strut) door			
	A. Entire periphery		0.05	
	B. Roll (defined by Detail A) 0.03 inch roll height is permissible up to 40% of periphery to obtain step limits.			
11	Along forward and aft ends of main landing gear doors			0.22
12	Speed brake			
	A. Around entire periphery		0.09	
	B. In radome contour fairing			0.019 (Note 3)
	C. Forward of FS 423.5			0.125
	D. Aft of FS 423.5			0.25
	E. Aft edge of speed brake			0.125
	F. Rolls (defined by Detail A)			
	1. 0.06 inch roll height is permissible for 15% of periphery to obtain step limits			
	2. 0.03 inch roll height is permissible for 40% of periphery to obtain step limits			
	3. Roll factor (RF) for 0.03 inch and 0.06 inch roll height is 0.06 minimum (H/L = RF). Dimensions L and H may be determined if one dimension is known and using 0.06 min (RF) as a constant.			
	Example: $\frac{H}{RF} = L$ (minimum) or $L \times RF = H$ (maximum)			
	4. Longitudinal chine fairing skins may be rolled along length to fair skin above chine hinge.			

90D019-02-12-84

Figure 1-15. Mid-Fuselage Aerodynamic Skin Tolerances (Sheet 2)

AERODYNAMIC SMOOTHNESS TOLERANCES (NOTES 1 AND 2)

Index No.	Area	Max Step (Inches)	Max Gap (Inches) Note 4
13	Access door to removable panel		0.12
14	Avionics access door A. Leading edge B. Up to 30% of periphery excluding leading edge C. Rolls (defined by Detail A) 0.03 inch roll height is permissible up to 25% of periphery to obtain step limits.	0.03 0.03	0.06
15	Between fixed skins at FS 346.50		0.09
16	Between aft edge of forward fairing assembly and forward edge of aft fairing assembly		0.10

NOTE

Fuselage Mid Section

1. All dimensions are in inches and include final finish unless otherwise noted.
2. Maximum wave tolerances are given in permissible wave height charts (Figure 1-13).
3. Minimum tolerance of 0.12 shall be maintained.
4. Minimum gap shall be 0.002 unless otherwise noted.
5. Do not use aerodynamic fairing compound to blend contour in this area.

90D019-03-12-84

Figure 1-15. Mid-Fuselage Aerodynamic Skin Tolerances (Sheet 3)

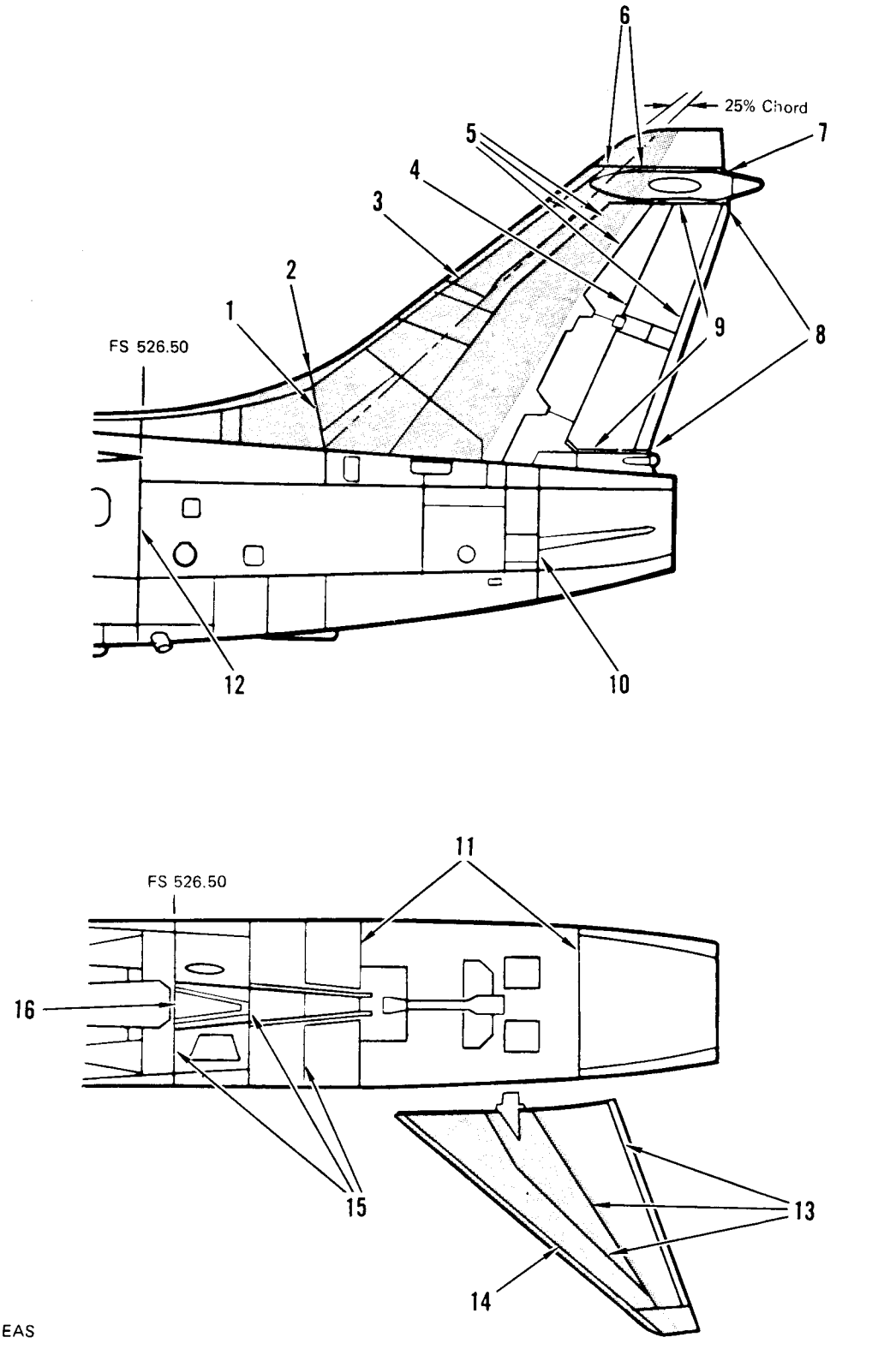


Figure 1-16. Aft Fuselage Aerodynamic Skin Tolerances (Sheet 1 of 2)

AERODYNAMIC SMOOTHNESS TOLERANCES (NOTES 1 AND 2)

Index No.	Area	Max Step (Inches)	Max Gap (Inches) Note 3
	Fuselage Aft Section		
1	Between dorsal skin and vertical stabilizer		0.06 (Note 4)
2	Vertical stabilizer expansion joint	Note 5	
3	Leading edge joint Step height before finishing. Contour shall be smooth to feel after painting and finishing	0.010	
4	Joint between rudder and fixed panel		
	A. Left side	0.020	
	B. Right side (forward step)	0.015	
	C. Right side (aft step)	0.020	
5	Forward steps Aft steps	0.015 0.020	
6	Vertical tail cap to vertical stabilizer	0.03	
7	Trailing edge of vertical cap, vertical tail fairing, and tail cone island fairing shall be within ±0.04 of rudder trailing edge at contour neutral (Y = 0)		
8	Rudder (upper and lower edge)		0.31
9	Rudder contour to vertical stabilizer contour	0.06 (contour mismatch)	
10	Along forward end of fairing assembly above engine removal door		0.10
11	Between fixed skins above longerons at FS 526.5	0.08	0.09
12	Along forward and aft ends of engine removal door	0.08	0.12
13	Horizontal stabilizer		
	A. Forward steps	0.015	
	B. Aft steps	0.020	
14	Leading edge joint Step height before finishing. Contour shall be smooth to feel after finishing	0.010	
15	Across bottom between longerons	0.08	0.09
16	Between forward edge of aft fairing assembly and aft edge of forward fairing assembly		0.10

NOTE

Fuselage Aft Section

1. All dimensions are in inches and include final finish unless otherwise noted.
2. Maximum wave tolerances are given in permissible wave height charts (Figure 1-13).
3. Minimum gap shall be 0.002 inches unless otherwise noted.
4. Gap opens when fuselage expands due to engine heat and closes when cooling occurs.
5. Allowable side movement of dorsal fairing is 0.08 inches either side of neutral axis (measured at aft end top center line).

90D020-02-12-84

Figure 1-16. Aft Fuselage Aerodynamic Skin Tolerances (Sheet 2)

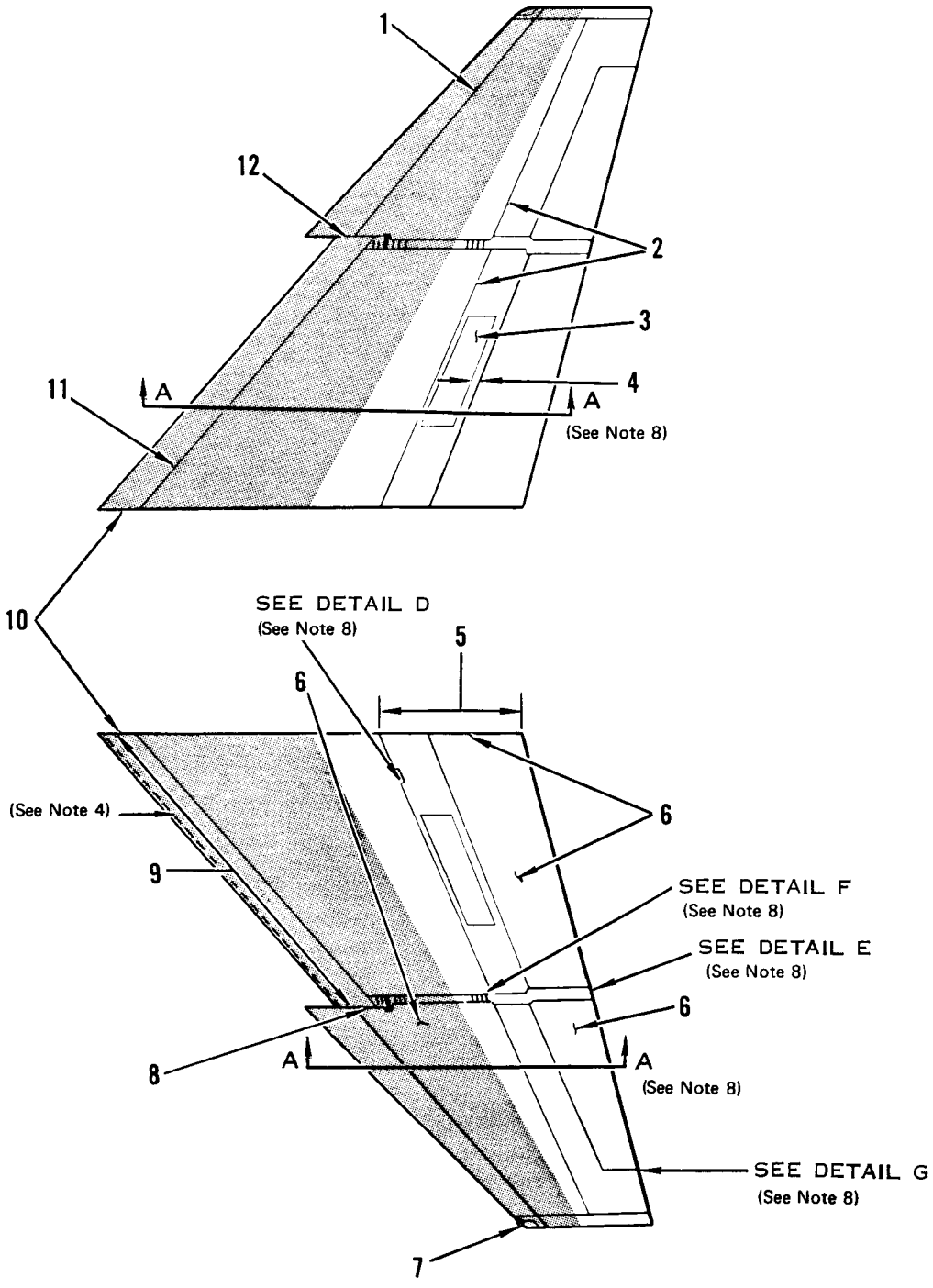


Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 1 of 7)

AERODYNAMIC SMOOTHNESS TOLERANCES (NOTES 1, 2, AND 8)

Index No.	Area	Max Step (Inches)	Max Gap (Inches) Note 5
	Wing Section		
1	Flap to outer panel (lower surface)		0.06
2	Trailing edge skin to adjacent structure		
3	Spoiler and deflector		
	A. Inboard, outboard, and aft edge of spoiler	0.025	0.18
	B. Forward edge	0.025	0.25
	C. Aft edge of deflector	0.025	0.31
4	Trailing edge to slot door and slot door to flap (lower surface)		0.12
5	Fuselage fairing along chord to flap and wing	0.125	0.37 Upper 0.48 Lower
6	Accumulative spanwise step between aileron to outer panel, aileron to flap, and flap to fuselage – clean condition, rigged	0.25	
7	Position light to adjacent surface	0.020	
8	Center section flap to outer panel	0.060	
9	Leading edge flap seal		
	A. Seal must be maintained for entire chord on at least one seal. Elsewhere, gap at seal shall not exceed 0.03		
	B. Where only upper surface is sealed, seal must be maintained for entire chord.		
10	Fuselage stub fairing to leading edge flap (step) 0.08 aft end, tapered to 0.18 at leading edge		
11	Flap to center section (lower surface)		
12	Step between inboard leading edge flap and fiberglass fairing on outboard leading edge flap	0.020	

NOTE

1. All dimensions are in inches and include final finish unless otherwise noted.
2. Maximum wave tolerances are given in permissible wave height charts (Figure 1-13).
3. Steps in leading edge flaps are classified as waves of zero chord.
4. Bow of center section and outer panel leading edge (measured perpendicular to leading edge in wing reference plane) shall not exceed 0.0005 per inch.
5. Minimum gap shall be 0.002 unless otherwise noted.
6. Measure steps and contour mismatch at droops, aileron, flaps, rudder, and wing fairing with surface aligned to the airfoil reference plane by contour board. Mismatch and step are developed by projecting continuity (Details H and J).
7. May be filled with aerodynamic fairing compound (paragraph 1-19.5).
8. See applicable section and/or detail views for tolerances not given in the aerodynamic smoothness tolerances chart.
9. Out of tolerance gaps at wing center section and outer panel leading edge flaps may be faired by building up thickness at aft edge of flap with glass fabric and epoxy resin as formulated in Section V.

90D021-02-12-84

Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 2)

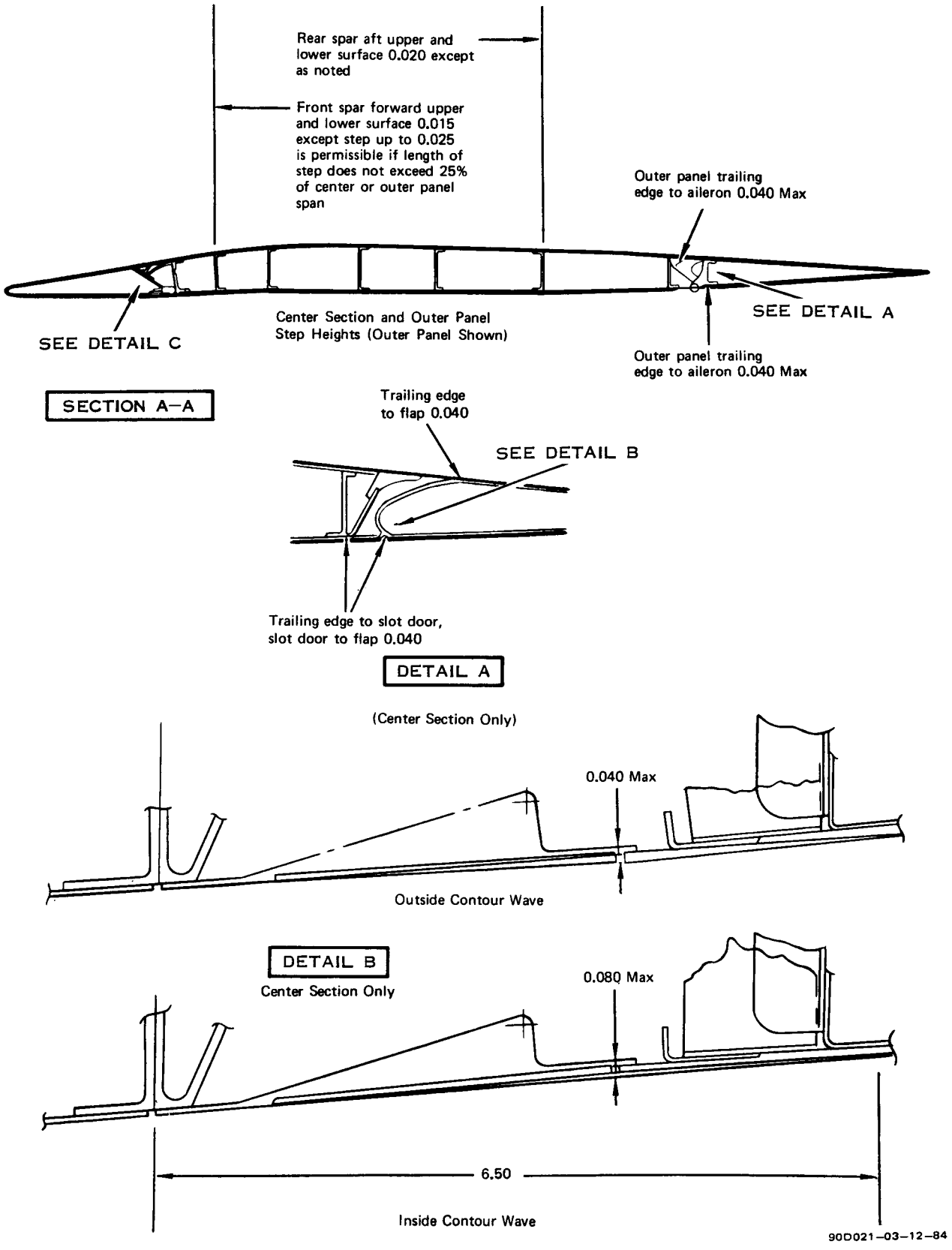


Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 3)

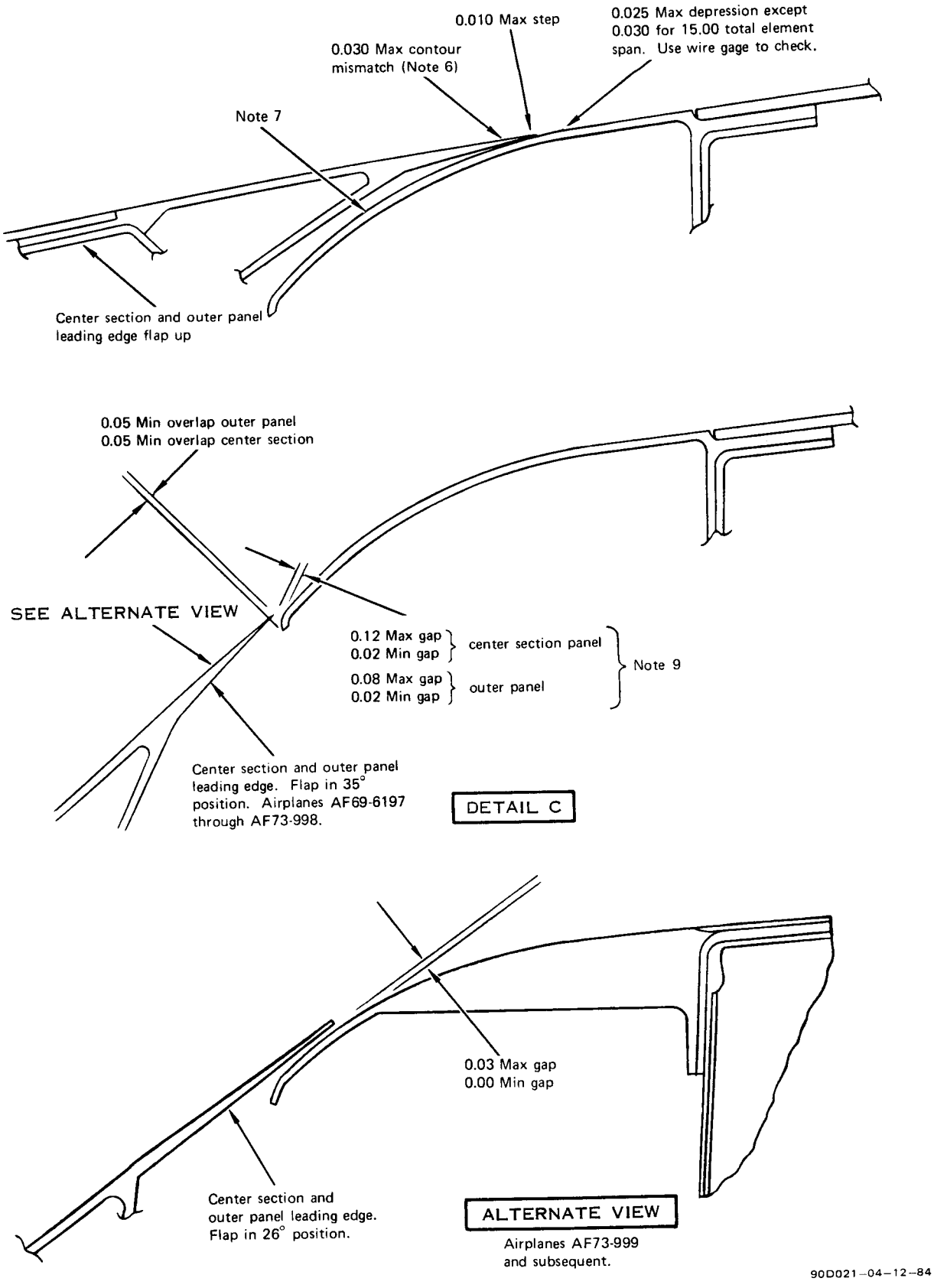


Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 4)

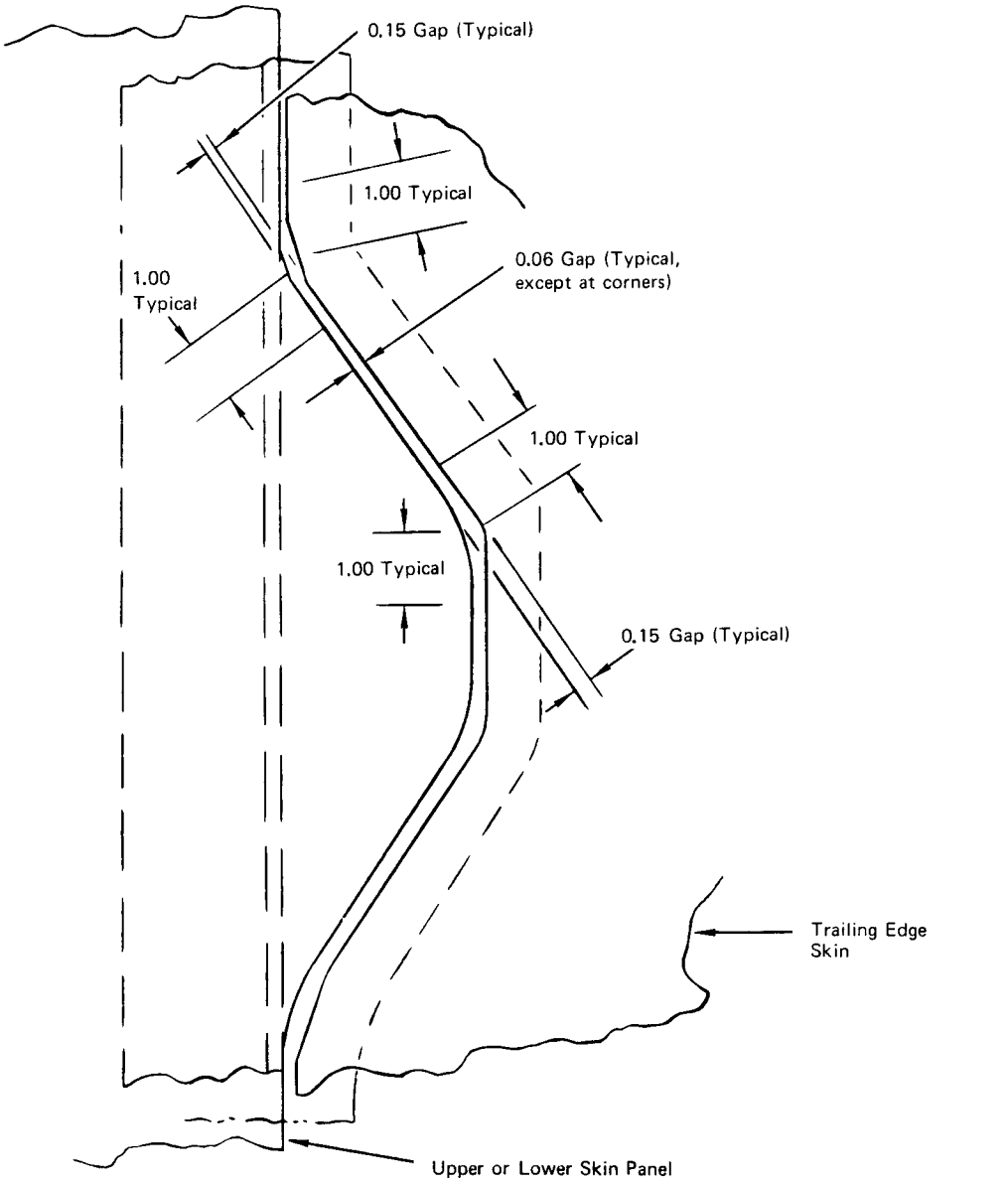


Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 5)

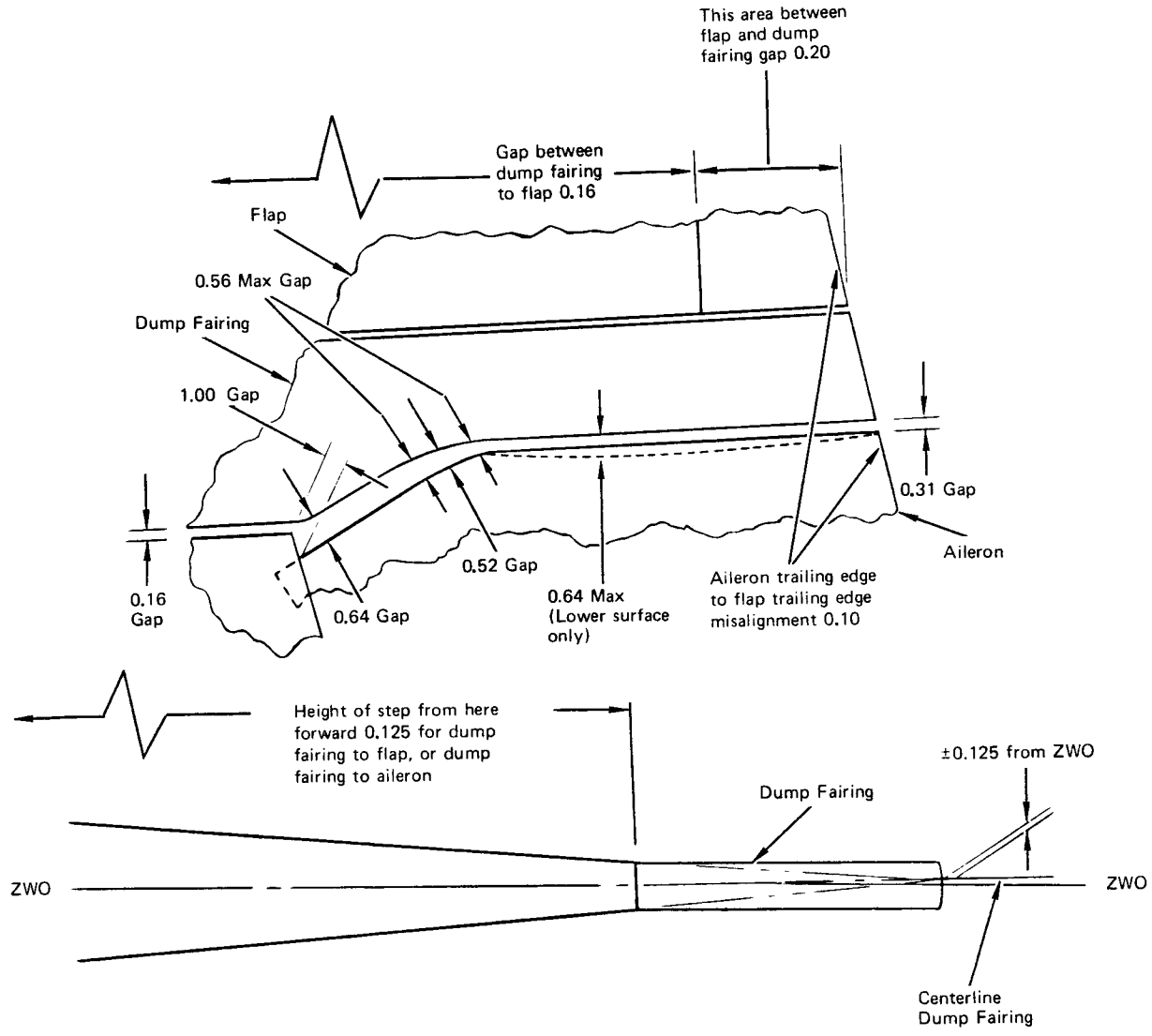


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Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 6)

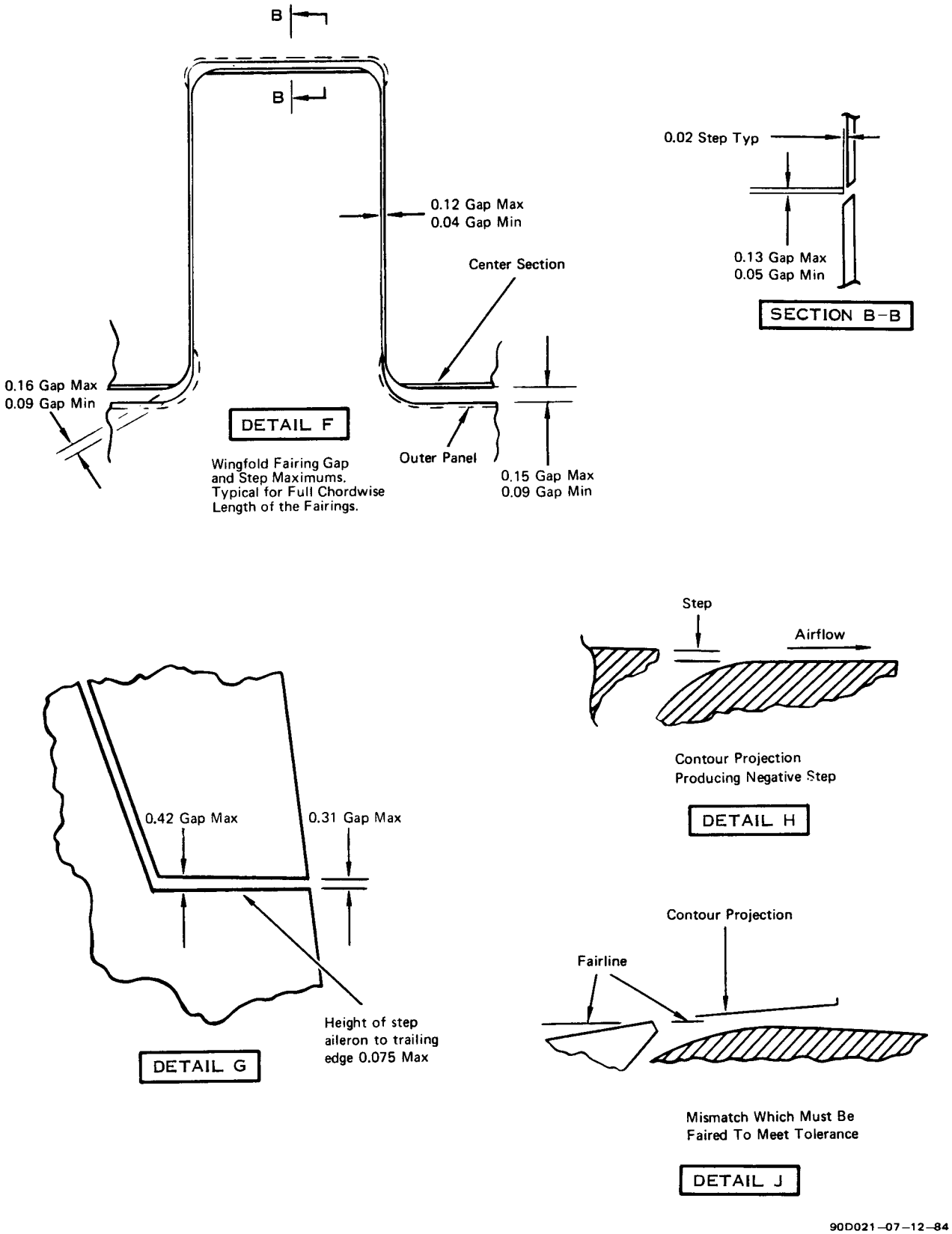


Figure 1-17. Wing Aerodynamic Skin Tolerances (Sheet 7)

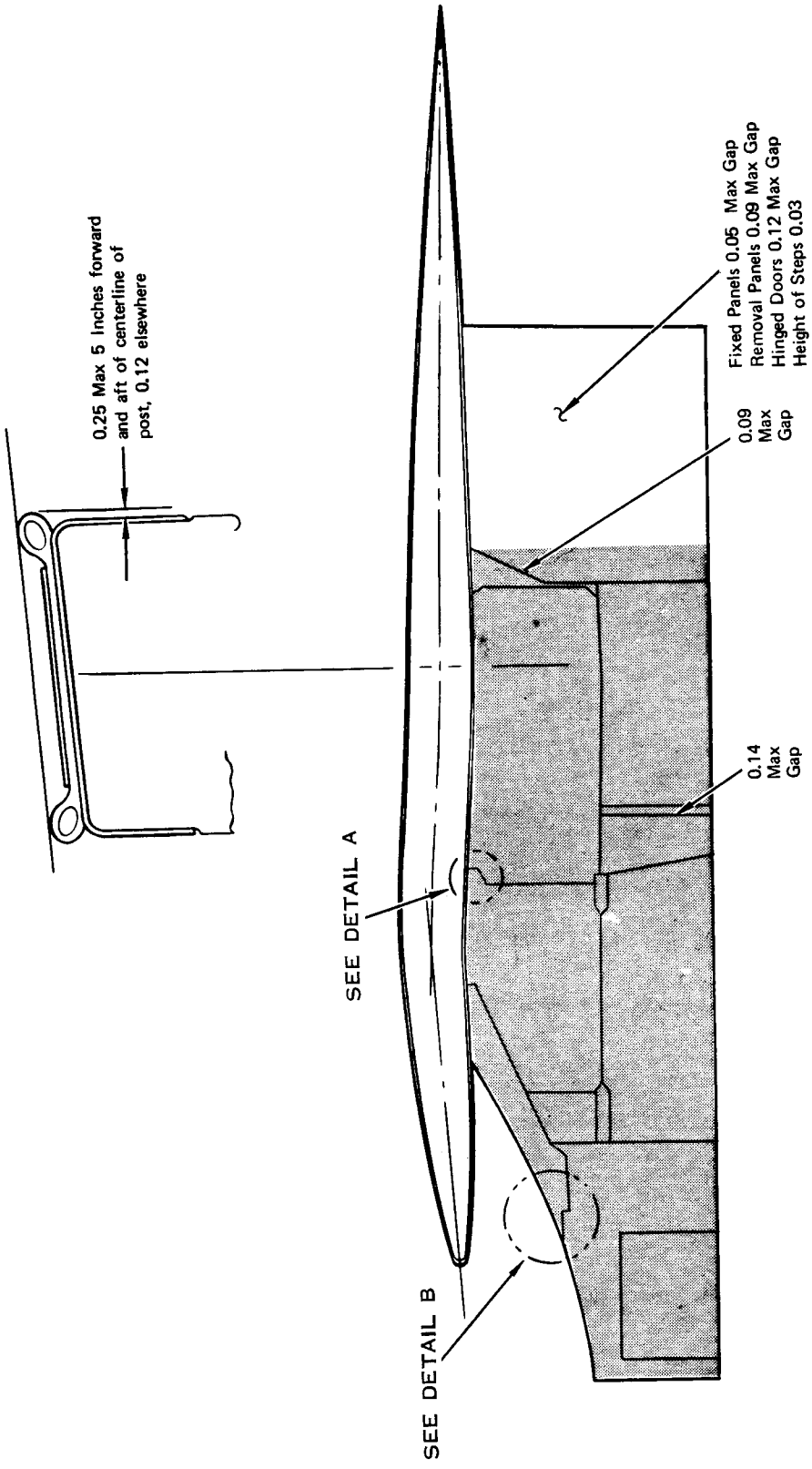
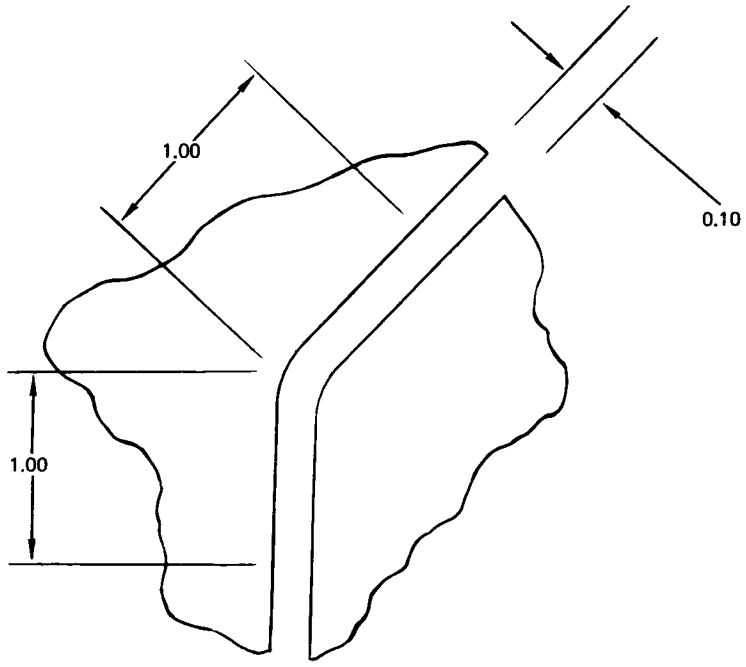


Figure 1-18. Pylon Aerodynamic Skin Tolerances (Sheet 1 of 3)

0.10 Gap, typical all fixed and removable panel corner area



DETAIL A

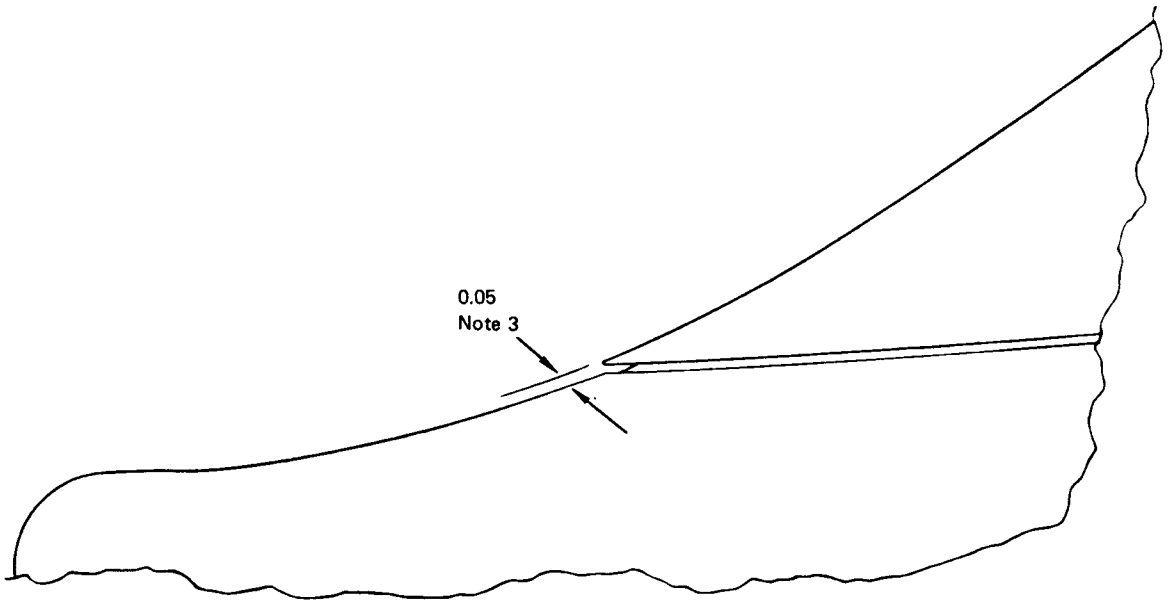
NOTE

(Pylon)

1. All dimensions are in inches and include final finish unless otherwise noted.
2. Maximum wave tolerances are given in permissible wave heights charts.
3. Measure steps and contour mismatch with surface aligned to airfoil reference plane by contour board. Mismatch and steps are developed by projecting contour continuity (Detail C).
4. Minimum gap shall be 0.002 unless otherwise noted.

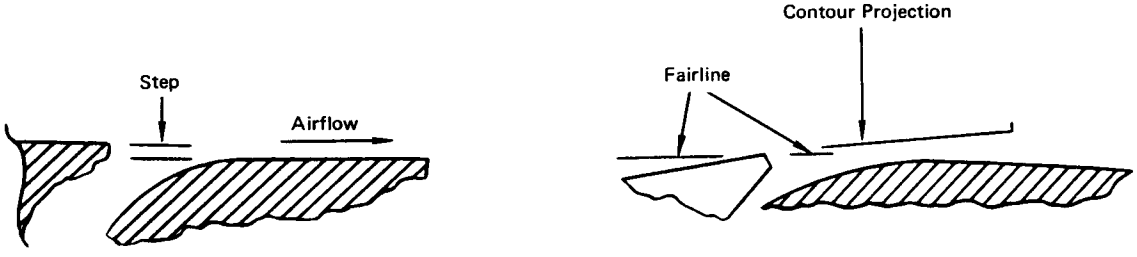
90D022-02-12-84

Figure 1-18. Pylon Aerodynamic Skin Tolerances (Sheet 2)



Pylon Leading Edge Fairing Mismatch (Typical All Wing Stations)

DETAIL B



Contour Projection Producing Negative Step

Mismatch Which Must Be Faired To Meet Tolerance

DETAIL C

90D022-03-12-84

Figure 1-18. Pylon Aerodynamic Skin Tolerances (Sheet 3)

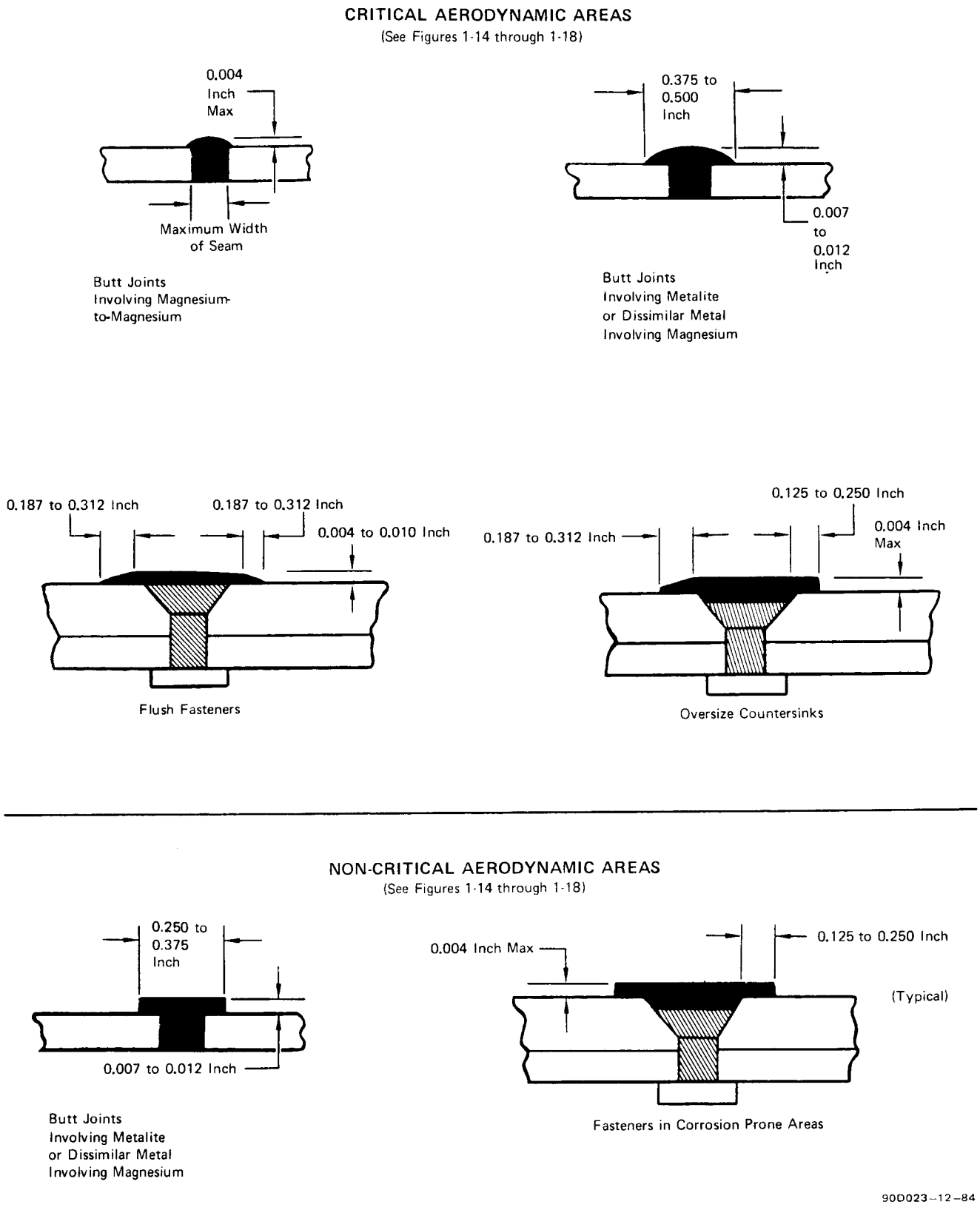
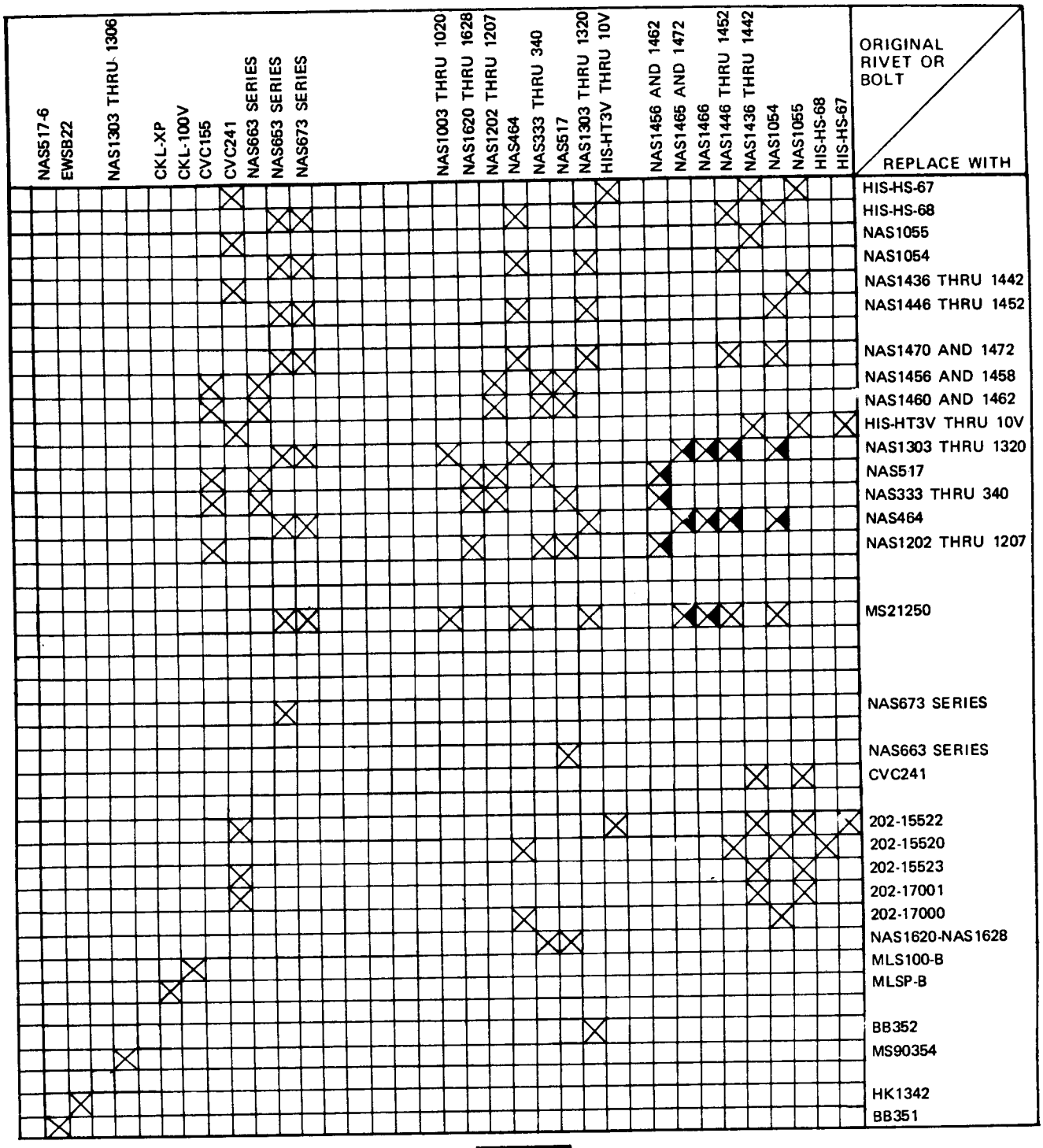


Figure 1-19. Typical Aerodynamic Fairing Applications



NOTE

Fasteners shown in Rivet or Bolt column may be replaced with fasteners opposite the check mark in "Replace With" column.

These interchangeability data are based only on structural requirements and, in certain instances, conditions may not permit installation of replacement fastener. Replacement fastener is equal to or of greater strength than replaced fastener.

Check bolthead and nut clearances when replacing Hi-Shear rivets and lockbolts with bolts and screws.

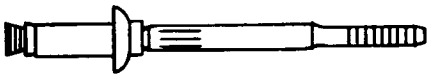
When primary fastener callout specifies steel collar, replacement fastener must also use steel collar.

Fasteners marked ⊠ require tension-type nut, i.e. MS21043 or MS21044.

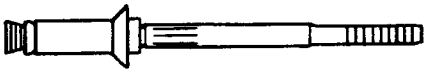
90D024-12-84

Figure 1-20. Interchangeable Fasteners

NAS BLIND RIVETS

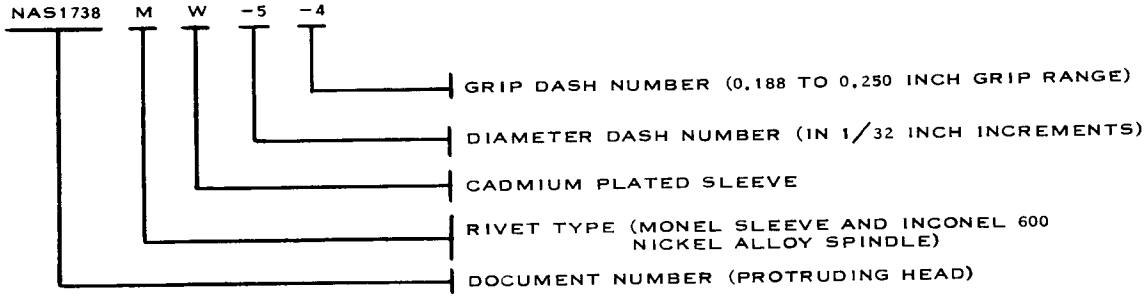


NAS1738 (PROTRUDING HEAD)



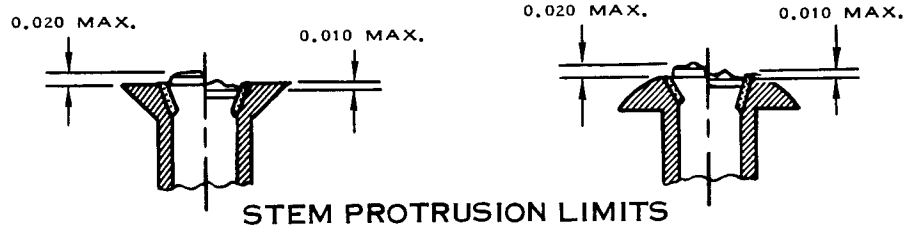
NAS1739 (100° COUNTERSUNK HEAD)

PART NUMBER EXAMPLE

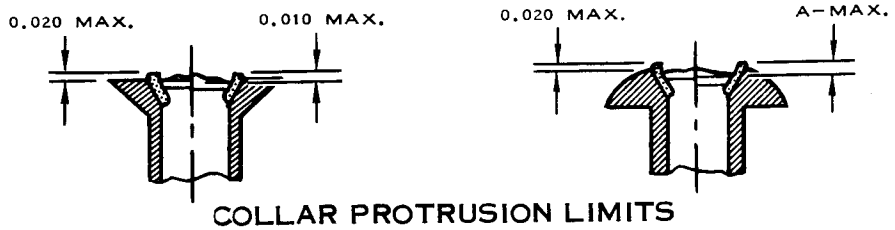


STEM AND COLLAR TOLERANCES

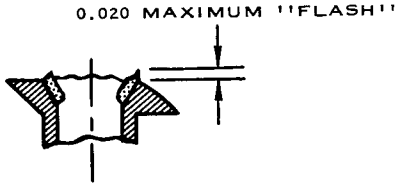
RIVET SIZE (DIA)	-4	-5	-6	-8
A-MAX.	0.015	0.020	0.025	0.030



STEM PROTRUSION LIMITS



COLLAR PROTRUSION LIMITS

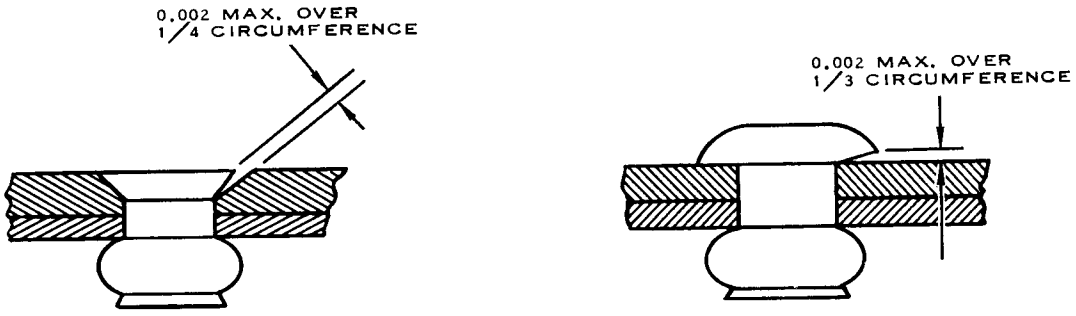


ALLOWABLE COLLAR "FLASH"

90D025-01-12-84

Figure 1-21. NAS1738 and NAS1739 Blind Rivet Identification, Installation, and Inspection Data (Sheet 1 of 2)

MAXIMUM PERMISSIBLE HEAD GAP



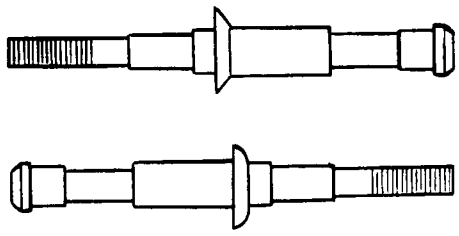
GRIP RANGES

GRIP DASH NUMBER	GRIP RANGE FOR NAS1738 PROTRUDING HEAD RIVETS (INCHES)						GRIP RANGE FOR NAS1739 100° COUNTERSUNK HEAD RIVETS (INCHES)					
	1/8 DIA		5/32 DIA		3/16 DIA		1/8 DIA		5/32 DIA		3/16 DIA	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
-1	0.020	0.062	0.025	0.062	0.030	0.062	0.045	0.062	--	--	--	--
-2	0.063	0.125	0.063	0.125	0.063	0.125	0.063	0.125	0.063	0.125	0.073	0.125
-3	0.126	0.187	0.126	0.187	0.126	0.187	0.126	0.187	0.126	0.187	0.126	0.187
-4	0.188	0.250	0.188	0.250	0.188	0.250	0.188	0.250	0.188	0.250	0.188	0.250
-5	0.251	0.312	0.251	0.312	0.251	0.312	0.251	0.312	0.251	0.312	0.251	0.312
-6	--	--	0.313	0.375	0.313	0.375	--	--	0.313	0.375	0.313	0.375
-7	--	--	--	--	0.376	0.437	--	--	--	--	0.376	0.437

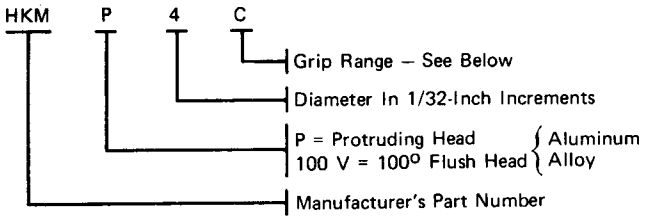
90D025-02-12-84

Figure 1-21. NAS1738 and NAS1739 Blind Rivet Identification, Installation, and Inspection Data (Sheet 2)

HUCK BLINK RIVETS (HKMP AND HKM 100 V TYPES)



PART NUMBER EXAMPLE (P AND 100 V TYPES)

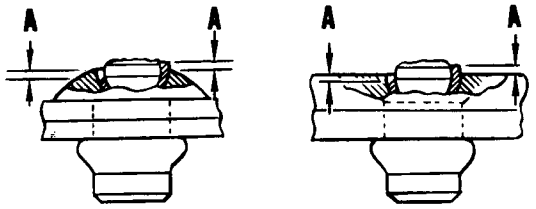


RIVET GUN SHIFT VALVE PRESSURE

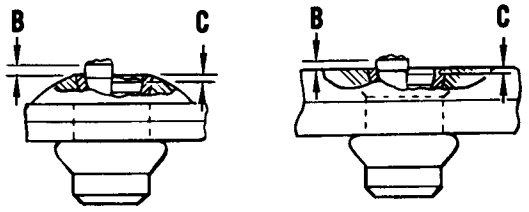
Rivet Diameter	Shift Valve Press
1/8	30 to 31 psi
5/32	46 to 47 psi
3/16	66 to 67 psi

PIN AND COLLAR TOLERANCES HUCK BLIND RIVETS

Rivet Diameter	A	B	C
1/8	0.012	0.016	0.008
5/32	0.015	0.020	0.010
3/16	0.018	0.024	0.012



INSPECTION OF COLLAR POSITION



INSPECTION OF PIN POSITION

GRIP RANGES

Grip Code Letter	Grip Range For Brazier Head Rivets						Grip Range For 100° Countersunk Head Rivets					
	1/8		5/32		3/16		1/8		5/32		3/16	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A	0.020	0.036	0.025	0.045	0.030	0.054	0.062	0.078	0.080	0.100	0.100	0.124
B	0.037	0.061	0.046	0.076	0.055	0.091	0.079	0.103	0.101	0.131	0.125	0.161
C	0.062	0.086	0.077	0.107	0.092	0.128	0.104	0.128	0.132	0.162	0.162	0.198
D	0.087	0.111	0.108	0.138	0.129	0.165	0.129	0.153	0.163	0.193	0.199	0.235
E	0.112	0.136	0.139	0.169	0.166	0.202	0.154	0.178	0.194	0.224	0.236	0.272
F	0.137	0.161	0.170	0.200	0.203	0.239	0.179	0.203	0.225	0.255	0.273	0.309
G	0.162	0.186	0.201	0.231	0.240	0.276	0.204	0.228	0.256	0.286	0.310	0.345
H	0.187	0.211	0.232	0.262	0.277	0.313	0.229*	0.253*	0.287	0.317	0.347	0.383
J	0.212	0.236	0.263	0.293	0.314	0.350	0.254*	0.278*	0.318*	0.348*	0.384	0.420
K			0.294	0.324	0.351	0.387			0.349*	0.379*	0.421*	0.457*
L			0.325	0.355	0.388	0.424			0.380*	0.410*	0.458*	0.494*
M			0.356	0.386	0.425	0.461			0.411*	0.411*	0.495*	0.531*
N			0.387	0.417	0.462	0.498			0.442*	0.472*	0.532*	0.568*
P					0.499	0.535					0.569*	0.605*

*Special Grip Lengths

90D026-12-84

Figure 1-22. Huck Blind Rivet Identification, Installation, and Inspection Data

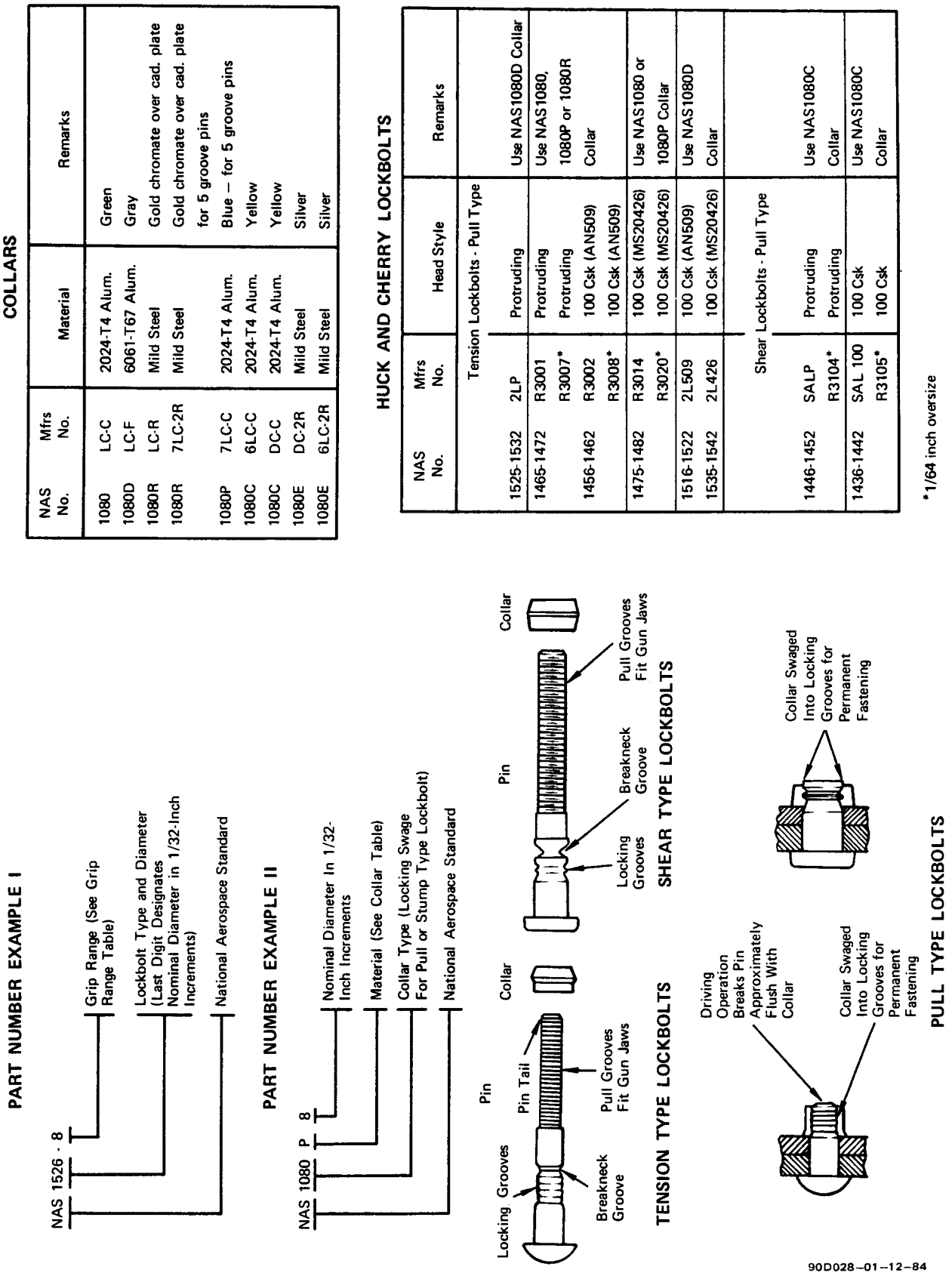


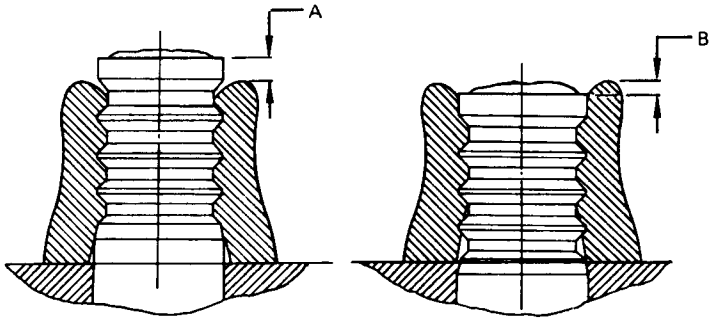
Figure 1-23. Huck and Cherry Lockbolts Identification, Inspection, and Grip Range Data (Sheet 1 of 2)

GRIP RANGE

Second Dash Number	Min (Inches)	Max (Inches)	Second Dash Number	Min (Inches)	Max (Inches)
-1	0.031	0.095	-9	0.531	0.595
-2	0.094	0.157	-10	0.594	0.657
-3	0.156	0.220	-11	0.656	0.720
-4	0.219	0.282	-12	0.719	0.782
-5	0.281	0.345	-13	0.781	0.845
-6	0.344	0.407	-14	0.844	0.907
-7	0.406	0.470	-15	0.906	0.970
-8	0.469	0.532	-16	0.969	1.032

HUCK LOCKBOLT PIN TOLERANCES

Lockbolt Diameter	Dimension	Through Aluminum Alloy	Through Metalite
3/16	A	0.03	0.045
	B	0.03	0.03
1/4	A	0.03	0.06
	B	0.03	0.03
5/16	A	0.03	
	B	0.03	
3/8	A	0.03	
	B	0.03	



90D028-02-12-84

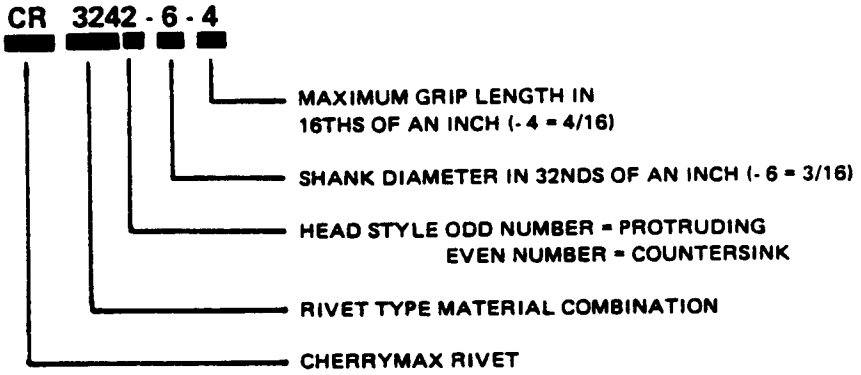
Figure 1-23. Huck and Cherry Lockbolts Identification, Inspection, and Grip Range Data (Sheet 2)

CHERRYMAX RIVETS (NOMINAL AND OVERSIZED)

UNIVERSAL HEAD

100 DEGREES FLUSH HEAD

PART NUMBER EXAMPLE



RIVET MATERIAL COMBINATIONS

Rivet Type	Nominal	Oversized	Material	
			Sleeve	Stem
321	X		5056 Alum. Alloy QQ-A-430	8740 Alum. Alloy AMS 6322
322	X		5056 Alum. Alloy QQ-A-430	15-7 PH CRES AMS 5657
324		X	5056 Alum. Alloy QQ-A-430	8740 Alum. Alloy AMS 6322
325		X	5056 Alum. Alloy QQ-A-430	15-7 PH CRES AMS 5657
352	X		MONEL QQ-N-281	15-7 PH CRES AMS 5657
355		X	MONEL QQ-N-281	15-7 PH CRES AMS 5657

90D027-01-12-84

Figure 1-24. Cherrymax Rivet Identification, Grip Range, and Hole Data (Sheet 1 of 2)

GRIP RANGE FOR 100 DEGREES FLUSH HEAD (NOMINAL AND OVERSIZED)

Second Dash No.	Grip Limits 1/16 Range		Second Dash No.	Grip Limits 1/16 Range	
	Min	Max		Min	Max
–1	–	–	–7	0.376	0.437
–2	①	0.125	–8	0.438	0.500
–3	0.126	0.187	–9	0.501	0.562
–4	0.188	0.250	–10	0.563	0.625
–5	0.251	0.312	–11	0.626	0.687
–6	0.313	0.375	–12	0.688	0.750

①

First Dash No.	Nominal Min Grip	Oversized Min Grip
–4	0.063	0.045
–5	0.065	0.063
–6	0.080	0.073

GRIP RANGE FOR UNIVERSAL HEAD (NOMINAL AND OVERSIZED)

Second Dash No.	Grip Limits 1/16 Range		Second Dash No.	Grip Limits 1/16 Range	
	Min	Max		Min	Max
–1	②	0.062	–7	0.376	0.437
–2	0.063	0.125	–8	0.438	0.500
–3	0.126	0.187	–9	0.501	0.562
–4	0.188	0.250	–10	0.563	0.625
–5	0.251	0.312	–11	0.626	0.687
–6	0.313	0.375	–12	0.688	0.750

②

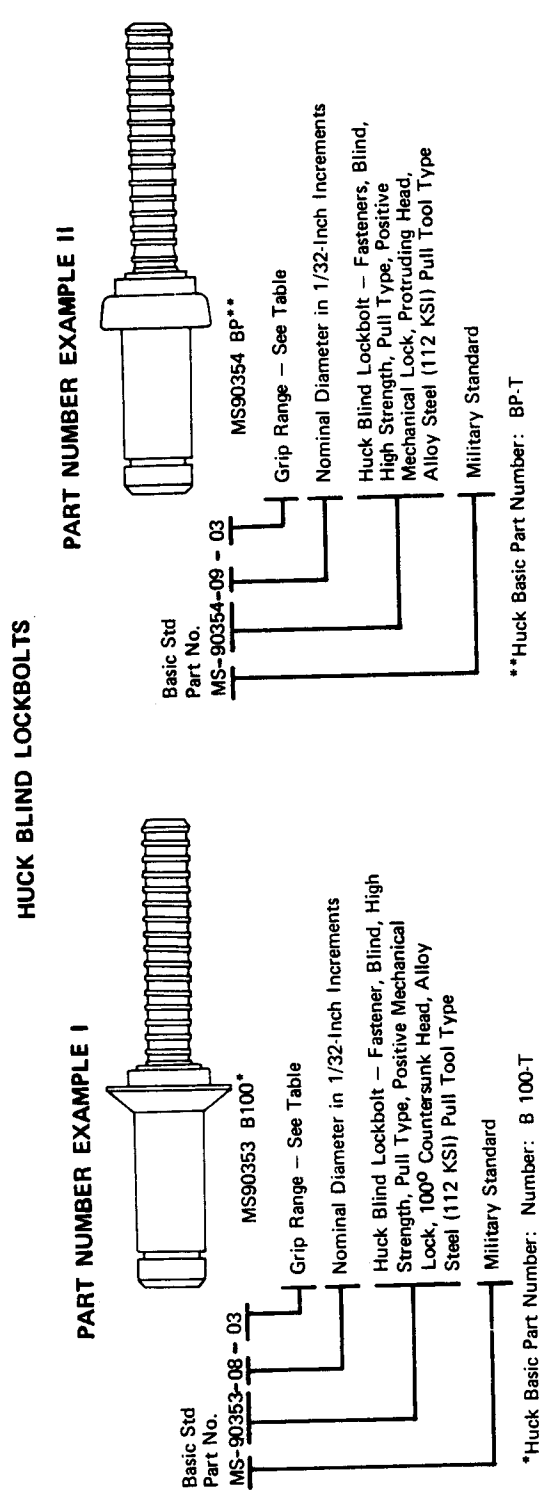
First Dash No.	Min Grip
–4	0.025
–5	0.031
–6	0.037

FASTENER HOLE LIMITS (NOMINAL AND OVERSIZED)

First Dash No.	Nominal Fastener Diameter	Diameter Hole Limits	Oversized Fastener Diameter	Diameter Hole Limits
–4	0.125–0.129	0.129–0.132	0.139–0.143	0.143–0.146
–5	0.156–0.160	0.160–0.164	0.172–0.176	0.176–0.180
–6	0.188–0.192	0.192–0.196	0.200–0.204	0.205–0.209

90D027-02-12-84

Figure 1-24. Cherrymax Rivet Identification, Grip Range, and Hole Data (Sheet 2)



GRIP RANGE

Second Dash Number	Min (Inches)	Max (Inches)	Second Dash Number	Min (Inches)	Max (Inches)
–1	0.031	0.095	–9	0.531	0.595
–2	0.094	0.157	–10	0.594	0.657
–3	0.156	0.220	–11	0.656	0.720
–4	0.219	0.282	–12	0.719	0.782
–5	0.281	0.345	–13	0.781	0.845
–6	0.344	0.407	–14	0.844	0.907
–7	0.406	0.470	–15	0.906	0.970
–8	0.469	0.532	–16	0.969	1.032

90D029–01–12–84

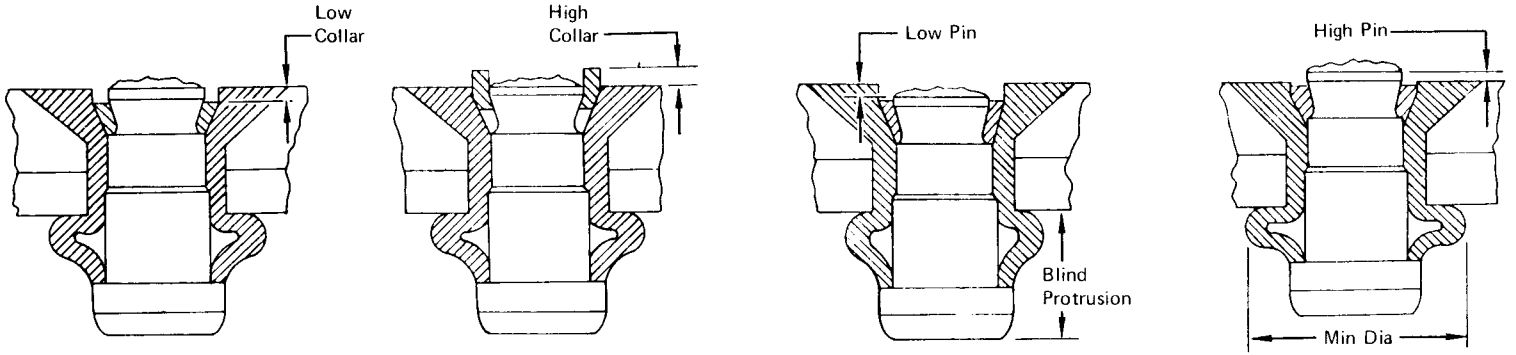
Figure 1-25. Huck Blind Lockbolt Identification, Inspection, Grip Range, and Hole Data (Sheet 1 of 2)

HUCK BLIND LOCKBOLTS – LOCKING COLLAR LIMITS

Bolt Size	Max High Collar	Max Low Collar
5/32	0.017	0.017
3/16	0.022	0.022
1/4	0.029	0.029
5/16	0.037	0.037
3/8	0.045	0.045

HUCK BLIND LOCKBOLTS – PIN AND BULB LIMITS

Bolt Size	Max High Pin	Max Low Pin	Min Bulb Dia	Max Blind Protrusion
5/32	0.010	0.010	0.212	0.215
3/16	0.012	0.012	0.258	0.260
1/4	0.015	0.015	0.338	0.340
5/16	0.019	0.019	0.405	0.410
3/8	0.023	0.023	0.487	0.510



NOMINAL DIAMETER SLEEVE AND HOLE DIMENSIONS

First Dash Number	Nominal Diameter	Fastener Sleeve Diameter (Inches)	Installation Hole Size
–5	5/32	0.162 – 0.164	0.164 – 0.167
–6	3/16	0.197 – 0.199	0.199 – 0.202
–8	1/4	0.258 – 0.260	0.260 – 0.263
–10	5/16	0.310 – 0.312	0.312 – 0.315
–12	3/8	0.372 – 0.374	0.375 – 0.378

Figure 1-25. Huck Blind Lockbolt Identification, Inspection, Grip Range, and Hole Data (Sheet 2)

90D029-02-12-84

BLIND LOCKBOLT REMOVAL

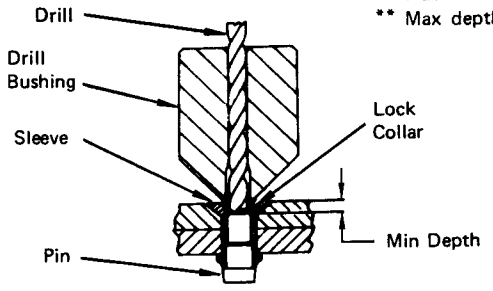
DRILL AND DRILL BUSHING

Nom Size	Drill*	Size	Min Depth**	Bushing*
5/32	502999	0.0980	0.050	103615
3/16	503000	0.1200	0.070	103616
1/4	503001	0.1562	0.090	103617
5/16	503003	0.1875	0.105	103618
3/8	503005	0.2280	0.130	103619
7/16	503373	0.2656	0.150	104389
1/2	503007	0.3125	0.180	104354

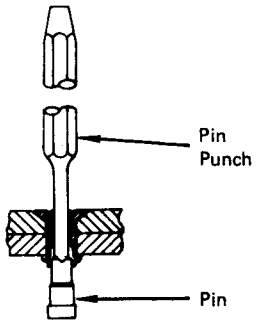
*Huck blind bolt removal kit item
** Max depth +0.020

PIN PUNCH

Nom Bolt Size	Part No.*	Punch Size
5/32	503010	3/32
3/16	503010	3/32
1/4	503012	5/32
5/16	503013	3/16
3/8	503014	7/32
7/16	503015	1/4
1/1/2	104100	5/16



STEP I



STEP II

CUTTER

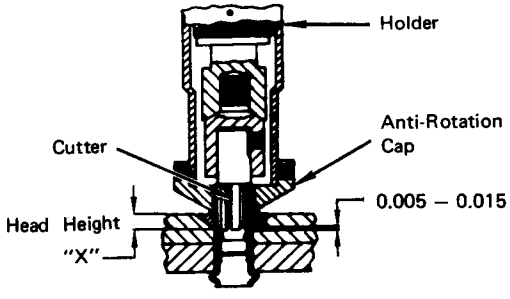
Nom Size	Holder	Cutter*	Size	Anti-Rotation Cap*
5/32	103610	103605	5/32	103620
3/16	103611	103606	3/16	103620
1/4	103611	103607	1/4	103621
5/16	103613	103608	5/16	103621
3/8	103613	103609	3/8	103622
7/16	103613	104391	7/16	104392
1/2	104358	104357	1/2	104356

SLEEVE PUNCH

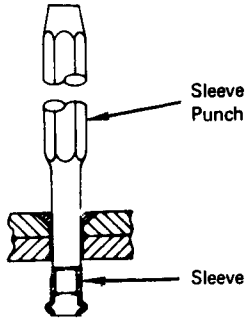
Nom Size	Part No.*	Size
5/32	503012	5/32
3/16	503013	3/16
1/4	503015	1/4
5/16	503016	5/16
3/8	503017	3/8
7/16	104396	7/16
1/2	104397	1/2

HEAD HEIGHT "X"

Protruding Head		C/Sunk Head
5/32	0.070	0.070
3/16	0.135	0.080
1/4	0.140	0.105
5/16	0.140	0.135
3/8	0.205	0.165
7/16	0.205	0.195
1/2	0.270	0.220



STEP III



STEP IV

90D030-12-84

Figure 1-26. Huck Blind Lockbolt Removal

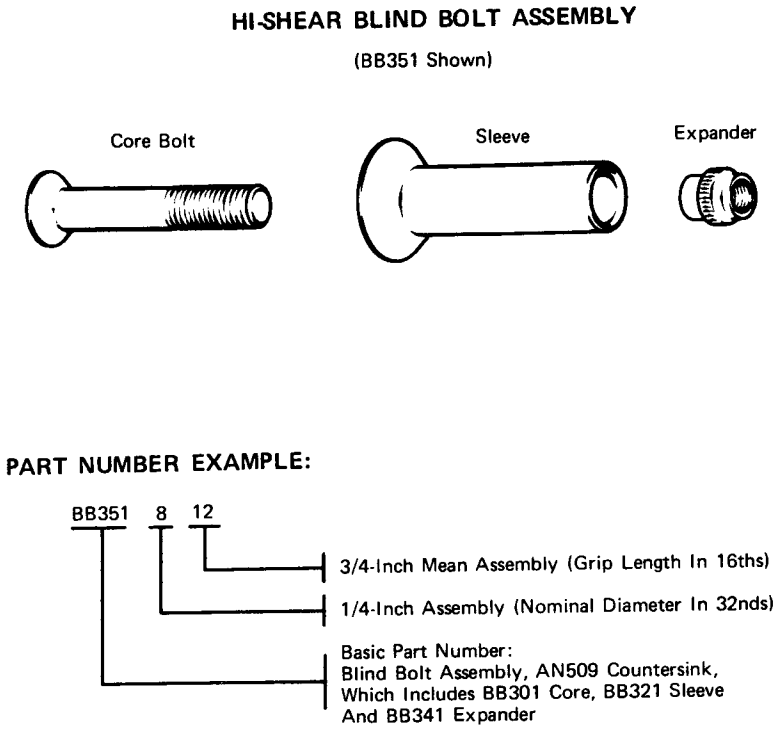
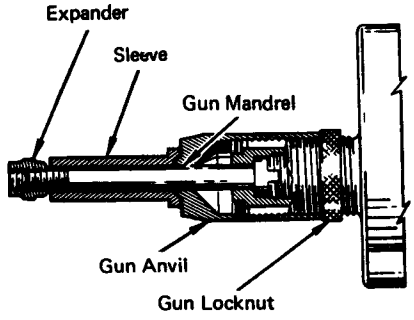
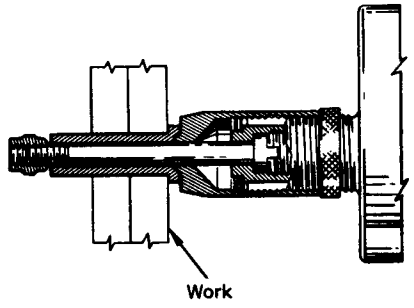


Figure 1-27. Hi-Shear Blind Bolt and Blind Nut Identification Data



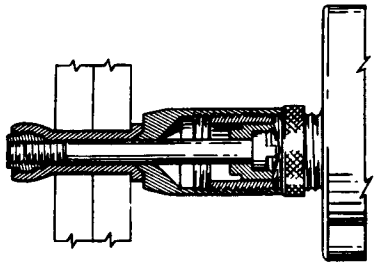
STEP 1

Insert the mandrel through the sleeve; then, by pressing the gun red control button, screw the mandrel onto the expander. To adjust the anvil to the correct sleeve length, spin the anvil to seat against the sleeve head and tighten locknut.



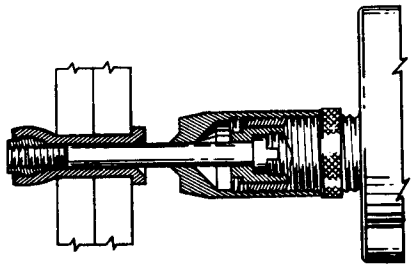
STEP 2

Insert the assembled expander and sleeve on the mandrel through the hole.



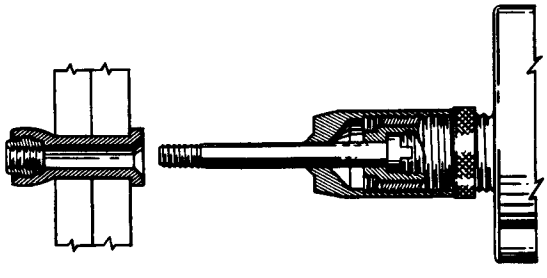
STEP 3

Press gun white control button to pull the expander into the sleeve. This pullup action locks the sleeve into the work and swells the sleeve walls to tightly fill the hole. No end loading by the mechanic is required on the gun.



STEP 4

The gun automatically backs off the sleeve head after the expander pullup is completed.



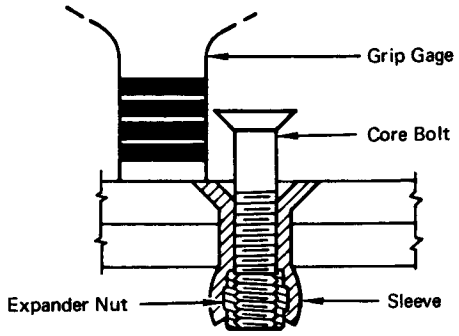
STEP 5

Press gun blue control button to spin the mandrel out of the installed sleeve and expander. This completes the blind nut assembly.

90D032-01-12-84

Figure 1-28. Installation of Hi-Shear Blind Bolts and Blind Nuts Using Power Tools (Sheet 1 of 2)

STEP 6



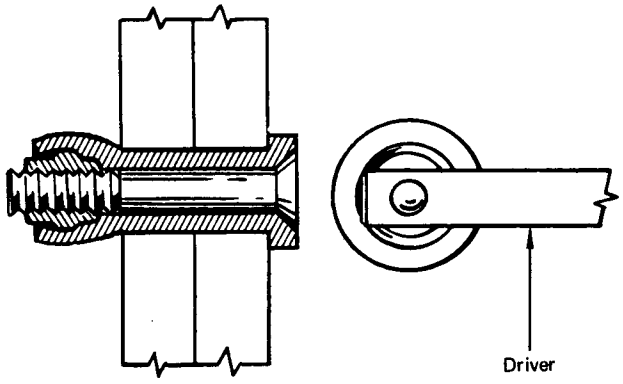
Inspect the blind nut installation as follows:

A. Use Hi-shear grip gage No. 2-1002 and check as follows:

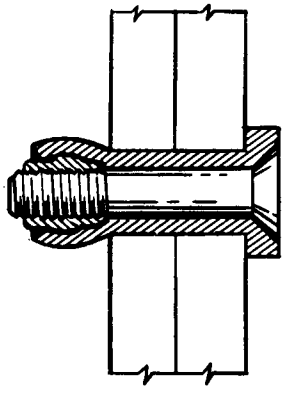
Insert the core bolt until it touches the expander's thread. If the core bolt head locates within range indicated on the gage, the sleeve is correctly installed. If not within correct range, first check to determine if the core bolt is the correct grip length; secondly, check the installation of the sleeve and expander.

B. Installation is not acceptable if following conditions exist:

1. Loose sleeve.
2. Installation leaks when located in pressurized area.
3. If larger than a 0.002-inch feeler gage can be inserted under more than 25% of the circumference of the sleeve head.



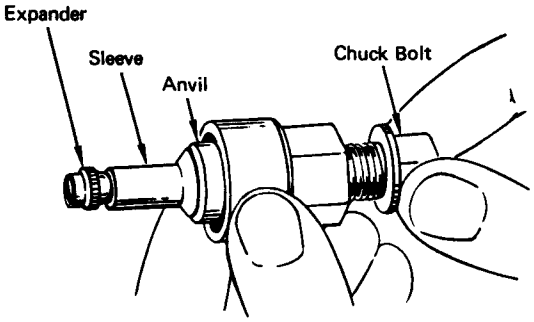
Insert core bolt into sleeve and expander and tighten with core bolt driver to the torque limits below. This completes the assembly of the blind bolt.



Blind Bolt Dash No.	Core Bolt Thread Size	Core Bolt Installation Torque Limits	
		Drag Loads (Lb-In.)	Final Torque (Lb-In.)
-5	4-40NC-3A	1.250 to 1.875	8 to 10
-6	5-40NC-3A	1.426 to 2.046	10 to 14
-8	8-32NC-3A	4.5 to 7.5	20 to 30
-10	12-28NF-3A	10 to 15	50 to 80
-12	1/4-28UNF-3A	10 to 15	125 to 150
-14	5/16-24UNF-3A	10 to 15	200 to 225
-16	3/8-24UNF-3A	10 to 15	380 to 400

90D032-02-12-84

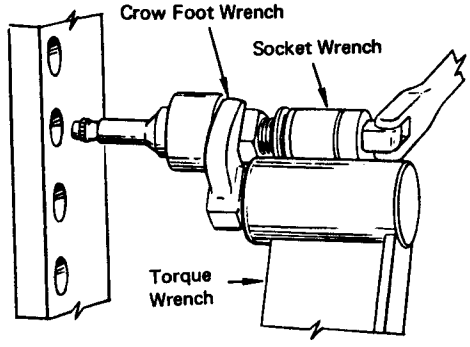
Figure 1-28. Installation of Hi-Shear Blind Bolts and Blind Nuts Using Power Tools (Sheet 2)



STEP 1
SET UP TOOLS

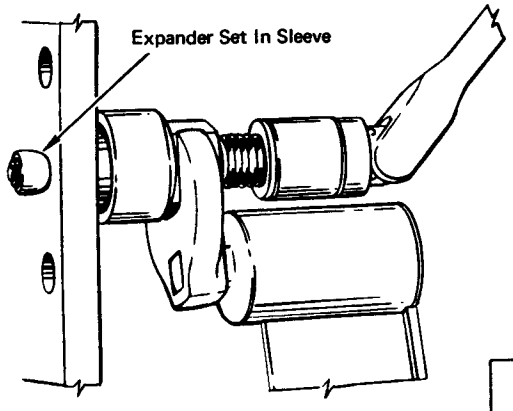
A. Turn the chuck bolt counterclockwise to fully engage in the body. Slip the sleeve onto the mandrel. Spin the expander onto the threaded end of the mandrel until it is fingertight.

B. Turn the chuck bolt clockwise to seat the anvil (on the body) firmly onto the head of the sleeve.



STEP 2
POSITION ASSEMBLY

Insert the expander and sleeve (on mandrel) fully into the hole in the work.



STEP 3
MAKE BLIND NUT INSTALLATION

A. Using a wrench to hold the chuck bolt, turn the hex on the body in a counterclockwise direction with a torque wrench with crow foot wrench until the expander resists the wrenching action.

CAUTION

To prevent mandrel breakage from overtightening (particularly on the –5, –6, and –8 sizes) do not exceed torque loads listed below:

TORQUE VALUES

BLIND BOLT OR BLIND NUT SIZE	ACTUAL TORQUE LOADS (LB–IN.)	STURTEVENT F300 OR F600 TORQUE WRENCH WITH AN8506 CROW FOOT (LB–IN.)
–5	65 to 75	60 to 70
–6	85 to 95	80 to 90
–8	190 to 215	175 to 200
–832		
–1032	270 to 295	250 to 275
–10	295 to 320	275 to 300
–12	465 to 495	425 to 450
–428		

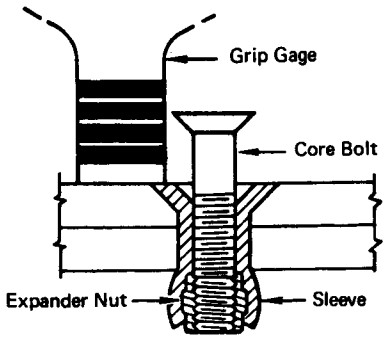
NOTE

If other torque wrenches and crow foot wrenches are used, the indicated torque must be calculated.

B. To remove the tool, turn the hex on the body clockwise a half turn to loosen, and unscrew the chuck bolt from the expander threads.

90D033–01–12–84

Figure 1-29. Installation of Hi-Shear Blind Bolts and Blind Nuts Using Hand Driving Tools (Sheet 1 of 2)



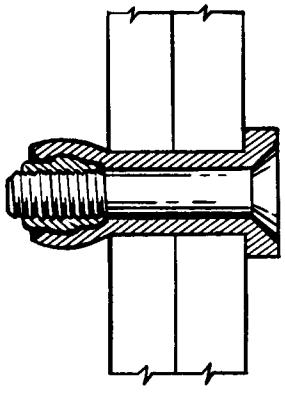
STEP 4
INSPECT BLIND NUT INSTALLATION

A. Use Hi-shear grip gage No. 2-1002 and check as follows:

Insert the core bolt until it touches the expander's thread. If the core bolt head locates within range indicated on the gage, the sleeve is correctly installed. If not within range, first check to determine if the core bolt is the correct grip length; secondly, check the installation of the sleeve and expander.

B. Installation is not acceptable if following conditions exist:

1. Loose sleeve.
2. Installation leaks when located in pressurized area.
3. If larger than a 0.002-inch feeler gage can be inserted under more than 25% of the circumference of the sleeve head.



STEP 5
MAKE BLIND BOLT INSTALLATION

Insert core bolt into sleeve and expander and tighten to following torque values:

BLIND BOLT DASH NO.	CORE BOLT THREAD SIZE	CORE BOLT INSTALLATION TORQUE LIMITS	
		DRAG LOADS (LB–IN.)	FINAL TORQUE (LB–IN.)
–5	4–40NC–3A	1.250 to 1.875	8 to 10
–6	5–40NC–3A	1.426 to 2.046	10 to 14
–8	8–32NC–3A	4.5 to 7.5	20 to 30
–10	12–28NF–3A	10 to 15	50 to 80
–12	1/4–28UNF–3A	10 to 15	125 to 150
–14	5/16–24UNF–3A	10 to 15	200 to 225
–16	3/8–24UNF–3A	10 to 15	380 to 400

90D033–02–12–84

Figure 1-29. Installation of Hi-Shear Blind Bolts and Blind Nuts Using Hand Driving Tools (Sheet 2)

STEP 1

Remove core bolt, measure outside diameter of sleeve, and select drill one size smaller.

STEP 2

Drill the sleeve until the countersink or protruding head breaks out.

STEP 3

Tap out remainder of the sleeve and the expander using a straight pin punch.

CAUTION

Use care to prevent damage to hole.

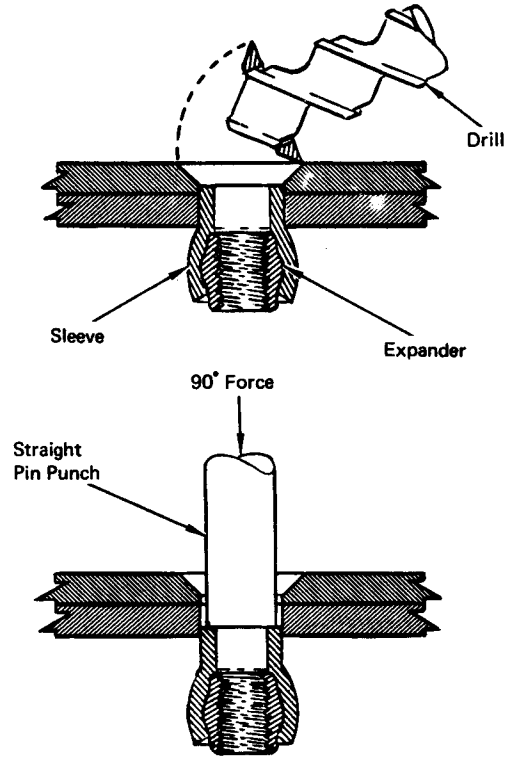


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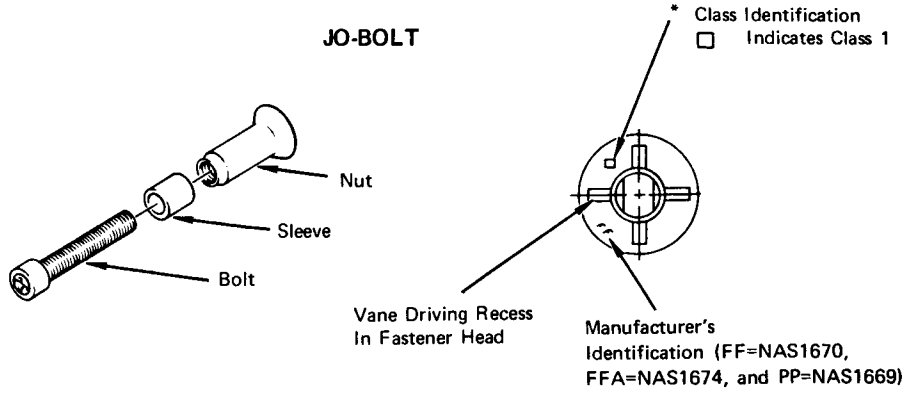
Figure 1-30. Removal of Hi-Shear Blind Bolt and Blind Nut Assemblies



EXAMPLE OF PART NUMBER CODE:

NAS1670 – 3 – 3

- Fastener, Blind Internally Threaded, External Sleeve, General Purpose, Flush Head
- Second Dash No. Designates Grip Range (See Jo-Bolt Grip Range Chart)
- First Dash No. Designates Fastener Diameter (See Jo-Bolt Diameter Code Chart)
- Manufacturer's Basic Part Number:
  - NAS1669 – Protruding Head, Steel
  - NAS1670 – Flush Head, Steel
  - NAS1674 – Millable Head, Aluminum

*Jo-Bolt Class Identification Marking:

□ Marking Indicates Class 1 Material and Finish As Follows:
Nut – Alloy Steel
Bolt – Alloy Steel
Sleeve – Cres
Cadmium Plate Finish

○ Marking Indicates Class 2 Material and Finish As Follows:
All Parts – A286 Heat-Resistant Steel
Passivated Finish

No Marking Indicates Class 3 Material and Finish As Follows:
Nut – Anodized Aluminum Alloy
Bolt – Cadmium Plated Steel Alloy
Sleeve – Cres

JO-BOLT GRIP RANGES

Dash Number	Grip Range		Dash Number	Grip Range	
	Minimum	Maximum		Minimum	Maximum
1	0.031	0.093			
2	0.094	0.156	10	0.595	0.656
3	0.157	0.219	11	0.657	0.719
4	0.220	0.281	12	0.720	0.781
5	0.282	0.344	13	0.782	0.844
6	0.345	0.406	14	0.845	0.906
7	0.407	0.469	15	0.907	0.969
8	0.470	0.531	16	0.970	1.031
9	0.532	0.594			

JO-BOLT DIAMETER CODE CHART

First Dash Number	Nominal Jo-Bolt Diameter (Inch)
08	0.164 (5/32)
3	0.200 (No. 10)
4	0.260 (1/4)
5	0.312 (5/16)
6	0.375 (3/8)

90D035-12-84

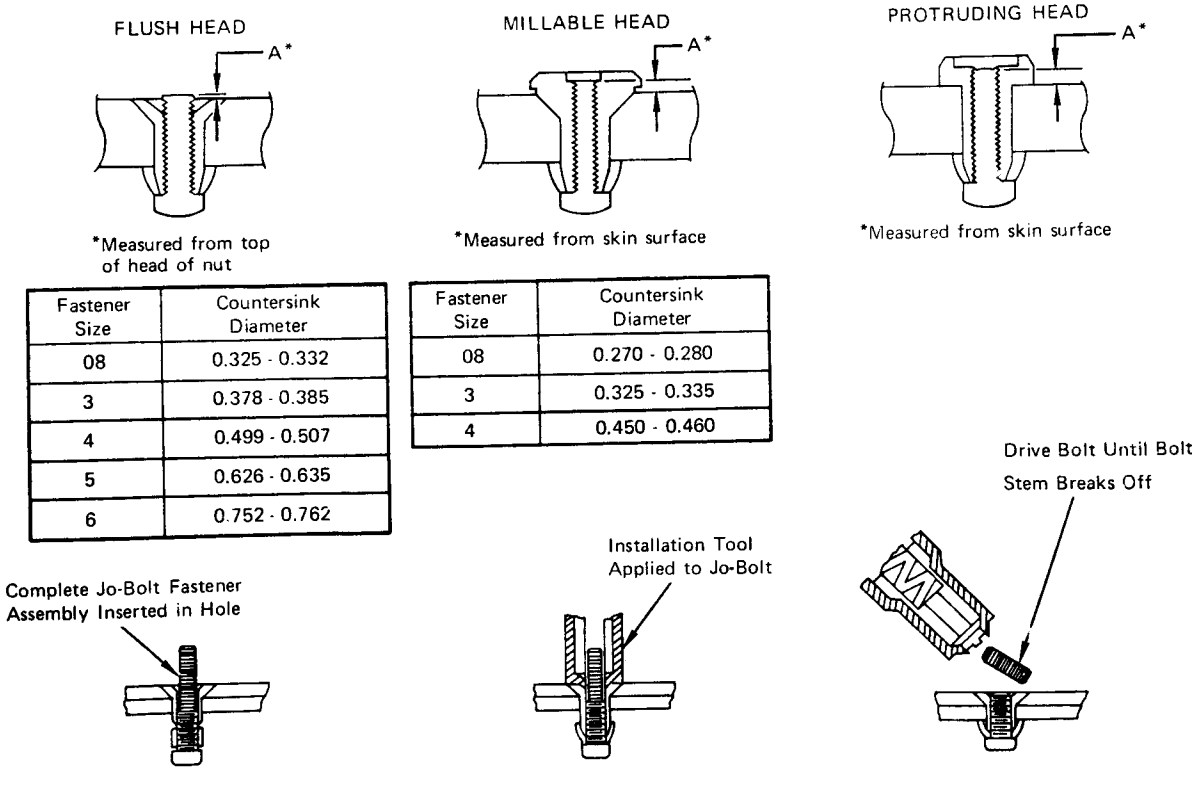
Figure 1-31. Jo-Bolt Identification and Grip Range Data

INSTALLATION MEASUREMENTS – JO-BOLT

First Dash Number Fastener Size	Nominal Diameter	Hole and Drill Sizes		A* Break-Off Limits		
		Predrill	Final Drill	NAS1670 Flush Head Steel	NAS1669 Protruding Head Steel	NAS1674 Millable Head Alum
08	0.164 Inch	25 (0.1495)	0.164 - 0.167	+0.020 -0.068	+0.000 +0.088	+0.000 +0.088
3	0.200 Inch (No. 10)	15 (0.180)	0.199 - 0.202	+0.015 -0.073	+0.010 +0.098	+0.010 +0.098
4	0.260 Inch (1/4 Inch)	D (0.246)	0.260 - 0.263	+0.010 -0.078	+0.047 +0.135	+0.010 +0.098
5	0.312 Inch (5/16 Inch)	L (0.290)	0.312 - 0.315	+0.010 -0.083	+0.043 +0.146	
6	0.375 Inch (3/8 Inch)	S (0.348)	0.3745 - 0.3785	+0.010 -0.093	+0.049 +0.152	

*Plus (+) a dimension indicates screw end projection above the plane of reference.
Minus (–) a dimension indicates screw end recess below the plane of reference.

STEM BREAK-OFF LIMITS CHART



Fastener Size	Countersink Diameter
08	0.325 - 0.332
3	0.378 - 0.385
4	0.499 - 0.507
5	0.626 - 0.635
6	0.752 - 0.762

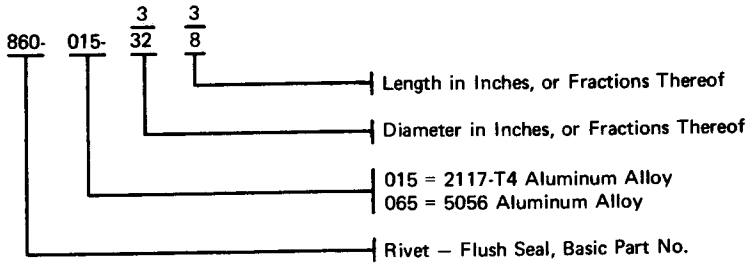
Fastener Size	Countersink Diameter
08	0.270 - 0.280
3	0.325 - 0.335
4	0.450 - 0.460

90D036-12-84

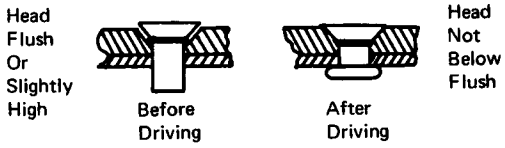
Figure 1-32. Jo-Bolt Preparation and Inspection Requirements

RIV-O-SEAL (FLUSH SEAL) RIVETS

PART NUMBER EXAMPLE



RIV-O-SEAL INSTALLATION



MATERIAL TABLE

Basic Part Number	Material	
	Rivet	O-Ring
860-015 860-065	21.17-T4 5056	MIL-R-6855 Class I (Fuel Res) Grade 60

LENGTH AND DIAMETER TABLE

Diameter	Length											
3/32	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1.0
1/8		3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1.0
5/32			1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1.0
3/16				5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1.0
1/4					3/8	7/16	1/2	9/16	5/8	3/4	7/8	1.0

90D037-12-84

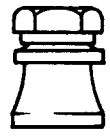
Figure 1-33. Riv-O-Seal and Flush Seal Rivet Identification and Size Data

HI-LOK FASTENERS

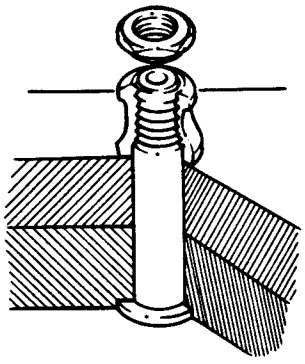
EXAMPLE OF PIN PART NUMBER CODE

HL18PB -6 -4

- -4: Max Grip Length (In 1/16 Inch)
- -6: Pin Diameter (In 1/32 Inch)
- HL18PB: MFRs Basic Part No. Pin, Protruding Shear Head, Titanium Alloy



Hi-Lok Collar



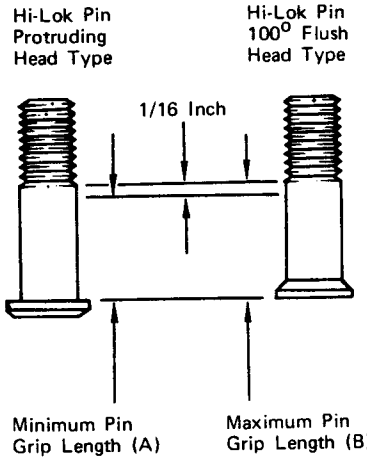
Hi-Lok Fastener Installation

EXAMPLE OF COLLAR PART NUMBER CODE:

HL 70 -8

- -8: Thread Size (In 1/32 Inch)
- HL 70: MFRs Basic Part No. Collar, Hi-Lok. Red Collar = Standard Collar. Blue Collar = Salvage Collar

GRIP LENGTH RANGE



NOTE

Touch up sheared areas of aluminum alloy collars and comply as soon as practical with corrosion control and refinishing instructions, T.O. 1A-7D-23.

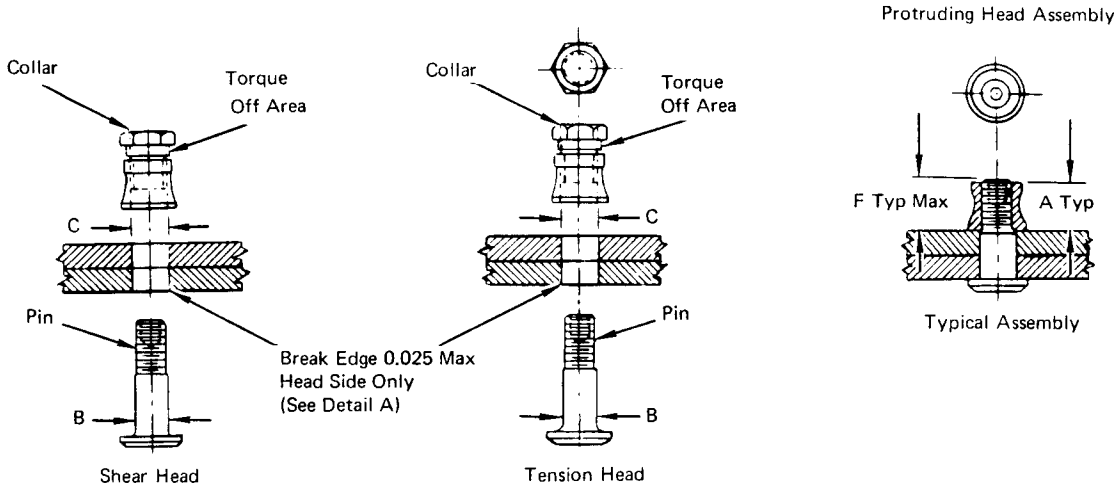
GRIP LENGTH SELECTION

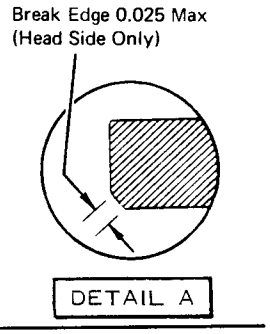
Second (Grip) Dash Number	Grip Length Range	
	Minimum (A)	Maximun (B)
-1	0	0.062
-2	0.063	0.125
-3	0.126	0.187
-4	0.188	0.250
-5	0.251	0.312
-6	0.313	0.375
-7	0.376	0.437
-8	0.438	0.500
-9	0.501	0.562
-10	0.563	0.625
-11	0.626	0.687
-12	0.688	0.750
-13	0.751	0.812
-14	0.813	0.875
-15	0.876	0.937
-16	0.938	1.000
-17	1.001	1.062
-18	1.063	1.125
-19	1.126	1.187
-20	1.188	1.250
-21	1.251	1.312
-22	1.313	1.375
-23	1.376	1.437
-24	1.438	1.500

90D038-12-84

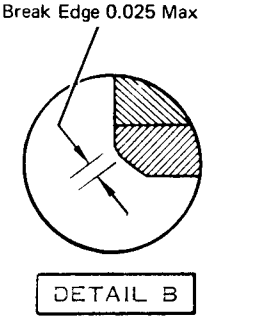
Figure 1-34. Hi-Lok Fastener Identification and Grip Length Data

PROTRUDING HEAD INSTALLATION

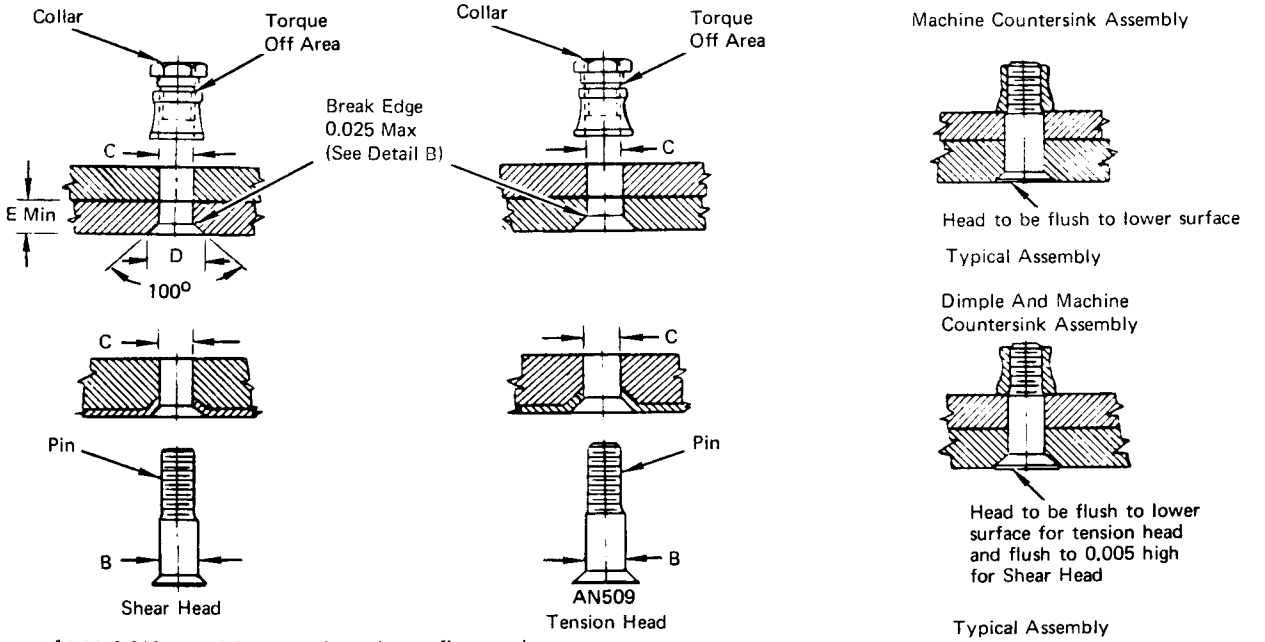




Nom Dia.	A Ref	B* Dia. Ref	C Dia.	D Dia.	E Min	F Max
3/16	0.280	0.1895 0.1885	0.1885 0.1865	0.3116 0.3016	0.063	0.397
1/4	0.340	0.2495 0.2485	0.2485 0.2465	0.4048 0.3948	0.090	0.467
5/16	0.430	0.3120 0.3110	0.3110 0.3090	0.4839 0.4739	0.100	0.572
3/8	0.470	0.3745 0.3735	0.3735 0.3715	0.5704 0.5604	0.125	0.617



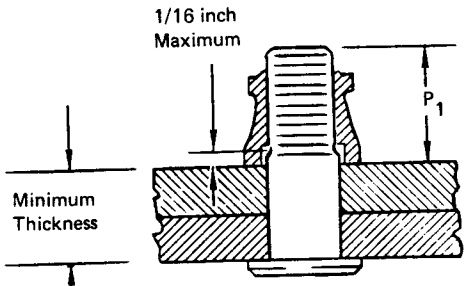
FLUSH HEAD INSTALLATION



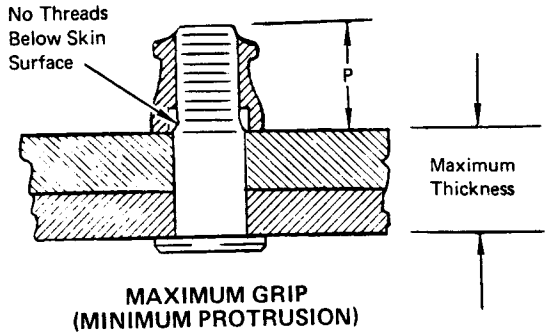
*Add 0.010 to minimum and maximum figures when installation is in steel, stainless steel, or titanium.

90D039-01-12-84

Figure 1-35. Hi-Lok Fastener Hole Preparation, Installation, and Removal (Sheet 1 of 2)



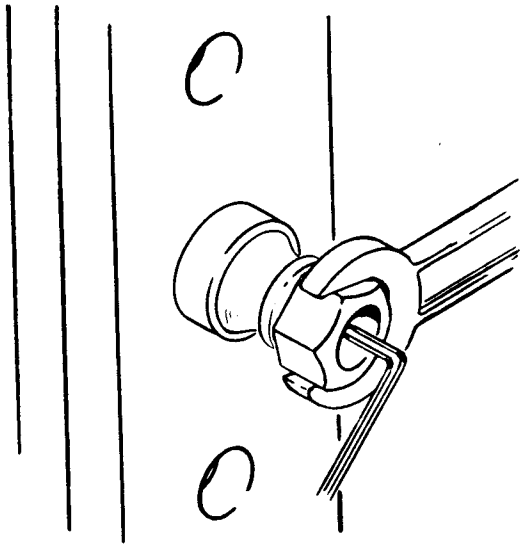
MINIMUM GRIP
(MAXIMUM PROTRUSION)



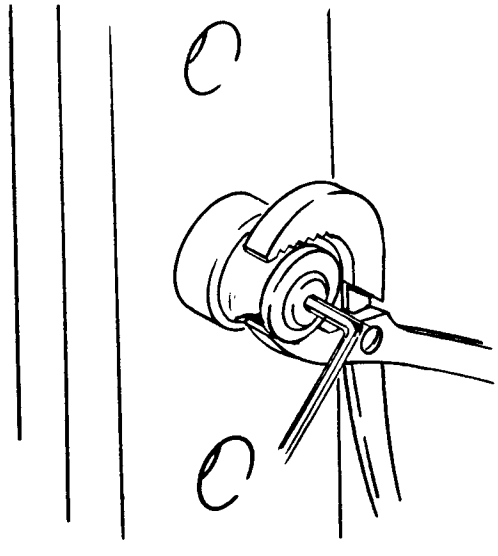
MAXIMUM GRIP
(MINIMUM PROTRUSION)

Fastener		Minimum Protrusion P	Maximum Protrusion P_1
First Dash Number (Diameter)	Nominal Diameter		
–5	5/32	0.302	0.384
–6	3/16	0.315	0.397
–8	1/4	0.385	0.467
–10	5/16	0.490	0.572
–12	3/8	0.535	0.617
–14	7/16	0.625	0.707
–16	1/2	0.675	0.757

FASTENER NOMINAL DIAMETERS AND INSTALLED FASTENER PROTRUSION LIMITS



FASTENER INSTALLATION

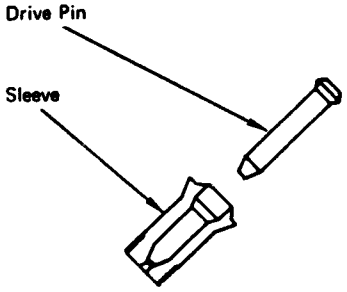


FASTENER REMOVAL

90D039–02–12–84

Figure 1-35. Hi-Lok Fastener Hole Preparation, Installation, and Removal (Sheet 2)

DEUTSCH DRIVE PIN BLIND RIVET

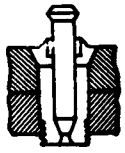


PART NUMBER EXAMPLE

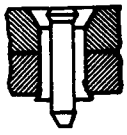
6950 - S - 06 - 3 SP

- 3 SP — Designates Short Pin Length for Dia – 06 And Above
- 3 — Grip Length Determined From Grip Range Table Below
- 06 — Diameter in 1/32-Inch Increments
- S — MATERIAL 1. S=303 Stainless Steel; 2. H=17-4 PH Stainless Steel
- 6950 — Basic Part Number: 1. 6950 - Countersunk Head; 2. 6951 - Protruding Head

DEUTSCH RIVET INSTALLATION



Before Driving



After Driving

GRIP RANGE TABLE

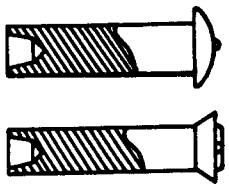
*Grip Range		Last	**Grip Range		Last	**Grip Range	
Min	Max	Dash No.	Min	Max	Dash No.	Min	Max
0.085	0.147	2			15	0.916	0.978
0.148	0.210	3	0.166	0.227	16	0.979	1.040
0.211	0.273	4	0.228	0.290	17	1.041	1.103
0.274	0.335	5	0.291	0.353	18	1.104	1.165
0.336	0.398	6	0.354	0.415	19	1.166	1.228
0.399	0.460	7	0.416	0.478	20	1.229	1.290
0.461	0.523	8	0.479	0.540	21	1.291	1.353
0.524	0.585	9	0.541	0.603	22	1.354	1.415
0.586	0.648	10	0.604	0.665	23	1.416	1.478
0.649	0.710	11	0.666	0.728	24	1.479	1.540
0.711	0.773	12	0.729	0.790	25	1.541	1.603
		13	0.791	0.853	26	1.604	1.665
		14	0.854	0.915	27	1.666	1.728

*Grip range for 1/8 and 5/32 diameter rivets only.

**Grip range for 3/16, 1/4, 5/16, and 3/8 diameter rivets only.

90D040–12–84

Figure 1-36. Deutsch Drive Pin Blind Rivet Identification and Grip Range Data



Raised Teat =
2017 Aluminum

Raised Cross =
5056 Aluminum

PART NUMBER EXAMPLE I

Basic Part No.

CVC 1389 -C 5 -D 9

- 9 — Length in 1/16-Inch Increments
- -D — Material: D – 2017 Aluminum Alloy; B – 5056 Aluminum Alloy
- 5 — Diameter in 1/32-Inch Increments
- -C — Head Type: C – Brazier Head Rivet; D – 100° CSK Head Rivet
- CVC 1389 — Designates Semi-Tubular Rivet

WASHER GAGE

Dash No.	Gage
A	0.016
1	0.025
2	0.032
3	0.040
4	0.051
5	0.064
6	0.081
7	0.091
8	0.125
9	0.188

PART NUMBER EXAMPLE II

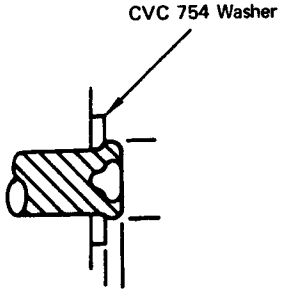
Basic Part No.

CVC 754 -4 75 D -27

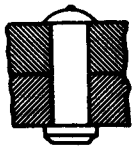
- -27 — Inside Diameter (ID) in 1/64-Inch Increments
- D — Material: C – CRES; D – 2024 Al Alloy
- 75 — Outside Diameter (OD) In 1/64-Inch Increments
- -4 — Gage of Material: See Table
- CVC 754 — Designates Washer – Special

INSPECTION TOLERANCES FOR SEMI-TUBULAR RIVETS

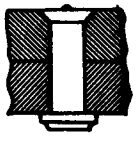
Rivet Diameter	Minimum Dimensions D	H
1/8	0.140	0.025
5/32	0.175	0.030
3/16	0.210	0.035
1/4	0.280	0.050



SEMI-TUBULAR RIVET INSTALLATION



STEP I
Insert rivet with at least one CVC 754 washer on the shank.

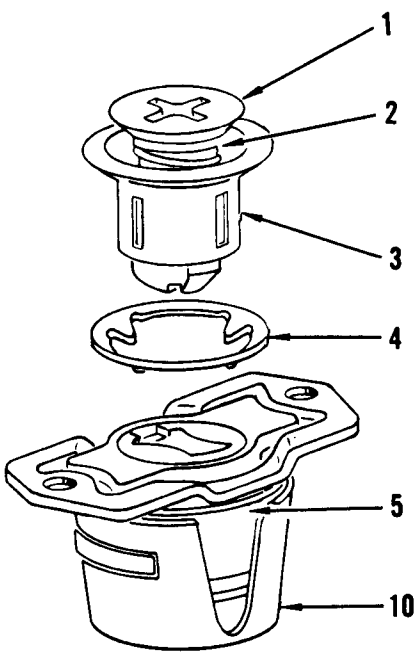


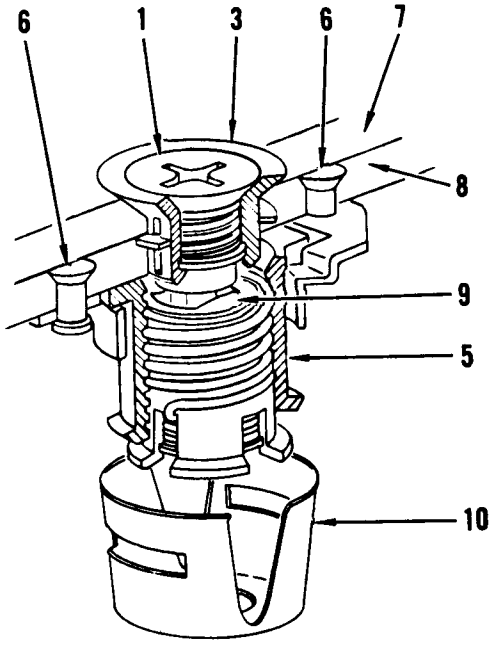
STEP II

Buck rivet head while shank is expanded.

90D041-12-84

Figure 1-37. Semi-Tubular Rivet Identification and Installation





1. Flush Stud
2. Ejection Spring
3. Bushing
4. Retaining Ring (countersunk type)
5. Receptacle Housing
6. Receptacle Assembly Attaching Rivets
7. Outer Skin (ref)
8. Inner Skin (ref)
9. Insert
10. Cover

PART NUMBER EXAMPLE II

4S14 – 8 – 6

- Bushing Length Dash Number
- Stud Grip Range Dash Number – See Chart
  - 14. Designates Steel Flush Head
  - 15. Designates Steel Protruding Head
  - 24. Designates 6061 Aluminum Flush Head
  - 25. Designates 6061 Aluminum Protruding Head
- Manufacturer's Basic Part Number For Camloc Stud Assembly:

PART NUMBER EXAMPLE III

4S41 – 1

- Designates 7/8-Inch Rivet Spacing
- Manufacturer's Basic Part Number:
  - 41. Designates Floating Receptacle
  - 48. Designates Sealed Floating Receptacle

PART NUMBER EXAMPLE I

4S9 – 1

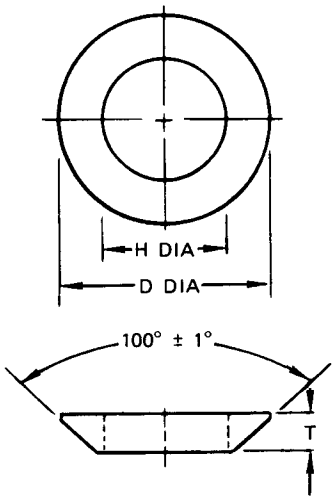
- –1 Designates Split Ring
- –2 Designates Solid Ring
- Manufacturer's Basic Part Number:
  - 10 Designates Cone (CSK) Shaped Retainer Ring
  - 9 Designates Flat Retainer Ring

GRIP RANGE CHART

Grip Range	Flush Head	Protruding Head
0.058 - 0.157		-4
0.158 - 0.257	-4	-6
0.258 - 0.357	-6	-8
0.358 - 0.457	-8	-10
0.458 - 0.557	-10	-12
0.558 - 0.657	-12	-14
0.658 - 0.757	-14	-16
0.758 - 0.857	-16	

90D042-12-84

Figure 1-38. Camloc Fastener Identification and Grip Range Data



CVC771 SKIN COUNTERSINK CONICAL WASHER

PART NUMBER	FASTENER SIZE (NOM.)	D DIA.	H DIA. ±0.005	T THICKNESS
CVC771-2	1/8	0.338	0.120	0.081
CVC771-3	3/16	0.383	0.180	0.086
CVC771-4	1/4	0.512	0.246	0.114
CVC771-5	5/16	0.646	0.290	0.147

MFG IDENT CODE: 80378

PART NUMBER CODE: Basic part number designates a conical washer as shown. Code letter following basic part number designates material and finish. Dash number designates undersize ID in 1/16 inch increments.

EXAMPLE: CVC771D3 = a conical washer as shown in figure and dimensioned in table with an undersize 3/16 inch ID and of 2024-T4 aluminum alloy material.

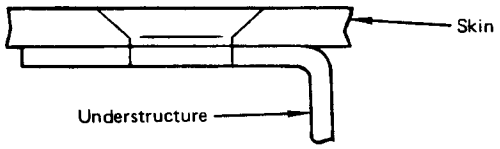
MATERIAL: D = 2024-T4 aluminum alloy, QQ-A-268.
E = 5356-H34 aluminum alloy, MIL-A-8701 COND 1/2 hard, or 5052-H34, QQ-A-315.

FINISH: D = Anodize, MIL-A-8625, or surface treat MIL-C-5541.
E = No protective finish. Dye orange outside edge of all surfaces.

NOTE

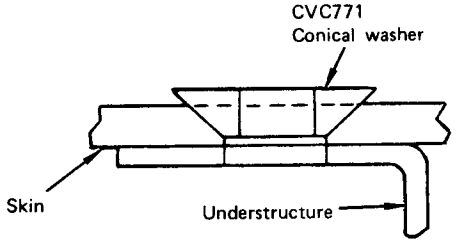
1. Washers are intended for use to fill countersink voids where existing fastener patterns are picked up to attach additional structure or components.
2. Washers have undersize ID's and added thickness (T dimension) to permit drilling, reaming, and shaving to size after they are bonded in place.
3. Allowable substitute: Bond short grip length MS20426AD/B rivets in countersink recess and drill through rivet heads with drill corresponding to final hole size for repair fasteners.

STEP 1



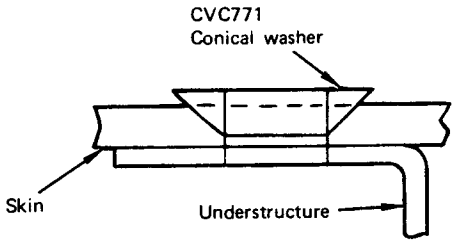
EXISTING RIVET HOLE (RIVET REMOVED)

STEP 2



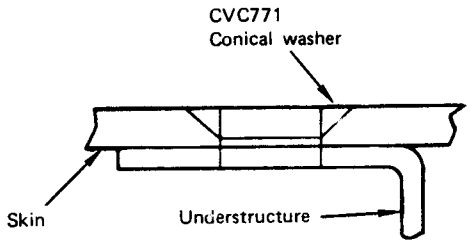
CONICAL WASHER BONDED IN EXISTING RIVET HOLE

STEP 3



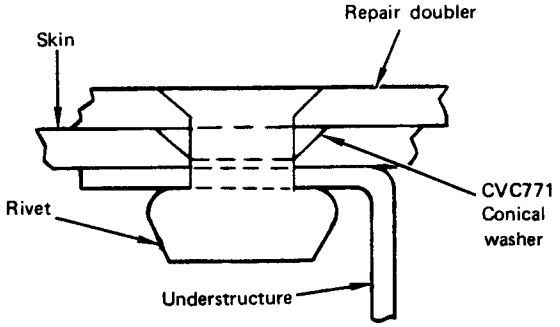
HOLE IN CONICAL WASHER DRILLED UP TO SAME SIZE AS EXISTING RIVET HOLE

STEP 4



CONICAL WASHER SHAVED FLUSH WITH SKIN SURFACE (+0.002 MAX)

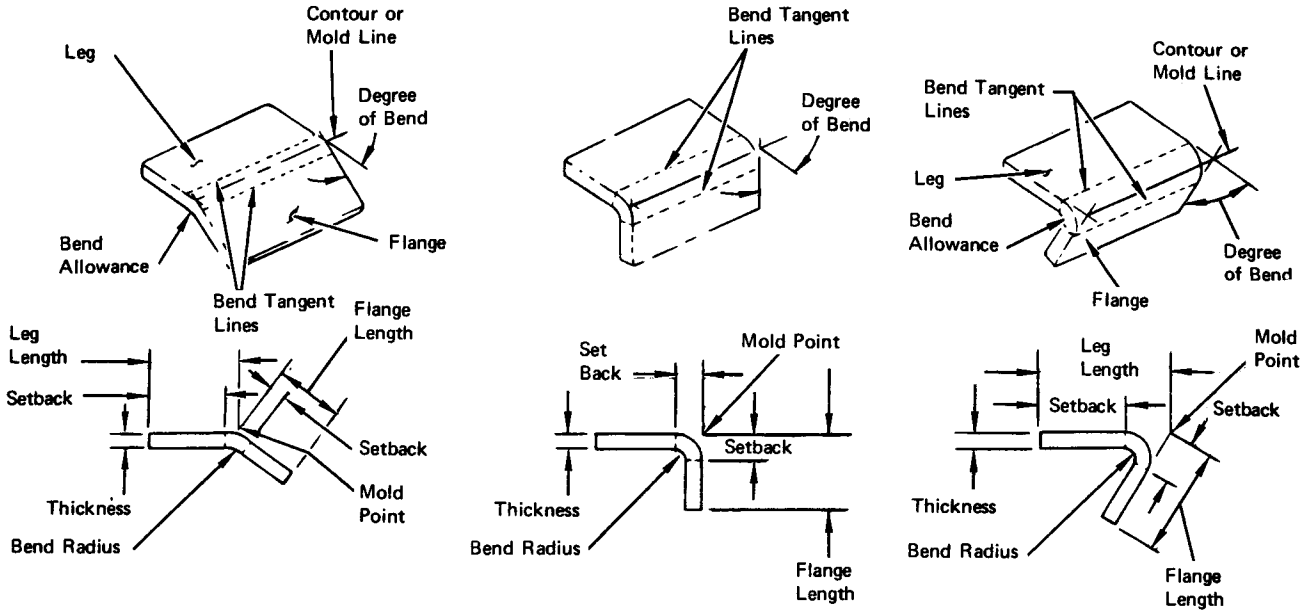
STEP 5



RIVET INSTALLED THROUGH REPAIR DOUBLER, CONICAL WASHER, SKIN, AND UNDERSTRUCTURE

90D043-12-84

Figure 1-39. CVC771 Skin Countersink Conical Washer Identification and Installation Data

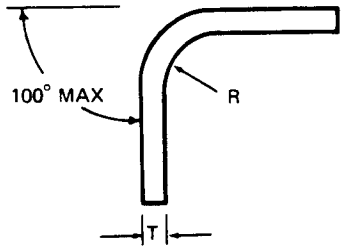


OPEN FLANGE | 90 DEGREES | CLOSED FLANGE

Leg	The longer part of a formed angle.
Flange	The short part of the formed angle. If each is the same length, each is known as a leg.
Mold Line (ML)	The line formed by extending the outside surface of the leg and flange.
Bend Tanget Line	The line at which the metal starts to bend.
Radius (R)	The radius of the bend, which is always the inside of the metal being formed.
Setback (SB)	The amount that the two mold line dimensions overlap when they are bent around the formed part.

90D044-12-84

Figure 1-40. Forming Terminology



LEGEND

T– Nominal Gage
R– Bend Radius
A– Hot-Formed
B– Cold-Formed

MINIMUM INSIDE BEND RADII

	ALUMINUM ALLOY CLAD			CORROSION–RESISTING STEEL				TITANIUM		
Nominal Gage	2024-0 7075-0 7075-T6(A)	2024-T3	7075-T6(B)	Annealed	1/4 Hard	1/2 Hard	Hard	Unalloyed AMS-4901	Alloy AMS-4908	Gage
0.005				0.03	0.03	0.03	0.03			
0.008				0.03	0.03	0.03	0.03			
0.010				0.03	0.03	0.03	0.06			
0.012				0.03	0.03	0.03	0.06		0.06	0.012
0.014				0.03	0.03	0.06	0.06			
0.016	0.06	0.06	0.09	0.03	0.03	0.06	0.09		0.09	0.016
0.018				0.03	0.06	0.06	0.09			
0.020	0.06	0.06	0.09						0.09	0.020
0.022									0.09	0.018
0.025	0.06	0.06	0.09	0.03	0.06	0.09	0.12		0.12	0.025
0.028				0.03	0.06	0.09	0.12			
0.032	0.06	0.09	0.12						0.16	0.032
0.035				0.06	0.06	0.12	0.16			
0.040	0.06	0.09	0.16						0.19	0.040
0.049				0.06	0.12	0.16	0.22		0.19	0.045
0.051	0.09	0.16	0.19						0.22	0.050
0.064	0.12	0.16	0.22						0.25	0.063
0.065				0.09	0.16	0.25	0.33			
0.072	0.12	0.22							0.31	0.071
0.081	0.16	0.25								
0.083				0.09	0.16	0.34	0.38		0.34	0.080
0.091	0.19								0.38	0.090
0.095				0.12	0.19	0.38	0.44			
0.102	0.22	0.34							0.41	0.100
0.125	0.31	0.38							0.50	0.125
0.156	0.31	0.56								
0.188	0.38	0.62								

90D045–12–84

Figure 1-41. Minimum Inside Bend Radii

BEND ALLOWANCE PER DEGREE OF BEND

BEND RADIUS	MATERIAL THICKNESS											
	0.020	0.025	0.032	0.040	0.050	0.063	0.071	0.080	0.090	0.100	0.125	0.190
1/32	0.00070	0.00074	0.00079	0.00085	0.00093	0.00104	0.00110	0.00117	0.00125	0.00132	0.00154	0.00202
1/16	0.00125	0.00129	0.00134	0.00140	0.00148	0.00158	0.00164	0.00171	0.00180	0.00187	0.00209	0.00256
3/32	0.00179	0.00183	0.00188	0.00195	0.00202	0.00212	0.00219	0.00226	0.00233	0.00242	0.00263	0.00312
1/8	0.00233	0.00237	0.00243	0.00249	0.00257	0.00267	0.00273	0.00282	0.00288	0.00296	0.00315	0.00366
5/32	0.00288	0.00292	0.00297	0.00303	0.00311	0.00321	0.00327	0.00334	0.00342	0.00350	0.00370	0.00420
3/16	0.00342	0.00347	0.00352	0.00358	0.00366	0.00375	0.00382	0.00389	0.00397	0.00404	0.00424	0.00475
7/32	0.00397	0.00401	0.00406	0.00412	0.00420	0.00430	0.00436	0.00443	0.00451	0.00459	0.00479	0.00529
1/4	0.00451	0.00455	0.00461	0.00467	0.00475	0.00484	0.00491	0.00498	0.00505	0.00513	0.00533	0.00583
9/32	0.00506	0.00510	0.00515	0.00521	0.00529	0.00539	0.00545	0.00552	0.00560	0.00568	0.00588	0.00638
5/16	0.00560	0.00564	0.00570	0.00576	0.00584	0.00593	0.00599	0.00606	0.00614	0.00622	0.00642	0.00692
11/32	0.00615	0.00619	0.00624	0.00630	0.00638	0.00647	0.00654	0.00661	0.00669	0.00676	0.00697	0.00747
3/8	0.00669	0.00673	0.00679	0.00685	0.00693	0.00702	0.00708	0.00715	0.00723	0.00731	0.00751	0.00774
13/32	0.00724	0.00728	0.00733	0.00739	0.00474	0.00756	0.00763	0.00770	0.00777	0.00785	0.00806	0.00856
7/16	0.00778	0.00782	0.00788	0.00794	0.00802	0.00811	0.00817	0.00824	0.00832	0.00840	0.00860	0.00910
15/32	0.00833	0.00837	0.00842	0.00848	0.00856	0.00865	0.00871	0.00878	0.00886	0.00894	0.00914	0.00964
1/2	0.00887	0.00891	0.00896	0.00903	0.00910	0.00919	0.00926	0.00933	0.00941	0.00948	0.00969	0.01019
17/32	0.00941	0.00945	0.00951	0.00957	0.00965	0.00974	0.00980	0.00987	0.00995	0.01003	0.01023	0.01073
9/16	0.00996	0.01000	0.01005	0.01012	0.01019	0.01028	0.01034	0.01042	0.01049	0.01057	0.01078	0.01127
19/32	0.01050	0.01054	0.01060	0.01066	0.01074	0.01083	0.01089	0.01096	0.01104	0.01112	0.01132	0.01182
5/8	0.01105	0.01109	0.01114	0.01121	0.01128	0.01137	0.01143	0.01150	0.01158	0.01166	0.01187	0.1236
21/32	0.01159	0.01163	0.01169	0.01175	0.01183	0.01191	0.01198	0.01205	0.01213	0.01220	0.01241	0.01291
11/16	0.01214	0.01218	0.01223	0.01230	0.01238	0.01248	0.01258	0.01261	0.01269	0.01281	0.01298	0.01351
23/32	0.01268	0.01273	0.01276	0.01283	0.01291	0.01301	0.01310	0.01316	0.01322	0.01333	0.01351	0.01403
3/4	0.01323	0.01327	0.01332	0.01338	0.01347	0.01357	0.01363	0.01370	0.01378	0.01385	0.01407	0.01455
25/32	0.01378	0.01381	0.01386	0.01392	0.01401	0.01411	0.01415	0.01425	0.01432	0.01437	0.01461	0.01508
13/16	0.01432	0.01436	0.01441	0.01447	0.01456	0.01466	0.01471	0.01479	0.01487	0.01493	0.01516	0.01564
27/32	0.01486	0.01490	0.01494	0.01501	0.01509	0.01519	0.01520	0.01534	0.01540	0.01542	0.01569	0.01612
7/8	0.01541	0.01545	0.01550	0.01556	0.01565	0.01575	0.01582	0.01588	0.01596	0.01619	0.01625	0.01682
29/32	0.01595	0.01599	0.01604	0.01610	0.01619	0.01629	0.01639	0.01643	0.01650	0.01664	0.01679	0.01734
15/16	0.01650	0.01654	0.01659	0.01665	0.01674	0.01684	0.01693	0.01697	0.01705	0.01716	0.01734	0.01786
31/32	0.01704	0.01708	0.01712	0.01718	0.01727	0.01737	0.01746	0.01752	0.01758	0.01769	0.01787	0.01839
1	0.01759	0.01763	0.01768	0.01774	0.01783	0.01793	0.01798	0.01806	0.01814	0.01821	0.01843	0.02191

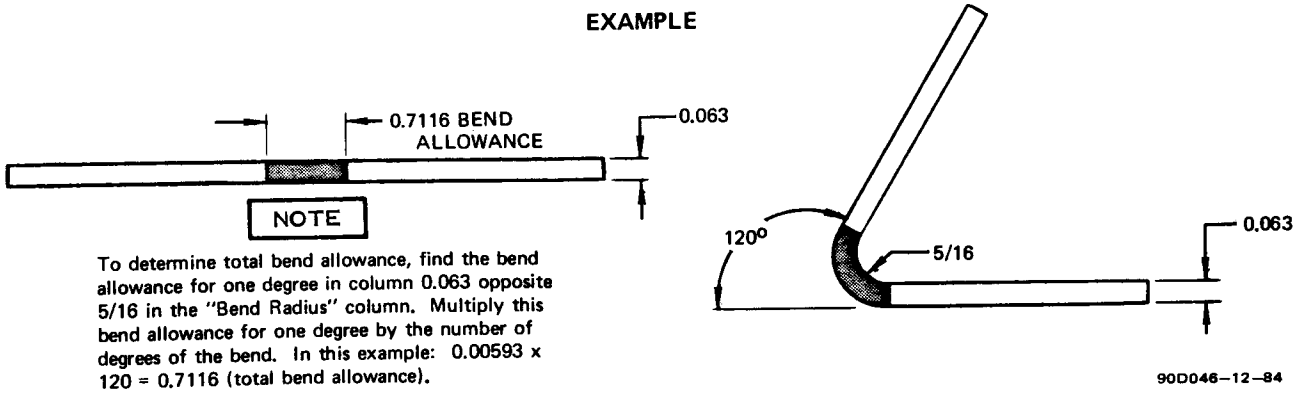
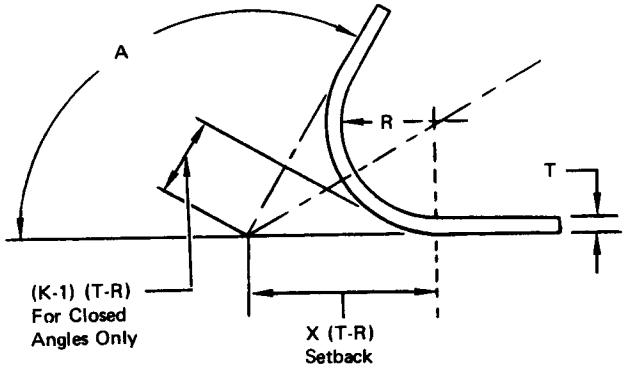


Figure 1-42. Bend Allowance Chart

ANGLE DEGREE	K	ANGLE DEGREE	K	ANGLE DEGREE	K	ANGLE DEGREE	K	ANGLE DEGREE	K	ANGLE DEGREE	K
1	0.00873	31	0.27732	61	0.58904	91	1.0176	121	1.7675	151	3.8667
2	0.01745	32	0.28674	62	0.60086	92	1.0355	122	1.8040	152	4.0108
3	0.02618	33	0.29621	63	0.61208	93	1.0538	123	1.8418	153	4.1653
4	0.03493	34	0.30573	64	0.62487	94	1.0727	124	1.8807	154	4.3315
5	0.04366	35	0.31530	65	0.63707	95	1.0913	125	1.9210	155	4.5107
6	0.05241	36	0.32492	66	0.64941	96	1.1106	126	1.9626	156	4.7046
7	0.06116	37	0.33459	67	0.66188	97	1.1303	127	2.0057	157	4.9151
8	0.06993	38	0.34433	68	0.67451	98	1.1504	128	2.0503	158	5.1455
9	0.07870	39	0.35412	69	0.68728	99	1.1708	129	2.0965	159	5.3995
10	0.08749	40	0.36397	70	0.70021	100	1.1917	130	2.1445	160	5.6713
11	0.09629	41	0.37388	71	0.71329	101	1.2131	131	2.1943	161	5.9758
12	0.10510	42	0.38386	72	0.72654	102	1.2349	132	2.2460	162	6.3137
13	0.11393	43	0.39391	73	0.73996	103	1.2572	133	2.2998	163	6.6911
14	0.12278	44	0.40403	74	0.75355	104	1.2799	134	2.3558	164	7.1154
15	0.13165	45	0.41421	75	0.76733	105	1.3032	135	2.4142	165	7.5957
16	0.14054	46	0.42447	76	0.78128	106	1.3270	136	2.4751	166	8.1443
17	0.14945	47	0.43481	77	0.79543	107	1.3514	137	2.5386	167	8.7769
18	0.15838	48	0.44523	78	0.80978	108	1.3764	138	2.6051	168	9.5144
19	0.16734	49	0.45573	79	0.82434	109	1.4019	139	2.6746	169	10.385
20	0.17633	50	0.46631	80	0.83910	110	1.4281	140	2.7475	170	11.430
21	0.18534	51	0.47697	81	0.85408	111	1.4550	141	2.8239	171	12.706
22	0.19438	52	0.48773	82	0.86929	112	1.4826	142	2.9042	172	14.301
23	0.20345	53	0.49858	83	0.88472	113	1.5108	143	2.9887	173	16.350
24	0.21256	54	0.50952	84	0.90040	114	1.5399	144	3.0777	174	19.081
25	0.22169	55	0.52057	85	0.91633	115	1.5697	145	3.1716	175	22.904
26	0.23087	56	0.53171	86	0.93251	116	1.6003	146	3.2708	176	26.636
27	0.24008	57	0.54295	87	0.94896	117	1.6318	147	3.3759	177	38.188
28	0.24933	58	0.55431	88	0.96569	118	1.6643	148	3.4874	178	57.290
29	0.25862	59	0.56577	89	0.98270	119	1.6977	149	3.6059	179	114.590
30	0.26795	60	0.57737	90	1.00000	120	1.7320	150	3.7320	180	INFINITE

Use to determine the distance between the mold line and the bend line of sheet metal flanges

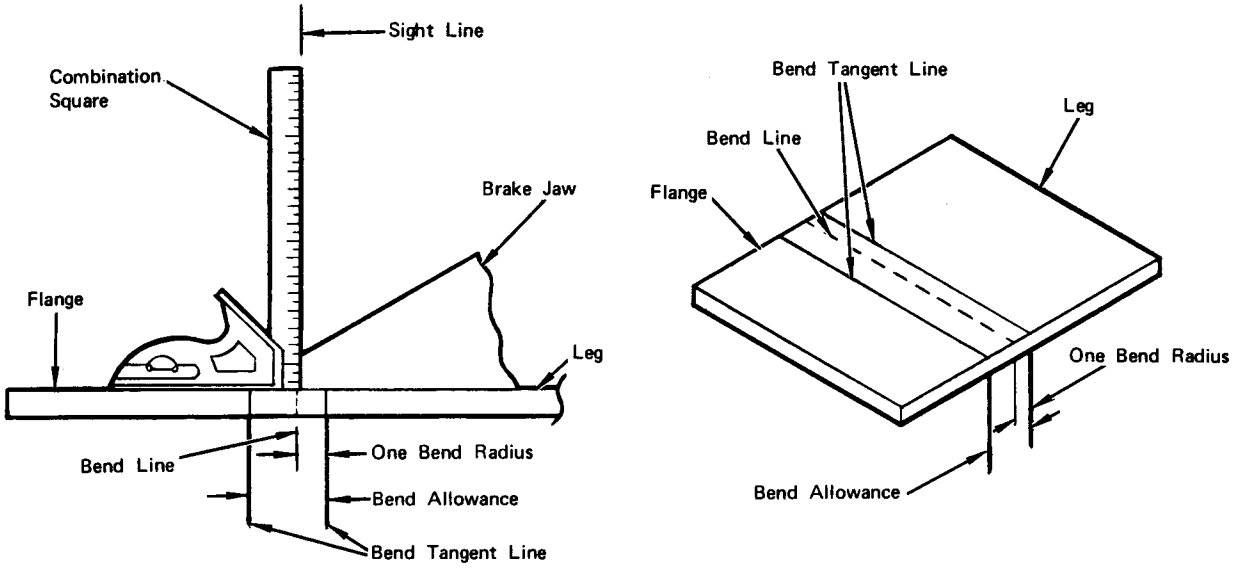


EXAMPLE

Degrees in Bend (A) = 120°
Gage (T) = 0.032
Radius = 0.125
K (From Table) = 1.732
Setback = 1.732 (0.032 + 0.125)
1.732 x 0.157
= 0.272

90D047-12-84

Figure 1-43. Setback Chart



PROCEDURE:

1. Lay out bend line a distance of one bend radius from the bend tangent line.
2. Line up the bend line with the nose of the bending tool by using a combination square.
3. If the bend is made with form blocks, the bend line is to line up with the edge of the form block.

Figure 1-44. Use of Bend Line

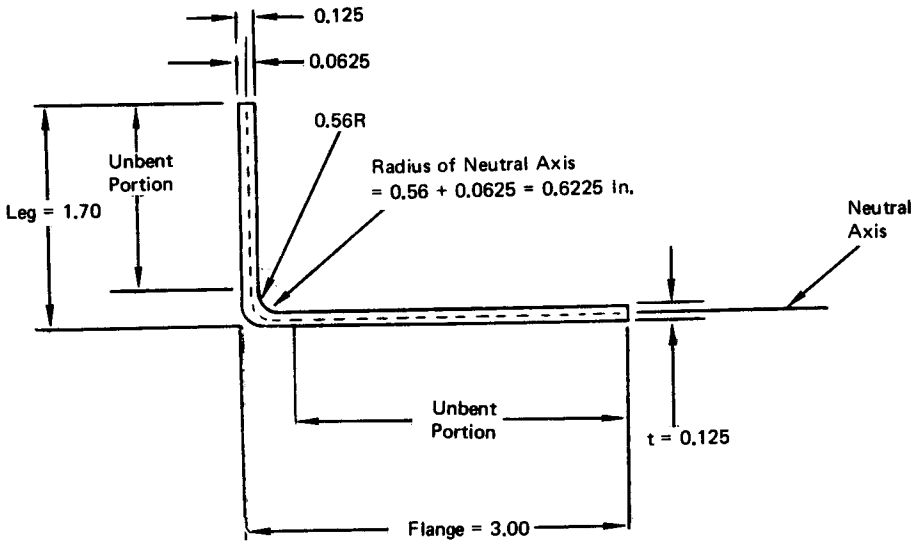


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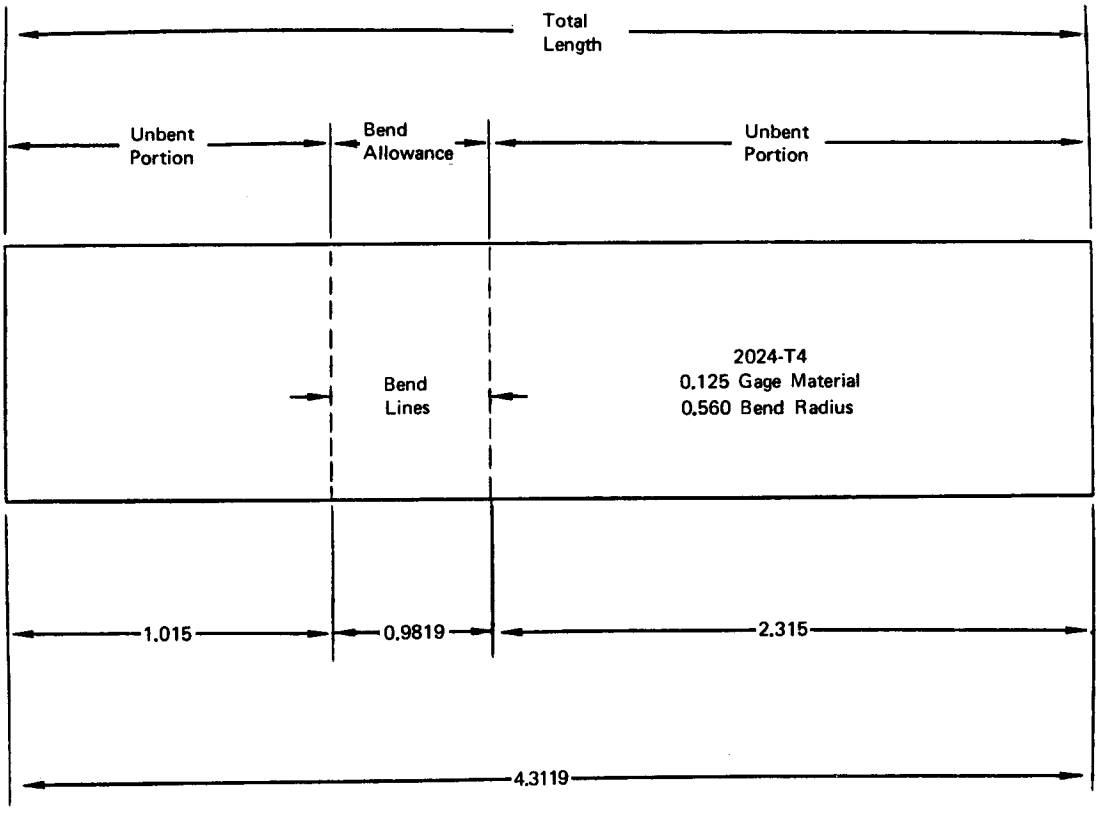
Figure 1-45. Forming Layout Diagram



LAYOUT PROCEDURE

Step 1 Assume the material shown in Forming Layout Diagram is 2024-T4 with a gage of 0.125 and a bend radius of 0.560.

Step 2 From the Bend Allowance Table, for 0.125 2024-T4 material with a bend radius of 0.560, we obtain a bend allowance of 0.01091 inch per degree of bend. Since the bend angle is 90 degrees, the total bend allowance is the bend angle multiplied by the bend allowance for one degree, or, Total bend allowance = 90 degrees x 0.01091 in./degree = 0.9819 inch.

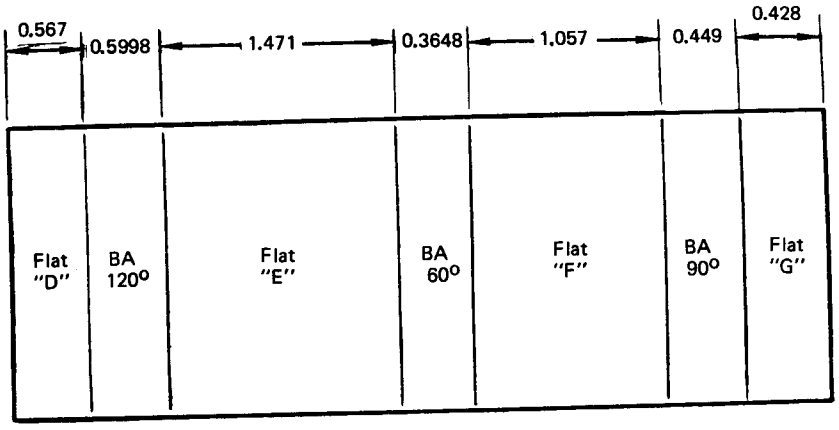
Step 3 From the Setback Chart, for a bend of 90 degrees, K = 1.000. Using the formula Setback = K (T + R) we obtain a setback of an amount equal to: Setback = K (T + R) = 1.00 (0.125 + 0.560) = 0.685.

Step 4 To obtain the length of stock required to form the bent-up section, subtract the setback from the leg and flange and add the bend allowance. Stock Length Required = (3.000 − 0.685) + (1.700 − 0.685) + 0.9819 = 2.315 + 1.015 + 0.9819 = 4.3119 inch (use 4.310).

90D050-12-84

Figure 1-46. Flat Pattern Layout From Charts–Example 1

STEP 4 LAYOUT



Layout Procedure

Use the Bend Allowance and Setback Charts in figuring the amount of material needed for flat pattern layout and for locating the bend tangent lines. Assume that the part to be developed is made of 0.072 gage, 2024-T3 Alclad, with flange angles of 120, 60, and 90 degrees respectively. The flat pattern of the part would be developed as follows:

Step 1 Shows the calculations for the setback at points A, B and Cu using the "K" value from the Setback Chart.

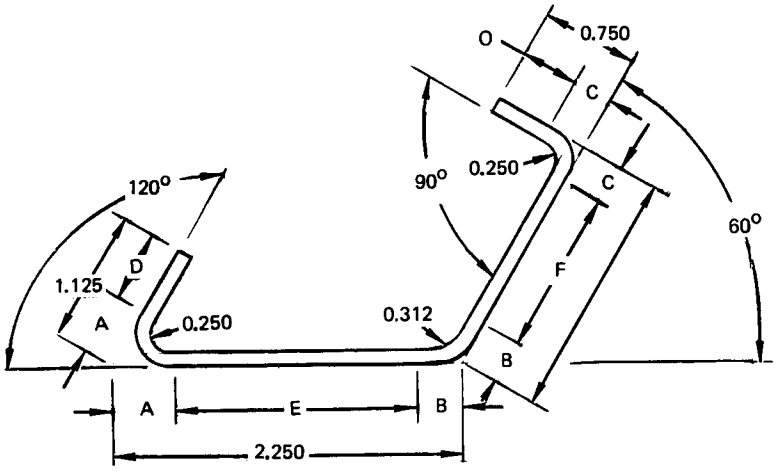
Step 2 Shows the calculation for the flat areas D, E, F and G by subtracting the setback from the respective mold line measurement.

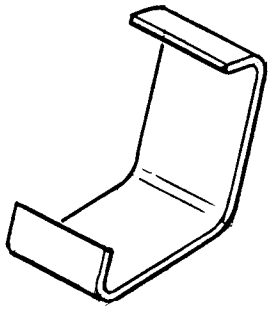
Step 3 Gives the calculations for finding the bend allowance for the 120, 60 and 90 degree bends using information from the Bend Allowance for One Degree Chart.

Step 4 Shows the flat pattern layout of the part.

90D051-01-12-84

Figure 1-47. Flat Pattern Layout From Charts–Example 2 (Sheet 1 of 2)





Material – 2024-T3 Alclad
Thickness = 0.072

STEP 1

Determine Setback

Setback Calculations
Setback = Bend Radius + Material Thickness X "K" Value

Setback at A = K (R + T)
Setback at A = 1.7320 (0.250 + 0.072)
Setback at A = 1.7320 x 0.322
Setback at A = 0.558

Setback at B = K (R + T)
Setback at B = 0.5773 (0.312 + 0.072)
Setback at B = 0.5773 x 0.384
Setback at B = 0.221

Setback at C = K (R + T)
Setback at C = 1 (0.250 + 0.072)
Setback at C = 1 x 0.322
Setback at C = 0.322

STEP 2

Determine Flat Areas

Flat Area Calculations
Flat Area = Mold Line Measurement (MLM) – Setback

Flat D = MLM – A
Flat D = 1.125 – 0.558
Flat D = 0.567

Flat E = MLM – A – B
Flat E = 2.250 – 0.221 – 0.558
Flat E = 1.471

Flat F = MLM – B – C
Flat F = 1.60 – 0.221 – 0.322
Flat F = 1.057

Flat G = MLM – C
Flat G = 0.750 – 0.322
Flat G = 0.428

STEP 3

Determine Bend Allowance

Bend Allowance Calculations
Bend Allowance = Bend Allowance per Degree x Number of Degrees in Bend

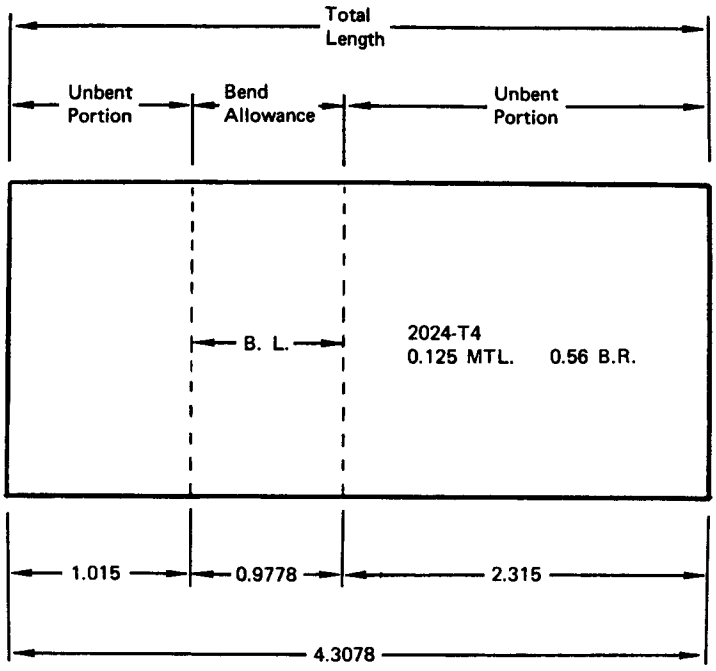
BA for 120° Bend = 120 (BA per Degree)
BA for 120° Bend = 120 x 0.00499
BA for 120° Bend = 0.5998

BA for 60° Bend = 60 (BA per Degree)
BA for 60° Bend = 60 x 0.00608
BA for 60° Bend = 0.3648

BA for 90° Bend = 90 (BA per Degree)
BA for 90° Bend = 90 x 0.00499
BA for 90° Bend = 0.4491

90D051–02–12–84

Figure 1-47. Flat Pattern Layout From Charts–Example 2 (Sheet 2)



LAYOUT PROCEDURE:

Figure 1-45 shows a simple sheet metal part having two sides at 90 degrees to each other. The true length of the bent stock can be found along the neutral axis.

Step 1 Find the radius of the neutral axis – Add the inside radius of the stock and one-half the stock thickness. With the inside radius of Figure 1-45 being 0.56 and the stock thickness is 0.125.

Neutral Axis = $(\frac{0.125}{2} + 0.56) = 0.6225$

Step 2 If the bend is made at a right angle, which is one-fourth of a circle, or 90 degrees, it is necessary to find the circumference of a circle having a radius of 0.6225 in. and then divide by 4.

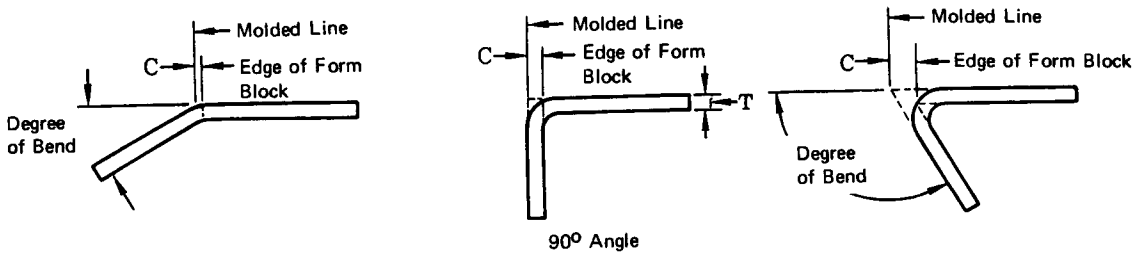
$C = 2 \pi R$
$C = 2 \times 3.1416 \times 0.6225 = 3.9113$
$3.9114 \div 4 = 0.9778$ Bend Allowance

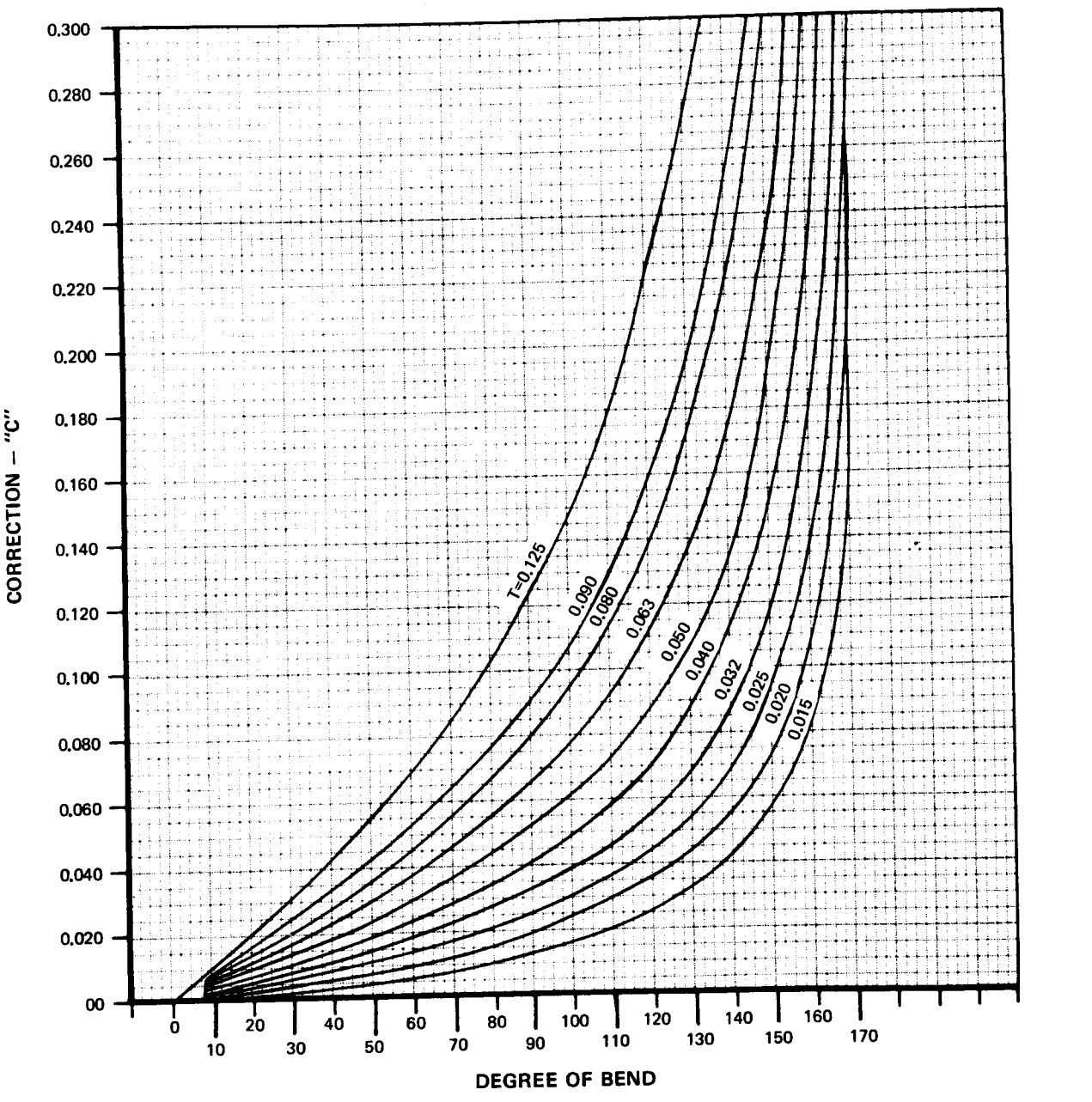
Step 3 Next the unbent portions in Figure 1-45 must be computed. To find this, subtract the stock thickness and the inside radius from the leg and the flange. Leg = 3.00 - (0.56 + 0.125) = 2.315 in. Flange = 1.70 - (0.56 + 0.125) = 1.015 in.

Step 4 Having found the lengths of the unbent portions, it is necessary to add the bend allowance to these distances.

90D052-12-84

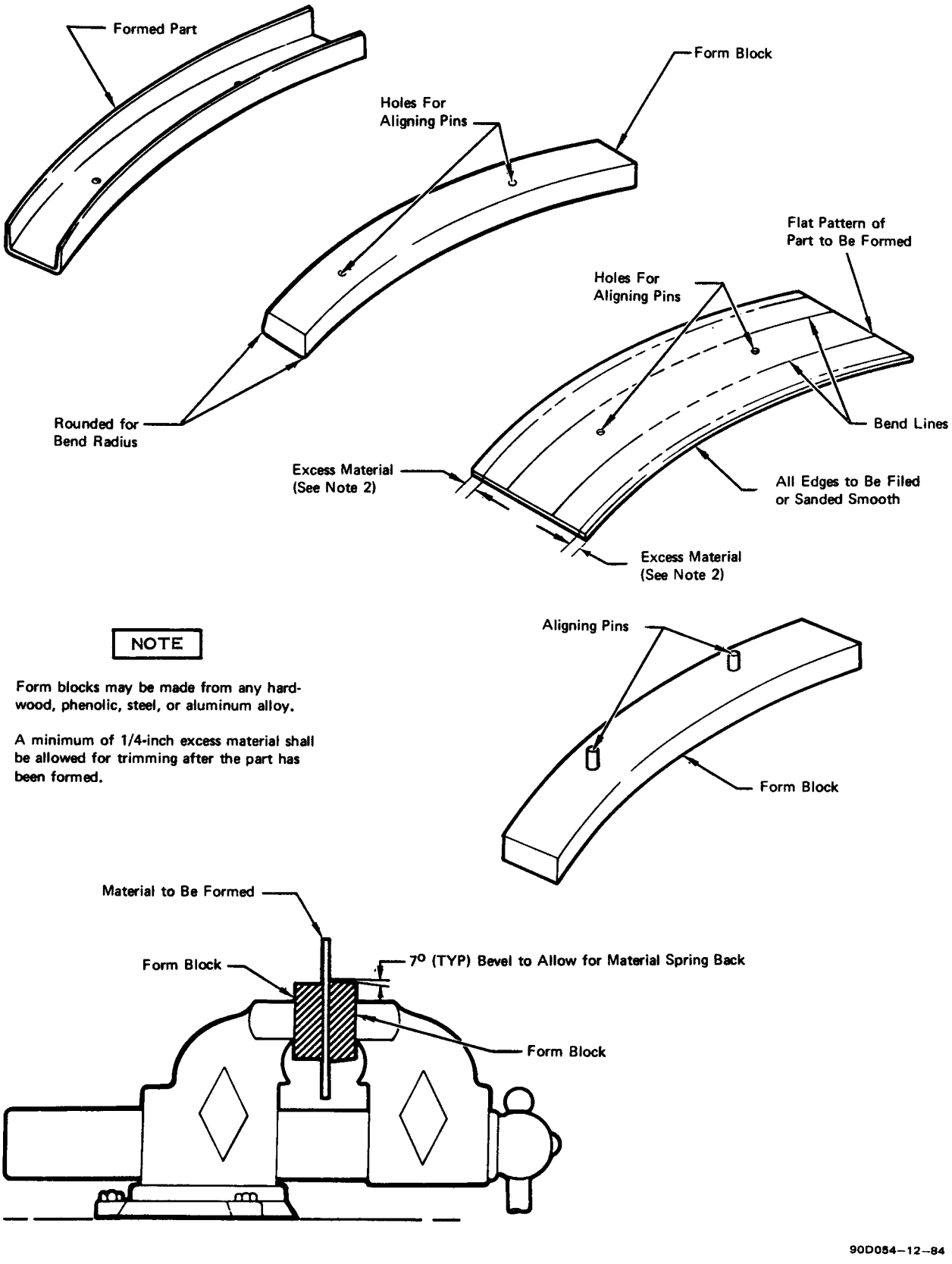
Figure 1-48. Flat Pattern Layout From Formula





90D053-12-84

Figure 1-49. Form Correction Chart

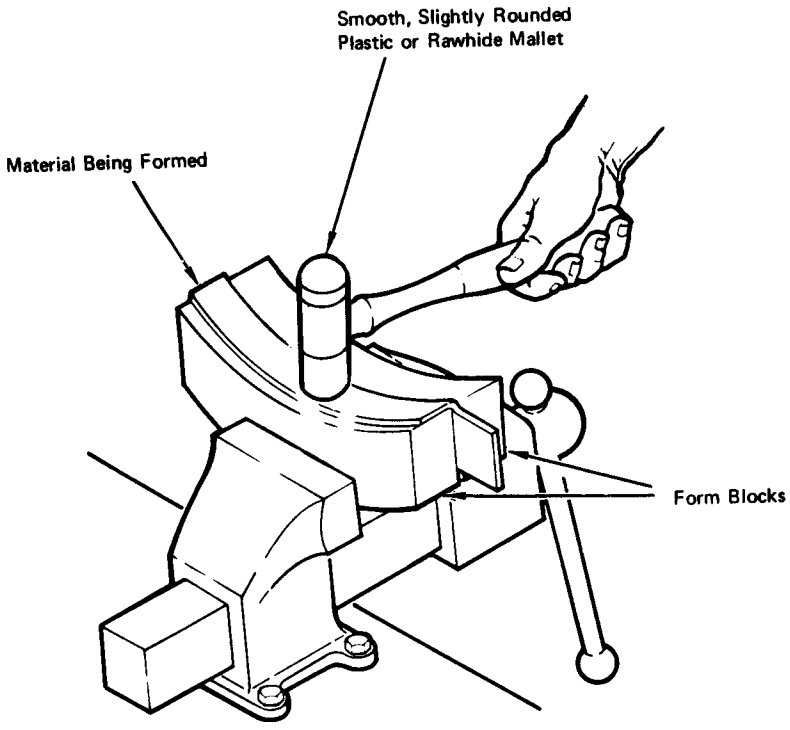


NOTE

1. Form blocks may be made from any hardwood, phenolic, steel, or aluminum alloy.
2. A minimum of 1/4-inch excess material shall be allowed for trimming after the part has been formed.

90D054-12-84

Figure 1-50. Procedure for Forming Parts



NOTE

The edges of the part should be smooth and free from any nicks or burrs that would cause the part to crack during the forming operation.

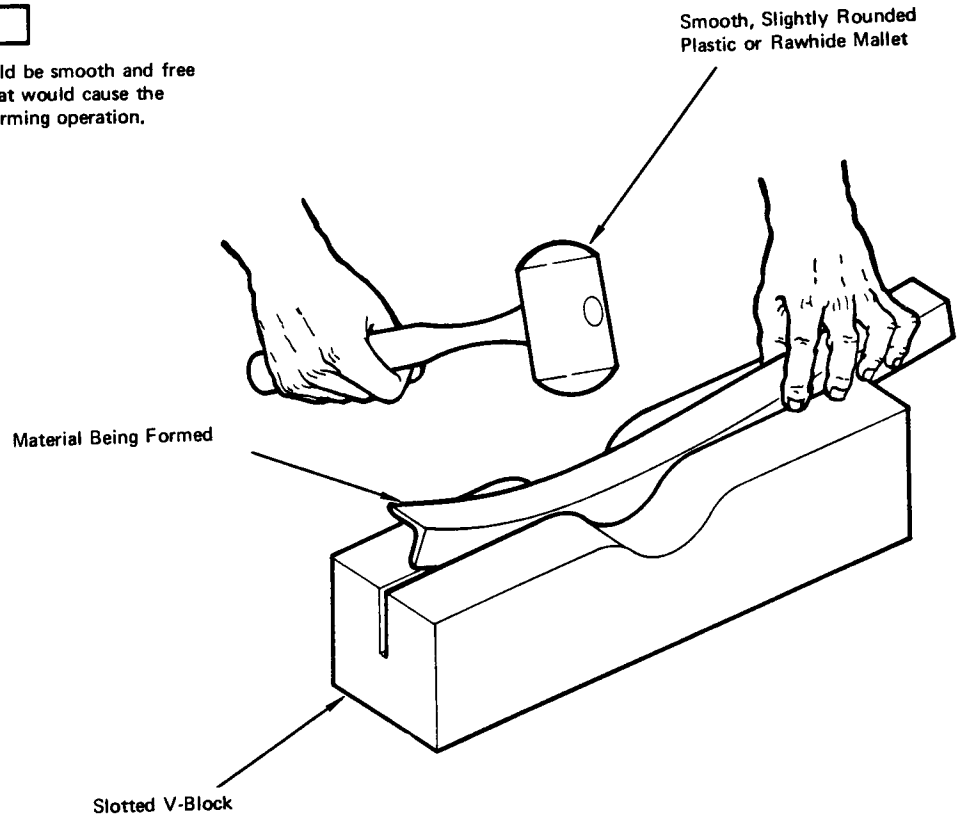


Figure 1-51. Procedure for Hand Forming Concave Surfaces

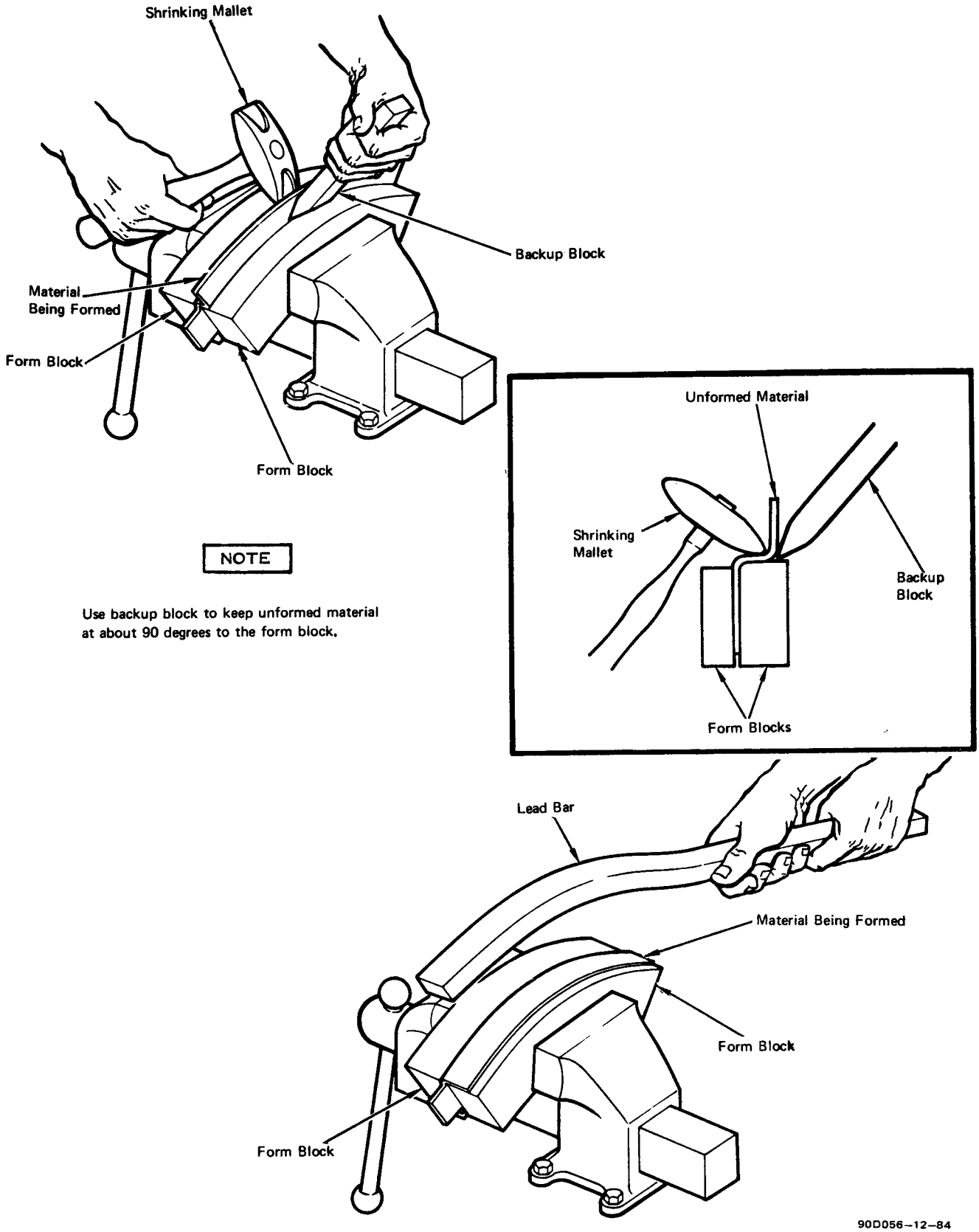
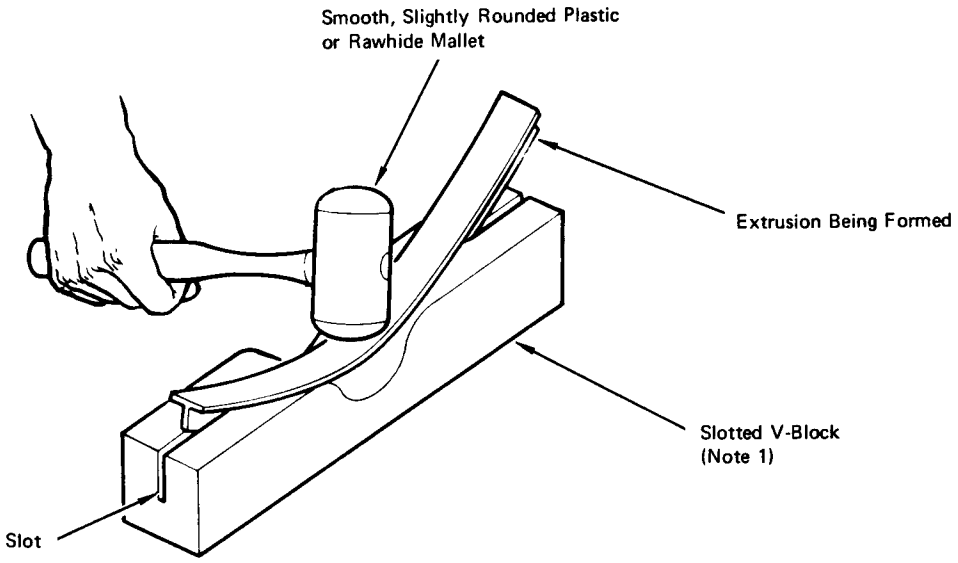


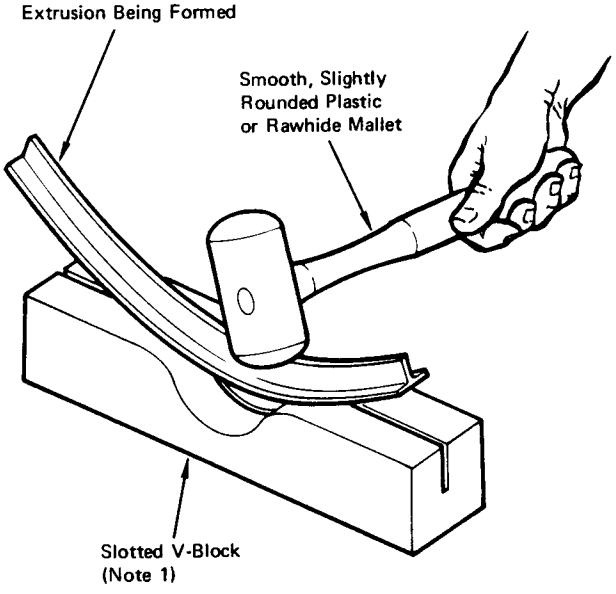
Figure 1-52. Procedure for Hand Forming Convex Surfaces



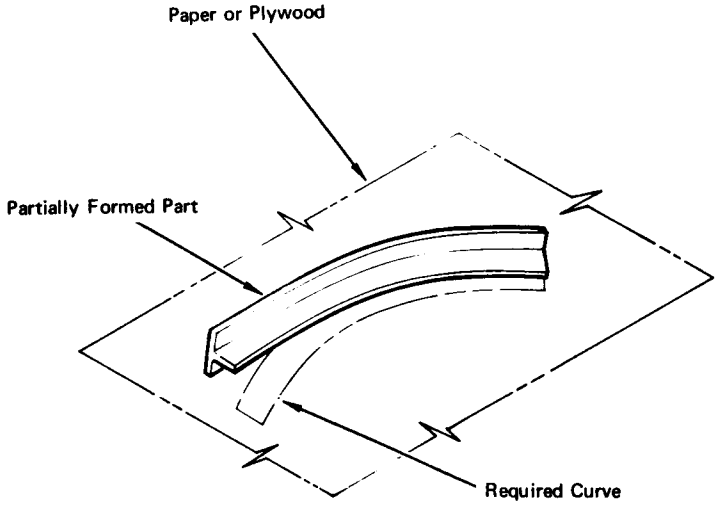
STRETCHING OPERATION

NOTE

1. The slotted V-block can be made from any hardwood, steel, or aluminum alloy.
2. The slot cut in the V-block should be just wide enough to receive the flange of the extrusion.
3. To form the part, strike the extrusion directly over the V of the block while moving the part back and forth over the block.



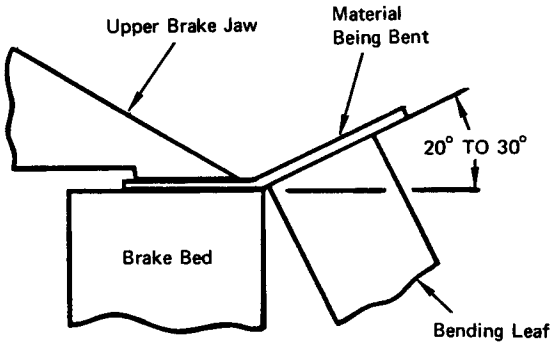
SHRINKING OPERATION



CHECKING FORMED PART FOR ACCURACY

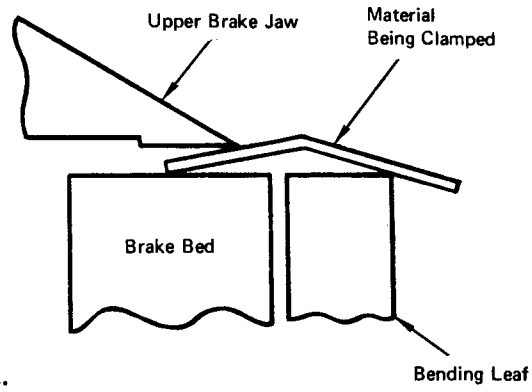
90D057-12-84

Figure 1-53. Procedure for Hand Forming Extruded Shapes



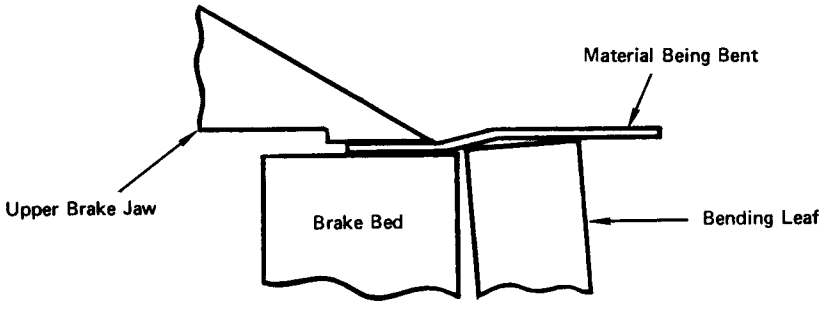
STEP 1.

Clamp material in brake and bend up 20 to 30 degrees



STEP 2.

Turn material over and clamp in brake

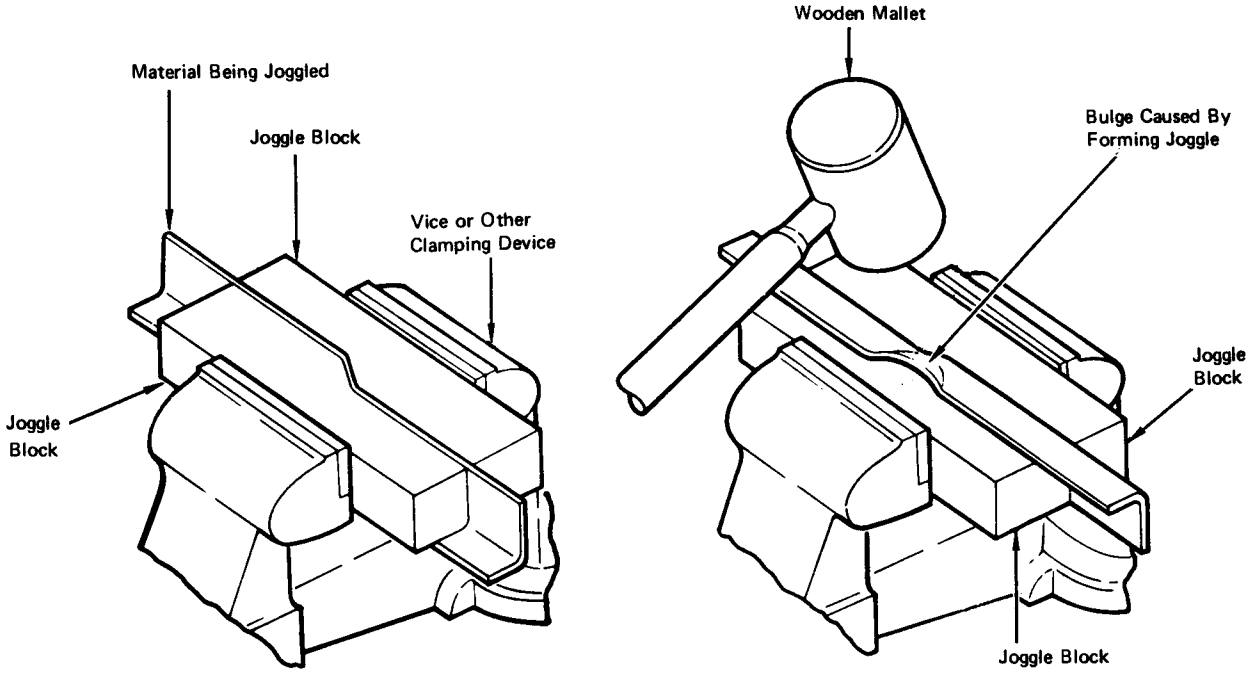


STEP 3.

Raise bending leaf of brake until correct offset is produced

90D058–12–84

Figure 1-54. Method for Brake Forming Joggles



STEP 1.

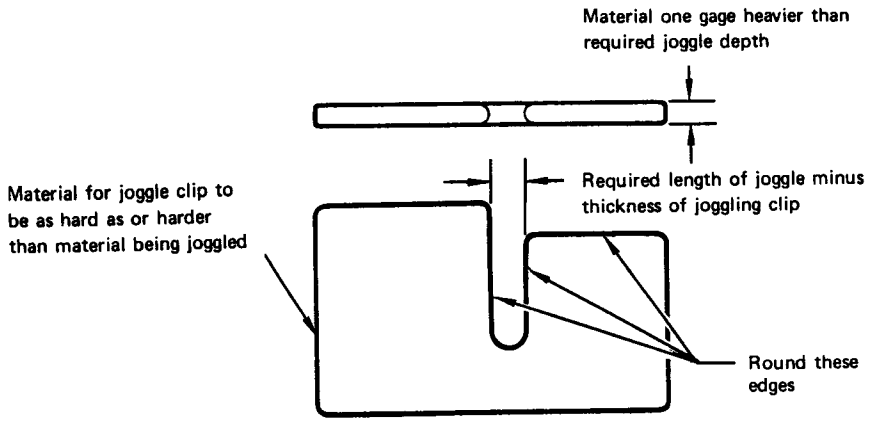
Place material between joggle blocks and squeeze in a vice or other clamping device

STEP 2.

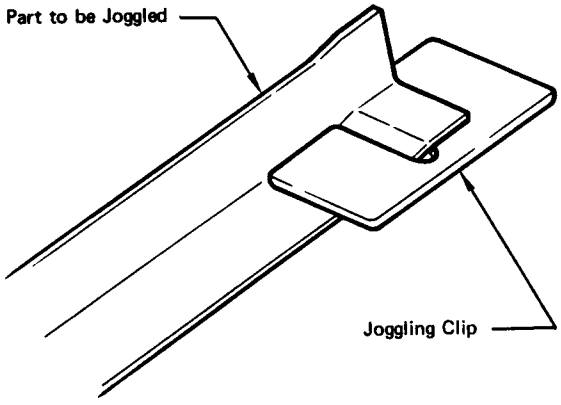
Turn joggle blocks over in vice and flatten bulge with wooden mallet.

90D059-12-84

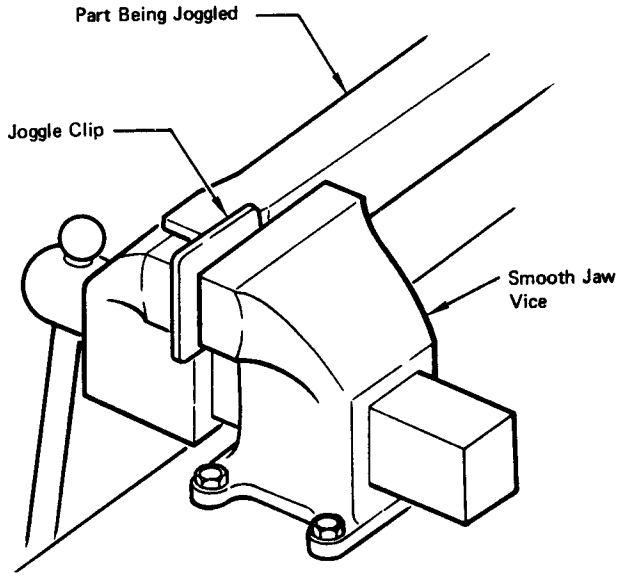
Figure 1-55. Forming Joggle with Joggle Blocks



JOGGLING CLIP



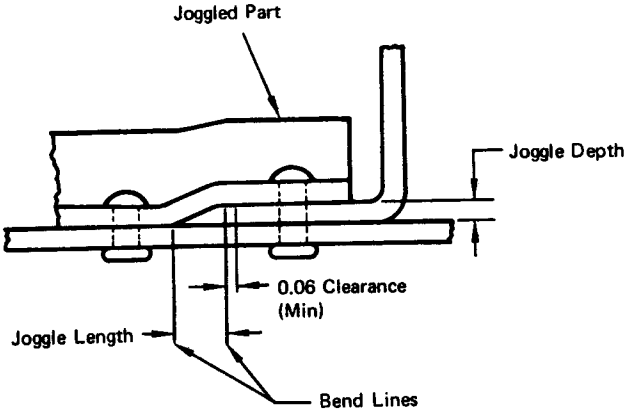
JOGGLE CLIP IN PLACE



FORMING JOGGLE

NOTE

1. For correct length of joggles see joggle dimension charts.
2. The jaws of the vice shall be machined smooth or be covered with a soft metal, such as brass, to prevent scratching the part during the forming operation.
3. After forming the joggle, check the joggled area for cracks.



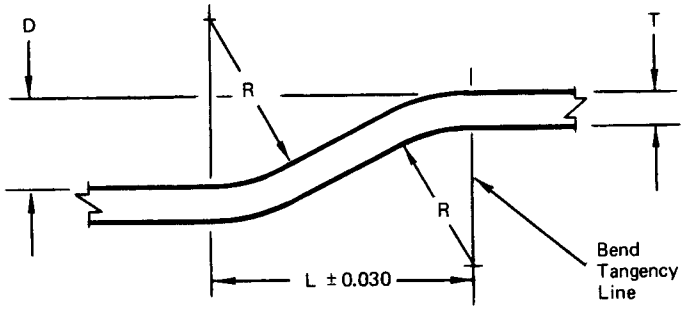
JOGGLE PART INSTALLED

90D060-12-84

Figure 1-56. Forming Joggle with Joggle Clip

NOTE

1. "R" for column "A" is 2024-T3 bend radius.
2. "R" for column "B" is 7075-T6 bend radius.
3. Tolerances for depth of offset D in flat sheet:
   D + 0.030 for sheet thickness of 0.068 or less.
   D + 0.020 for sheet thickness of 0.069 or greater.



Material	Use Column
2024-0	A
2024-T3	A
6061-0	A
6061-T6	A
7075-0	A
7075-T6	B
Titanium	B
Stainless Steel (Hard)	B
Stainless Steel (Annealed)	A
Alloy Steel (Annealed)	A

JOGGLE LENGTH "L"
FOR SHEET METAL THICKNESS T

Depth of Offset D	Up Through 0.022		0.023 Through 0.027		0.028 Through 0.035		0.036 Through 0.044		0.045 Through 0.054		0.055 Through 0.068		0.069 Through 0.075	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
UP Through 0.022	0.14	0.17	0.16	0.18	0.17	0.19	0.18	0.21	0.19	0.22	0.21	0.24	0.22	0.24
0.023 Through 0.027	0.15	0.18	0.17	0.19	0.19	0.22	0.19	0.22	0.21	0.24	0.23	0.25	0.24	0.27
0.028 Through 0.035	0.16	0.19	0.18	0.20	0.20	0.26	0.20	0.24	0.22	0.26	0.25	0.28	0.26	0.29
0.036 Through 0.044	0.17	0.20	0.20	0.22	0.22	0.30	0.22	0.26	0.24	0.28	0.27	0.30	0.28	0.32
0.045 Through 0.054	0.20	0.21	0.21	0.23	0.24	0.37	0.24	0.28	0.26	0.31	0.29	0.33	0.31	0.35
0.055 Through 0.068	0.21	0.24	0.24	0.25	0.25	0.44	0.25	0.30	0.28	0.33	0.32	0.36	0.34	0.38
0.069 Through 0.075	0.22	0.25	0.25	0.26	0.26	0.49	0.26	0.32	0.29	0.34	0.31	0.38	0.35	0.41
0.076 Through 0.084	0.22	0.26	0.26	0.29	0.27	0.54	0.27	0.33	0.30	0.36	0.35	0.40	0.37	0.42
0.085 Through 0.097	0.23	0.26	0.27	0.29	0.30	0.59	0.30	0.35	0.31	0.38	0.36	0.41	0.38	0.44
0.098 Through 0.113	0.23	0.27	0.27	0.30	0.31	0.65	0.31	0.36	0.32	0.39	0.37	0.43	0.39	0.46
0.114 Through 0.139	0.24	0.28	0.29	0.32	0.33	0.78	0.33	0.39	0.37	0.42	0.40	0.47	0.43	0.50
0.140 Through 0.172	0.24	0.30	0.30	0.34	0.35	0.96	0.35	0.45	0.39	0.46	0.46	0.51	0.47	0.55
0.173 Through 0.219	0.24	0.30	0.31	0.35	0.36	1.13	0.36	0.47	0.41	0.51	0.48	0.54	0.52	0.59
0.220 Through 0.262	0.24	0.30	0.31	0.37	0.37	1.49	0.38	0.51	0.44	0.56	0.53	0.62	0.57	0.68

Depth of Offset D	0.076 Through 0.097		0.098 Through 0.113		0.114 Through 0.139		0.140 Through 0.172		0.173 Through 0.219		0.220 Through 0.262	
	A	B	A	B	A	B	A	B	A	B	A	B
UP Through 0.022	0.23	0.27	0.24	0.28	0.27	0.32	0.30	0.34	0.34	0.38	0.37	0.38
0.023 Through 0.027	0.25	0.29	0.26	0.30	0.29	0.35	0.34	0.38	0.37	0.41	0.41	0.43
0.028 Through 0.035	0.27	0.31	0.29	0.33	0.32	0.38	0.37	0.42	0.41	0.46	0.44	0.49
0.036 Through 0.044	0.30	0.34	0.31	0.36	0.36	0.42	0.40	0.46	0.45	0.50	0.49	0.51
0.045 Through 0.054	0.33	0.37	0.34	0.39	0.39	0.46	0.44	0.50	0.49	0.56	0.54	0.61
0.055 Through 0.068	0.35	0.40	0.37	0.43	0.43	0.51	0.47	0.55	0.54	0.61	0.58	0.68
0.069 Through 0.075	0.37	0.42	0.39	0.45	0.45	0.53	0.50	0.59	0.57	0.65	0.62	0.72
0.076 Through 0.084	0.38	0.44	0.41	0.47	0.47	0.56	0.53	0.62	0.60	0.69	0.66	0.77
0.085 Through 0.097	0.40	0.47	0.42	0.50	0.48	0.59	0.55	0.65	0.63	0.72	0.69	0.80
0.098 Through 0.113	0.42	0.49	0.44	0.52	0.51	0.62	0.58	0.69	0.66	0.75	0.72	0.85
0.114 Through 0.139	0.45	0.53	0.48	0.56	0.55	0.68	0.63	0.75	0.71	0.82	0.79	0.94
0.140 Through 0.172	0.51	0.58	0.53	0.62	0.62	0.74	0.69	0.83	0.79	0.91	0.87	1.03
0.173 Through 0.219	0.53	0.62	0.56	0.66	0.66	0.80	0.74	0.89	0.85	0.99	0.94	1.12
0.220 Through 0.262	0.60	0.69	0.64	0.74	0.76	0.90	0.84	1.01	0.96	1.12	1.07	1.29

90D061-12-84

Figure 1-57. Joggle Dimension Chart–Flat Sheet, Joggled Cold

NOTE

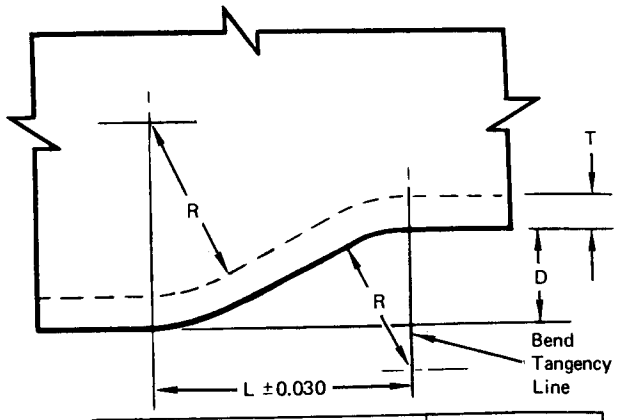
1. "R" for column "A" is 2024-T3 bend radius
2. "R" for column "B" is 7075-T6 bend radius
3. Tolerances for depth of offset D inflange sheet:

   D $^{+0.030}_{-0.010}$ for sheet thickness of 0.044 or less.

   D $^{+0.020}_{-0.010}$ for sheet thickness of 0.045 or greater

CAUTION

When the part will be press formed, use these joggle lengths; otherwise, design must allow for joggle lengths given under extruded and bent sheet sections.



Material	Use Column
2024-0	A
2024-T3	A
6061-0	A
6061-T6	A
7075-0	A
7075-T6	B
Titanium	B
Stainless Steel (Hard)	B
Stainless Steel (Annealed)	A
Alloy Steel (Annealed)	A

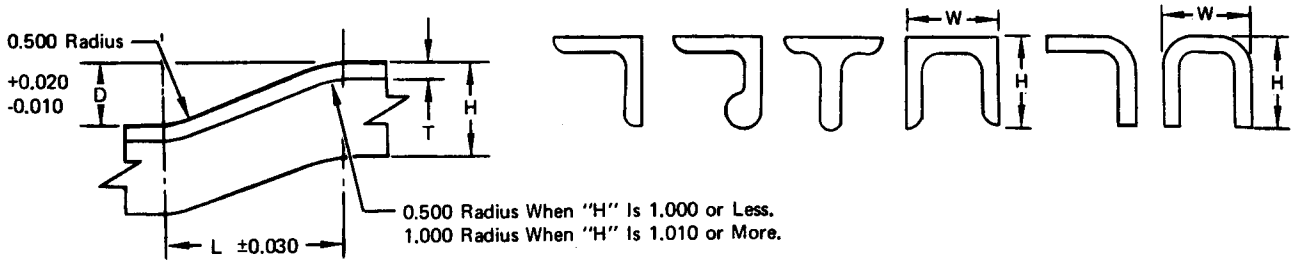
JOGGLE LENGTH "L" FOR SHEET METAL THICKNESS T

Depth of Offset	Up Through 0.022		0.023 Through 0.027		0.028 Through 0.035		0.036 Through 0.044		0.045 Through 0.054		0.055 Through 0.068		0.069 Through 0.075	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
UP Through 0.022	0.12	0.18	0.13	0.19	0.15	0.19	0.15	0.20	0.15	0.21	0.18	0.22	0.19	0.24
0.023 Through 0.027	0.14	0.21	0.15	0.22	0.16	0.22	0.16	0.23	0.17	0.24	0.20	0.25	0.21	0.27
0.028 Through 0.035	0.15	0.25	0.17	0.26	0.18	0.26	0.18	0.27	0.19	0.28	0.22	0.29	0.23	0.31
0.036 Through 0.044	0.18	0.29	0.19	0.30	0.20	0.30	0.20	0.31	0.21	0.32	0.24	0.33	0.25	0.35
0.045 Through 0.054	0.21	0.36	0.22	0.37	0.23	0.37	0.23	0.38	0.25	0.39	0.27	0.40	0.28	0.42
0.055 Through 0.068	0.24	0.43	0.25	0.44	0.27	0.44	0.27	0.45	0.28	0.46	0.31	0.47	0.32	0.49
0.069 Through 0.075	0.26	0.43	0.27	0.49	0.29	0.49	0.29	0.50	0.30	0.51	0.33	0.52	0.34	0.54
0.076 Through 0.084	0.29	0.53	0.30	0.54	0.32	0.54	0.32	0.55	0.33	0.56	0.35	0.57	0.37	0.59
0.085 Through 0.097	0.32	0.58	0.33	0.59	0.34	0.59	0.34	0.60	0.36	0.61	0.38	0.62	0.39	0.64
0.098 Through 0.113	0.35	0.64	0.36	0.65	0.37	0.65	0.37	0.66	0.39	0.67	0.41	0.68	0.42	0.70
0.114 Through 0.139	0.41	0.77	0.42	0.78	0.44	0.78	0.44	0.79	0.44	0.80	0.47	0.81	0.49	0.83
0.140 Through 0.172	0.51	0.95	0.52	0.96	0.53	0.96	0.53	0.97	0.55	0.98	0.57	0.99	0.59	1.01
0.173 Through 0.219	0.60	1.12	0.61	1.13	0.62	1.13	0.62	1.14	0.64	1.15	0.66	1.16	0.68	1.18
0.220 Through 0.262	0.77	1.48	0.79	1.49	0.79	1.49	0.79	1.50	0.81	1.51	0.83	1.52	0.85	1.54

Depth of Offset	0.076 Through 0.084		0.085 Through 0.097		0.098 Through 0.113		0.114 Through 0.139		0.140 Through 0.172		0.173 Through 0.219		0.220 Through 0.262	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
UP Through 0.022	0.20	0.24	0.21	0.25	0.23	0.27	0.24	0.30	0.27	0.33	0.31	0.36	0.34	0.37
0.023 Through 0.027	0.22	0.27	0.23	0.28	0.25	0.30	0.26	0.32	0.31	0.36	0.34	0.40	0.38	0.42
0.028 Through 0.035	0.24	0.31	0.26	0.32	0.27	0.34	0.29	0.36	0.34	0.41	0.38	0.44	0.41	0.48
0.036 Through 0.044	0.27	0.35	0.28	0.36	0.30	0.38	0.33	0.40	0.37	0.44	0.42	0.49	0.46	0.53
0.045 Through 0.054	0.30	0.42	0.31	0.43	0.34	0.45	0.36	0.47	0.41	0.51	0.46	0.55	0.51	0.60
0.055 Through 0.068	0.33	0.49	0.35	0.50	0.37	0.52	0.40	0.54	0.44	0.58	0.51	0.62	0.55	0.66
0.069 Through 0.075	0.35	0.54	0.37	0.55	0.39	0.57	0.42	0.59	0.47	0.63	0.54	0.67	0.59	0.71
0.076 Through 0.084	0.38	0.59	0.39	0.60	0.42	0.62	0.44	0.64	0.50	0.68	0.57	0.72	0.63	0.76
0.085 Through 0.097	0.41	0.64	0.42	0.65	0.44	0.67	0.47	0.69	0.52	0.73	0.60	0.77	0.66	0.81
0.098 Through 0.113	0.44	0.69	0.45	0.71	0.47	0.73	0.50	0.75	0.56	0.79	0.61	0.83	0.69	0.82
0.114 Through 0.139	0.50	0.83	0.51	0.84	0.54	0.86	0.56	0.88	0.62	0.92	0.69	0.96	0.76	1.00
0.140 Through 0.172	0.60	1.01	0.61	1.02	0.64	1.04	0.66	1.06	0.71	1.10	0.78	1.14	0.85	1.18
0.173 Through 0.219	0.69	1.18	0.70	1.19	0.73	1.21	0.75	1.23	0.80	1.27	0.86	1.31	0.94	1.35
0.220 Through 0.262	0.86	1.54	0.87	1.55	0.90	1.57	0.92	1.59	0.97	1.63	1.04	1.67	1.11	1.71

90D062-12-84

Figure 1-58. Joggle Dimension Chart–Flanged Sheet, Rubber Formed and Joggled Cold



This chart is based on the above illustrated commonly used shapes; however, it may be specified for variations of these shapes provided the joggle dimensions are based on the same proportions of "H" to "T" as shown. Do not specify for channels where "W" is less than "2H". Where a section has webs or flanges of different thicknesses or where the thickness varies in the joggle area, use the greatest thickness to determine "T".

JOGGLE LENGTH "L"

Depth of Offset "D"	When "H" is 0.50 Through 1.00 and When "T" is			When "H" is 1.01 Through 1.50 and When "T" is			When "H" is 1.51 Through 2.00 and When "T" is		
	0.040 Through 0.078	0.079 Through 0.094	0.095 Through 0.125	0.063 Through 0.102	0.103 Through 0.156	0.157 Through 0.188	0.063 Through 0.125	0.126 Through 0.188	0.189 Through 0.250
Up Through 0.22	0.22	0.23	0.25	0.27	0.28	0.29	0.27	0.28	0.29
0.023 Through 0.027	0.27	0.27	0.27	0.32	0.32	0.32	0.33	0.32	0.33
0.028 Through 0.035	0.31	0.31	0.31	0.36	0.36	0.36	0.37	1.36	0.37
0.036 Through 0.044	0.34	0.34	0.34	0.41	0.41	0.41	0.44	0.41	0.42
0.045 Through 0.054	0.37	0.38	0.38	0.44	0.44	0.44	0.50	0.44	0.45
0.055 Through 0.068	0.43	0.41	0.41	0.52	0.49	0.49	0.59	0.52	0.50
0.069 Through 0.075	0.47	0.43	0.42	0.56	0.52	0.52	0.64	0.56	0.53
0.076 Through 0.084	0.51	0.46	0.43	0.62	0.57	0.55	0.70	0.62	0.58
0.085 Through 0.097	0.57	0.51	0.48	0.69	0.63	0.59	0.80	0.69	0.64
0.098 Through 0.113	0.65	0.57	0.52	0.78	0.70	0.65	0.90	0.78	0.71
0.114 Through 0.139	0.77	0.67	0.61	0.93	0.82	0.75	1.08	0.93	0.83
0.140 Through 0.172	0.93	0.80	0.71	1.13	0.98	0.89	1.33	1.13	0.99
0.173 Through 0.219	1.15	0.97	0.85	1.40	1.20	1.07	1.65	1.40	1.21
0.220 Through 0.262	1.36	1.14	0.98	1.64	1.42	1.25	1.95	1.64	1.43

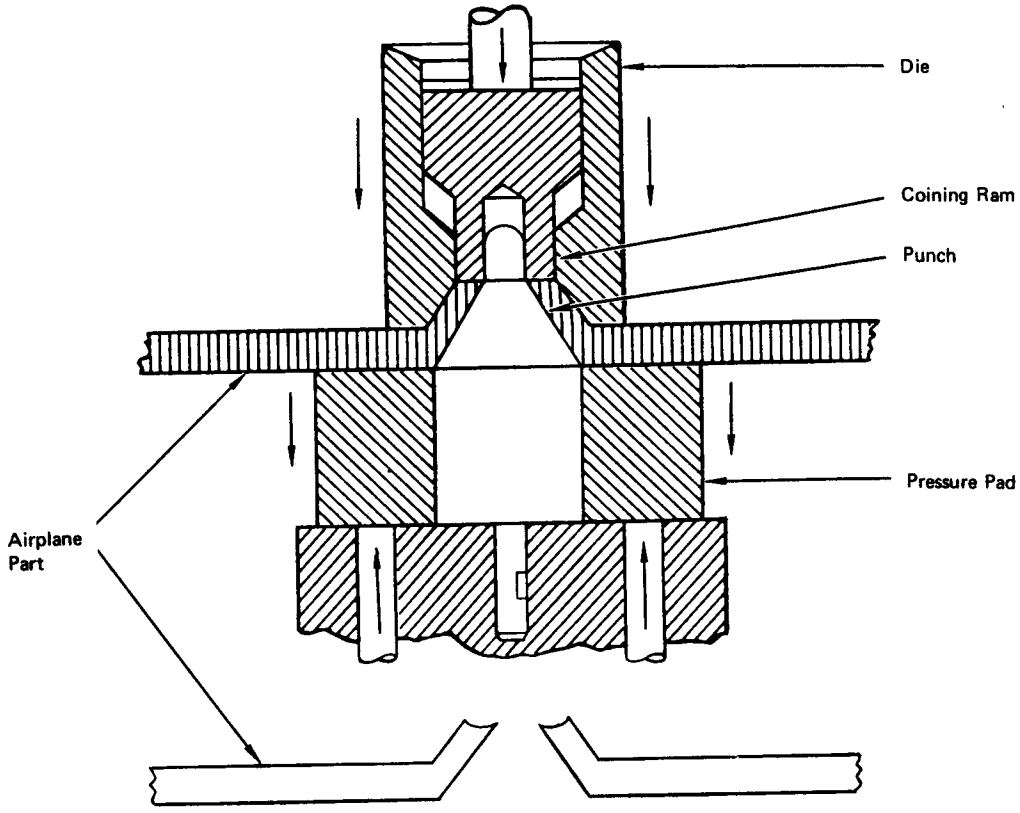
Depth of Offset "D"	When "H" is 2.01 Through 2.50 and When "T" is			When "H" is 2.51 Through 3.00 and When "T" is		
	0.078 Through 0.125	0.126 Through 0.188	0.189 Through 0.250	0.125 Through 0.188	0.189 Through 0.250	0.251 Through 0.312
Up Through 0.22	0.28	0.28	0.29	0.28	0.29	0.31
0.023 Through 0.027	0.28	0.32	0.33	0.32	0.33	0.35
0.028 Through 0.035	0.35	0.36	0.37	0.36	0.37	0.39
0.036 Through 0.044	0.43	0.41	0.43	0.41	0.43	0.44
0.045 Through 0.054	0.51	0.49	0.50	0.49	0.50	0.47
0.055 Through 0.068	0.61	0.57	0.52	0.59	0.58	0.54
0.069 Through 0.075	0.67	0.62	0.57	0.65	0.63	0.59
0.076 Through 0.084	0.74	0.67	0.61	0.71	0.68	0.64
0.085 Through 0.097	0.85	0.76	0.68	0.81	0.77	0.72
0.098 Through 0.113	0.97	0.85	0.75	0.91	0.86	0.81
0.114 Through 0.139	1.18	1.01	0.89	1.09	1.02	0.96
0.140 Through 0.172	1.46	1.22	1.06	1.34	1.23	1.16
0.173 Through 0.219	1.83	1.51	1.30	1.66	1.52	1.43
0.220 Through 0.262	2.18	1.78	1.51	1.96	1.79	1.66

NOTE

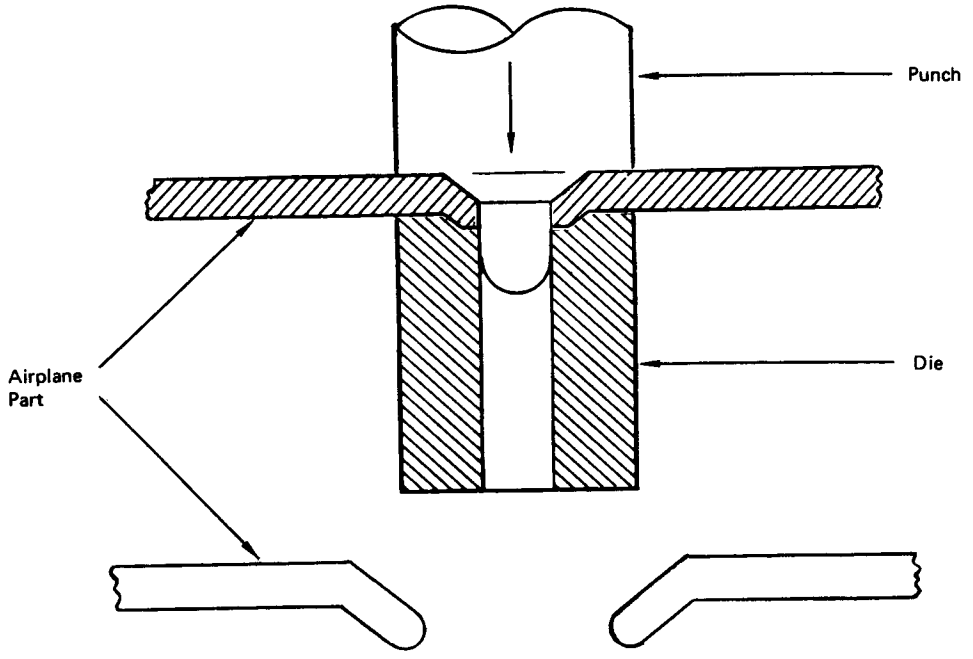
7075-T6 Joggled hot only.
Other alloys joggled cold.

90D063-12-84

Figure 1-59. Joggle Dimension Chart–Extruded or Bent Sheet Sections, Die Joggled



TRIPLE ACTION RAM COIN DIMPLING

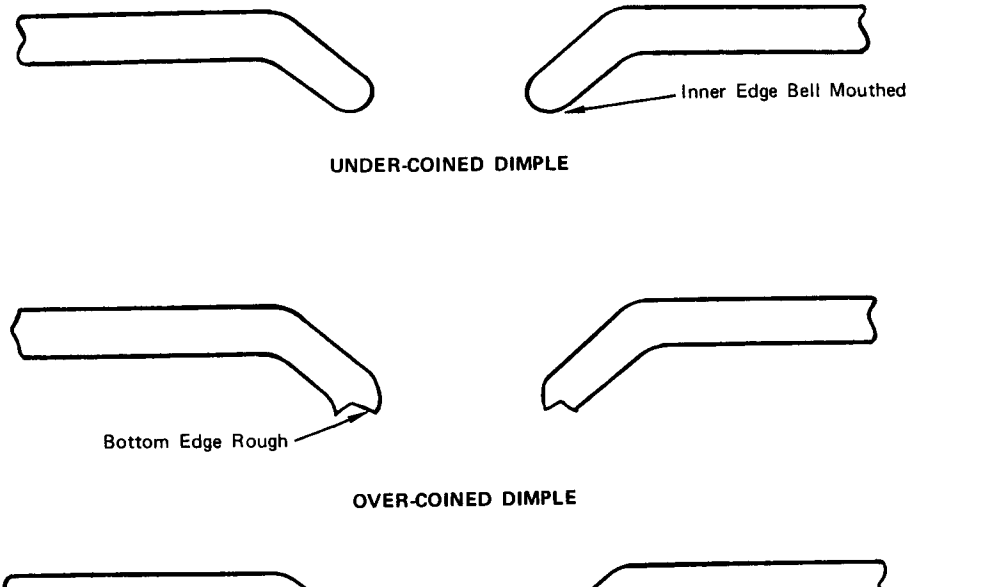


MODIFIED RADIUS DIMPLING

90D064-12-84

Figure 1-60. Dimpling of Sheet Metal

COINING RAM PRESSURE TEST



NOTE

1. Pressure shall be determined with test strips. There should be a slight ring around the outside and inside of the coined area.
2. Insufficient pressure is indicated by a rough surface on the web surface of the dimple.
3. Excessive pressure is indicated by a heavy extrusion of material on the bottom edge of the dimple.

DWELL TIME FOR ALUMINUM ALLOYS

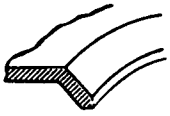
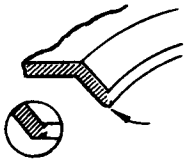
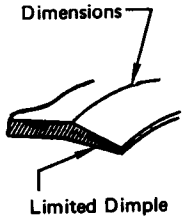
(Both Dies Heated to 600° (±25°) F)

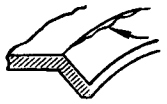
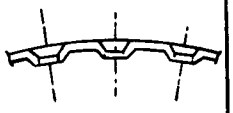
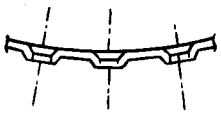
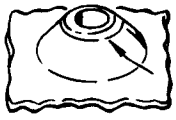
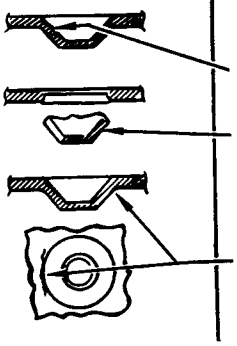
Sheet Thickness	Dwell Time (Seconds)
0.016	1/2 – 1
0.020	1/2 – 1
0.025	3/4 – 1
0.032	3/4 – 1-1/4
0.040	1-1/4 – 2
0.050	1-3/4 – 2
0.063	2-1/2
0.071	3 – 3-1/2
0.080	3-1/2 – 5

90D065-12-84

Figure 1-61. Ram Pressure Test and Dwell Time

HOT DIMPLING

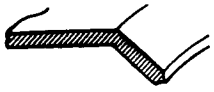
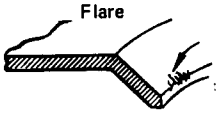
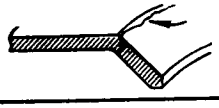
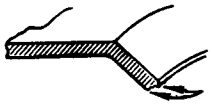
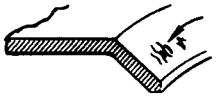
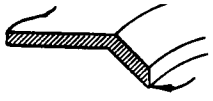
Condition	Acceptance Limits and Probable Cause
Correct Dimple 	Acceptable Good ram pressure. No scratches or marks on dimple surface. No cracks. Good definition. For single sheet dimpling the diameter of the ram flat should be equal to the diameter of the ram itself. For simultaneous dimpling, the ram flat should be slightly less, indicating slightly less ram pressure.
Circumferential Tension Crack	Not acceptable Insufficient heat in the sheet. Sheet redimpled in reverse direction to original. This type of crack is more apt to appear in thin sheet dimpled for large fasteners.
Cracks in Dimple Flare	Not acceptable Ties not properly heated. Insufficient ram pressure. Inner rams cracked. Pilot holes too small. This type of crack is more apt to appear in thin sheet dimpled for large fasteners, particularly the screws.
Ram Flat Too Small 	Not acceptable In the case of substructure dimples made with modified radius tools, the requirement for a coining ram flat is waived though in most applications some flat will be evident.
Ringed Ram Flat	Acceptable Excessive ram pressure. Inner ram worn.
Proper Head Side Dimensions  Limited Dimple Protrusion	Not acceptable Caused by die being filled with epoxy primer or other paint. Compare with dimple properly formed in clean die to identify.

Condition	Acceptance Limits and Probable Cause
Marks on Dimple	Acceptable Scratches or marks usually indicate scored punches or dies, or foreign matter on tools. Tools shall be kept as clean as possible to avoid this condition. Tools shall be replaced if marks caused by dirty or defective tools.
Ringed Dimple 	Acceptable Excessive dimpling pressure.
Convex sheet (Due to Dimpling) 	Not acceptable except as noted Dimpling pressure too high. Note: sample strips shall be checked across the width by means of a straight edge. If pressure must be set higher to produce a suitable production part, this requirement is waived.
Concave sheet (Due to Dimpling) 	Not acceptable except as noted Dimpling pressure too low. Restrike dimples to correct. Note: sample strips shall be checked across the width by means of a straight edge. If the machine will not produce sufficient pressure to produce a flat strip, but will produce a suitable production part, this requirement is waived.
	Acceptable A raised die mark at this point is common on dimples produced for a few sheet thickness and fastener combinations. The depth of this mark should be kept to a minimum by proper balance of dimples and ram pressures. The unavoidable amount which accompanies good dimpling technique is in the alclad only.
	Not acceptable Insufficient heat in the sheet. Dimple formed too fast (speed of operation valve open, etc.). Redimpled to reverse a dimple. Internal Circumferential Shear Area Broken out dimple washer indicates internal circumferential shear cracks — Dimple defective Cracks starting at sharp radius at junction of bottom dimple cone and sheet

90D066-01-12-84

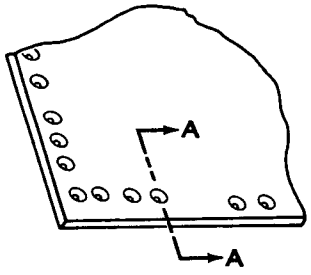
Figure 1-62. Hot and Cold Dimpling Inspection (Sheet 1 of 2)

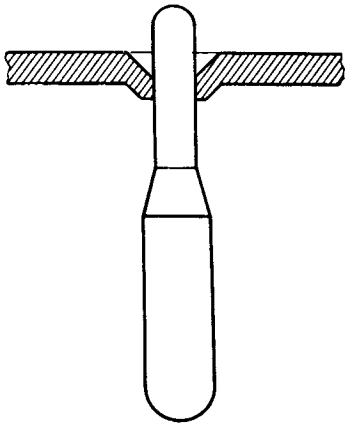
COLD DIMPLING

Condition	Acceptance Limits and Probable Cause
Correct Dimple 	Acceptable Good ram pressure. No scratches or marks on dimple surface. No cracks. Good definition. For single sheet dimpling, the diameter of the ram flat should be equal to the diameter of the ram itself. For simultaneous dimpling, the ram flat should be slightly less, indicating slightly less ram pressure.
Cracks in Dimple Flare 	Not acceptable Insufficient ram pressure. Pilot holes too small. Inner ram cracked. This type of crack is more likely to occur in thin sheet dimpled for large fasteners, particularly the screws. If cracking cannot be eliminated by cold dimpling, use hot dimpling technique.
Circumferential Tension Crack 	Not Acceptable Sheet redimpled in reverse direction to original. This type of crack may not show up visually if parts are primed.
Ringed Ram Flat 	Acceptable Excessive ram pressure.
Marks on Dimple 	Acceptable Scratches or marks usually indicate scored punches or dies, or foreign matter on tools. Tools shall be kept as clean as possible to avoid this condition. Tools shall be replaced if marks caused by dirty or defective tools.
Ram Flat too Small or No Ram Flat 	Acceptable if dimples are made with tools of other than ram coin type. Not acceptable if dimples are made with ram coin type. May be redimpled with proper ram pressure to correct if no radial cracks are present.

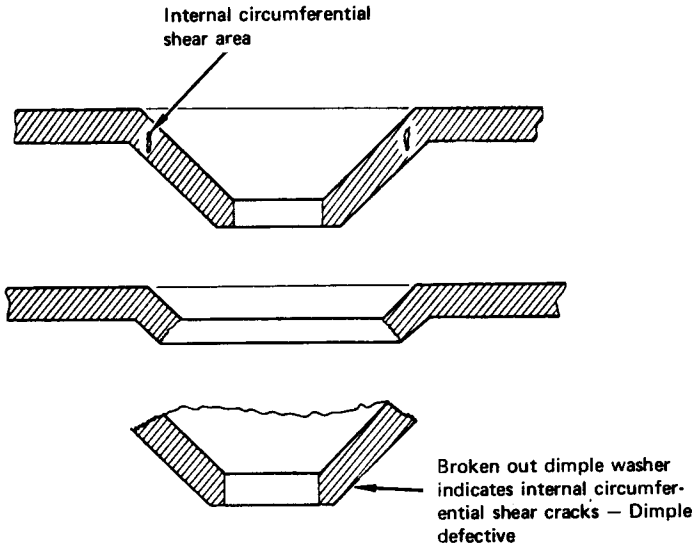
90D066-02-12-84

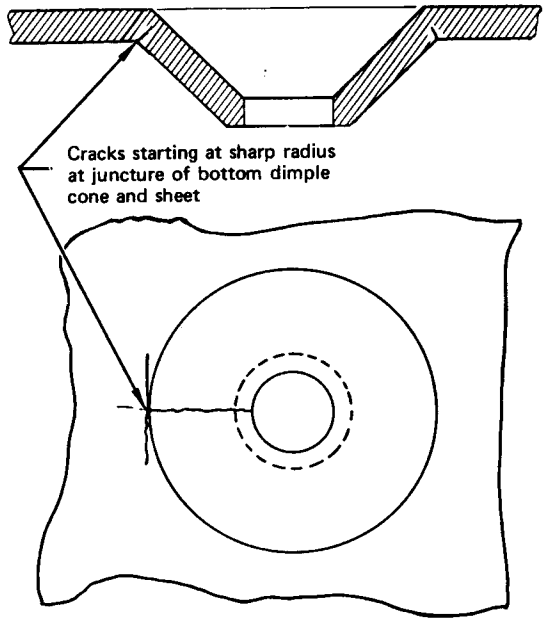
Figure 1-62. Hot and Cold Dimpling Inspection (Sheet 2)





SECTION A-A





TEST PROCEDURE

Punches used for pry checking should be of the same nominal diameter as the fastener for which the dimple is made. Prying may be done from either side, however, care shall be taken to see that the end of the punch protrudes through the dimple sufficiently so that the dimple is not cut through by the end of the punch. In addition, the tapered part of the punch should not contact the dimple.

NOTE

1. This test is designed primarily to detect internal circumferential shear cracks in the dimple (see details above). When present, these cracks will show up during the pry test as follows:
   (A) Break out of complete dimple washer as pictured.
   (B) Clean break out of segment of a dimple washer with break in the internal circumferential shear area. Note in the drawing above that internal circumferential shear cracks do not start at the sharp radius at the juncture of the dimple cone and the sheet but slightly down on the dimple cone.
2. Failures of the above type denote unsatisfactory dimples and shall cause the machine to be shut down until the cause can be found and corrected.
3. Good dimples will normally fail radially during the pry test. However, occasionally the failure will start circumferentially in the area at the sharp radius at the juncture of the dimple cone and the sheet but these cracks should not progress circumferentially around the dimple. This failure is not indicative of internal circumferential shear cracks and shall not be cause for rejection of the dimples.
4. If, during pry testing, several dimples fail initially by radial cracking, but upon reaching the internal circumferential shear area the failure turns into an internal circumferential shear failure, some of the dimples shall be removed from the panel and examined metallurgically.

90D067-12-84

Figure 1-63. Dimple Pry Test

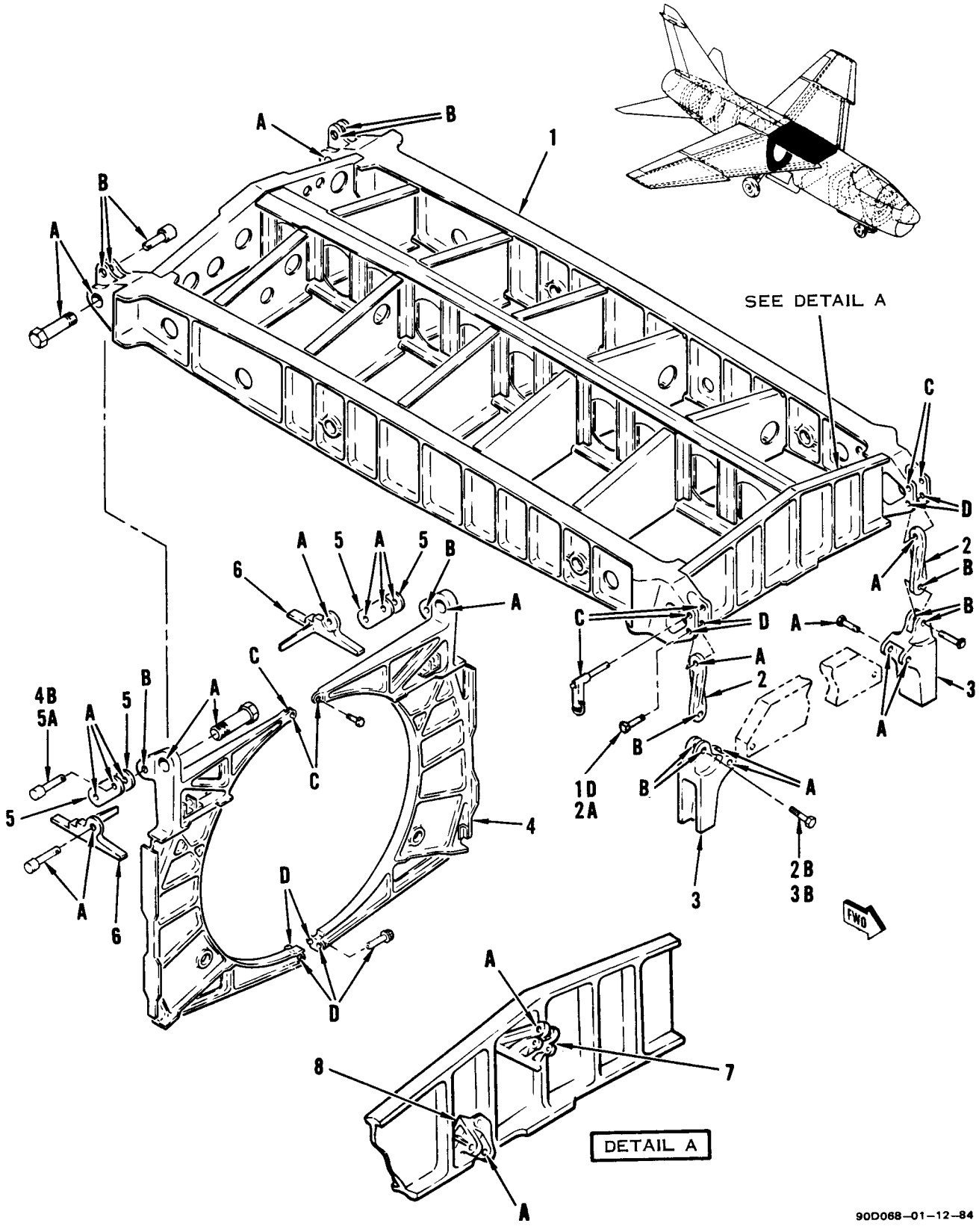


Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 1 of 6)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Wing Attach Rib Assembly, L/R 215-70057							
	Bushing (Note 10) CVC475-24-150	A	Shear Bolt 215-70521	1.5010	1.4980	0.0030	1.5020	1.4970
	Bushing (Note 11) 218-30513-7	A	Shear Bolt 215-70521	1.501	1.4980	0.0030	1.5020	1.4970
	Bushing (Note 10) NAS537-10P-70	B	Pin 215-01006	0.6486	0.6150	0.0336	Note 6	0.6050
	Bushing (Note 11) 218-30513-4	B	Pin 215-01006	0.6486	0.6150	0.0336	Note 6	0.6050
	Bushing (Note 10) NAS537-7P-50	C	Pin NAS1337A2C18	0.4591	0.4345	0.0246	Note 6	0.4245
	Bushing (Note 11) 218-30513-6	C	Pin NAS1337AZC18	0.4591	0.4345	0.0246	Note 6	0.4245
	Bushing (Note 10) NAS537-9P-60	D	Bolt EWSB22-9-29	0.5630	0.5607	0.0023	0.5640	0.5597
	Bushing (Note 11) 218-30513-5	D	Bolt EWSB22-9-29	0.5630	0.5607	0.0023	0.5640	0.5597
2	Link Assembly 215-30075							
	Bearing 215-30413	A	Bolt EWSB22-9-29	0.5625	0.5607	0.0018	0.5635	0.5597
	Bearing 215-30413	B	Bolt NAS464P9-20	0.5625	0.5607	0.0018	0.5635	0.5597
3	Adapter (Note 10) 215-30400-5, -6							
		A	Bolt NAS464P5-9	0.3145	0.3108	0.0037	0.3155	0.3098
		B (Note 4)	Bolt NAS464P9-20	0.5625	0.5607	0.0018	0.5635	0.5597
		B (Note 5)	Bolt NAS464P9-20	0.5781	0.5607	0.0174	0.5831	0.5597

90D068-02-12-84

Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
	Adapter (Note 11) 215-30400-9, -10							
		A	Bolt NAS464P5-9	0.3145	0.3108	0.0037	0.3155	0.3098
	Bushing (Note 11) 218-30513-3	B (Note 12)	Bolt NAS464P9-20	0.5625	0.5607	0.0018	0.5635	0.5597
	Bushing (Note 11) 218-30513-3	B (Note 13)	Bolt NAS464P9-20	0.5781	0.5607	0.0174	0.5831	0.5597
4	Bulkhead Assembly 215-30078							
	(Note 8)	A	Shear Bolt 215-70521	1.5010	1.4980	0.0030	1.5020	1.4970
	Bushing (Note 9) 218-30513-1	A	Shear Bolt 215-70521	1.5010	1.4980	0.0030	1.5020	1.4970
	(Note 8)	B	Truss Pin 215-30412	1.1260	1.1220	0.0040	1.1270	1.1210
	Bushing (Note 9) 218-30513-2	B	Truss Pin 215-30412	1.1260	1.1220	0.0040	1.1270	1.1210
		C	Bolt NAS464-10-20	0.6255	0.6234	0.0021	0.6265	0.6224
		D	Bolt MS21250-05018	0.3145	0.3110	0.0035	0.3160	0.3100
5	Truss Link, L/R 215-30410	A	Truss Pin 215-30412	1.1250	1.1220	0.0030	1.1260	1.1210
6	Fitting, L/R (Note 8) 215-30411-5, -6	A	Truss Pin 215-30412	1.1260	1.1220	0.0040	1.1270	1.1210
	Fitting, L/R (Note 9) 215-30411-11, -12							
	Bushing 218-30513-2	A	Truss Pin 215-30412	1.1260	1.1220	0.0040	1.1270	1.1210
7	Support Assembly 216-78460							
	Bushing CVC480-4-26	A	Bolt NAS464-4-22	0.2505	0.2495	0.0010	0.2515	0.2485
8	Support Assembly 216-78462							
	Bushing CVC480-4-26	A	Bolt NAS464-4-22	0.2505	0.2495	0.0010	0.2515	0.2485

90D068-03-12-84

Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 3)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Wing Attach Rib Assembly 215-70057							
	Bushing (Note 10) CVC475-24-150 (Note 2)	A	1.6885	4130 Steel	125,000 Minimum	1.5000	1.5010	63
	Bushing (Note 11) 218-30513-7	A	1.6885	Aluminum Bronze		1.5000	1.5010	63
	Bushing (Note 10) NAS537-10P-70 (Note 2)	B	0.8130	4130 Steel	125,000 to 145,000	0.6486 (Note 3)	0.6506 (Note 3)	125
	Bushing (Note 11) 218-30513-4	B	0.8130	Aluminum Bronze		0.6486 (Note 3)	0.6506 (Note 3)	125
	Bushing (Note 10) NAS537-7P-50 (Note 2)	C	0.5630	4130 Steel	125,000 to 145,000	0.4591 (Note 3)	0.4631 (Note 3)	125
	Bushing (Note 11) 218-30513-6	C	0.5630	Aluminum Bronze		0.4591 (Note 3)	0.4631 (Note 3)	125
	Bushing (Note 10) NAS537-9P-60 (Note 2)	D	0.6880	4130 Steel	125,000 to 145,000	0.5620	0.5630	63
	Bushing (Note 11) 218-30513-5	D	0.6880	Aluminum Bronze		0.5620	0.5630	63
2	Link Assembly 215-30075							
	Bearing 215-30413	A	1.0940					
	Bearing 215-30413	B	1.0940					
3	Adapter, L/R (Note 10) 215-30400-5, -6							
		A	None					
		B (Note 4)	None					
		B (Note 5)	None					

90D068-04-12-84

Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 4)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
	Adapter, L/R (Note 11) 215-30400-9, -10	A	None					
	Bushing 218-30513-3	B (Note 4)	0.6885	Aluminum Bronze		0.5620	0.5625	63
	Bushing 218-30513-3	B (Note 5)	0.6885	Aluminum Bronze		0.5771 (Note 3)	0.5781 (Note 3)	125
4	Bulkhead Assembly 215-30078							
	(Note 8)	A	None					
	Bushing (Note 9) 218-30513-1	A	1.7503	Aluminum Bronze		1.5000	1.5010	63
	(Note 8)	B	None					
	Bushing (Note 9) 218-30513-2	B	1.2510	Aluminum Bronze		1.1250	1.1260	63
		C	None					
		D	None					
5	Truss Link, L/R 215-30410	A	None					
6	Fitting, L/R (Note 8) 215-30411	A	None					
	Fitting, L/R (Note 9) 215-30411							
	Bushing 218-30513-2	A	1.2510	Aluminum Bronze		1.1250	1.1260	63
7	Support Assembly 216-78460							
	Bushing CVC480-4-26	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125

90D068-05-12-84

Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 5)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
8	Support Assembly 216-78462							
	Bushing CVC480-4-26	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. Line drilled to this dimension after installation.
4. Applicable to left adapter only.
5. Applicable to right adapter only.
6. Change bushing when wall wears to 0.030 inch thick.
7. Wear allowance includes manufacturing allowance.
8. Airplanes through AF 73-995.
9. Airplanes AF 73-996 and subsequent.
10. Airplanes through AF 73-1015.
11. Airplanes AF 74-1737 and subsequent.

90D068-06-12-84

Figure 1-64. Wing Attach and Support Structure Hardware Repair Limits (Sheet 6)

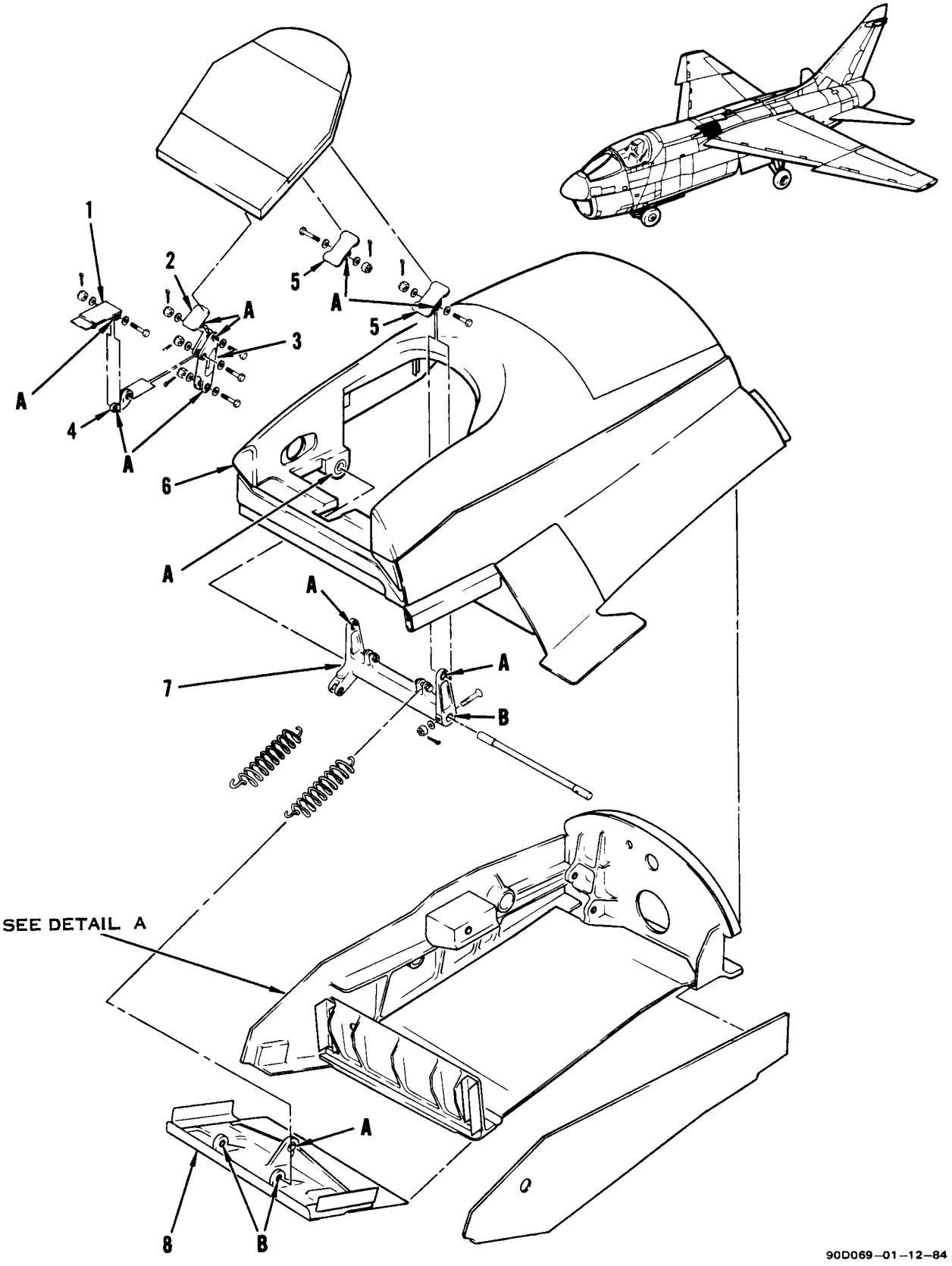
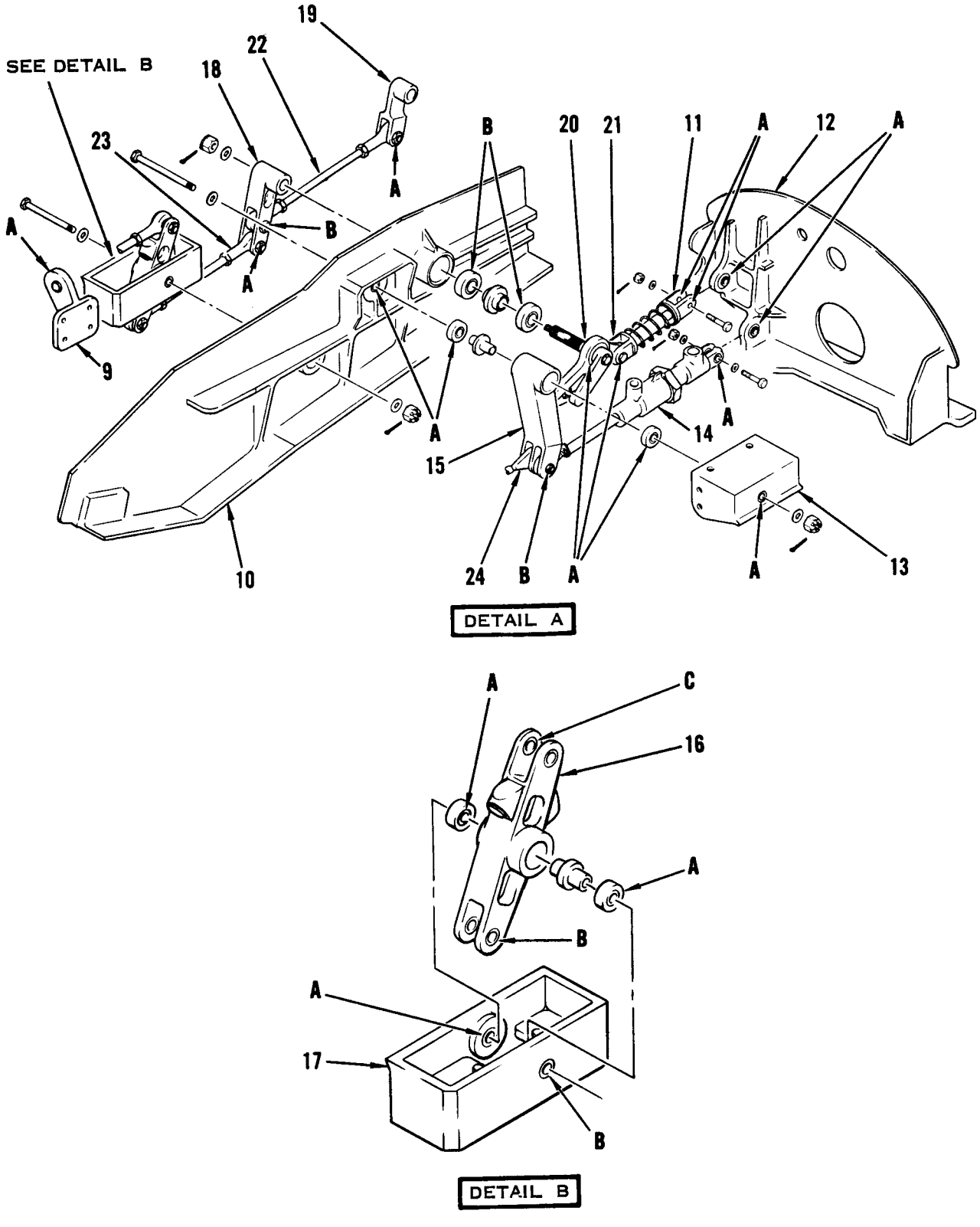


Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 1 of 9)



90D069-02-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Door 216-70443							
	Bushing CVC480-3-16	A	Bolt NAS464P3-10	0.1920	0.1890	0.0030	0.1930	0.1885
2	Pad 216-70446							
	Bearing-MS21232-4	A	Bolt NAS464P4-11	0.2500	0.2483	0.0017	0.2500	0.2478
3	Link 216-70437							
	Bushing CVC480-4-25	A	Bolt NAS464P4-11	0.2505	0.2483	0.0022	0.2515	0.2478
4	Link 216-70444							
	Bushing NAS538B3P-10	A	Bolt NAS464P3-10	0.192	0.1885	0.0035	0.1930	0.1880
5	Pad 216-70439							
	Bushing CVC480-4-20	A	Bolt NAS464P4-11	0.2505	0.2483	0.0022	0.2515	0.2478
6	Cover 216-70435							
	Bearing 202-19002G8	A	Shaft 216-70440	0.5000	0.4973	0.0027	0.5000	0.4968
7	Arm 216-70436							
	Bearing MS21232-4	A	Bolt NAS464P4-11	0.2500	0.2483	0.0017	0.2500	0.2478
	Bushing NAS537-8P47	B	Shaft 216-70440	0.502	0.5020	0.0047	0.5030	0.4968
8	Support 216-70429							
	Bearing MS21232-4	A	Bolt NAS464P4-11	0.2500	0.2483	0.0017	0.2500	0.2478
	Bushing NAS537-7P20	B	Spring 216-70532	0.4290			0.4300	
9	Pad 216-70441							
	Bearing 202-19012K7	A	Push-Pull Control 216-28352	0.4375	0.4287	0.0088	0.4375	0.4282
10	Support 216-70431							
	Bushing NAS537-5P85	A	Bolt NAS464-5-45	0.3130	0.3104	0.0026	0.3140	0.3099

90D069-03-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
	Bearing MS20201KP8A	B	Shaft 216-78409	0.5000	0.4986	0.0014	0.5010	0.4981
	Spacer CVC1991-8-26							
11	Retainer 216-78406							
	Bushing NAS537-4-25	A	Bolt NAS464-4-12	0.2505	0.2487	0.0018	0.2515	0.2482
12	Support 216-70428							
	Bearing MS21232-4	A	Bolt NAS464-4-12	0.2500	0.2483	0.0017	0.2500	0.2478
13	Support 216-70448							
	Bushing NAS537-5P42	A	Bolt NAS464-5-45	0.3130	0.3104	0.0026	0.3140	0.3099
14	Cylinder 216-72020							
	Bushing CVC480-4-20	A	Bolt NAS464-4-12	0.252	0.2487	0.0033	0.2530	0.2482
	Bearing MS27261KSP4A	B	Bolt NAS464-4-19	0.2500	0.2487	0.0013	0.2500	0.2482
15	Bellcrank 216-78405							
	Bearing MS20201KP5A	A	Bolt NAS464-5-45	0.3125	0.3112	0.0013	0.3125	0.3107
	Spacer CVC1991-5-68							
	Bushing CVC480-4-25	B	Bolt NAS464-4-19	0.2505	0.2487	0.0018	0.2515	0.2482
	CVC480-4-22		NAS464-4-19	0.2505	0.2487	0.0018	0.2515	0.2482
16	Lever 216-78402							
	Bearing MS20201KP4A	A	Bolt NAS464-4-30	0.2500	0.2487	0.0013	0.2500	0.2482
	Bushing CVC480-4-22	B	Bolt NAS464-4-13	0.2505	0.2487	0.0018	0.2515	0.2482
	Bushing CVC480-4-22	C	Bolt NAS464-4-13	0.2505	0.2487	0.0018	0.2515	0.2482

90D069-04-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
17	Support 216-70442							
	Bushing CVC480-4-35	A	Bolt NAS464-4-30	0.2505	0.2479	0.0026	0.2515	0.2474
	Bushing CVC480-4-25	B	Bolt NAS464-4-30	0.2505	0.2479	0.0026	0.2515	0.2474
18	Lever 216-78403							
	Bushing CVC480-4-22	A	Bolt NAS464-4-13	0.2505	0.2487	0.0018	0.2515	0.2482
	Bushing CVC480-4-22	B	Bolt NAS464-4-13	0.2505	0.2487	0.0018	0.2515	0.2482
19	Lever 216-78404							
	Bushing CVC480-4-22	A	Bolt NAS464-4-13	0.2505	0.2487	0.0018	0.2515	0.2482
20	Arm 216-78401							
	Bearing MS21232-4	A	Bolt NAS464-4-12	0.2500	0.2487	0.0013	0.2500	0.2482
	Bearing MS20201KP8A	B	Shaft 216-78409	0.5000	0.4986	0.0014	0.5000	0.4976
21	Retainer 216-78406							
	Bushing NAS537-4-25	A	Bolt NAS464-4-12	0.2505	0.2487	0.0018	0.2515	0.2482
22	Link 216-78407							
	Bearing 202-19021-4-5RW	A	Bolt NAS464-4-13	0.2500	0.2487	0.0013	0.2500	0.2482
	Bearing 202-19021-4-5R	B	Bolt NAS464-4-13	0.2500	0.2487	0.0013	0.2500	0.2482
23	Link 216-78407							
	Bearing 202-19021-4-5R	A	Bolt NAS464-4-13	0.2500	0.2487	0.0013	0.2500	0.2482
	Bearing 202-19021-4-5RW	B	Bolt NAS464-4-13	0.2500	0.2487	0.0013	0.2500	0.2482
24	Rod End 216-70445							
	Bearing MS21232-4	A	Bolt NAS464-4-19	0.2500	0.2487	0.0013	0.2500	0.2482

90D069-05-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 5)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Door 216-70443							
	Bushing CVC480-3-16	A	0.3130	4130 Steel	125,000 Minimum	0.1890	0.1920	125
2	Pad 216-70446							
	Bearing MS21232-4	A	None					
3	Link 216-70437							
	Bushing CVC480-4-25	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
4	Link 216-70444							
	Bushing NAS538B3P-10	A	0.3130	Aluminum Bronze	85,000 to 90,000	0.1890	0.1920	125
5	Pad 216-70439							
	Bushing CVC480-4-20	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
6	Cover 216-70435							
	Bearing 202-19002G8	A	None					
7	Arm 216-70436							
	Bearing MS21232-4	A	None					
	Bushing NAS537-8P47	B	0.6255	4130 Steel	125,000 to 145,000	0.5000	0.5020	125
8	Support 216-70429							
	Bearing MS21232-4	A	None					
	Bushing NAS537-7P20	B	0.5630	4130 Steel	125,000 to 145,000	0.4220	0.4290	125
9	Pad 216-70441							
	Bearing 202-19012K7	A	None					
10	Support 216-70431							
	Bushing NAS537-5P85	A	0.4380	4130 Steel	125,000 to 145,000	0.3120	0.3130	125
	Bearing MS20201KP8A	B	None					

90D069-06-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 6)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
	Spacer CVC1991-8-26							
11	Retainer 216-78406							
	Bushing NAS537-4-25	A	0.4380	4130 Steel	125,000 to 145,000	0.2495	0.2505	125
12	Support 216-70428							
	Bearing MS21232-4	A	None					
13	Support 216-70448							
	Bushing NAS537-5P42	A	0.4380 (Note 3)	4130 Steel	125,000 to 145,000	0.3120	0.3130	125
14	Cylinder 216-72020							
	Bushing CVC480-4-20	A	0.3755	4130 Steel	125,000 Minimum	0.250	0.252	63
	Bearing MS27261KSP4A	B	None					
15	Bellcrank 216-78405							
	Bearing MS20201KP5A	A	None					
	Spacer CVC1991-5-68							
	Bushing CVC480-4-25 CVC480-4-22	B	0.2505	4130 Steel	125,000 Minimum	0.2495	0.2505	125
16	Lever 216-78402							
	Bearing MS20201KP4A	A	None					
	Bushing CVC480-4-22	B	0.4380 (Note 3)	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bushing CVC480-4-22	C	0.4380 (Note 3)	4130 Steel	125,000 Minimum	0.2495	0.2505	125
17	Support 216-70442							
	Bushing CVC480-4-35	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125

90D069-07-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 7)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
	Bushing CVC480-4-25	B	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
18	Lever 216-78403							
	Bushing CVC480-4-22	A	0.4380 (Note 3)	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bushing CVC480-4-22	B	0.4380 (Note 3)	4130 Steel	125,000 Minimum	0.2495	0.2505	125
19	Lever 216-78404							
	Bushing CVC480-4-22	A	0.4380 (Note 3)	4130 Steel	125,000 Minimum	0.2495	0.2505	125
20	Arm 216-78401							
	Bearing MS21232-4	A	None					
	Bearing MS20201KP8A	B	None					
21	Retainer 216-78406							
	Bushing NAS537-4-25	A	0.4380 (Note 3)	4130 Steel	125,000 to 145,000	0.2495	0.2505	125
22	Link 216-78407							
	Bearing 202-19021-4-5RW	A	None					
	Bearing 202-19021-4-5R	B	None					
23	Link 216-78407							
	Bearing 202-19021-4-5R	A	None					
	Bearing 202-19021-4-5RW	B	None					

90D069-08-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 8)

PERMISSIBLE REAMING AND BUSHING LIMITS

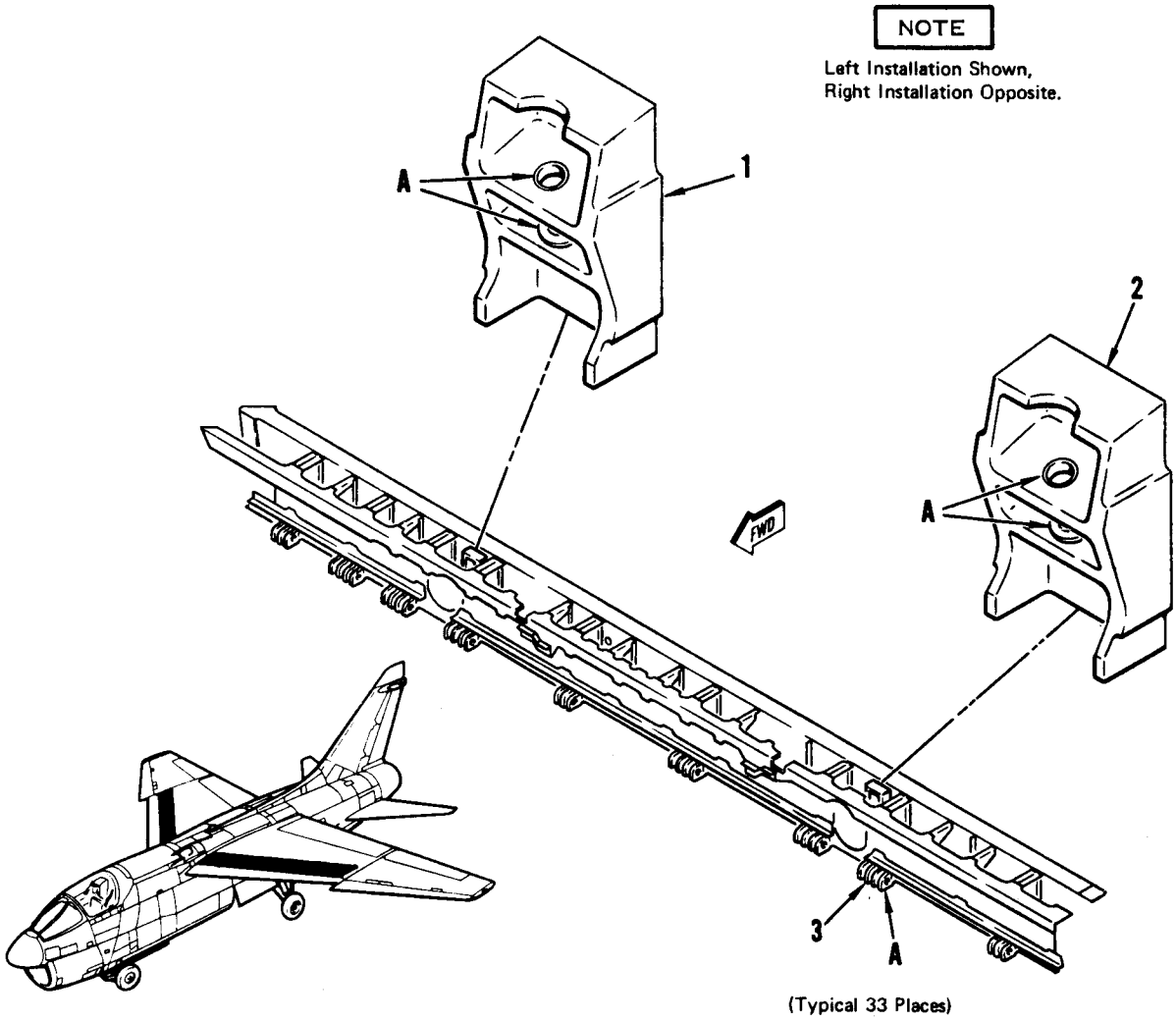
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
24	Rod End 216-70445							
	Bearing MS21232-4	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. Special bushing required when reaming hole to this diameter.

90D069-09-12-84

Figure 1-65. Wing Air Refueling Cavity Hardware Repair Limits (Sheet 9)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Inboard Actuator Support, L/R 215-70170 Bushing NAS538-8P39	A	Bolt NAS1308-29H	0.5000	0.4985	0.0015	0.5010	0.4975
2	Outboard Actuator Support, L/R 215-70091 Bushing NAS538-8P39	A	Bolt NAS1308-29H	0.5000	0.4985	0.0015	0.5010	0.4975
3	Hinge, L/R 215-70023	A	Pin 215-70643	0.2550	0.2480	0.0070	0.2820	0.2460

Figure 1-66. Wing Center Section Leading Edge Flap Hinge and Actuator Supports Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

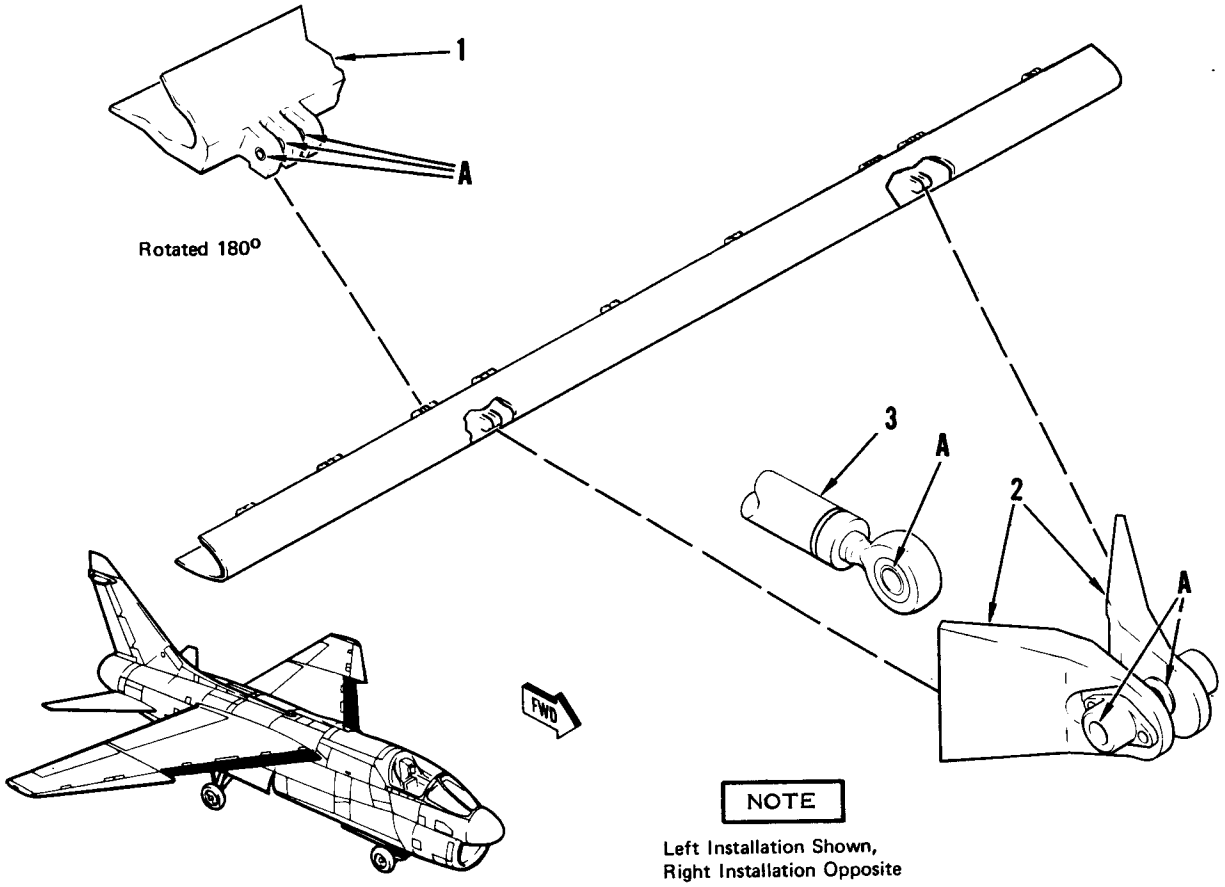
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Inboard Actuator Support, L/R 215-70170							
	Bushing NAS538-8P39 (Note 2) (Note 3)	A	0.6255	4130 Steel	125,000 to 145,000	0.4770	0.5000	125
2	Outboard Actuator Support, L/R 215-70091							
	Bushing NAS538-8P39 (Note 2) (Note 3)	A	0.6255	4130 Steel	125,000 to 145,000	0.4770	0.5000	125
3	Hinge, L/R 215-70023	A	0.3500	4130 Steel	125,000 Minimum	0.2500	0.2550	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. After installation, spotface outside ends flush with surface of receiving part.
4. Wear allowance includes manufacturing allowance.
5. Hinge Repair:
   A. No repair is required if any one lug in a bank of three or four lugs, or any one lug in a bank of 5 or 6 lugs is missing or worn beyond the specified wear maximum allowance.
   B. In a bank of seven lugs, no repair action is required if any one lug is missing or worn beyond the specified wear maximum allowance.
   C. In a bank of seven lugs, two lugs may be missing or worn beyond the specified wear maximum allowance, with no repair action required if:
      1. In the case of affected lugs next to each other, there are at least two lugs within the specified wear maximum allowance on either side of the affected lugs.
      2. In case condition (a) is not met, one or both of the affected lugs is at the end of the lug bank.
      3. The opposite lug bank meshing with the affected bank must have no lugs next to the affected lugs that are missing or that do not conform to the specified wear maximum allowance.

90D070-02-12-84

Figure 1-66. Wing Center Section Leading Edge Flap Hinge and Actuator Supports Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Hinge 215-70200	A	Pin 215-70643	0.2550	0.2480	0.0070	0.2570	0.2470
2	Support Assembly 215-70226							
	Bushing NAS538-8P26	A	Bolt NAS1308-20H	0.5000	0.4995	0.0005	0.5010	0.4985
3	Rod End 215-72418							
	Bearing MS21230-8	A	Bolt NAS1308-20H	0.5000	0.4995	0.0005	0.5001	0.4994

Figure 1-67. Wing Center Section Leading Edge Flap Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow. Ream Dia	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-Inches)
1	Hinge 215-70200	A	0.3500	4130 Steel	125,000 Minimum	0.2500	0.2550	125
2	Support Assembly 215-70226							
	Bushing NAS538-8P26	A	0.6255	4130 Steel	125,000 to 145,000	0.4770	0.5000	125
3	Rod End 215-72418							
	Bearing MS21230-8	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. No repair action is required if any one end lug is a bank of three or four lugs, or any one lug in a bank of 5 or 6 lugs is missing or worn beyond the specified wear maximum allowance.
4. In a bank of seven lugs, no repair action is required if any one lug is missing or worn beyond the specified wear maximum allowance.
5. In a bank of seven lugs, two lugs may be missing or worn beyond the specified wear maximum allowance, with no repair action required if:
   A. In the case of affected lugs next to each other, there are at least two lugs within the specified wear maximum allowance on either side of the affected lugs.
   B. In case condition (A) is not met, one or both of the affected lugs is at the end of the lug bank.
   C. The opposite lug bank meshing with the affected bank must have no lugs next to the affected lugs that are missing or that do not conform to the specified wear maximum allowance.

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Figure 1-67. Wing Center Section Leading Edge Flap Hardware Repair Limits (Sheet 2)

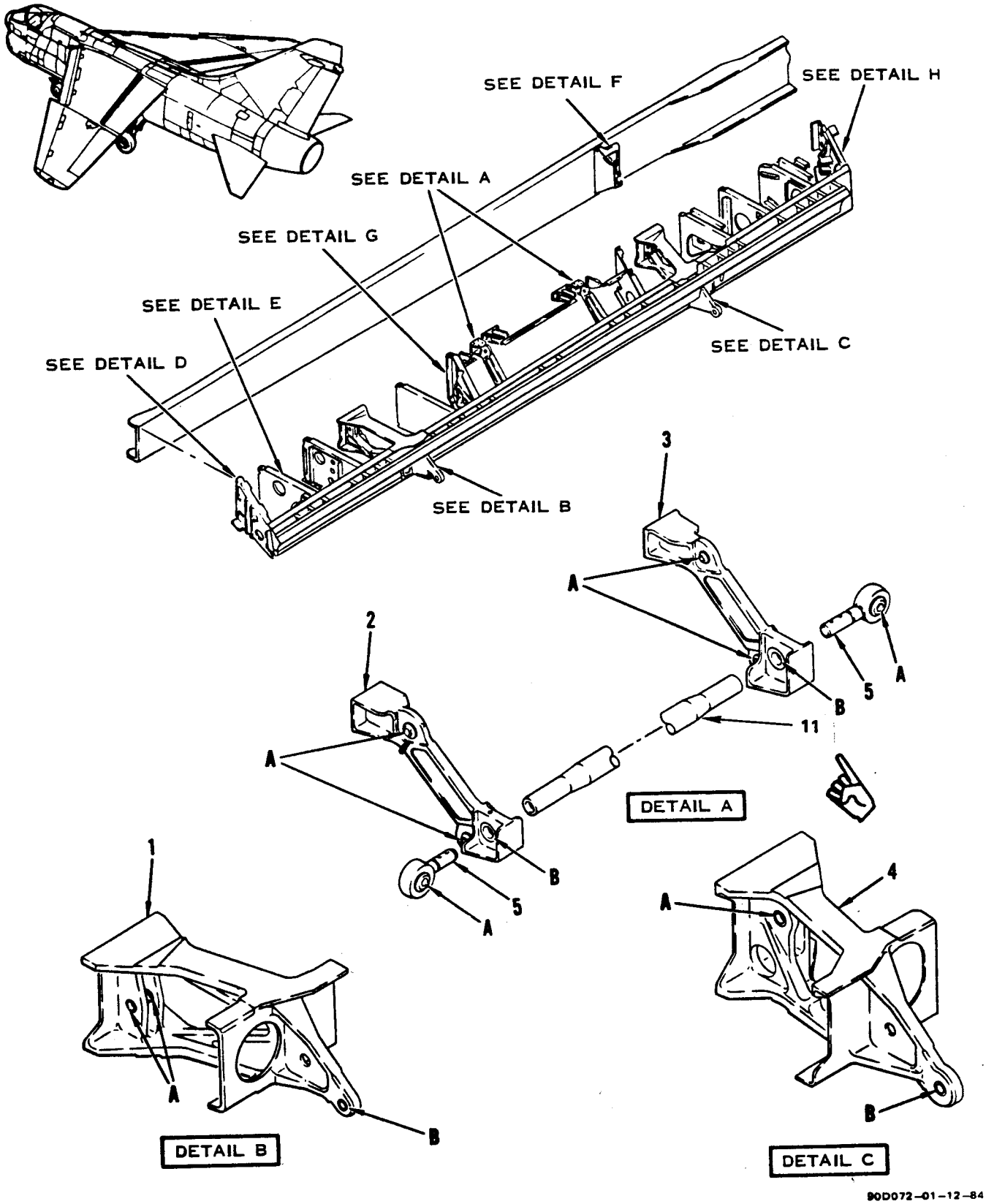


Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 1 of 6)

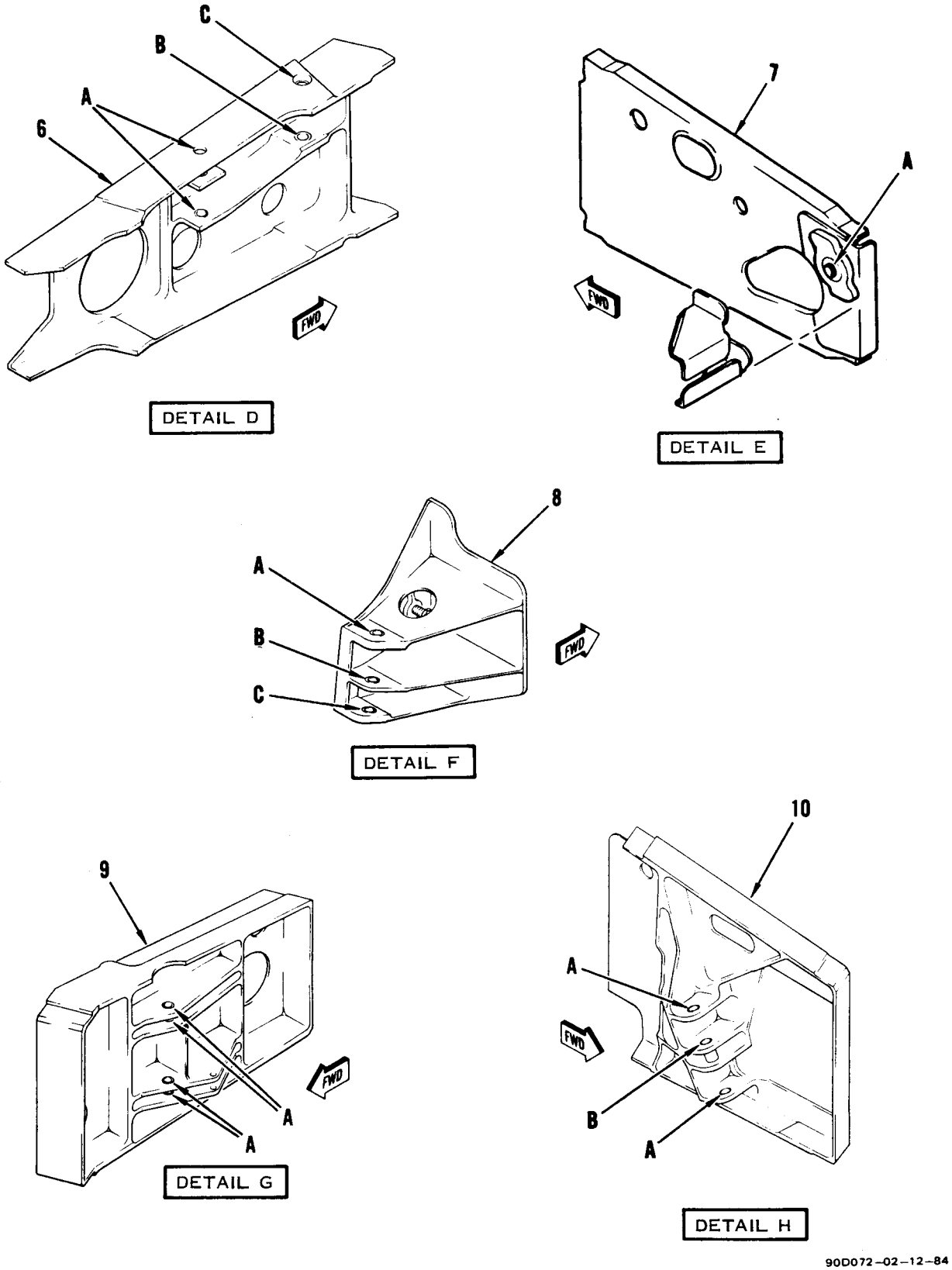


Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 3)	
							Hole	Shaft
1	Outboard Flap Hinge Rib, L/R 215-70326							
	Bushing NAS537B10P038	A	Bolt NAS464P10-24	0.6255	0.6230	0.0025	0.6275	0.6220
	Bushing NAS537B8P058	B	Bolt NAS464P8-26	0.5005	0.4982	0.0023	0.5055	0.4962
2	Outboard Spoiler Slot Deflector Support L/R 215-70059							
	Bearing 215-70460 (Note 4)	A	Pin 215-70600	0.3122	0.3116	0.0006	0.3127	0.3114
	Bearing 215-70461 (Note 5)	B	Bearing Unit 215-70412	0.7497	0.7491	0.0006	0.7507	0.7481
3	Inboard Spoiler Slot Deflector Support L/R 215-70060							
	Bearing 215-70460 (Note 4)	A	Pin 215-70600	0.3122	0.3116	0.0006	0.3127	0.3114
	Bearing 215-70461 (Note 5)	B	Bearing Unit 215-70412	0.7497	0.7491	0.0006	0.7507	0.7481
4	Inboard Flap Hinge Rib, L/R 215-70325							
	Bushing NAS537B10P043	A	Bolt NAS464P10-26	0.6255	0.6230	0.0025	0.6275	0.6220
	Bushing NAS537B10P075	B	Bolt NAS464P10-31	0.6255	0.6230	0.0025	0.6305	0.6210
5	Bearing Unit 215-70412							
	Bearing 202-19010-10	A	Bolt 215-78401	0.6247	0.6241	0.0006	0.6267	0.6231
6	Trailing Edge Rib 215-70101							
	Bushing NAS537-4P-25	A	Bolt NAS1304-27DH	0.2505	0.2485	0.0020	0.2525	0.2475
	Bushing NAS537-6P-40	B	Bolt CVC155-6-38	0.3755	0.3737	0.0018	0.3761	0.3734
	Bushing NAS537-6P-20	C	Bolt CVC155-6-38	0.3755	0.3737	0.0018	0.3761	0.3734

90D072-03-12-84

Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 3)	
							Hole	Shaft
7	Bearing Housing 215-78453							
	Bearing 202-19012K7	A	Push-Pull Control 215-28351	0.4375	0.4287	0.0088	0.4405	0.4267
8	Bellcrank Support 215-70102							
	Bushing CVC480-4-33	A	Bolt NAS1304-520H	0.2505	0.2485	0.0020	0.2511	0.2481
	Bushing CVC480-4-22	B	Bolt NAS1304-52DH	0.2505	0.2485	0.0020	0.2511	0.2481
	Bushing CVC480-4-31	C	Bolt NAS1304-52DH	0.2505	0.2485	0.0020	0.2511	0.2481
9	Trailing Edge Rib 215-70099							
	Bearing CVC480-4-23	A	Bolt NAS464-4-12	0.2505	0.2487	0.0018	0.2511	0.2484
10	Trailing edge Rib 215-70100							
	Bushing NAS537-B4-P20	A	Bolt NAS464-4-56	0.2505	0.2487	0.0018	0.2511	0.2484
	Bushing NAS537-B4-P98	B	Bolt NAS464-4-56	0.2505	0.2487	0.0018	0.2511	0.2484
11	Spoiler Strut 215-70141 (Note 6)							

90D072-04-12-84

Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 4)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Outboard Flap Hinge Rib, L/R 215-70326							
	Bushing (Note 2) NAS537B10P038	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
	Bushing (Note 2) NAS537B8P058	B	0.6255	Aluminum Bronze	85,000 to 90,000	0.5000	0.5005	63
2	Outboard Spoiler Slot Deflector Support, L/R 215-70059							
	Bearing 215-70460	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6870	0.6875	125
	Bearing 215-70461	B	1.5000	Aluminum Bronze	85,000 to 90,000	1.3745	1.3750	125
3	Inboard Spoiler Slot Deflector Support, L/R 215-70060							
	Bearing 215-70460	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6870	0.6875	125
	Bearing 215-70461	B	1.5000	Aluminum Bronze	85,000 to 90,000	1.3745	1.3750	125
4	Inboard Flap Hinge Rib, L/R 215-70325							
	Bushing (Note 2 NAS537B10P075	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
	Bushing (Note 2) NAS537B10P043	B	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
5	Bearing Unit 215-70412							
	Bearing 202-19010-10	A	None					
6	Trailing Edge Rib 215-70101							
	Bushing NAS537-4P-25	A	0.3755	4130 Steel	125,000 to 145,000	0.2496	0.2505	125
	Bushing NAS537-6P-40	B	0.5005	4130 Steel	125,000 to 145,000	0.3750	0.3755	125
	Bushing NAS537-6P-20	C	0.5005	4130 Steel	125,000 to 145,000	0.3750	0.3755	125

90D072-05-12-84

Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 5)

PERMISSIBLE REAMING AND BUSHING LIMITS

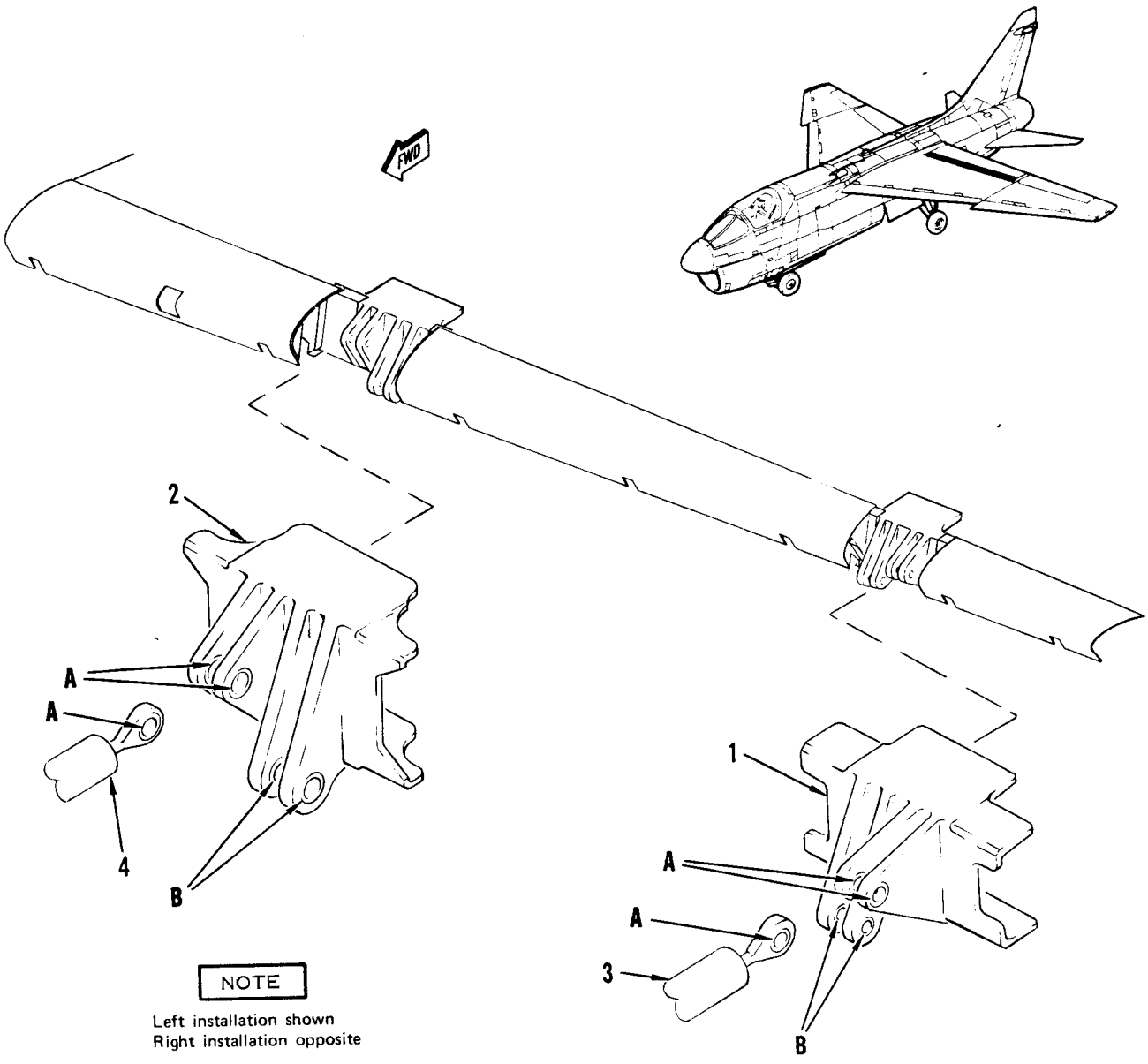
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
7	Bearing Housing 215-78453							
	Bearing 202-19012K7	A	None					
8	Bellcrank Support 215-70102							
	Bushing CVC480-4-33	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bushing CVC480-4-22	B	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bushing CVC480-4-31	C	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
9	Trailing Edge Rib 215-70099							
	Bearing CVC480-4-23	A	None					
10	Trailing Edge Rib 215-70100							
	Bushing NAS537B4P20	A	0.3755	Aluminum Bronze	85,000 to 90,000	0.2500	0.2505	125
	Bushing NAS537B4P98	B	0.3755	Aluminum Bronze	85,000 to 90,000	0.2500	0.2505	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. Wear allowance includes manufacturing allowance.
4. Refer to Section XVII for bearing staking tool.
5. Bearings were not staked during original manufacture. Loose or new bearings shall be staked utiilizing appropriate staking tool shown in Section XVII.
6. Maximum allowable sideplay of strut installation is 0.015 inch. Refer to figure 5-2A for inspection and repair procedures.

90D072-06-12-84

Figure 1-68. Wing Trailing Edge Flap Hinge and Spoiler Slot Deflector Support Hardware Repair Limits (Sheet 6)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Support Assembly, Outboard 215-70328							
	Bushing NAS537B10P-025	A	Bolt NAS464P10-20	0.6255	0.6230	0.0025	0.6259	0.6228

Figure 1-69. Wing Trailing Edge Flap Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
	Bushing NAS537B8P-040	B	Bolt NAS464P8-26	0.5005	0.4982	0.0023	0.5009	0.4980
2	Support Assembly, Inboard 215-70327							
	Bushing NAS537B10P-035	A	Bolt NAS464P10-24	0.6255	0.6230	0.0025	0.6259	0.6228
	Bushing NAS537B10P-054	B	Bolt NAS464P10-31	0.6255	0.6230	0.0025	0.6259	0.6228
3	Rod End 215-72463							
	Bearing MS21230-10	A	Bolt NAS464P10-20	0.6250	0.6230	0.0020	0.6253	0.6227
4	Rod End 215-72463							
	Bearing MS21230-10	A	Bolt NAS464P10-24	0.6250	0.6230	0.0020	0.6253	0.6227

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Suport Assembly, Outboard 215-70328							
	Bushing NAS537B10P025	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
	Bushing NAS537B8P040	B	0.6255	Aluminum Bronze	85,000 to 90,000	0.5000	0.5005	63
2	Support Assembly, Inboard 215-70327							
	Bushing NAS537B10P035	A	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
	Bushing NAS537B10P054	B	0.8130	Aluminum Bronze	85,000 to 90,000	0.6250	0.6255	63
3	Rod End 215-72463							
	Bearing MS21230-10	A	None					
4	Rod End 215-72463							
	Bearing MS21230-10	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D073-02-12-84

Figure 1-69. Wing Trailing Edge Flap Hardware Repair Limits (Sheet 2)

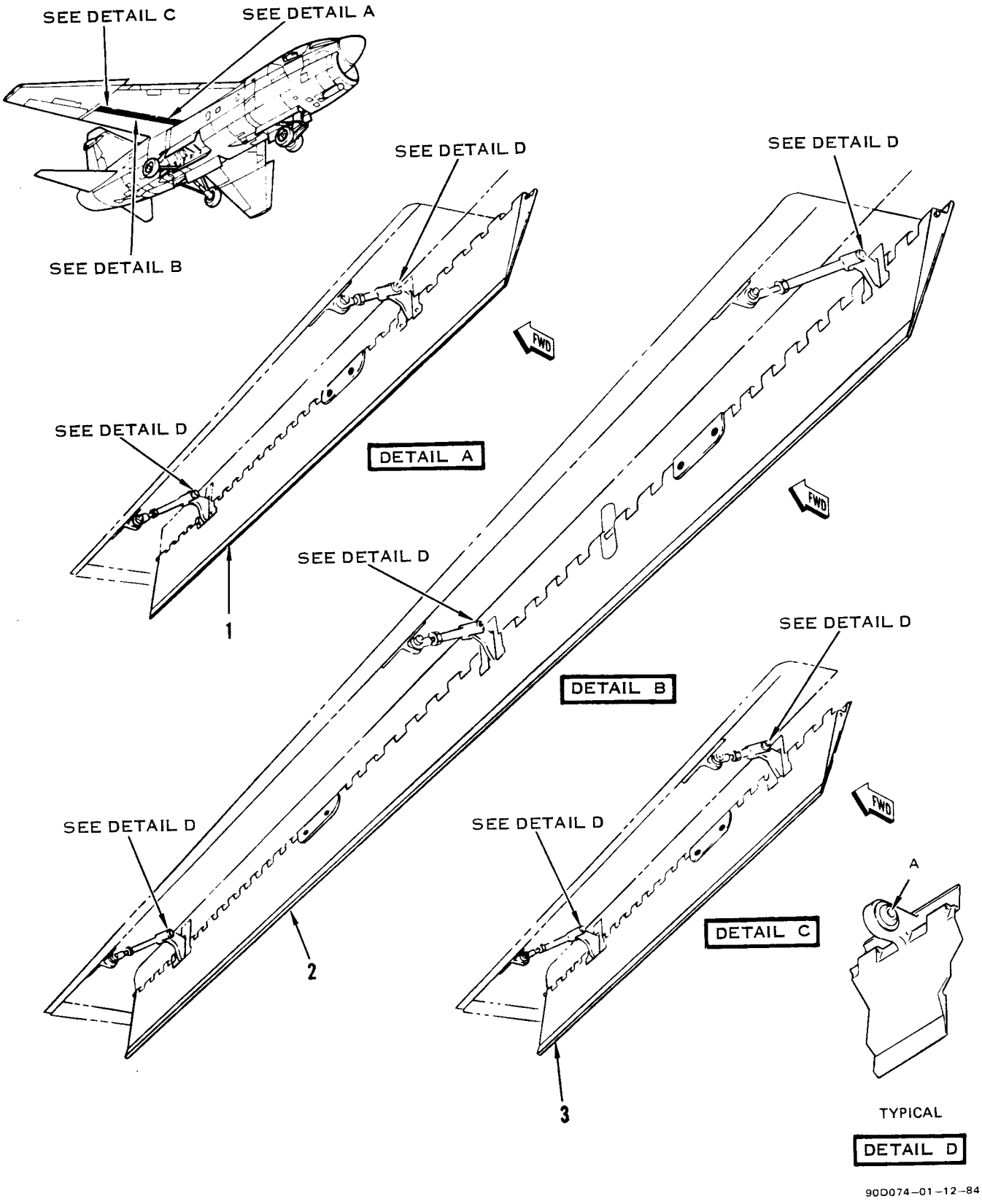


Figure 1-70. Wing Trailing Edge Flap Door Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 3)	
							Hole	Shaft
1	Door Assembly, L/R 215-70196							
	Bearing NV-3 (Note 2)	A	Pin, MS20392-2C17	0.1905	0.1840	0.0065	0.1925	0.1830
2	Door Assembly, L/R 215-70195							
	Bearing, NV-3 (Note 2)	A	Pin, MS20392-2C17	0.1905	0.1840	0.0065	0.1925	0.1830
3	Door Assembly, L/R 215-70194							
	Bearing NV-3 (Note 2)	A	Pin, MS20392-2C17	0.1905	0.1840	0.0065	0.1925	0.1830

PERMISSIBLE REAMING AND BUSHING LIMITS

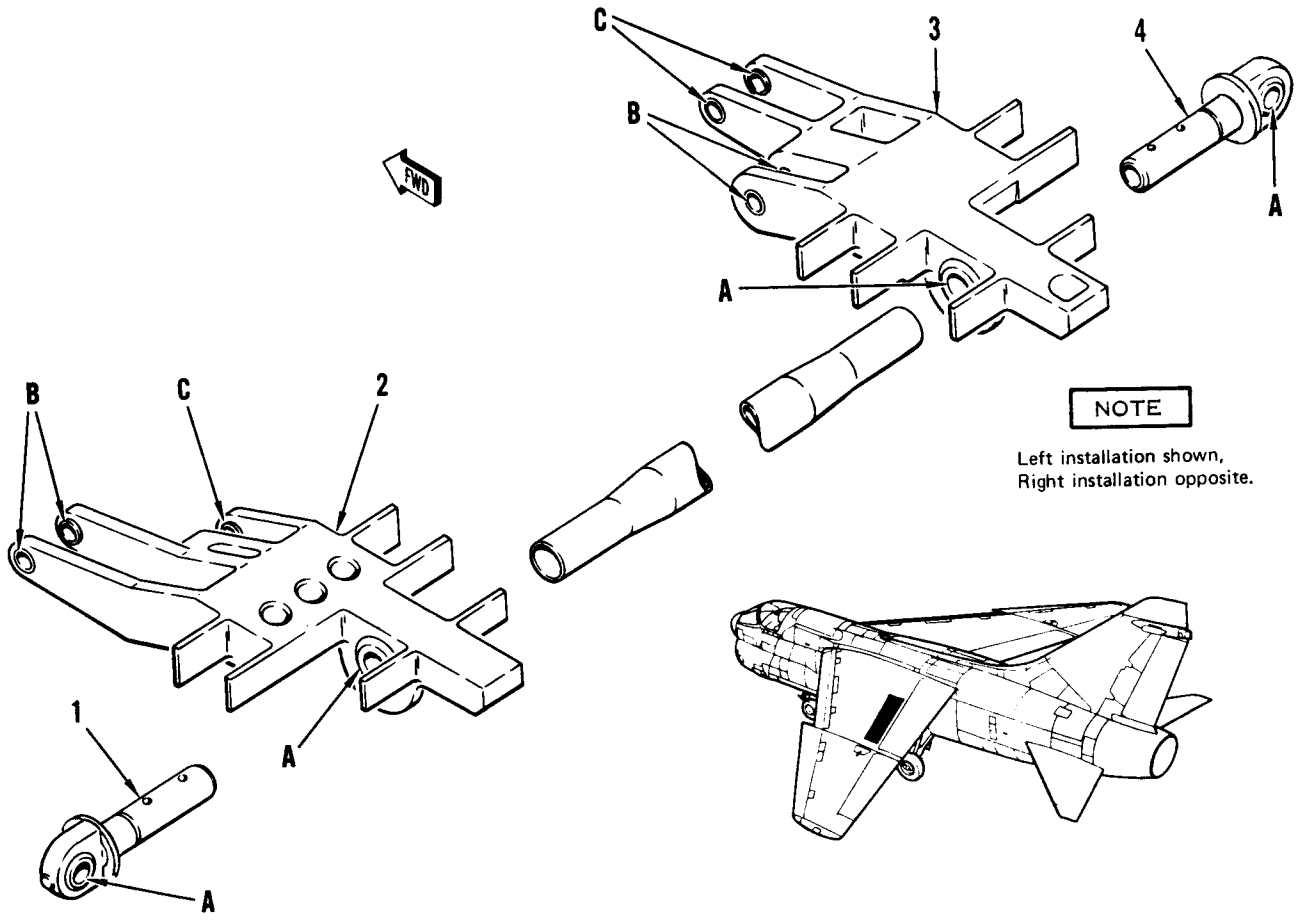
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Door Assembly, L/R 215-70196							
	Bearing, NV-3 (Note 2)	A	None					
2	Door Assembly, L/R 215-70195							
	Bearing, NV-3 (Note 2)	A	None					
3	Door Assembly, L/R 215-70194							
	Bearing, NV-3 (Note 2)	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Part number of Heim Universal Corp.
3. Wear allowance includes manufacturing allowance.

90D074-02-12-84

Figure 1-70. Wing Trailing Edge Flap Door Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Bearing Unit 215-70428							
	Bearing 215-70462 (Note 5)	A	Bolt 215-78404	0.3747	0.3741	0.0006	0.3767	0.3731
2	Outboard Support, L/R 215-70360							
	Bearing 215-70463 (Note 5)	A	Bearing Unit 215-70428	0.7497	0.7491	0.0006	0.7517	0.7481
	Bushings NAS537B5P026 and NAS537B5P031	B	Bolt 215-78405	0.3122	0.3116	0.0006	0.3127	0.3111
	Bushings NAS537B5P036 and NAS537B5P110	C	Pin 215-70600	0.3122	0.3116	0.0006	0.3132	0.3106

Figure 1-71. Spoiler Hinge Support Hardware Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
3	Inboard Support, L/R 215-70385							
	Bearing 215-70463 (Note 5)	A	Bearing Unit 215-70429	0.7497	0.7491	0.0006	0.7517	0.7481
	Bushings NAS537B5P033 and NAS537B5P103	B	Pin 215-70600	0.3122	0.3116	0.0006	0.3132	0.3106
	Bushing NAS537B5P031	C	Bolt 215-78405	0.3122	0.3116	0.0006	0.3127	0.3111
4	Bearing Unit 215-70429							
		A	Bolt 215-78404	0.3747	0.3741	0.0006	0.3767	0.3731

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Bearing Unit 215-70428							
	Bearing 215-70462	A	None					
2	Outboard Support, L/R 215-70360							
	Bearing 215-70463	A	None					
	Bushings (Note 2) NAS537B5P026 and NAS537B5P031	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120 (Note 3)	0.3122 (Note 3)	16
	Bushings (Note 2) NAS537B5P036 and NAS537B5P110	C	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120 (Note 3)	0.3122 (Note 3)	16
3	Inboard Support, L/R 215-70385							
	Bearing 215-70463	A	None					
	Bushings (Note 2) NAS537B5P033 and NAS537B5P103	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120 (Note 3)	0.3122 (Note 3)	16
	Bushing (Note 2) NAS537B5P031	C	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120 (Note 3)	0.3122 (Note 3)	16

90D075-02-12-84

Figure 1-71. Spoiler Hinge Support Hardware Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

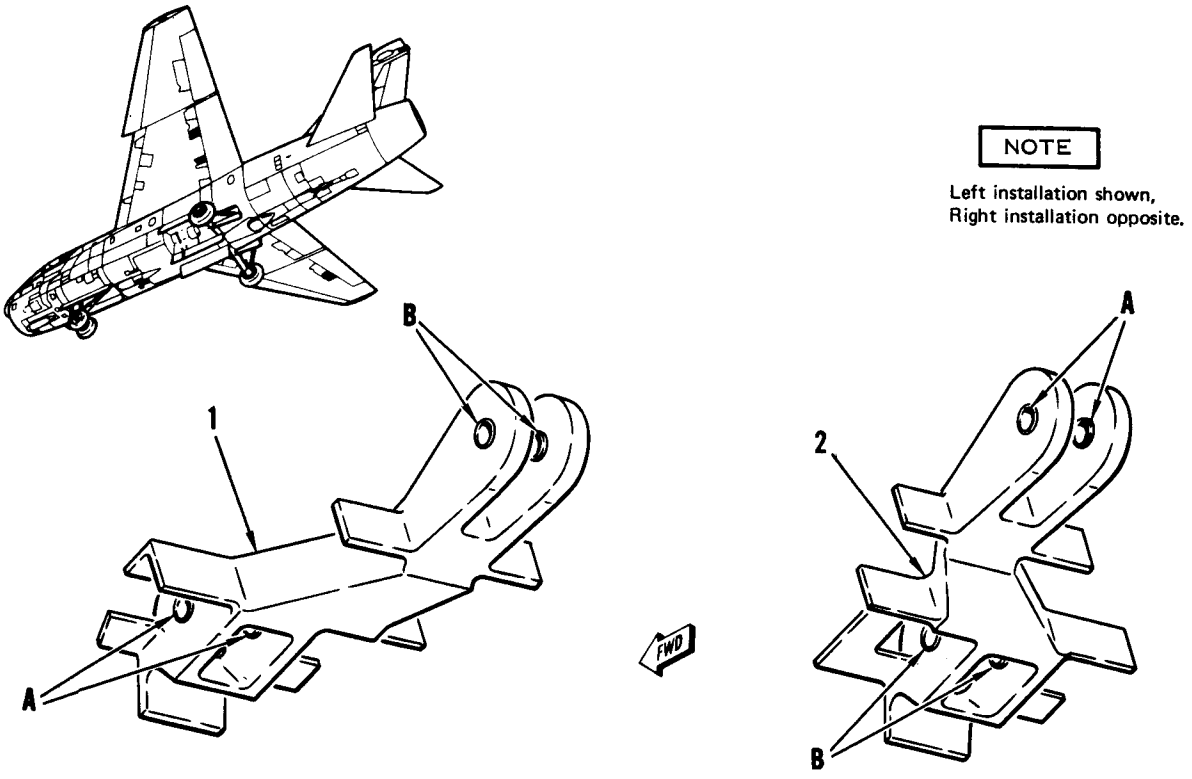
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
4	Bearing Unit 215-70429							
	Bearing 202-19010-6	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. Line lap to finished size and specified machine finish after installation.
4. Wear allowance includes manufacturing allowance.
5. Refer to Section XVII for bearing staking tool.

90D075-03-12-84

Figure 1-71. Spoiler Hinge Support Hardware Repair Limits (Sheet 3)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Inboard Support, L/R 215-70380							
	Bushing CVC485-10-26	A	Bolt 215-78405	0.3120	0.3116	0.0004	0.3125	0.3111
	Bushing CVC485-10-34	B	Pin 215-70600	0.3120	0.3116	0.0004	0.3130	0.3106
2	Outboard Support, L/R 215-70381							
	Bushing CVC485-10-34	A	Pin 215-70600	0.3120	0.3116	0.0004	0.3130	0.3106
	Bushing CVC485-10-26	B	Bolt 215-78405	0.3120	0.3116	0.0004	0.3125	0.3111

Figure 1-72. Deflector Hinge Support Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Inboard Support, L/R 215-70380							
	Bushing (Note 2) CVC485-10-26	A	0.4380	4130 Steel	180,000 Minimum	0.3118 (Note 3)	0.3120 (Note 3)	16
	Bushing (Note 2) CVC485-10-34	B	0.4380	4130 Steel	180,000 Minimum	0.3118 (Note 3)	0.3120 (Note 3)	16
2	Outboard Support, L/R 215-70381							
	Bushing (Note 2) CVC485-10-34	A	0.4380	4130 Steel	180,000 Minimum	0.3118 (Note 3)	0.3120 (Note 3)	16
	Bushing (Note 2) CVC485-10-26	B	0.4380	4130 Steel	180,000 Minimum	0.3118 (Note 3)	0.3120 (Note 3)	16

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. Line lap to finished size and specified machine finish after installation.
4. Wear allowance includes manufacturing allowance.

90D076-02-12-84

Figure 1-72. Deflector Hinge Support Hardware Repair Limits (Sheet 2)

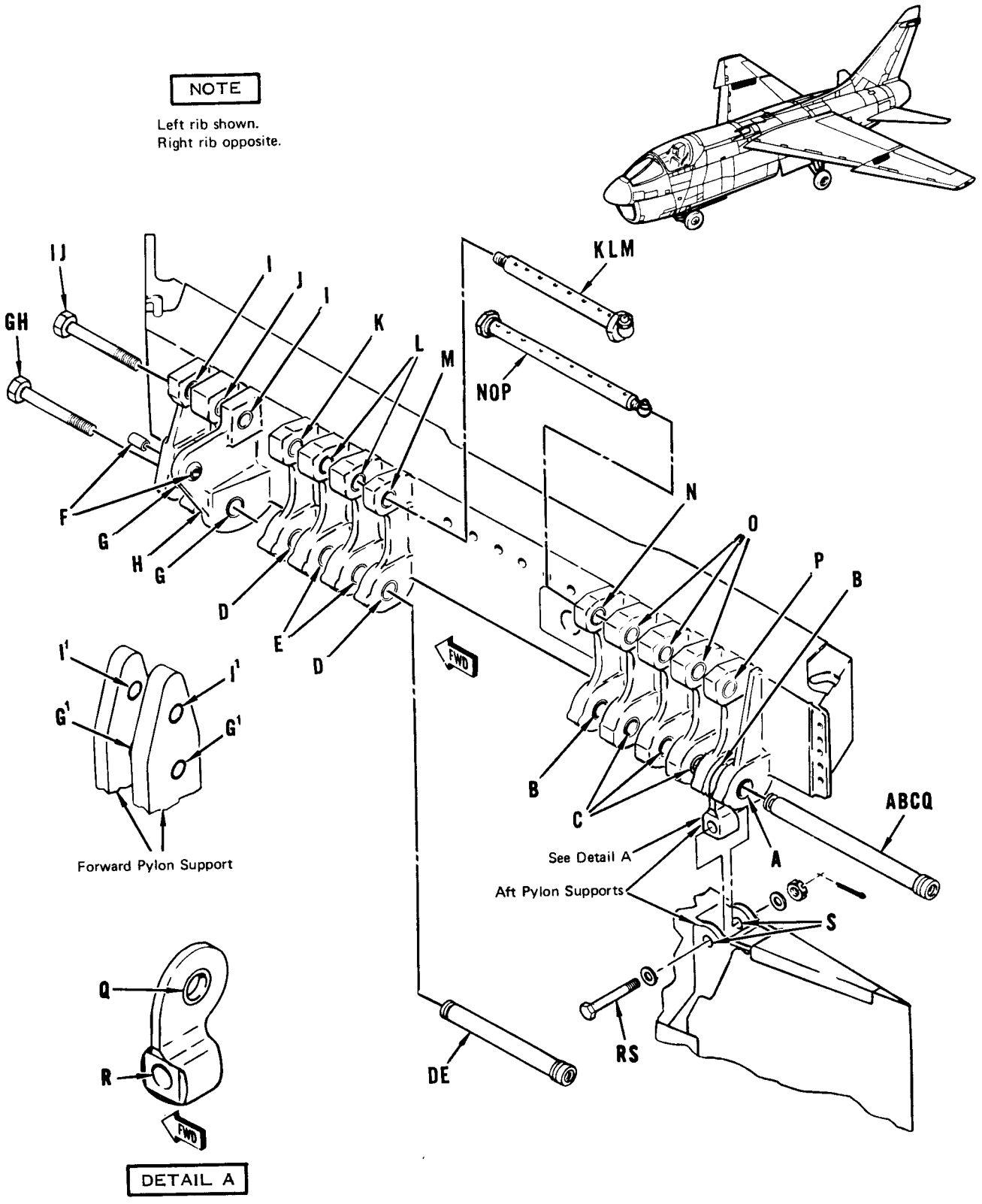


Figure 1-73. Wing Center Section Wingfold Rib Hardware Repair Limits (Sheet 1 of 4)

PERMISSIBLE WEAR ALLOWANCES

Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) Note 4			Accumulative Max Allowance (Inches)	Total Accumulative Max Allowance (Inches) (Note 5)
						Hole	Shaft			
Center Section Wingfold Rib Assembly 215-70058 (Note 2)										
Bushing 215-70452	A, B, C, D, E	Hinge Pin Pull Act. Cyl Piston and Rod 215-72403	0.9385	0.9345	0.0040	Note 3	Note 3		Note 3	Note 3
Bearing MS21230-10	F	Pin 215-72437	0.6250	0.6235	0.0015	Note 3	Note 3		Note 3	Note 3
Bushing 215-70452	K, L, M, N, O, P	Wingfold Hinge Bolt 215-70112	0.9375	0.9345	0.0030	Note 3	Note 3		Note 3	Note 3
Bushing NAS537-16P78 (Forward Pylon Lug) 215-70467 Bushing NAS537-16P122	G	Bolt 215-99406	1.0005	0.9965	0.0040	0.002	0.001		0.0070	0.0140 for Joint G, G[1], or H, G[1]
	G[1]		1.0005	0.9965	0.0040	0.002	0.001		0.0070	
	H		1.0005	0.9965	0.0040	0.002	0.001		0.0070	
Bushing NAS537-14P78 (Forward Pylon Lug) 215-70467 Bushing NAS537-14P122	I	Bolt 215-99406	0.8755	0.8720	0.0035	0.0025	0.001		0.0070	0.0140 for Joint I, I[1], or J, I[1]
	I[1]		0.8755	0.8720	0.0035	0.0025	0.001		0.0070	
	J		0.8755	0.8720	0.0035	0.0025	0.001		0.0070	
Aft Pylon Support 215-70190										
Bushing 215-70452	Q	Hinge Pin Pull Act. Cyl Piston and Rod 215-72403	0.9385	0.9345	0.0040	0.9400	Note 3		0.0040	
Bushing (Note 6) NAS537-12P142	R	Bolt NAS464P12–40	0.7510	0.7477	0.0033	0.7530	0.7467		0.0063	
Support 215-70072	S	Bolt NAS464P12-40	0.7510	0.7477	0.0033					

90D077–02–12–84

Figure 1-73. Wing Center Section Wingfold Rib Hardware Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
	Center Section Wingfold Rib Assembly 215-70058 (Note 2)		None					
	Bushing 215-70452	A, B, C, D, E	1.0635	Aluminum Bronze		0.9380	0.9385	16
	Bearing MS21230-10	F	None					
	Bushing NAS537-16P78	G	1.1885	4130 Steel	145,000	0.9840	0.9910	63
	(Pylon Support)	G[1]	1.1205	4340 Steel	180,000	1.0005	0.9995	63
	Bushing NAS537-16P122	H	1.1885	4130 Steel	145,000	0.9840	0.9910	63
	Bushing NAS537-14P78	I	1.0635	4130 Steel	145,000	0.8590	0.8660	63
	(Pylon Support)	I[1]	0.9955	4340 Steel	180,000	0.8755	0.8745	63
	Bushing NAS537-14P122	J	1.0635	4130 Steel	145,000	0.8590	0.8660	63
	Bushing 215-70452	K, L, M, N, O, P	1.0635	Aluminum Bronze		0.9370	0.9375	63
	Aft Pylon Support 215-70190	Q	1.0635	Aluminum Bronze	85,000 to 90,000	0.9380	0.9385	16
		R	None					
	Support 215-70072	S	None					

90D077-03-12-84

Figure 1-73. Wing Center Section Wingfold Rib Hardware Repair Limits (Sheet 3)

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushing in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.

2. Do not seal bushings after installation.

3. No wear is permissible in excess of manufacturing tolerances given.

4. Wear allowance is in addition to manufacturing allowance.

5. If the parts do not fall within the individual allowances defined above, the following alternate check may be made for hole/bolt/hole joints G, G[1], H, I, I[1], and J:

Max Wing Hole Diam	x.xxxx
Max Pylon Hole Diam	x.xxxx
Total of Hole Diam	x.xxxx
Total Max. Allowance	0.0140
2 x Minimum Bolt Diam	x.xxxx
Sum	x.xxxx

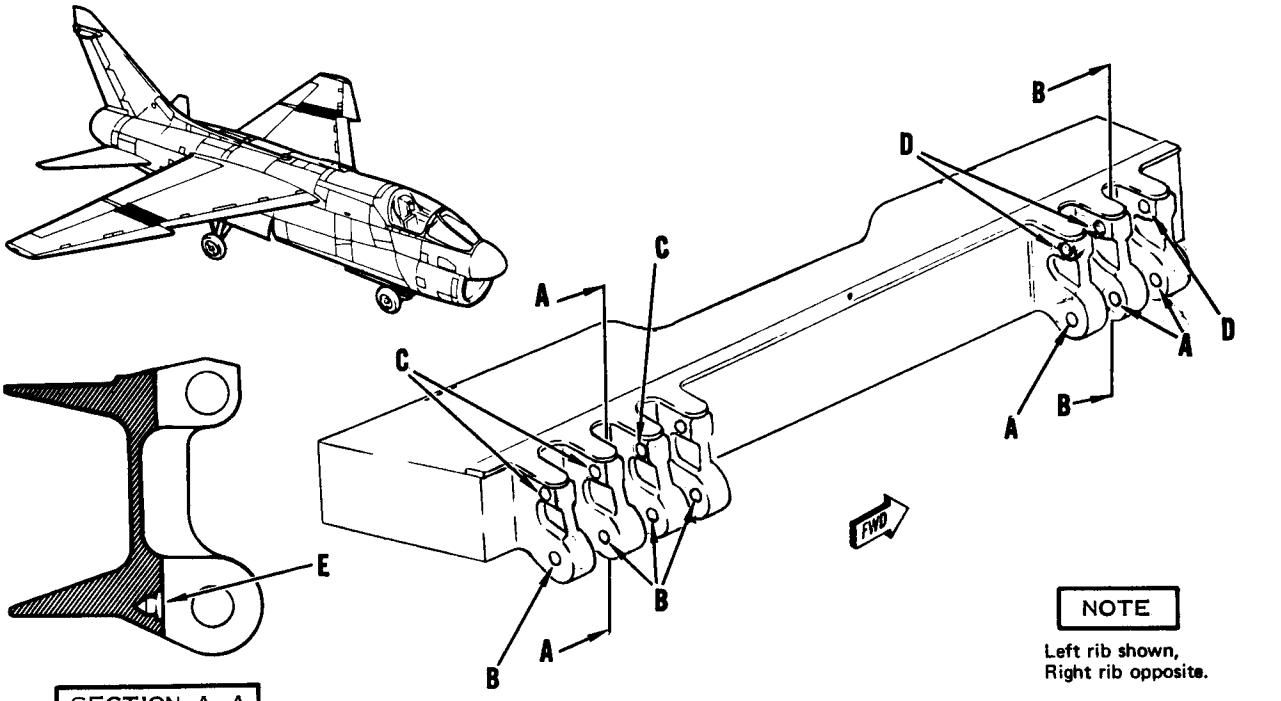
If the "Total of Hole Diameters" is equal to or less than the "Sum", the joint is acceptable. However, if this alternate check is required to make the joint acceptable, the pylon is no longer considered interchangeable; i.e. the specific pylon cannot be moved to another airplane or a different pylon cannot be moved to this airplane without making a new joint dimensional check. Also, the individual parts which are out of tolerance should be noted in the log book and reworked at the next PAR (T.O. 1A-7D-6).

6. Support is not originally manufactured with a bushing. Bushing shall be installed as salvage action only.

7. Do not heat damage high strength steel support during reaming operation. Use reamer turned very slowly with plenty of oil to keep reamer and material cool.

90D077-04-12-84

Figure 1-73. Wing Center Section Wingfold Rib Hardware Repair Limits (Sheet 4)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
	Outer Panel Wingfold Rib Assembly 215-80057							
	Bushing 215-70452	A, B	Hinge Pin Pull Act. Cyl Piston and Rod 215-72403	0.9385	0.9345	0.0040	Note 3	Note 3
	Bushing 215-70452	C, D	Wingfold Hinge Bolt 215-70112	0.9375	0.9345	0.0030	Note 3	Note 3
		E	Bushing CV15-810544	0.4225	0.4225	0.000	Note 3	Note 3

Figure 1-74. Wing Outer Panel Wingfold Rib Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

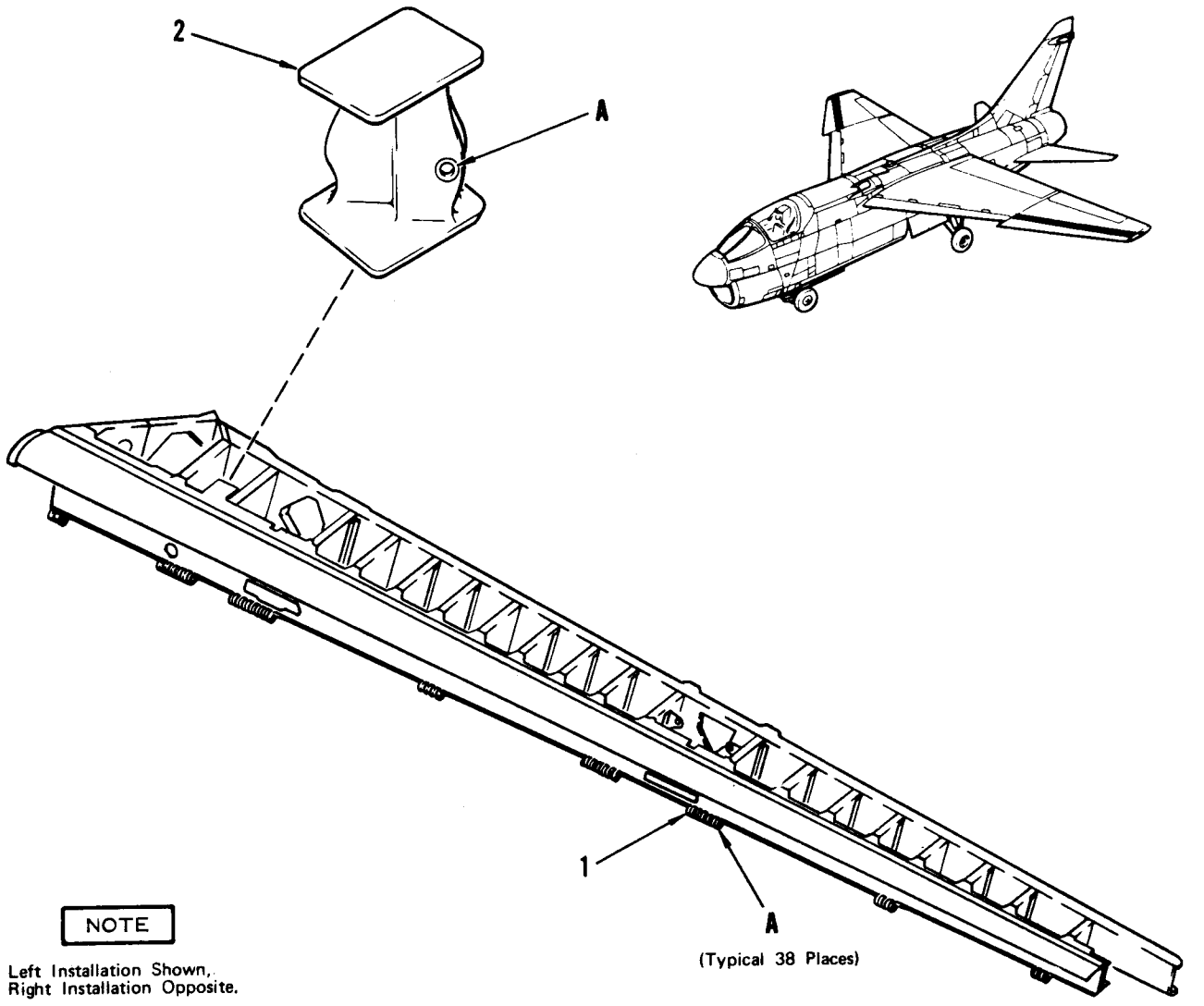
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
	Outer Panel Wingfold Rib Assembly 215-80057 (Note 2)							
	Bushing 215-70452	A, B	1.0635	Aluminum Bronze		0.9380	0.9385	16
	Bushing 215-70452	C, D E	1.0635 None	Aluminum Bronze		0.9370	0.9375	63

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. No wear is permissible in excess of manufacturing tolerances given.

90D078-02-12-84

Figure 1-74. Wing Outer Panel Wingfold Rib Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Flap Support, L/R 215-80023	A	Pin 215-70643	0.2550	0.2480	0.0070	0.2820	0.2460
2	Wingfold Actuator Support, L/R 215-80093		None					
	Bushing (Note 2) NAS538-8P - 32	A	Bolt NAS464P8-22	0.5005	0.4982	0.0023	0.5015	0.4972

Figure 1-75. Wing Outer Panel Leading Edge Flap Hinge and Wingfold Actuator Supports Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

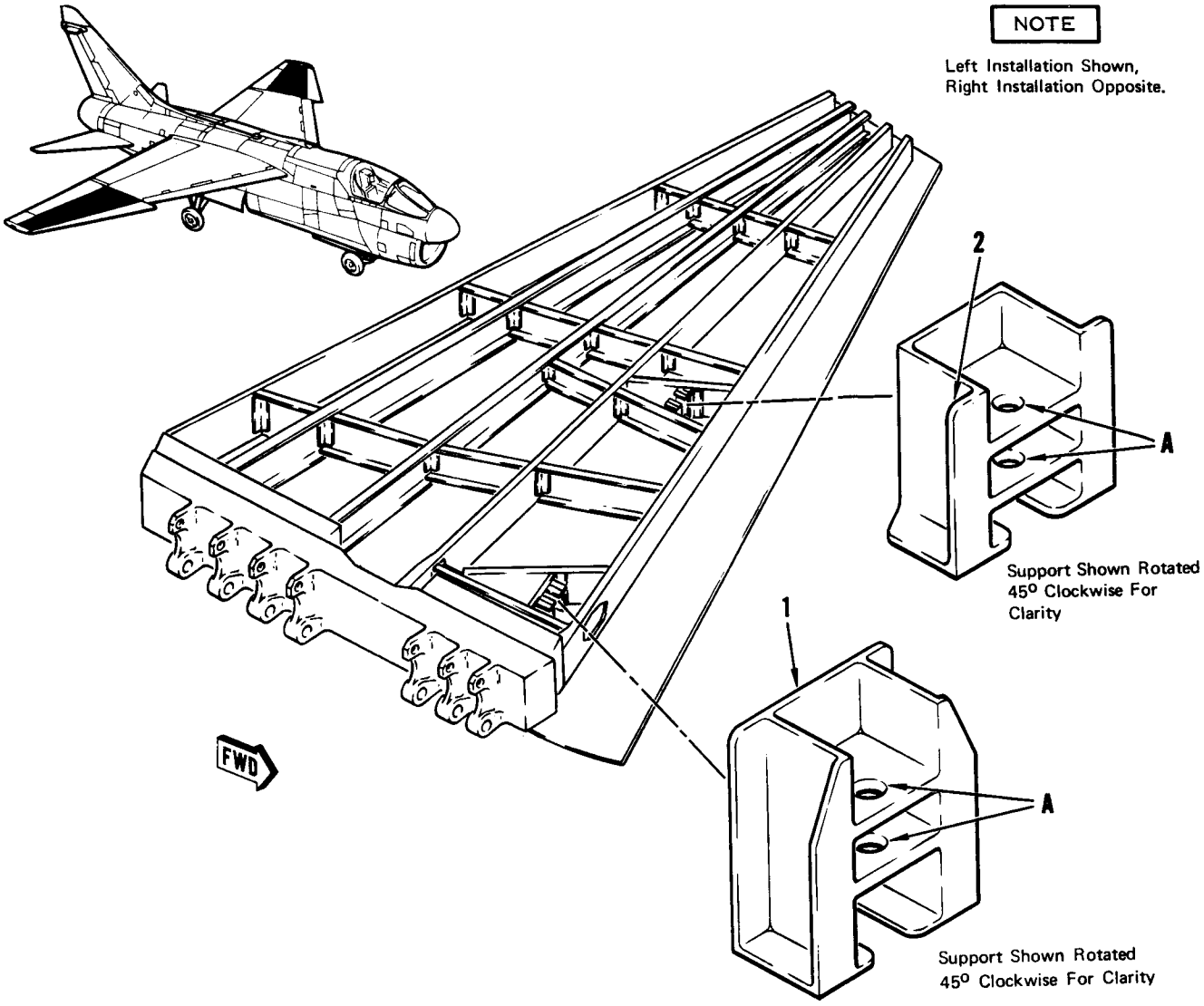
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Flap Support, L/R 215-80023	A	0.3500	4130 Steel	125,000 Minimum	0.2500	0.2550	
2	Wingfold Actuator Support, L/R 215-80093		None					
	Bushing NAS538-8P32	A	0.6255	4130 Steel	125,000 to 145,000	0.4995	0.5005	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. After installation, spotface outside ends flush with surface of receiving part.
3. Wear allowance includes manufacturing allowance.
4. No repair action is required if any one end lug in a bank of three or four lugs, or any one lug in a bank of 5 or 6 lugs is missing or worn beyond the specified wear maximum allowance.
5. In a bank of seven lugs, no repair action is required if any one lug is missing or worn beyond the specified wear maximum allowance.
6. In a bank of seven lugs, two lugs may be missing or worn beyond the specified wear maximum allowance with no repair action required, if:
   A. In the case of affected lugs next to each other, there are at least two lugs within the specified wear maximum allowance on either side of the affected lugs.
   B. In case condition (A) is not met, one or both of the affected lugs is at the end of the lug bank.
   C. The opposite lug bank meshing with the affected bank must have no lugs next to the affected lugs that are missing or that do not conform to the specified wear maximum allowance.

90D079-02-12-84

Figure 1-75. Wing Outer Panel Leading Edge Flap Hinge and Wingfold Actuator Supports Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	Total
1	Inboard Flap Actuator Support, L/R 215-80090	A	Bolt MS21250-10028	0.6255	0.6230	0.0025	0.6265	0.6220	
2	Outboard Flap Actuator Support, L/R 215-80091	A	Bolt MS21250-10028	0.6255	0.6230	0.0025	0.6265	0.6220	

Figure 1-76. Wing Outer Panel Leading Edge Flap Actuator Supports Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

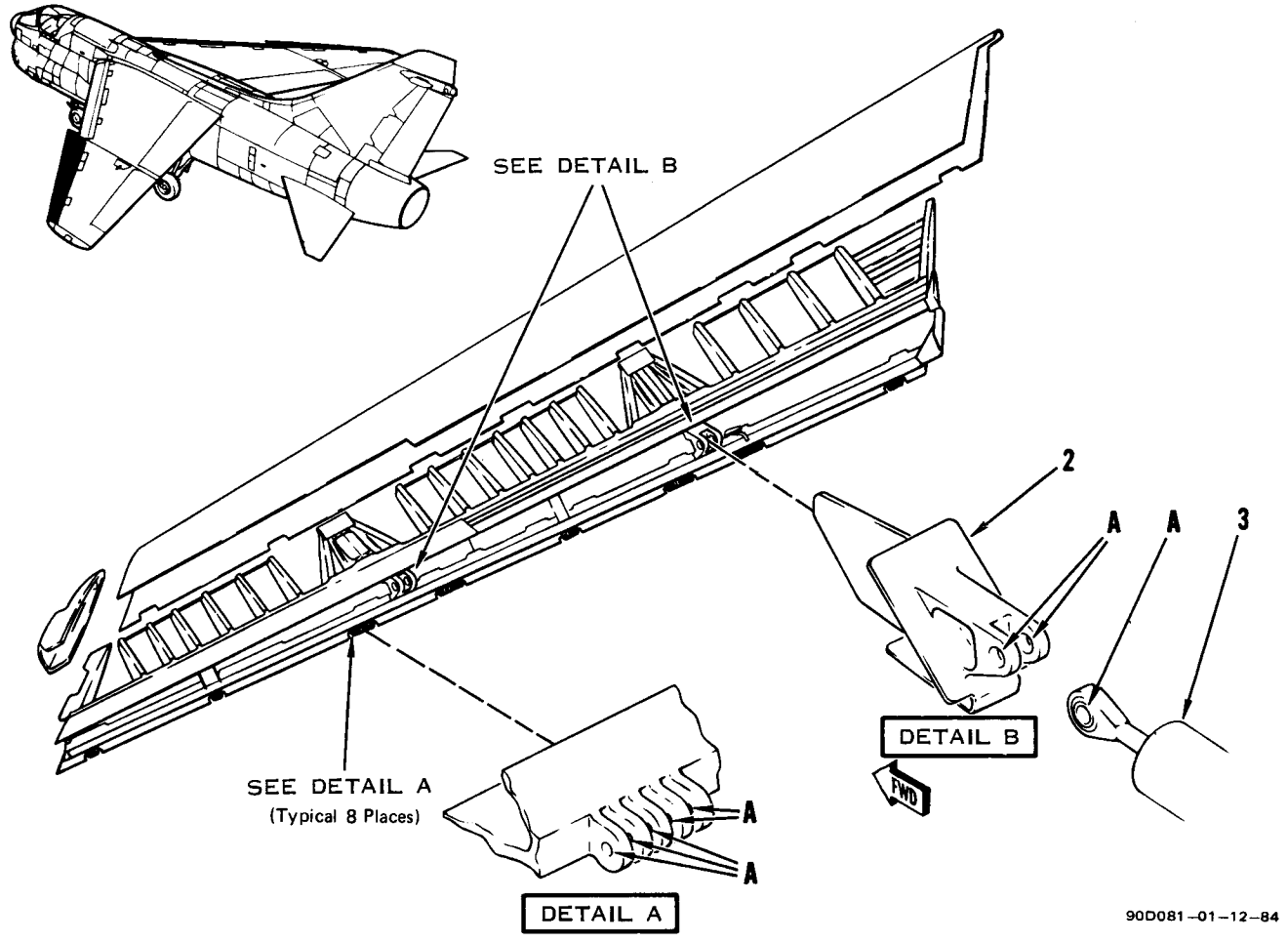
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Inboard Flap Actuator Support, L/R 215-80090	A	0.6880	4130 Steel	125,000 Minimum	0.6245	0.6255	125
2	Outboard Flap Actuator Support, L/R 215-80091	A	0.6880	4130 Steel	125,000 Minimum	0.6245	0.6255	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D080-02-12-84

Figure 1-76. Wing Outer Panel Leading Edge Flap Actuator Supports Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	Total
1	Hinge 215-80200	A	Pin 215-70643	0.2550	0.2480	0.0070	0.2570	0.2470	
2	Support Assembly, Outboard 215-80225								
	Support Assembly Inboard 215-80226	A	Bolt NAS464P10-24	0.6255	0.6230	0.0025	0.6260	0.6227	
3	Rod End 215-72418								
	Bearing MS21230-10	A	Bolt NAS464P10-24	0.6250	0.6230	0.0020	0.6253	0.6227	

Figure 1-77. Wing Outer Panel Leading Edge Flap Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

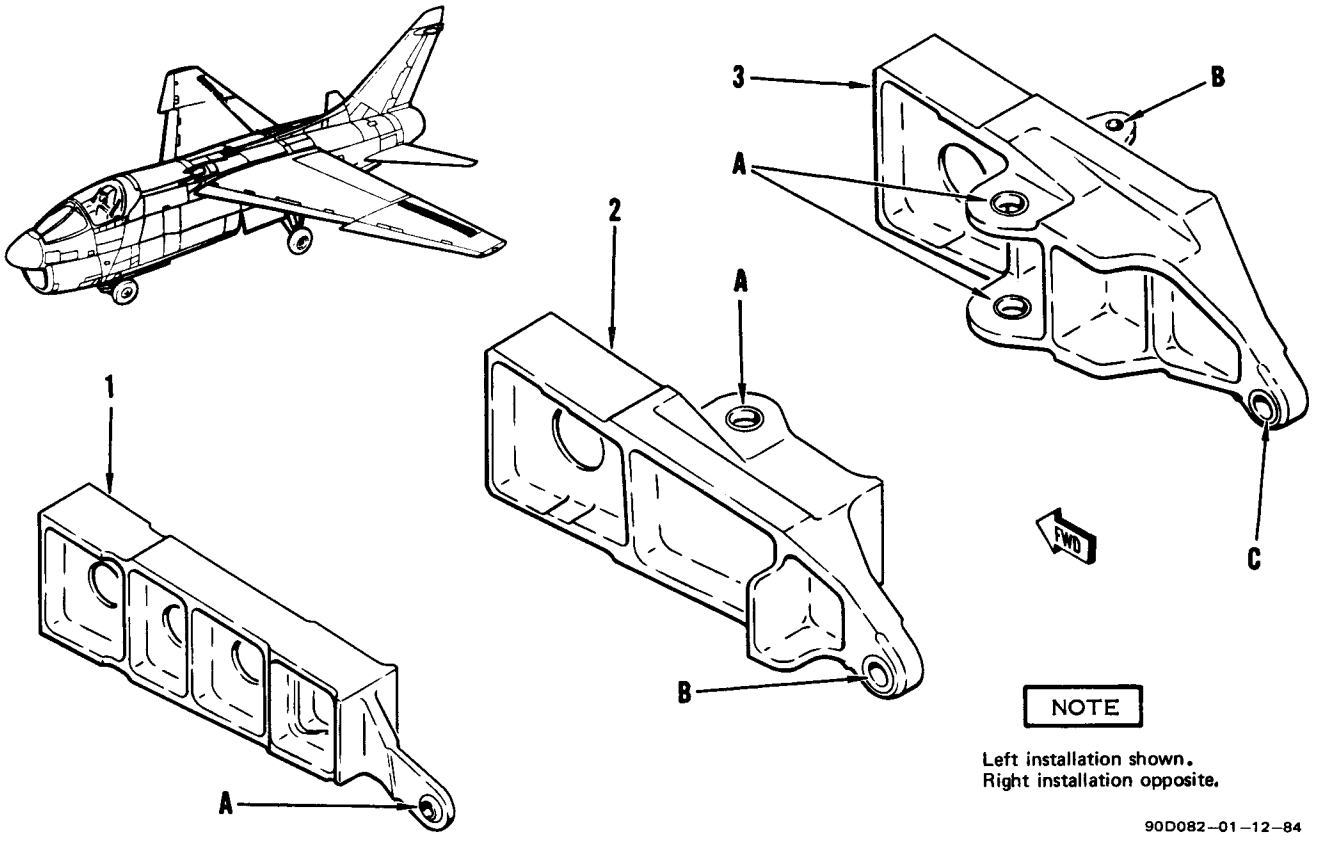
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Hinge 215-80200	A	0.3500	4130 Steel	125,000 Minimum	0.2500	0.2550	125
2	Support Assembly, Outboard 215-80225							
	Support Assembly, Inboard 215-80226	A	None					
3	Rod End 215-72418							
	Bearing MS21230-10	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. No repair action is required if any one end lug in a bank of three or four lugs, or any one lug in a bank of 5 or 6 lugs is missing or worn beyond the specified wear maximum allowance.
4. In a bank of seven lugs, no repair action is required if any one lug is missing or worn beyond the specified wear maximum allowance.
5. In a bank of seven lugs, two lugs may be missing or worn beyond the specified wear maximum allowance, with no repair action required if:
   A. In the case of affected lugs next to each other, there are at least two lugs within the specified wear maximum allowance on either side of the affected lugs.
   B. In case condition (A) is not met, one or both of the affected lugs is at the end of the lug bank.
   C. The opposite lug bank meshing with the affected bank must have no lugs next to the affected lugs that are missing or that do not conform to the specified wear maximum allowance.

90D081-02-12-84

Figure 1-77. Wing Outer Panel Leading Edge Flap Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Outboard Aileron Hinge Assembly, L/R 215-80072							
	Bearing MS21232-4	A	Bolt NAS1004-11-4	0.2500	0.2470	0.0030	0.2505	0.2465
2	Center Aileron Hinge Assembly, L/R 215-80071							
	Bushing 215-80406	A	Pin 215-88402	0.7495	0.7491	0.0004	0.7497	0.7490
	Bearing 202-19010-10	B	Bolt 215-80409	0.6247	0.6241	0.0006	0.6252	0.6236
3	Inboard Aileron Hinge Assembly, L/R 215-80070		None					
	Bushing 215-80406	A	Pin 215-88402	0.7495	0.7491	0.0004	0.7497	0.7490
	Bushing CVC480-4-34	B	Bolt NAS1304-40DH	0.2505	0.2485	0.0020	0.2525	0.2465
	Bearing 202-19010-10	C	Bolt 215-80409	0.6247	0.6241	0.0006	0.6252	0.6236

Figure 1-78. Aileron Hinge Assemblies Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Microinches)
1	Outboard Aileron Hinge Assembly, L/R 215-80072							
	Bearing MS21232-4	A	None					
2	Center Aileron Hinge Assembly, L/R 215-80071							
	Bushing 215-80406	A	1.0005	4130 Steel	125,000 Minimum	0.7493 (Note 2)	0.7495 (Note 2)	16
	Bearing 202-19010-10	B	None					
3	Inboard Aileron Hinge Assembly, L/R 215-80070							
	Bushing 215-80406	A	1.0005	4130 Steel	125,000 Minimum	0.7493 (Note 2)	0.7495 (Note 2)	16
	Bushing CVC480-4-34 (Note 3) (Note 4)	B	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bearing 202-19010-10	C	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Line hone to finished size and specified machine finish after installation.
3. Do not seal bushings after installation.
4. After installation, spotface ends flush with outside of 0.05-inch thick rigging bracket, or 0.055 (+0.010, −0.005) inch beyond surface of receiving part.
5. Wear allowance includes manufacturing allowance.

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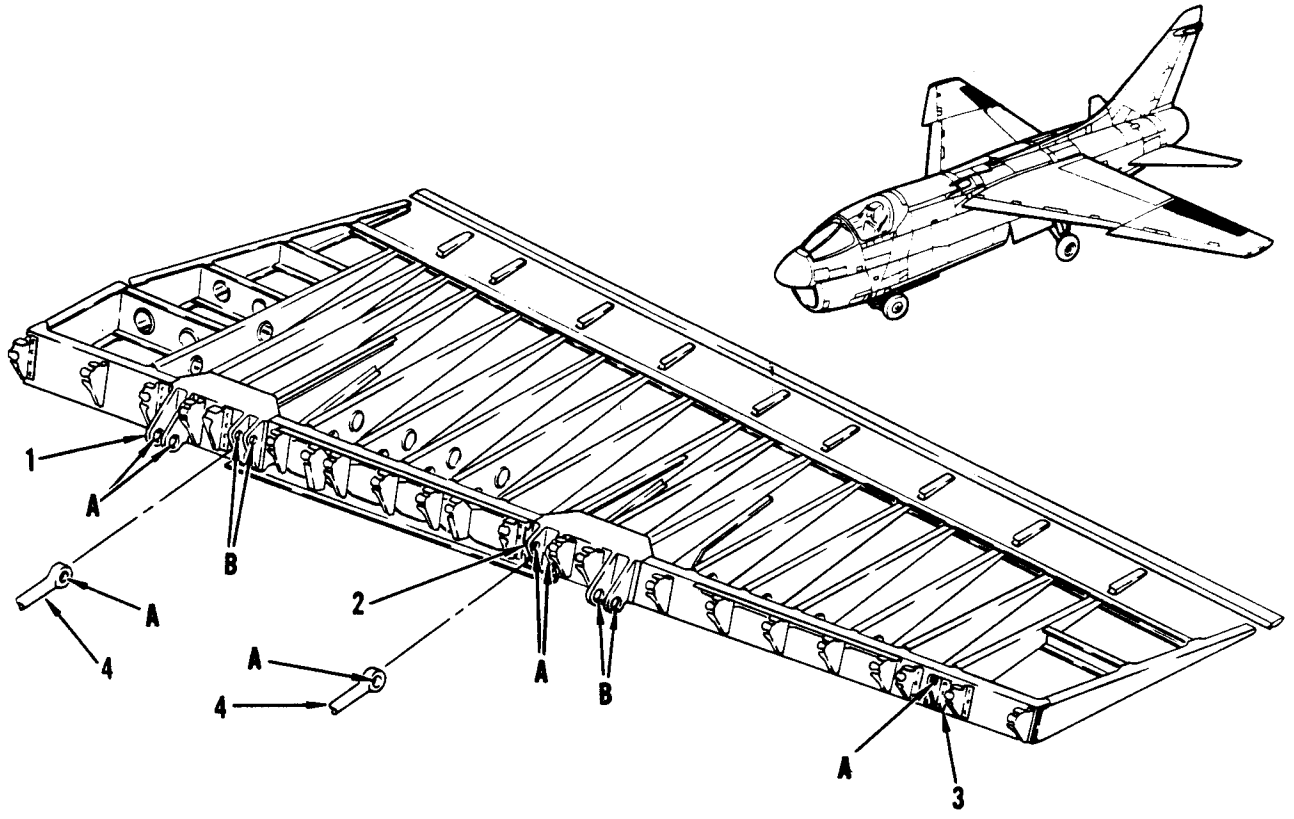
Figure 1-78. Aileron Hinge Assemblies Hardware Repair Limits (Sheet 2)



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PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Hinge Assembly 215-80320							
	Bushing NAS537-10P38	A	Bolt 215-80409	0.6245	0.6242	0.0003	0.6246	0.6241
	Bushing NAS537-8P42	B	Pin 215-88403	0.4995	0.4991	0.0004	0.4996	0.4990
2	Hinge Assembly 215-80321		None					
	Bushing NAS537-8P42	A	Pin 215-88403	0.4995	0.4991	0.0004	0.4996	0.4990
	Bushing NAS537-10P38	B	Bolt 215-80409	0.6245	0.6242	0.0003	0.6246	0.6241
3	Hinge CVC10060-30	None						
	Bearing MS21232-4	A	Bolt NAS1004-11	0.2500	0.2470	0.0030	0.2504	0.2466
4	Link 215-88022	None						
	Bearing 215-88406 (Note 3)	A	Pin 215-88403	0.4997	0.4991	0.0006	0.4998	0.4990

Figure 1-79. Aileron Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

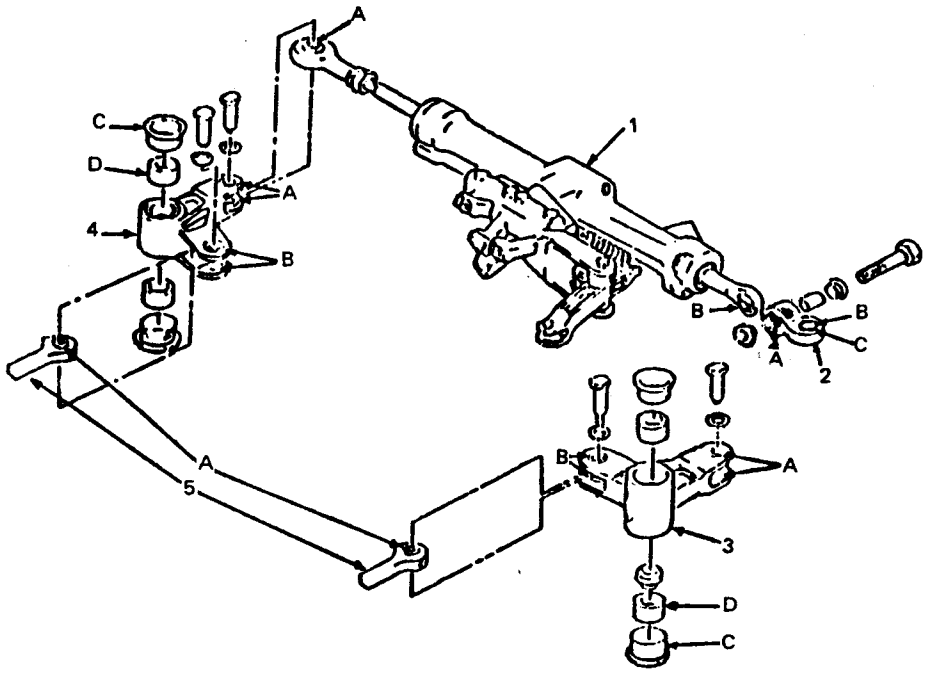
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Hinge Assembly 215-80320							
	Bushing NAS537-10P38	A	0.8130	4130 Steel	125,000 to 145,000	0.6243	0.6245	16
	Bushing NAS537-8P42	B	0.6255	4130 Steel	125,000 to 145,000	0.4993	0.4995	16
2	Hinge Assembly 215-80321							
	Bushing NAS537-8P42	A	0.6255	4130 Steel	125,000 to 145,000	0.4993	0.4995	16
	Bushing NAS537-10P38	B	0.8130	4130 Steel	125,000 to 145,000	0.6243	0.6245	16
3	Hinge CVC10060-30							
	Bearing MS21232-4	A	None					
4	Link 215-88022							
	Bearing 215-88406	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. Refer to Section XVII for bearing staking tool.

90D083-02-12-84

Figure 1-79. Aileron Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mid Max Hole ID (Inches)	Mid Min Shaft OD (Inches)	Mid Max Allowance (Inches)	Wear Maximum Allowances (Inches) Note 1
1	Aileron Actuator 215-82031						
	Bearing 215-82406	A	Pin 215-88403	0.4997	0.4991	0.0006	
	Bushing NAS537-12-52	B	Pin CV18-158518	0.7495	0.7491	0.0004	
2	Adapter Assembly 215-88024						
	Bushing NAS537-12P28	A	Pin CV18-158518	0.7495	0.7491	0.0004	
	Bearing AA35523	B	Pin 215-88403	0.4997	0.4991	0.0006	
	Bushing 215-88401	C	Bearing Unit AA35523	1.1247	1.1245	0.0002	

Figure 1-79A. Aileron Installation Hardware Repair Limits (Sheet 1 of 2)

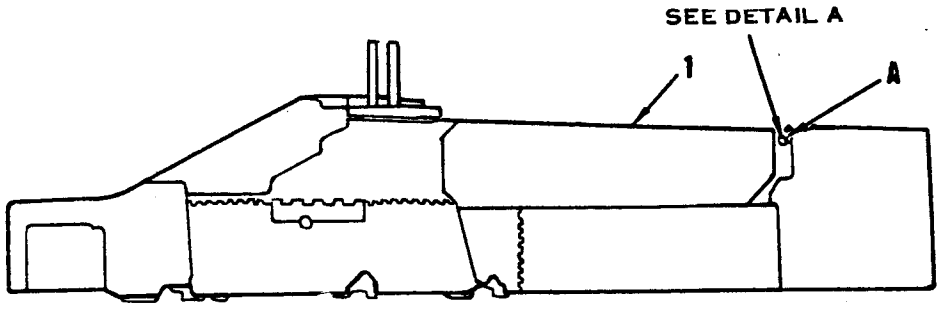
PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mid Max Hole ID (Inches)	Mid Min Shaft OD (Inches)	Mid Max Allowance (Inches)	Wear Maximum Allowances (Inches) Note 1
3	Bellcrank Assembly 215-88021						
	Bushing 215-88401	A	Pin 215-88403	0.4995	0.4991	0.0004	
	Bushing CVC485-16-34	B	Pin 215-88403	0.4995	0.4991	0.0004	
	Bushing 215-88401	C	Bearing Unit 16516	1.3747	1.3745	0.0002	
	Bearing 16516	D	Pin 215-88402	0.7497	0.7491	0.0008	
4	Bellcrank Assembly 215-88021						
	Bushing 215-88401	A	Pin 215-88403	0.4995	0.4991	0.0004	
	Bushing CVC485-16-34	B	Pin 215-88403	0.4995	0.4991	0.0004	
	Bushing 215-88401	C	Bearing Unit 16516	1.3747	1.3745	0.0002	
	Bearing 16516	D	Pin 215-88402	0.7497	0.7491	0.0006	
5	Link 215-88020						
	Bearing WBG8	A	Pin 215-88403	0.4993	0.4991	0.0002	

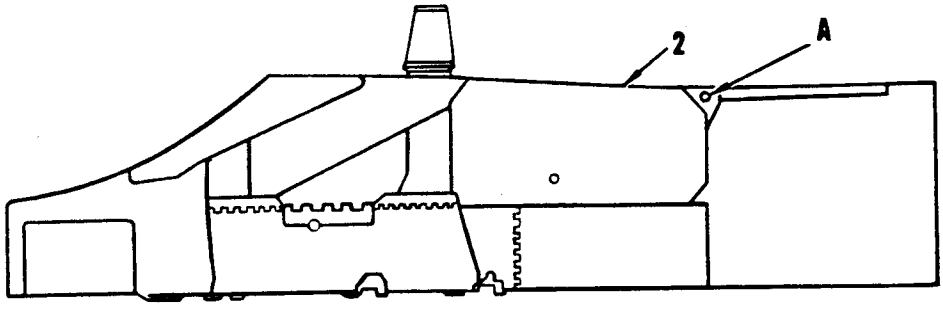
NOTE

1. These dimensions are original manufacturing tolerances and are given for reference only. Total surface slop is the factor which governs wear allowances in these items. For surfaces which exhibit excessive slop, these dimensions are to be used as a guide in determining which components have experienced the most wear and must be replaced to reduce surface slop to acceptable limits.

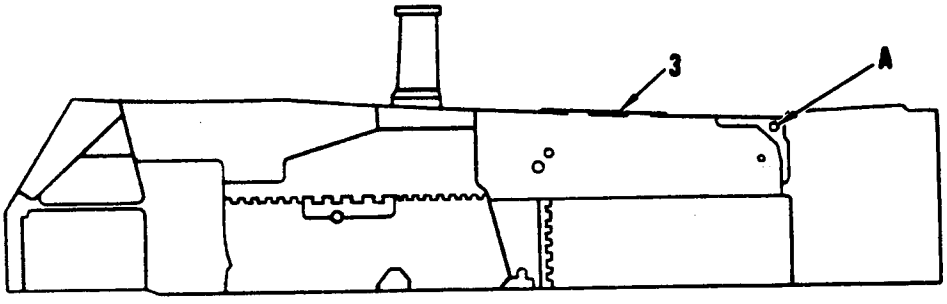
Figure 1-79A. Aileron PC Installation Hardware Repair Limits (Sheet 2 of 2)



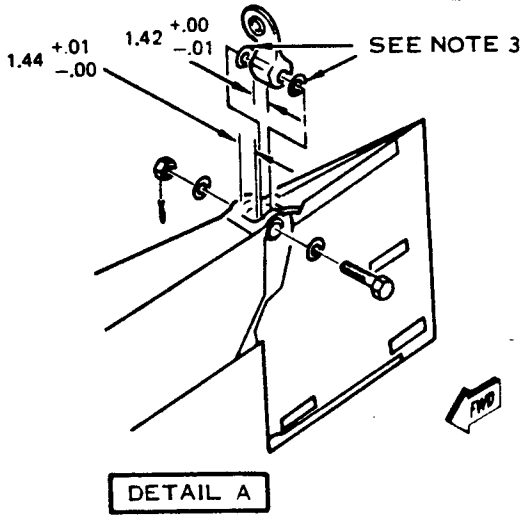
PYLON WING STA. 1 AND 8



PYLON WING STA 2 AND 7



PYLON WING STA 3 AND 6



DETAIL A

NOTE

All measurements are in inches

Figure 1-80. Pylons Installation Bushing Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)		
							Hole	Shaft	Total
1	Pylon Installation, Wing Stations 1 and 8, 216-99021								
	Bushing, NAS537-12	A	Bolt NAS464-P12-40	0.7510	0.7477	0.0033	0.7530	0.7467	
2	Pylon Installation, Wing Stations 2 and 7, 216-99021								
	Bushing, 215-70678	A	Bolt NAS464-P12-67	0.7510	0.7477	0.0033	0.7530	0.7467	
3	Pylon Installation, Wing Stations 3 and 6, 216-99021								
	Bushing, 215-70678	A	Bolt NAS464-P10-47	0.6260	0.6230	0.0030	0.6280	0.6220	

90D084-02-12-84

Figure 1-80. Pylons Installation Bushing Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

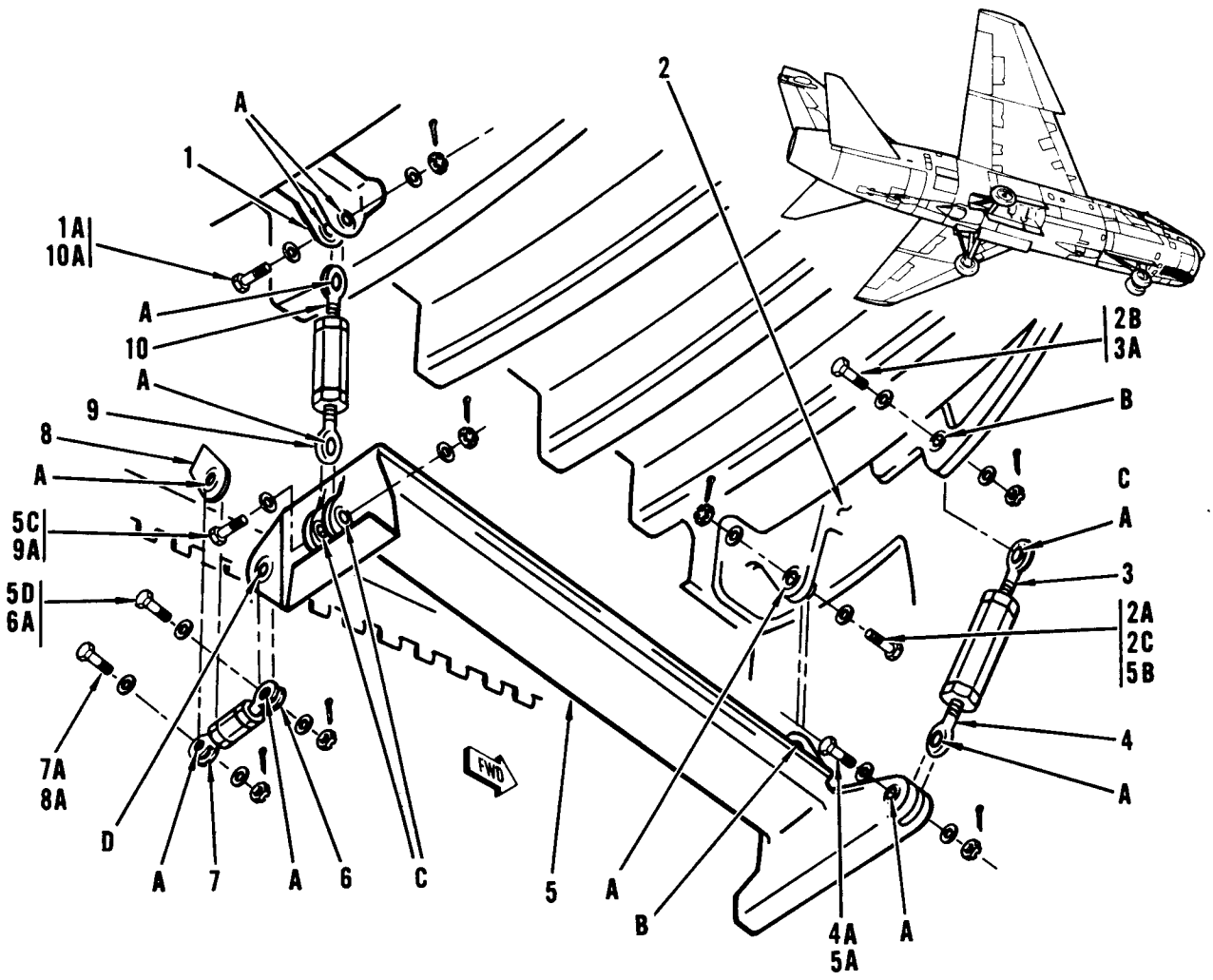
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Pylon Installation, Wing Stations 1 and 8, 216-99021							
	Bushing, NAS537-12	A	0.9393	4130 Steel	125,000 Minimum	0.7500	0.7510	125
2	Pylon Installation, Wing Stations 2 and 7, 216-99021							
	Bushing, 215-70678	A	0.8500	CRES 17-4-PH	150,000 Minimum	0.7500	0.7510	125
3	Pylon Installation, Wing Stations 3 and 6, 216-99021							
	Bushing, 215-70678-2	A	0.7250	CRES 17-4-PH	150,000 Minimum	0.6250	0.6260	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. If excessive movement is present, observe the following.
   A. Shake pylon by the trailing edge. If any play in the aft support between the clevis and the pylon lugs is noticed, then shim out all the play using washer shims, 1-3/8 inch O.D. x 13/16 inch I.D. fabricated from MIL-S-22499, composition 3, Type I Class I laminated shim stock.
   B. Shake pylon by the bottom in line with the aft support. If play is still noticed and the aft mount is properly shimmed, then remove pylon from wing and dimensional check all aft and forward support components per figures 1-73 and 1-80. Repair as required.
   C. If play is still noticed and lateral movement measured at the bottom of the pylon in line with the aft mount does not exceed 0.125 inch, the pylon is flight acceptable.

90D084-03-03-90

Figure 1-80. Pylons Installation Bushing Repair Limits (Sheet 3)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfg Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	Total
1	Support 216-20618								
	Bushing (2) NAS537B4P17	A	Bolt NAS1304-12D	0.2505	0.2485	0.0020			
2	Support 216-20617								
	Bushing NAS538B6P20	A	Bolt NAS1306-16D	0.3755	0.3735	0.0020			
	Bushing (2) NAS537B5P30	B	Bolt NAS1305-16D	0.3130	0.3110	0.0020			
	Bushing NAS538B6P23	C	Bolt NAS1306-16D	0.3755	0.3735	0.0020			

90D085-01-12-84

Figure 1-81. Detector Pod Adapter Fitting Repair Limits (Sheet 1 of 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	Total
3	Rod End M81935/1-5								
	Bearing MS14103-5	A	Bolt NAS1305-16D	0.3125	0.3110	0.0015			
4	Rod End M81935/1-5L								
	Bearing MS14103-5	A	Bolt NAS1305-16D	0.3125	0.3110	0.0015			
5	Pod Adapter Fitting 216-20721								
	Bushing (2) NAS537B5P28	A	Bolt NAS1305-16D	0.3130	0.3110	0.0020			
	Bearing MS14103-6	B	Bolt NAS1306-16D	0.3750	0.3735	0.0015			
	Bushing (2) NAS537B4P25	C	Bolt NAS1304-12D	0.2545	0.2485	0.0060			
	Bearing MS14103-4	D	Bolt NAS1304-11D	0.2500	0.2485	0.0015			
6	Rod End 216-20722	A	Bolt NAS1304-11D	0.2550	0.2485	0.0065			
7	Rod End 216-20722	A	Bolt NAS1304-11D	0.2550	0.2485	0.0065			
8	Horizontal Support Fitting 216-20635								
	Bearing MS14103-4	A	Bolt NAS1304-11D	0.2500	0.2485	0.0015			
9	Rod End 216-20722	A	Bolt NAS1304-12D	0.2550	0.2485	0.0065			
10	Rod End 216-20722	A	Bolt NAS1304-12D	0.2550	0.2485	0.0065			

90D085-02-12-84

Figure 1-81. Detector Pod Adapter Fitting Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Support 216-20618							
	Bushing (2) NAS537B4P17	A	0.3755	Aluminum Bronze	85,000 to 90,000	0.2495	0.2505	250
2	Support 216-20617							
	Bushing NAS538B6P20	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	250
	Bushing (2) NAS537B5P30	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	250
	Bushing NAS538B6P23	C	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	250
3	Rod End M81935/1-5							
	Bearing MS14103-5	A	None					
4	Rod End M81935/1-5L							
	Bearing MS14103-5	A	None					
5	Pod Adapter Fitting 216-20721							
	Bushing (2) NAS537B5P28	A	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	250
	Bearing MS14103-6	B	None					
	Bushing (2) NAS537B4P25	C	0.3755	Aluminum Bronze	85,000 to 90,000	0.2505	0.2545	250
	Bearing MS14103-4	D	None					

90D085-03-12-84

Figure 1-81. Detector Pod Adapter Fitting Repair Limits (Sheet 3)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
6	Rod End 216-20722	A	None					
7	Rod End 216-20722	A	None					
8	Horizontal Support Fitting 216-20635							
	Bearing MS14103-4	A	None					
9	Rod End 216-20722	A	None					
10	Rod End 216-20722	A	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING
   B. Ream bushings to finished size and specified machine finish after installation.

2. Wear allowance includes manufacturing allowance.

90D085-04-12-84

Figure 1-81. Detector Pod Adapter Fitting Repair Limits (Sheet 4)

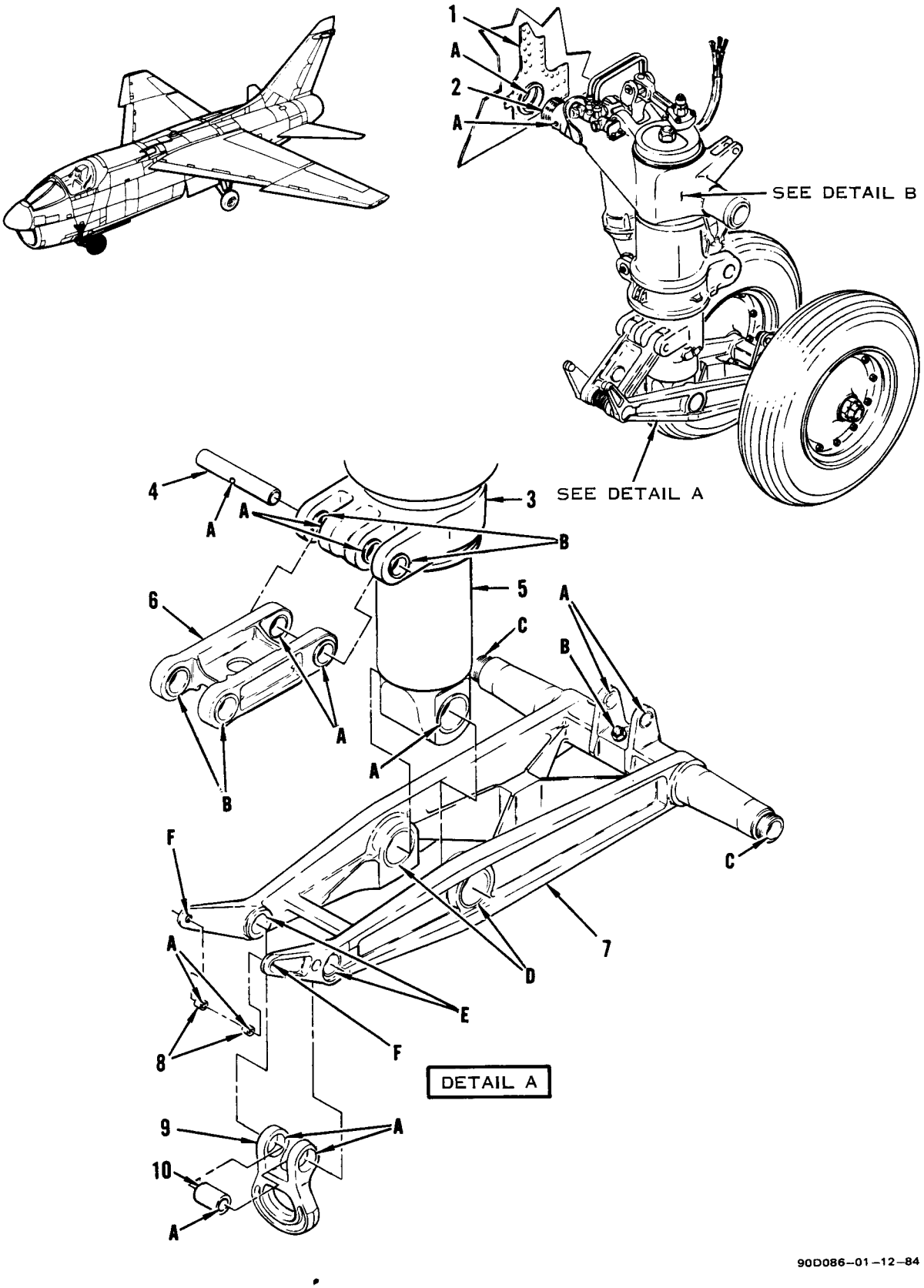


Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 1 of 8)

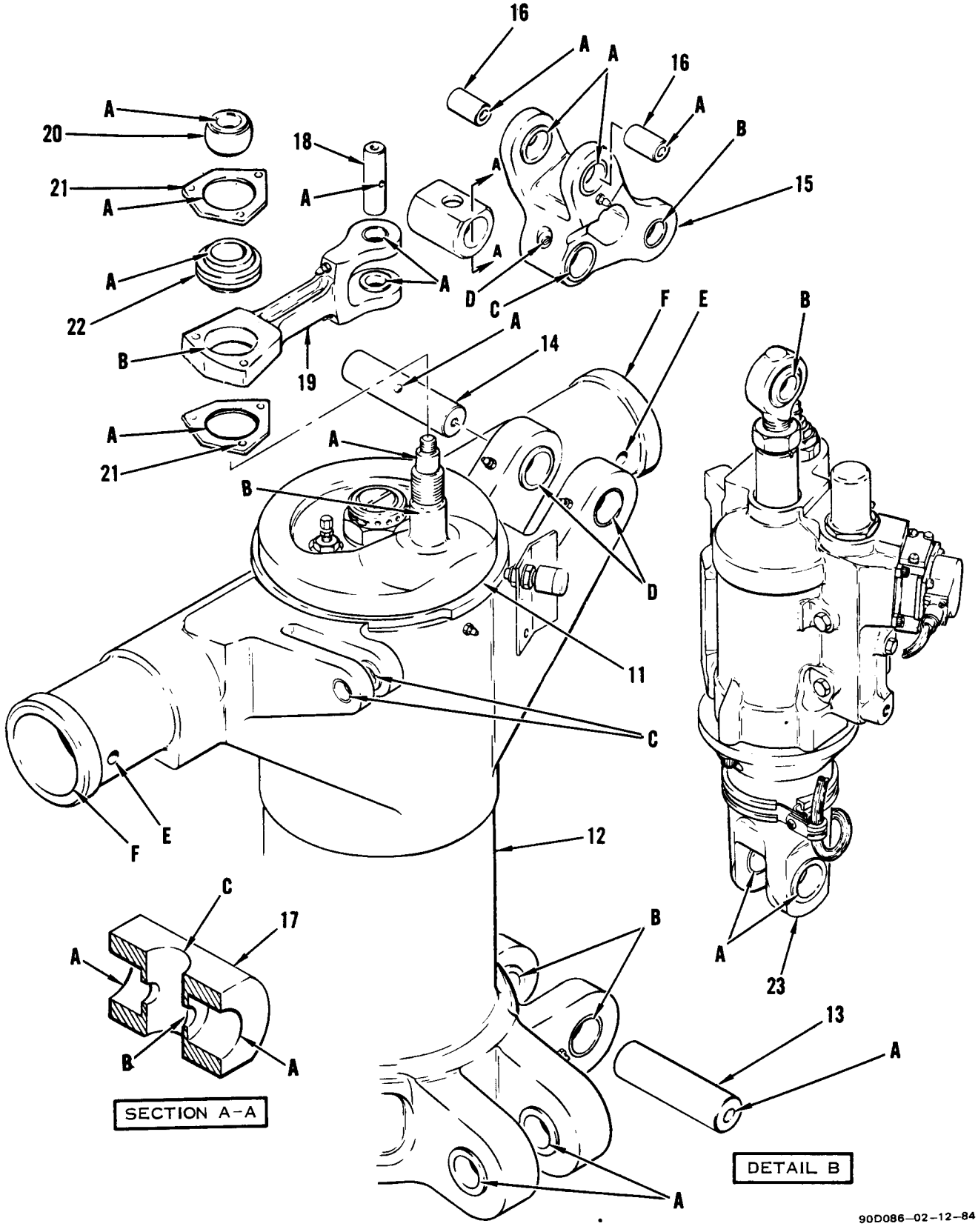


Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	NLG Trunnion Support 215-20421							
	Bushing 215-20468	A	Trunnion Pin 215-24400	2.1260	2.1220	0.0040	2.1270	2.1210
2	Trunnion Pin 215-24400	A	Bolt NAS464P6-51	0.3906	0.3742	0.0164	0.3930	0.3730
3	NLG Shock Strut Cylinder 215-24032							
	Bearing 215-24468	A	Pin 215-24441	1.0005	0.9978	0.0027	1.0020	0.9970
	Bearing 215-24471	B	Pin 215-24441	1.0005	0.9978	0.0027	1.0020	0.9970
4	Pin 215-24441	A	Bolt NAS1304-27DH	0.2500	0.2485	0.0015	0.2510	0.2480
5	NLG Shock Strut Piston 215-24033							
	Bearing 215-24470	A	Pin 215-24431	2.0005	1.9978	0.0027	2.0015	1.9975
6	Link Assembly 215-24029							
	Bearing 215-24467	A	Pin 215-24441	1.0005	0.9978	0.0027	1.0020	0.9970
	Bearing 215-24468	B	Pin 215-24430	1.3130	1.3110	0.0020	1.3135	1.3105
7	NLG Axle Beam Assembly 215-24021							
	Bushing NAS538-12P38	A	Bolt NAS464P12-49	0.7505	0.7477	0.0028	0.7520	0.7470
		B	Jack Adapter 215-24439	0.5000	0.4920	0.0080	0.5020	0.4900
		C	Bolt NAS333CA6	0.1910	0.1885	0.0025	0.1920	0.1880
	Bearing 215-24468	D	Pin 215-24431	2.0015	2.0005	0.0010	2.0020	2.0000
	Bearing 215-24468	E	Pin 215-24430	1.3130	1.3110	0.0020	1.3135	1.3105
		F	Bolt NAS1203-7	0.1910	0.1885	0.0025	0.1920	0.1880

90D086-03-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
8	Stop 215-24813	A	Bolt NAS1203-7	0.1910	0.1885	0.0025	0.1920	0.1880
9	Mooring Ring 215-24435	A	Pin 215-24430	1.3130	1.3110	0.0020	1.3135	1.3105
10	Sleeve 215-24442	A	Pin 215-24430	1.3230	1.3110	0.0120	1.3250	1.3090
11	Cap, Nose Gear Steering 215-24476		None					
12	Housing Assembly 215-24031							
	Bearing 215-24468	A	Pin 215-24579	1.2505	1.2480	0.0025	1.2515	1.2475
	Bearing 215-24467	B	Pin 215-24556	0.9380	0.9355	0.0025	0.9390	0.9350
	Bearing 215-24468	C	Bolt NAS464P8-29	0.5000	0.4991	0.0009	0.5006	0.4986
	Bearing 215-24467	D	Pin 215-24555	0.8755	0.8730	0.0025	0.8765	0.8725
		E	Bolt NAS464P6-51	0.3755	0.3742	0.0013	0.3760	0.3740
	Bearing 215-24468	F	Trunnion Pin 215-24400	2.1260	2.1220	0.0040	2.1270	2.1210
13	Pin 215-24556	A	Bolt NAS464P4-68	0.2810	0.2483	0.0327	0.2820	0.2470
14	Pin 215-24555	A	Bolt NAS464P4-24	0.2810	0.2483	0.0327	0.2820	0.2470
15	Bellcrank 215-24043							
	Bearing 215-24467	A	Pin 215-24553	0.7505	0.7480	0.0025	0.7520	0.7470
	Bearing 215-24468	B	Bolt 215-24557	0.7505	0.7477	0.0028	0.7520	0.7470
	Bearing 215-24468	C	Pin 215-24555	0.8755	0.8730	0.0025	0.8765	0.8725
		D	Bolt NAS464P4-24	0.2570	0.2483	0.0080	0.2590	0.2470
16	Pin 215-24553	A	Bolt NAS464P4-49	0.2810	0.2483	0.0327	0.2820	0.2470

90D086-04-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
17	Universal Joint Housing 215-24551	A	Pin 215-24553	0.7505	0.7480	0.0025	0.7520	0.7470
		B	Bolt NAS464P4-49	0.2570	0.2483	0.0087	0.2590	0.2470
		C	Pin 215-24552	0.6255	0.6230	0.0025	0.6270	0.6220
18	Pin 215-24552	A	Bolt NAS464P4-49	0.2810	0.2483	0.0327	0.2820	0.2470
19	Steering Link Assembly 215-24041							
	Bearing 215-24467	A	Pin 215-24552	0.6255	0.6230	0.0025	0.6270	0.6220
		B	Bearing BSSN16161G	1.5620	1.4450	0.0020	0.1920	0.1880
20	Roller 215-24478	A	Cap 215-24476	0.6250	0.6239	0.0011		
21	Retainer 215-24554	A	Bearing BSSN16161G (Note 3)	1.4450	1.4300	0.0150		
22	Bearing BSSN16161G (Note 3)	A	Cap 215-24476	1.000	0.9980	0.0020		
23	Nose Gear Steering Cylinder 215-22033							
	Bearing 215-24468	A	Pin 215-24556	0.9380	0.9355	0.0025	0.9390	0.9350
	Bearing 55264 (Note 4)	B	Bolt 215-24557	0.7500	0.7477	0.0023	0.7520	0.7470

90D086-05-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 5)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	NLG Trunnion Support 215-20421							
	Bushing 215-20468	A	2.3140	Aluminum Bronze		2.0750	2.0870	63
2	Trunnion Pin 215-24400	A	None					
3	NLG, Shock Strut Cylinder 215-24032							
	Bearing 215-24468	A	1.1885	Aluminum Bronze		0.9995	1.0005	63
	Bearing 215-24471	B	1.1885	Aluminum Bronze		0.9995	1.0005	63
4	Pin 215-24441	A	None					
5	NLG Shock Strut Piston 215-24033							
	Bearing 215-24470	A	2.005	Aluminum Bronze		1.9995	2.0005	63
6	Link Assembly 215-24029							
	Bearing 215-24467	A	1.1885	Aluminum Bronze		0.9995	1.0005	63
	Bearing 215-24468	B		Aluminum Bronze		1.3125	1.3130	63
7	NLG Axle Beam Assembly 215-24021							
	Bushing NAS538-12P38	A	0.9380	4130 Steel	125,000 to 145,000	0.7495	0.7005	63
		B,C	None					
	Bearing 215-24468	D	2.2515	4340 Steel	125,000	2.0000	2.0015	63
	Bearing 215-24468	E	1.501	4340 Steel	125,000	1.3125	1.3130	63
		F	None					
8	Stop 215-24813	A	None					

90D086-06-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 6)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
9	Mooring Ring 215-24435	A	None					
10	Sleeve 215-24442	A	None					
11	Cap, Nose Gear Steering 215-24476	A	None					
12	Housing Assembly 215-24031							
	Bearing 215-24468							
	Bearing 215-24468	A	1.4385	Aluminum Bronze		1.2495	1.2505	63
	Bearing 215-24467	B	1.1260	Aluminum Bronze		0.9370	0.9380	63
	Bearing 215-24468	C	0.6255	Aluminum Bronze		0.4995	0.5005	63
	Bearing 215-24467	D	1.0635	Aluminum Bronze		0.8745	0.8755	63
		E	None					
	Bearing 215-24468	F	2.3140	Aluminum Bronze		2.1250	2.1260	63
13	Pin 215-24556	A	None					
14	Pin 215-24555	A	None					
15	Bellcrank 215-24043		None					
	Bearing 215-24467	A	0.9380	Aluminum Bronze		0.7495	0.7505	63
	Bearing 215-24468	B	0.9380	Aluminum Bronze		0.7495	0.7505	63
	Bearing 215-24468	C	1.0635	Aluminum Bronze		0.8745	0.8755	63
		D	None					
16	Pin 215-24553	A	None					

90D086-07-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 7)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
17	Universal Joint Housing 215-24551	A, B, C	None					
18	Pin 215-24552	A	None					
19	Steering Link Assembly 215-24041							
	Bearing 215-24467	A	0.8130	Aluminum Bronze		0.6245	0.6255	63
		B	None					
20	Roller 215-24478	A	None					
21	Retainer 215-24554	A	None					
22	Bearing BSSN16161G (Note 3)	A	None					
23	Nose Gear Steering Cylinder 215-22033							
	Bearing 215-24468	A	1.1260	Aluminum Bronze		0.9370	0.9380	125
	Bearing 55264 (Note 4)	B	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Manufacturer's code 29666.
3. Manufacturer's code 81376.
4. Manufacturer's code 09455.
5. Wear allowance dimensions include manufacturing allowance.

90D086-08-12-84

Figure 1-82. Nose Landing Gear Shock Strut Hardware Repair Limits (Sheet 8)

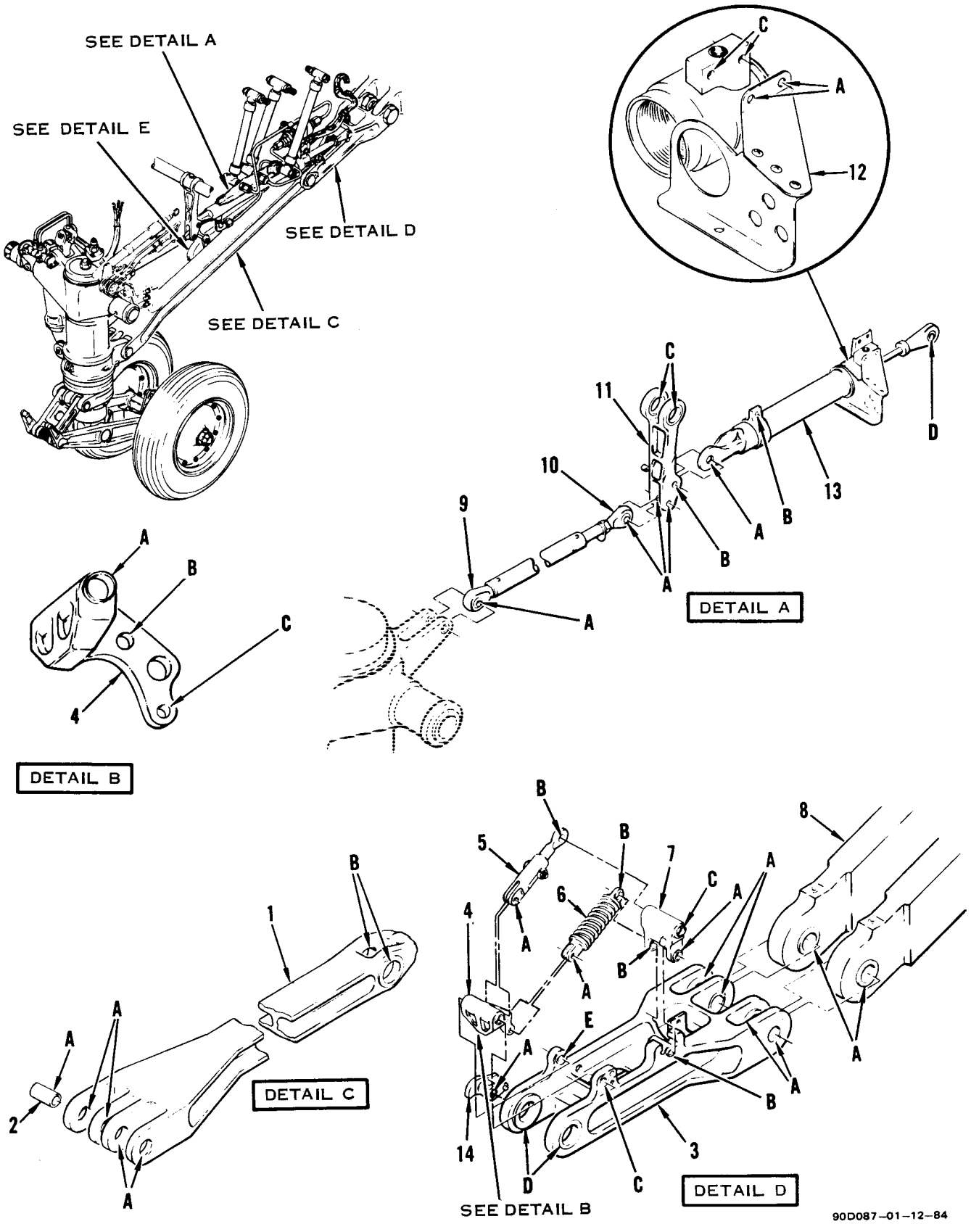
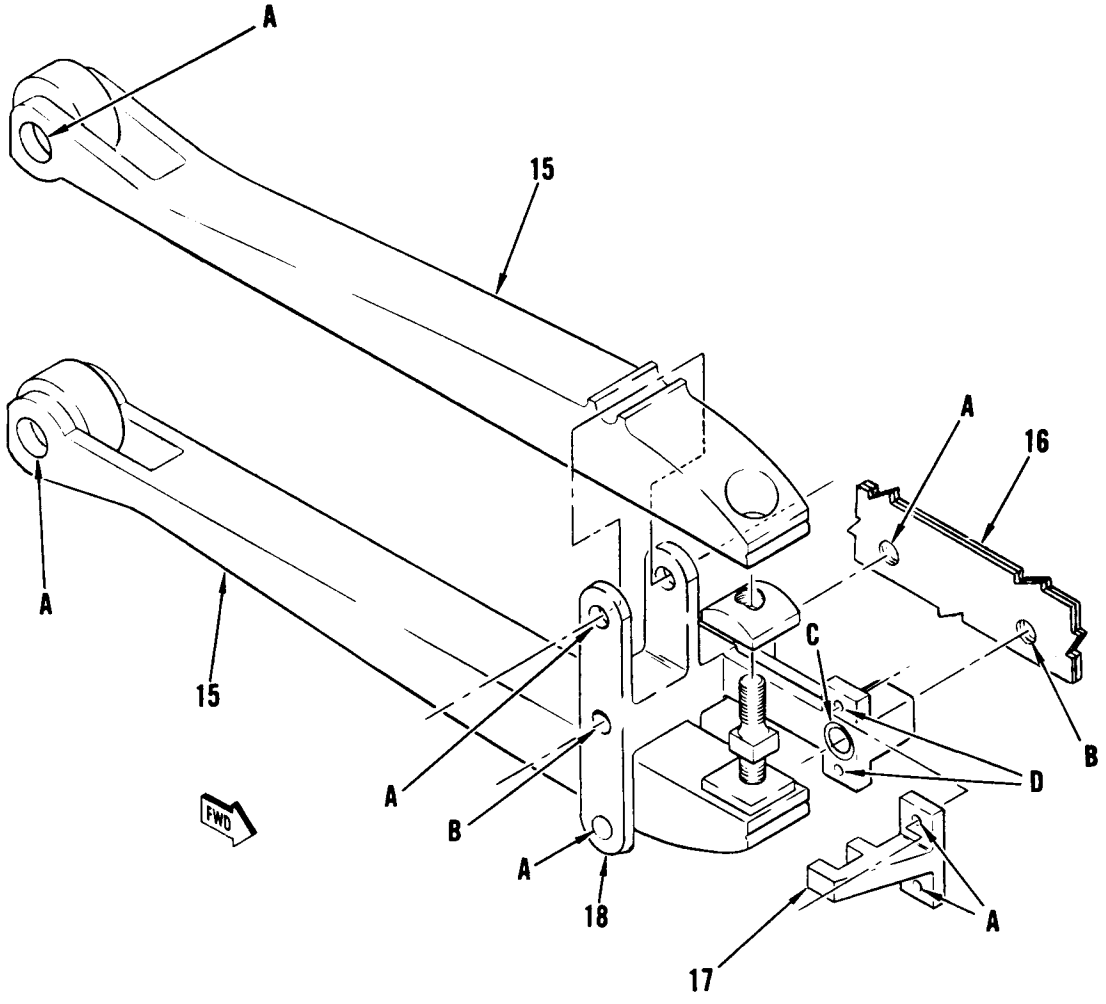


Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 1 of 10)



90D087-02-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Lower Link Assembly 215-24071							
		A	Pin 215-24579	1.2505	1.2480	0.0025	1.2515	1.2475
	Bearing 215-24577	B	Bolt 215-24307	1.5015	1.4985	0.0030	1.5020	1.4980
2	Roller 215-24581	A	Pin 215-24579	0.5050	0.4900	0.0105	0.5060	0.488
3	Drag Brace Link 215-24072							
	Bearing 215-24577	A	Pin 216-24308	1.1255	1.1225	0.0030	1.1270	1.1220
	Bearing 215-24577	B	Bolt 215-24488	0.4380	0.4357	0.0023	0.4390	0.4350
	Bearing 215-24577	C	Bolt 215-24571	0.5630	0.5605	0.0025	0.5640	0.5595
	Bearing 215-24577	D	Bolt 215-24307	1.5015	1.4985	0.0030	1.5020	1.4980
	Bearing 215-24577	E	Bolt 215-24571	0.4380	0.4355	0.0025	0.4390	0.4350
4	Drag Brace Pawl 215-24074							
	Bearing 215-24577	A	Bolt 215-24571	0.5005	0.4985	0.0020	0.5010	0.4980
		B	Bolt NAS464P6-11	0.3790	0.3733	0.0057	0.3795	0.3730
		C	Bolt NAS464P4-12	0.2550	0.2483	0.0067	0.2560	0.2480
5	Drag Brace Assembly 215-24070							
	Guide 215-24546	A	Bolt NAS464P6-11	0.3755	0.3733	0.0022	0.3760	0.3730
	Rod 215-24545	B	Bolt NAS464P8-57	0.5040	0.4982	0.0058	0.5050	0.4980

90D087-03-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
6	Spring Assembly 215-24075							
	Guide 215-24575	A	Bolt NAS464P4-12	0.2550	0.2483	0.0067	0.2560	0.2480
	Rod 215-24574	B	Bolt 215-24488	0.3790	0.3730	0.0060	0.3800	0.3725
7	Bellcrank Assembly 215-24077							
	Bushing NAS537B7P25 (Note 11) CVC475BE7-25 (Note 12)	A	Bolt 215-24488	0.4380	0.4357	0.0023	0.4390	0.4350
	Bushing NAS538B7P25 (Note 11) CVC477BE7-25 (Note 12)	B	Bolt 215-24488	0.4380	0.4357	0.0023	0.4390	0.4350
	Bushing NAS538B8P38	C	Bolt NAS464P8-57	0.5005	0.4982	0.0023	0.5015	0.4975
8	Catapult Longeron Assembly, L/R 215-30081							
	Bushing CVC487-36-46	A	Pin 216-24308	1.1300	1.1260	0.0040	1.1310	1.1240
9	Rod End Assembly 215-24304 (Note 2)							
	Bearing MS21230-8	A	Bolt NAS464P8-29	0.5000	0.4982	0.0018	0.5015	0.4975
10	Rod End Assembly 215-72418 (Note 2)							
	Bearing MS21230-8	A	Bolt NAS464P8-20	0.5000	0.4982	0.0023	0.5015	0.4975

90D087-04-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
11	Bellcrank 215-24303							
	Bearing 215-24577	A	Bolt NAS464P8-20	0.5005	0.4982	0.0023	0.5015	0.4975
	Bearing 215-24577	B	Bolt NAS464P8-20	0.5005	0.4982	0.0023	0.5015	0.4975
	Bearing 215-24577	C	NLG Door Straight Shaft 215-24751	1.8760	1.8720	0.0040	1.8775	1.8705
12	Bracket Assembly 216-22385	A	Bolt NAS1303-18	0.2180	0.1885	0.0295	0.2190	0.1880
13	NLG Actuating Cylinder Assembly 215-22050							
	Bearing MS21230-8	A	Bolt NAS464P8-20	0.5000	0.4982	0.0018	0.5015	0.4975
	Housing Assembly 215-22134	B	Bolt NAS1304-9	0.2830	0.2485	0.0345	0.2780	0.2480
	Cap 215-22401	C	NAS1303-18	0.2180	0.1885	0.0295	0.2190	0.1880
	Bearing MS21230-8	D	Bolt NAS464P8-57	0.5000	0.4982	0.0018	0.5015	0.4975
14	Cam 215-24306							
		A	Bolt 215-24307	0.7510	0.7470	0.0040	0.7510	0.7470
15	Spring 215-24833							
	Bearing MS24465-8	A	Bolt AIC83-8A19 (Note 5) or BA45132-8A19 (Note 6) or 106334-8-19D (Note 7) or JT1631-8-19T (Note 8)	0.5000	0.4985	0.0015	0.5015	0.4980

90D087-05-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
16	Link Assembly, Lower 215-24071							
		A	Bolt NAS1308-60	0.5050	0.4985	0.0065	0.5070	0.4980
		B	Bolt AIC83-8-23 (Note 5) or BA45132-8-23 (Note 6) or 106334-8-23 (Note 7) or JT1631-8-23 (Note 8)	0.5390	0.4985	0.0405	0.5400	0.4980
17	Bracket 215-24836							
		A	Bolt NAS464P3A7	0.2010	0.1885	0.0125	0.2030	0.1870
18	Shackle 215-24832							
		A	Bolt AIC220-8A29 (Note 5) or BM55132-8A29 (Note 6) or EWSB22-8-29 (Note 7) or VS2521-8F29S (Note 8)	0.5050	0.4982	0.0068	0.5060	0.4975
		B	Bolt NAS1308-60	0.5050	0.4985	0.0065	0.5070	0.4980
		C	Bolt AIC83-8-23 (Note 5) or BA45132-8-23 (Note 6) or 106334-8-23 (Note 7) or VT1631-8-23 (Note 8)	0.5050	0.4985	0.0065	0.5070	0.4980
		D	Bolt	0.2010	0.1885	0.0125	0.2030	0.1870

90D087-06-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 6)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Lower Link Assembly 215-24071	A (Note 3)	None					
	Bearing 215-24577	B	1.6885	4340 Steel	150,000	1.5005	1.5015	63
2	Roller 215-24581	A	None					
3	Drag Brace Link 215-24072							
	Bearing 215-24577	A	1.3135	4340 Steel	150,000	1.1245	1.1255	125
	Bearing 215-24577	B	0.5005	Aluminum Bronze		0.4370	0.4380	63
	Bearing 215-24577	C	0.6880	Aluminum Bronze		0.5620	0.5630	125
	Bearing 215-24577	D	1.6885	4340 Steel	150,000	1.5005	1.5015	63
	Bearing 215-24577	E	0.5630	Aluminum Bronze		0.4370	0.4380	125
4	Drag Brace Pawl 215-24074							
	Bearing 215-24577	A	0.6255	Aluminum Bronze		0.5000	0.5005	63
		B, C	None					
5	Drag Brace Assembly 215-24070							
	Guide 215-24546	A	None					
	Rod 215-24545	B	None					
6	Spring Assembly 215-24075							
	Guide 215-24575	A	None					
	Rod 215-24574	B	None					

90D087-07-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 7)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
7	Bellcrank Assembly 215-24077-2							
	Bushing NAS537B7P25 (Note 9)	A	0.6255	Aluminum Bronze	85,000 to 90,000	0.4370	0.4380	125
	CVC475BE7-25 (Note 10)	A	0.5630	Beryllium Copper	165,000 to 190,000	0.4370	0.4380	125
	Bushing NAS538B7P25 (Note 9)	B	0.6255	Aluminum Bronze	85,000 to 90,000	0.4370	0.4380	125
	CVC477BE7-25 (Note 10)	A	0.5630	Beryllium Copper	165,000 to 190,000	0.4370	0.4380	125
	Bushing NAS538B8P38	C	0.6255	Aluminum Bronze	85,000 to 90,000	0.4995	0.5005	63
8	Catapult Longeron Assembly, L/R 215-30081							
	Bushing CVC487-36-46	A	1.3135	4130 Steel	180,000	1.1250	1.1300	63
9	Rod End Assembly 215-24304 (Note 2)							
	Bearing MS21230-8	A	None					
10	Rod End Assembly 215-72418 (Note 2)							
	Bearing MS21230-8	A	None					
11	Bellcrank 215-24303							
	Bearing 215-24577	A	0.6255	Aluminum Bronze		0.4995	0.5005	125
	Bearing 215-24577	B	0.6255	Aluminum Bronze		0.4995	0.5005	125
	Bearing 215-24577	C	2.0010	Aluminum Bronze		1.8750	1.8760	125
12	Bracket Assembly 216-22385	A	None					

90D087-08-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 8)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
13	NLG Actuating Cylinder Assembly 215-22050							
	Bearing MS21230-8	A, D	None					
	Housing Assembly 215-22134	B	None					
	Cap 215-22401	C	None					
14	Cam 215-24306							
		A	None					
15	Spring 215-24833							
		A	None					
16	Link Assembly, Lower 215-24071							
		A	None					
		B	None					
17	Bracket 215-24836							
		A	None					
18	Shackle 215-24832							
		A	None					
		B	None					
		C	None					
		D	None					

90D087-09-12-84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 9)

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Part of matched assembly 215-24302.
3. No reaming of hole is permissible.
4. Wear allowance dimensions include manufacturing allowance.
5. Manufacturer's code 06725.
6. Manufacturer's code 85495.
7. Manufacturer's code 56878.
8. Manufacturer's code 92215.
9. Airplanes through AF73-1015.
10. Airplanes AF74-1737 and subsequent.
11. Replace bushings in pairs. After installation, line ream bushings to I.D. given in chart. The distance between outside faces of bushing shoulders must be 1.538 + 0.005, —0.000 inches, machine faces of bushings equally to obtain this dimension after installation.

90D087—10—12—84

Figure 1-83. Nose Gear Drag Brace Hardware Repair Limits (Sheet 10)

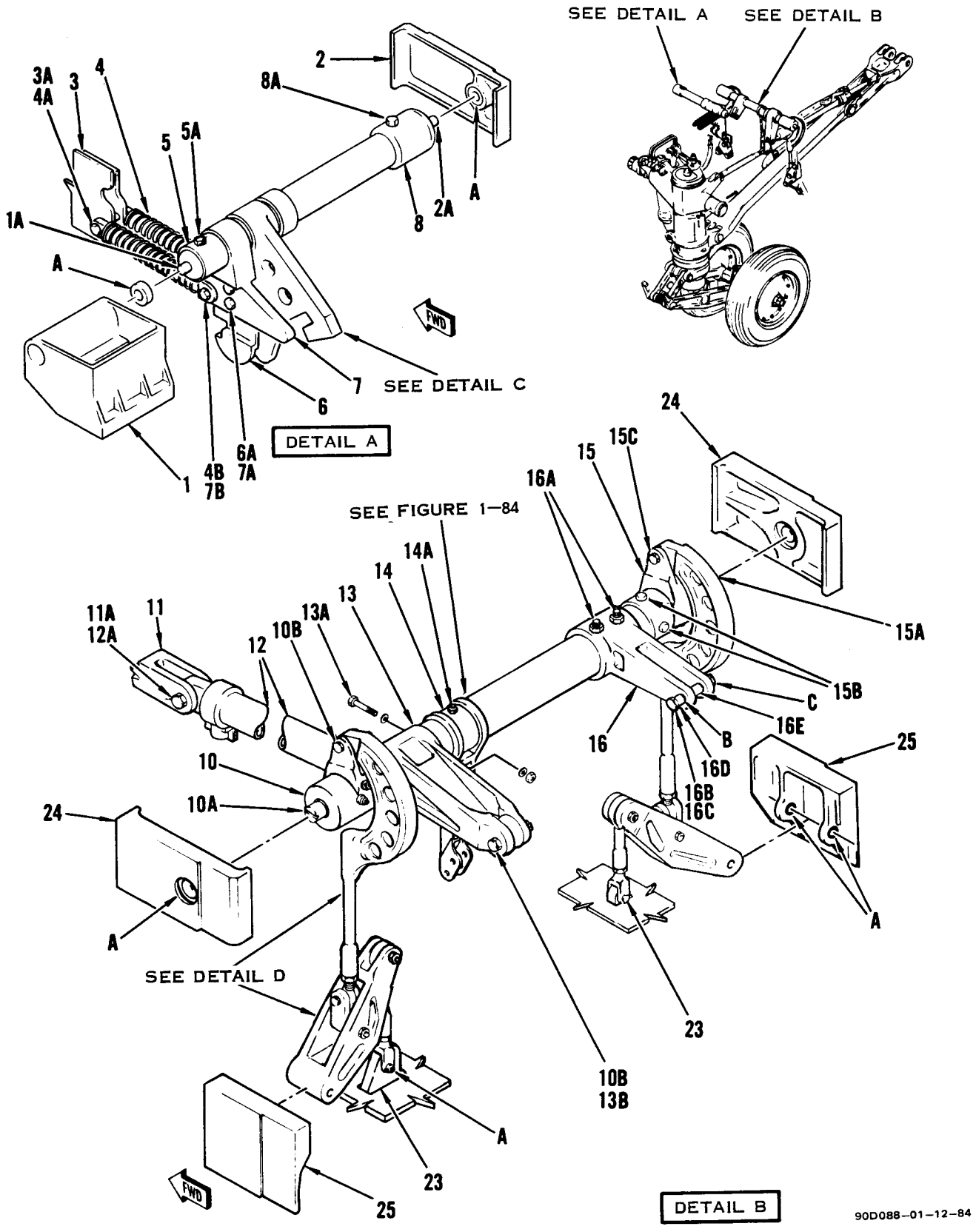
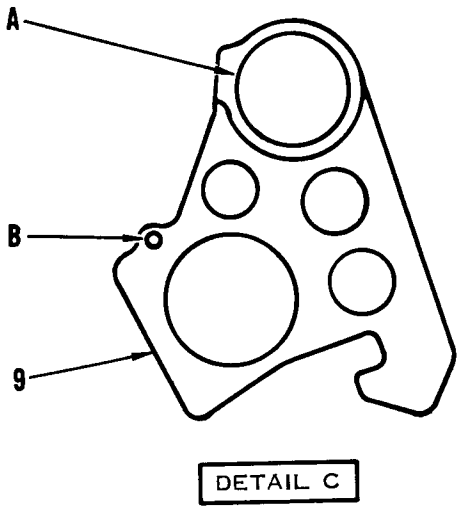


Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 1 of 10)



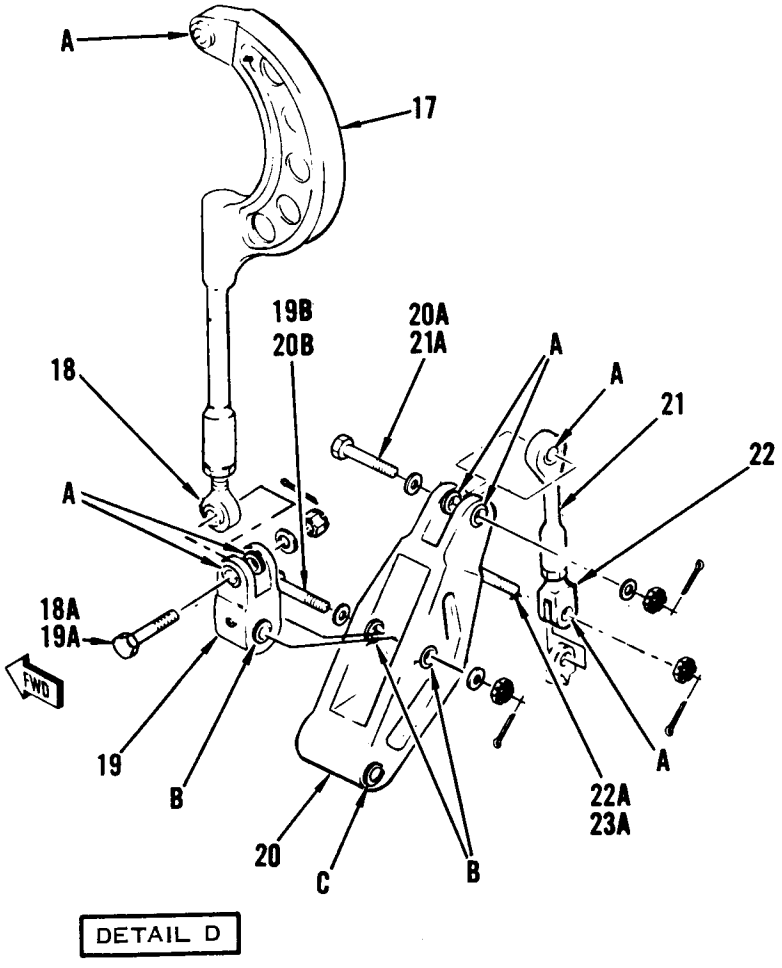


Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)		
							Hole	Shaft	Total
1	Support Assembly 215-20349								
	Bearing 215-24301	A	Support 215-24755	0.3750	0.3728	0.0022	0.3760	0.3718	
2	Support Assembly 215-20332								
	Bearing 215-24301	A	Support 215-24756	0.3750	0.3728	0.0022	0.3760	0.3718	
3	Bracket 215-20153								
		A	Bolt NAS464P3-19	0.1960	0.1885	0.0075	0.1980	0.1875	
4	Spring Assembly 215-24091 (Note 3) Strut Tension 216-24311 (Note 4)								
		A	Bolt NAS464P3-19	0.1960	0.1885	0.0075	0.1980	0.1875	
		B	Bolt NAS464P3-8	0.1960	0.1885	0.0075	0.1980	0.1875	
5	Support 215-24755 (Note 5)								
		A	Bolt NAS464P4-24	0.2505	0.2483	0.0022	0.2515	0.2473	
6	Hook 215-24758								
		A	Bolt NAS464P4A7	0.2870	0.2483	0.0387	0.2890	0.2470	
7	Arm 215-24757 (Note 5)								
		A	Bolt NAS464P4A7	0.2870	0.2483	0.0387	0.2890	0.2470	
		B	Bolt NAS464P3-8	0.1960	0.1885	0.0075	0.1980	0.1875	

90D088-03-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)		
							Hole	Shaft	Total
8	Support 215-24756 (Note 5)								
		A	Bolt NAS464P4-27	0.1905	0.1885	0.0020	0.1915	0.1875	
9	Arm Assembly 215-24757 (Note 5)								
	Bearing 215-24762	A	Shaft 215-24753 (Note 5)	1.5005	1.4978	0.0027	1.5015	1.4968	
		B	Bolt NAS464P3-8	0.1960	0.1885	0.0075	0.1980	0.1875	
10	Arm Assembly 215-24088 (Note 6)								
	Bushing NAS537-10P75	A	Pin 215-24752 (Note 6)	0.6257	0.6230	0.0027	0.6267	0.6220	
	Bushing NAS537B6P25	B	Bolt NAS464P6-15	0.3755	0.3733	0.0022	0.3765	0.3723	
11	Support Assembly 215-20321								
	Bushing NAS537B5P23	A	Bolt NAS464P5-15	0.3130	0.3108	0.0022	0.3140	0.3098	
12	Cylinder Assembly CV15-501135								
	Bearing MS21230-5	A	Bolt NAS464P5-15	0.3125	0.3108	0.0017	0.3135	0.3098	
	Bearing MS21230-5	B	Bolt NAS464P5-25	0.3125	0.3108	0.0017	0.3135	0.3098	
13	Arm Assembly 215-24093								
		A	Bolt NAS464P6-36	0.3755	0.3733	0.0022	0.3765	0.3723	
	Bushing NAS537B5P55	B	Bolt NAS464P5-25	0.3130	0.3108	0.0022	0.3135	0.3098	

90D088-04-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)		
							Hole	Shaft	Total
14	Spacer Assembly 215-24487 (Note 6)								
		A	Bolt NAS1204-35D	0.2520	0.2485	0.0035	0.2540	0.2465	
15	Arm Assembly 215-24088 (Note 6)								
	Bushing NAS537-10P75	A	Pin 215-24752 (Note 6	0.6257	0.6230	0.0027	0.6267	0.6220	
		B	Bolt NAS464P4-35	0.2505	0.2483	0.0022	0.2515	0.2473	
	Bushing NAS537B6P25	C	Bolt NAS464P6-15	0.3755	0.3733	0.0022	0.3765	0.3723	
16	Arm 215-24763 (Note 6)								
		A	Bolt NAS464P4-35	0.2505	0.2483	0.0022	0.2515	0.2473	
		B	Bolt 215-24764	0.3130	0.3103	0.0027	0.3150	0.3090	
		C	Bolt 215-24764	0.2505	0.2480	0.0025	0.2515	0.2470	
	Sleeve 215-24759	D	Bolt 215-24764	0.3170	0.3103	0.0067	0.3190	0.3090	
	Sleeve 215-24759	E	Bolt 215-24764	0.3170	0.3103	0.0067	0.3190	0.3090	
17	Link Assembly 215-24084								
	Bearing MS21232-6	A	Bolt NAS464P6-15	0.3750	0.3733	0.0017	0.3765	0.3723	
18	Bearing Unit Assembly 215-24087								
	Bushing NAS538-6P13	A	Bolt NAS464P6-11	0.3755	0.3733	0.0022	0.3765	0.3723	

90D088-05-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)		
							Hole	Shaft	Total
19	Link Assembly 215-24092								
	Bushing NAS537B6P20	A	Bolt NAS464P6-11	0.3755	0.3733	0.0022	0.3765	0.3723	
	Bushing NAS538B6P33	B	Bolt NAS464P6-30	0.3755	0.3733	0.0022	0.3765	0.3723	
20	Bellcrank Assembly 215-24083								
	Bushing NAS537B5P33	A	Bolt NAS464P5-17	0.3130	0.3108	0.0022	0.3140	0.3098	
	Bushing NAS537B6P55	B	Bolt NAS464P6-30	0.3755	0.3733	0.0022	0.3765	0.3723	
	Bushing NAS538B5P62	C	Bolt NAS464P5-41	0.3130	0.3108	0.0022	0.3140	0.3098	
21	Link Assembly 215-24085								
	Bearing MS21232-5	A	Bolt NAS464P5-17	0.3125	0.3108	0.0017	0.3135	0.3098	
22	Clevis, Rod End 215-24760								
		A	Bolt NAS464P5-10	0.3130	0.3108	0.0022	0.3140	0.3098	
23	Adapter Assembly 215-20328								
	Bearing MS21232-5	A	Bolt NAS464P5-10	0.3125	0.3108	0.0017	0.3135	0.3098	
24	Support Assembly 215-20320								
	Bearing 215-24301	A	Pin 215-24752 (Note 6)	0.6250	0.6230	0.0020	0.6260	0.6220	
25	Bracket Assembly 215-20347								
	Bushing NAS537B5P24	A	Bolt NAS464P5-41	0.3130	0.3108	0.0022	0.3140	0.3098	

90D088-06-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 6)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Support Assembly 215-20349							
	Bearing 215-24301	A	None					
2	Support Assembly 215-20332							
	Bearing 215-24301	A	None					
3	Bracket 215-20153							
		A	None					
4	Spring Assembly 215-24091 (Note 3) Strut ,Tension 216-24311 (Note 4)							
		A	None					
		B	None					
5	Support 215-24755 (Note 5)							
		A	None					
6	Hook 215-24758							
		A	None					
7	Arm 215-24757 (Note 5)							
		A	None					
		B	None					
8	Support 215-24756							
		A	None					

90D088-07-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 7)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
9	Arm Assembly 215-24757 (Note 5)							
	Bearing 215-24762	A	1.6260	Aluminum Bronze	85,000 to 90,000	1.4995	1.5005	63
		B	None					
10	Arm Assembly 215-24088 (Note 6)							
	Bushing NAS537-10P75	A	0.8130	4130 Steel	125,000 to 145,000	0.6250	0.6257	63
	Bushing NAS537B6P25	B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
11	Support Assembly 215-20321							
	Bushing NAS537B5P23	A	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	125
12	Cylinder Assembly CV15-501135							
		A	None					
		B	None					
13	Arm Assembly 215-24093							
		A	None					
	Bushing NAS537B5P55	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	63
14	Spacer Assembly 215-24487-1							
		A	None					
15	Arm Assembly 215-24088 (Note 6)							
	Bushing NAS537-10P75	A	0.8130	4130 Steel	125,000 to 145,000	0.6250	0.6257	63
		B	None					
	Bushing NAS537B6P25	C	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63

90D088-08-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 8)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
16	Arm 215-24763 (Note 6)							
		A	None					
		B	None					
		C	None					
	Sleeve 215-24759	D	None					
	Sleeve 215-24759	E	None					
17	Link Assembly 215-24084							
	Bearing MS21232-6	A	None					
18	Bearing Unit Assembly 215-24087							
	Bushing NAS537-6P13	A	0.5005	4130 Steel	125,000 to 145,000	0.3745	0.3755	63
19	Link Assembly 215-24092							
	Bushing NAS537B6P20	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
	Bushing NAS538B6P33	B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
20	Bellcrank Assembly 215-24083							
	Bushing NAS537B5P33	A	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	63
	Bushing NAS537B6P55	B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
	Bushing NAS538B5P62	C	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3110	63
21	Link Assembly 215-24085							
	Bearing MS21232-5	A	None					

90D088-09-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 9)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
22	Clevis, Rod End 215-24760	A	None					
23	Adapter Assembly 215-20328							
	Bearing MS21232-5	A	None					
24	Support Assembly 215-20320							
	Bearing 215-24301	A	None					
25	Bracket Assembly 215-20347							
	Bushing NAS537B5P24	A	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushing to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. Airplanes AF69-6197 through AF70-968.
4. Airplanes AF70-969 and subsequent.
5. Installed and maintained as a matched set.
6. Installed and maintained as a matched set 215-24081-3.
7. When replacing bushings they should protrude approximately 0.060 inches to the inside of the bracket, and the distance between the bushings shall be 2.005 inches + 0.005 - 0.000.
8. After installation of bushings insure lube slot between the two bushings is free of primer. After installation of bushings, mill shoulders equally until distance across shoulders is 0.375 inches + 0.000 - 0.005. After milling, brush cadmium plate shoulders of bushing. (One coat of MIL-P-23377 epoxy primer is an acceptable substitute.)

90D088-10-12-84

Figure 1-84. Nose Landing Gear Door Linkage Repair Limits (Sheet 10)

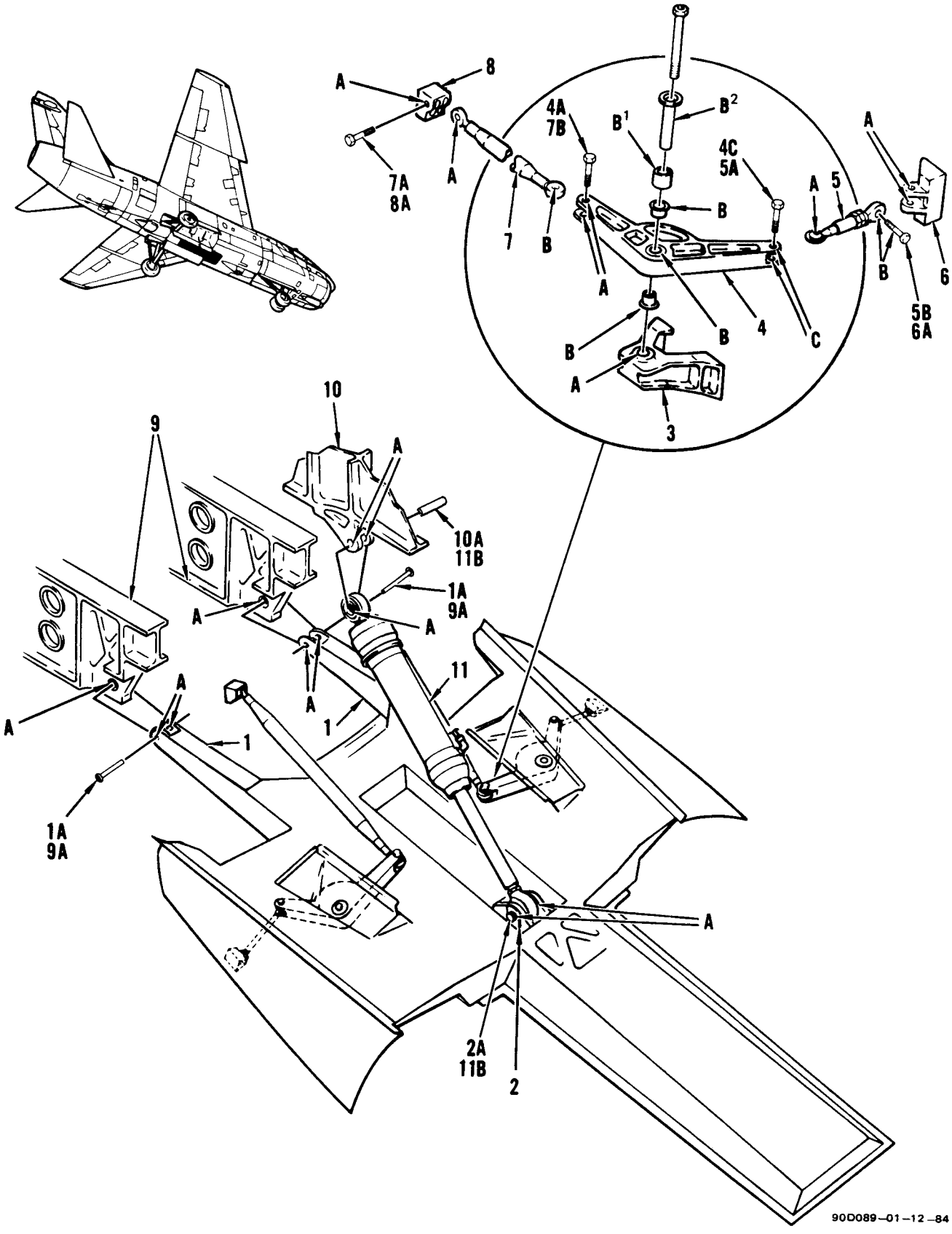


Figure 1-85. Speed Brake Installation Hardware Repair Limits (Sheet 1 of 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 3)		
							Hole	Shaft	Total
1	Beam Assembly, L/R 215-30354								
	Bushing 215-30483	A	Pin 215-30534	1.2510	1.2485	0.0025	1.2520	1.2475	
2	Actuating Cylinder Support Assembly 215-30551								
	Bushing NAS538-16-25	A	Pin 215-30564	1.0005	0.9985	0.0020	1.0015	0.9975	
3	Pivot Support Assembly 215-30305	A	Pin 215-30523	1.0005	0.9975	0.0030	1.0010	0.9975	
4	Arm Assembly 215-30303								
	Bushing NAS537-6P26	A, C	Bolt NAS464-6-23	0.3755	0.3737	0.0018	0.3760	0.3732	
	Bushing 215-30483	B	Bushing 215-30522	1.2505	1.2475	0.0030	1.2510	1.2470	
	Bushing 215-30522	B[1]	Pin 215-30523	1.000	0.9975	0.0025	1.005	0.9975	
	Pin 215-30523	B[2]	Bolt NAS1304-56D	0.2754	0.2485	0.0269	0.2759	0.2485	
5	Link Assembly 215-30422								
	Rod End 215-30365	A	Bolt NAS464-6-23	0.3750	0.3737	0.0013	0.3755	0.3732	
	Rod End 215-30365	B	Bolt 215-30576	0.3750	0.3733	0.0017	0.3755	0.3728	
6	Trunnion Assembly 215-30424								
	Bushing NAS537-6P40	A	Bolt 215-30576	0.3755	0.3733	0.0022	0.3765	0.3728	
7	Link Assembly 215-30427								
	Rod End KNE6	A	Bolt NAS464-6-14	0.3750	0.3737	0.0013	0.3755	0.3732	
	Rod End 215-30365	B	Bolt NAS464-6-23	0.3750	0.3737	0.0013	0.3755	0.3732	

90D089-02-05-87

Figure 1-85. Speed Brake Installation Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 3)		
							Hole	Shaft	Total
8	Chine Linkage Support, L/R 215-30484								
	Bushing NAS538B6P17	A	Bolt NAS464-6-14	0.3755	0.3737	0.0018	0.3765	0.3727	
9	Support Assembly, L/R 218-30350								
	Bushing 215-30483	A	Pin 215-30534	1.2510	1.2483	0.0027	1.2530	1.2473	
10	Keel 215-30507								
	Bushing 215-30581	A	Pin 215-32423	1.0005	0.9985	0.0020	1.0015	0.9975	
11	Actuating Cylinder 215-32031								
	Bearing 202-19001-16	A	Pin 215-32423	1.0000	0.9985	0.0015	1.0010	0.9975	
	Bearing 202-19001-16	B	Pin 215-30564	1.0000	0.9985	0.0015	1.0005	0.9980	

90D089-03-05-87

Figure 1-85. Speed Brake Installation Hardware Repair Limits (Sheet 3)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Beam Assembly, L/R 215-30354							
	Bushing 215-30483	A	1,3760	Aluminum Bronze		1.2500	1.2510	63
2	Actuating Cylinder Support Assembly 215-30551							
	Bushing NAS538-16-25	A	1.1885	4130 Steel	125,000 to 145,000	0.9995	1.0005	125
3	Pivot Support Assembly 215-30305	A	None					
	Bushing NAS537B16P162		1.1885	Aluminum Bronze	85,000 to 90,000	0.9995	1.0005	125
4	Arm Assembly 215-30303							
	Bushing NAS537-6P26 (Note 2)	A, C	0.5005	4130 Steel	125,000 to 145,000	0.3750	0.3755	63
	Bushing 215-30483	B	1,3760	Aluminum Bronze		1.2500	1.2505	63
	Bushing 215-30522	B[1]	None					
	Pin 215-30523	B[2]	None					
5	Link Assembly 215-30422							
	Rod End 215-30365	A, B	None					
6	Trunnion Assembly 215-30424							
	Bushing NAS537-6P40 (Note 2)	A	0.5005	4130 Steel	125,000 to 145,000	0.3750	0.3755	125
7	Link Assembly 215-30427							
	Rod End KNE6	A	None					
	Rod End 215-30365	B	None					

90D089-04-12-84

Figure 1-85. Speed Brake Installation Hardware Repair Limits (Sheet 4)

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PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
8	Chine Linkage Support, L/R 215-30484							
	Bushing NAS538B6P17 (Note 2)	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3750	0.3755	63
9	Support Assembly, L/R 218-30350							
	Bushing 215-30483	A	1,3760	Aluminum Bronze		1.2350	1.2500	125
10	Keel 215-30507							
	Bushing 215-30581	A	1.1885	Aluminum Bronze	85,000 to 90,000	0.9995	1.0005	63
11	Actuating Cylinder 215-32031							
	Bearing MS21230-16	A,B	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. Wear allowance includes manufacturing allowance.

90D089-05-12-84

Figure 1-85. Speed Brake Installation Hardware Repair Limits (Sheet 5)

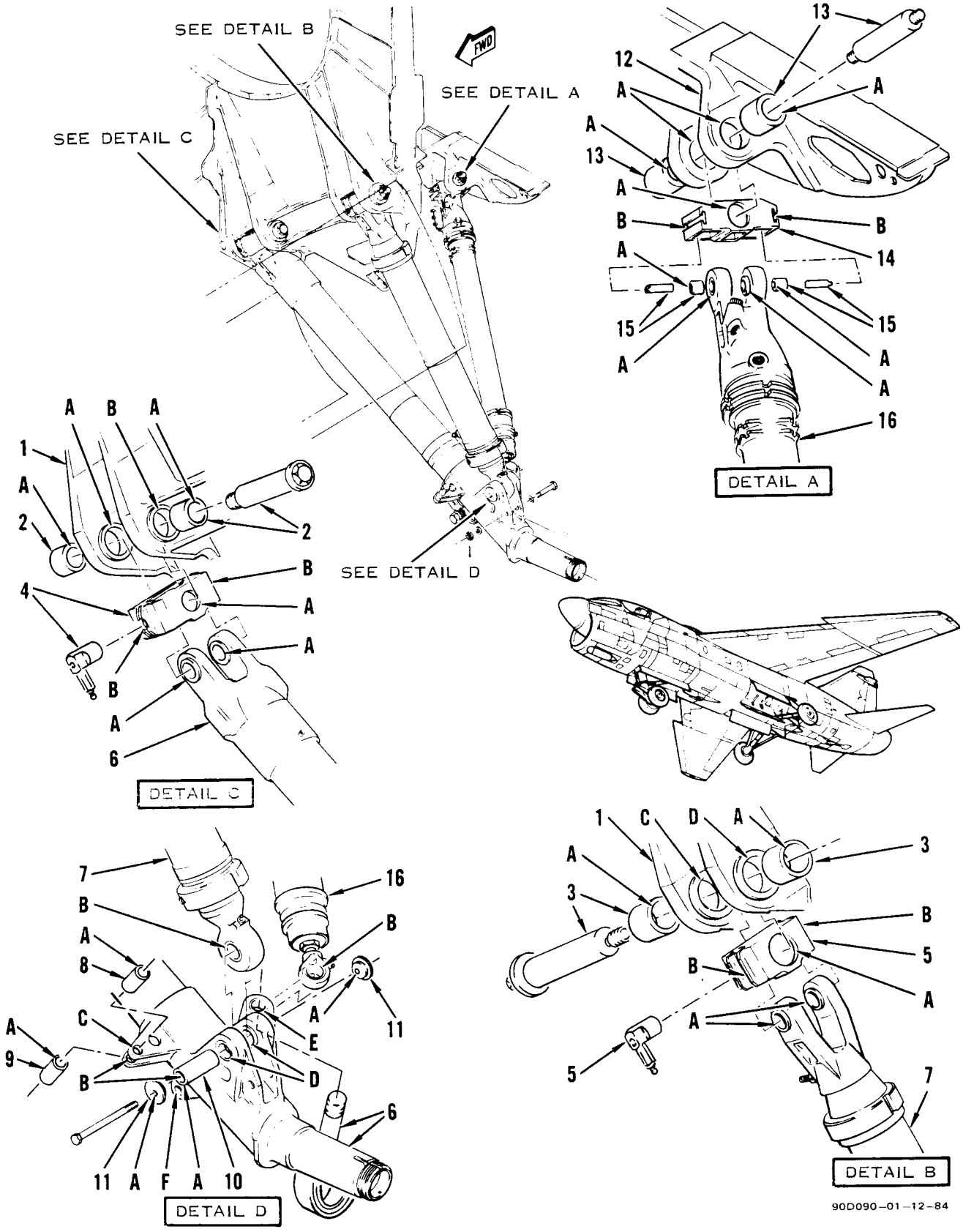


Figure 1-86. Main Landing Gear Hardware Repair Limits (Sheet 1 of 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 7)	
							Hole	Shaft
1	MLG Attach Bulkhead 215-30079							
	Sleeve Bushing 215-30404	A, B, C, D	Sleeve 215-34625	1.6242	1.6227	0.0015	1.6252	1.6222
2	Sleeve Bushing 215-34625	A	Special Attach Bolt 215-34620	1.3135	1.3115	0.0020	1.3145	1.3105
3	Sleeve Bushing 215-34625	A	Special Attach Bolt 215-34621	1.3135	1.3115	0.0020	1.3145	1.3105
4	Trunnion 215-34616	A	Special Attach Bolt 215-34620	1.3135	1.3115	0.0020	1.3145	1.3105
		B	Pin Assembly CV21-564502	1.2492	1.2477	0.0015	1.2502	1.2472
5	Trunnion 215-34618	A	Special Attach Bolt 215-34621	1.3135	1.3115	0.0020	1.3145	1.3105
		B	Pin Assembly CV21-564502	1.2492	1.2477	0.0015	1.2502	1.2472
6	MLG Tension Strut 215-34040							
	Bushing 215-34605	A	Pin Assembly CV21-564502	1.2505	1.2477	0.0028	1.2510	1.2476
	Bushing NAS538B6P28	B	Shoulder Bolt 215-34604	0.3755	0.3735	0.0020	0.3765	0.3730
	Bushing NAS538B8P28	C	Shoulder Bolt 215-34604	0.5005	0.4980	0.0025	0.5025	0.4970
	Bushing 215-34605	D	Pin 215-34613	1.5005	1.4960	0.0045	1.5020	1.4950
	Bushing 215-34605	E	Tiedown Ring 215-34401	1.0005	0.9975	0.0030	1.0020	0.9960
		F	Bolt AN10DD25	0.6257	0.6200	0.0057	0.6280	0.6190
7	MLG Shock Strut 215-34301 986100-501 (Note 4)							
	Bushing 986162-1 (Note 4)	A	Pin Assembly CV21-564502	1.2496	1.2477	0.0019	1.2510	1.2470
	Bearing BH24S10 (Note 5)	B	Pin 215-34613	1.5000	1.4960	0.0040	1.5020	1.4950

90D090-02-12-84

Figure 1-86. Main Landing Gear Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 7)	
							Hole	Shaft
8	Bearing 215-34673-2	A	Shoulder Bolt 215-34604	0.5670	0.4980	0.0690	0.5690	0.4970
9	Bearing 215-34673-1	A	Shoulder Bolt 215-34604	0.5670	0.4980	0.0690	0.5690	0.4970
10	Pin 215-34613	A	Retainer 215-34614	1.1200	1.1000	0.0200	1.125	1.085
		B	Bolt NAS464P3-58	0.2500	0.1885	0.0615	0.2510	0.1881
11	Retainer 215-34614	A	Bolt NAS464P3-58	0.2190	0.1885	0.0305	0.2200	0.1881
12	MLG Actuator Support 215-30080							
	Sleeve Bushing 215-30476	A	Sleeve Bushing 215-34624	1.0635	1.0610	0.0025	1.0650	1.0600
13	MLG Actuator Attach Bushing 215-34624	A	Pin 215-34622	0.8770	0.8740	0.0030	0.8790	0.8730
14	Trunnion 215-34617	A	Pin 215-34622	0.8755	0.8740	0.0015	0.8775	0.8730
		B	Pin CV15-564596	0.6255	0.6240	0.0015	0.6265	0.6235
15	Sleeve Bushing 215-34623	A	Pin CV15-564596	0.6260	0.6240	0.0020	0.6270	0.6230
16	MLG Actuating Cylinder 215-32300							
	Bushing 986412-1, -2 (Note 4)	A	Sleeve Bushing 215-34623	0.8130	0.8110	0.0020	0.8140	0.8100
	Bearing KSBG-16SS (Note 6)	B	Tiedown Ring 215-34401	1.0000	0.9975	0.0025	1.0020	0.9960

90D090-03-12-84

Figure 1-86. Main Landing Gear Hardware Repair Limits (Sheet 3)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	MLG Attach Bulkhead 215-30079							
	Sleeve Bushing 215-30404	A, B, C, D	1.9385	Aluminum Bronze		1.6237	1.6242	32
2	Sleeve Bushing 215-34625	A	1.6242	4340 Steel	180,000	1.3125	1.3135	63
3	Sleeve Bushing 215-34625	A	1.6242	4340 Steel	180,000	1.3125	1.3135	63
4	Trunnion 215-34616	A, B	None					
5	Trunnion 215-34618	A, B	None					
6	Tension Strut 215-34040							
	Bushing 215-34605	A	1.3760	4130 Steel	150,000	1.2495	1.2505	63
	Bushing NAS538B6P28	B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
	Bushing NAS538B8P28	C	0.6255	Aluminum Bronze	85,000 to 90,000	0.4995	0.5005	63
	Bushing 215-34605	D	1.6885	4130 Steel	150,000	1.4995	1.5005	63
	Bushing 215-34605	E	1.1885	4130 Steel	150,000	0.9995	1.0005	63
		F	0.6257					
7	MLG Shock Strut 215-34301 986100-501 (Note 4)							
	Bushing 986162-1 (Note 4)	A	1.3755	Beryllium Copper		1.2486	1.2496	63
	Bearing BH24S10 (Notes 3, 5)	B	None					
8	Bearing 215-34673	A	None					
9	Bearing 215-34673	A	None					
10	Pin 215-34613	A, B	None					
11	Retainer 215-34614	A	None					

90D090-04-12-84

Figure 1-86. Main Landing Gear Hardware Repair Limits (Sheet 4)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
12	MLG Actuator Support 215-30080							
	Sleeve Bushing 215-30476 (Note 2)	A	1.2510	Aluminum Bronze		1.0625	1.0635	63
13	Sleeve Bushing 215-34624-1	A	1.0635	4340 Steel	180,000	0.875	0.877	63
14	Trunnion 215-34617	A, B	None					
15	Sleeve Bushing 215-34623	A	0.8130	4340 Steel	180,000	0.625	0.626	63
16	MLG Actuating Cylinder 215-32300 986400-501, -502							
	Bushing 986412-1, -2 (Note 4)	A	1.0010	17-4PH Steel	170,000	0.8125	0.8130	63
	Bearing KSBG-16SS (Note 6)	B	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Within 5 minutes after installation, grease flow to bushing must be verified to be unobstructed.
3. Do not seal bushings after installation.
4. Manufacturer's code 39661.
5. Manufacturer's code 57448.
6. Manufacturer's code 97613.
7. Wear allowance dimensions include manufacturing allowance.

90D090-05-12-84

Figure 1-86. Main Landing Gear Hardware Repair Limits (Sheet 5)

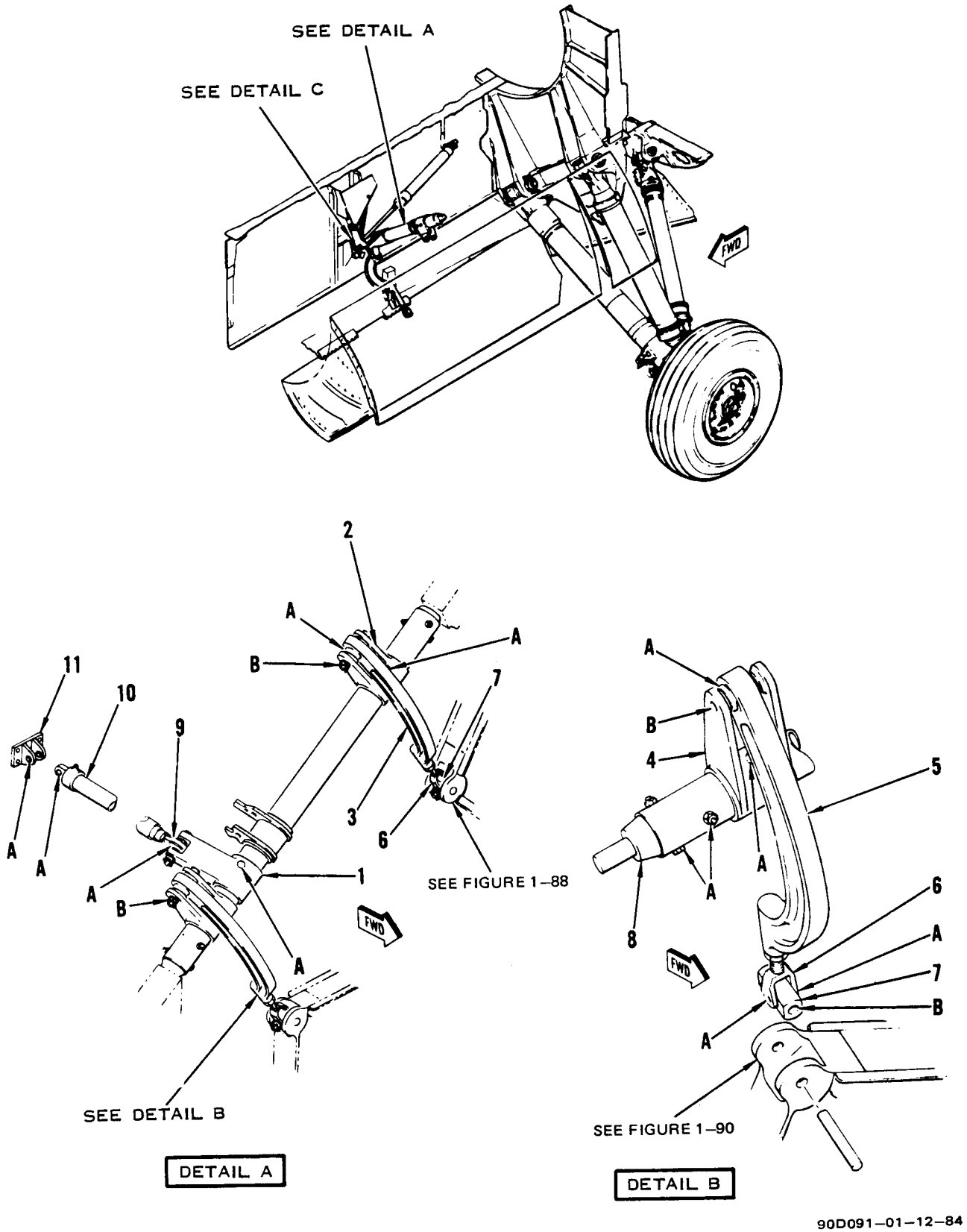
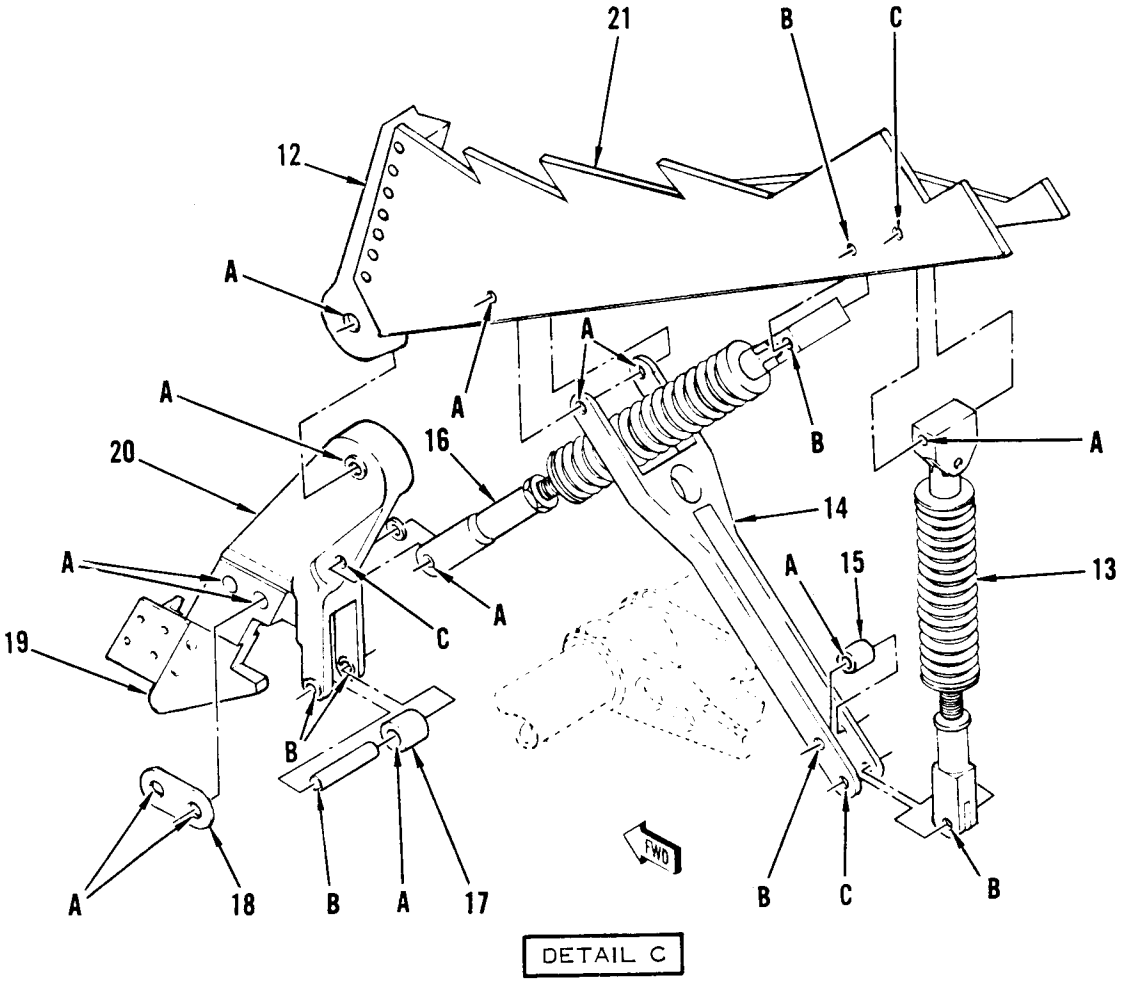


Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 1 of 9)



NOTE

Reference Vought DWG 215-34030 for door downlock link attach hole location. Index 21A.

90D091-02-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (NOTE 2)		
							Hole	Shaft	Total
1	Actuator Arm Assembly 215-34033								
		A	Bolt NAS1204-40	0.2505	0.2485	0.0020	0.2515	0.2475	
	Bushing NAS537B5P55	B	Bolt NAS464P5-24	0.3130	0.3108	0.0022	0.3140	0.3095	
2	Arm Assembly 215-34032								
		A	Bolt NAS1204-38	0.2520	0.2485	0.0035	0.2540	0.2470	
	Bushing NAS537-4P40	B	Bolt NAS464P4-29	0.2505	0.2483	0.0022	0.2515	0.2470	
3	Link Assembly 215-34034								
	Bearing MS28914-4C	A	Bolt NAS464P4-29	0.2500	0.2483	0.0017	0.2510	0.2470	
4	Arm Assembly 215-34037								
		A	Bolt NAS1205-38	0.3145	0.3110	0.0035	0.3165	0.3095	
	Bushing NAS537-5P31	B	Bolt NAS464P5-29	0.3130	0.3108	0.0022	0.3140	0.3095	
5	Link Assembly 215-34035								
	Bearing MS28914-5C	A	Bolt NAS464P5-29	0.3125	0.3108	0.0017	0.3135	0.3095	
6	Link, End Assembly 215-34036								
	Bushing NAS537-6P20	A	Bolt NAS464P6-17	0.3755	0.3733	0.0022	0.3765	0.3720	

90D091-03-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (NOTE 2)		
							Hole	Shaft	Total
7	Sleeve CV15-564519								
		A	Bolt NAS464P6-17	0.3770	0.3733	0.0037	0.3790	0.3720	
		B	Pin 215-34631	0.5005	0.4980	0.0025	0.5018	0.4967	
8	End Fitting CV15-564026								
		A	Bolt NAS464P4A32	0.2520	0.2483	0.0037	0.2540	0.2465	
9	Rod End Assembly 215-32332								
	Bearing MS21230-5	A	Bolt NAS464P5-24	0.3125	0.3108	0.0017	0.3133	0.3095	
10	Cylinder Assembly CV15-501135								
	Bearing MS21230-5	A	Bolt NAS464P5-15	0.3125	0.3108	0.0017	0.3133	0.3097	
11	Support Assembly 215-30525								
	Bushing NAS537-5P24	A	Bolt NAS464P5-15	0.3130	0.3108	0.0022	0.3141	0.3097	
12	Support 215-30537								
		A	Bolt NAS464P6-20	0.3810	0.3733	0.0077	0.3830	0.3713	
13	Strut Assembly 215-34315								
		A	Bolt NAS464P3-20	0.1960	0.1885	0.0075	0.1990	0.1855	
		B	Bolt NAS464P3-12	0.1920	0.1885	0.0035	0.1940	0.1855	

90D091-04-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 4)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (NOTE 2)		
							Hole	Shaft	Total
14	Link 215-34407								
		A	Bolt NAS464P4-21	0.2550	0.2483	0.0067	0.2590	0.2453	
		B	Bolt NAS464P3-12	0.1960	0.1885	0.0075	0.1980	0.1875	
		C	Bolt NAS464P3-12	0.1960	0.1885	0.0075	0.1990	0.1925	
15	Roller Assembly 215-34316								
	Bushing NAS537B3P48	A	Bolt NAS464P3-12	0.1905	0.1885	0.0020	0.1915	0.1875	
16	Strut Assembly CV15-564057								
		A	Bolt NAS464P3-8	0.1920	0.1885	0.0035	0.1940	0.1870	
		B	Bolt NAS464P3-20	0.1960	0.1885	0.0075	0.1990	0.1855	
17	Roller CV15-564541								
		A	Bushing CV15-564561	0.2550	0.2487	0.0063	0.2580	0.2457	
	Bushing CV15-564561	B	Rivet MS20615-4M20	0.1310	0.1240	0.0060	0.1340	0.1230	
18	Plate CV15-564513								
		A	Bolt NAS464P4A14	0.2530	0.2483	0.0067	0.2580	0.2453	
19	Hook 215-34632								
		A	Bolt NAS464P4A14	0.5060	0.2483	0.2577	0.5090	0.2453	

90D091-05-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (NOTE 2)		
							Hole	Shaft	Total
20	Plate Assembly CV15-564575								
	Bushing NAS537B6P76	A	Bolt NAS464P6-20	0.3755	0.3733	0.0022	0.3768	0.3713	
	Bushing NAS537-4P19	B	Bushing CV15-564561	0.2505	0.2492	0.0013	0.2505	0.2492	
		C	Bolt NAS464P3-8	0.1960	0.1885	0.0075	0.1960	0.1870	
21	Support 215-30071								
		A	Bolt NAS464P4-21	0.2550	0.2483	0.0067	0.2590	0.2453	
		B	Bolt NAS464P3-20	0.1960	0.1885	0.0075	0.1990	0.1855	
		C	Bolt NAS464P3-20	0.1960	0.1885	0.0075	0.1990	0.1885	

90D091-06-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 6)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Actuator Arm Assembly 215-34033							
		A	None					
	Bushing NAS537B5P55	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	63
2	Arm Assembly 215-34032							
		A	None					
	Bushing NAS537-4P40	B	0.3755	4130 Steel	125,000 to 145,000	0.2495	0.2505	63
3	Link Assembly 215-34034							
	Bearing MS28914-4C	A	None					
4	Arm Assembly 215-34037							
		A	None					
	Bushing NAS537-5P31	B	0.4380	4130 Steel	125,000 to 145,000	0.3120	0.3130	63
5	Link Assembly 215-34035							
	Bearing MS28914-5C	A	None					
6	Link, End Assembly 215-34036							
	Bushing NAS537-6P20	A	0.5005	4130 Steel	125,000 to 145,000	0.3745	0.3755	63
7	Sleeve CV15-564519-1							
		A	None					
		B	None					

90D091-07-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 7)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
8	End Fitting CV15-564026							
		A	None					
9	Rod End Assembly 215-32332							
	Bearing MS21230-5	A	None					
10	Cylinder Assembly CV15-501135							
	Bearing MS21230-5	A	None					
11	Support Assembly 215-30525							
	Bushing NAS537-5P24	A	0.4380	4130 Steel	125,000 to 145,000	0.3120	0.3130	125
12	Support 215-30537							
		A	None					
13	Strut Assembly 215-34315							
		A	None					
		B	None					
14	Link 215-34407							
		A	None					
		B	None					
		C	None					
15	Roller Assembly 215-34316							
	Bushing NAS537B3P48	A	0.3130	Aluminum Bronze	85,000 to 90,000	0.1895	0.1905	125

90D091-08-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 8)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
16	Strut Assembly CV15-564057							
		A	None					
		B	None					
17	Roller CV15-564541							
		A	None					
	Bushing CV15-564561	B	0.2550	4130 Steel	180,000 Minimum	0.1270	0.1310	125
18	Plate CV15-564513							
		A	None					
19	Hook 215-34632							
		A	None					
20	Plate Assembly CV15-564575							
	Bushing NAS537B6P76	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
	Bushing NAS537-4P19	B	0.3755	4130 Steel	125,000 to 145,000	0.2495	0.2505	63
		C	None					
21	Support 215-30071							
		A	None					
		B	None					
		C	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D091-09-12-84

Figure 1-87. Main Landing Gear Door and Uplock Mechanism Repair Limits (Sheet 9)

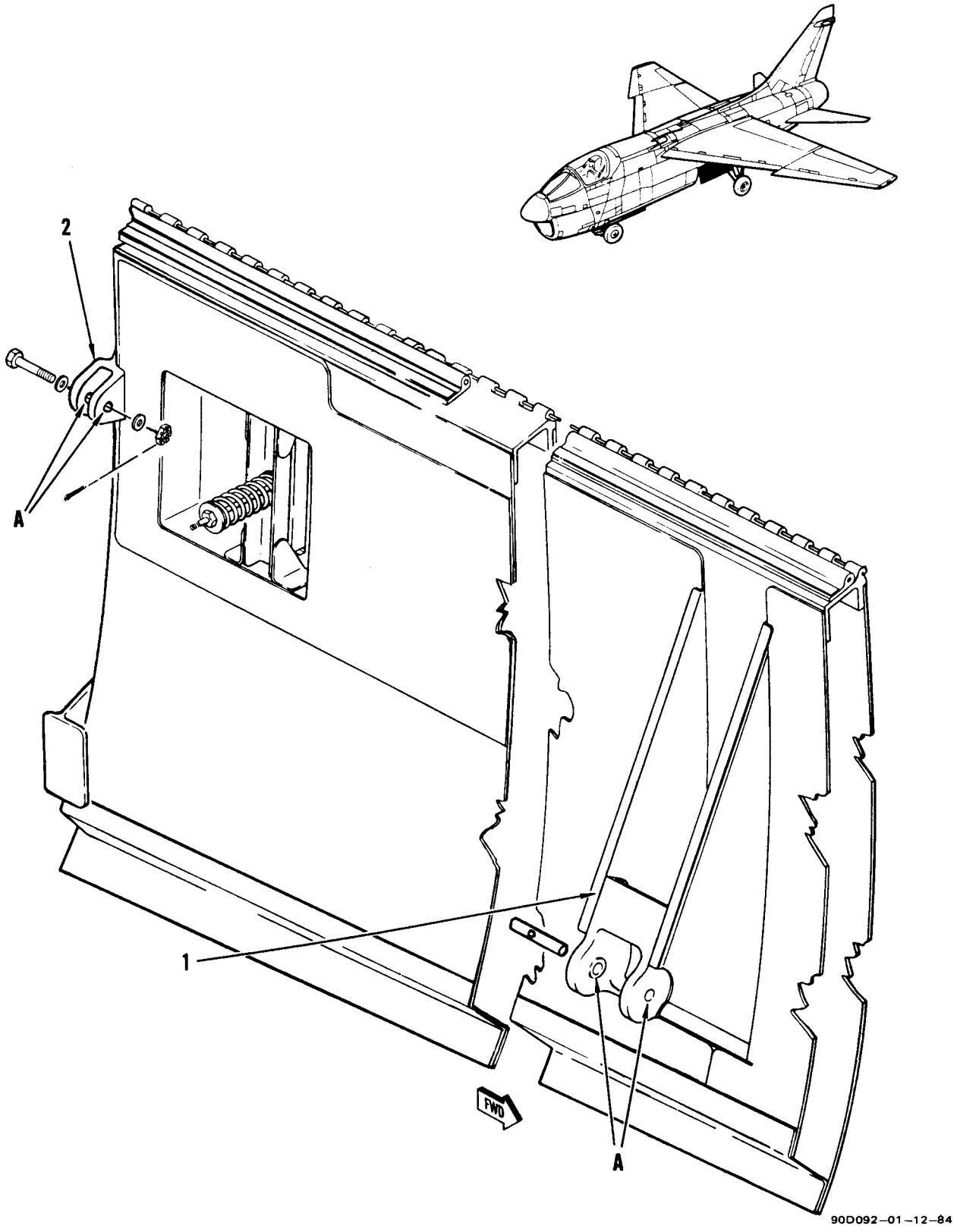


Figure 1-88. Main Landing Gear Upper Forward Door Assembly Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Adapter 215-30361							
	Bushing CVC477M8-27	A	Pin 215-34631	0.5005	0.4980	0.0025	0.5025	0.4970
2	Adapter 215-30171							
	Bushing, CVC480-4-24	A	Bolt, NAS464P4-15	0.2505	0.2483	0.0022	0.2515	0.2473

PERMISSIBLE REAMING AND BUSHING LIMITS

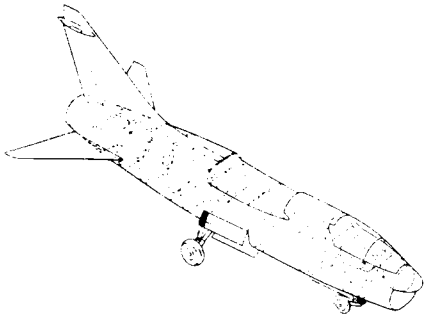
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Adapter, 215-30361							
	Bushing CVC477M8-27	A	0.6255	Manganese Aluminum Bronze	110,000 PSI minimum	0.4995	0.5005	63
2	Adapter, 215-30171							
	Bushing, CVC480-4-24	A	0.3755	4130 Steel	125,000 minimum	0.2495	0.2505	125

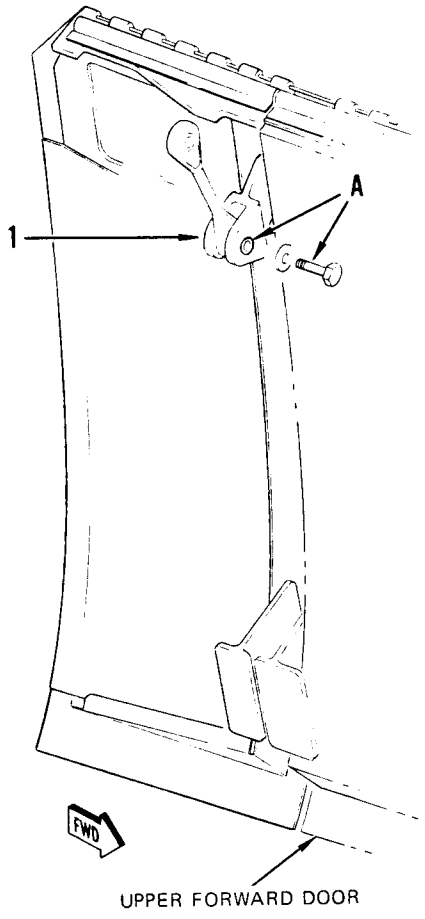
NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D092-02-12-84

Figure 1-88. Main Landing Gear Upper Forward Door Assembly Hardware Repair Limits (Sheet 2)





90D093-01-12-84

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Adaptor, 215-30170							
	Bushing CVC480-4-18	A	Bolt NAS464P4-13	0.2505	0.2483	0.0022	0.2515	0.2473

Figure 1-89. Main Landing Gear Upper Aft Door Assembly Hardware Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

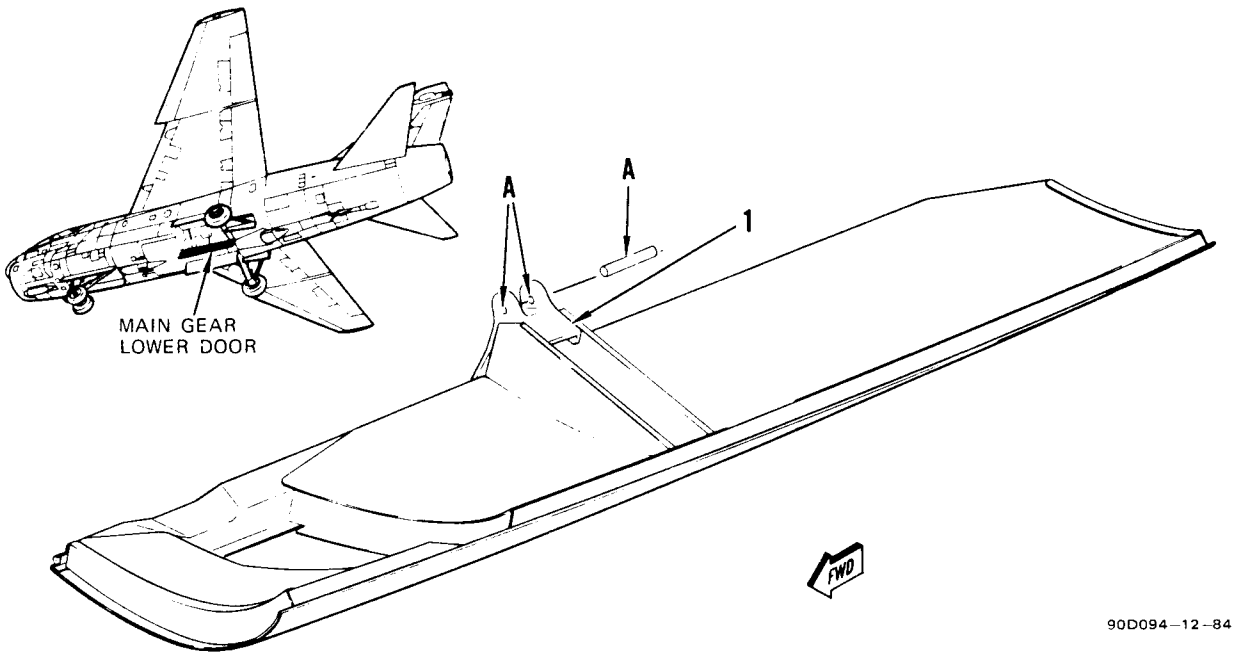
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Adaptor 215-30170							
	Bushing CVC480-4-18	A	0.3755	4130 Steel	125,000 minimum	0.2495	0.2505	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D093-02-12-84

Figure 1-89. Main Landing Gear Upper Aft Door Assembly Hardware Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Fitting Assembly, L/R, 215-30360							
	Bushing, CVC 477M8-35	A	Pin 215-34631	0.5005	0.4980	0.0025	0.5025	0.4970

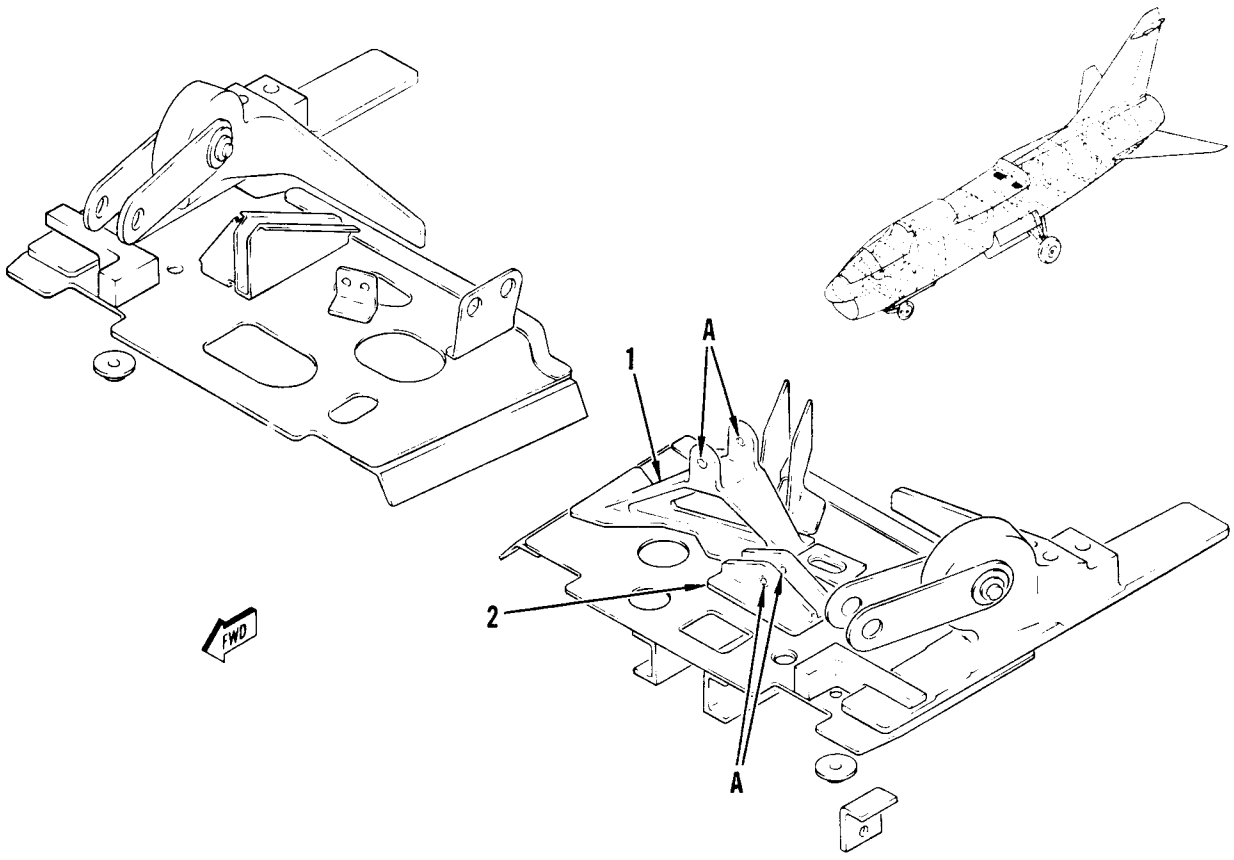
PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Fitting Assembly, L/R, 215-30360							
	Bushing, CVC 477M8-35	A	0.6255	Manganese Aluminum Bronze	110,000 PSI minimum	0.4995	0.5005	63

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

Figure 1-90. Main Landing Gear Lower Door Hardware Repair Limits



90D095-01-12-84

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Support Assy, 215-30320							
	Bushing CVC480-4-25 (Note 2) (Note 3)	A	Bolt NAS464-4-33	0.2505	0.2487	0.0018	0.2515	0.2477
2	Support Assy, 215-30373							
	Bushing CVC480-4-23 (Note 2) (Note 3)	A	Bolt NAS464-4-17	0.2505	0.2487	0.0018	0.2515	0.2477

Figure 1-91. Partition Installation-Upper Fuselage Station 480.00 to 490.50–Bushing Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Support Assy, 215-30320		None					
	Bushing CVC480-4-25 (Note 2) (Note 3)	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
2	Support Assy, 215-30373		None					
	Bushing CVC480-4-23 (Note 2) (Note 3)	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. After installation, spotface outside ends flush with surface of receiving part.
4. Wear allowance includes manufacturing allowance.

90D095-02-12-84

Figure 1-91. Partition Installation-Upper Fuselage Station 480.00 to 490.50–Bushing Repair Limits (Sheet 2)

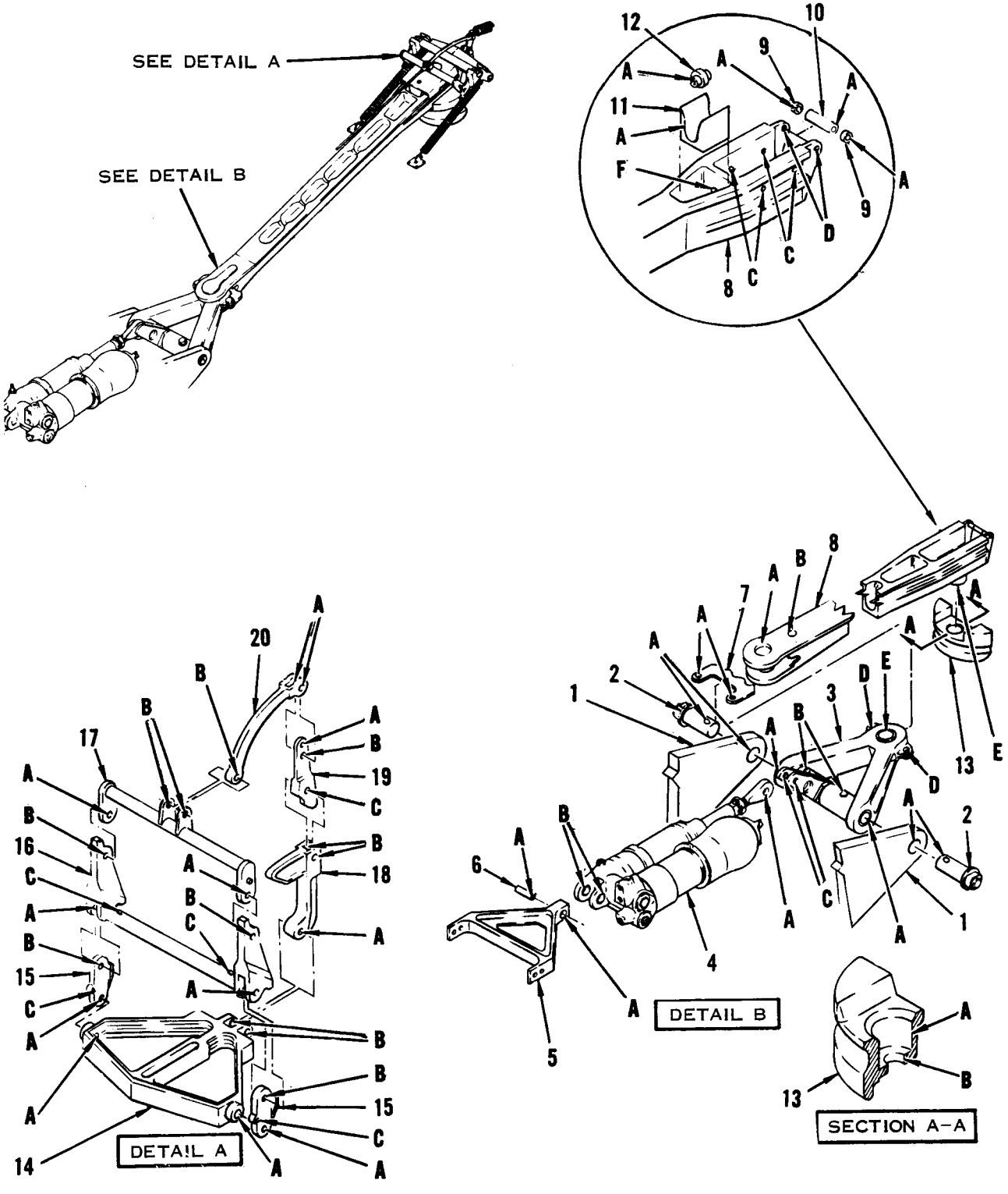


Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 1 of 6)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Arresting Gear Attach Lug 215-40410							
	Shoulder Bushing 215-40417	A	Drag Link Attach Pin Assembly 215-44303	1.3755	1.3690	0.0065	1.3775	1.3680
2	Drag Link Attach Pin Assembly 215-44303	A	Bolt NAS464P7-31	0.4400	0.4358	0.0042	0.4420	0.4340
3	Drag Link Assembly 215-44060	A	Drag Link Attach Pin Assembly 215-44303	1.3755	1.3690	0.0065	1.3770	1.3680
		B	Bolt NAS464P7-31	0.4531	0.4358	0.0173	0.4560	0.4340
	Bushing CVC485-20-28	C	Bolt 215-44462	0.6255	0.6230	0.0025	0.6270	0.6220
		D	Bolt NAS464P6A11	1.3792	0.3733	0.0059	0.3805	0.3725
	Bushing CV15-664547	E	Pin Assembly 215-44504	1.5005	1.4973	0.0032	1.5010	1.4970
4	Arresting Gear Actuating Cylinder 215-42030							
	Bearing HLF-KWB-10GC (Note 2)	A	Bolt 215-44462	0.6250	0.6230	0.0020	0.6260	0.6220
	Bushing CVC485-24-38	B	Pin 215-44461	0.7505	0.7475	0.0030	0.7515	0.7465
5	Arresting Gear Actuator Support 215-40416							
	Bushing NAS537-12P100	A	Pin 215-44461	0.7505	0.7475	0.0030	0.7515	0.7465
6	Pin 215-44461	A	Bolt NAS464P4-35	0.2610	0.2483	0.0127	0.2630	0.2430
7	Cam 215-44501	A	Bolt NAS464P6A11	0.3762	0.3733	0.0029	0.3775	0.3725
8	Arresting Gear Shank CV15-664643	A	Pin Assembly 215-44504	1.5010	1.4993	0.0017	1.5018	1.4988
		B	Pin Assembly 215-44504	0.4375	0.3600	0.0775	0.4450	0.3550
		C	Bolt NAS464P3A38	0.2180	0.1885	0.0295	0.2215	0.1865
		D	Bolt NAS464-6-38	0.3770	0.3733	0.0037	0.3785	0.3725
		E	Bolt NAS1312-42	0.7520	0.7480	0.0040	0.7545	0.7465
		F	Bolt NAS464P3A38	0.2210	0.1885	0.0325	0.2225	0.1875

90D096-02-12-84

Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
9	Roller CV15-664634	A	Bolt NAS464-6-38	0.3755	0.3733	0.0022	0.3765	0.3725
10	Bearing TOR-NR6L12 (Note 3)	A	Bolt NAS464-6-38	0.3755	0.3733	0.0022	0.3765	0.3725
11	Cam CV15-664632	A	Bolt NAS464P3A6	0.2188	0.1885	0.0303	0.2200	0.1850
12	Roller CV15-664562	A	Bolt NAS464P3-10	0.1905	0.1885	0.0020	0.1915	0.1875
13	Point CV15-664664							
		A	Arresting Gear Shank CV15-664643	1.9040	1.9000	0.0040	1.9060	1.8990
		B	Bolt	0.7656	0.7480	0.0176	0.7670	0.7470
14	Arresting Gear Bumper 215-44304							
	Bushing NAS538B6P47	A	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
	Bushing NAS537B6P28	B	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
15	Lower Bumper Link 215-44305							
	Bushing NAS537B6P25	A	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
	Bushing NAS537B6P25	B	Pin 215-44455	0.3755	0.3712	0.0043	0.3775	0.3695
		C	Spring 215-44459	0.1718	0.072	0.0998	0.1730	0.0700
16	Bumper Link Assembly 215-44301							
	Bearing 215-44453	A	Pin 215-44455	0.3755	0.3712	0.0043	0.3775	0.3695
	Bearing 215-44453	B	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
		C	Bolt NAS464P3A10	0.1935	0.1885	0.0050	0.1960	0.1870
17	Bellcrank Assembly 215-44308							
	Bushing NAS537B6P16	A	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
	Bushing NAS537B3P12	B	Bolt NAS464-3-10	0.1905	0.1889	0.0016	0.1915	0.1879

90D096-03-12-84

Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
18	Latch Assembly 215-44306							
	Bearing 215-44453	A	Pin 215-44454	0.3755	0.3712	0.0043	0.3775	0.3695
	Bushing NAS538B4P12	B	Bolt NAS464P4-10	0.2505	0.2483	0.0022	0.2515	0.2475
19	Lever Assembly 215-44307							
	Bushing NAS537-3P10	A	Spring 215-44456	0.1905	0.1250	0.0655	0.1915	0.1235
	Bushing NAS537B3P10	B	Bolt NAS464P3-4	0.1905	0.1885	0.0020	0.1915	0.1875
	Bushing NAS537B4P28	C	Bolt NAS464P4-10	0.2505	0.2483	0.0022	0.2515	0.2475
20	Link 215-44458	A	Bolt NAS464P3-4	0.1905	0.1885	0.0020	0.1915	0.1875
		B	Bolt NAS464-3-10	0.1905	0.1885	0.0020	0.1915	0.1875

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Arresting Gear Attach Lug 215-40410							
	Shoulder Bushing 215-40417	A	1.5010	4340 Steel	200,000	1.3745	1.3755	125
2	Drag Link Attach Pin Assembly 215-44303	A	None					
3	Drag Link Assembly 215-44060	A, B	None					
	Bushing CVC485-20-28	C	0.8130	4130 Steel	180,000	0.6245	0.6255	63
		D	None					
	Bushing CV15-664547	E	1.6885	4130 Steel	180,000	1.5000	1.5005	16

90D096-04-12-84

Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 4)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
4	Arresting Gear Actuating Cylinder 215-42030							
	Bearing HLF-KWB-10GC (Note 2)	A						
	Bushing CVC485-24-38	B	0.9380	4130 Steel	180,000	0.7495	0.7505	63
5	Arresting Gear Actuator Support 215-40416							
	Bushing NAS537-12P100	A	0.9380	4130 Steel	125,000 to 145,000	0.7495	0.7505	125
6	Pin 215-44461	A	None					
7	Cam 215-44501	A	None					
8	Arresting Gear Shank CV15-664643	A, B, C, D, E, F	None					
9	Roller CV15-664634	A	None					
10	Bearing TOR-NR6L12 (Note 3)	A	None					
11	Cam CV15-664632	A	None					
12	Roller CV15-664562	A	None					
13	Point CV15-664664	A, B	None					
14	Arresting Gear Bumper 215-44304							
	Bushing NAS538B6P47	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3590	0.3660	63
	Bushing NAS537B6P28	B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3590	0.3660	63
15	Lower Bumper Link 215-44305							
	Bushing NAS537B6P25	A, B	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
		C	None					
16	Bumper Link Assembly 215-44301							
	Bearing 215-44453	A, B	0.5005	Aluminum Bronze		0.3745	0.3755	63
		C	None					

90D096-05-12-84

Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 5)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
17	Bellcrank Assembly 215-44308							
	Bushing NAS537B6P16	A	0.5005	Aluminum Bronze	85,000 to 90,000	0.3745	0.3755	63
	Bushing NAS537B3P12	B	0.3130	Aluminum Bronze	85,000 to 90,000	0.1895	0.1905	63
18	Latch Assembly 215-44306							
	Bearing 215-44453	A	0.5005	Aluminum Bronze		0.3745	0.3755	63
	Bushing NAS538B4P12	B	0.3755	Aluminum Bronze	85,000 to 90,000	0.3746	0.3755	63
19	Lever Assembly 215-44307							
	Bushing NAS537-3P10	A	0.3130	4130 Steel	125,000 to 145,000	0.1790	0.1840	63
	Bushing NAS537B3P10	B	0.3130	Aluminum Bronze	85,000 to 90,000	0.1790	0.1840	63
	Bushing NAS537B4P28	C	0.3755	Aluminum Bronze	85,000 to 90,000	0.2380	0.3430	63
20	Link 215-44458	A, B	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Manufacturer's code 97613.
3. Manufacturer's code 60380.
4. Wear allowance dimensions include manufacturing allowance.

90D096-06-12-84

Figure 1-92. Arresting Gear Hardware Repair Limits (Sheet 6)

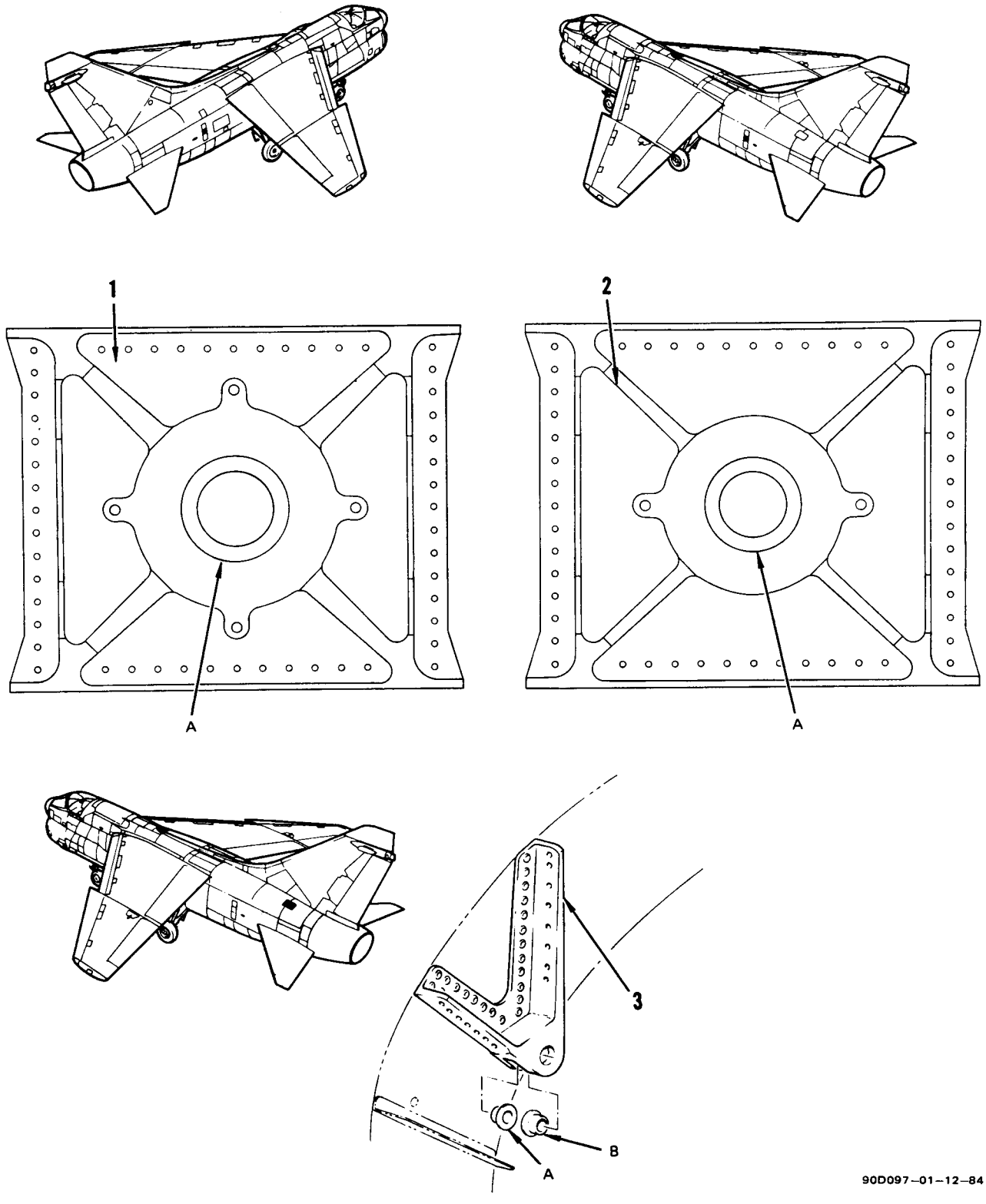


Figure 1-93. Engine Mounts Bushing Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 6)	
							Hole	Shaft
1	Engine Forward Mount, RH 216-40451-4							
	Bushing Tapered 216-40451-3	A	Thrust Mount Trunnion, Tapered 216-55464-4	2.1300 (Note 3)	2.0000 (Note 3)	0.1300	None	None
2	Engine Forward Mount, LH 216-40447-5							
	Bushing, Tapered 216-40447-4	A	Thrust Mount Trunnion, Tapered	1.8800 (Note 3)	1.7000 (Note 3)	0.1800	None	None
3	Engine Aft Mount 216-40446-2							
	Bushing NAS538-10P-39	A	Bolt NAS464-10-30	0.6255	0.6234	0.0021	0.6267	0.6227
	Bushing NAS538-10P-30	B	Bolt NAS464-10-30	0.6255	0.6234	0.0021	0.6267	0.6227

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Engine Forward Mount, RH 216-40451-4							
	Bushing, Tapered 216-40451-3 (Note 2, 5)	A	3.0015	Aluminum Bronze QQ-B-671, Type II, C14		2.1300 (Note 3).		32
2	Engine Forward Mount, LH 216-40447-5							
	Bushing, Tapered 216-40447-4 (Note 4, 5)	A	2.7515	Aluminum Bronze QQ-B-671, Type II, C14		1.8800 (Note 3)		32

90D097-02-12-84

Figure 1-93. Engine Mounts Bushing Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

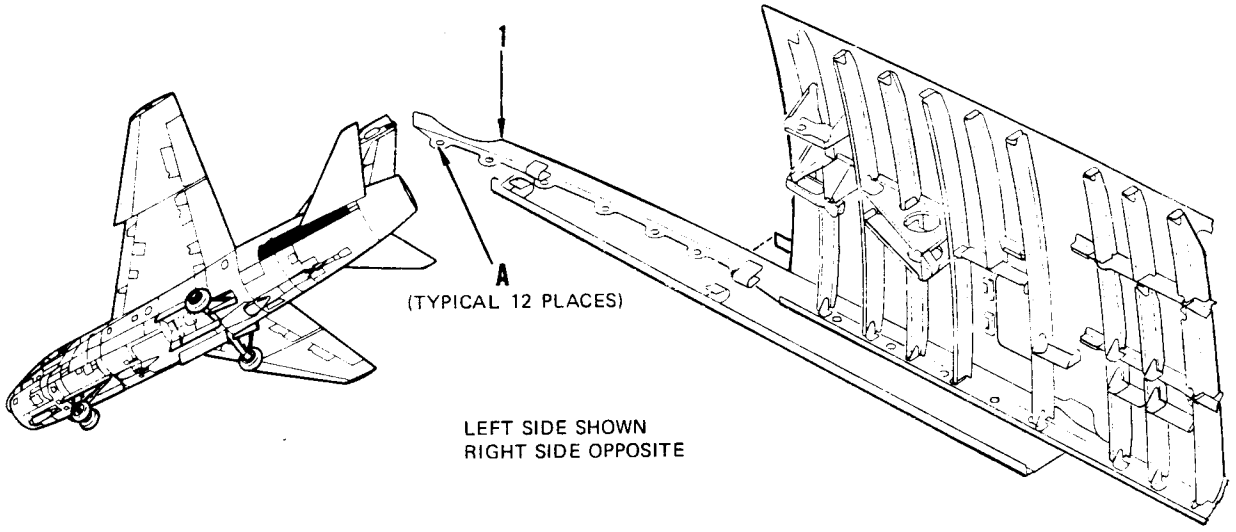
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
3	Engine Aft Mount 216-40446-2							
	Bushing NAS538-10P-39 (Note 5)	A	0.8130	4130 Steel	125,000 to 145,000	0.6245	0.6255	63
	Bushing NAS538-10P-30 (Note 5)	B	0.8130	4130 Steel	125,000 to 145,000	0.6245	0.6255	63

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING DATA.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Make from 216-40449-1.
3. 0.2500 taper on basic diameter per inch of length of bushing and trunnion mating surfaces.
4. Make from 216-40449-2.
5. Spotface unflanged end of bushing flush with surface of receiving part after installation.
6. Wear allowance includes manufacturing allowance.

90D097-03-12-84

Figure 1-93. Engine Mounts Bushing Repair Limits (Sheet 3)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	Total
1	Skin Installation, Aft Fuselage Section								
	Bushing NAS538-6P20	A	Pin, Shear CVC1345-6-5-6	0.3770	0.3698	0.0072			

PERMISSIBLE REAMING AND BUSHING LIMITS

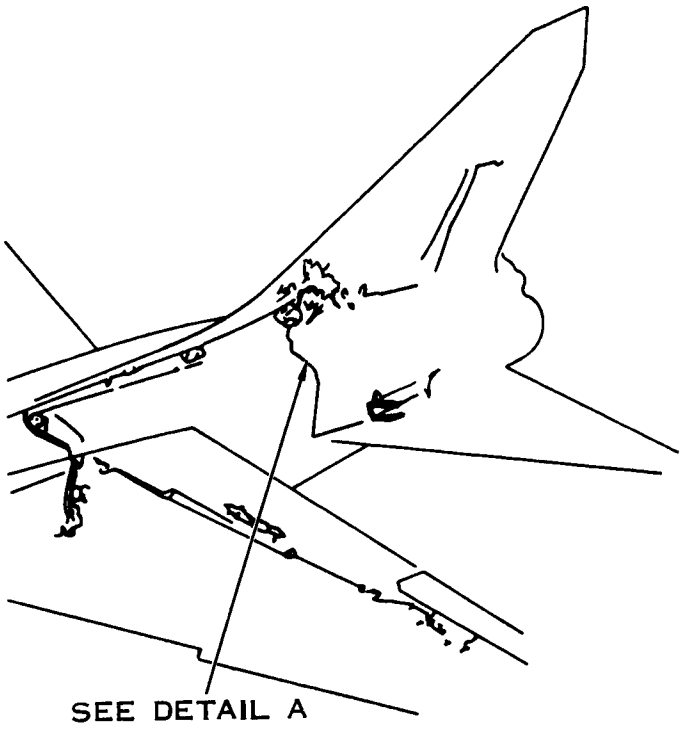
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Skin Installation, Aft Fuselage Section							
	Bushing NAS538-6P20	A	0.5005	4130 Steel	125,000 to 145,000	0.3740	0.3770	125

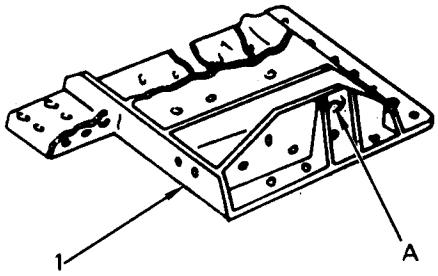
NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushing in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D098-12-84

Figure 1-94. Skin Installation, Aft Fuselage, Bushing Repair Limits





DETAIL A

90D099-01-12-84

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Bobweight Support Assembly 215-68309-3 (Note 2)							
	Bushing NAS537-5P27	A	Bolt NAS464-5-59	0.3130	0.3108	0.0022	0.3135	0.3105

Figure 1-95. Aft Bobweight Support Assembly Bushing Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Bobweight Support Assembly 215-68309-3 (Note 2)							
	Bushing NAS537-5P27 (Note 3)	A	0.4775	Aluminum Bronze	85,000 to 90,000	0.3120	0.3130	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushing to finished size and specified machine finish after installation.
2. Originally installed AZ91C-T6 Magnesium Bobweight Support Assembly, Part No. 215-68309-1, shall be replaced with A356-T6 Aluminum Bobweight Support Assembly, Part No. 215-68309-3, whenever bushing is no longer tight in support assembly.
3. An oversized bushing may be installed in Bobweight Support Assembly Part No. 215-68309-3, when bushing is no longer tight in support assembly. In this case, ream support to 0.4775 inch + 0.0000/ - 0.0005 and install bushing with outside diameter of 0.4780 inch + 0.0005/ - 0.0000. Bushing shall protrude inside of support a distance of 0.030 inch + / - 0.010. Inside distance between the two bushings must be 3.245 inch + 0.005/ - 0.000. New bushing must be line reamed to proper inside diameter.
4. Wear allowance includes manufacturing allowance.

90D099-02-12-84

Figure 1-95. Aft Bobweight Support Assembly Bushing Repair Limits (Sheet 2)

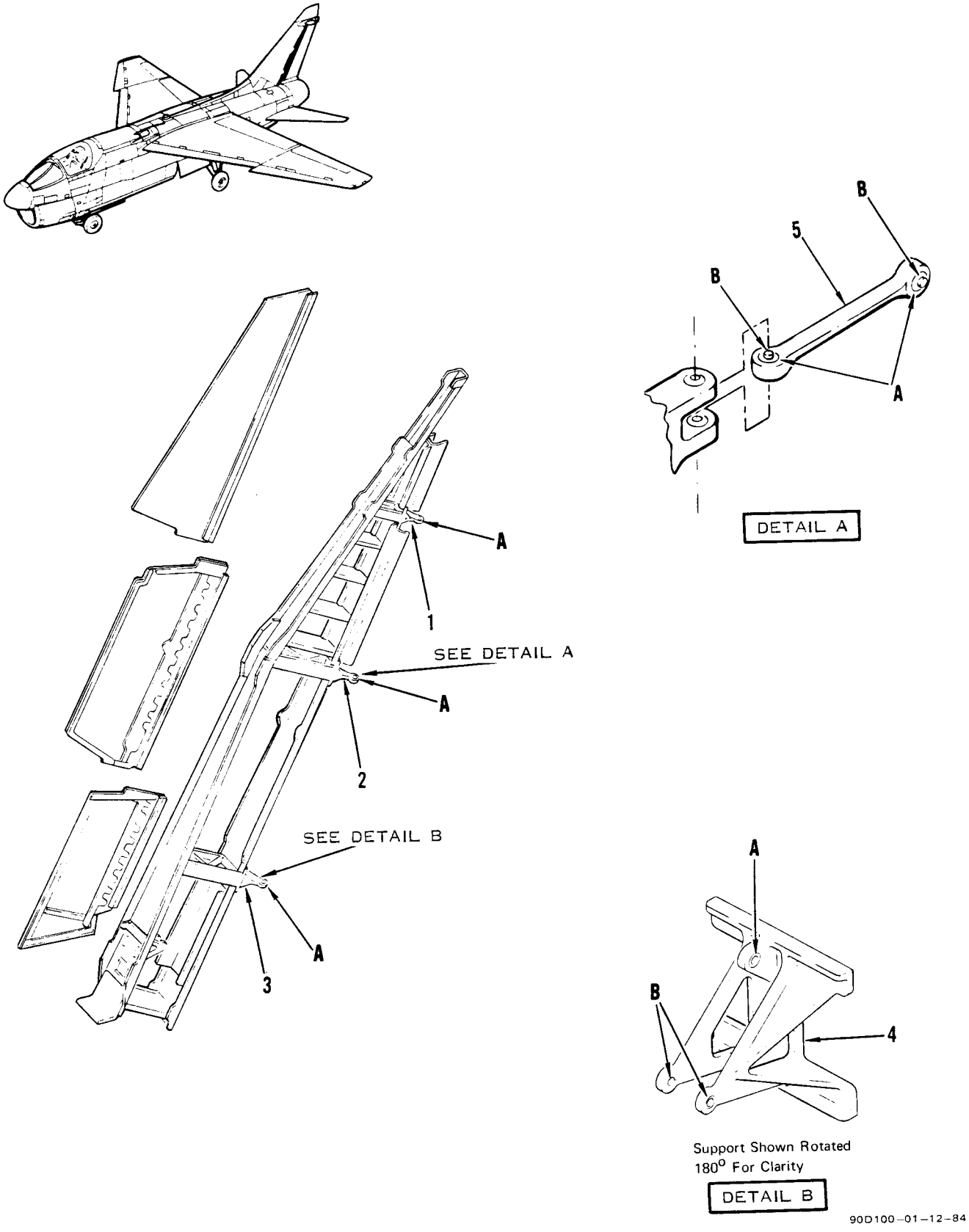


Figure 1-96. Rudder Hinge Fittings and Power Control Valve Support Hardware Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 4)	
							Hole	Shaft
1	Upper Hinge Fitting Assembly CV15-150075							
	Bearing NAS504-4	A	Bolt NAS1304-13D	0.2500	0.2485	0.0015	0.2510	0.2475
2	Center Hinge Fitting Assembly CV15-150536-2							
	Bearing NAS505-8	A	Bolt CV15-140503	0.5000	0.4991	0.0009	0.5010	0.4981
3	Lower Hinge Fitting Assembly CV15-150066							
	Bearing NAS504-5	A	Bolt NAS1304-13D	0.2500	0.2485	0.0015	0.2510	0.2475
4	Power Control Valve Support Assembly 215-60107							
	Bushing CVC475-4-25	A	Bolt NAS464-4-10	0.2505	0.2487	0.0018	0.2525	0.2477
	Bushing NAS537-4P26	B	Bolt NAS464-4-30	0.2505	0.2487	0.0018	0.2525	0.2477
5	Link Assembly CV15-158761							
	Bearing (Note 2) SHA-YD-130	A	Pin CV15-158593	0.7500	0.7497	0.0003	0.7501	0.7496
	Pin CV15-158593	B	Bolt NAS464-4-43	0.2500	0.2482	0.0018	0.2510	0.2472

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Upper Hinge Fitting Assembly CV15-150075							
	Bearing NAS504-4	A	None					
2	Center Hinge Fitting Assembly CV15-150536							
	Bearing NAS505-8	A	None					

90D100-02-12-84

Figure 1-96. Rudder Hinge Fittings and Power Control Valve Support Hardware Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

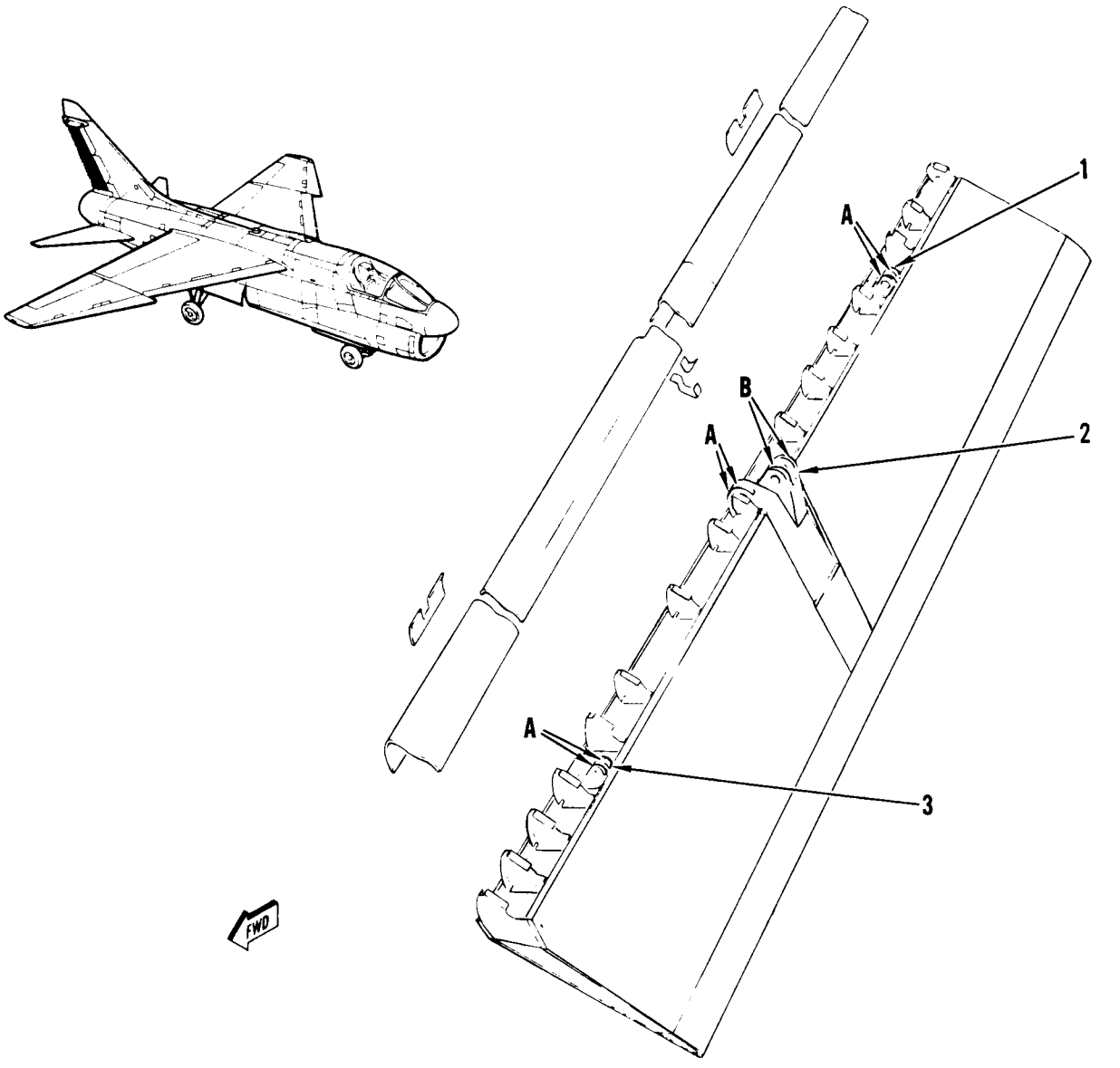
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
3	Lower Hinge Fitting Assembly CV15-150066							
	Bearing NAS504-4	A	None					
4	Power Control Valve Support Assembly 215-60107							
	Bushing (Note 2) CVC475-4-25	A	0.3755	4130 Steel	125,000 Minimum	0.2495	0.2505	125
	Bushing NAS537-4P26 (Note 2) (Note 3)	B	0.3755	4130 Steel	125,000 to 145,000	0.2495	0.2505	125
5	Link Assembly CV15-158761							
	Bearing (Note 2) SHA-YD-130	A	None					
	Pin CV15-158593	B	None					

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Do not seal bushings after installation.
3. After installation, spotface outside ends flush with surface of receiving part.
4. Wear allowance includes manufacturing allowance.

90D100-03-12-84

Figure 1-96. Rudder Hinge Fittings and Power Control Valve Support Hardware Repair Limits (Sheet 3)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Fitting Assembly CV15-140023							
	Bushing CVC475-4-18	A	Bolt NAS1304-13D	0.2505	0.2485	0.0010	0.2507	0.2484

Figure 1-97. Rudder Bushing Repair Limits (Sheet 1 of 2)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
2	Fitting Assembly 215-60105		None					
	Bushing CV15-140502	A	Bolt CV15-140503	0.4995	0.4991	0.0004	0.4996	0.4990
	Bushing CVC485-24-84	B	Pin CV15-158593	0.7499	0.7495	0.0004	0.7524	0.7480
3	Fitting Assembly CV15-140021		None					
	Bushing CVC475-4-18	A	Bolt NAS1304-13D	0.2505	0.2485	0.0010	0.2507	0.2484

PERMISSIBLE REAMING AND BUSHING LIMITS

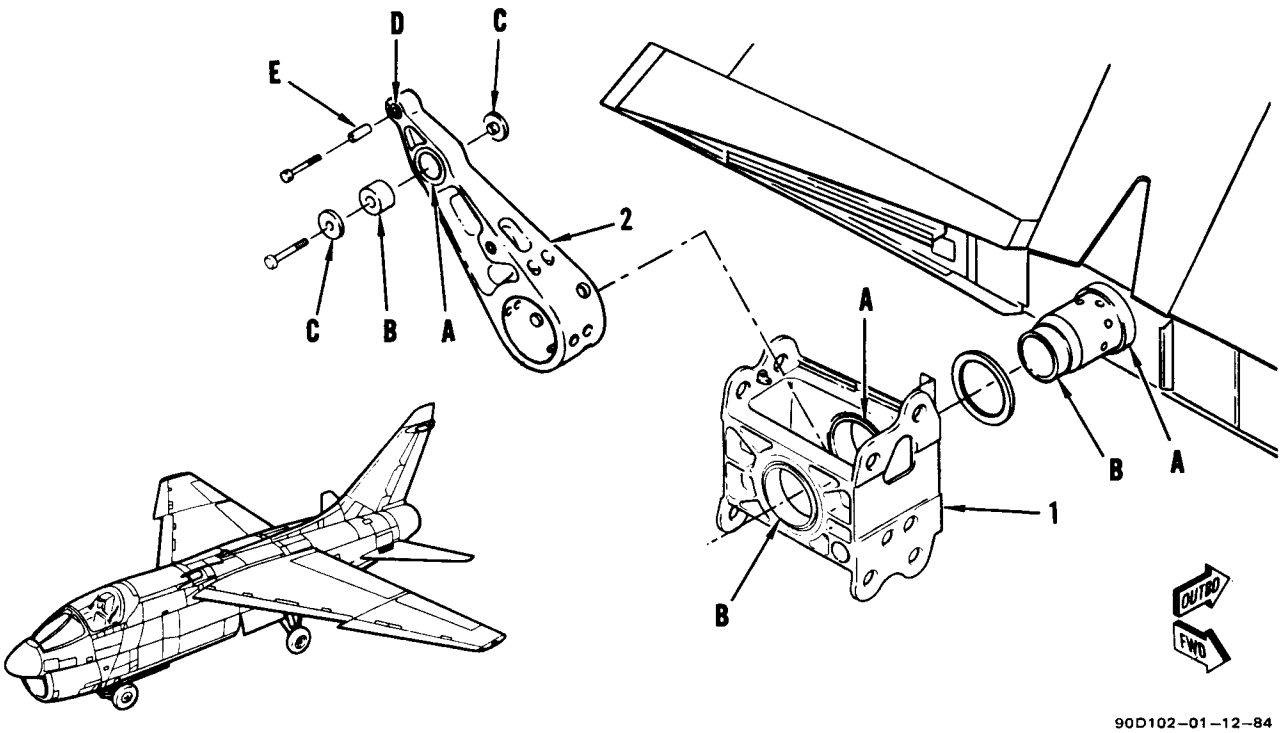
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Fitting Assembly CV15-140023							
	Bushing CVC475-4-18	A	0.3755	4130 Steel	125,000	0.2495	0.2505	125
2	Fitting Assembly 215-60105							
	Bushing CV15-140502	A	0.6257	4130 Steel	180,000	0.4993	0.4995	32
	Bushing CVC485-24-84	B	0.9380	4130 Steel	180,000	0.7497	0.7499	32
3	Fitting Assembly CV15-140021							
	Bushing CVC475-4-18	A	0.3755	4130 Steel	125,000	0.2495	0.2505	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D101-02-12-84

Figure 1-97. Rudder Bushing Repair Limits (Sheet 2)



PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note 2)	
							Hole	Shaft
1	Bearing Housing 215-60210							
	Bearing (Note 1) YD120F	A	Shaft CV15-160033	4.7500	4.7475 (Note 4)	0.0025	4.7501	4.7474
	Bearing (Note 1) YD118D	B	Shaft CV15-160033	4.000	3.9975 (Note 4)	0.0025	4.0001	3.9974
2	Arm 216-60201							
	Bearing YD129 (Notes 1 and 3)	A	Pin CV15-608526	1.0000	0.9995	0.0005	1.0001	0.9994
	Pin CV15-608526	B	Retainer CV15-158591	0.5100	0.4700	0.0400	0.5300	0.4500
	Retainer CV15-158591	C	Bolt NAS464-4-32	0.2600	0.2487	0.0113	0.2700	0.2437
	Bearing (Note 3) 202-19001-8	D	Spacer CVC328-64ST	0.5000	0.4988	0.0012	0.5002	0.4986
	Spacer CVC328-64ST	E	Bolt NAS464P6-18	0.3755	0.3733	0.0022	0.3760	0.3728

Figure 1-98. Horizontal Stabilizer Bushing Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Bearing Housing 215-60210							
	Bearing (Note 1) YD120F	A	None					
	Bearing (Note 1) YD118D	B	None					
2	Arm 216-60201							
	Bearing YD129 (Notes 1 and 3)	A	None					
	Pin CV15-608526	B		4140 Steel	200,000	0.4900	0.5100	125
	Retainer CV15-158591-1	C		4130 Steel	125,000	0.2400	0.2600	125
	Bearing (Note 3) 202-19001-8	D	None					
	Spacer CVC 328-64ST	E		4130 Steel	125,000	0.3745	0.3755	125

NOTE

1. Manufacturer's code ident. 77896.
2. Wear allowance includes manufacturing allowance.
3. Press fit of bearing in horn (or arm) shall require a mimimum ram force of 250 pounds. If less than 250 pounds, remove bearing and reinstall with LOCTITE bearing mount compound 72 in accordance with manufacturer's instructions.
4. This dimension is before plating and does not include thickness of cadmium.

90D102-02-12-84

Figure 1-98. Horizontal Stabilizer Bushing Repair Limits (Sheet 2)

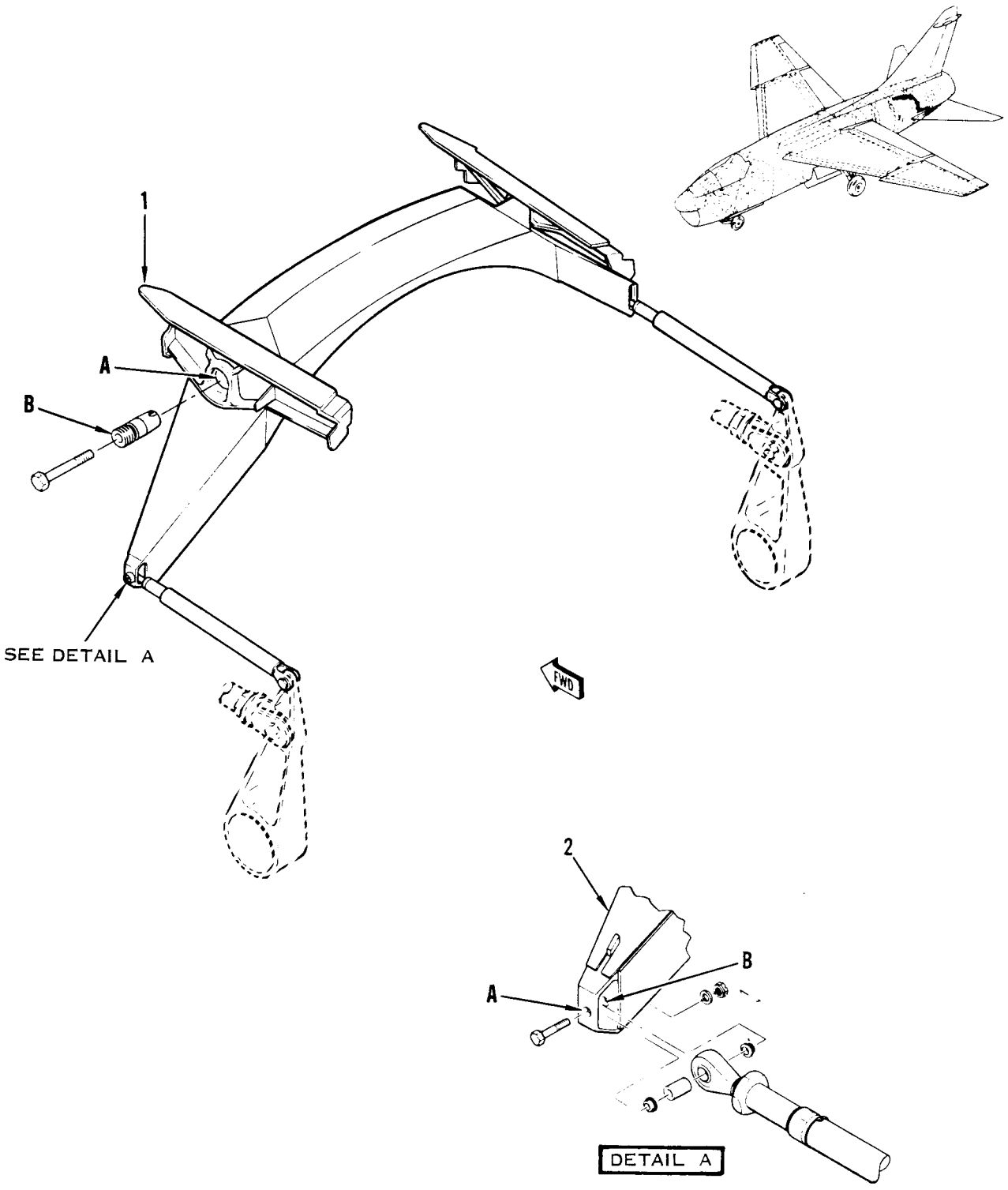


Figure 1-99. Horizontal Stabilizer Backup Controls Torque Tube Hardware Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches) (Note .2)	
							Hole	Shaft
1	Yoke Support 218-40429							
	Bushing (NOTE 3)	A	Bearing MS21232-12	1.4382	1.4370	0.0012	1.4389	1.4368
	Bearing MS21232-12	A	Tapered Pin 216-48458	0.7500	0.7488	0.0012	0.7506	0.7482
	Tapered Pin 216-48458	B	Bolt NAS1306-50H	0.3960	0.3735	0.0225	0.4010	0.3685
2	Torque Tube Assembly 216-48100							
	Bushing NAS538-6P-15	A	Bolt NAS464P6-18	0.3755	0.3733	0.0022	0.3761	0.3727
	Bushing NAS538-6P-20	B	Bolt NAS464P6-18	0.3755	0.3733	0.0022	0.3761	0.3727

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Yoke Support 218–40429							
	Bushing (NOTE 3)	A	1.6260	Aluminum Bronze	85,000 to 90,000	1.4370	1.4375	125
	Bearing MS21232–12	A	None					
	Tapered Pin 216–48458	B	None					
2	Torque Tube Assembly 216–48100							
	Bushing NAS538–6P–15	A	0.5005 (Structure)	4130 Steel	125,000 to 145,000	0.3745	0.3755	125
	Bushing NAS538–6P–20	B	0.5005 (Structure)	4130 Steel	125,000 to 145,000	0.3745	0.3755	125

90D103–02–12–84

Figure 1-99. Horizontal Stabilizer Backup Controls Torque Tube Hardware Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)

NOTE

1. Unless otherwise specified, observe the following:

   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.

2. Wear allowance includes manufacturing allowance.

3. Yoke support to be bushed when hole exceeds permissible wear allowance. Bushing dimensions are as follows: length −0.58 + 0.01/−0.00, O.D. −1.6270 + 0.000/−0.0005, outside edges chamfered 0.015 X 45°, inside edges chamfered 0.030 X 45°.

90D103-03-12-84

Figure 1-99. Horizontal Stabilizer Backup Controls Torque Tube Hardware Repair Limits (Sheet 3)

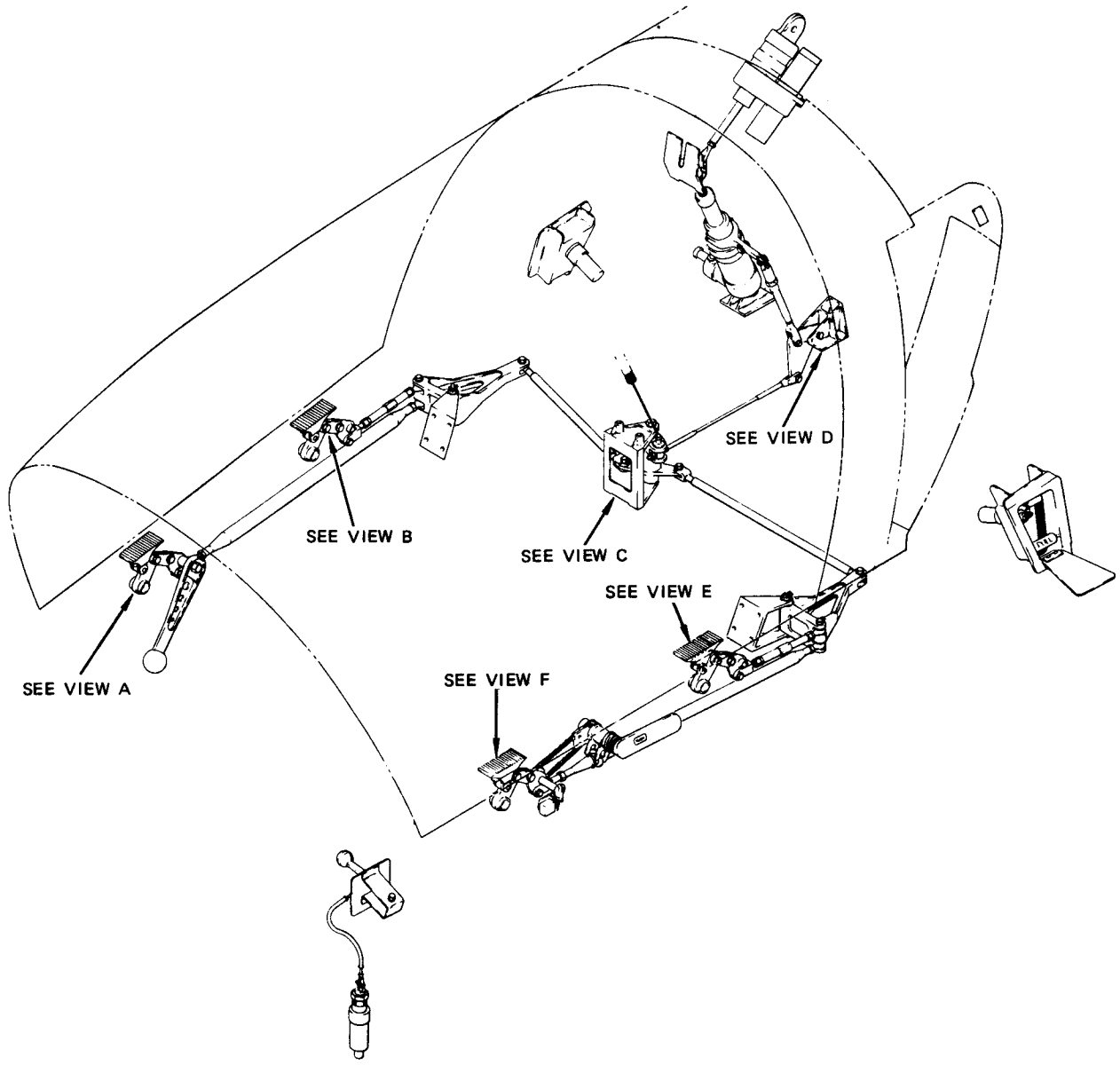


Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 1 of 11)

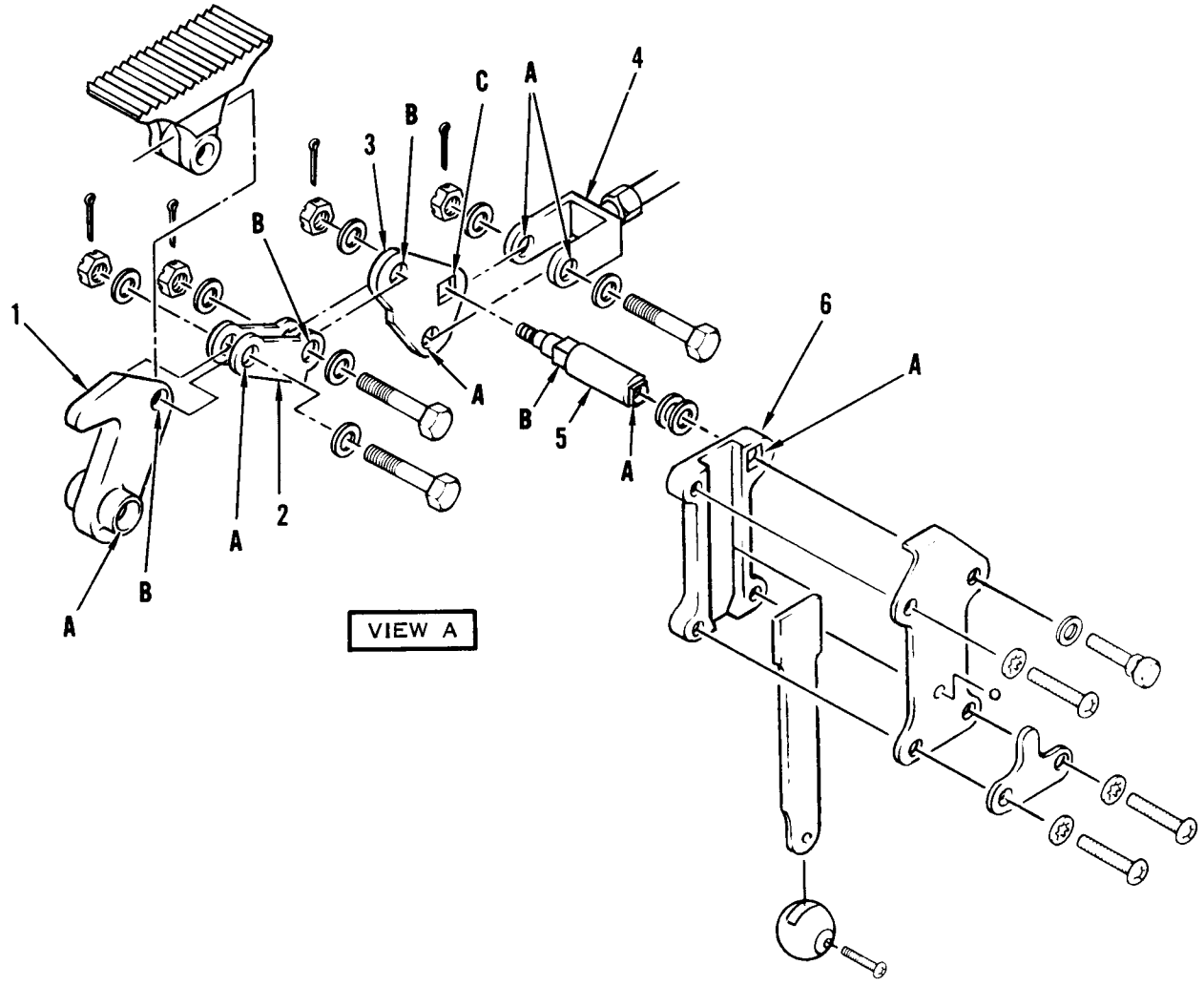


Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 2)

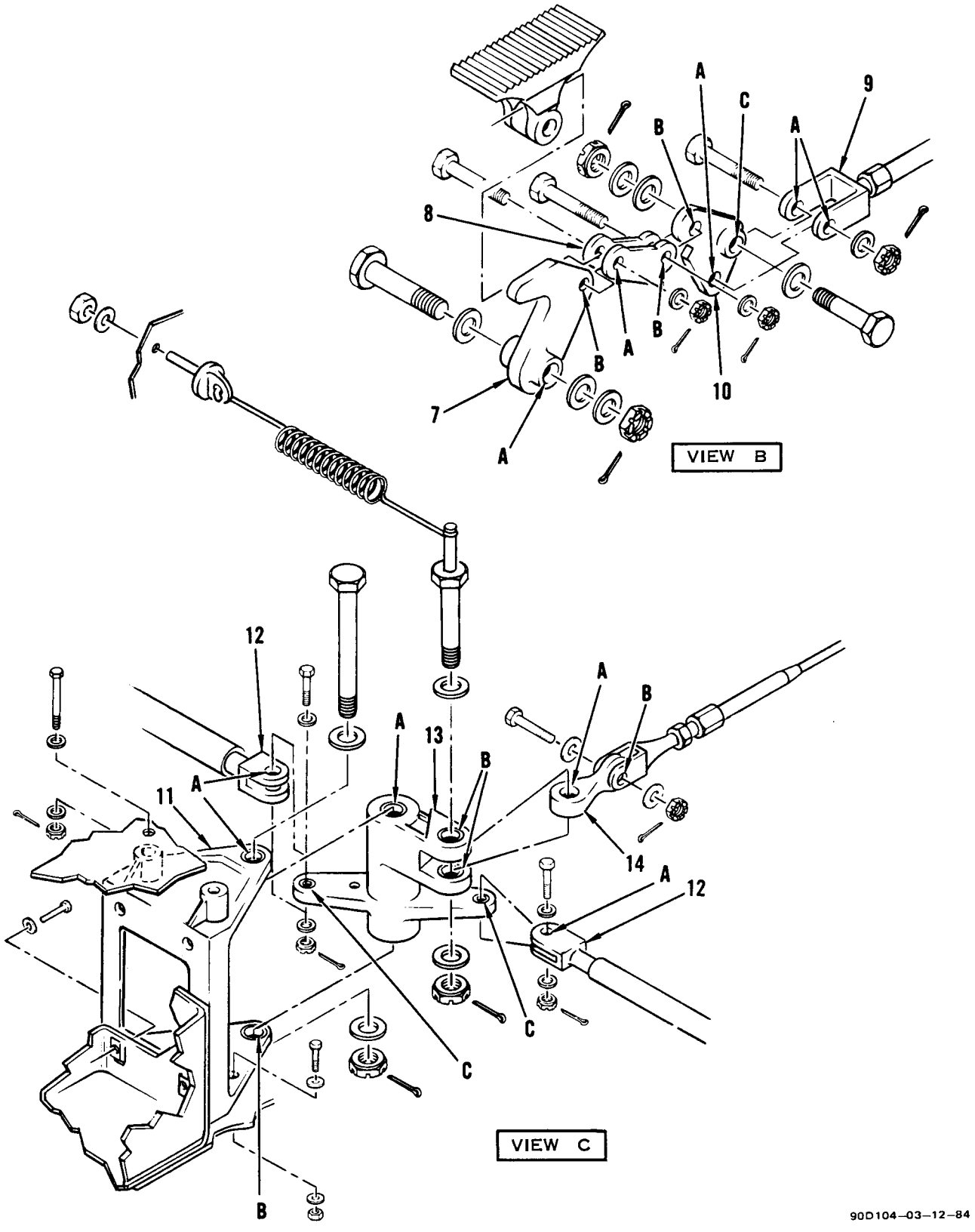


Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 3)

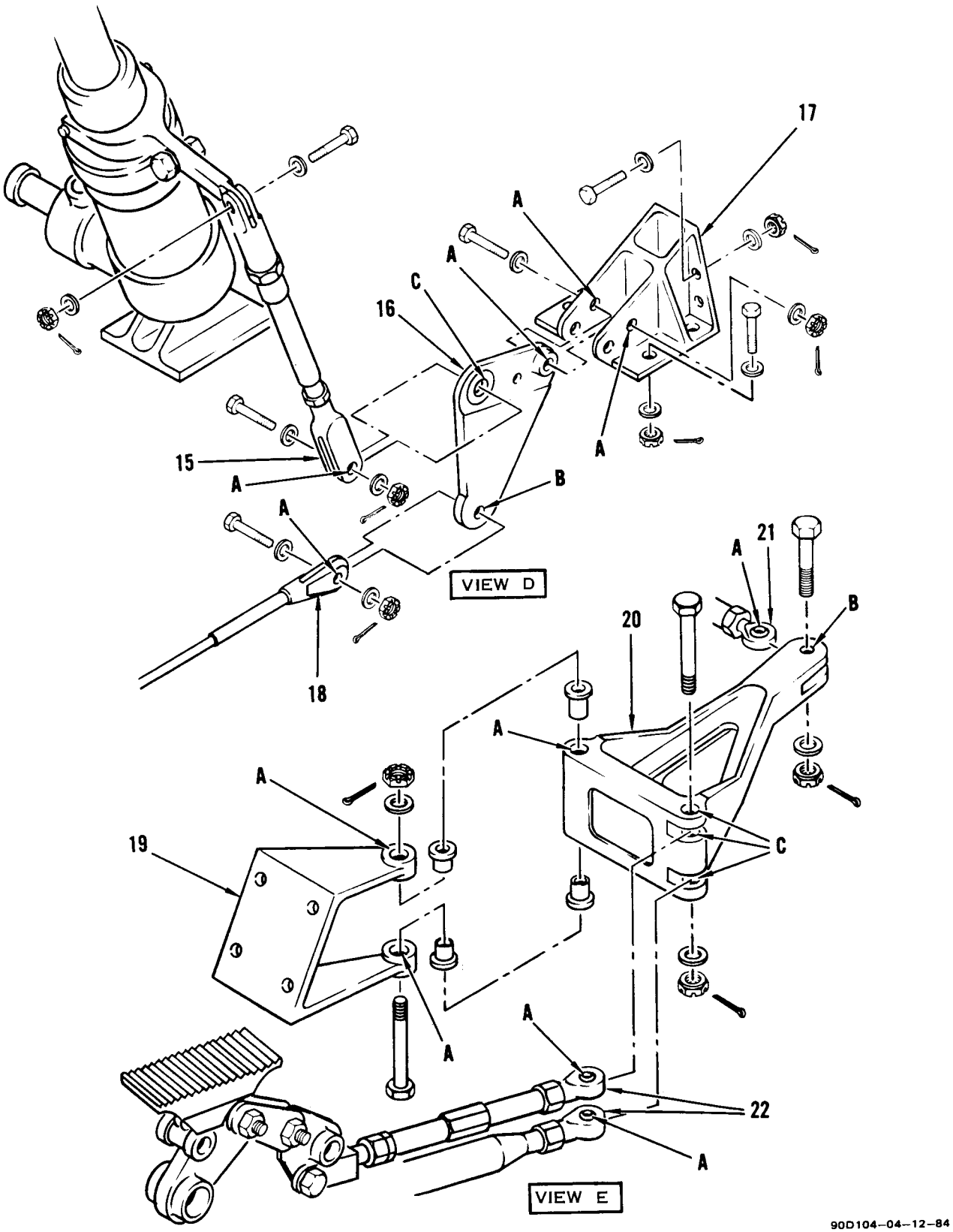
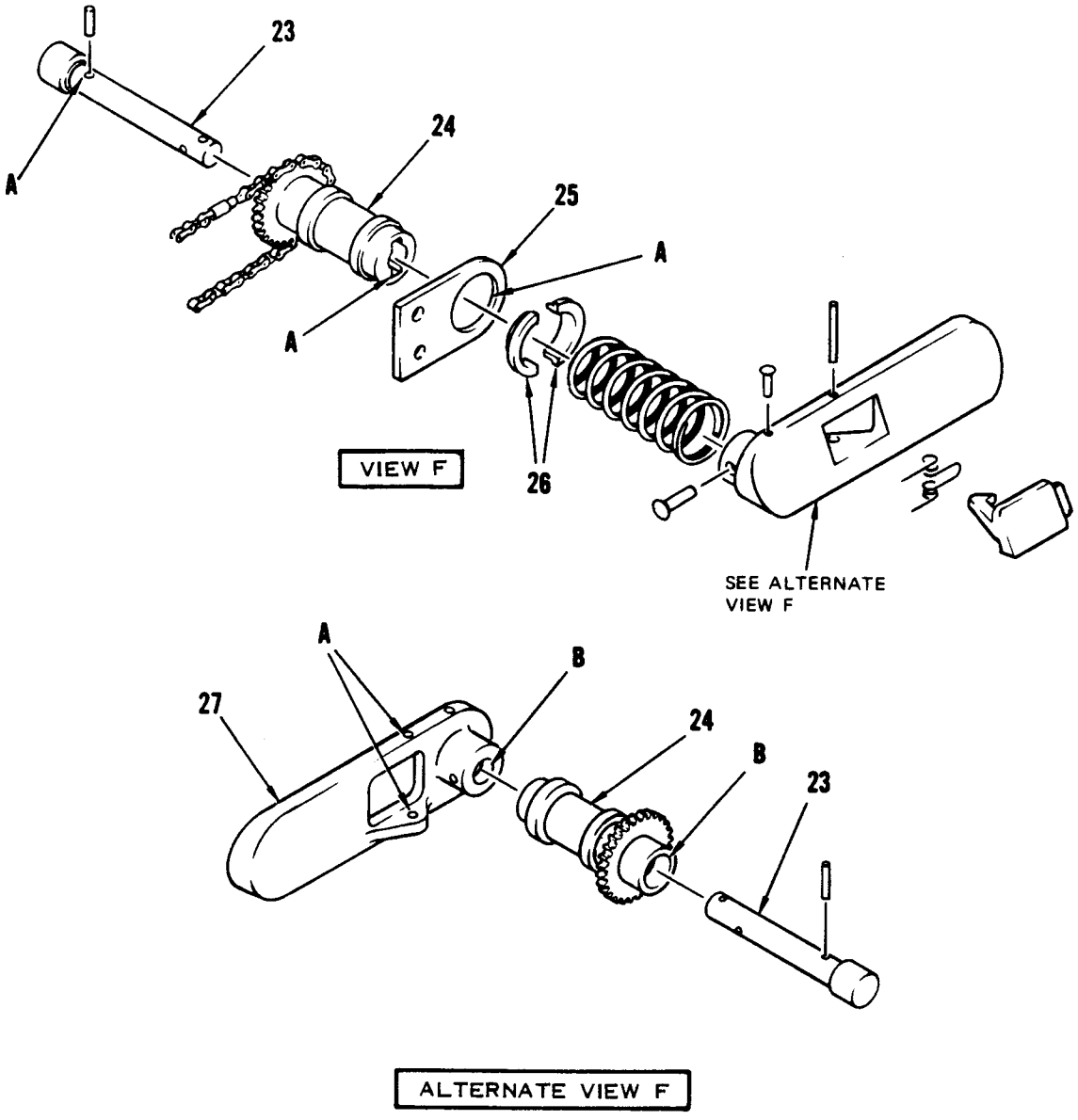


Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 4)



90D104-05-09-87

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 5)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Hook 215-20441	A	Bolt NAS464-8-30	0.5005	0.4986	0.0019	0.5015	0.4975
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
2	Link CV15-490533	A	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
3	Link, Drive 215-20619	A	Bolt NAS464-4-8	0.2505	0.2487	0.0018	0.2515	0.2475
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
		C	Shaft, Shouldered 215-20443	0.4470	0.4320	0.0150	0.4550	0.4240
4	Rod End 215-20439	A	Bolt NAS464--4-8	0.2505	0.2487	0.0018	0.2515	0.2475
5	Shaft, Shouldered 215-20443	A	Square Shoulder Short	0.4470	0.4320	0.0150	0.4550	0.4240
		B	Square Shoulder Long	0.4420	0.4320	0.0100	0.4470	0.4270
6	Plate 218-20692	A	Square Hole (215-20443)	0.4420	0.4320	0.0100	0.4470	0.4270
7	Hook 215-20441	A	Bolt NAS464-8-30	0.5005	0.4986	0.0019	0.5015	0.4975
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
8	Link CV15-490533	A	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100

90D104-06-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 6)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
9	Rod End 215-20439	A	Bolt NAS464-4-8	0.2505	0.2487	0.0018	0.2515	0.2475
10	Link, Drive 215-20440	A	Bolt NAS464-4-8	0.2505	0.2487	0.0018	0.2515	0.2475
		B	Bolt NAS464-5-9	0.3130	0.3112	0.0018	0.3140	0.3100
		C	Bolt NAS464-7-30	0.4380	0.4362	0.0018	0.4390	0.4350
11	Bracket Assy 215-20307							
	Bushing NAS538B5P29	A	Bolt NAS464-5-73	0.3125	0.3112	0.0013	0.3130	0.3100
	Bushing NAS538B5P35	B	Bolt NAS464-5-73	0.3125	0.3112	0.0013	0.3130	0.3100
12	Rod End 215-20438	A	Bolt NAS464-4-11	0.2505	0.2487	0.0018	0.2515	0.2475
13	Bellcrank Assy 215-20305							
	Bearing HSBG-5	A	Bolt NAS464-5-73	0.3125	0.3112	0.0013	0.3130	0.3105
	Bushing NAS538B3P15	B	Bolt 215-20590	0.1900	0.1850	0.0050	0.1925	0.1825
	Bushing NAS538B4P14	C	Bolt NAS464-4-11	0.2500	0.2487	0.0013	0.2515	0.2475
14	Universal Rod 215-20586	A	Eyebolt 215-20590	0.1910	0.1900	0.0010	0.1915	0.1895
		B	Bolt NAS464-4-7	0.2570	0.2487	0.0083	0.2610	0.2445
15	Clevis, Rod End 215-20447	A	Bolt NAS464-4-10	0.2505	0.2487	0.0018	0.2515	0.2475
16	Bellcrank Assembly 215-20309	A	Bolt NAS464-4-20	0.2505	0.2487	0.0018	0.2515	0.2475
		B	Bolt NAS464-4-8	0.2570	0.2487	0.0083	0.2610	0.2445
	Bushing HSBG-4	C	Bolt NAS464-4-10	0.2500	0.2487	0.0013	0.2515	0.2475

90D104-07-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 7)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
17	Bracket 215-20308							
	Bushing NAS538B4P15	A	Bolt NAS464-4-20	0.2500	0.2487	0.0013	0.2515	0.2475
18	Cable Assembly NAS305-02-0100	A	Bolt NAS464-4-8	0.2520	0.2487	0.0033	0.2540	0.2470
19	Bracket Assembly 215-20306							
	Bushing NAS538B4P25	A	Bolt NAS1304-44DH	0.2505	0.2485	0.0020	0.2515	0.2475
20	Bellcrank Assembly 215-20310							
	Bushing NAS538B4P16	A	Bolt NAS1304-44DH	0.2505	0.2485	0.0020	0.2515	0.2475
		B	Bolt NAS464-4-10	0.2505	0.2487	0.0018	0.2515	0.2475
		C	Bolt NAS464-4-31	0.2505	0.2487	0.0018	0.2515	0.2475
21	Rod End DREM4	A	Bolt NAS464-4-10	0.2500	0.2487	0.0013	0.2515	0.2475
22	Rod End DREM4	A	Bolt NAS464-4-31	0.2500	0.2487	0.0013	0.2515	0.2475
23	Shaft Assembly 215-20433	A	Pin 215-20433	0.1870	0.1875	Interference Fit	None	None
24	Shaft 215-20589	A	Shaft 215-20433	0.5020	0.4900	0.0120	0.5080	0.4840
		B	Shaft 215-20433	0.8140	0.8000	0.0140	0.8210	0.7930
25	Bracket 215-20435	A	Bushing 215-20593	1.1565	1.1510	0.0055	1.1590	1.1480
26	Bushing 215-20593	A	Shaft 215-20589	0.9385	0.9350	0.0035	0.9400	0.9330
27	Handle, External 215-20432	A	Pin NAS561-P4-20	0.1270	0.1250	0.0020	0.1300	0.1220
		B	Shaft 215-20433	0.5000	0.4900	0.0100	0.5050	0.4850

90D104-08-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 8)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Hook 215-20441	A	None					
		B	None					
2	Link CV15-490533	A	None					
		B	None					
3	Link, Drive 215-20619	A	None					
		B	None					
		C	None					
4	Rod End 215-20439	A	None					
5	Shaft, Shouldered 215-20443	A	None					
		B	None					
6	Fitting, Release Handle 215-20677	A	None					
		B	None					
7	Hook 215-20441	A	None					
		B	None					
8	Link CV15-490533	A	None					
		B	None					
9	Rod End 215-20439	A	None					
10	Link, Drive 215-20440	A	None					
		B	None					
		C	None					
11	Bracket Assy 215-20307							
	Bushing NAS538B5P29	A	0.4380	Aluminum Bronze	85,000 to 90,000	0.3010	0.3125	125
	Bushing NAS538B5-P29	B	0.4380	Aluminum Bronze	85,000 to 90,000	0.3010	0.3125	125
12	Rod End 215-20438	A	None					

90D104-09-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 9)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
13	Bellcrank Assembly 215-20305							
	Bearing HSBG-5	A	0.7503	Aluminum Bronze	85,000 to 90,000	0.3120	0.3125	63
	Bushing NAS538B3P15	B	0.3130	Aluminum Bronze	85,000 to 90,000	0.1790	0.1900	63
	Bushing NAS538B4P14	C	0.3755	Aluminum Bronze	85,000 to 90,000	0.2380	0.2500	63
14	Universal Rod 215-20586	A	None					
		B	None					
15	Clevis, Rod End 215-20447	A	None					
16	Bellcrank Assembly 215-20309	A	None					
		B	None					
	Bushing HSBG-4	C	0.6565	Aluminum Bronze	85,000 to 90,000	0.2495	0.2500	63
17	Bracket 215-20308							
	Bushing NAS538B4P15	A	0.3755	Aluminum Bronze	85,000 to 90,000	0.2380	0.2500	63
18	Cable Assembly NAS305-02-0100	A	None					
19	Bracket Assembly 215-20306							
	Bushing NAS538B4-P25	A	0.3755	Aluminum Bronze	85,000 to 90,000	0.2380	0.2500	63
20	Bellcrank Assembly 215-20310							
	Bushing NAS538B4-P16	A	0.3755	Aluminum Bronze	85,000 to 90,000	0.2380	0.2500	63
		B	None					
		C	None					
21	Rod End DREM4	A	None					
22	Rod End DREM4	A	None					
23	Shaft 215-20433	A	None					

90D104-10-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 10)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
24	Shaft 215-20589	A	None					
		B	None					
25	Bracket 215-20435	A	None					
26	Bushing 215-20593	A	None					
27	Handle, External 215-20432	A	None					

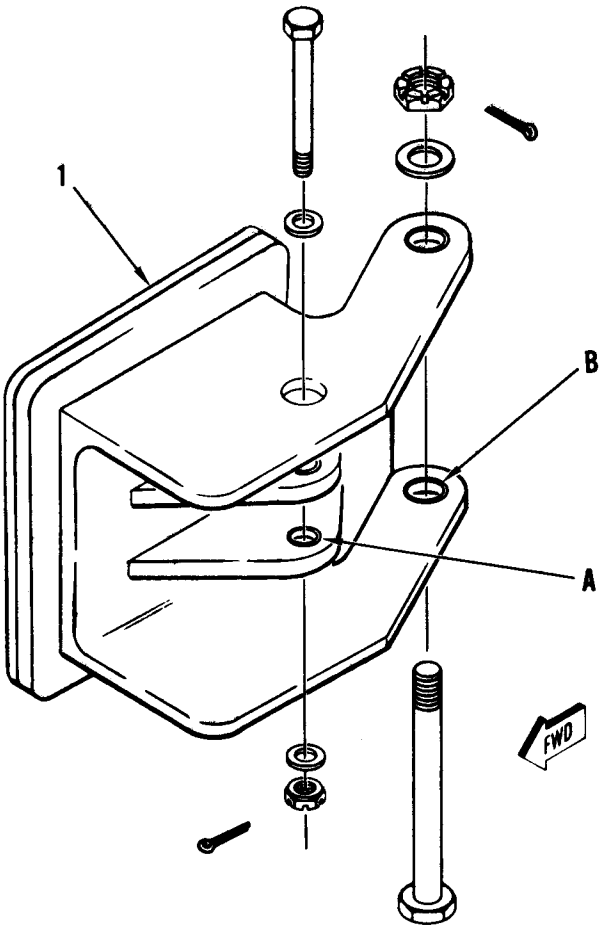
NOTE

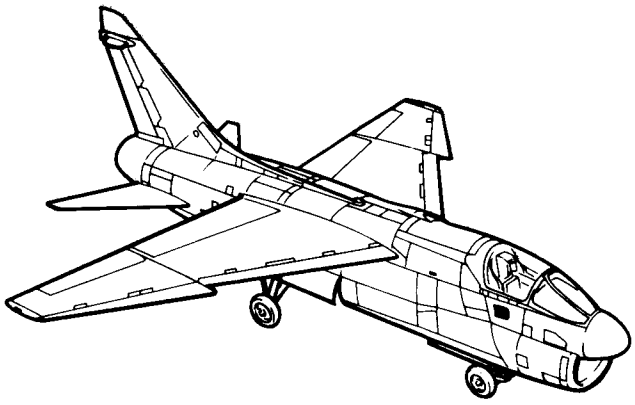
1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.

2. Wear allowance includes manufacturing allowance.

90D104-11-12-84

Figure 1-100. Canopy Release Mechanism Hardware Repair Limits (Sheet 11)





PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Hole ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Scoop Assembly CV15-406795							
	Bushing CVC481-3-21	A	Bolt NAS1303-15D	0.2250	0.1885	0.0365	0.2350	0.1875
	Bushing CVC481-3-21	B	Bolt NAS1303-40	0.1905	0.1885	0.0020	0.1915	0.1875

90D910-01-07-87

Figure 1-100.1. Ram Air Scoop Assembly Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

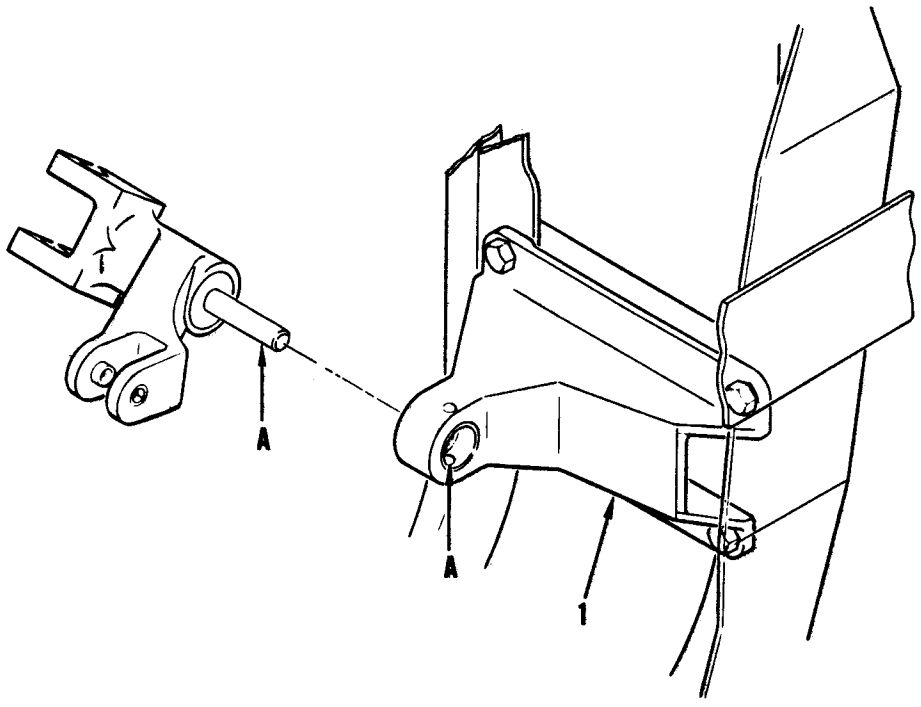
Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Microinches)
1	Scoop Assembly CV15-406795							
	Bushing CVC481-3-21	A	0.3130	4130 Steel	125,000 to 145,000	0.2180	0.2250	125
	Bushing CVC481-3-21	B	0.3130	4130 Steel	125,000 to 145,000	0.1895	0.1905	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D910-02-07-87

Figure 1-100.1. Ram Air Scoop Assembly Repair Limits (Sheet 2)



90D105-01-12-84

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)		
							Hole	Shaft	
1	Support Assembly, Pivot, Throttle Control 216-48311								
	Bearing 218-48400	A	Adapter 215-48407	0.3755	0.3733	0.0022	0.3765	0.3723	

Figure 1-101. Engine Throttle Control Support Bearing Repair Limits (Sheet 1 of 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Support Assembly, Pivot, Throttle Control 216-48311							
	Bearing 218-48400	A	0.8750	Aluminum Bronze, Steel		0.3745	0.3755	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with instructions given in REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.

90D105-02-12-84

Figure 1-101. Engine Throttle Control Support Bearing Repair Limits (Sheet 2)

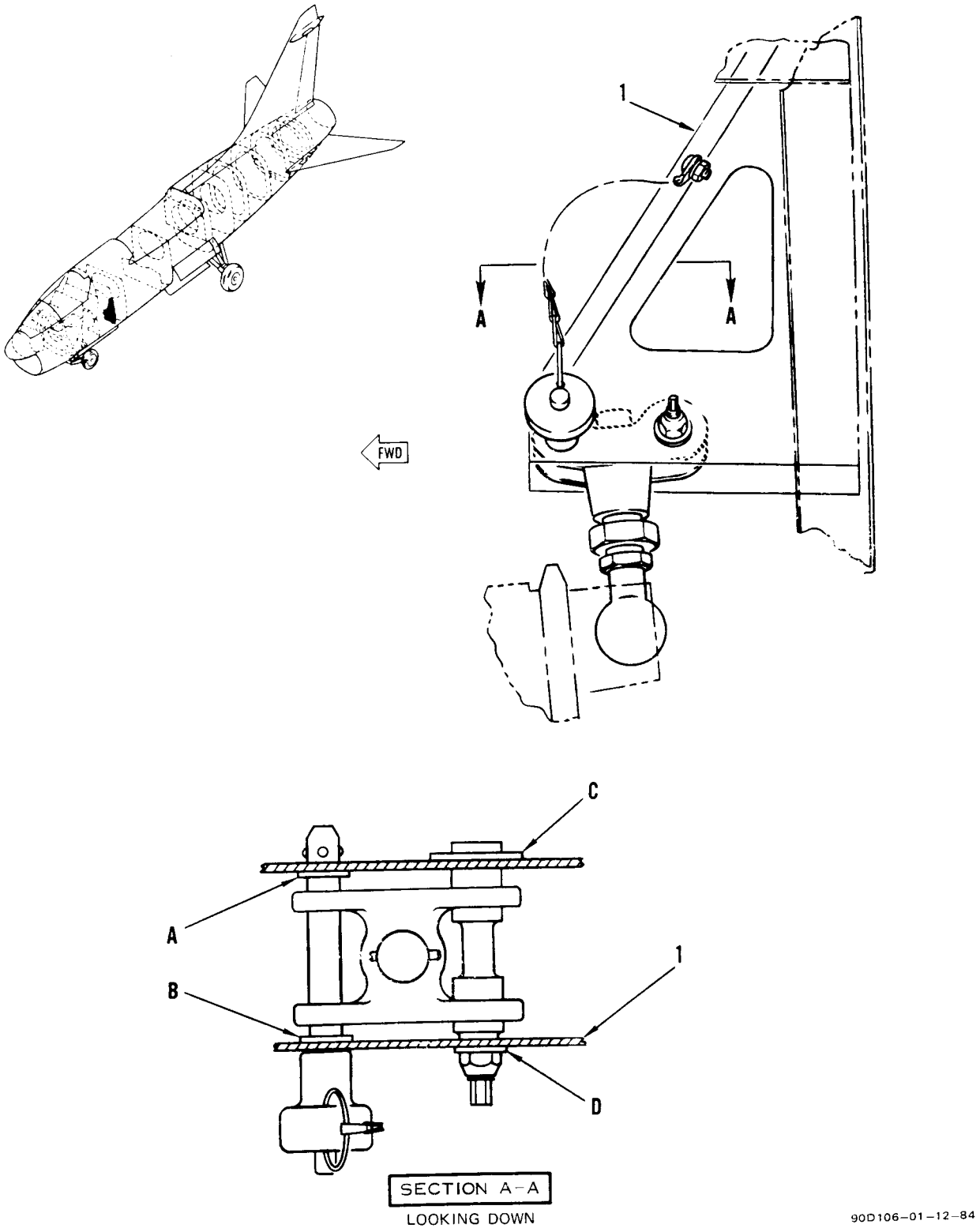


Figure 1-102. Aft Gun Mount Support Assembly Bushing Repair Limits (Sheet 1 of 3)

PERMISSIBLE WEAR ALLOWANCES

Index No.	Part Description	Hole	Shaft Description	Mfd Max Shaft ID (Inches)	Mfd Min Shaft OD (Inches)	Mfd Max Allowance (Inches)	Wear Maximum Allowances (Inches)	
							Hole	Shaft
1	Aft Gun Mount Support Assembly 216-20646-3 (Note 3) 216-20646-5 (Note 4)							
	Bushing	A	Pin					
	NAS538-8P12 (Note 3)		NAS1338A3C29F	0.5010	0.4970	0.0040	0.5030	0.4960
	CVC347-8-220 (Note 4)		NAS1338A3C29F	0.5010	0.4970	0.0040	0.5030	0.4960
	Bushing	B	Pin					
	NAS538-8P12 (Note 3)		NAS1338A3C29F	0.5010	0.4970	0.0040	0.5030	0.4960
	CVC347-8-220 (Note 4)		NAS1338A3C29F	0.5010	0.4970	0.0040	0.5030	0.4960
	Bushing	C	Shaft					
	NAS538-12P12 (Note 3)		216-29412-1	0.7510	0.7458	0.0052	0.7530	0.7448
	CVC347-12-220 (Note 4)		216-29412-1	0.7510	0.7458	0.0052	0.7530	0.7448
	Bushing	D	Shaft					
	NAS538-6P12		216-29412-1	0.3760	0.3700	0.0060	0.3780	0.3690

Index No.	Part Description	MFD Deminsions	MFD Tolerance	Max Allowable Wear
	Spherical Ball	1.499	+0.000 −0.002	0.004

90D106-02-12-84

Figure 1-102. Aft Gun Mount Support Assembly Bushing Repair Limits (Sheet 2)

PERMISSIBLE REAMING AND BUSHING LIMITS

Index No.	Part Description	Hole	Hole Max Allow Ream Dia (Inches)	Bushings (Note 1)				
				Material	Heat Treat (PSI)	Finished Min ID (Inches)	Finished Max ID (Inches)	Machine Finished (Micro-inches)
1	Aft Gun Mount Support Assembly 216-20646-3 (Note 3) 216-20646-5 (Note 4)							
	Bushing NAS538-8P12 (Note 3)	A	0.6255	4130 Steel	125,000 to 145,000	0.5000	0.5010	125
	CVC347-8-220 (Note 4)		0.6255	4130 Steel	125,000 to 145,000	0.5000	0.5010	125
	Bushing NAS538-8P12 (Note 3)	B	0.6255	4130 Steel	125,000 to 145,000	0.5000	0.5010	125
	CVC347-8-220 (Note 4)		0.6255	4130 Steel	125,000 to 145,000	0.5000	0.5010	125
	Bushing NAS538-12P12 (Note 3)	C	0.9380	4130 Steel	125,000 to 145,000	0.7500	0.7510	125
	CVC347-12-220 (Note 4)		0.9380	4130 Steel	125,000 to 145,000	0.7500	0.7510	125
	Bushing NAS538-6P12	D	0.5005	4130 Steel	125,000 to 145,000	0.3750	0.3760	125

NOTE

1. Unless otherwise specified, observe the following:
   A. Install bushings in accordance with REAMING AND BUSHING.
   B. Ream bushings to finished size and specified machine finish after installation.
2. Wear allowance includes manufacturing allowance.
3. Airplanes through AF69-6207.
4. Airplanes AF69-6208 and subsequent.

90D106-03-12-84

Figure 1-102. Aft Gun Mount Support Assembly Bushing Repair Limits (Sheet 3)

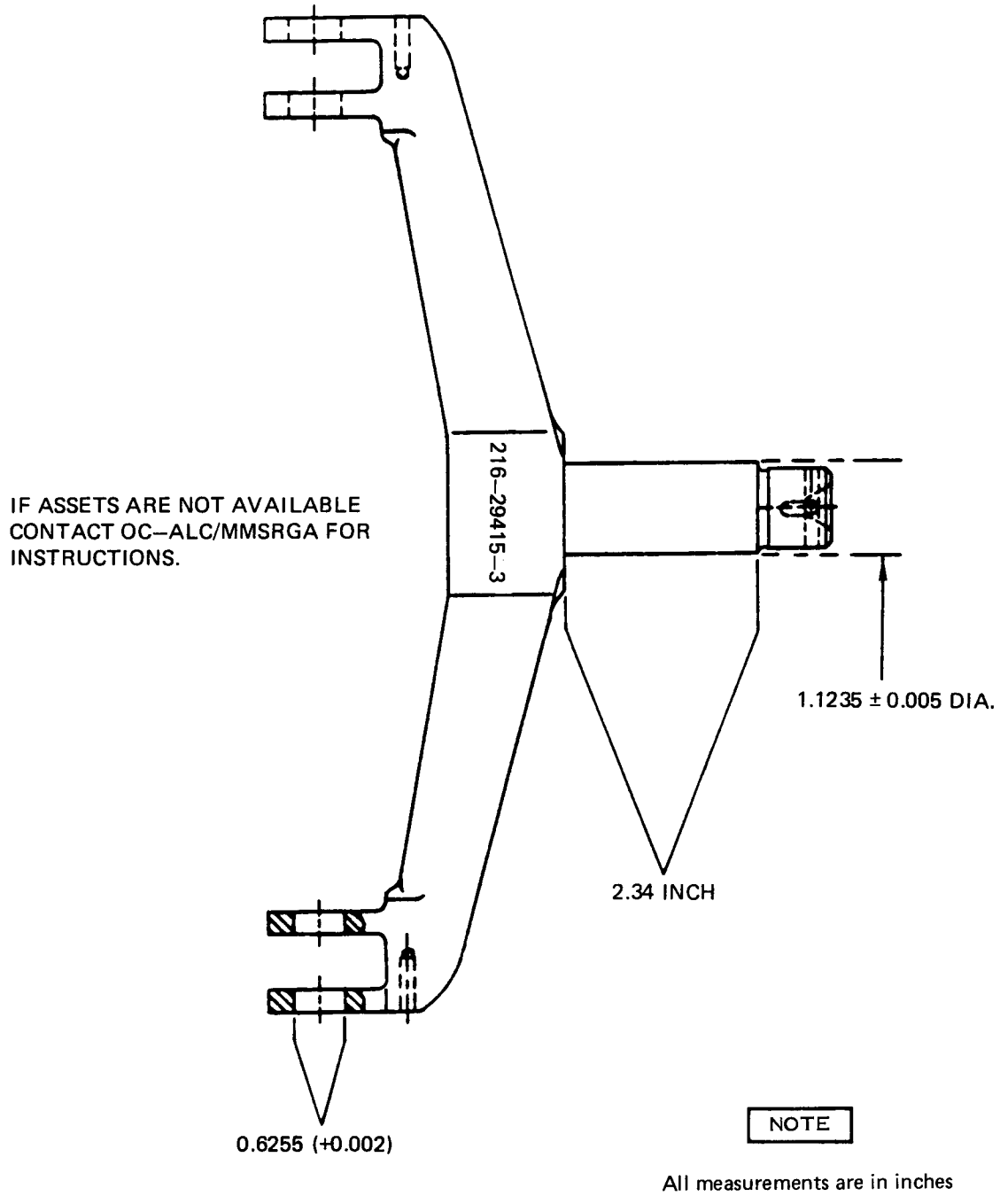


Figure 1-103. Forward Gun Mount Yoke Assembly Dimensions

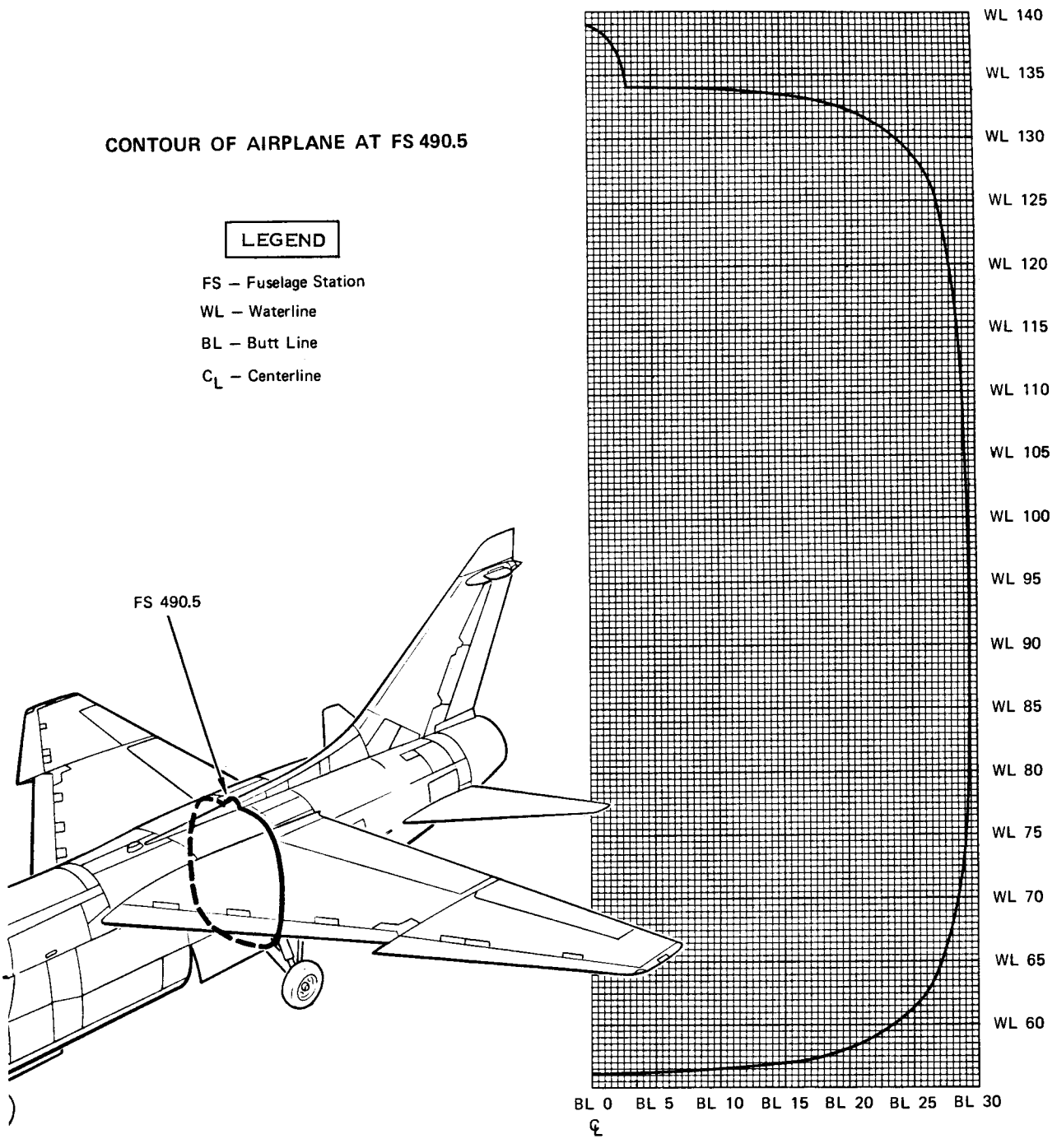
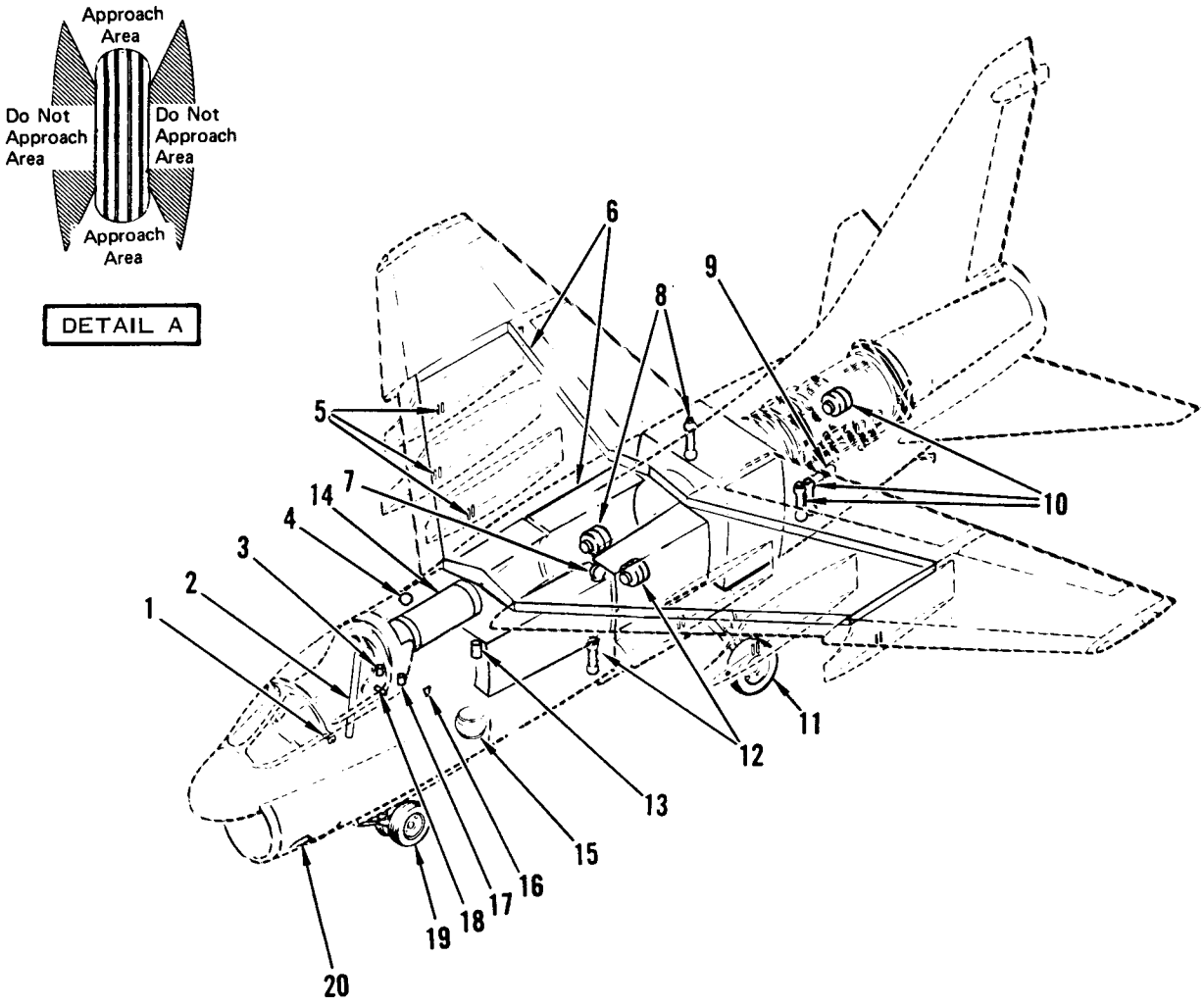


Figure 1-104. Typical Contour Data and Dimensions



LEGEND

1. Canopy jettison handle (internal)
2. Seat catapult
3. Emergency wheel brake accumulator (access 1123-1)
4. Emergency trailing edge and leading edge flap accumulators (access 2123-3)
5. Ejector cartridges (wing pylons)
6. Wing and fuselage fuel tanks
7. Accumulator pneumatic filler valve package (right wheel well)
8. PC No. 2 accumulator (access 6113-1) and reservoir (right wheel well)
9. Arresting gear accumulator (access 5223-2-1)
10. PC No. 3 accumulators (access 5222-1) and reservoir (access 5122-6)
11. Main gear shock strut and tires (hot tires – SEE DETAIL A)
12. PC No. 1 accumulator and reservoir (left wheel well)
13. Emergency landing gear accumulator (access 1123-3)
14. Ammunition drum (Access 1121–9)
15. Liquid oxygen converter (access 1222-3)
16. Canopy jettison handle (external)
17. Emergency power package accumulator (access 2123-3)
18. Wheel brake accumulator (access 1123-1)
19. Nose gear shock strut and tires
20. Gun port (left side)

90D109–12–84

Figure 1-105. Hazardous Component Locations

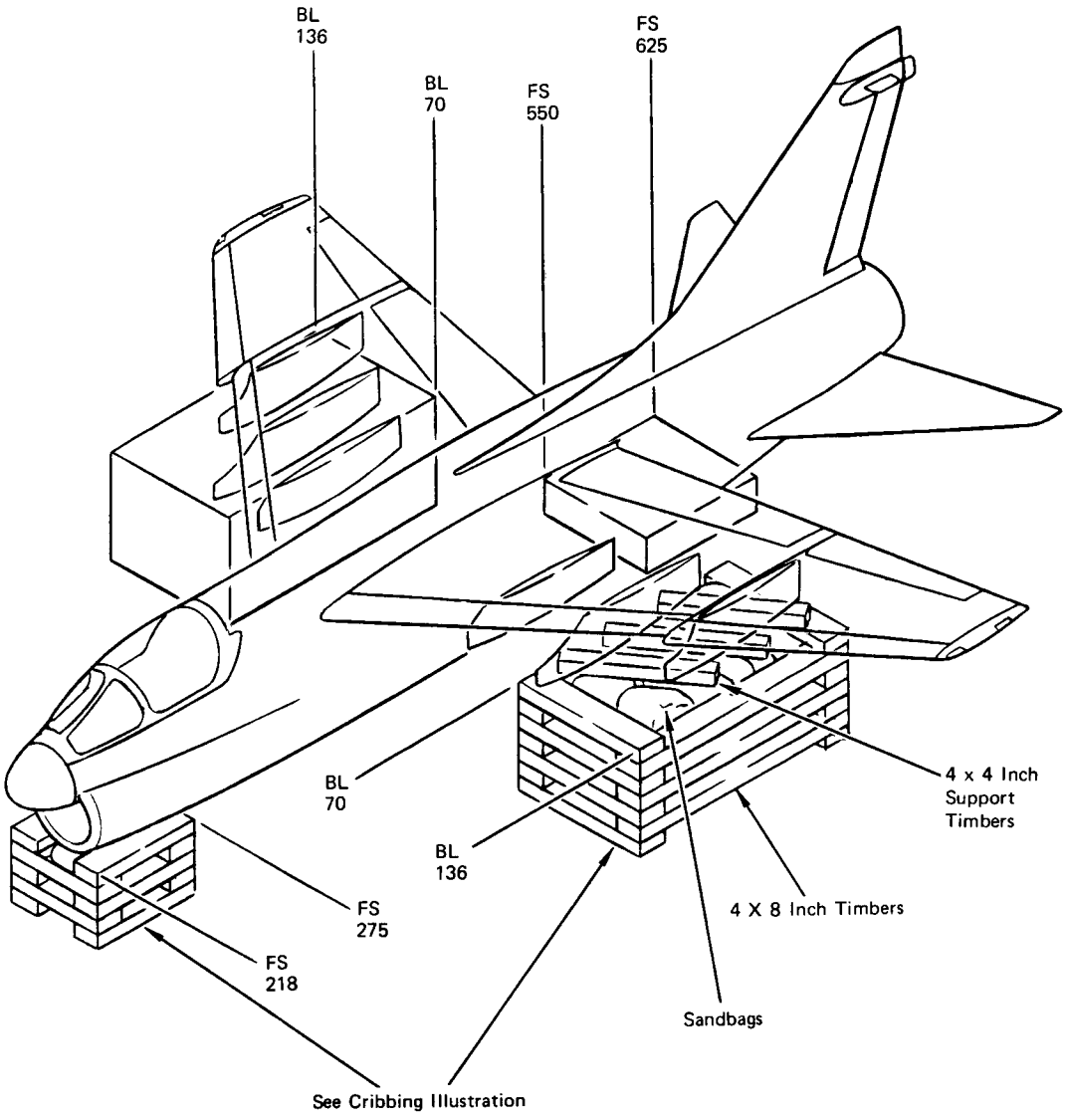
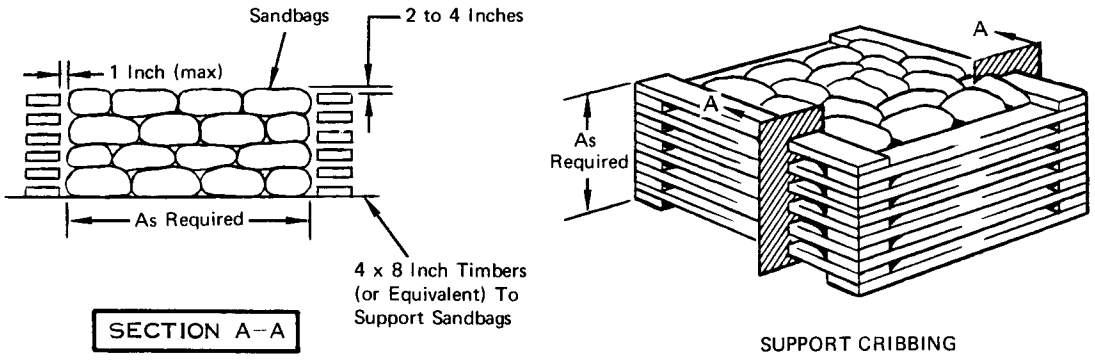


Figure 1-106. Sandbag and Cribbing Details (Sheet 1 of 2)



TYPICAL CRIBBING CONSTRUCTION

NOTE

1. Pylons must be installed to support airplane with cribbing and sandbags.

2. If landing gear tiedown points cannot be used, proceed as follows.
   a. On left side remove panels 1123-4 and 1222-8.
   b. Attach tiedown line to exposed portion of 216-20057 longeron at approximately FS 310.
   c. On right side remove panels 2123-6 and 2123-9.
   d. Attach tiedown line to exposed portion of 216-20024 bulkhead cap, passing line through cutout in bulkhead web.
   e. Extend lines outward and approximately 30° forward. Secure each to a stable object.
   f. Complete tiedown by using wingfold tiedown points in accordance with T.O. 1A-7D-2-1. On aft section, install lower adapters for vertical stabilizer lifting sling, S/N 315443. Attach tiedown lines to adapters and extend outward from fuselage for lateral stability. Secure to a stationary object.

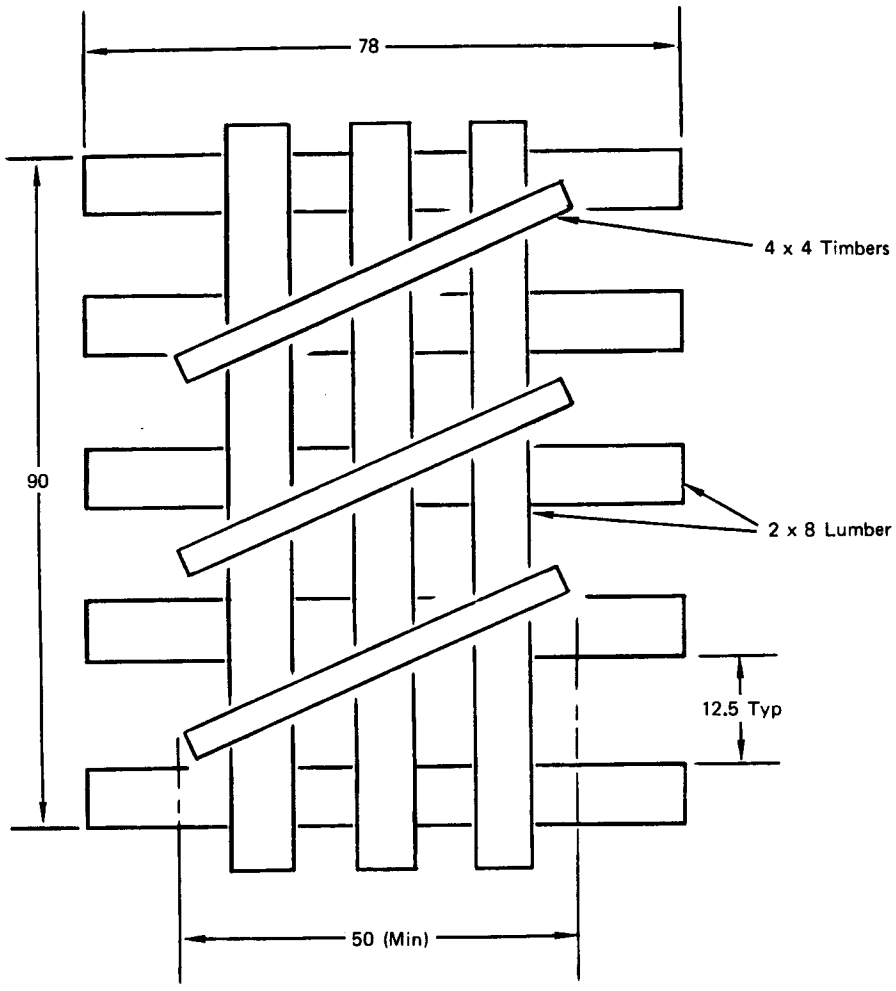
3. As large a weight percentage as possible must be supported by the wings. To ensure this, construct the sandbag supports so that as wing pylons just contact support timbers as airplane is lowered onto supports there will still be approximately 1 inch clearance between the nose and aft section supports and the fuselage. Most of the load will then be taken up by the wings before the nose and aft supports contact the fuselage.

4. Make sure airplane fuselage is supported entirely by sandbags and that cribbing does not contact airplane surface. Make sure wing pylons are contacted by support timbers and not by cribbing or sandbags.

5. For removal of cribbing and sandbags, the airplane must be raised by jacking or hoisting.

90D110-02-12-84

Figure 1-106. Sandbag and Cribbing Details (Sheet 2)



VIEW LOOKING DOWN

NOTE

1. Platform shown is for left side. For right side platform, slant the 4 x 4 timbers in the opposite direction.
2. Secure platform lumber and timbers in place with nails or nuts and bolts.
3. All dimensions are in inches.

90D111-12-84

Figure 1-107. Lifting Platform Details

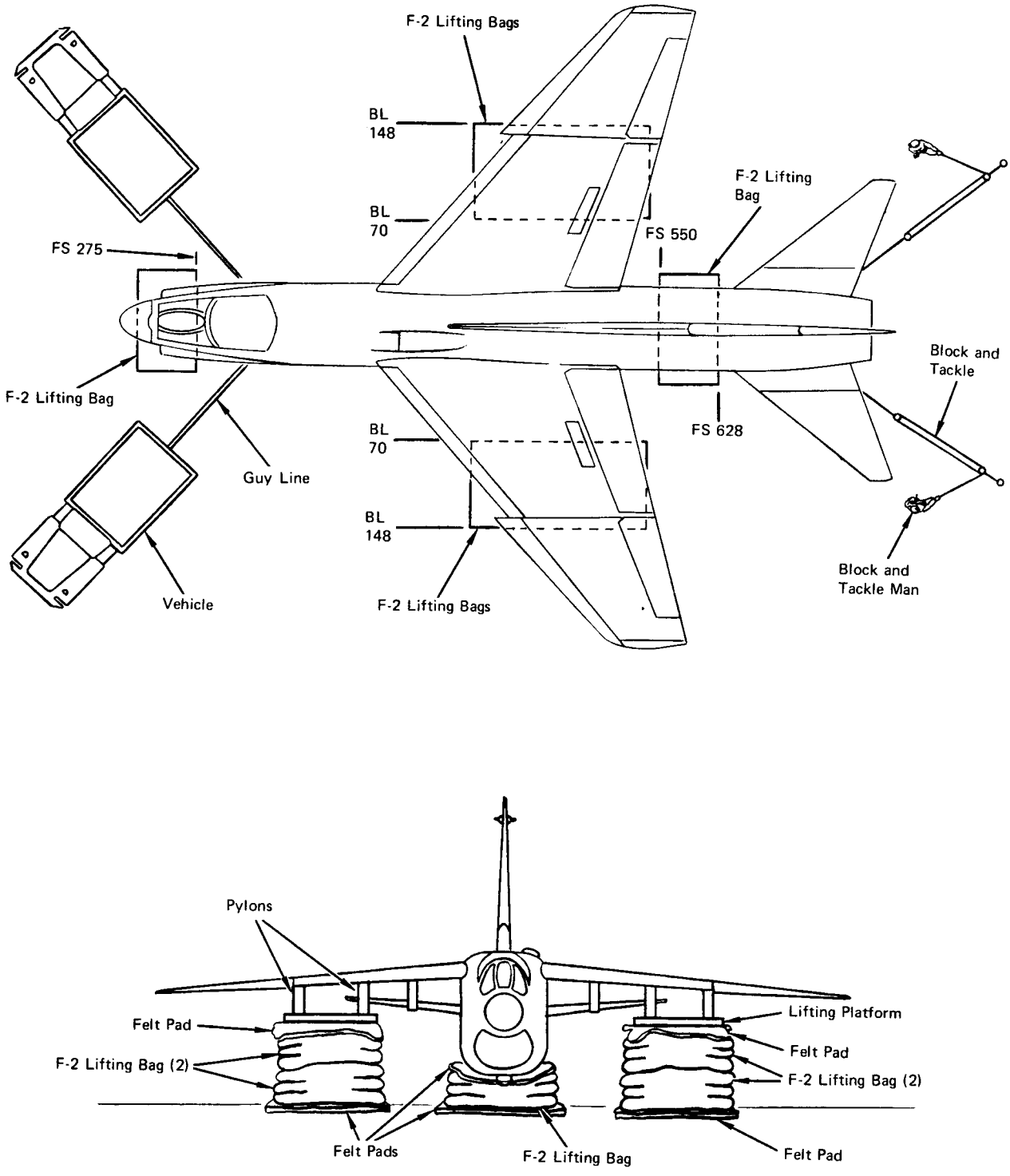
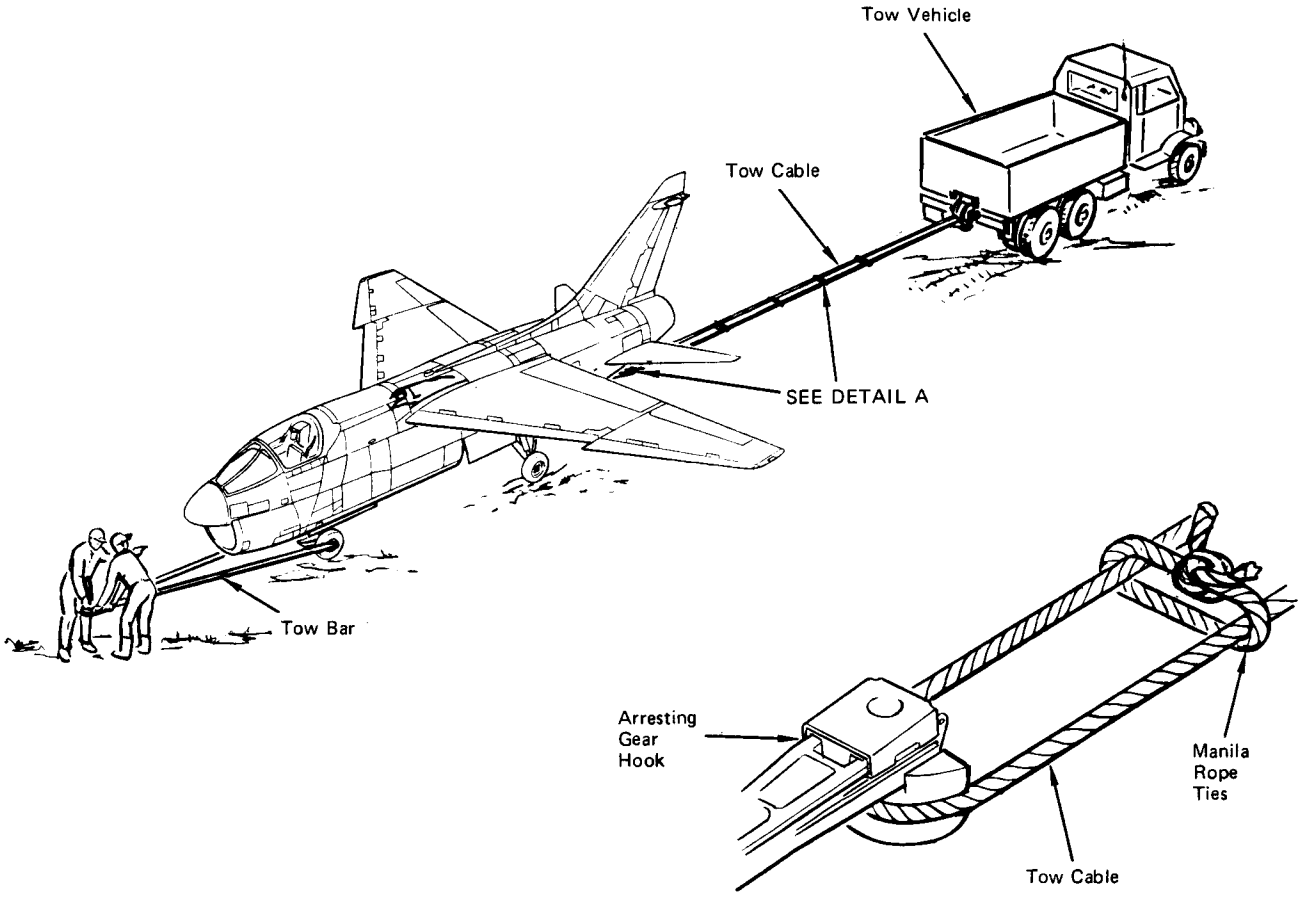


Figure 1-108. Lifting Damaged Airplane Using Pneumatic Lifting Bags

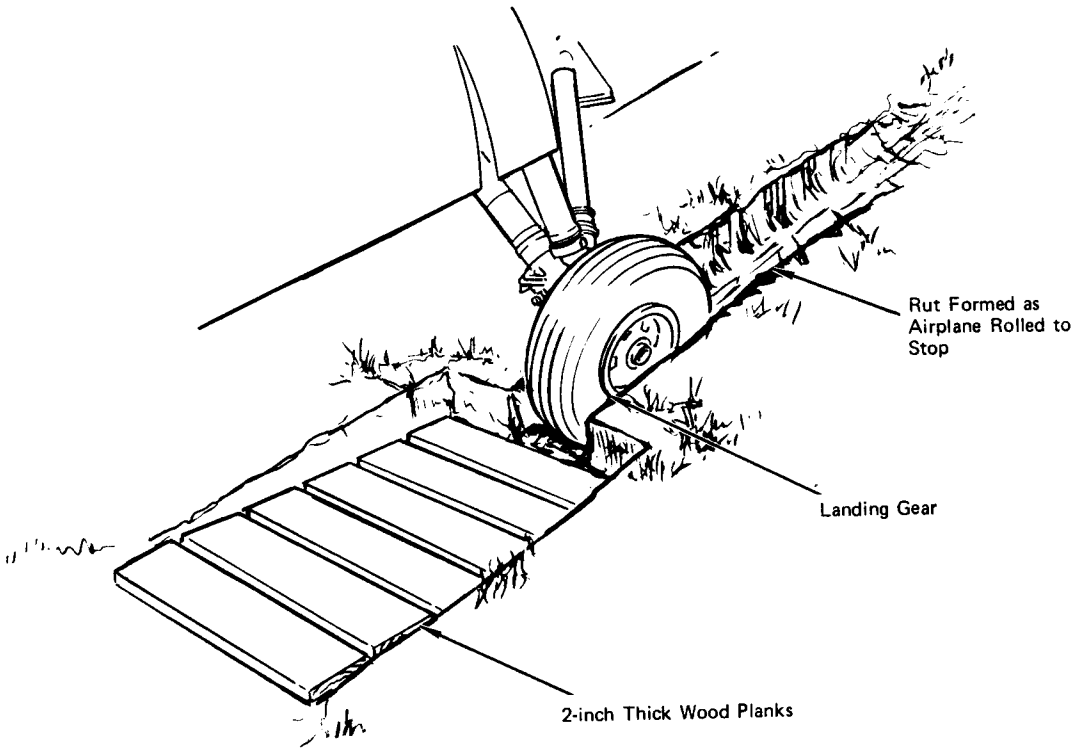


NOTE

1. Attach nose gear towbar to use for manual steering of airplane.
2. Pass tow cable around arresting hook and attach free end(s) to tow vehicle.
3. Tow cable must be capable of withstanding 30,000 pound pull.
4. Bridge cables together at frequent intervals with manila rope ties to prevent whipping action, damage to airplane, and injury to personnel in the event of a towing cable failure under load.

90D113-12-84

Figure 1-109. Towing Airplane Using Arresting Gear Hook

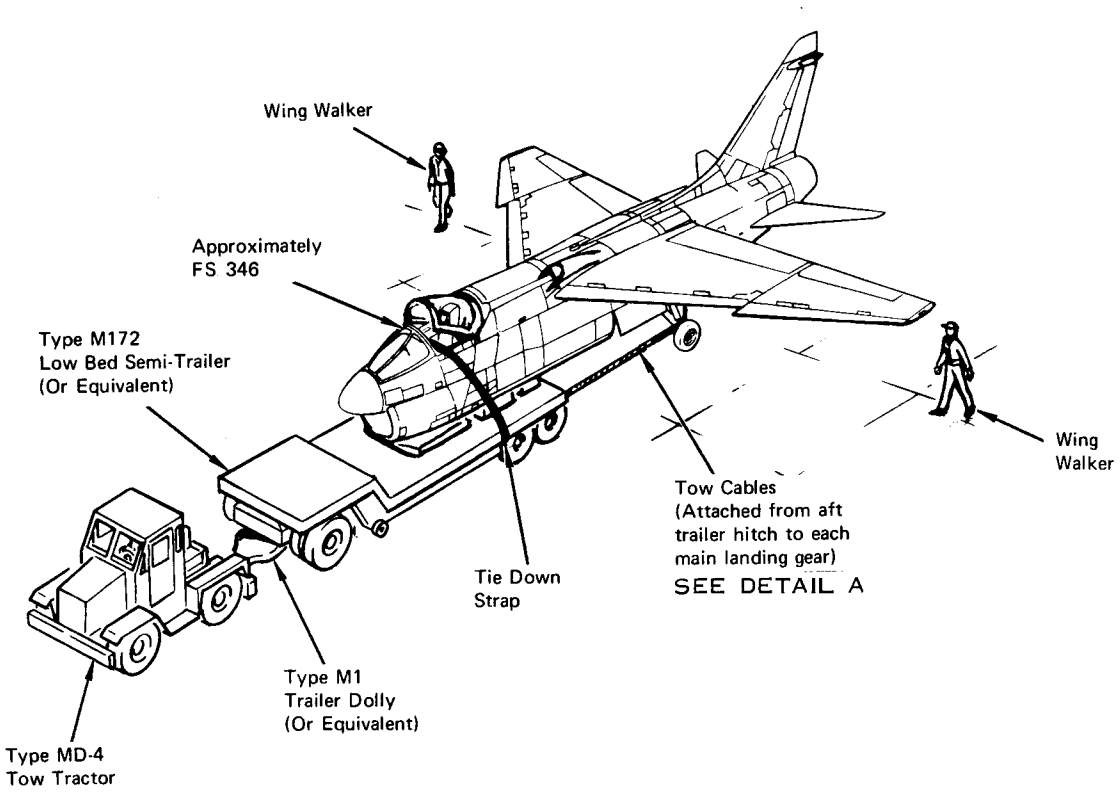


NOTE

1. Use this procedure if landing gear is sunken deeper than rim-deep.
2. Remove soil to form a ramp in the direction the airplane is to be towed. Repeat procedure for all effected wheels.
3. Position 2-inch thick wood planks on ramp to distribute weight of airplane.

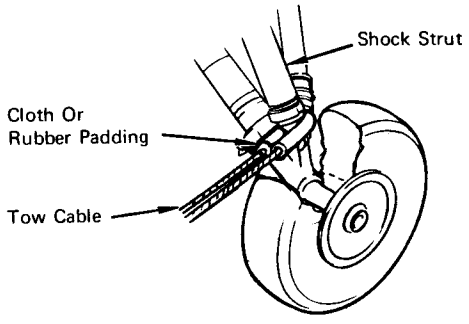
90D114-12-84

Figure 1-110. Towing Airplane Out of Soft Ground



NOTES

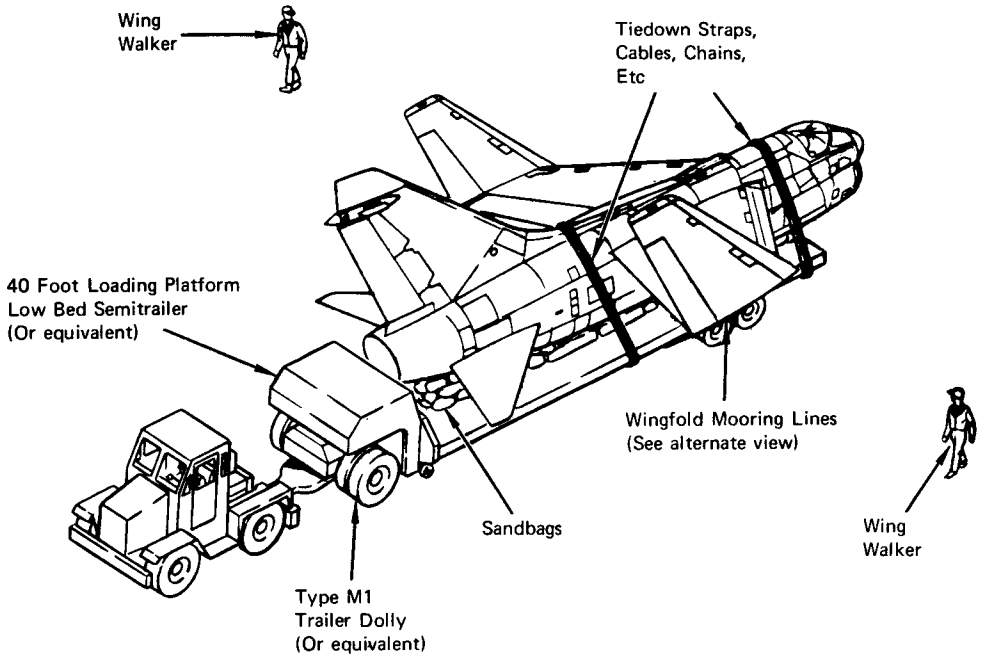
1. Lift aircraft using wing jacks, or crane and airplane hoisting sling as applicable.
2. Position trailer under airplane.
3. Inflate main gear shock struts as high as possible.
4. Protect airplane by positioning padding (cotton mattresses, felt pads, etc.) between airplane nose section and trailer bed.
5. Carefully lower nose of airplane onto trailer bed.
6. Secure airplane to trailer (using straps, padded cables, etc) as necessary.
7. Wing, horizontal stabilizer, and/or vertical stabilizer cap may be removed if necessary to reduce weight or clear obstructions.
8. Connect tow tractor to trailer dolly hitch.
9. Move airplane carefully and slowly.

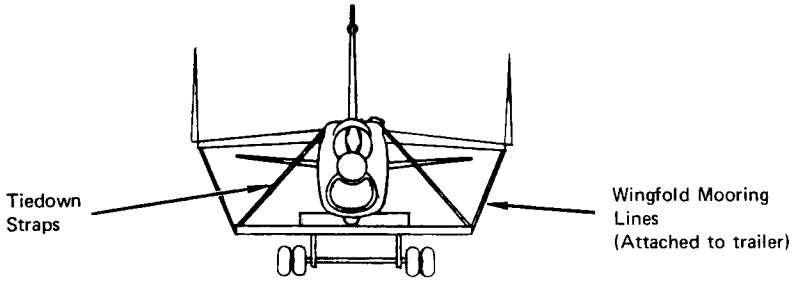


DETAIL A

90D115-12-84

Figure 1-111. Moving Airplane with Damaged Nose Landing Gear





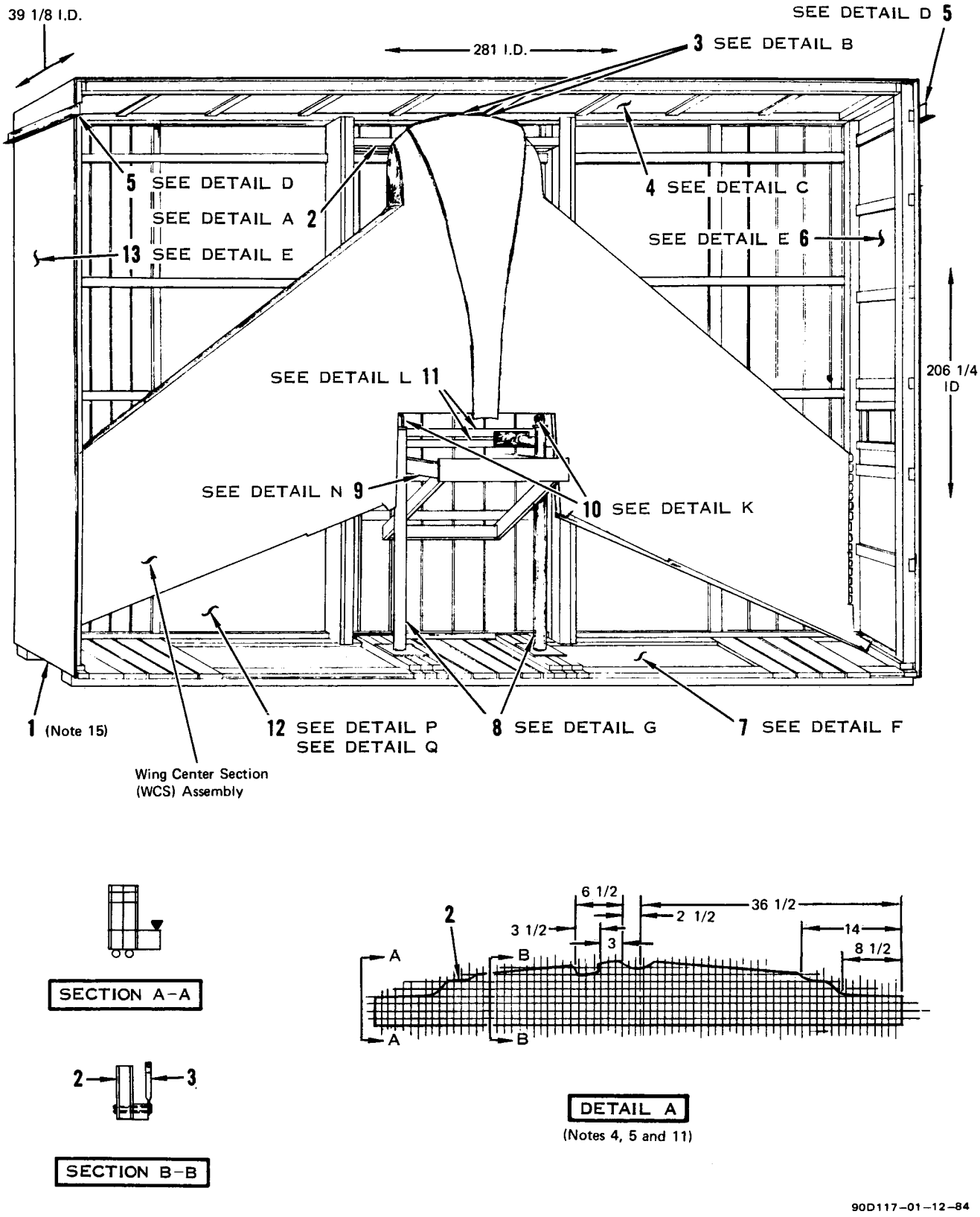
ALTERNATE VIEW

NOTE

1. Lift airplane using crane and airplane hoisting sling.
2. Position trailer under airplane.
3. Protect airplane by positioning padding (cotton mattresses, felt pads, sandbags, etc) between fuselage and trailer bed before positioning airplane on trailer.
4. Carefully lower airplane until supported by trailer.
5. Shore and crib around fuselage, using sandbags, to provide firm support.
6. Secure airplane to trailer (using straps, padded cables, etc) as necessary.
7. Wing, horizontal stabilizer, and vertical stabilizer cap may be removed if necessary to reduce weight or clear obstructions.
8. Connect a towing tractor to trailer dolly hitch.
9. Move airplane slowly and carefully; avoid jerking motions and hard bumps.

90D116-12-84

Figure 1-112. Moving Airplane with Damaged Main Landing Gear



SECTION A-A

SECTION B-B

DETAIL A

(Notes 4, 5 and 11)

90D117-01-12-84

Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 1 of 7)

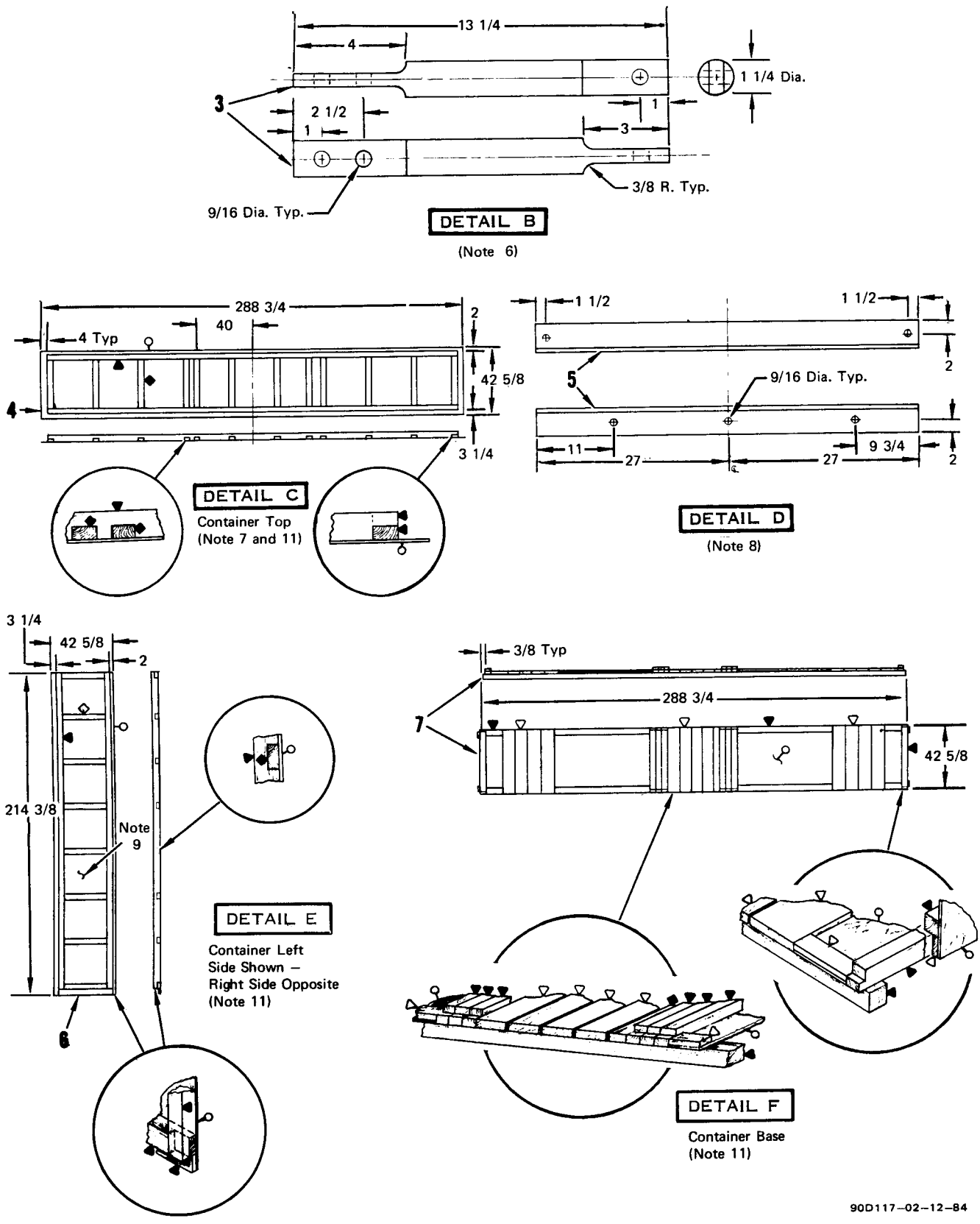


Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 2)

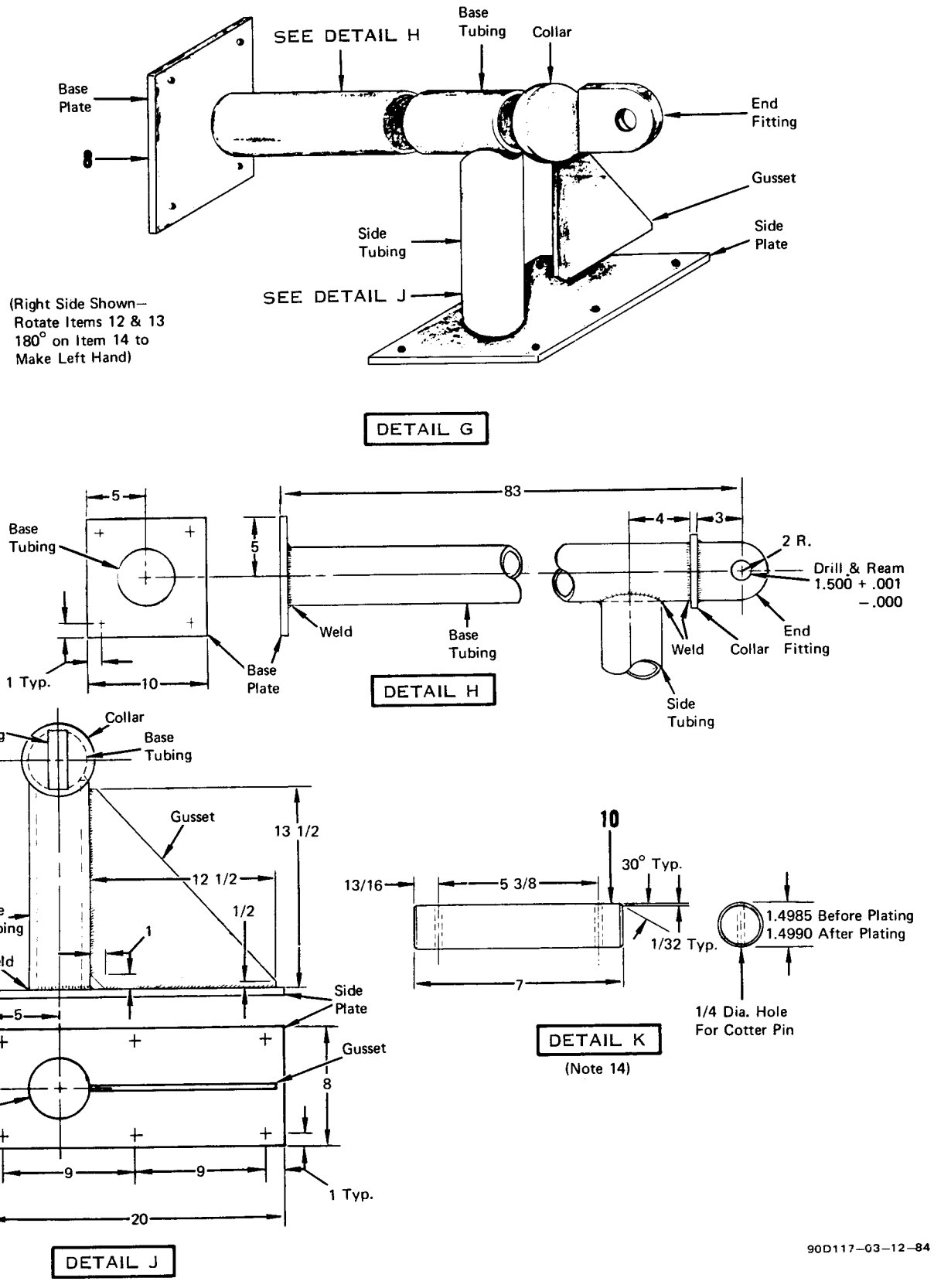


Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 3)

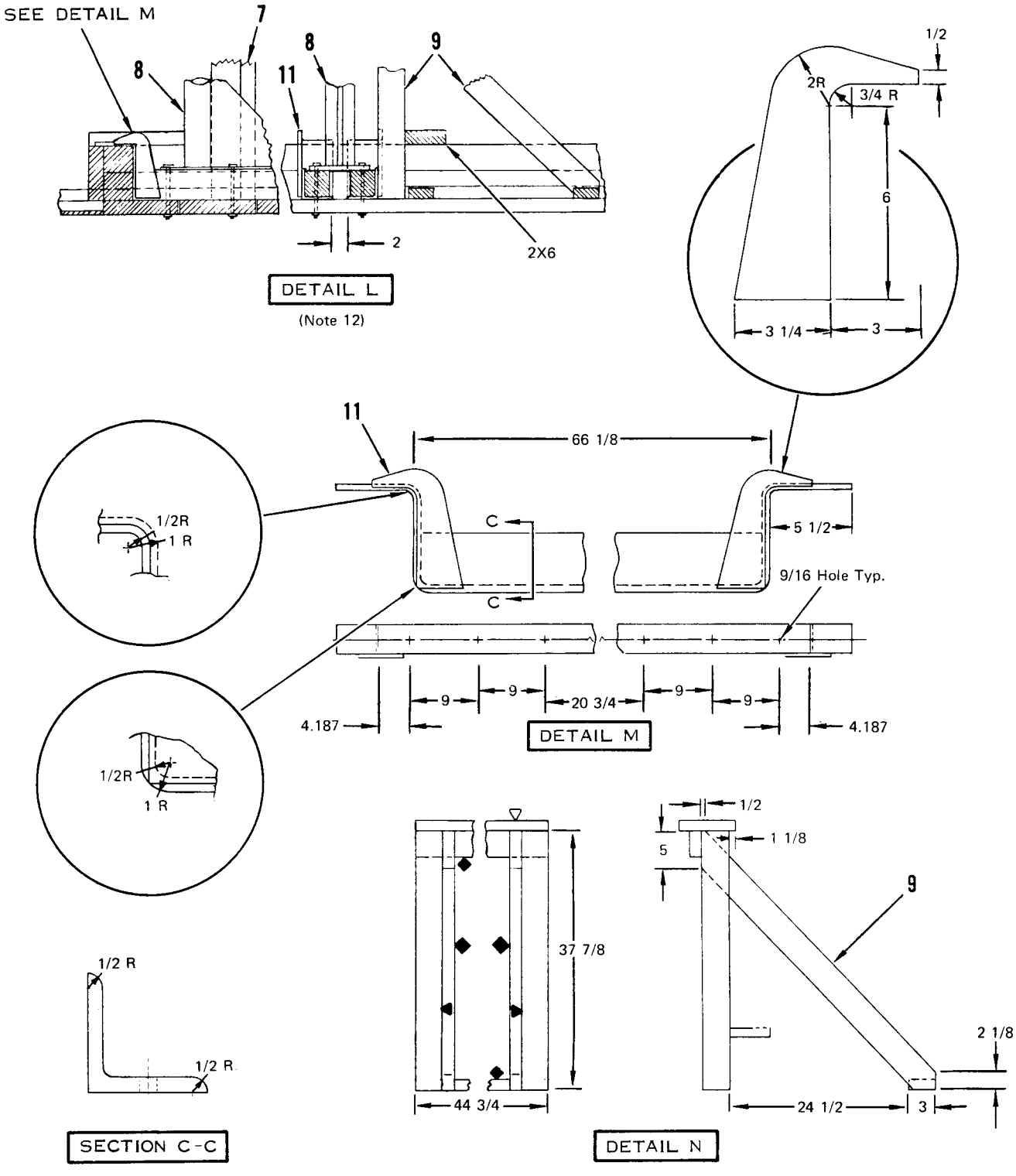


Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 4)

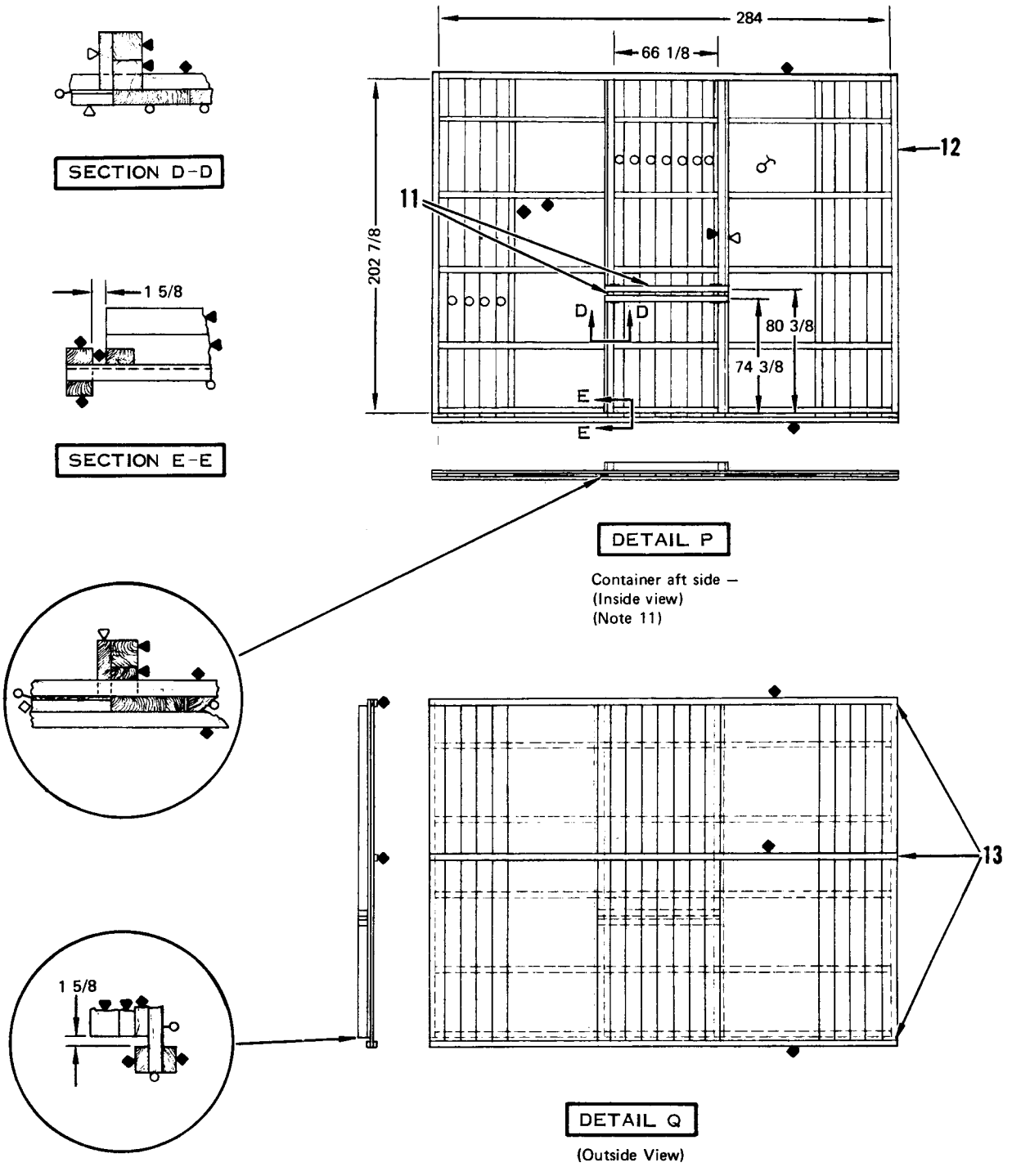


Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 5)

Item	Qty	Dimensions (Note 1)	Material
1	1	288 3/4 X 44 1/2 X 213 1/2	See specifications
2	1	2 X 9 X 73	Lumber
	2	5/16 X 9 X 73	Plywood (Note 2)
	1	4 X 4 X 73	Lumber
3	2	1 1/4 Dia. X 13 1/4	1020 Steel Tube
4	1	3/8 X 288 3/4 X 42 5/8	Plywood
	2	4 X 4 X 280 3/4	Lumber
	12	2 X 4 X 37 3/8	Lumber
5	2	1/2 X 4 X 4	1020 Steel or Iron Angle
	6	1/2 X 5	Steel Bolt (Note 13)
	6	1/2 I.D. X 5/8 O.D.	Steel Nut (Note 13)
	6	1/2 I.D. X 5/8 O.D.	Washer (Note 13)
6	2	4 X 4 X 214 3/8	Lumber
	8	2 X 4 X 37 3/8	Lumber
	1	3/8 X 214 3/8 X 42 5/8	Plywood
7	4	3/8 X 42 5/8 X AR	Plywood
	2	4 X 4 X 288 3/4	Lumber
	12	2 X 8 X 42 5/8	Lumber
	8	4 X 4 X 42 5/8	Lumber
	8	1 X 4 X AR	Lumber
	1	2 X 4 X 42 5/8	Lumber
8	2	10 X 10 X 1/2	1020 Steel (Base Plate)
	2	4 O.D. X 79 X 1/2 Thick	1020 Steel (Base Tubing)
	2	4 O.D. X 14 X 1/2 Thick	1020 Steel (Side Tubing)
	2	1/2 X 5 Dia.	1020 Steel (Collar)
	2	5 X 1.35 Thick	1020 Steel (End Fitting)
	2	13 1/2 X 12 1/2 X 1/2 Thick	1020 Steel (Gusset)
	2	20 X 8 X 1/2	1020 Steel (Side Plate)
	10	1/2–20 X 6 1/2	Steel Machine Screw (Note 3)
	10	1/2–20	Steel Machine Nut (Note 3)
	10	1/2 I.D. X 7/8 O.D.	Steel Washer (Note 3)
9	1	2 X 8 X 44 3/4	Lumber
	2	4 X 4 X 37 7/8	Lumber
	2	2 X 4 X 37 7/8	Lumber
	1	2 X 4 X 44 3/4	Lumber
	1	2 X 4 X 32 3/4	Lumber
10	2	1.499 Dia. X 7	4130 Cad. Plated Steel Pin
11	2	4 X 4 X 66 1/8 X 1/2 Thick	1020 Steel Angle
12	10	2 X 4 X 108	Lumber
	4	4 X 4 X 202 7/8	Lumber
	18	2 X 10 X 202 7/8	Lumber
	5	2 X 4 X 66 1/8	Lumber
	1	2 X 4 X 284	Lumber
	1	2 X 4 X 288 3/4	Lumber
	2	2 X 8 X 202 7/8	Lumber
	12	1 X 4 X AR	Lumber
	2	3/8 X 202 7/8 X AR	Plywood
	3	2 X 4 X 284	Lumber (Skids)
13	2	4 X 4 X 214 3/8	Lumber
	8	2 X 4 X 37 3/8	Lumber
	1	3/8 X 42 5/8 X AR	Plywood

90D117–06–12–84

Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 6)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated as illustrated except container front side cover is to be fabricated in accordance with MIL-C-104, Style A, Type 1, Class 2.

Dimensions (Inside)
284 X 37 3/8 X 206 1/4

Cube
1603 Cubic Feet

Gross Weight
6182 Pounds

Preservation and Packaging
In accordance with MIL-P-116.

PACKAGING INSTRUCTIONS:

1. Cover all openings in wing center section with MIL-B-121, Grade A barrier material and seal with PPP-T-60 tape.
2. Position container with Item 13 skids on floor to load wing section in container.
3. Hoist wing section into loading position above container using a suitable hoist and 215-00211 hoisting sling (T.O. 1A-7D-2-1).
4. Slowly lower wing into container until wing aft mount lugs align with Item 8 end fitting. Install Item 10 pins and secure with cotter pins.
5. Lower wing section until forward part rests on Item 2.
6. Attach Item 3 to wing forward mount lugs.
7. Drill holes in Item 2 using Item 3 as a guide.
8. Attach Item 2 to Item 4.
9. Attach middle section of plywood on container top.
10. Secure front side (not shown), fabricated in accordance with MIL-C-104, to container with lag screws.

SHIPPING CONDITION:

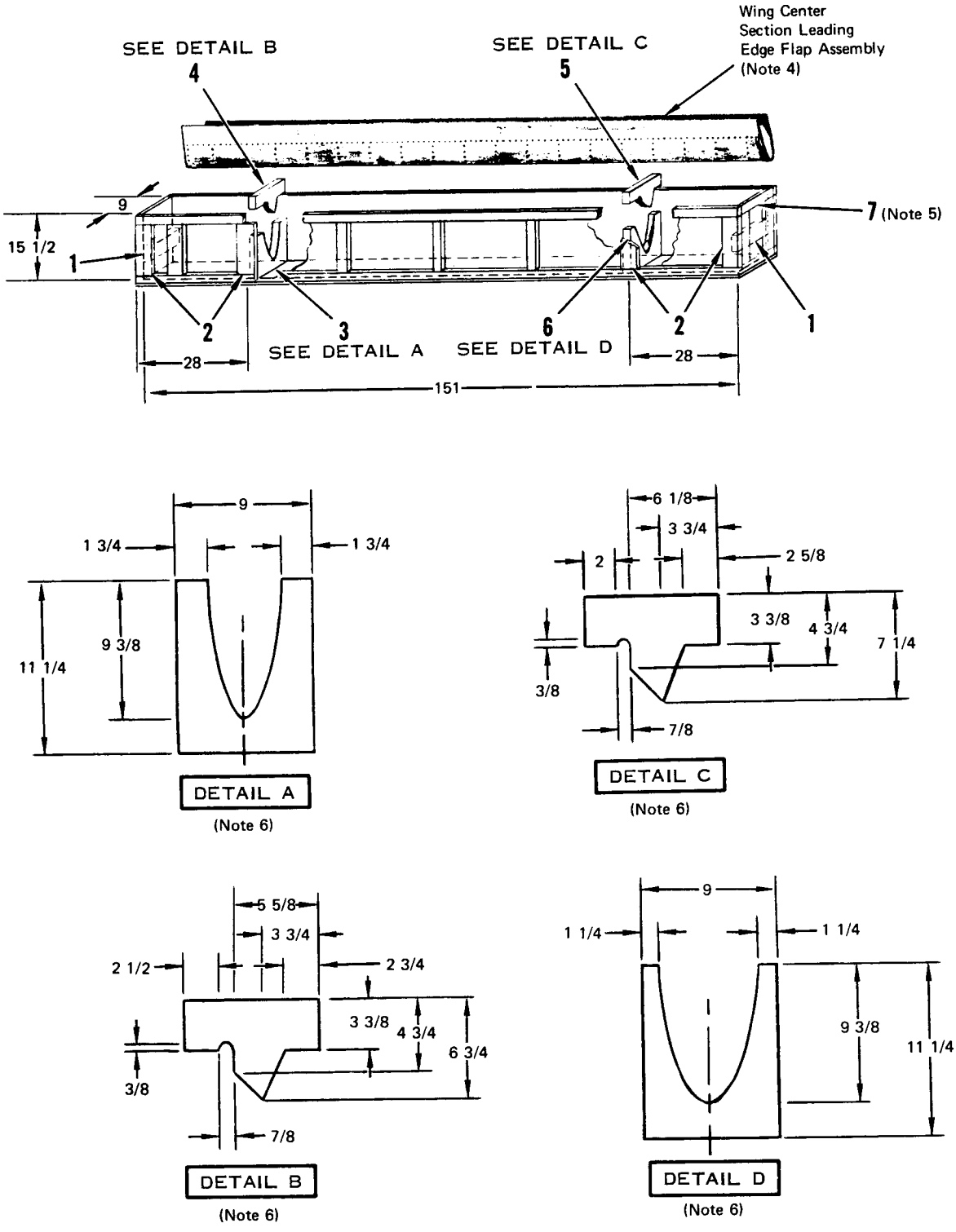
The container shall be shipped on a standard depressed center rail car.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on both sides of lumber core.
3. Four required to attach base plate and six required to attach side plate to container.
4. Each square represents one square inch.
5. To ensure precise drilling of holes in Item 2 for attachment of Item 3, do not drill holes until wing center section is in place in the container.
6. Item 3 attaches to wing center section forward mount lugs and Item 2.
7. Middle section of plywood on container top should not be permanently attached until Item 2 is drilled and Item 3 is attached.
8. Attach behind first cross member from top of container.
9. Place inspection door here on container right side only.
10. Lap joint typical for all 4 X 4 intersections.
11. Lumber symbols are as follows:
    ▲ 4 X 4 —○ 3/8 Plywood ■ 2 X 4
    △ 2 X 8 ○ 2 X 10 ◇ 1 X 4
12. Depicts placement of Items 8, 9, and 11.
13. Attaching parts for Item 5.
14. Use to attach Item 8 to wing center section off mount lugs and secure pin with cotter pins.
15. Secure portion of container shown with nominal length carriage bolts.

90D117-07-12-84

Figure 1-113. Wing Center Section Assembly (216-70020) Shipping Container (Sheet 7)



90D118-01-12-84

Figure 1-114. Wing Center Section Leading Edge Flap Assembly (215-70200) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	2	2 X 4 X 9	Lumber
2	8	1 X 4 X 15 1/2	Lumber (cut to length)
3	1	2 X 9 X 11 1/4	Lumber
	2	5/16 X 9 X 11 1/4	Plywood (Note 2)
4	1	2 X 6 3/4 X 9	Lumber
	1	5/16 X 6 3/4 X 9	Plywood (Note 3)
5	1	2 X 7 1/4 X 9	Lumber
	1	5/16 X 7 1/4 X 9	Plywood (Note 3)
6	1	2 X 9 X 11 1/4	Lumber
	2	5/16 X 9 X 11 1/4	Plywood (Note 2)
7	1	153 X 11 X 17 1/2	See specifications

SPECIFICATIONS:

Exterior Container
Level A containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C containers to be fabricated in accordance with Federal Specification PPP-B-576, Style A, Type 3, Class I.

Dimensions (Inside)
151 X 9 X 15 1/2

Cube
17.7 Cubic Feet

Gross Weight
Level A – 105 Pounds
Levels B and C – 97 Pounds

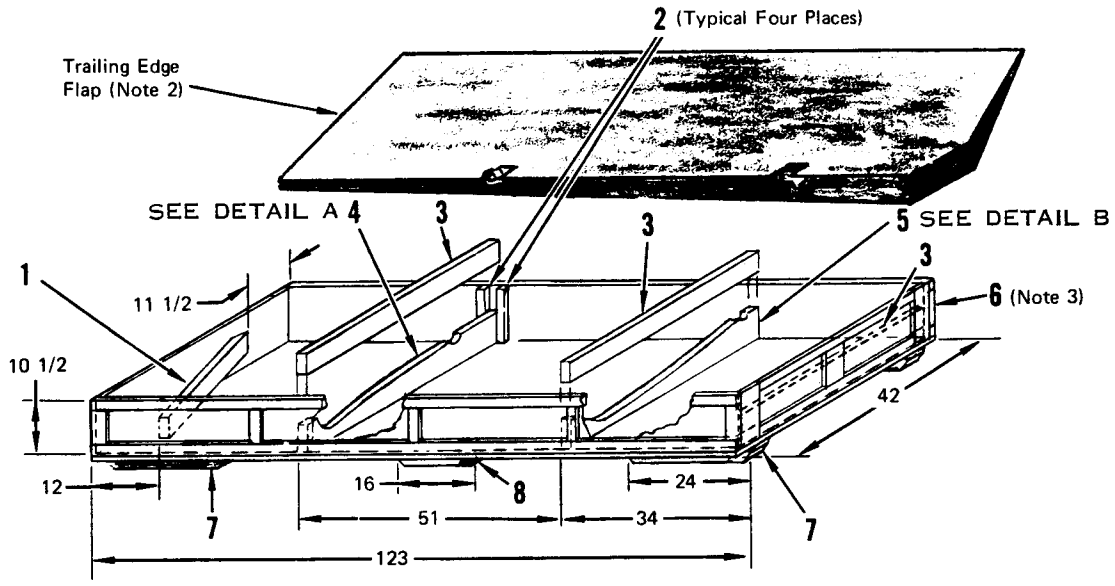
Preservation and Packaging
In accordance with MIL-P-116.

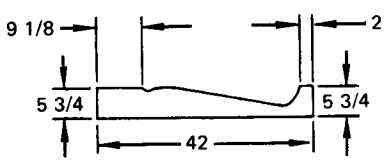
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on both sides of lumber core.
3. Plywood to be tacked on one side of lumber.
4. Preserve all bare areas with P-II preservative and wrap with L-P-378 polyethylene wrap.
5. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
6. Cut outs to be contoured to part.

90D118-02-12-84

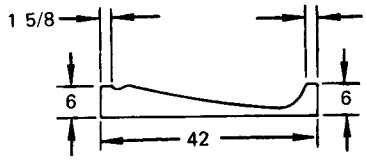
Figure 1-114. Wing Center Section Leading Edge Flap Assembly (215-70200) Shipping Container (Sheet 2)





DETAIL A

(Note 4)



DETAIL B

(Note 4)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 4 X 32	Lumber (cut to length)
2	8	1 X 2 X 10 1/2	Lumber (cut to length)
3	2	2 X 4 X 42	Lumber
4	1	2 X 6 X 42	Lumber
5	1	2 X 6 X 42	Lumber
6	1	125 X 44 X 14	See specifications
7	4	2 X 4 X 24	Lumber
8	2	2 X 4 X 16	Lumber

SPECIFICATIONS:

Exterior Container
Level A, B and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
123 X 42 X 10 1/2

Cube
44.6 Cubic Feet

Gross Weight
226 Pounds

Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Preserve bare areas with P-11 preservative and wrap with MIL-B-121, Grade A barrier material.
3. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
4. Cut outs to be contoured to part.

90D119-12-84

Figure 1-115. Wing Trailing Edge Flap (215-70310) Shipping Container

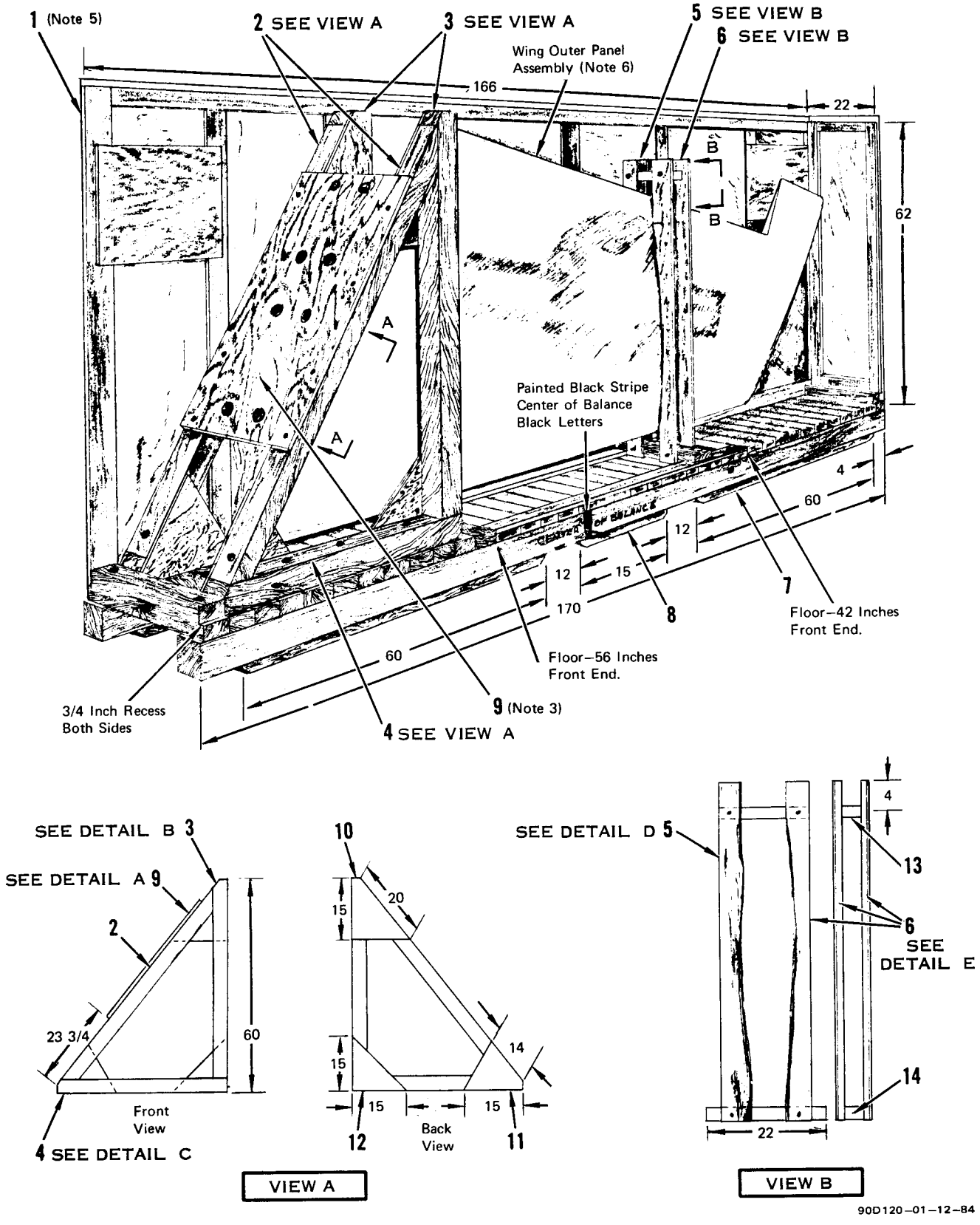


Figure 1-116. Wing Outer Panel Assembly (215-80020) Shipping Container (Sheet 1 of 3)

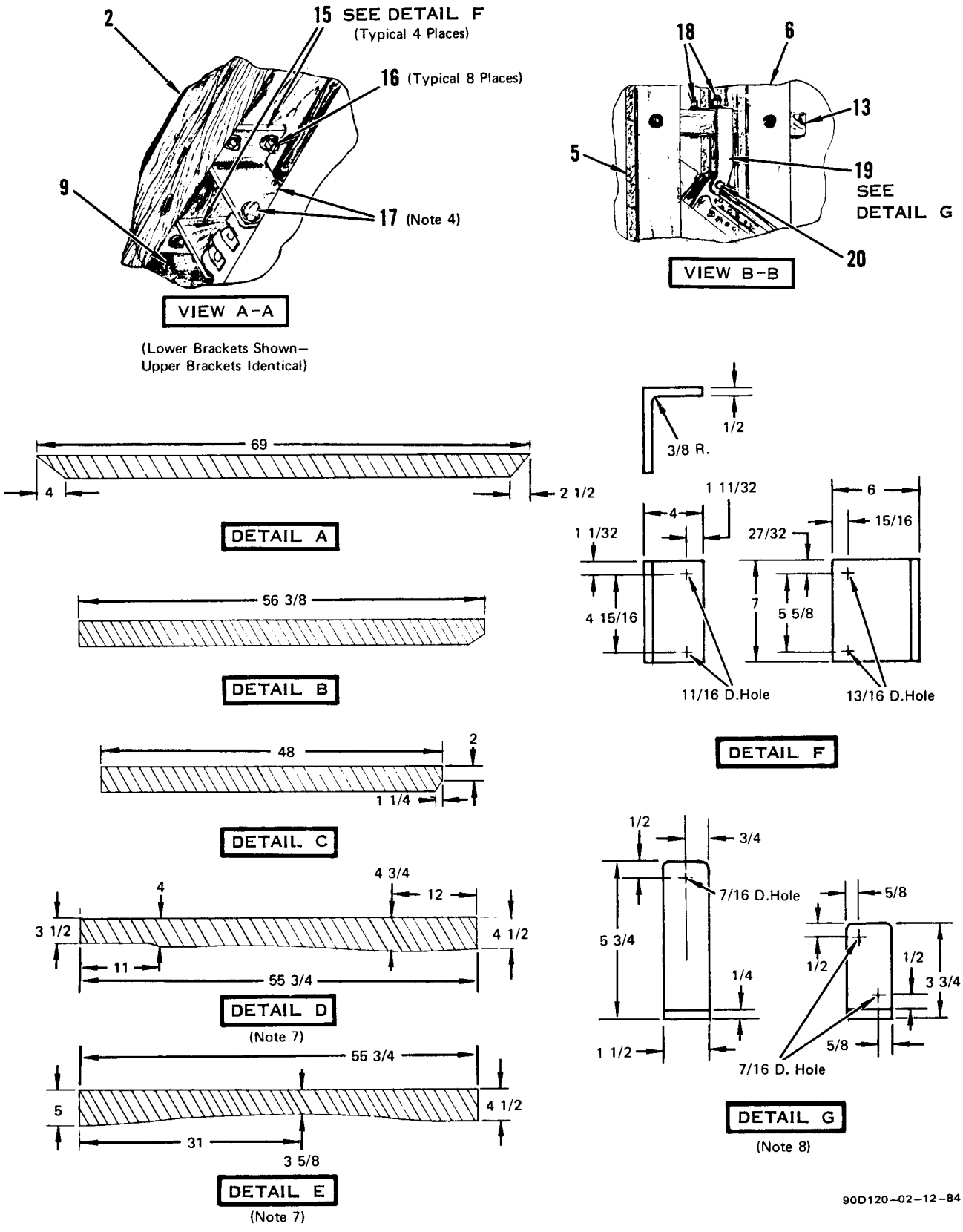


Figure 1-116. Wing Outer Panel Assembly (215-80020) Shipping Container (Sheet 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	170 X 24 1/4 X 71	See specifications
2	2	4 X 4 X 69	Lumber
3	2	4 X 4 X 56 3/8	Lumber
4	2	4 X 4 X 48	Lumber
5	2	1 X 4 1/2 X 55 3/4	Lumber
	2	5/16 X 4 1/2 X 55 3/4	Plywood (Note 2)
6	2	1 X 5 X 55 3/4	Lumber
	2	5/16 X 5 X 55 3/4	Lumber
7	4	2 X 4 X 60	Lumber
8	2	2 X 4 X 15	Lumber
9	2	3/4 X 22 X 42	Plywood (Note 3)
10	1	3/4 X 15 X 15	Plywood
11	1	3/4 X 15 X 15	Plywood
12	1	3/4 X 15 X 15	Plywood
13	1	2 X 4 X AR	Lumber
14	1	2 X 4 X 22	Lumber
15	4	1/2 X 6 X 11	1020 Steel
16	8	3/8 X 3 1/2	Bolt
	8	3/8 Hex	Nut
	16	5/8 O.D. X 3/8 I.D.	Washers
	8	1/2 O.D. X 3/8 I.D.	Lock Washers
17	2	6 X 15/16 O.D. X 3/4 I.D.	Aluminum Bushings (Note 4)
	2	3/4 X 8 1/2	Bolt (Note 4)
	4	3/4 Hex	Nut
	8	3/4 I.D.	Aluminum Washers
	4	3/4 I.D.	Lock Washers
18	2	3/8 X 2 1/2	Bolt
	2	3/8 Hex	Nut
	4	3/8 I.D. X 5/8 O.D.	Aluminum Washers
19	1	1/2 X 1 1/2 X 9 1/2	1020 Steel
20	1	3/8 I.D. X 5/8 O.D. X 1	Bolt
	1	3/8 I.D.	Nut
	1	3/8 I.D.	Washer (AN6-16)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with MIL-C-104, Style A, Type 2, Class 2.

Dimensions (Inside)
166 X 22 X 62

Cube
167.7 Cubic Feet

Gross Weight
1012 Pounds

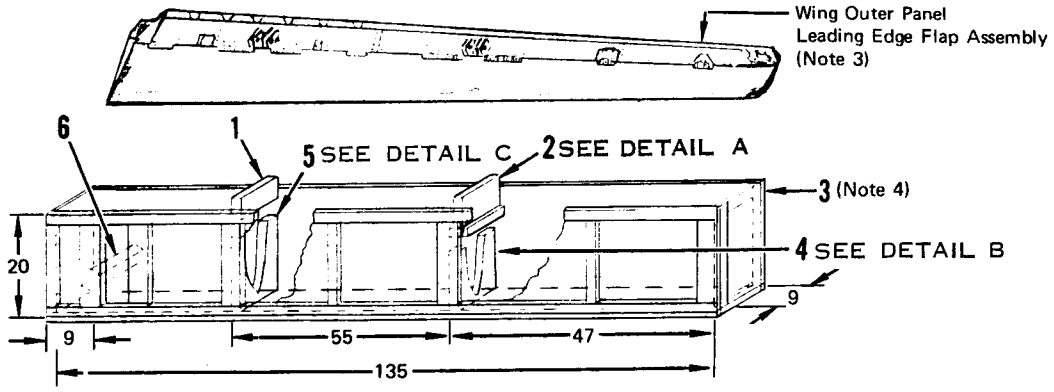
Preservation and Packaging
In accordance with MIL-P-116.

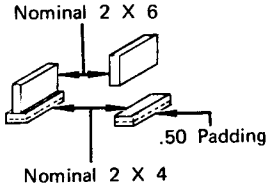
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on one side of lumber.
3. Item 9 consists of 2 sheets of plywood back to back.
4. For upper brackets use two 8 3/8 X 15/16 O.D. X 3/4 I.D. bushings with 11 inch bolts.
5. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
6. Preserve bushings with P-11 preservative and wrap with MIL-B-121 barrier material.
7. Cut outs to be contoured to part.
8. To permit alignment with part, do not bend Item 19 until assembly.

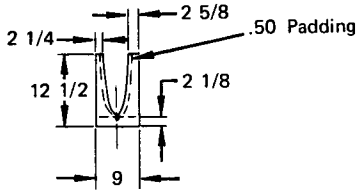
90D120-03-12-84

Figure 1-116. Wing Outer Panel Assembly (215-80020) Shipping Container (Sheet 3)

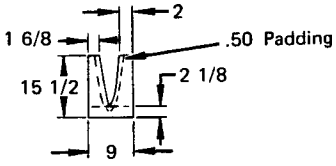




DETAIL A



DETAIL B
(Note 5)



DETAIL C
(Note 5)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 4 X 9	Lumber
2	1	2 X 4 X 9	Lumber
	1	2 X 6 X 9	Lumber
3	1	137 X 11 X 22	See specifications
4	1	2 X 9 X 12 1/2	Lumber
	2	2 X 9 X 12 1/2	Plywood (Note 2)
5	1	2 X 9 X 15 1/2	Lumber
	2	2 X 9 X 15 1/2	Plywood (Note 2)
6	1	2 X 4 X 9	Lumber

SPECIFICATIONS:

Exterior Container
Level A containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C containers to be fabricated in accordance with Federal Specification PPP-B-576, Style A, Type 3, Class I.

Dimensions (Inside)
135 X 9 X 20

Cube
19.2 Cubic Feet

Gross Weight
Level A – 151 Pounds
Level B and C – 105 Pounds

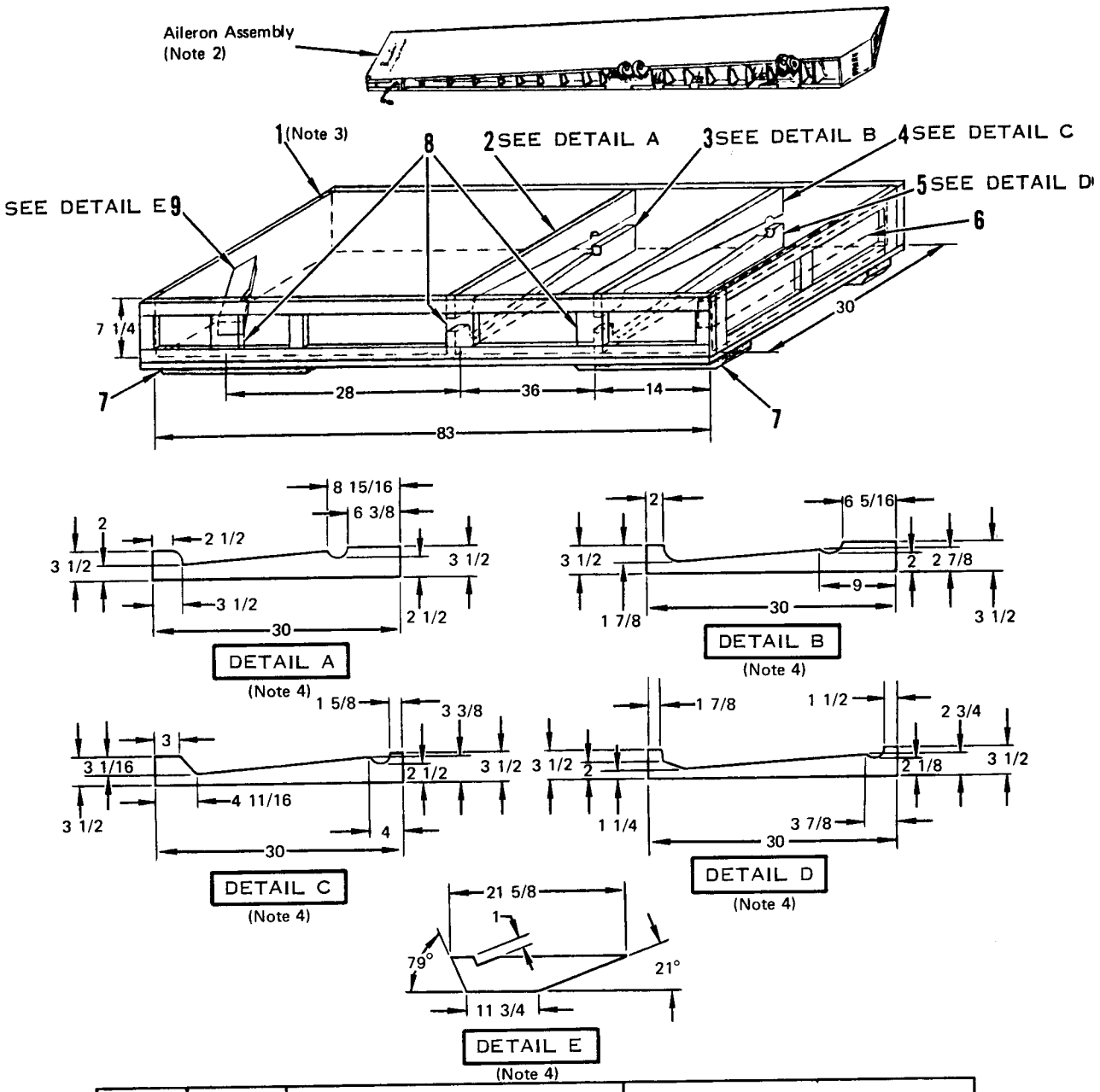
Preservation and Packaging
In accordance with MIL-P-116

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on both sides of lumber core.
3. Preserve all bare areas with P-II preservative and wrap with L-P-378 polyethylene wrap.
4. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
5. Cut outs to be contoured to part.

90D121-12-84

Figure 1-117. Wing Outer Panel Leading Edge Flap Assembly (215-80200) Shipping Container



Item	Qty	Dimensions (Note 1)	Material
1	1	85 X 32 X 10 3/4	See specifications
2	1	2 X 4 X 30	Lumber
	1	5/16 X 3 1/2 X 30	Plywood (Note 5)
3	1	2 X 4 X 30	Lumber
	1	5/16 X 3 1/2 X 30	Plywood (Note 5)
4	1	2 X 4 X 30	Lumber
	1	5/16 X 3 1/2 X 30	Plywood (Note 5)
5	1	2 X 4 X 30	Lumber
	1	5/16 X 3 1/2 X 30	Plywood (Note 5)
6	1	2 X 4 X 30	Lumber
7	4	2 X 4 X 24	Lumber
8	6	1 X 4 X 7 1/4	Lumber (cut to length)
9	1	2 X 4 X 21 5/8	Lumber

90D122-01-12-84

Figure 1-118. Aileron Assembly (215-80300) Shipping Container (Sheet 1 of 2)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
83 X 30 X 7 1/4

Cube
17 Cubic Feet

Gross Weight
105 Pounds

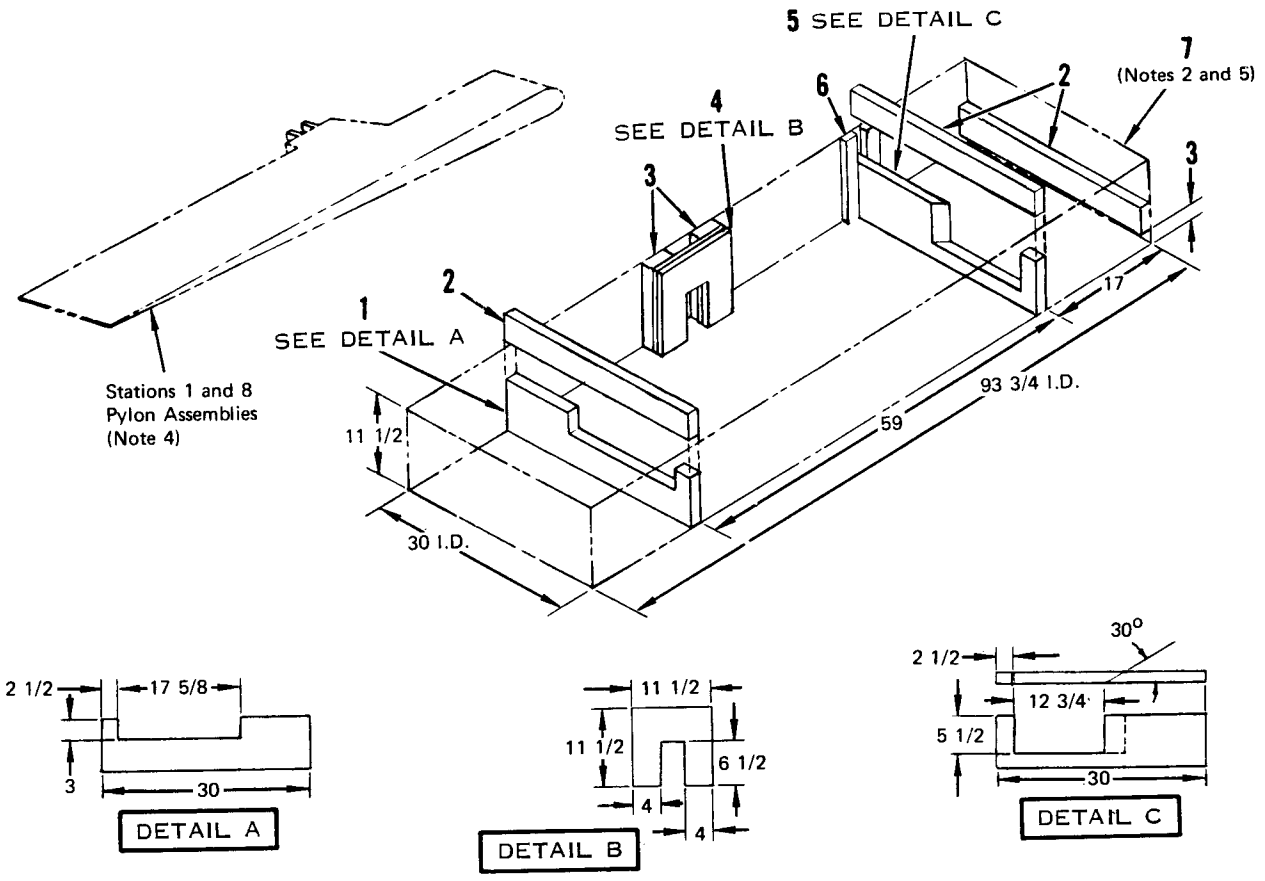
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Preserve bushings with P-11 preservative and wrap with L-P-378 polyethylene wrap.
3. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
4. All cradles are to be contoured to part.
5. Plywood to be tacked on one side of lumber.

90D122-02-12-84

Figure 1-118. Aileron Assembly (215-80300) Shipping Container (Sheet 2)



Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 8 X 30	Lumber
2	3	2 X 4 X 30	Lumber
3	2	2 X 4 X 11 1/2	Lumber
4	2	3/4 X 11 1/2 X 11 1/2	Plywood
5	1	2 X 8 X 30	Lumber
6	8	1 X 2 X 11 1/2	Lumber
7	1	93 3/4 X 30 X 11 1/2	See specifications (note 2)
8	2	2 X 4 X 97 3/4	Lumber, skids (note 3)
9	2	2 X 4 X 16	Lumber, skid plates (note 3)
10	4	2 X 4 X 24	Lumber, skid plates (note 3)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
93 3/4 X 30 X 11 1/2

Cube
26.7 Cubic Feet

Gross Weight
319 Pounds

Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Inside dimensions only are shown for container.
3. Skids and skid plates are required in accordance with MIL-STD-794.
4. Preserve bare areas with P-II preservative and wrap with MIL-B-121 barrier material. Protect sharp edges with PPP-C-843 fibropad covered with MIL-B-121 barrier material.
5. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.

90D123-12-84

Figure 1-119. Wing Stations 1 and 8 Pylon Assembly (216-70065) Shipping Container

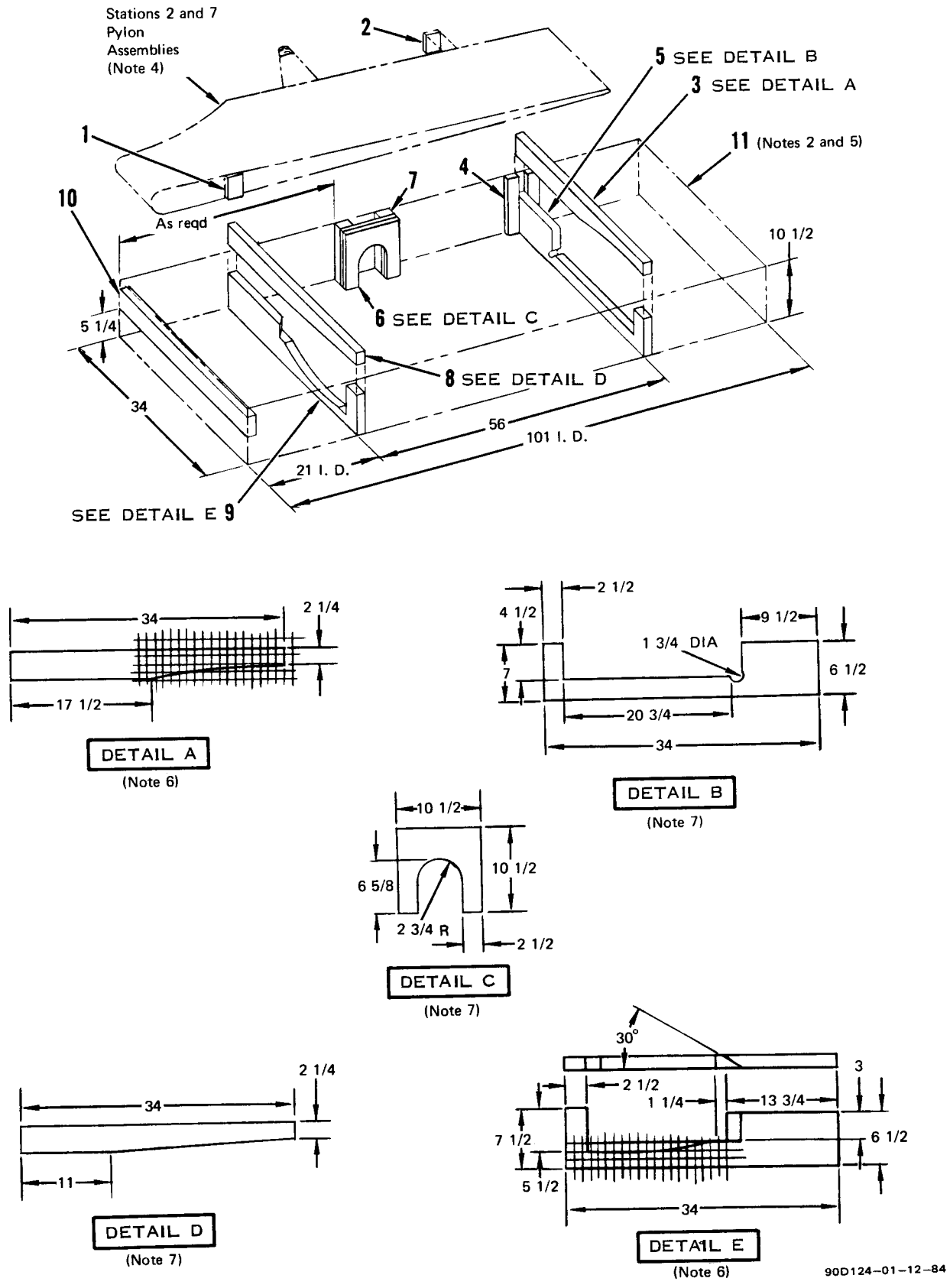


Figure 1-120. Wing Stations 2 and 7 Pylon Assembly (216-70067) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	1/2 X 5 1/4 X 3	Plywood
2	1	1/2 X 3 1/4 X 5	Plywood
3	1	2 X 4 X 34	Lumber
4	8	1 X 2 X 10 1/2	Lumber
5	1	2 X 8 X 34	Lumber
6	2	3/4 X 10 1/2 X 10 1/2	Plywood
7	2	2 X 2 1/2 X 10 1/2	Lumber
8	1	2 X 4 X 34	Lumber
9	1	2 X 8 X 34	Lumber
10	1	2 X 4 X 34	Lumber
11	1	101 X 34 X 10 1/2	See specifications (Note 2)
12	2	2 X 4 X 103	Lumber, Skid (Note 3)
13	4	2 X 4 X 24	Lumber, Skid Plate (Note 3)
14	2	2 X 4 X 16	Lumber, Skid Plate (Note 3)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
101 X 34 X 10 1/2

Cube
30.1 Cubic Feet

Gross Weight
343 Pounds

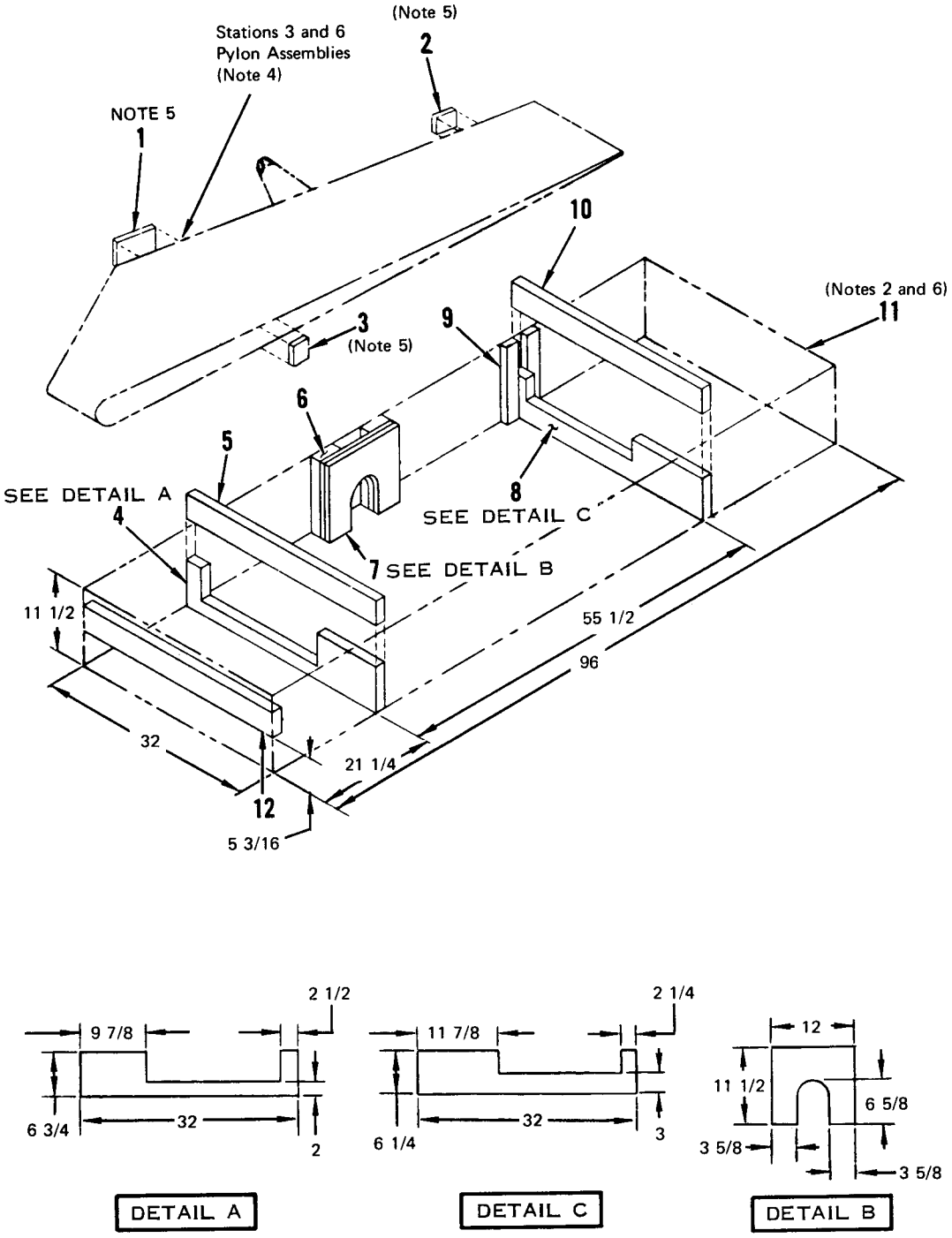
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Inside dimensions only are shown for container.
3. Skid and skid plates are required in accordance with MIL-STD-794.
4. Preserve all bare areas with P-II preservative and wrap with MIL-B-121 barrier material. Protect all sharp edges with PPP-C-843 fibropad.
5. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
6. Each square represents one square inch.
7. Cut outs to be contoured to part.

90D124-02-12-84

Figure 1-120. Wing Stations 2 and 7 Pylon Assembly (216-70067) Shipping Container (Sheet 2)



90D125-01-12-84

Figure 1-121. Wing Stations 3 and 6 Pylon Assembly (216-70069) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	1/2 X 3 1/2 X 6	Plywood
2	1	3/8 X 2 1/2 X 6	Plywood
3	1	3/4 X 2 1/2 X 4 1/4	Plywood
4	1	2 X 8 X 32	Lumber
5	1	2 X 4 X 32	Lumber
6	2	2 X 4 X 11 1/2	Lumber
7	2	3/4 X 12 X 11 1/2	Plywood
8	1	2 X 8 X 32	Lumber
9	8	1 X 2 X 11 1/2	Lumber
10	1	2 X 4 1/2 X 32	Lumber
11	1	96 X 32 X 11 1/2	See specifications (Note 2)
12	1	2 X 4 X 32	Lumber
	2	2 X 4 X 96	Lumber, Skids (Note 3)
	4	2 X 4 X 24	Lumber, Skid Plate (Note 3)
	2	2 X 4 X 16	Lumber, Skid Plate (Note 3)

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
96 X 32 X 11 1/2

Cube
29 Cubic Feet

Gross Weight
319 Pounds

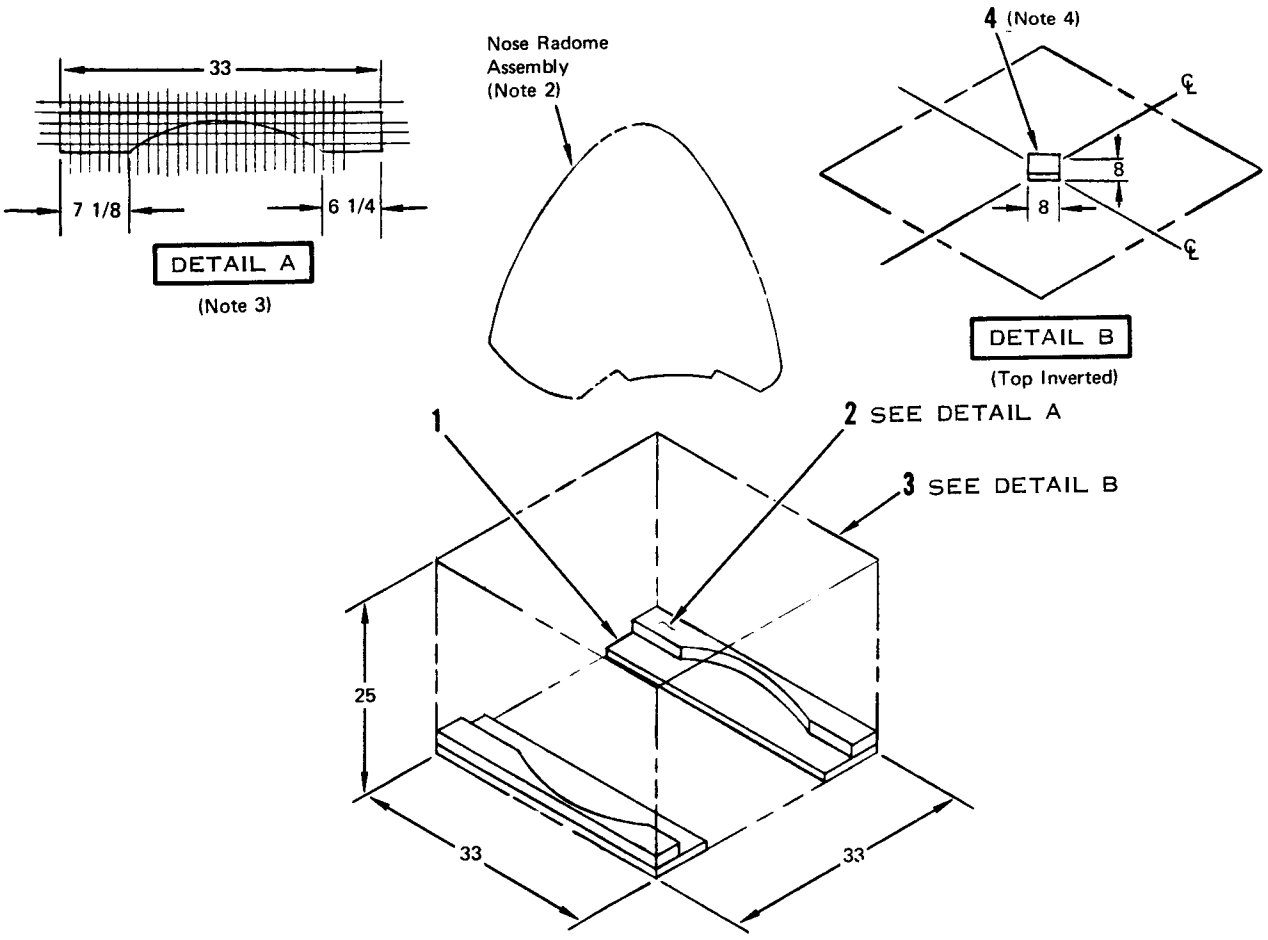
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Inside dimensions only are shown for container.
3. Skid and skid plates are required in accordance with MIL-STD-794. (Skids not illustrated).
4. Preserve bare areas with P-II preservative and wrap with MIL-B-121 barrier material Protect sharp edges with PPP-C-843 fibropad covered with MIL-B-121 barrier material.
5. Locate Items 1, 2, and 3 approximately where cradles contact pylon.
6. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.

90D125-02-12-84

Figure 1-121. Wing Stations 3 and 6 Pylon Assembly (216-70069) Shipping Container (Sheet 2)



Item	Qty	Dimensions (Note 1)	Material
1	2	1 X 8 X 33	Lumber
2	2	2 X 4 X 33	Lumber
3	1	33 X 33 X 25(ID)	See specifications (Note 5)
4	1	1/2 X 8 X 8	Cushioning Material (MIL-C-46842)

SPECIFICATIONS:

Exterior Container
Level A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
33 X 33 X 25

Cube
19.2 Cubic Feet

Gross Weight
84 Pounds

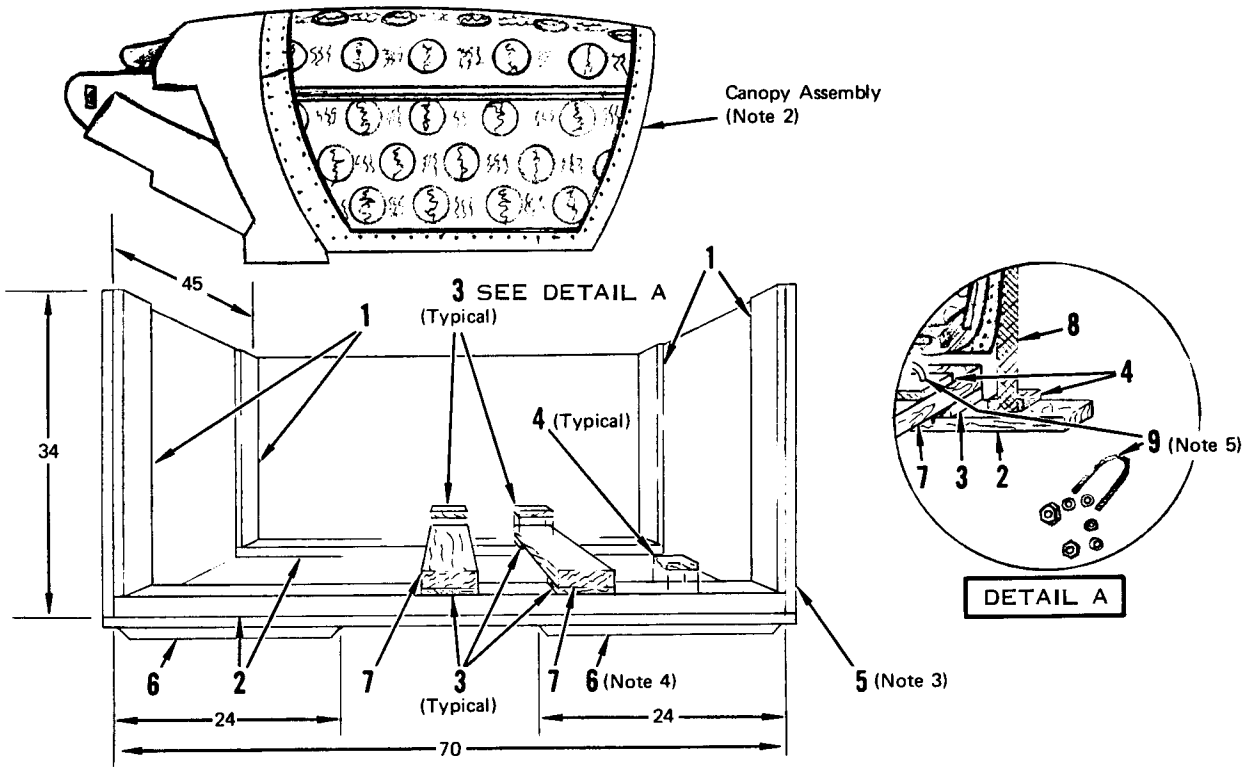
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Preserve bushings with P-II preservative and wrap with MIL-B-121 barrier material.
3. Each square represents one square inch.
4. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
5. Inside dimensions only are shown for container.

90D126-12-84

Figure 1-122. Nose Radome Assembly (216-20175) Shipping Container



Item	Qty	Dimensions (Note 1)	Material
1	4	1 X 4 X 32 3/8	Lumber
2	2	2 X 4 X 70	Lumber
3	8	3/4 X 3 1/2 X 5 1/2	Plywood
4	4	3/4 X 3 X 4	Plywood
5	1	72 X 47 X 37 1/2	See specifications
6	4	2 X 4 X 24	Lumber
7	2	2 X 6 X 45	Lumber
8	2	2 X cut to length	Webbing (commercial)
9	4	4 1/2 X 1/4 Dia	U-Bolt

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
70 X 45 X 34

Cube
74.5 Cubic Feet

Gross Weight
310 Pounds

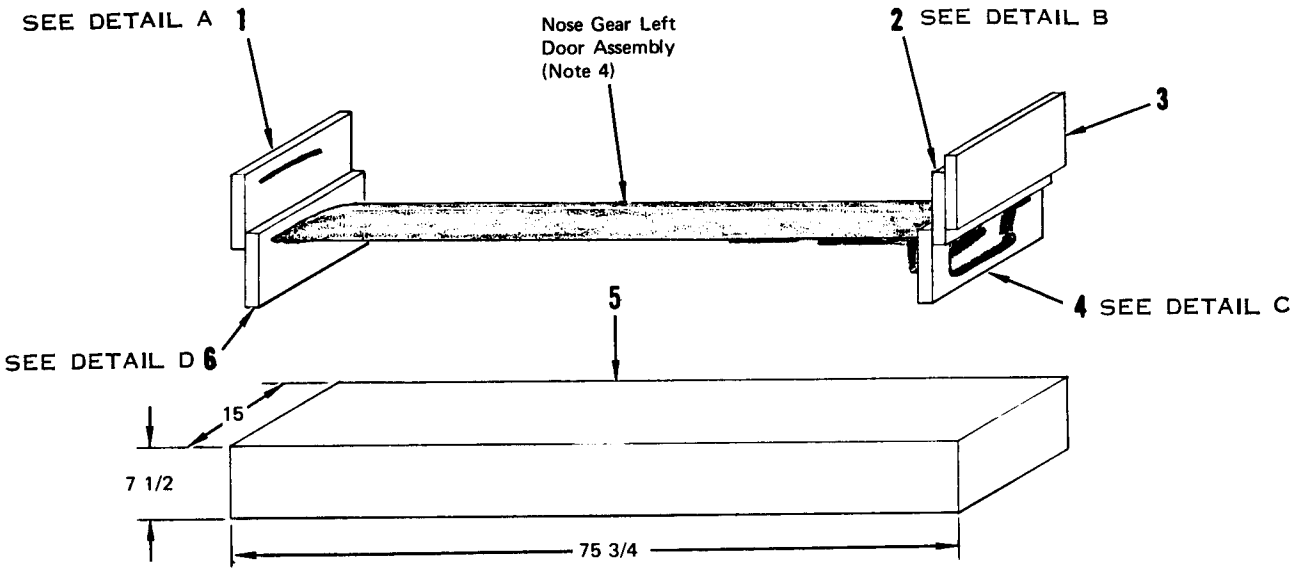
Preservation and Packaging
In accordance with MIL-P-116.

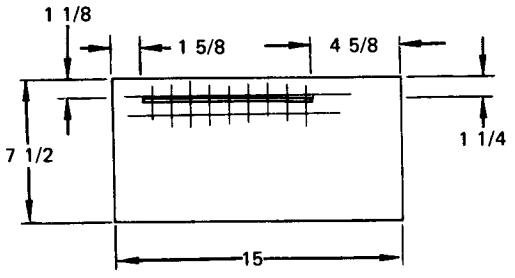
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Preserve canopy bushings with P-II preservative and wrap with L-P-378 polyethylene wrap.
3. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
4. Skids to be recessed 2 1/2 inches from sides and notched for bands.
5. U-bolts to be used to bolt canopy latch assemblies to items 3 and 7. Place 1/4 inch felt between bolt and part.
6. Use 2 inch webbing to hold canopy in place. Place MIL-B-121, Grade A paper between webbing and canopy.

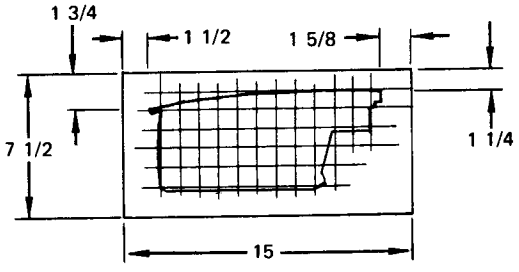
90D127-12-84

Figure 1-123. Canopy Assembly (215-20079) Shipping Container

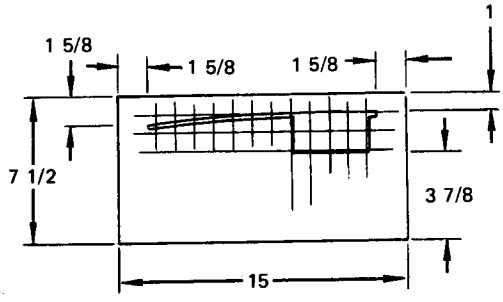




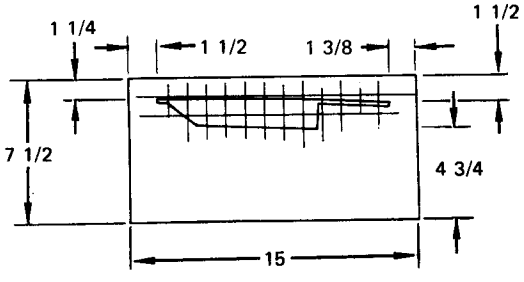
DETAIL A
(Notes 5 and 6)



DETAIL B
(Notes 5 and 6)



DETAIL C
(Notes 5 and 6)



DETAIL D
(Notes 5 and 6)

90D128-01-12-84

Figure 1-124. Nose Landing Gear Left Door Assembly (215-20100) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 15 X 7 1/2	Polystyrene (Note 2)
2	1	2 X 15 X 7 1/2	Polystyrene (Note 2)
3	1	2 X 15 X 7 1/2	Polystyrene (Note 2)
4	1	2 X 15 X 7 1/2	Polystyrene (Note 2)
5	1	77 3/4 X 17 X 9 1/2	See specifications (Note 3)
6	1	2 X 15 X 7 1/2	Polystyrene (Note 2)

SPECIFICATIONS:

Exterior Container
Level A container to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C to be fabricated in accordance with Federal Specification PPP-B-636, Style FTC, Type 1, Class I.

Dimensions (Inside)
75 3/4 X 15 X 7 1/2

Cube
Level A – 7.3 Cubic Feet
Levels B and C – 5.7 Cubic Feet

Gross Weight
Level A – 47 Pounds
Levels B and C – 29 Pounds

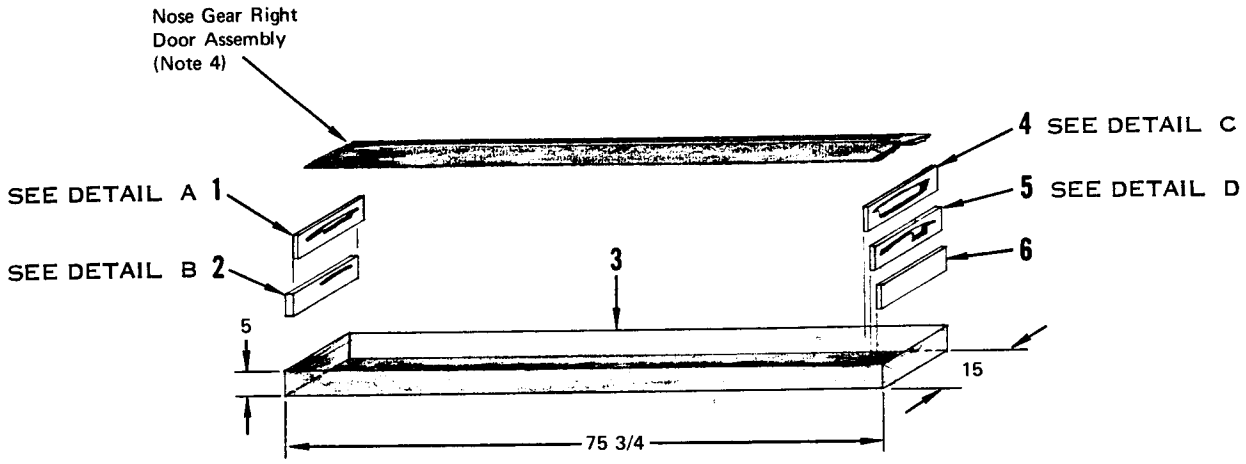
Preservation and Packaging
In accordance with MIL-P-116.

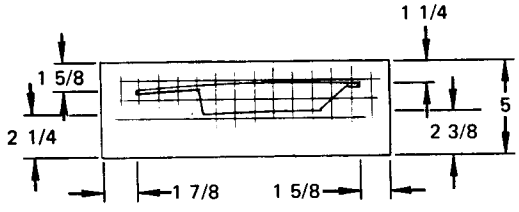
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Use MIL-P-19644 Polystyrene Foam.
3. Dimensions listed are for level A containers, outside dimensions for levels B and C are 76 3/4 X 16 X 8.
4. Preserve bearings with P-II preservative and wrap with L-P-378 polyethylene wrap.
5. Each square represents one square inch.
6. All cut outs to be contoured to part.

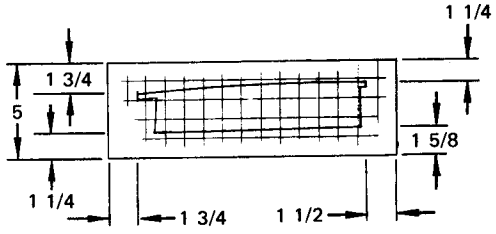
90D128-02-12-84

Figure 1-124. Nose Landing Gear Left Door Assembly (215-20100) Shipping Container (Sheet 2)

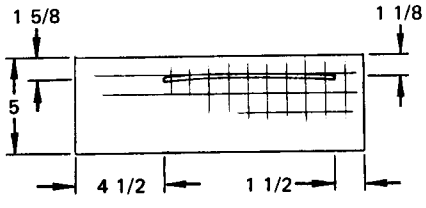




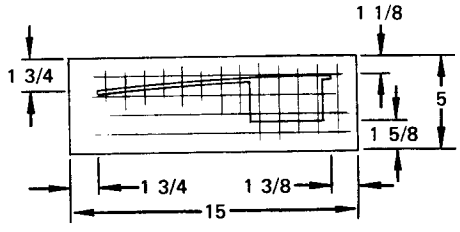
DETAIL A
(Notes 5 and 6)



DETAIL C
(Notes 5 and 6)



DETAIL B
(Notes 5 and 6)



DETAIL D
(Notes 5 and 6)

90D129-01-12-84

Figure 1-125. Nose Landing Gear Right Door Assembly (215-20100) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 15 X 5	Polystyrene (Note 2)
2	1	2 X 15 X 5	Polystyrene (Note 2)
3	1	77 3/4 X 17 X 7	See specifications (note 3)
4	1	2 X 15 X 5	Polystyrene (Note 2)
5	1	2 X 15 X 5	Polystyrene (Note 2)
6	1	2 X 15 X 5	Polystyrene (Note 2)

SPECIFICATIONS:

Exterior Container
Level A container to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C to be fabricated in accordance with Federal Specification PPP-B-636, Style FTC, Type 1, Class I.

Dimensions (Inside)
75 3/4 X 15 X 5

Cube
Level A – 5.4 Cubic Feet
Levels B and C – 4.3 Cubic Feet

Gross Weight
Level A – 39 Pounds
Levels B and C – 26 Pounds

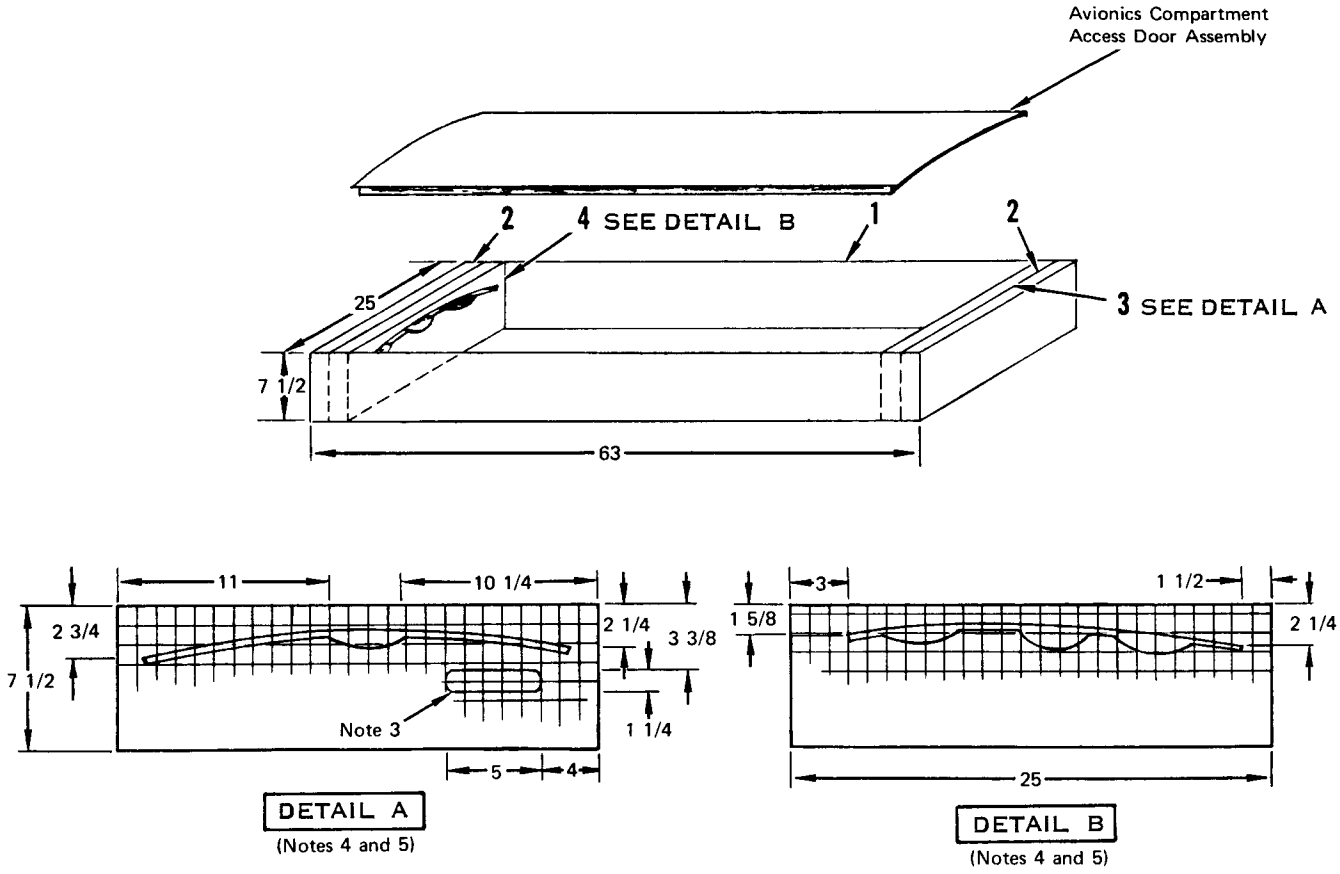
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Use MIL-P-19644 Polystyrene Foam.
3. Dimensions listed are for level A containers, outside dimensions for levels B and C are 76 3/4 X 16 X 5 1/2.
4. Preserve bearings with P-II preservative and wrap with L-P-378 polyethylene wrap.
5. Each square represents one square inch.
6. All cut outs to be contoured to part.

90D129-02-12-84

Figure 1-125. Nose Landing Gear Right Door Assembly (215-20100) Shipping Container (Sheet 2)



Item	Qty	Dimensions (Note 1)	Material
1	1	63 X 25 X 7 1/2 I.D.	See specifications
2	2	2 X 25 X 7 1/2	Polystyrene (Note 2)
3	1	2 X 25 X 7 1/2	Polystyrene (Note 2)
4	1	2 X 25 X 7 1/2	Polystyrene (Note 2)

SPECIFICATIONS:

Exterior Container
Level A container to be fabricated in accordance with Federal Specification PPP-B-601, Style A; levels B and C containers to be fabricated in accordance with Federal Specification PPP-B-636, Style FTC.

Dimensions (Inside)
63 X 25 X 7 1/2

Cube

Gross Weight

Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Use MIL-P-0019644, Type II, Polystyrene Foam.
3. This cut out is typical for right access door only.
4. Each square represents one square inch.
5. Cut outs to be contoured to part.

90D130-12-84

Figure 1-126. Avionics Compartment Access Door Assembly (215-30045) Shipping Container

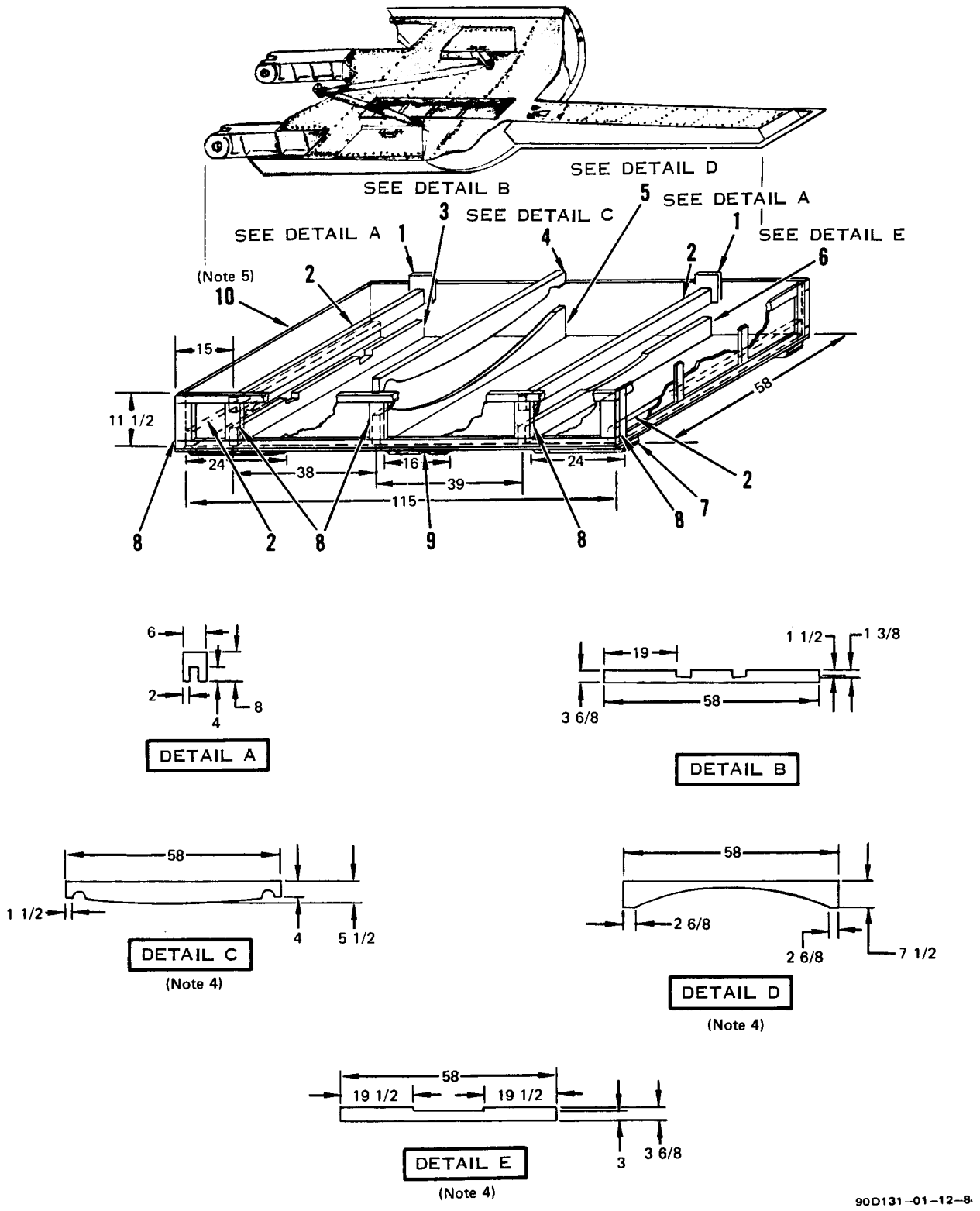


Figure 1-127. Speed Brake Assembly (215-30085) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	4	6 X 8 X 3/4	Plywood
2	4	2 X 4 X 58	Lumber
3	1	2 X 4 X 58	Lumber
	1	5/16 X 4 X 58	Plywood (Note 2)
4	1	2 X 4 X 58	Lumber
	1	5/16 X 4 X 58	Plywood (Note 2)
5	1	2 X 8 X 58	Lumber
	1	5/16 X 8 X 58	Plywood (Note 2)
6	1	2 X 4 X 58	Lumber
	1	5/16 X 4 X 58	Plywood (Note 2)
7	4	2 X 4 X 24	Lumber (Note 2)
8	18	1 X 4 X AR	Lumber
9	2	2 X 4 X 16	Lumber (Note 3)
10	1	117 X 60 X 15	See specifications

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class 1.

Dimensions (Inside)
115 X 58 X 11 1/2

Cube
61 Cubic Feet

Gross Weight
370 Pounds

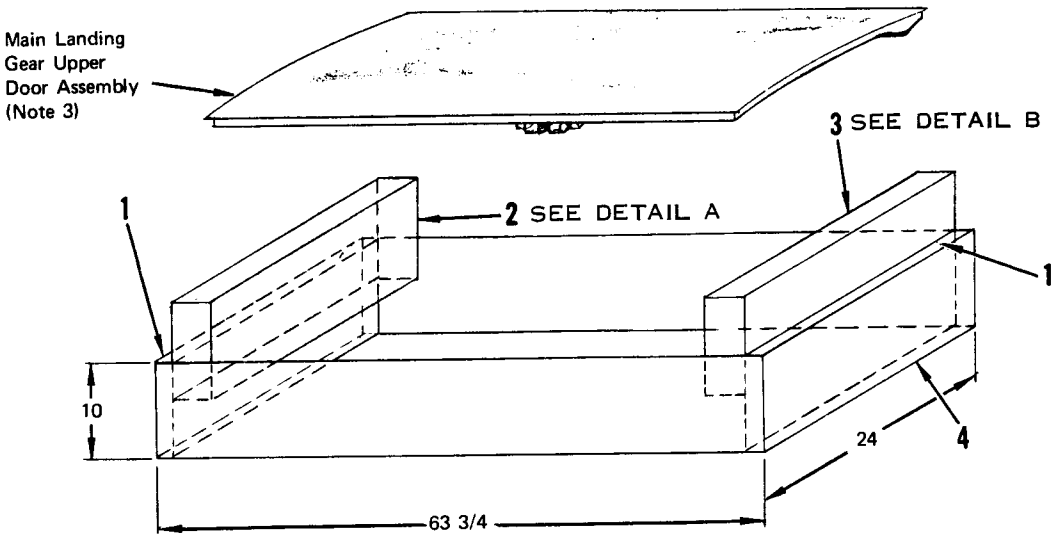
Preservation and Packaging
In accordance with MIL-P-116.

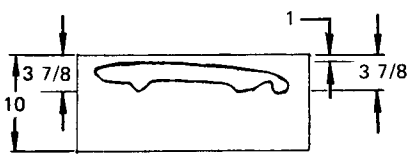
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on one side of lumber.
3. Skids are to be notched for bands on level A containers only.
4. Cut outs to be contoured to part.
5. All load bearing surfaces to be padded with 1/2 inch thick MIL-C-46842 material.
6. Preserve bare areas with P-11 preservative and wrap with L-P-378 polyethylene wrap.

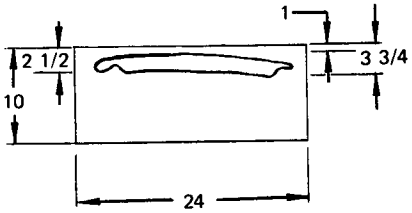
90D131-02-12-84

Figure 1-127. Speed Brake Assembly (215-30085) Shipping Container (Sheet 2)





DETAIL A
(Note 4)



DETAIL B (Note 4)

Item	Qty	Dimensions (Note 1)	Material
1	2	2 X 10 X 24	Polystyrene
2	1	4 X 10 X 24	Polystyrene
3	1	4 X 10 X 24	Polystyrene
4	1	63 3/4 X 25 X 10 1/2	See specifications (Note 2)

SPECIFICATIONS:

Exterior Container
Level A containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C to be fabricated in accordance with Federal Specification PPP-B-636, Style FTC, Type 1, Class I.

Dimensions (Inside)
63 3/4 X 24 X 10

Cube
Level A – 12 Cubic Feet
Level B and C – 10.4 Cubic Feet

Gross Weight
Level A – 40.9 Pounds
Level B and C – 31.9 Pounds

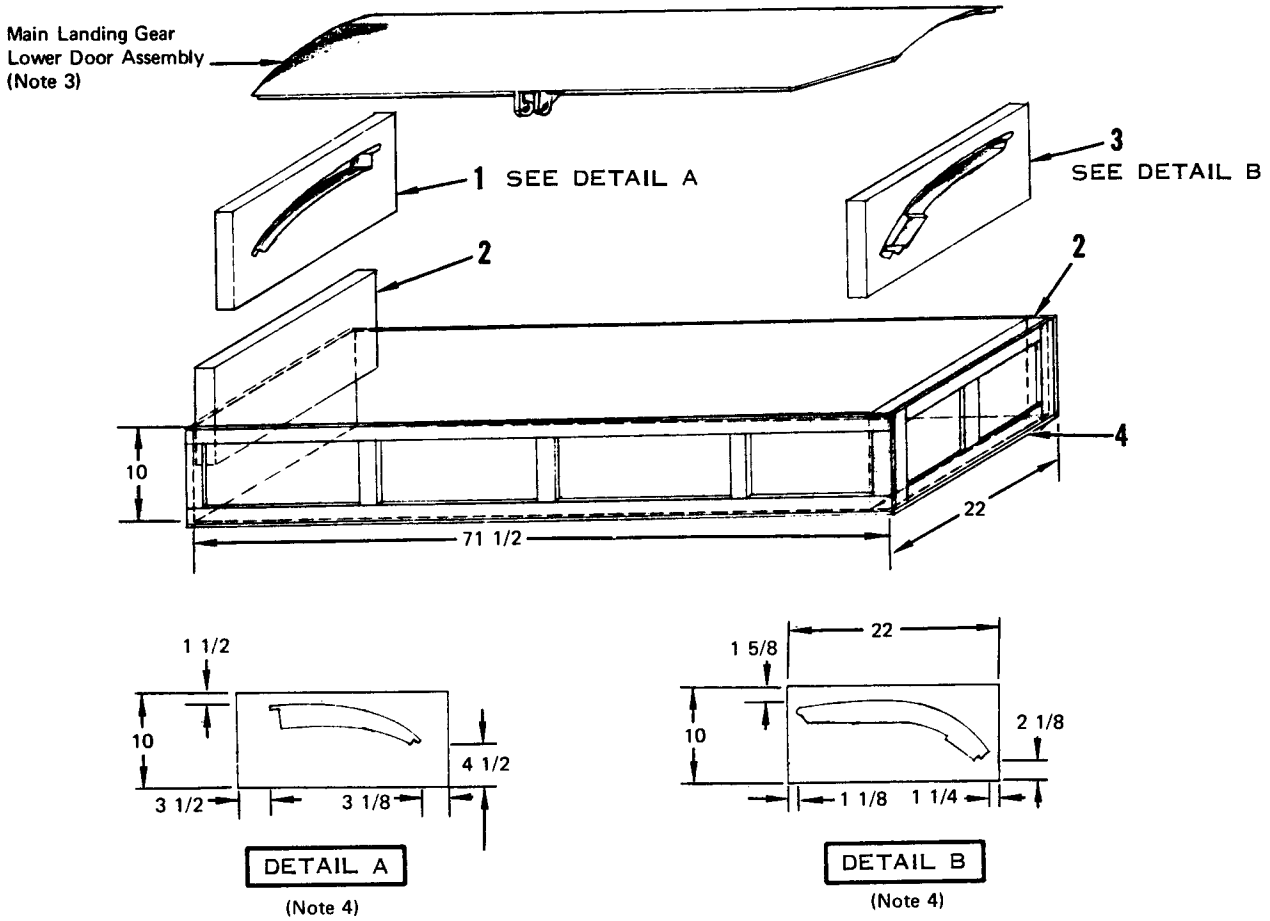
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Levels B and C dimensions listed, Level A dimensions are 66 X 26 X 12.
3. Preserve bare areas with P-II preservative, except for level C which requires no preservative, and wrap with MIL-B-121 barrier material.
4. Cut outs to be contoured to part.

90D132-12-84

Figure 1-128. Main Landing Gear Upper Door Assembly (215-30047) Shipping Container



Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 10 X 22	Polystyrene
2	2	2 X 10 X 22	Polystyrene
3	1	2 X 10 X 22	Polystyrene
4	1	71 1/2 X 22 X 10	See specifications (Note 2)

SPECIFICATIONS:

Exterior Container
Level A container to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I; levels B and C to be fabricated in accordance with Federal Specification PPP-B-576, Style A, Type 3, Class I.

Dimensions (Inside)
71 1/2 X 22 X 10

Cube
12.3 Cubic Feet

Gross Weight
62 Pounds

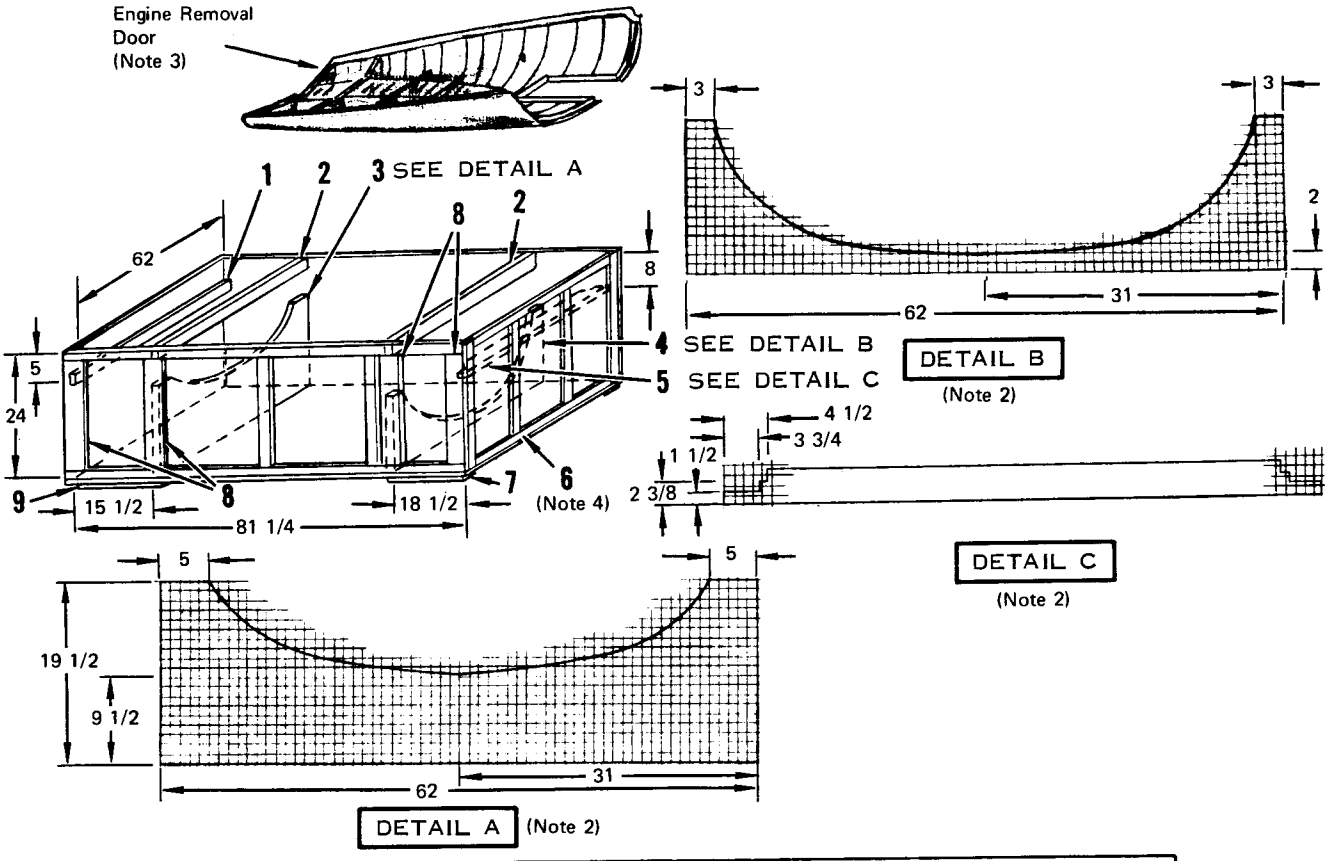
Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Inside dimensions only listed.
3. Preserve bare areas with P-II preservative, except for level C which requires no preservative, and wrap with MIL-B-121 barrier material.
4. Cut outs to be contoured to part.

90D133-12-84

Figure 1-129. Main Landing Gear Lower Door Assembly (215-30048) Shipping Container



Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 4 X 62	Lumber
2	2	2 X 4 X 62	Lumber
3	2	19 1/2 X 5/16 X 62	Plywood (Note 5)
	1	19 1/2 X 2 X 62	Lumber (Core)
4	2	16 X 5/16 X 62	Plywood (Note 5)
	1	16 X 2 X 62	Lumber (Core)
5	1	2 X 4 X 62	Lumber
6	1	82 X 64 X 27 1/2	See specifications
7	2	2 X 4 X 18 1/2	Lumber
8	18	1 X 4 X AR	Lumber
9	2	2 X 4 X 15 1/2	Lumber

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
80 X 62 X 24

Cube
85.1 Cubic Feet

Gross Weight
315 Pounds

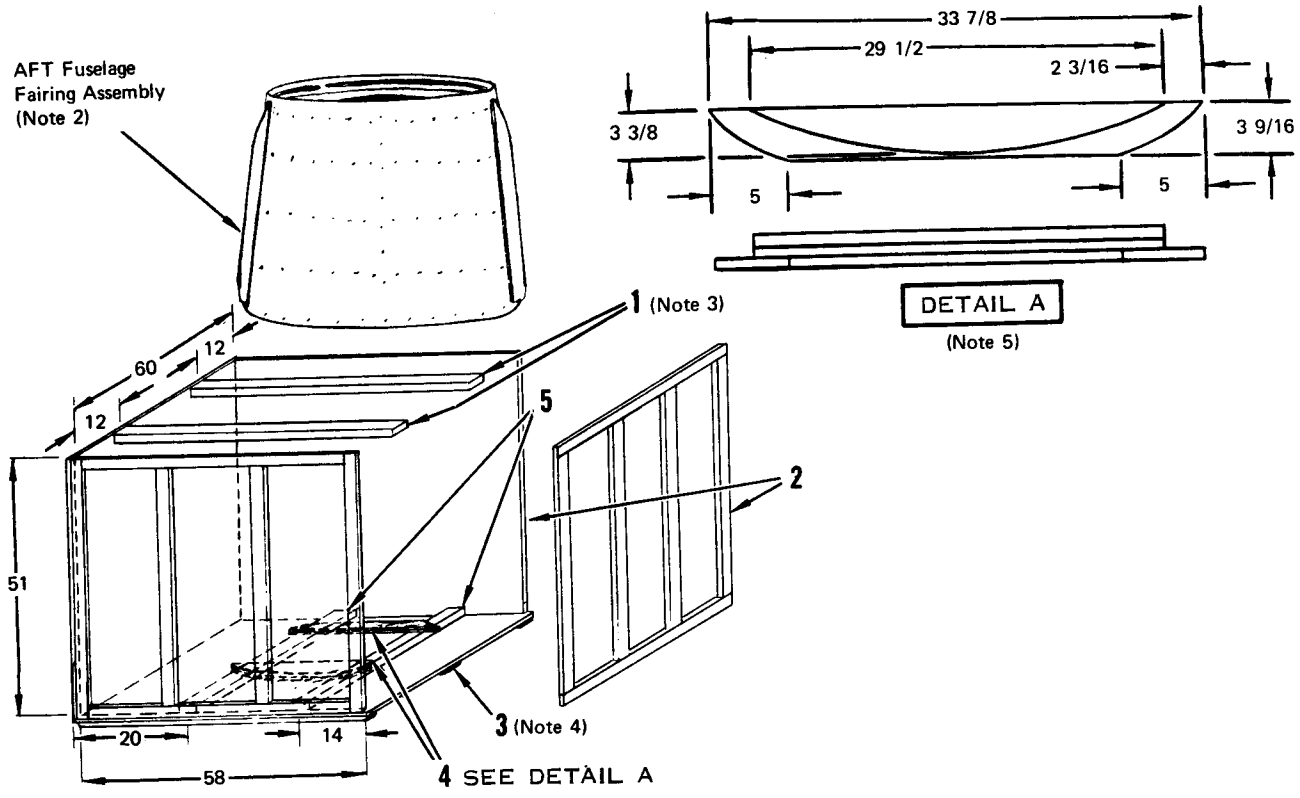
Preservation and Packaging
In accordance with MIL-P-116, Method 1.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Each square represents one square inch.
3. Preserve bare areas with P-11 preservative and wrap with L-P-378 polyethylene wrap.
4. All load bearing surfaces to be padded with 1/2 inch thick MIL-C-46842 cushioning material.
5. Plywood to be tacked on both sides of lumber core.

90D134-12-84

Figure 1-130. Engine Removal Door (216-40040) Shipping Container



Item	Qty	Dimensions (Note 1)	Material
1	2	2 X 4 X 58	Lumber
2	1	62 X 60 X 54 1/2	See specifications
3	3	2 X 4 X 58	Lumber (Note 4)
4	2	3/4 X 3 9/16 X 33 7/8	Plywood (Note 5)
5	2	2 X 4 X 60	Lumber

SPECIFICATIONS:

Exterior Container
Levels A, B, and C containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class I.

Dimensions (Inside)
60 X 58 X 51

Cube
118.4 Cubic Feet

Gross Weight
275 Pounds

Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Preserve all bare areas with P-II preservative and wrap with L-P-378 polyethylene wrap.
3. Pad all load bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
4. Notch skids for bands on Level A containers only.
5. Fabricate from 3 pieces of 3/4 plywood.

90D135-12-84

Figure 1-131. Aft Fuselage Fairing Assembly (215-40060) Shipping Container

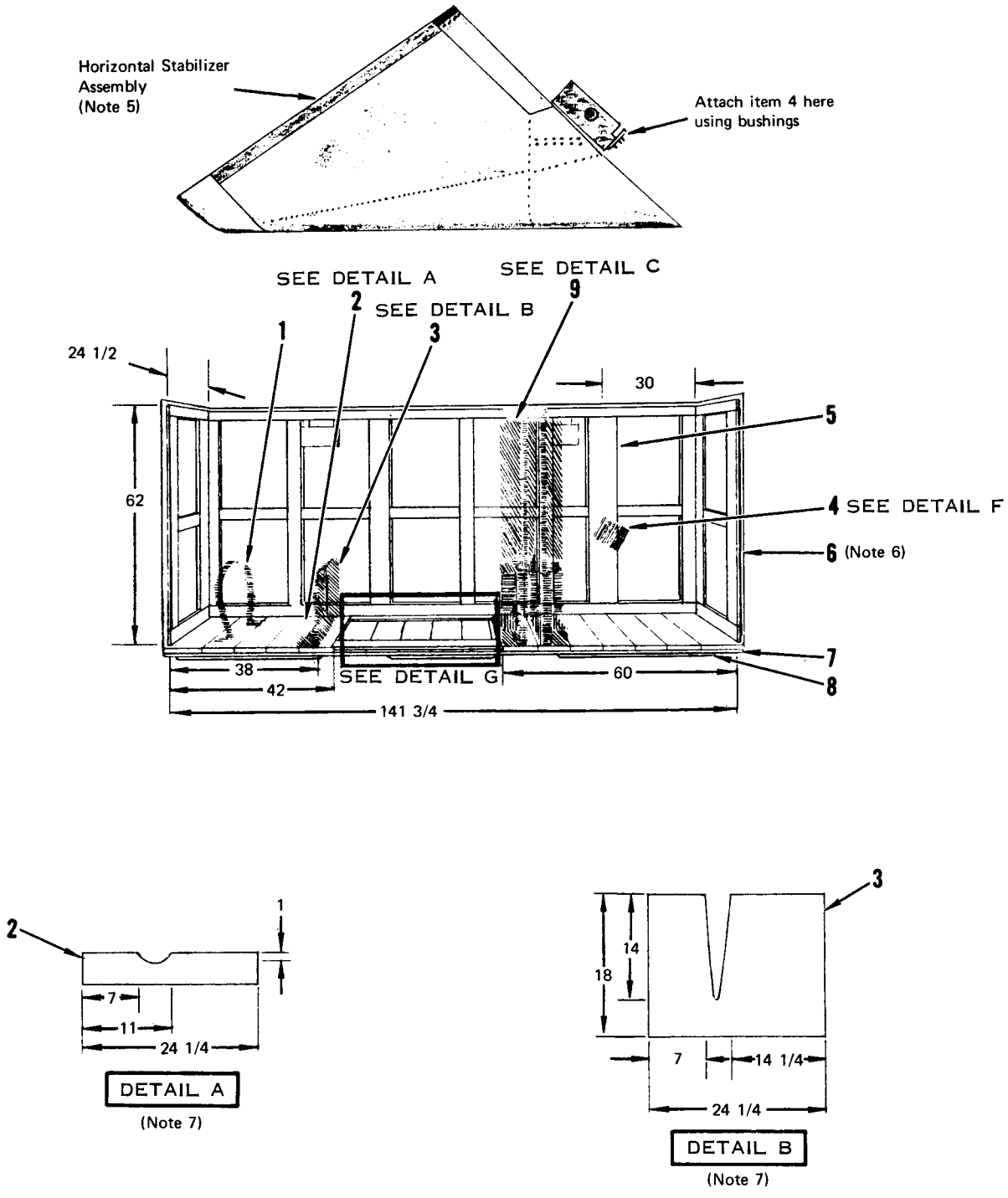


Figure 1-132. Horizontal Stabilizer Assembly (216-60200) Shipping Container (Sheet 1 of 3)

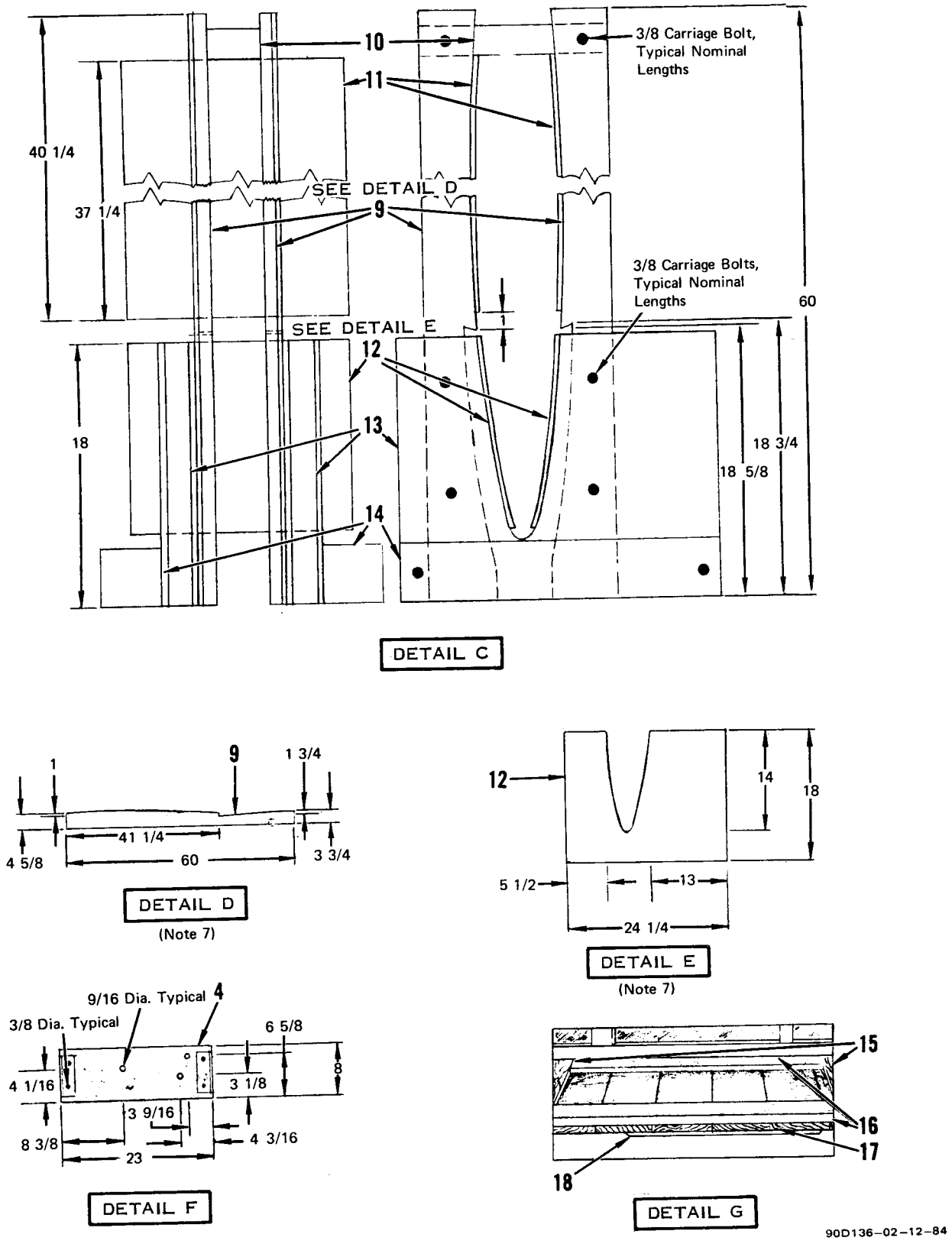


Figure 1-132. Horizontal Stabilizer Assembly (216-60200) Shipping Container (Sheet 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X AR	Webbing, Commercial (Note 2)
2	1	4 X 4 X 24 1/4	Lumber (Note 3)
3	1	2 X 18 X 24 1/4	Lumber
	1	5/16 X 18 X 24 1/4	Plywood (Note 4)
4	2	3/4 X 8 X 23	Plywood
	2	2 X 2 X 6	Angle Iron 1/4-inch Thick
	3	1 O.D. X 9/16 I.D. X AR	Aluminum Bushings
5	1	2 X 8 X AR	Lumber
6	1	144 X 26 1/2 X 69	See specifications
7	2	2 X 4 X 144	Lumber (Skid Plate)
8	4	2 X 4 X 24	Lumber (Skids)
9	4	1 X 8 X 60	Lumber
10	1	2 X 4 X 24 1/4	Lumber
11	1	5/16 X 37 1/4 X AR	Plywood (Load Bearing Face)
12	1	5/16 X AR	Plywood (Load Bearing Face)
13	2	2 X 18 X 24 1/4	Lumber
	4	5/16 X 18 X 24 1/4	Plywood (Note 8)
14	2	4 X 4 X 24 1/4	Lumber
15	AR	2 X 8 X 24 1/4	Lumber
16	2	1 X 4 X AR	Lumber
17	5	1 X 8 X 24 1/4	Lumber
18	2	2 X 4 X 18	Lumber (Skids)

SPECIFICATIONS:

Exterior Container
Level A and B containers to be fabricated in accordance with MIL-C-104, Style-Crate, Type 2, Class 2.

Dimensions (Inside)
141 3/4 X 24 1/2 X 62

Cube
155.3 Cubic Feet

Gross Weight
764 Pounds

Preservation and Packaging
In accordance with MIL-P-116.

NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Webbing attaches to floor of container and loops over horizontal stabilizer. Webbing must be snug tight only.
3. Item 2 is a part of and attaches to Item 3.
4. Plywood to be tacked to one side of wood core.
5. Preserve bare areas with P-II preservative and wrap with MIL-B-121 barrier material.
6. Pad all loading bearing surfaces with 1/2 inch thick MIL-C-46842 cushioning material.
7. All cut outs to be contoured to part.
8. Plywood to be tacked on both sides of wood core.

90D136-03-12-84

Figure 1-132. Horizontal Stabilizer Assembly (216-60200) Shipping Container (Sheet 3)

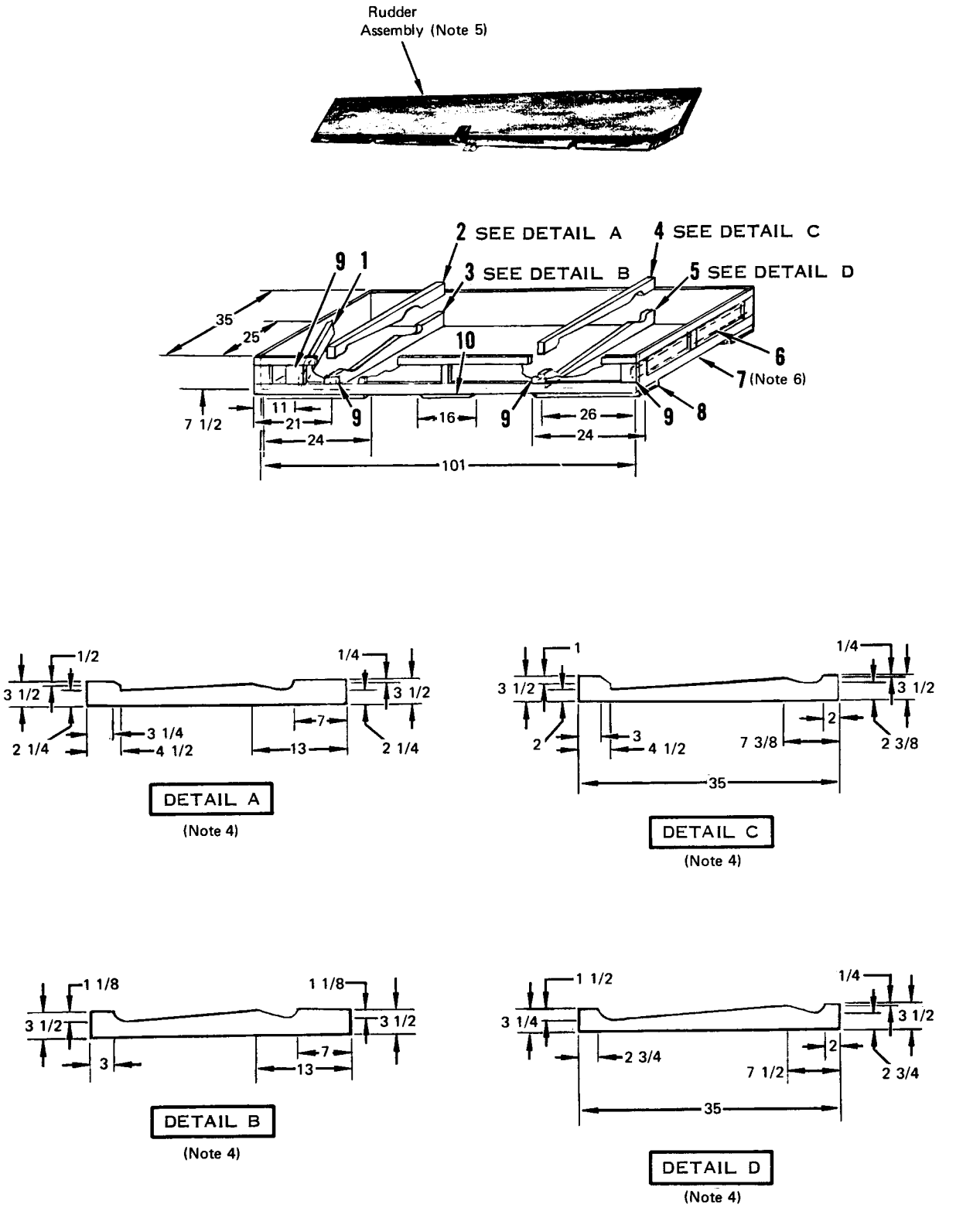


Figure 1-133. Rudder Assembly (215-60100) Shipping Container (Sheet 1 of 2)

Item	Qty	Dimensions (Note 1)	Material
1	1	2 X 4 X 25	Lumber
2	1	2 X 4 X 35	Lumber
	1	5/16 X 4 X 35	Plywood (Note 2)
3	1	2 X 4 X 35	Lumber
	1	5/16 X 4 X 35	Plywood (Note 2)
4	1	2 X 4 X 35	Lumber
	1	5/16 X 4 X 35	Plywood (Note 2)
5	1	2 X 4 X 35	Lumber
	1	5/16 X 4 X 35	Plywood (Note 2)
6	1	2 X 4 X 35	Lumber
7	1	103 X 37 X 11	See specifications
8	4	2 X 4 X 24	Lumber (Note 3)
9	8	1 X 4 X 7 1/2	Lumber (cut to length)
10	2	2 X 4 X 16	Lumber (Note 3)

SPECIFICATIONS:

Exterior Container
Level A containers to be fabricated in accordance with Federal Specification PPP-B-601, Style A, Type 3, Class 1; Levels B and C containers to be fabricated in accordance with Federal Specification PPP-B-576, Style A, Type 3, Class I.

Dimensions (Inside)
101 X 35 X 7 1/2

Cube
24.3 cubic feet

Gross Weight
119 pounds

Preservation and Packaging
In accordance with MIL-P-116.

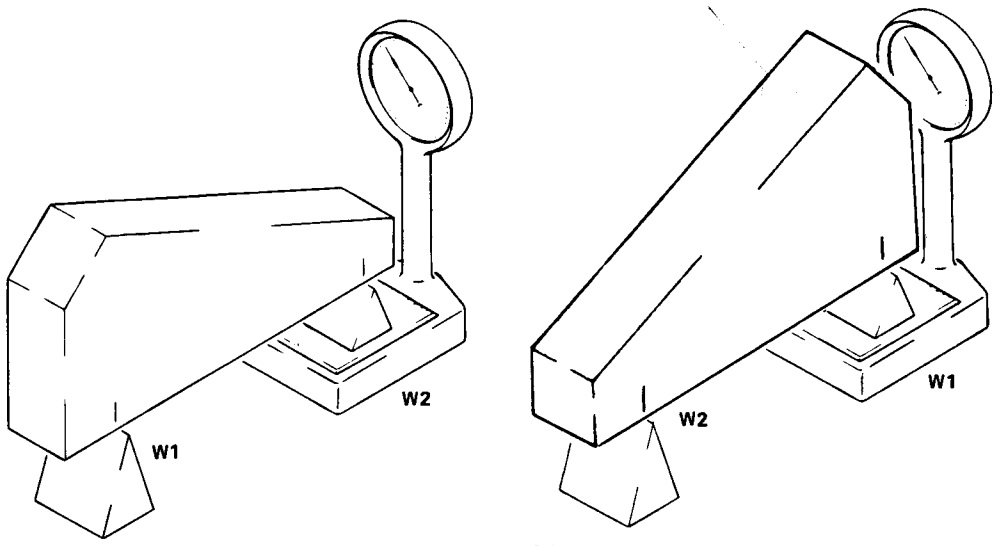
NOTE

1. All wood is in nominal dimensions and all dimensions are in inches unless otherwise noted.
2. Plywood to be tacked on one side of lumber.
3. Skids to be notched for band and installed on level A containers only.
4. Cut outs to be contoured to part.
5. Preserve bushings with P-11 preservative and wrap with L-P-378 polyethylene wrap.
6. Pad all load bearing surfaces with 1/2 inch thick PPP-C-843 cushioning material lined with MIL-B-121 barrier material.

90D137-02-12-84

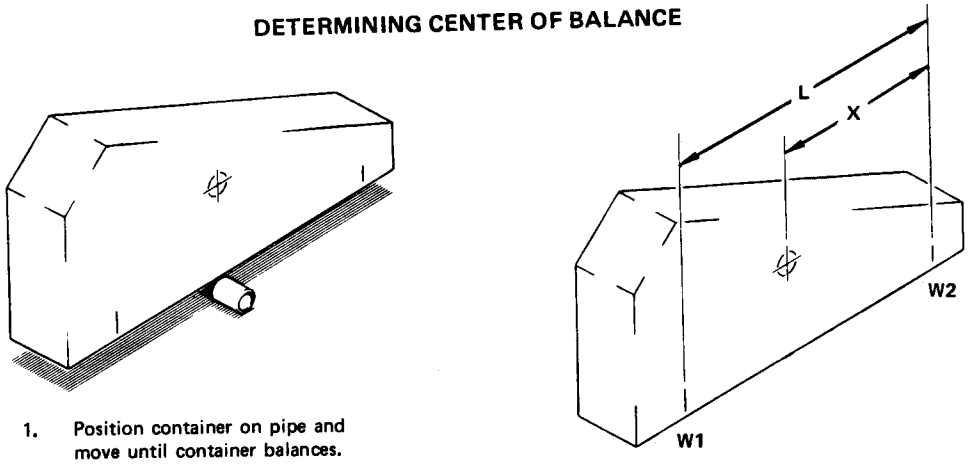
Figure 1-133. Rudder Assembly (215-60100) Shipping Container (Sheet 2)

DETERMINING WEIGHT OF CONTAINER



1. Use iron angles as fulcrums. Weigh each end of container.
2. Mark fulcrum locations on sides of container when first end (W1) is weighed. Align fulcrums with marks when opposite end (W2) is weighed.
3. Add end weights (W1 and W2) to determine gross weight of container.

DETERMINING CENTER OF BALANCE



1. Position container on pipe and move until container balances. Mark balance points.

OR

2. Multiply distance between fulcrum points by weight at fulcrum W1 to determine moment at fulcrum point W2.

OR

3. Divide moment of fulcrum point W2 by total unit weight (W1 and W2) to determine center of balance of container

$$\frac{L \cdot W1}{W1 \text{ and } W2} = X$$

L = Distance between fulcrum points.

W1 = Weight of one end of container.

W2 = Weight of opposite end of container.

X = Distance from fulcrum point.

90D138-12-84

Figure 1-134. Determining Weight and Center of Balance For Shipping Containers with Component Installed

SECTION II

AIRPLANE EXTERIOR MARKINGS

2-1. EXTERIOR MARKINGS. This section gives data for applying markings used during maintenance to identify, locate, and service airplane components and systems. The markings may be destroyed by overspray, repainting, and airstream erosion and should be restored promptly.

2-1.1. Types of Exterior Markings. The markings are insignias, airplane conspicuity markings, and functional markings. Markings shall be put on with stencils and spray paint, except where decals are used. Use MIL-C-83286 polyurethane enamel for all airplane markings except airplane conspicuity. Use MIL-P-21563 high visibility fluorescent paint for conspicuity markings. The exterior markings, sizes, and location shall be as shown in figures 2-1 through 2-13, except conspicuity markings which shall be according to T.O. 1-1-4. All sizes shown on figures are in inches. Put on markings and decals as outlined in the following procedures.

2-1.2. Exterior Stencils. Table 2-1 lists Air Force Stencil Set drawings for reapplying all destroyed stencils. Stencils will be locally made with these drawings.

Table 2-1. Exterior Stencils

Drawing number	Title
	NOTE The four stencil sizes currently authorized and available through Air Force stock (1 3/4-inch, 1-inch, 1/2-inch, and 1/4-inch) are considered standardized for these external markings. The nearest available size to that dimension currently called out in this manual will be used.
7338750 (Size D)	Master stencil set, access panels A-7D
7338751 (Size D)	Left forward and aft stencil set, fuselage
7338828 (Size D)	Right forward and aft stencil set, fuselage
7338890 (Size D)	Top fuselage, stencil set
7338904 (Size D)	Bottom fuselage, stencil set
7338922 (Size D)	Top wing, stencil set
7338948 (Size D)	Bottom wing, stencil set
7338988 (Size D)	Station 1 pylon, stencil set
7338997 (Size D)	Station 2 pylon, stencil set
7339007 (Size D)	Station 3 pylon, stencil set
7339019 (Size D)	Station 6 pylon, stencil set
7339031 (Size D)	Station 7 pylon, stencil set
7339041 (Size D)	Station 8 pylon, stencil set

2-2. SAFETY PRECAUTIONS. To prevent injury to personnel and damage to airplane, comply with all requirements in the safety summary of this manual. Also, comply with all applicable AFOSH standards and observe the following:

a. Accelerators and accelerator thinners are highly toxic and must be washed from the skin immediately.

b. Rags used in metal surface treatment are fire hazards when dry. Discard in metal safety containers.

c. Do not let MIL-M-10578 metal conditioner, Tec No. 901 cleaner, MIL-P-16232 (Granodine 50) metal cleaner, or other acidic materials to contact landing gear and other ultra-high-strength heat-treated steel parts subjected to hydrogen embrittlement (T.O. 1A-7D-23).

2-3. AIRPLANE INSIGNIAS AND FUNCTIONAL MARKINGS. The following procedures are given for applying airplane insignias and functional markings.

2-3.1. Application on Refinished Surfaces. Apply markings over final coat as follows.

WARNING

The paint used for markings is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

CAUTION

Observe safety precautions (paragraph 2-2) when applying markings and insignias.

NOTE

Markings shall be applied directly on final primer or lacquer coat, as applicable. Masking shall not begin until the top coat is tack-free.

Do not apply markings on epoxy primed surfaces until finish coat has dried 1 hour, but before 4 hours elapse. On lacquer finished surfaces, apply markings after 45 minutes, but before 96 hours elapse.

a. Using correct stencil and/or masking, spray marking on prepared surface with first coat of paint. See figures 2-1 through 2-12 for stencil and material required.

b. Let first coat dry.

c. Spray second (finish) coat.

d. Do wet tape paint adhesion test (T.O. 1A-7D-23) when insignias and markings cover large areas, such as national star and squadron identification.

2-3.2. Application on Aged Surface Finish. Apply markings on aged surface finish as follows.

a. Clean surface as needed.

b. Apply mist coat using same color and materials as finish coat.

c. Apply marking as specified in paragraph 2-3.1.

2-4. DECALS AND REFLECTIVE TAPE. Apply decals defined in figures 2-1 through 2-12 as follows.

a. Read safety precautions (paragraph 2-2).

WARNING

TT-T-266 thinner is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

Trichloroethane is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

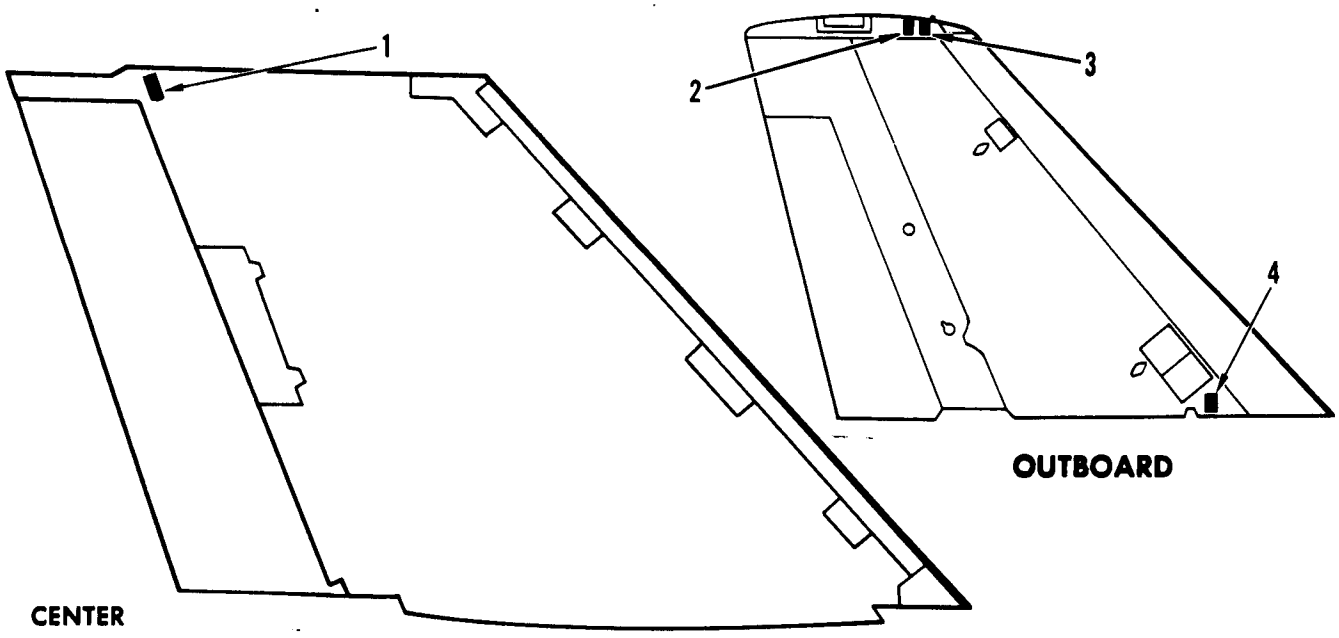
b. Clean receiving surface (bare or painted) with TT-T-266 thinner or O-T-620 (1,1,1) trichloroethane and wipe dry with cloth.

c. Peel paper liner from one edge of adhesive side of decal or end of tape. Fold liner away from adhesive surface.

d. Place decal or tape on surface and press exposed adhesive area against surface.

e. Peel away rest of liner while applying hand pressure along decal or tape face to force out air bubbles.

f. Seal edges with brush-coat of 4150 edge sealant (700 sealant on fluorescent decals) if decal is on airplane exterior.



1

0.50

NO STEP

Color Black
Part No. CVC3306-171T

3

0.35

NO STEP

Color Black
Part No. CVC3305-10T

2

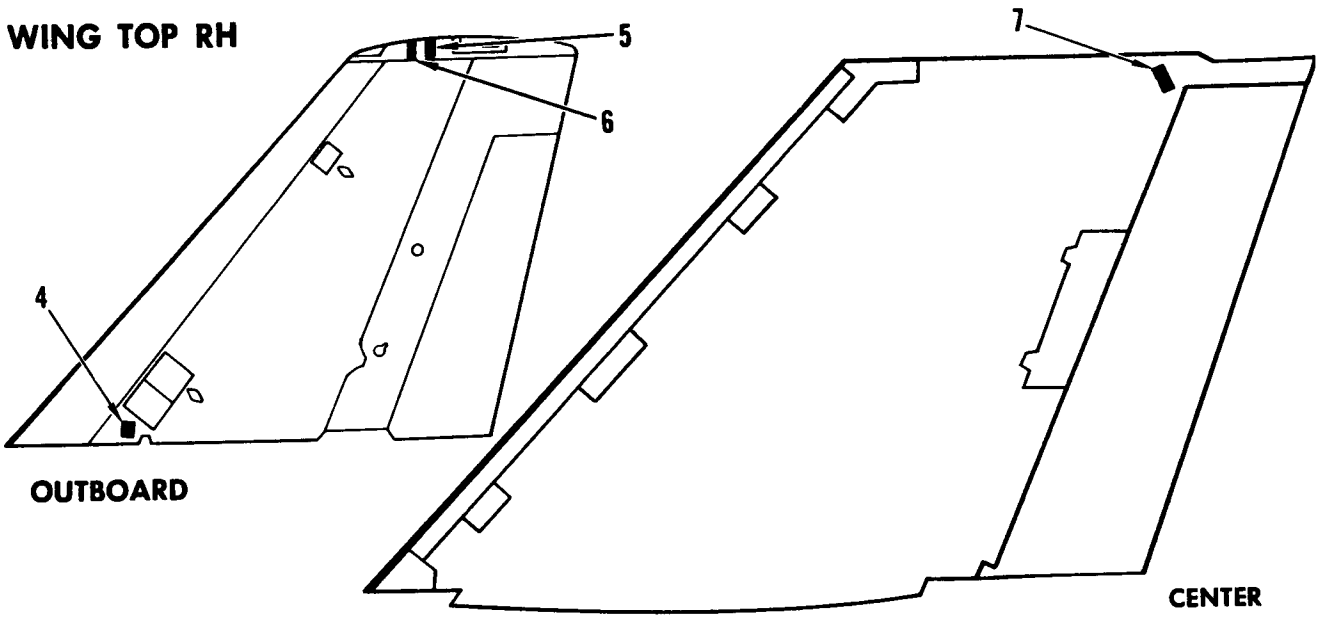
0.48

NO PUSH

Color Black
Part No. CVC3306-3T

90D161-01-03-90

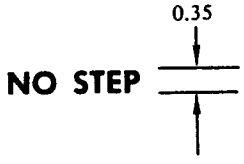
Figure 2-1. Wing Exterior Markings (Sheet 1 of 5)



4

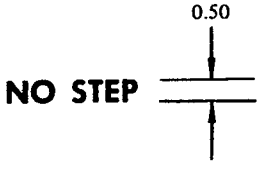
Color Black
Part No. CVC3310-194T

5



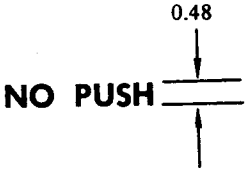
Color Black
Part No. CVC3305-10T

7



Color Black
Part No. CVC3306-171T

6

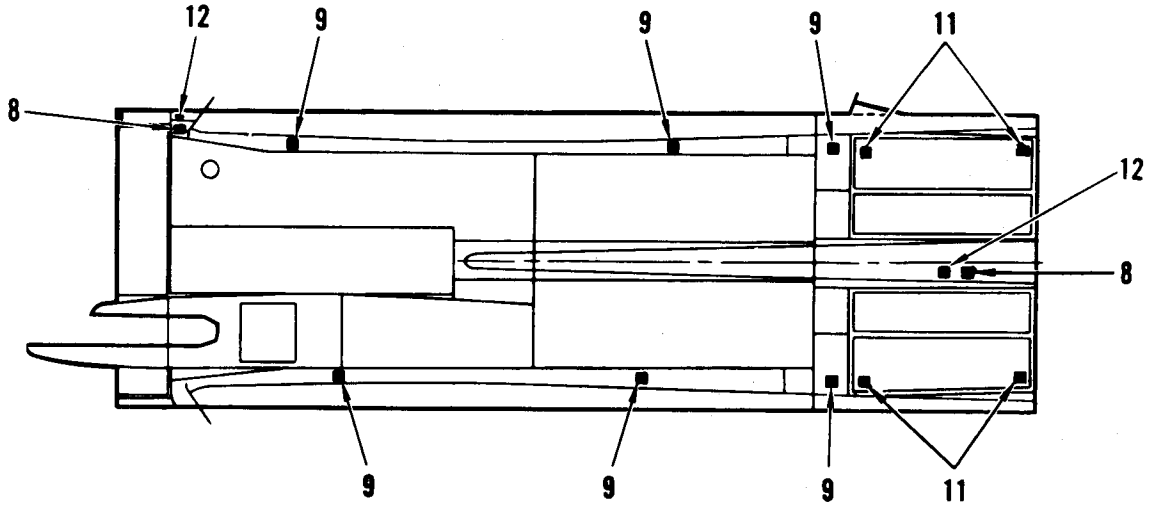


Color Black
Part No. CVC3306-3T

90D161-02-12-84

Figure 2-1. Wing Exterior Markings (Sheet 2)

WING TOP CENTER



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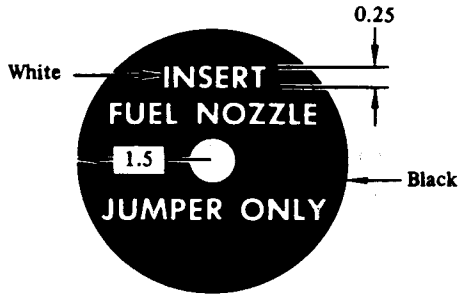
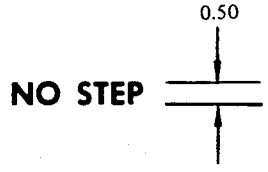


Color Black Background, White Lettering
Part No. CVC3430-1T

9



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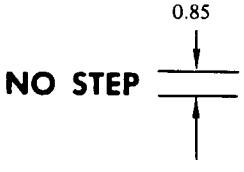
Part No. CVC3306-171T

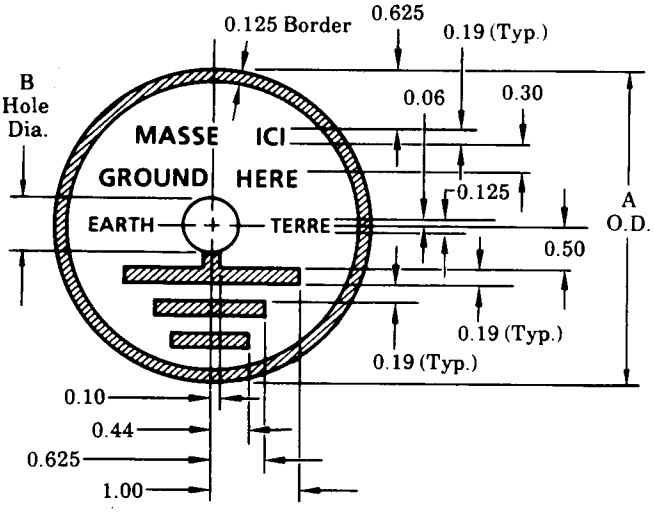
10 Deleted

11



Color Black
Part No. CVC3321-1T

12



Symmetrical About Centerline

PART NUMBER	DECAL SIZE	A O.D.	B HOLE DIA
MS27606-1	Small	3.500 (±.125)	0.625
MS27606-2	Large	4.000	1.200

Color, Shaded Areas and Lettering Black, Background Yellow
Part No. MS27606

90D161-03-10-89

Figure 2-1. Wing Exterior Markings (Sheet 3)

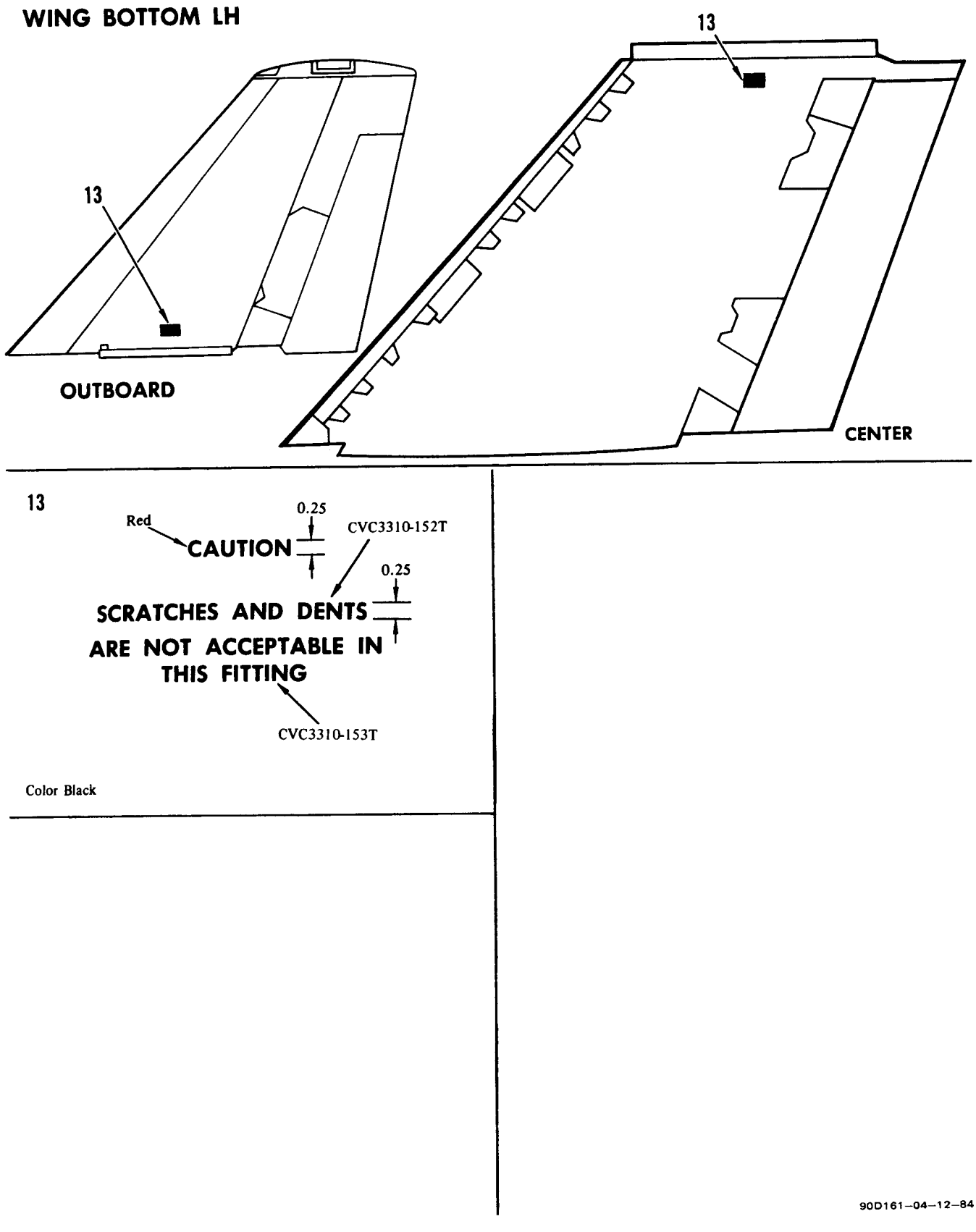


Figure 2-1. Wing Exterior Markings (Sheet 4)

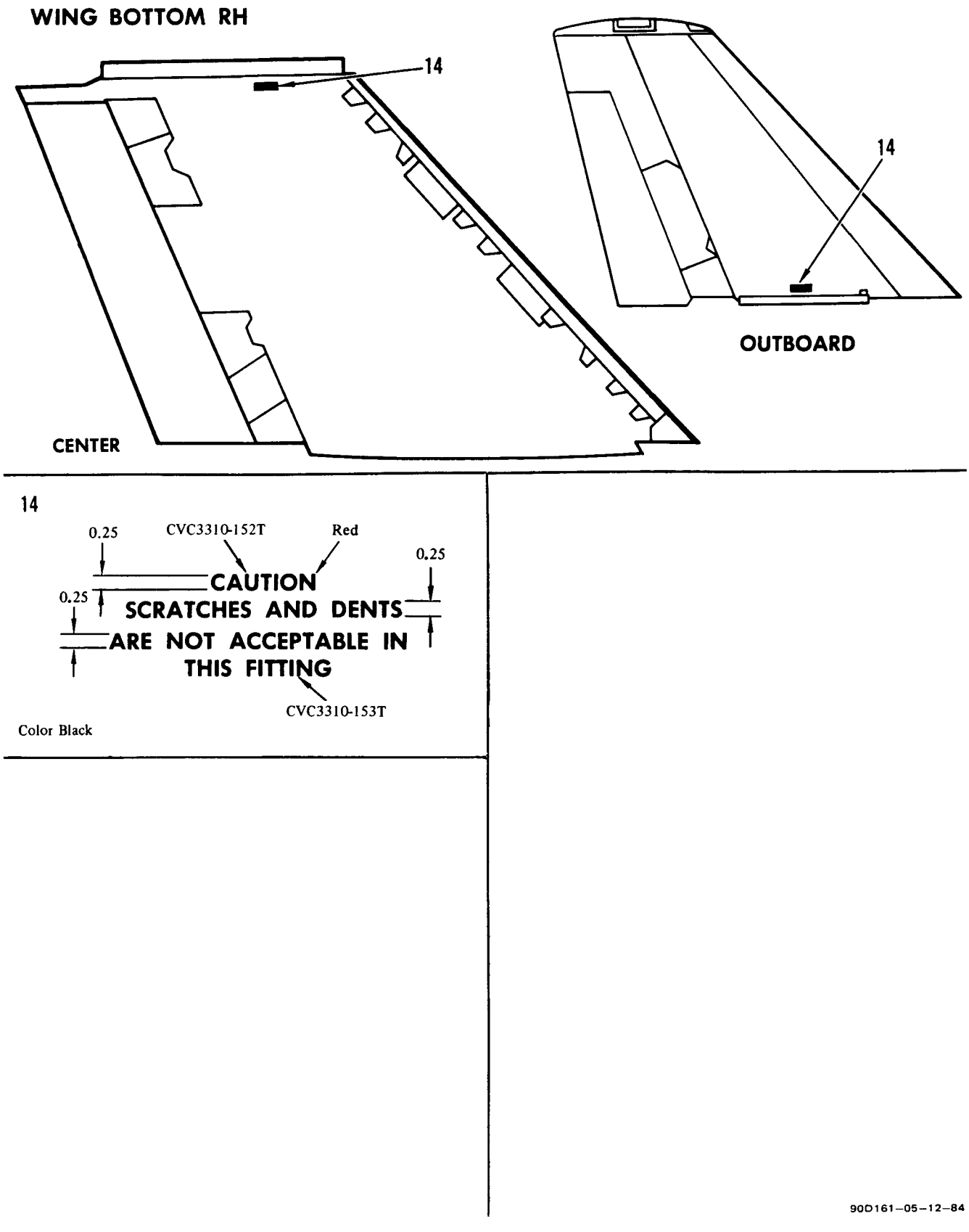
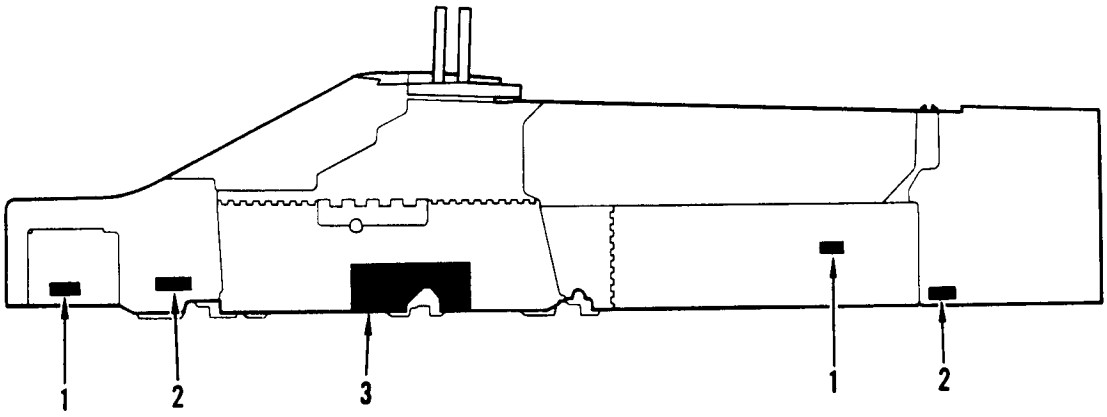


Figure 2-1. Wing Exterior Markings (Sheet 5)

WING STATION NO. 1 PYLON



OUTBOARD

1

ELECTRICAL ACCESS

0.25

Color Black
Part No. CVC3310-200

2

LIFT HERE

0.35

Color Black
Part No. CVC3305-9T

3

Red
CAUTION
INSTALL ORIFICE FROM THIS SIDE
0.38
0.25
0.13
30°
0.63
0.19

HOOK MANUAL RELEASE
0.19
30°
30°
10°
0.63R
0.13
30°
0.75 Dia
0.13

0.38
CAUTION
Red
INSTALL ORIFICE FROM THIS SIDE
0.19

GROUND SAFETY PIN HOLE
0.19

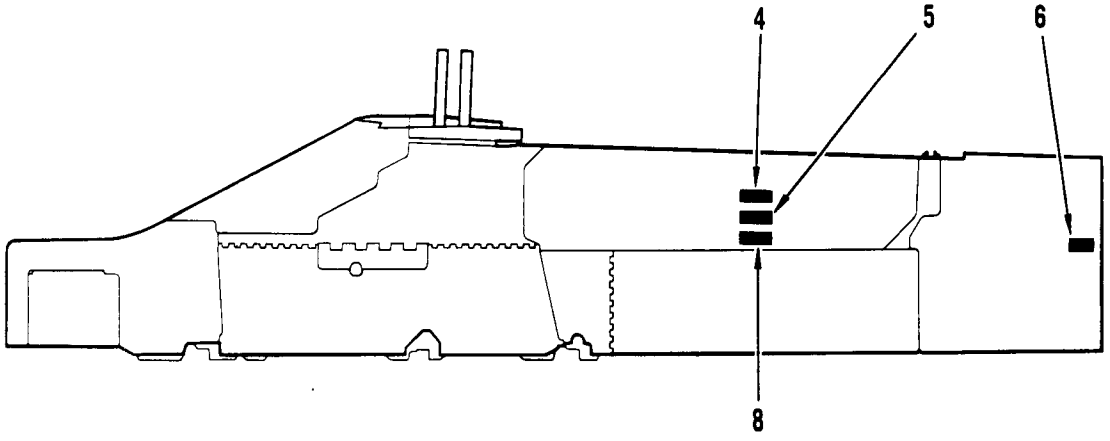
Red
CAUTION
IF RED SHAFT IS VISIBLE LINKAGE IS UNLATCHED
0.25
0.16

Part No. 216-99407-1

90D162-01-03-90

Figure 2-2. Wing Station No. 1 Pylon Exterior Markings (Sheet 1 of 5)

WING STATION NO. 1 PYLON



OUTBOARD

4

0.25

NO VOLTAGE TEST
MAU 12 RACK

Color Black
Part No. CVC3310-197T

7 Deleted

5

0.25

NO VOLTAGE TEST
STORES

Color Black
Part No. CVC3310-198T

8

0.25

NO VOLTAGE TEST
AUX JETTISON

Color Black
Part No. CVC3310-199T

6

0.48

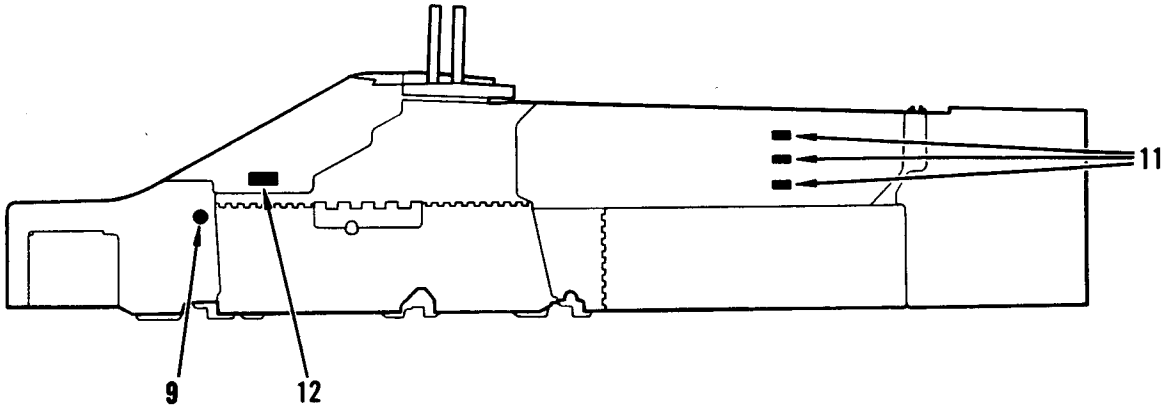
NO PUSH

Color Black
Part No. CVC3306-3T

90D162-02-03-90

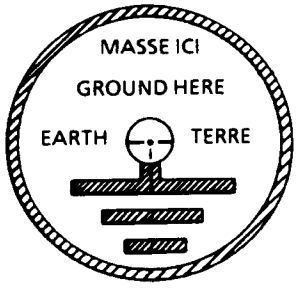
Figure 2-2. Wing Station No. 1 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 1 PYLON



OUTBOARD

9



10 Deleted

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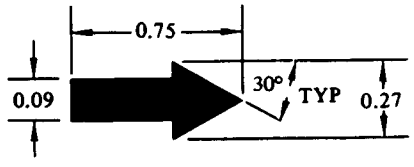


Color Black
Part No. CVC3349-1T

12

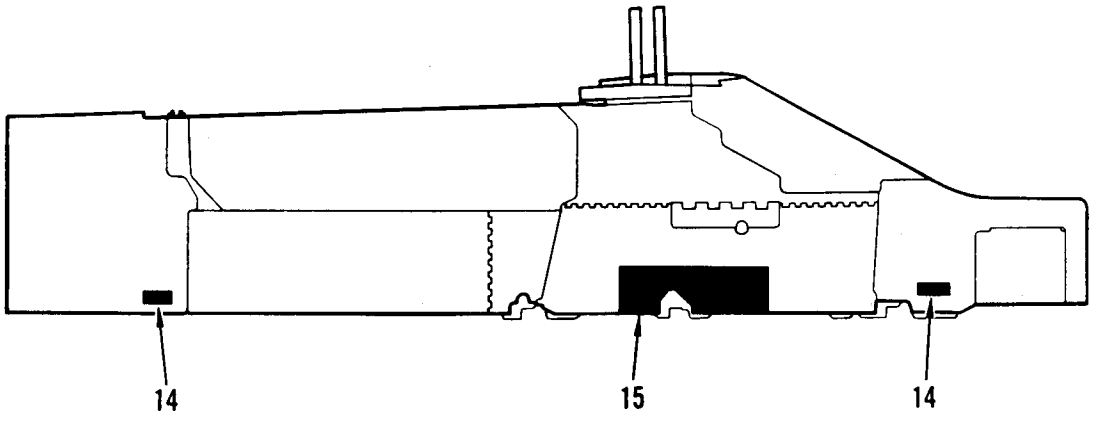
PYLON ELECTRICAL DISCONNECT ACCESS

Color Black
Part No. CVC3310-178T

90D162-03-10-89

Figure 2-2. Wing Station No. 1 Pylon Exterior Markings (Sheet 3)

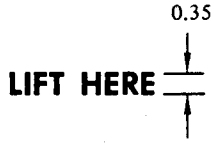
WING STATION NO. 1 PYLON



INBOARD

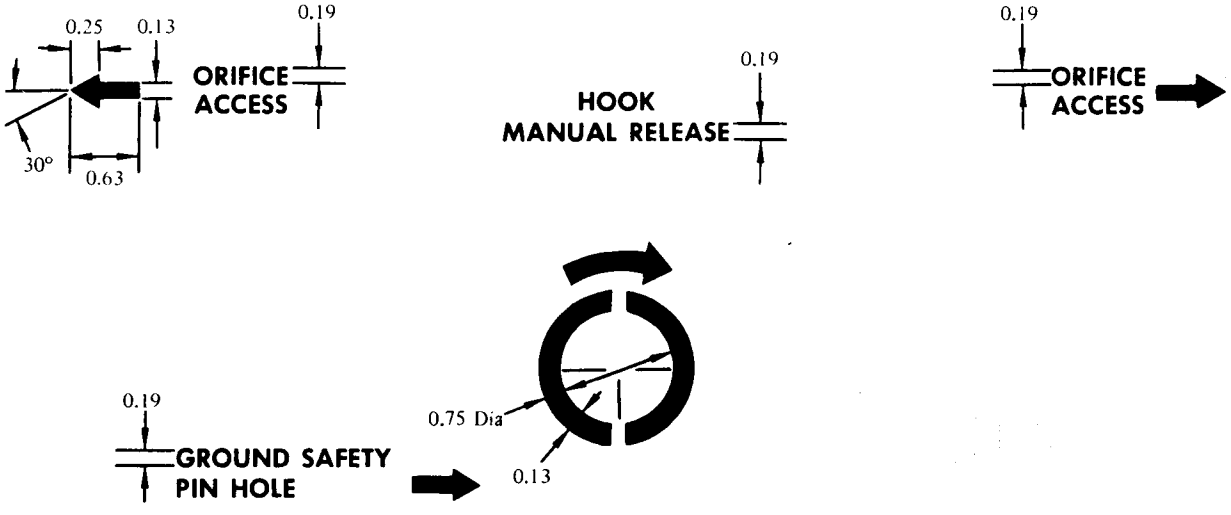
13 Deleted

14



Color Black
Part No. CVC3305-9T

15

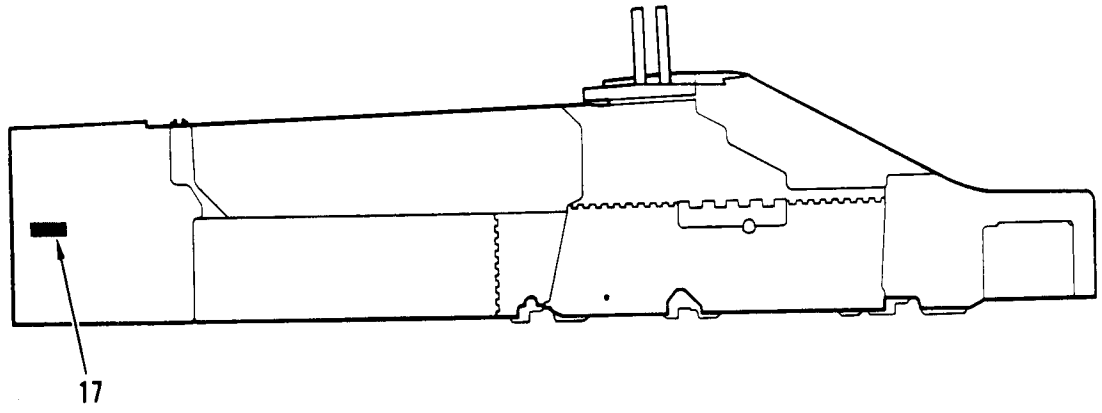


Part No. 216-99407-3

90D162-04-10-89

Figure 2-2. Wing Station No. 1 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 1 PYLON



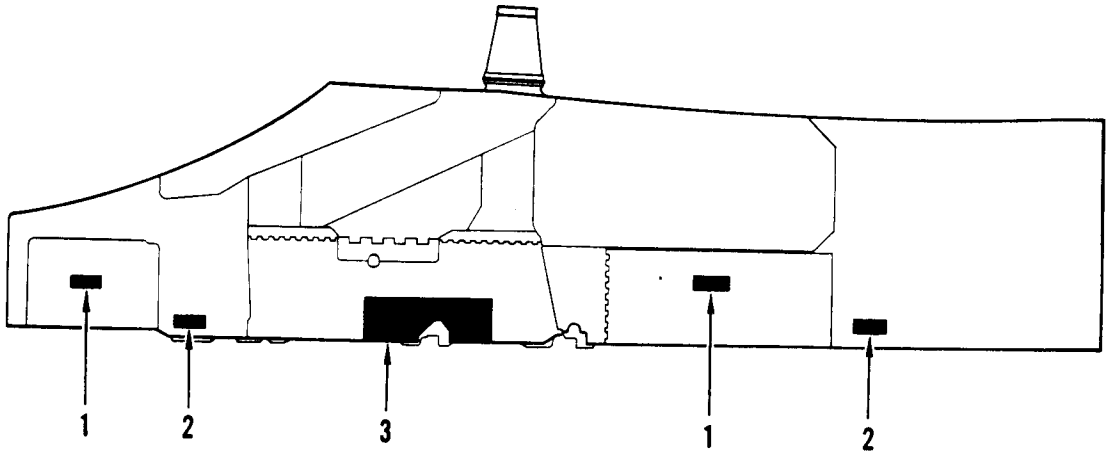
INBOARD

16 Deleted	**17** 0.48 **NO PUSH** Color Black Part No. CVC3306-3T

90D162-05-10-89

Figure 2-2. Wing Station No. 1 Pylon Exterior Markings (Sheet 5)

WING STATION NO. 2 PYLON



OUTBOARD

1

0.25

ELECTRICAL ACCESS

Color Black
Part No. CVC3310-200T

2

0.35

LIFT HERE

Color Black
Part No. CVC3305-9T

3

Red

0.38

0.25 0.13 **CAUTION**

INSTALL ORIFICE FROM THIS SIDE

30° 0.63 0.19

0.19

HOOK MANUAL RELEASE

30° 30° 10°

0.63R

0.13

30°

0.75 Dia

0.13

0.38

CAUTION Red

INSTALL ORIFICE FROM THIS SIDE

0.19

0.19

GROUND SAFETY PIN HOLE

Red

0.25 **CAUTION**

IF RED SHAFT IS VISIBLE LINKAGE IS UNLATCHED

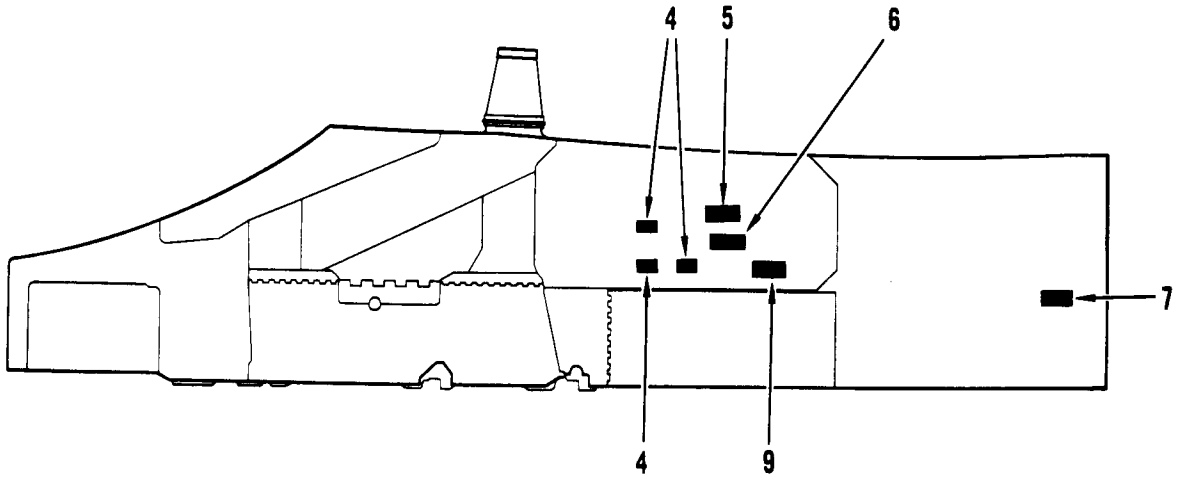
0.16

Part No. 216-99407-1

90D163-01-03-90

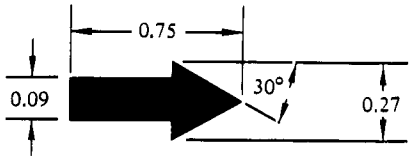
Figure 2-3. Wing Station No. 2 Pylon Exterior Markings (Sheet 1 of 5)

WING STATION NO. 2 PYLON



OUTBOARD

4



Color Black
Part No. CVC3349-1T

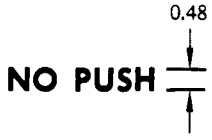
5

Color Black
Part No. CVC3310-197T

6

Color Black
Part No. CVC3310-198T

7



Color Black
Part No. CVC3306-3T

8 Deleted

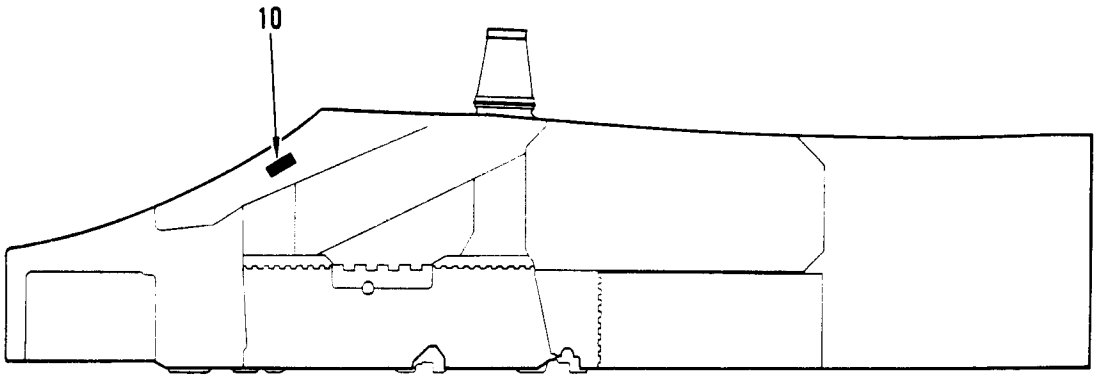
9

Color Black
Part No. CVC3310-199T

90D163-02-03-90

Figure 2-3. Wing Station No. 2 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 2 PYLON



OUTBOARD

10

PYLON ELECTRICAL DISCONNECT ACCESS

0.25

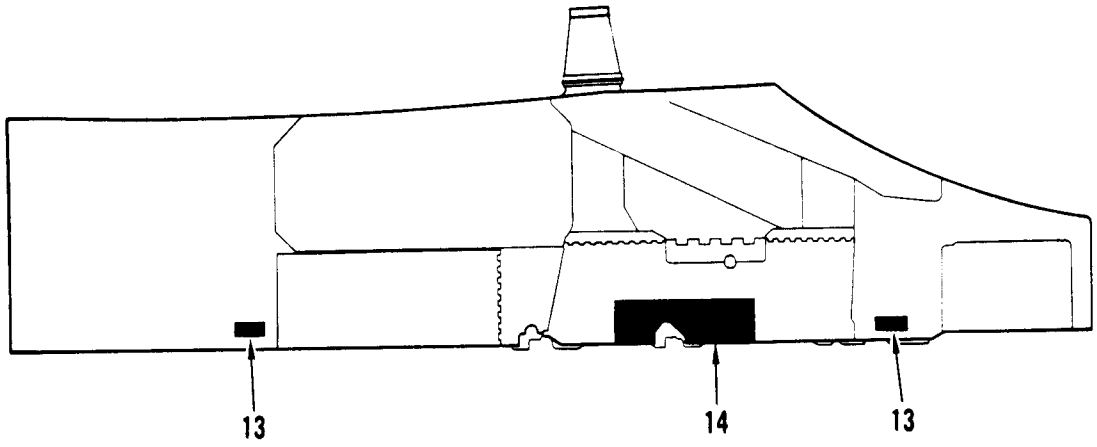
Color Black
Part No. CVC3310-178T

11 Deleted

90D163-03-10-89

Figure 2-3. Wing Station No. 2 Pylon Exterior Markings (Sheet 3)

WING STATION NO. 2 PYLON



INBOARD

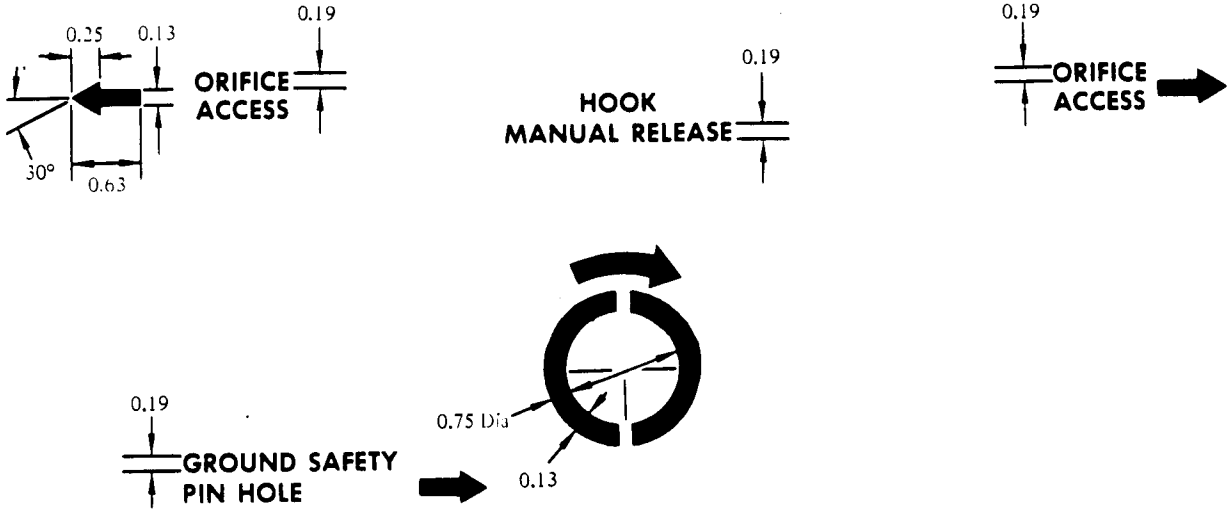
12 Deleted

13

0.35
LIFT HERE

Color Black
Part No. CVC3305-9T

14

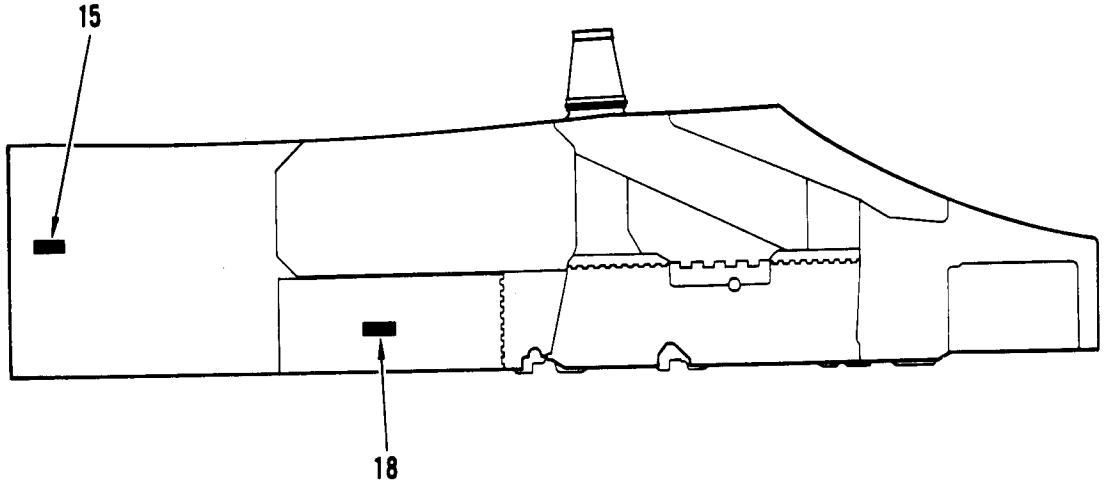


Part No. 216-99407-3

90D163-04-10-89

Figure 2-3. Wing Station No. 2 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 2 PYLON



INBOARD

15

0.48

NO PUSH

Color Black
Part No. CVC3306-3T

17 Deleted

16 Deleted

18

0.25

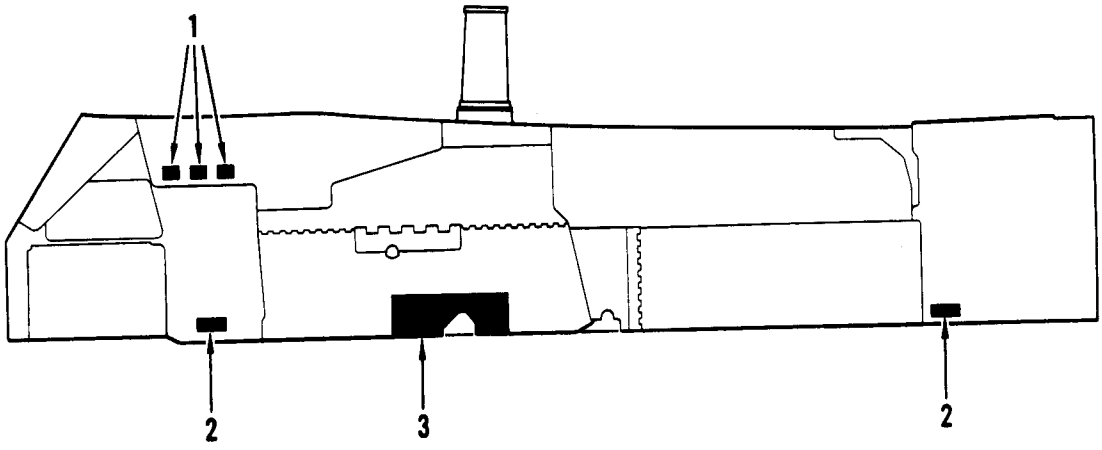
ELECTRICAL ACCESS

Color Black
Part No. CVC3310-200T

90D163-05-03-90

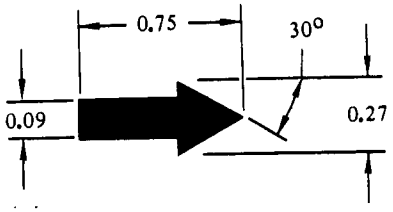
Figure 2-3. Wing Station No. 2 Pylon Exterior Markings (Sheet 5)

WING STATION NO. 3 PYLON



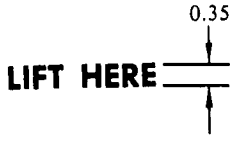
OUTBOARD

1



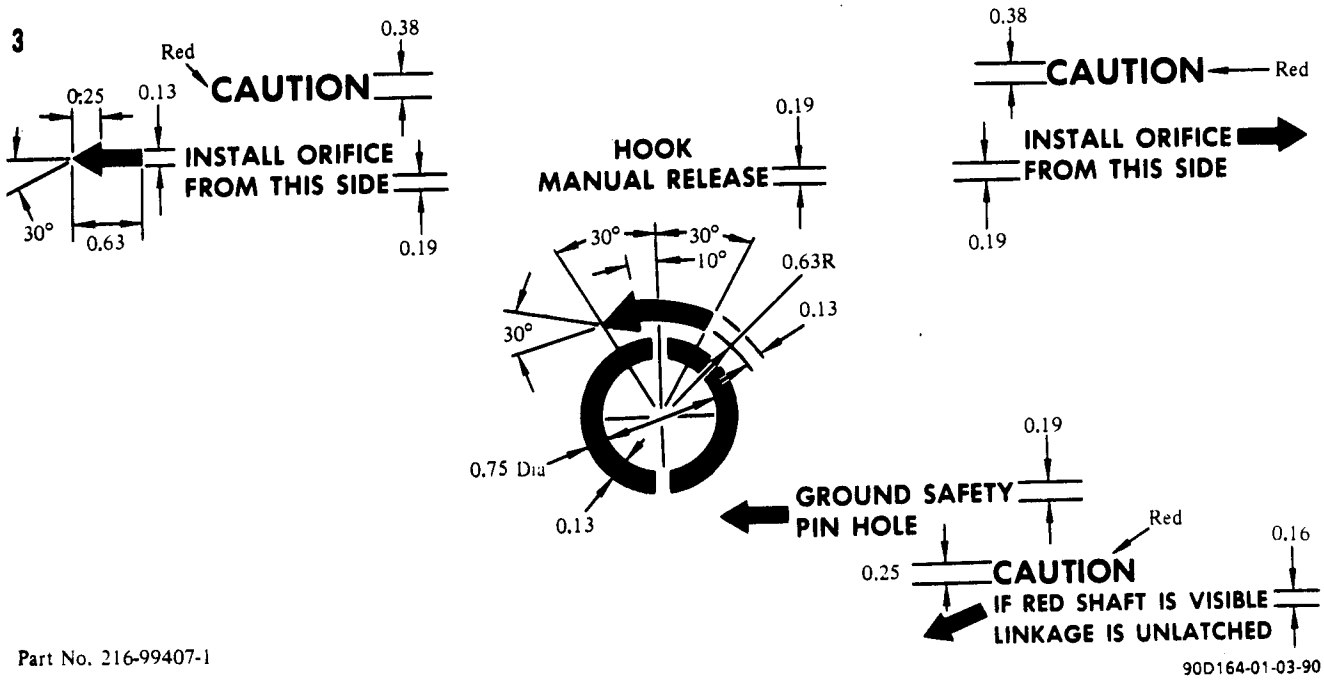
Color Black
Part No. CVC3349-1T

2



Color Black
Part No. CVC3305-9T

3

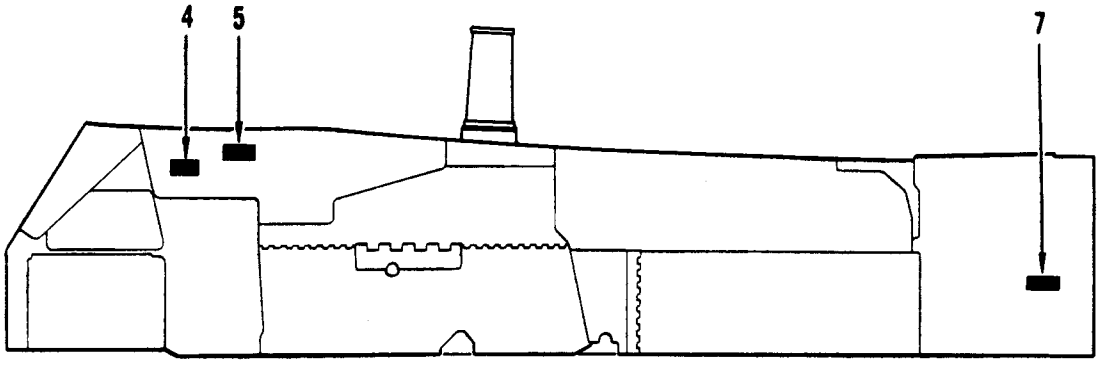


Part No. 216-99407-1

90D164-01-03-90

Figure 2-4. Wing Station No. 3 Pylon Exterior Markings (Sheet 1 of 5)

WING STATION NO. 3 PYLON



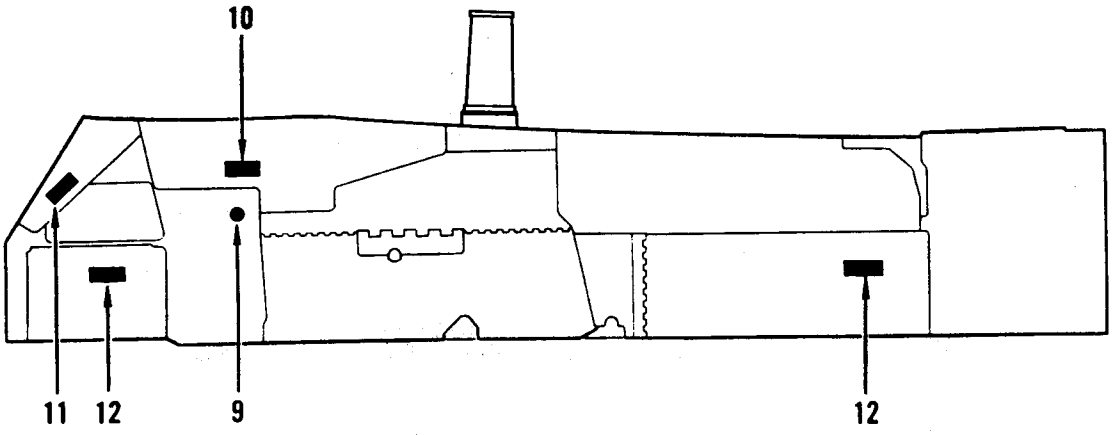
OUTBOARD

4 **NO VOLTAGE TEST** **MAU 12 RACK** 0.25 Color Black Part No. CVC3310-197T	**7** **NO PUSH** 0.48 Color Black Part No. CVC3306-3T
5 **NO VOLTAGE TEST** **STORES** 0.25 Color Black Part No. CVC3310-198T	**8** Deleted
6 Deleted	

90D164-02-03-90

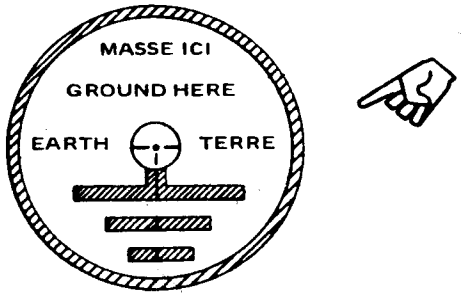
Figure 2-4. Wing Station No. 3 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 3 PYLON



OUTBOARD

9



11

PYLON ELECTRICAL DISCONNECT ACCESS

0.25

Color Black
Part No. CVC3310-178T

10

0.25

NO VOLTAGE TEST AUX JETTISON

Color Black
Part No. CVC3310-199T

12

ELECTRICAL ACCESS

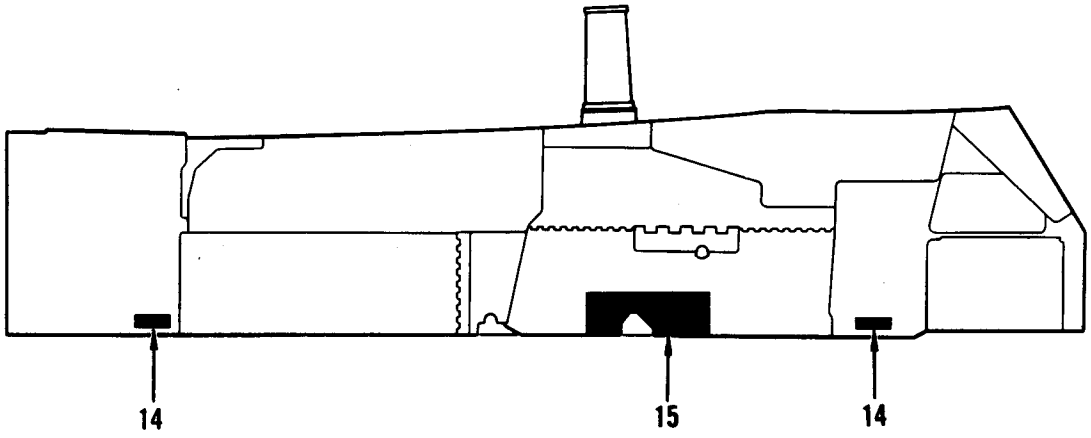
0.25

Color Black
Part No. CVC3310-200T

90D164-03-12-84

Figure 2-4. Wing Station No. 3 Pylon Exterior Markings (Sheet 3)

WING STATION NO. 3 PYLON



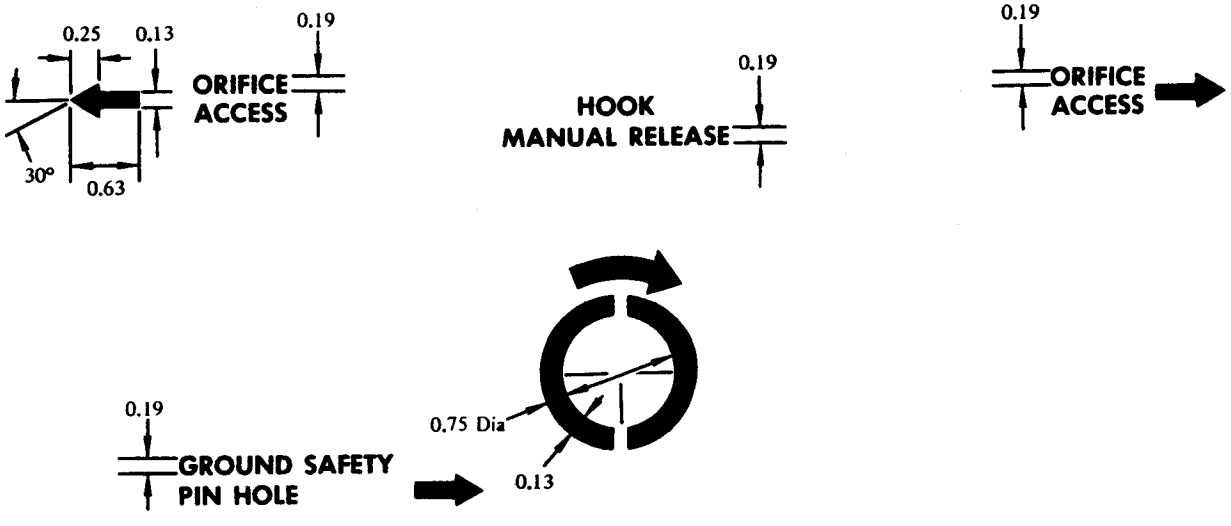
INBOARD

13 Deleted

14

Color Black
Part No. CVC3305-9T

15

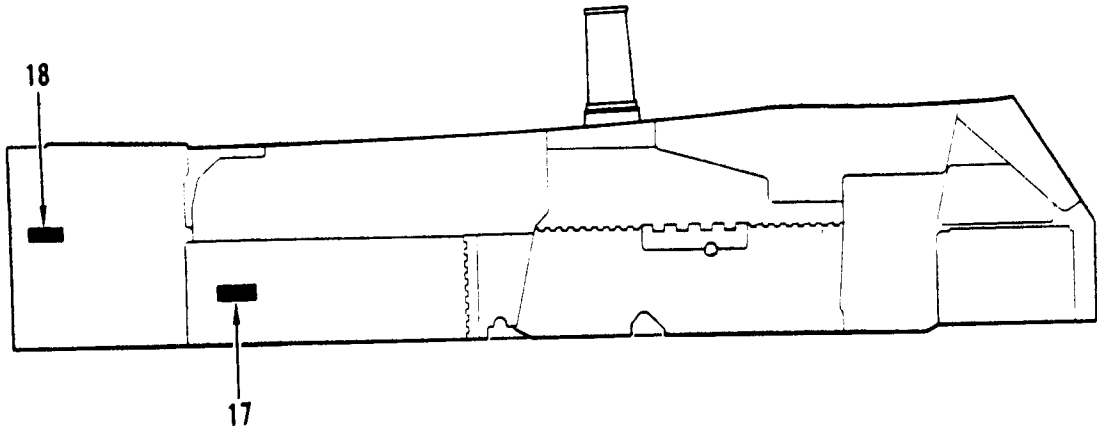


Part No. 216-99407-3

90D164-04-10-89

Figure 2-4. Wing Station No. 3 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 3 PYLON



INBOARD

16 Deleted

18

0.48
NO PUSH

Color Black
Part No. CVC3306-3T

17

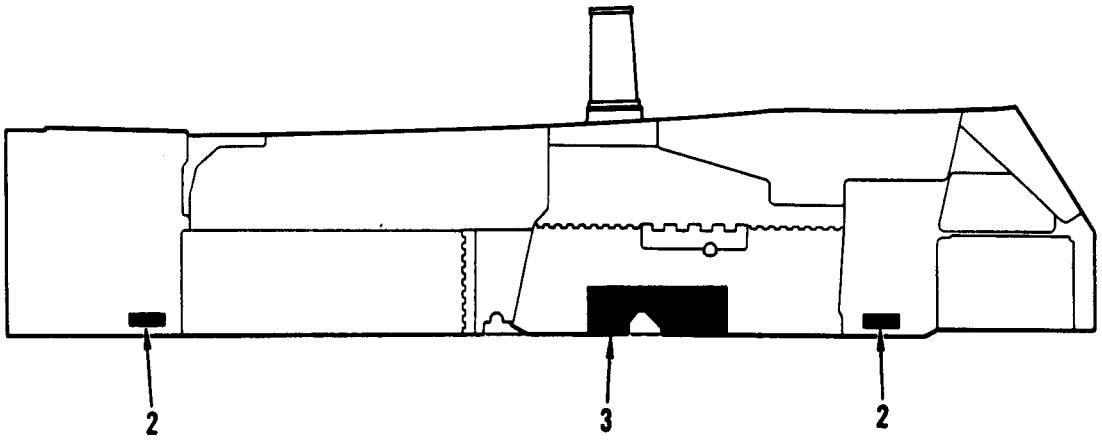
0.25
ELECTRICAL ACCESS

Color Black
Part No. CVC3310-200T

90D164-05-10-89

Figure 2-4. Wing Station No. 3 Pylon Exterior Markings (Sheet 5)

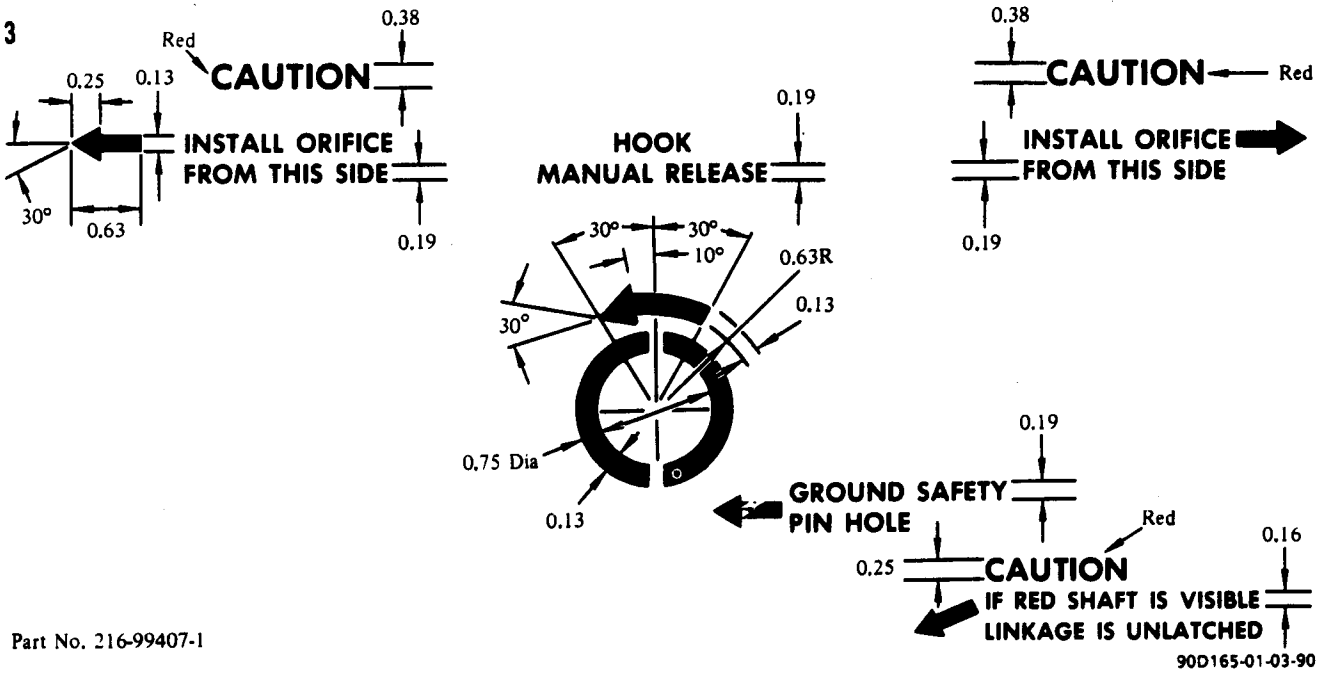
WING STATION NO. 6 PYLON



OUTBOARD

1 Deleted	2 0.35 LIFT HERE Color Black Part No. CVC3305-9T

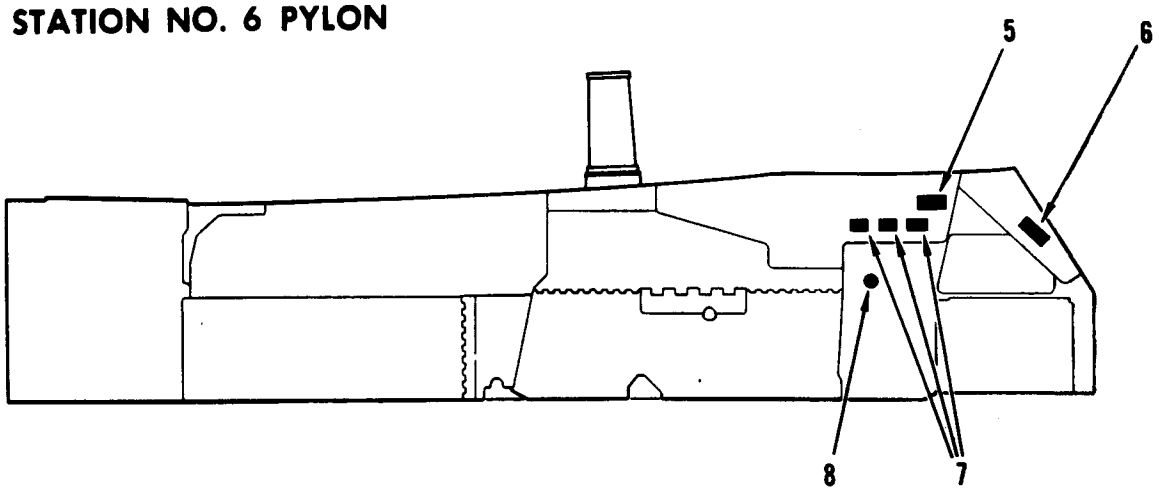
3



Part No. 216-99407-1

Figure 2-5. Wing Station No. 6 Pylon Exterior Markings (Sheet 1 of 5)

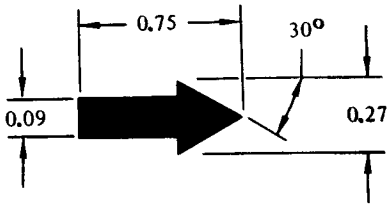
WING STATION NO. 6 PYLON



OUTBOARD

6 Deleted

7



Color Black
Part No. CVC3349-1T

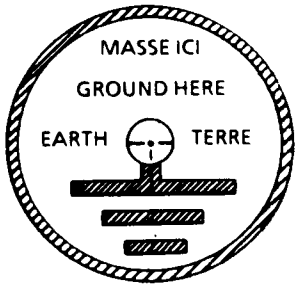
5

NO VOLTAGE TEST
MAU 12 RACK

0.25

Color Black
Part No. CVC3310-197T

8



6

PYLON ELECTRICAL
DISCONNECT ACCESS

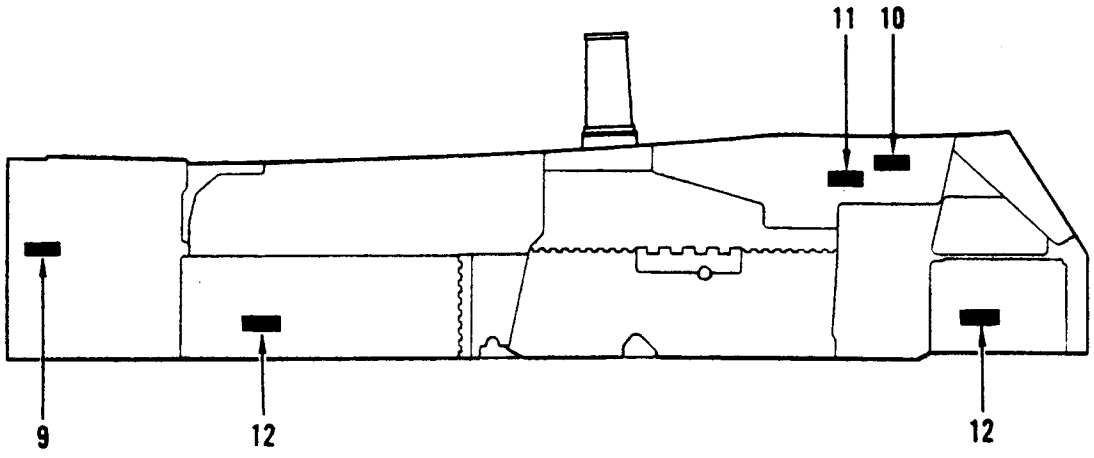
0.25

Color Black
Part No. CVC3310-178T

90D165-02-03-90

Figure 2-5. Wing Station No. 6 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 6 PYLON



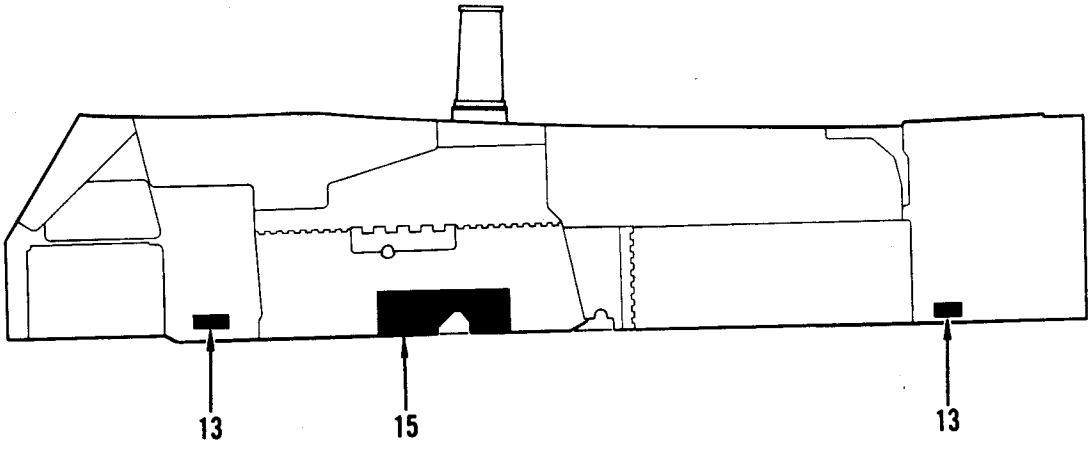
OUTBOARD

9 0.48 NO PUSH Color Black Part No. CVC3306-3T	**11** 0.25 NO VOLTAGE TEST AUX JETTISON Color Black Part No. CVC3310-199T
10 0.25 NO VOLTAGE TEST STORES Color Black Part No. CVC3310-198T	**12** 0.25 ELECTRICAL ACCESS Color Black Part No. CVC3310-200T

90D165-03-12-84

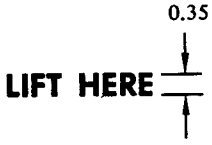
Figure 2-5. Wing Station No. 6 Pylon Exterior Markings (Sheet 3)

WING STATION NO. 6 PYLON



INBOARD

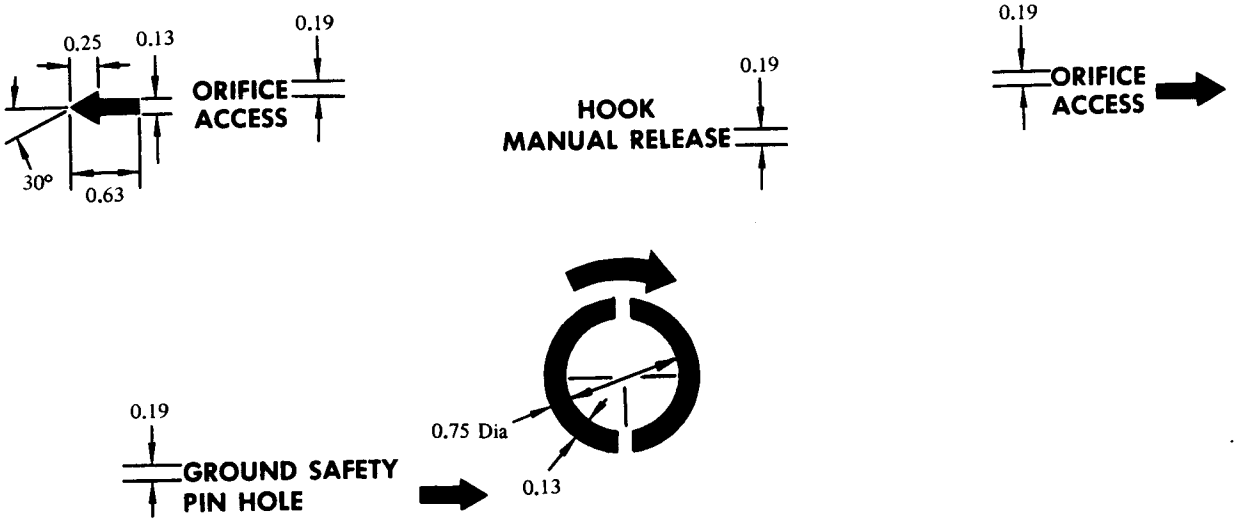
13



Color Black
Part No. CVC3305-9T

14 Deleted

15

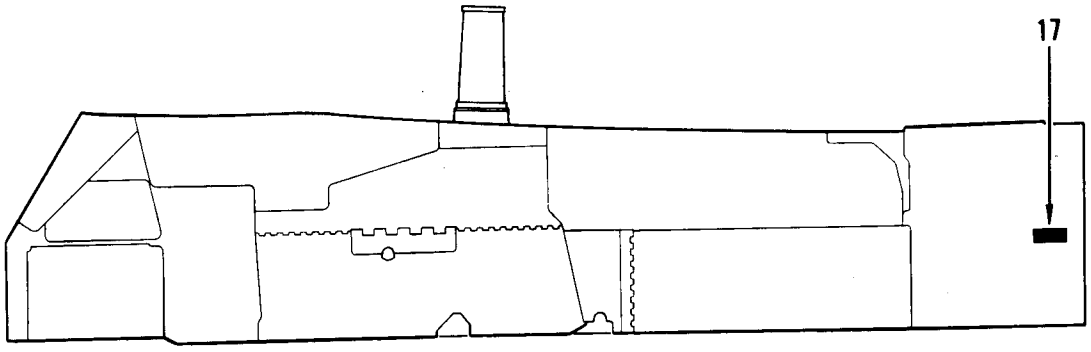


Part No. 216-99407-3

90D165-04-10-89

Figure 2-5. Wing Station No. 6 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 6 PYLON



INBOARD

16 Deleted

17

0.48

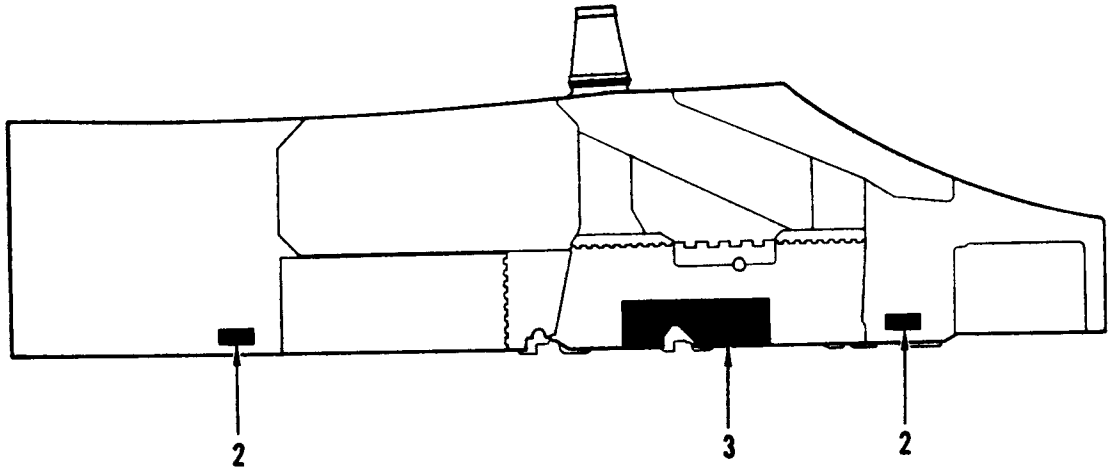
NO PUSH

Color Black
Part No. CVC3306-3T

90D165-05-10-89

Figure 2-5. Wing Station No. 6 Pylon Exterior Markings (Sheet 5)

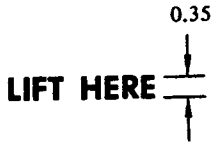
WING STATION NO. 7 PYLON



OUTBOARD

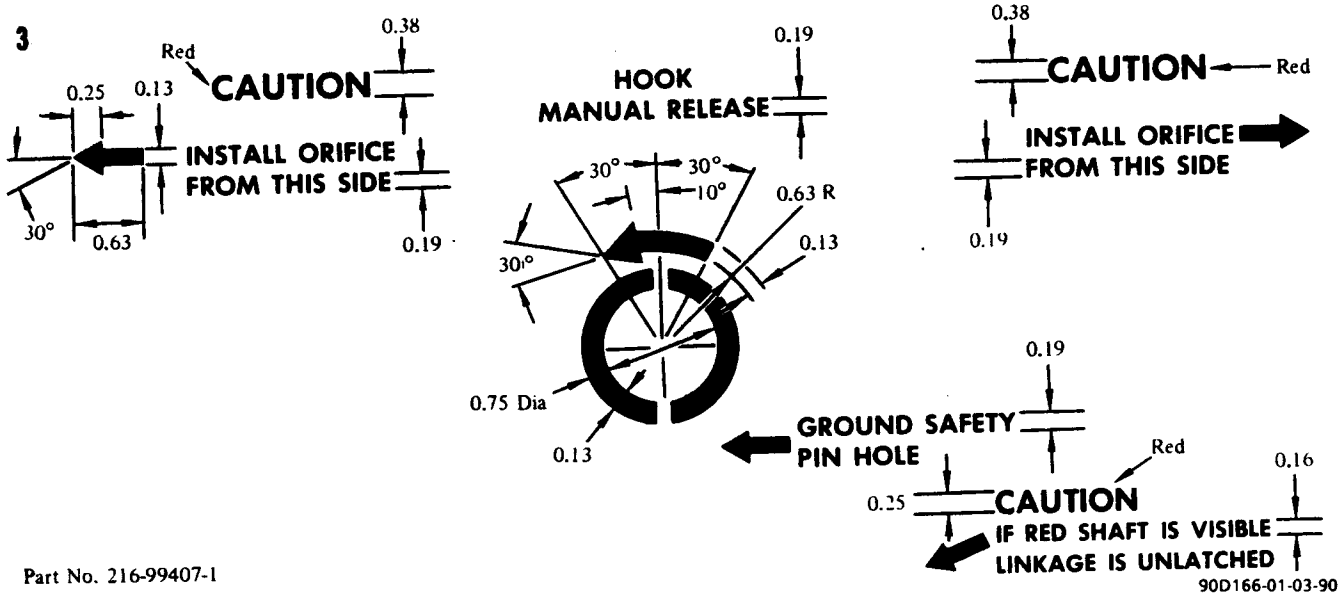
1 Deleted

2



Color Black
Part No. CVC3305-9T

3

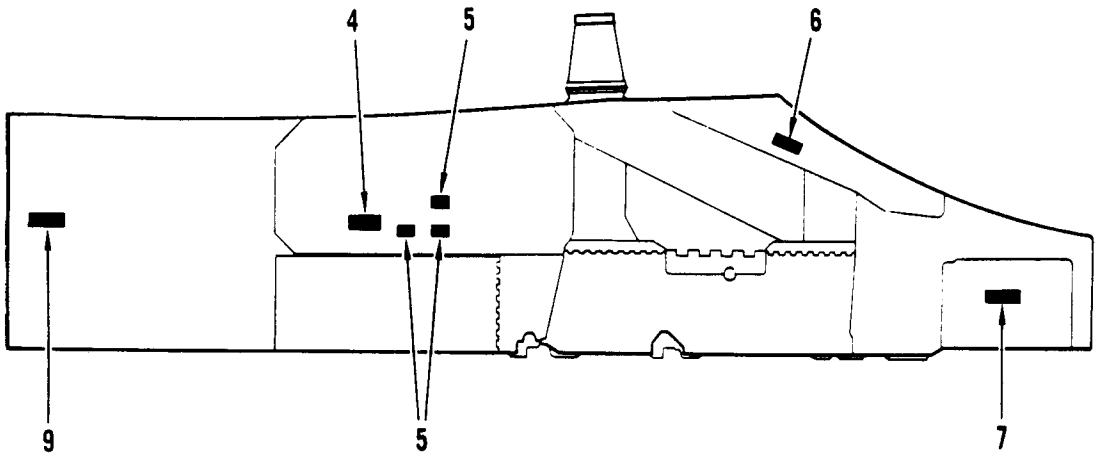


Part No. 216-99407-1

90D166-01-03-90

Figure 2-6. Wing Station No. 7 Pylon Exterior Markings (Sheet 1 of 5)

WING STATION NO. 7 PYLON



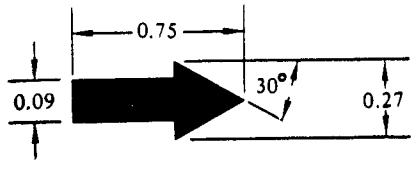
OUTBOARD

4

NO VOLTAGE TEST
AUX JETTISON
0.25

Color Black
Part No. CVC3310-199T

5



Color Black
Part No. CVC3349-1T

6

PYLON ELECTRICAL
DISCONNECT ACCESS
0.25

Color Black
Part No. CVC3310-178T

7

ELECTRICAL
ACCESS
0.25

Color Black
Part No. CVC3310-200T

8 Deleted

9

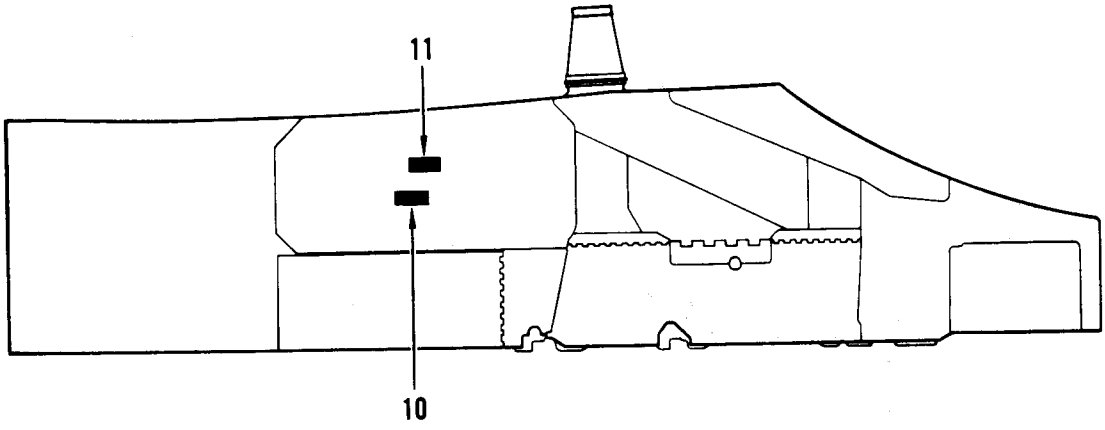
NO PUSH
0.48

Color Black
Part No. CVC3306-3T

90D166-02-10-89

Figure 2-6. Wing Station No. 7 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 7 PYLON



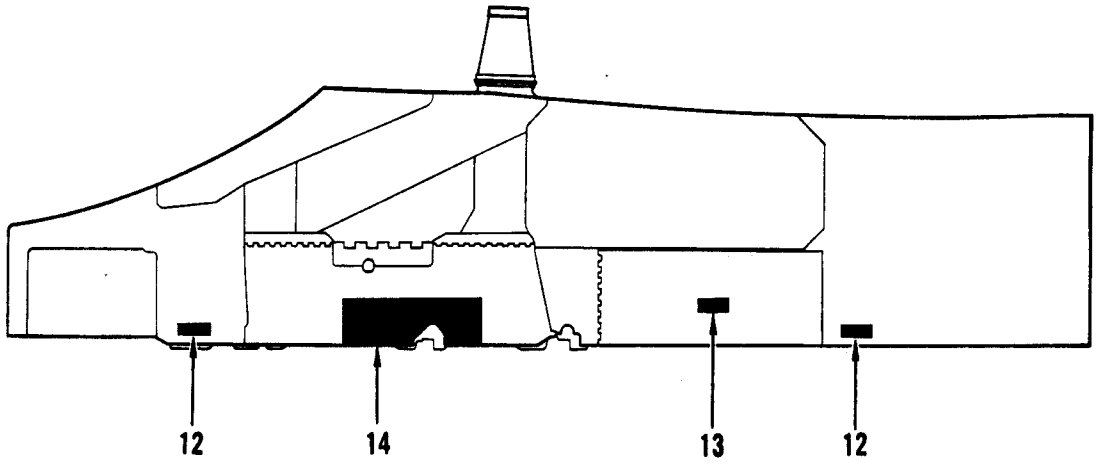
OUTBOARD

10	11
0.25 **NO VOLTAGE TEST STORES** Color Black Part No. CVC3310-198T	0.25 **NO VOLTAGE TEST MAU 12 RACK** Color Black Part No. CVC3310-197T

90D166-03-03-90

Figure 2-6. Wing Station No. 7 Pylon Exterior Markings (Sheet 3)

WING STATION NO. 7 PYLON



INBOARD

12

0.35
LIFT HERE

Color Black
Part No. CVC3305-9T

13

0.25
ELECTRICAL ACCESS

Color Black
Part No. CVC3310-200T

14

0.25 0.13 0.19
ORIFICE ACCESS
30° 0.63

0.19
HOOK MANUAL RELEASE

0.19
ORIFICE ACCESS

0.19
GROUND SAFETY PIN HOLE

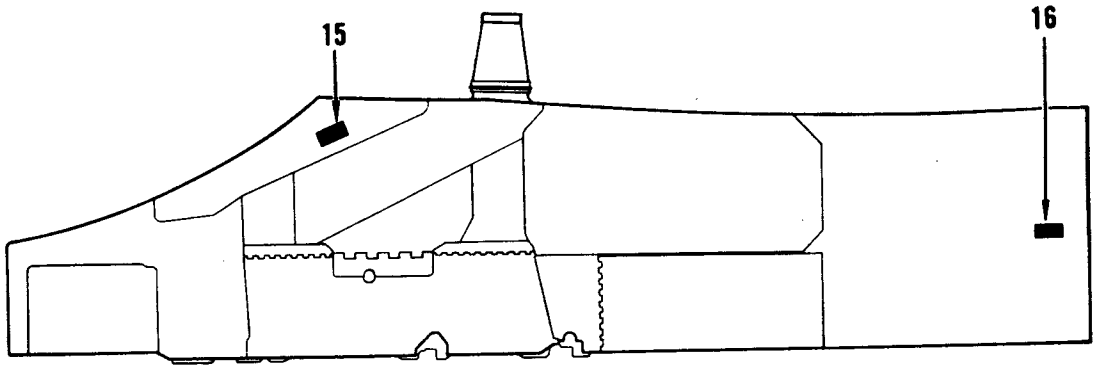
0.75 Dia
0.13

Part No. 216-99407-3

90D166-04-12-84

Figure 2-6. Wing Station No. 7 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 7 PYLON



INBOARD

15

PYLON ELECTRICAL DISCONNECT ACCESS

0.25

Color Black
Part No. CVC3310-178T

16

NO PUSH

0.48

Color Black
Part No. CVC3306-3T

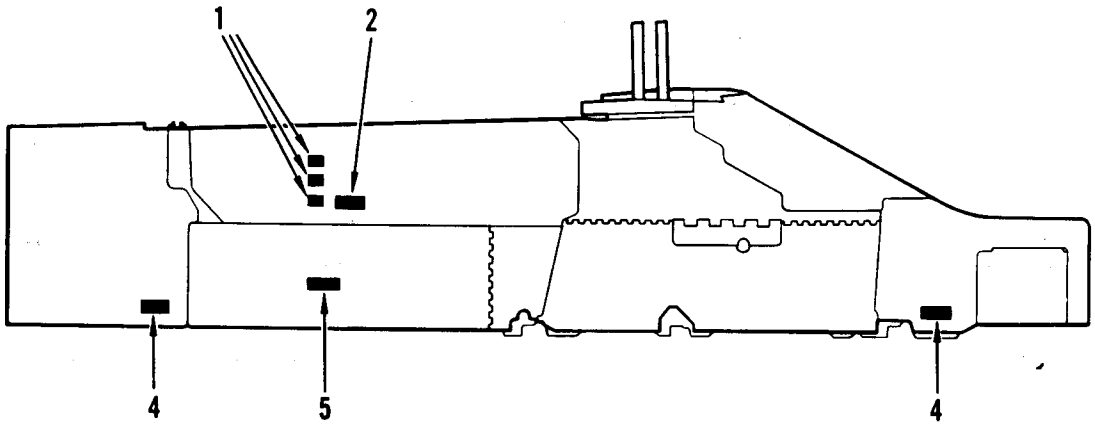
17 Deleted

18 Deleted

90D166-05-10-89

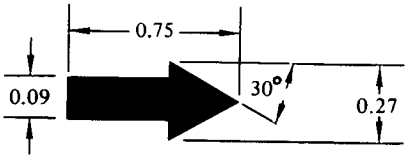
Figure 2-6. Wing Station No. 7 Pylon Exterior Markings (Sheet 5)

WING STATION NO. 8 PYLON



OUTBOARD

1



Color Black
Part No. CVC3349-1T

2

0.25
NO VOLTAGE TEST
AUX JETTISON

Color Black
Part No. CVC3310-199T

3 Deleted

4

0.35
LIFT HERE

Color Black
Part No. CVC3305-9T

5

0.25
ELECTRICAL
ACCESS

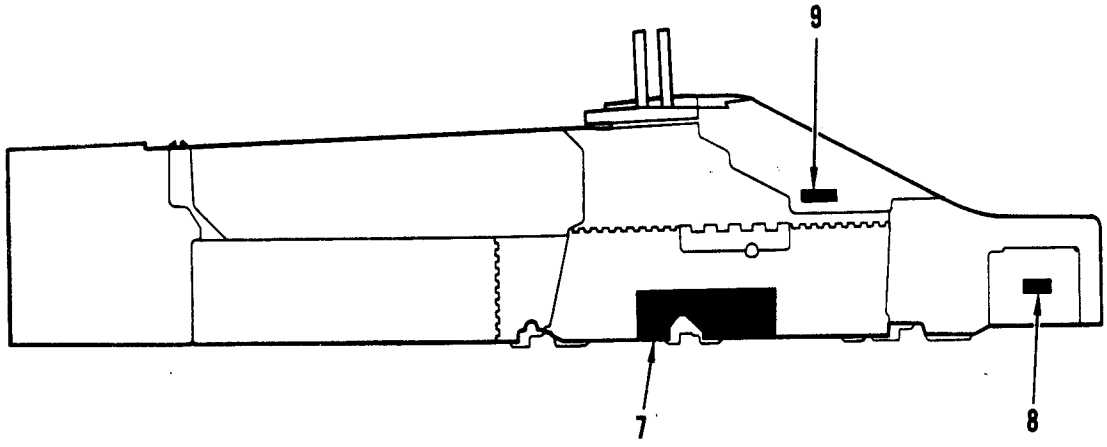
Color Black
Part No. CVC3310-200T

6 Deleted

90D167-01-10-89

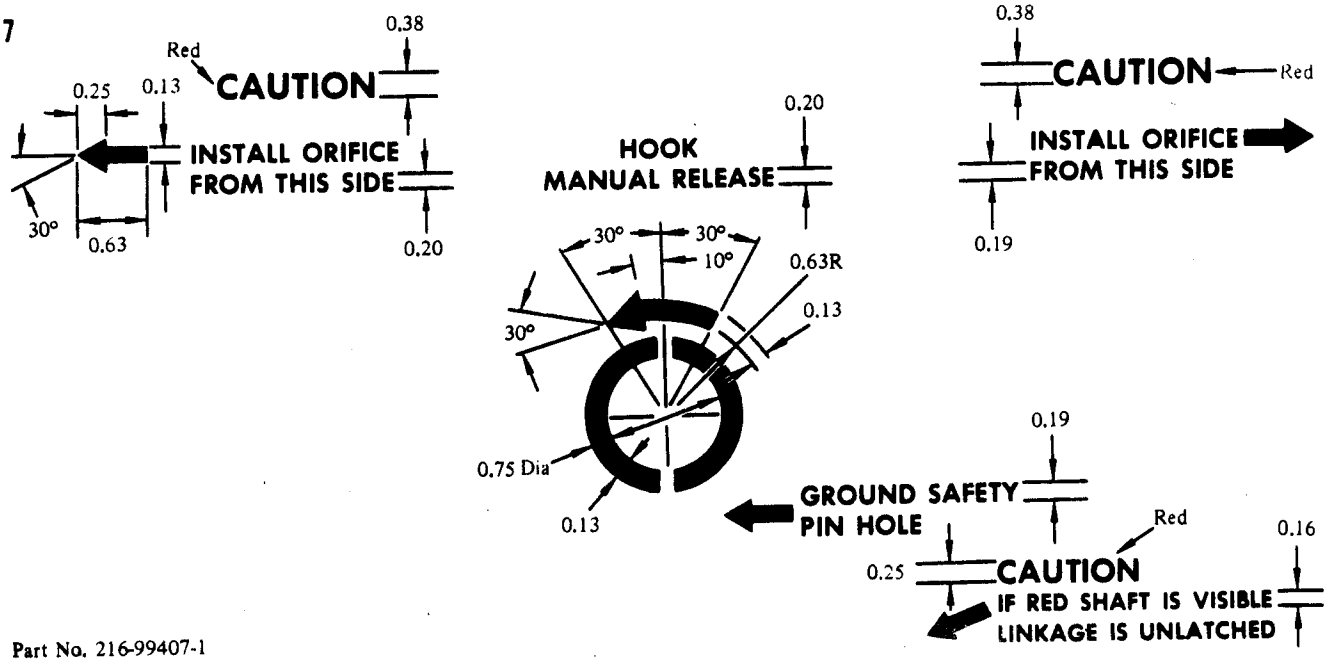
Figure 2-7. Wing Station No. 8 Pylon Exterior Markings (Sheet 1 of 5)

WING STATION NO. 8 PYLON



OUTBOARD

7



Part No. 216-99407-1

8

Color Black
Part No. CVC3310-200T

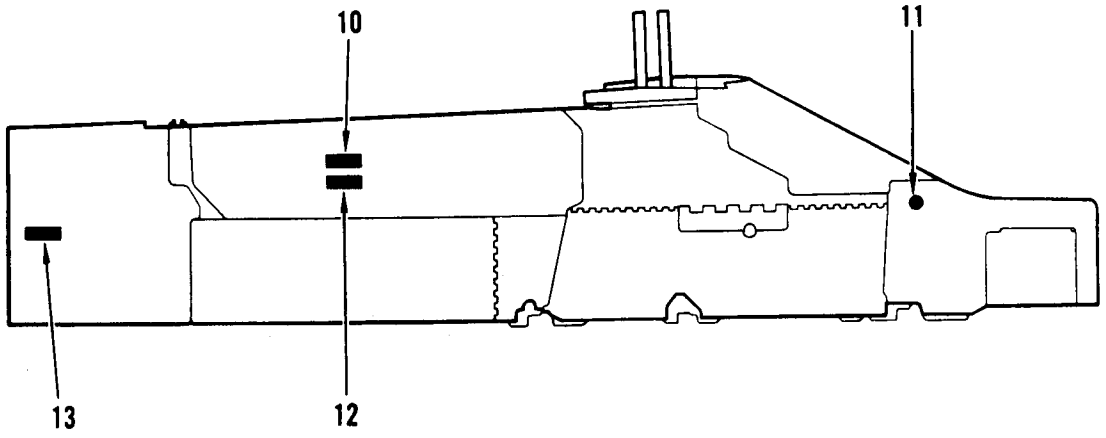
9

Color Black
Part No. CVC3310-178T

90D167-02-03-90

Figure 2-7. Wing Station No. 8 Pylon Exterior Markings (Sheet 2)

WING STATION NO. 8 PYLON



OUTBOARD

10

0.25

NO VOLTAGE TEST
MAU 12 RACK

Color Black
Part No. CVC3310-197T

12

0.25

NO VOLTAGE TEST
STORES

Color Black
Part No. CVC3310-198T

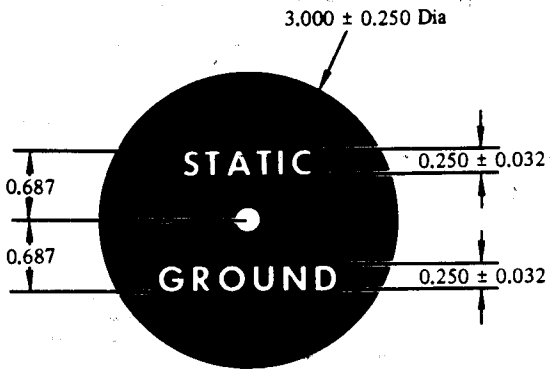
13

0.48

NO PUSH

Color Black
Part No. CVC3306-3T

11

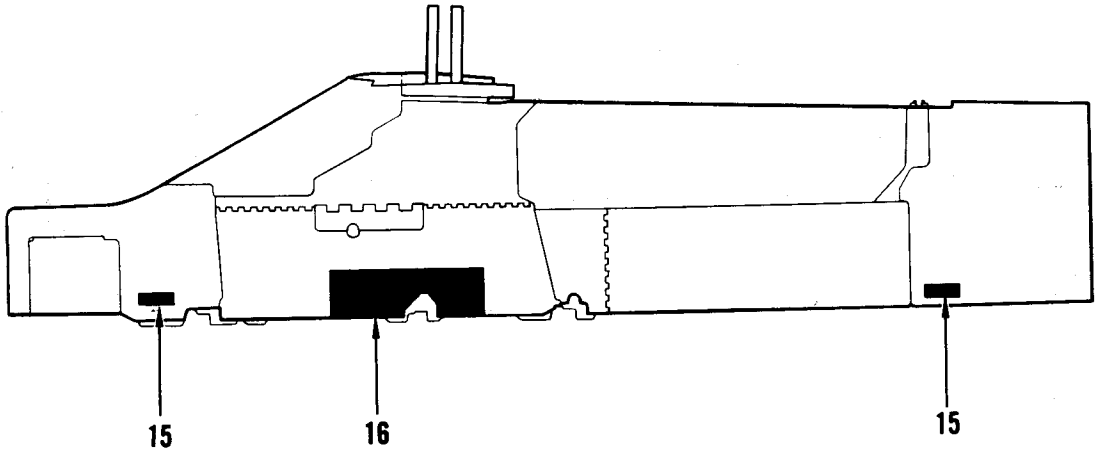


Color Black Background,
White Lettering
Part No. CVC3430-2

90D167-03-03-90

Figure 2-7. Wing Station No. 8 Pylon Exterior Markings (Sheet 3)

WING STATION NO. 8 PYLON



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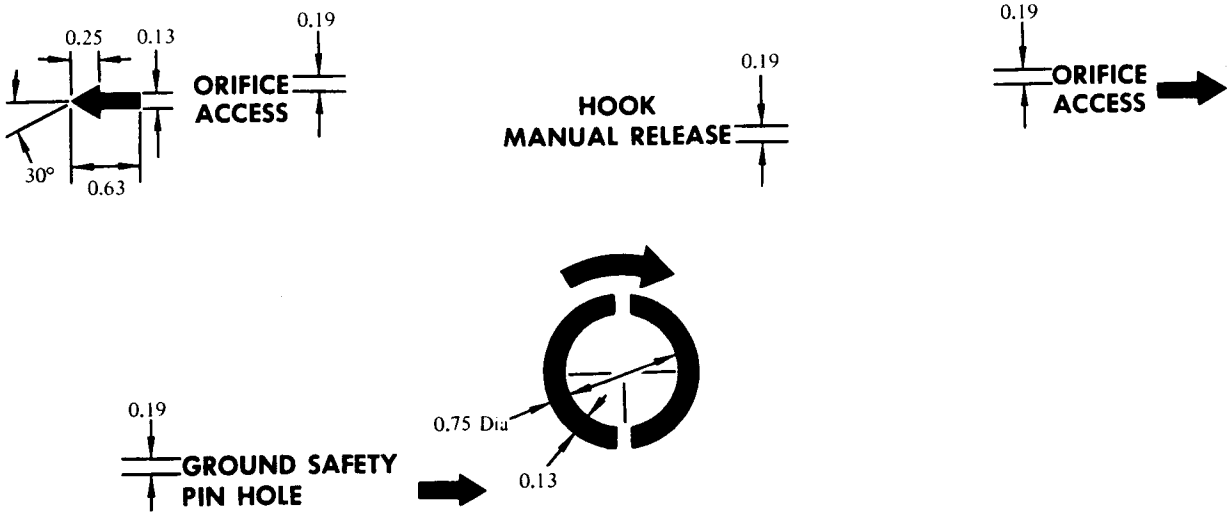
Color Black
Part No. CVC3305-9T

16

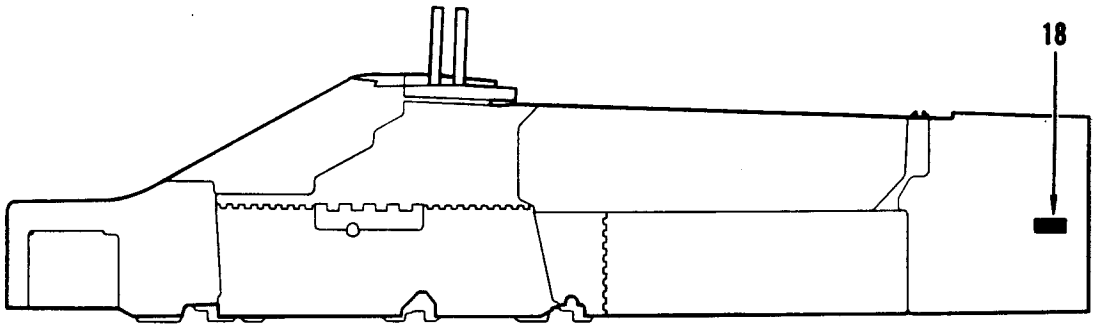


Part No. 216-99407-3

90D167-04-10-89

Figure 2-7. Wing Station No. 8 Pylon Exterior Markings (Sheet 4)

WING STATION NO. 8 PYLON



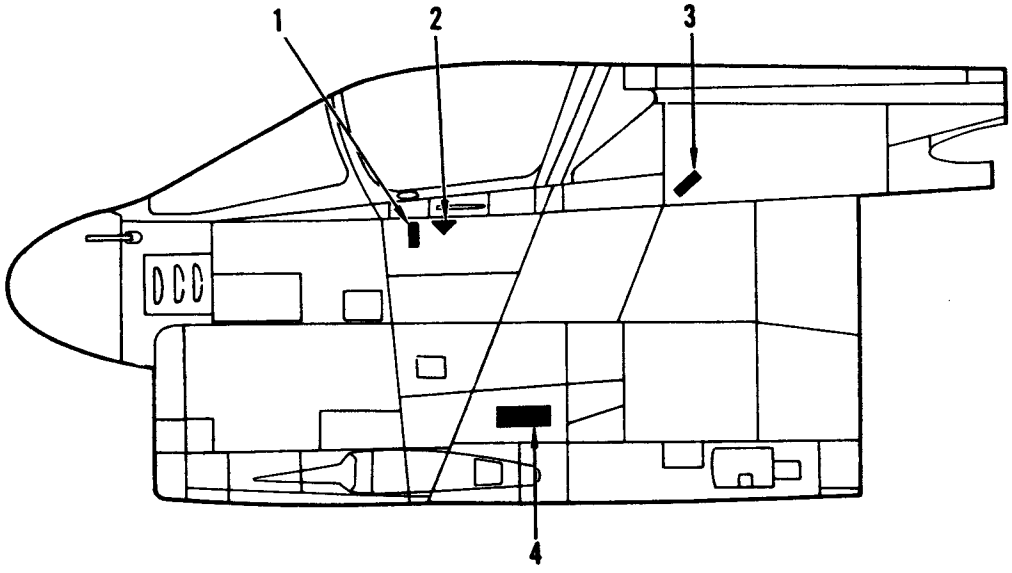
INBOARD

17 Deleted	**18** 0.48 **NO PUSH** Color Black Part No. CVC3306-3T

90D167-05-10-89

Figure 2-7. Wing Station No. 8 Pylon Exterior Markings (Sheet 5)

NOSE SECTION LH



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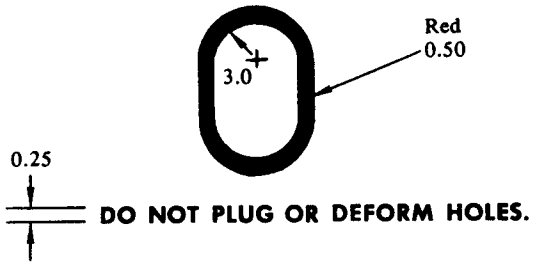
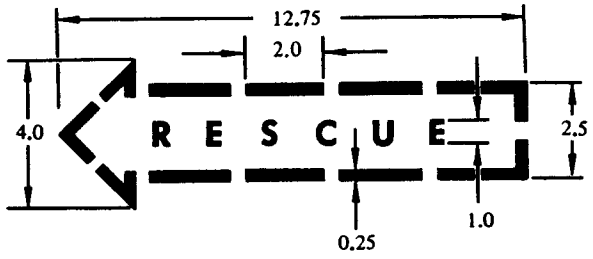


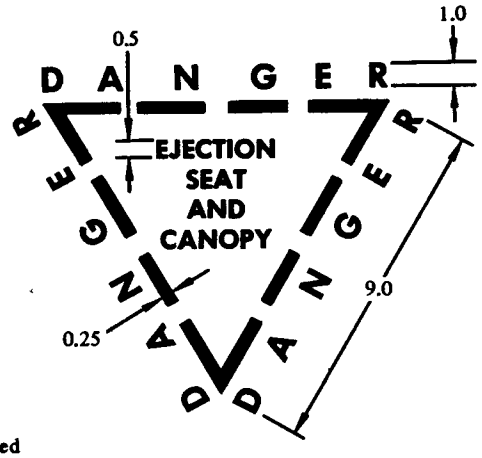
Color Black
Part No. 215-26080

3



Color Orange-Yellow
Part No. CVC3424-1

2



Color Red
Part No. CVC3425-1

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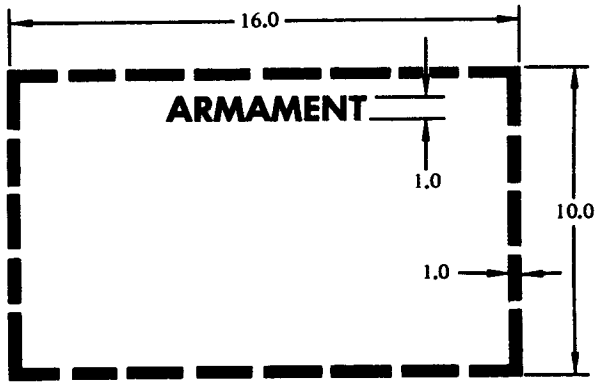
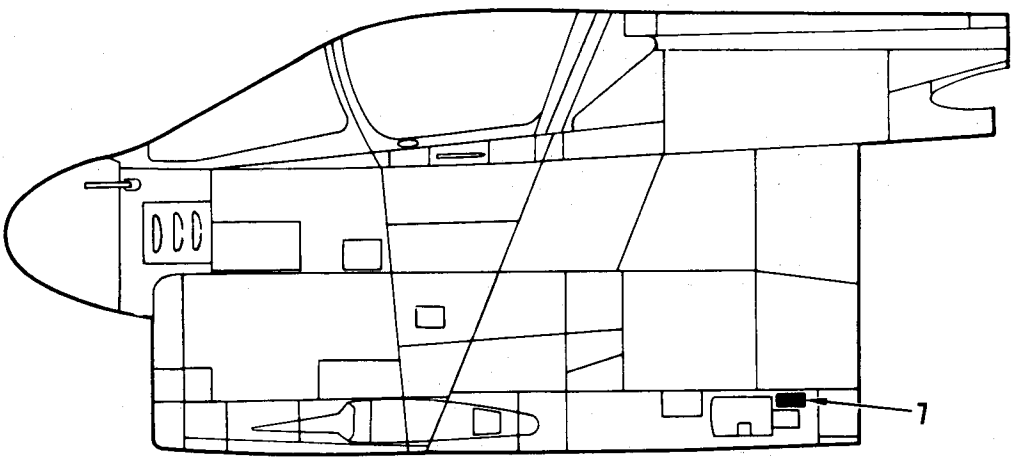


Color Black
Part No. CVC3427-2

90D168-01-12-84

Figure 2-8. Fuselage Nose Section Exterior Markings (Sheet 1 of 5)

NOSE SECTION LH



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6 Deleted

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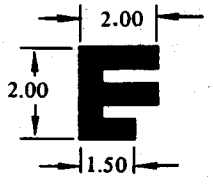
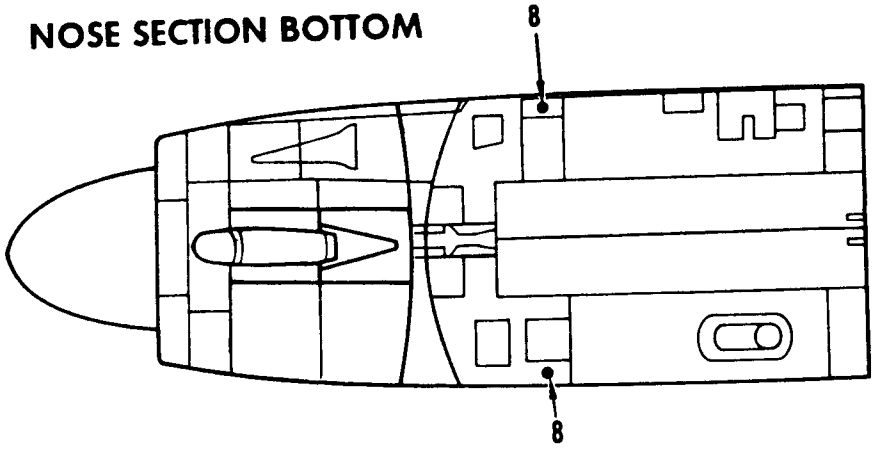


Color Black
Part No. CVC3413-2

90D168-02-10-89

Figure 2-8. Fuselage Nose Section Exterior Markings (Sheet 2)

NOSE SECTION BOTTOM



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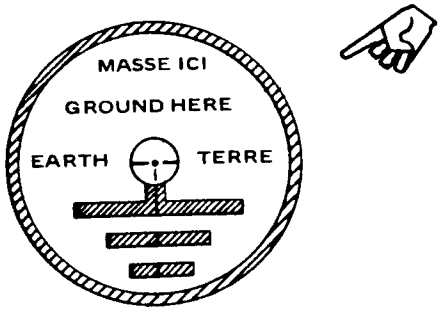
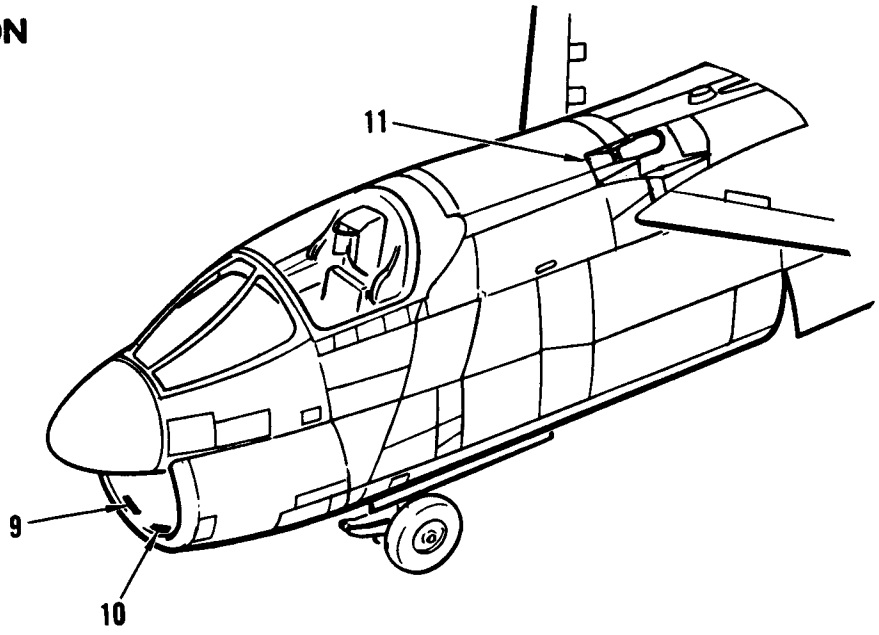


90D168-03-12-84

Figure 2-8. Fuselage Nose Section Exterior Markings (Sheet 3)

NOSE SECTION



9

0.95

NO STEP

Color Black
Part No. CVC3321-1

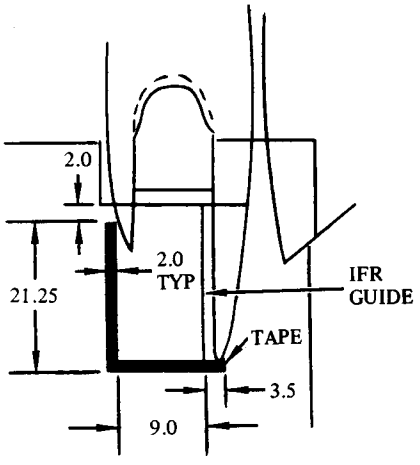
10

0.95

NO PUSH

Color Black
Part No. CVC3321-2

11

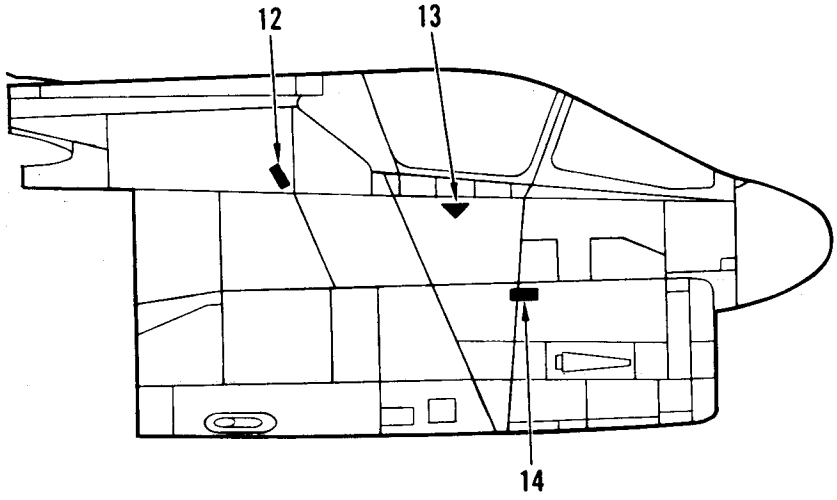


Reflective Tape
Part No. 3770

90D168-04-12-84

Figure 2-8. Fuselage Nose Section Exterior Markings (Sheet 4)

NOSE SECTION RH



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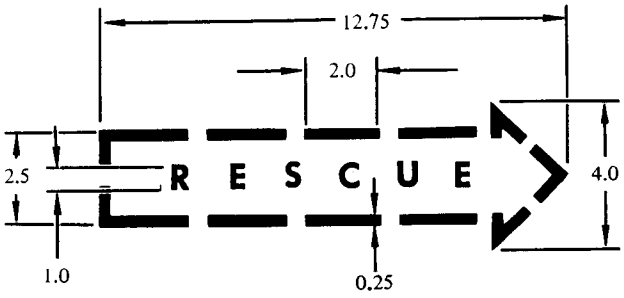

Color Orange–Yellow
Part No. CVC3424-2

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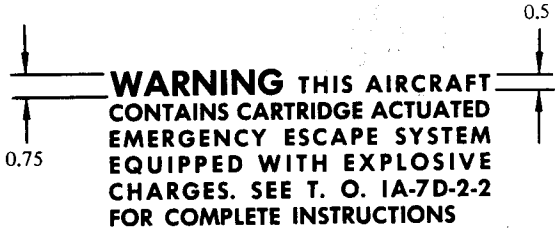

Color Black
Part No. CVC3426-1

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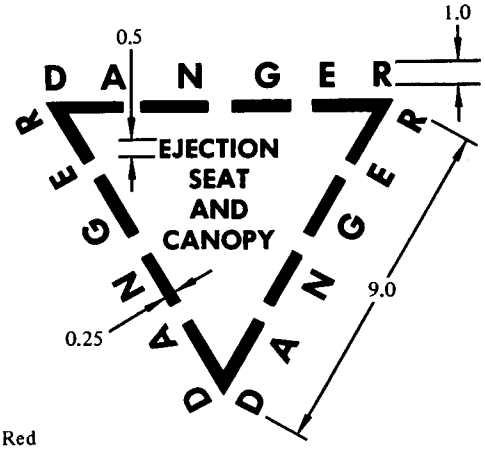

Color Red
Part No. CVC3425-1

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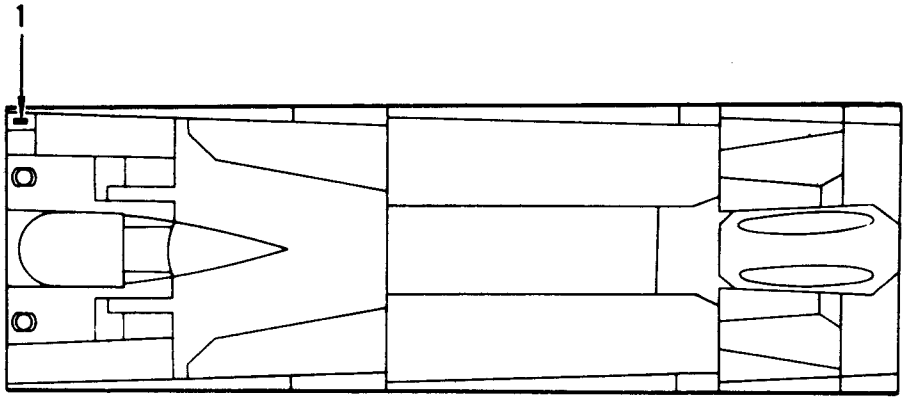
90D168-05-10-89

Figure 2-8. Fuselage Nose Section Exterior Markings (Sheet 5)

MID SECTION BOTTOM



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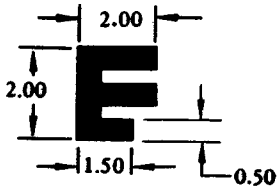


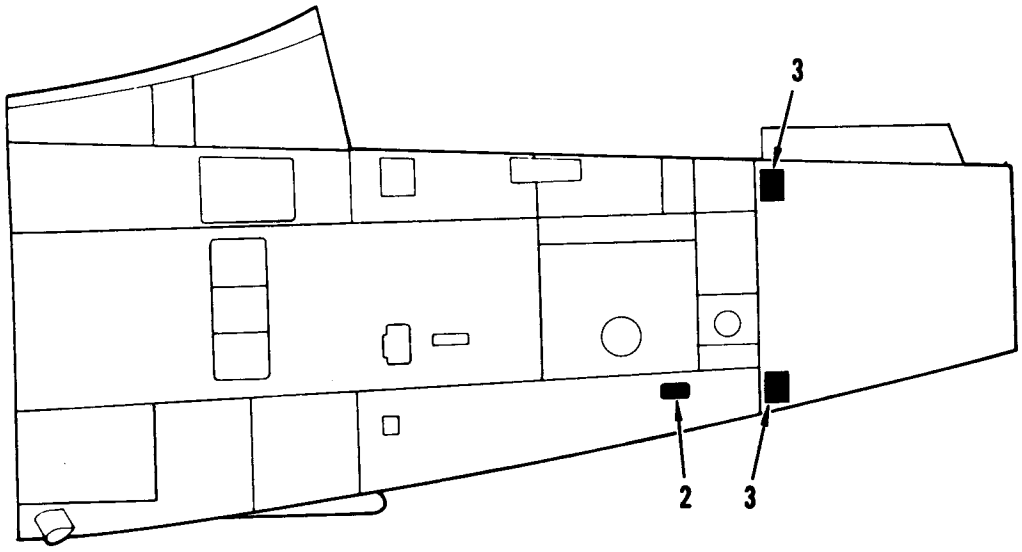
Color Black
Part No. CVC3413-2T

90D169-10-89

Figure 2-9. Fuselage Mid Section Exterior Markings

All data on pages
2-45 and 2-46 deleted.

AFT SECTION LH



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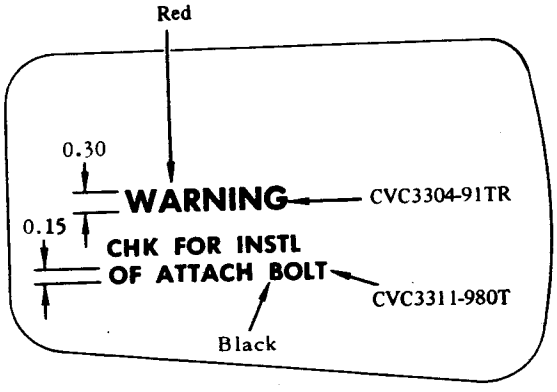

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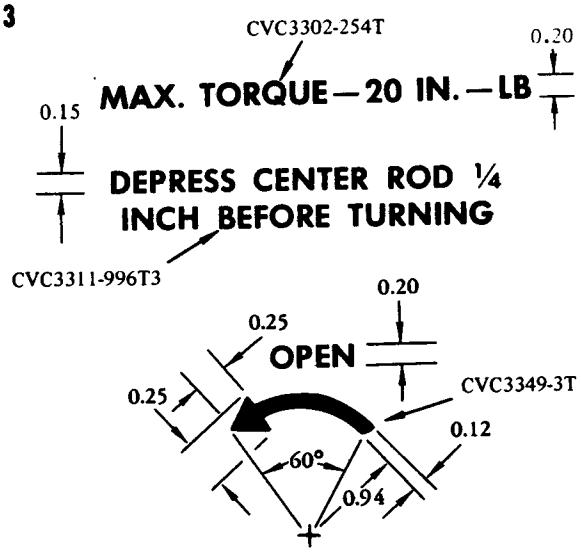
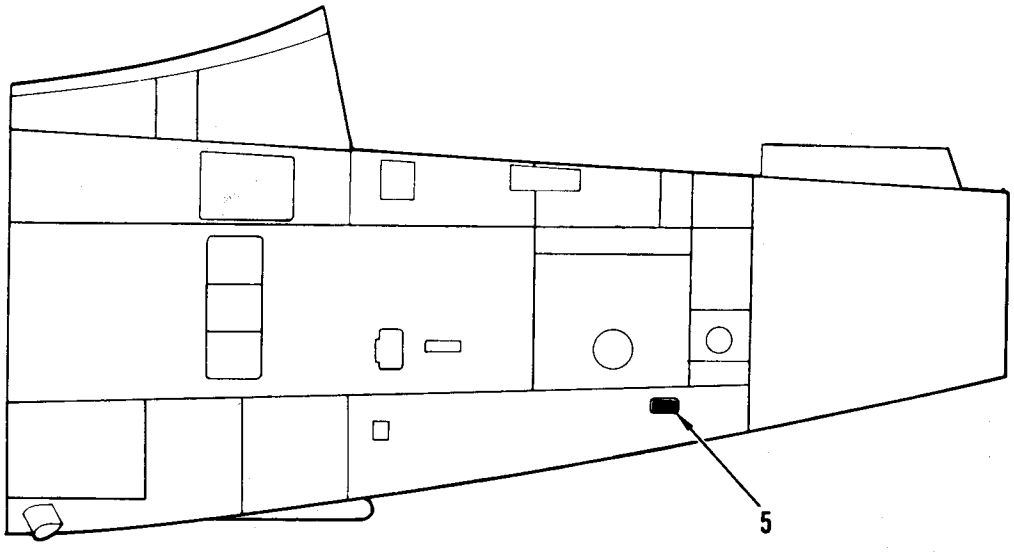


Color Black

90D170-01-10-89

Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 1 of 7)

AFT SECTION LH



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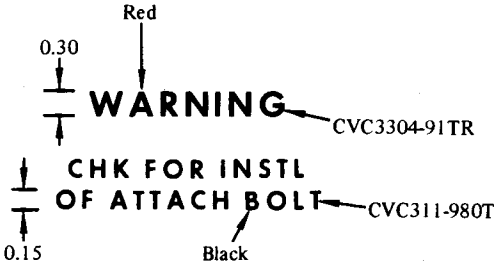
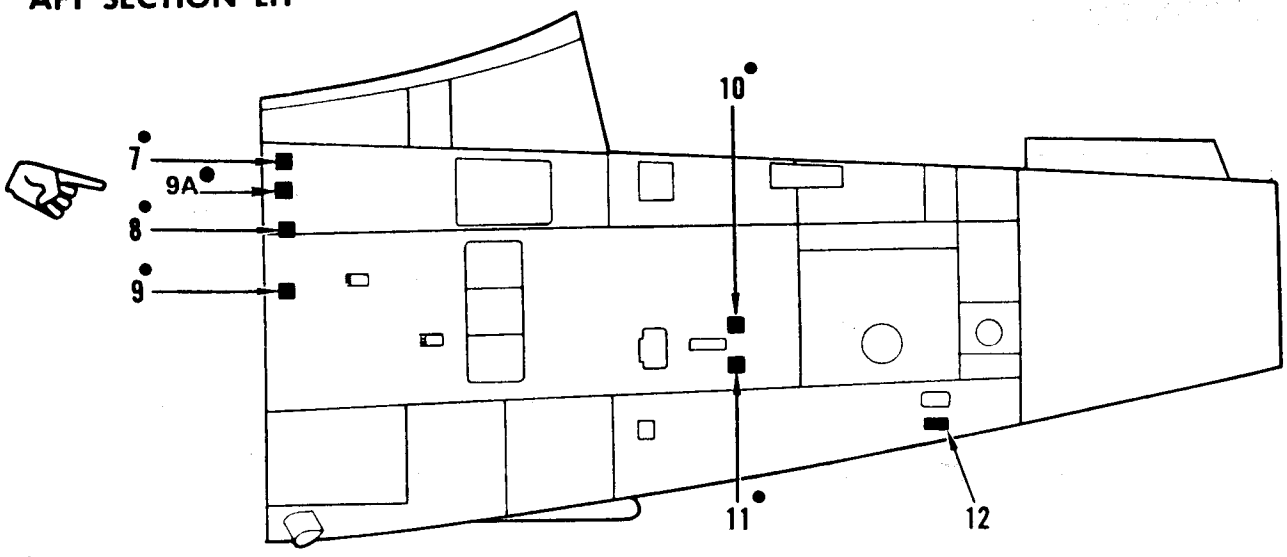


90D170-02-10-89

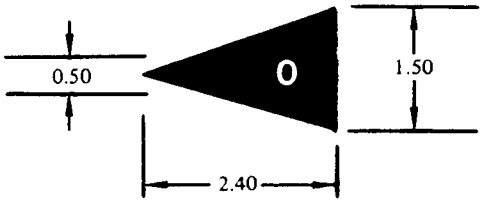
Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 2)

AFT SECTION LH



● Use Protractor to Locate Position for Markings

7



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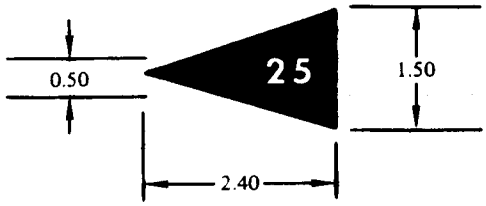

Color Black Background, White Lettering

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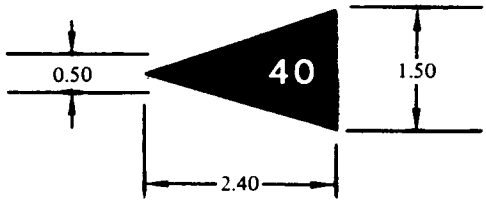

Color Black Background, White Lettering

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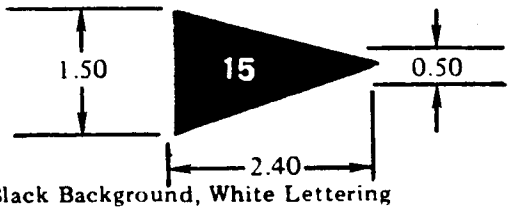

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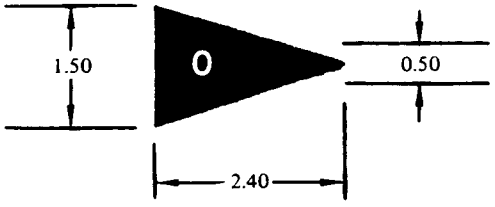

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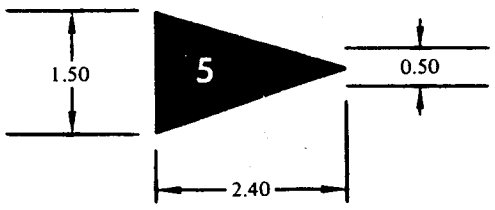

Color Black Background, White Lettering

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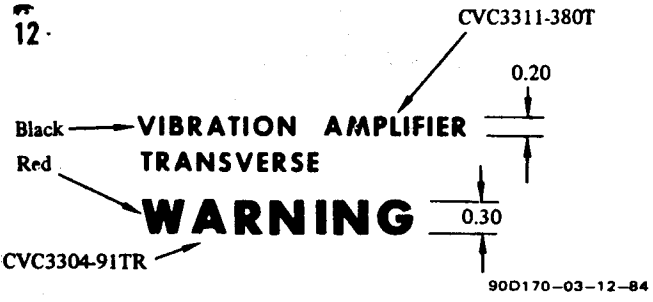
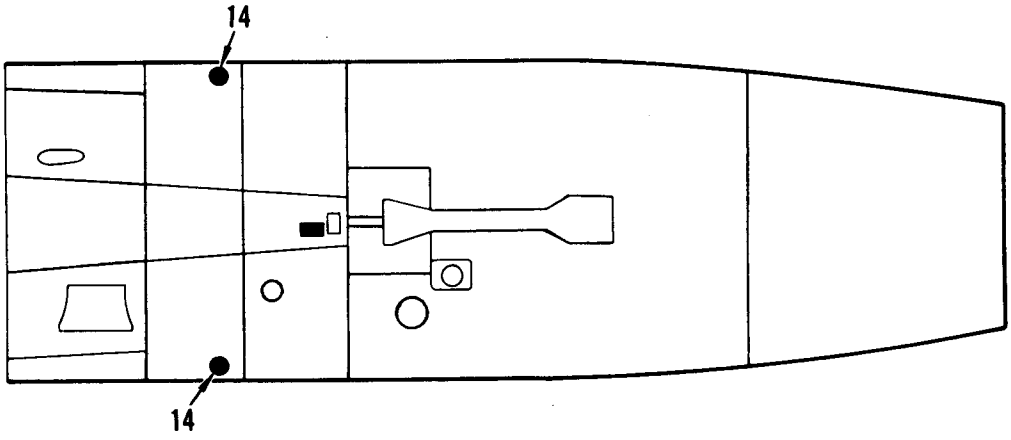


Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 3)

AFT SECTION BOTTOM



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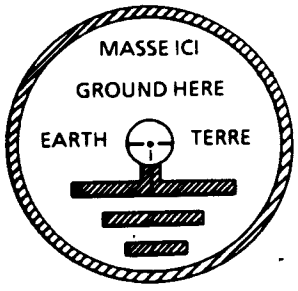
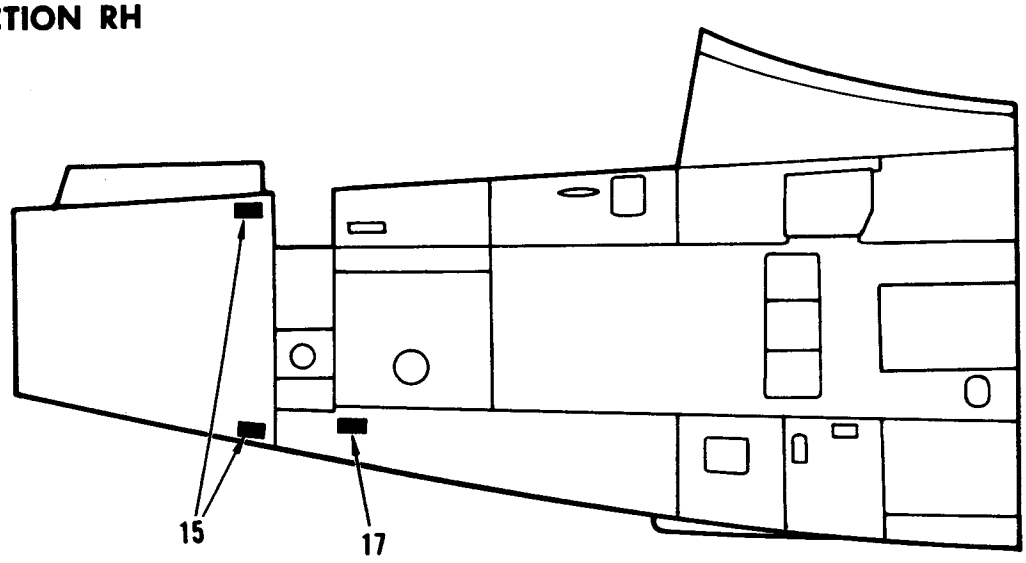


90D170-04-10-89

Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 4)

AFT SECTION RH



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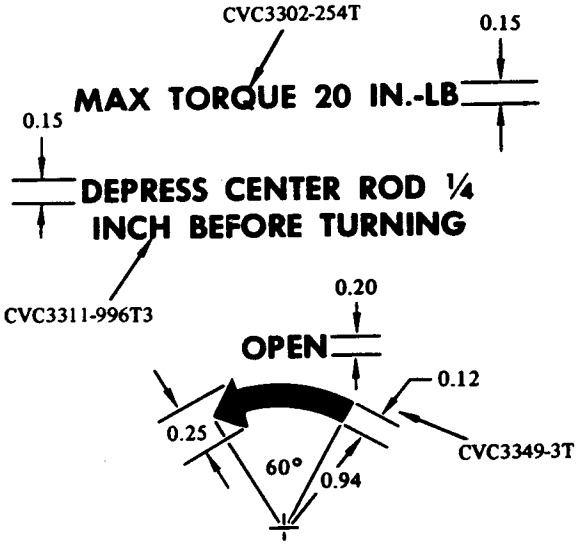

Color Black

16 Deleted

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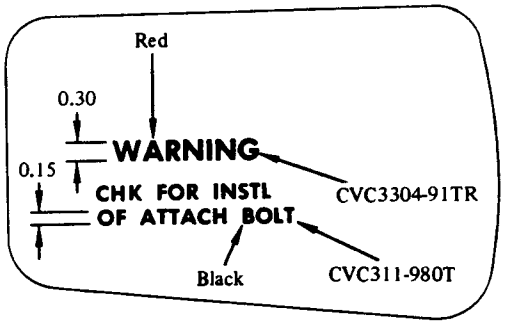
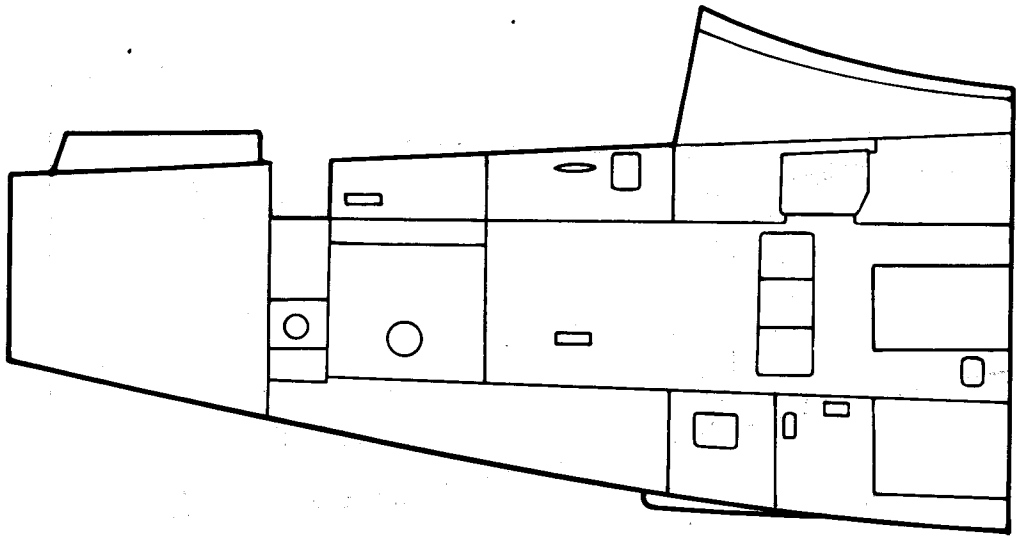


90D170-05-10-89

Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 5)

AFT SECTION RH



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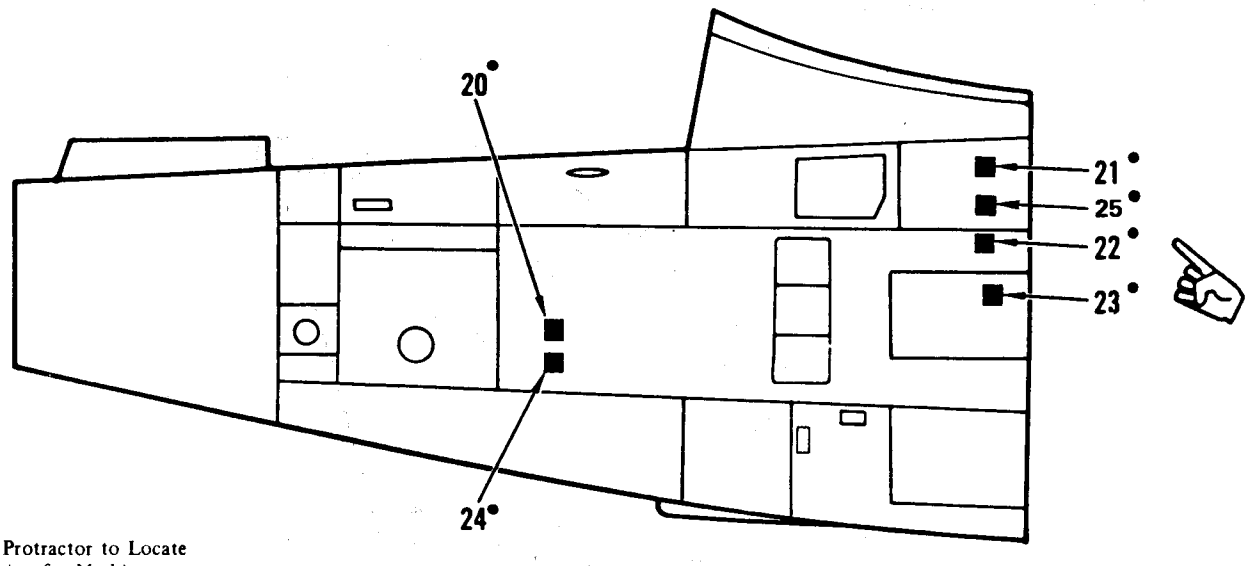
90D170-06-10-89

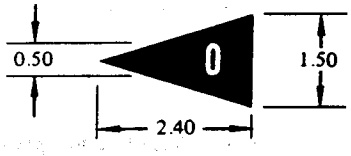
Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 6)

AFT SECTION RH



• Use Protractor to Locate Position for Markings.

20



Color Black Background, White Lettering

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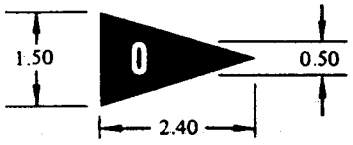

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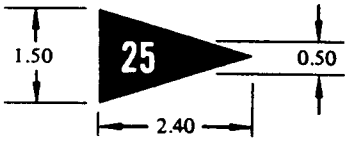

Color Black Background, White Lettering

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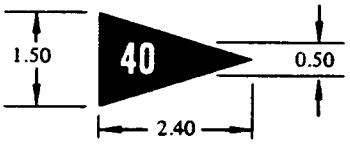
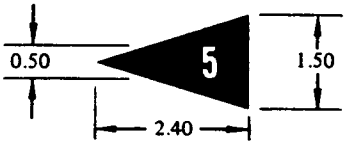


Color Black Background, White Lettering

24



Color Black Background, White Lettering

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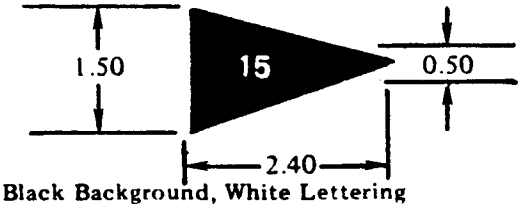
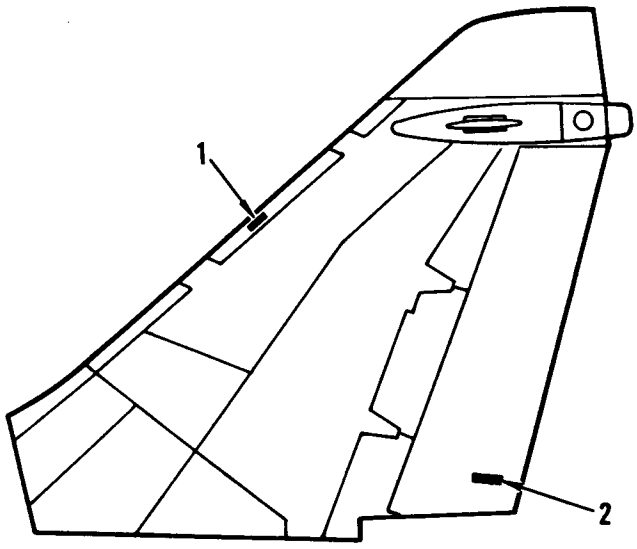


Color Black Background, White Lettering

90D170-07-12-84

Figure 2-10. Fuselage Aft Section Exterior Markings (Sheet 7)

VERTICAL STABILIZER LH

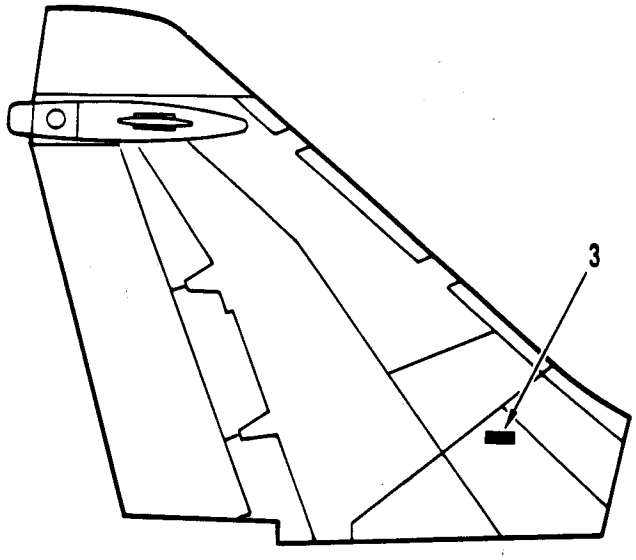


1	2
0.20 ANTENNA COUPLER ACCESS	0.35 THESE HOLES ARE FOR ATTACHMENT OF RUDDER PROTRACTOR
Color Black Part No. CVC3303-654T	Color Black Part No. CVC3320-45T

90D171-01-10-89

Figure 2-11. Vertical Stabilizer Exterior Markings (Sheet 1 of 2)

VERTICAL STABILIZER RH



3

0.25

VISCOUS DAMPER FILLER
WARNING! AFTER SERVICING
RED BAND MUST NOT SHOW

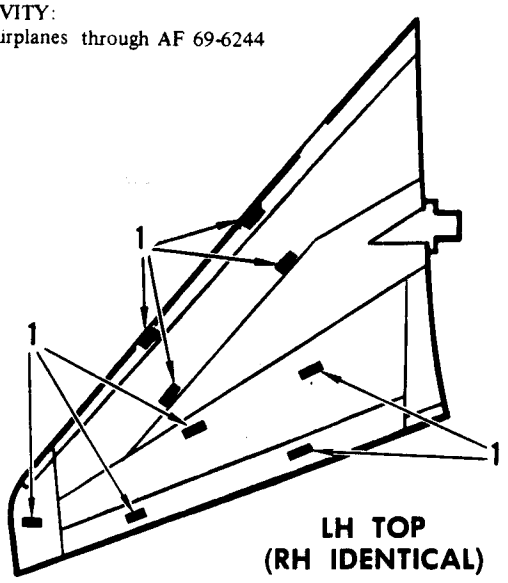
Color Black
Part No. CV15-401881-2

90D171-02-10-89

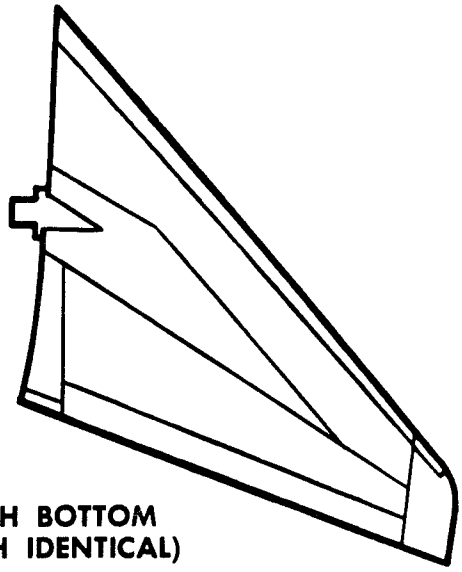
Figure 2-11. Vertical Stabilizer Exterior Markings (Sheet 2)

HORIZONTAL STABILIZER

- EFFECTIVITY:
  Airplanes through AF 69-6244



LH TOP
(RH IDENTICAL)



LH BOTTOM
(RH IDENTICAL)

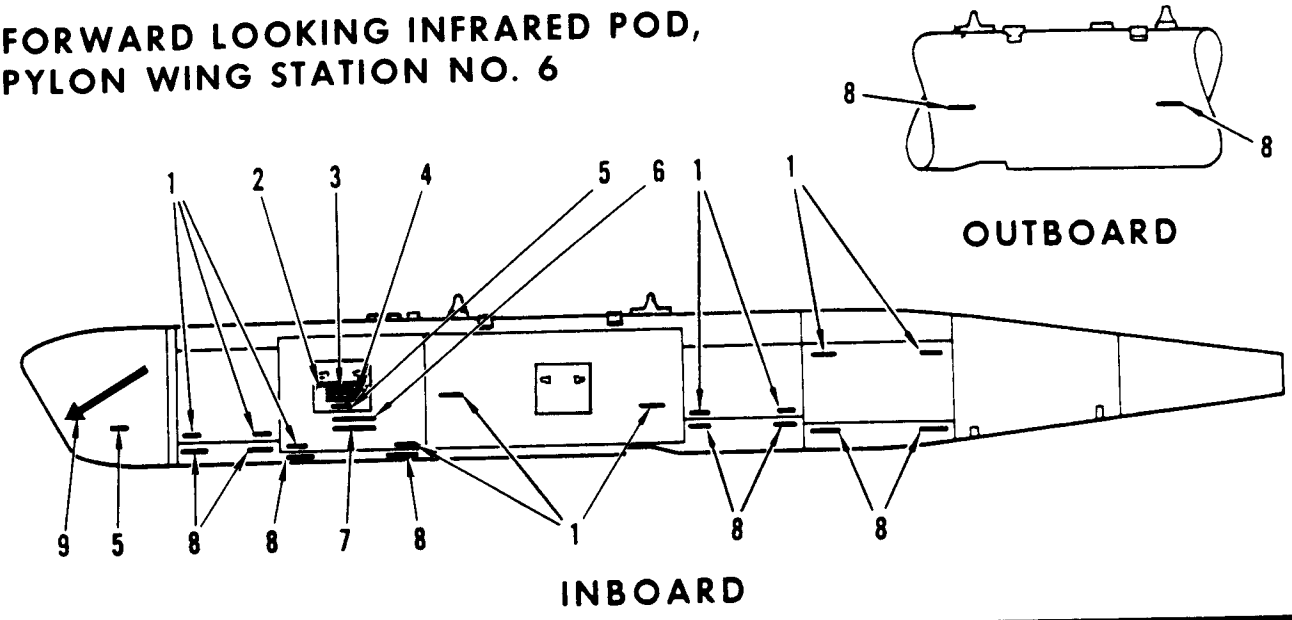
1

Color Black
Part No. CVC3321-1

90D172-03-90

Figure 2-12. Horizontal Stabilizer Exterior Markings

FORWARD LOOKING INFRARED POD, PYLON WING STATION NO. 6



1 0.25

DOOR STOWAGE STUD

Color Black
Part No. CVC3303-773T

2 0.66

CIRCUIT BREAKER

Color Black
Part No. CVC3306-371T

3 0.66

AND STATUS

Color Black
Part No. CVC3306-372T

4 0.66

INDICATORS

Color Black
Part No. CVC3306-373T

5 0.66

ACCESS

Color Black
Part No. CVC3306-42T

6 0.66

COOLING LINES AND

Color Black
Part No. CVC3306-370T

7 0.66

ELECTRICAL ACCESS

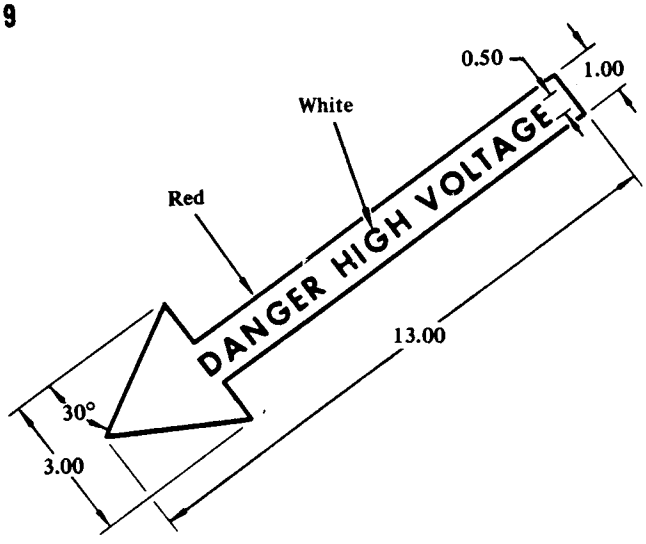
Color Black
Part No. CVC3306-205T

8 0.25

DOOR STOWAGE RECEPTACLE

Color Black
Part No. CVC3303-774T

9

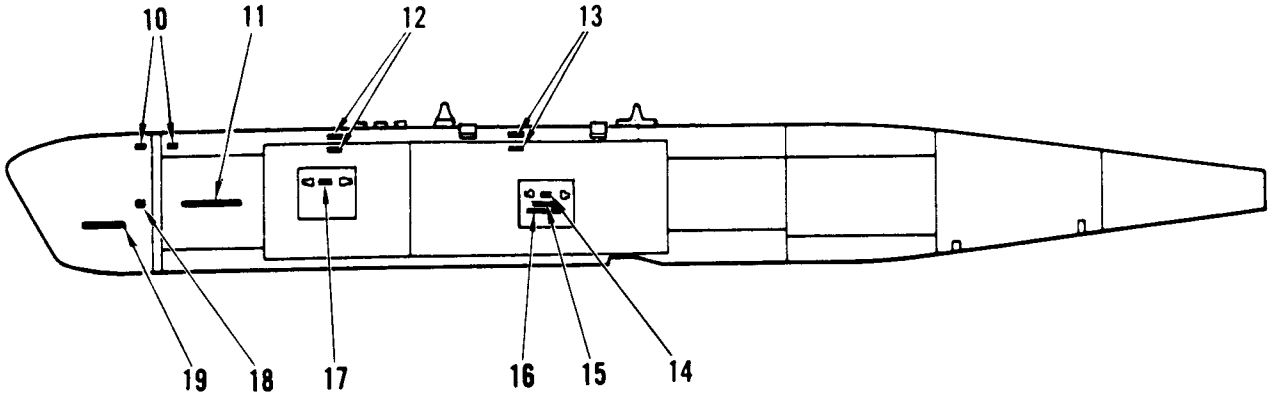


Part No. CVC3349-11T LH Side
Part No. CVC3349-12T RH Side

90D900-01-03-86

Figure 2-13. Forward Looking Infrared Pod Exterior Markings (Airplanes After T.O. 1A-7-530) (Sheet 1 of 3)

FORWARD LOOKING INFRARED POD, PYLON WING STATION NO. 6

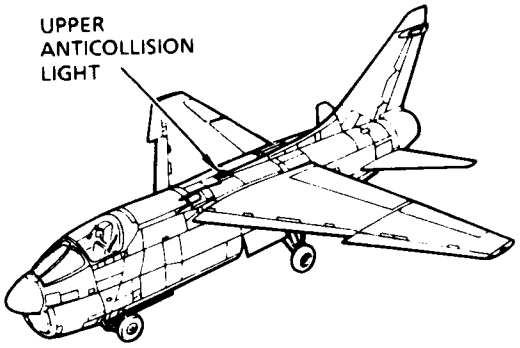


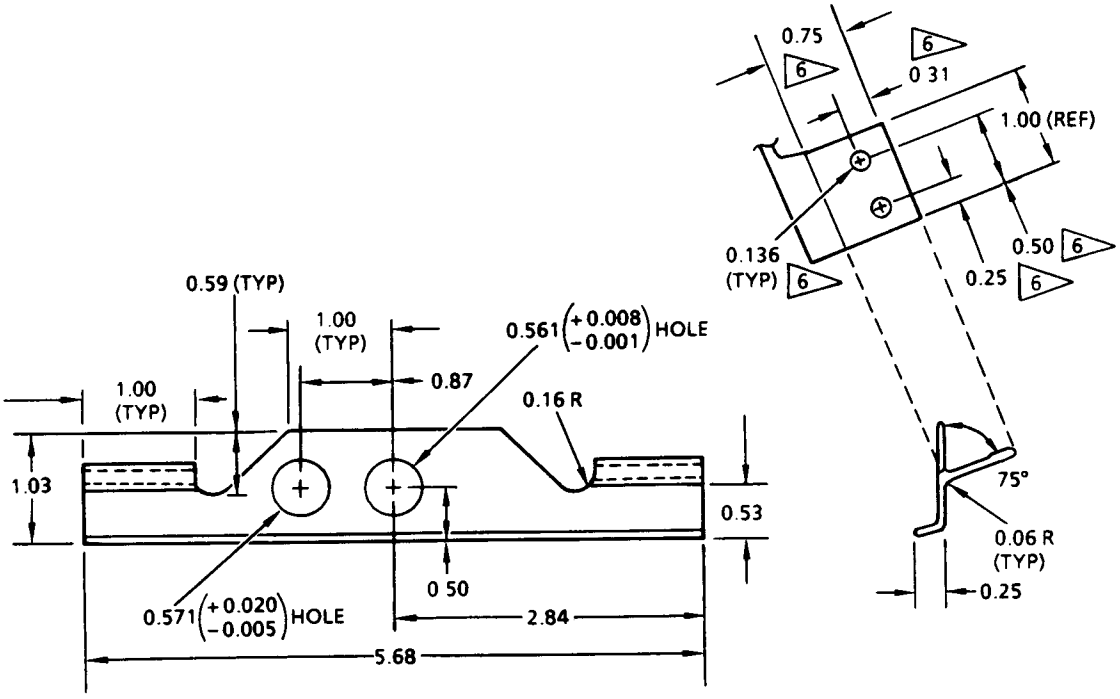
INBOARD

10 0.25 10212–1 Color Black Part No. CVC3303-764T	15 0.40 INSP. DOOR Color Black Part No. CVC3305-14T
11 0.66 ELECTRONICS ACCESS Color Black Part No. CVC3306-369T	16 0.33 AIR CONDITIONING Color Black Part No. CVC3304-49T
12 0.25 10212–3 Color Black Part No. CVC3303-766T	17 0.25 10212–31 Color Black Part No. CVC3303-767T
13 0.25 10222–1 Color Black Part No. CVC3303-768T	18 0.19 INDEX HERE Color Black Part No. CVC3311-1550T3
14 0.25 10222–11 Color Black Part No. CVC3303-799T	19 0.66 OPTICS/RECEIVER Color Black Part No. CVC3306-368T

90D900–02–03–86

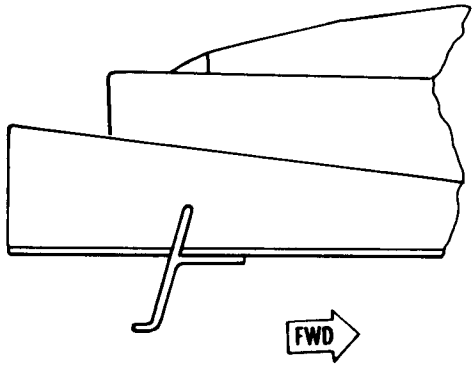
Figure 2-13. Forward Looking Infrared Pod Exterior Markings (Airplanes After T.O. 1A-7-530) (Sheet 2)





NOTE

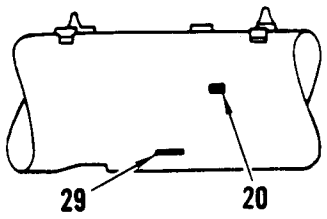
1. MATERIAL – 5052-H32 (0.63 THK) QQ-A-250/8.
2. BREAK SHARP EDGES 0.010 TO 0.015.
3. MARK PART NUMBER PER MIL-STD-130 METHOD RUBBER STAMP.
4. APPLY CHROMATE CONVERSION COATING. MIL-C-5541, CLASS 1A/MIL-C-81706 (BRUSH-ON METHOD) TO ENTIRE PART PER T.O. 1-1-2, PAR 6-10.
5. APPLY ONE COAT MIL-P-23377, EPOXY PRIMER.
6. FASTENER HOLE LOCATIONS ARE PROVIDED FOR REFERENCE ONLY. HOLES MUST MATCH FASTENER HOLES IN MATING PART.
7. INSTALLATION RIVETS MS20426AD4-5 (4 EA).



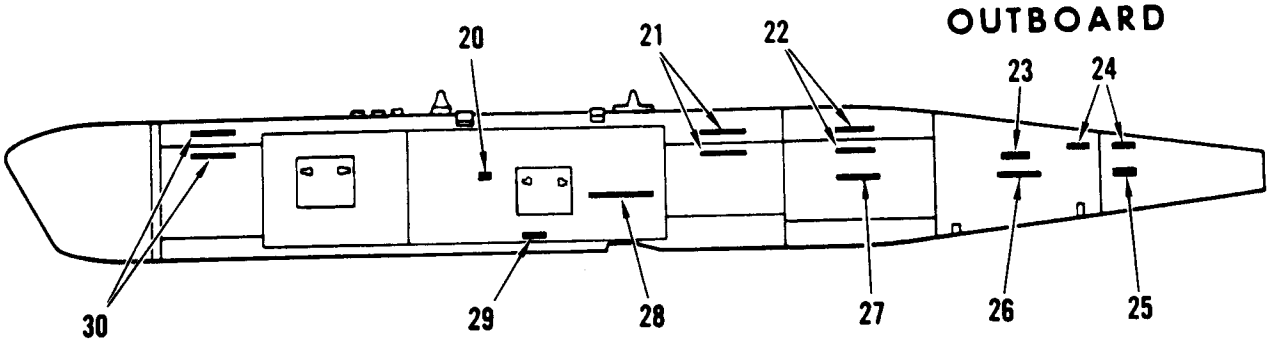
90D920-10-89

Figure 5-22.1. Upper Anticollision Light Connector Bracket

FORWARD LOOKING INFRARED POD, PYLON WING STATION NO. 6



OUTBOARD



INBOARD

20 0.19

HOIST HERE
C.G.

Color Black
Part No. CVC3311-1549T3

21 0.25

10222–2

Color Black
Part No. CVC3303-769T

22 0.25

10222–3

Color Black
Part No. CVC3303-770T

23 0.25

10232–1

Color Black
Part No. CVC3303-771T

24 0.25

10232–2

Color Black
Part No. CVC3303-772T

25 0.25

NAS 517–3–3

Color Black
Part No. CVC3303-75T

26 0.66

VIDEO RECORDER ACCESS

Color Black
Part No. CVC3306-377T

27 0.66

SERVO CONTROL ACCESS

Color Black
Part No. CVC3306-376T

28 0.66

AIR CONDITIONER ACCESS

Color Black
Part No. CVC3306-374T

29 0.25

CRADLING AREA

Color Black
Part No. CVC3303-775T

30 0.25

10212–2

Color Black
Part No. CVC3303-765T

90D900–03–03–86

Figure 2-13. Forward Looking Infrared Pod Exterior Markings (Airplanes After T.O. 1A-7-530) (Sheet 3)

SECTION III

FUEL TANK REPAIR, SEALING, AND TESTING

3-1. FUEL TANK REPAIR, SEALING, AND TESTING. Airplane internal fuel tanks are contained in both the wing and the fuselage. The wing tank consists of an integral (wet-wing) type fuel tank contained in the wing center section. The fuselage fuel tank consists of one self-sealing and five bladder type fuel cells contained in various compartments in the fuselage. Data for fuel leak analysis and repair of the wing integral fuel tank is given in this section. For fuselage fuel cell removal and installation procedures, refer to T.O. 1A-7D-2-6. For fuel cell repair, refer to T.O. 1-1-3.

3-2. WING INTEGRAL FUEL TANK. The wing integral fuel tank is formed by the wing center section (WCS) main box structure. The WCS is constructed of multiple spanwise spars joined by ribs and beams covered with two-piece upper and two-piece lower tapered skin panels. The panels are chemically milled and rolled to contour. A groove is milled into the skin mating surface perimeter which joins with the boundary spar/rib structures. The groove forms a leak-proof seal when filled with G651 General Electric Cyanosilicone sealant or Q4-2805 Dow Corning sealant. Attachment holes are in the center of the groove to allow sealant to flow around the fasteners. This seals the fasteners as well as the seam or mating surface. This is known as the Center-Line-Seal method of sealing. Other methods and sealing devices used are O-rings, Stat-O-Seal washers, sealant covered dome nuts, O-ring seals (not to be confused with fastener O-rings), and Gask-O-Seal assemblies. Refer to Section XVI for repair materials and procurement sources.

3-3. SAFETY PRECAUTIONS. To prevent injury to personnel or damage to airplane, comply with all requirements in the safety summary of this manual. Also, the following safety precautions shall be followed.

a. To ensure safe working conditions in and near fuel tanks, all safety requirements in T.O. 1-1-3 shall be strictly followed.

b. All unprotected and unauthorized personnel shall be kept out of work area.

3-4. ORIGINAL FUEL TANK SEALING. To ensure a fuel-tight tank, certain sealing and corrosion protection measures are done when the wing is first built. During major repair and/or overhaul of the wing, resealing of the integral fuel tank may be necessary. The following original fuel tank sealing requirements are provided as a guide for resealing fuel tanks during wing repair and for repairing original seals and coatings.

a. All structures which will have contact with fuel shall receive a chromic acid anodic treatment.

b. Before final mating of beams to wingfold, attach ribs and upper and lower skins to mating structures. All mating surfaces shall be cleaned with TEC No. 901 mild acid cleaner or equivalent (paragraph 3-11.1).

c. Dome nuts and pylon support fittings shall be sealed with MIL-S-8802 heat resistant sealant and covered with a spray coat of MIL-S-4383 topcoating sealant (paragraphs 3-11.3 and 3-11.10).

d. The wing lower splice plate shall be installed with Gask-O-Seal type seals (paragraph 3-11.6).

e. Hydraulic fittings installed in fuel tank structure shall be installed with Stat-O-Seal washers (paragraph 3-11.8).

f. Electrical receptacles installed in fuel tank structure shall be installed with O-ring seals (paragraph 3-11.9).

g. Fuel dump valves and fasteners protruding into the fuel tank shall be installed with O-ring seals and Stat-O-Seal washers (paragraphs 3-9.1, 3-9.2, and 3-9.12).

h. The inner surface of the lower wing skin panels and mating structure shall be coated with MIL-S-4383 topcoat sealant before installing upper skin (paragraph 3-12).

i. The sealing grooves along the perimeter of the wing integral fuel tank mating surfaces shall be injected with G651 General Electric Cyanosilicone sealant or Q4-2805 Dow Corning sealant to form a fuel-tight seal (paragraph 3-11.7).

3-5. SPECIAL SEALING WITH G651 OR Q4-2805 SEALANT. The original PR-702 polysulfide sealant is replaced with new G651 General Electric or Q4-2805 Dow Corning sealant when making fuel leak repairs along the perimeter of the wing integral fuel tank skins. Use the following procedures and the steps in specific repairs of this section when injecting these sealants.

CAUTION

Use of any sealant other than G651 or Q4-2805 may require removal of main wing skins and other components to clean unauthorized sealant from sealing grooves (paragraph 3-8).

NOTE

G651 General Electric Cyanosilicone sealant or Q4-2805 Dow Corning sealant should be procured only from GSA through local supply activity. Material procured directly from the vendor will not have been quality acceptance tested.

For information on type and use of sealant injection tools refer to Section XVII.

a. Use a 23118 Semco Cartridge Adapter Kit (NSN 5120-00-941-9976) with 223 Grover Model sealant injection gun.

b. Fill gun supply cylinder with G651 or Q4-2805 sealant.

c. Enlarge injection gun nozzles to 0.070-inch diameter or use 215-00331-1 nozzle set.

d. Attach required nozzle to gun.

e. With 60 (±5) psi air pressure on gun, inject sealant into injection hole.

NOTE

To be sure all old sealant is forced out, inject new sealant until a bead of new sealant is squeezed out open hole. Squeeze-out should be about three times longer than distance between injection holes.

f. If there is old PR-702 polysulfide sealant in sealant groove, make sure it is completely forced out.

NOTE

If sealant in wing or in gun is cold, it will be too stiff to flow easily.

g. If necessary, heat wing or sealant gun to 250° maximum to make sealant flow easily.

h. If sealant does not come out of open hole, check for the following:

(1) Sealant too cold

(2) Low air pressure

(3) Gun not working properly

(4) Gun out of sealant

(5) Air space in supply cylinder.

i. Clean up excess sealant with wood or plastic tool.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

j. Finish cleanup using a cloth dampened with TT-T-548 toluene.

3-6. INVESTIGATION OF FUEL LEAKS. The following paragraph gives inspection requirements and what to do for fuel leaks in the wing integral fuel tank.

3-6.1. Locating Fuel Leaks. When fuel is in the tank, a leak can often be found by tracing the fuel flow to the leak source. Since fuel is colorless, it is hard to find a leak when the tank surface is wet with fuel. When the fuel level is above the suspected leak, liquid dye may be used to find the leak. Make leak checks using liquid dye as follows.

NOTE

Use only MIL-D-81928 yellow dye when the engine will be operated (T.O. 42B1-1-10). Fuel in the airplanes will remain colored until tanks have been filled and emptied several times.

a. Add 1.75 ounces of dye to a partially filled tank for each 100 gallons of fuel.

b. Completely fill tank with fuel.

c. Do a fuel vent pressurization system operational checkout (T.O. 1A-7D-2-6).

d. Observe airplane for signs of fuel leakage. Dyed fuel will discolor skin.

CAUTION

Graphite lead pencils or sharp pointed tools shall not be used to mark or sketch on metal surfaces. Graphite or pointed tools have been found to cause severe corrosion. Use MIL-P-83953 airplane marking pencil.

e. Clearly mark leak location.

f. Classify leak (paragraph 3-7).

g. Record location and classification of leak.

h. Depressurize fuel tank (T.O. 1A-7D-2-6).

WARNING

P-D-680 solvent, type II is toxic to skin, eyes, and respiratory tract. Eye and skin protection is required. Use only in a well ventilated area.

i. Clean dye stains from airplane structure with P-D-680, type II drycleaning solvent.

3-6.2. Wing Fuel Tank Integral Structure Pressure Testing. (See figure 3-1.) The wing fuel tank shall be pressure tested for leaks after installing a structural part, such as a skin, spar, or rib. The test should be done under steady temperature conditions to lessen fluctuation of pressure meters used.

3-7. CLASSIFICATION OF FUEL LEAKS. Leaks are classified by the amount of fuel leaking and location on the airplane. The amount and location of leakage will determine what corrective action to take or if corrective action is required before flight. Classify leaks according to the following paragraphs. Refer to paragraph 3-9 for fuel leak repairs.

3-7.1. Integral Wing Fuel Tank Leakage Evaluation/ Classification. There are four types of fuel leaks: slow seep, seep, heavy seep, and running leak. All areas are marked. Then, after each inspection, they are wiped clean so leakage can be checked again later. Definitions of the four types of leaks are as follows:

Type A – Slow Seep. A fuel seepage which wets a small area. Over a period of hours, the wetted area may become larger. A slow seep, when wiped dry, will not reappear within an hour.

Type B – Seep. A fuel leak which, when wiped dry, reappears within 5 minutes to 1 hour, but does not run or drip from the structure.

Type C – Heavy Seep. A fuel leak which, when wiped dry, reappears within 5 minutes, but does not run or drip from the structure.

Type D – Running Leak. A leak which, when wiped dry, reappears immediately and fuel steadily runs or drips from the structure.

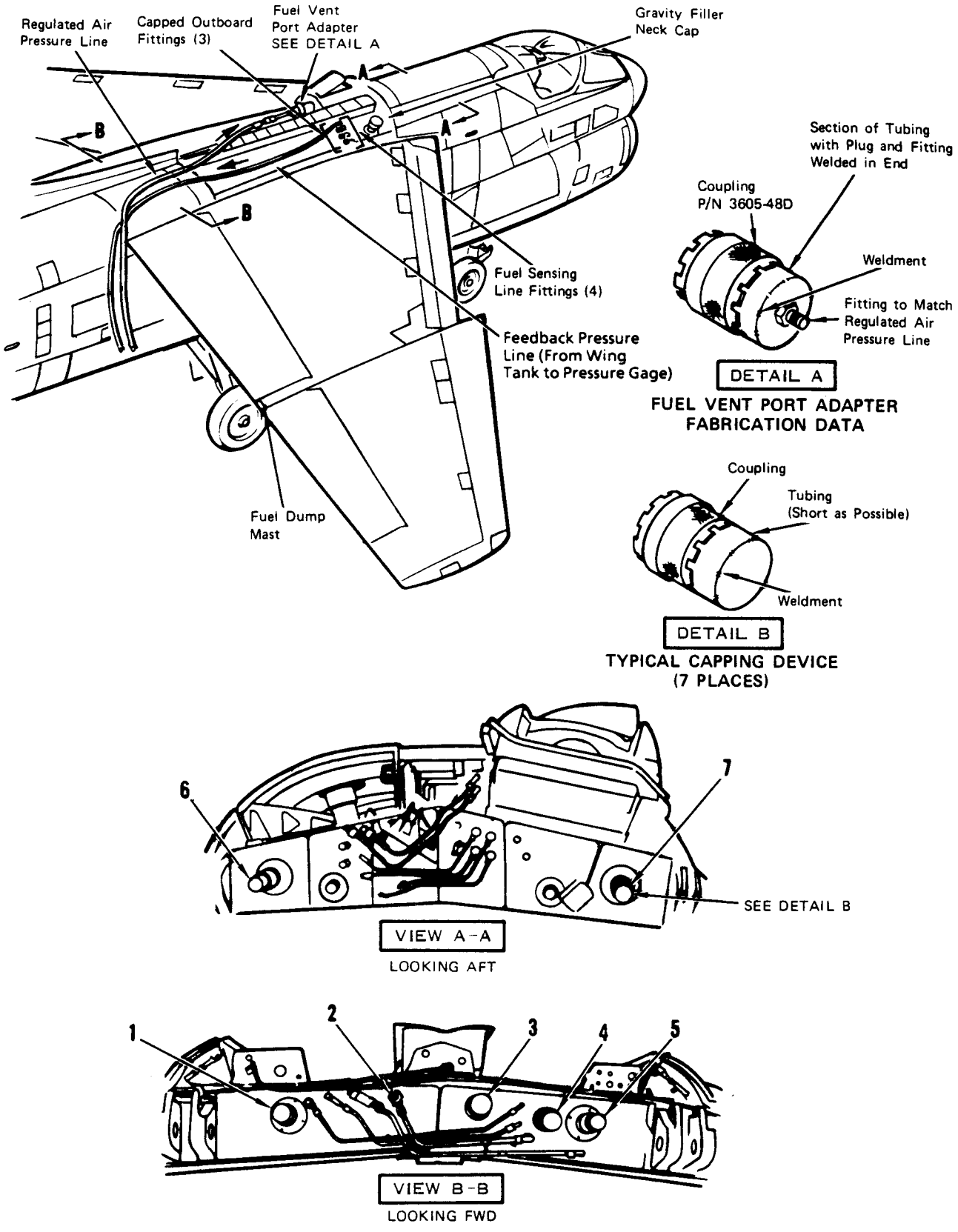
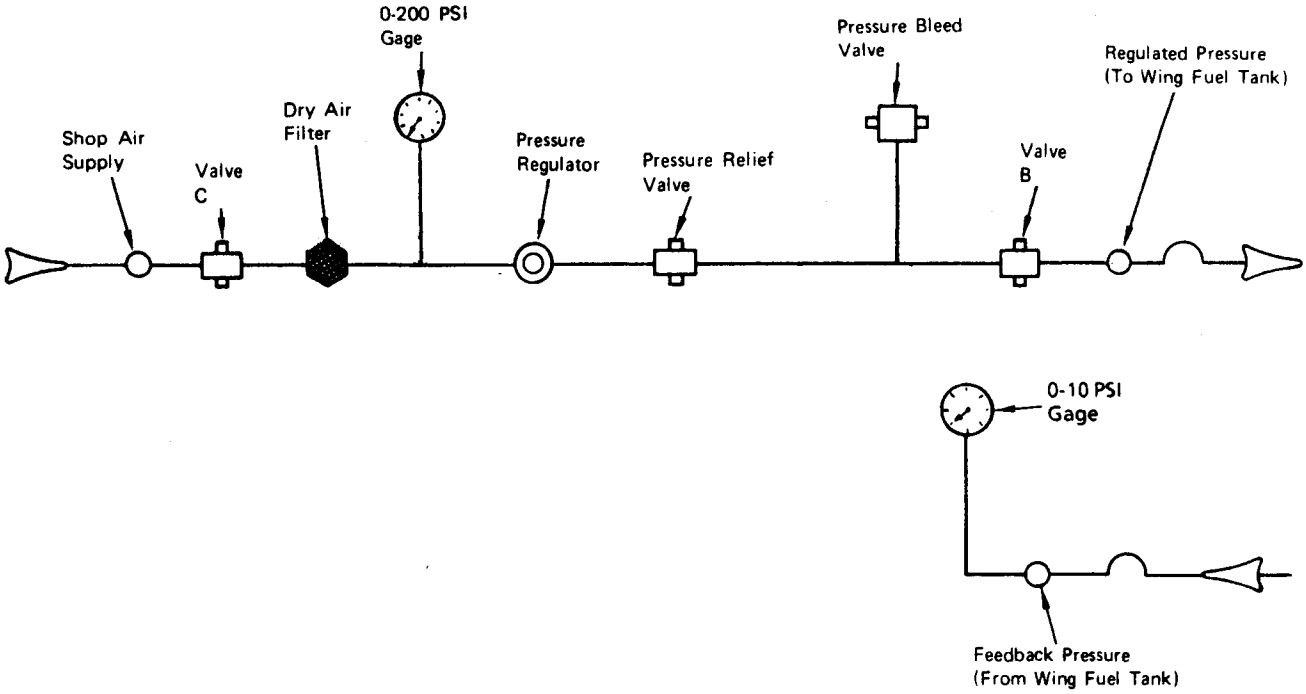


Figure 3-1. Wing Fuel Tank Integral Structure Pressure Test (Sheet 1 of 3)



FLOW SCHEMATIC

1. Install gravity filler neck cap, and seal with masking tape.
2. Install caps on three outboard fuel sensing line fittings.
3. Cover opening of fuel dump masts with masking tape. Punch 1/16 inch hole in tape covering each mast.

CAUTION

When disconnecting fuel lines, cap or plug open lines and fittings. If pylon 3 or 6 is removed, ensure fuel transfer threaded insert is fully seated in wing rib before installing block off plug.

4. Disconnect fuel lines 1 thru 7 and cap fittings at wing tank. If pylons 1, 3, 6, or 8 are removed the respective transfer connection will be capped or plugged.
5. Adjust pressure regulator to minimum pressure setting.
6. Close valve B and open valve C.
7. Connect shop air pressure to valve C.
8. Adjust pressure regulator to obtain 9.5 (± 0.5) psi.
9. Adjust pressure relief valve to relieve at 10.5 psi.
10. Decrease pressure to 0 psi.
11. With fuel vent line disconnected, connect fuel vent port adapter to fuel vent port on wing tank, and regulated air pressure line to fitting on adapter.

90D186-02-07-90

Figure 3-1. Wing Fuel Tank Integral Structure Pressure Test (Sheet 2)

12. Connect feedback pressure line to inboard fuel sensing line fitting.
13. Open valve B.

WARNING

Pressure in wing tank must not exceed 10.5 psi.

14. Slowly adjust pressure regulator to obtain 9.0 (± 0.5) psi in wing tank.
15. Close valves B and C.
16. Adjust pressure regulator to minimum pressure setting.
17. Monitor 0-10 psi gage indication for one hour. Pressure drop indicates tank leakage.
18. Apply MIL-L-25567 leak detector fluid to all attachments, joints, seams, and holes in masking tape covering opening of fuel dump masts. Mark leaks with MIL-P-83953 aircraft marking pencil.
19. Repair leaks using applicable procedures in this section.
20. Open valve B.
21. Bleed pressure from wing tank with pressure bleed valve.
22. Disconnect regulated air pressure line from fuel vent port adapter.
23. Remove fuel vent port adapter from fuel vent port.
24. Disconnect feedback pressure line from inboard sensing line fitting.
25. Remove caps from three outboard fuel sensing line fittings.
26. Remove caps from fuel lines 1 through 7 and wing tank fittings and reconnect lines.
27. Remove masking tape from opening of fuel vent masts and from gravity filler neck cap.

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Figure 3-1. Wing Fuel Tank Integral Structure Pressure Test (Sheet 3)

3-7.2. Fuel Leak Classification/Limits. Integral fuel tank leakage limits acceptable for flight and those requiring maintenance before flight are listed in table 3-1.

CAUTION

Be sure that leakage does not run into critical areas of the airplane, such as engine bay area, electrical connectors, and that it is not possible for fuel to be blown into the engine area. Electrical connectors or apparatus shall be thoroughly dried and inspected after leak repairs are made. Any of the above conditions must be corrected before flight.

3-8. CAUSES OF LEAKS. Fuel tank leaks are usually caused by one or more of the following things. When making repairs, every possible leak should be found and stopped.

3-8.1. Blisters. Blisters may be caused by air bubbles or cleaning solvents trapped in the sealant. Expansion of the air in the blister at altitude, flexing of the wing structure, and/or an extreme increase in temperature can burst the blister and open a path for fuel to leak through the sealant.

3-8.2. Ruptures. Ruptures can be caused by excessive flexing of the wing in flight, rough landings, or rapid taxiing over rough ground with a heavy fuel load.

Table 3-1. Fuel Leak Criterial Airworthiness Evaluation

Leak location	Type of leak				
	A	B	C	D	
	Repair requirements				
Areas exposed to airstream during flight (Open areas)	1	1	2	3	
Wingfold areas	1	2	2	3	
Areas inside access panel numbers 4113-10, 3133-5, 4133-5, 3113-10* (front and rear wing attach points)	1	2	3	3	
Areas inside access panel numbers 6112-1, 5112-1† (lower wing splice plate area)	1	2	3	3	

Repair Requirements

1. Airplane is airworthy. No repair required. Inspections shall be made in accordance with T.O. 1A-7D-6 to monitor increase in leak intensity.
2. Airplane is airworthy. No immediate repair is required. Inspections shall be made in accordance with T.O. 1A-7D-6 to monitor increase in leak intensity. Repair should be made at the next phased inspection or during repair of running leaks.
3. Airplane is grounded. Immediate repair is required.

*Maximum of 2 leaks

†Maximum of 1 leak

3-8.3. Voids. Voids can be caused by poor adhesion and/or incomplete sealing in hard-to-reach areas, along seams, and around joints.

3-8.4. Poor Adhesion. This can be caused by sealing over improperly cleaned surface and over a seam or joint containing trapped moisture.

3-8.5. Wrong Sealant. After using the wrong sealant, it will be hard or impossible to inject G651 or Q4-2805 sealant, or it may not stick to the groove. Use only G651 or Q4-2805 sealants. No others are allowed.

3-9. FUEL LEAK REPAIRS.

The following paragraphs include repairs of leaking Stat-O-Seal washers, O-ring seals, attaching fasteners, Center-Line-Seal, and small holes in tank structure. These are for areas where repairs may be made without removal of major wing structures or removal of the wing from the airplane. For major sealing repairs, wing overhaul, partial disassembly, or wing removal, refer to paragraph 3-11.

3-9.1. Stat-O-Seal Washer (600-042 Series) Leak Repair. (See figure 3-2.) The following procedures apply to leaking Stat-O-Seal washer used with bolts.

a. Remove bolt and Stat-O-Seal washer.

b. Check bolt for cross threading. If bolt is cross threaded, replace with one of the same type, material, and grip length.

c. Check bolt grip length for bottoming out. Replace bolt with one of proper grip length if bolt is too long.

d. For 1/4-inch diameter bolts, check hole size. If hole size is 0.260 inch or larger, replace Stat-O-Seal washer with 600-042 1/4 OS (oversize) Stat-O-Seal washer; if the hole size is less than 0.260 inch, replace Stat-O-Seal washer with new Stat-O-Seal washer of same size (paragraph 3-9.8).

e. For 5/16-inch diameter and larger bolts, replace Stat-O-Seal washer with new Stat-O-Seal washer of same size.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

f. Clean bolt, Stat-O-Seal washer, and mounting surface with TT-T-548 toluene.

NOTE

Avoid contaminating cleaned surfaces to ensure a proper seal. No form of lubrication shall be used to install Stat-O-Seal washer.

g. Install bolt and Stat-O-Seal washer. Tighten bolt to correct torque (figure 3-3).

h. Check fastener for required smoothness (Section I).

i. Apply corrosion protection and finish (T.O. 1A-7D-23).

NOTE

If necessary, add extra washers to get cotter pin hole in bolt to line up with slot in bolt.

3-9.2. Rear-Spar-To-Attach-Rib Nuts. Remove four AN320-14 (rear-spar-to-attach-rib) nuts. Replace one AN960D1416 washer under nut with one 600-042 7-8 Stat-O-Seal washer and one AN960D1416L washer. Reinstall nut and tighten to 1,650 (±140) inch-pounds maximum torque.

3-9.3. Countersunk Screw Leak Repair, O-Ring Under Screwhead. (See figure 3-2.) Countersunk screws with an O-ring under the head are located in the wing center section upper and lower panels. Screws in the upper surface are below skin level to permit application of corrosion protection sealant.

a. Remove screw and O-ring.

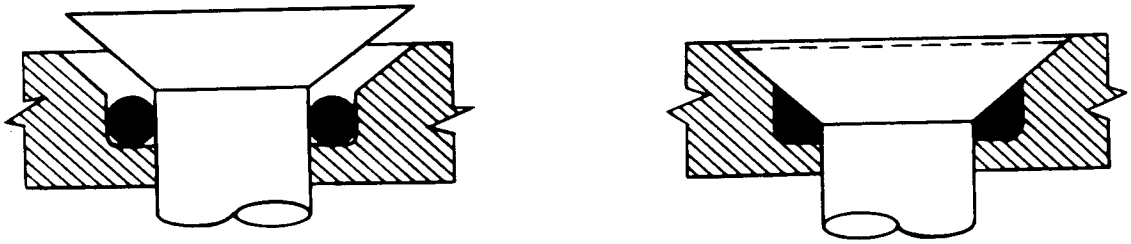
STAT-O-SEAL WASHER SEALING

Before Tightening

After Tightening

O-RING SEALING OF COUNTERSUNK FASTENERS

O-RING REPLACEMENT	
COUNTERSUNK FASTENER DIAMETER (INCHES)	TYPE OF O-RING
1/4	MS29513-010
5/16	MS29513-011
3/8	MS29513-012
1/2	MS29513-014



Before Tightening

After Tightening

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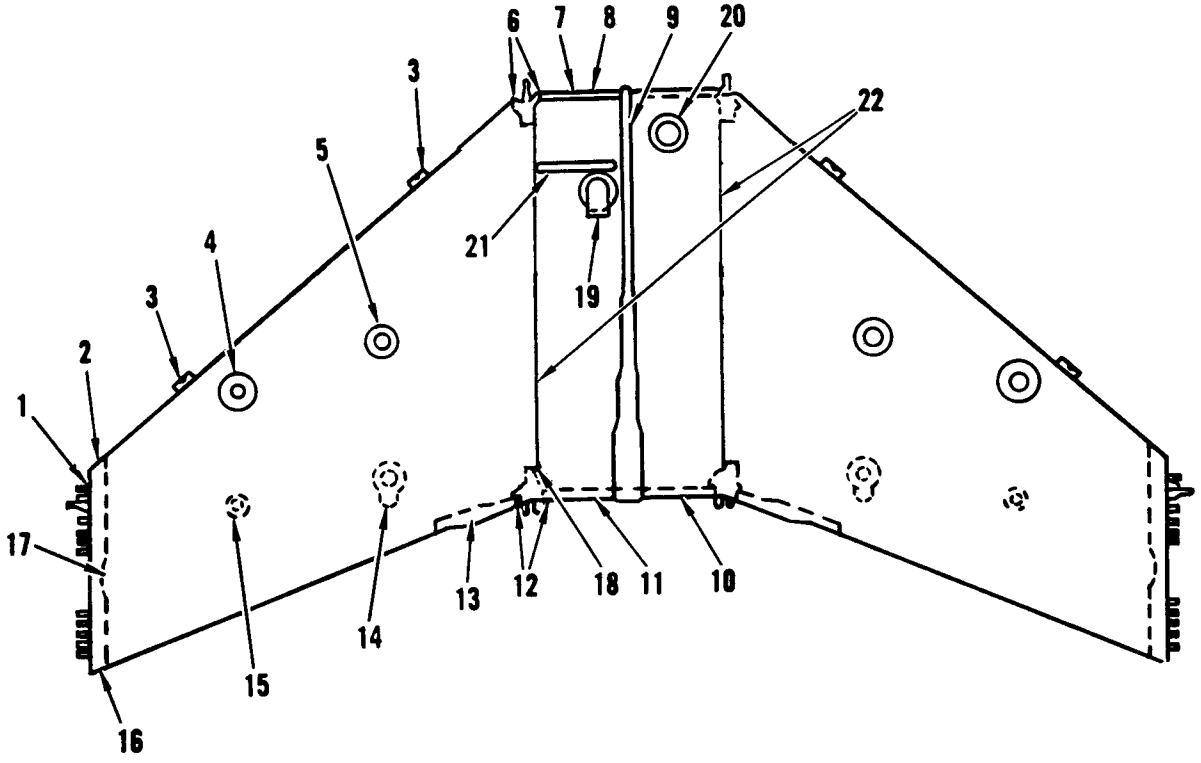
Figure 3-2. Stat-O-Seal Washer and O-Ring Sealing of Fasteners



90D188-01-11-84

Figure 3-3. Wing Fastener Torque Values (Sheet 1 of 3)

1. Wingfold rib to lower skin outboard row, 38 screws, apply torque (Table B), typical L and R.
2. Wingfold rib to front spar, 3 bolts, apply torque (Table B), typical L and R.
3. Flap actuator support fitting to front spar, 4 bolts each fitting, apply torque (Table B), typical L and R.
4. Center pylon forward support fitting to upper and lower skins, 28 screws, apply torque (Table B), typical L and R.
5. Inboard pylon forward support fitting to upper and lower skins, 27 screws, apply torque (Table B), typical L and R.
6. Front spars to attach rib, 9 bolts, apply torque (Table B), typical L and R.
7. Electrical adapter plate (2) to center front spar, 12 bolts, apply torque to 35 pound-inches maximum.

   Fueling vent adapter (2) to center front spar, 16 bolts, apply torque to 75 pound-inches maximum.
8. Center front spar to upper and lower skins, 18 screws, apply torque to 75 pound-inches maximum.

   Center front spar to upper and lower skins, 64 bolts, apply torque (Table B).
9. Upper and lower centerline splices to upper and lower skins, front and rear center spars, 378 bolts, apply torque (Table B).
10. Fuel system castings (4) to center rear spar, 32 bolts, apply torque to 75 pound-inches maximum.
11. Center rear spar to upper and lower skins, 3 screws, 53 bolts, apply torque (Table B).
12. Rear spar to attach rib, 2 bolts, apply torque (Table B), typical L and R.
13. Outboard rear spar to upper and lower skins, 22 screws, apply torque (Table B), typical L and R.
14. Inboard pylon aft support fitting to lower skin and external plate, 17 screws, apply torque (Table B), typical L and R.
15. Outboard pylon aft support fitting to lower skin, 8 screws, apply torque (Table B), typical L and R.
16. Wingfold to rear spar, 4 bolts, apply torque (Table B), typical L and R.
17. Wingfold rib to upper skin outboard row, 32 screws, apply torque to 175 pound-inches maximum.
18. Attach rib to upper and lower skins 4 screws (upper), 4 bolts (lower), apply torque (Table B), typical L and R.
19. Fuel vent to upper skin, 8 bolts, apply torque to 65 pound-inches maximum.
20. Filler neck to upper skin, 8 bolts, apply torque to 65 pound-inches maximum.
21. Inflight refueling structure to upper wing skin, 7 bolts, apply torque (Table B).
22. Tools 7727527-10 thru -80 may be used to torque lower wing bolts above fuselage.

90D188-02-11-84

Figure 3-3. Wing Fastener Torque Values (Sheet 2)

NOTE

Any frictional torque determined to result from slight misalignment of holes in adjacent parts is in addition to the maximum values of Tables A, B, and noted fasteners. If fastener is engaging the nut locking device when the frictional torque measure is made, deduct the nut locking torque below from the measured values:

FASTENER DIAMETER (INCHES)	NUT LOCKING TORQUE (POUND-INCHES)
1/4	–20
5/16	–35
3/8	–40
1/2	–75

NOTE

Tools 7727527-10 thru -80 may be used to torque lower wing skin bolts above fuselage. These tools must only be used as an alternative to wing removal and then only with a calibrated torque wrench. Misuse of these tools beyond that which they are intended can cause damage to wing skin bolts or nuts.

TABLE A

Maximum torque values for all bolts and screws not noted

FASTENER DIAMETER (INCHES)	BOLTS MAXIMUM TORQUE (POUND-INCHES)	SCREWS 100° HEAD MAXIMUM TORQUE (POUND-INCHES)	BOLT-TORQUE WITH 7727527 SERIES TOOLS AND 10 INCH TORQUE WRENCH (POUND-INCHES) (AREA 23)
1/4	102 ± 10	125 ± 15	24 ± 2
5/16	195 ± 20	255 ± 25	42 ± 5
3/8	240 ± 30	340 ± 40	55 ± 7
1/2	500 ± 40	810 ± 60	114 ± 9
7/8	1650 ± 140	–	–

TABLE B

Maximum torque values for bolts and screws through centerline sealing grooves except those noted

FASTENER DIAMETER (INCHES)	BOLTS MAXIMUM TORQUE (POUND-INCHES)	SCREWS 100° HEAD MAXIMUM TORQUE (POUND-INCHES)	BOLT-TORQUE WITH 7727527 SERIES TOOLS AND 10 INCH TORQUE WRENCH (POUND-INCHES) (AREA 23)
1/4	70 ± 5	90 ± 8	16 ± 1
5/16	160 ± 15	208 ± 20	36 ± 3
3/8	220 ± 20	282 ± 30	50 ± 5
1/2	500 ± 40	647 ± 55	114 ± 9
7/8	1650 ± 140	–	–

90D188–03–11–84

Figure 3-3. Wing Fastener Torque Values (Sheet 3)

b. Check screw for cross threading. Replace cross-threaded screw with screw of same type, material, and grip length.

c. Check screw grip length for bottoming out. Replace screw with one of proper grip length if screw is too long.

d. Install new O-ring (paragraph 3-9.7).

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

e. Clean screw, O-ring, and countersunk hole with TT-T-548 toluene.

CAUTION

No lubricants other than paraffin wax or JP fuel are recommended for O-rings. Paraffin is less volatile and is the preferred lubricant to lessen explosion/fire hazard.

NOTE

Avoid contaminating cleaned surfaces to ensure a proper seal.

f. Install screw with new O-ring. Tighten screw to correct torque (figure 3-3).

g. Check fastener for required smoothness (Section I).

h. Apply corrosion protection and finish (T.O. 1A-7D-23).

3-9.4. Leak Repair at Anchor, Plate, and Gang Channel Nuts. Use the following repair on fasteners where O-ring seals or Stat-O-Seal washers are used as sealing devices.

a. Remove fastener. Replace damaged fastener with one of same type, material, and grip length.

b. Replace O-ring or Stat-O-Seal washer, as applicable, on fastener (paragraphs 3-9.7 and 3-9.8).

c. If nut is not damaged, install fastener.

d. If nut is damaged, knock nut into tank and install blind fastener (paragraph 3-9.6).

e. Check fastener for required smoothness (Section I).

f. Apply corrosion protection and finish (T.O. 1A-7D-23).

3-9.5. Repair of Loose or Damaged Nuts. The following procedure is for repair of stripped or loose anchor, plate, and gang channel nuts in fuel tank.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

Use a vacuum cleaner or other suitable equipment during repair to ensure that no chips, shavings, or foreign material fall into fuel tank.

a. Drill through fastener head and remove head of fastener. Use a drill the same size as shank of fastener.

b. Push remainder of fastener and nut into fuel tank.

c. Install blind fastener (paragraph 3-9.6).

d. Check fastener for required smoothness (Section I).

e. Apply corrosion protection and finish (T.O. 1A-7D-23).

3-9.6. Installation of Blind Fastener in Fuel Tank. (See figure 3-4.) Install blind fastener according to Section I or paragraph 3-9.10 and as follows.

a. Select blind fastener of proper type, size, and grip length (table 3-2).

WARNING

Reaming operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

NOTE

Use a vacuum cleaner or other suitable equipment during reaming operation to ensure that no chips, shavings, or foreign material fall into fuel tank.

b. Ream hole to final hole size (table 3-2).

c. Prepare blind fastener for sealing and install (figure 3-4).

d. Check fastener for required smoothness (Section I).

e. Apply corrosion protection and finish (T.O. 1A-7D-23).

3-9.7. Fastener O-Ring Replacement. (See figure 3-2.) The following procedure applies where O-ring seals are used as sealing devices for fasteners installed in fuel tank.

a. Remove leaking fastener (paragraph 3-9.3).

b. Remove old O-ring from fastener.

c. Examine fastener surface under countersunk head where O-ring was seated. Replace fastener if surface is damaged or irregular.

d. Select new O-ring that is uniform, unbroken or not torn, and clean.

e. Install O-ring on fastener shank under countersunk head.

f. Install fastener (paragraph 3-9.3).

3-9.8. Stat-O-Seal Washer Replacement. (See figure 3-2.) Use the following procedure where Stat-O-Seal washers are used as sealing devices for fasteners installed in fuel tank.

a. Remove leaking fastener (paragraph 3-9.1).

b. Remove old Stat-O-Seal washer from fastener.

c. Examine fastener shank surface where sealing washer was seated. Replace fastener if surface is damaged or irregular.

d. Select new Stat-O-Seal washer. Carefully inspect washer for the following:

(1) Rubber O-ring is uniform and unbroken.

(2) Steel part of washer is uniformly flat and not out of shape or damaged in any way.

e. Replace all metal washer under fastener head with new perfectly flat washer.

NOTE

No lubrication of any kind shall be used to install Stat-O-Seal washers.

f. Install new Stat-O-Seal washer under all metal washer.

g. Install fastener (paragraph 3-9.1).

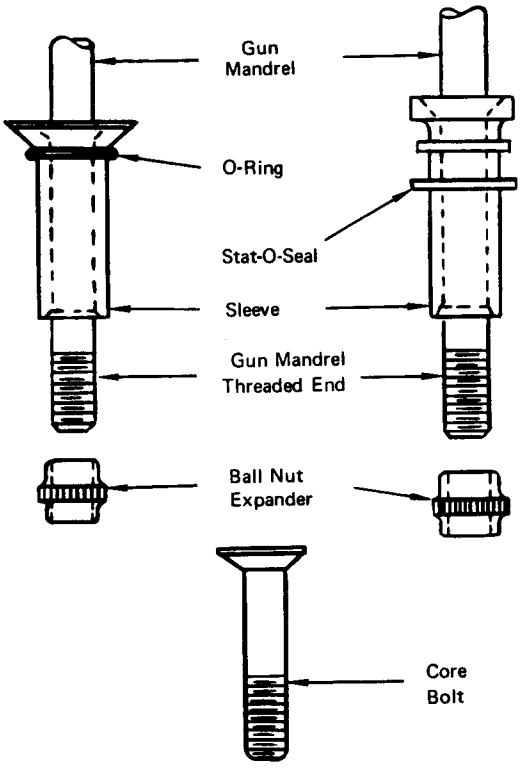
3-9.9. Fastener Leak Repair in Center-Line-Seal Groove. Repair leaking fasteners installed through a sealant groove as follows.

a. Remove one sealant injection hole screw on each side of replaced fastener that is leaking.

b. Inject sealant into groove (paragraph 3-5).

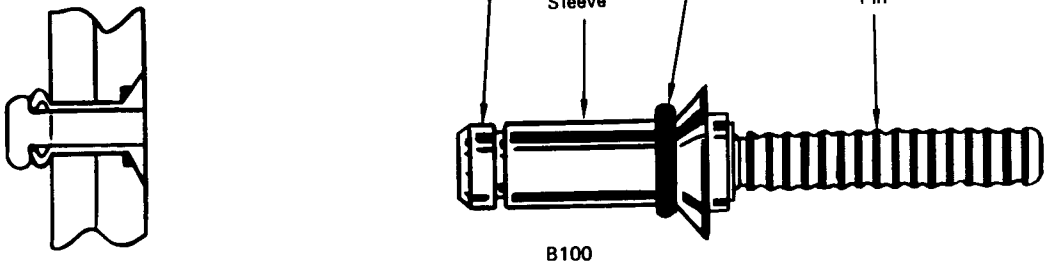
c. Replace sealant injection hole screws.

BLIND HI-SHEAR FASTENER SEALING PREPARATION



1. Insert gun mandrel through fastener sleeve. Screw ball nut expander on mandrel thread end.
2. Dip ball nut expander in MIL-S-4383 top coating sealant (paragraph 3-11.10).
3. Replace O-ring or stat-o-seal, if one exists on fastener being replaced (paragraph 3-9.7 or 3-9.8).
4. Insert fastener sleeve and expander into reamed hole.
5. Drive gun mandrel to install expander nut into sleeve. Remove gun mandrel.
6. Dip thread end of core bolt in top sealant coating (MIL-S-4383), and apply MIL-S-8802 sealing compound under core bolthead (T.O. 1A-7D-23 and paragraph 3-11.10).
7. Install core bolt in fastener sleeve and tighten to proper torque value (Figure 3-3).

BLIND HUCK FASTENER SEALING PREPARATION

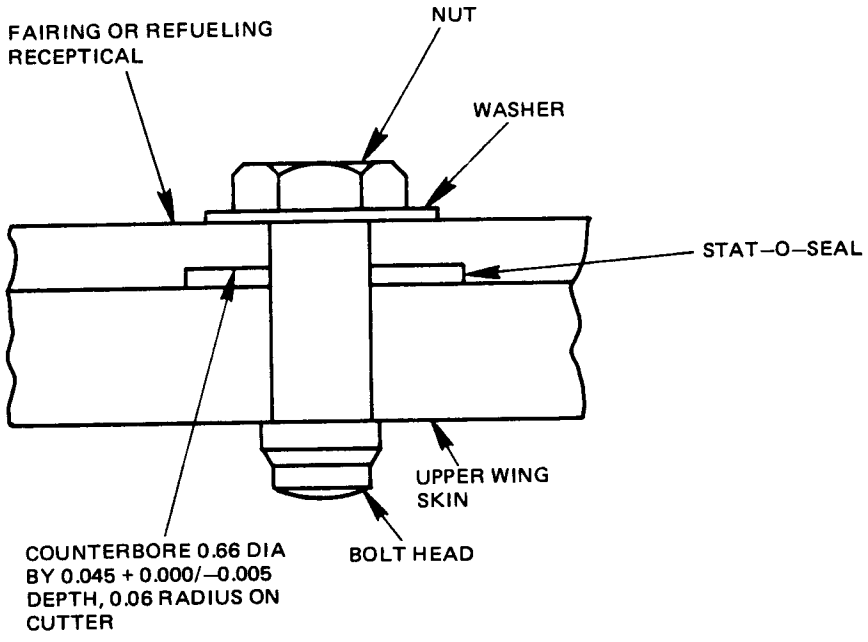


1. Install O-ring (paragraph 3-9.7).
2. Dip fastener sleeve in MIL-S-4383 top coating sealant (paragraph 3-11.10).
3. Apply MIL-S-8802 sealing compound under fastener head (T.O. 1A-7D-23).
4. Install in accordance with information on fasteners (Section I).

90D189-01-11-84

Figure 3-4. Blind Fastener Sealing and Installation (Sheet 1 of 2)

JO–BOLT FASTENER SEALING PREPARATION



1. In locations where the fastener is not installed through a rib or spar it will be necessary to remove the fairing or refueling receptical, counterbore the underside of the fastener hole to the dimension given in the figure above, and install a Stat-O-Seal.

2. Install AN960D washer under the nut.

3. Install fasteners in accordance with Section I.

90D189–02–11–84

Figure 3-4. Blind Fastener Sealing and Installation (Sheet 2)

Table 3-2. Replacement Fastener Selection

Blueprint fastener	Replacement fastener: Huck[1]	Voi-shan/ monogram[2]	Hi-shear[3]	Jo-bolt[4]	Hole diameter
	NOTE Grip length is notated as (GL) following the part number when applicable.				
202-15520-4-(GL)	MS90354-08(GL)	PLT1060-8-(GL)		NAS1669-4(GL)	0.263/0.260
202-15520-5-(GL)	MS90354-10(GL)	PLT1060-10-(GL)		NAS1669-5(GL)	0.3145/0.3115
202-15520-6-(GL)	MS90354-12(GL)	PLT1060-12-(GL)		NAS1669-6(GL)	0.379/0.374
202-15521-4-(GL)	MS90353-08(GL)	PLT1059-8-(GL)			0.263/0.260
202-15521-5-(GL)	MS90353-10(GL)	PLT1059-10-(GL)			0.3145/0.3115
202-15521-6-(GL)	MS90353-12(GL)	PLT1059-12-(GL)			0.377/0.374
NAS517-4-(GL)	MS90353-08(GL)	PLT1059-8-(GL)			0.263/0.260
NAS517-5-(GL)	MS90353-10(GL)	PLT1059-10-(GL)			0.3145/0.3115
NAS517-6-(GL)	MS90353-12(GL)	PLT1059-12-(GL)			0.377/0.374
NAS517-8-(GL)			BB351-16-(GL)		0.534/0.531
	MS90353-16(GL)				0.504/0.500
NAS1304-(GL)	MS90354-08(GL)	PLT1060-6-(GL)		NAS1669-4(GL)	0.263/0.260
NAS1305-(GL)	MS90354-10(GL)	PLT1060-10-(GL)		NAS1669-5(GL)	0.3145/0.3115
NAS1306-(GL)	MS90354-12(GL)	PLT1060-12-(GL)		NAS1669-6(GL)	0.377/0.374
NAS1308-(GL)			BB352-16-(GL)		0.534/0.531
	MS90354-16(GL)				0.504/0.500

[1]Preferred replacement fastener. Install in accordance with 208-13-230.

[2]Install in accordance with CVA 13-236. Shave in accordance with CVA 13-208.

[3]Install in accordance with CVA 13-248. Core bolt installation torque = 390 (±10) inch-pounds.

[4]Authorized only in wing root fairing, wing dorsal fairing, and air refueling receptical areas where preferred replacement fasteners cannot be installed due to fastener hole inaccessibility. Jo-Bolt fasteners shall be installed in these areas in accordance with figure 3-4.

NOTE

The following method is an optional field level repair to be used if movement of airplane to depot for rework is not possible or desirable.

3-9.10. Lower Wing Skin Resealing or Retorquing Through Engine Intake Duct. Access to the lower wing skin to retorque loose bolts or to reseal wing lower skin may be made as follows.

a. Mask all open accesses including engine inlet, vents, and screens in the intake. Removal of engine is not necessary, but is highly desirable.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

b. Drill out all rivets in 215-30150 and 215-30151 skin panels. Remove panels being careful not to damage edges.

c. Retorque loose bolts or reseal lower wing skin as required.

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

MIL-S-81733 sealant is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

d. Clean sealant from skin panels and ribs. Reseal all surfaces using MIL-S-81733 or MIL-S-8802 sealant.

e. Reinstall skin panels using Monel Cherrylock blind-bulbed rivets. Follow all procedures in accordance with paragraph 8-7.1.

f. Clean engine duct carefully to remove all FOD.

g. Notify QC that panels are ready for rivet inspection.

3-9.11. Center-Line-Seal, Seam, and Attachment Leak Repair. Perform the following sealant injection procedure for repair of Center-Line-Seal, seam, and attachment fuel leaks.

a. Check attaching bolt grip lengths for possible bottoming out. Where necessary, replace bolt with one of proper grip length.

b. Check all bolts in area of leak for proper torque value before injecting with sealant (figure 3-3).

NOTE

Sealant injection screws should be removed with care. If a screw cannot be removed with application of moderate torque, the adjacent screw should be removed. If a screw head breaks, it should not be drilled out. Overcoat the defective screw with MIL-S-8802 sealant.

c. Remove at least one injection hole screw on each side of leak area.

d. Inject G651 or Q4-2805 sealant into groove (paragraph 3-5).

NOTE

When replacing the sealant injection screws, the screws should be tightened only until the head of the screw contacts the wing skin. Using too much torque may make screws hard to get out if sealant injection is needed again.

e. Remove sealant gun and install injection hole screw in hole from which gun was removed.

f. Repeat injection procedure, injecting sealant into hole from which sealant squeezed out. Inject sealant into hole until sealant squeezes out the proper length from next injection hole.

g. Repeat step f for remainder of open holes.

h. Replace final injection hole screw.

i. Perform injection screw installation corrective actions as follows:

(1) If injection hole threads have been stripped, replace injection hole screws with next larger diameter of same type screw. Use washer under head of screw as required to prevent bottoming out.

(2) If injection screws are countersunk, enlarge countersink as required to obtain flush fit of screw with wing surface. Countersink screw may be cut off to prevent bottoming.

(3) If four or more screw heads are broken and sealant cannot be injected using described methods, repair of the area should be treated as a special case. Operational units should contact Oklahoma City, ALC/MMSR for specific instructions.

j. Recheck all fasteners for torque values (figure 3-3).

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

k. Remove excess sealant from wing surface with wooden spatula. Finish cleaning by using clean, lint-free cloth dampened with TT-T-548 toluene.

3-9.12. Component O-Ring Seal Leak Repair. O-ring seals are used on the wing fuel dump valve assemblies located on the wing center section trailing edge. Replace defective O-ring seals as follows.

a. Remove fuel dump valve (T.O. 1A-7D-2-6).

b. Inspect O-ring grooves in valve and adapter for nicks, corrosion, or foreign materials which may prevent sealing.

c. Check mounting bolts for cross threading. Replace cross-threaded bolts with new bolts of same type, material, and grip length.

d. Check bolt grip length for bottoming out before replacing O-ring. If bolt bottoms out, replace with new one of proper grip length.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

e. Clean wing dump valve, wing rear spar mating surface, and O-ring groove with TT-T-548 toluene.

NOTE

To ensure proper seal, avoid contamination of the mating surfaces from grease, dirt, metal chips, and foreign material.

f. Install fuel dump valve (T.O. 1A-7D-2-6).

3-9.13. Hole Repair. Small holes in the wing tank skin which can be drilled out and cleaned without exceeding 1/2-inch diameter or affecting structural

strength may be sealed by installing a blind fastener in the drilled hole as follows.

WARNING

Drilling and counterboring operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Clean out damaged hole to proper size for blind fastener (table 3-2).

b. Counterbore hole for O-ring (figure 3-2).

c. Install fastener (figure 3-4).

3-10. WING INTEGRAL FUEL TANK FOAM BAFFLES.

(See figure 3-5.) Foam baffles are installed in the internal spaces provided in the wing integral fuel tank for the storage of fuel. The purpose of the foam baffles is to suppress explosion and retard fire if the fuel tank is pierced or ruptured in an accident or during combat. Each baffle is made of blue-colored reticulated polyurethane, cut to fit and fill an internal space in the fuel tank. The baffles are sized and shaped for clearance around internal components, probes, and tubing in the fuel tank. When installed, the wing skins and internal partitions compress each baffle approximately 2%. The compression holds the foam material in position and maintains clearances. The baffles reduce total fuel quantity by approximately 3%.

3-10.1. Foam Baffle Identification. (See figure 3-5.) Each foam baffle is identified by a part number marked on the first side showing during removal. The identifying dash number indicates the location of the baffle in the fuel tank. Except in the wing centerline rib attachment area (detail A), all odd dash-numbered baffles are installed in the left wing and all even dash-numbered baffles in the right wing. To help install baffles in the correct position, arrows indicating up, forward, aft, inboard, or outboard are also marked on each baffle. Numbers and arrows are marked with permanent ink felt-tip marking pens.

3-10.2. Removal, Inspection, and Cleaning. Removal, inspection, and cleaning of baffles shall be accomplished according to T.O. 1-1-3. To make installation easier, each baffle should be checked immediately after removal for proper location and markings. Figure 3-5 may be used to assist in making proper location. Faded markings should be remarked before installation (paragraph 3-10.1).

3-10.3. Fabrication of Replacement Baffles.

CAUTION

Designed voids in the baffle shall be cut to maintain required clearances around fuel components.

a. Using old baffle as pattern, cut MIL-B-83054 polyurethane foam blank to identical shape. Foam material can easily be cut with sharp electric knife.

NOTE

Each foam baffle is identified with part number (including dash number) as well as arrows showing up, forward, aft, inboard, or outboard.

b. Mark new baffle with same markings as old baffle (paragraph 3-10.1). See figure 3-5 for part number and baffle locations.

3-10.4. Installation. (See figure 3-5.) When in position, all pieces are compressed approximately 2%. This compression holds the foam in position and maintains clearances.

WARNING

Before installation, the foam baffles shall be dry of fuel to prevent vapors from creating an explosive hazard or a nauseating environment.

CAUTION

Correct positioning and installation of all baffles in fuel tanks is extremely important. Designed voids in the foam shall be positioned to maintain required clearances around fuel components and prevent static charge generation.

a. Using rubber gloves, install foam baffles in locations given in figure 3-5.

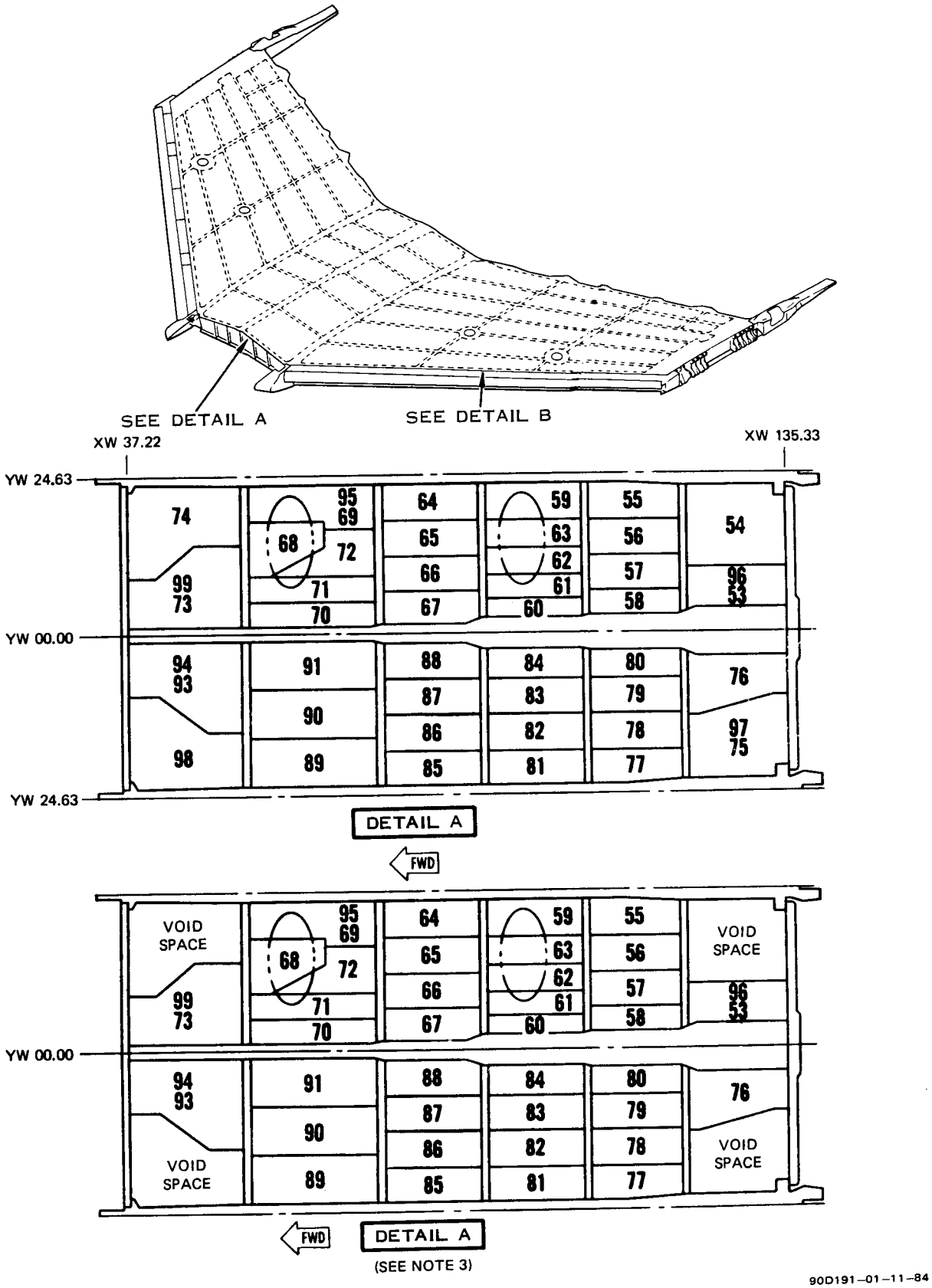


Figure 3-5. Wing Integral Fuel Tank Foam Baffle Locations (Sheet 1 of 3)

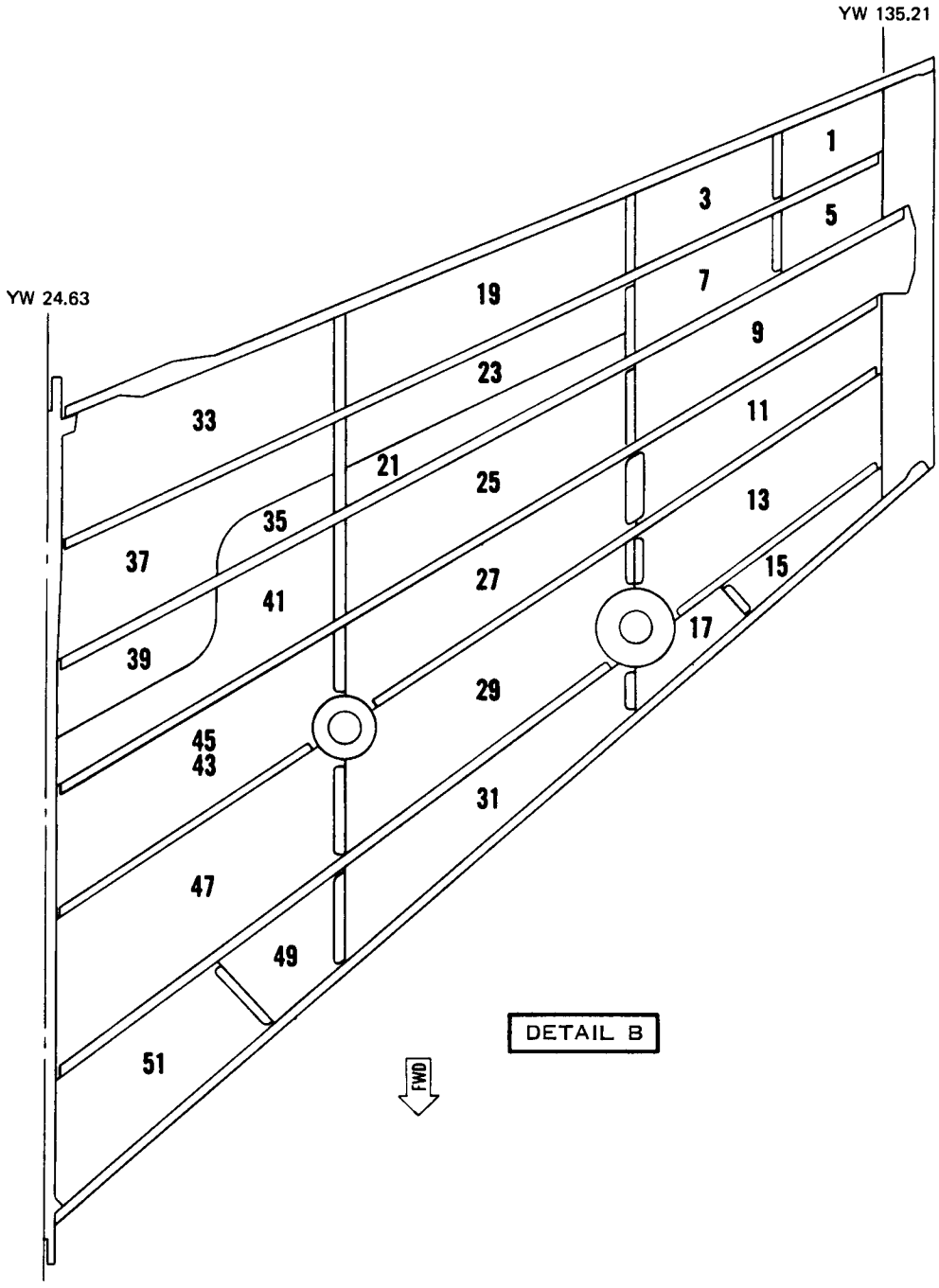


Figure 3-5. Wing Integral Fuel Tank Foam Baffle Locations (Sheet 2)

NOTE

1. Left side shown, right side same except as shown in detail A.
2. Each foam baffle is identified with part number (including dash number) as well as arrows designating up, forward or aft, inboard or outboard.
3. Preferred foam baffle installation deletes the 7827235-31, -115, -127, and -153 blue foam baffles. This allows void spaces at fuel inlet areas. Either blue foam configuration is acceptable.

BLUE BAFFLES

BAFFLE, L/R	(7827235-37, -38)
BAFFLE, L/R	(7827235-23, -24)
BAFFLE, L/R	(7827235-05, -06)
BAFFLE, L/R	(7827235-57, -58)
BAFFLE, L/R	(7827235-13, -14)
BAFFLE, L/R	(7827235-01, -02)
BAFFLE, L/R	(7827235-43, -44)
BAFFLE, L/R	(7827235-17, -18)
BAFFLE, L/R	(7827235-53, -54)
BAFFLE, L/R	(7827235-161, -162)
BAFFLE, L/R	(7827235-181, -182)
BAFFLE, L/R	(7827235-171, -172)
BAFFLE, L/R	(7827235-157, -158)
BAFFLE, L/R	(7827235-183, -184)
BAFFLE, L/R	(7827235-123, -124)
BAFFLE, L/R	(7827235-121, -122)
BAFFLE, L/R	(7827235-177, -178)
BAFFLE, L/R	(7827235-133, -134)
BAFFLE, L/R	(7827235-173, -174)
BAFFLE, L/R	(7827235-45, -46)
BAFFLE, L/R	(7827235-41, -42)
BAFFLE, L/R	(7827235-61, -62)
BAFFLE, L/R	(7827235-63, -64)
BAFFLE, L/R	(7827235-65, -66)
BAFFLE, L/R	(7827235-111, -112)
BAFFLE, L/R	(7827235-131, -132)
BAFFLE, R	(7827235-101)
BAFFLE, R	(7827235-115) – DELETED (NOTE 3)
BAFFLE, R	(7827235-25)
BAFFLE, R	(7827235-27)
BAFFLE, R	(7827235-15, -147)
BAFFLE, R	(7827235-105)
BAFFLE, R	(7827235-71)
BAFFLE, R	(7827235-35, -73)
BAFFLE, R	(7827235-51)
BAFFLE, R	(7827235-141)
BAFFLE, R	(7827235-11)
BAFFLE, R	(7827235-07)
BAFFLE, R	(7827235-03)
BAFFLE, R	(7827235-95)
BAFFLE, R	(7827235-55)
BAFFLE, R	(7827235-75, -77)
BAFFLE, R	(7827235-151)
BAFFLE, R	(7827235-113)
BAFFLE, R	(7827235-153) – DELETED (NOTE 3)
BAFFLE, L	(7827235-87)
BAFFLE, L	(7827235-163, -143)
BAFFLE, L	(782727235-145)
BAFFLE, L	(7827235-155)
BAFFLE, L	(7827235-165, -103)
BAFFLE, L	(7827235-91)
BAFFLE, L	(7827235-135)
BAFFLE, L	(7827235-167, -125, -97)
BAFFLE, L	(7827235-117)
BAFFLE, L	(7827235-175)
BAFFLE, R	(7827235-107)
BAFFLE, R	(7827235-93)
BAFFLE, L	(7827235-21)
BAFFLE, L	(7827235-127) – DELETED (NOTE 3)
BAFFLE, R	(7827235-137)
BAFFLE, L	(7827235-47)
BAFFLE, L	(7827235-31) – DELETED (NOTE 3)
BAFFLE, L	(7827235-81, -83)
BAFFLE, L	(7827235-85)

90D191-03-11-84

Figure 3-5. Wing Integral Fuel Tank Foam Baffle Locations (Sheet 3)

b. To ensure that each baffle is properly installed, apply enough, but not too much, pressure on baffle. Avoid rubbing one baffle against another as much as possible.

3-11. FUEL TANK SEALING. During major repair and/or overhaul of the wing center section (WCS), resealing or repair of various areas of the wing integral fuel tank may be necessary. The following paragraphs contain wing fuel tank repair and sealing procedures which may require partial dismantling of the WCS, including removal of upper skin and/or removal of the wing from the airplane. Special tools and equipment required for the repair operations involved are listed in Section XVII.

3-11.1. Cleaning. When repairs require the removal of the wing skin, all mating surfaces shall be cleaned before reinstallation as follows.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

a. Wipe surfaces with clean cloth saturated with TT-T-548 toluene.

b. Dry with clean cloth before toluene dries. Work small areas.

WARNING

TEC No. 901 cleaner is toxic to eyes, skin, and respiratory tract. Eye and skin protection is required. Use only in a well ventilated area.

c. Wipe surfaces with cloth saturated in mild acid cleaner (TEC No. 901, or equivalent).

d. Dry with clean cloth before acid cleaner dries.

NOTE

Bad seals could result if the clean areas are touched or if 8 hours pass before sealing. Clean area again if either occurs.

3-11.2. Sealant Removal. Remove excess or old sealant as follows.

CAUTION

Do not use scrapers of material that could scratch the sealing surfaces. Leakage could result.

a. Remove sealant with acrylic plastic scraper, wooden scraper, or hard rubber wheel and drill motor.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

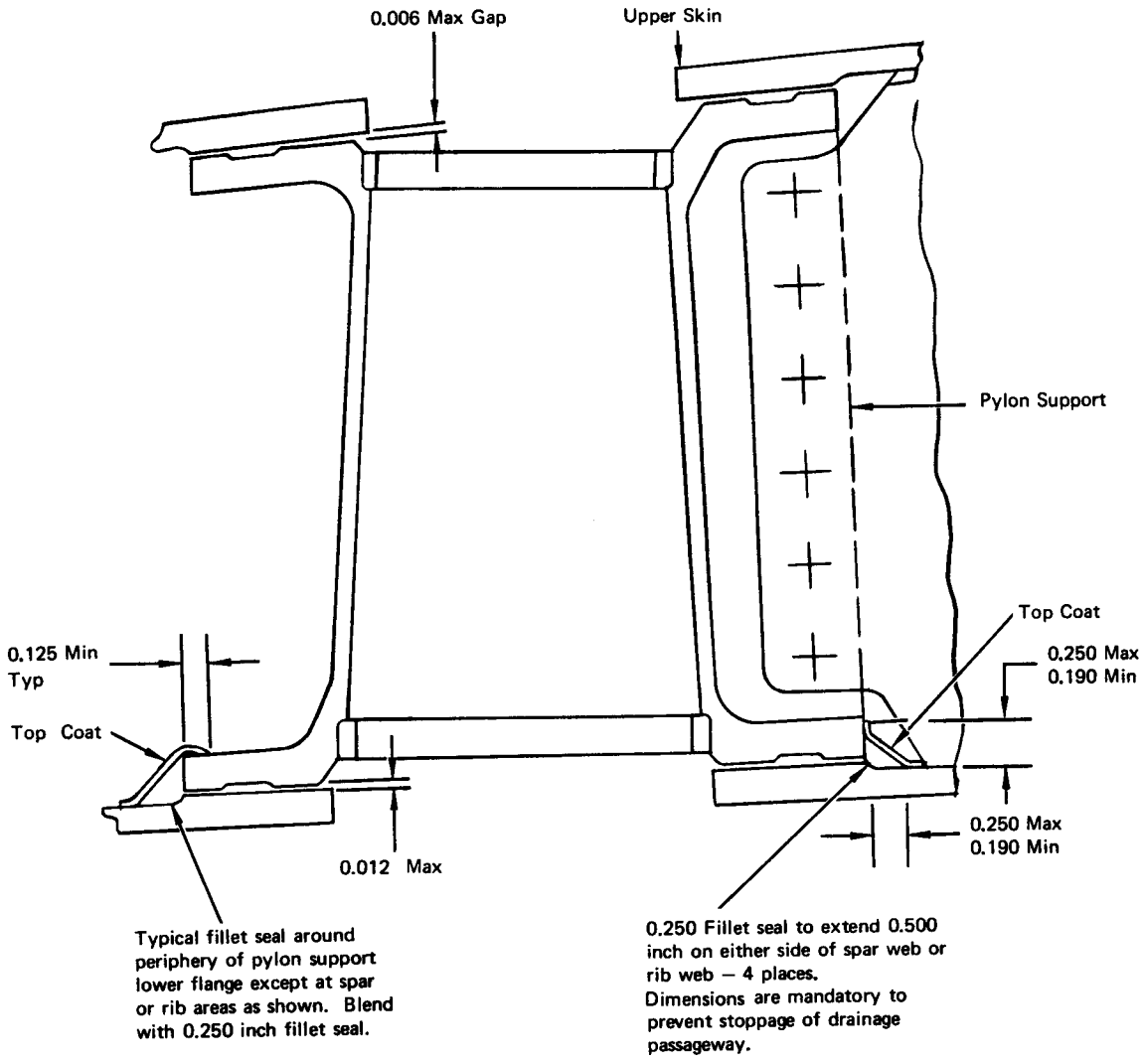
b. Remove any sealant that cannot be removed with scraper or hard rubber wheel with clean cloth saturated with TT-T-548 toluene.

3-11.3. Sealing of Pylon Support. (See figure 3-6.) Apply sealant around pylon support and adjacent structure as follows.

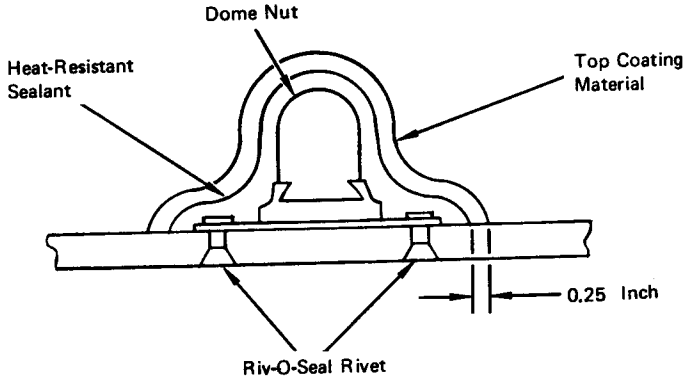
a. Clean area to be sealed in accordance with paragraph 3-11.1.

b. Treat surface with Lithoform No. 2 phosphate coating.

c. Allow surface to dry approximately 15 minutes before applying sealant.



PYLON SUPPORT SEALING



DOME NUT SEALING

90D192–11–84

Figure 3-6. Pylon Support and Dome Nut Sealing

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

NOTE

Dimensions are mandatory to prevent stoppage of drainage passageway.

d. Apply 1/4-inch fillet seal of MIL-S-8802 heat resistant sealant around periphery of pylon support lower flange (figure 3-6).

e. Extend 1/4-inch fillet seal 1/2 inch on either side of beam web or rib web, four places (figure 3-6).

3-11.4. Dome Nut Replacement. (See figure 3-7.) Remove, install, and seal damaged or leaking dome nuts as follows.

WARNING

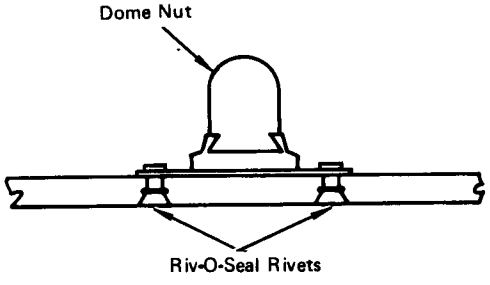
Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

a. Drill out Riv-O-Seal rivets and remove old dome nut (paragraph 3-11.5).

b. Clean replacement dome nut mounting flange and adjacent structure (paragraph 3-11.1).

c. Treat replacement dome nut with Lithoform No. 2 phosphate coating.

d. Install new dome nut and secure with Riv-O-Seal rivets (paragraph 3-11.5).



DOME NUT INSTALLATION

RIV-O-SEAL RIVET INSTALLATION

90D193-11-84

Figure 3-7. Dome Nut and Riv-O-Seal Rivet Installation

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

e. Apply coat of MIL-S-8802 heat resistant sealant. Shape sealant as shown in figure 3-6. Allow to cure until tack-free.

WARNING

MIL-S-4383 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

f. Apply one brush coat of MIL-S-4383 topcoat sealant about 2 mils thick over sealant and extending 1/8 inch beyond perimeter (figure 3-6). Allow to dry until tack-free.

g. Apply second coat of topcoat sealant and allow to dry completely before working in area.

3-11.5. Riv-O-Seal Rivet Removal and Installation. Riv-O-Seal rivets have countersunk heads that are cut back to seat an O-ring (figure 3-7). The rivet head is slightly larger than a matching standard rivet and projects above the 100° countersink to allow the rivet gun to bear fully on the rivet. Rivets should be replaced as follows.

a. Carefully drill out old rivet.

b. Inspect new rivet for torn, broken, or necked-down (unsymmetrical) O-ring. Do not remove O-ring from rivet.

c. Install rivet by squeezing method whenever possible.

d. After installation, rivet head should be flush or project above metal surface. Shave rivet heads that project above surface in accordance with table 3-3.

Table 3-3. Rivet Head Shaving Tolerances

Dash No.	Diameter	Maximum protuberance before shaving	Minimum acceptable head diameter after shaving
-2	1/16	0.007	0.097
-3	3/32	0.004	0.190
-4	1/8	0.004	0.260
-5	5/32	0.012	0.257
-6	3/16	0.009	0.380
-8	1/4	0.010	0.470

3-11.6. Lower Splice Plate Gask-O-Seal Installation. (See figure 3-8.) A two-piece Gask-O-Seal set is installed between the lower wing splice plate and the lower wing skins. The set consists of a prematched, two-piece aluminum frame with a rubber seal installed in channels in the upper and lower surfaces of the frame. To install the Gask-O-Seal, the wing must be removed from the airplane and the lower splice plate removed from the wing center section. If only the lower splice plate is to be removed and the upper splice plate is installed and all upper wing center section fasteners are properly torqued, the WCS may be supported on work stands. Install Gask-O-Seal as follows.

CAUTION

The Gask-O-Seal assembly is a prematched, two-part set. Parts from one prematched set shall not be mixed with parts from another set.

Gask-O-Seal and splice shall be stored in a protective bag until ready for installation. Be very careful not to damage or contaminate seal assembly.

Hands, tools, and work area shall be free of oil, grease, and foreign materials.

All metal chips and filings shall be removed from part and work area after drilling operations.

a. Remove wing from airplane (T.O. 1A-7D-2-1).

b. Install wing in SN310416 center section joining fixture (Section XVII) or on work stands if only the lower splice plate is to be removed.

WARNING

TT-T-735 alcohol is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

c. Clean Gask-O-Seal with clean, lint-free cloth saturated with TT-T-735 alcohol.

d. Clean mating surfaces of splice plate and lower skin in accordance with paragraph 3-11.1.

e. Join seal halves at Jig-O-Seal joint.

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

CAUTION

Do not apply excessive sealant to the Jig-O-Seal joint, as all excess must be removed. Sealant shall not be allowed to remain on the extreme tip of the Gask-O-Seal rubber crown.

f. Put a Semco 410 nozzle (or equivalent) on sealant gun filled with MIL-S-8802 sealant.

g. Apply MIL-S-8802 sealant to both sides of Jig-O-Seal joint (figure 3-8).

h. Remove excess sealant from metal mating surfaces of Gask-O-Seal with clean, lint-free cloths.

i. Remove excess sealant from Gask-O-Seal rubber crown with wooden spatula. Install Gask-O-Seal assembly immediately after application of sealant.

j. Install lower splice plate, torquing all fasteners in accordance with figure 3-3.

k. At terminal hole No. 32 (figure 3-9) inject sealant until a 1/8- to 1/4-inch bead comes out of the four holes No. 27 and No. 28.

l. Plug these four holes with MS24621-2 screws.

m. Inject sealant into hole No. 30 until sealant comes out of the two holes just aft of No. 30.

n. Plug these holes with MS24621-2 screws.

o. Plug remaining holes in lower splice plate (figure 3-9) with MS24621-2 screws.

p. Pressure-leak check Gask-O-Seal and Stat-O-Seals (paragraph 3-6.2).

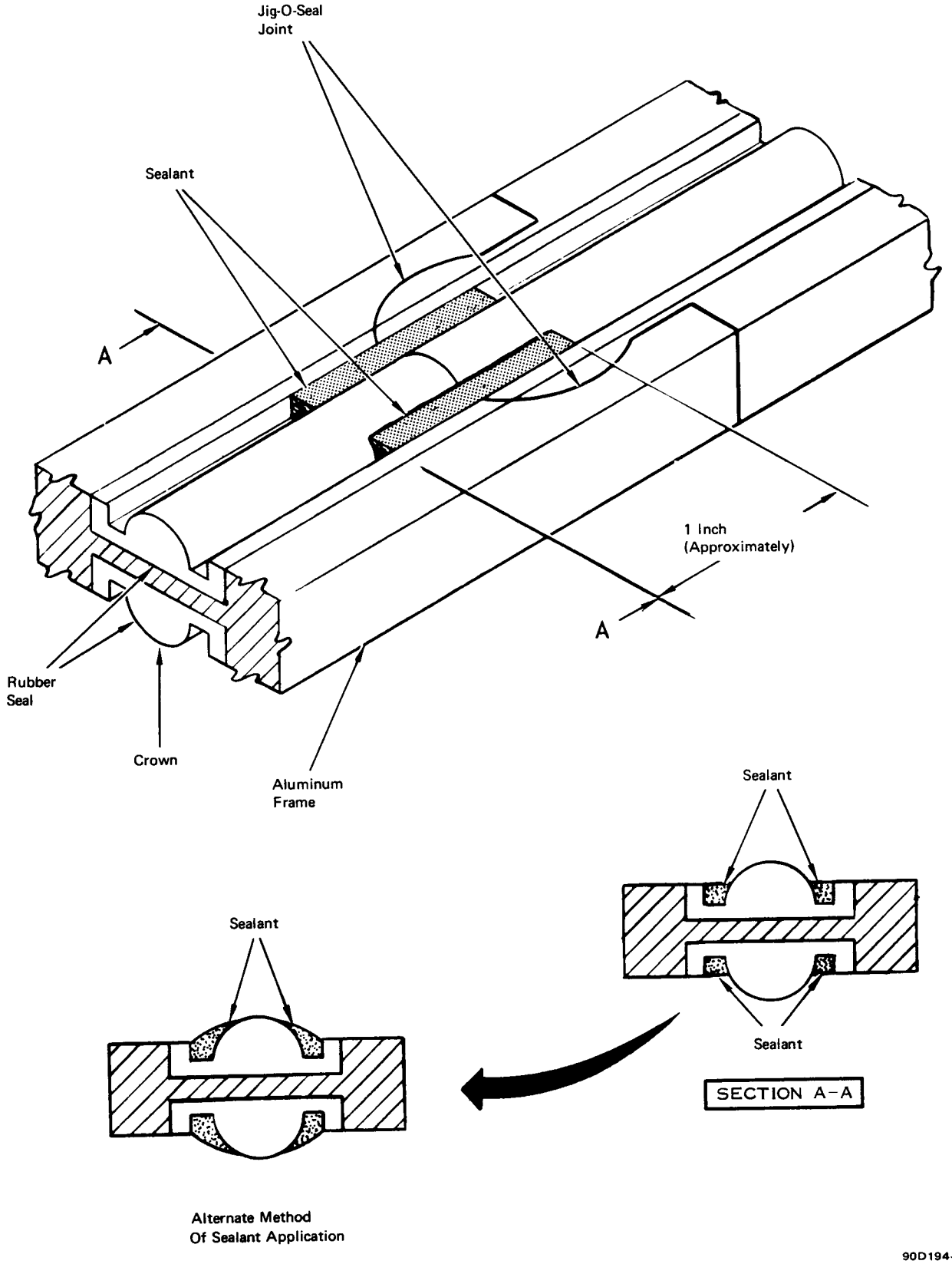


Figure 3-8. Gask-O-Seal Joint Sealing

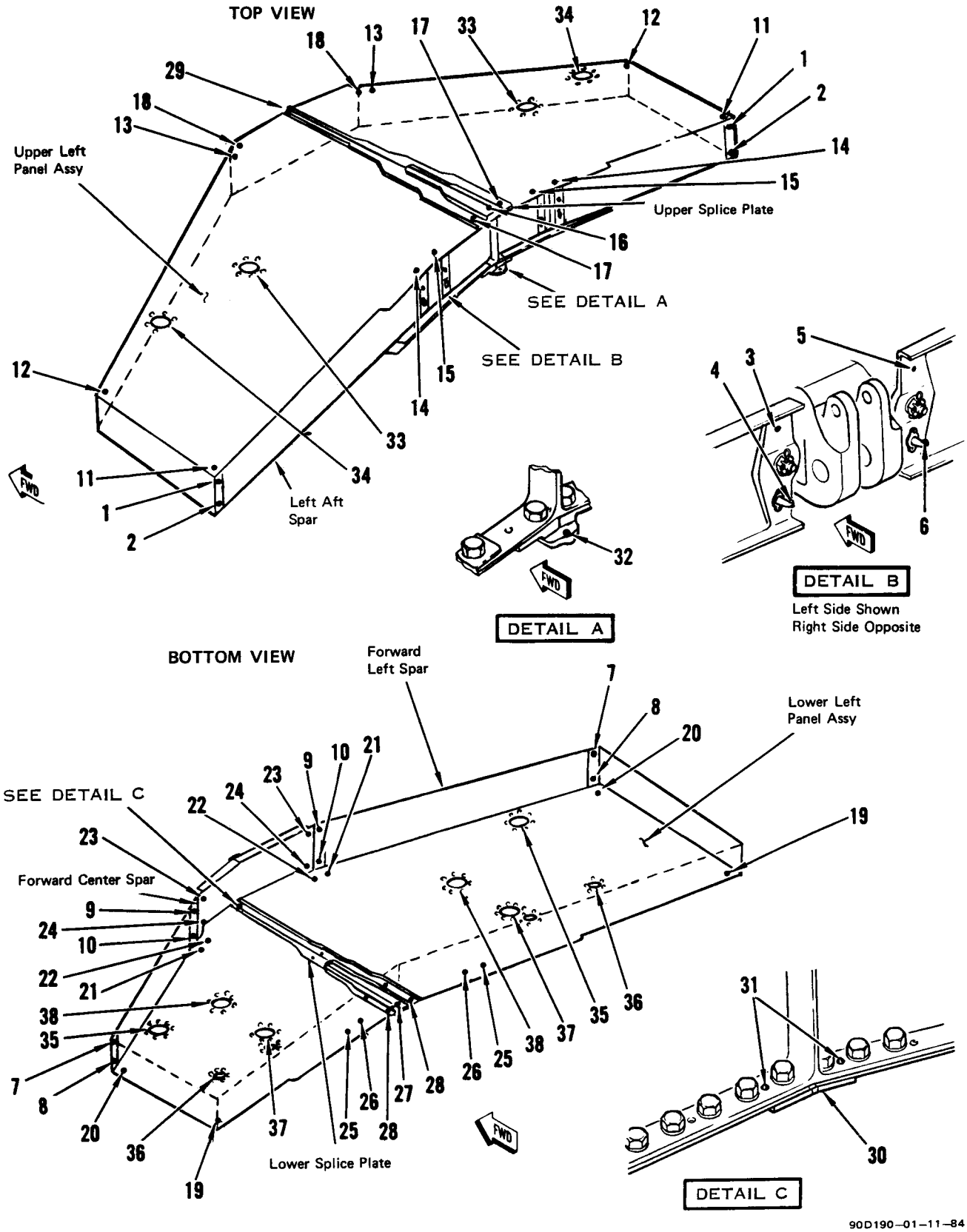


Figure 3-9. Wing Tank Injection Sealing Sequence (Sheet 1 of 3)

SEALANT INJECTION SEQUENCE

Component	Inject Sealant in Hole No.	Sealant Extrudes from Hole No.	Tape Hole No.	Install Screw in Hole No.
Aft spars	1	2 and 11	11	1
	2	19	19	2
	3 } Refer	4 and 14	14	3
	4 } to	25	25	4
	5 } Note	6 and 15	15	5
	6	26	26	6
Forward spars	7	8 and 12	12	7
	8	20	20	8
	9	10 and 13	13	9
	10	21	21	10
	23	18 and 24	18	23
	24	22	22	24
Upper wing	11 and each intermediate injection hole, working along upper wingfold edge toward terminal hole No. 12*	Each intermediate injection hole, terminating at hole No. 12	12	Terminal hole No. 11 and each intermediate injection hole.
	Intermediate injection hole next to 11 and each intermediate injection hole working along upper aft spar toward terminal hole No. 16	Each intermediate injection hole, terminating at hole No. 16	16	Each intermediate injection hole.
	12 and each intermediate injection hole, working along upper forward spar toward terminal hole No. 13	Each intermediate injection hole, terminating at hole No. 13	13	Terminal hole No. 12 and each intermediate injection hole.
Lower wing	19 and each intermediate injection hole, working along lower wingfold edge toward terminal hole No. 20**	Each intermediate injection hole, terminating at hole No. 20		All holes.
	Intermediate injection hole next to 19 and each intermediate injection hole, working along lower aft spar toward terminal hole No. 27	Each intermediate injection hole, terminating at hole No. 27	27	Each intermediate injection hole.
	20 and each intermediate injection hole, working along lower forward spar toward terminal hole No. 22	Each intermediate injection hole, terminating at hole No. 22	22	Terminal hole No. 20 and each intermediate injection hole.
Upper splice plate and forward center spar	16	17		16 and 17
	Intermediate injection hole next to 16 and each intermediate injection hole, working along upper center splice plate toward terminal hole No. 29	Each intermediate injection hole, terminating at hole No. 29		Each intermediate injection hole.
	29 and each intermediate injection hole, working along upper edge of forward center spar toward terminal hole No. 13	Each intermediate injection hole, terminating at hole No. 13		All holes.

90D190-02-11-84

Figure 3-9. Wing Tank Injection Sealing Sequence (Sheet 2)

SEALANT INJECTION SEQUENCE (Continued)

Component	Inject Sealant in Hole No.	Sealant Extrudes From Hole No.	Tape Hole No.	Install Screw in Hole No.
Lower splice plate and lower forward center spar	32 30	27 and 28 Intermediate injection holes just aft of terminal hole No. 30	30	27 and 28 Each intermediate injection hole.
		31 and each intermediate injection hole through terminal hole 21, then terminating at terminal hole No. 22		All holes.
Sealant rings	33 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 33		All holes.
	34 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 34		All holes.
	35 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 35		All holes.
	36 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 36		All holes.
	37 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 37		All holes.
	38 and each intermediate injection hole, working around ring	Each intermediate injection hole, terminating at hole No. 38		All holes.

NOTE

Before injection of sealant at injection fittings in wing root areas, loosen AN320-14 nut (Detail B) one full turn to release pressure on injection area, inject sealant, then torque nut to a maximum 1790 pound-inches.

*Sealant can be simultaneously injected from the hole adjacent to No. 11 toward hole No. 12 and from hole No. 11 toward hole No. 16.
**Sealant can be simultaneously injected from the hole adjacent to No. 19 toward hole No. 20 and from hole No. 19 toward hole No. 27.

90D190-03-11-84

Figure 3-9. Wing Tank Injection Sealing Sequence (Sheet 3)

q. Repeat sealing procedure and pressure test if leaks show up.

r. When pressure test shows no signs of leaks, remove wing from fixture (Section XVII) and install wing on airplane (T.O. 1A-7D-2-1).

3-11.7. Center-Line-Seal Sealant Injection. (See figure 3-9.) Apply sealant as follows:

a. Remove screws from sealant injection holes.

b. Prepare sealant gun and inject sealant in groove (paragraph 3-5).

c. After removing excess sealant, install self-tapping screws or masking tape.

d. Replace masking tape with screws after adjacent structure is sealed.

e. Repeat steps a through d until all holes or required holes have been injected.

3-11.8. Leak Repair Around Hydraulic Fittings. (See figure 3-10.) Hydraulic fittings for lines routed through the fuel tank are sealed at entrance and exit points with Stat-O-Seal washers. Replace Stat-O-Seal washers as follows.

WARNING

Be sure that external hydraulic power is disconnected from airplane. PC No. 1 accumulator must be relieved of system pressure to ensure safety of personnel and equipment.

a. Disconnect hydraulic power from airplane (T.O. 1A-7D-2-1).

b. Relieve pressure from PC No. 1 accumulator.

c. Disconnect hydraulic line at fuel tank fitting.

d. Remove steel lockwire from locknut.

e. Remove locknut, lockwire, jamnut, flat washers, and Stat-O-Seal washer from bulkhead fitting.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

f. Using TT-T-548 toluene, clean surfaces to be sealed.

NOTE

To ensure a proper seal, avoid contamination to sealing surfaces from grease, dirt, and other foreign materials.

g. Replace Stat-O-Seal washer with new Stat-O-Seal washer of same type and size.

h. Position Stat-O-Seal washer and then flat washers on bulkhead fitting (figure 3-10).

i. Install jamnut and tighten to proper torque value (T.O. 1-1A-8).

j. Secure jamnut with lockwire.

k. Install locknut and tighten to proper torque value (T.O. 1-1A-8). Secure with steel lockwire.

l. Connect hydraulic line to fitting.

m. Service hydraulic system (T.O. 1A-7D-2-1).

3-11.9. Leak Repair Around Electrical Receptacles. (See figure 3-10.) Electrical receptacles enclosed in adapters and sealed with O-rings are repaired by performing the following procedures.

a. Disconnect electrical connector.

b. Remove bolts and washers securing adapter plate to mounting surface.

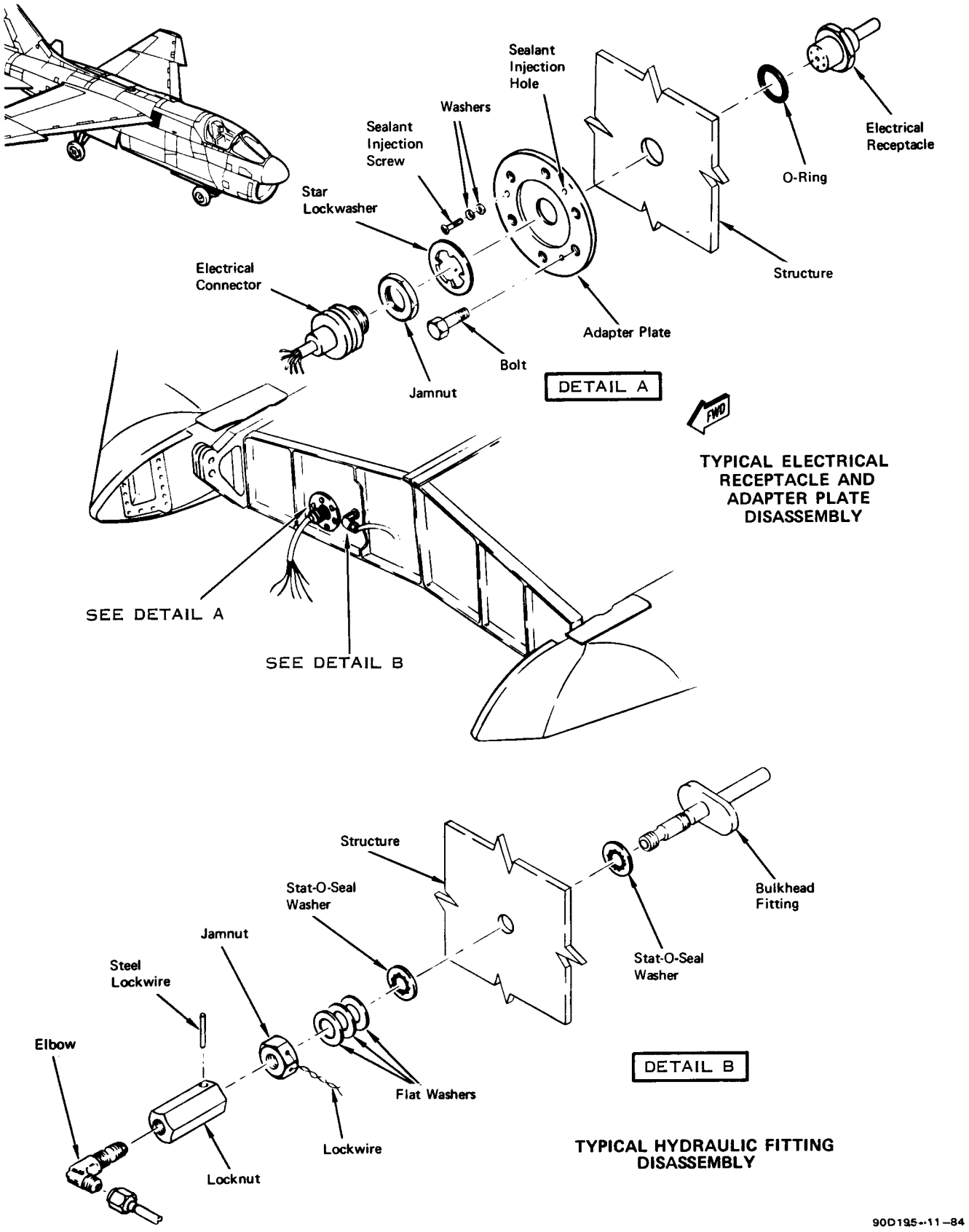


Figure 3-10. Sealing Around Hydraulic Fittings and Electrical Receptacles

c. Secure electrical wiring to mounting surface to prevent electrical receptacle from falling into fuel tank.

d. Remove jamnut, star lockwasher, adapter plate, and O-ring from electrical receptacle.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

e. Clean sealing surfaces using TT-T-548 toluene.

NOTE

To ensure a proper seal, avoid contamination to sealing surfaces from grease, dirt, and other foreign materials.

f. Replace O-ring with new O-ring of same type and size.

g. Position O-ring on electrical receptacle, insert receptacle through bulkhead, and then install adapter plate, star lockwasher, and jamnut in proper sequence (figure 3-10).

h. Tighten adapter plate attaching bolts to proper torque value (T.O. 1-1A-8).

i. Connect electrical connector to receptacle.

j. Remove adapter plate sealant injection hole screws.

k. Prepare sealant gun and inject sealant (paragraph 3-5).

l. Replace injection hole screw in original hole.

m. Repeat injection procedure, injecting sealant into hole from which sealant was just squeezed out. Inject sealant into hole until sealant squeezes out the proper length from next injection hole.

n. Install final sealant injection hole screw in adapter plate.

3-11.10. General Topcoat Application. To increase resistance to hydraulic fluid, fuel, oil, or other deteriorating products, MIL-S-4383 sealing compound may be used as a topcoat for sealants or used as a sealing material for fasteners and mating surfaces. General application procedures for MIL-S-4383 sealing compound are provided as follows.

NOTE

Sealing compound may be applied by spray or brush.

a. Observe safety precautions (paragraph 3-3).

b. Prepare for application as follows.

WARNING

Methyl isobutyl ketone (MIBK) is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

(1) For brush, thin with TT-M-261 methyl isobutyl ketone until smooth flow is obtained.

(2) For spray, mix according to table 3-4.

c. Apply sufficient coats to obtain dry film thickness of 1.5 to 4 mils.

d. Allow coats to cure until tack-free, approximately 4 hours. When used as sealant, install parts in wet condition.

Table 3-4. Mixing Proportions for Topcoating Material

Material	Percent by volume
Top coating material	40
Methyl isobutyl ketone (MIBK)	40
Methyl ethyl ketone	20

3-12. CORROSION PREVENTION. The wing integral fuel tank lower inner surfaces can corrode from water condensation and water in fuel. To protect the lower surfaces from corrosion, the entire inner surface of the lower skin panel assemblies and up to a 1-inch height (minimum) on all adjacent structures (ribs, beams, stiffeners, etc) is coated with MIL-S-4383 topcoat sealant. If corrosion is found in fuel tank structures, refer to T.O. 1A-7D-23 for corrosion removal and surface treatment. Before installing the wing upper skin, apply topcoat sealing compound as follows.

WARNING

MIL-S-4383 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

NOTE

The following steps can be done only with wing upper skin removed.

a. Thin MIL-S-4383 topcoat sealant for spraying in accordance with table 3-4.

NOTE

Mask open gang channel nuts on top surfaces of beam and rib flanges to prevent spray contact with these areas.

b. Clean surfaces to receive topcoat sealant in accordance with paragraph 3-11.1.

c. Treat cadmium plate surfaces to be sealed with Lithoform No. 2 phosphate coating.

NOTE

A Devilbiss MBC spray gun (with pressure pot) with No. 30 aircap nozzle shall be used for spraying. Spray with nozzle approximately 6 inches from work surface.

d. Spray entire inner surface of lower panel assemblies and up to a 1-inch height (minimum) on all adjacent structures (ribs, beams, and stiffeners).

e. Final topcoat sealant thickness of 1.5 to 4 mils is required. This is about five coats. Air-dry about 15 minutes between coats.

f. Coat all joints, gaps, and seams in lower area of fuel tank with topcoat sealant.

g. Brush-coat bare areas or areas that appear to be only lightly coated.

Section IV

RADOME REPAIR

4-1. RADOME REPAIR. Radome repair information covered in this section includes:

Leading Particulars Peculiar Repair Procedures

Damage Evaluation Typical Repair Procedures

Finish Requirements

A detail figure is given for each radome. This figure has basic construction materials, critical thicknesses and measurements, and other data needed for damage repair. See figure 4-1 for radome locations and references to detail figures.

4-2. DESCRIPTION. The airplane radome structures are made of solid glass fabric, reinforced plastic laminates. The structures consist of plies of woven glass fabric impregnated with a synthetic resin. The plies are bonded together, while wet, under controlled temperature and pressure. The number of plies and type of glass fabric used are defined by the electrical requirements of the radome.

4-3. DAMAGE INVESTIGATION. (Refer to Section XIV.)

4-4. DAMAGE EVALUATION. Damage to a radome is evaluated according to type, size, and location. The permissible accumulation of damage to an assembly is based on the effect on electrical performance, structural integrity, and serviceability. Evaluate damage according to damage evaluation chart found on the radome detail figure referenced in figure 4-1. Refer to paragraph 4-5 for general repair information.

4-5. REPAIR. Repair procedures should retain the electrical and structural properties of the basic assembly with a small increase in weight. This can be done by using approved materials and techniques. To prevent dangerous stress areas, abrupt changes in cross-sectional areas should be avoided. To do this, taper joints, make small patches round or oval shaped, and round the corners of all repairs. Uniform thickness and density of the radome shell is important; any change may reduce proper reception and transmission of radar and radio equipment. Smooth outside surfaces are essential for high-speed airplane performance. Replace damaged material with approved material of the same thickness, unless otherwise specified.

4-5.1. Electrical Parameter Check. After repair, certain areas of the repaired radome may need an electrical check to be sure that electrical properties are kept within set limits. For clarity, these areas have been divided into types. Types I through III areas are denoted electrical window areas and Type IV area is the radome edge attachment area. Each type of area is shown on the detailed figure. The areas are defined as follows:

Type I – A critical area that requires an electrical test after any repair except as noted on damage evaluation charts.

Type II – An area that does not require an electrical test after repair. A test should be performed if the radome is tested for a repair to Type I area.

Type III – An area that does not require an electrical test after repair.

Type IV – Edge attachment area.

4-5.2. General Repair Procedure Guide. The following procedure is a guide to help in evaluating damage and deciding the correct repair.

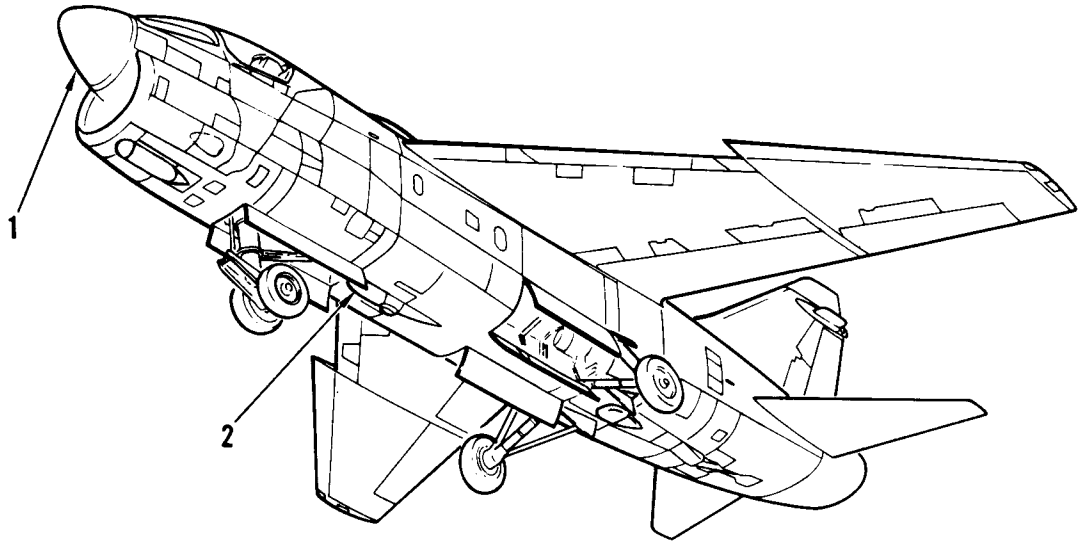
a. When damage is found, inspect to find the extent of damage (Section XIV).

b. Evaluate damage (paragraph 4-4).

c. Define type of construction, dimensions, and tolerances to be complied with during repair. See detail figure referenced in figure 4-1.

d. Define repair procedure. See damage evaluation chart on detail figure.

e. Define electrical check requirements. See damage evaluation chart on detail figure.



INDEX NO.	NOMENCLATURE	DAMAGE EVALUATION FIGURE NO.
1	Nose radome (AN/APQ-126 antenna)	4–2
2	Doppler radome (Doppler radar antenna)	4–3

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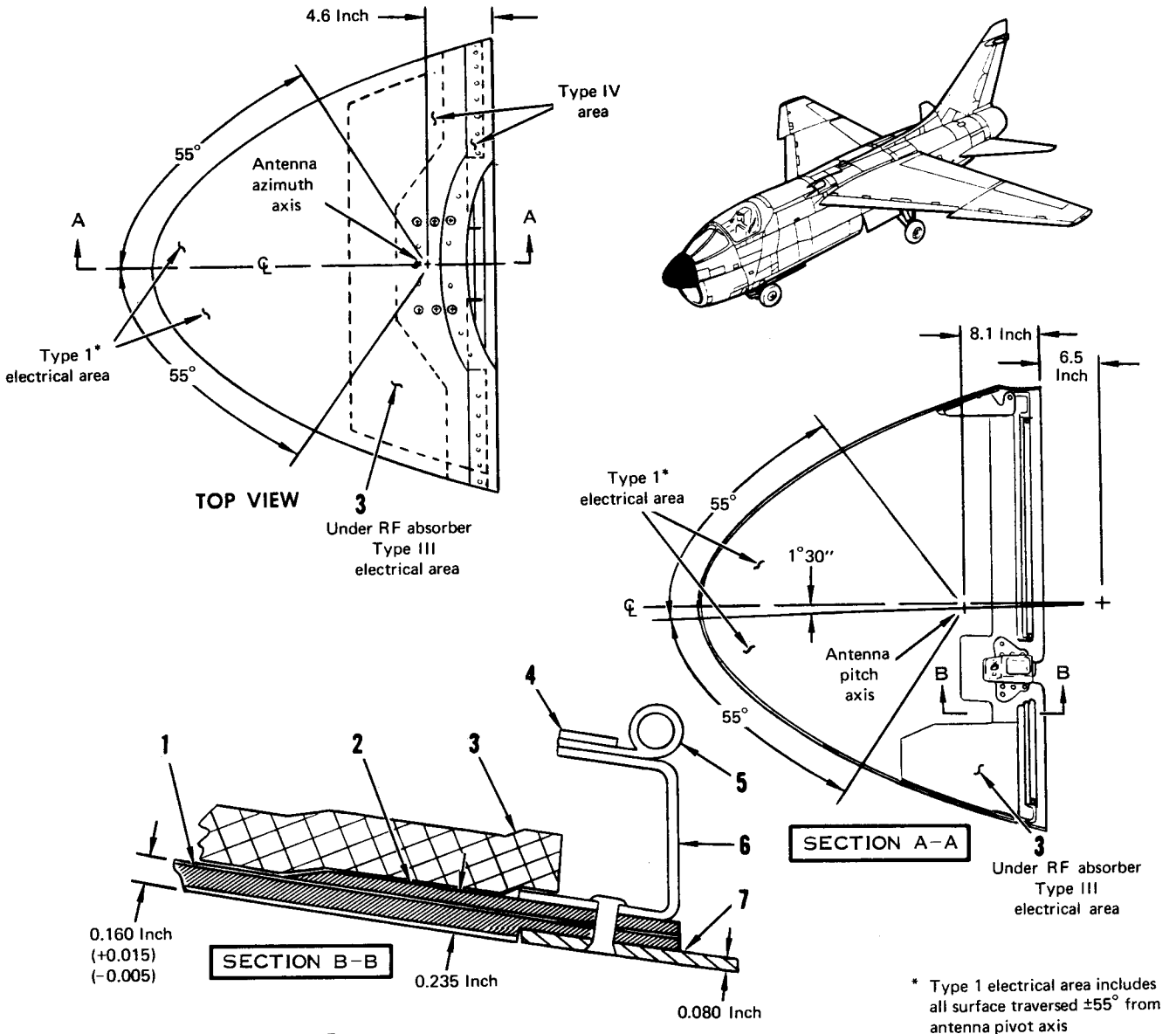
Figure 4-1. Radome General Arrangement



LEADING PARTICULARS: 216-20175-5

INDEX	COMPONENT	MATERIAL	FINISH
1	Radome shell 216-20357-3	No. 181-75 glass fabric impregnated with MIL-R-9300, Type 1, Class 3 resin	A
2	Solid laminate buildup	MIL-C-9084, No. 184, Type XI, glass fabric impregnated with MIL-R-9300, Type 2, Class 3 resin	
3	RF absorber 215-27852	Eccosorb or Custom Absorb 1001 (1)	B
4	Retainer 216-20175	2024-T3	
5	Seal 216-20175	Made from CVC10085-3 extrusion	
6	Stiffening ring	Same as index No. 1	
7	Base ring BD0802003	2024-T4	

90D002-01-11-84

Figure 4-2. Nose Radome Leading Particulars and Damage Evaluation (Sheet 1 of 2)

FINISH:

NOTE

Touchup and patch repairs to finish shall be made with like materials. MIL-C-7439 neoprene and MIL-C-83231 polyurethane coatings are not compatible and one shall not be used on surface finished with the other.

A. One spray coating of MIL-C-83231, Class A, Type II, black elastometric rain-erosion-protection, 0.013 to 0.017 inch thick (T.O. 1-1-24). Alternate coating: MIL-C-7439, Class I, 0.010 to 0.013 inch thick (T.O. 1-1-24).

DAMAGE EVALUATION CHART

DAMAGE LIMITATIONS (Note 2)	REPAIR PROCEDURE (Section XIV)	REPAIR AREA TYPE	ELECTRICAL CHECK (Notes 3 and 4)
Damage not penetrating through the outer ply of the laminated skin	A	I II III	No (note 1) No (note 1) No
Soft spots up to 1.5 inches in diameter	B	I II III	Yes (note 3) No (note 1) No
Delamination of skin (void area)	B	I II III	Yes (note 3) No (note 1) No
Skin mutilated or missing with damaged area major dimension less than 1 inch	C	I II III	Yes (note 3) No (note 1) No
Skin mutilated or missing up to 3 plies deep and with damaged area major dimension 1 inch or greater	D	I II III	Yes (note 3) No (note 1) No
Delaminated edge plies in built-up fastener area	H	IV	No
Mutilated edge plies such as torn fastener holes and crushed edges	J	IV	No
Mutilated or missing plies, damage extending deeper than 3 plies but not completely through laminate. Major dimension less than 1.5 inches	K	I II III	Yes (note 3) No No

NOTE

1. Damage totaling less than 5% of the Type I surface can be repaired without electrical check in window electrical areas Type I and Type II.
2. After 5% of entire radome area has been repaired, further damage is cause for replacement.
3. For radome electrical check procedures, refer to T.O. 1-1-24.

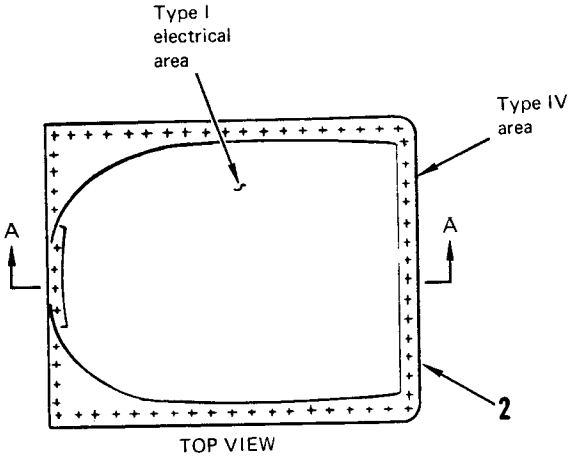
CAUTION

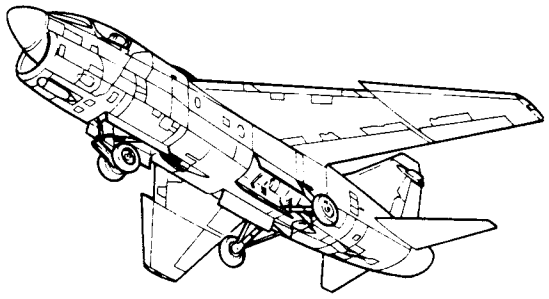
Missing compensating patch(es) will cause a degrading of radar performance. Radome shall be returned to depot for boresight check.

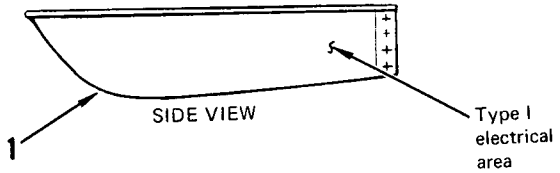
4. All A7 nose radomes are tested at the vendor antenna range for uniformity of the transmission pattern. Compensating patches are installed inside the radome at that time and should not be removed.

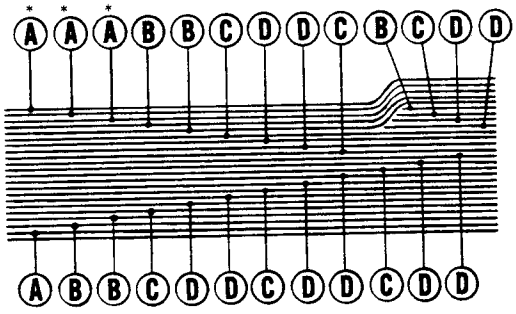
90D002-02-09-89

Figure 4-2. Nose Radome Leading Particulars and Damage Evaluation (Sheet 2)



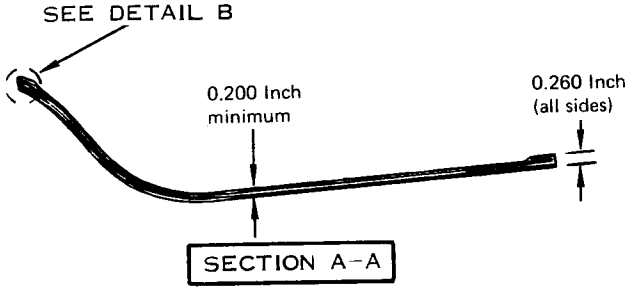






DETAIL B

(Line diagram showing typical layup)



*These plies are optional to obtain proper thickness

LEADING PARTICULARS: 216-30604-1

INDEX	COMPONENT	MATERIAL	FINISH
1	Radome shell	Glass fabric impregnated with MIL-R-9300, Type 1, Class 3 resin. Fabric grade and type is as shown in detail B and as follows: A. MIL-C-9084, Type III, No. 120 B. No. 181-75 C. MIL-C-9084, Type II, No. 116 D. No. 183-150	MIL-C-27315, Class 1, rain-erosion protective coating. Refer to T.O. 1-1-24
2	Edge attachment area	Same as above	

90D003-01-11-84

Figure 4-3. Doppler Radome Leading Particulars and Damage Evaluation (Sheet 1 of 2)

DAMAGE EVALUATION CHART			
DAMAGE LIMITATIONS (Note 2, 4)	REPAIR PROCEDURE (Section XIV)	REPAIR AREA TYPE	ELECTRICAL CHECK
Damage not penetrating through the outer ply of the laminated skin	A	I II III	No (note 1) No (note 1) No
Soft spots up to 1.5 inches in diameter	B	I II III	No (note 1) No (note 1) No
Delamination of skin (void area)	B	I II III	No (note 1) No (note 1) No
Skin mutilated or missing with damaged area major dimension less than 1 inch	C	I II III	No (note 1) No (note 1) No
Skin mutilated or missing up to 3 plies deep and with damaged area major dimension 1 inch or greater	D	I II III	No (note 1) No (note 1) No
Delaminated edge plies in built-up fastener area	H	IV	No
Mutilated edge plies such as torn fastener holes and crushed edges	J	IV	No
Mutilated or missing plies, damage extending deeper than 3 plies but not completely through laminas. Major dimension less than 1.5 inches	K	I II III	Yes No No

NOTES

1. Damage totaling less than 5% of the entire radome surface can be repaired without electrical check in window electrical areas Type I and Type II.
2. After 5% of entire radome area has been repaired, further damage is cause for replacement.
3. For radome electrical check procedures, refer to T.O. 1-1-24.
4. Crack extending completely through laminas of radome is cause for replacement.

90D003-02-11-84

Figure 4-3. Doppler Radome Leading Particulars and Damage Evaluation (Sheet 2)

f. Define finish requirements. See leading particulars on detail figure.

g. Perform repair, refinish as required and do electrical check if required.

4-6. RF ABSORBER INSTALLATION AND REPAIR. Microwave (rf) absorbers are used in the nose radome and duct lip upper antenna fairing areas. The absorber material is made of multilayers of flexible foam with one white and one bronze surface. Refer to table 4-1 for type and thickness of material and installation requirements for radome and fairing.

4-6.1. Preparation. Prepare bonding surfaces and rf absorber material for bonding as follows:

a. Mask perimeter of area to receive absorber.

b. Using basic absorber installation as a guide, prepare a template of the absorbers (or part of absorber) to be replaced.

WARNING

TT-T-548 toluene is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

c. Remove old absorber by peeling from surface. Use TT-T-548 toluene and plastic scraper, if required, to aid in absorber removal.

CAUTION

The fiber glass surface of radome is sealed against moisture penetration; do not sand through sealer.

d. Dry-vapor-blast or lightly sand new plastic or glass laminate surfaces to remove surface gloss.

e. Remove protective coatings, except zinc chromate primer and epoxy paint, from metal surfaces to be bonded. Refinish damaged zinc chromate primed surfaces (T.O. 1A-7D-23).

WARNING

P-D-680 solvent is toxic to eyes, skin, and respiratory tract. Eye and skin protection is required. Use only in a well ventilated area.

f. Wipe surfaces to be bonded with clean, lint-free cloth wet with P-D-680 solvent. Wipe dry with clean cloth.

g. Wipe metal surfaces with clean, lint-free cloth wet with TEC 901 mild acid cleaner. Wipe dry with clean cloth.

h. Air-dry surfaces a minimum of 15 minutes.

i. Using basic absorber for pattern, cut absorber material to required shape. Refer to table 4-1 for material and bonding surface. Absorber may be either locally made or procured precut (T.O. 1A-7D-4-17).

Table 4-1. RF Absorber Data

Used on	Type (part No.)	Thickness (inches)	Metallic side[1] (bronze)
Nose radome	Eccosorb or Custom Absorb 1001 (1)	3/8 (±1/16)	Bond to radome.
Engine air duct upper lip fairing	Eccosorb or Custom Absorb 1009 (2)	1-1/8 (±1/16)	Bond to duct lip structure.

[1] Green color of coating designates bronze surface of rf absorber.

j. Apply moisture-proof coating to all absorber surfaces (paragraph 4-6.2).

4-6.2. Moisture-Proof Finish Coating for RF Absorbers. The rf absorber parts should be completely moisture-proofed before installation. Moisture-proofing requires coating of two types: AN-WP (909C Eccocoat) is applied as the base coat and SC-WP (90N Eccocoat) is applied as the finish coat. Apply coatings as follows:

a. Wipe dust and loose particles from area to receive coating.

b. Mix AN-WP coating until color is uniform.

NOTE

For subsequent bonding operation, identify the bronze colored side before applying coating.

c. Brush on coat of AN-WP coating to areas not accessible to direct spray. Air-dry 15 minutes between coats. Apply more coats until all areas are covered.

d. Spray the rest of the surface using 60 to 70 psi pressure with 18-inch distance between spray gun nozzle and area being coated. Air-dry 15 minutes between coats. Apply more coats until all areas are covered.

e. Ensure that final coat covers cells of material being coated, is uniform, has few pinholes, and is free of foreign matter. Small air bubbles near surface of coating are acceptable.

f. Brush on coat of SC-WP coating immediately after final coat of AN-WP. Air-dry for 30 minutes.

g. Apply second coat of SC-WP coating.

h. Allow to cure 12 to 24 hours at room temperature. Cured coating should be tack-free.

i. Install absorber (paragraph 4-6.3).

4-6.3. Bonding. Bond rf absorber to prepared surface as follows:

a. Apply coat of EC-847 cement to prepared surface and mating surface of absorber (table 4-1). Allow to dry until cement is tacky but will not transfer when touched.

NOTE

If cement dries beyond tacky condition, a second coat should be applied before absorber installation.

b. Place absorber on surface. Use rubber roller to press absorber in place.

c. Cure no less than 24 hours.

SECTION V

WING GROUP

5-1. WING GROUP. Data needed for analysis and repair of wing damage is supplied or referenced in this section. Data covered is a description of wing major components, classification of damage, negligible damage limits, damage investigation and evaluation, repairs, repair kit data, and templates and repair jigs.

5-2. WING GROUP INDEX. (See figure 5-1.) The wing group index locates major component figures which shows repair information.

5-3. WING CONSTRUCTION. The fixed-position wing is a highly tapered, low-aspect-ratio structure with a 35° sweepback at the 25% chord. The wing group consists of one center section attached to the fuselage, two foldable outer panels attached to the center section wingfold ribs, leading and trailing edge flaps, spoiler-deflectors, trailing edge ailerons on the outer panels, and pylons. The wing is attached to the fuselage at four points: a lug and 1.5-inch close-tolerance shear bolt on each side of the fuselage just aft of the wing rear beam, and a lug and 9/16-inch close-tolerance shear bolt on each side of the fuselage forward of the wing front beam.

5-3.1. Wing Center Section (WCS). The wing center section structure consists of a main box and fairings in the wing-fuselage area.

5-3.1.1. Wing Center Section Main Box. The wing center section main box is of multiple spanwise beam construction. The beams brace the skin panels, reduce skin deflection, and carry loads from external stores, fuel, and flight. The upper and lower skins carry all wing spanwise bending loads. The upper skin is 7079-T6 aluminum alloy, the lower skin is 7075-T6 aluminum alloy. The skins are relatively thick, tapered, milled, and rolled to contour. All main box beams are 7075-T6 aluminum alloy machined plate or formed sheet metal. Box ribs are formed or forged of 7075-T6 aluminum alloy. They are located at the wing root, wingfold, pylon support lines, and the wing centerline. The main box forms a fuel tank.

5-3.1.2. Wing Root Fairing. The wing root fairing is conventional aluminum skin and rib construction. The fairing provides an aerodynamic contour between the wing root and the wing upper center skin panels.

5-3.1.3. Leading Edge Fairing. The leading edge fairing consists of contoured aluminum alloy skin, an aluminum alloy rib, a fiberglass rib, and aluminum alloy gussets. The fairing is attached to the fuselage and mates with the center section leading edge flap to provide an aerodynamically smooth surface.

5-3.1.4. Wing Dorsal Fairing. The wing dorsal fairing mates with the aft section dorsal fairing to provide an aerodynamically smooth contour. The wing dorsal consists of a conventional beam-and-rib structure and a contoured fairing skin.

5-3.2. Wing Outer Panels (WOP). The wing outer panels are of skin and rib-and-beam construction. An outer panel structural box consists of five 7075-T6 aluminum alloy beams and wingfold, wingtip, and aileron support ribs of 7075-T6 aluminum alloy. The 7079-T6 aluminum alloy upper skins and the 7075-T6 aluminum alloy lower skins are chemically milled, tapered, and rolled to proper contour. The wingtips are laminated glass cloth fairings riveted to the outboard end of the panels. The outer panels attach to the center section wingfold ribs and fold hydraulically about an axis parallel to the airplane centerline.

5-3.3. Wingfold Structure. The wingfold ribs are forged from 7075-T6 aluminum alloy. The wingfold axis runs through the hinge upper lugs and parallel to the airplane centerline. The hinge lower lugs accept the wingfold locking pins.

5-3.4. Wing Leading Edge Assemblies. The wing leading edge assemblies consist of flap assemblies and a built-in droop. The flap assemblies are conventional thin-skin, spar-and-rib construction. The 6061-T6 aluminum alloy skins are chemically milled and rolled to proper contour. The ribs are of 7075-T6 aluminum alloy. The flaps are on the wing center section and outer panel leading edges. The flaps extend down 35° for more stability and lift during takeoff and landing.

5-3.5. Wing Trailing Edge Assemblies. The wing trailing edge assemblies consist of ailerons, flaps, and spoiler-deflectors.

5-3.5.1. Aileron. The aileron is of conventional thin-skin, spar-and-rib construction. The 7075-T6 aluminum alloy skins are chemically milled. The ribs are press-formed from 7075-T6 aluminum alloy. The aileron is installed on the outer panel trailing edge and has 25° up and down travel for roll control.

5-3.5.2. Trailing Edge Flap. Each trailing edge flap is of conventional thin-skin, spar-and-rib construction. The 2024-T351 aluminum alloy skins are chemically milled and rolled to proper contour. The ribs are press-formed from 7075-T6 aluminum alloy. The trailing edge flaps are on the center section trailing edge and extend down 40° to increase stability and lift during takeoff and landing.

5-3.5.3. Spoiler-Deflector. The spoiler and deflector assemblies are essentially spar-and-skin construction with ribs located at the drive points. The spoilers and deflectors operate in conjunction with the ailerons for increased roll control.

5-3.6. Pylons. Six pylons are attached to the wing (three pylons on each side of the center section) to support external stores. Each pylon is of forged aluminum alloy, with aft panels of 7075-T6 aluminum alloy, and has two structural ties to the wing center section.

5-4. DAMAGE. Airplane damage should be investigated, evaluated, and classified according to references contained in Section I. Unless otherwise specified or referenced in detailed component figures in this section, general procedures as contained in classification and repair of negligible damage shall apply.

5-5. REPAIRS. Repairs and repair recommendations are referenced on the detail component figures.

5-5.1. Wing Center Section Upper Skin Removal and Installation. Wing center section upper skin is removed for access to wing integral fuel tanks to inspect or replace foam baffles or to repair system components such as brazed hydraulic fittings. The airplane shall be secured in a hangar and not moved until the task is finished. The upper left skin and the upper right skin are removed in separate procedures without removing the wing. Observe safety precautions in T.O. 1-1-3.

a. To ensure proper fit and function of all fasteners during installation of center wing skin:

(1) Ensure all attachment holes contain proper size receptacles (nutplate or threaded device).

(2) Position skin and align all fastener holes.

(3) Install 1/2-inch diameter fasteners before installing smaller diameter fasteners.

5-5.1.1. Airplane Preparation. (See figure 5-58.)

a. Defuel wing tanks (T.O. 1A-7D-2-1).

b. Depressurize landing gear shock struts (T.O. 1A-7D-2-1).

NOTE

The wing center section upper skin may be removed for fuel leak repairs when tiedown points are not present. To prevent movement of the airplane, bolt wheel chocks together at both nose and main gears using two threaded rods at each set of chocks. Stabilize the fuselage with a jack raised snug against the arresting gear lug.

c. Chock wheels and tie down nose and main landing gear (T.O. 1A-7D-2-1).

d. Stabilize wing with wing outer panels down by placing jacks immediately inboard of wingfold hinge. Use suitably padded 2-inch by 6-inch planks between jacks and wing with padded side of planks against wing skin. Raise jacks only enough for firm contact with wing.

e. Deleted. ■

5-5.1.2. Preparation, Upper Left Skin. (See figures 5-59 through 5-61.) For access to wing upper

left skin, remove dorsal fairing structure, dorsal fairing underlying equipment, and wing leading and trailing edge skin attachments as follows:

a. Open access doors 1121-5, 1121-6, 1121-7, 1121-8, 3113-11, 3113-13, 3123-1, 5111-1, 5111-4, 10113-1, 10113-2, and 10123-1, and remove anticollision light panel (T.O. 1A-7D-2-1).

NOTE

When disconnecting hydraulic, pneumatic, or fuel lines and electrical connectors, cap the open lines and connectors.

b. Remove air refueling (AR) cover and receptacle assemblies (T.O. 1A-7D-2-6).

NOTE

Bag and tag loose parts for reinstallation. Tie bags to removed components where possible.

c. Disconnect electrical connectors for all overwing electrical conduits or harnesses. Remove harness and conduit clamps and remove conduits. Secure harnesses clear of wing.

d. Disconnect fuel and/or hydraulic systems. Remove fuel and hydraulic tubing and associated valves, clamps, and supports.

e. Disconnect rudder control cable turnbuckles and secure cables clear of wing at front and rear spars (T.O. 1A-7D-2-8).

f. Disconnect wingfold push-pull (Controlex) at joining plate and remove support bracket. Remove clamps and secure push-pulls clear of wing. Refer to T.O. 1A-7D-2-1 for Controlex handling precautions.

g. Disconnect horizontal stabilizer control rods from bellcranks and remove rods (T.O. 1A-7D-2-8).

h. Remove bolts from skin securing AR receptacle supports, pan, and short section of dorsal rib structure at centerline. Remove AR cavity support assembly and forward dorsal rib structure as one unit. Disconnect AR cavity drainline.

i. Remove bolts securing dorsal rib assembly to skin and remove rib assembly.

j. Remove rudder cable pulley brackets at front spar and horizontal stabilizer bellcrank support at rear spar.

k. Remove bolts securing left wing root fairing and remove fairing.

l. Remove wing fuel tank transmitters (T.O. 1A-7D-2-6).

m. Remove inboard bolt securing aileron control rod (part No. 215-78454-1) to bellcrank. Move control rod out of way using care not to change rod end adjustment.

n. At attachment of wing skin to trailing edge skin, remove three Hi-Lok pins. Drill out blind bolts and blind rivets (figure 5-60). Remove at least two solid rivets in trailing edge skin at each rib to relieve clamping pressure on wing skin.

o. At attachment of wing skin to leading edge skin, remove blind rivets attaching four leading edge skin panels and wing-to-fuselage fairing (figure 5-61). Remove fairing and panels.

p. Remove tack rivets securing leading edge ribs to wing skin projections.

5-5.1.3. Preparation, Upper Right Skin. (See figures 5-59 through 5-61.) For access to wing center section upper right skin, remove dorsal fairing structure and underlying equipment and wing skin attachments to the leading and trailing edge components as follows:

a. Open access doors 1121-5, 2121-6, 2121-7, 2121-8, 4113-11, 4123-1, 6111-1, 6111-3,

10113-1, and 10123-1, and remove anticollision light panel (T.O. 1A-7D-2-1).

NOTE

When disconnecting hydraulic, pneumatic, or fuel lines and electrical connectors, cap the open lines and connectors.

b. Remove bleed air ducts, clamps, and supports. For air-conditioning system data, refer to T.O. 1A-7D-2-3.

NOTE

Bag and tag loose parts for reinstallation. Tie bags to removed components where possible.

c. Remove strike camera cooling air duct, clamps, and supports.

d. Remove air-conditioning sensing and pressure lines, clamps, and supports.

e. Remove fuel gravity filler neck (T.O. 1A-7D-2-6).

f. Remove fuel sensing lines, fuel vent line and check valve, clamps, and supports (T.O. 1A-7D-2-6).

g. Disconnect rudder control cable turnbuckles and secure cables clear of wing (T.O. 1A-7D-2-8).

h. Disconnect wingfold push-pull (Controlex) at joining plate and remove support bracket. Remove clamps and secure push-pulls clear of wing. Observe Controlex handling precautions (T.O. 1A-7D-2-1).

i. Disconnect horizontal stabilizer control rods from bellcranks and remove (T.O. 1A-7D-2-8).

j. Remove rivets securing left side of forward dorsal rib structure to inboard AR cavity supports at locations detailed in figure 5-59. Remove bolts securing forward dorsal rib structure to wing skin. Remove rib structure.

CAUTION

In subsequent procedures, avoid damage to projecting supports left attached to AR cavity after removal of forward dorsal rib structure. Damage could require in replacing cavity support structure and time consuming rework.

k. Remove bolts securing dorsal rib assembly to wing skin. Remove rib assembly.

l. Remove rudder cable pulley brackets at front spar and horizontal stabilizer bellcrank supports at rear.

m. Remove bolts securing right wing root fairing and remove fairing.

n. Remove wing fuel tank transmitters (T.O. 1A-7D-2-6).

o. Remove inboard bolt securing aileron control rod (part No. 215-78454-1) to bellcrank. Move control rod out of way using care not to change rod end adjustment.

p. At attachment of wing skin to trailing edge skin, remove three Hi-Lok pins. Drill out blind bolts and blind rivets (figure 5-60). Remove at least two solid rivets in trailing edge skin at each rib to relieve clamping pressure on wing skin.

q. At attachment of wing skin to leading edge skin, remove blind rivets attaching four leading edge skin panels and wing-to-fuselage fairing (figure 5-61). Remove fairing and panels.

r. Remove tack rivets securing leading edge ribs to wing skin projections.

5-5.1.4. Removal. Remove left or right wing center section upper skin as follows:

a. Using plastic wedge scrapers, remove aerodynamic fairing compound from flush screwheads in wing skin. Pick hard compound from screwhead recesses with sharp-pointed metal tool.

NOTE

Bag and tag brackets removed from wing skin in dorsal area for reinstallation.

b. Remove bolts and screws securing brackets and wing skin to underlying structure (figures 5-62 through 5-76).

NOTE

In the following step, stainless steel sheet strips are used to separate nested dimples so wing skin may be pulled forward from the overlapping trailing edge skin. Local manufacture strip to dimension (inches) of 0.015 to 0.020 by 3.0 by 10.0.

c. Insert strips of stainless steel sheet between wing skin and forward edge of overlapping trailing edge skin where top skin is dimpled into recess in lower skin.

d. Using plastic wedges, pry wing skin loose at front spar and lift forward edge of skin 2 to 4 inches.

WARNING

Since skin weighs about 325 pounds, six to eight men are required to lift and handle it.

e. Grasping skin at forward edge and each side, slide skin forward and up, taking care that projecting dome nuts do not hang on spars.

f. Turn skin over and place upside down on suitably padded support.

5-5.1.5. Inspection and Cleaning.

a. Remove, inspect, and store foam baffles (Section III).

b. Inspect wing tank interior surfaces and inner surface of removed skin for dirt, foreign matter, corrosion, damage, and any faulty attaching hardware installed through lower wing skin area.

c. Inspect fuel tank equipment such as transmitters, transmitter wiring, fuel lines, vent tubes, hydraulic tubes, ejector pumps, and fuel sensing lines for damage and secure mounting.

d. Clean dirt and foreign matter from inner surfaces of fuel tank and removed skin.

5-5.1.6. Repair.

a. During repair of hydraulic tubing, replacement of brazed fittings may be necessary. Make factory like repairs using AE5065633 induction brazing machine (Section XVII).

b. Repair previously noted fuel leaks (Section III).

c. Repair damaged fuel tank protective topcoat (Section III).

5-5.1.7. Installation, Upper Left Skin.

a. Install foam baffles (Section III).

b. Prepare mating surfaces of removed skin for sealing. Inspect all WCS spar and rib nutplates and nut channels and upper skin dome nutplates for damage, looseness, cross-threading, etc. Clean all debris from nutplates.

WARNING

Since skin weighs about 325 pounds, six to eight men are required to lift and handle it.

c. Lift skin off support and turn over with exterior surface up.

d. Grasping skin at forward edge and each side, slide aft edge into position on wing taking care that projecting dome nuts do not hang on spars. Align skin and structure screw holes.

e. Tighten all fasteners penetrating wing skin to torque values given in figure 3-3. If

nutplates are damaged during skin installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive, blind fasteners are allowed in any row or pattern.

f. Inject fuel sealant into wing skin channels, corners, and joints (Section III).

g. Reinstall outboard bolt securing aileron control rod (part No. 215-78454-1) to bellcrank.

h. Install wing fuel tank transmitters in wing skin (T.O. 1A-7D-2-6).

i. Pressure test wing integral fuel tank for leakage (Section III).

WARNING

Sealant is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

j. Overcoat flush screwheads at WS 24.63 (double row of fasteners attaching upper wing skin to the wing root rib) from FS 375 to FS 480 with MIL-S-81733, Type II-1/2 sealant to thickness of 9 to 12 mils. The sealant shall bridge area between fasteners and shall extend 1 inch beyond area between fasteners. Sealant shall be cured for minimum of 16 hours. Overcoat all other flush screwheads in upper skin with aerodynamic fairing compound in accordance with Section I.

k. Install four leading edge skin panels and wing-to-fuselage fairing (figure 5-61).

l. Install solid rivets, blind rivets, blind bolts, and Hi-Lok pins in trailing edge skin (figure 5-60).

NOTE

Prior to fairing installation, the WS 24.63 fastener sealant overcoat shall be inspected for proper cure. This sealant must be tack free and must not move under an applied pressure.

m. Install left wing root fairing (see figure 5-16A for installation of fasteners and sealine devices). Torque all fasteners in accordance with figure 3-3. If nutplates are damaged during fairing installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive, blind fasteners are allowed in any fastener row.

n. Install rudder cable pulley brackets at front spar and horizontal stabilizer bellcrank at rear spar.

o. Install dorsal rib assembly torquing all fasteners in accordance with figure 3-3. If nutplates are damaged during rib assembly installation, blind fasteners may be used in accordance with Section III; however, no more than two nonconsecutive, blind fasteners are allowed in any fastener row.

p. Connect AR cavity drainline. Install AR cavity support assembly and forward dorsal rib structure as one unit. If nutplates are damaged during support assembly and rib structure installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive, blind fasteners are allowed in any fastener row.

q. Install horizontal stabilizer control rods (T.O. 1A-7D-2-8).

r. Install wingfold push-pull (Controlex) support bracket and connect push-pulls at joining plate. Observe Controlex handling precautions (T.O. 1A-7D-2-1).

s. Connect rudder control cable turnbuckles and secure turnbuckles with safety wire (T.O. 1A-7D-2-8).

t. Install fuel and hydraulic tubing and associated valves, clamps, and supports (figure 5-59).

u. Install electrical harnesses and conduits; connect plugs to receptacles.

v. Install AR receptacle and cover (T.O. 1A-7D-2-6).

w. Install anticollision light panel (T.O. 1A-7D-2-1).

x. After performing operational checkout (paragraph 5-6), reinstall access doors 1121-5, 1121-6, 1121-7, 1121-8, 3113-11, 3113-13, 3123-1, 5111-1, 5111-4, 10113-1, 10113-2, and 10123-1 (T.O. 1A-7D-2-1).

5-5.1.8. Installation, Upper Right Skin.

a. Install foam baffles (Section III).

b. Prepare mating surfaces of removed skin for sealing. Inspect all WCS spar and rib nutplates and nut channels and upper skin dome nutplates for damage, looseness, cross-threading, etc. Clean all debris from nutplates.

WARNING

Since skin weighs about 325 pounds, six to eight men are required to lift and handle it.

c. Lift skin off support and turn over with exterior surface up.

d. Grasping skin at forward edge and each side, slide aft edge into position on wing, taking care that projecting dome nuts do not hang on spars. Align skin and structure screw holes.

e. Install bolts and screws in wing skin and underlying structure (figures 5-62 through 5-76). Install tagged/bagged brackets and supports in proper place in wing dorsal area. Torque fasteners penetrating wing skin to values in figure 3-3. If nutplates are damaged during skin installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive, blind fasteners are allowed in any row or pattern.

f. Inject fuel sealant into wing skin channels, corners, and joints (Section III).

g. Reinstall outboard bolt securing aileron control rod (part No. 215-78454-1) to bellcrank.

h. Install wing fuel tank transmitters in wing skin (T.O. 1A-7D-2-6).

i. Pressure test wing integral fuel tank for leakage (Section III).

WARNING

Sealant is toxic to skin, eyes, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

j. Overcoat flush screwheads at WS 24.63 (double row of fasteners attaching upper wing skin to wing root rib) from FS 375 to FS 480 with MIL-S-81733, Type II-1/2, sealant to thickness of 9 to 12 mils. Sealant shall bridge area between fasteners and extend 1 inch beyond fasteners. Sealant shall be cured for a minimum of 16 hours. Overcoat all other flush screwheads in upper skin with aerodynamic fairing compound in accordance with Section I.

k. Install four leading edge skin panels and wing-to-fuselage fairing (figure 5-61).

l. Install solid rivets, blind rivets, blind bolts, and Hi-Lok pins in trailing edge skin (figure 5-60).

NOTE

Prior to fairing installation, the WS 24.63 fastener sealant overcoat shall be inspected for proper cure. This sealant must be tack free and must not move under an applied pressure.

m. Install right wing root fairing (see figure 5-16A for installation of fasteners and sealing devices). Torque all fasteners in accordance with figure 3-3. If nutplates are damaged during fairing installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive blind fasteners are allowed in any fastener row.

n. Install rudder cable pulley brackets at front spar and horizontal stabilizer bellcrank supports at rear spar.

o. Install dorsal rib assembly (see figure 5-21A for installation of fasteners and sealing devices).

p. Install forward dorsal rib structure. Replace rivets attaching left side of rib structure to inboard AR cavity supports at locations shown in figure 5-59. If nutplates are damaged during rib structure installation, blind fasteners may be used in accordance with Section III; however, no more than two, nonconsecutive, blind fasteners are allowed in any fastener row.

q. Install horizontal stabilizer control rods (T.O. 1A-7D-2-8).

r. Install wingfold push-pull (Controlex) support bracket and connect push-pulls at joining plate. Observe Controlex handling precautions (T.O. 1A-7D-2-1).

s. Connect rudder control cable turnbuckles and secure turnbuckles with lockwire (T.O. 1A-7D-2-8).

t. Install fuel sensing lines, fuel vent line and check valve, clamps, and supports (T.O. 1A-7D-2-6).

u. Install fuel gravity filler neck (T.O. 1A-7D-2-6).

v. Install air-conditioning sensing and pressure lines, clamps, and supports.

w. Install strike camera cooling air duct, clamps, and supports.

x. Install bleed air ducts, clamps, and supports (T.O. 1A-7D-2-3).

y. Install anticollision light panel (T.O. 1A-7D-2-1).

z. After performing operational checkout (paragraph 5-6) reinstall access doors 1121-5, 2121-6, 2121-7, 2121-8, 4113-11, 4123-1, 6111-1, 6111-3, 10113-1, 10113-2, and 10123-1 (T.O. 1A-7D-2-1).

5-6. OPERATIONAL CHECKOUT.

a. Remove wing support jacks, service hydraulic system, and refuel airplane (T.O. 1A-7D-2-1).

b. Check for wing fuel tank leaks (Section III).

c. Remove rigging pin in horizontal stabilizer cam linkage (access 5121-2) and perform horizontal stabilizer operational checkout (T.O. 1A-7D-2-8).

d. Perform rudder operational checkout (T.O. 1A-7D-2-8).

e. Perform air refueling and wing fuel system operational checkout (T.O. 1A-7D-2-6).

f. Perform air-conditioning system operational checkout (T.O. 1A-7D-2-3).

g. Perform wingfold system operational checkout (T.O. 1A-7D-2-1).

h. Perform exterior lights operational system checkout (T.O. 1A-7D-2-1).

i. Start engine (T.O. 1A-7D-2-1) and check the following:

(1) Hydraulic system pressure.

(2) Fuel quantity indicating system.

(3) Leaks in fuel, hydraulic, and pneumatic lines in wing dorsal area.

(4) Open accesses for freedom from foreign objects and cleanness.

(5) Close accesses.

5-7. TEMPLATES AND REPAIR JIGS. Templates or jigs may be required for repair of major structural damage. Contour data for making templates or jigs are in Section I.

5-8. SAFETY PRECAUTIONS. To prevent injury to personnel or damage to airplane, comply with all requirements in the safety summary of this manual.

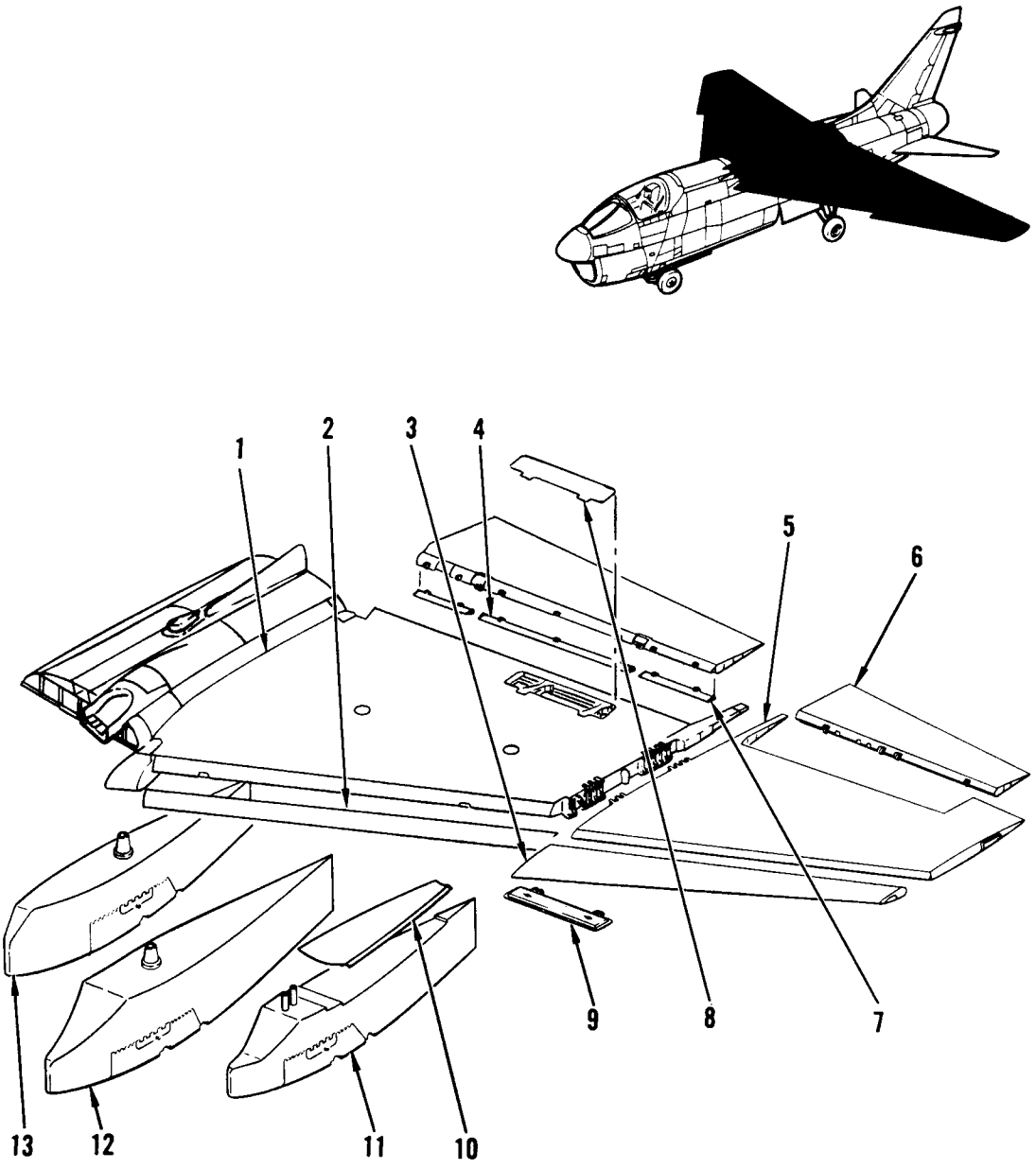


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Figure 5-1. Wing Group Index (Sheet 1 of 2)

INDEX NUMBER	ASSEMBLY NUMBER	MAJOR COMPONENT	INDEX FIGURE
1	216-70020	Wing Center Section	5-2
2	215-70200	Wing Center Section Leading Edge Flap Assembly	5-34
3	215-80200	Wing Outer Panel Leading Edge Flap Assembly	5-42
4	215-70300	Wing Trailing Edge Flap Installation	5-45
5	215-80020	Wing Outer Panel	5-26
6	215-80300	Aileron Assembly	5-44
7	215-70192	Door Installation, Wing Center Section Trailing Edge Flap Slot	5-46
8	215-70350	Spoiler Assembly	5-51
9	215-70375	Deflector Assembly	5-53
10	215-70111	Wingfold Pylon Fairing Installation	5-54
11	216-70065	Wing Stations 1 and 8 Pylon Assembly	5-55
12	215-70067	Wing Stations 2 and 7 Pylon Assembly	5-56
13	215-70069	Wing Stations 3 and 6 Pylon Assembly	5-57

Figure 5-1. Wing Group Index (Sheet 2)

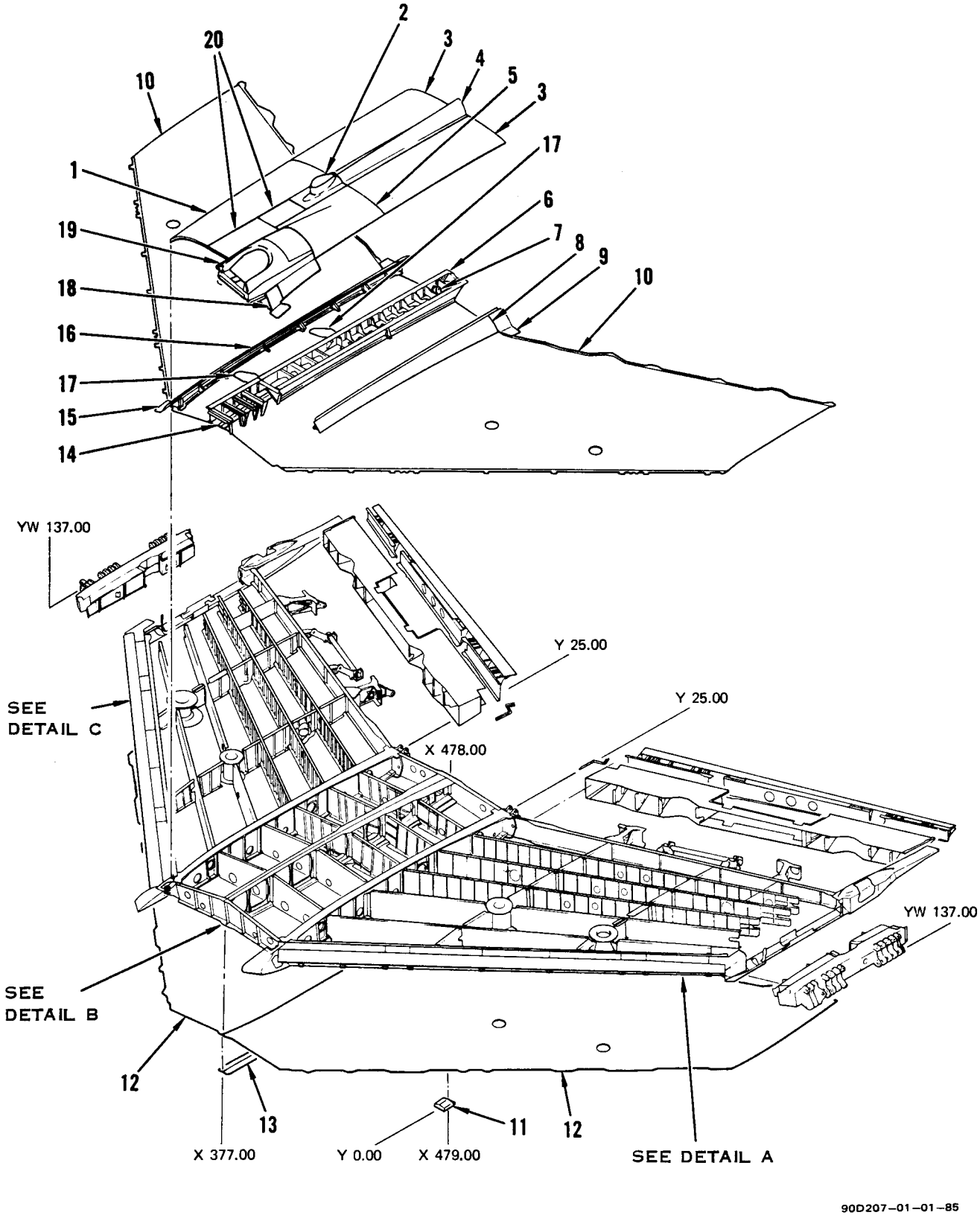

Figure 5-2. Wing Center Section (Sheet 1 of 8)

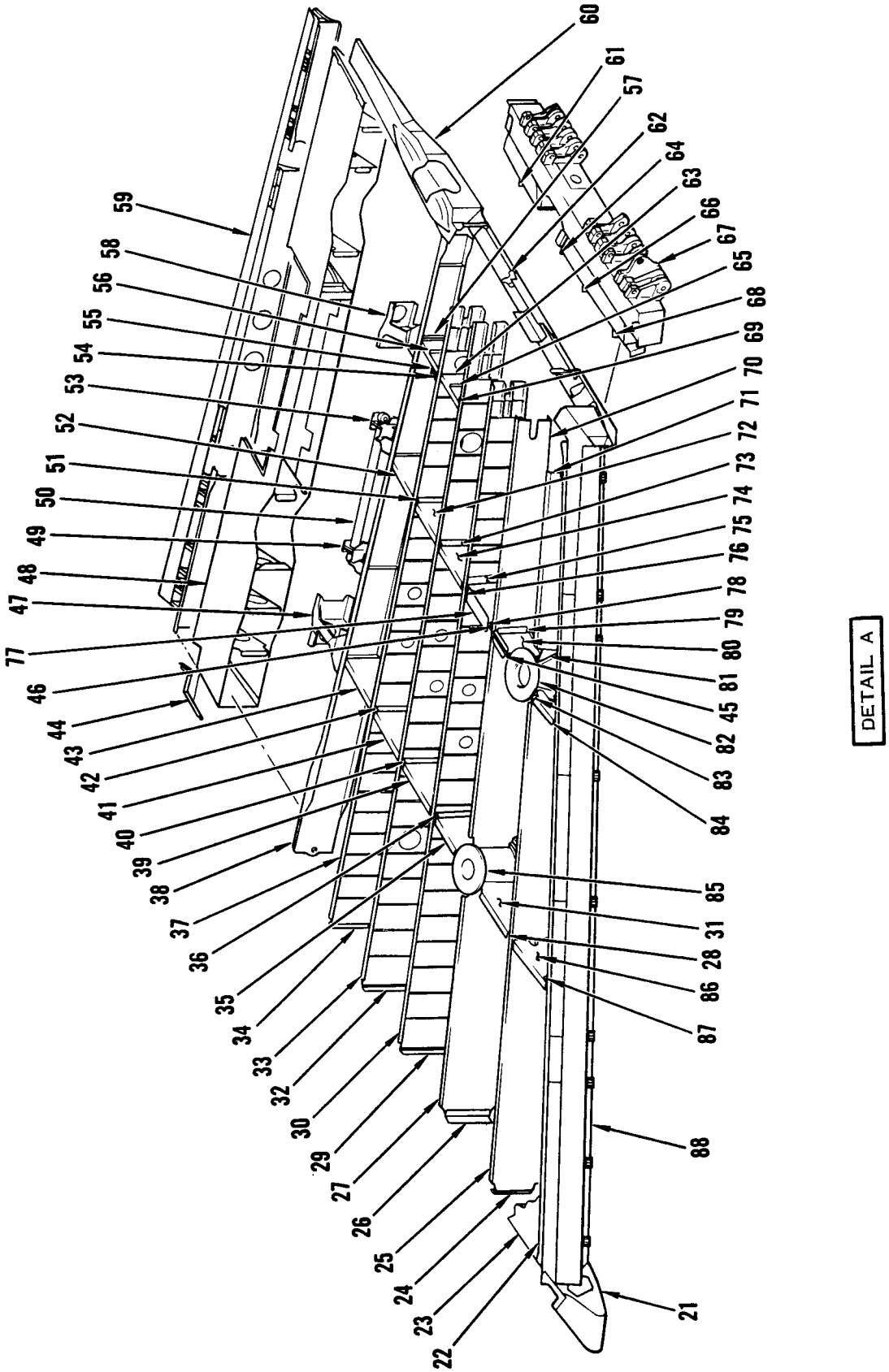

Figure 5-2. Wing Center Section (Sheet 2)

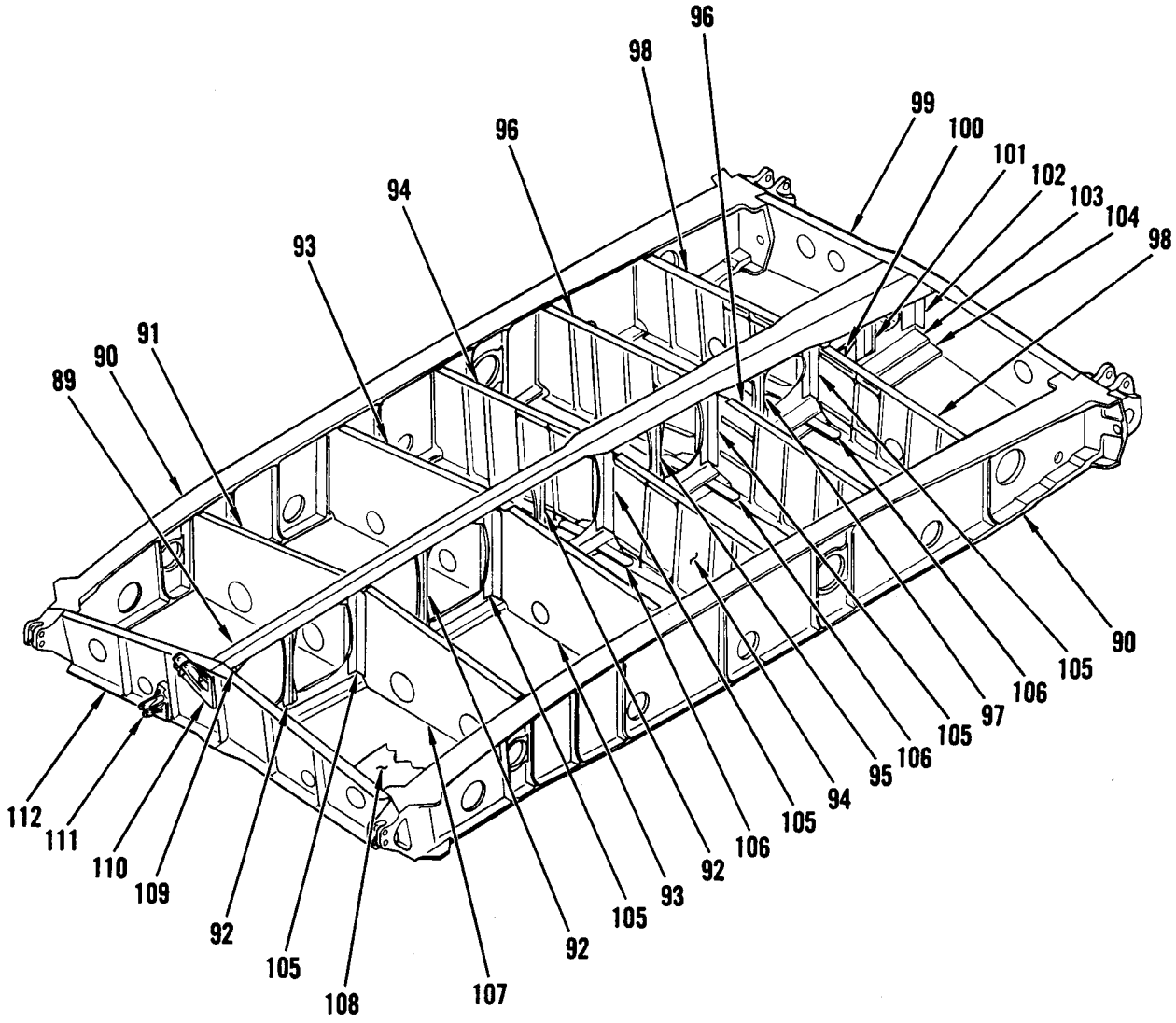

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Figure 5-2. Wing Center Section (Sheet 3)

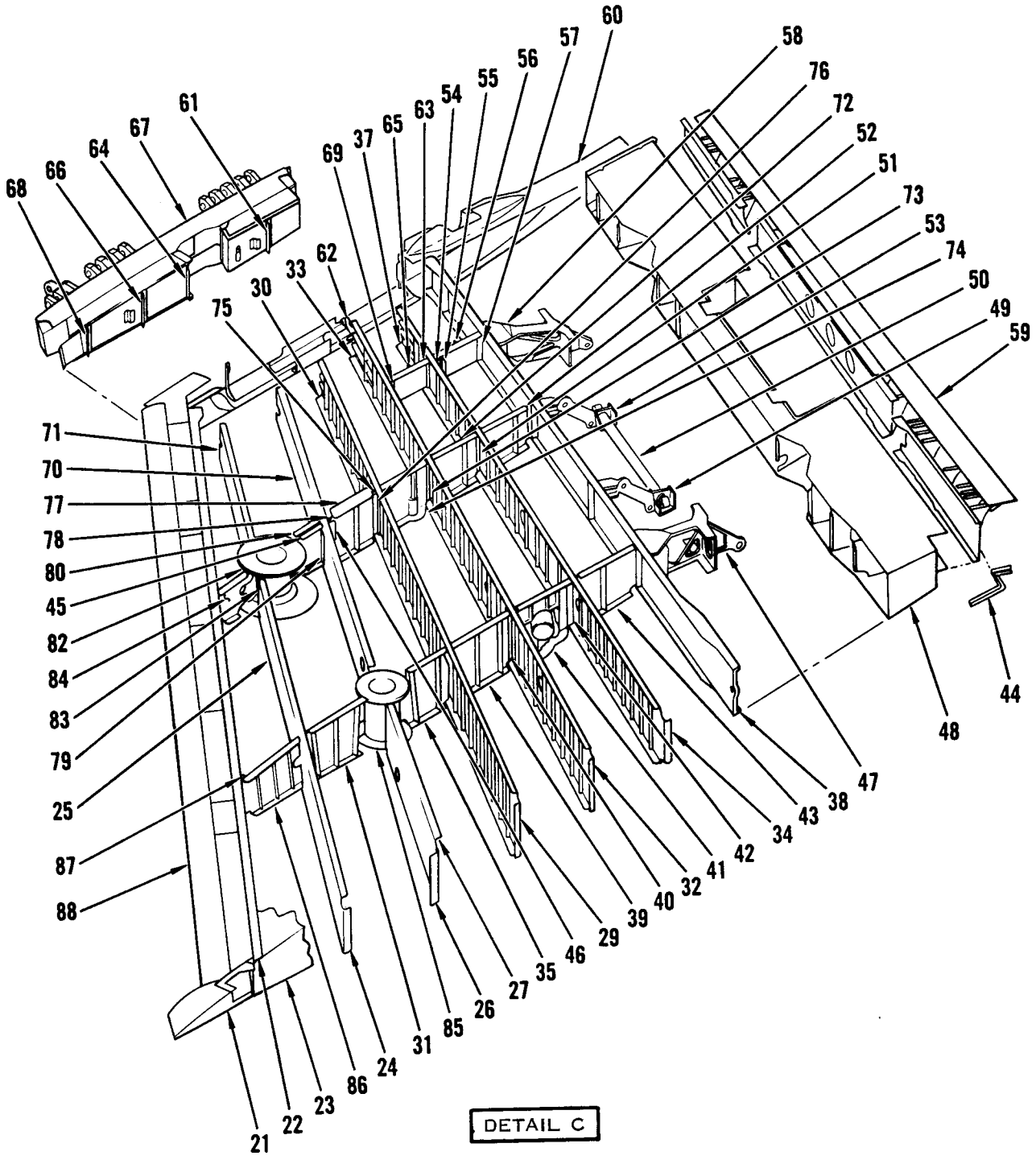

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Figure 5-2. Wing Center Section (Sheet 4)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70020	Wing Center Section Assembly			
1	216-70105	Access Door			5-24
2	216-77514	Navigation Light .			5-21
3	215-70107	Access Door			5-25
4	216-70104	Aft Dorsal Fairing			5-21
5	216-70024	Access Door			5-24
6	216-70075	Rib Installation .			5-21
7	215-78308	Support (Cstg) . .		357-T6	Replace
8	216-70097	Wing Root Fairing .			5-16
9	215-70109	Aft Access Door . .			5-17
10*	216-70025	Upper Skin (Mach) .	0.625 X 100.3 X 206.6	7079-T651 §	Section XII, 5-29
11	215-70131	Skin Support, Block	0.875 X 4.5 X 5.0	7075-T651	Replace
12*	215-70026	Lower Skin (Mach) .	0.750 X 100.3 X 208.1	7075-T651	Section XII
13	215-70632	Splice (Chem Mill)	0.500 X 122.0 X 10.0	7075-T651	Section XII
14	215-70633	Splice (Chem Mill)	0.375 X 122.0 X 10.0	7075-T651	Section XII
15	215-70108	Access Door			5-15
16	215-70097	Wing Root Fairing			5-16
17	215-70095	Access Door			5-22
18	216-70021	Access Door			5-23
19	216-70021	Air Refueling Cavity			5-23
20	216-70103	Fwd Dorsal Access Door			5-21
21	215-70096	Wing/Fuselage Fairing			5-14
22	215-70417	Spar (Extr)	CVC10020-2	7075-T6511	Section XV
23	216-73069	Foam Baffle			Section III
24	216-70036	Clip	0.125 X 2.4 X 8.3	7075-T6	Section XII

See footnotes at the end of the figure.

Figure 5-2. Wing Center Section (Sheet 5)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
25	215-70423	Spar (Mach)	1.25 X 10.0 X 88.0	7075-T651	Section XII
26	215-70037	Clip	0.090 X 2.8 X 9.2	7075-T6	Section XII
27	215-70431	Spar (Mach)	1.25 X 11.3 X 41.0	7075-T651	Section XII
28	215-70052	Angle	0.071 X 2.7 X 7.2	7075-T6	Section XII
29	215-70038	Clip	0.090 X 2.3 X 9.9	7075-T6	Section XII
30	215-70446	Spar (Mach)	1.25 X 12.0 X 120.0	7075-T651	Section XII
31	215-70435	Rib (Mach)	1.25 X 9.3 X 13.5	7075-T651	Section XII
32	215-70039	Clip	0.090 X 2.4 X 9.6	7075-T6	Section XII
33	215-70448	Spar (Mach)	1.25 X 11.0 X 120.0	7075-T651	Section XII
34	215-70040	Clip	0.090 X 3.1 X 7.6	7075-T6	Section XII
35	215-70436	Rib (Mach)	1.25 X 10.0 X 10.6	7075-T651	Section XII
36	215-70052	Angle (Extr) . . .	CVC10000-4	7075-T6511	Section XV
37	215-70450	Spar (Mach)	1.25 X 11.0 X 120.0	7075-T651	Section XII
38	215-70041	Rear Spar			5-3
39	215-70472	Rib (Mach)	1.25 X 10.1 X 13.6	7075-T651	Section XII
40	215-70052	Angle (Extr) . . .	CVC10000-5	7075-T6511	Section XV
41	215-70098	Rib (Forg)		7075-T6	Section XII, 5-13
42	215-70052	Angle (Extr) . . .	CVC10000-3	7075-T6511	Section XV
43	215-70474	Rib (Mach)	1.5 X 9.2 X 13.2	7075-T651	Section XII
44	215-70189	Seal (Extr)	Made from 215-80322-5	Rubber	Section XV
45	215-70434	Rib (Mach)	1.25 X 7.6 X 8.0	7075-T651	Section XII
46	215-70051	Angle	0.125 X 3.4 X 6.9	7075-T6	Section XII
47	215-70325	Rib			5-4
48	215-70027	Trailing Edge . . .			5-5
49	215-70060	Support			5-5
50†	215-70411	Strut (Tube) . . .	1.25 D X 0.25 X 22.0	2024-T3	Replace
51	215-70051	Angle (Extr) . . .	CVC10000-3	7075-T6511	Section XV
52	215-70470	Rib (Mach)	1.25 X 8.0 X 11.0	7075-T651	Section XII
53	215-70059	Support			5-5
54	215-70082	Angle	0.090 X 2.1 X 6.3	7075-T6	Section XII
55		Support	0.063 X 1.6 X 2.3	2024-T3	Replace
56		Doubler	0.100 X 5.6 X 6.8	7075-T6	Section XII
57	215-70082	Support	0.090 X 9.0 X 9.4	7075-T6	Section XII

See footnotes at the end of the figure.

Figure 5-2. Wing Center Section (Sheet 6)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
58	215-70326	Rib			5-4
59	215-70042	Trailing Edge Spar			5-4
60	215-70077	Wingfold Fairing .			5-12
61	215-70040	Clip	0.080 X 2.5 X 5.9	7075-T6	Section XII
62	215-70093	Wingfold Fairing .			5-11
63	215-70082	Support	0.080 X 10.0 X 9.9	7075-T6	Section XII
64	215-70038	Clip	0.063 X 2.2 X 6.1	2024-T3	Section XII
65	215-70082	Doubler	0.080 X 7.0 X 5.8	7075-T6	Section XII
66	215-70037	Clip	0.090 X 2.5 X 6.3	7075-T6	Section XII
67	215-70050	Wingfold Rib . . .			5-6
68	215-70036	Clip	0.125 X 2.5 X 5.6	7075-T6	Section XII
69	215-70082	Angle	0.080 X 2.3 X 6.9	7075-T6	Section XII
70	215-70431	Spar (Mach)	1.25 X 11.3 X 77.0	7075-T651	Section XII
71	215-70423	Spar (Mach)	1.25 X 10.0 X 32.0	7075-T651	Section XII
72	215-70469	Rib (Mach)	1.5 X 8.5 X 11.0	7075-T651	Section XII
73	215-70051	Angle (Extr) . . .	CVC10000-5	7075-T6511	Section XV
74	215-70094	Fitting (Forg) . .		7075-T6	Section XII
75	215-70051	Angle	0.125 X 3.2 X 7.5	7075-T6	Section XII
76		Angle (Extr) . . .	CVC10000-4	7075-T6511	Section XV
77	215-70468	Rib (Mach)	2.50 X 9.0 X 11.0	7075-T651	Section XII
78	215-70051	Angle	0.125 X 3.3 X 7.0	7075-T6	Section XII
79		Tee (Extr)	CVC10012-5	7075-T6511	Section XV
80	215-70434	Rib (Mach)	1.25 X 8.0 X 8.0	7075-T651	Section XII
81	215-70036	Clip	0.160 X 3.1 X 4.9	7075-T6	Section XII
82††	215-70422	Support (Forg) . .		7075-T6	Replace
‡‡		Support (Forg) . .		7050-T736‡	Section XII
83	215-70036	Clip	0.160 X 3.2 X 5.3	7075-T6	Section XII
84	215-70433	Rib (Mach)	1.50 X 6.8 X 9.6	7075-T6	Section XII
85††	215-70425	Support (Forg) . .		7075-T6	Replace
‡‡		Support (Forg) . .		7050-T736	Section XII
86	215-70471	Rib (Mach)	1.25 X 8.5 X 13.6	7075-T651	Section XII
87	215-70052	Angle	0.071 X 2.3 X 5.9	7075-T6	Section XII
88	215-70023	Leading Edge . . .			5-18

See footnotes at the end of the figure.

Figure 5-2. Wing Center Section (Sheet 7)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
89	215-70406	Capstrip (Extr) . .	CVC10010-40	7075-T6	Section XV
90	215-70405	Rib (Forg)		7075-T6	Section XII
91	215-70529	Spar (Mach)	1.25 X 13.0 X 24.3	7075-T651	Section XII
92	215-70053	Stiffener (Extr) .	AND10136-1601	7075-T6511	Section XV
93	215-70430	Spar (Mach)	1.5 X 13.0 X 25.0	7075-T651	Section XII
94	215-70445	Spar (Mach)	1.75 X 13.0 X 25.0	7075-T651	Section XII
95	215-70053	Stiffener (Extr) .	AND10136-2401	7075-T6511	Section XV
96	215-70447	Spar (Mach)	1.75 X 12.0 X 25.0	7075-T651	Section XII
97	215-70053	Stiffener (Extr) .	AND10136-2402	7075-T6511	Section XV
98	215-70449	Spar (Mach)	2.0 X 11.0 X 25.0	7075-T651	Section XII
99	215-70416	Spar (Mach)	2.0 X 9.6 X 47.0	7075-T651	Section XII
100	215-70053	Support (Extr) . .	CVC100001-11	7075-T6	Section XV
101		Stiffener (Extr) .	AND10136-3002	7075-T6511	Section XV
102		Stiffener (Extr) .	AND10136-2006	7075-T6511	Section XV
103	215-70421	Capstrip (Extr) . .	CVC10010-31	7075-T6	Section XV
104	215-70437	Plate (Chem Mill) .	0.375 X 12.18 X 122.0	7075-T651	Section XII
105	215-70053	Stiffener (Extr) .	AND10136-2404	7075-T6511	Section XV
106		Splice	0.071 X 2.8 X 13.2	17-7PH (180 KSI)	Section XII
107	216-70529	Spar (Mach)	1.25 X 13.0 X 24.3	7075-T651	Section XII
108	216-73069	Foam Baffle			Section III
109	215-70053	Stiffener (Extr) .	AND10134-2003	7075-T6511	Section XV
110	216-78460	Support (Cstg) . .		356-T6	Replace
111*	216-78462	Support (Cstg) . .		AZ91C-T6	Replace
**		Support (Cstg) . .		356-T6	Section XII
112	216-70530	Spar (Mach)	2.0 X 12.3 X 46.7	7075-T651	Section XII

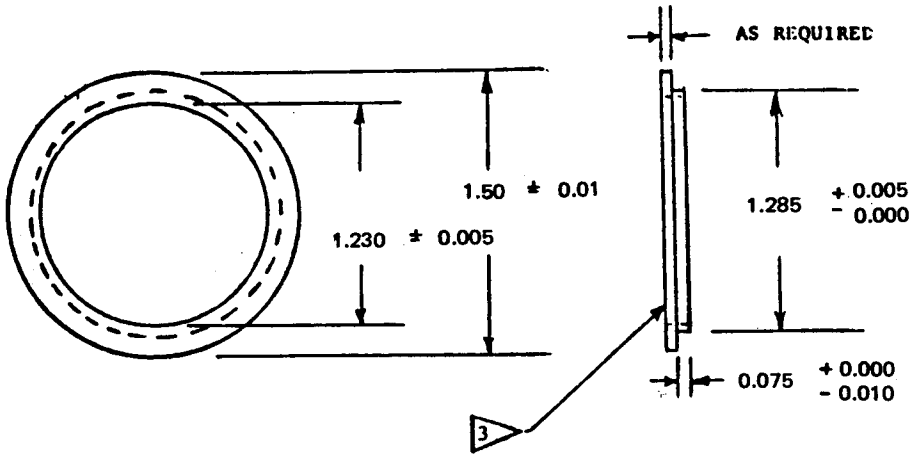
*Made from 215-70609.
†When replacing 215-70411 strut, use 218-00271-1 spoiler strut holddown fixture (Section XVII). Install new AN386-1-10A taper pins.
‡Alternate material is 7049-T73.
§Alternate material is 7050-T7651.
•Airplanes AF69-6197 through AF70-964.
••Airplanes AF70-965 and subsequent.
††Airplanes through AF75-397.
‡‡Airplanes AF75-398 and subsequent.

Figure 5-2. Wing Center Section (Sheet 8)

1. Material: 2024-T3 per QQ-A-250/4, thichness as required.

2. Apply chromate conversion coating to entire part, MIL-C-81706, Class 1A brush-on method by T.O. 1-1-2, paragraph 6-10.

3. Apply dry-film lubricant, MIL-L-23398 or MIL-L-46147, in accordance with T.O. 42C2-1-7, Chapter 26, this surface only. (Optional)



1. Disconnect spoiler actuator bellcranks, Part No. 215-78031-5, from lower strut installation, Part No. 215-70141-1, -4.

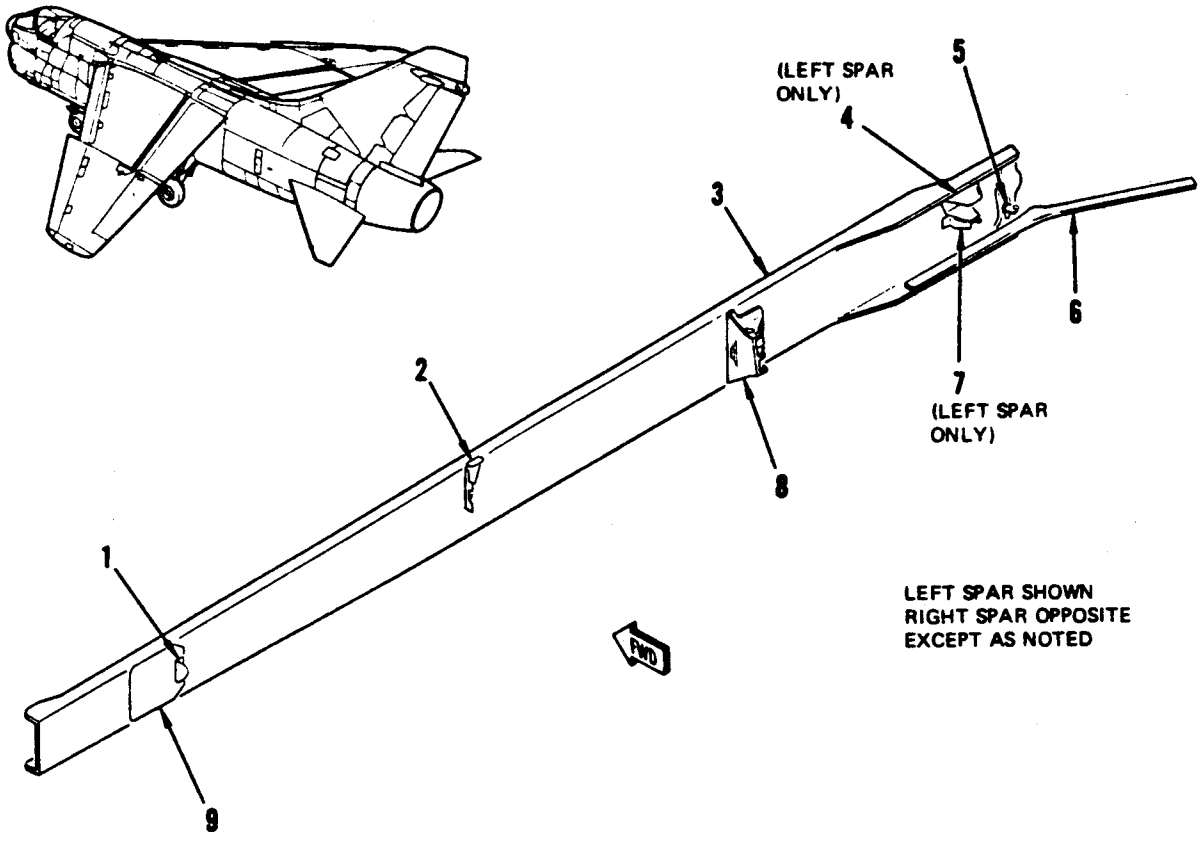
2. Measure side play in strut installation. This can be accomplished by pushing rod assembly fully outboard and measuring the gap between 215-70605-2 spacer and 215-70059-3/-4 support. Maximum allowable sideplay is 0.015 inches. If sideplay exceeds 0.015 inches, proceed to step 3.

3. Record measurement obtained in step 2. After shimming torque tube assembly, sideplay must be 0.005 to 0.008 inches. The difference between the recorded dimension and the final sideplay allowance is the "as required" dimension for the repair spacer in figure.

4. Manufacture repair spacer in accordance with figure. To install repair spacer, remove paint from mating surface of Part No. 215-70605-2 spacer. Touch up bare metal areas with alodine. Bond repair spacer to existing spacer with MIL-S-81733 sealant or equivalent. Squeeze out excess sealant and form fillet between spacer and repair spacer. Reinstall spacer and strut installation. Reconnect actuator bellcranks to lower strut.

5. Perform spoiler/deflector rigging in accordance with T.O. 1A-7D-2-8.

Figure 5-2A. Spoiler Strut Installation Repair Limits and Spacer Installation



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70041	Wing Center Section Rear Spar			
1	215-70041	Bracket	0.063 X 2.2 X 2.7	7075-T6	Replace
2		Bracket	0.040 X 2.8 X 5.2	2024-T3	Replace
3	215-70415	Spar (Extr)	CVC10032-1	7075-T6511	Section XV
4	215-70041	Bracket	0.090 X 4.3 X 7.0	7075-T6	Section XII
5	215-70613	Fitting (Cstg) . .		356-T6	Section XII
6	215-70420	Strap (Mach Forg) .		4340 (180 KSI)	Section XII
7	215-70041	Support	0.090 X 3.8 X 4.3	7075-T6	Replace
8	215-70102	Spar (Mach Cstg). .		A356-T6	Section XII
9*	215-70041	Door	0.160 X 5.7 X 6.6	7075-T6	Section XII

*Made from 215-70455.

Figure 5-3. Wing Center Section Rear Spar

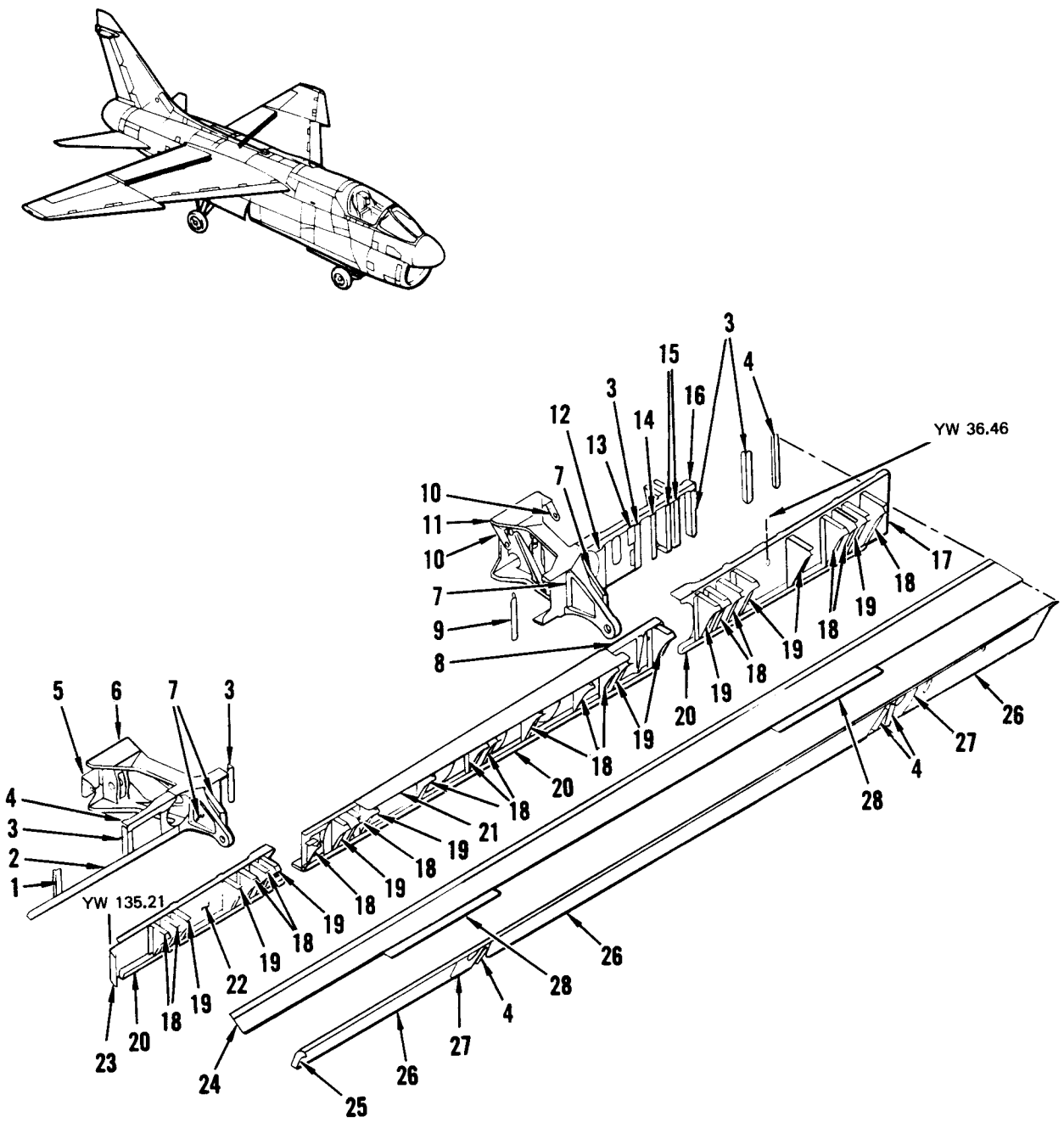


Figure 5-4. Wing Center Section Trailing Edge Spar Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70042	Spar Installation, Trailing Edge			
1	215-70042	Angle	0.050 X 1.2 X 4.2	7075-T6	Replace
2		Filler	0.040 X 0.9 X 23.1	2024-T3	Section XII
3		Clip	0.040 X * X *	2024-T3	Replace
4		Angle	0.032 X * X *	2024-T3	Replace
5	215-70056	Bracket	0.063 X 2.5 X 4.60	2024-T3	Replace
6	215-70326	Rib (Forg)		7075-T6	Section XII
7	215-70702	Plate	0.025 X * X *	2024-T3	Replace
8	215-70457	Spar (Extr)	CVC10001-18	7075-T6511	Section XV
9	215-70042	Clip	0.100 X 2.0 X 5.3	7075-T6	Replace
10	215-70055	Bracket	0.063 X 3.0 X *	2024-T3	Replace
11	215-70325	Rib (Forg)		7075-T6	Section XII
12	215-70042	Doubler	0.040 X 4.4 X 6.1	7075-T6	Replace
13		Support	0.040 X 2.9 X 4.9	7075-T6	Replace
14		Clip	0.032 X 1.3 X 6.2	2024-T3	Replace
15		Bracket	0.040 X 4.5 X 8.6	7075-T6	Replace
16		Angle	0.032 X 2.8 X 17.0	7075-T6	Section XII
17		Spar	0.032 X 8.8 X 29.6	7075-T6	Section XII
18		Rib	0.032 X * X *	7075-T6	Section XII
19		Rib	0.040 X * X *	7075-T6	Section XII
20		Corner (Extr) . . .	CVC10051-4	2024-T3511	Section XV
21		Skin	0.040 X 2.7 X 37.9	7075-T6	Section XII
22		Spar	0.040 X 7.7 X 24.1	7075-T6	Section XII
23		Clip	0.040 X 2.5 X 3.9	7075-T6	Replace
24	215-70441	Tip (Extr)	CVC10051-3	2024-T3511	Section XV
25	215-70042	Clip	0.032 X 2.2 X 5.0	7075-T6	Section XII
26		Skin	0.025 X * X *	2024-T3	Section XII
27		Skin	0.040 X * X *	2024-T3	Section XII
28	215-70045	Deflector	0.016 X 2.7 X *	17-7PH	Replace

*Length or length and width may vary with location.

Figure 5-4. Wing Center Section Trailing Edge Spar Installation (Sheet 2)

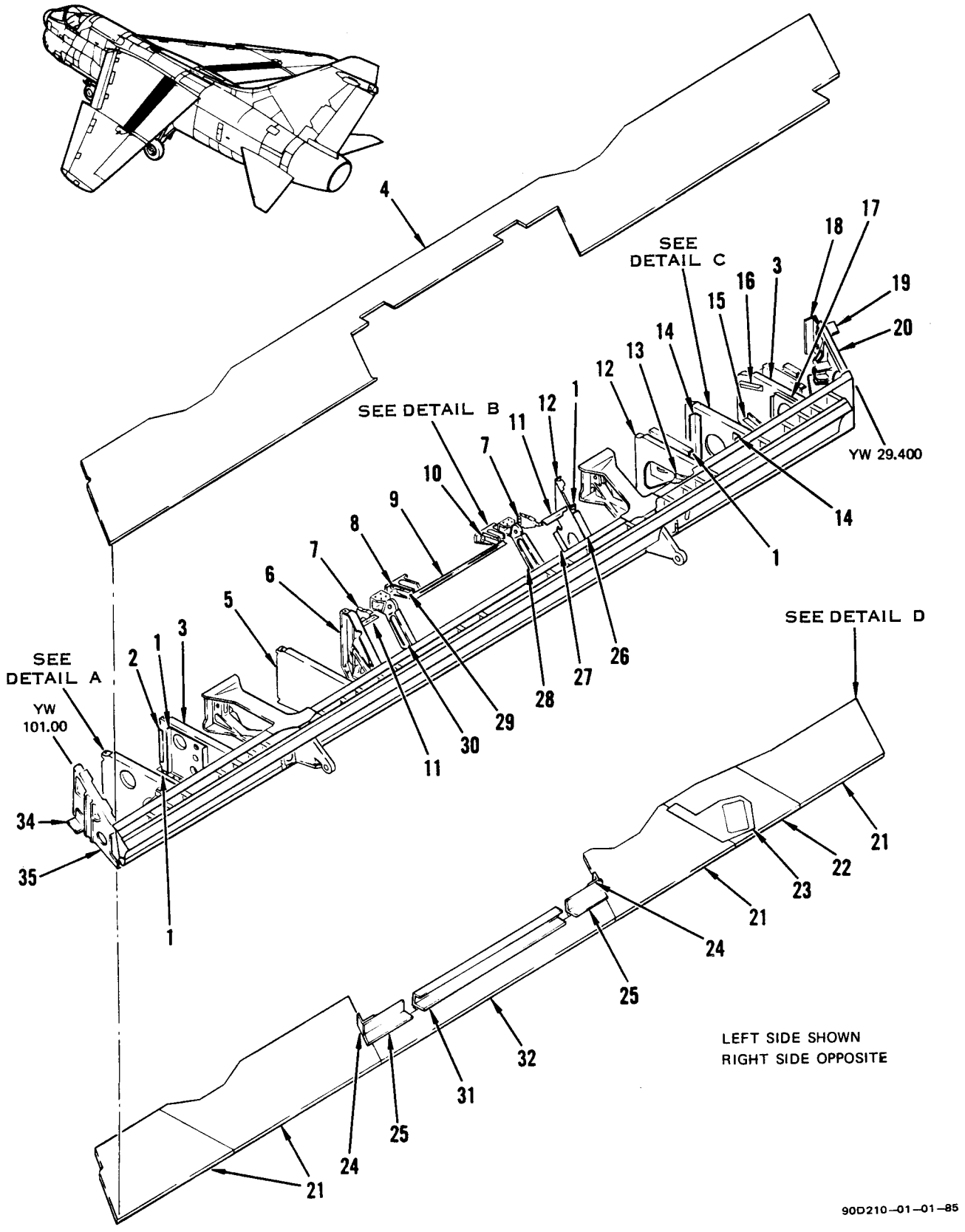
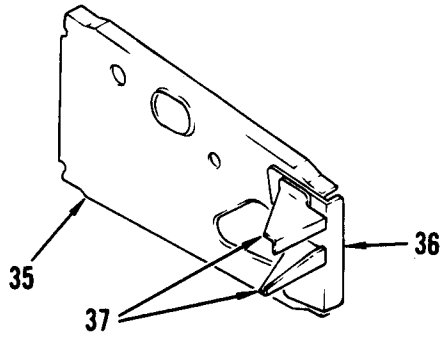
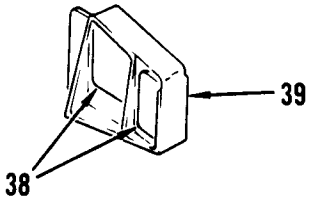


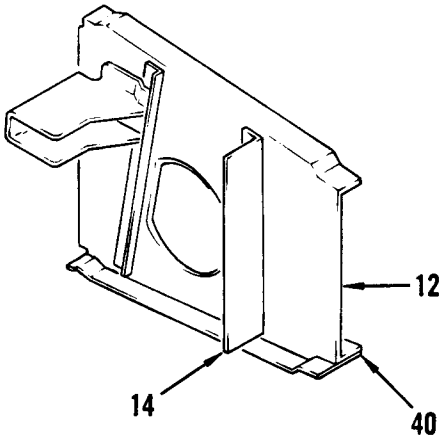
Figure 5-5. Wing Center Section Trailing Edge Installation (Sheet 1 of 4)



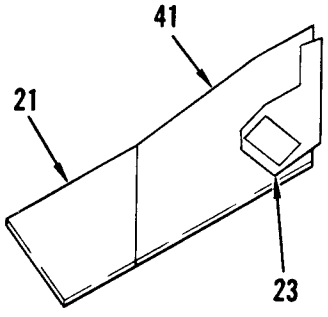
DETAIL A



DETAIL B



DETAIL C



DETAIL D
(Right Side Only)

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Figure 5-5. Wing Center Section Trailing Edge Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70027	Trailing Edge Installation, Wing Center Section			
1	215-70027	Doubler	0.040 X * X *	2024-T3	Section XII
2		Clip	0.040 X 1.9 X 4.5	2024-T42	Section XII
3		Rib	0.032 X * X *	2024-T42	Section XII
4		Skin	0.040 X 13.3 X 118.0	7075-T6	Section XII
5		Rib	0.040 X 8.8 X 11.3	7075-T6	Section XII
6	215-70099	Rib (Mach)		7075-T651	Section XII
7	215-70027	Gusset	0.050 X * X *	2024-T42	Section XII
8	215-70516	Bracket (Cstg) . .		356-T6	Section XII
9	215-70027	Stiffener	0.050 X 2.9 X 21.7	2024-T42	Section XII
10		Bracket	0.050 X 2.3 X 6.6	2024-T42	Section XII
11		Seal Sill	0.050 X 2.3 X *	2024-T42	Replace
12		Rib	0.040 X * X *	2024-T42	Section XII
13		Bracket	0.040 X 2.5 X 5.1	2024-T42	Section XII
14		Angle	0.040 X * X *	2024-T3	Section XII
15		Clip	0.050 X 1.6 X 3.8	2024-T42	Replace
16		Clip	0.050 X 1.6 X 3.8	2024-T42	Replace
		Clip	0.050 X 1.6 X 3.8	2024-T42	Replace
17		Doubler	0.040 X 6.1 X 7.8	2024-T42	Section XII
18		Clip	0.070 X 2.3 X 6.3	7075-T6	Replace
19		Support (Extr) . .	AND10134-1205	7075-T6511	Section XV
20	215-70100	Rib (Mach)		7075-T651	Section XII
21	215-70028	Panel (Chem Mill) .	0.080 X * X *	7075-T6	Section XII
22		Skin, LH (Chem Mill)	0.080 X 11.3 X 14.4	7075-T6	Section XII
23		Doubler	0.040 X 8.7 X 10.6	7075-T6	Section XII
24		Clip	0.050 X 1.1 X *	2024-T3	Replace
25		Angle	0.050 X * X *	2024-T42	Section XII
26	215-70027	Seal Sill	0.040 X 1.7 X 10.0	2024-0	Replace
27		Sill	0.040 X 2.0 X 12.0	7075-T6	Replace
28	215-70060	Support (Forg) . .		7075-T6	Section XII

See footnote at the end of the figure.

Figure 5-5. Wing Center Section Trailing Edge Installation (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
29	215-70027	Bracket	0.050 X 2.1 X 4.4	2024-T42	Replace
30	215-70059	Support (Forg) . .		7075-T6	Section XII
31	215-70028	Channel	0.050 X 3.3 X 22.0	2024-T42	Section XII
32		Skin	0.040 X 3.6 X 37.8	2024-T3	Section XII
33	215-70101	Rib (Mach)		7075-T651	Section XII
34	215-70027	Clip	0.100 X 3.3 X 5.1	2024-T42	Replace
35		Rib	0.050 X 8.2 X 11.3	7075-T6	Section XII
36		Angle	0.040 X 3.3 X 4.6	7075-T6	Section XII
37		Gusset	0.071 X * X *	7075-T6	Section XII
38	215-72459	Plate	0.080 X * X *	2024-T3	Replace
39	215-70517	Bracket (Cstg) . .		356-T6	Section XII
40	215-70027	Doubler	0.050 X 3.2 X 11.0	2024-T42	Section XII
41	215-70028	Skin (Chem Mill) .	0.080 X 14.6 X 19.5	7075-T6	Section XII

*Length or length and width may vary with location.

Figure 5-5. Wing Center Section Trailing Edge Installation (Sheet 4)

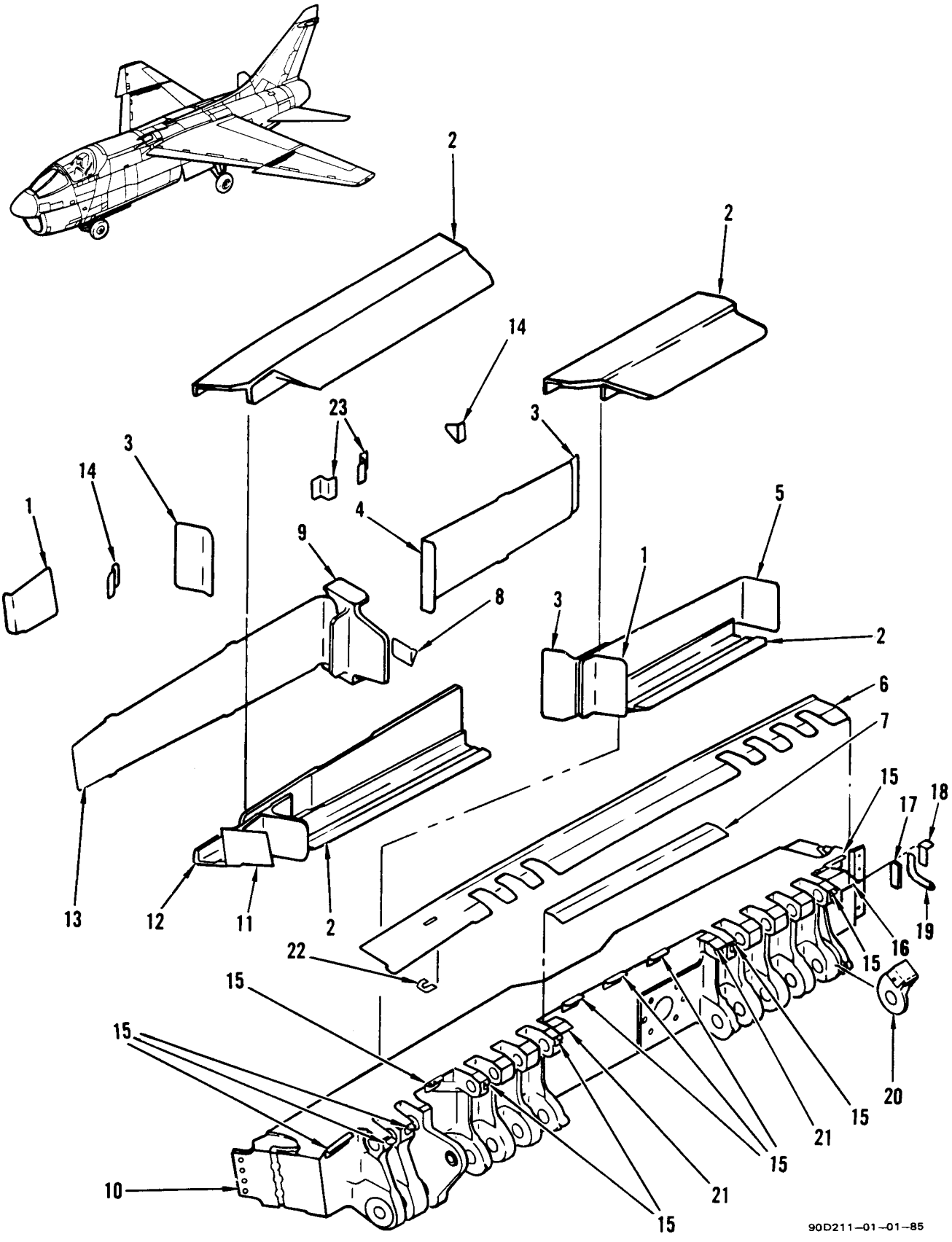


Figure 5-6. Wing Center Section Wingfold Rib Installation and Fairing Replacement (Sheet 1 of 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70050	Rib Installation, Wing Center Section Wingfold			
1	215-70050	Clip	0.190 X * X *	7075-T6	Section XII
2	215-70410	Plate (Mach) . . .		7075-T6	Section XII
3	215-70050	Clip	0.125 X * X *	7075-T6	Replace
4		Web	0.125 X 6.1 X 16.1	7075-T6	Section XII
5		Web	0.190 X 5.0 X 19.0	7075-T6	Section XII
6†		Fairing	0.050 X 3.7 X 41.9	7075-T6	Replace
7		Doubler	0.050 X 2.3 X 15.0	7075-T6	Replace
8		Clip	0.071 X 2.7 X 4.9	2024-T42	Replace
9	215-70477	Support (Forg) . .		7075-T6	Section XII
10§,●	215-70058	Rib (Forg)		7075-T6	5-7 Thru 5-9
**,§		Rib (Forg)		7050-T736	5-7 Thru 5-9
11	215-70476	Extension (Forg) .	4.0 Long	7075-T6	Section XII
12	215-70520	Plate (Mach) . . .		7075-T651	Section XII
13	215-70050	Web	0.160 X 6.2 X 26.8	7075-T6	Section XII
14		Clip	0.063 X * X *	2024-T42	Section XII
15		Clip	0.040 X * X *	2024-T42	Section XII
16		Clip	0.050 X 2.5 X 3.4	2024-T42	Section XII
17		Spacer	0.187 X 0.8 X 1.4	Phenolic	Replace
18‡		Clip	0.064 X * X *	2024-T3	Section XII
19		Support	0.090 X 2.0 X 2.4	7075-T6	Section XII
20	215-70190	Support (Forg) . .		4340	Section XII
21	215-70050	Clip	0.050 X * X *	7075-T6	Section XII
22		Guide	0.125 X 1.1 X 1.3	7075-T6	Section XII
23		Clip	0.063 X 1.8 X 2.6	2024-T3	Section XII

*Length and width may vary with location.
†Fairing replacement:
a. Check fairing for looseness by applying hand pressure to detect movement.
b. [redacted]ovement or looseness of fairing is detected, remove fairing attachment clips and angles to ensure good bonding to wingfold forging.

Figure 5-6. Wing Center Section Wingfold Rib Installation and Fairing Replacement (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE

WARNING

Trichloroethane is highly toxic to eyes, skin, and respiratory tract. Avoid all contact. Skin and eye protection is required. Use only with adequate ventilation.

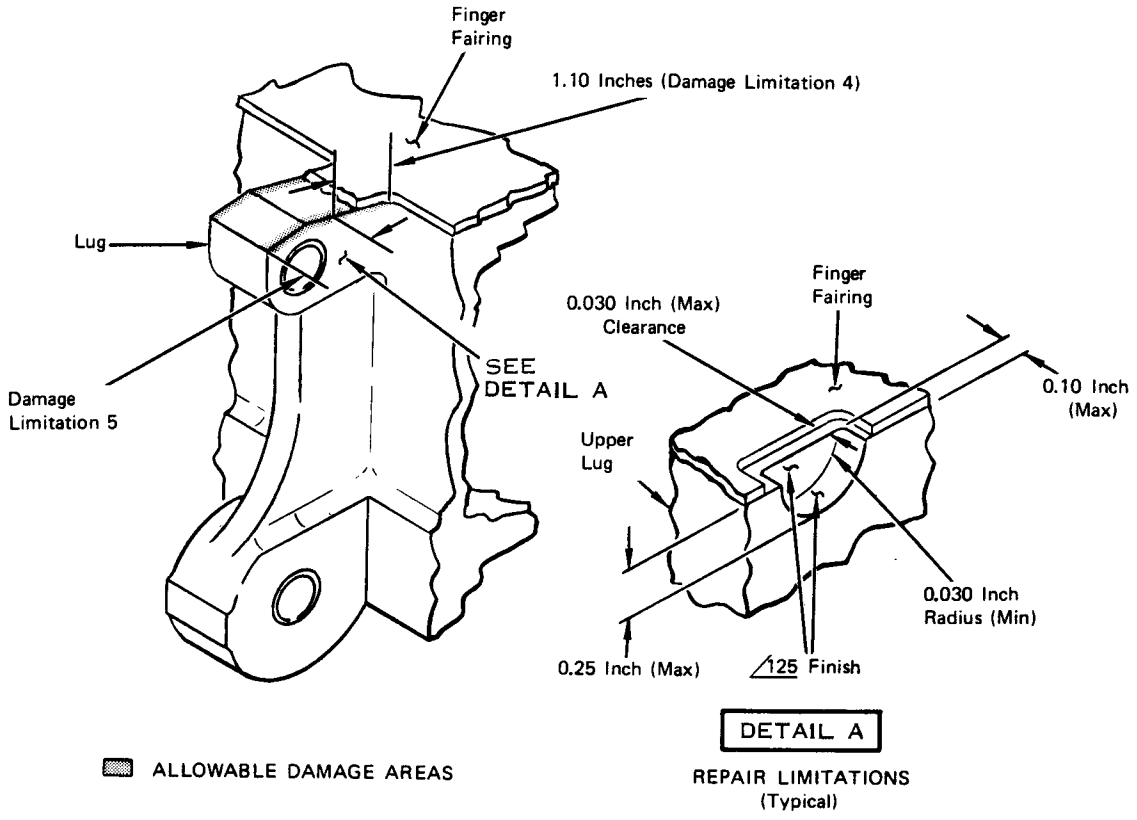
Ketone solvent and MIL-S-8802 sealant are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

c. Replace all cracked or damaged clips and/or angles. (There are six single riveted clips and four double riveted clips.)

(1) Prepare all surfaces (forging, angle clips, and fairing) by thoroughly cleaning with trichloroethane (Federal Specification O-T-620) in accordance with T.O. 1-1-1. Follow up cleaning by wiping all bonding surfaces with clean cloth moistened with any ketone solvent, allow to dry for 15 minutes or wipe dry with clean dry cloth.
(2) Preposition predrilled clips with suitable straight edge to ensure proper aerodynamic smoothness of installed fairing.
(3) Install predrilled angle clips to forging with MIL-S-8802 sealant. Recheck alignment to ensure aerodynamic smoothness of wingfold fairing.
(4) Dry fit fairing (preposition) to determine clearances in accordance with Standard Aerodynamics Tolerances (Section I). Perform trimming and adjustments at this time to reduce amount of working time while sealant is curing.
(5) Apply MIL-S-8802 sealant liberally to forging and fairing bonding surfaces including angle clips, and place fairing in position ensuring all tolerances to be correct in accordance with Standard Aerodynamic Tolerances (Section I). Rivet angle clips and perform final clearance tolerances as quickly as possible to prevent MIL-S-8802 sealant from setting before final adjustment. Ensure all cavities are filled with MIL-S-8802 sealant.
(6) Use sandbags or similar weights to hold fairing against forging and adhesive until adhesive has cured. Use caution when applying weights to center section of fairing as this section tends to deflect and will result in deteriorated bond.

‡Make from CVC499R80E1 and CVC499L80E1.
§Made from 215-70409 forging.
•Airplanes through AF75-399.
**Airplanes AF75-400 and subsequent.

Figure 5-6. Wing Center Section Wingfold Rib Installation and Fairing Replacement (Sheet 3)



DAMAGE LIMITATIONS:

1. Upper lug upper surface – after repair of nicks and gouges, the maximum allowable dimensions of a repaired area are as follows:
   a. 0.10 inch horizontal depth as measured from lug vertical surface
   b. 0.25 inch vertical depth as measured from the top surface
2. All remaining surfaces – negligible damage allowed as follows:
   a. Scratch depth equal to 0.020 inch or 10% of the material thickness, whichever is less, may be considered negligible.
   b. Refer to Section XII to determine negligible damage of holes, cracks, dents, and nicks.
3. Remaining rib areas – no damage allowed.
4. Damage within 1.10 inches of lug root shall be repaired before flight.
5. Damage outside of 1.10 inches of lug root shall be repaired at next progressive aircraft rework (PAR).

REPAIR PROCEDURE:

1. Remove paint (T.O. 1A-7D-23) and sealant (Section I) from damaged area.

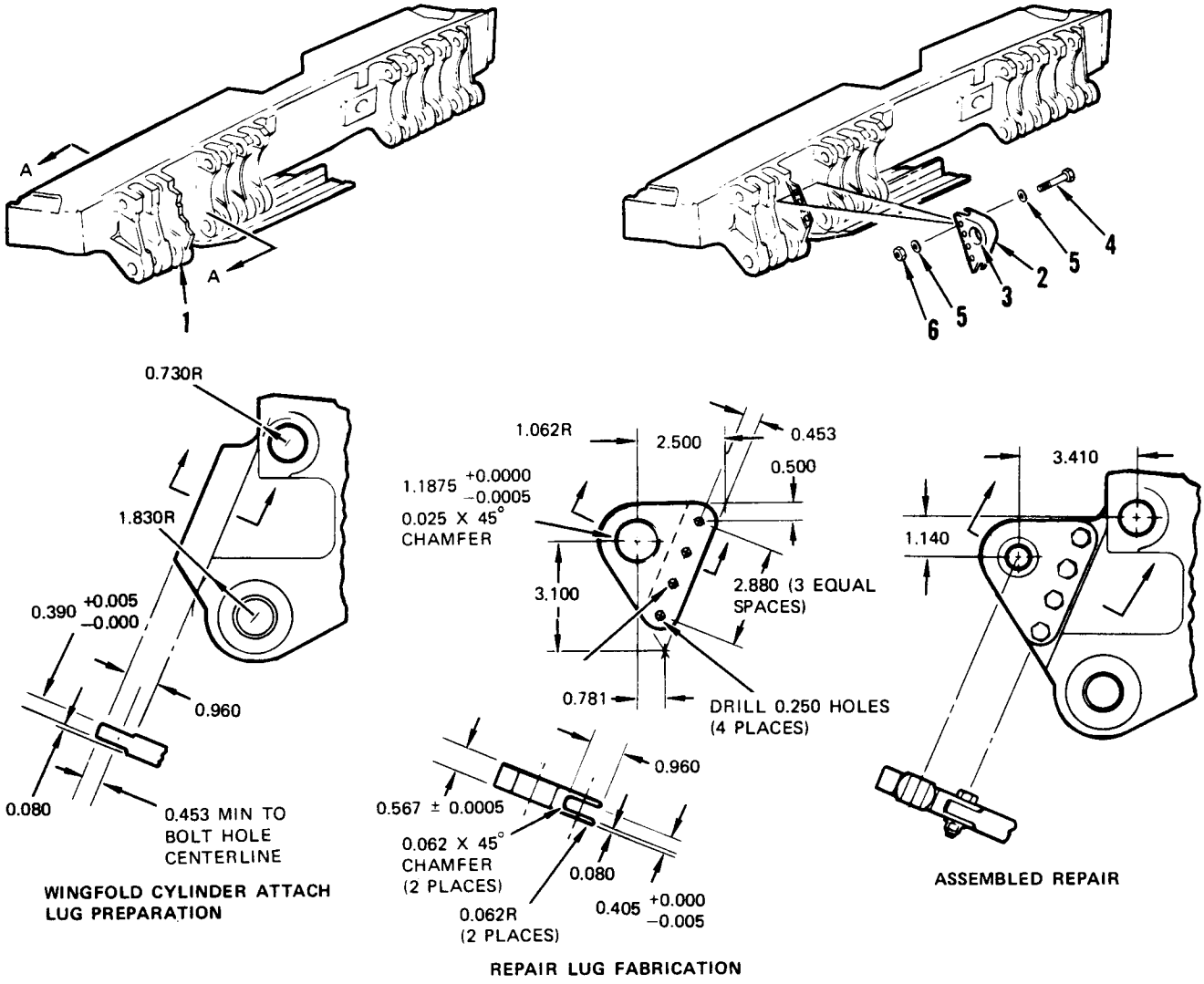
WARNING

Grinding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

2. Hone or grind finger fairing to clear damaged area (0.030 inch maximum).
3. Remove damage. Blend area and break sharp corners to a 0.030 inch minimum radius.
4. Smooth surface of area to a 125 finish.
5. Treat area with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
6. Refinish surface with original finish materials (T.O. 1A-7D-23).

90D212-01-85

Figure 5-7. Wingfold Rib Damage and Repair Limits



SECTION A-A

INDEX NUMBER	NOMENCLATURE	PART NUMBER	MATERIAL	QUANTITY REQUIRED
1	Wingfold cylinder attach lug	215-70058	7075-T6	Existing
2	Repair lug assembly		4130	1
3	Bearing	202-19001-10		1
4	Bolt	NAS464P5A10		4
5	Washer	AN960C516L		8
6	Nut	MS21042L5		4

90D213-01-01-85

Figure 5-8. Wingfold Rib Cylinder Attachment Lug Repair (Sheet 1 of 2)

REPAIR

1. Machine damaged area from attach lug (1) as shown in Section A-A.

NOTE

Treat all bare metal surfaces with a chemical conversion coating according to T.O. 1-1-2.

2. Fabricate repair lug (2) from 4130 steel as shown.

3. Heat treat repair lug to 130 KSI before installing bearing.

WARNING

MIL-S-22473 adhesive is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

4. Install bearing (3) using MIL-S-22473, Class A adhesive, press fit and seat flush with lug.

5. Finish machined area of wingfold rib with one coat of MIL-P-23377 epoxy polyamide primer, and one coat of MIL-C-22750 gloss white epoxy polyamide enamel (T.O. 1A-7D-23).

6. Finish repair lug with wash primer, one coat of epoxy primer, and one coat of gloss white epoxy enamel (T.O. 1A-7D-23).

7. Aling repair lug assembly (2) in exact position of original lug.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

8. Drill four 0.312-inch holes on assembly through machined area of attach lug (1) using repair lug (2) as a guide.

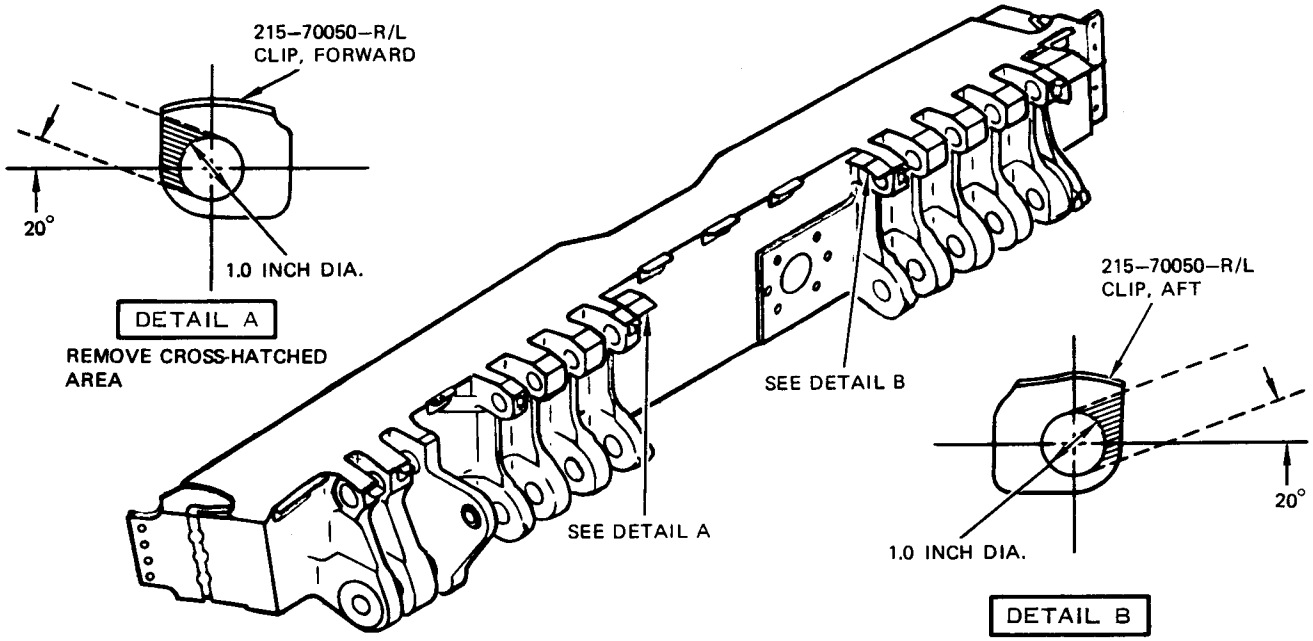
NOTE

Shim if required to dimension using aluminum laminated shim; maximum shim shall be 0.020-inch.

9. Secure repair lug to wingfold cylinder attach lug rework area using four NAS464P5A10 bolts (4), eight AN960C516L washers (5) and four MS21042L5 nuts (6).

90D213-02-01-85

Figure 5-8. Wingfold Rib Cylinder Attachment Lug Repair (Sheet 2)



WINGFOLD RIB CLIP REPLACEMENT

1. Remove four fasteners attaching clip to doubler and fairing.
2. Remove nut from wing outer panel bolt.
3. Retract bolt enough to gain access to clip (approximately one inch).

CAUTION

The clips are bonded to the rib. The rib is critical aircraft structure which cannot tolerate nicks or scratches. Ensure that the clip is separated from the wingfold rib and the rib is protected against damage from any tools before cutting a slot into the clip.

4. Using a sharpened piece of wood or phenolic, separate the clip from the rib.
5. Cut a slot in the clip (Detail A or B).
6. Remove clip.
7. Cut a slot in replacement clip (Detail A or B).
8. Treat exposed edges of clip with MIL-C-81706 or MIL-C-5541 chemical conversion coating (T.O. 1A-7D-23).
9. Apply MIL-C-23377 epoxy primer in accordance with MIL-C-22751.
10. Apply MIL-C-22750 epoxy polyamide enamel, color 17875 of FED-STD-595 in accordance with MIL-C-22751.
11. Remove old bonding material from rib and prepare bonding surface of clip and rib.

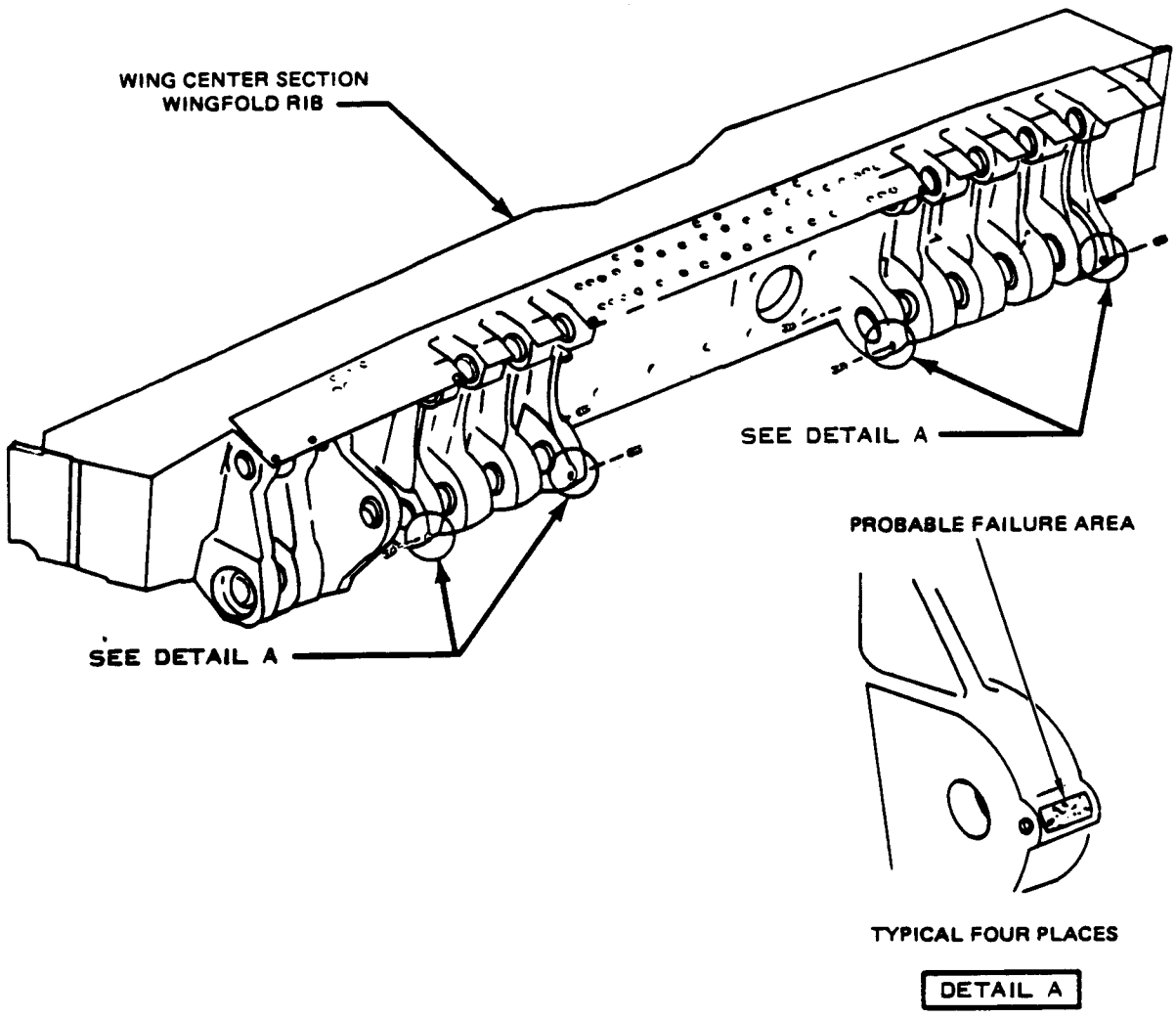
WARNING

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

12. Completely coat one faying surface with MIL-S-81733 sealant 1/32 inch ±1/64 inch thickness.
13. Immediately, install clip using pressure to obtain a squeeze out of sealant around all edges. Remove the squeeze out to form a fillet around all edges.
14. Secure clip in position by tightening wing outer panel attach bolt.
15. Replace fasteners (MS20601 AD4-3) removed in step 1.

90D214–01–85

Figure 5-9. Wingfold Rib Clip Replacement



DAMAGE LIMITATIONS

Cracks in the hinge pin cylinder attach point bolt holes or hinge pin lock latch assembly attach point bolt holes (Detail A) are acceptable if helicoils are secure in bolt holes. Ensure proper attaching hardware and torque values are used when reinstalling components.

REPAIR

If bolt holes (Detail A) are cracked and helicoils are loose in hole, repair as follows:

1. Remove helicoil.
2. Reinstall components with bolts and MS 21042 nuts.

NOTE

Machine (file) surface of lug to provide flat surface for nut. Refinish reworked area in accordance with T.O. 1A-7D-23.

3. Verify new attaching hardware does not interfere with wingfold operation.

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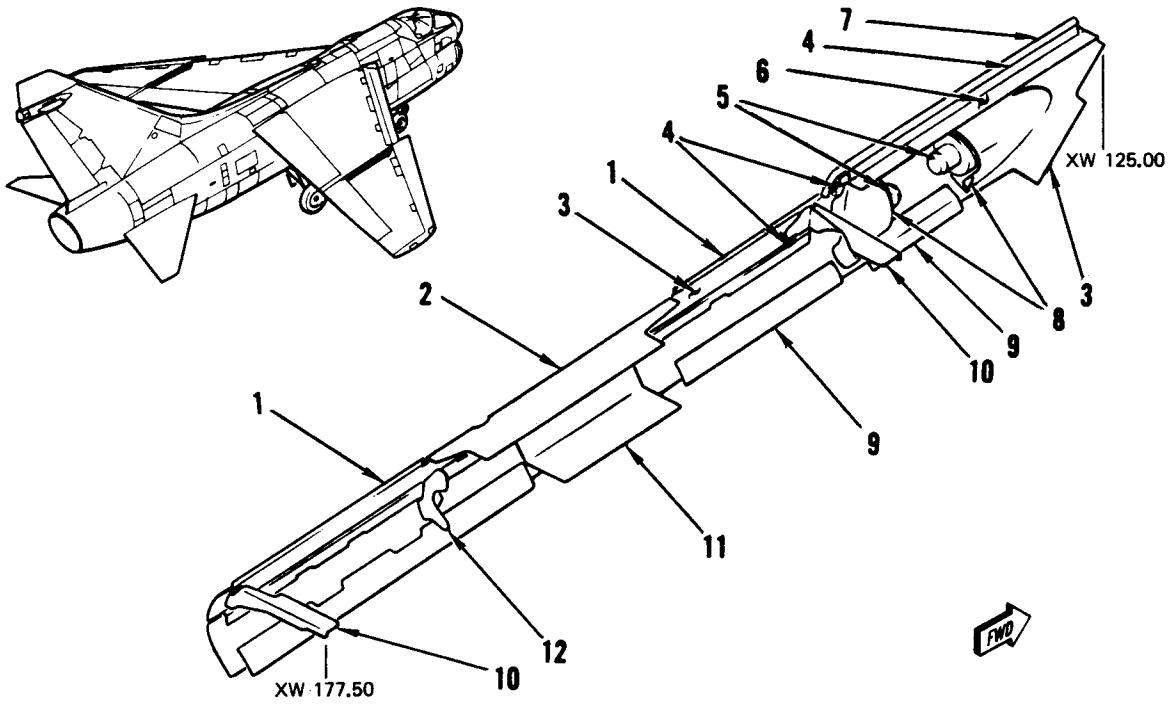
Figure 5-10. Wingfold Rib Hinge Pin Cylinder/Lock Latch Assembly Bolt Hole Repair



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70093	Fairing Installation, Wingfold			
1	215-70093	Extension, Outer .	0.025 X * X *	2024-T3	Section XII
2		Angle, Outboard . .	0.080 X 3.40 X 14.60	2024-T42	Section XII
3†		Fairing, WOP . . .	0.72 X * X *	2024-T42	Section XII
4		Retainer	0.020 X * X *	2024-T3	Section XII
5	215-70515	Plug	2.200 Dia X 1.40	Reinforced Plastic	Replace
6	215-70093	Stiffener (Extr) .	CPC20E2 (16440)	2024-T3511	Section XV
7		Seal (Extr)	CPC15E36 (PWR-P-78)	Rubber	Section XV
8		Bracket	0.050 X 3.40 X *	2024-T42	Section XII
9		Extension, WCS . .	0.025 X * X *	2024-T3	Section XII

See footnotes at the end of the figure.

Figure 5-11. Wingfold Fairing Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
10		Clip	0.050 X * X *	2024-T3	Section XII
11		Angle, WCS	0.080 X 3.70 X 7.20	2024-T6	Section XII
12		Clip	0.040 X 3.00 X 3.70	2024-T3	Section XII

*Length or length and width may vary with location.
†Fairing replacement:

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

a. Apply MIL-S-8802 sealant to fairing faying surface.
b. Install fairing.
c. Inject sealant in all voids and gaps existing after installation.
d. Ensure adequate trim of fairing by folding wings to check clearance of fairing to wing during folding cycle.

Figure 5-11. Wingfold Fairing Installation (Sheet 2)

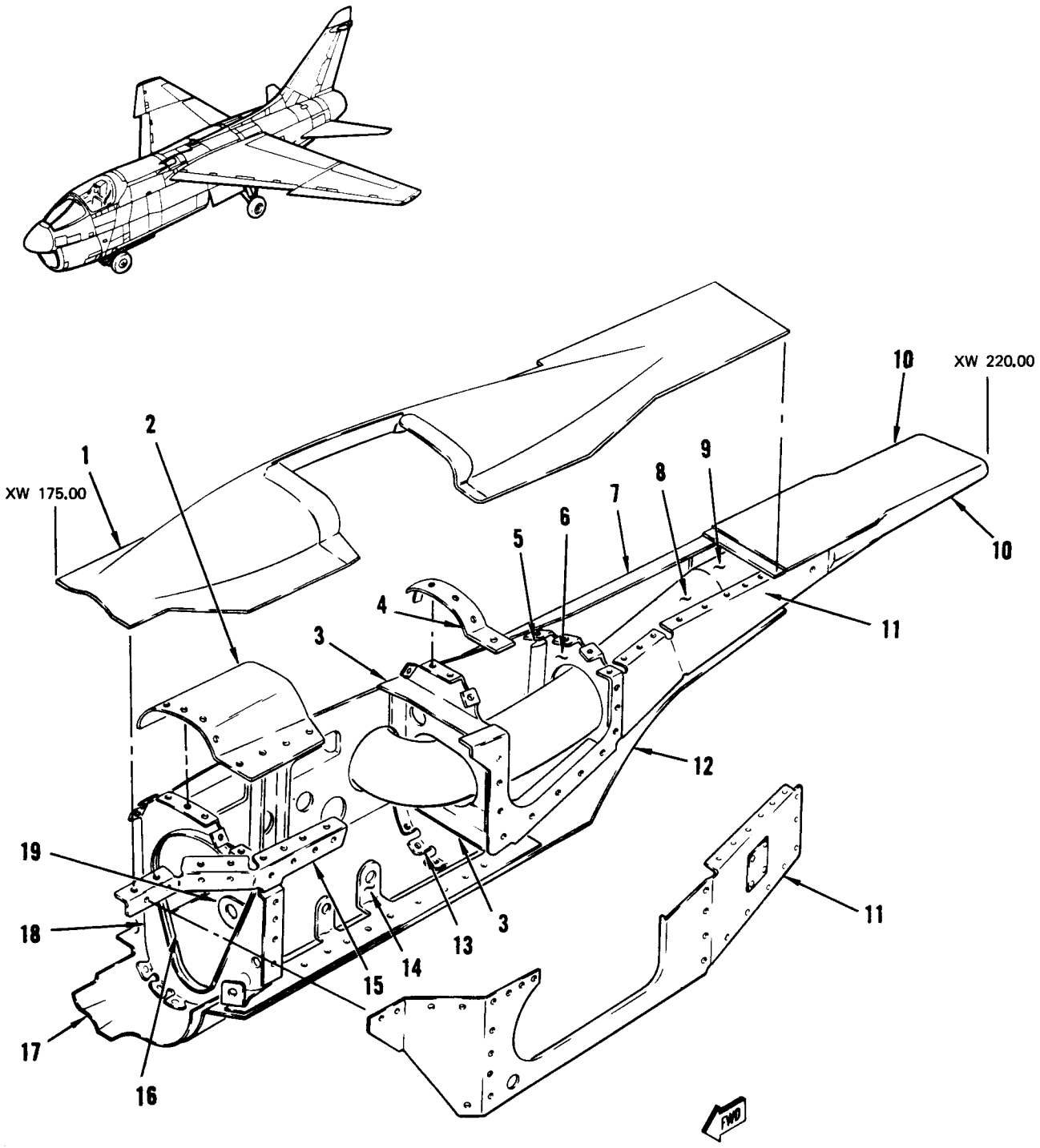


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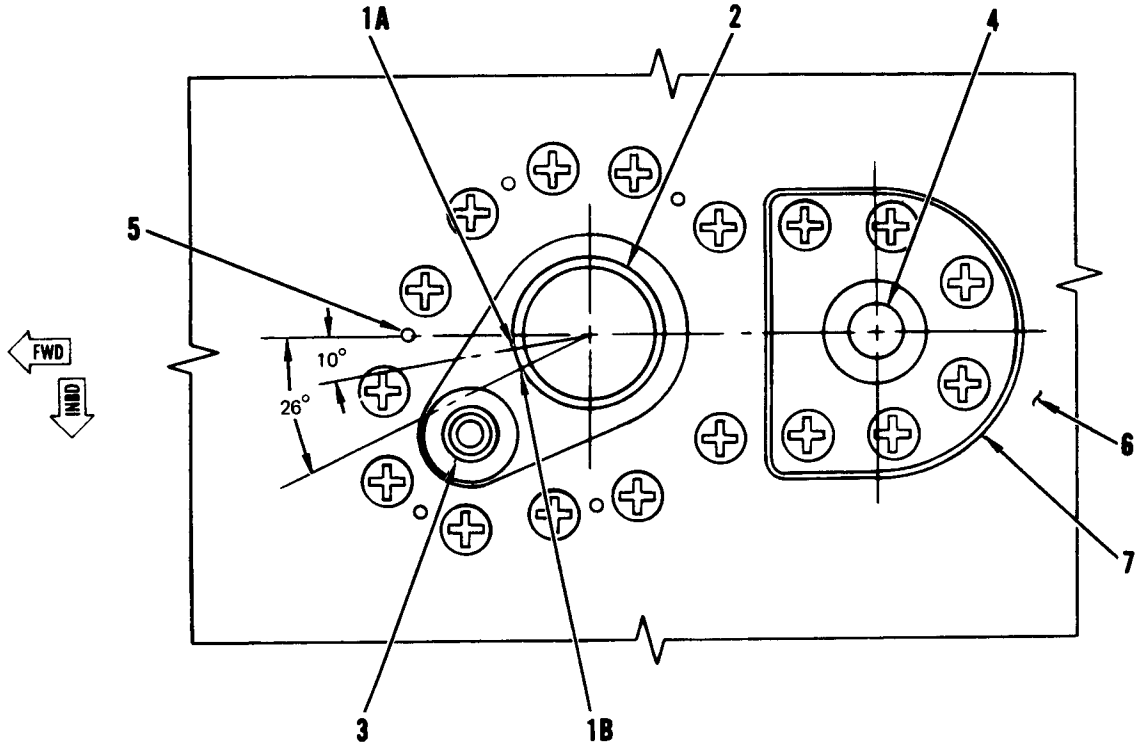
Figure 5-12. Wing Center Section Wingfold Fairing (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70077	Fairing Installation, Wing Center Section Trailing Edge			
1	215-70077	Skin, Upper	0.040 X 7.80 X 34.00	2024-T42	Section XII
2		Reinforcement . . .	0.040 X 5.20 X 5.80	2024-T42	Section XII
3		Clip	0.050 X * X *	7075-T6	Section XII
4		Doubler	0.040 X 1.50 X 5.80	2024-T42	Section XII
5		Support (Extr) . .	AND10134-1202	7075-T6511	Section XV
6		Bulkhead	0.032 X 5.80 X 6.50	7075-T6	Section XII
7		Rib	0.050 X 6.50 X 13.90	7075-T6	Section XII
8		Tube	0.049 X 2.00 X 23.00	6061-T6	Section XII
9		Tube Half	0.032 X 4.30 X 3.00	6061-T6	Section XII
10		Nozzle	0.040 X 5.70 X 15.90	6061-T4	Section XII
11		Rib	0.032 X * X *	2024-T42	Section XII
12		Skin, Lower	0.025 X 10.60 X 27.40	2024-T42	Section XII
13		Bulkhead	0.040 X 6.90 X 9.10	7075-T6	Section XII
14		Reinforcement . . .	0.071 X 3.10 X 14.30	2024-T42	Section XII
15		Edge	0.040 X 4.00 X 9.30	2024-T42	Section XII
16		Angle	0.080 X 3.60 X 7.60	7075-T6	Section XII
17		Splice	0.040 X 2.90 X 7.30	2024-T42	Section XII
18		Frame	0.040 X 7.50 X 9.90	7075-T6	Section XII
19		Clip	0.050 X 1.20 X 2.70	2024-T42	Section XII

*Length or length and width may vary with location.

Figure 5-12. Wing Center Section Wingfold Fairing (Sheet 2)



WING LOWER SURFACE
AT PYLON NO. 3 FUEL ATTACH POINT
(Pylon No. 6 Opposite)

Index Number	Nomenclature	Part Number	Material	Quantity Required
1 A B	Spring pin Original pin location New pin location	NAS 561-3-4	Steel	1
2	Insert	215-70473-1	Cres 303	1
3	Air connector (Ref)	215-70098-11, -12	7075-T6	Existing
4	Pylon aft attach hole (Ref)			Existing
5	Tooling hole			Existing
6	Skin (Ref)	215-70026-15, -16		Existing
7	Retainer (Ref)	215-70052-15	2024-T3	Existing

REPAIR PROCEDURE:

1. Collect the following tools and materials:

EQUIPMENT

Metal saw or file
H-B-351 brush (2)
No. 42 drill (0.093)
Drill stop
Drill motor
Reamer (for No. 42 drill hole)

MATERIALS

O-A-51 Acetone, technical
MIL-S-22473, Grade T or N sealing, locking and retaining compound
MIL-R-46082 Retaining compound, single component, anaerobic
MIL-C-81706 Chemical conversion coating.
Grease pencil

90D218-01-01-85

Figure 5-13. Pylon-to-Wing Fuel Connection Insert Repair (Sheet 1 of 2)

2. When the NAS 561-3-4 spring pin (1) has been sheared by a loosened 215-70473-1 insert (2), proceed as follows:

CAUTION

When removing pin (1) and insert (2) take extreme care not to score or damage inside walls of rib fuel hole cavity.

a. Remove 215-70473-1 (2) insert from rib fuel hole cavity.

NOTE

If difficulty is encountered, cut through one side of insert with a metal saw or file and collapse inward to remove.

b. Remove broken NAS 561-3-4 (1) spring pin.

WARNING

Acetone is flammable and highly toxic to skin; eyes and respiratory tract. Skin and eye protection required. Avoid all contact. Good general ventilation is normally adequate. Keep away from open flames or other sources or ignition.

c. Clean rib fuel hole with Q-A-51 acetone and air dry.

d. If insert was removed undamaged, clean with acetone and air dry.

3. If spring pin hole in rib fuel hole cavity is undamaged, prepare parts for reinstallation as follows:

WARNING

MIL-S-22473 sealing compound is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

NOTE

Make sure the parts are at room temperature.

a. Apply a thin coat of MIL-S-22473, Grade T or N sealing compound to the insert and rib fuel hole cavity. Use a H-B-351 nylon bristle brush or other suitable application tool.

b. Allow sealing compound coat to dry 5 minutes.

WARNING

MIL-R-46082 retaining compound is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

c. Apply MIL-R-46082 retaining compound to mating surfaces using a nylon bristle brush or other suitable application tool.

d. Install insert and new spring pin as in original installation.

e. Allow retaining compound to cure 30 minutes.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

4. If new hole for spring pin must be drilled, proceed as follows:

CAUTION

Do not drill spring pin hole in any other area than specified as wing fuel cavity will be penetrated resulting in additional damage.

a. Locate new hole (1B) 26° toward the air connector hole (3) from a centerline taken through the pylon aft attach hole (4), rib fuel hole, and tooling hole (5). Mark 26° line on wing surface using a grease pencil.

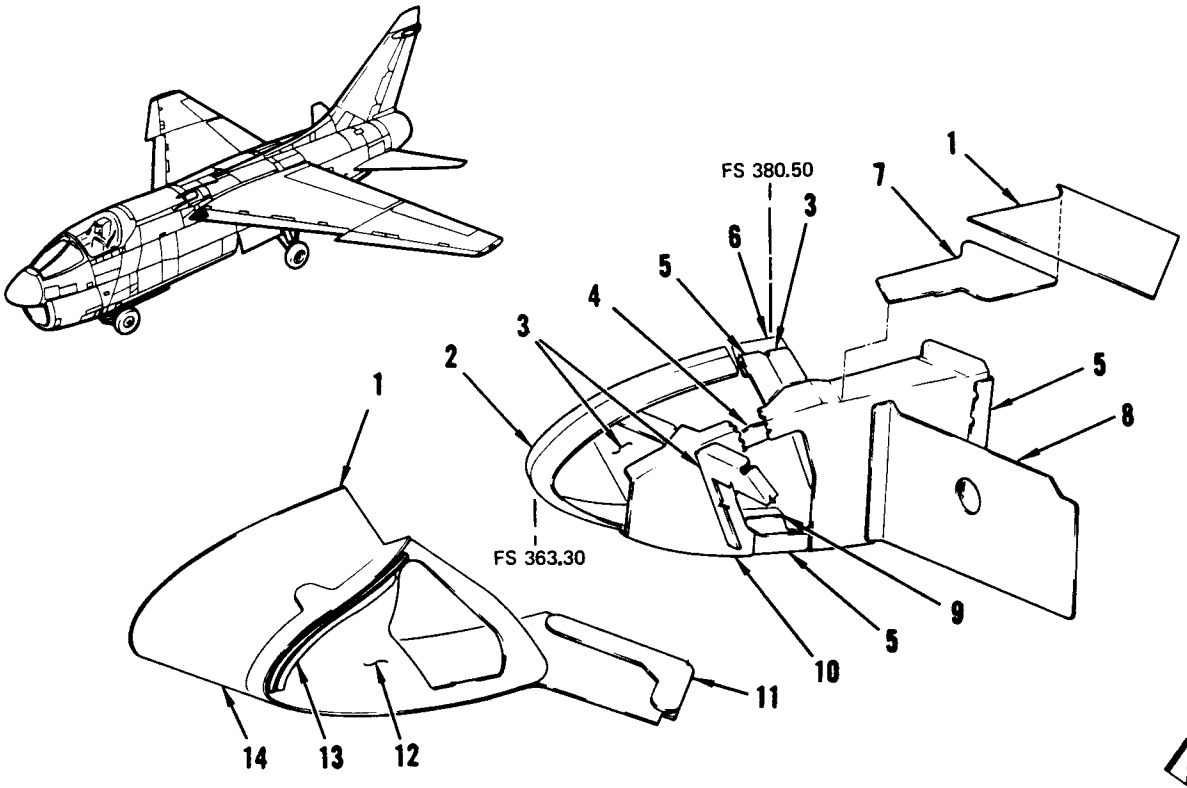
b. Using a No. 42 drill (0.093 inch diameter) and drill stop, drill new spring pin hole 0.380 inch deep into the fuel hole cavity wall at a 30° angle to the surface of the wing. Ream to 0.0938 (+0.002, −0.001) inch.

c. Apply a MIL-C-81706 chemical conversion coating to inside surfaces of new hole (T.O. 1A-7D-23).

d. Repeat procedure 3.

90D218-02-01-85

Figure 5-13. Pylon-to-Wing Fuel Connection Insert Repair (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70096	Fairing Installation, Leading Edge			
1	215-70096	Skin	0.050 X * X *	7075-T6	Section XII
2		Cuff	6 Ply	Reinforced Plastic	Section XIV
3		Gusset	0.050 X * X *	7075-T6	Section XII
4		Angle	0.080 X 1.80 X 7.20	7075-T6	Section XII
5		Angle	0.050 X * X *	7075-T6	Section XII

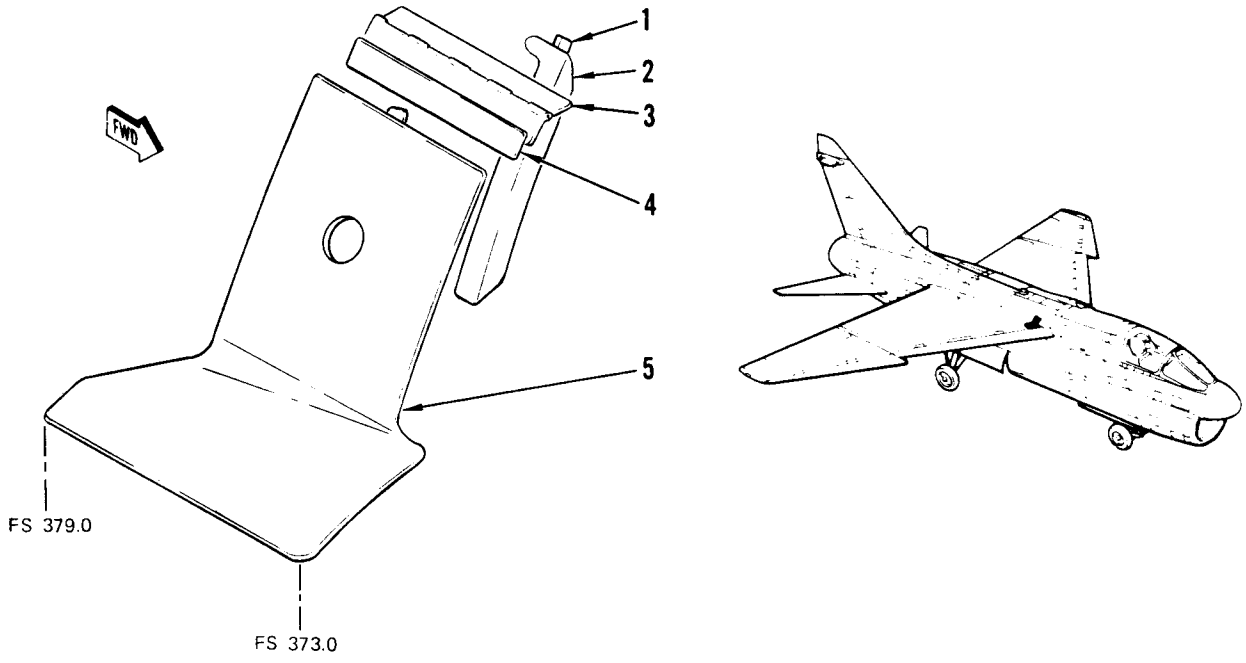
See footnote at the end of the figure.

Figure 5-14. Wing-to-Fuselage Fairing Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
6		Bumper	0.750 X 1.50 X 2.50	Rubber	Replace
7		Doubler	0.050 X 3.50 X 6.50	7075-T6	Section XII
8		Web	0.040 X 6.00 X 8.50	7075-T6	Section XII
9		Bumper	0.500 X 1.50 X 2.50	Rubber	Replace
10		Rib	0.050 X 11.50 X 17.00	7075-T6	Section XII
11		Doubler	0.040 X 4.00 X 5.50	7075-T6	Section XII
12		Rib	6 Ply	Reinforced Plastic	Section XIV
13		Stiffener	0.040 X 1.50 X 7.00	7075-T6	Section XII
14		Seal (Extr)	215-70149-1	Teflon	Section XV

*Length or length and width may vary with location.

Figure 5-14. Wing-to-Fuselage Fairing Installation (Sheet 2)



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INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70108	Door Installation, Access, Hoist, Forward			
1	215-70108	Stiffener	0.040 X 1.00 X 6.10	7075-T6	Section XII
2		Frame	0.040 X 2.25 X 6.10	7075-T6	Section XII
3		Hinge (Extr) . . .	MS20001-4	2024-T3511	Section XV
4		Filler	0.040 X 0.55 X 3.50	7075-T6	Section XII
5		Skin	0.072 X 6.70 X 10.00	7075-T6	Section XII

Figure 5-15. Wing Forward Hoist Point Access Door

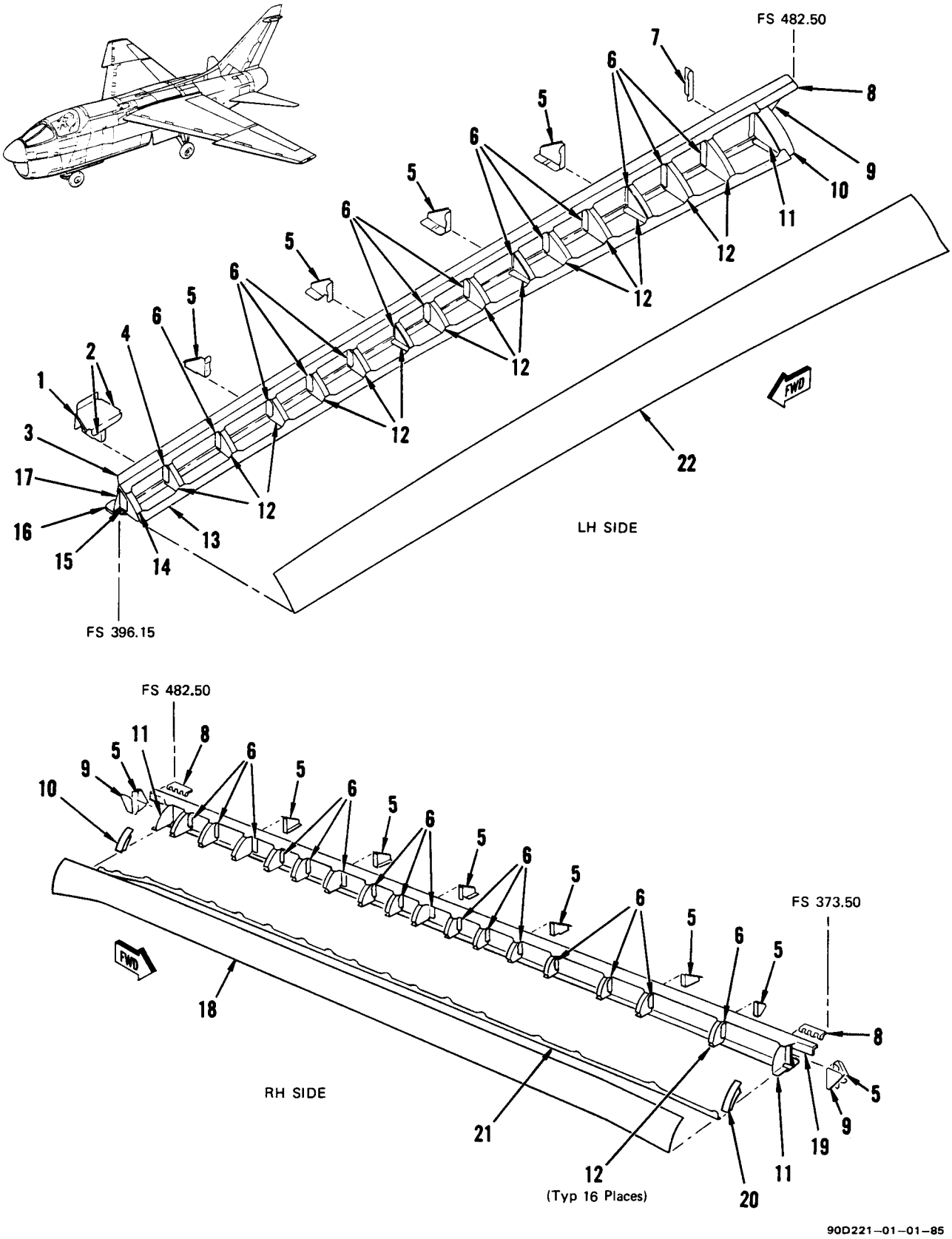


Figure 5-16. Wing Root Fairing (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70097	Rib Installation,			
	218-70097	Wing Center Section Fairing, Outboard			
1	216-70097	Gusset	0.040 X 2.9 X 3.4	2024-T3	Section XII
2		Bracket	0.040 X 5.2 X 4.2	2024-T3	Section XII
3		Cap (Extr)	CVC10013-147	7075-T6	Section XV
4		Clip	0.040 X 1.5 X 2.3	7075-T6	Replace
5	215-70097	Bracket	0.050 X * X *	7075-T6	Section XII
6		Clip	0.040 X * X *	7075-T6	Replace
7		Clip	0.050 X 1.8 X 3.2	7075-T6	Replace
8		Hinge (Extr) . . .	MS20001-5	2024-T4	Section XV
9		Web	0.040 X * X *	7075-T6	Section XII
10‡		Tee (Extr)	CVC10010-16	7075-T6511	Section XV
§	218-70097	Tee (Extr)	CVC10010-16	7075-T6511	Section XV
11	215-70097	Former	0.040 X 4.6 X 5.0	7075-T6	Section XII
12‡,†		Former	0.020 X * X *	2024-T62	Replace
§	218-70097	Former	0.040 X * X *	2024-T62	Replace
13‡,†	216-70097	Stiffener (SW) . .	0.020 X 1.5 X 81.6	2024-T3	Section XII
§	218-70097	Stiffener	0.040 X 1.5 X 81.6	2024-T62	Section XII
14‡	216-70097	Former	0.050 X 3.0 X 4.0	7075-T6	Replace
§	218-70097	Former	0.050 X 3.0 X 4.0	7075-T6	Replace
15	216-70097	Clip	0.050 X 1.8 X 2.0	7075-T6	Replace
16	216-70487	Cap (Extr)	CVC10013-33	7075-T6511	Section XV
17	216-70097	Web	0.025 X 3.8 X 82.1	7075-T6	Section XII
18†	215-70097	Skin (SW)	0.020 X 6.1 X 100.5	2024-T3	Section XII
19		Cap (Extr)	CVC10013-34	7075-T6511	Section XV
20‡		Tee (Extr)	CPC20E3 (11771)	7075-T6	Section XV
§	218-70097	Tee (Extr)	CPC20E3 (11771)	7075-T6	Section XV
21†	215-70097	Stiffener (SW) . .	0.020 X 1.5 X 100.5	2024-T62	Section XII
22‡	216-70097	Skin (SW)	0.020 X 6.1 X 81.6	2024-T3	Section XII
§	218-70097	Skin	0.040 X 6.1 X 81.6	2024-T3	Section XII

*Length or length and width may vary with location.
†Replace/repair parts can be made from 0.040-gage material.
‡Airplanes AF69-6197 through AF73-1014.
§Airplanes AF73-1015 and subsequent.

Figure 5-16. Wing Root Fairing (Sheet 2)

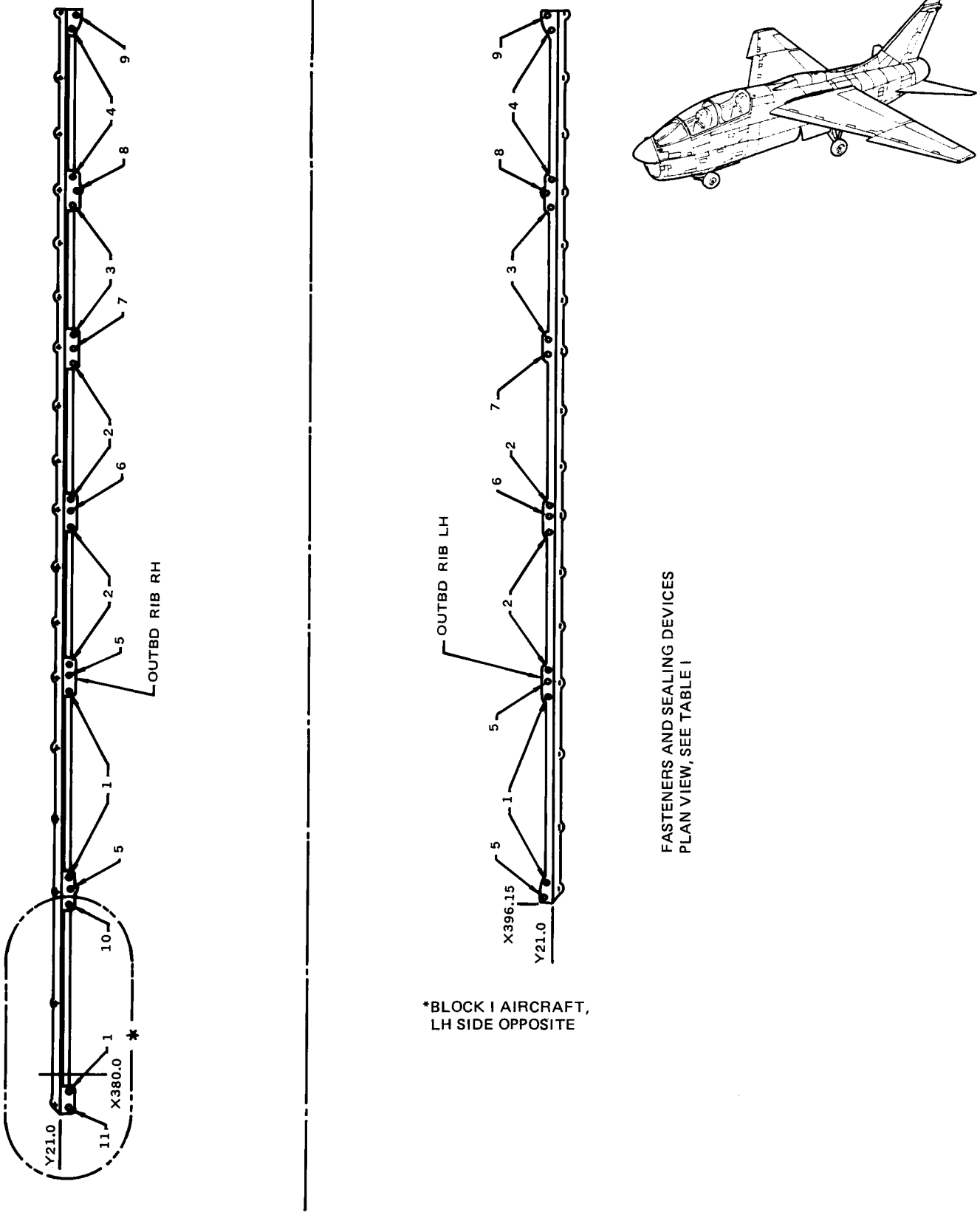


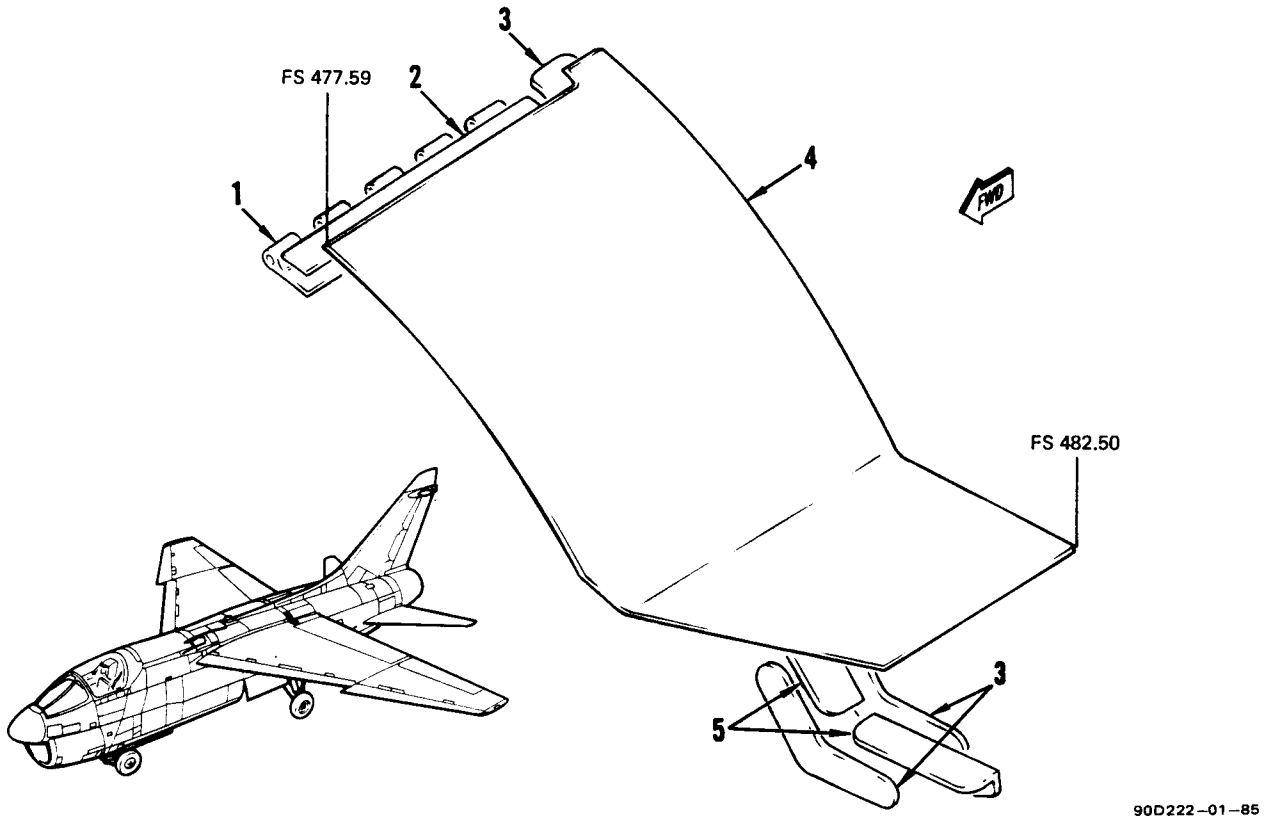
Figure 5-16.1. Wing Root Fairing Installation (Sheet 1)

TABLE I

WING ROOT FAIRING FASTENERS AND SEALING DEVICES

ITEM	BOLT	WASHER	NUT	SEALING DEVICE
1	NAS1304-7	AN960D416		NAS1473A4 IN WING
2	NAS1304-8	AN960D416		NAS1473A4 IN WING
3	NAS1304-9	AN960D416		NAS1473A4 IN WING
4	NAS1304-11	AN960D416		NAS1473A4 IN WING
5	NAS1304-10	AN960D416		600-042-1/4 UNDER LOWER CAP
6	NAS1304-11	AN960D416		600-042-1/4 UNDER LOWER CAP
7	NAS1304-12	AN960D416		600-042-1/4 UNDER LOWER CAP
8	NAS1304-14	AN960D416		600-042-1/4 UNDER LOWER CAP
9	NAS464P5A17	AN960D516 2 REQD	MS21042-5	
10	NAS1304-6	AN960D416		NAS1473A4 IN WING
11	NAS464P4A11	AN960D416 2 REQD	MS21042L4	

Figure 5-16.1. Wing Root Fairing Installation (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70109	Door Installation, Access Hoist, Aft			
1	215-70109	Hinge (Extr) . . .	MS20001-4PH550	2024-T3511	Section XV
2		Filler	0.032 X 0.60 X 5.00	7075-T6	Section XII
3		Plate	0.032 X * X *	7075-T6	Section XII
4		Skin	0.072 X 5.80 X 10.50	7075-T6	Section XII
5		Frame	0.040 X * X *	7075-T6	Section XII

*Length or length and width may vary with location.

Figure 5-17. Wing Aft Hoist Point Access Door

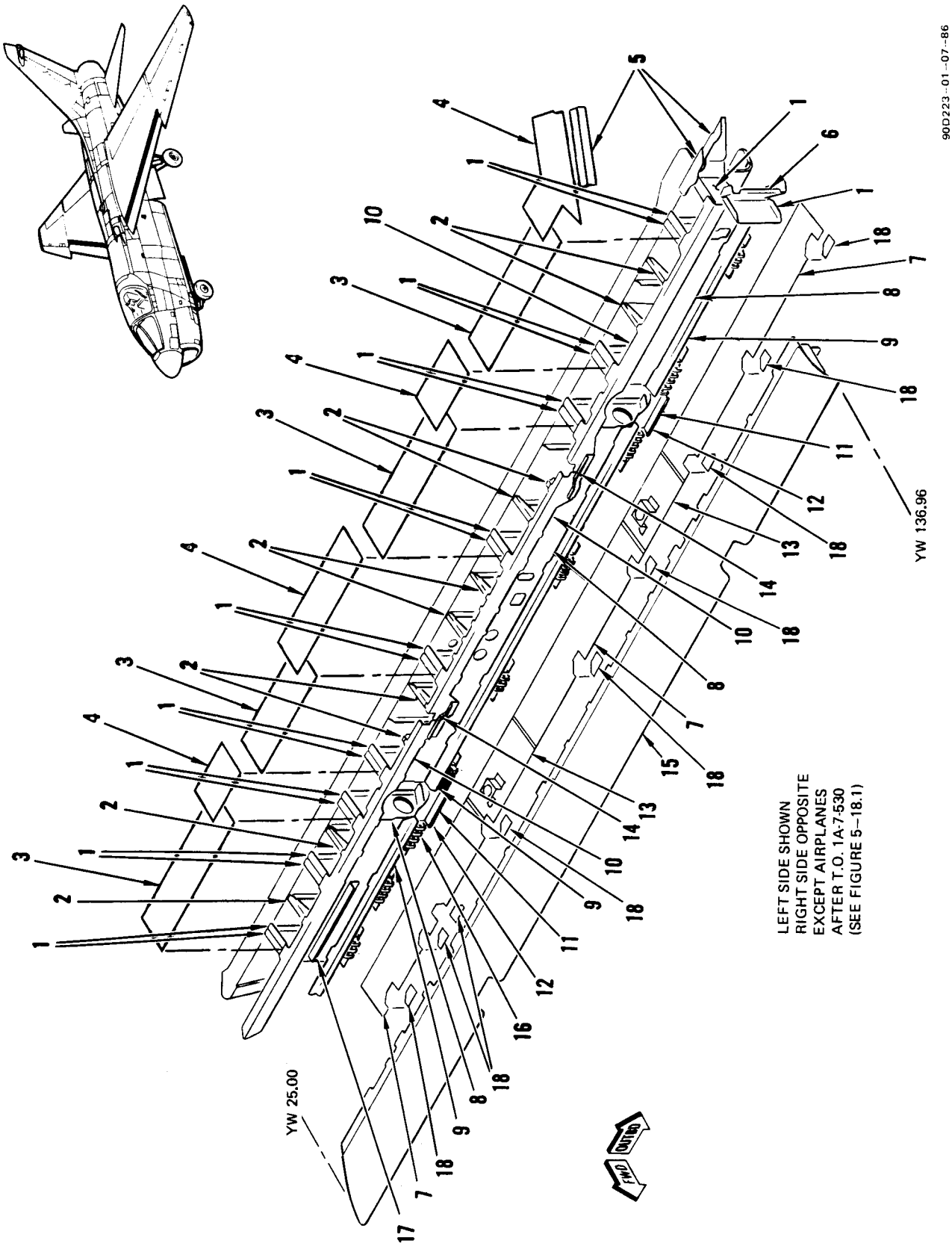


Figure 5-18. Wing Center Section Leading Edge Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70023	Leading Edge Installation, Wing Center Section			
1	215-70023	Rib	0.063 X * X *	7075-T6	Section XII
2		Gusset	0.050 X * X *	7075-T6	Section XII
3		Skin, Upper	0.050 X 3.40 X *	7075-T6	Section XII
4		Cover	0.050 X 3.40 X *	7075-T6	Section XII
5		Angle	0.040 X * X *	7075-T6	Section XII
6		Rib	0.040 X 4.70 X 6.80	7075-T6	Section XII
7		Skin, Lower (Chem Mill) . . .	0.090 X 8.10 X *	7075-T6	Section XII
8		Web	0.040 X * X *	7075-T6	Section XII
9		Seal	0.025 X 1.70 X *	7075-T6	Section XII
10		Cap	0.063 X * X *	7075-T6	Section XII
11		Retainer	0.020 X 0.50 X *	7075-T6	Replace
12		Seal (Extr)	215-70149-5	Rubber	Section XV
13		Cover	0.090 X 4.10 X *	7075-T6	Section XII
14		Angle	0.071 X 1.50 X *	7075-T6	Section XII
15	218-77703	Harness (Bonded) .		Reinforced Plastic	5-20
16	215-70023	Hinge (Extr) . . .	CVC10041-20	7075-T6511	Section XV
17		Angle	0.050 X 1.60 X 13.50	7075-T6	Section XII
18		Door	0.090 X 1.60 X *	7075-T6	Replace

*Length or length and width may vary with location.

Figure 5-18. Wing Center Section Leading Edge Installation (Sheet 2)

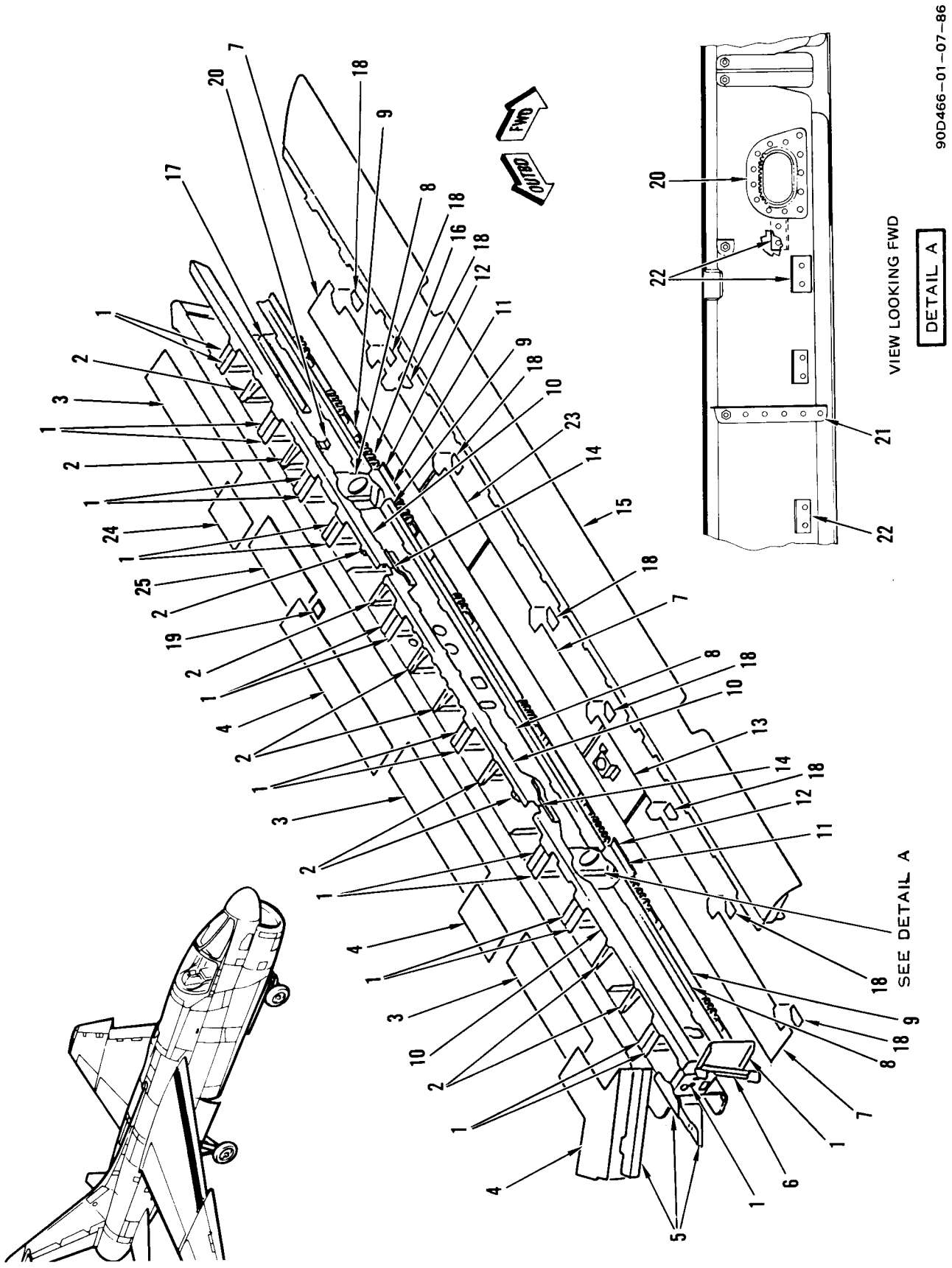


Figure 5-18.1. Right Wing Center Section Leading Edge Installation (Airplanes After T.O. 1A-7-530) (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70023	Leading Edge Installation, Wing Center Section			
1	215-70023	Rib	0.063 X * X *	7075-T6	Section XII
2		Gusset	0.050 X * X *	7075-T6	Section XII
3		Skin, Upper	0.050 X 3.40 X *	7075-T6	Section XII
4	236-70023	Cover	0.050 X 3.40 X *	7075-T6	Section XII
5	215-70023	Angle	0.040 X * X *	7075-T6	Section XII
6		Rib	0.040 X 4.70 X 6.80	7075-T6	Section XII
7		Skin, Lower (Chem Mill) . . .	0.090 X 8.10 X *	7075-T6	Section XII
8		Web	0.040 X * X *	7075-T6	Section XII
9		Seal	0.025 X 1.70 X *	7075-T6	Section XII
10		Cap	0.063 X * X *	7075-T6	Section XII
11		Retainer	0.020 X 0.50 X *	7075-T6	Replace
12		Seal (Extr)	215-70149-5	Rubber	Section XV
13		Cover	0.090 X 4.10 X *	7075-T6	Section XII
14		Angle	0.071 X 1.50 X *	7075-T6	Section XII
15	218-77703	Harness (Bonded) .		Reinforced Plastic	5-20
16	215-70023	Hinge (Extr) . . .	CVC10041-20	7075-T6511	Section XV
17		Angle	0.050 X 1.60 X 13.50	7075-T6	Section XII
18		Door	0.090 X 1.60 X *	7075-T6	Replace
19	236-70023	Filler	0.100 X 1.5 X 1.5	2024-T3	Replace
20	236-70023	Doubler	0.063 X 2.8 X 4.2	2024-T3	Replace
21	236-70023	Bracket	0.050 X 4.0 X 7.0	2024-0	Section XII
22	236-70023	Support	0.063 X 1.5 X 1.9	2024-T3	Replace
23	236-70023	Skin	0.090 X 4.1 X 13.0	7075-T6	Section XII
24		Door	0.050 X 3.4 X 14.45	7075-T6	Section XII
25		Skin	0.050 X 3.4 X †	7076-T6	Section XII

*Length or length and width may vary with location.
†Cut length to obtain 0.002 to 0.060 gap at each end.

Figure 5-18.1. Right Wing Center Section Leading Edge Installation (Airplanes After T.O. 1A-7-530) (Sheet 2)

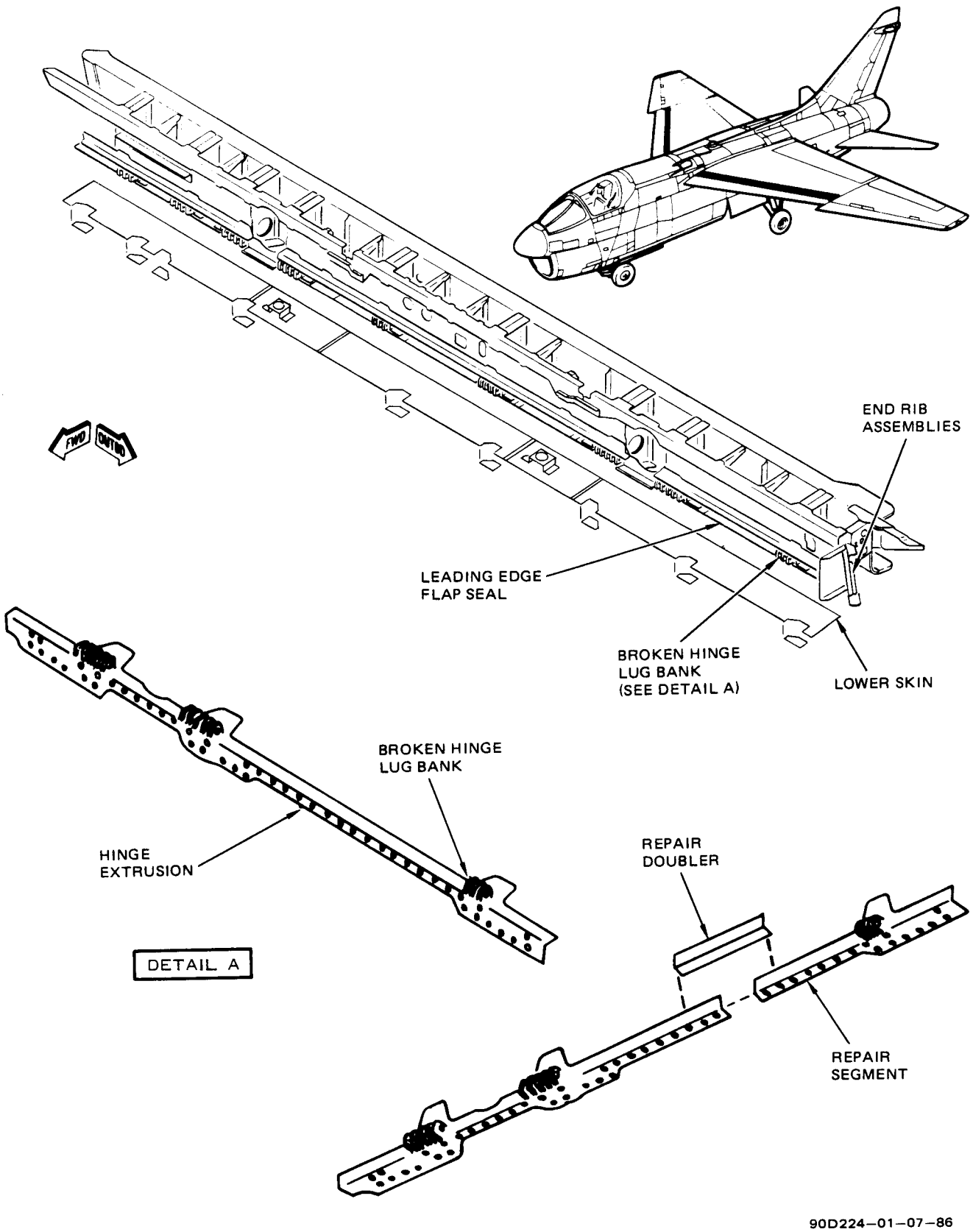


Figure 5-19. Wing Center Section Leading Edge Flap Hinge Repair (Sheet 1 of 2)

REPAIR LIMITATIONS

Repair left or right wing center section outboard leading edge flap hinge lugs using repair segment Part No. 7935792-01/02, if more than one lug is broken/cracked.

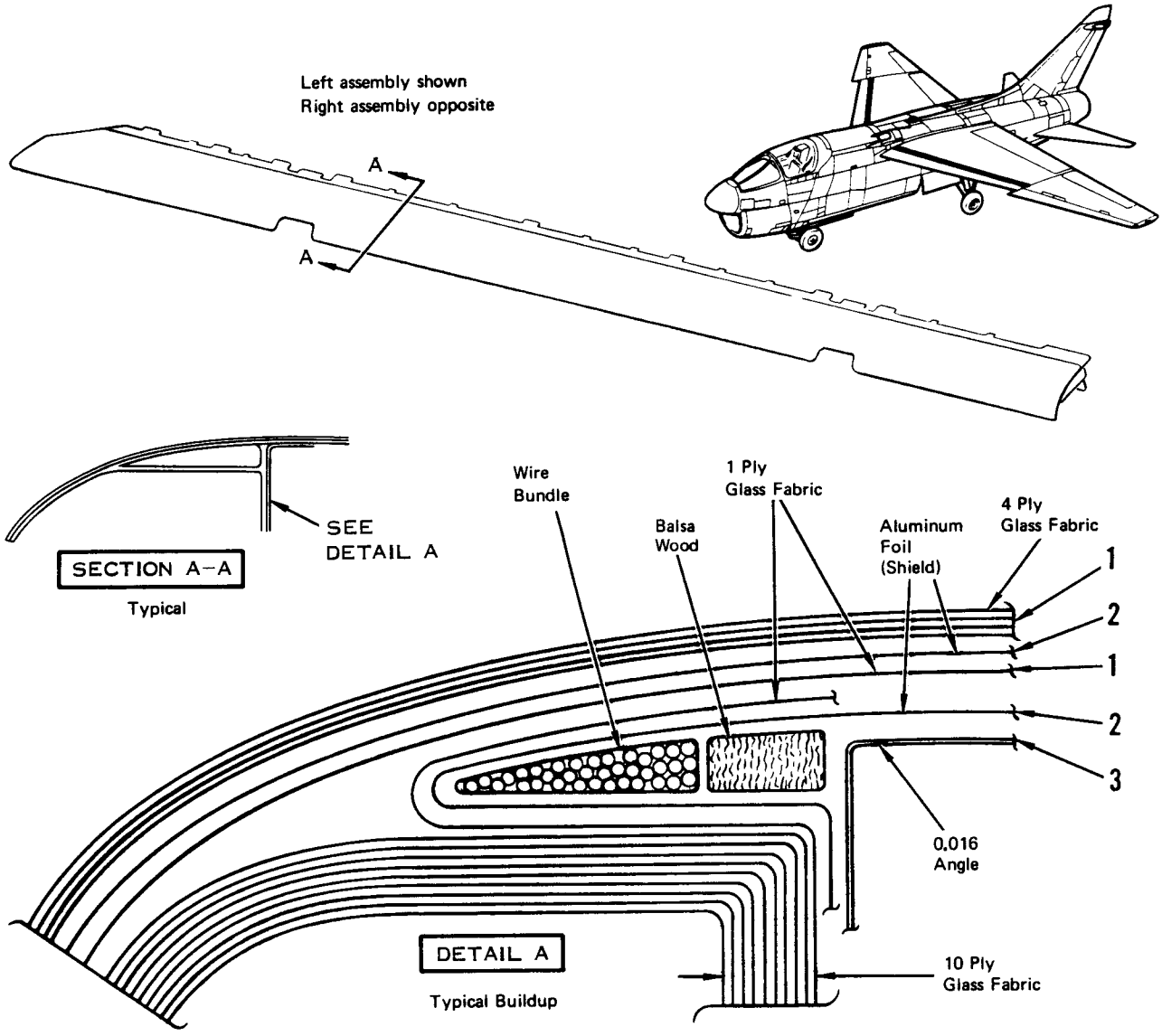
REPAIR

Repair broken or damaged left or right wing center section outboard leading edge flap hinge lug banks, with wing outer panel removed or folded, as follows:

1. Remove leading edge flap for access to broken hinge lug bank(s) as appropriate.
2. Remove fasteners extending through leading edge flap seal, Part No. 215-70023-49/-50.
3. Remove fasteners extending through lower skin, Part No. 215-70023-117/118, from outboard end of skin to the outboard actuator. Position skin out of way.
4. Remove end rib assemblies, Part No. 215-70023.
5. Cut existing damaged hinge extrusion 12.40 inches from outboard end. Avoid damage to surrounding structure. Slide out damaged hinge section.
6. Fabricate a repair doubler from 0.063 gauge CRES (301, 302, 321, etc.) 1/4 hard to nest inside 7935792-01/-2 repair segment. This "L" shape doubler shall be approximately 0.80 x 0.75 inch, 6.5 inches long, with a 100 degree bend angle.
7. Position doubler and repair segment, Part No. 7935792-01/02, in center section.
8. Locate repair segment using leading edge flap as fixture.
9. Locate nutplates for access panel screws.
10. Reinstall fasteners extending through lower skin and flap seal.
11. Reinstall end rib assemblies.

90D224-02-01-85

Figure 5-19. Wing Center Section Leading Edge Flap Hinge Repair (Sheet 2)



LEADING PARTICULARS: 218-77703

90D225-01-01-85

INDEX	COMPONENT	MATERIAL	FINISH
1	Reinforced Plastic	Style no. 181-150 glass fabric (MIL-C-9084, type VIII A) with MIL-R-9299 resin.	1 coat epoxy primer (MIL-P-23377) and 2 coats acrylic nitrocellulose lacquer (MIL-L-19538). Refer to T.O. 1A-7D-23.
2	Shield	0.0002-inch aluminum foil (HH-I-001252, type I, class A), 1149-H19 mill finish	None required when used for repairs in accordance with this procedure
3	Angle	0.016 x 2.50 width aluminum (QQ-A-225/11), 6061-T6	1. Chemical conversion coating (T.O. 1A-7D-23). 2. 1 Coat of MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2.

Figure 5-20. Wing Center Section Leading Edge Electrical Cable Assembly Repair (Sheet 1 of 3)

INSPECTION PROCEDURES:

1. To inspect the cable assembly the center section actuators must be disconnected and the droop lowered.
2. Visually inspect cable assembly lower surface and at actuator cutouts for delamination, separation, cracks, and chafing or roughness. A mirror and a flashlight may be used to aid the visual inspection.
3. Tap-test actuator cutout areas with a coin to locate voids. A sharp, ringing sound generally indicates a well bonded area while a dull sound indicates a void. Tap-testing in the reinforced plastic is not required.

PREPARATION PROCEDURES:

Clean and degrease damaged area in same manner as for radomes (Section XIV)

DAMAGE EVALUATION AND REPAIR CHART

DAMAGE	REPAIR
Separation of reinforced plastic layup at outboard actuator cutout: 1. Separation visible on edge of cutout. 2. Separation not visible (void area) on edge of cutout.	Follow repair procedure J, Section XIV, using MIL-A-8623 epoxy adhesive or MIL-R-9300 epoxy resin. Follow repair procedure B, Section XIV, using MIL-A-8623 epoxy adhesive or MIL-R-9300 epoxy resin. Observe the following exception when drilling holes: **WARNING** Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate. Drill two No. 40 holes into the sharp radius of the fairing just above the cutout and approximately 2 inches apart.
Delamination of lower reinforced plastic skin to aluminum foil of upper reinforced plastic skin.	**WARNING** Fiberglass sanding is hazardous to personnel. Protective equipment consists of long sleeve shop coats or coveralls, gloves, goggles and respirators or vented exhaust hoods are required. Sand, separated surfaces with No. 240 grit wet-or-dry sandpaper before cleaning and degreasing. **WARNING** MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition. Mix MIL-S-8802 sealant or Epocast 8528A/B adhesive according to manufacturer's instructions. **CAUTION** Use care to avoid increasing delamination. Apply sealant or adhesive to faying surfaces using a spatula. Cure at room temperature according to manufacturer's instructions.

90D225-02-01-85

Figure 5-20. Wing Center Section Leading Edge Electrical Cable Assembly Repair (Sheet 2)

DAMAGE EVALUATION AND REPAIR CHART, CONT

DAMAGE	REPAIR
Hole or cut through upper reinforced plastic skin and exposed wires.	Replace cable assembly. If cable assembly cannot be replaced immediately, perform interim repairs as follows: 1. Shield wires with HH-I-001252 aluminum foil or thin aluminum plate, 0.012-inch maximum thickness, which should extend under the upper reinforced plastic skin to ground to the aluminum foil in the upper skin. 2. Fill in any cavities with MIL-R-9300 epoxy resin using techniques in accordance with repair procedure C, Section XIV. 3. Use stepped joint technique in accordance with repair procedure D, Section XIV, for repairing the upper reinforced skin with glass fabric and epoxy resin. 4. Sand or fill repaired areas to meet contour requirements. 5. Repair any damage to the lower skin in accordance with repair procedure A, Section XIV, except that two plies of No. 181 glass fabric must be used with epoxy resin to cover the damaged area.
Cracked cable assembly: 1. Cracks on lower surface. 2. Cracks on upper surface.	Repair in accordance with repair procedure A, Section XIV, except that two plies of No. 181 glass fabric must be used with epoxy resin to cover the damaged area. Repair in accordance with repair procedure D, Section XIV, using the stepped joint technique to cut back two plies of the reinforced skin in steps of approximately 1/2 inch each. Replace the two plies of glass fabric with No. 181 glass fabric patches and MIL-R-9300 epoxy resin.
Bowed cable assembly (evidence of crack or delamination damage).	Repair the upper surfaces in accordance with repair procedure D, Section XIV, using the stepped joint technique to cut back two plies of the upper reinforced skin in steps of approximately 1/2 inch each. Replace the two plies of glass fabric with No. 181 glass fabric patches and MIL-R-9300 epoxy resin. Repair the lower surfaces in accordance with repair procedure A, Section XIV, by the addition of two plies of No. 181 glass fabric and epoxy resin.
Chafed or rough cable assembly.	Fill surfaces with MIL-R-9300 epoxy resin in accordance with repair procedure C, Section XIV. Sand surfaces to contour.

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Figure 5-20. Wing Center Section Leading Edge Electrical Cable Assembly Repair (Sheet 3)

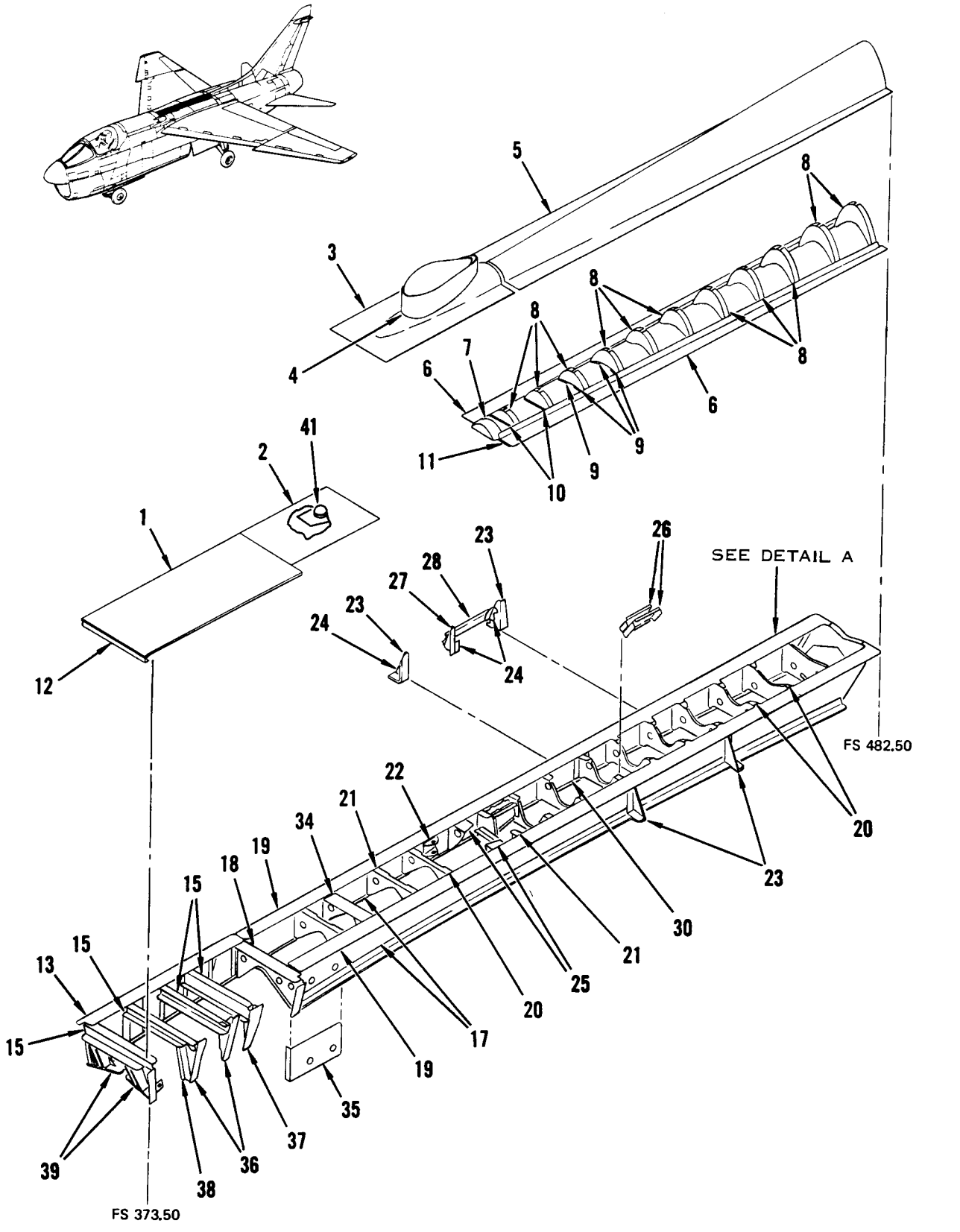

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Figure 5-21. Wing Dorsal Installation (Sheet 1 of 4)

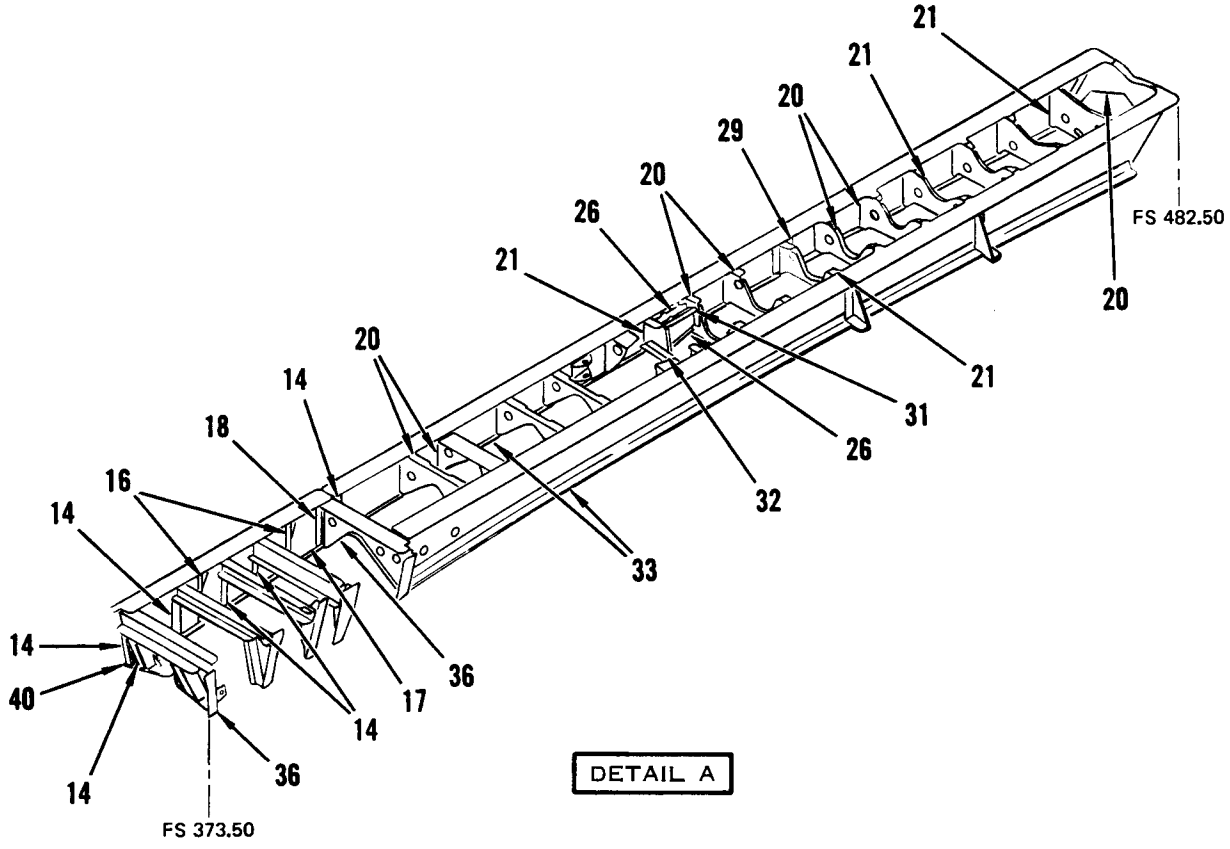

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Figure 5-21. Wing Dorsal Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70103	Door Installation, Center			
	216-70104	Door Installation, Aft			
	216-70075	Rib Installation, Wing Center Section Fairing			
1	216-70103	Skin (Chem Mill) .	0.125 X 12.0 X 25.7	7075-T6	Section XII
2		Skin (Chem Mill) .	0.080 X 10.0 X 16.0	7075-T6	Section XII
3	216-77514	Flange	0.080 Thick	6061-T6	Section XII
4		Pedestal (Weld) . .	0.063 Thick	6061-T6	Section XII
5	216-70104	Skin	0.032 X 14.0 X 55.5	7075-T6	Section XII
6		Reinforcement . . .	0.050 X 2.9 X 55.5	7075-T6	Section XII
7		Frame	0.040 X 3.8 X 5.3	7075-T6	Section XII
8	215-70104	Frame	0.032 X * X *	7075-T6	Section XII
9		Reinforcement . . .	0.050 X * X 2.6	7075-T6	Replace
10		Strap	0.050 X * X 6.0	7075-T6	Section XII
11	216-70104	Strap	0.050 X 1.8 X 6.0	7075-T6	Section XII
12	216-70103	Frame	0.032 X 1.5 X 9.6	7075-T6	Section XII
13	216-70075	Cap (Extr)	CVC10013-146	7075-T6511	Section XV
14		Support	0.040 X * X *	7075-T6	Section XII
15		Former	0.050 X * X *	7075-T6	Section XII
16		Stiffener	0.040 X 2.9 X *	7075-T6	Section XII
17		Web	0.025 X * X *	7075-T6	Section XII
18		Former (Extr) . . .	CPC20E3 (11771)	7075-T6511	Section XV
19		Cap (Extr)	CPC20E3 (11771)	7075-T6511	Section XV
20	215-70075	Former	0.032 X * X *	7075-T6	Section XII
21		Former	0.040 X * X *	7075-T6	Section XII
22	215-70166	Support (Mach Cstg)		356-T6	Section XII
23	215-70481	Support (Mach Cstg)		356-T6	Section XII
24	215-70075	Clip	0.071 X * X *	7075-T6	Replace
25	216-70075	Former	0.032 X 3.4 X 5.3	7075-T6	Section XII
26	216-70075	Support	0.040 X * X *	7075-T6	Section XII

See footnote at the end of the figure.

Figure 5-21. Wing Dorsal Installation (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
27		Support (Extr) . .	CVC10001-8	2024-T3511	Section XV
28		Channel	0.040 X 1.9 X 6.7	7075-T6	Section XII
29		Stiffener	0.040 X 1.0 X 4.1	7075-T6	Section XII
30		Web	0.025 X 4.3 X 55.4	7075-T6	Section XII
31		Clip	0.040 X 1.0 X 3.5	7075-T6	Replace
32		Angle (Extr) . . .	AND10134-0602	7075-T6511	Section XV
33	216-70486	Cap (Extr)	CVC10002-4	7075-T6511	Section XV
34	215-70075	Doubler	0.050 X 1.9 X 5.9	7075-T6	Section XII
35	216-70075	Doubler	0.040 X 8.3 X 4.4	7075-T6	Section XII
36		Support	0.050 X * X *	7075-T6	Section XII
37		Support (Extr) . .	CPC20E3 (11771)	7075-T6511	Section XV
38		Clip	0.050 X 1.5 X 4.4	7075-T6	Replace
39	216-78322	Support (Mach Cstg)		356-T6	Section XII
40	216-70447	Cap (Extr)	CVC10002-4	7075-T6511	Section XV
41	7425174-10	Stiffener Assembly			Section XII

*Length or length and width may vary with location.

Figure 5-21. Wing Dorsal Installation (Sheet 4)

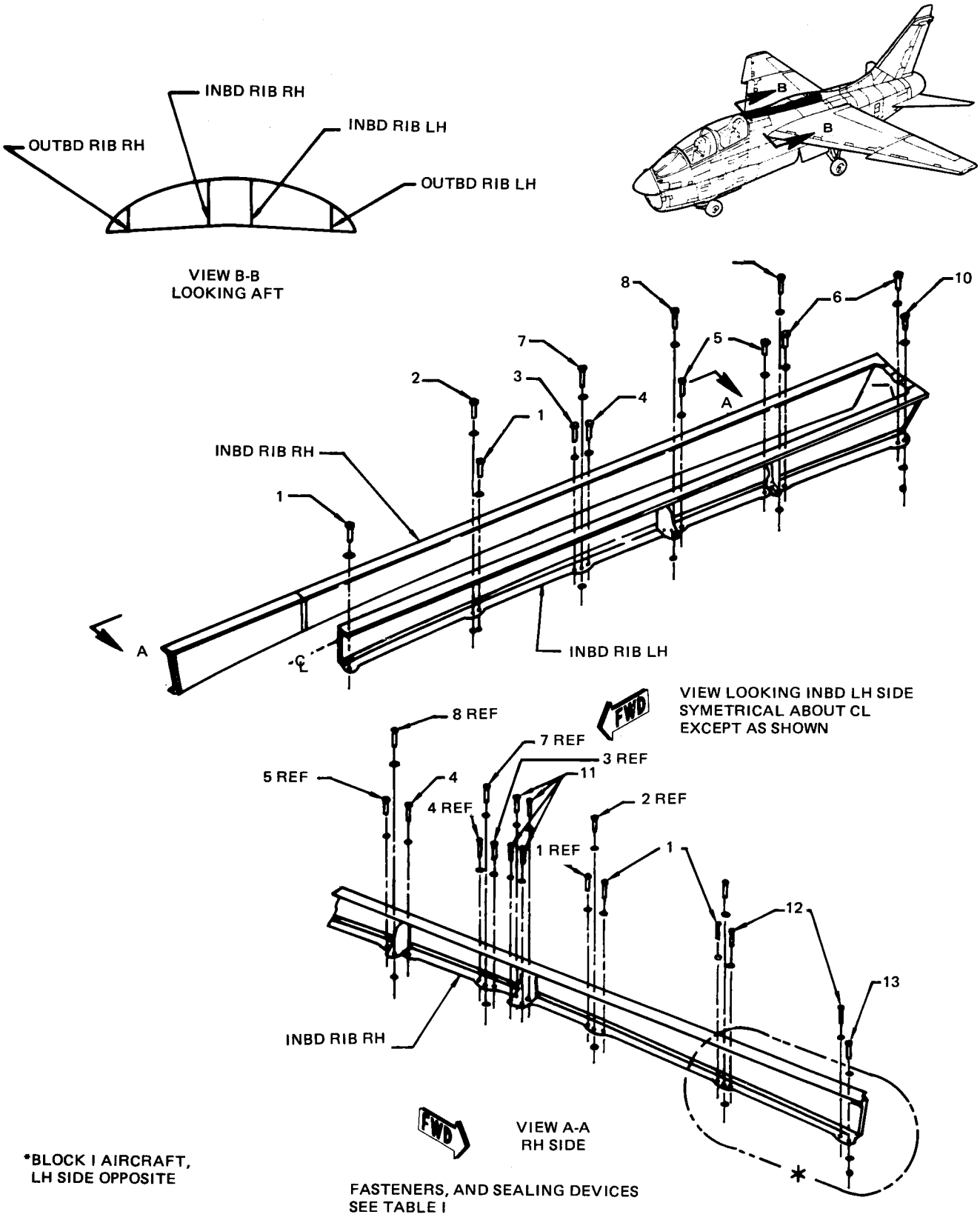


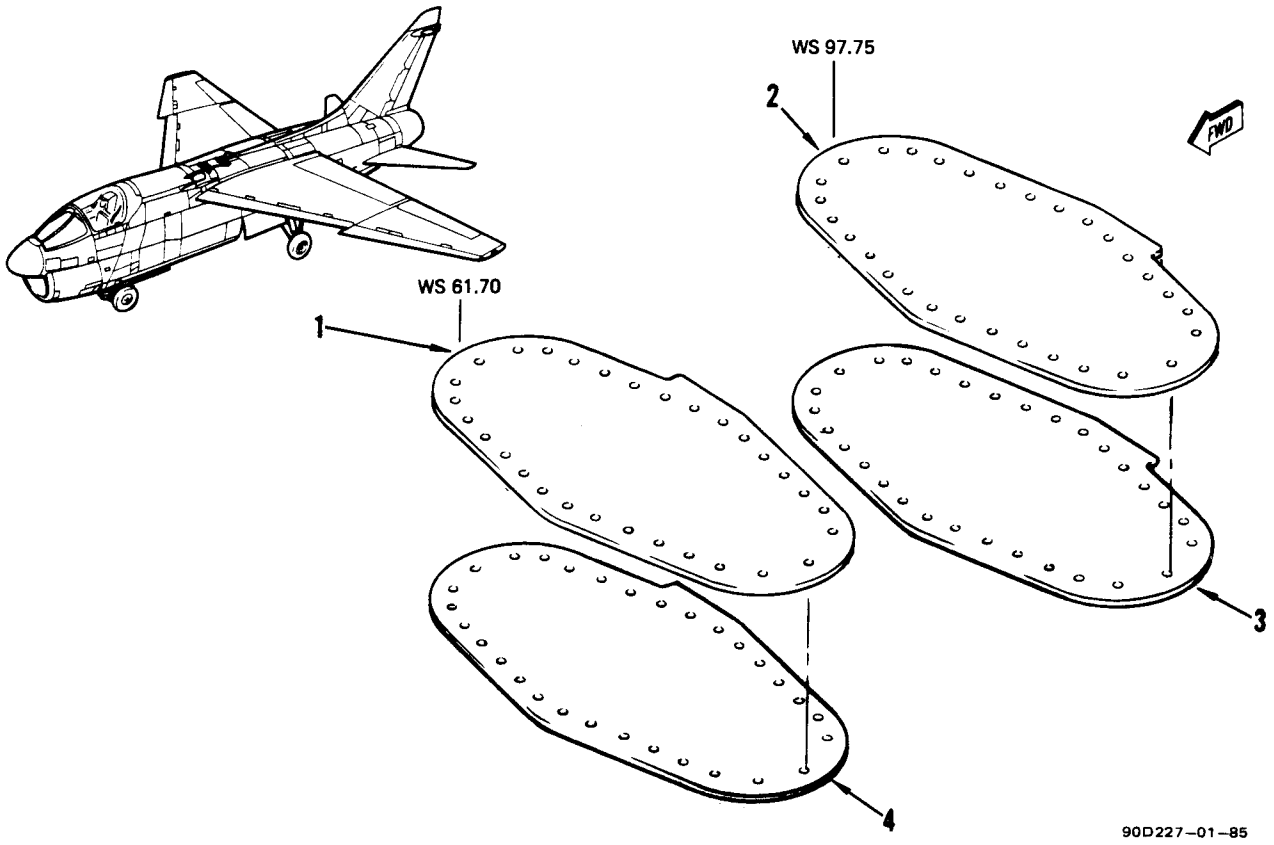
Figure 5-21.1. Wing Dorsal Fairing Installation (Sheet 1)

TABLE I

WING DORSAL FAIRING FASTENERS AND SEALING DEVICES

ITEM	BOLT	WASHER	NUT	SEALING DEVICE
1	NAS1304-8	AN960D416		NAS1473A4 IN WING
2	NAS1304-10	AN960D416		600-042-1/4 UNDER LOWER CAP
3	NAS1305-8	AN960D516		NAS1473A5 IN WING
4	NAS1305-9	AN960D516		NAS1473A5 IN WING
5	NAS1305-10	AN960D516		NAS1473A5 IN WING
6	NAS1305-11	AN960D516		NAS1473A5 IN WING
7	NAS1305-11	AN960D516		600-042-5/16 UNDER LOWER CAP
8	NAS1305-14	AN960D516		600-042-5/16 UNDER LOWER CAP
9	NAS1305-15	AN960D516		600-042-5/16 UNDER LOWER CAP
10	NAS464P5A17	AN960D516 2 REQD	MS21042-5	
11	NAS1304-9	AN960D416		NAS473A4 IN WING
12	NAS1304-7	AN960D416		NAS1473A4 IN WING
13	NAS464P4A14	AN960D416 2 REQD	MS21042L4	

Figure 5-21.1. Wing Dorsal Fairing Installation (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70095	Door Installation, Access			
1	215-70095	Door, Exterior (Mach)	0.125 x 7.30 X 15.40	7075-T6	Section XII
2		Door, Exterior (Mach)	0.160 X 7.30 X 15.40	7075-T6	Section XII
3		Door, Interior . .	0.160 X 7.50 X 15.60	7075-T6	Section XII
4		Door, Interior . .	0.125 X 7.50 X 15.60	7075-T6	Section XII

Figure 5-22. Wing Upper Access Door Installation

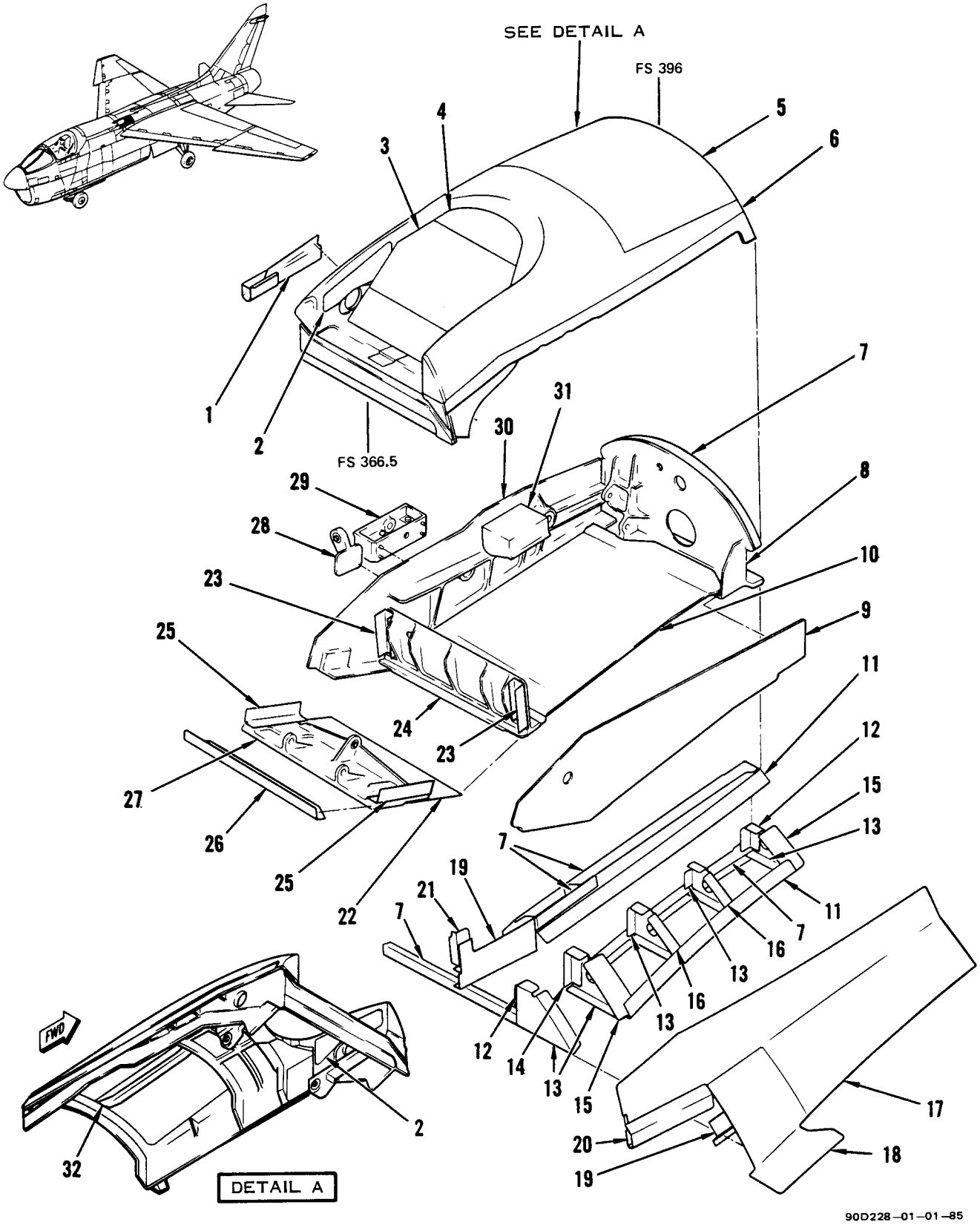


Figure 5-23. Wing Air Refueling Cavity (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70021	Wing Air Refueling Cavity, FS 366.41 to 396.15			
1	216-70452	Seal		Rubber	Replace
2	216-70435	Plate	0.050 X 2.3 X 7.5	301	Section XII
3	216-70106	Cover	1.125 X 6.5 X 10.0	17-4PH (155 KSI)	Section XII
4		Frame	0.625 X 10.0 X 11.3	17-4PH (155 KSI)	Section XII
5	216-70021	Panel (Chem Mill) .	0.080 X 13.0 X 16.0	7075-T6	Section XII
6	216-70435	Cover (Cstg) . . .		A356-T6	Section XII
7	216-70021	Angle	0.050 X * X *	7075-T6	Section XII
8	216-70428	Support (Mach Forg)	3.50 X 15.8 X 8.40	7075-T7352	Section XII
9	216-70432	Support (Mach) . .	1.5 X 8.0 X 30.0	7075-T651	Section XII
10	216-70021	Skin	0.050 X 19.0 X 12.7	7075-T6	Section XII
11		Pan	0.050 X * X *	7075-T6	Section XII
12		Clip (Extr)	AND10134-1204	7075-T6511	Section XV
13		Rib	0.050 X * X *	7075-T6	Section XII
14		Clip (Extr)	CPC18E3 (K23157)	7075-T6511	Section XV
15		Tee (Extr)	CPC20E3 (11771)	7075-T6	Section XV
16		Clip	0.050 X * X 2.0	7075-T6	Replace
17		Panel	0.100 X 30.0 X 10.3	7075-T6	Section XII
18		Skin (Chem Mill) .	0.100 X 8.5 X 11.8	7075-T6	Section XII
19		Stiffener	0.050 X * X *	7075-T6	Section XII
20	216-70451	Seal		Rubber	Replace
21	216-70021	Channel	0.063 X 2.8 X 3.0	7075-T6	Replace
22		Skin	0.040 X 6.5 X 12.5	7075-T6	Section XII
23		Clip	0.063 X * X *	7075-T6	Replace
24	216-70430	Support	3.2 X 16.0 X 5.2	7075-T7352	Section XII
25	216-70021	Clip (Extr)	AND10134-1205	7075-T6511	Section XV
26		Angle (Extr) . . .	CVC10001-25	7075-T6511	Section XV
27	216-70429	Support (Cstg) . .		356-T6	Section XII
28	216-70441	Pad (Cstg)		356-T6	Section XII
29	216-70442	Support (Cstg) . .		356-T6	Section XII
30	216-70431	Support (Mach) . .	1.5 X 8.5 X 30.0	7075-T6511	Section XII
31	216-70448	Support (Cstg) . .		356-T6	Section XII
32	216-70021	Channel	0.050 X 9.3 X 2.1	7075-T6	Section XII

*Length or length and width may vary with location.

Figure 5-23. Wing Air Refueling Cavity (Sheet 2)

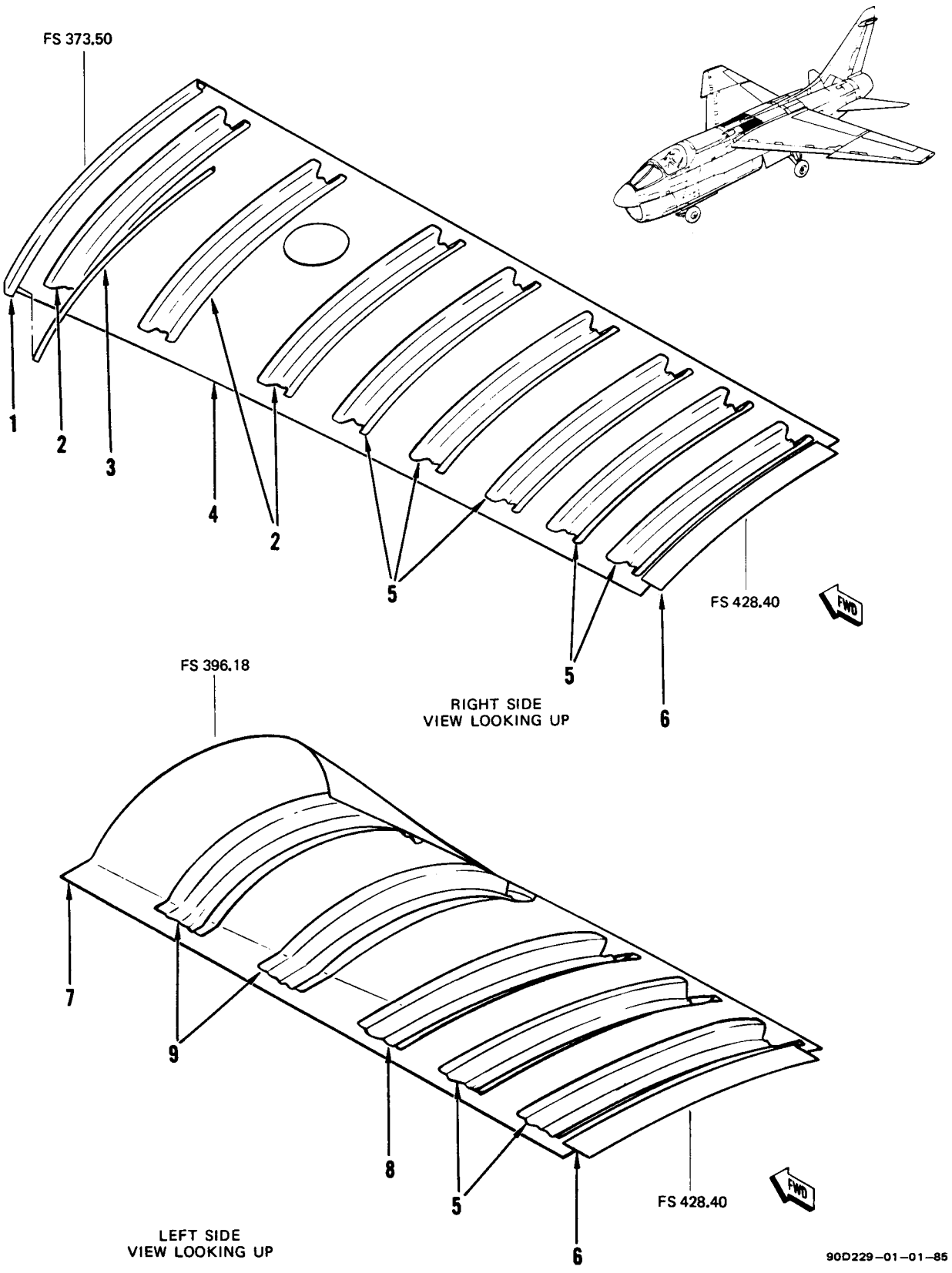
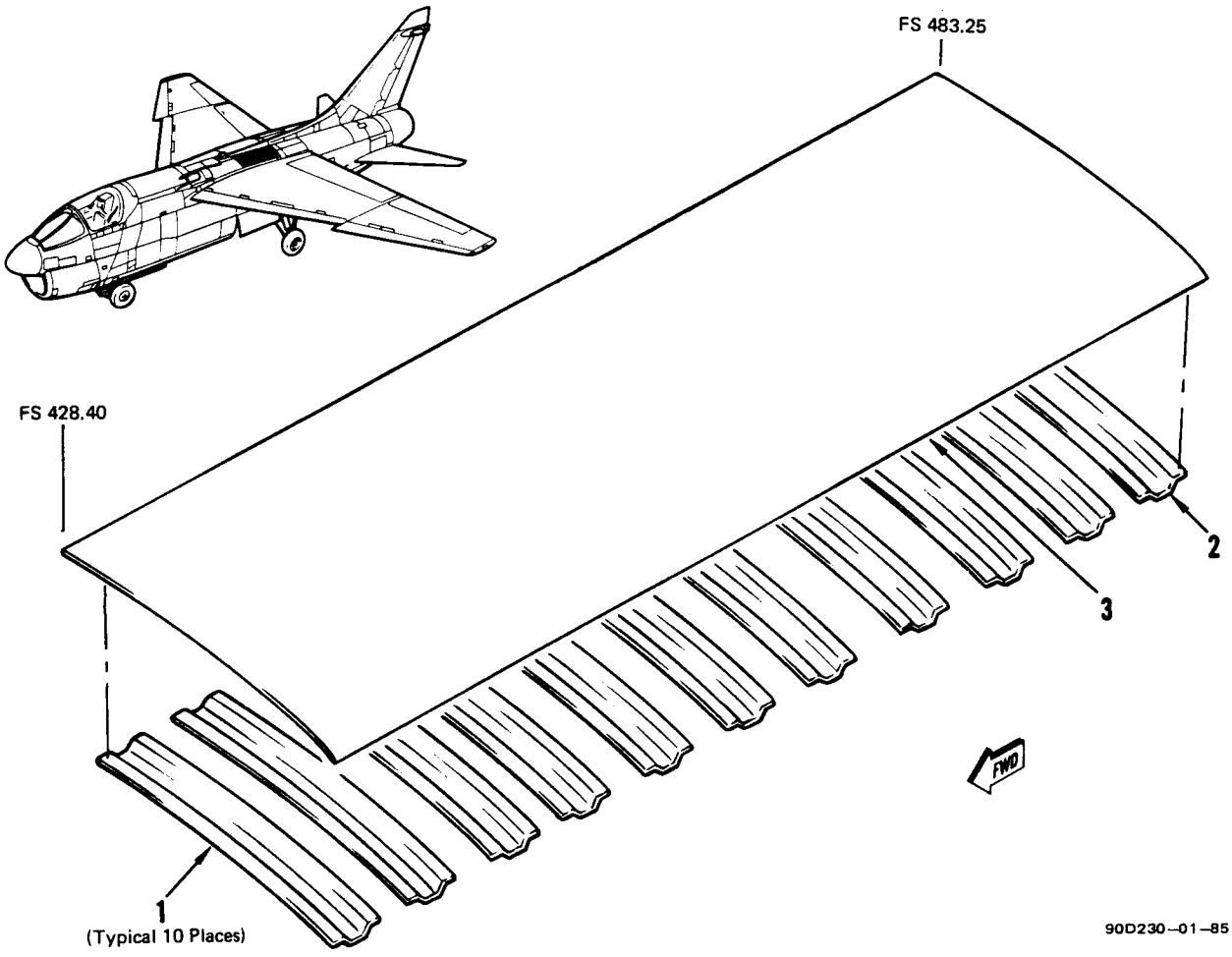


Figure 5-24. Wing Access Door Installation, FS 373.50 to 428.40 (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70024	Access Door, Left			
	216-70105	Access Door, Right			
1	215-70105	Frame	0.040 X 4.0 X 19.0	7075-T6	Section XII
2		Frame (SW)	0.032 X 3.4 X *	7075-T6	Section XII
3		Stiffener	0.040 X 0.68 X 17.6	7075-T6	Section XII
4	216-70105	Skin (Chem Mill) .	0.080 X 24.0 X 59.0	7075-T6	Section XII
5	215-70105	Frame (SW)	0.025 X 3.4 X *	7075-T6	Section XII
6		Splice	0.050 X 1.8 X 15.7	7075-T6	Section XII
7	216-70024	Skin (Chem Mill) .	0.080 X 24.0 X 40.0	7075-T6	Section XII
8		Frame (SW)	0.025 X 3.5 X 15.8	7075-T6	Section XII
9		Frame (SW)	0.032 X 3.5 X *	7075-T6	Section XII

*Length or length and width may vary with location.

Figure 5-24. Wing Access Door Installation, FS 373.50 to 428.40 (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70107	Door Installation, Access			
1	215-70107	Frame	0.025 X 3.60 X 15.70	7075-T6	Section XII
2		Frame	0.032 X 3.60 X 15.70	7075-T6	Section XII
3		Skin (Chem Mill) .	0.080 X 21.00 X 59.00	7075-T6	Section XII

Figure 5-25. Door Installation, FS 428.40 to 483.25

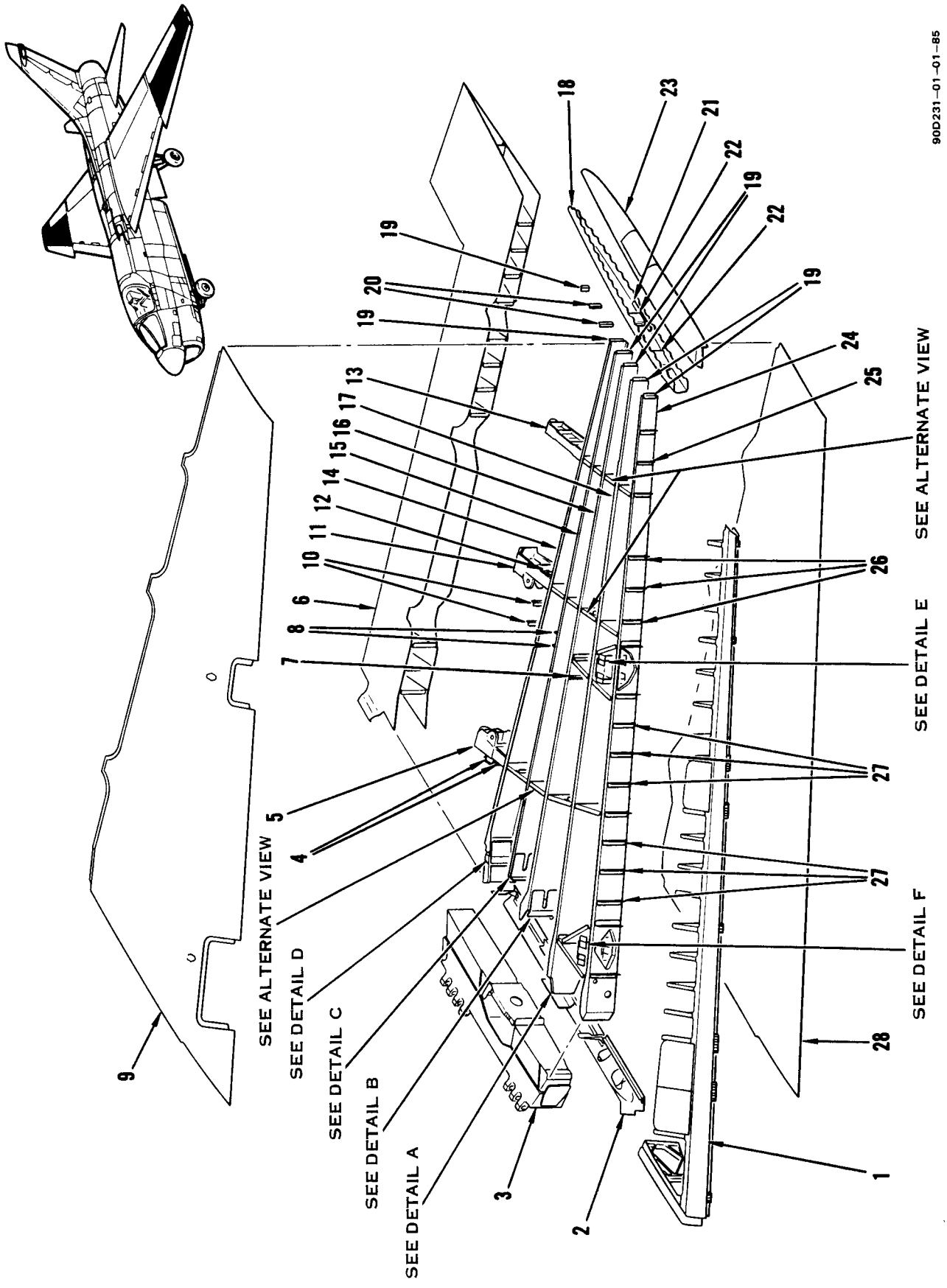
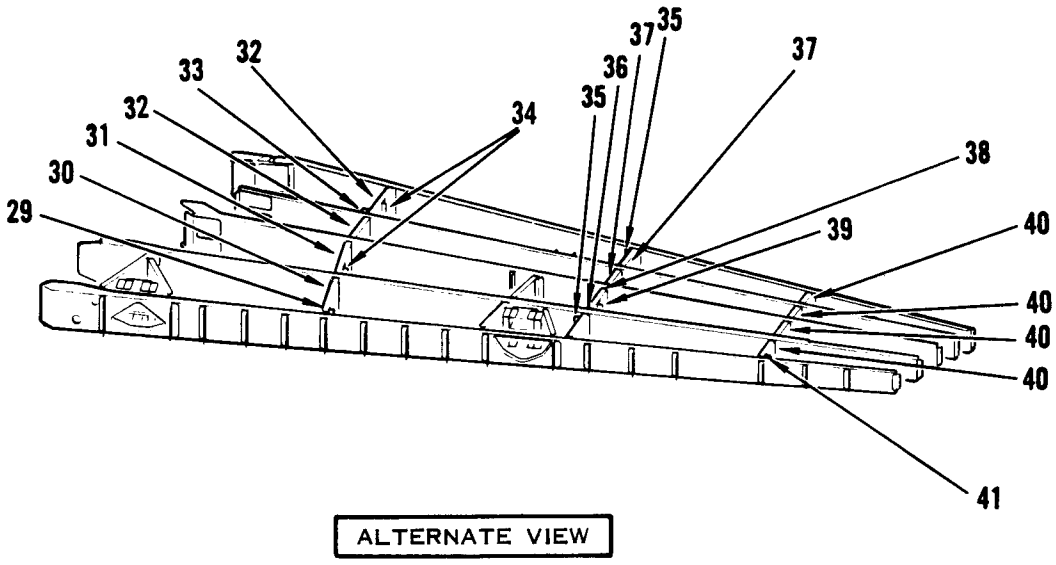


Figure 5-26. Wing Outer Panel (Sheet 1 of 5)



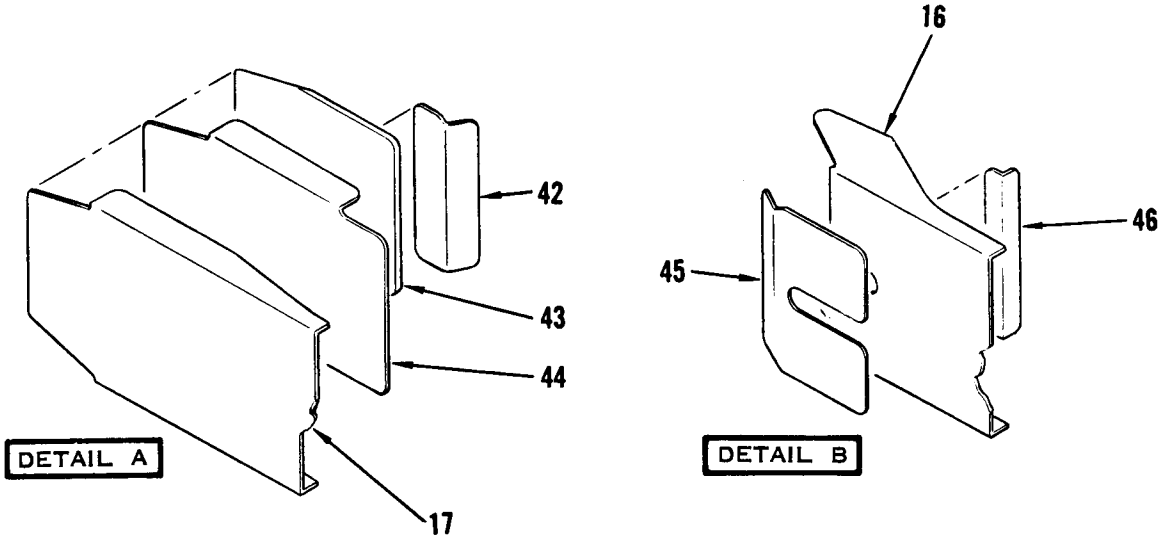


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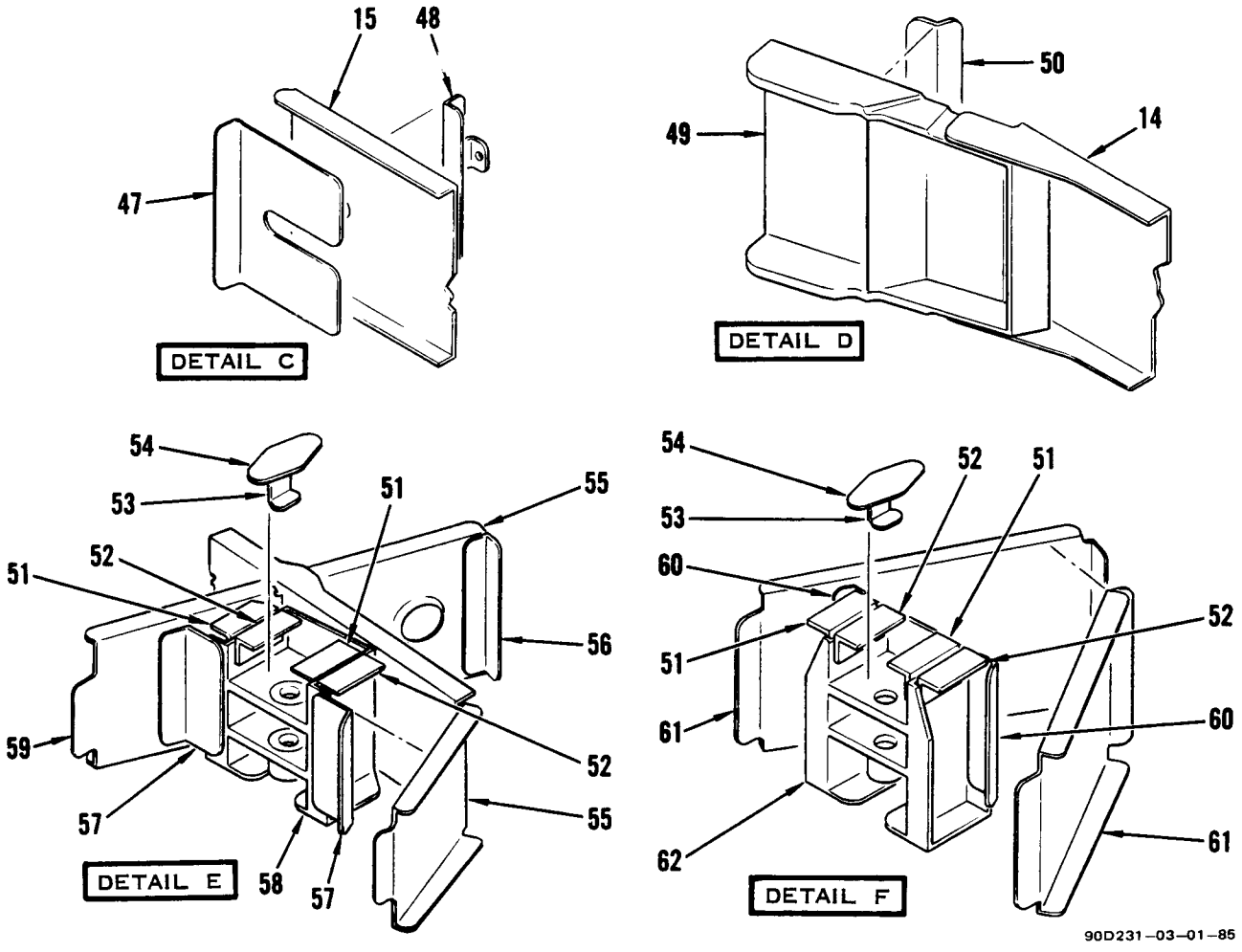
Figure 5-26. Wing Outer Panel (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
‡	215-80020	Wing Section Assembly, Outer			
§	216-80020	Wing Section Assembly, Outer			
1‡	215-80023	Leading Edge . . .			5-39
§	216-80023	Leading Edge . . .			5-39
2	215-70093	Fairing			5-11

See footnotes at the end of the figure.

Figure 5-26. Wing Outer Panel (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
					5-31
3	215-80050	Wingfold Rib . . .			
4	215-80056	Bracket	0.050 X * X *	2024-T42	Section XII
5	215-80070	Hinge (Forg) . . .		7075-T6	Section XII
6	216-80051	Trailing Edge . . .			5-29
7	215-80037	Stiffener	0.063 X 1.6 X 4.8	2024-T42	Section XII
8	215-80038	Angle	0.063 X 1.2 X 4.9	2024-T42	Section XII
9†	215-80025	Skin (Mach Typr) .	0.375 X 48.0 X 125.0	7079-T651	Section XII 5-27, 5-28
10	215-80039	Stiffener	0.050 X 1.2 X 4.4	2024-T42	Section XII
11	215-80071	Hinge (Forg) . . .		7075-T6	Section XII
12	215-80054	Cover	3 Ply	Reinforced Plastic	Section XIV
13	215-80072	Hinge	2.00 X 4.1 X 14.2	7075-T651	Section XII
14	215-80039	Spar, Rear	0.050 X 8.7 X 92.4	7075-T6	Section XII
15	215-80038	Spar (Chem Mill) .	0.071 X 10.5 X 94.5	7075-T6	Section XII
16	215-80037	Spar (Chem Mill) .	0.071 X 14.8 X 101.0	7075-T6	Section XII
17	215-80036	Spar (Chem Mill) .	0.071 X 10.7 X 106.8	7075-T6	Section XII
18	215-80052	Rib	0.050 X 6.6 X 43.4	7075-T6	Section XII
19		Clip	0.040 X * X *	2024-T3	Section XII
20		Clip	0.050 X 1.1 X *	2024-T42	Section XII
21		Capstrip	0.032 X 1.1 X 7.2	7075-T6	Section XII
22		Support	0.050 X * X *	2024-T42	Section XII
23		Tip			5-32
24	215-80404	Spar (Mach)	2.0 X 6.0 X 106.0	7075-T651	Section XII
25	215-80035	Clip	0.050 X 1.3 X 3.2	2024-T42	Section XII
26		Clip	0.063 X 1.4 X *	2024-T42	Section XII
27		Clip	0.071 X 1.4 X *	2024-T42	Section XII
28	215-80026	Skin (Mach Typr) .	0.460 X 48.0 X 125.0	7079-T651	Section XII
29	215-80056	Clip	0.080 X 1.5 X 4.3	7075-T6	Section XII
30		Rib	0.080 X 7.9 X 8.4	7075-T6	Section XII
31		Rib	0.071 X 8.2 X 8.2	7075-T6	Section XII
32		Rib	0.063 X * X *	7075-T6	Section XII
33		Clip	0.063 X 1.5 X 5.3	7075-T6	Section XII
34		Clip	0.063 X 1.4 X 5.5	2024-T42	Section XII

See footnotes at the end of the figure.

Figure 5-26. Wing Outer Panel (Sheet 4)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
35	215-80054	Clip	0.071 X * X *	7075-T6	Section XII
36		Rib	0.080 X 6.2 X 6.6	7075-T6	Section XII
37		Rib	0.063 X * X *	7075-T6	Section XII
38		Rib	0.071 X 7.0 X 7.2	7075-T6	Section XII
39		Clip	0.050 X 1.2 X 4.6	2024-T3	Section XII
40	215-80053	Rib	0.063 X * X *	7075-T6	Section XII
41		Clip	0.063 X 1.5 X 2.9	7075-T6	Section XII
42	215-80036	Clip	0.090 X 2.4 X 5.5	7075-T6	Section XII
43		Splice	0.190 X 5.6 X 6.5	7075-T6	Section XII
44		Doubler	0.063 X 8.3 X 9.8	7075-T6	Section XII
45	215-80037	Doubler	0.100 X 4.6 X 5.8	2024-T3	Section XII
46		Stiffener	0.063 X * X *	2024-T3	Section XII
47	215-80038	Doubler	0.071 X 4.9 X 5.5	7075-T6	Section XII
48		Stiffener	0.063 X 2.2 X 5.5	2024-T42	Section XII
49	215-80405	Spar (Mach)	2.0 X 6.0 X 7.9	7075-T651	Section XII
50	215-80039	Clip	0.040 X 1.5 X 5.6	2024-T3	Section XII
51	215-80058	Clip (Extr)	Die No. 28003	7075-T6511	Section XV
52		Clip (Extr)	Die No. 17646	7075-T6511	Section XV
53		Retainer	0.040 X 0.9 X *	7075-T6	Section XII
54		Door	0.050 X 1.3 X 2.7	2024-T3	Replace
55		Rib	0.050 X * X *	7075-T6	Section XII
56	215-80037	Stiffener	0.063 X 1.6 X 4.8	2024-T42	Section XII
57**	215-80058	Clip	0.050 X 2.1 X 4.0	2024-T3	Section XII
58	215-80091	Support (Cstg) . .		17-4PH	Section XII
59	215-80058	Rib	0.063 X 6.2 X 7.2	7075-T6	Section XII
60**		Clip	0.063 X * X 4.9	2024-T3	Section XII
61		Rib	0.071 X * X *	7075-T6	Section XII
62	215-80090	Support (Cstg) . .		17-4PH	Section XII

*Length or length and width may vary with location.

†Loose or failed fasteners attaching upper skin to air load ribs require that all rivets in those ribs be replaced with NAS1739MW-5 rivets of equal length. See figure 5-39 for air load ribs affected.

‡Airplanes through AF71-379.

§Airplanes AF72-169 and subsequent.

**It is not required to repair/replace cracked or damaged clips. Replace loose B100T (MS90353) fasteners securing 215-80090 and 215-80091 supports (index No. 62 and 58) to upper and lower skins with next larger size fasteners. If maintenance is being performed within the support area, clips may be replaced using 7075-T6 material approximately 50% thicker than original clips.

Figure 5-26. Wing Outer Panel (Sheet 5)

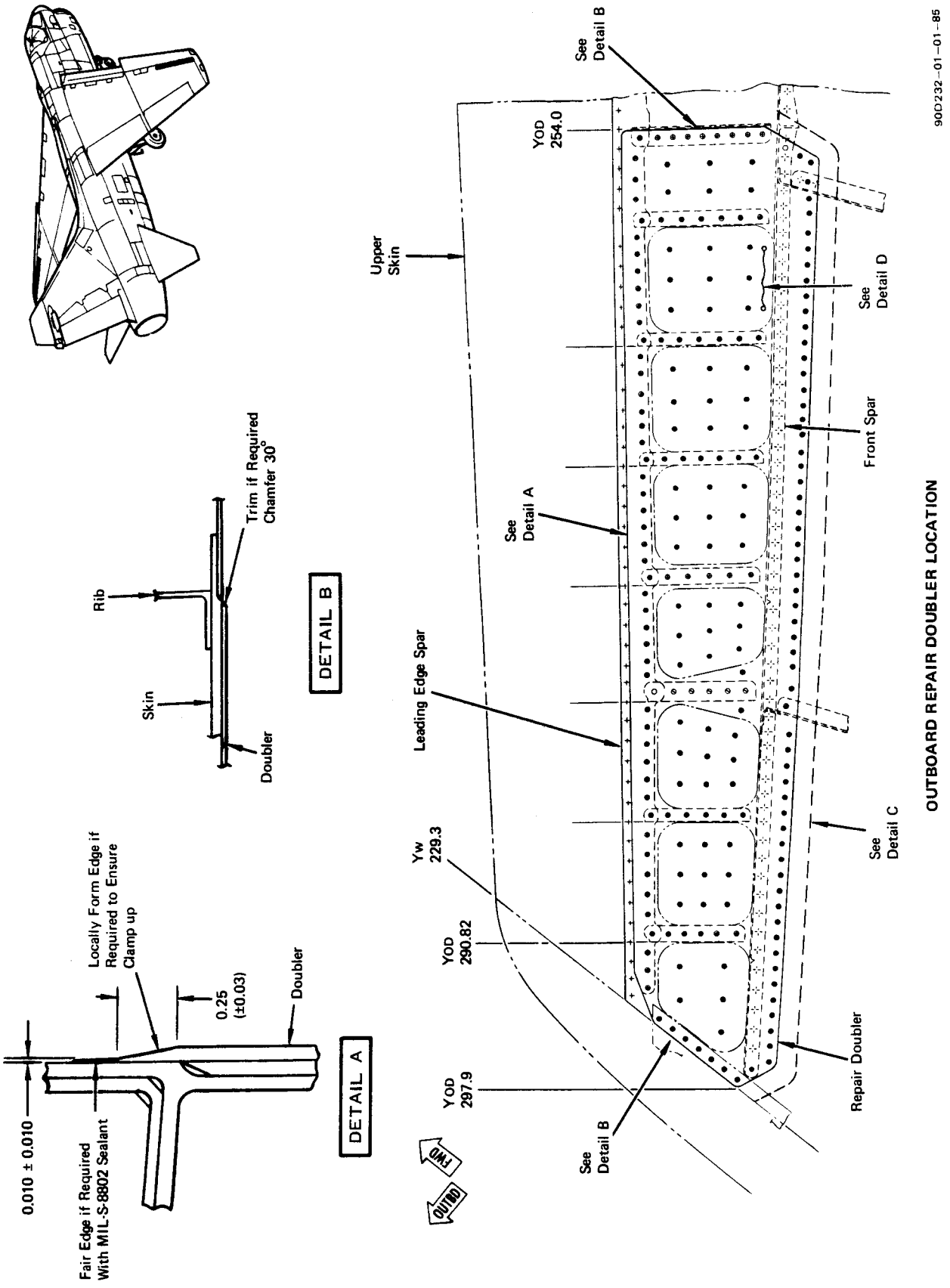
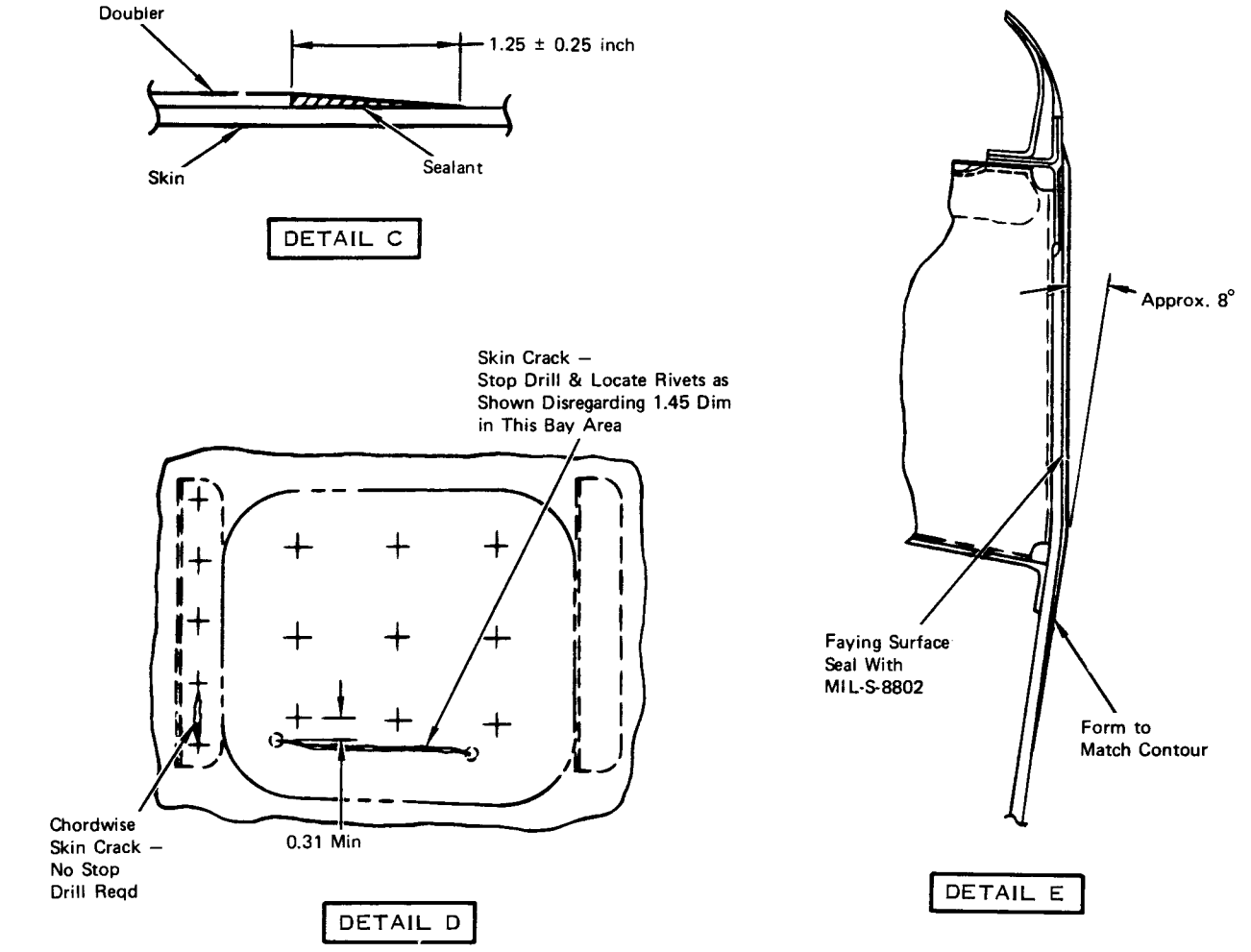
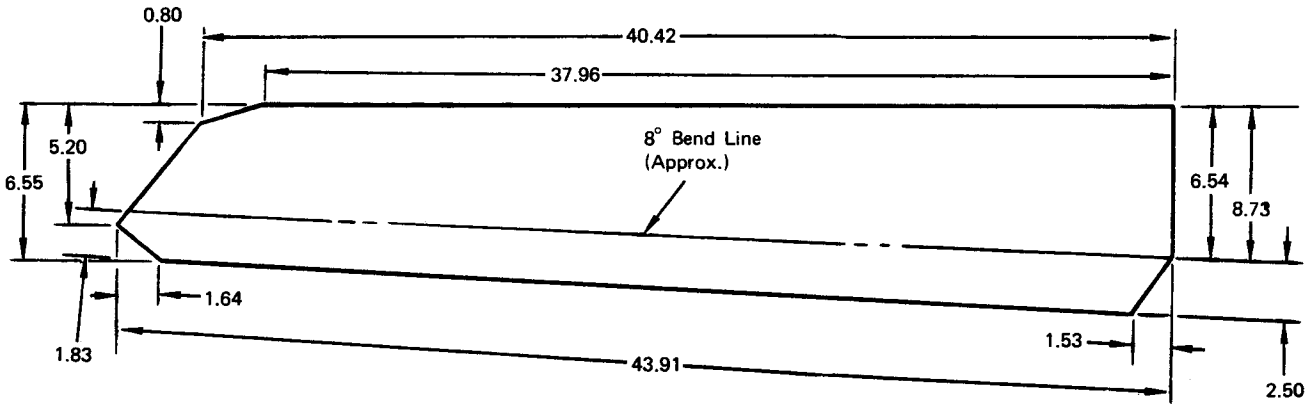


Figure 5-27. Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298 (Sheet 1 of 5)





OUTBOARD REPAIR DOUBLER DIMENSIONS

90D232–02–01–85

Figure 5-27. Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298 (Sheet 2)

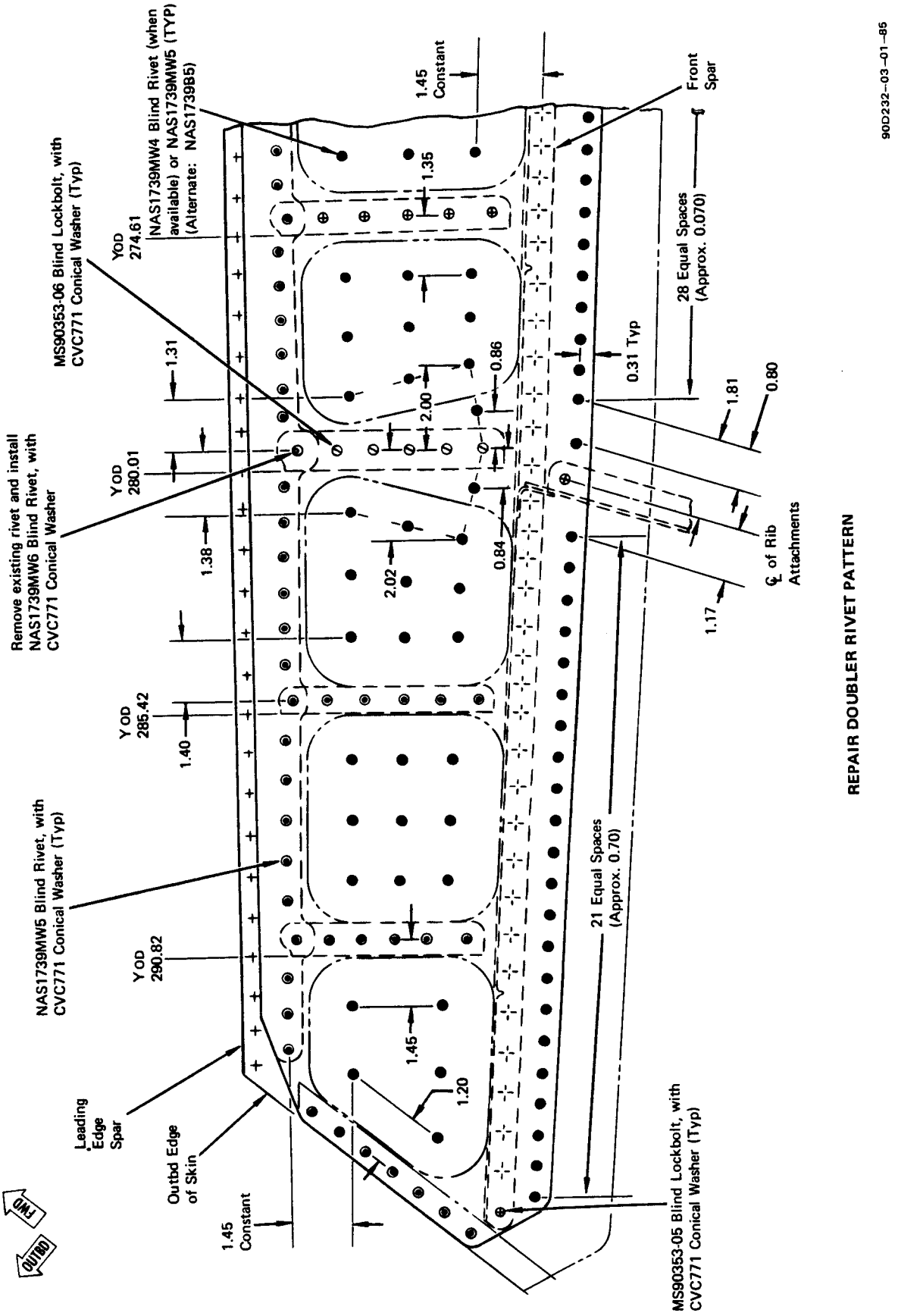


Figure 5-27. Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298 (Sheet 3)

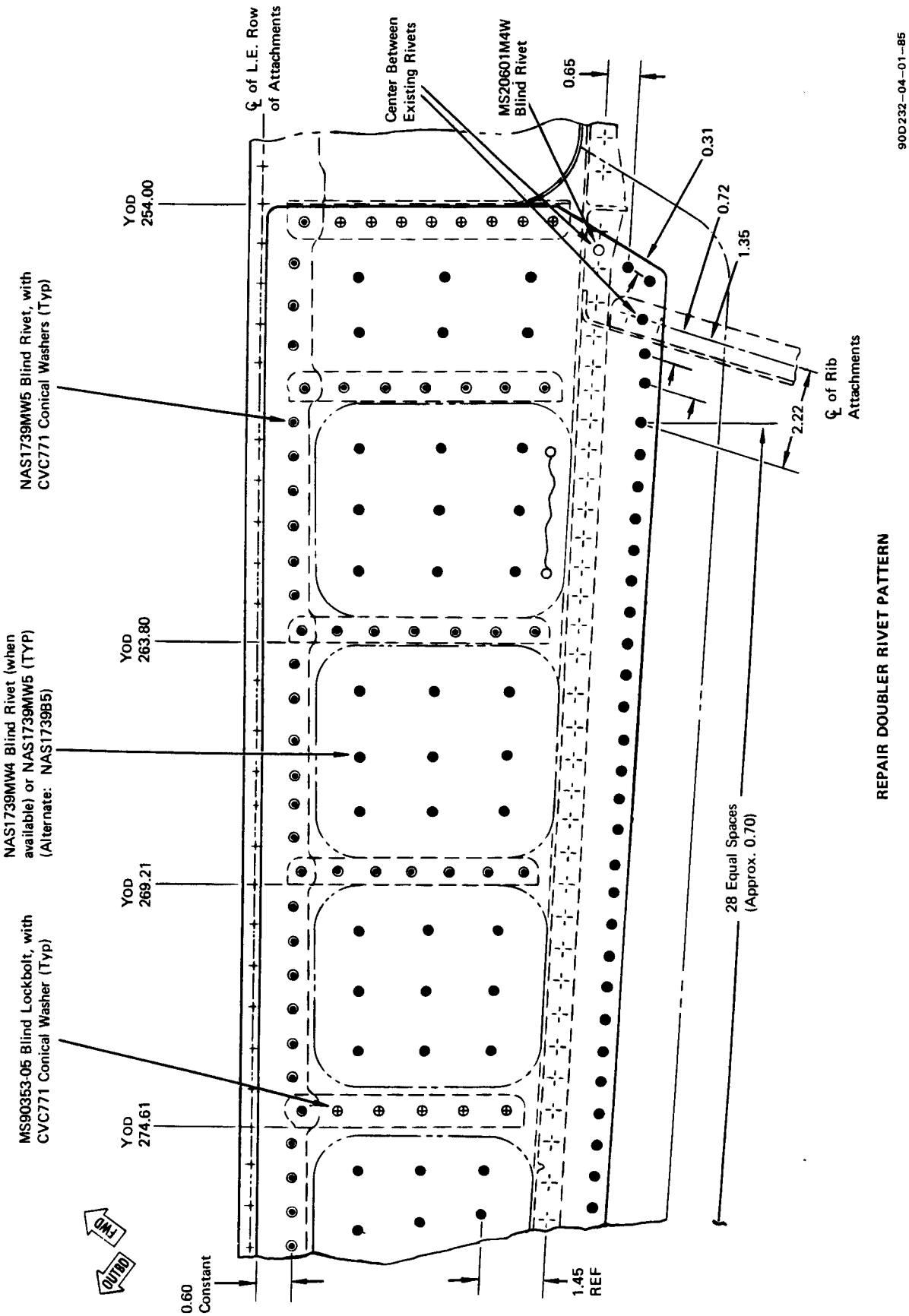


Figure 5-27. Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298 (Sheet 4)

REPAIR LIMITATION

The following data is applicable only for repair of cracks which occur in the upper skin of the outer wing panel from the front spar to the leading edge, between wing outer panel leading edge flap stations Yod 254.0 and Yod 297.9.

REPAIR PROCEDURE

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

1. Remove any previous repair patch and strip old finish from skin area to be repaired (T.O. 1A-7D-23).
2. Stop drill both ends of crack using a No. 15 (0.180-inch diameter) drill. If previously repaired crack has continued beyond stop drill, add new stop drill.
3. Fabricate a 0.063-inch gage 2024-T3 clad aluminum alloy doubler to approximate dimensions shown. Bend 8° at point shown. Chamfer forward edge (detail A) and sides (detail B).
4. Treat repair doubler and bare area of skin with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
5. Remove fasteners (Symbols ◉, ⊕, and ⊘) and install CVC771 conical washers as directed in Section I. Bond washers in skin with MIL-S-8802 sealant.
6. Layout and drill rivet pattern as shown.
   a. Lay out rivet pattern. Mark for rivets at midpoint and ends with locating dimensions first, then fill in remaining rivet marks with equal spacing between rivets shown.
   b. Do not pick up existing rivets where symbols + and ⊣⊢ are used. Install ALL other rivets shown.
   c. Pick up hole pattern of any previous repair patch. Adjust layout to local variations in rib bay and to rear of front spar.
   d. Maintain 0.31 inch minimum distance between centerline of rivet row and crack in bay area. Disregard 1.45 constant dimension in that rib bay.
   e. Maintain 0.31 inch minimum edge distance. All dimensions are given in inches, ±0.06 inch tolerance.
   f. Drill as indicated.
7. Apply MIL-S-8802 heat-resistant sealant to faying surfaces of skin and doubler (T.O. 1A-7D-23).
8. Install repair doubler as shown.
9. Fair aft edges of doubler with MIL-S-8802 sealant tapered 1.25 ± 0.25 inches.
10. Paint touchup repair area (Section III).

90D232-05-01-85

Figure 5-27. Wing Outer Panel Upper Skin Crack Repair, Outboard – Station YOD 254 to YOD 298 (Sheet 5)

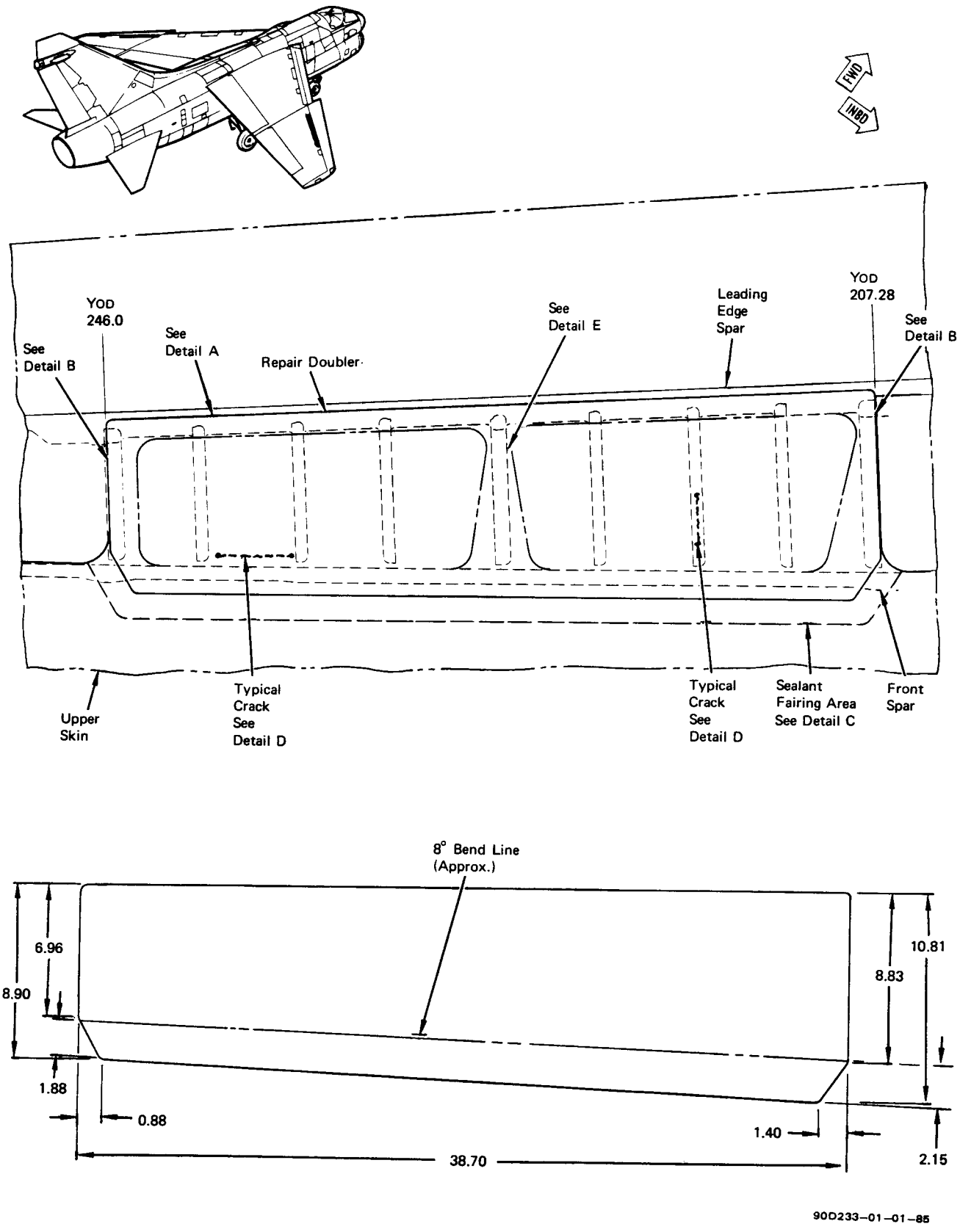


Figure 5-28. Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246 (Sheet 1 of 5)

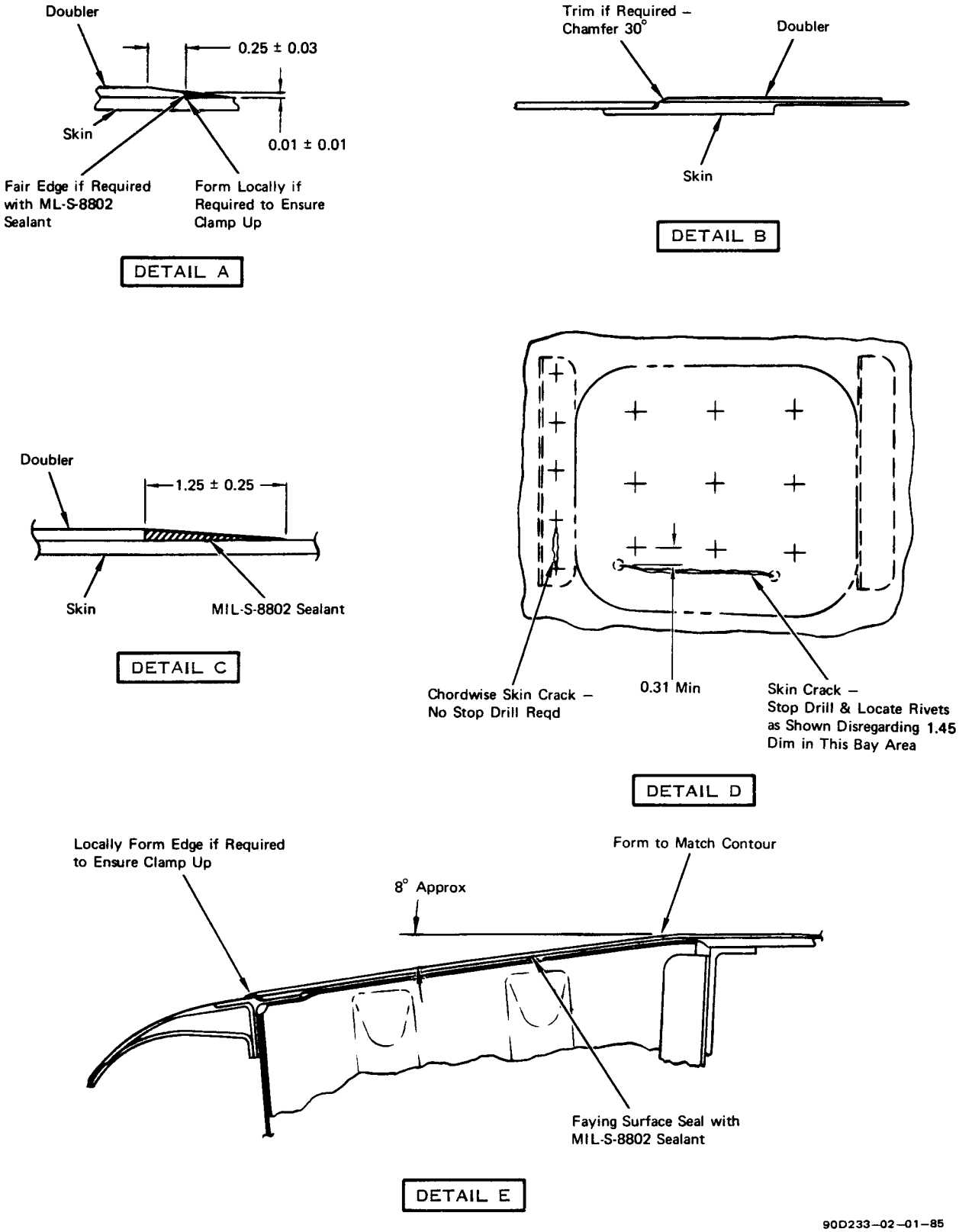


Figure 5-28. Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246 (Sheet 2)

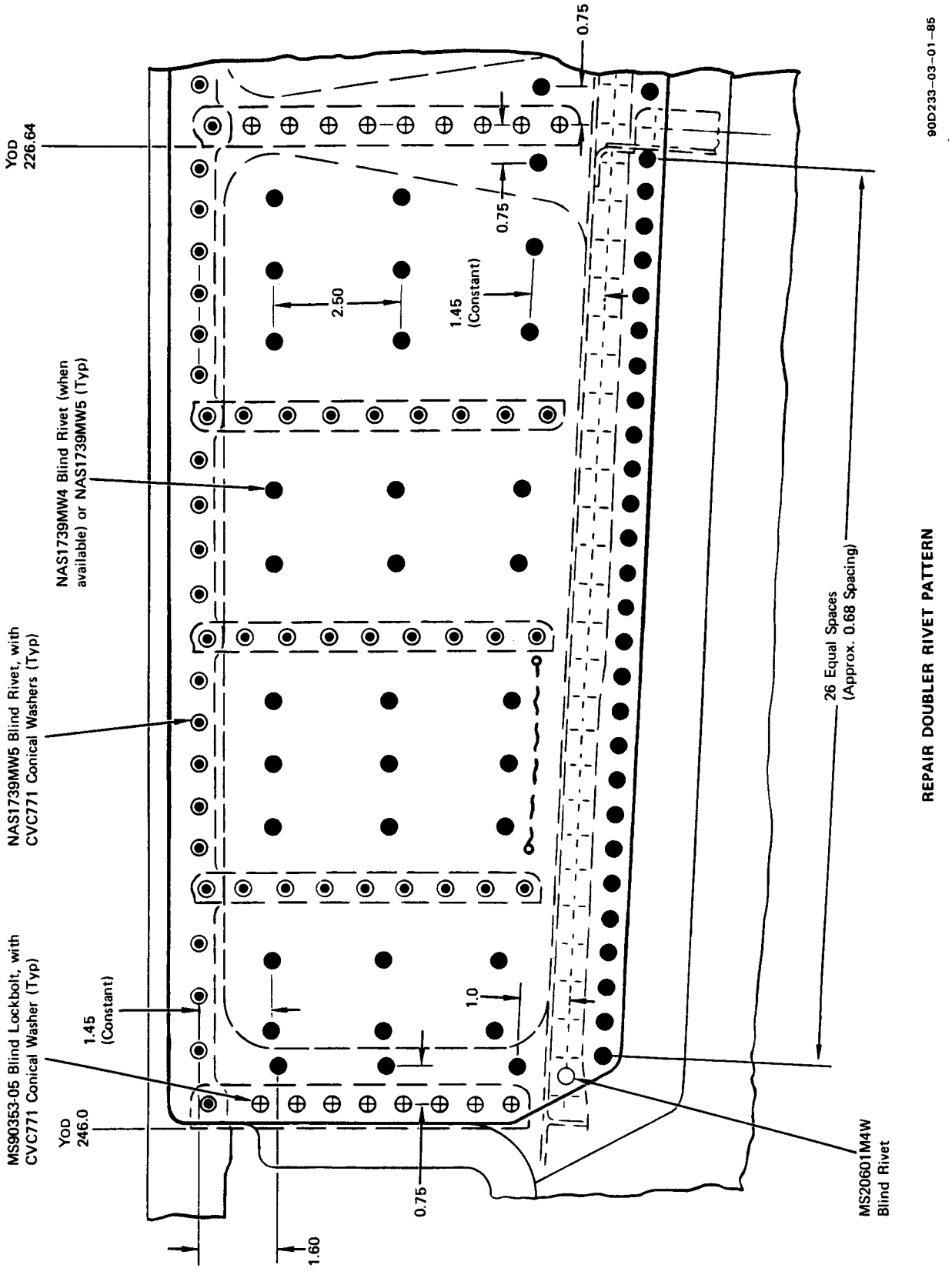


Figure 5-28. Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246 (Sheet 3)

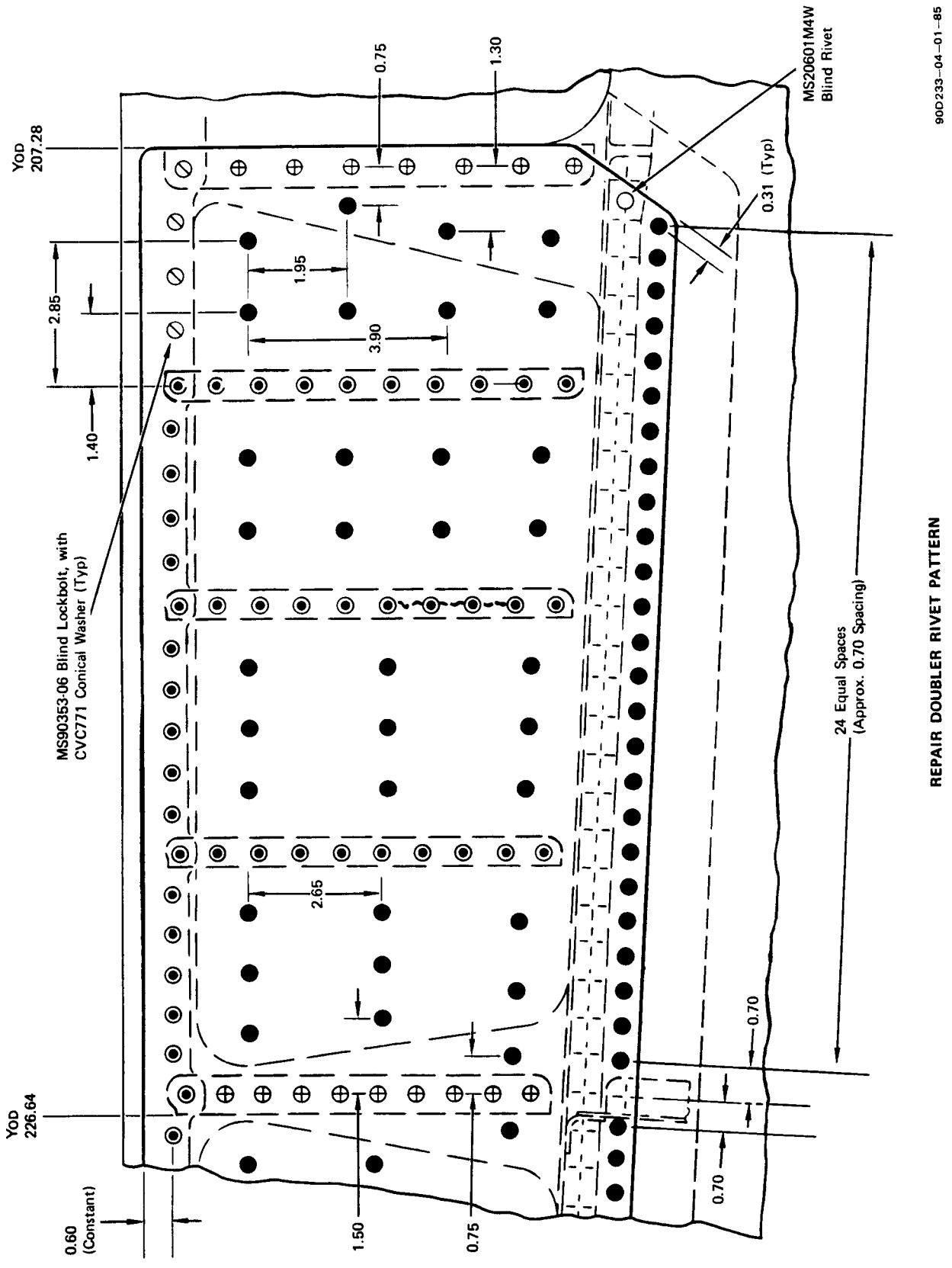


Figure 5-28. Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246 (Sheet 4)

REPAIR LIMITATION

The following data is applicable only for repair of cracks which occur in the upper skin of the outer wing panel from the front spar to the leading edge, between wing outer panel leading edge flap stations Yod 207 and Yod 246.

REPAIR PROCEDURE

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

1. Remove any previous repair patch and strip old finish from skin area to be repaired (T.O. 1A-7D-23).
2. Stop drill both ends of crack using a No. 15 (0.180-inch diameter) drill. If previously repaired crack has continued beyond stop drill, add new stop drill.
3. Fabricate a 0.063-inch gage 2024-T3 clad aluminum alloy doubler to approximate dimensions shown. Bend 8° at point shown. Chamfer forward edge (detail A) and sides (detail B).
4. Treat repair doubler and bare area of skin with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
5. Remove fasteners (Symbols ◉, ⊕, and ⊘) and install CVC771 conical washers as directed in Section I. Bond washers in skin with MIL-S-8802 sealant.
6. Layout and drill rivet pattern as shown.
   a. Lay out rivet pattern. Mark for rivets at midpoint and ends with locating dimensions first, then fill in remaining rivet marks with equal spacing between rivets shown.
   b. Do not pick up existing rivets where symbols + and ⊣ are used. Install ALL other rivets shown.
   c. Pick up hole pattern of any previous repair patch. Adjust layout to local variations in rib bay and to rear of front spar.
   d. Maintain 0.31 inch minimum distance between centerline of rivet row and crack in bay area. Disregard 1.45 constant dimension in that rib bay.
   e. Maintain 0.31 inch minimum edge distance. All dimensions are given in inches, ±0.06 inch tolerance.
   f. At each end of repair doubler, install one MS20601M4W blind rivet in front spar halfway between existing rivets.
7. Apply MIL-S-8802 heat-resistant sealant to faying surfaces of skin and doubler (T.O. 1A-7D-23).
8. Install repair doubler as shown.
9. Fair aft edges of doubler with MIL-S-8802 sealant tapered 1.25 ± 0.25 inches.
10. Paint touchup repair area (T.O. 1A-7D-23).

90D233-05-01-85

Figure 5-28. Wing Outer Panel Upper Skin Crack Repair, Inboard – Station YOD 207 to YOD 246 (Sheet 5)

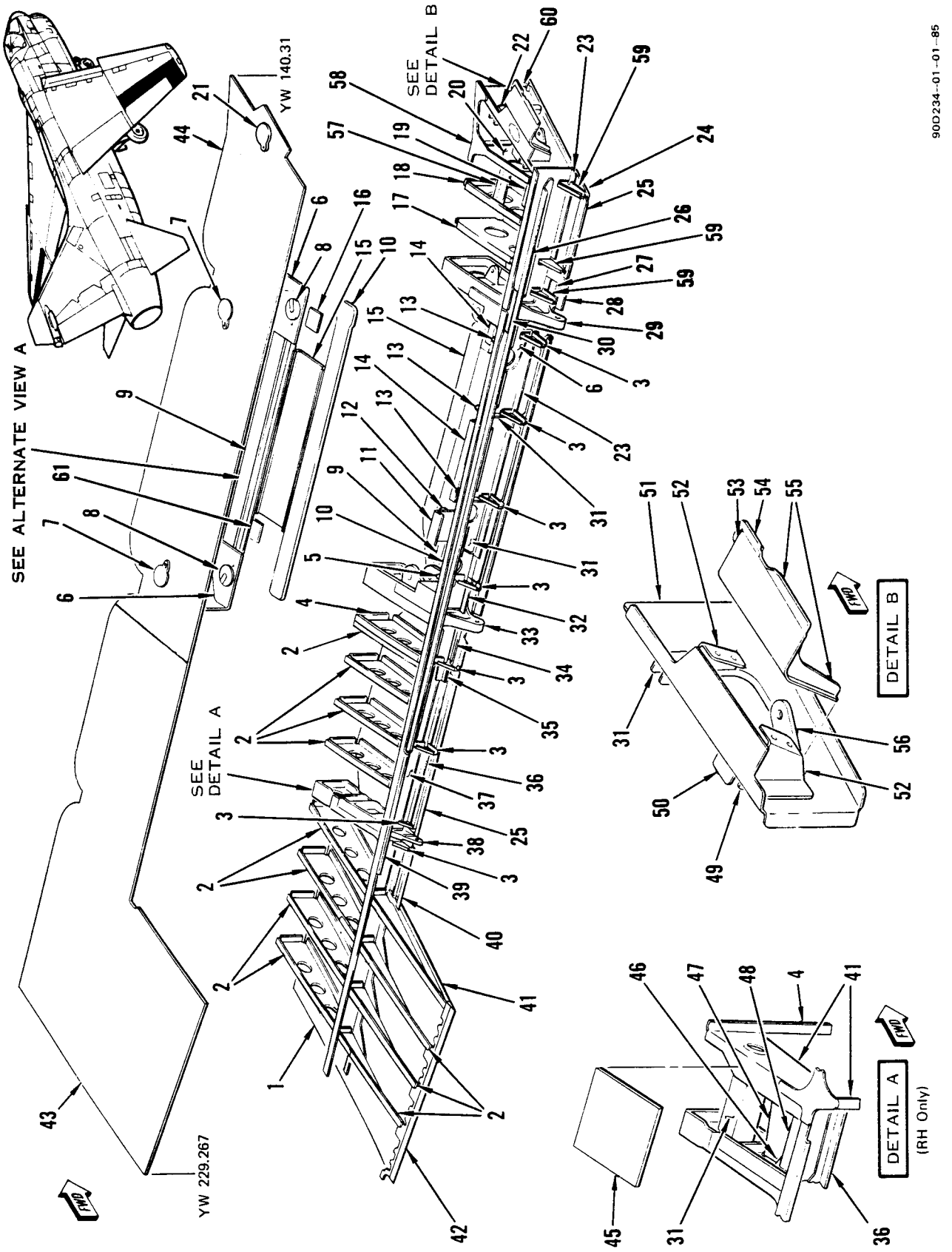
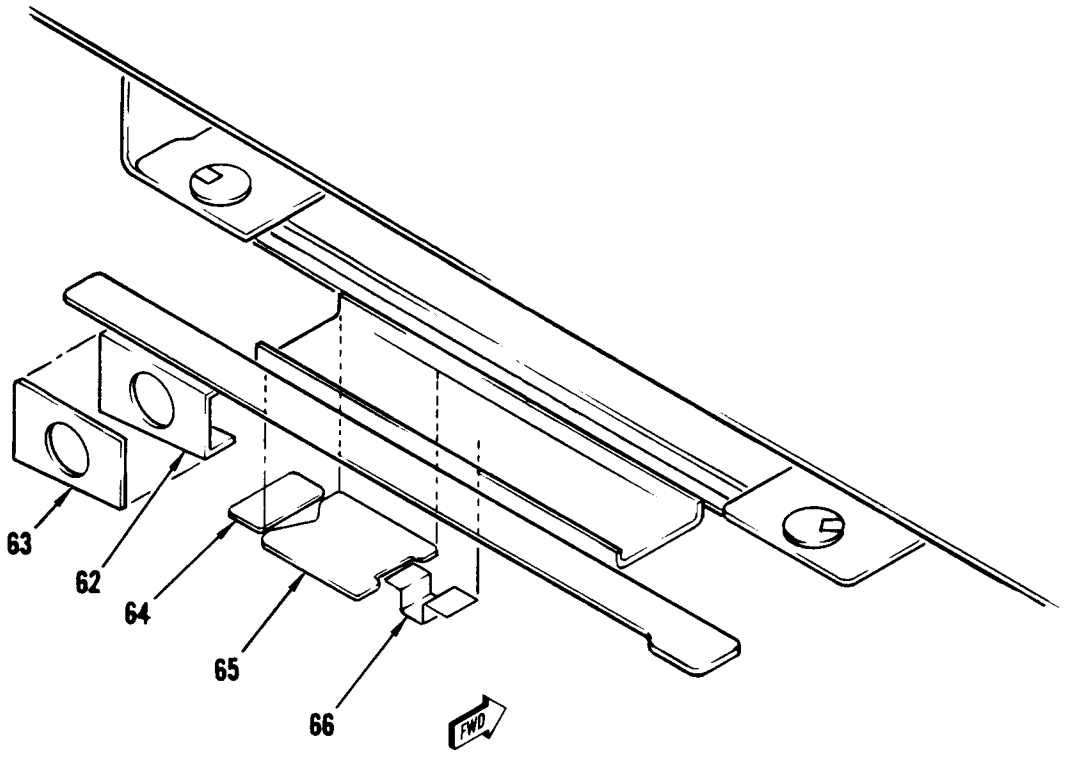


Figure 5-29. Wing Outer Panel Trailing Edge Installation (Sheet 1 of 5)



ALTERNATE VIEW A

90D234-02-01-85

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
‡	216-80051	Trailing Edge			
§	218-80051	Installation, Wing Outer Section			
1	216-80051	Skin (Chem Mill) .	0.063 X 26.8 X 54.4	7075-T6	Section XII
2	216-80051	Rib	0.032 X * X *	7075-T6	Section XII
3	215-80051	Gusset	0.032 X * X *	2024-T42	Section XII
4	216-80051	Splice Plate . . .	0.040 X 1.55 X 10.0	7075-T6	Section XII
5	215-80051	Support	0.032 X 1.0 X 2.9	2024-T3	Replace
6		Doubler	0.040 X * X *	7075-T6	Section XII
7‡		Door	0.032 X 2.1 X 2.9	2024-T3	Replace

See footnotes at the end of the figure.

Figure 5-29. Wing Outer Panel Trailing Edge Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
§	218-80051	Door	0.063 X 2.1 X 2.9	2024-T3	Replace
8	215-80051	Tab	0.050 X 0.6 X 1.6	2024-T42	Replace
9		Stiffener	0.050 X * X *	2024-T42	Section XII
10	215-80065	Strut (Mach) . . .		7075-T6	Section XII
11‡	215-80051	Channel	0.100 X 3.5 X 5.8	2024-T42	Section XII
12		Doubler	0.100 X 1.4 X 2.8	7075-T6	Replace
13		Support	0.025 X 0.8 X *	2024-T3	Replace
14‡		Channel	0.080 X 5.0 X 8.5	2024-T42	Section XII
§	218-80051	Channel	0.080 X 5.0 X 7.2	2024-T42	Section XII
15	215-80051	Stiffener	0.050 X 5.1 X *	2024-T3	Section XII
16		Support	0.063 X * X *	2024-T3	Section XII
17‡		Rib	0.032 X 7.8 X 10.10	2024-T42	Section XII
§	218-80051	Rib	0.050 X 7.8 X 10.1	2024-T42	Section XII
18‡	215-80051	Rib	0.025 X 7.2 X 10.90	2024-T42	Section XII
§	218-80051	Rib	0.040 X 7.2 X 10.9	2024-T42	Section XII
19‡	215-80051	Stiffener	0.040 x 2.3 X 4.1	2024-T3	Section XII
§	218-80051	Stiffener	0.040 X 2.3 X 4.1	2024-T3	Section XII
20	215-80051	Rib	0.040 X 7.2 X 10.80	2024-T3	Section XII
21‡		Door	0.032 X 1.2 X 2.3	7075-T6	Replace
§	218-80051	Door	0.063 X 1.2 X 2.3	7075-T6	Replace
22	216-80051	Actuator	0.040 X 1.5 X 3.3	2024-T3	Replace
23‡	215-80051	Spar	0.040 X * X *	7075-T6	Section XII
§	218-80051	Spar	0.050 X 6.9 X 14.8	7075-T6	Section XII
24	215-80051	Skin	0.032 X 15.1 X 15.1	7075-T6	Section XII
25		Seal	0.016 X * X *	301	Section XII
26	216-80051	Stiffener	0.040 X 4.0 X 61.0	7075-T6	Section XII
27	215-80051	Stiffener	0.016 X 1.3 X 3.0	301	Replace
28		Door (Chem Mill) .	0.063 X 18.4 X 41.1	7075-T6	Section XII
29	215-80070	Hinge (Forg) . . .		7075-T6	Section XII
30	215-80051	Splice	0.040 X 1.1 X 4.6	7075-T6	Replace
31		Stiffener	0.040 X * X *	2024-T42	Section XII
32		Stiffener	0.050 X 4.5 X 7.5	7075-T6	Section XII
33	215-80071	Hinge (Forg) . . .		7075-T6	Section XII
34	215-80051	Filler	0.160 X 1.1 X 5.0	2024-T3	Replace
35		Stiffener	0.071 X 2.2 X 6.7	7075-T6	Section XII

See footnotes at the end of the figure.

Figure 5-29. Wing Outer Panel Trailing Edge Installation (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
36		Stiffener	0.040 X 2.4 X 29.4	7075-T6	Section XII
37	216-80051	Spar	0.040 X 6.0 X 48.5	7075-T6	Section XII
38	215-80072	Hinge (Mach) . . .		7075-T651	Section XII
39	216-80051	Stiffener	0.063 X 2.4 X 38.7	7075-T6	Section XII
40		Seal	0.016 X 1.6 X 6.5	301	Section XII
41	216-80051	Rib	0.032 X * X *	7075-T6	Section XII
42	216-80051	Trailing Edge			
		(Extr)	CVC10051-10	2024-T3511	Section XV
43		Skin (Chem Mill) .	0.063 X 26.8 X 50.2	7075-T6	Section XII
44‡		Skin	0.035 X 14.2 X 57.0	7075-T6	5-30
§	218-80051	Skin	0.063 X 14.2 X 57.0	7075-T6	Section XII
45	215-80051	Door	0.050 X 5.8 X 6.8	2024-T3	Section XII
46	215-80051	Gusset	0.032 X 2.6 X 3.5	2024-T3	Replace
47	216-80051	Bracket	0.050 X 6.8 X 9.2	7075-T6	Section XII
48	215-80051	Support	0.040 X 2.0 X 6.7	2024-T3	Section XII
49		Stiffener	0.040 X 1.6 X 4.7	2024-T3	Section XII
50		Stiffener	0.071 X 2.8 X 6.6	2024-T42	Section XII
51		Rib	0.040 X 9.0 X 12.4	2024-T42	Section XII
52		Bracket	0.050 X 4.4 X *	7075-T6	Section XII
53		Door	0.040 X 6.4 X 6.5	7075-T6	Section XII
54		Stiffener	0.040 X 1.3 X 5.7	7075-T6	Section XII
55		Rib	0.071 X * X *	7075-T6	Section XII
56		Support (Extr) . .	AND10137-2407	2024-T3511	Section XV
57‡		Stiffener	0.040 X 2.3 X 4.1	2024-T42	Section XII
§	218-80051	Stiffener	0.040 X 2.3 X 4.1	2024-T42	Section XII
58‡	215-80051	Doubler	0.032 X 7.1 X 12.5	7075-T6	Section XII
§	218-80051	Doubler	0.032 X 7.1 X 12.5	7075-T6	Section XII
59‡	215-80051	Gusset	0.032 X * X *	2024-T42	Section XII
§	218-80051	Gusset	0.032 X * X *	2024-T42	Section XII
60	215-80051	Doubler	0.032 X 7.1 X 12.5	7075-T6	Section XII
61†		Support	0.064 X 1.00 X 1.75	2024-T3	Section XII
62§	218-80051	Channel	0.100 X 4.6 X 4.7	2024-T42	Section XII
63§		Doubler	0.100 X 2.6 X 4.7	2024-T3	Section XII

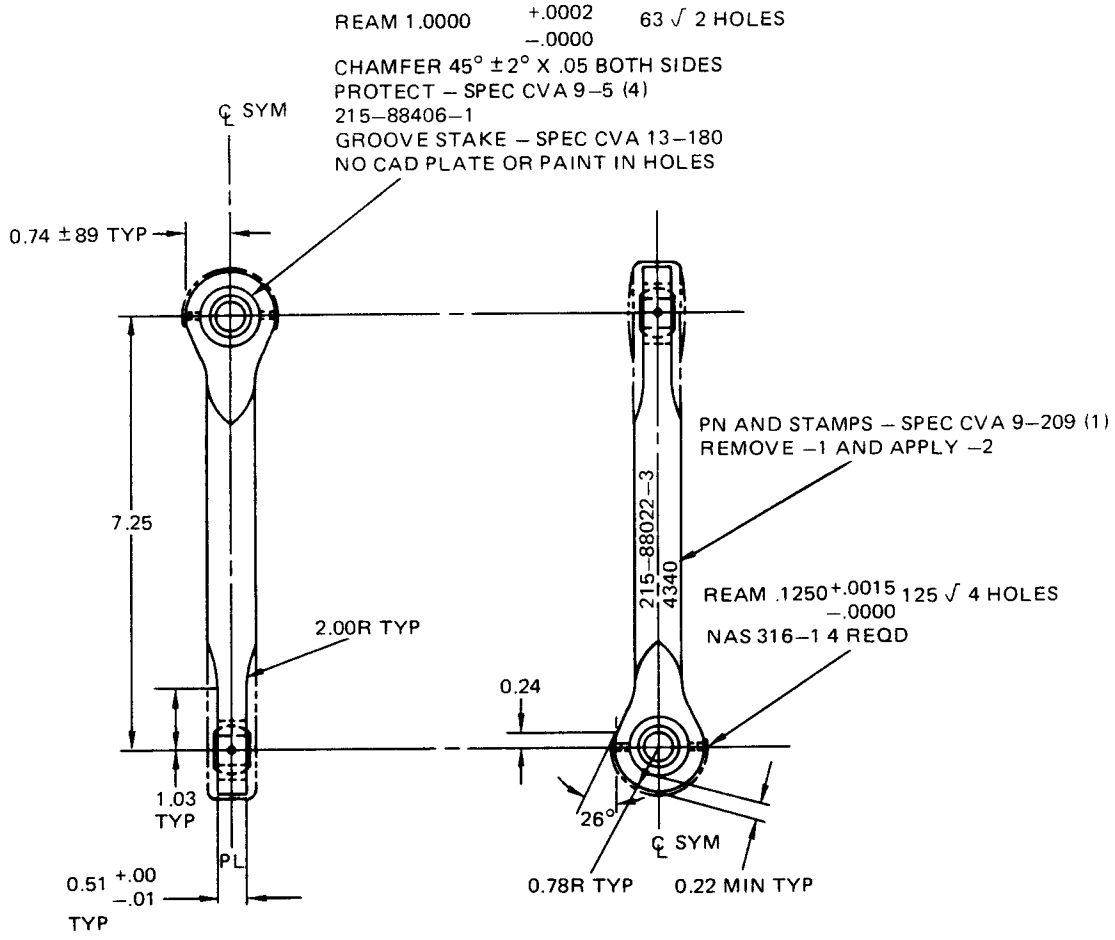
See footnotes at the end of the figure.

Figure 5-29. Wing Outer Panel Trailing Edge Installation (Sheet 4)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
64§		Plate	0.050 X 1.7 X 4.2	2024-T3	Section XII
65§		Rub Strip	0.062 X 3.7 X 4.2	Phenolic	Section XII
66§		Bracket	0.050 X 1.1 X 3.7	2024-T3	Section XII

*Length or length and width may vary with location.
†Make from CVC501B2G10.
‡Airplanes AF69-6197 through AF73-1014.
§Airplanes AF73-1015 and subsequent.

Figure 5-29. Wing Outer Panel Trailing Edge Installation (Sheet 5)



REPAIR:

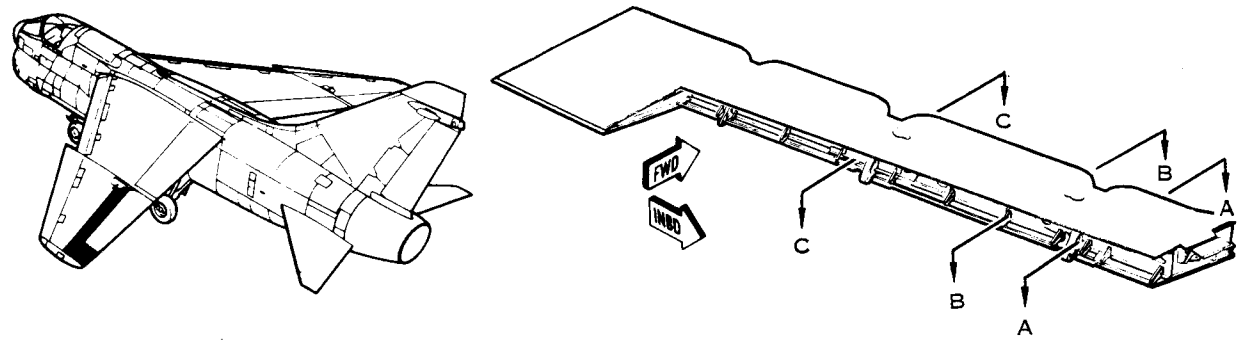
1. Remove old bearing.
2. Measure bearing bore, reject any link whose inside diameter exceeds 01.005 inches.
3. Strip paint from ends of link.
4. Plate inside diameter of bearing bore using Class 2 neutral-nickel plating per QQ-N-290A. Plating shall be of sufficient thickness to allow reaming to final dimension given below. Within 4 hours of plating, bake part at 357°F (±25°F) for 3 hours.
5. Ream bore to 0.9990 inch (+0.0005, −0.0000 inch). Touch up chamber as required.
6. Install new bearing using MIL-R-46082 retaining compound. Inject grease to ensure grease paths are not obstructed. Ball must move freely by hand.
7. Stake bearing in accordance with Section XVII.
8. Repaint bare areas with MIL-P-23377 epoxy primer.

NOTE

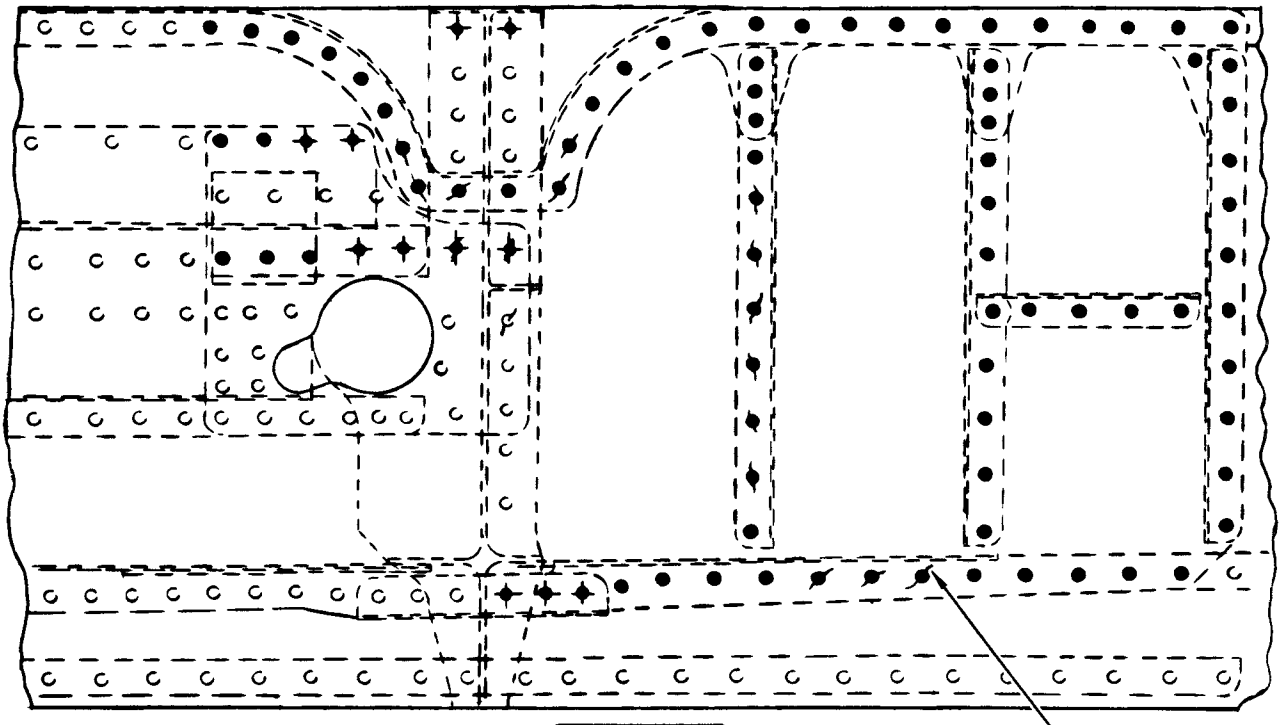
1. All dimensions in inches

90D520–09–87

Figure 5-29.1. Outer Wing Section Aileron Link Repair



216GL0138-1 DOUBLER FABRICATION AND INSTALLATION

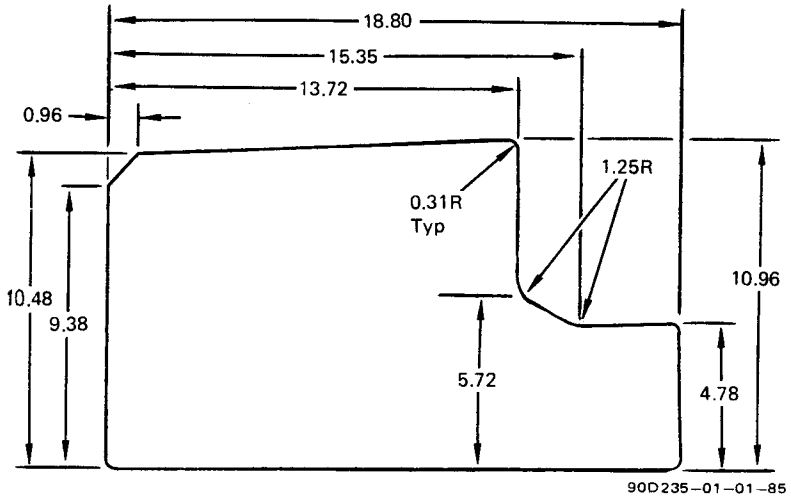


STEP 1: FASTENER REMOVAL

VIEW A-A
LOOKING DOWN

NOTE

1. All dimensions are given in inches, ±0.06 tolerance.
2. Maintain edge distance as shown.



STEP 2: 216GL0138-1 DOUBLER FABRICATION

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Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 1 of 7)

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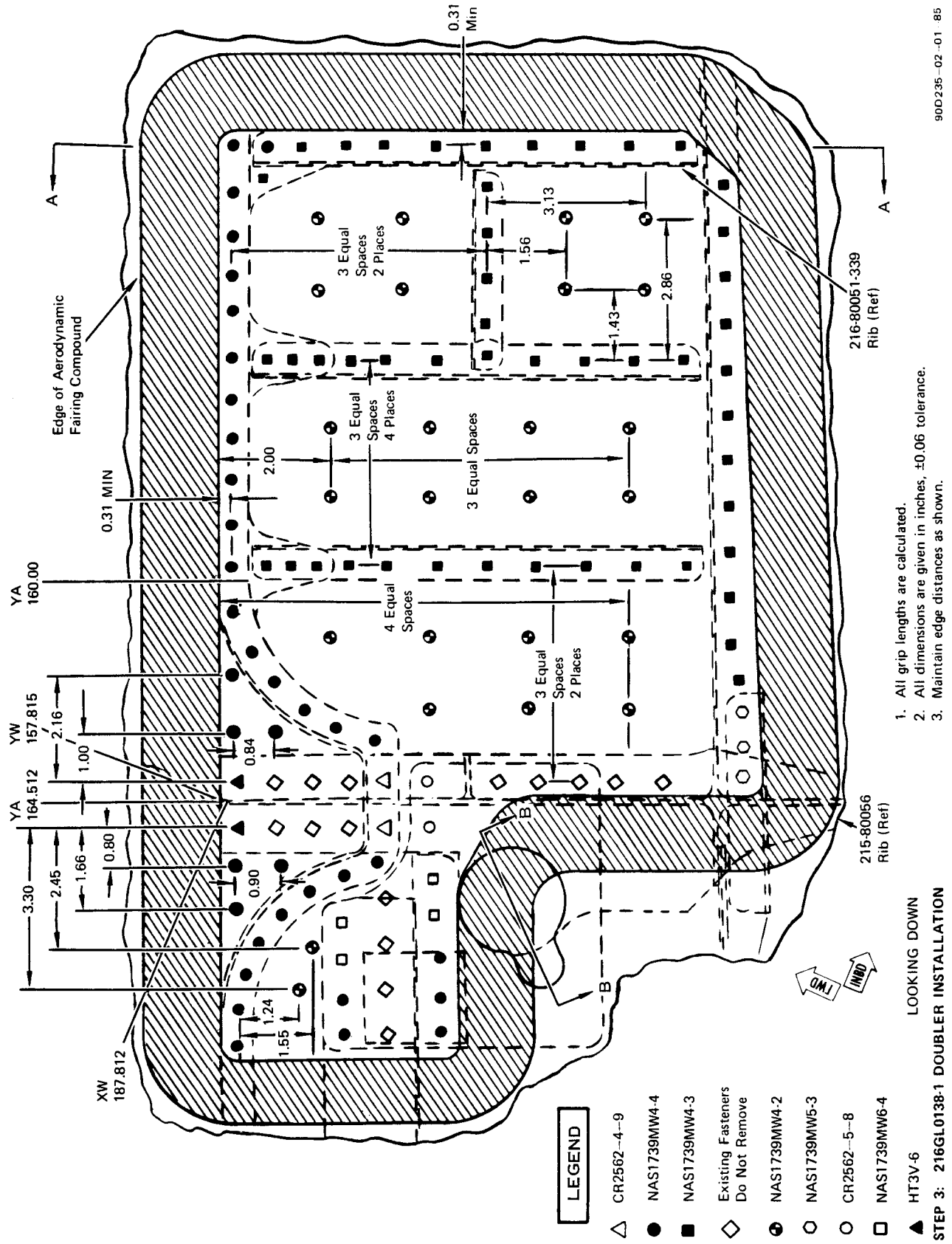
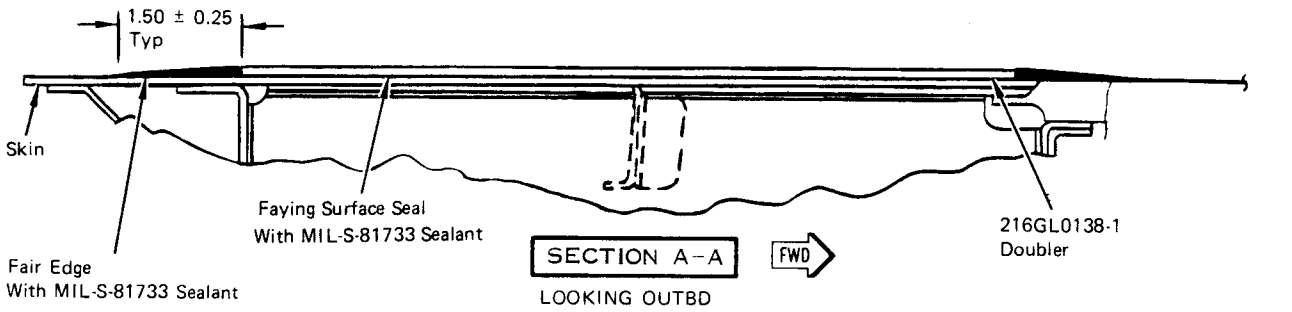


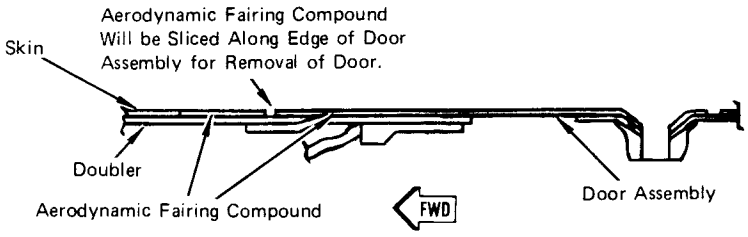
Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 2)



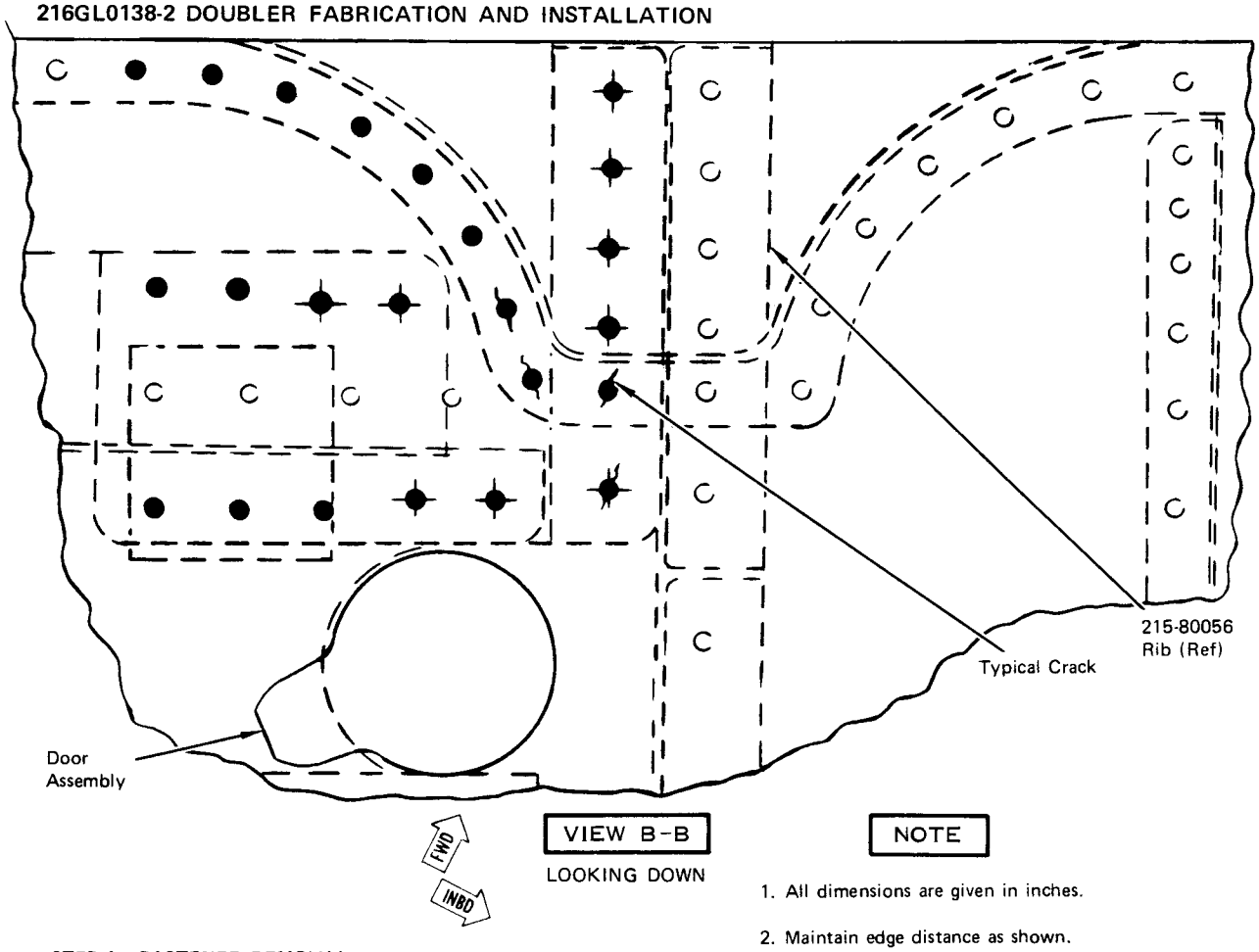
WARNING

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

Aerodynamic fairing compound is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.



216GL0138-2 DOUBLER FABRICATION AND INSTALLATION



NOTE

1. All dimensions are given in inches.
2. Maintain edge distance as shown.

STEP 1: FASTENER REMOVAL

90D235-03-01-85

Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 3)

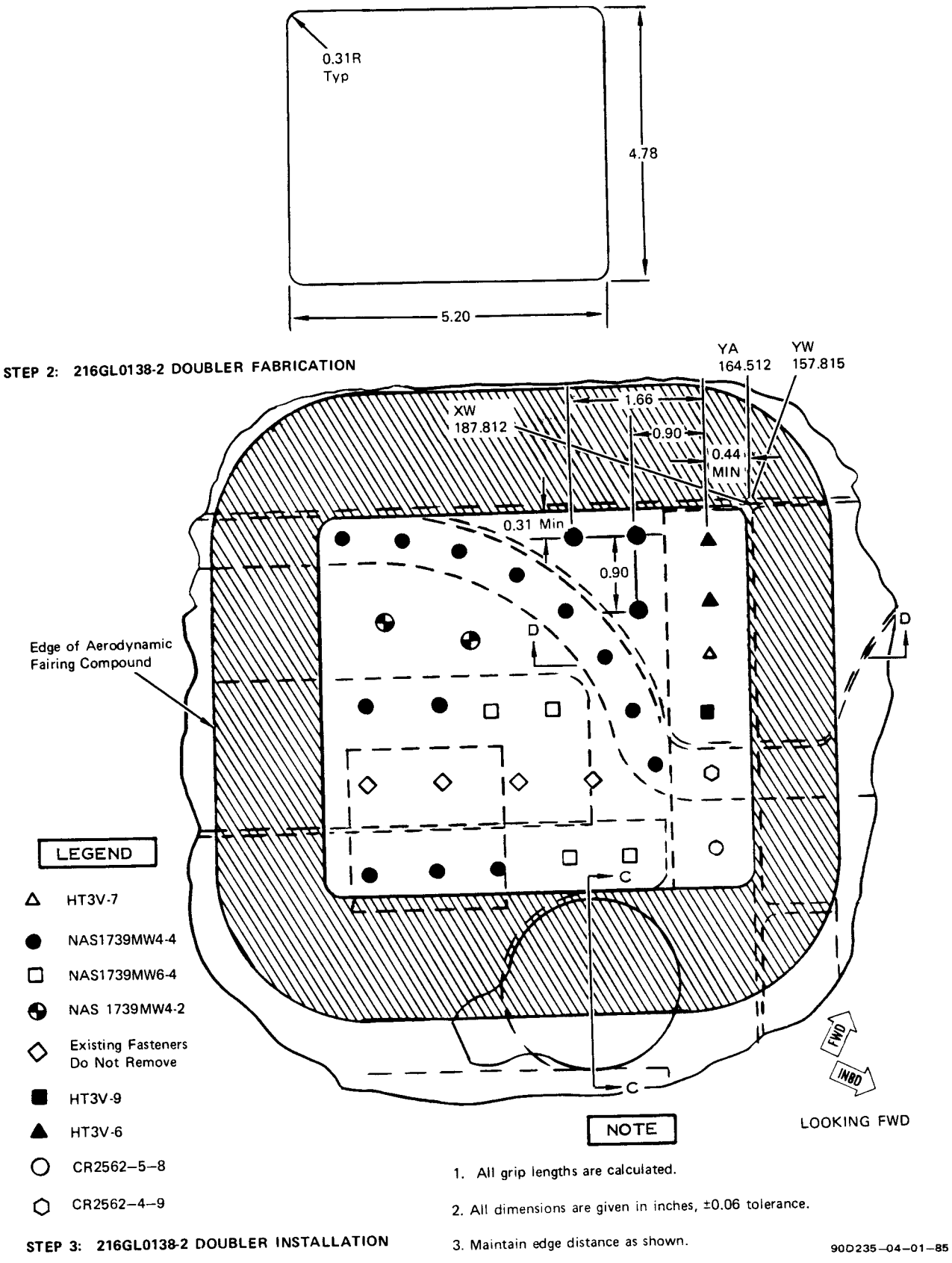
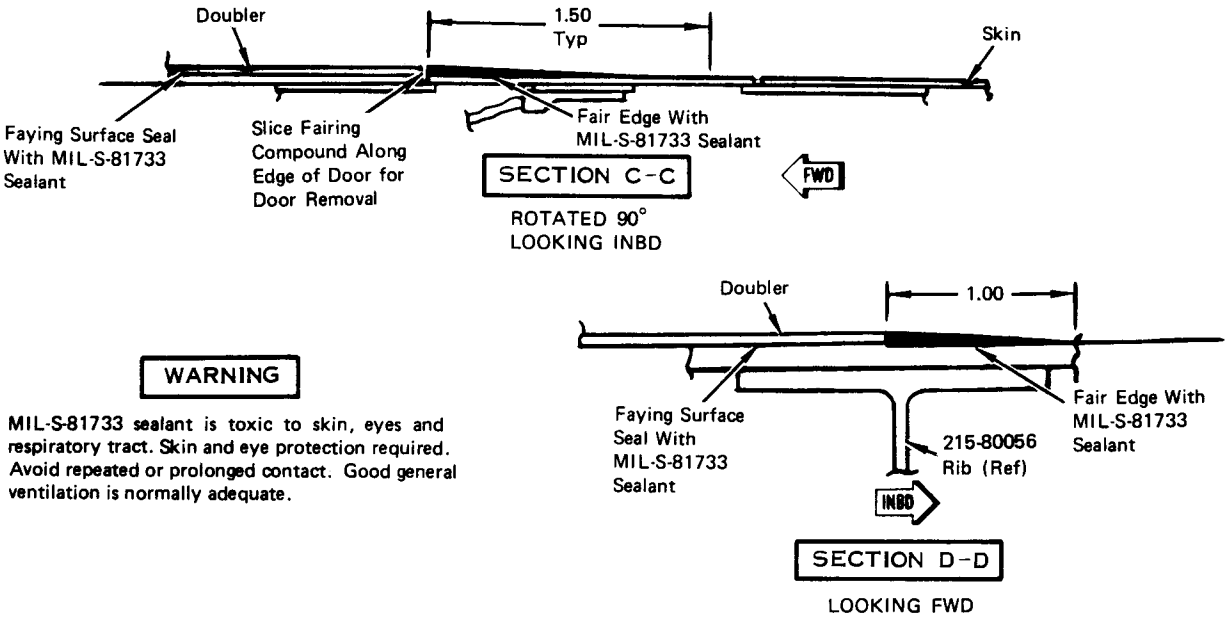


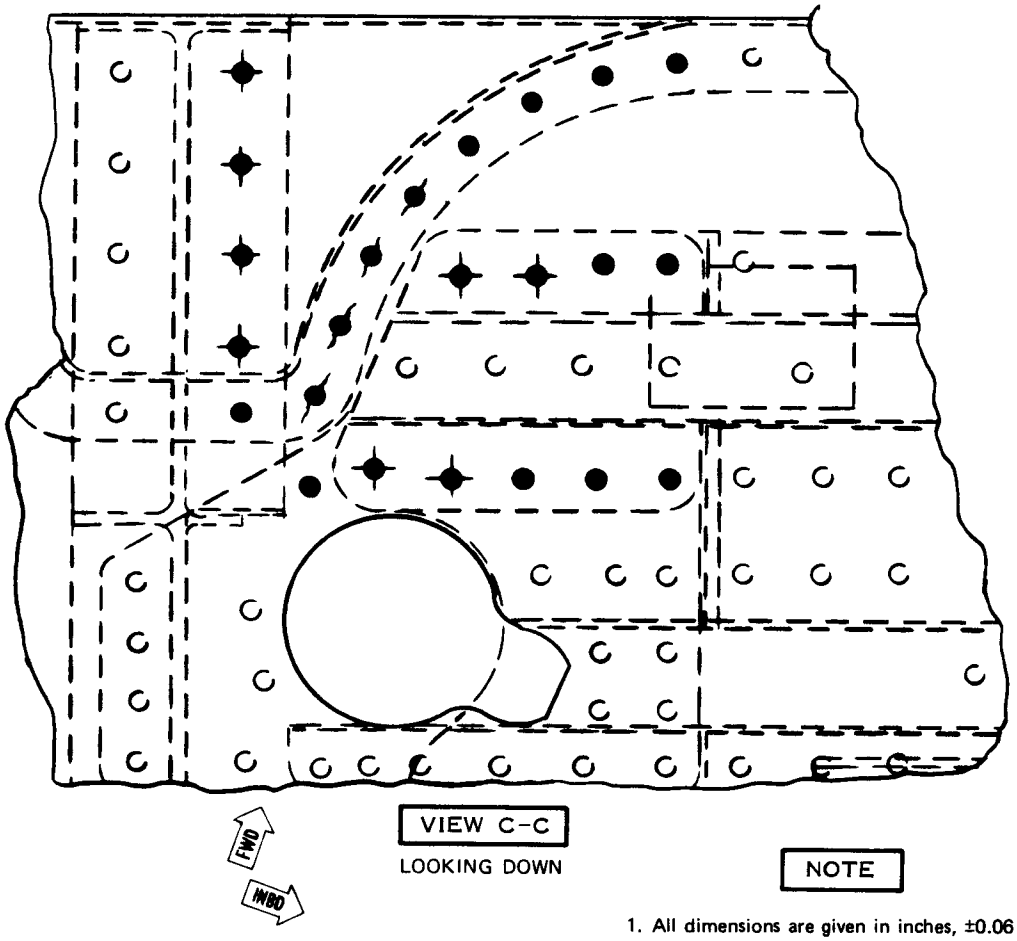
Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 4)



WARNING

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

216GL0138-3 DOUBLER FABRICATION AND INSTALLATION



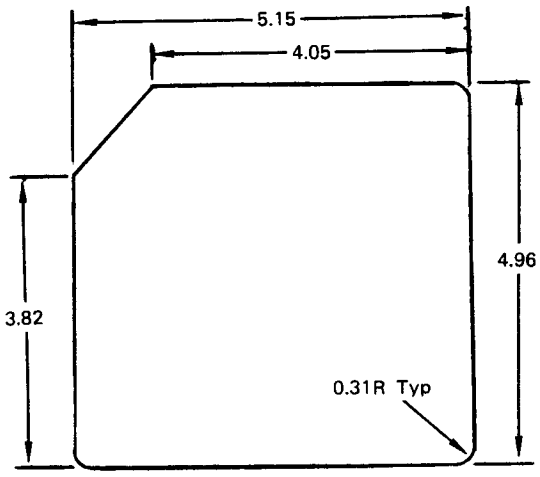
NOTE

1. All dimensions are given in inches, ±0.06 tolerance.
2. Maintain edge distance as shown.

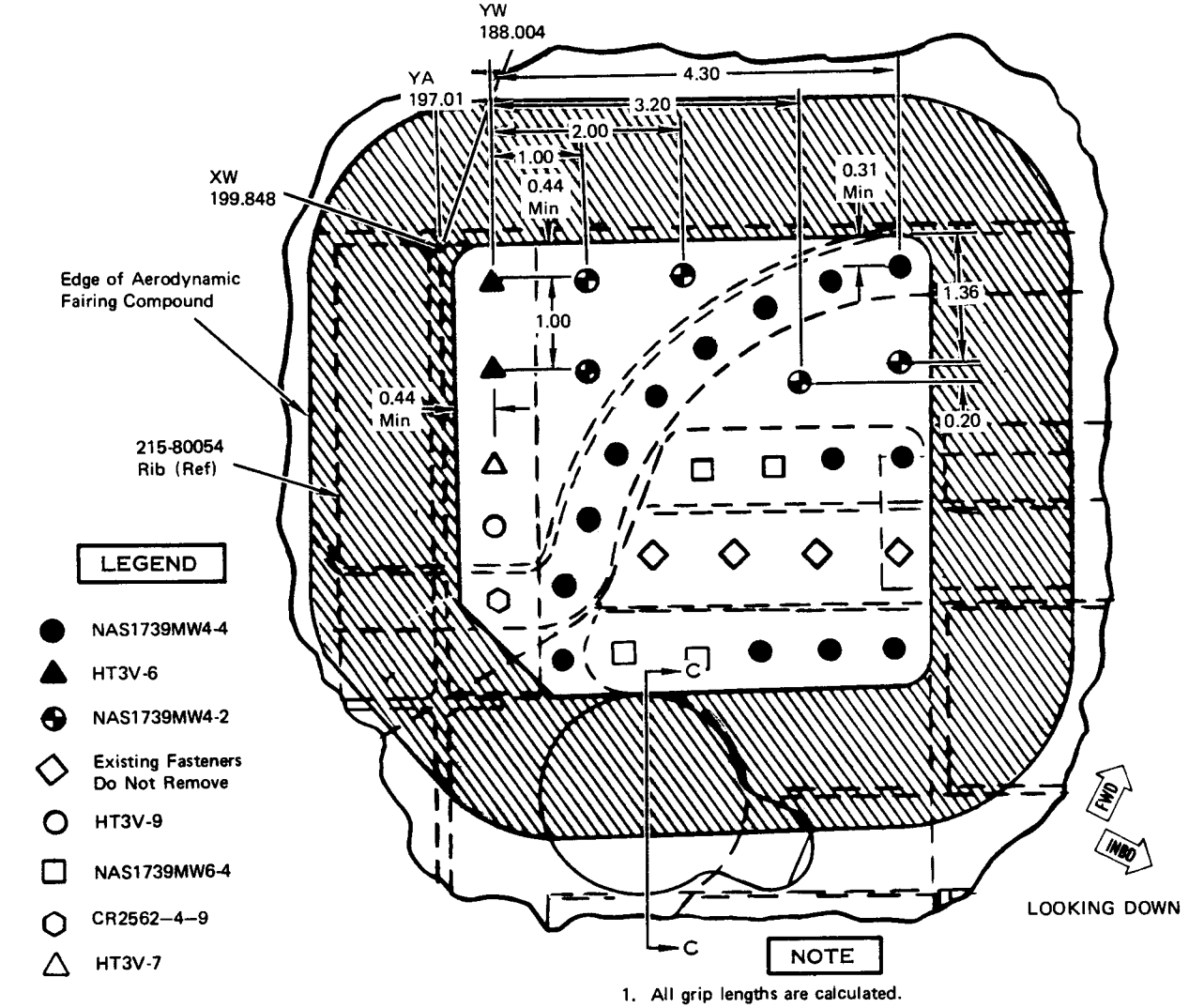
STEP 1: FASTENER REMOVAL

90D235-05-01-85

Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 5)



STEP 2: 216GL0138-3 DOUBLER FABRICATION



NOTE

1. All grip lengths are calculated.
2. All dimensions are given in inches, ±0.06 tolerance.
3. Maintain edge distance as shown.

90D235–06–01–85

STEP 3: 216GL0138-3 DOUBLER INSTALLATION

Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 6)

REPAIR LIMITATIONS

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

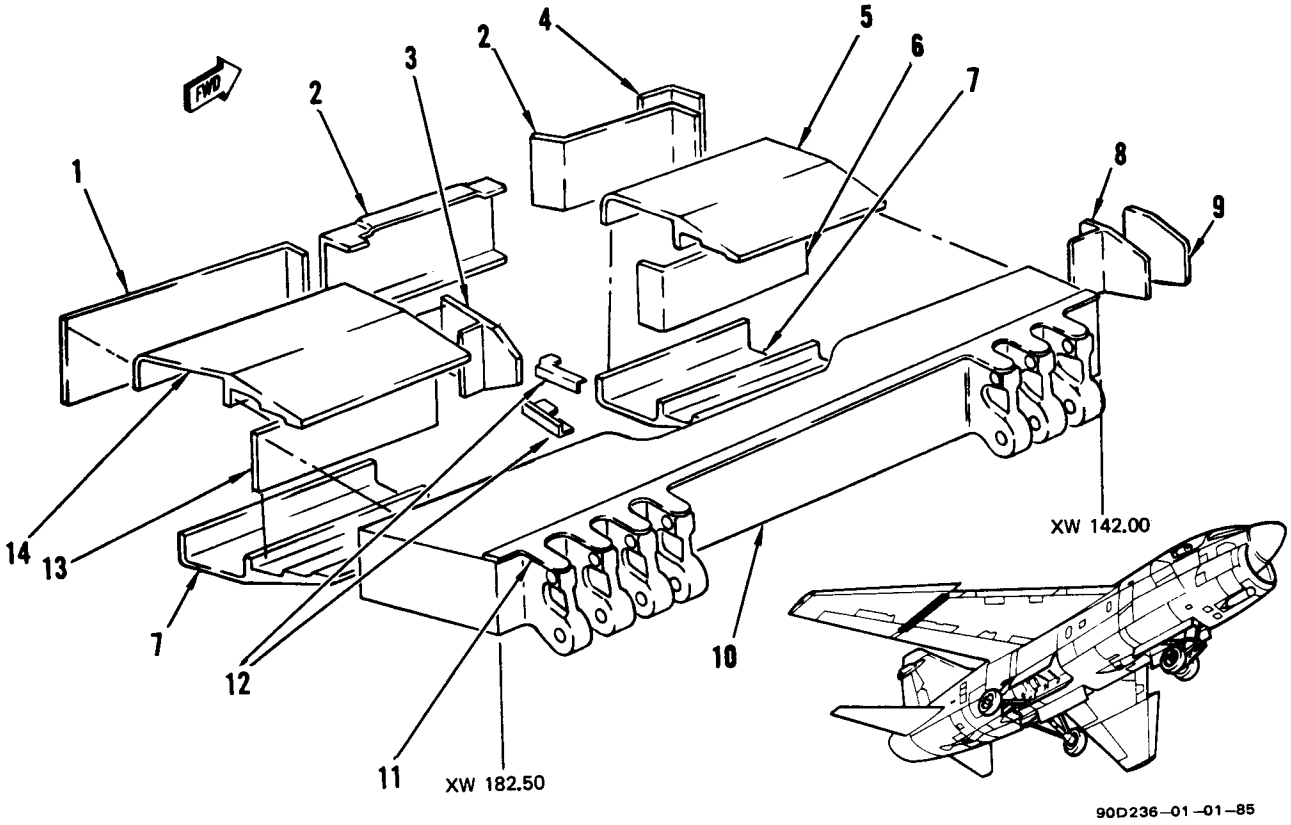
1. The 216GL0138-1 doubler shall be used on aircraft having cracks, loose rivets or other evidence of structural damage inboard of the 215-80056 rib.
2. The 216GL0138-2 doubler may be used on aircraft having cracks on the outboard side of the 215-80056 rib when there is no evidence of any structural problem inboard of the 215-80056 rib.
3. The 216GL0138-3 doubler shall be used on aircraft having cracks on the inboard side of the 215-80054 rib.

REPAIR PROCEDURE (TYPICAL FOR ALL DOUBLERS)

1. Strip old finish from skin area to be repaired (T.O. 1A-7D-23).
2. Remove fasteners (symbols ● ⊕). Install CVC771D2 skin countersink conical washers for symbol ● and CVC771D3 for symbol ⊕. Washers to be installed as directed in Section I. Bond washers in skin with MIL-S-81733 sealant.
3. Fabricate a 0.063-inch gage 2024-T3 clad aluminum alloy doubler to dimensions shown.
4. Treat repair patch and bare area of skin with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
5. Layout and drill rivet pattern.
6. Apply MIL-S-81733 heat resistant sealant to faying surfaces of skin and repair doubler (T.O. 1A-7D-23).
7. Install fasteners wet with MIL-S-81733 sealant.
8. Install repair doubler as shown. See legend for fastener identification.
9. Touchup paint in repaired area T.O. 1A-7D-23.

90D235-07-01-85

Figure 5-30. Wing Outer Panel Trailing Edge Upper Skin Crack Repair (Sheet 7)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-80050	Wingfold Rib Installation, Wing Outer Panel			
1	215-80050	Web	0.125 X 6.00 X 18.40	7075-T6	Section XII
2		Web	0.090 X * X *	7075-T6	Section XII
3		Tee (Extr)	CVC10013-27	7075-T6	Section XV
4		Clip	0.090 X 2.20 X 5.00	7075-T6	Section XII
5	215-80408	Plate (Extr) . . .	CVC10060-34	7075-T6511	Section XV
6	215-80050	Web	0.160 X 4.90 X 12.00	7075-T6	Section XII

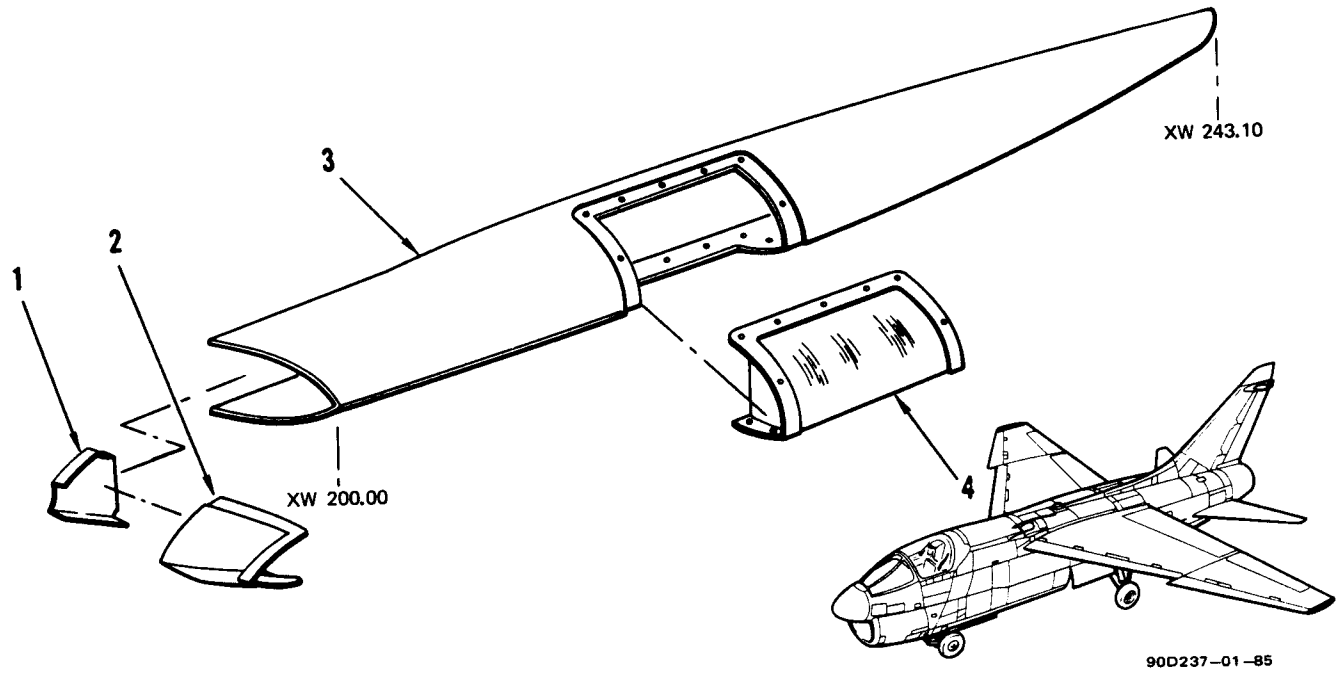
See footnotes at the end of the figure.

Figure 5-31. Wing Outer Panel Wingfold Rib Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
7	215-80408	Plate (Mach) . . .	2.000 X * X *	7075-T651	Section XII
8	215-80050	Tee (Extr)	CVC10013-31	7075-T651	Section XV
9		Splice	0.190 X 5.00 X 5.10	7075-T6	Section XII
10‡,†	215-80057	Rib (Mach Forg) . .		7075-T6	5-7
§,†		Rib (Forg)		7050-T736	5-7
11	215-80050	Fairing	0.050 X 3.70 X 36.40	7075-T6	Replace
12		Clip	0.100 X 3.20 X 3.30	7075-T6	Replace
13		Web	0.190 X 5.20 X 14.70	7075-T6	Section XII
14	215-80408	Plate (Extr) . . .	CVC10060-33	7075-T6511	Section XV

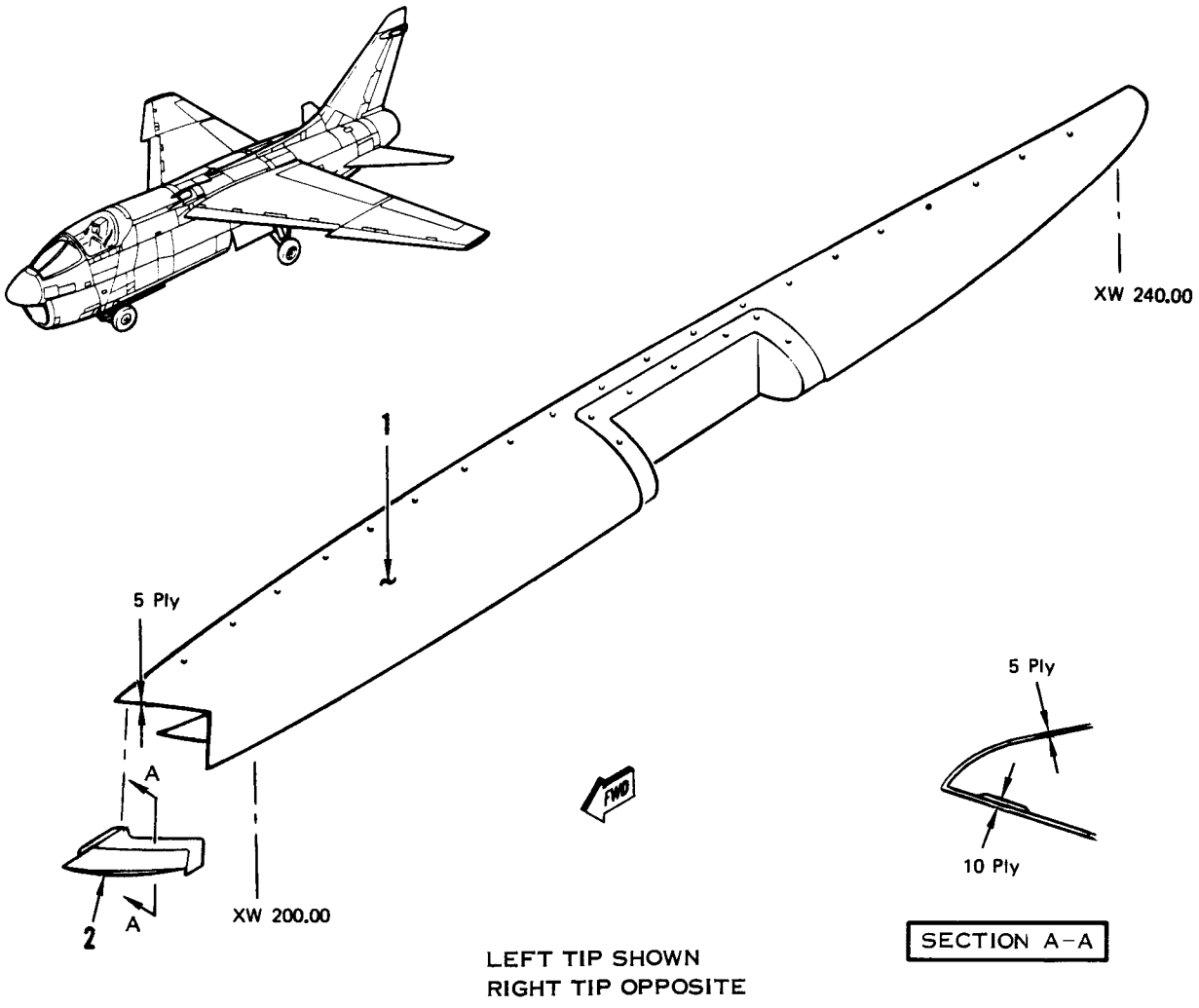
*Length or length and width may vary with location.
†Made from 215-80403 forging.
‡Airplanes through AF75-399.
§Airplanes AF75-400 and subsequent.

Figure 5-31. Wing Outer Panel Wingfold Rib Installation (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-80045	Tip Installation, Wing			
1	215-80045	Support	0.040 X 3.60 X 4.00	2024-T42	Section XII
2		Nose (Bonded) . . .	5 Ply	Reinforced Plastic	5-33
3		Tip (Bonded) . . .	5 Ply	Reinforced Plastic	5-33
4	215-87120	Light Assembly . .			Replace

Figure 5-32. Wing Outer Panel Tip Installation



LEADING PARTICULARS: 215-80045

INDEX	COMPONENT	MATERIAL	FINISH
1	Tip	5-Ply construction of MIL-C-9084 Type VIII, No. 181-150 glass cloth	See Section XIV
2	Nose	Fabric impregnated with MIL-R-9300 resin.	

90D238-01-01-85

Figure 5-33. Wing Outer Panel Tip Repair (Sheet 1 of 2)

DAMAGE EVALUATION AND REPAIR CHART	
DAMAGE LIMITATIONS (Note 1)	REPAIR PROCEDURE SECTION XIV
Damage not penetrating through the outer ply of the laminated skin	A
Soft spots up to 1.5 inches in diameter	B
Delamination of skin (void area)	B
Skin ply mutilated or missing with damaged area major dimension less than 1 inch	C
Skin ply mutilated or missing with damaged area major dimension 1 inch or greater	D
Damage penetrating one through four plies	D
Damage penetrating all plies	G
Delaminated plies in fastener area	H
Mutilated edge plies such as torn fastener holes and crushed edges	J

NOTE

1. After 5% of entire area has been repaired, further damage is cause for replacement.

90D238-02-01-85

Figure 5-33. Wing Outer Panel Tip Repair (Sheet 2)

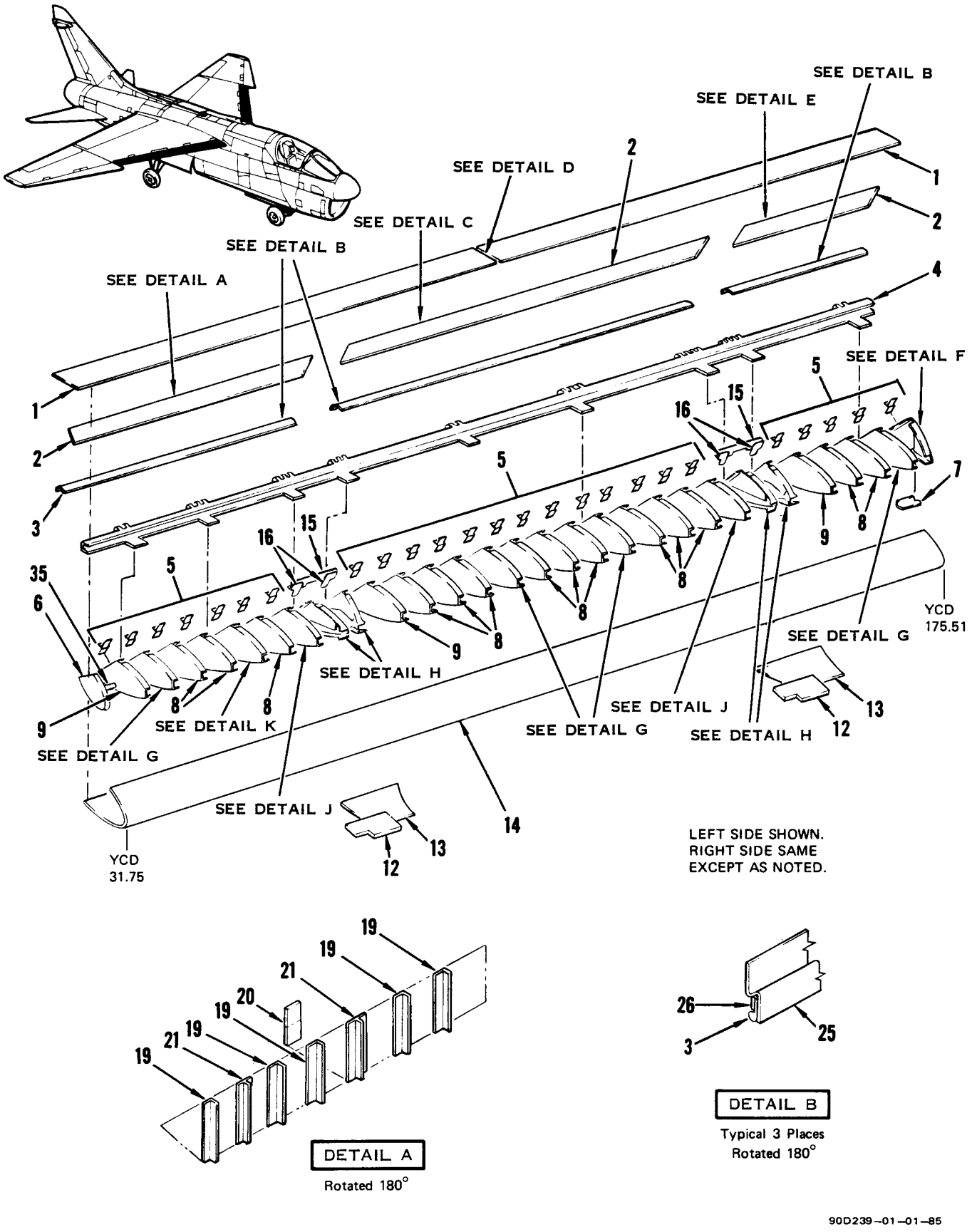


Figure 5-34. Wing Center Section Leading Edge Flap Assembly Repair (Sheet 1 of 5)

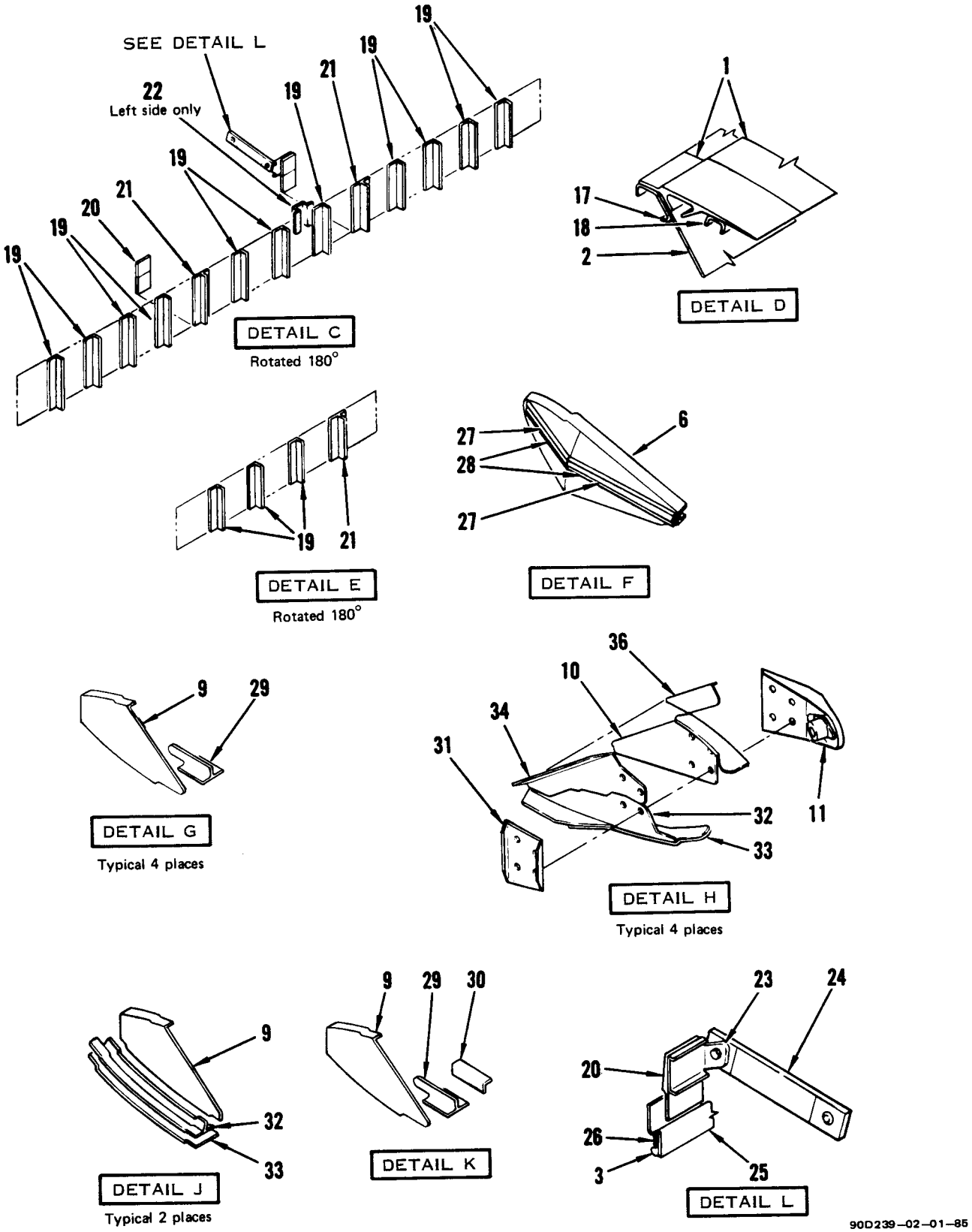


Figure 5-34. Wing Center Section Leading Edge Flap Assembly Repair (Sheet 2)

Repair of Wing Center Section Leading Edge Flap Actuator Attach Point Ribs.

GENERAL INFORMATION

This repair requires the use of an 0.625 inch long bushing, diameter not to exceed 0.75, to properly separate/align the actuator rod end lugs. All cracked ribs shall be retained and used as templates to locate the holes in the replacement ribs. REPLACEMENT of the cracked actuator attach point ribs shall be accomplished, one side at a time only, using standard structural repair techniques and the following procedure:

1. Remove damaged inboard flap.

2. Remove actuator attach point rib structure (33, 34, 36) containing cracked rib from flap.

NOTE

If both rib structures at one actuator attach point contain cracked ribs, remove and replace only one structure at a time.

3. Fabricate new ribs as required from 0.063, 7075–76 aluminum using cracked rib as sample parts.

4. Install forged support, Part No. 215-70226, in flap with a 0.625 inch long bushing between supports to obtain proper spacing. Secure supports with the actuator bolt to obtain proper alignment.

WARNING

Welding operations produce heat, highly toxic fumes, injurious radiation, metal slag and airborne particles. Protection equipment consisting of welding goggles, with proper tinted lenses, apron or jacket, and welder's boots are required. Good general ventilation is normally adequate.

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilzation is normally adequate.

NOTE

If both rib structures at one actuator attach point are cracked and being repaired, the distance required to insure an 0.625 inch gap between supports may be divided between both structures.

5. Using the old ribs as templates and the flap as a fixture, locate holes in new ribs. Install new ribs against forged supports in flap. Mark holes in rib flanges through skin to insure proper edge distance from flange radius. If holes are too close to the radius, flap skin (6061-76 aluminum) may be welded, smoothed, and redrilled for proper hole location.

6. Install new ribs in flap and rework repaired area in accordance with T.O. 1A-7D-23. If other side of actuator attach point is being repaired, do not permanently install ribs at this time since their removal may be necessary.

NOTE

Locating and securing three aft upper rib fasteners is extremely difficult. A 2 inch diameter hole may be cut in the web between ribs to gain access behind the actuator rib structure on the blind side. Bolts and nuts may then be used in this location. This access hole will have to be repaired in accordance with Section 1.

Repair of these inboard actuator attach point ribs requires care and expertise to insure satisfactory installation of the new ribs. Considerable effort must be expended to insure that the forged supports are relocated in the same position after rework. Proper use of this procedure will also insure correction of a manufacturing defect in which improper spacing was maintained between forged supports.

90D239–03–01–85

Figure 5-34. Wing Center Section Leading Edge Flap Assembly Repair (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70200	Flap Assembly, Wing Leading Edge			
1	215-70200	Fairing (Extr) . .	215-70507-1 (CVC10060-16)	7075-T6511	Section XV, 5-35
2		Spar	0.040 X * X *	7075-T6	Section XII
3		Seal (Extr)	215-70149	Teflon	5-37
4		Hinge (Extr) . . .	CVC10041-22	7075-T6511	Section XV
5		Support (Extr) . .	CVC10002-3	7075-T6511	Section XV
6		Rib (Bonded) . . .	6 Ply	Reinforced Plastic	Section XIV
7		Angle	0.032 X * X *	7075-T6	Section XII
8†		Rib	0.025 X * X *	7075-T6	Section XII
9†		Rib	0.032 X * X *	7075-T6	Section XII
10		Rib	0.063 X * X 10.5	7075-T6	Section XII
11	215-70226	Support (Forg) . .		7075-T6	Section XII
12	215-70020	Doubler	0.050 X 2.1 X *	7075-T6	Section XII
13		Door (Chem Mill) .	0.080 X 13.0 X 17.0	6061-T6	Replace
14		Skin (Chem Mill) .	0.080 X 18.0 X 180.0	6061-T6	Section XII/5-38
15		Stiffener	0.063 X * X *	7075-T6	Section XII
16		Support (Extr) . .	CVC10002-3	7075-T6511	Section XV
17		Splice	0.071 X 2.7 X 4.7	7075-T6	Section XII
18		Splice	0.050 X 1.3 X 3.3	7075-T6	Section XII
19		Angle	0.050 X * X *	7075-T6	Section XII
20		Splice (Extr) . . .	CVC10060-26	7075-T6511	Section XV
21		Tee (Extr)	CVC10010-25	7075-T6511	Section XV
22		Clip	0.040 X 5.7 X 5.0	7075-T6	Section XII
23		Clip	0.050 X 1.9 X 2.9	7075-T6	Section XII
24		Webbing	9.5 Long	MIL-W-27265, Class R, Type II	Replace
25		Clip	0.025 X 2.1 X *	2024-T3	Section XII
26		Retainer	0.020 X 0.4 X *	7075-T6	Replace
27		Seal (Extr)	CPC15E40 (CHR4680)	Teflon	Replace
28		Retainer (Extr) . .	CPC29E1 (86494)	2024-0	Replace
29		Tee (Extr)	CVC10010-23	7075-T6511	Section XV

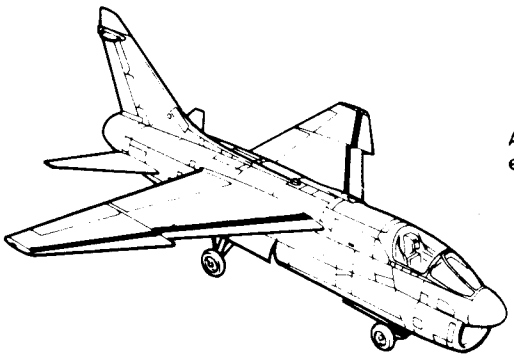
See the footnotes at the end of the figure.

Figure 5-34. Wing Center Section Leading Edge Flap Assembly Repair (Sheet 4)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
30		Angle	0.040 X 0.9 X 2.7	7075-T6	Section XII
31		Channel	0.063 X 2.7 X *	7075-T6	Section XII
32		Tee (Extr)	CVC10011-16	7075-T6	Section XV
33		Doubler	0.100 X * X *	7075-T6	Section XII
34		Angle	0.063 X * X *	7075-T6	Section XII
35		Angle	0.025 X 1.4 X 4.6	7075-T6	Section XII
36		Clip	0.063 X 1.8 X *	7075-T6	Section XII

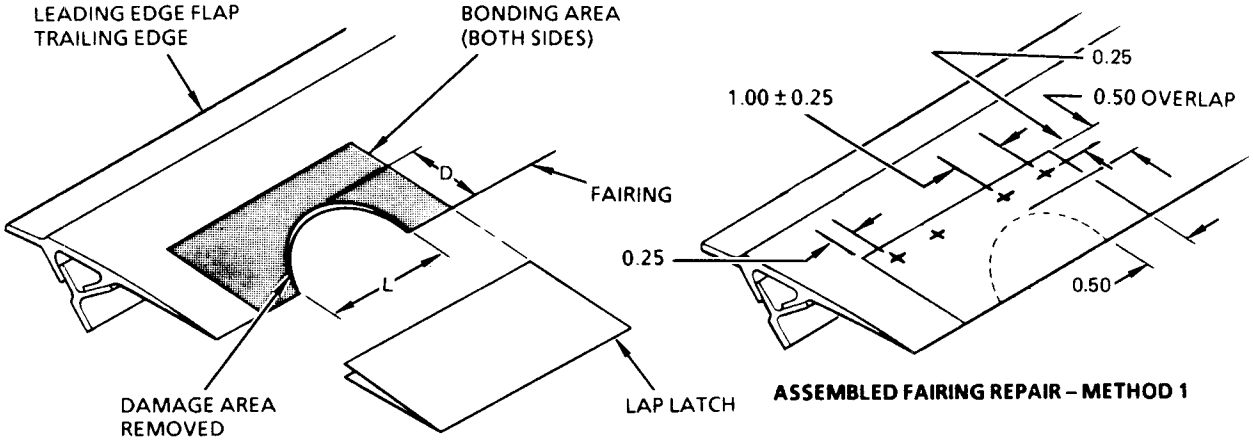
*Length or length and width may vary with location.
†Rib material for spare leading edge flap assembly is 0.040-inch 2024-T42 aluminum.

Figure 5-34. Wing Center Section Leading Edge Flap Assembly Repair (Sheet 5)



NOTE

All dimensions are in inches except as shown.



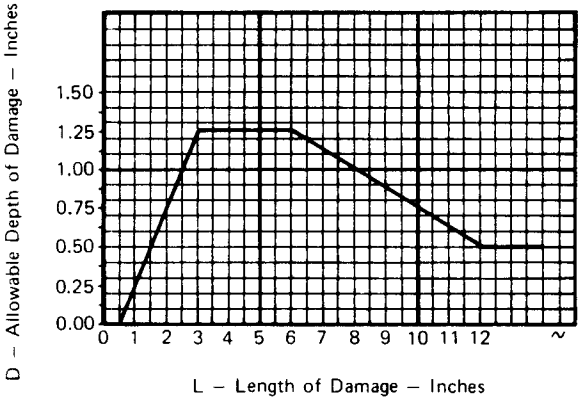
ASSEMBLED FAIRING REPAIR – METHOD 1

FAIRINGS

Damage Limits:

1. Use damage limitation chart to determine if damage is major or minor.

DAMAGE LIMITATION CHART



NOTE

Chart gives maximum depth (D) allowable for a given length (L) of minor damage.

2. If damage is minor, proceed with Method 1 or Method 2 repair. If damage is major, replace part.

Method 1 Repair (Center Section and Outboard):

1. Remove damage area as required.

NOTE

Damage that does not exceed 0.50 inch depth may extend the entire length of trailing edge except for 0.50 inch overlap on each end.

2. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

3. Prepare a lap patch, bent as shown, from a single sheet of 0.005 inch gage, type 301 stainless steel. Locate and drill holes for MS20426 B3 rivets through patch and blade. Remove patch and dimple. Countersink outside surface of blade to match dimpled patch.

CAUTION

Edges of lap patch should have round, smooth edges to prevent damage to mating reinforced plastic fairing.

4. Clean faying surfaces to be bonded.

90D240-01-03-88

Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 1 of 4)

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

5. Apply sufficient amount of MIL-S-8802 sealant to inner surface of lap patch to fill damage area.
6. Apply MIL-S-8802 sealant to bonding area of fairing trailing edge.
7. Position lap patch on fairing trailing edge.
8. Clamp in place (do not install rivets).
9. Allow repair to cure 24 hours.
10. Remove sealant from holes and dimples, then install rivets.

Method 2 Repair (Center Section Only):

1. Trim center section wiper blade as shown in Section A-A.
2. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
3. Fabricate replacement fairing as shown in Detail A or B. Make fairing from 0.063-inch stock aluminum alloy sheet (Type 2024-T3 CLAD, QQ-A-250/5). Apply finish in accordance with T.O. 1A-7D-23.
4. Install replacement fairing using NAS1739-4-2 rivets as shown. Countersink outside surface. Pickup existing fastener locations in fairing where applicable.
5. Apply MIL-S-81733 sealant to faying surface of fairing and repair part.
6. Fair forward edge step with MIL-S-81733 as shown in Section A-A.
7. Allow sealant to cure for 24 hours.
8. Rig gap and overlap (T.O. 1A-7D-2-8).
9. Alternate method of rigging may be accomplished by crimping or reforming replacement fairing.

CENTER SECTION RIBS

Damage Limits:

Cracks in excess of 0.6 inch on actuator support ribs require flap removal and replacement. The maximum allowable crack length is determined by the sum of all cracks in both actuator support flanges. Cracks less than 0.6 inch are considered noncritical and may be flown to phased inspection.

Repair:

Flaps will be considered serviceable unless they exceed the following criteria: 40% of the airload ribs are broken or more than 3 consecutive airload ribs are broken. Flaps that exceed this criteria may be flown until spares for replacement become available.

CENTER SECTION HINGE LUGS

Damage Limits:

All flap hinge lugs are subject to a maximum of one broken or cracked lug per bank except lug banks on either side of the flap actuators. On either lug bank adjacent to the flap actuators, two nonconsecutive lugs may be broken or cracked. These above conditions are considered noncritical providing there is no damage in the corresponding wing/wing center section hinge half.

Repair:

Damage within the above limits may be flown to phased inspection but require the following:

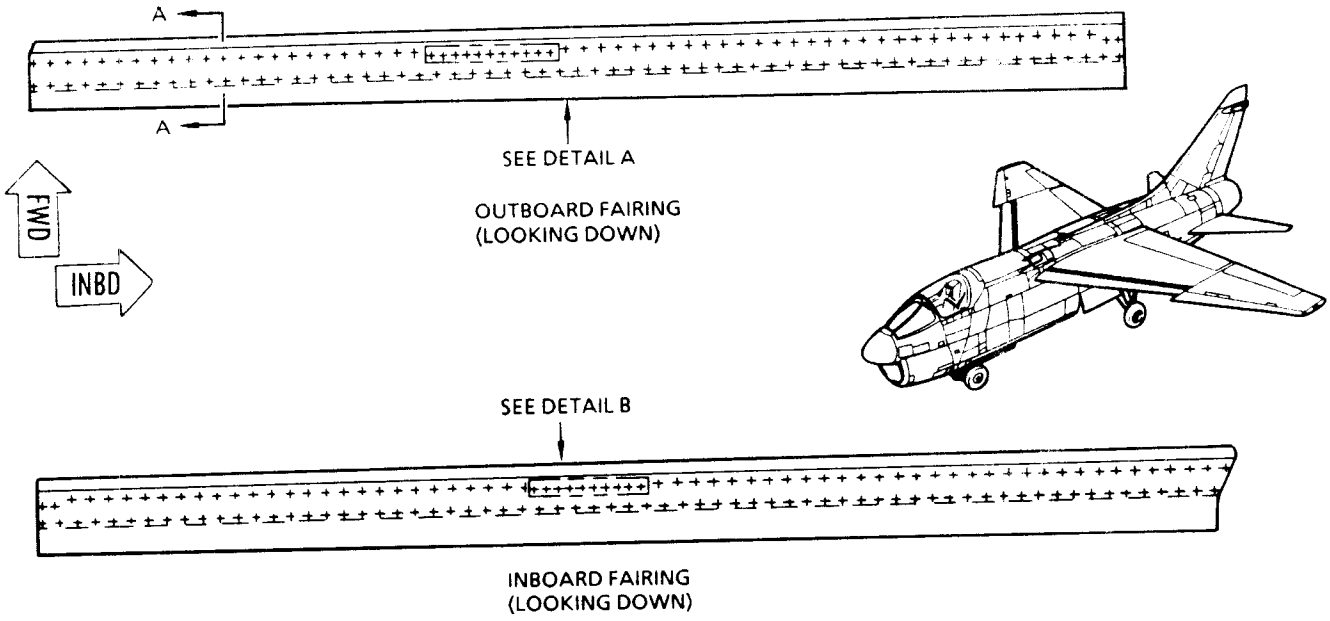
a. Burnish broken hinge lugs.

b. NDI (dye penetrant) the remaining hinge lugs (T.O. 1A-7D-36).

c. If remaining hinge lugs are not cracked, treat for corrosion (T.O. 1A-7D-23).

90D240-02-03-88

Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 2)



ASSEMBLED FAIRING REPAIR – METHOD 2

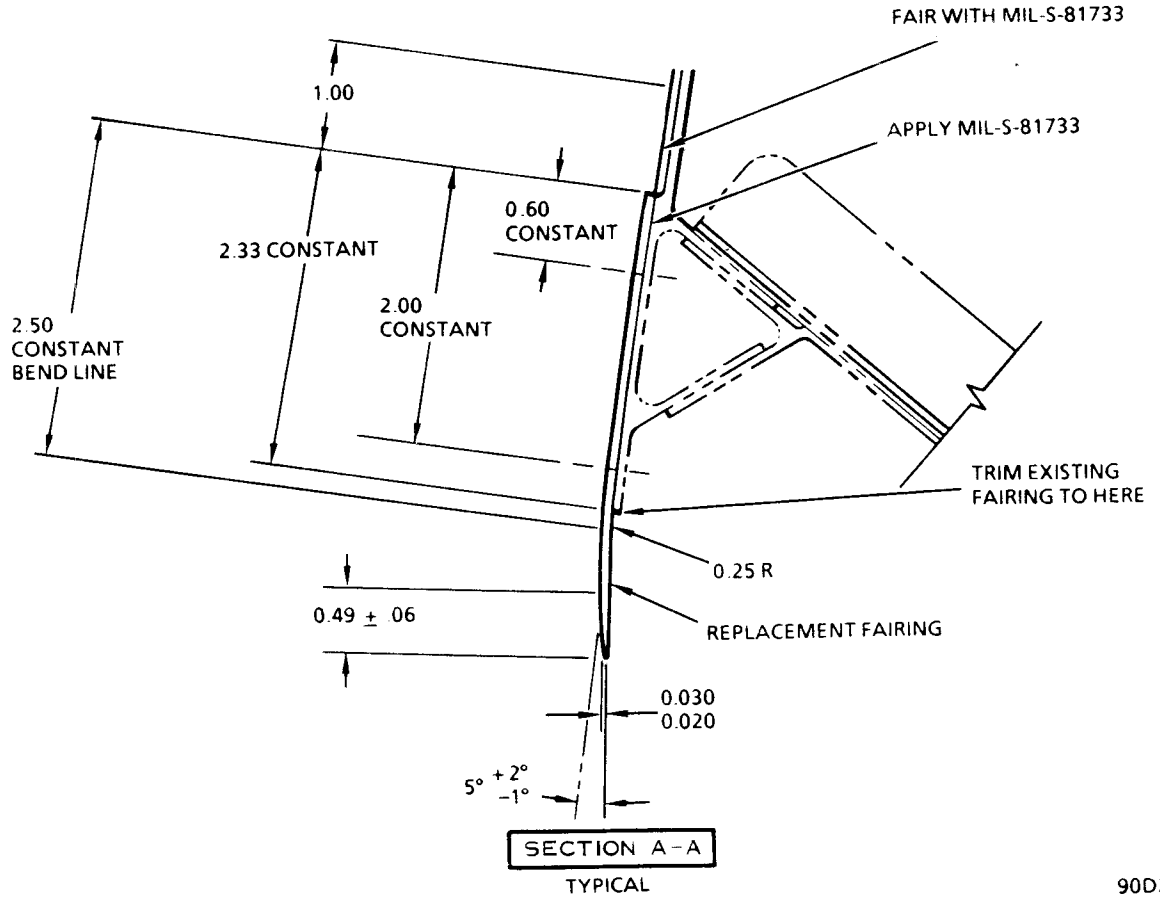


Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 3)

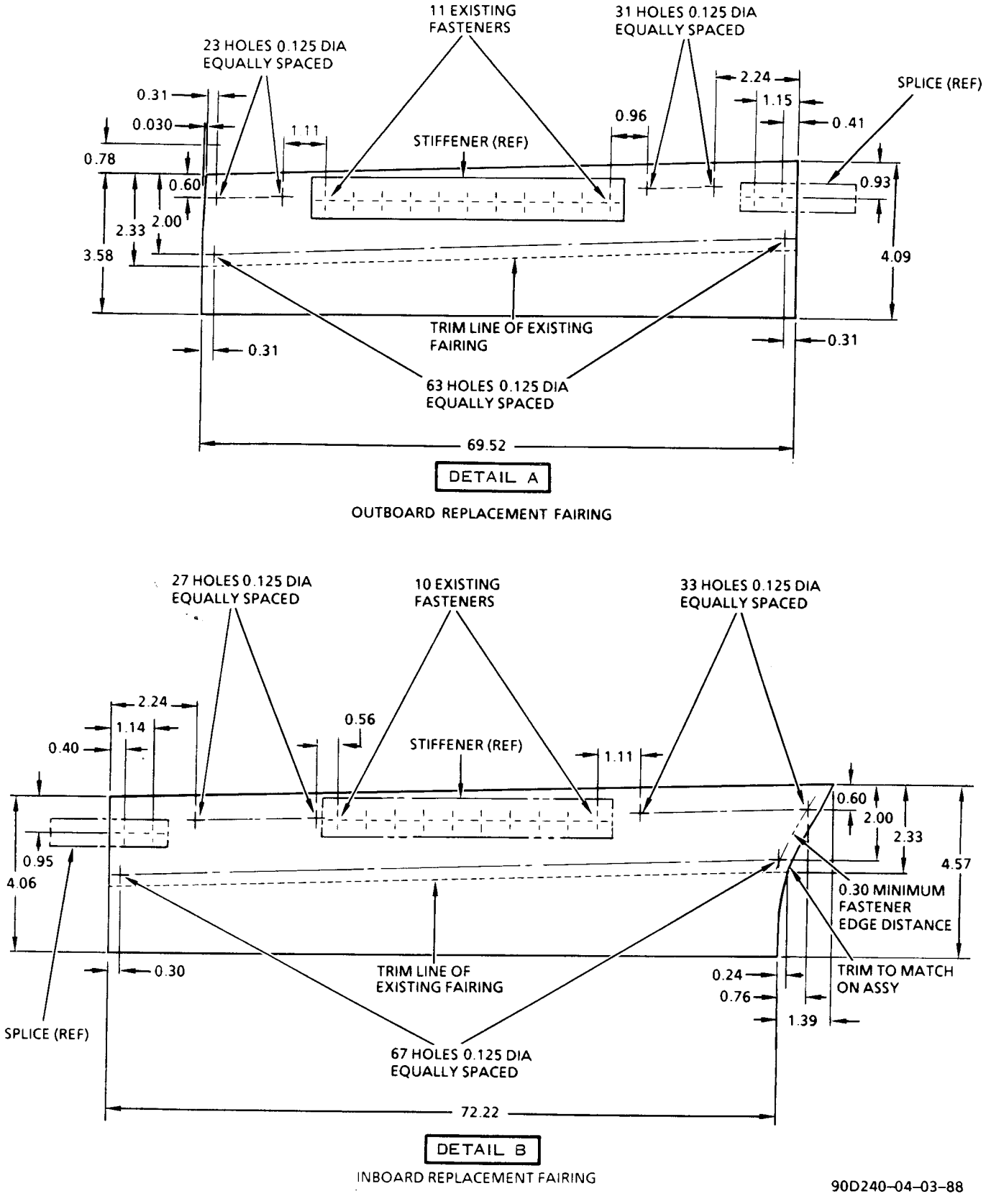
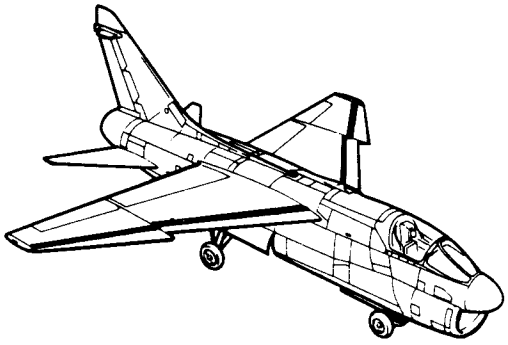
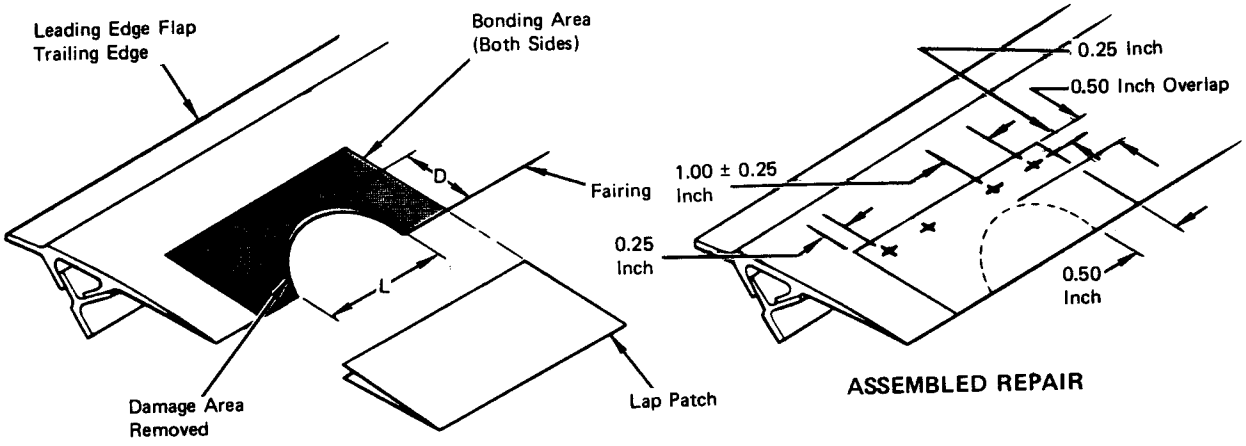
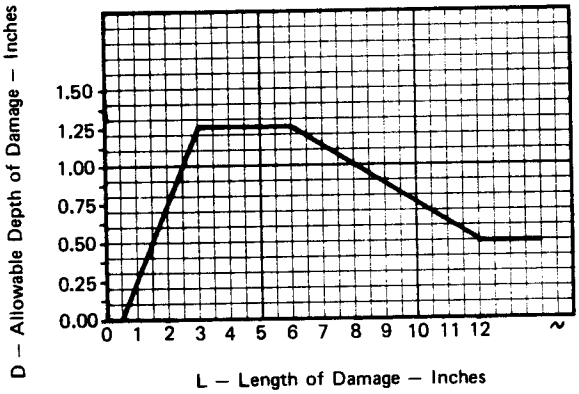


Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 4)





DAMAGE LIMITATION CHART



REPAIR

1. Use damage limitation chart to determine if damage is major or minor.

NOTE

Chart gives maximum depth (D) allowable for a given length (L) of minor damage.

2. If damage is minor, proceed with repair. If damage is major, replace part.

3. Remove damage area as required.

NOTE

Damage that does not exceed 0.50 inch depth may extend the entire length of trailing edge except for 0.50 inch overlap on each end.

4. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

5. Prepare a lap patch, bent as shown, from a single sheet of 0.005 inch gage, type 301 stainless steel. Locate and drill holes for MS20426 B3 rivets through patch and blade. Remove patch and dimple. Countersink outside surface of blade to match dimpled patch.

CAUTION

Edges of lap patch should have round, smooth edges to prevent damage to mating reinforced plastic fairing.

6. Clean faying surfaces to be bonded.

90D240-01-01-85

Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 1 of 2)

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

7. Apply sufficient amount of MIL-S-8802 sealant to inner surface of lap patch to fill damage area.
8. Apply MIL-S-8802 sealant to bonding area of fairing trailing edge.
9. Position lap patch on fairing trailing edge.
10. Clamp in place (do not install rivets).
11. Allow repair to cure 24 hours.
12. Remove sealant from holes and dimples, then install rivets.

DAMAGE LIMITATIONS – Wing Ceneter Section Leading Edge Flap Rib Cracks.

Cracks in excess of 0.6 inch on actuator support ribs require flap removal and replacement. The maximum allowable crack length is determined by the sum of all cracks in both actuator support flanges. Cracks less than 0.6 inch are considered non-critical and may be flown to phased inspection.

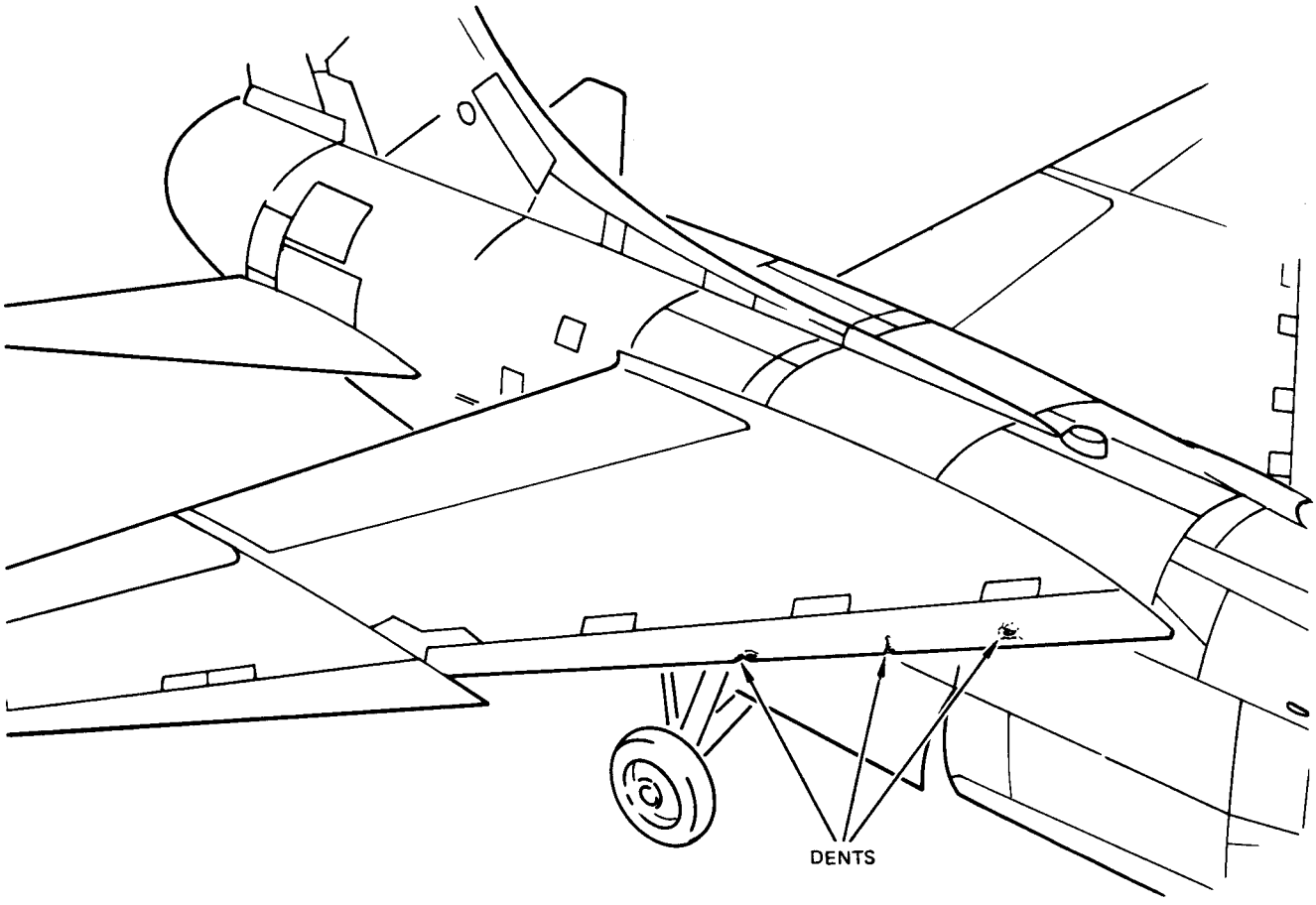
Flaps will be considered serviceable unless they exceed the following criteria: 40% of the airload ribs are broken or more than 3 consecutive airload ribs are broken. Flaps that exceed this criteria may be flown until spares for replacement become available.

Wing Center Section Leading Edge Flap Hinge Lugs. All flap hinge lugs are subject to a maximum of one broken or cracked lug per bank except lug banks on either side of the flap actuators. On either lug bank adjacent to the flap actuators, two nonconsecutive lugs may be broken or cracked. These above conditions are considered noncritical providing there is no damage in the corresponding wing/wing center section hinge half. Damage within the above limits may be flown to phased inspection but require the following:

1. Burnish broken hinge lugs.
2. NDI (dye penetrant) the remaining hinge lugs (T.O. 1A-7D-36).
3. If remaining hinge lugs are not cracked, treat for corrosion (T.O. 1A-7D-23).

90D240–02–01–85

Figure 5-35. Wing Leading Edge Flap Trailing Edge Repair (Sheet 2)



DAMAGE LIMITATION

1. Dent(s) not exceeding 3/16 inch depth and 1 1/2 inch length. Maximum – three dents.
2. Flap with dent(s) exceeding above limits or have sharp edges require special disposition from Service Engineering.

REPAIR

1. Remove paint from damaged area (T.O. 1A-7D-23).
2. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).

WARNING

MIL-S-8802 sealing compound is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

3. Fill dent with MIL-S-8802 sealing compound smoothed to contour of leading edge during application.
4. Refinish repaired area with primer and topcoat (T.O. 1A-7D-23).

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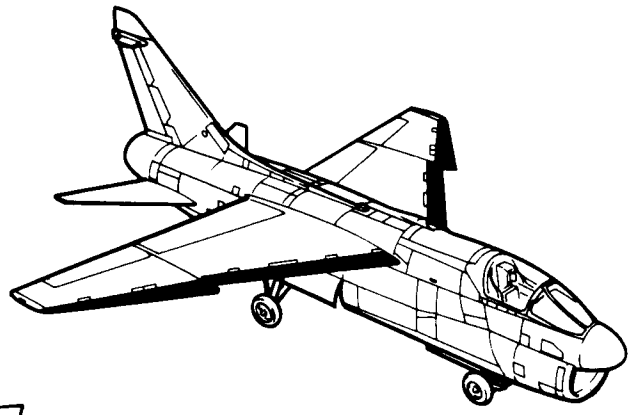
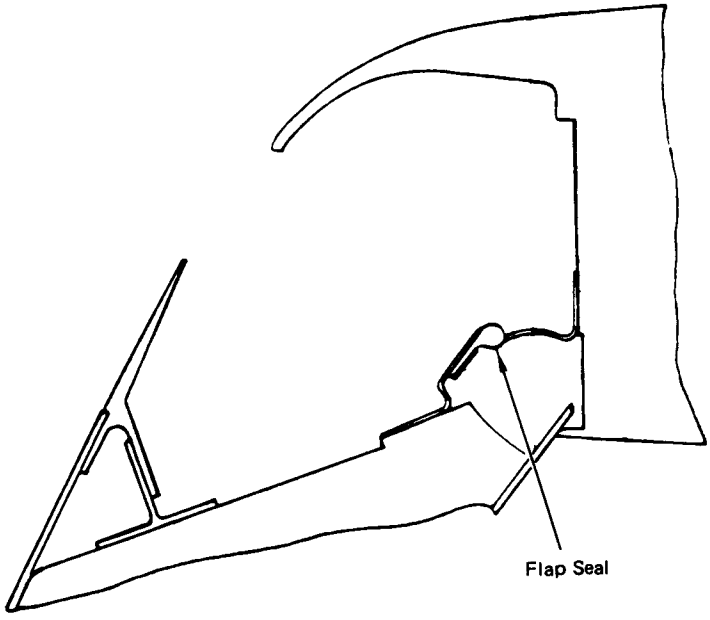
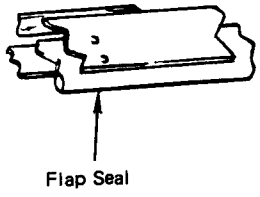
Figure 5-36. Wing Center Section Leading Edge Flap Dent Repair







REPAIR LIMITATIONS

Repair leading edge flap seal if exterior teflon coating is worn or missing from existing seal. Repair all cuts, tears, and abrasions.

WARNING

P-D-680, Type II solvent is toxic to eyes, skin and respiratory tract. Eye and skin protection required. Use only in a well ventilated area.

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

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Figure 5-37. Wing Leading Edge Flap Repair (Sheet 1 of 2)

REPAIR:

1. Teflon coating

   a. Clean flap seal with P-D-680, Type II solvent or equivalent.

   b. Cover damaged areas with 2 inch wide teflon tape (NSN 5970-00-913-4230 or equivalent), picking up existing NAS 1097 rivets through the seal retainer. Tape shall extend approximately 1 inch on each side of damaged areas.

   NOTE

   Tape must be smooth and wrinkle free in area of contact with seal striker.

2. Vertical cuts, abrasions and longitudinal cuts and tears up to 0.125 inch long.

   a. Clean flap seal with P-D-680, Type II solvent or equivalent.

   b. Fill in damaged areas with MIL-S-81733 sealant or equivalent.

   c. Cover reworked areas with teflon tape as outlined in paragraph A.

3. Longitudinal cuts and tears extending beyond 0.125 inch long.

   a. Clean flap seal with P-D-680, Type II solvent or equivalent.

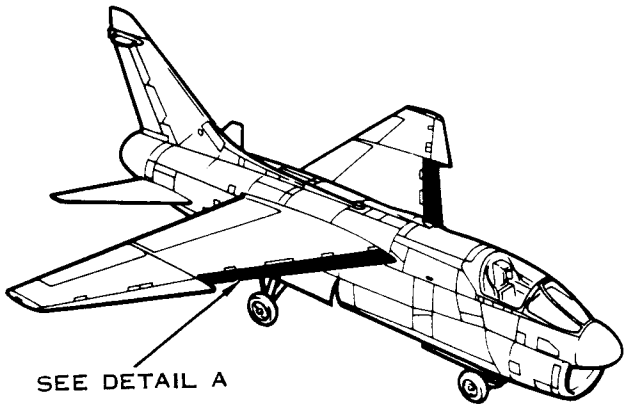
   b. Replace the entire seal or splice in a seal segment fabricated from extrusion, P/N 215-70149-4, or equivalent. If parts are not available, a replacement seal or seal segment can be fabricated by covering a rubber bulb seal, P/N BAC 1521-413 (NAS 9390-00-554-9674 or equivalent) with 2 inch wide teflon tape (NAS 5970-00-913-4230 or equivalent).

   c. Fill in splice joints with MIL-S-81733 sealant or equivalent.

   d. Cover splice joints with teflon tape as outlined in paragraph A.

90D242-02-01-85

Figure 5-37. Wing Leading Edge Flap Repair (Sheet 2)



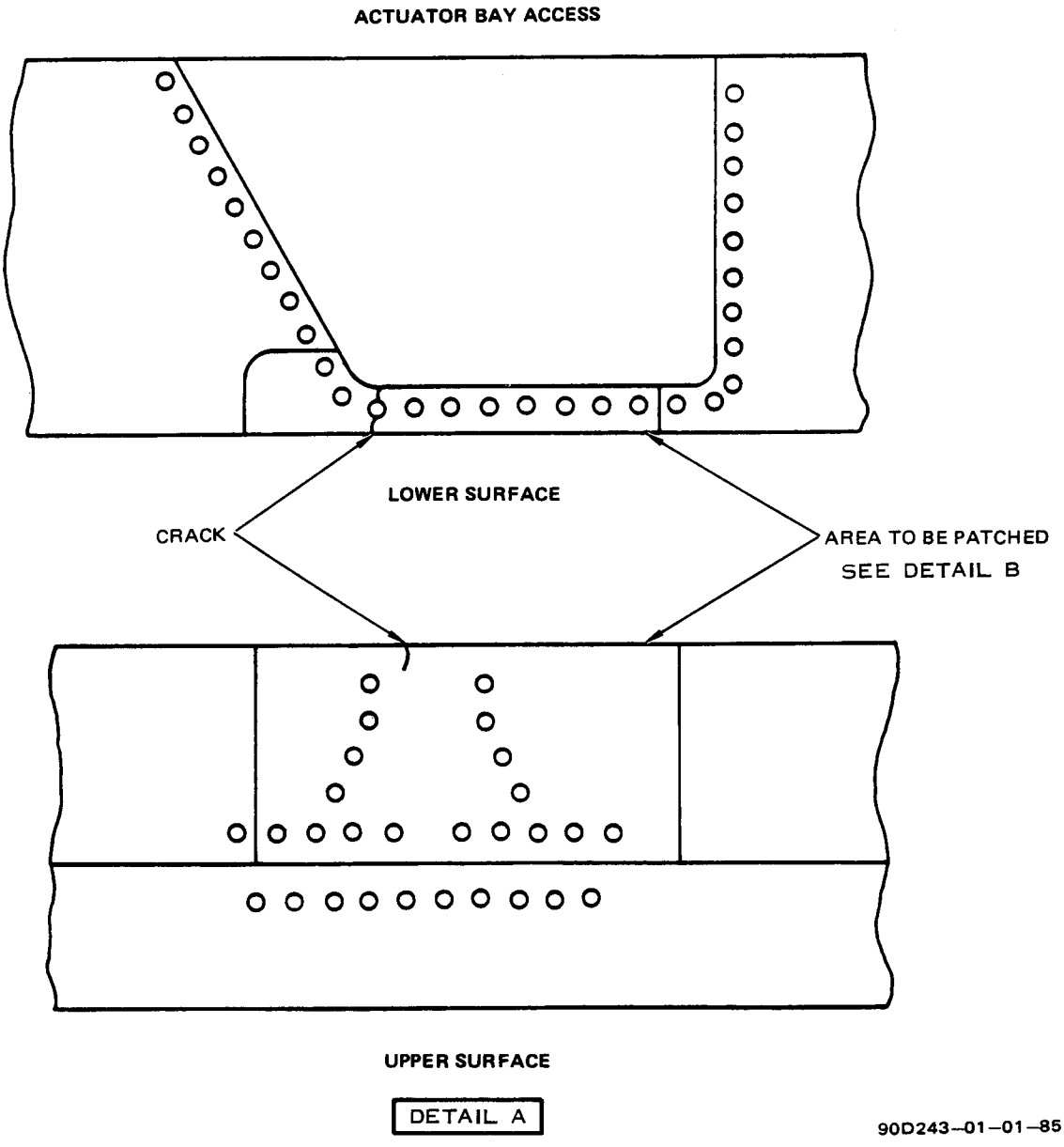


Figure 5-38. Wing Center Section Inboard Leading Edge Flap Actuator Bay Access Skin Repair (Sheet 1 of 3)

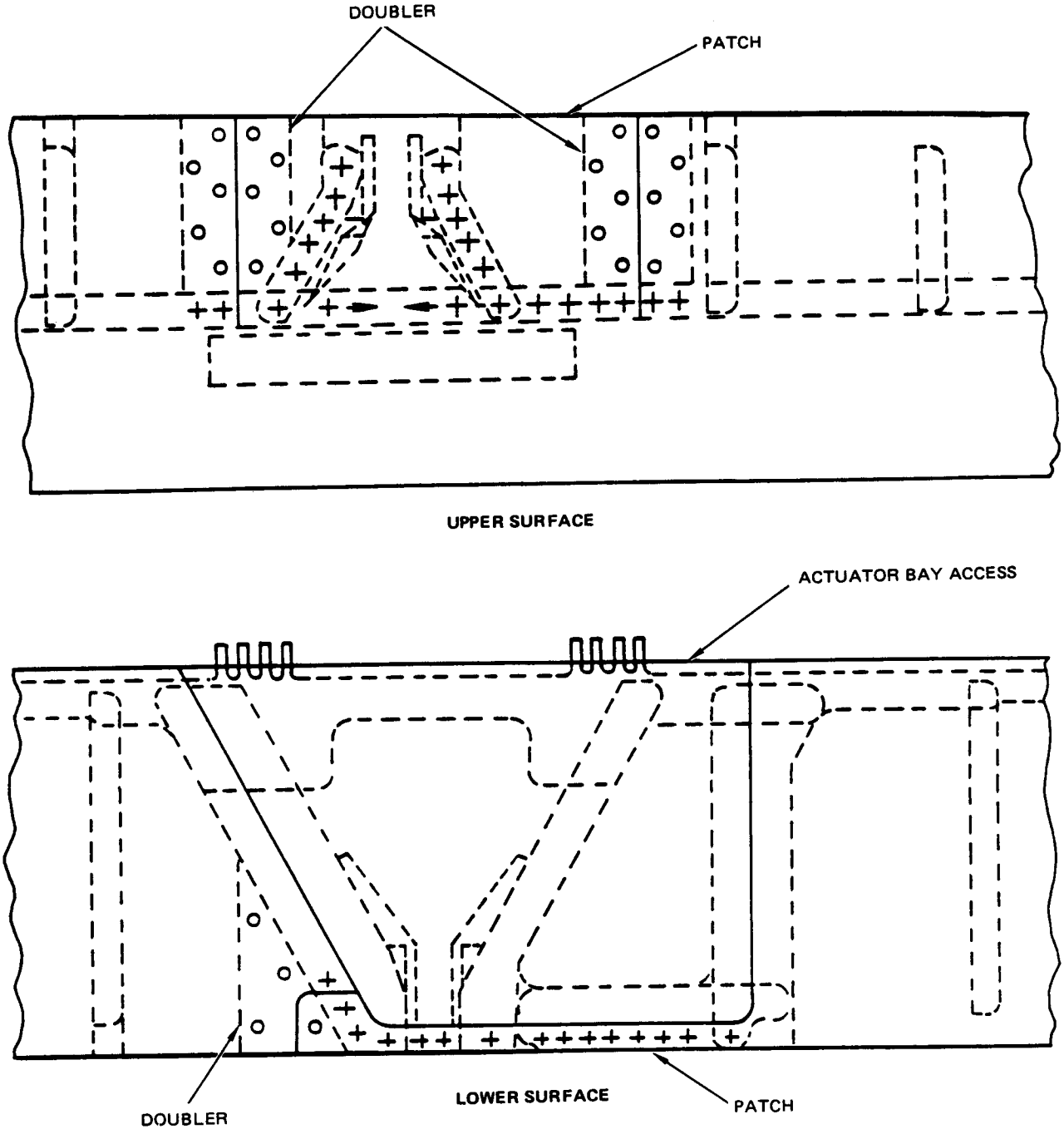


Figure 5-38. Wing Center Section Inboard Leading Edge Flap Actuator Bay Access Skin Repair (Sheet 2)

REPAIR LIMITATIONS

The following data is applicable only for repair of cracks eminating from fasteners in the forward edge of the Inboard Leading Edge Flap Actuator Bay Access. (See Detail A.)

REPAIR

1. Remove all fasteners through flap skin in area to be patched. (See Detail B.)
2. Cut away damaged section of skin as shown in Detail B.
3. Smooth rough edges in cutout area.
4. Fabricate doublers from 7075-T6 Aluminum, 0.040 inch thick and 2.5 inch wide (Detail B)
5. Fabricate shims, as required, to be installed between doublers and flap skin in chem mill area.
6. Fabricate patch from 6061-T6 Aluminum, 0.080 inch thick using the cut away section of skin as a pattern.
7. Treat repair patch with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).
8. Install shims, doublers using NAS1739MW5 blind fasteners and picking up existing fasteners (Detail B).

90D243-03-01-85

Figure 5-38. Wing Center Section Inboard Leading Edge Flap Actuator Bay Access Skin Repair (Sheet 3)

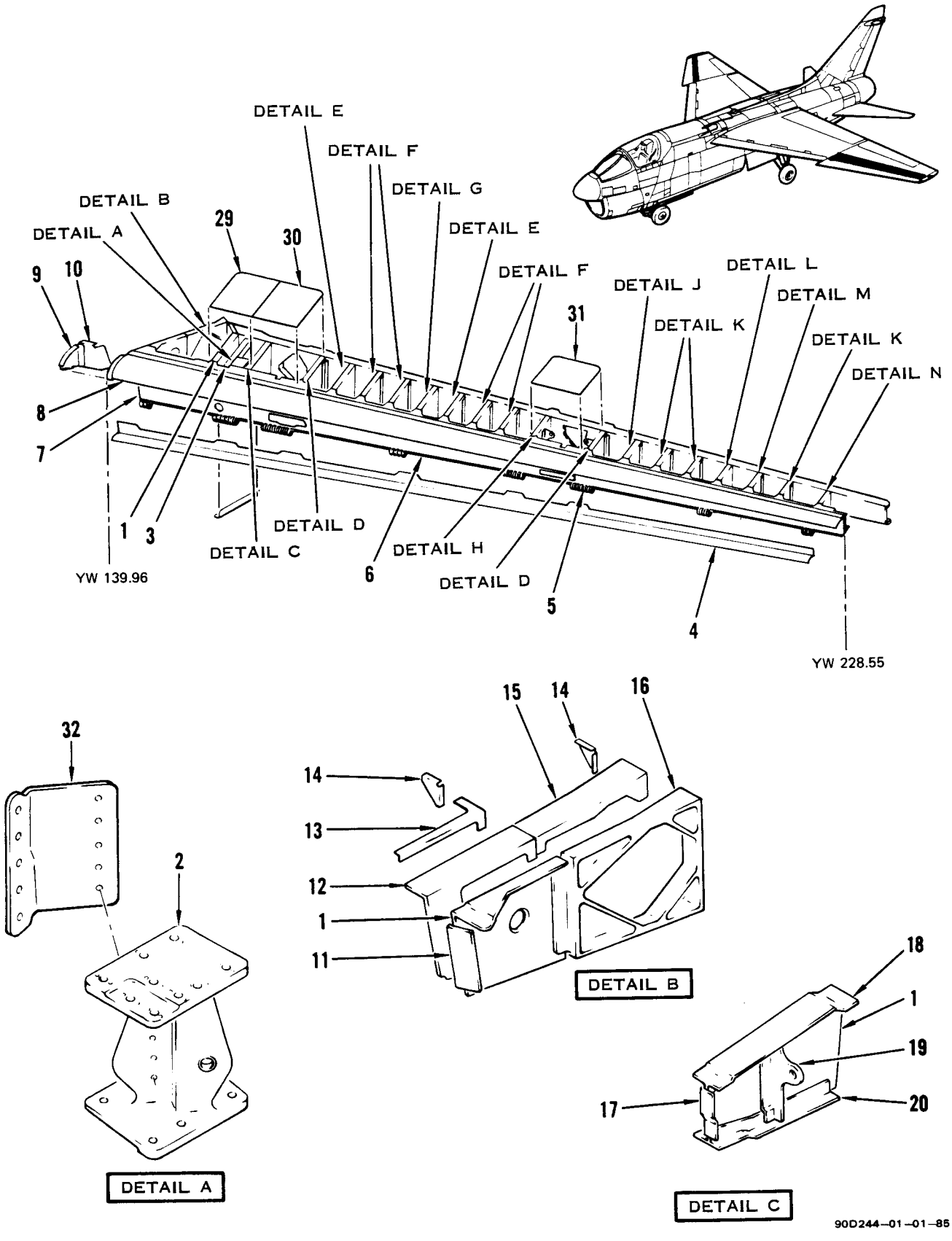


Figure 5-39. Wing Outer Panel Leading Edge Installation (Sheet 1 of 4)

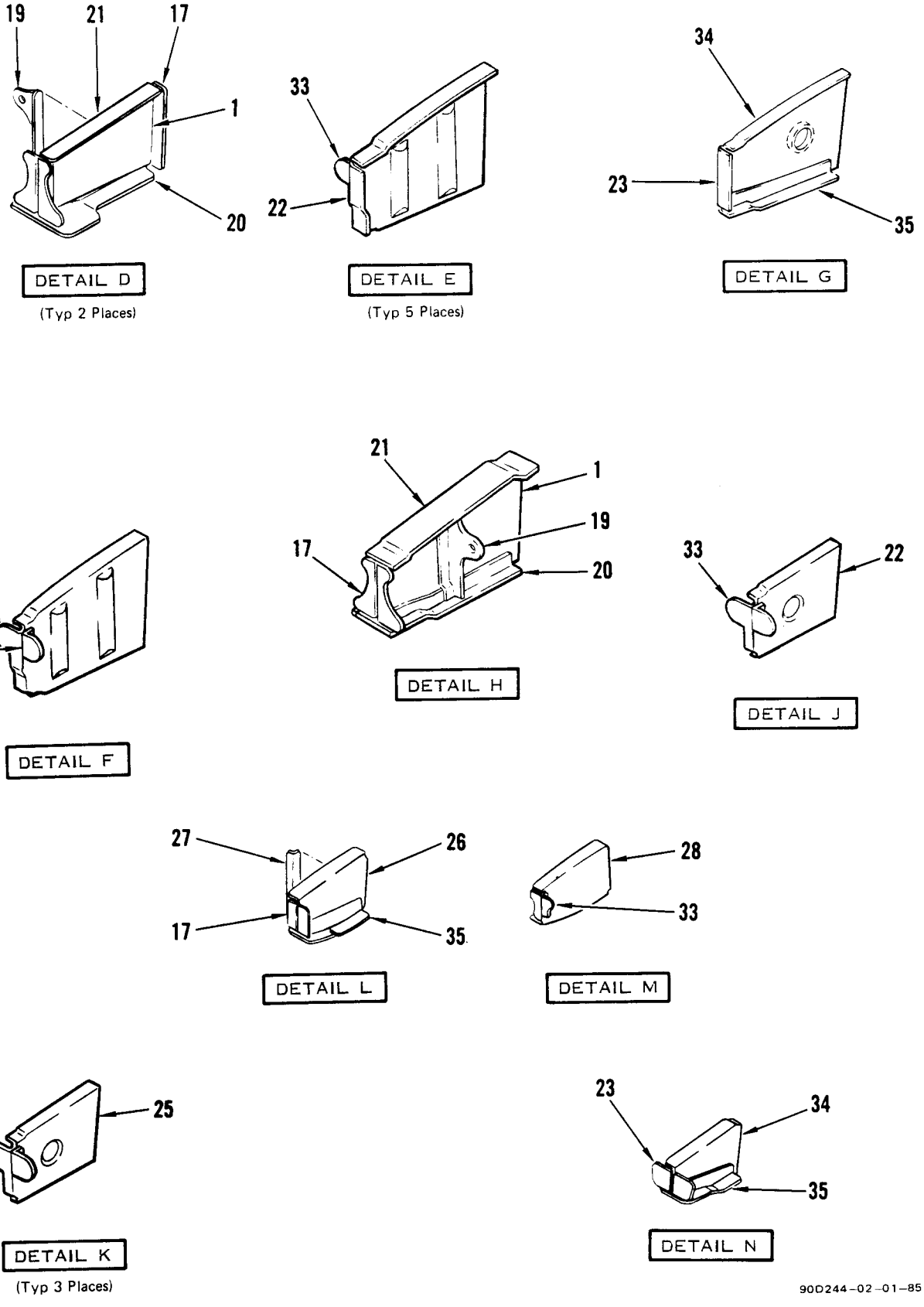


Figure 5-39. Wing Outer Panel Leading Edge Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
††	215-80023	Leading Edge Installation, Wing Outer Panel			
‡‡	216-80023	Leading Edge Installation, Wing Outer Panel			
1	215-80023	Rib	0.062 X * X *	7075-T6	Section XII
2	215-80093	Support (Mach) . .		7075-T651	Section XII
3	215-80023	Stiffener	0.063 X 7.1 X 1.8	7075-T6	Section XII
4		Seal Angle	0.025 X 1.5 X 113.5	7075-T6	Section XII
5†		Support (Extr) . .	CVC10041-23	7075-T6511	Section XV
6		Cap (Extr)	CVC10013-81	7075-T6511	Section XV
7		Web	0.032 X 4.2 X 114.7	7075-T6	Section XII
8	215-80402	Fairing	7 Ply X 5.3 X 118.5	Reinforced Plastic	5-41
9	215-80023	Gusset	0.025 X 4.7 X 4.6	7075-T6	Replace
10		Clip	0.040 X 4.1 X 5.0	7075-T6	Replace
11		Clip	0.090 X 4.6 X 5.0	7075-T6	Replace
12		Fairing	8 Ply X 7.4 X 8.5	Reinforced Plastic	Replace
13		Stiffener	0.025 X 3.6 X 6.6	7075-T6	Replace
14‡		Clip	0.025 X * X *	7075-T6	Replace
15		Fairing	0.071 X 3.7 X 8.2	7075-T6	Replace
16	215-80411	Rib (Mach)		7075-T651	Section XII
17	215-80023	Clip	0.050 X * X *	7075-T6	Replace
18		Cap, Upper (Extr) .	CVC10010-36	7075-T6511	Section XV
19		Angle	0.050 X 2.7 X *	7075-T6	Replace
20		Cap, Lower (Extr) .	CVC10010-52	7075-T6511	Section XV
21		Cap, Upper (Extr) .	CPC18E3 (K23157)	7075-T6511	Section XV
22††,§		Rib	0.032 X * X *	7075-T6	Section XII
‡‡,§§	216-80023	Rib	0.063 X * X *	7075-T6	
23	215-80023	Clip	0.063 X * X *	7075-T6	Replace
24††,§		Rib	0.040 X 6.1 X 8.2	7075-T6	Section XII
‡‡,§, §§	216-80023	Rib	0.063 X 6.3 X 8.2	7075-T6	
25††,§	215-80023	Rib	0.025 X * X *	7075-T6	Section XII

See footnotes at the end of the figure.

Figure 5-39. Wing Outer Panel Leading Edge Installation (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
‡‡,§, §§	216-80023	Rib	0.063 X * X *	7075-T6	
26††	215-80023	Rib	0.050 X 4.3 X 8.0	7075-T6	Section XII
‡‡	216-80023	Rib	0.063 X 4.3 X 8.0	7075-T6	Section XII
27	215-80023	Stiffener	0.050 X 1.2 X 2.8	7075-T6	Replace
28		Rib	0.071 X 5.2 X 7.2	7075-T6	Section XII
29		Door (Chem Mill) .	0.125 X 11.3 X 13.6	7075-T6	Section XII
30		Door	0.100 X 12.1 X 13.4	7075-T6	Section XII
31		Door	0.063 X 7.1 X 8.1	7075-T6	Section XII
32●		Clip	0.063 X 2.8 X 3.8	7075-T6	Section XII
**		Clip	0.100 X 2.8 X 3.8	7075-T6	Section XII
33††		Clip	0.025 X * X *	7075-T6	Replace
‡‡	216-80023	Clip	0.025 X * X *	7075-T6	Replace
34††	215-80023	Rib	0.063 X 5.7 X 10.6	7075-T6	Section XII
‡‡	216-80023	Rib	0.063 X 5.7 X 10.6	7075-T6	Section XII
35	215-80023	Cap, Lower (Extr) .	CVC10010-36	7075-T6	Section XV

*Length or length and width may vary with location.
†Made in accordance with 215-80401.
‡May be fabricated from 2024-T3 material with bend radii of 0.12 inch.
§Loose or failed fasteners attaching upper skin to air load ribs requires all rivets in ribs be replaced with NAS1739MW-5 rivets.
●Airplanes through AF70-1056.
**Airplanes AF71-0292 and subsequent.
††Airplanes through AF71-379.
‡‡Airplanes AF72-169 and subsequent.
§§Cracked or broken ribs do not have to be repaired or replaced if the wing outer panel has been repaired according to figure 5-27 or 5-28. Otherwise, repair according to Section XII.

Figure 5-39. Wing Outer Panel Leading Edge Installation (Sheet 4)

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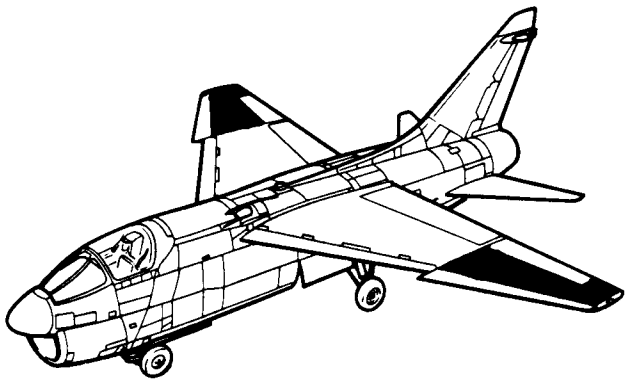

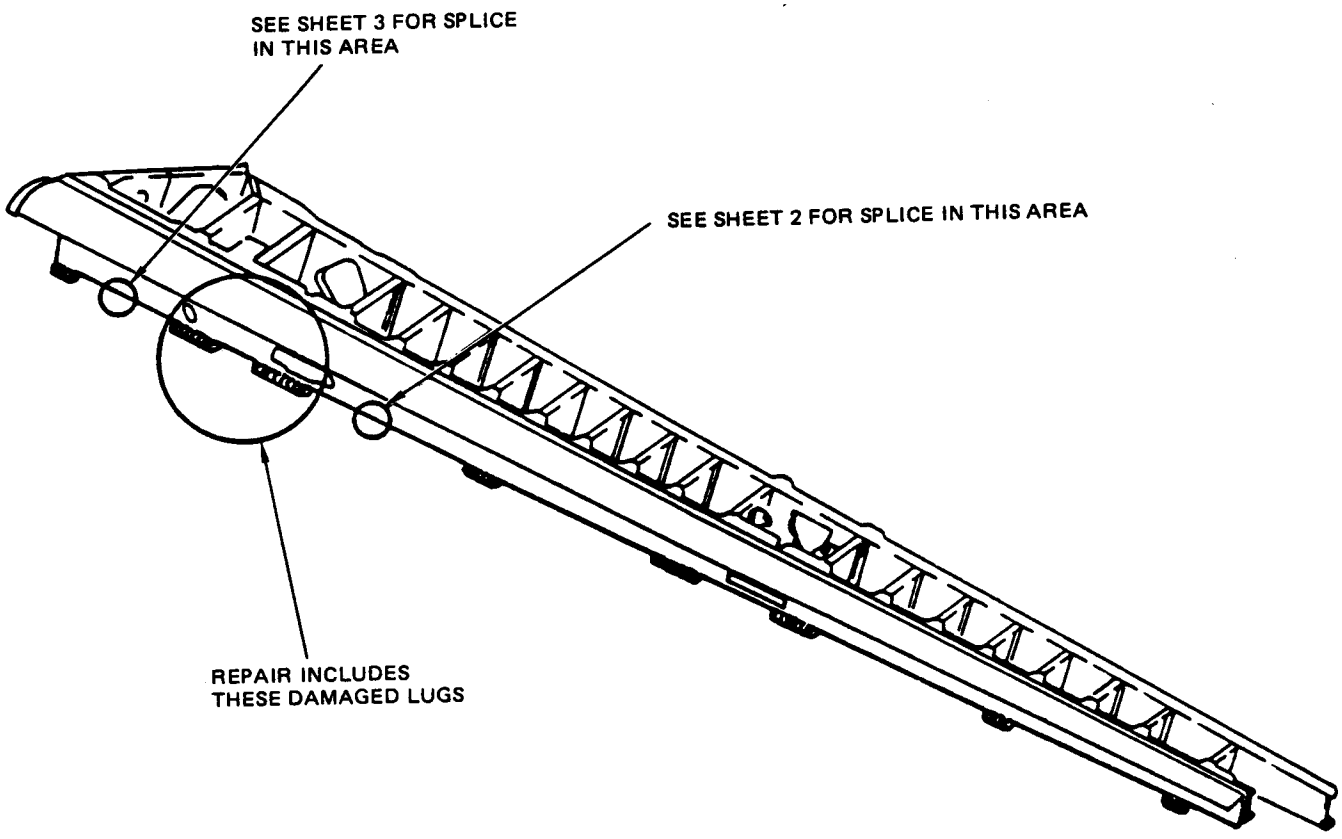

NOTE

LEFT INSTALLATION SHOWN,
RIGHT INSTALLATION OPPOSITE.

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Figure 5-40. Wing Outer Panel Leading Edge Flap Hinge Repair (Sheet 1 of 4)

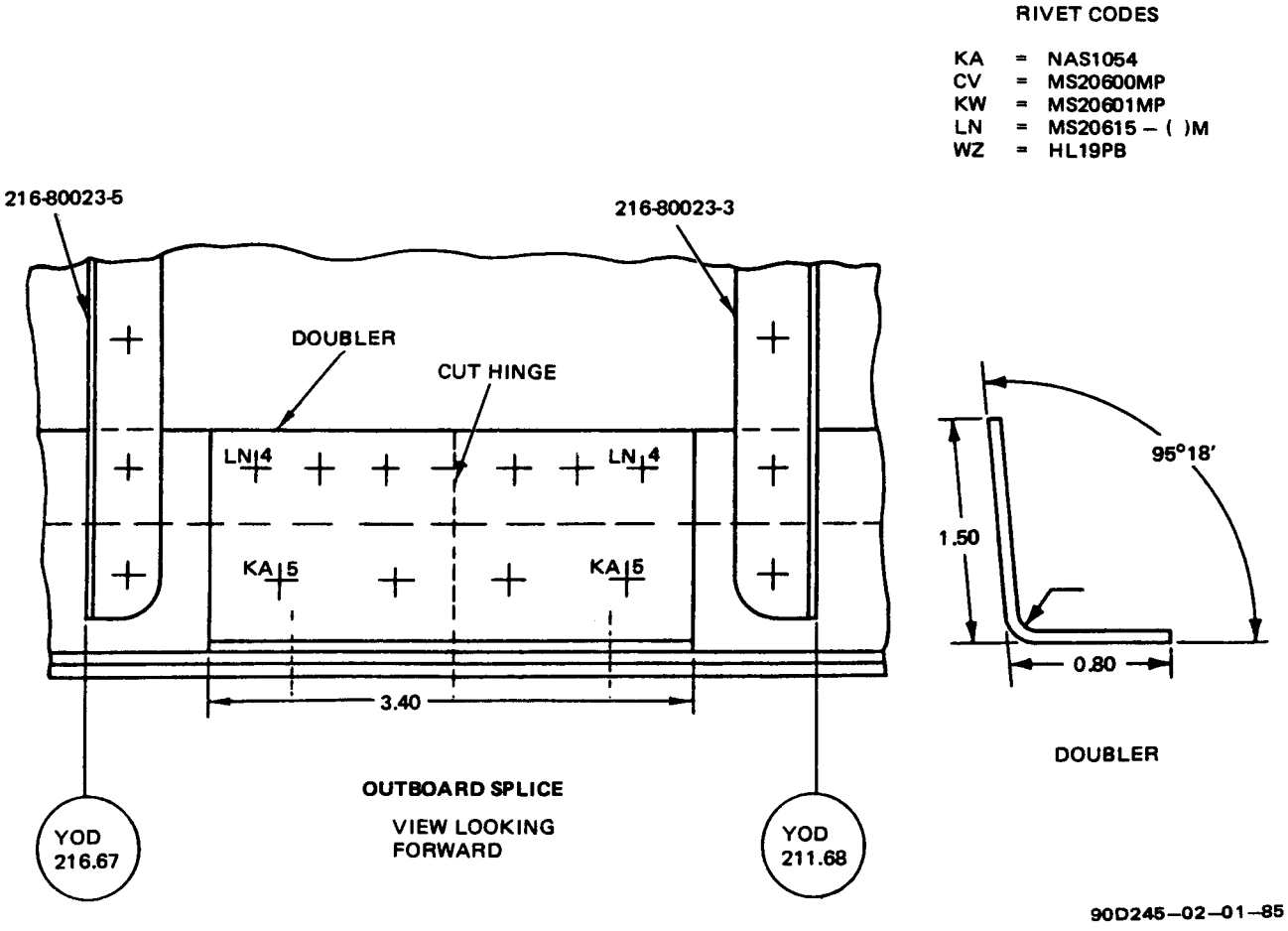


Figure 5-40. Wing Outer Panel Leading Edge Flap Hinge Repair (Sheet 2)

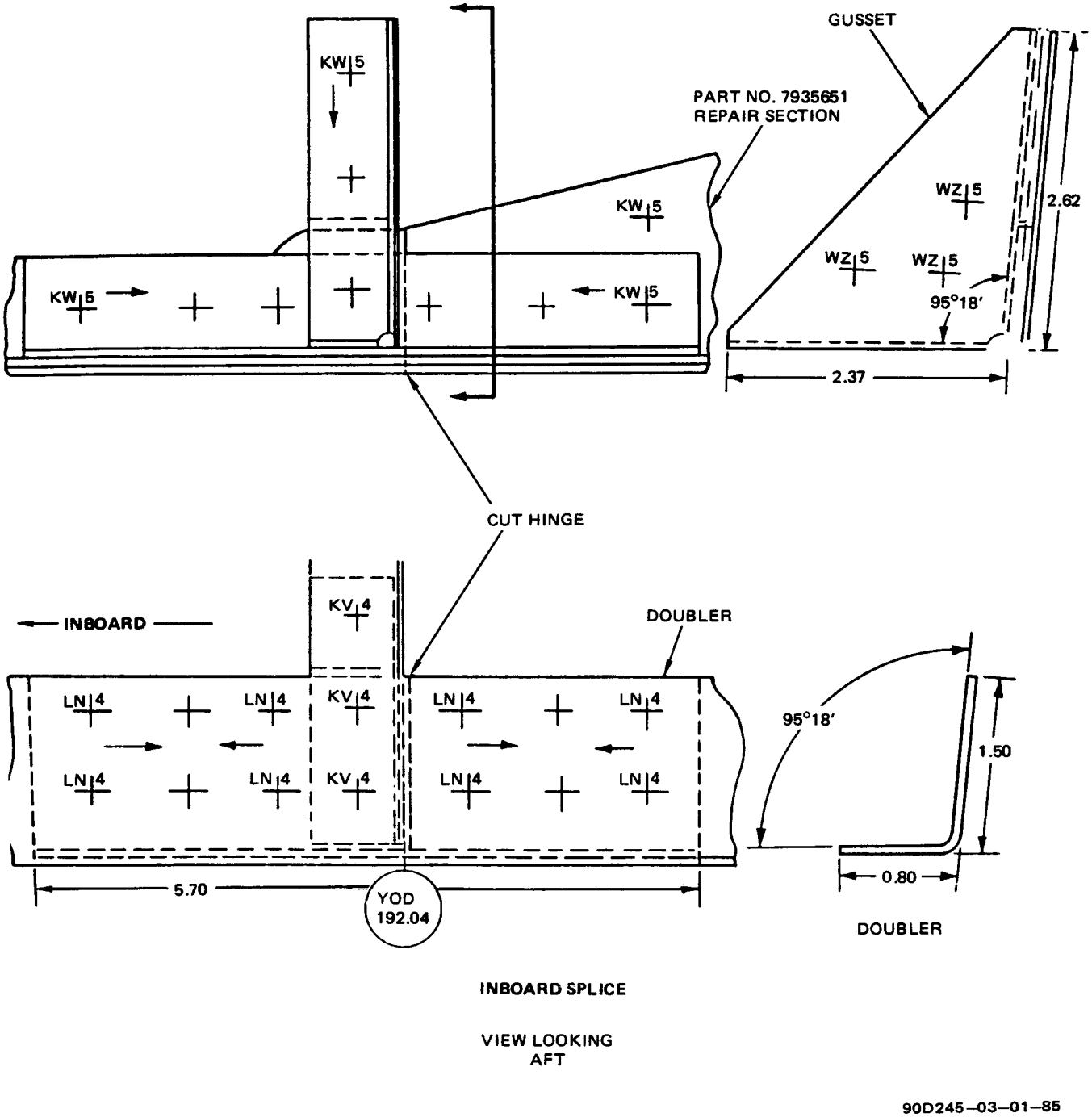


Figure 5-40. Wing Outer Panel Leading Edge Flap Hinge Repair (Sheet 3)

FLAP HINGE LUG

DAMAGE LIMITATIONS

The aircraft is structurally safe for flight operations until the next phase inspection or when logistic support is available, provided there is only one broken lug per bank or two nonconsecutive broken lugs in banks on either side of the flap actuator attach point. If damage exceeds these limits or there is damage in the corresponding opposite hinge, half the wing panel shall be repaired/ replaced before the next flight. The following maintenance shall be accomplished on detected broken lugs that are within these limits:

REPAIR

1. Burnish the broken hinge.
2. NDI (Dye Penetrant) the remaining hinge lugs (T.O. 1A-7D-36).
3. Corrosion treat (T.O. 1A-7D-23).
4. Reinspect both wing and flap side lug bank at each 50 hour post flight inspection until replacement is accomplished.

REPAIR LIMITATIONS

Repair wing outer panel leading edge flap hinge lugs using Part No. 7935651 repair section if more than two lugs are broken/ cracked in the lug banks on either side of the inboard actuator.

REPAIR

NOTE

Prior to this repair all lug banks except those banks on either side of inboard actuator shall be dye penetrant inspected (T.O. 1A-7D-36). No cracks are allowed.

1. Remove wing outer panel from aircraft and place in wing outer panel support stand, Part No. SN310721. Remove leading edge flap.
2. Remove all fasteners in the upper skin inboard of actuator access panel 3112-1/411-2. Remove fasteners in lower skin that extend through inboard 36 inches of hinge extrusion.
3. Lift upper skin to gain access to hinge extrusion and hold in place.
4. Cut hinge extrusion at outboard splice as shown on sheet 2 and slide damaged hinge extrusion from inboard end of outer panel.
5. Locate hinge repair section, Part No. 7935651, in outer panel. Measure and cut damaged hinge extrusion as shown on sheet 3 to reuse inboard bank of lugs. Fit lug bank section in mounting position and Kleco in place.
6. Lower upper skin and Kelco in place. Position flap on wing outer panel to properly position Part No. 7935651 hinge repair section.
7. With flap still installed, install all fasteners in lower wing skin and forward web.

NOTE

Do not install fasteners that will pick up doublers or gusset.

8. Fabricate inboard and outboard doublers from 0.063 inch 1/2 hard stainless steel to dimensions shown on (sheet 2 and 3. Fabricate gusset from 0.032 inch 1/2 hard stainless steel to dimensions shown on sheet 3.
9. Remove flap, lift upper skin, and install doublers and gussets in accordance with sheet 2 and 3. Lower upper skin and rivet in place using original type fasteners.
10. Remove wing outer panel from support stand and reinstall on aircraft as required.

90D245-04-01-85

Figure 5-40. Wing Outer Panel Leading Edge Flap Hinge Repair (Sheet 4)

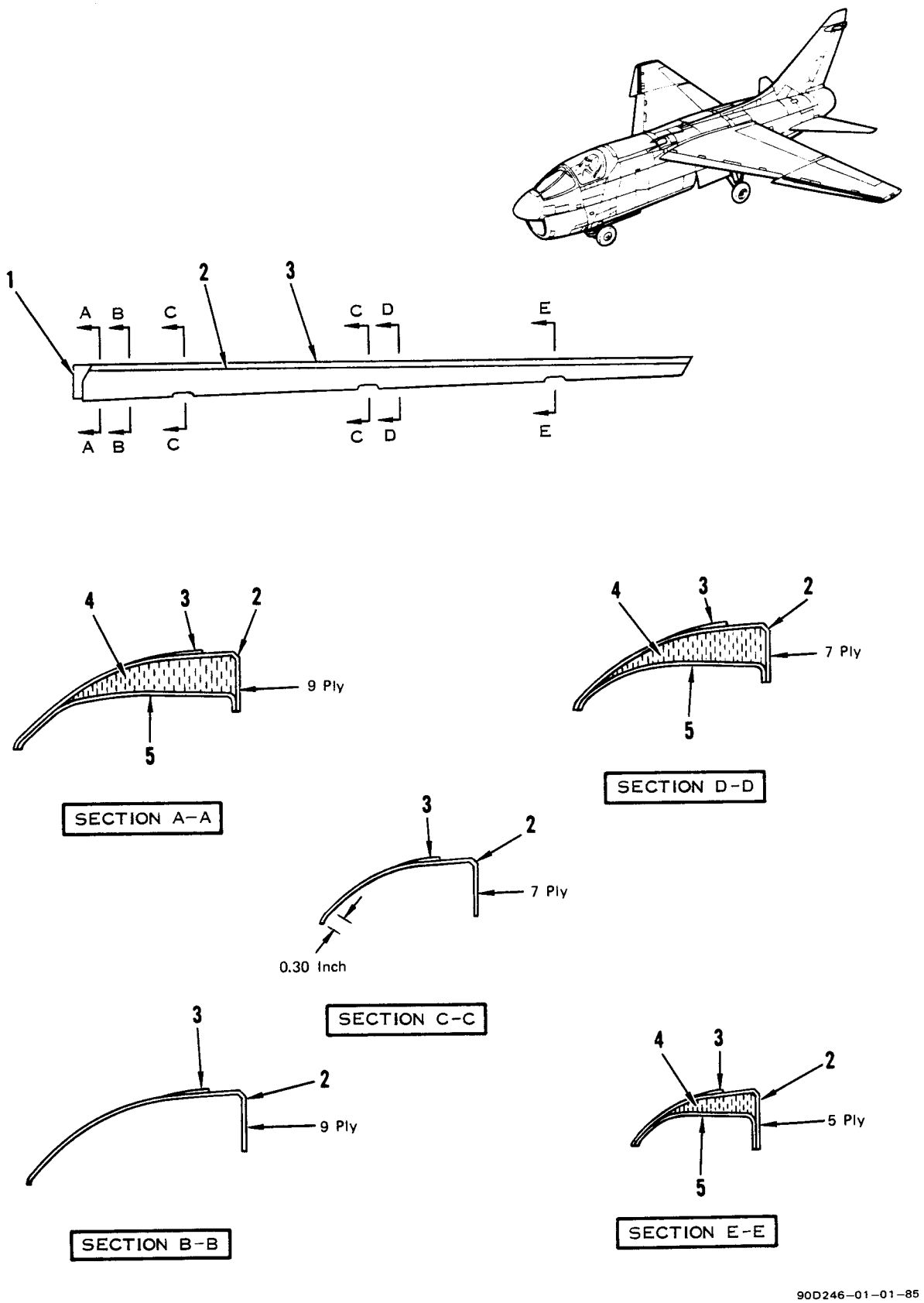


Figure 5-41. Wing Outer Panel Leading Edge Fairing Repair (Sheet 1 of 2)

LEADING PARTICULARS: 215-80402

INDEX	COMPONENT	MATERIAL	FINISH
1	Flange	7 ply style No. 181-150 glass fabric (MIL-C-9084, type VIII A) with epoxy resin.	1 coat epoxy polyamide enamel MIL-C-22750 (MOD) light gull gray camouflage color 36440 per specification MIL-C-22751 (T.O. 1A-7D-23).
2	Upper plastic laminated	Style No. 181-50 glass fabric (MIL-C-9084, type VIII A) with epoxy resin.	Same as index No. 1
3	Abrasion shield	MMM-A-132 adhesive film	Same as index No. 1
4	Stiffener	Balsa wood	
5	Lower plastic laminated	6 ply style No. 181-150 glass fabric (MIL-C-9084, type VIII A) with epoxy resin	Same as index No. 1

DAMAGE EVALUATION AND REPAIR CHART

DAMAGE LIMITATIONS (Note 1)	REPAIR PROCEDURE (SECTION XIV)
Damage not penetrating through the outer ply of the laminated skin	A
Soft spots up to 1.5 inches in diameter	B
Delamination of skin (void area)	B
Skin ply mutilated or missing with damaged area major dimension less than 1 inch	C
Skin ply mutilated or missing with damaged area major dimension 1 inch or greater	D
Damage penetrating one through four plies	D
Damage penetrating all plies	G
Delaminated plies in fastener area	H
Mutilated edge plies such as torn fastener holes and crushed edges	J

NOTE

1. After 5% of entire area has been repaired, further damage is cause for replacement. For removal and installation, refer to T.O. 1A-7D-2-1.

90D246-02-01-85

Figure 5-41. Wing Outer Panel Leading Edge Fairing Repair (Sheet 2)

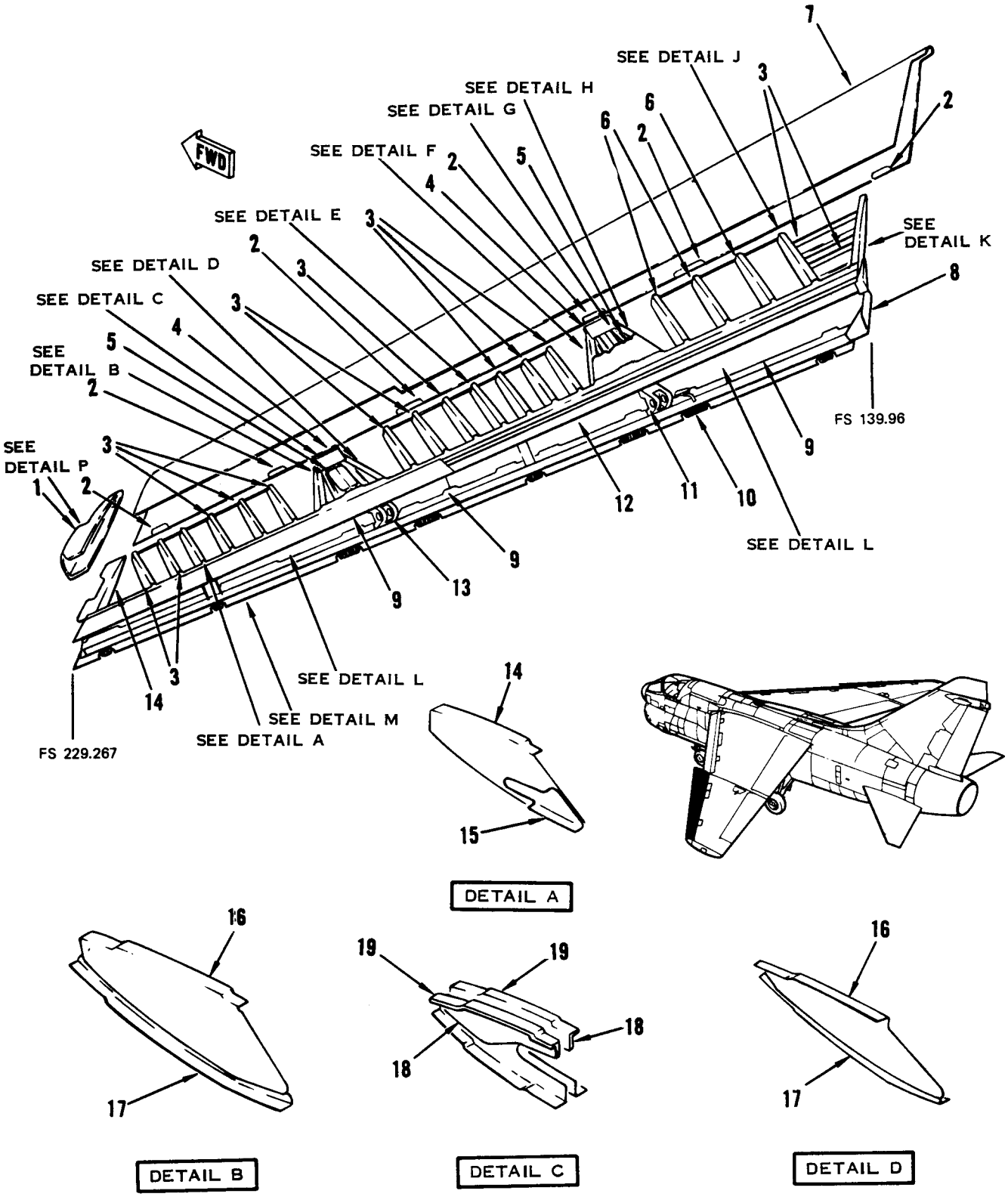


Figure 5-42. Wing Outer Panel Leading Edge Flap Assembly (Sheet 1 of 5)

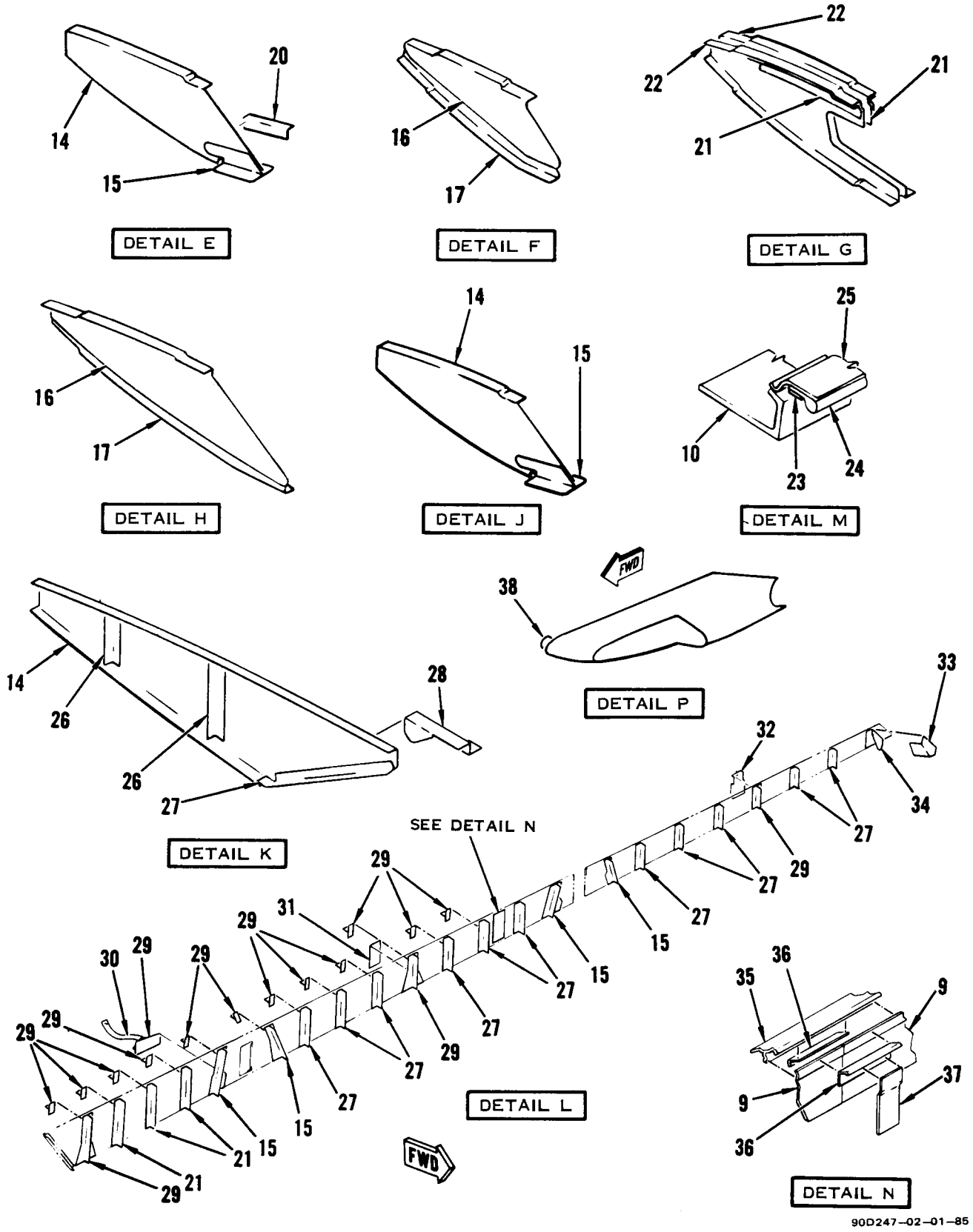


Figure 5-42. Wing Outer Panel Leading Edge Flap Assembly (Sheet 2)

DAMAGE LIMITS – Wing Outer Panel Leading Edge Flap Rib Cracks.

Cracks in excess of 0.6 inch on actuator support ribs require flap removal and replacement. The maximum allowable crack length is determined by the sum of all cracks in both actuator support flanges. Cracks less than 0.6 inch are considered non-critical and may be flown in phased inspection.

Flaps will be considered serviceable unless they exceed the following criteria: 40% of the airload ribs are broken or more than 3 consecutive airloads ribs are broken. Flaps that exceed this criteria may be flown until spares for replacement become available.

Wing Outer Panel Leading Edge Flap Hinge Lugs. All flap hinge lugs are subject to a maximum of one broken or cracked lug per bank except lug banks on either side of the flap actuators. On either lug bank adjacent to the flap actuators, two nonconsecutive lugs may be broken or cracked. These above conditions are considered noncritical providing there is no damage in the corresponding wing/wing outer panel hinge half. Damage within the above limits may be flown to phase inspection but require the following:

1. Burnish broken hinge lugs.
2. NDI (dye penetrant) the remaining hinge lugs (T.O. 1A-7D-36).
3. If remaining hinge lugs are not cracked, treat for corrosion (T.O. 1A-7D-23).

90D247–03–01–85

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
§	215-80200	Flap Assembly, Wing Outboard Leading Edge			
•	216-80200	Flap Assembly, Wing Outboard Leading Edge			
1	31-0701	Skin, Light		6061-T6	Section XII
2	215-80200	Door	0.080 X * X *	7075-T6	Section XII
3§		Rib	0.032 X * X *	7075-T6	Section XII
•	216-80200	Rib	0.040 X * X *	7075-T6	Section XII
4	215-80200	Doubler	0.050 X 5.0 X 5.6	7075-T6	Section XII
5		Doubler	0.032 X * X *	7075-T6	Section XII
6§		Rib	0.025 X * X *	7075-T6	Section XII
•	216-80200	Rib	0.040 X * X *	7075-T6	Section XII
7§	215-80200	Skin (Chem Mill) .	0.080 X 33.0 X 160.0	6061-T6	Section XII
•	216-80200	Skin (Chem Mill) .	0.080 X 33.0 X 160.0	6061-T6	Section XII

See footnotes at the end of the figure.

Figure 5-42. Wing Outer Panel Leading Edge Flap Assembly (Sheet 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
8	215-80200	Rib	6 Ply	Reinforced Plastic	Section XIV
9		Spar (Chem Mill) .	0.071 X * X *	7075-T6	Section XII
10†,‡		Hinge (Extr) . . .	CVC10041-21	7075-T6511	Section XV
11†	215-80225	Support (Cstg) . .		17-4PH	Section XII
12§	215-80200	Fairing (Extr) . .	CVC10060-17	7075-T6511	Section XV, 5-35
•	216-80200	Fairing (Extr) . .	CVC10060-17	7075-T6511	Section XV, 5-35
13‡	215-80226	Support (Cstg) . .		17-4PH	Section XII
14	215-80200	Rib	0.040 X * X *	7075-T6	Section XII
15		Tee (Extr)	CVC10010-23	7075-T6511	Section XV
16		Rib	0.050 X * X *	7075-T6	Section XII
17		Tee (Extr)	CVC10010-10	7075-T6511	Section XV
18		Angle	0.063 X 2.6 X 6.7	7075-T6	Section XII
19		Rib	0.070 X 5.2 X 7.7	7075-T6	Section XII
20§		Angle	0.032 X 0.9 X 2.2	7075-T6	Section XII
21		Angle	0.050 X * X *	7075-T6	Section XII
22		Rib	0.063 X * X *	7075-T6	Section XII
23		Retainer	0.020 X 0.4 X 112.4	7075-T6	Section XII
24		Seal (Extr)	Made from 215-70149	Teflon	5-37
25		Angle	0.025 X 1.9 X 112.4	7075-T6	Section XII
26		Angle	0.032 X * X *	7075-T6	Section XII
27		Angle	0.040 X * X *	7075-T6	Section XII
28		Clip	0.040 X 2.2 X 4.2	7075-T6	Section XII
29		Tee (Extr)	CPC20E3 (11171)	7075-T6511	Section XV
30		Strap (Webbing) . .	10.5 Long	MIL-W-27265, Class R, Type II	Replace
31		Splice (Extr) . . .	CVC10060-26	7075-T6511	Section XV
32		Splice	0.032 X 2.2 X 2.9	CRES 301	Section XII
	216-80200	Splice	0.032 X 2.2 X 2.9	CRES 301	Section XII
33	215-80200	Clip	0.063 X 2.5 X 3.3	7075-T6	Section XII
34		Clip	0.050 X 2.7 X 3.0	7075-T6	Section XII
35§	215-80200	Fairing (Extr) . .	CVC10060-18	7075-T6511	Section XV, 5-35

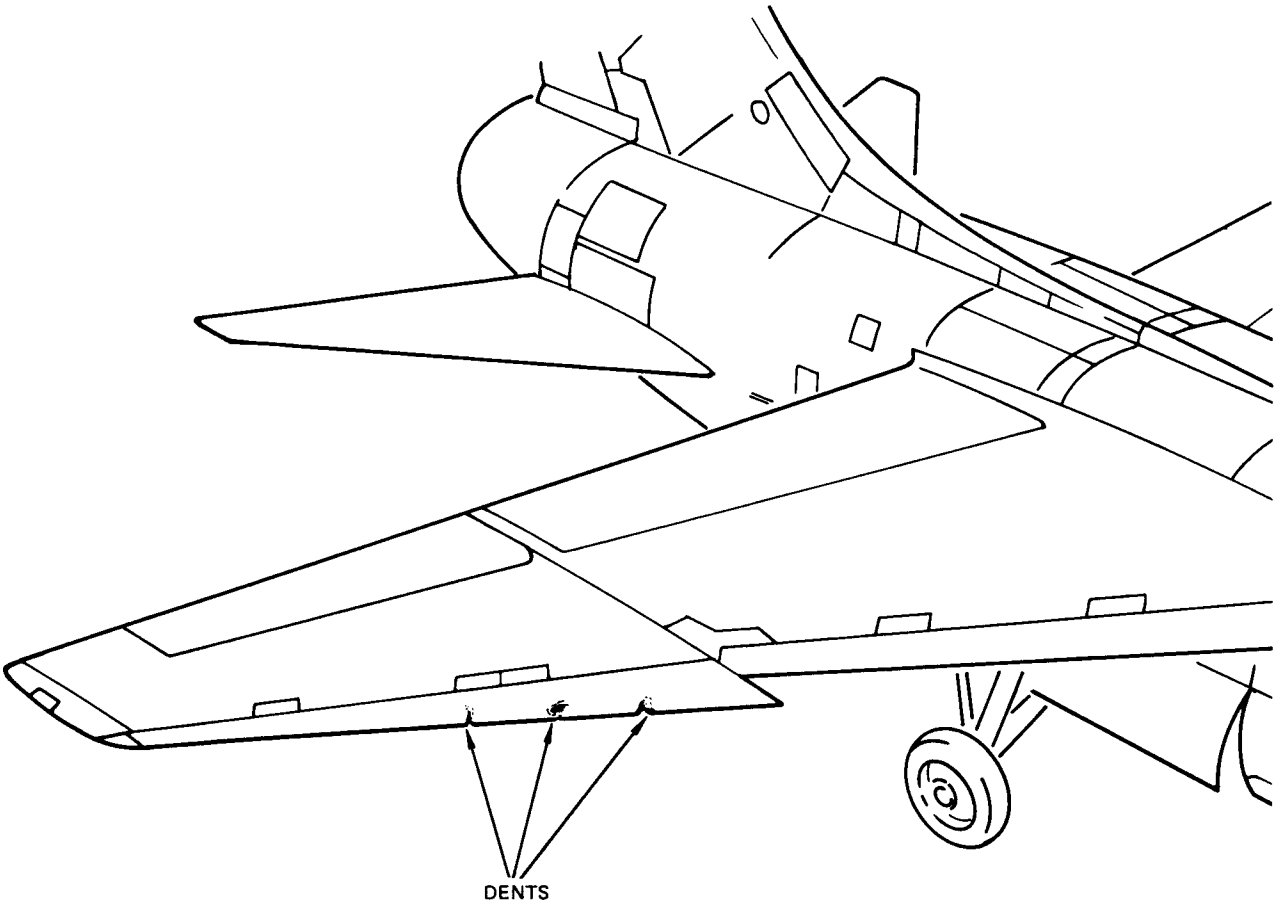
See footnotes at the end of the figure.

Figure 5-42. Wing Outer Panel Leading Edge Flap Assembly (Sheet 4)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
•	216-80200	Fairing (Extr) . .	CVC10060-18	7075-T6511	Section XV, 5-35
36	215-80200	Splice	0.080 X * X 4.2	7075-T6	Section XII
37		Splice	0.040 X 1.7 X 3.9	7075-T6	Section XII
38	31-0696-1	Block, Filler (Cast)	1.00 X 1.125 X 0.75	356-T6	Replace

*Length or length and width may vary with location.
†Made according to 215-80400.
‡Screws and nutplates originally installed on either side of supports (index No. 11 and 13) through lower skin and hinge will be replaced with BT100T fasteners when replacing hinge (index No. 10). Corrosion protection procedures for dissimilar metals shall be practiced (T.O. 1A-7D-23).
§Airplanes through AF72-265.
•Airplanes AF73-992 and subsequent.

Figure 5-42. Wing Outer Panel Leading Edge Flap Assembly (Sheet 5)



DAMAGE LIMITATION

1. Dent(s) not exceeding 3/16 inch depth and 1 1/2 inch length. Maximum – three dents.
2. Flap with dent(s) exceeding above limits or have sharp edges require special disposition from Service Engineering.

REPAIR

1. Remove paint from damaged area (T.O. 1A-7D-23).
2. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1A-7D-23).

WARNING

MIL-S-8802 sealing compound is flamable and toxic to eyes, skin and respirator tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

3. Fill dent with MIL-S-8802 sealing compound smoothed to contour of leading edge during application.
4. Refinish repaired area with primer and topcoat (T.O. 1A-7D-23).

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Figure 5-43. Wing Outer Panel Leading Edge Flap Dent Repair

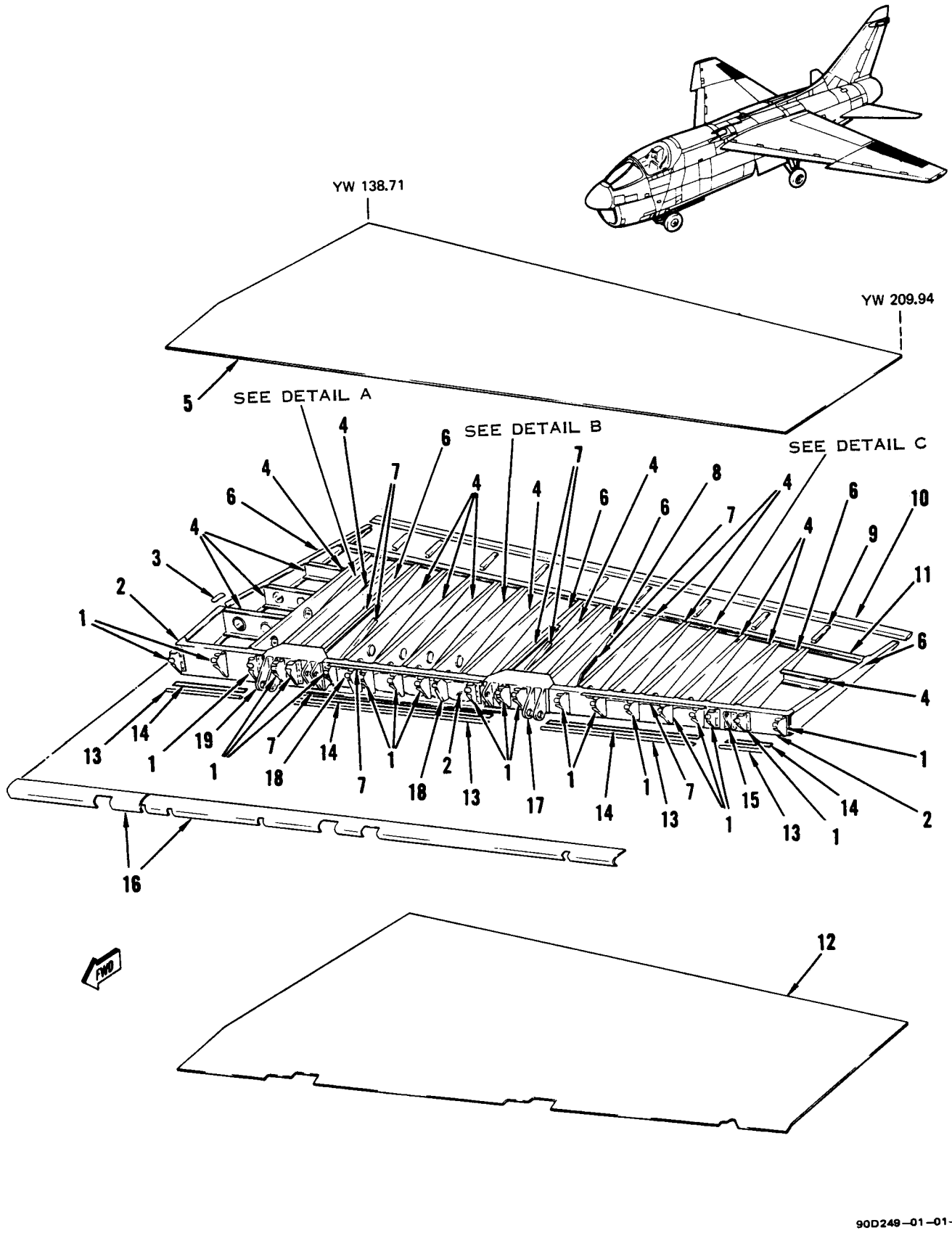

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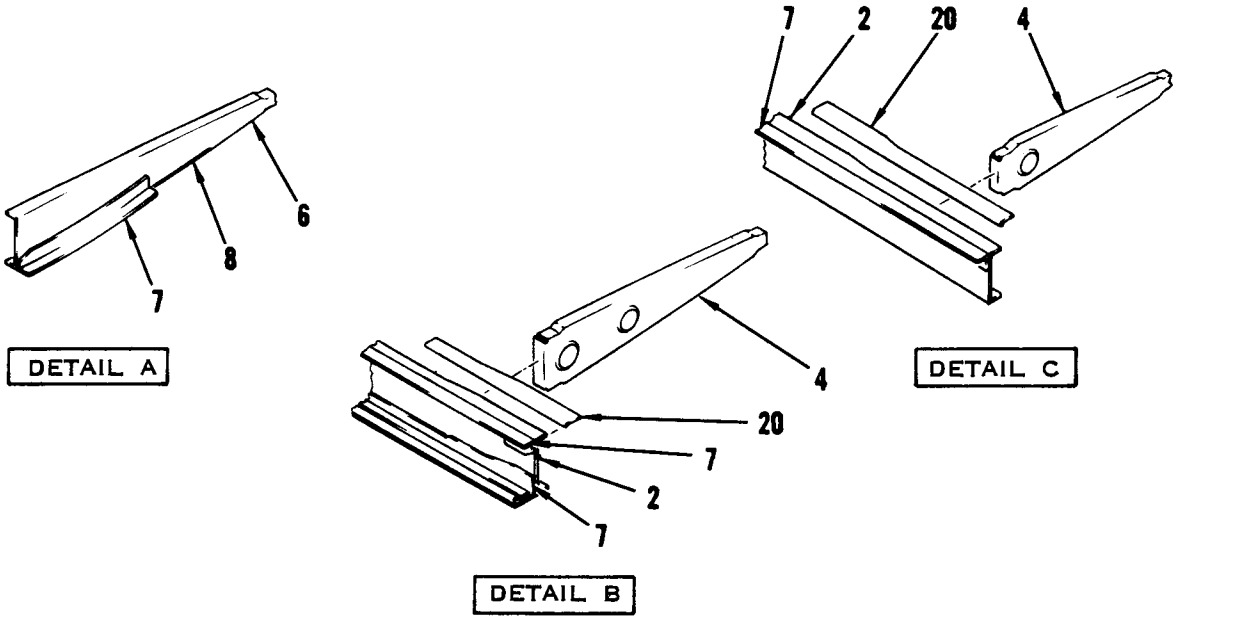
Figure 5-44. Aileron Assembly (Sheet 1 of 3)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-80300	Aileron Assembly, Wing Outer Section Trailing Edge			
1	215-80300	Gussett	0.032 X * X *	2024-T42	Section XII
2		Spar	0.040 X * X *	7075-T6	Section XII
3		Doubler	0.040 X 1.0 X 2.8	2024-T3	Section XII
4		Rib	0.025 X * X *	2024-T42	Section XII
5		Skin (Chem Mill) .	0.063 X 28.0 X 85.0	7075-T6	Section XII
6		Rib	0.040 X * X *	7075-T6	Section XII
7		Stiffener	0.040 X * X *	7075-T6	Section XII
8		Doubler	0.032 X 3.1 X *	7075-T6	Section XII
9		Support	0.025 X 1.9 X 3.2	2024-T3	Section XII

See footnote at the end of the figure.

Figure 5-44. Aileron Assembly (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
10		Trailing Edge (Extr)	CVC10051-9	7075-T6511	Section XV
11		Spar	0.063 X 2.9 X 73.5	7075-T6	Section XII
12		Skin	0.080 X 28.0 X 85.0	7075-T6	Section XII
13		Seal (Extr)	Made From 215-80322	Rubber	Replace
14		Retainer	0.025 X 0.6 X *	2024-T3	Section XII
15		Hinge (Extr) . . .	CVC10060-30	7075-T6511	Section XV
16		Skin	0.020 X * X *	2024-T3	Section XII
17	215-80321	Hinge (Forg) . . .		7075-T6	Section XII
18	215-80300	Rib	0.032 X * X *	2024-T42	Section XII
19	215-80320	Hinge (Forg) . . .		7075-T6	Section XII
20	215-80300	Stiffener	0.050 X 1.4 X *	7075-T6	Section XII

*Length or length and width may vary with location.

Figure 5-44. Aileron Assembly (Sheet 3)

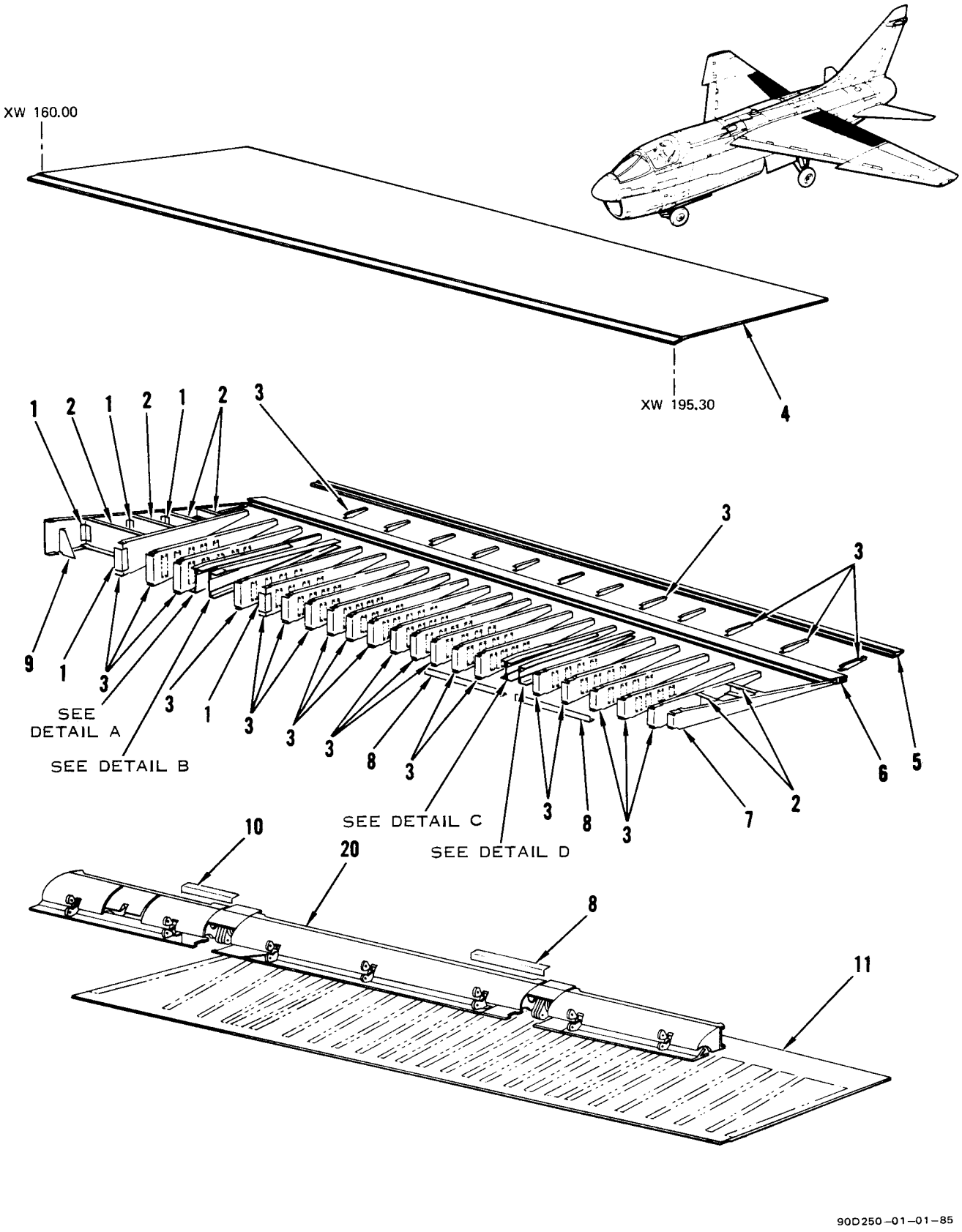


Figure 5-45. Wing Trailing Edge Flap Installation (Sheet 1 of 3)

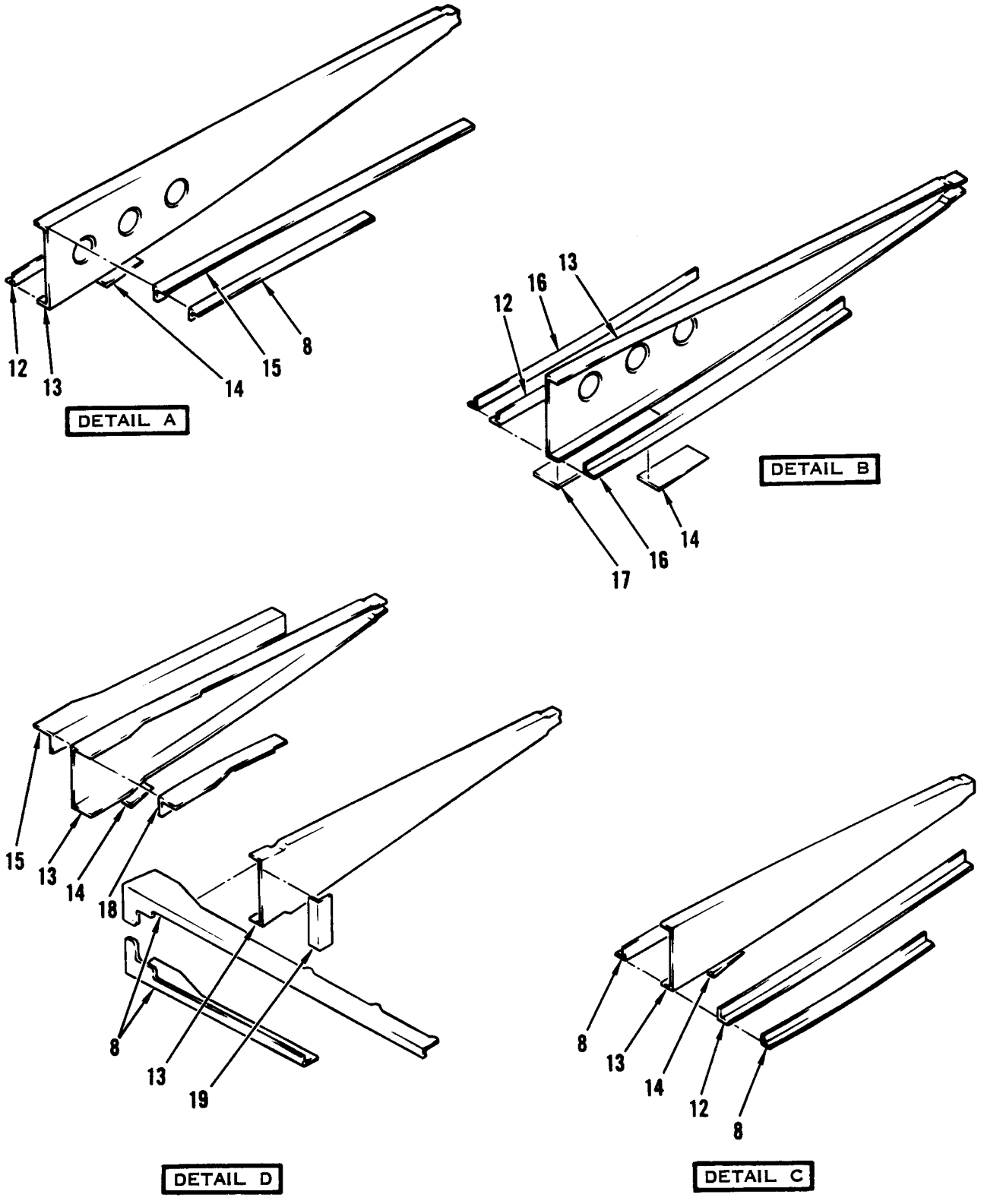


Figure 5-45. Wing Trailing Edge Flap Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70310	Trailing Edge Installation, Trailing Edge Wing Flap			
1	215-70310	Clip	0.025 X * X *	2024-T3	Section XII
2		Intercostal	0.025 X * X *	7075-T6	Section XII
3		Rib	0.025 X * X *	7075-T6	Section XII
4		Skin	0.063 X 40.0 X 123.2	7075-T6	Section XII
5		Trailing Edge (Extr)	CVC10051-9	7075-T6511	Section XV
6		H-Section (Extr) .	CVC10031-1	7075-T6511	Section XV
7		Rib	0.032 X * X *	7075-T6	Section XII
8		Angle	0.063 X * X *	7075-T6	Section XII
9		Gusset	0.032 X 2.6 X 5.7	7075-T6	Section XII
10		Angle	0.032 X 7.5 X 6.9	7075-T6	Section XII
11		Skin	0.080 X 40.5 X 123.2	7075-T6	Section XII
12		Angle	0.050 X * X *	7075-T6	Section XII
13		Rib	0.050 X * X *	7075-T6	Section XII
14		Spacer	0.250 X * X *	Reinforced Plastic	Replace
15		Angle	0.071 X * X *	7075-T6	Section XII
16		Angle	0.080 X * X *	7075-T6	Section XII
17		Splice Plate . . .	0.063 X 2.9 X 6.0	7075-T6	Section XII
18		Angle	0.050 X 1.7 X 6.6	7075-T6	Section XII
19		Clip	0.025 X 1.5 X 3.2	2024-T42	Section XII
20		Leading Edge . . .			5-46

*Length or length and width may vary with location.

Figure 5-45. Wing Trailing Edge Flap Installation (Sheet 3)

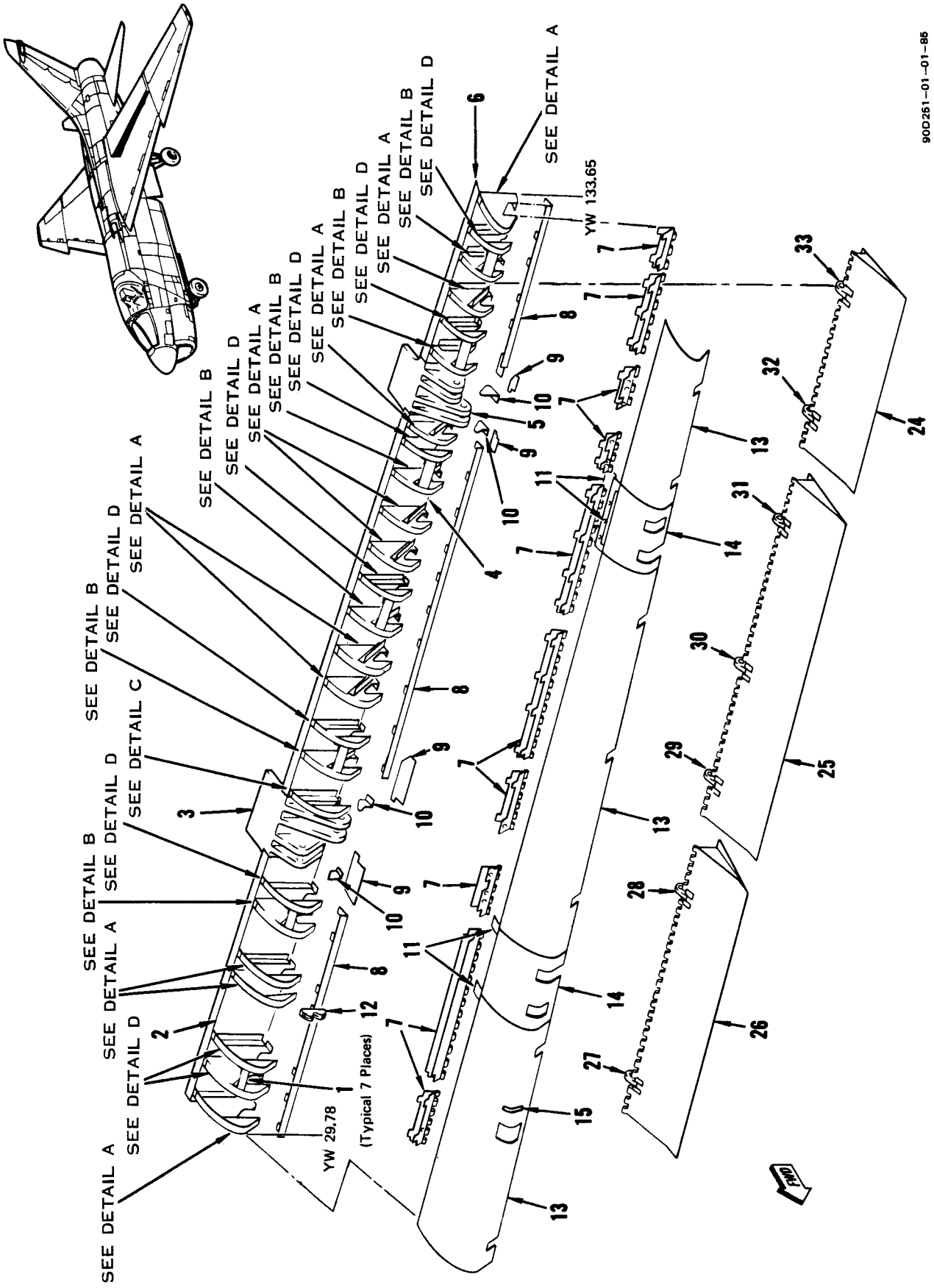
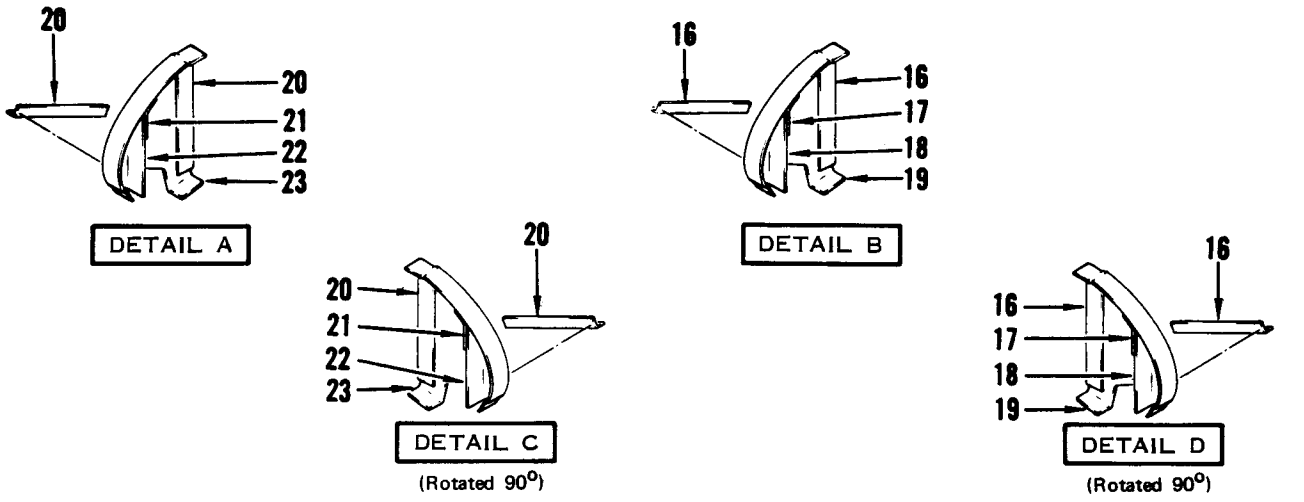


Figure 5-46. Wing Trailing Edge Flap Leading Edge Installation (Sheet 1 of 3)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70330	Leading Edge Installation, Trailing Edge Wing Flap			
1	215-70330	Angle	0.050 X * X *	2024-T42	Section XII
2	215-70310	Spar, Inboard . . .	0.032 X 9.00 X 23.30	7075-T6	Section XII
3	215-70327	Support (Forg) . .		7075-T6	Section XII
4	215-70310	Spar, Center . . .	0.040 X 8.90 X 51.60	7075-T6	Section XII
5	215-70328	Support (Forg) . .		7075-T6	Section XII
6	215-70310	Spar, Outboard . .	0.040 X 6.30 X 24.00	7075-T6	Section XII
7	215-70330	Hinge Half (Extr) .	CVC10041-35	7075-T6	Section XV
8		Angle	0.040 X * X *	2024-T42	Section XII
9		Door	0.040 X * X *	7075-T6	Section XII
10		Clip	0.040 X * X *	2024-T42	Replace
11		Doubler	0.040 X 1.00 X *	2024-T3	Section XII
12	215-70377	Anchor (Cstg) . . .		17-4PH	Section XII
13	215-70330	Skin	0.025 X * X *	7075-T6	Section XII

See the footnotes at the end of the figure.

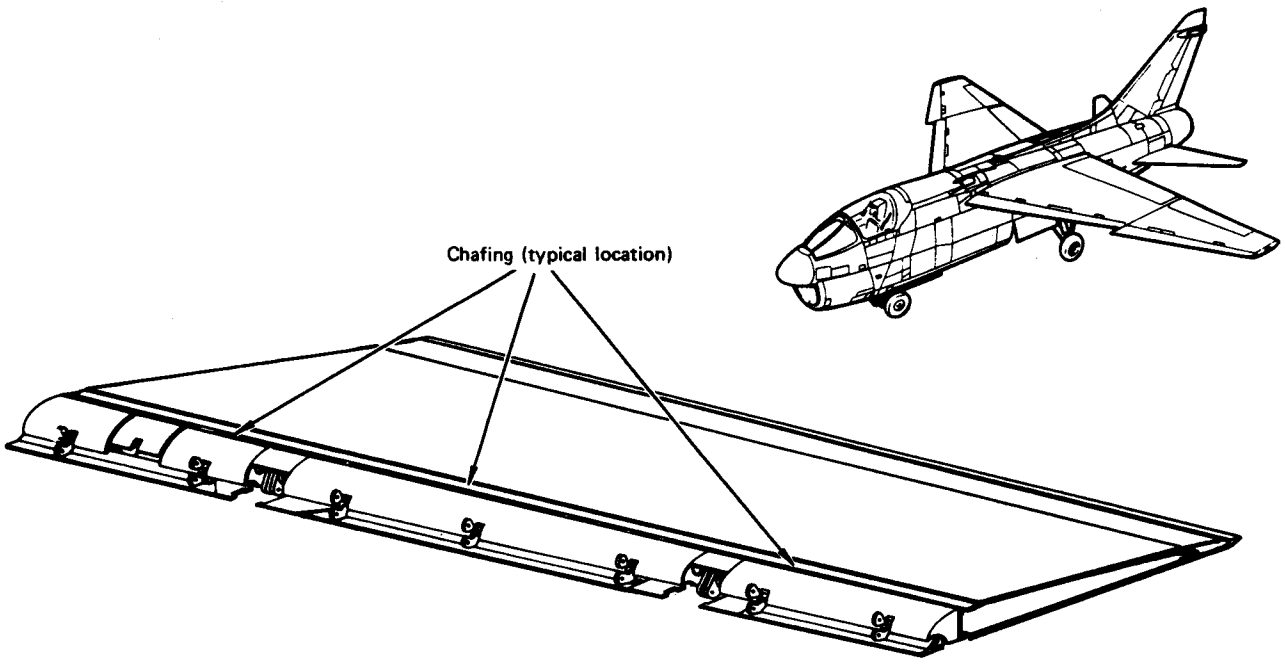
Figure 5-46. Wing Trailing Edge Flap Leading Edge Installation (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
14		Door	0.025 X * X *	7075-T6	Section XII
15		Rub Strip	0.031 X 2.50 X 8.20	Phenolic	Section XIV
16	215-70330	Angle	0.040 X * X *	2024-T42	Section XII
17		Clip	0.040 X 0.90 X *	2024-T3	Replace
18		Tee (Extr)	CVC10010-22	7075-T6511	Section XV
19		Rib	0.040 X * X *	7075-T6	Section XII
20		Angle	0.032 X * X *	2024-T42	Section XII
21		Clip	0.032 X 0.90 X *	2024-T3	Replace
22		Tee (Extr)	CVC10010-41	7075-T6511	Section XV
23		Rib	0.032 X * X *	7075-T6	Section XII
	215-70192	Door Installation, Wing Center Section Trailing Edge Flap Slot			
24†	215-70194	Door (Extr)	CVC10041-38	7075-T6511	Section XV/5-49
25†	215-70195	Door (Extr)	CVC10041-38	7075-T6511	Section XV/5-49
26†	215-70196	Door (Extr)	CVC10041-36	7075-T6511	Section XV/5-49
27	7527509	Lug Slot Door . . .	7527509-30 R&L Inbd Lug	AISI 4130	Section XII/5-50
28	7527509	Lug Slot Door . . .	7527509-10 R&L Outbd Lug	AISI 4130	Section XII/5-50
29	/527508	Lug Slot Door . . .	7527508-50 R&L Inbd Lug	AISI 4130	Section XII/5-50
30	7527508	Lug Slot Door . . .	7527508-30 R&L Center Lug	AISI 4130	Section XII/5-50
31	7527508	Lug Slot Door . . .	7527508-10 R&L Outbd Lug	AISI 4130	Section XII/5-50
32	7527507	Lug Slot Door . . .	7527507-10 R&L Outbd Lug	AISI 4130	Section XII/5-50
33	7527507	Lug Slot Door . . .	7527507-30 R&L Outbd Lug	AISI 4130	Section XII/5-50

*Length or length and width may vary with location.

†Allowable limits for broken lugs on trailing edge flap slot door. Door may be used if broken lugs are not adjacent to each other, criteria allows every other lug on a door to be broken.

Figure 5-46. Wing Trailing Edge Flap Leading Edge Installation (Sheet 3)



DAMAGE LIMITATION:

Chafed spot(s) not worn through skin.

REPAIR (Chafed 0.010-inch or less).

WARNING

The following WARNINGS should be observed when repairing small chafed areas on the flaps:

1. O-T-620 trichloroethane is highly toxic to eyes, skin and respiratory tract. Avoid all contact. Skin and eye protection required. Use only with adequate ventilation. Avoid smoking or using welding equipment during use. Organic vapor respirator recommended.

2. Sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate. An approved dust mask is recommended.

3. Spraying operations are hazardous to the eyes and respiratory tract. Eye protection and mist/dust respirator required. Good general ventilation is normally adequate.

1. Remove paint in area(s) where chafing has occurred (T.O. 1A-7D-23).
2. Clean area with O-T-620 trichloroethane.
3. Sand lightly with P-C-451, 320 or 400-grit aluminum oxide abrasive cloth to remove corrosion and smooth surface.
4. Remove sanding dust with clean, dry cotton wiping rag.
5. Immediately spray area with RIAPD 703 corrosion inhibiting dry film lubricant.

90D252-01-01-85

Figure 5-47. Wing Trailing Edge Flap Leading Edge Repair (Sheet 1 of 2)

REPAIR (Chafed more than 0.010-inch but not through skin).

WARNING

The following WARNINGS should be observed when repairing small chafed areas on the flaps:

1. O-T-620 trichloroethane is highly toxic to eyes, skin and respiratory tract. Avoid all contact. Skin and eye protection required. Use only with adequate ventilation. Avoid smoking or using welding equipment during use. Organic vapor respirator recommended.

2. Sanding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate. An approved dust mask is recommended.

3. DEVCON F surface filler is toxic to eyes, skin and respiratory tract. Eye and skin protection required. Use only in a well ventilated area.

4. Spraying operations are hazardous to the eyes and respiratory tract. Eye protection and mist/dust respirator required. Good general ventilation is normally adequate.

1. Remove paint in area(s) where chafing has occurred.
2. Clean area with O-T-620 trichloroethane.
3. Wash area with P-S-602 soap and water. Rinse with clean water and dry with clean cotton wiping rag.
4. Sand lightly with P-C-451, 320 or 400-grit aluminum oxide abrasive cloth to remove corrosion and smooth surface.
5. Remove sanding dust with clean, dry cotton wiping rag.
6. Fill worn spots with layer of DEVCON F surface filler.
7. Sand filler to contour of skin with aluminum oxide abrasive cloth. Remove sanding dust with clean, dry cloth.
8. Immediately spray area with RIAPD 703 corrosion inhibiting dry film lubricant.

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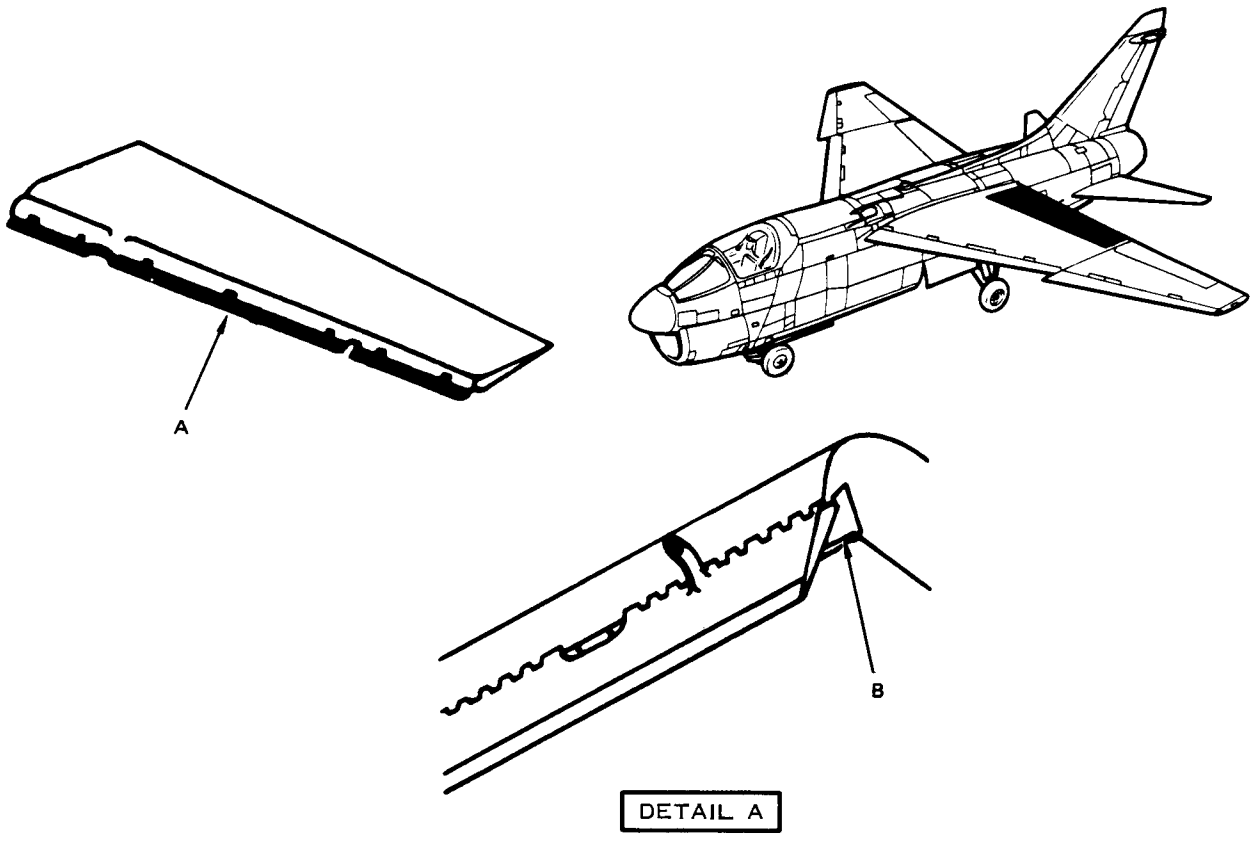
Figure 5-47. Wing Trailing Edge Flap Leading Edge Repair (Sheet 2)



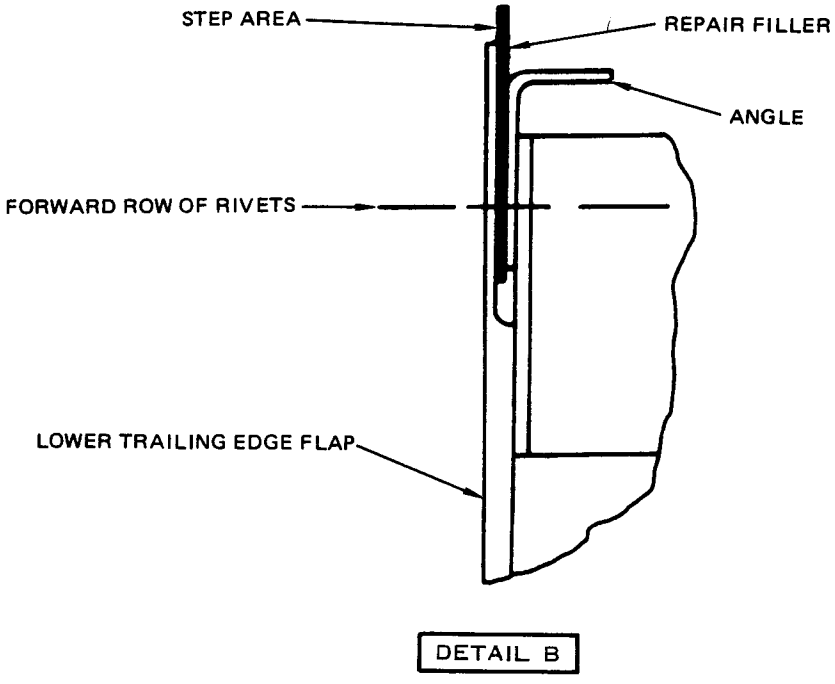


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Figure 5-48. Wing Trailing Edge Flap Lower Leading Edge Skin Repair (Sheet 1 of 2)

REPAIR LIMITATIONS

Repair forward edge of lower flap skin if it has become irregular, causing excessive gap between forward edge of lower flap skin slot deflectors.

REPAIR

1. Trim defective area of forward edge the minimum required to clean up to a neat appearance.
2. Remove forward row of rivets attaching angle and ribs to skin in defective area.
3. Fabricate filler of 0.020 1/2 hard stainless steel, approximately 1.25 inches wide by length of defective area. Pre-fit filler to provide proper gap to slot deflector. Break exposed corners to 0.06R. Finish filler with one coat of MIL-P-2377 epoxy primer in accordance with T.O. 1A-7D-23.

WARNING

MIL-S-81733 sealant is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

4. Install filler between angle and skin as shown in sketch (Detail B), using NAS 1739M rivets, picking up existing holes. Install filler and rivets wet with MIL-S-81733 sealant.
5. Fill and fair step area (See Detail B) with MIL-S-81733 sealant.
6. Refinish reworked area in accordance with T.O. 1A-7D-23.

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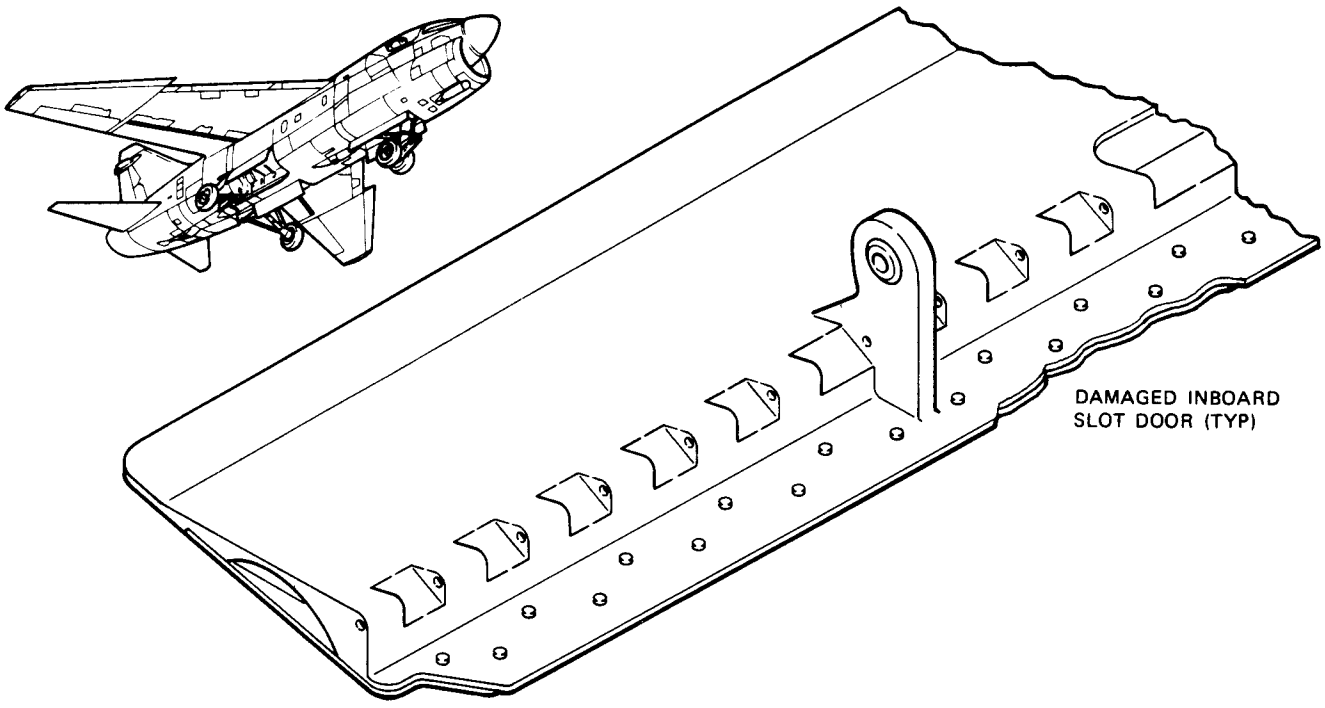
Figure 5-48. Wing Trailing Edge Flap Lower Leading Edge Skin Repair (Sheet 2)



REPAIR LIMITATIONS

Repair slot doors if existing trailing edge lip is cut, torn, missing, or worn to extent that it could damage trailing edge flap skin.

REPAIR (Typical for all slot doors)

WARNING

Grinding operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

1. Grind existing lip on slot door flush with skin.
2. Remove existing rivets from trailing edge of slot door.
3. Fabricate doubler and filler from 0.050 inch 7075-T6 aluminum to overall dimensions shown. Trim doubler to provide clearance for slot door lugs as shown. Make all radii 0.060 inch minimum.
4. Treat bare metal with MIL-C-81706 chemical conversion coating (T.O. 1-1-2) and prime (T.O. 1A-7D-23).

WARNING

MIL-S-8802 sealing compound is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

5. Install doubler and filler as shown, picking up existing rivet pattern on slot door. Use MIL-S-8802 sealing compound as faying surface seal and install rivets wet with MIL-S-8802 or primer.
6. Trim doubler and filler to match slot door contour.
7. Refinish reworked area (T.O. 1A-7D-23).

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Figure 5-49. Wing Trailing Edge Flap Slot Door Repair (Sheet 1 of 3)

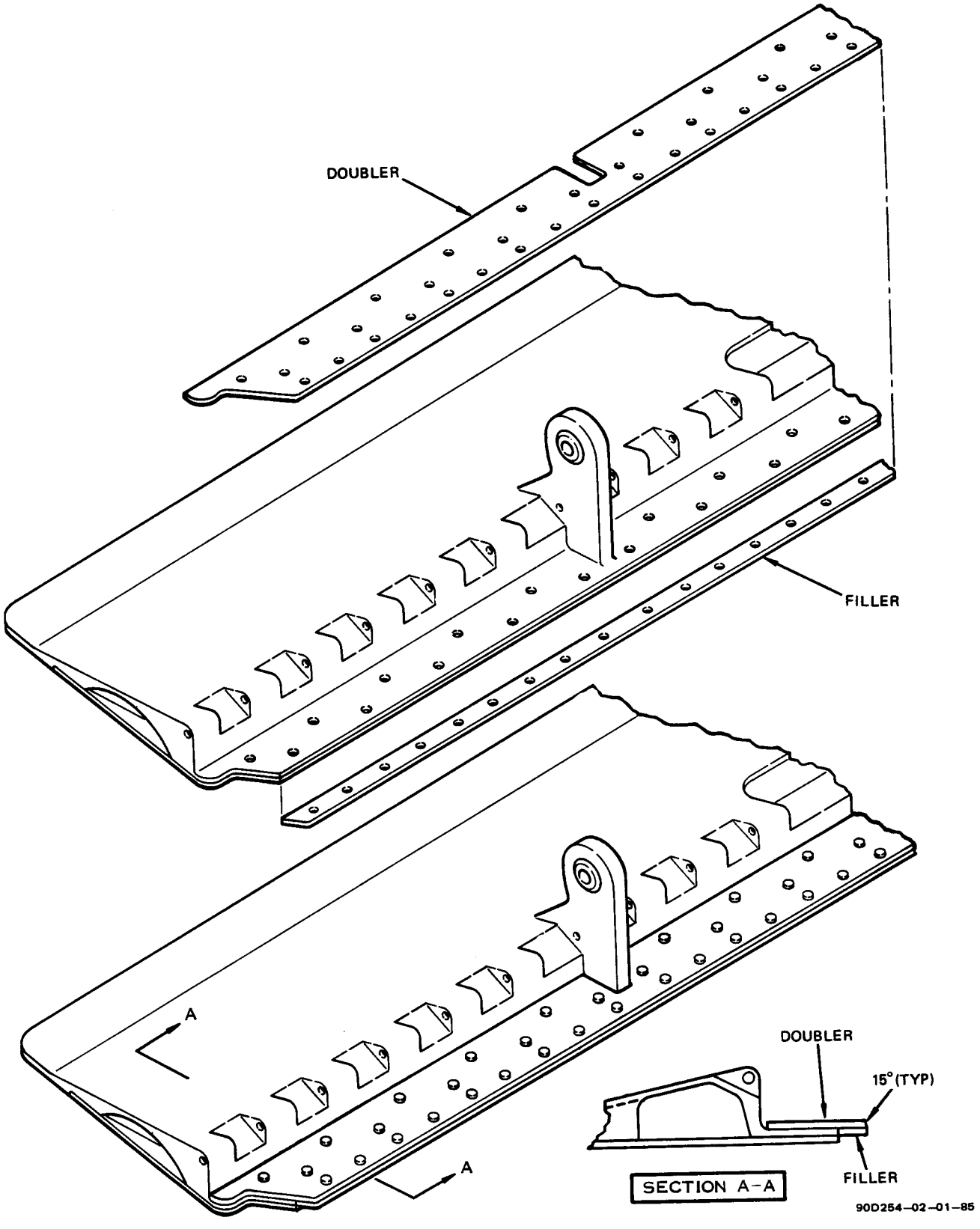
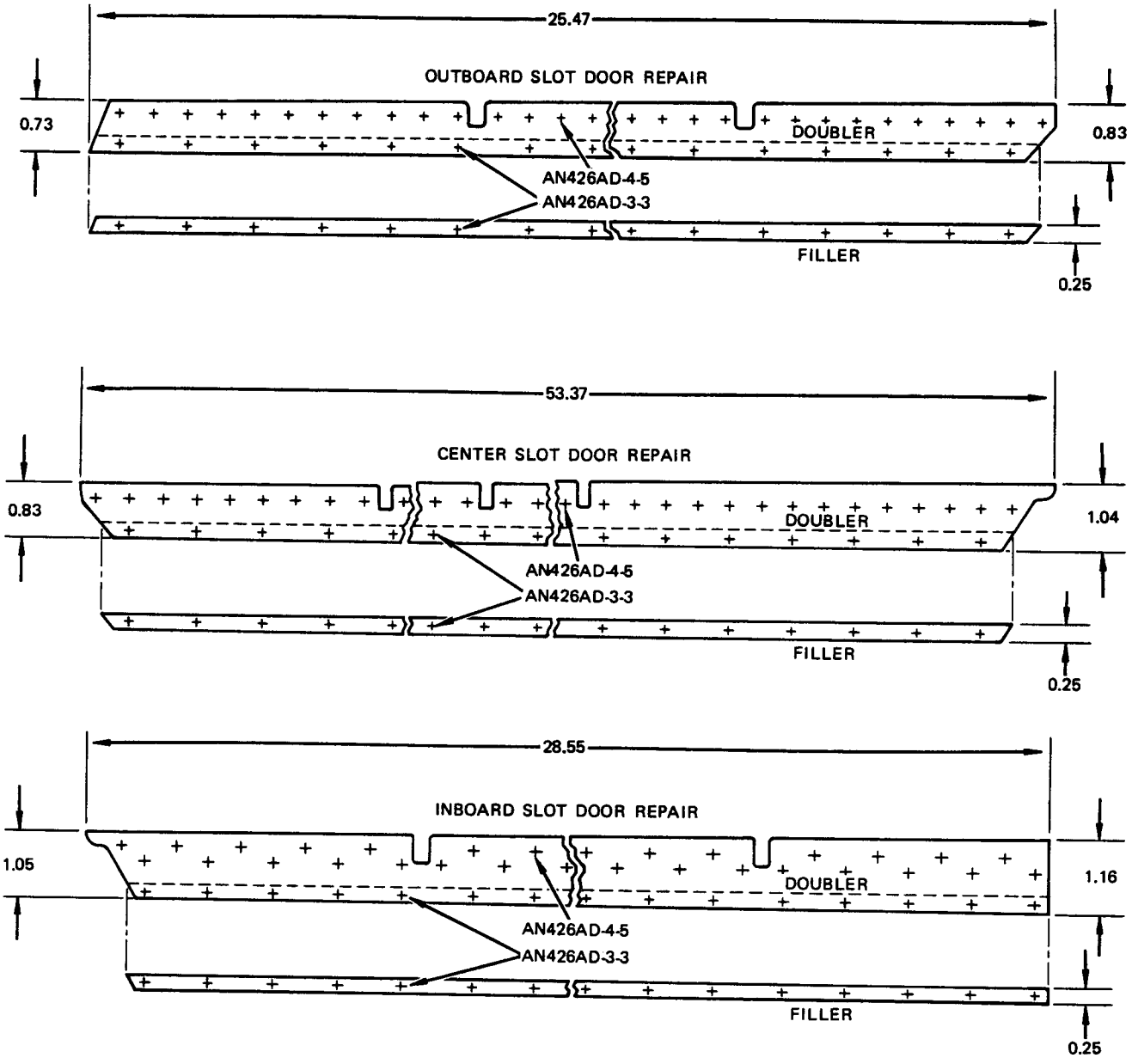


Figure 5-49. Wing Trailing Edge Flap Slot Door Repair (Sheet 2)



NOTE

1. All dimensions are in inches ±0.06 inch tolerance.
2. All radii 0.06 inch minimum.

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Figure 5-49. Wing Trailing Edge Flap Slot Door Repair (Sheet 3)

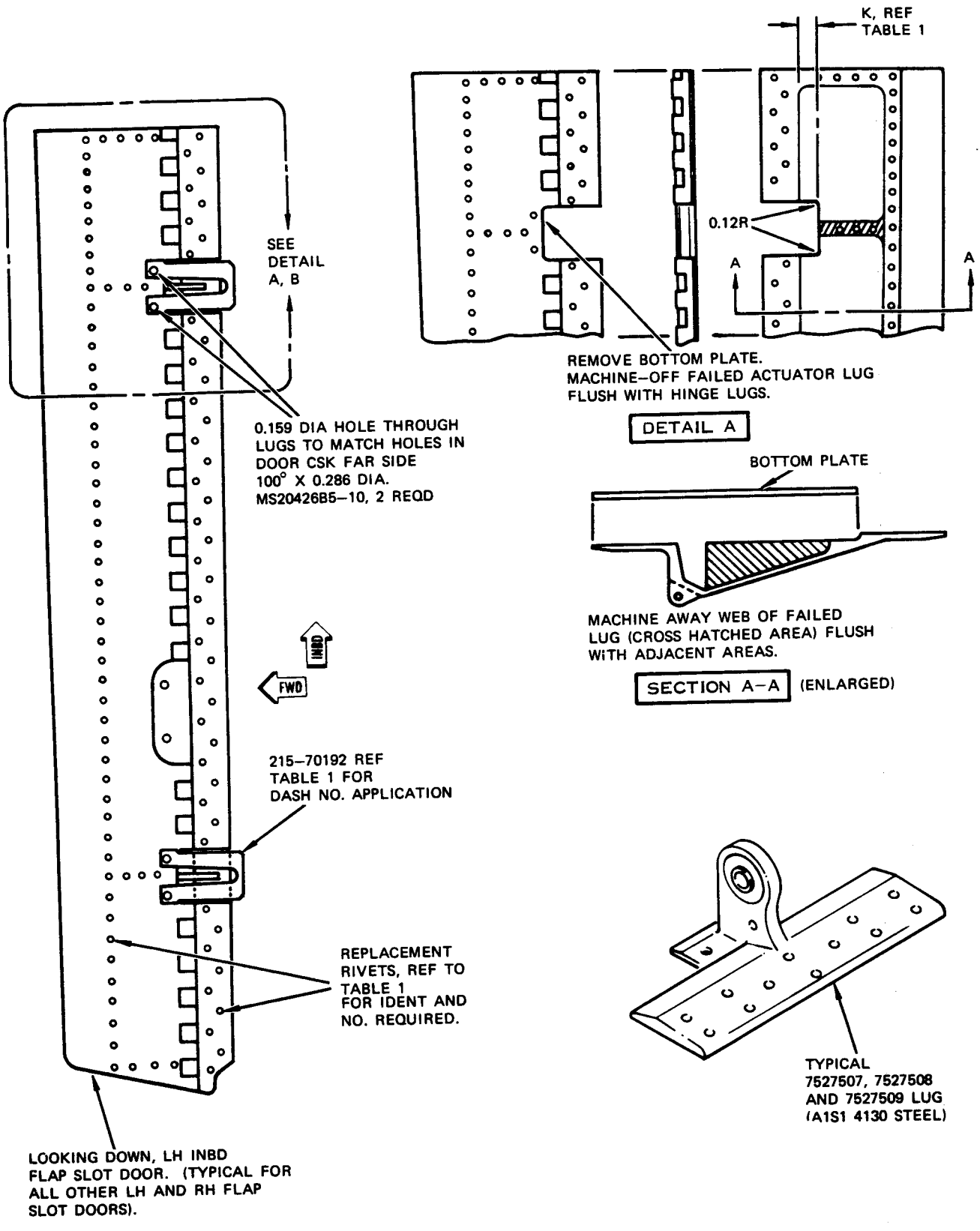
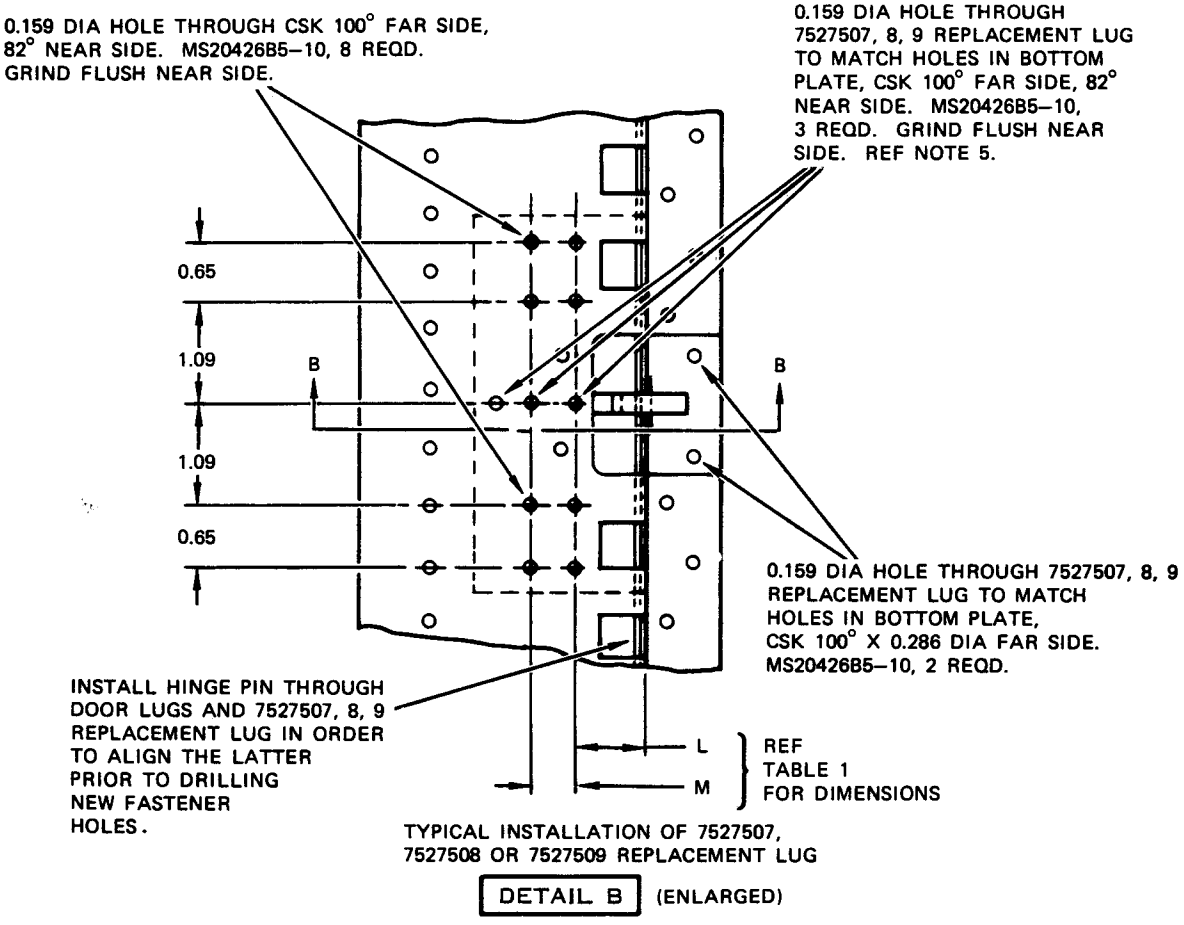


Figure 5-50. Wing Trailing Edge Flap Slot Door Actuator Lug Repair (Sheet 1 of 3)



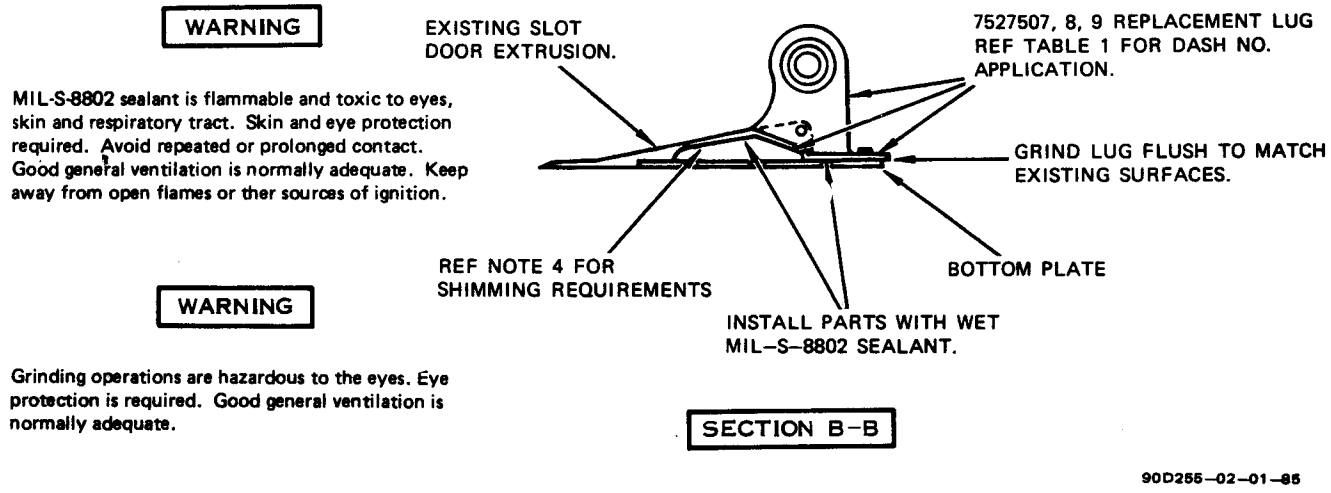


Figure 5-50. Wing Trailing Edge Flap Slot Door Actuator Lug Repair (Sheet 2)

TABLE 1

FLAP SLOT DOOR POSITION AND LUG LOCATION		REWORK DIMENSIONS (INCHES)			REPLACEMENT ACTUATOR LUG	REQUIRED 215-70192 AIR SEAL	RECOMMENDED REPLACEMENT RIVETS (NOTE 6)
DOOR	LUG	K	L	M			
LEFT HAND INBOARD	INBOARD	0.40	0.80	1.10	7527509–30	215–70192–45	MS20426AD4 100 REQD
	OUTBOARD	0.40	0.80	1.10	7527509–10	215–70192–46	
RIGHT HAND INBOARD	INBOARD	0.40	0.80	1.10	7527509–30	215–70192–45	MS20426AD4 100 REQD
	OUTBOARD	0.40	0.80	1.10	7527509–10	215–70192–46	
LEFT HAND CENTER	INBOARD	0.47	0.80	1.05	7527508–50	215–70192–47	MS20426AD4 176 REQD
	CENTER	0.47	0.80	0.80	7527508–30	215–70192–48	
	OUTBOARD	0.47	0.80	0.55	7527508–10	215–70192–49	
RIGHT HAND CENTER	INBOARD	0.47	0.80	1.05	7527508–50	215–70192–47	MS20426AD4 176 REQD
	CENTER	0.47	0.80	0.80	7527508–30	215–70192–48	
	OUTBOARD	0.47	0.80	0.55	7527508–10	215–70192–49	
LEFT HAND OUTBOARD	INBOARD	0.55	0.70	0.55	7527507–30	215–70192–50	MS20426AD4 84 REQD
	OUTBOARD	0.55	0.70	0.40	7527507–10	215–70192–51	
RIGHT HAND OUTBOARD	INBOARD	0.55	0.70	0.55	7527507–30	215–70192–50	MS20426AD4 84 REQD
	OUTBOARD	0.55	0.70	0 .40	7527507–10	215–70192–51	

NOTE

1. Break sharp edges and remove all burrs.
2. Alodine reworked areas per MIL-C-5541, apply one coat MIL-P-23377 per MIL-C-22751.
3. Refinish door assy per T.O. 1A-7D-23.
4. Shim this surface with laminated shim stock per MIL-S-22499, AL ALLOY 1100, QQ-A-250/1 or ALCLAD 2024, QQ-A-250/5, as reqd to insure good fit.
5. For center and outboard flap slot doors only two MS20426B5-10 rivets reqd in this pattern.
6. These are the original size and matl type rivets. Length to be determined on instl, or –10 length can be cut to length as reqd. Oversize MS20426B5 can be used if holes are either oversize or a softer matl rivet is desired.

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Figure 5-50. Wing Trailing Edge Flap Slot Door Actuator Lug Repair (Sheet 3)

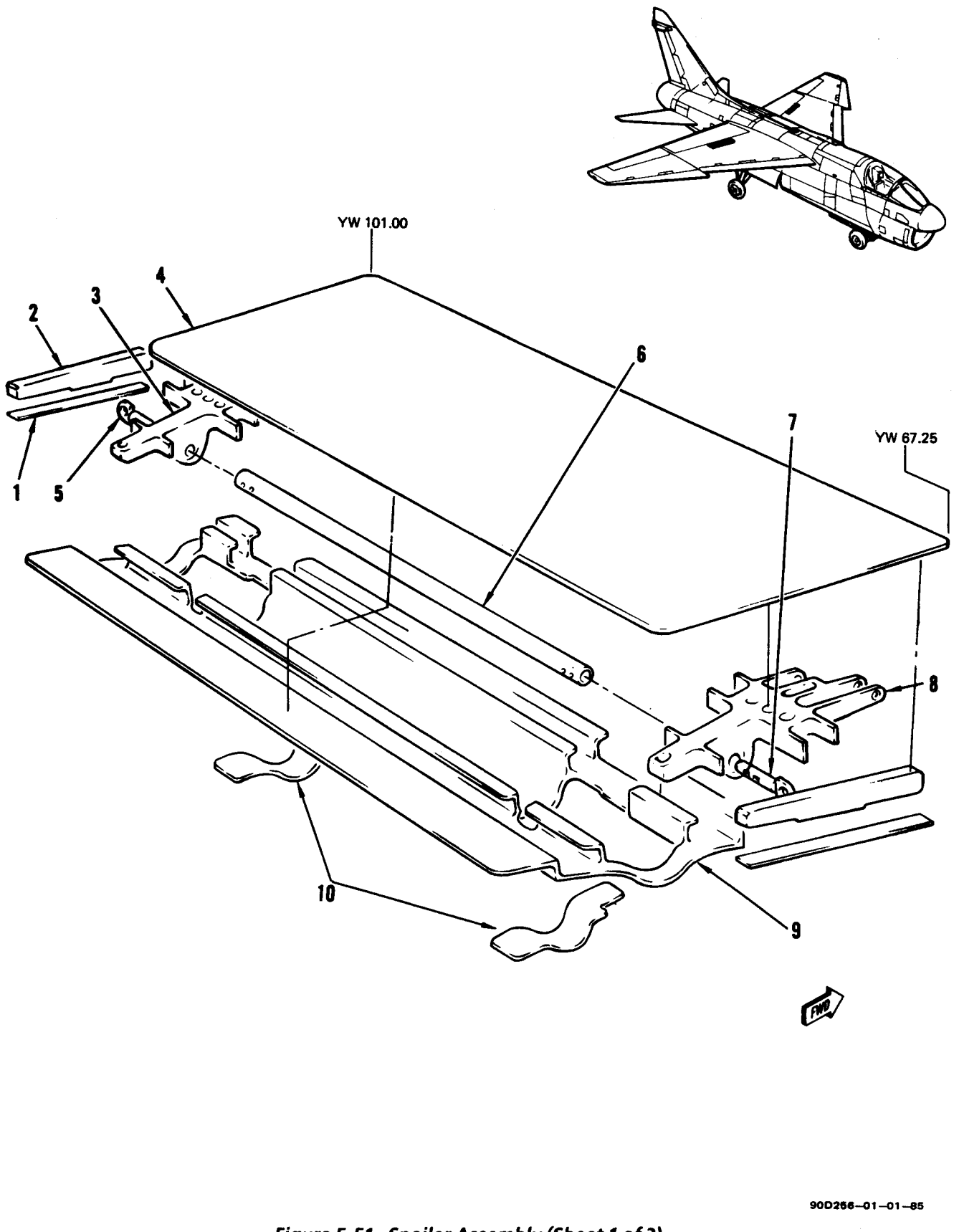
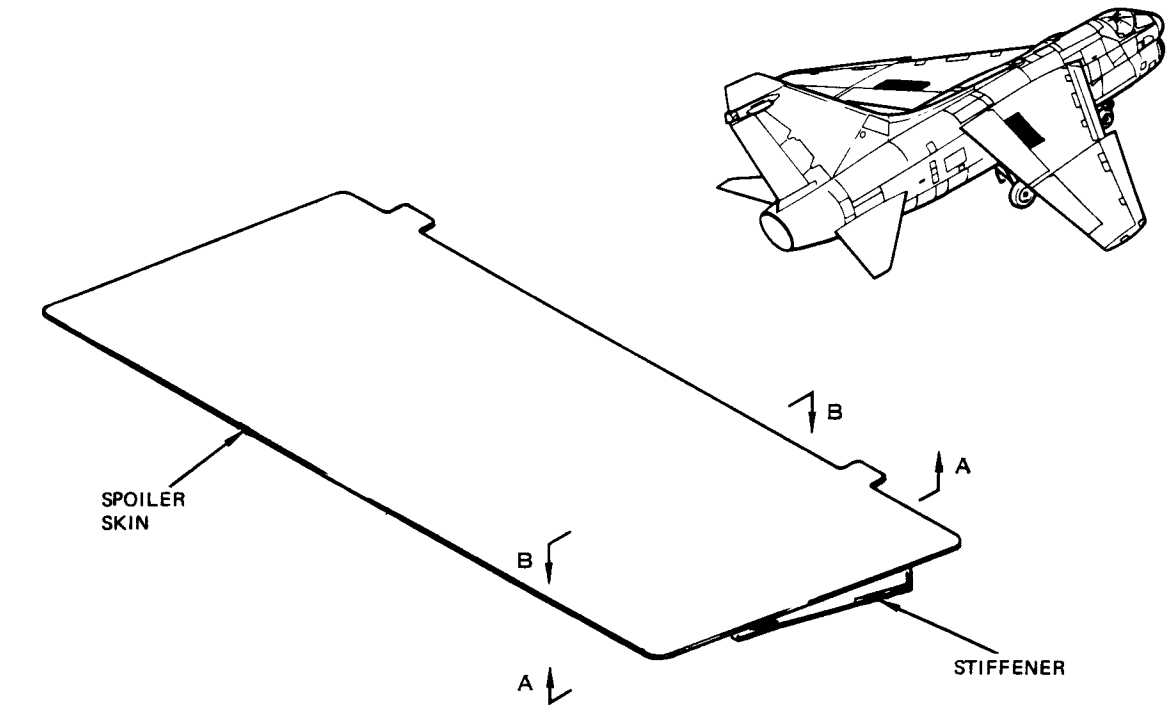


Figure 5-51. Spoiler Assembly (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70350	Spoiler Assembly, Wing Center Section Trailing Edge			
1	215-70350	Doubler	0.071 X 0.70 X 5.60	2024-T3	5-52
2	215-70601	Rib	1.000 X 0.70 X 5.50	Reinforced Plastic	Section XIV
3	215-70360	Support (Mach) . .	2.000 X 6.00 X 9.90	7075-T651	Section XII
4	215-70350	Skin	0.080 X 9.40 X 40.20	7075-T6	Section XII
5	215-70428	Bearing Unit (Mach)	1.250 X 4.50	4340	5-52
6	215-70426	Strut	1.125 X 0.187 X 23.20	2024-T3	5-52
7	215-70429	Bearing Unit (Mach)	1.250 X 4.50	4340	5-52
8	215-70385	Support (Mach) . .	2.000 X 6.00 X 9.90	7075-T651	Section XII
9	215-70440	Stiffener (Extr, Chem Mill) . . .	CVC10060-22	7075-T6511	Section XV
10	215-70350	Doubler	0.071 X 1.80 X 6.00	7075-T6	5-52

Figure 5-51. Spoiler Assembly (Sheet 2)



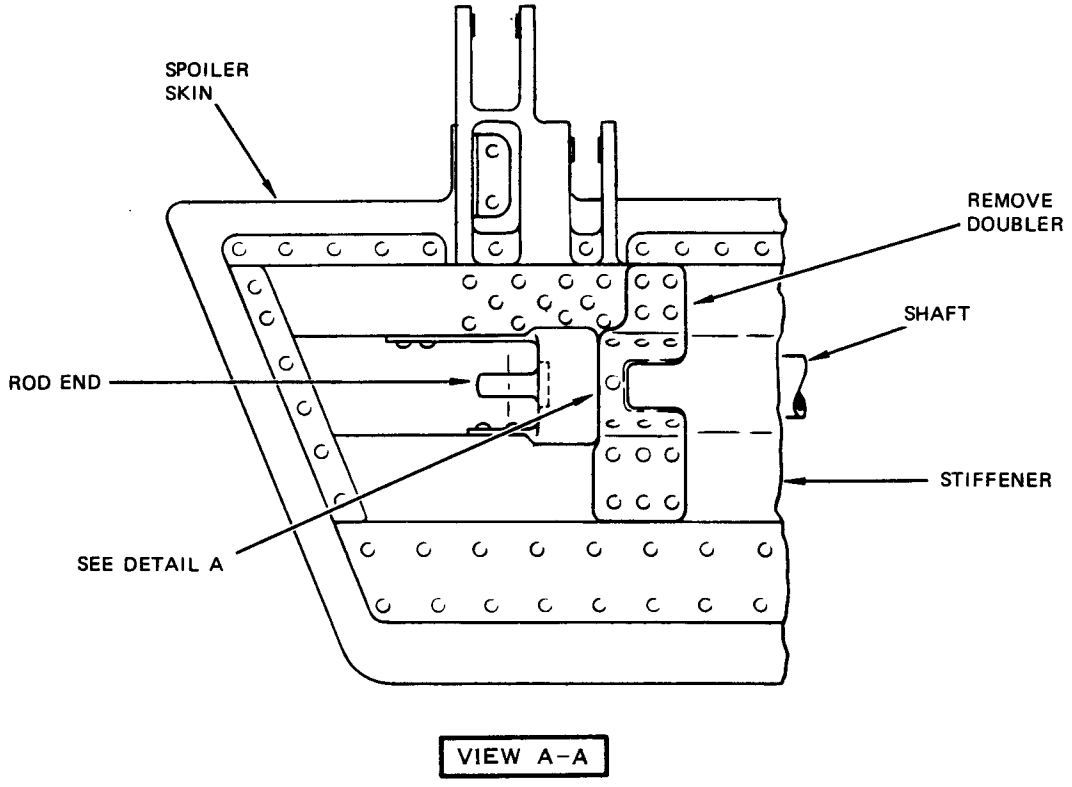


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Figure 5-52. Spoiler Rod End Removal and Skin Cutout Repair (Sheet 1 of 4)

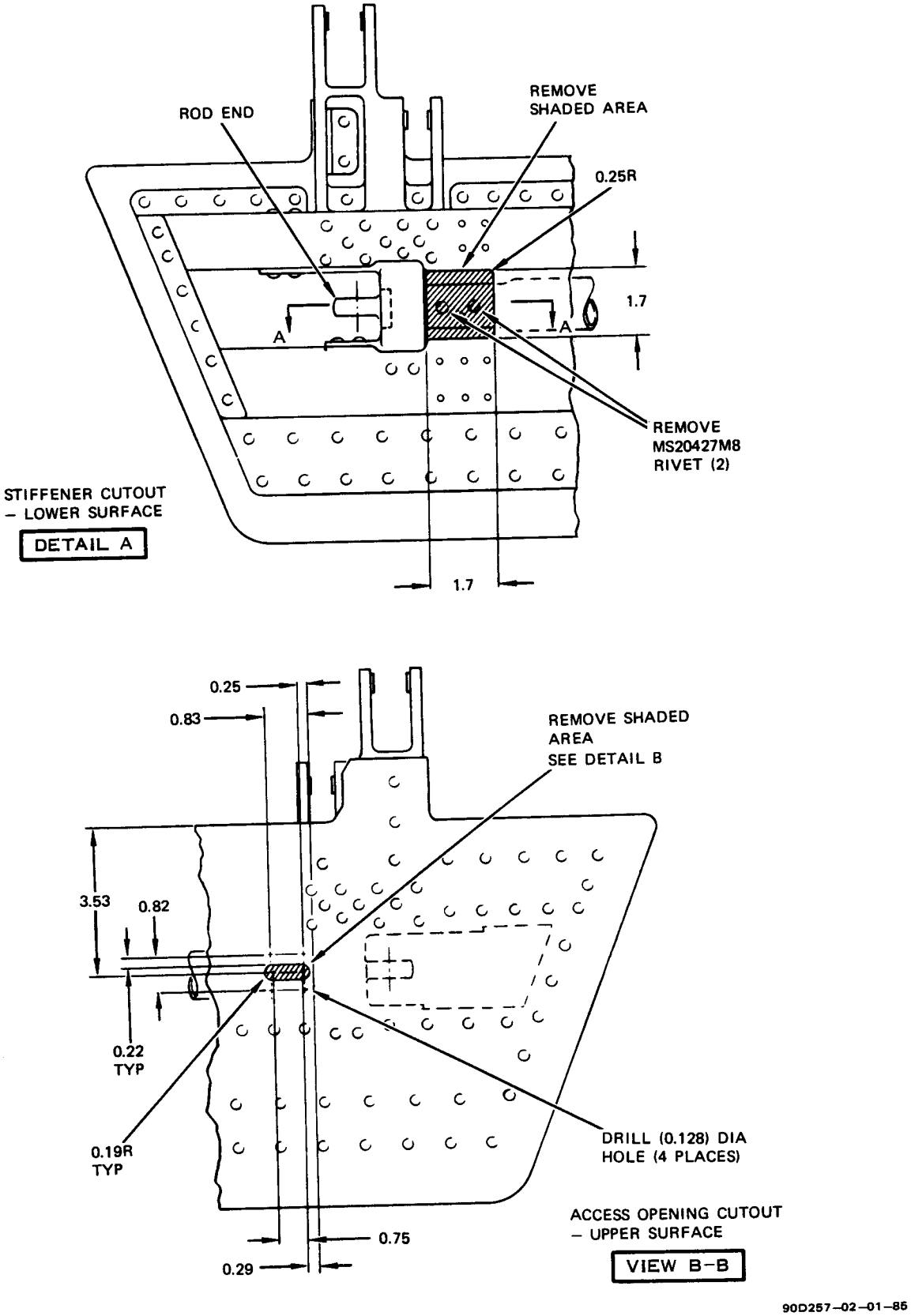
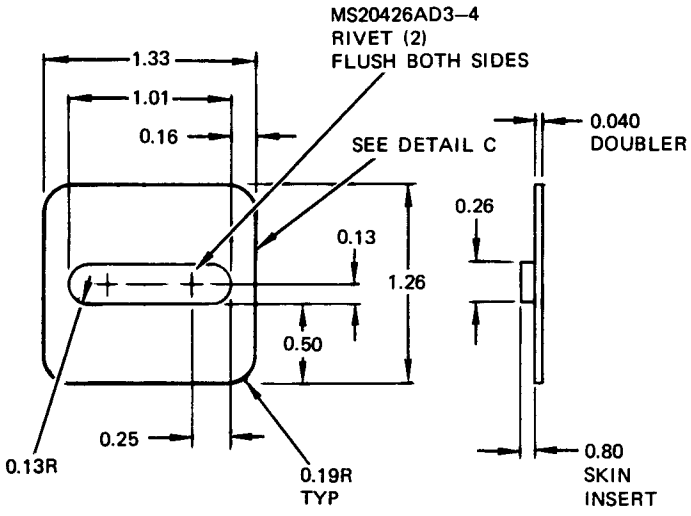
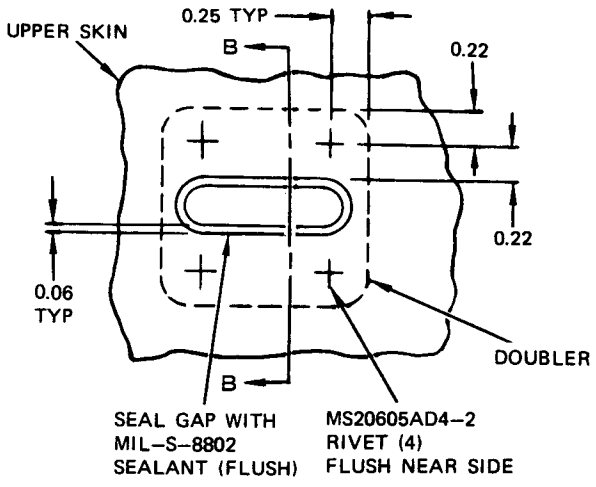


Figure 5-52. Spoiler Rod End Removal and Skin Cutout Repair (Sheet 2)

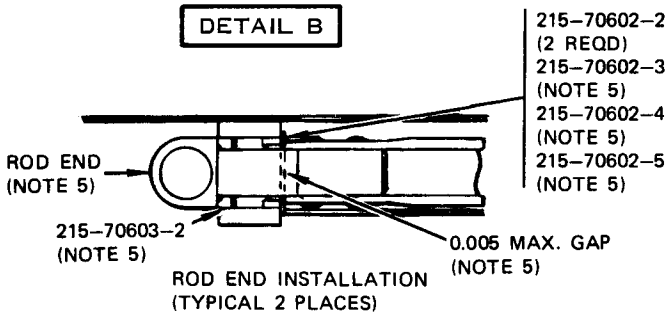


INSERT AND DOUBLER ASSEMBLY



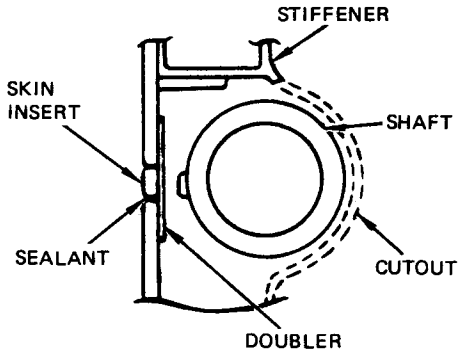
INSERT AND DOUBLER ASSEMBLY INSTALLATION

DETAIL B



SECTION A-A

DETAIL C



SECTION B-B

ROD END REMOVAL AND REPLACEMENT PROCEDURE

1. Remove and discard doubler from lower surface of spoiler (View A-A)

CAUTION

Avoid damage to shaft when enlarging access in stiffener lower surface.

2. Enlarge access opening in stiffener by cutting out a 1.7 by 1.7 inch area over end of shaft (Detail A).
3. Cut out 1.3 by 0.38 inch access opening in upper skin (View B-B).
4. Remove two MS20427M8 rivets securing rod end to shaft. Remove rod end.
5. Install replacement rod end as follows:

90D257-03-01-86

Figure 5-52. Spoiler Rod End Removal and Skin Cutout Repair (Sheet 3)

WARNING

Alodine is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

CAUTION

Ensure rod end, Part No. 215-70429, with roller bearings, is installed at the inboard end of the spoiler door and rod end, Part No. 215-70428, with ball bearings, is installed at the outboard end of the spoiler door.

a. Install rod end in shaft wet with MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2.
b. Install 215-70603-2 washer with the inside diameter chamfer facing toward the bearing end of the 215-70428-3 and 215-70429-3 rod end bearing units. This allows the washer to seat over the 0.0060 fillet radius adjacent to the bearing end of the bearing units.
c. Secure rod end with two MS20427M8-20 rivets (Section A–A).
d. Rod ends must be maintained parallel and bearing center to center dimension of 25.84 ± 0.010 inch.

SPOILER UPPER SKIN INSERT REPAIR PROCEDURE

1. Fabricate 0.080 X 0.26 X 1.01 skin insert and 0.040 X 1.26 X 1.33 doubler (Detail B) from 6061–6 aluminum alloy sheet.
2. Rivet skin insert to doubler (Detail B). Flush countersink both ends of rivets with 100° rivet head in insert and 78° upset head in doubler.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required. Good general ventilation is normally adequate.

3. Layout and predrill matching hole pattern in skin and doubler, using a No. 40 size drill (Detail C).
4. Pass insert and doubler assembly around shaft through opening in stiffener and position inside upper skin with insert located in upper skin access hole. Secure with two or three clecos.
5. Drill holes in skin and doubler to final hole size, using a No. 30 drill (Detail C).

WARNING

MIL-S-8802 sealant is flammable and toxic to eyes, skin and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate. Keep away from open flames or other sources of ignition.

6. Seal gap between insert and skin opening with MIL-S-8802 sealant and secure doubler to skin with MS20605AD4-2 blind rivets.
7. Touchup paint as directed in T.O. 1A-7D-23.

90D257–04–01–85

Figure 5-52. Spoiler Rod End Removal and Skin Cutout Repair (Sheet 4)

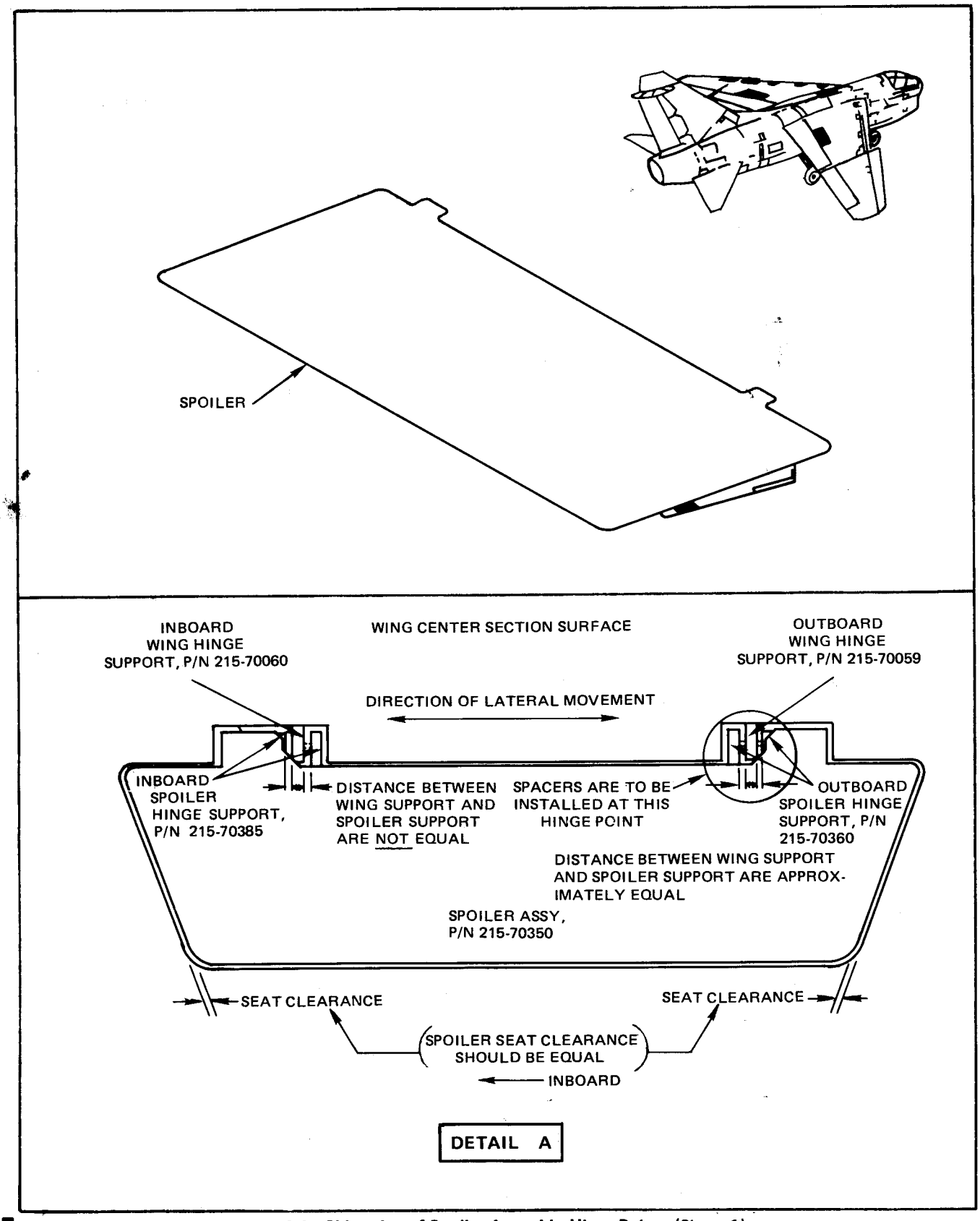
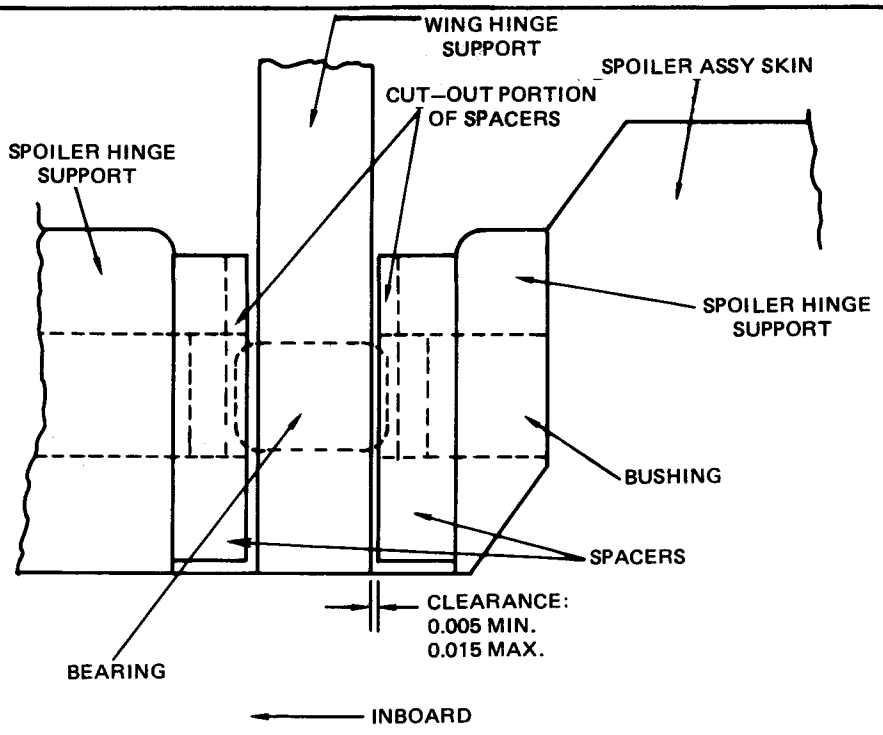


Figure 5-52.1. Shimming of Spoiler Assembly Hinge Points (Sheet 1)



DETAIL B

REPAIR LIMITATIONS

The Spoiler Hinge Supports shall be shimmed if spoiler lateral (inboard/outboard) movement exceeds 0.015 inches.

REPAIR PROCEDURES

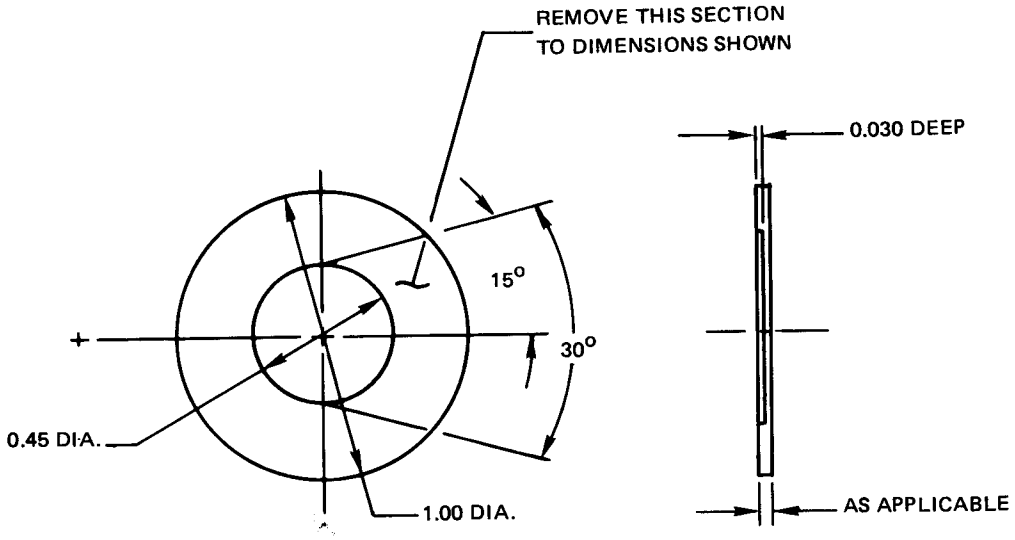
1. Disconnect bonding jumpers, spoiler links and deflector rods from the spoiler to be shimmed in accordance with T.O. 1A-7D-2-8, Paragraph 4-35.
2. Center spoiler in the seat on the wing center section.
3. Determine which spoiler hinge support is approximately centered within the wing hinge support, i.e., the hinge point with the gaps closest to bring equivalent in dimension. Refer to Detail B. This is the hinge point that must be shimmed.
4. Measure the gap between the spoiler and wing hinge lugs to determine the thickness of spacers required. Allowable clearance after spacer installation is 0.005 inch minimum and 0.015 inch maximum. Thus, a gap of 0.090 inch requires a 0.075 inch thick spacer.
5. Fabricate spacers of required thickness in accordance with Air Force Drawing 8513750. Refer to Sheet 3. The cutout section in the spacer allows the spacer to slide over the protruding bearing during installation.
6. Remove spoiler and place spacers over appropriate spoiler hinge bushings with cutout portions facing each other. Refer to Detail C. Grease may be applied between the spacer and spoiler hinge support to hold the spacers in place during spoiler installation.
7. Reinstall spoiler in accordance with T.O. 1A-7D-2-8, Paragraph 4-35.

Figure 5-52.1. Shimming of Spoiler Assembly Hinge Points (Sheet 2)

NOTES:

1. BREAK SHARP EDGES 0.010 TO 0.015.
2. MARK P/N IN ACCORDANCE WITH MIL-STD-130, RUBBER STAMP.

3 MATERIAL: POLYTETRAFLUOROETHYLENE PLASTIC ROD 1.00 DIA. IN ACCORDANCE WITH MIL-P-19468 OR AMS 3651.



-1 THRU -6

NOMENCLATURE	IDENTIFYING NO.	MATERIAL/SPECIFICATIONS
SPACER	8513750-06	0.080 THK. 3
SPACER	8513750-05	0.075 THK. 3
SPACER	8513750-04	0.070 THK. 3
SPACER	8513750-03	0.065 THK. 3
SPACER	8513750-02	0.060 THK. 3
SPACER	8513750-01	0.055 THK. 3

8513750

Figure 5-52.1. Shimming of Spoiler Assembly Hinge Points (Sheet 3)

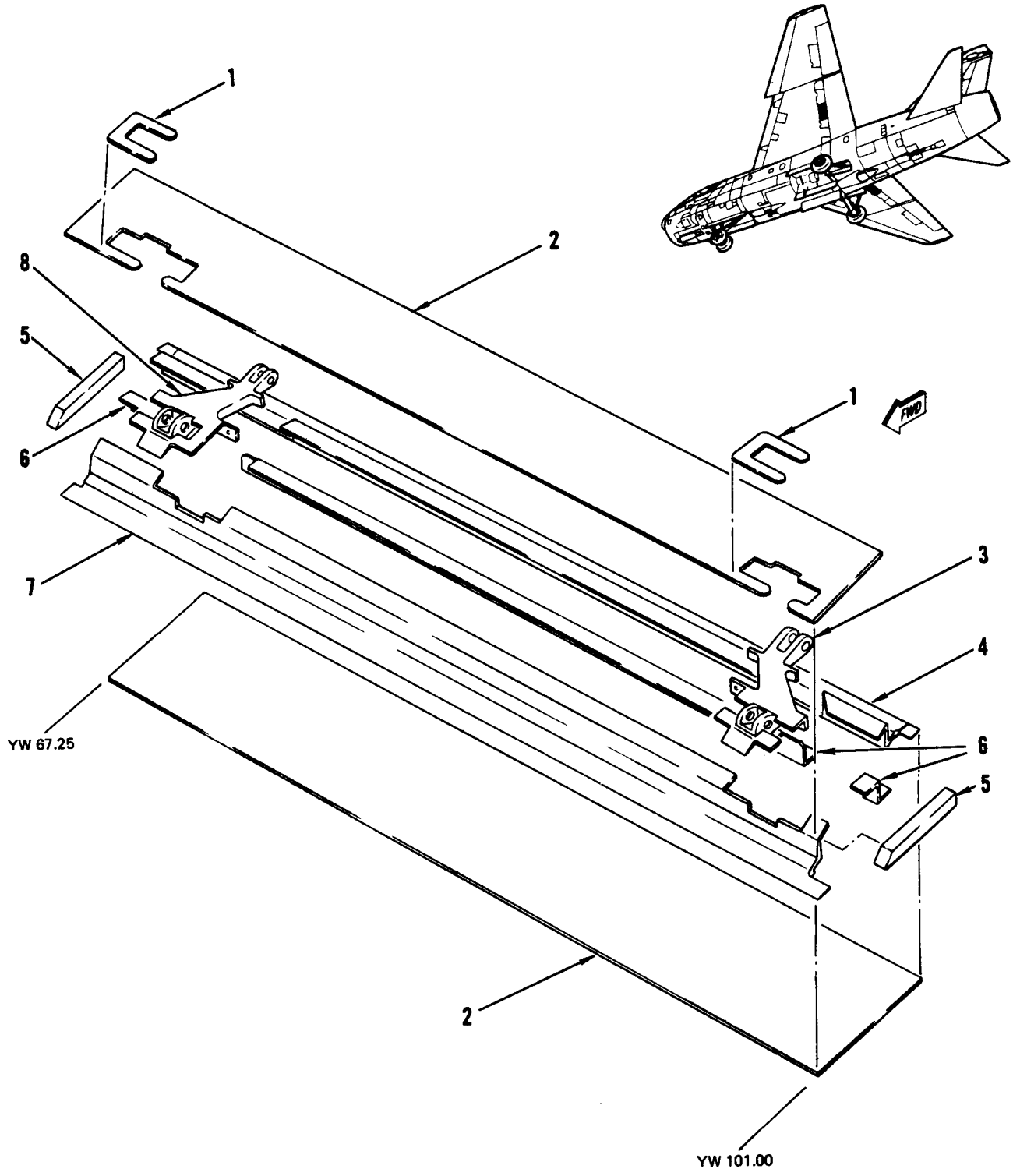
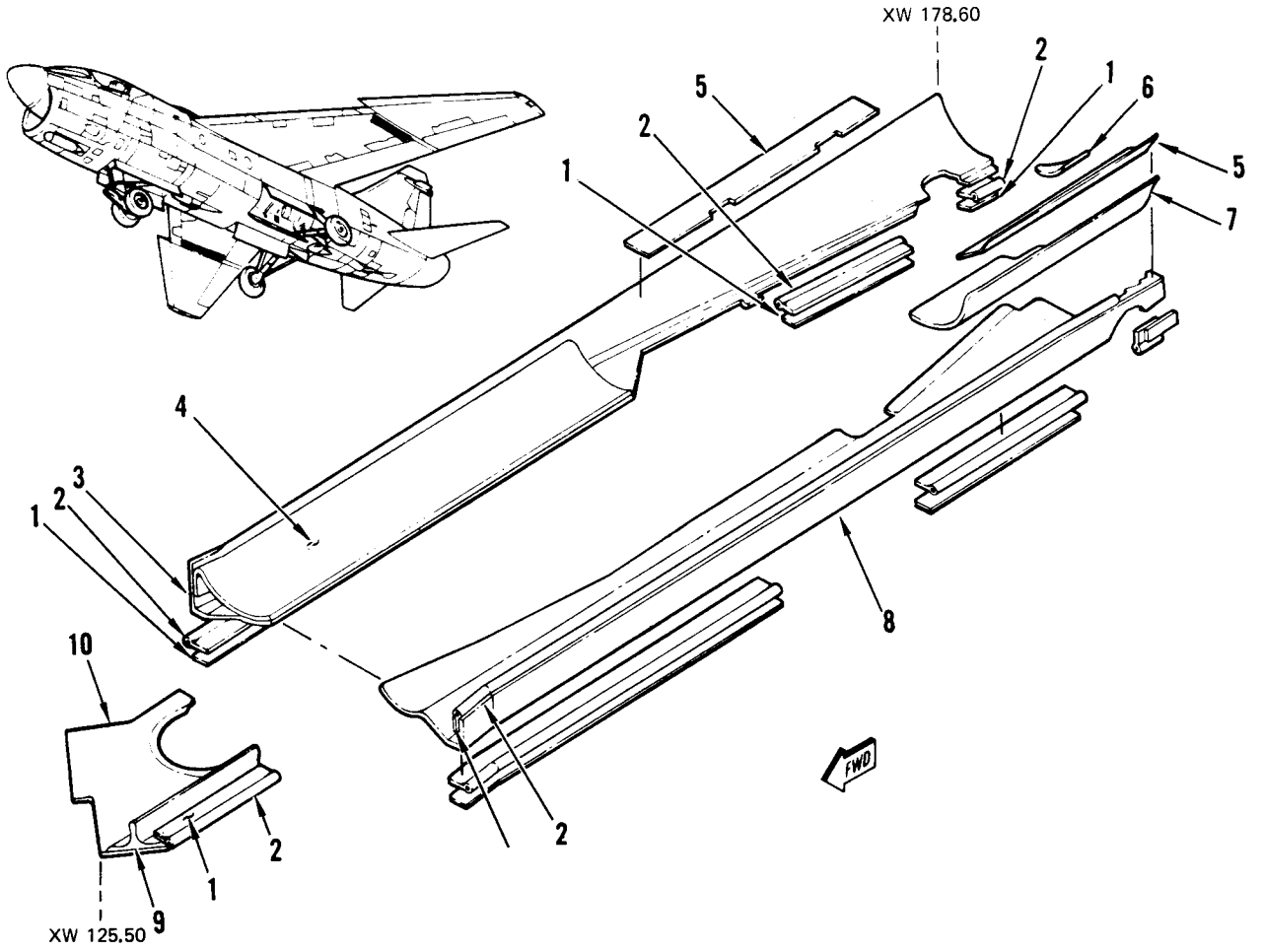


Figure 5-53. Deflector Assembly (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70375	Deflector Assembly, Wing Center Section Trailing Edge			
1	215-70375	Doubler	0.050 X * X 2.70	7075-T6	Replace
2		Skin	0.050 X * X *	7075-T6	Section XII
3	215-70381	Support (Mach) . .	1.500 X 5.10 X 6.70	7075-T651	Section XII
4	215-70442	Stiffener (Extr) .	CVC10050-2	2024-T3511	Section XV
5	215-70443	Rib	1.000 X 0.70 X 4.70	Reinforced Plastic	Section XIV
6	215-70375	Stiffener (Extr) .	CVC10050-3	2024-T3511	Section XV
7	215-70444	Stiffener (Extr) .	CVC10050-1	2024-T3511	Section XV
8	215-70380	Support (Mach) . .	1.500 X 5.20 X 6.70	7075-T651	Section XII

*Length or length and width may vary with location.

Figure 5-53. Deflector Assembly (Sheet 2)



INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	215-70111	Fairing Installation, Wingfold Pylon			
1	215-70111	Retainer	0.020 X * X *	2024-T3	Section XII
2		Seal (Extr)	CPC15E36 (PWR-P-78)	Rubber	Section XV
3		Fairing, Inboard .	0.071 X 5.00 X 37.00	2024-T42	Section XII

See footnote at the end of the figure.

Figure 5-54. Wingfold Pylon Fairing Installation (Sheet 1 of 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
4		Angle	0.050 X 3.00 X 19.00	2024-T42	Section XII
5		Extension	0.025 X * X *	2024-T3	Section XII
6		Tab	0.050 X 2.00 X 2.30	2024-T42	Section XII
7		Tab	0.071 X 3.00 X 10.20	2024-T3	Section XII
8		Fairing, Outboard .	0.050 X 5.00 X 38.60	2024-T42	Section XII
9		Stiffener (Extr) .	CPC20E2 (16440)	2024-T3511	Section XV
10		Fairing, Forward .	0.071 X 7.00 X 8.60	2024-T42	Section XII

*Length or length and width may vary with location.

Figure 5-54. Wingfold Pylon Fairing Installation (Sheet 2)

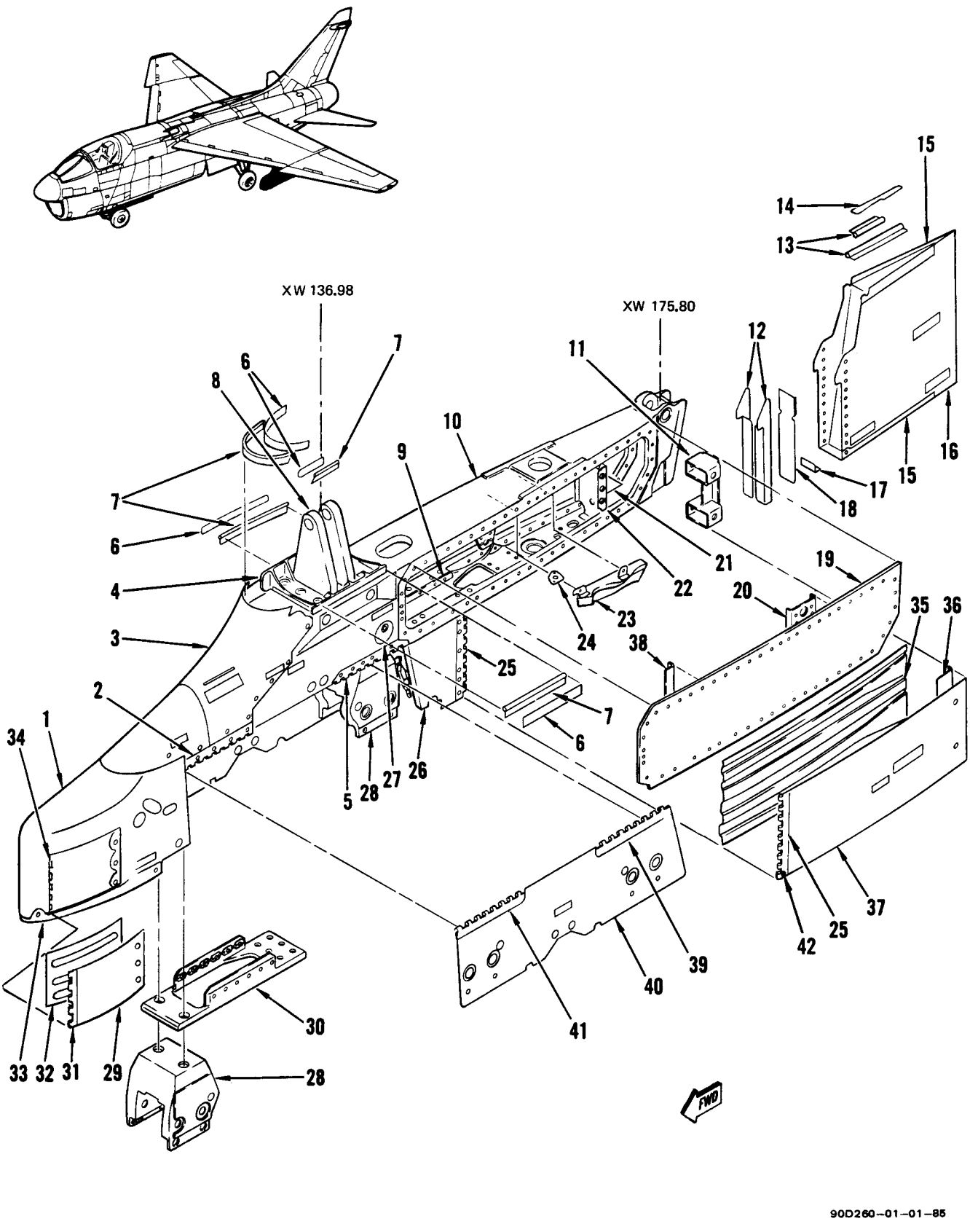


Figure 5-55. Wing Stations 1 and 8 Pylon Assembly (Sheet 1 of 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70065	Pylon Structure Assembly, Outboard			
1†	216-70490	Leading Edge (Cstg)		356-T6	Section XII
2	215-70065	Hinge (Extr) . . .	MS20001PY6-850	2024-T4	Section XV
3		Skin (Chem Mill) .	0.090 X 23.00 X 35.50	7075-T6	Section XII
4	215-70162	Support (Cstg) . .		356-T6	Section XII
5	215-70065	Hinge (Extr) . . .	MS20001PX6-900	2024-T4	Section XV
6		Retainer	0.040 X * X *	7075-T6	Section XII
7		Seal (Extr)	CPC15E36 (PWR-P-88)	Rubber	Replace
8‡	216-70467	Support (Forg) . .		4340	Section XII
9	215-70036	Plate	0.063 X 1.70 X 10.10	7075-T6	Section XII
10	215-70072	Support (Forg) . .		7075-T652	Section XII
11	215-70718	Support (Cstg) . .		356-T6	Section XII
12	215-70065	Bulkhead Tee (Extr)	AND10136-1503	7075-T6511	Section XV
13		Seal (Extr)	CPC15E36 (LASR4680)	Rubber	Replace
14		Retainer	0.032 X 1.10 X 5.90	7075-T6	Section XII
15		Channel	0.040 X * X *	7075-T6	Section XII
16		Trailing Edge Assembly (Bonded)		Fabrilite	Section XIV
17		Clip	0.040 X 1.70 X 1.80	7075-T6	Replace
18		Web	0.050 X 2.30 X 9.30	7075-T6	Section XII
19	216-70387	Skin	0.125 X 8.70 X 31.80	7075-T6	Section XII
20		Doubler	0.090 X 4.30 X 5.30	7075-T6	Section XII
21	216-70065	Bracket	0.063 X 2.80 X 6.00	7075-T6	Section XII
22		Bracket	0.090 X 5.50 X 8.80	7075-T6	Section XII
23	215-77079	Channel	4 Ply X 3.10 X 8.50	Reinforced Plastic	Section XIV
24	215-70069	Retainer	0.063 X 1.40 X 1.90	7075-T6	Replace
25	215-70376	Hinge (Extr) . . .	MS20001H8-900	2024-T4	Section XV
26§,**	216-70504	Support (Cstg) . .		356-T6	Section XII

See footnotes at the end of the figure.

Figure 5-55. Wing Stations 1 and 8 Pylon Assembly (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
††	216-70531	Support (Cstg) . .		356-T6	Section XII
27	215-70522	Cover (Mldg) . . .		MIL-M-22096, Type IV	Replace
28	216-70492	Support (Forg) . .		7075-T652	Section XII
29	215-70065	Skin (SW)	0.063 X 6.40 X *	7075-T6	Section XII
30	216-70493	Channel (Extr) . .	CVC10022-8	7075-T6511	Section XV
31	215-70065	Hinge (Extr) . . .	MS20001PY6-600	2024-T4	Section XV
32		Doubler	0.032 X 4.80 X 5.80	7075-T6	Section XII
33	215-70725	Deflector	0.032 X 8.10 X 14.70	17-7PH	Section XII
34	215-70065	Hinge (Extr) . . .	MS20001PX5-600	2024-T4	Section XV
35	215-70376	Stiffener	0.040 X 9.50 X 24.00	7075-T6	Section XII
36		Angle	0.050 X 2.60 X 8.80	7075-T6	Section XII
37●		Door	0.050 X 8.80 X 24.10	7075-T6	Section XII
38	215-70065	Stiffener	0.063 X 1.60 X 5.30	7075-T6	Section XII
39	216-70168	Hinge (Extr) . . .	MS20001PY6-950	2024-T4	Section XV
40		Door (Chem Mill) .	0.190 X 9.60 X 30.00	7075-T6	Section XII
41		Hinge (Extr) . . .	MS20001PY6-850	2024-T4	Section XV
42	MS20427M3-8	Rivet		Monel	

*Length or length and width may vary with location.
†Made from 215-70490.
‡Made from 215-70467.
§Made from 215-70504.
●When installing door, hinge pin shall be smooth and free from burrs.
**Airplanes through AF69-6205.
††Airplanes AF69-6206 and subsequent.

Figure 5-55. Wing Stations 1 and 8 Pylon Assembly (Sheet 3)

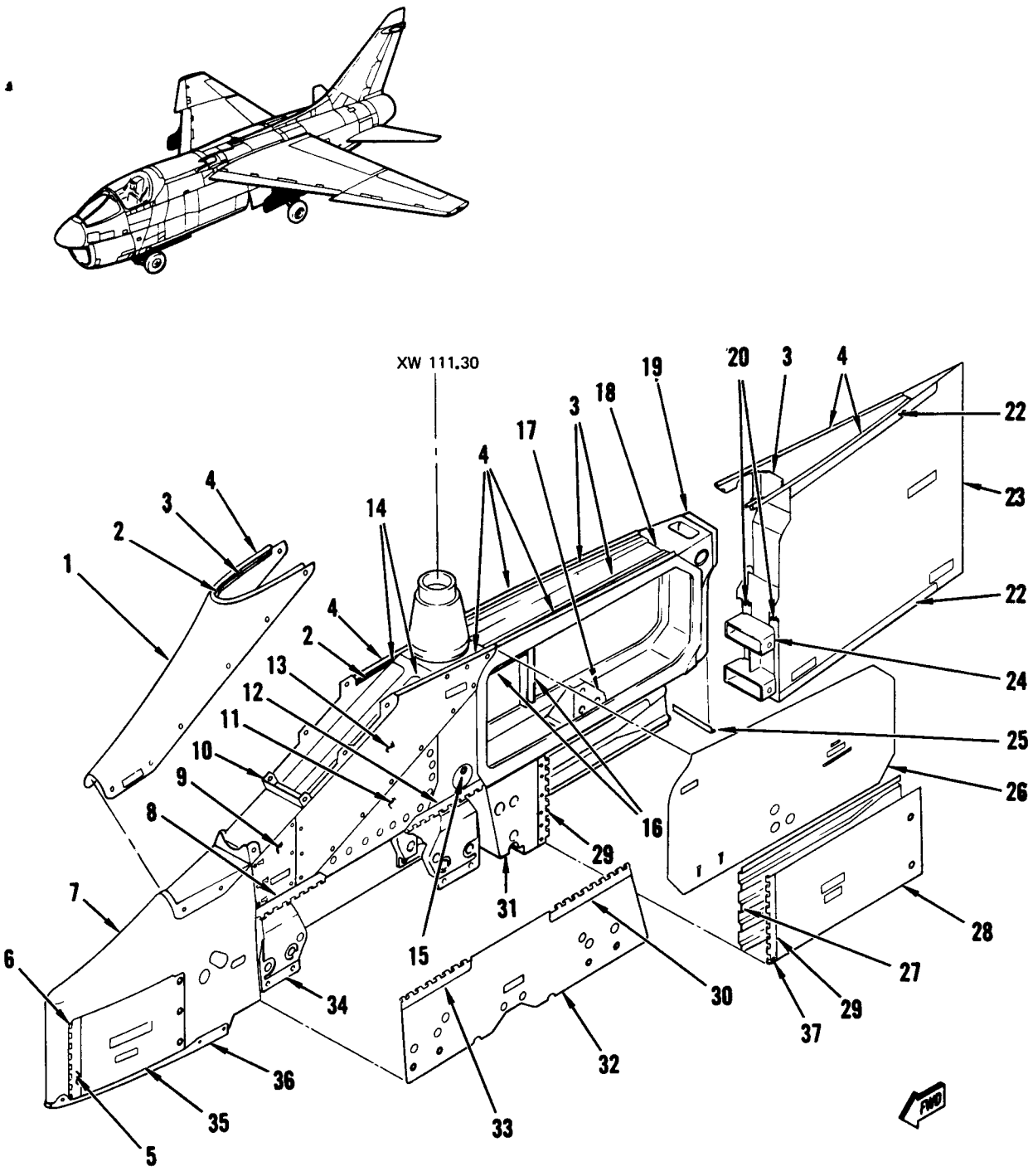


Figure 5-56. Wing Stations 2 and 7 Pylon Assembly (Sheet 1 of 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70067	Pylon Structure Assembly, Center			
1	215-70067	Skin	0.090 X 9.4 X 27.9	7075-T6	Section XII
2		Retainer	0.032 X * X *	7075-T6	Section XII
3		Retainer	0.040 X * X *	7075-T6	Section XII
4		Seal (Extr)	CPC15E36 (JR-32407)	Rubber	Replace
5		Hinge (Extr) . . .	MS20001PX6-781	2024-T4	Section XV
6	215-70581	Hinge (Extr) . . .	MS20001Y5-750	2024-T4	Section XV
7	216-70489	Leading Edge (Cstg)		356-T6	Section XII
8	215-70067	Hinge (Extr) . . .	MS20001PX9-850	2024-T4	Section XV
9		Panel	0.090 X 4.7 X 6.4	7075-T6	Section XII
10	216-70503	Support (Cstg) . .		356-T6	Section XII
11	215-70494	Plate	0.750 X 15.10 X 19.30	7075-T651	Section XII
12	215-70067	Hinge (Extr) . . .	MS20001PX6-900	2024-T4	Section XV
13		Fairing	0.080 X 7.3 X 25.8	7075-T6	Section XII
14		Angle	0.090 X 4.3 X 13.4	7075-T6	Section XII
15	215-70522	Cover (Mldg) . . .		MIL-M-22096, Type IV	Replace
16	215-70067	Stiffener (Extr) .	AND10137-1012	7075-T6511	Section XV
17	216-70067	Bracket	0.063 X 5.6 X 9.8	2024-T3	Section XII
18	215-70067	Support	0.040 X 5.7 X 22.1	7075-T6	Section XII
19	215-70071	Support (Forg) . .		7075-T652	Section XII
20	215-70067	Tee (Extr)	AND10136-1503	7075-T6511	Section XV
21		Web	0.040 X 4.0 X 11.25	7075-T6	Section XII
22		Channel	0.040 X * X *	7075-T6	Section XII
23		Trailing Edge . . .		Fabrilite	Section XIV
24	215-70719	Support (Cstg) . .		356-T6	Section XII
25	215-70067	Clip	0.040 X 1.7 X 3.4	7075-T6	Section XII
26	216-70388	Cover (Chem Mill) .	0.250 X 15.5 X 29.00	7075-T6	Section XII
27	215-70376	Stiffener	0.040 X 9.2 X 21.0	7075-T6	Section XII
28†		Door	0.050 X 8.8 X 21.0	7075-T6	Section XII
29		Hinge (Extr) . . .	MS20001HB-900	2024-T4	Section XV

See footnotes at the end of the figure.

Figure 5-56. Wing Stations 2 and 7 Pylon Assembly (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
30	216-70168	Hinge (Extr) . . .	MS20001PY-950	2024-T4	Section XV
31	216-70504	Support (Cstg) . .		356-T6	Section XII
32	216-70168	Door (Chem Mill) .	0.190 X 9.6 X 30.0	7075-T6	Section XII
33		Hinge (Extr) . . .	MS20001PY6-860	2024-T4	Section XV
34	216-70492	Support (Forg) . .		7075-T652	Section XII
35	215-70067	Door (SW)	0.063 X 8.6 X 11.4	7075-T6	Section XII
36	215-70725	Closing Rib	0.032 X 8.10 X 14.70	17-7PH	Section XII
37	MS20427M3-8	Rivet		Monel	

*Length or length and width may vary with location.
†When installing door, hinge pin shall be smooth and free from burrs.

Figure 5-56. Wing Stations 2 and 7 Pylon Assembly (Sheet 3)

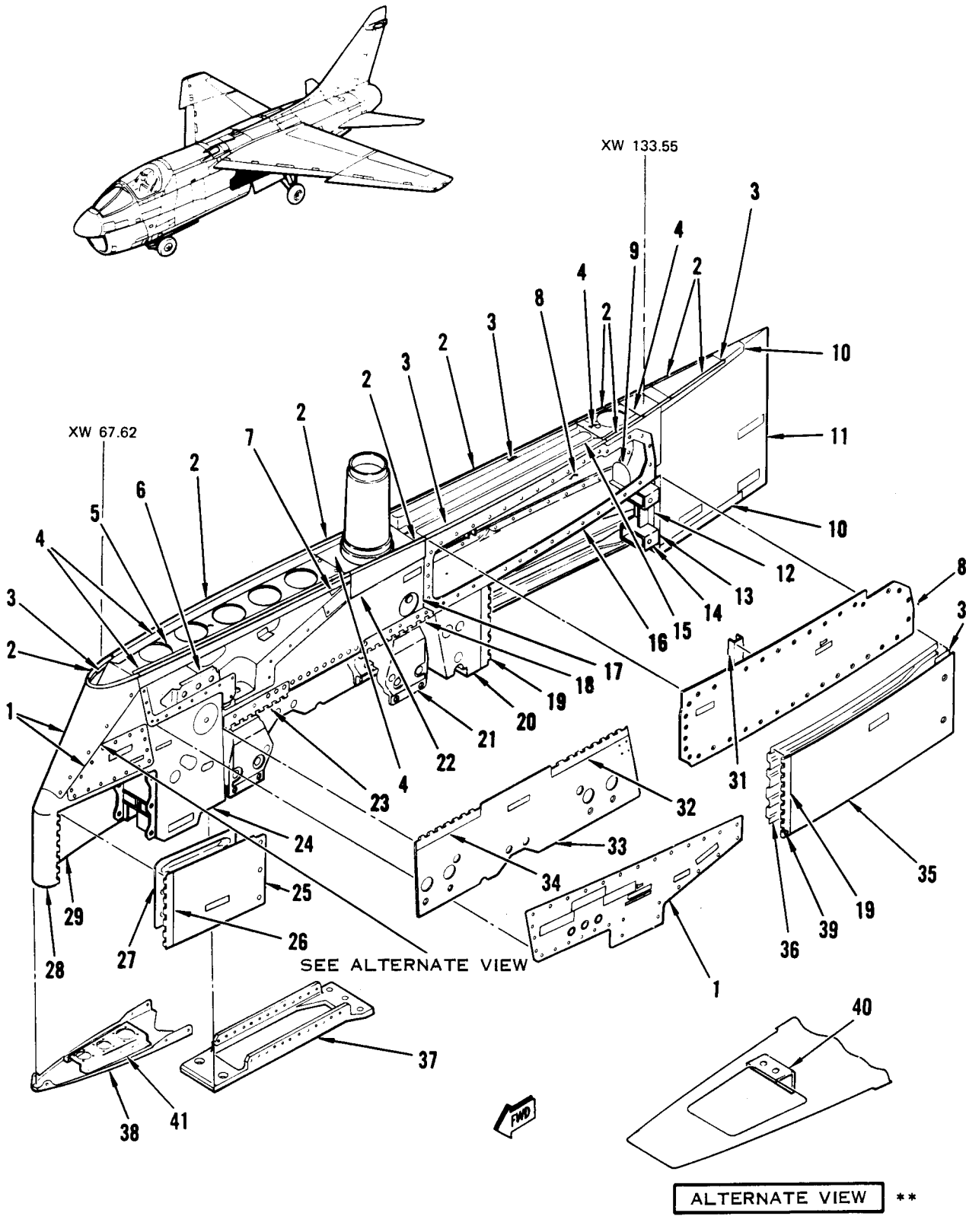


Figure 5-57. Wing Stations 3 and 6 Pylon Assembly (Sheet 1 of 3)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
	216-70069	Pylon Structure Assembly, Inboard			
1	215-70069	Skin	0.063 X * X *	7075-T6	Section XII
2		Seal (Extr)	CPC15E36 (JR-32428)	Rubber	Replace
3		Retainer	0.040 X * X *	7075-T6	Section XII
4		Retainer	0.032 X * X *	7075-T6	Section XII
5		Channel	0.063 X 14.50 X 26.00	7075-T6	Section XII
6	216-70069	Bracket	0.080 X 5.00 X 10.00	2024-T3	Section XII
7	215-70069	Support	0.080 X 3.20 X 4.10	7075-T6	Section XII
8	216-70389	Skin (Chem Mill) .	0.250 X * X 32.40	7075-T6	Section XII
9	216-70069	Bracket	0.063 X 2.10 X 2.70	7075-T6	Section XII
10	215-70069	Channel	0.040 X * X *	7075-T6	Section XII
11		Trailing Edge Assembly (Bonded)		Fabrilite	Section XIV
12		Tee (Extr)	AND10136-1503	7075-T6511	Section XV
13		Web	0.050 X 2.40 X 11.30	7075-T6	Section XII
14	215-70718	Support (Cstg) . .		356-T6	Section XII
15	215-70069	Support	0.040 X 6.10 X 23.20	7075-T6	Section XII
16	215-70070	Support (Forg) . .		7075-T652	Section XII
17	215-70522	Cover (Mldg) . . .		Nylon	Replace
18	215-70069	Hinge (Extr) . . .	MS20001PX10-850	2024-T4	Section XV
19	215-70376	Hinge (Extr) . . .	MS20001HB-900	2024-T4	Section XV
20†	216-70504	Support (Cstg) . .		356-T6	Section XII
21	216-70492	Support (Forg) . .		7075-T652	Section XII
22	215-70069	Skin	0.090 X * X 9:10	7075-T6	Section XII
23		Hinge (Extr) . . .	MS20001PX10-850	2024-T4	Section XV
24‡	215-70488	Leading Edge (Cstg)		356-T6	Section XII
25	215-70067	Door (SW)	0.063 X 8.60 X 11.40	7075-T6	Section XII
26		Hinge (Extr) . . .	MS20001PX6-781	2024-T4	Section XV
27		Panel (SW)	0.032 X 7.40 X 9.00	7075-T6	Section XII
28	215-70581	Hinge (Extr) . . .	MS20001Y5-750	2024-T651	Section XV

See footnotes at the end of the figure.

Figure 5-57. Wing Stations 3 and 6 Pylon Assembly (Sheet 2)

INDEX NUMBER	DRAWING NUMBER	NOMENCLATURE	GAGE AND SIZE	MATERIAL AND HEAT TREAT	REPAIR SECTION/ FIGURE
29	215-70067	Skin (SW)	0.063 X 8.60 X 11.00	7075-T6	Section XII
30	215-70376	Angle	0.050 X 2.60 X 8.80	7075-T6	Section XII
31	215-70069	Channel (Extr) . .	AND10137-1012	7075-T6511	Section XV
32	216-70168	Hinge (Extr) . . .	MS20001PY-950	2024-T4	Section XV
33		Door (Chem Mill) .	0.190 X 9.60 X 30.00	7075-T6	Section XII
34		Hinge (Extr) . . .	MS20001PY6-850	2024-T4	Section XV
35§	215-70376	Door	0.050 X 8.80 X 23.10	7075-T6	Section XII
36		Stiffener	0.040 X 9.50 X 23.00	7075-T6	Section XII
37	216-70493	Channel (Extr) . .	CVC10022-8	7075-T6511	Section XV
38	215-70725	Deflector	0.032 X 8.10 X 14.70	17-7PH	Section XII
39	MS20427M3-8	Rivet		Monel	
40**	CVC499LB				
	120D	Support	0.063 X * X *	2024-T3	Replace
41**	236-70023	Bracket	0.040 X 5.9 X 7.6	CRES Type 301 1/2H	Section XII

*Length or length and width may vary with location.
†Made from 215-70504.
‡Made from 215-70488.
§When installing door, hinge pin shall be smooth and free from burrs.
**Airplanes after T.O. 1A-7-530 (right pylon only).

Figure 5-57. Wing Stations 3 and 6 Pylon Assembly (Sheet 3)

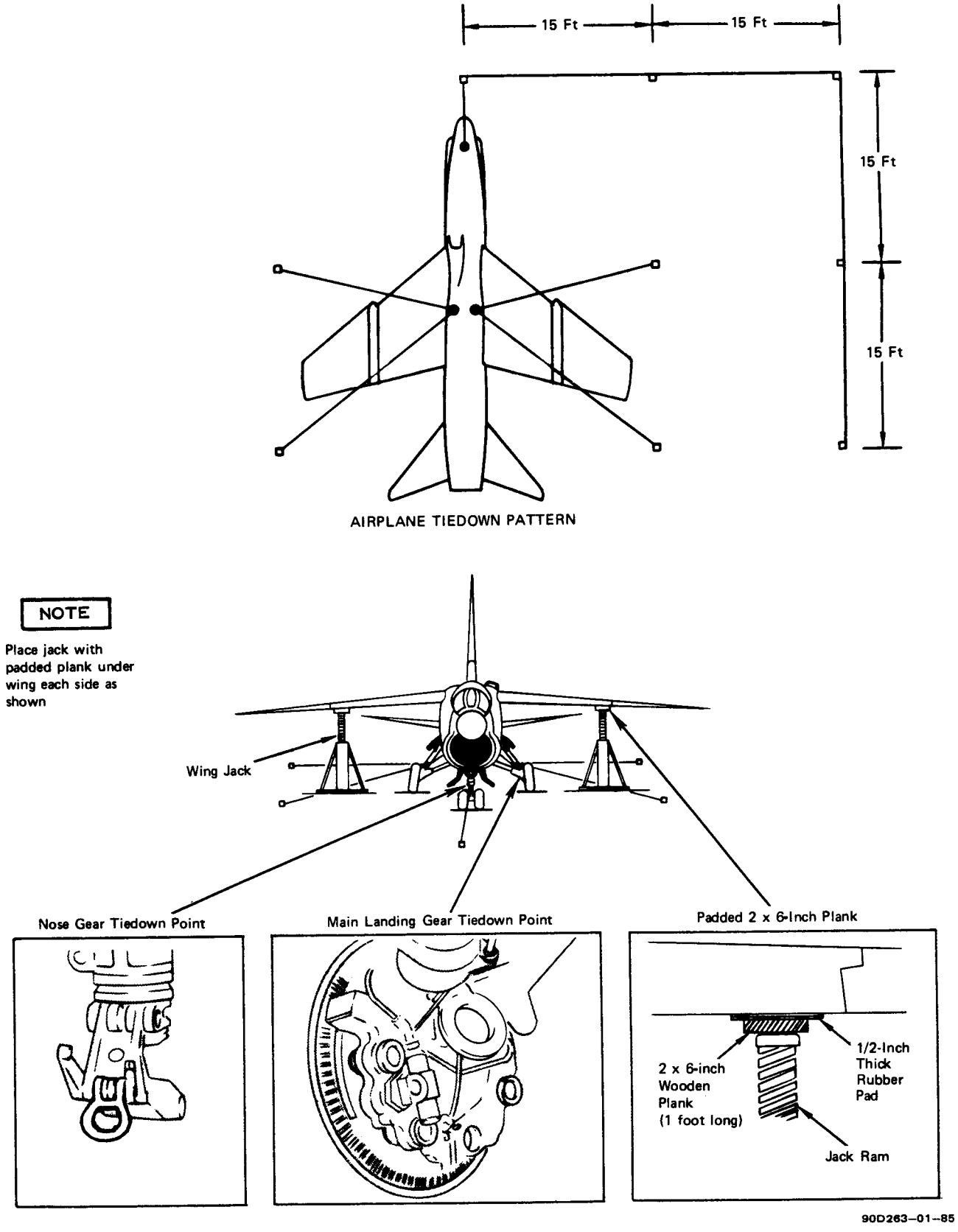


Figure 5-58. Preparation for Removal of Wing Center Section Upper Skin

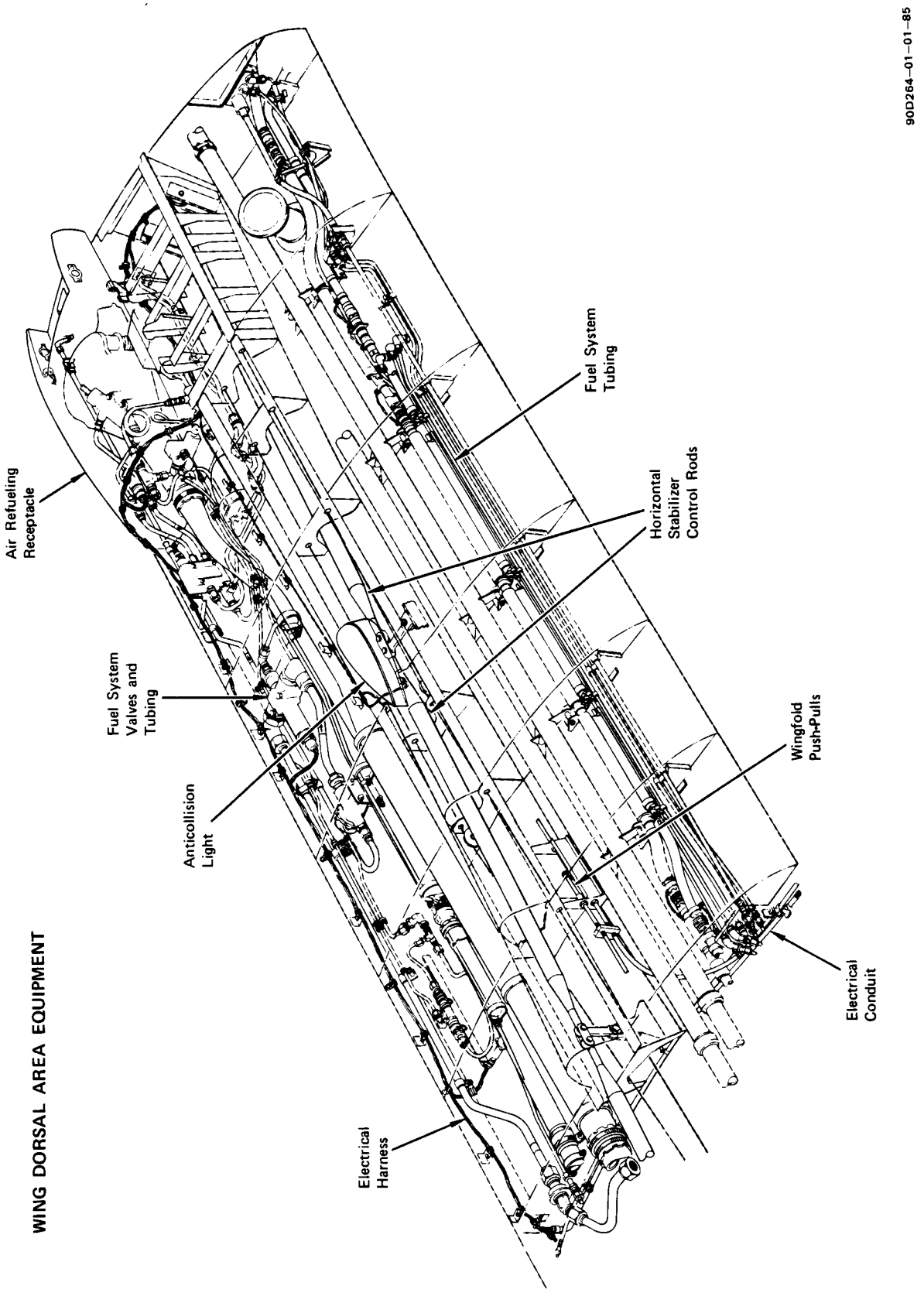


Figure 5-59. Wing Dorsal Area Equipment Locations (Sheet 1 of 3)

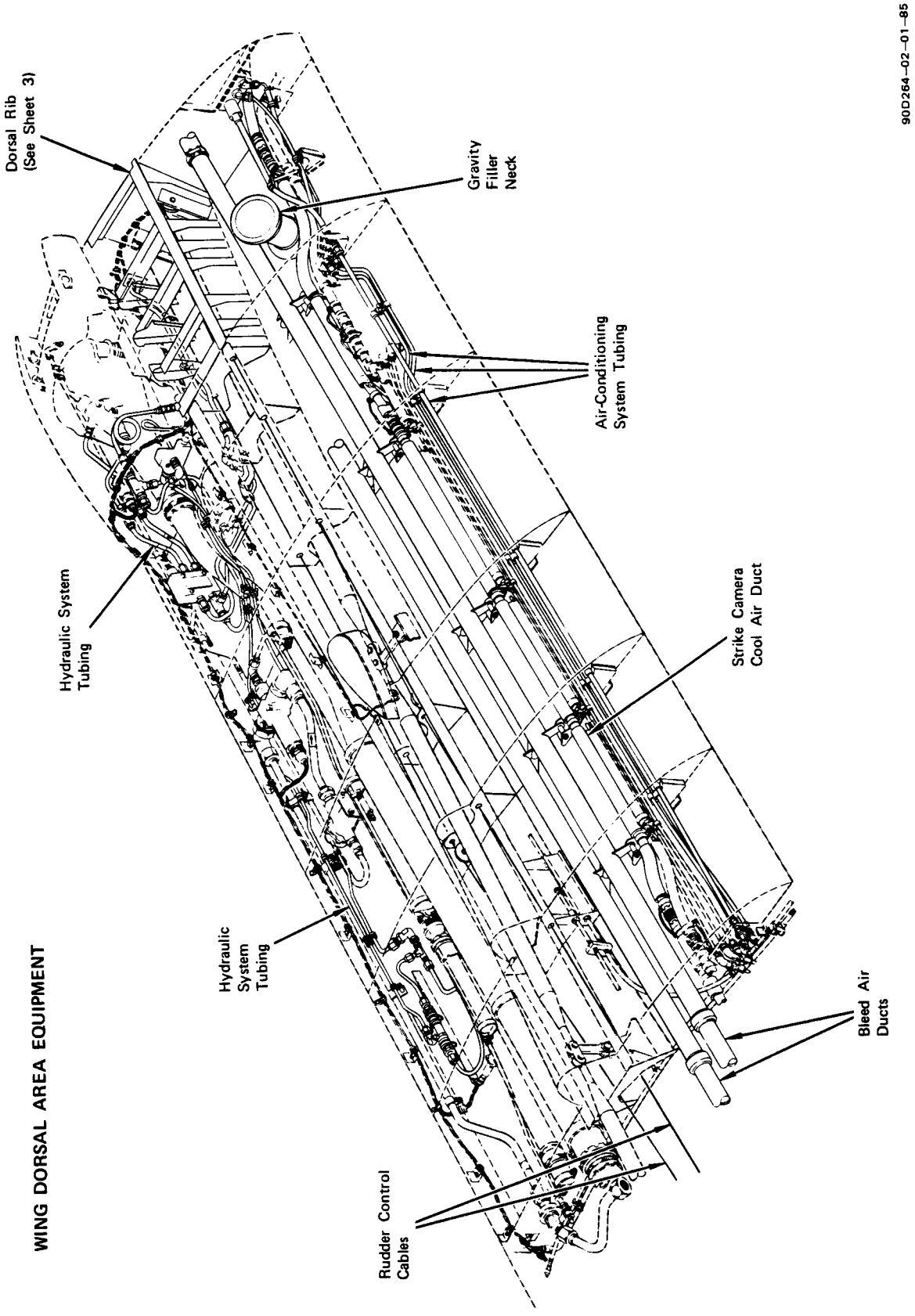


Figure 5-59. Wing Dorsal Area Equipment Locations (Sheet 2)

FORWARD DORSAL RIB FASTENER DETAILS

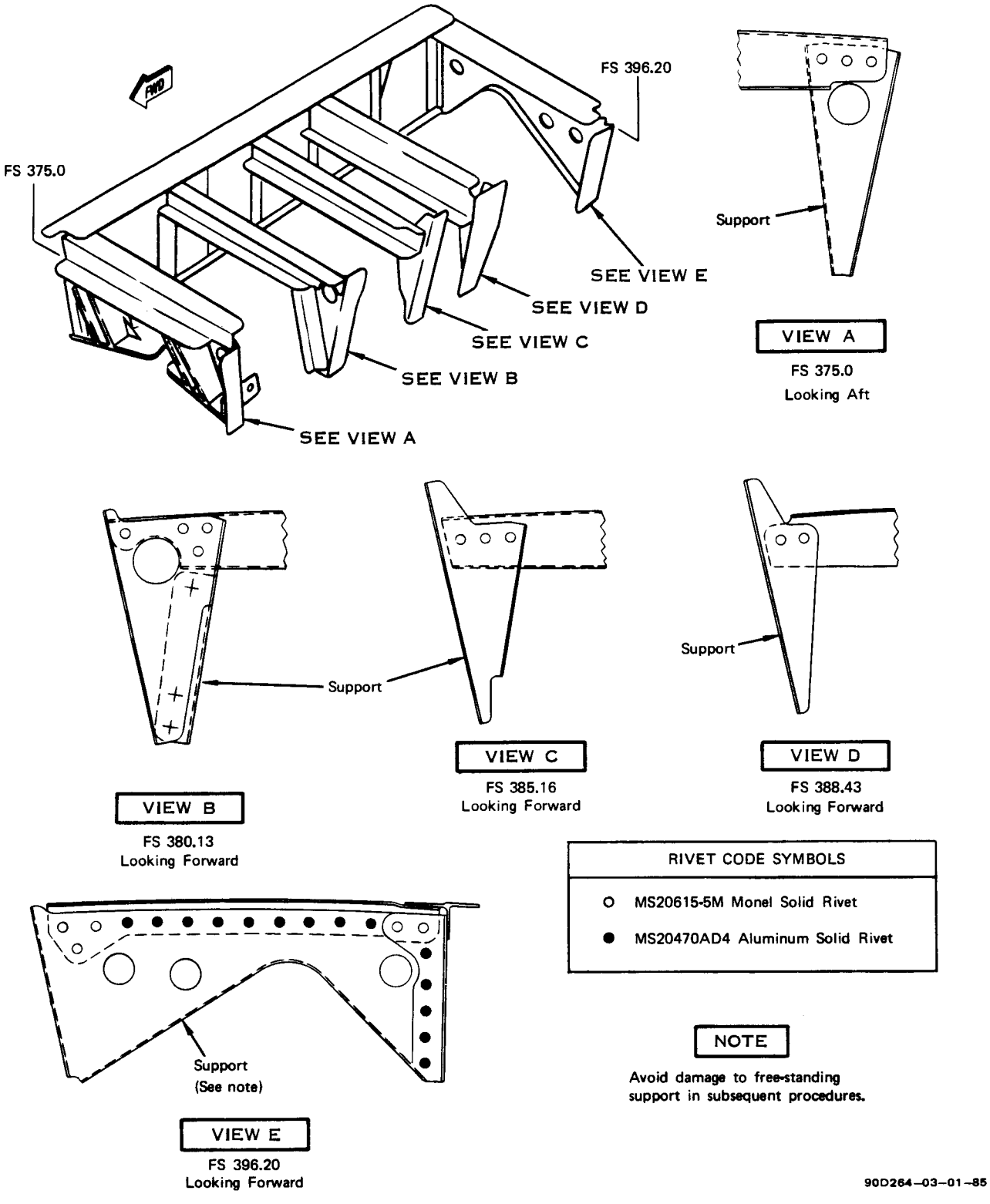
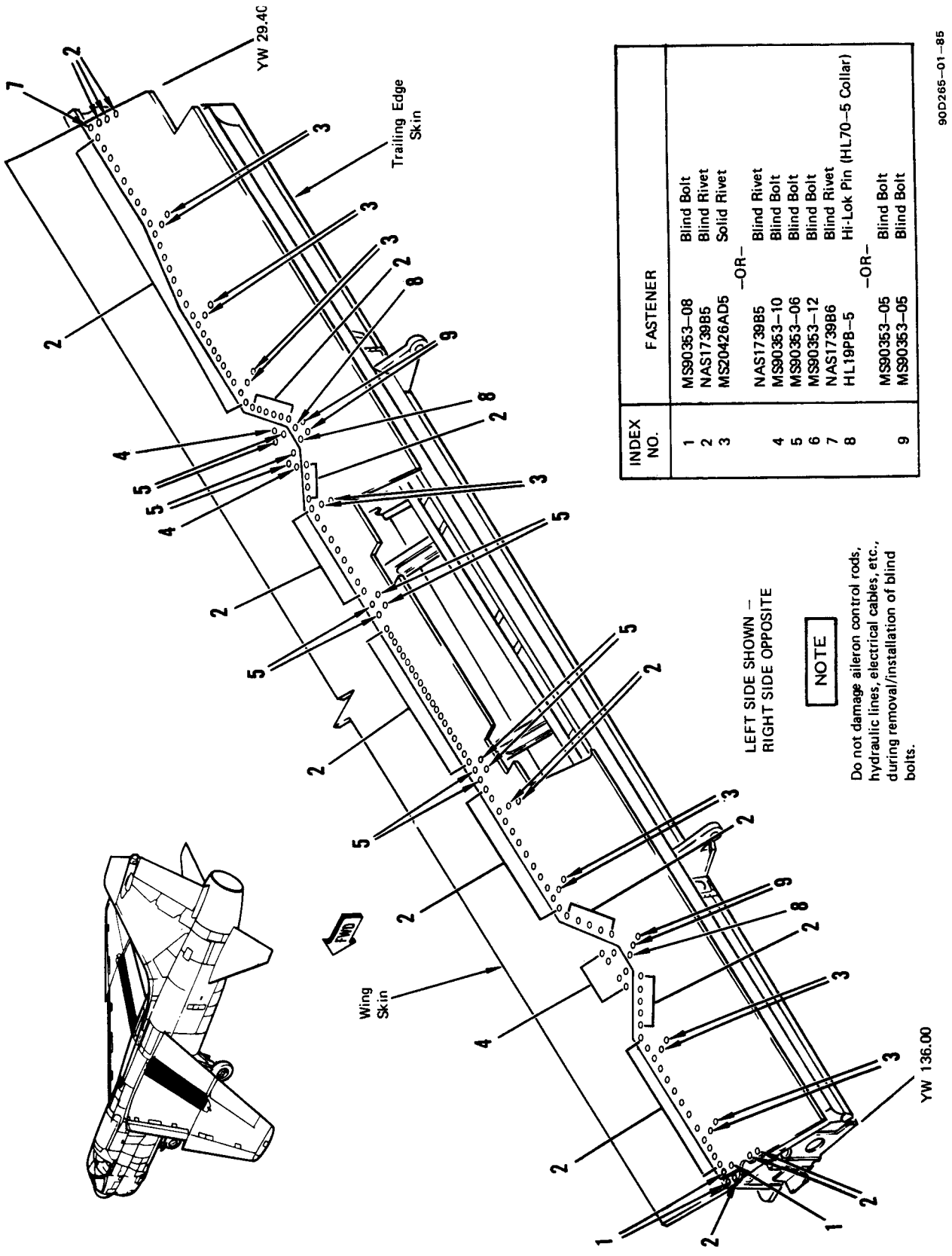
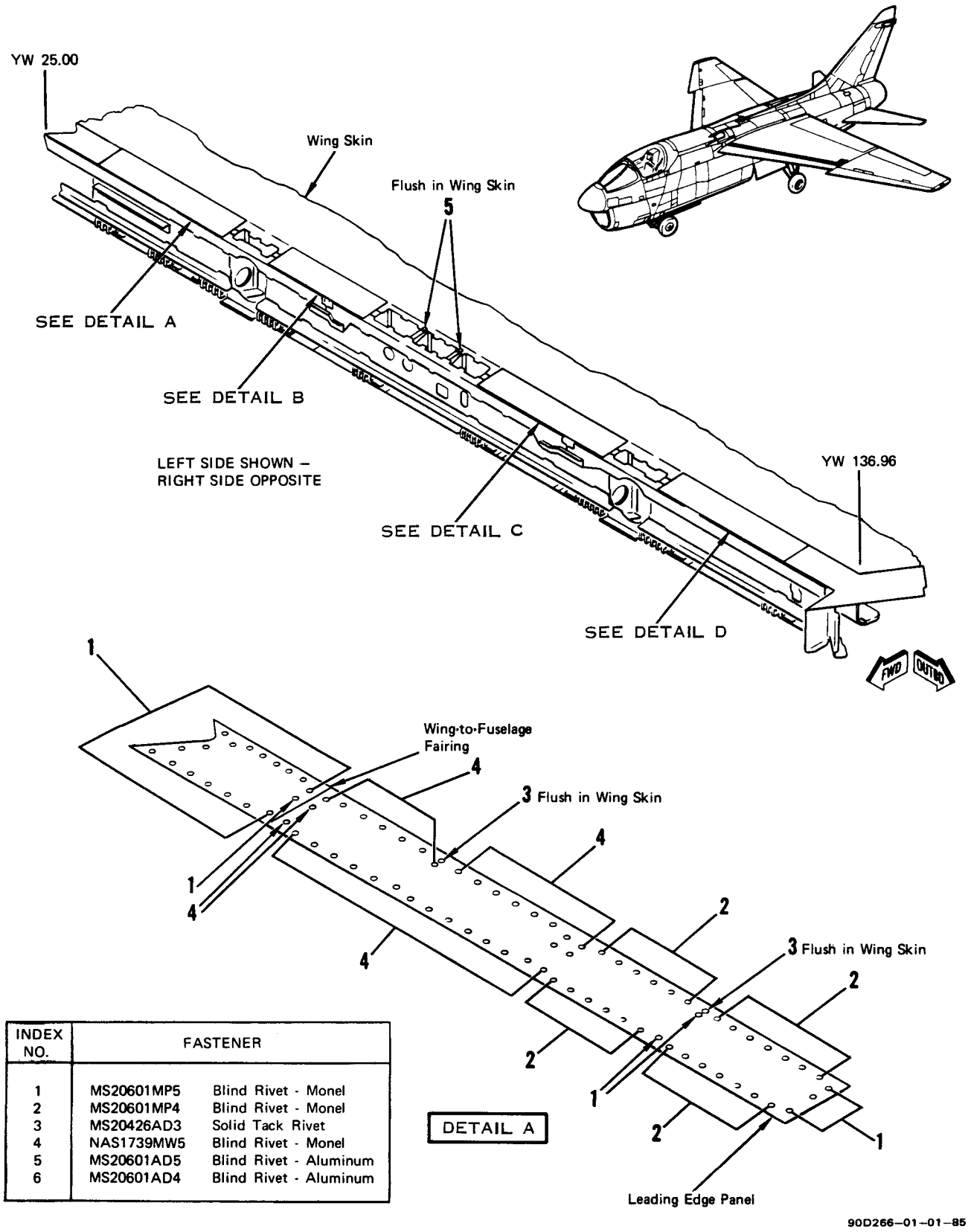


Figure 5-59. Wing Dorsal Area Equipment Locations (Sheet 3)



INDEX NO.	FASTENER	
1	MS90353-08	Blind Bolt
2	NAS1739B5	Blind Rivet
3	MS20426AD5	Solid Rivet
	–OR–	
	NAS1739B5	Blind Rivet
4	MS90353-10	Blind Bolt
5	MS90353-06	Blind Bolt
6	MS90353-12	Blind Bolt
7	NAS1739B6	Blind Rivet
8	HL19PB-5	Hi-Lok Pin (HL70-5 Collar)
	–OR–	
	MS90353-05	Blind Bolt
9	MS90353-05	Blind Bolt

Figure 5-60. Wing Center Section Upper Skin Fasteners at Trailing Edge



INDEX NO.	FASTENER	
1	MS20601MP5	Blind Rivet - Monel
2	MS20601MP4	Blind Rivet - Monel
3	MS20426AD3	Solid Tack Rivet
4	NAS1739MW5	Blind Rivet - Monel
5	MS20601AD5	Blind Rivet - Aluminum
6	MS20601AD4	Blind Rivet - Aluminum

Figure 5-61. Wing Center Section Upper Skin Fasteners at Leading Edge (Sheet 1 of 2)

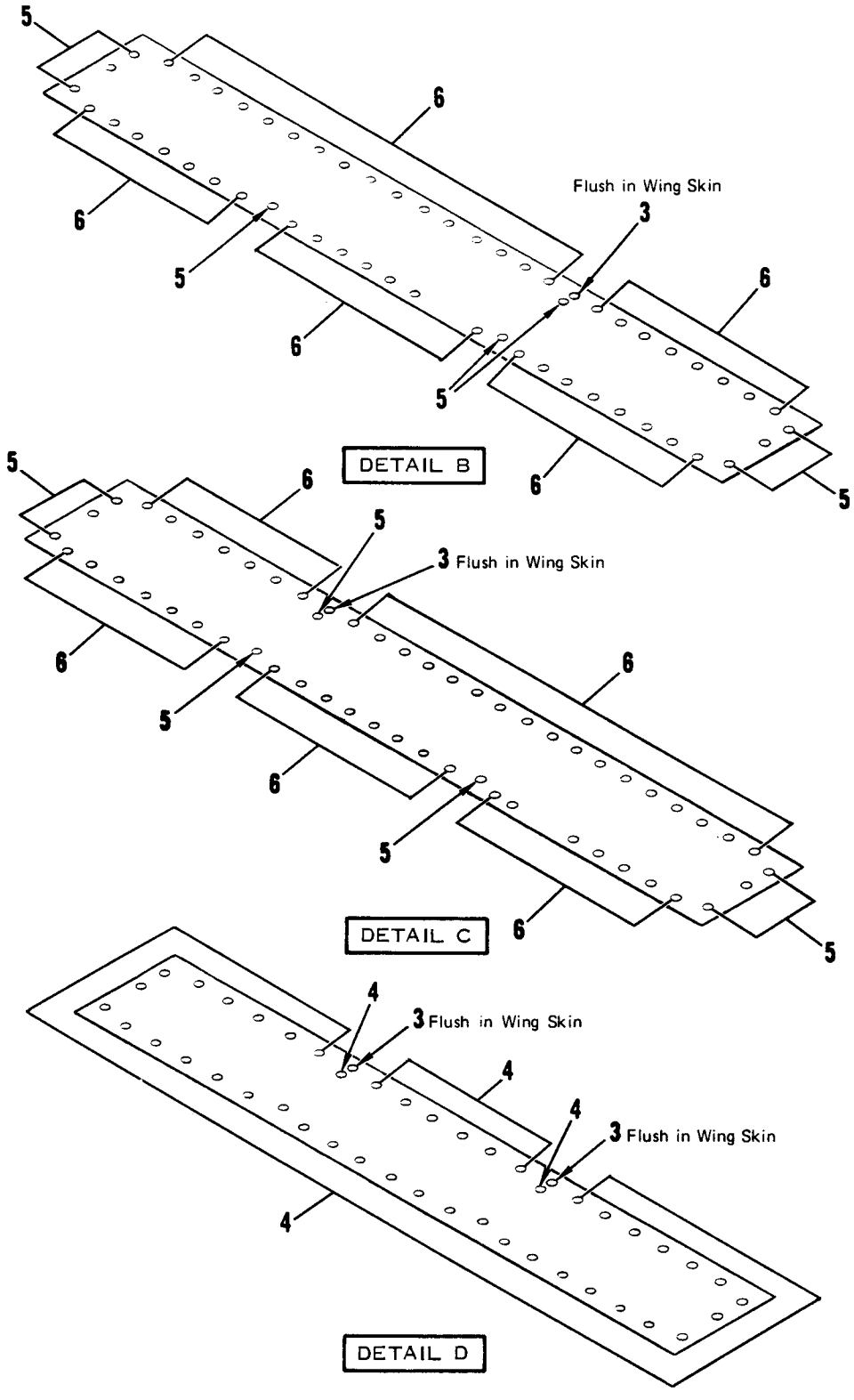
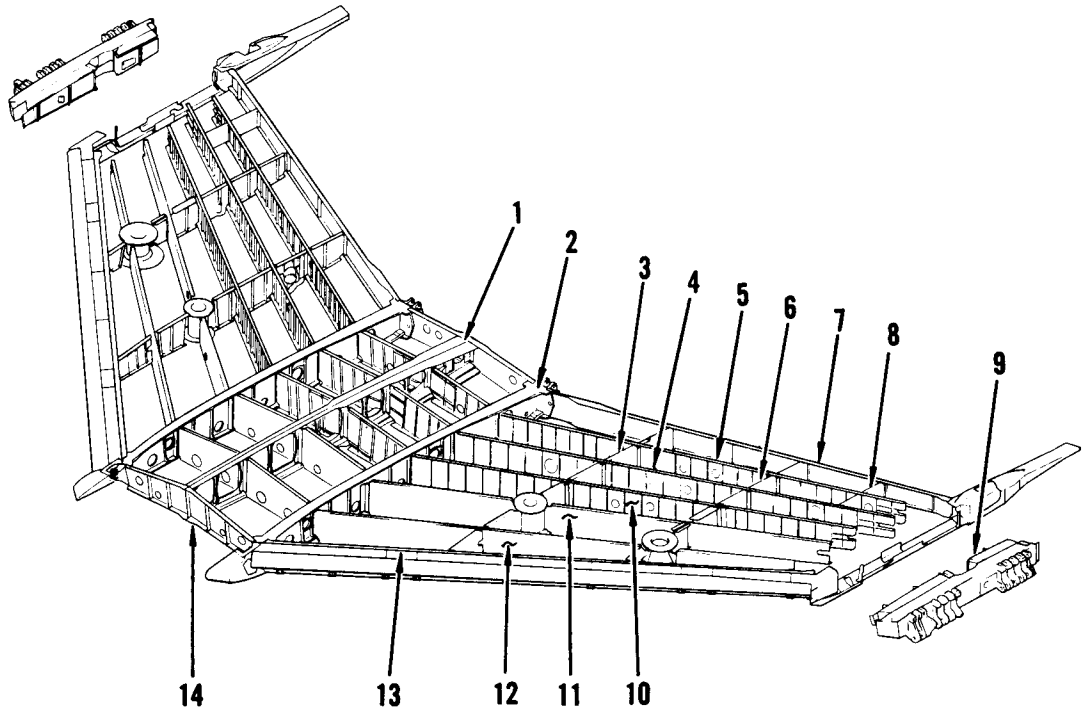


Figure 5-61. Wing Center Section Upper Skin Fasteners at Leading Edge (Sheet 2)



NOTE: Refer to figures 5-63 through 5-75 for fastener details.

INDEX NO.	DRAWING NO.	NOMENCLATURE	FASTENER DATA
1	215-70053	Centerline Rib	Figure 5-63
2	215-70054	Wing Attach Rib	Figure 5-64
3	215-70052	Sta Wy 61.2 Rib	Figure 5-65
4	215-70039	Intermediate No. 4 Spar	Figure 5-66
5	215-70040	Intermediate No. 5 Spar	Figure 5-67
6	215-70051	Sta Wy 97.2 Rib	Figure 5-68
7	215-70041	Rear Spar	Figure 5-69
8	215-70082	Flap Support Rib	Figure 5-70
9	215-70050	Wingfold Rib	Figure 5-71
10	215-70038	Intermediate No. 3 Spar	Figure 5-72
11	215-70037	Intermediate No. 2 Spar	Figure 5-73
12	215-70036	Intermediate No. 1 Spar	Figure 5-74
13	215-70035	Front Spar	Figure 5-75
14	216-70035	Front Spar, Center	Figure 5-76

90D267-01-85

Figure 5-62. Wing Center Section Upper Skin Fasteners Index

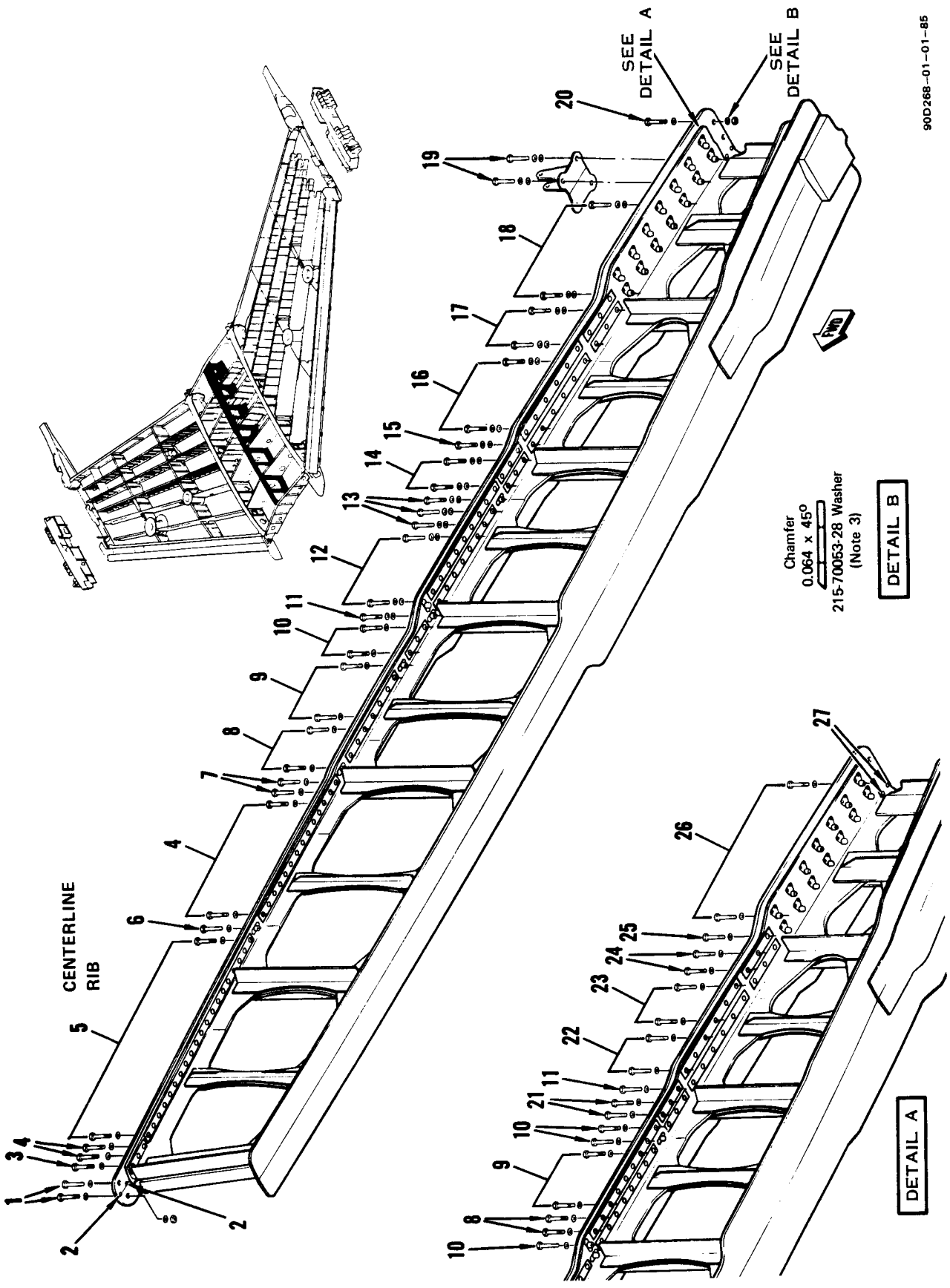


Figure 5-63. Wing Center Section Centerline Rib Upper Skin Fasteners (Sheet 1 of 2)

INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1304-13 Bolt	A	15	NAS1306-16 Bolt	I
2	215-70053-31 Rollpin	Note 2	16	NAS1306-17 Bolt	J
3	NAS1304-16 Bolt	B	17	NAS1306-20 Bolt	J
4	NAS1304-11 Bolt	B	18	NAS1308-20 Bolt	K
5	NAS1304-10 Bolt	C	19	NAS1308-22 Bolt	K
6	NAS1304-10 Bolt	D	20	NAS1308-19 Bolt	L
7	NAS1304-11 Bolt	C	21	NAS1305-13 Bolt	F
8	NAS1305-12 Bolt	E	22	NAS1306-14 Bolt	M
9	NAS1305-12 Bolt	F	23	NAS1306-14 Bolt	N
10	NAS1305-13 Bolt	E	24	NAS1306-16 Bolt	N
11	NAS1305-14 Bolt	G	25	NAS1306-17 Bolt	M
12	NAS1305-14 Bolt	H	26	NAS1308-17 Bolt	O
13	NAS1305-15 Bolt	G	27	215-70053-29 Rollpin	Note 2
14	NAS1305-16 Bolt	H			

SEALING DEVICES, NUTS, AND WASHERS (Note 1)

A.	AN960D416 Washer(s) and MS21042-4 Nut.
B.	AN960D416 Washer(s)
C.	AN960-416L Washer(s).
D.	AN960D416L Washer(s).
E.	AN960D516 Washer(s).
F.	AN960-516L Washer(s).
G.	AN960D516 Washer Under Bolthead and 600-042-5/16 Stat-O-Seal Under Bolthead Washer.
H.	AN960-516L Washer Under Bolthead and 600-042-5/16 Stat-O-Seal Under Bolthead Washer.
I.	AN960-616L Washer Under Bolthead and 600-042-3/8 Stat-O-Seal Under Bolthead Washer.
J.	AN960D616 Washer Under Bolthead and 600-042-3/8 Stat-O-Seal Under Bolthead Washer.
K.	AN960D816 Washer Under Bolthead and 600-042-1/2 Stat-O-Seal Under Bolthead Washer.
L.	AN960D816 Washer Under Bolthead and 215-70053-28 Washer Under NAS1022A8 Nut.
M.	AN960D616 Washer(s).
N.	AN960-616L Washer(s).
O.	AN960D816 Washer(s).

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Made from NAS561P8-10 rollpin.
3. 215-70053-28 washer made from AN960D816 washer.

90D268-02-01-85

Figure 5-63. Wing Center Section Centerline Rib Upper Skin Fasteners (Sheet 2)

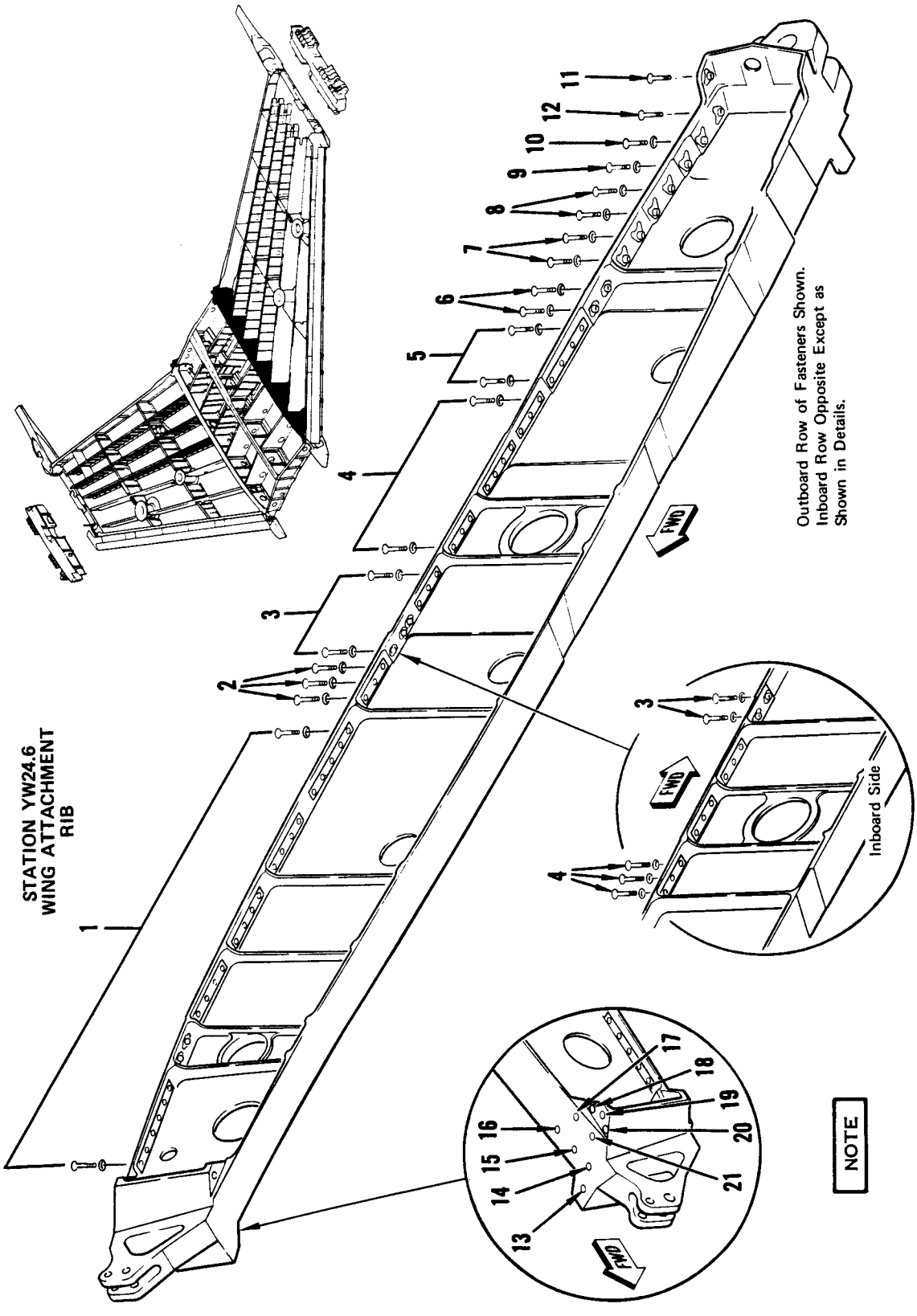


Figure 5-64. Wing Center Section Wing Attach Rib Upper Skin Fasteners (Sheet 1 of 2)

INDEX NO.	FASTENER (Note 2)	SEALING DEVICES	INDEX NO.	FASTENER (Note 2)	SEALING DEVICES
1	NAS1625-6 Screw	B	12	NAS517-8-18 Screw	None
2	NAS1625-7 Screw	B	13	NAS1625-8 Screw	None
3	NAS1625-8 Screw	B	14	NAS517-6-10 Screw	None
4	NAS1625-9 Screw	B	15	NAS1625-10 Screw	B
5	NAS1626-11 Screw	C	16	NAS1625-6 Screw	B
6	NAS1626-12 Screw	C	17	NAS1626-14 Screw	C
7	NAS517-8-12 Screw	D	18	215-70054-26 Rollpin	Note 3
8	NAS517-8-14 Screw	D	19	NAS1624-14 Screw	A
9	NAS517-8-15 Screw	D	20	215-70054-27 Rollpin	Note 3
10	NAS517-8-18 Screw	D	21	NAS517-6-14 Screw	None
11	NAS1626-13 Screw	None			

SEALING DIVICES (Note 1)

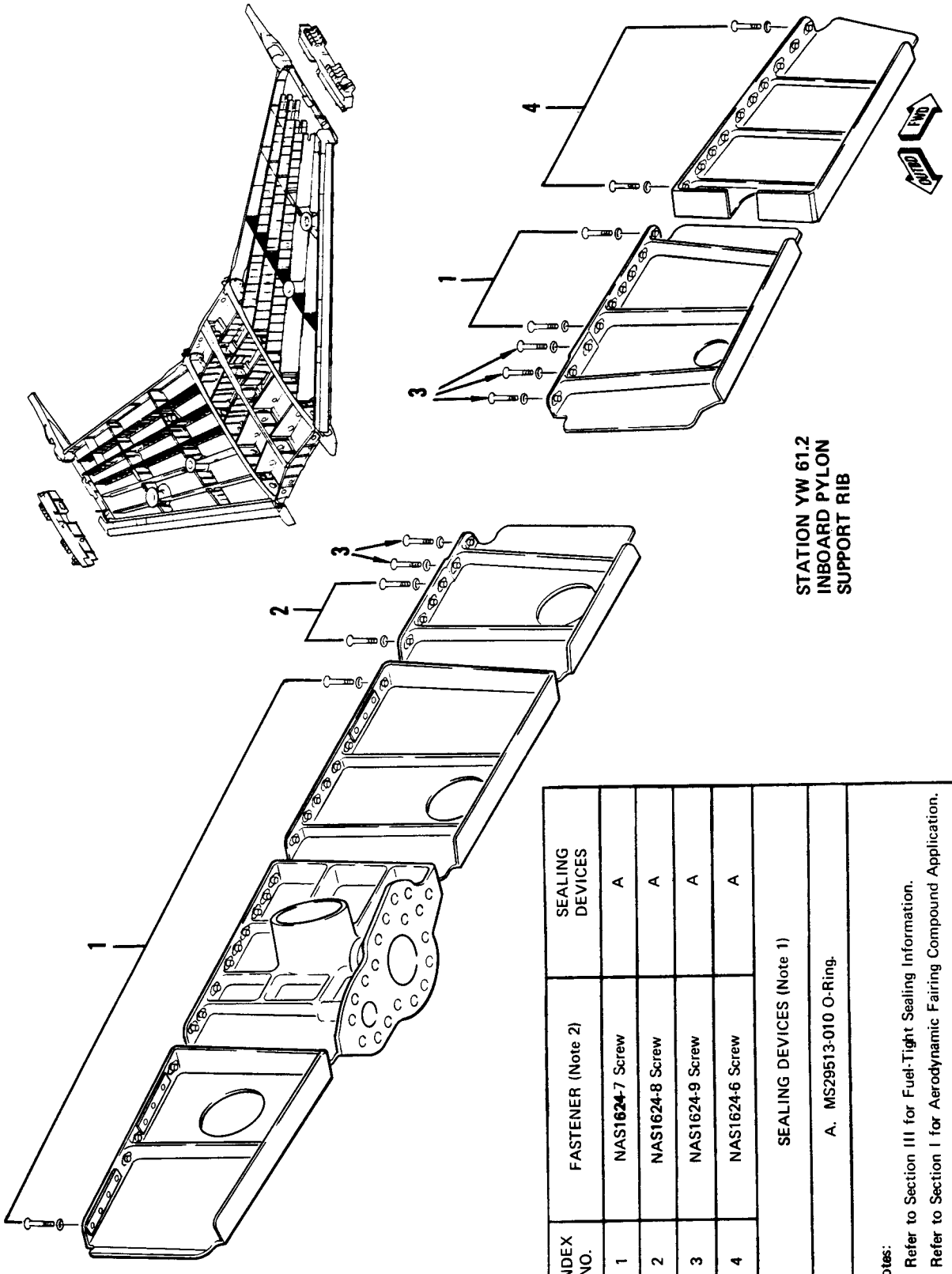
A. MS29513-010 O-Ring
B. MS29513-011 O-Ring
C. MS29513-012 O-Ring
D. MS29513-014 O-Ring

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.
3. Made from NAS561P8-8 rollpin.

90D269-02-01-85

Figure 5-64. Wing Center Section Wing Attach Rib Upper Skin Fasteners (Sheet 2)



INDEX NO.	FASTENER (Note 2)	SEALING DEVICES
1	NAS1624-7 Screw	A
2	NAS1624-8 Screw	A
3	NAS1624-9 Screw	A
4	NAS1624-6 Screw	A
	SEALING DEVICES (Note 1)	
	A. MS29513-010 O-Ring.	

Notes:
1. Refer to Section III for Fuel-Tight Sealing Information.
2. Refer to Section I for Aerodynamic Fairing Compound Application.

Figure 5-65. Wing Center Section Station YW 61.2 Rib Upper Skin Fasteners

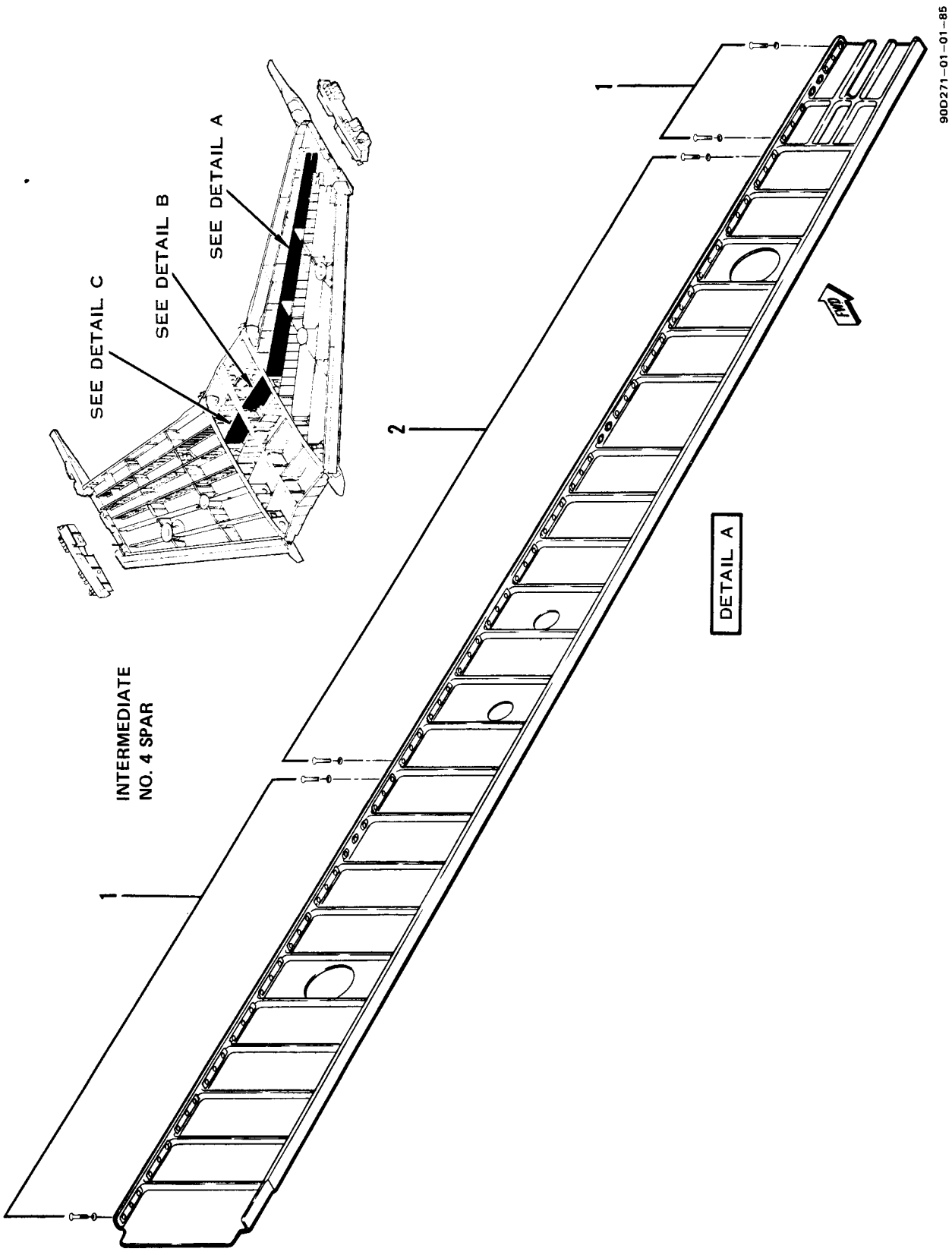
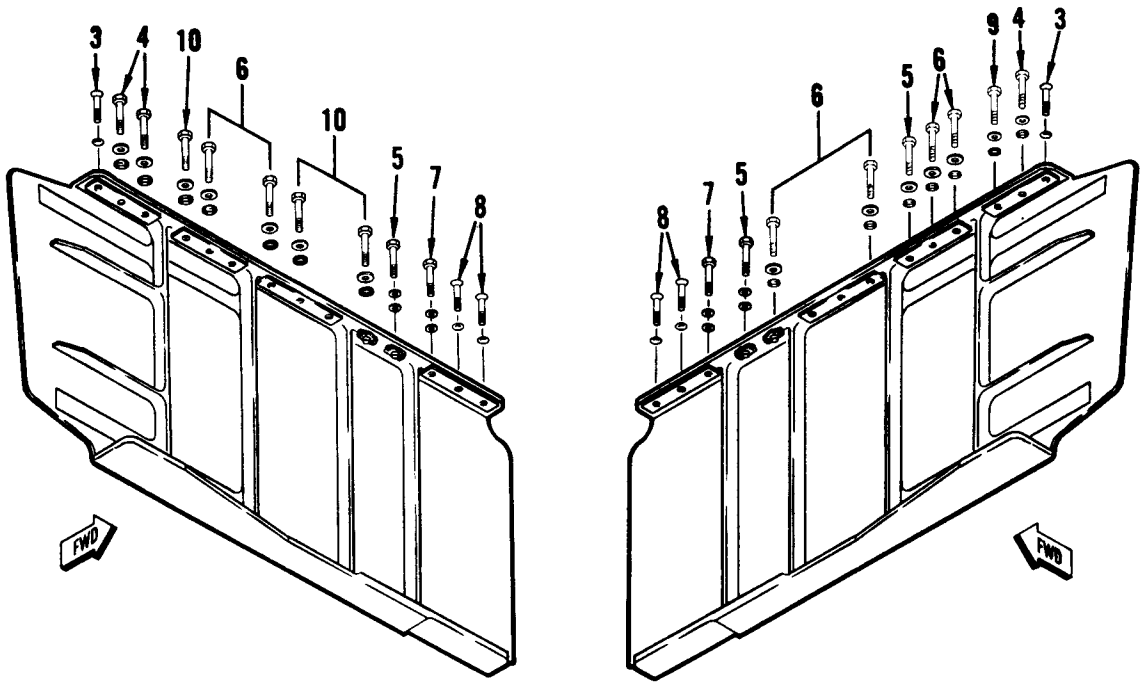


Figure 5-66. Wing Center Section Intermediate No. 4 Spar Upper Skin Fasteners (Sheet 1 of 2)



INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-8 Screw	A, Note 2	6	NAS1304-11 Bolt	D
2	NAS1624-7 Screw	A, Note 2	7	NAS1304-12 Bolt	D
3	NAS1625-9 Screw	B, Note 2	8	NAS1624-9 Screw	A, Note 2
4	NAS1305-9 Bolt	C	9	NAS1305-11 Bolt	C
5	NAS1304-9 Bolt	D	10	NAS1304-10 Bolt	D

SEALING DEVICES AND WASHERS (Note 1)

A. MS29513-010 O-Ring.

B. MS29513-011 O-Ring.

C. AN960D516 Washer Under Bolthead and 600-042-5/16 Stat-O-Seal Under Bolthead Washer.

D. AN960D416 Washer Under Bolthead and 600-042-1/4 Stat-O-Seal Under Bolthead Washer.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

90D271-02-01-85

Figure 5-66. Wing Center Section Intermediate No. 4 Spar Upper Skin Fasteners (Sheet 2)

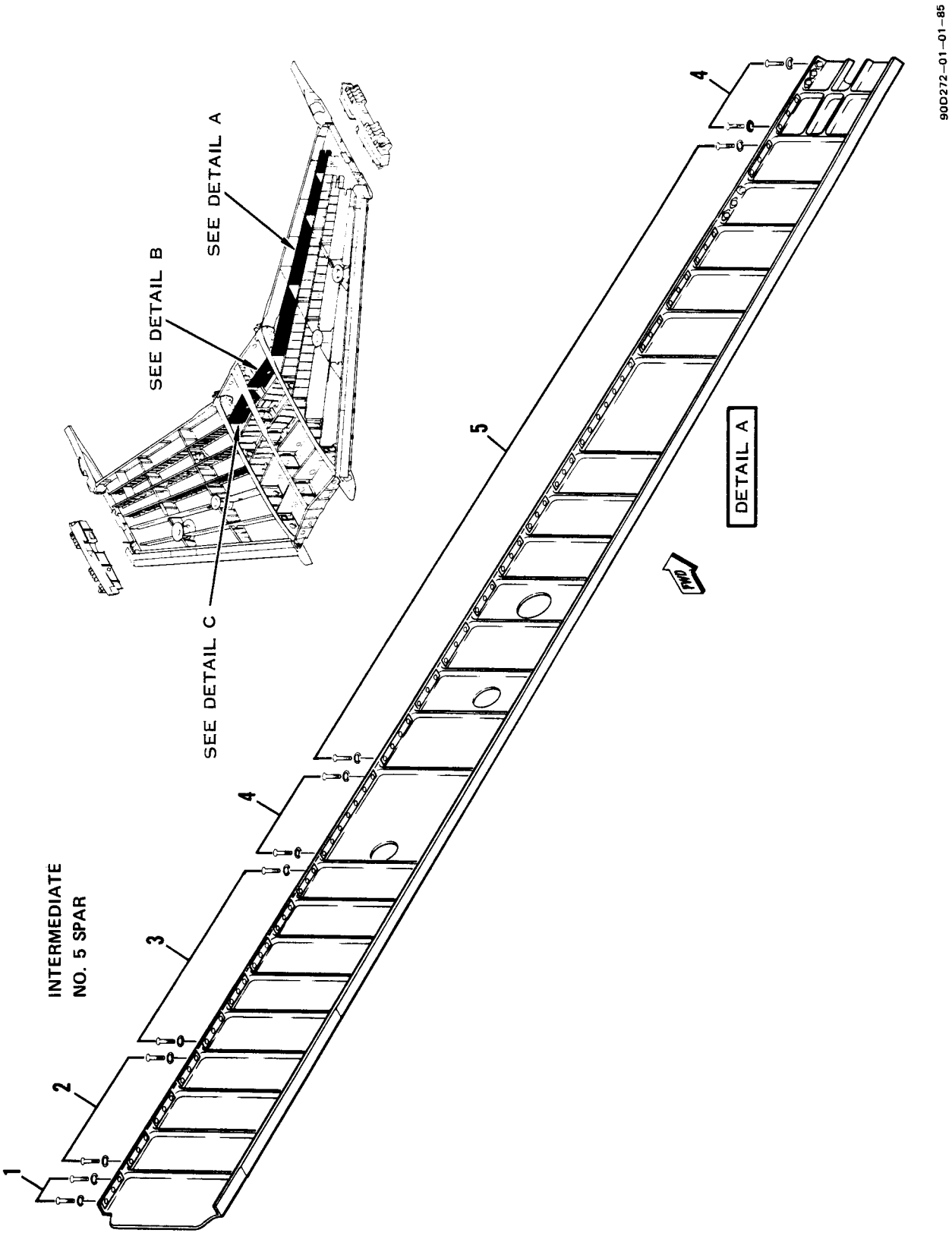
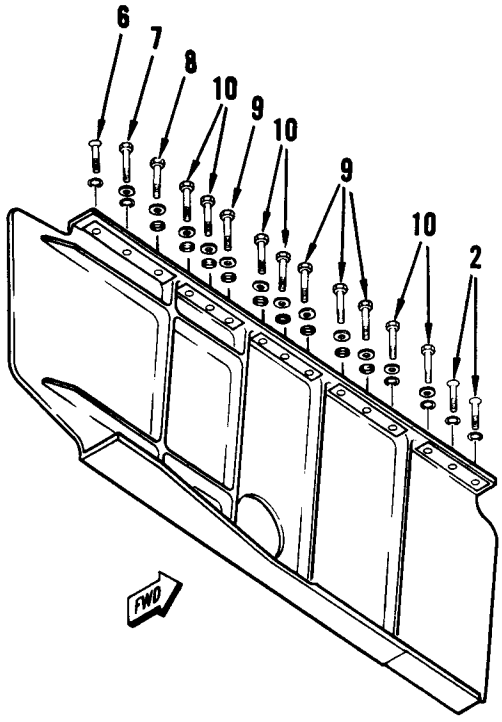
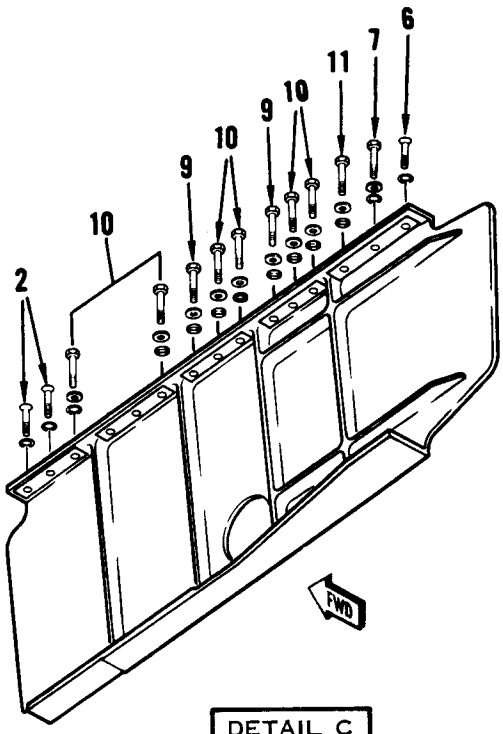


Figure 5-67. Wing Center Section Intermediate No. 5 Spar Upper Skin Fasteners (Sheet 1 of 2)



DETAIL B



DETAIL C

INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-11 Screw	A, Note 2	7	NAS1305-15 Bolt	C
2	NAS1624-10 Screw	A, Note 2	8	NAS1305-13 Bolt	C
3	NAS1624-9 Screw	A, Note 2	9	NAS1304-13 Bolt	D
4	NAS1624-8 Screw	A, Note 2	10	NAS1304-14 Bolt	D
5	NAS1624-7 Screw	A, Note 2	11	NAS1305-14 Bolt	C
6	NAS1625-11 Screw	B, Note 2			

SEALING DEVICES AND WASHERS (Note 1)

A. MS29513-010 O-Ring

B. MS29513-011 O-Ring.

C. AN960D516 Washer Under Bolthead and 600-042-5/16 Stat-O-Seal Under Bolthead Washer.

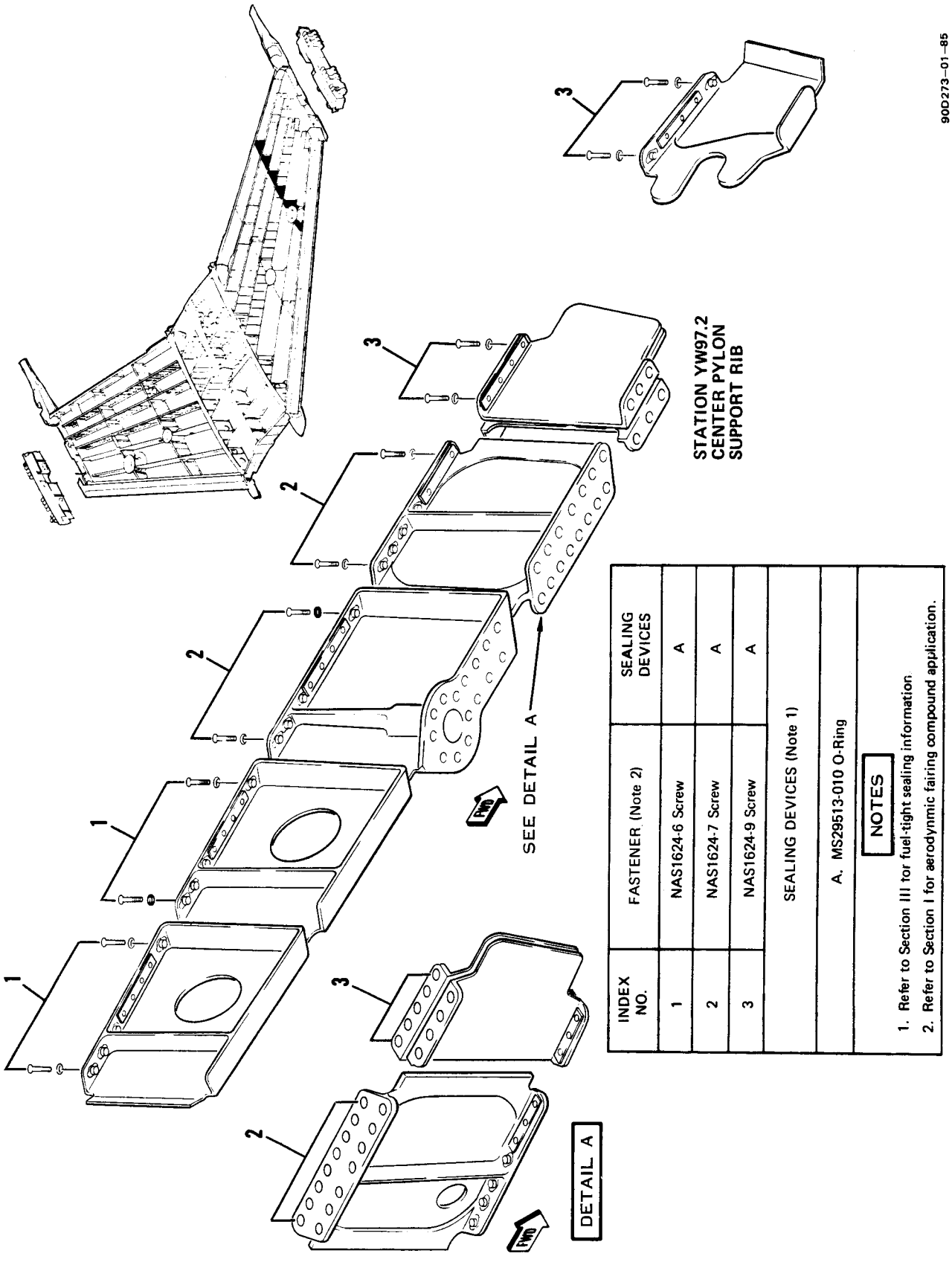
D. AN960D416 Washer Under Bolthead and 600-042-1/4 Stat-O-Seal Under Bolthead Washer.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

90D272-02-01-85

Figure 5-67. Wing Center Section Intermediate No. 5 Spar Upper Skin Fasteners (Sheet 2)



INDEX NO.	FASTENER (Note 2)	SEALING DEVICES
1	NAS1624-6 Screw	A
2	NAS1624-7 Screw	A
3	NAS1624-9 Screw	A
	SEALING DEVICES (Note 1)	
	A. MS29513-010 O-Ring	

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

Figure 5-68. Wing Center Section Station YW 97.2 Rib Upper Skin Fasteners

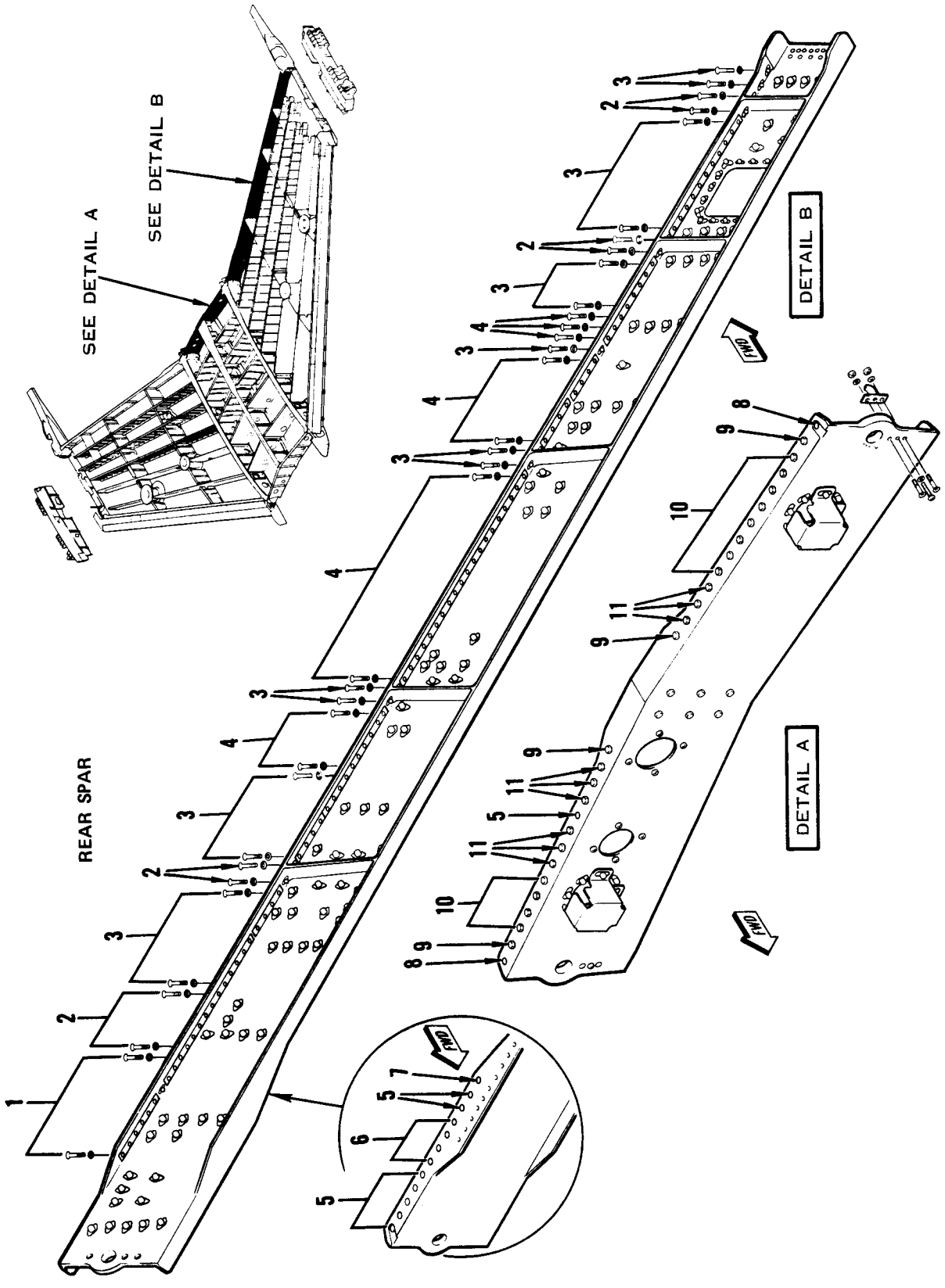


Figure 5-69. Wing Center Section Rear Spar Upper Skin Fasteners (Sheet 1 of 2)

INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-9 Screw	A, Note 2	7	NAS1625-10 Screw	B, Note 2
2	NAS1624-8 Screw	A, Note 2	8	NAS1625-13 Screw	B, Note 2
3	NAS1624-7 Screw	A, Note 2	9	NAS464P5A17 Bolt	B
4	NAS1624-6 Screw	A, Note 2	10	NAS464P5A14 Bolt	B
5	NAS1625-12 Screw	B, Note 2	11	NAS464P5A13 Bolt	B
6	NAS1625-11 Screw	B, Note 2			

SEALING DEVICES, NUTS, AND WASHERS (Note 1)

A. MS29513-010 O-Ring.

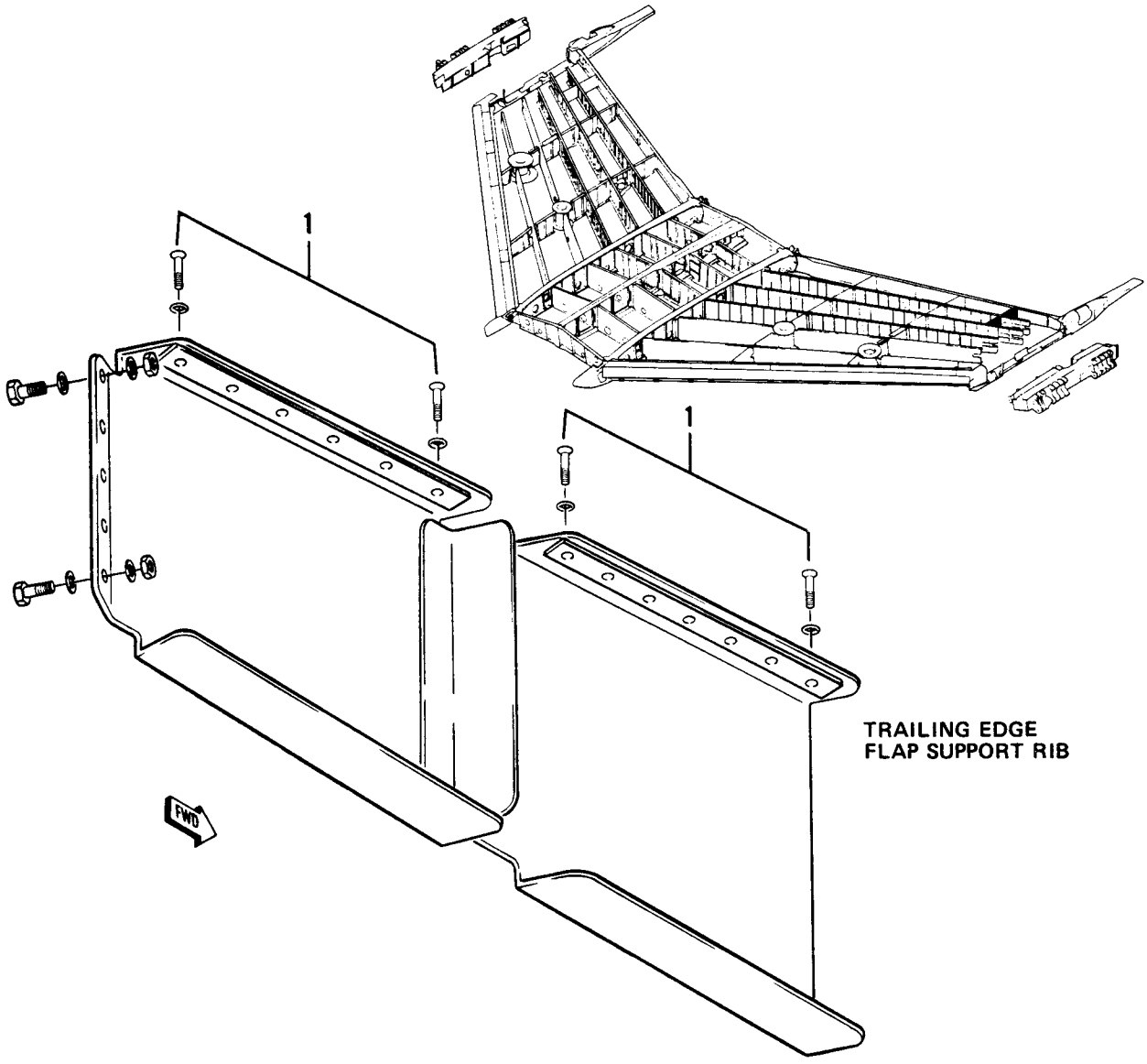
B. AN960D516 Washer and MS21042-5 Nut.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

90D274-02-01-85

Figure 5-69. Wing Center Section Rear Spar Upper Skin Fasteners (Sheet 2)



INDEX NO.	FASTENER (Note 2)	SEALING DEVICES
1	NAS1624-6 Screw	A
SEALING DEVICES (Note 1)		
A. MS29513-010 O-Ring		

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynmic fairing compound application.

90D275-01-85

Figure 5-70. Wing Center Section Flap Support Rib Upper Skin Fasteners

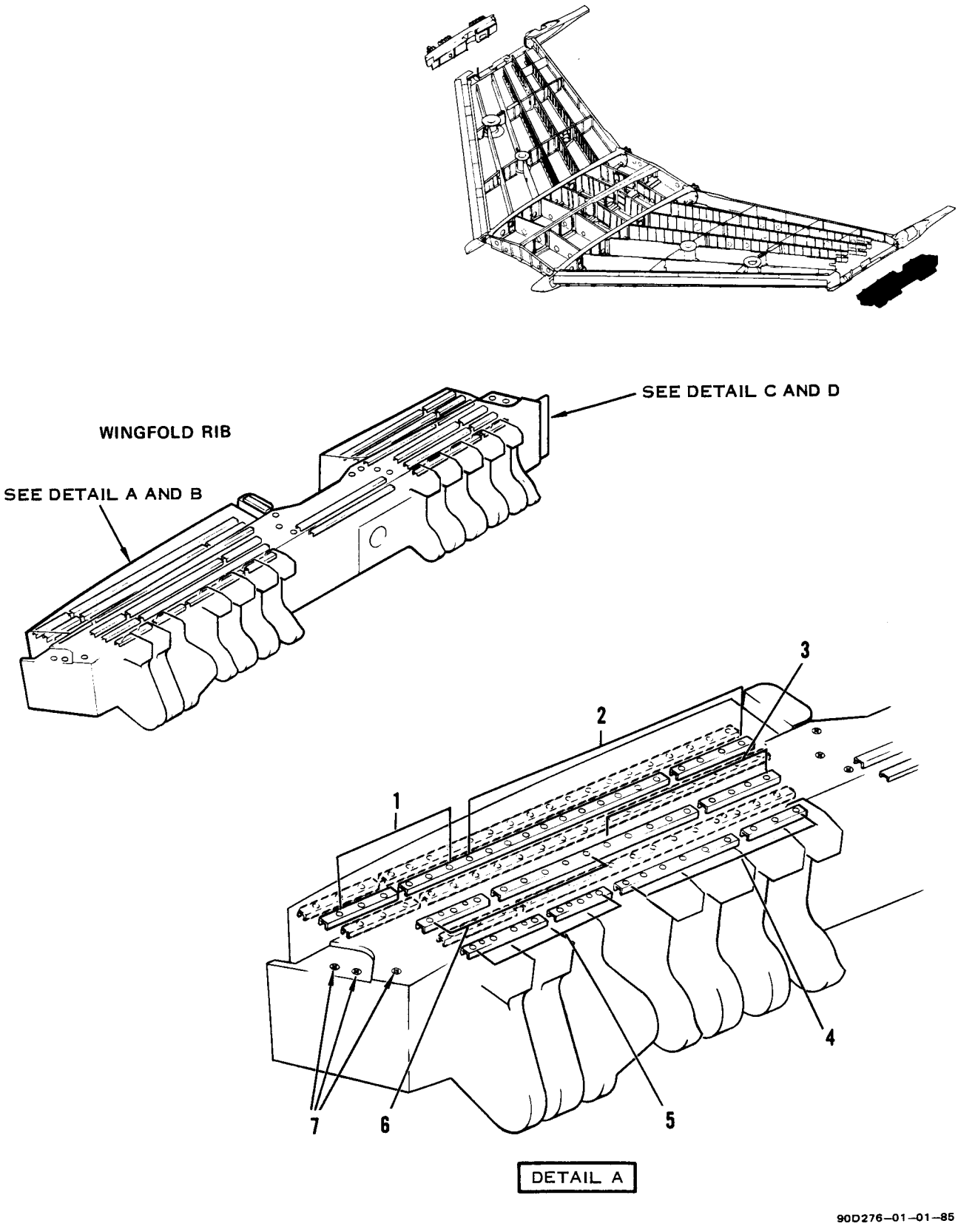


Figure 5-71. Wing Center Section Wingfold Rib Upper Skin Fasteners (Sheet 1 of 3)

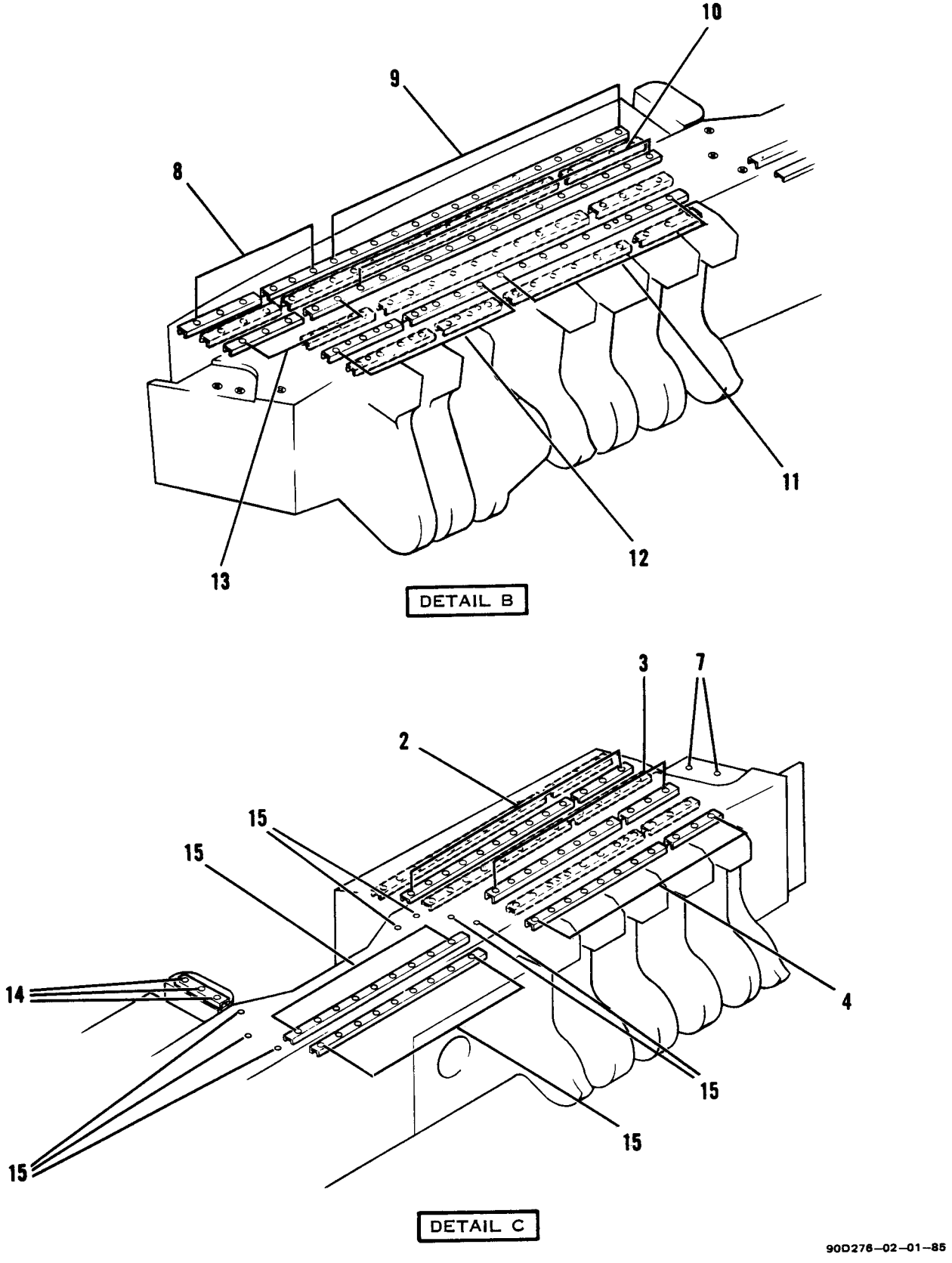
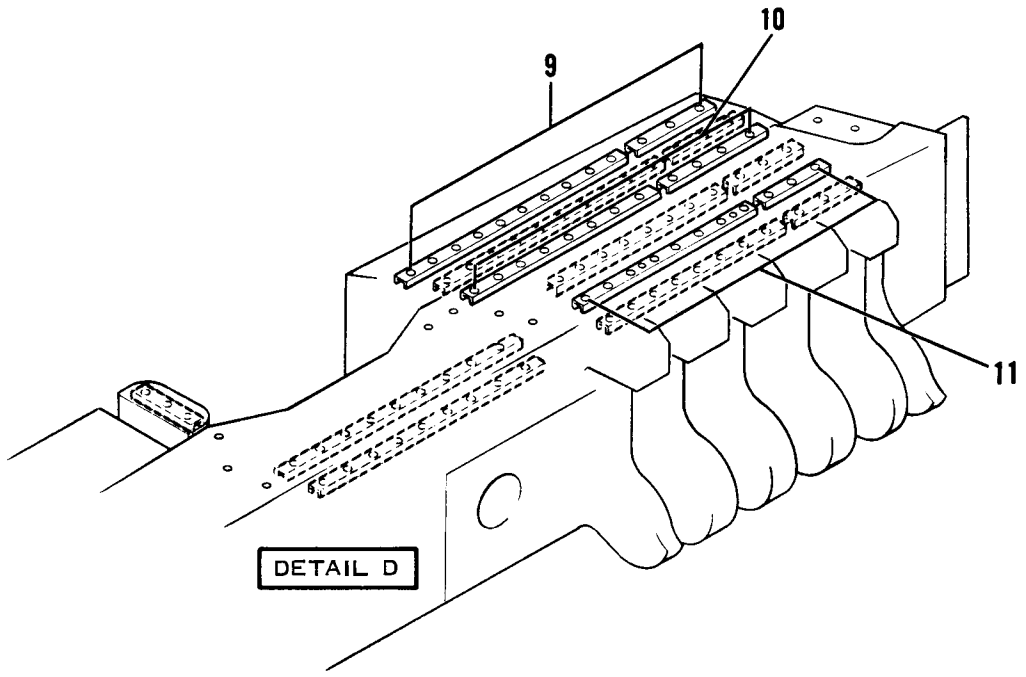


Figure 5-71. Wing Center Section Wingfold Rib Upper Skin Fasteners (Sheet 2)



INDEX NO.	FASTENER (Note 2)	SEALING DEVICES	INDEX NO.	FASTENER (Note 2)	SEALING DEVICES
1	NAS1624-11 Screw	A	9	NAS1624-10 Screw	A
2	NAS1624-12 Screw	A	10	NAS1624-14 Screw	A
3	NAS1625-18 Screw	B	11	NAS1625-21 Screw	B
4	NAS1625-24 Screw	B	12	NAS1625-24 Screw	B
5	SFT22-6A23 Bolt	C	13	NAS1624-13 Screw	A
6	SFT22-5A18 Bolt	B	14	NAS1625-9 Screw	B
7	NAS1625-15 Screw	B	15	NAS1625-10 Screw	B
8	NAS1624-9 Screw	A			

SEALING DEVICES (Note 1)

A. MS29513-010 O-Ring.
B. MS29513-011 O-Ring.
C. MS29513-012 O-Ring.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynmic fairing compound application.

90D276-03-01-85

Figure 5-71. Wing Center Section Wingfold Rib Upper Skin Fasteners (Sheet 3)

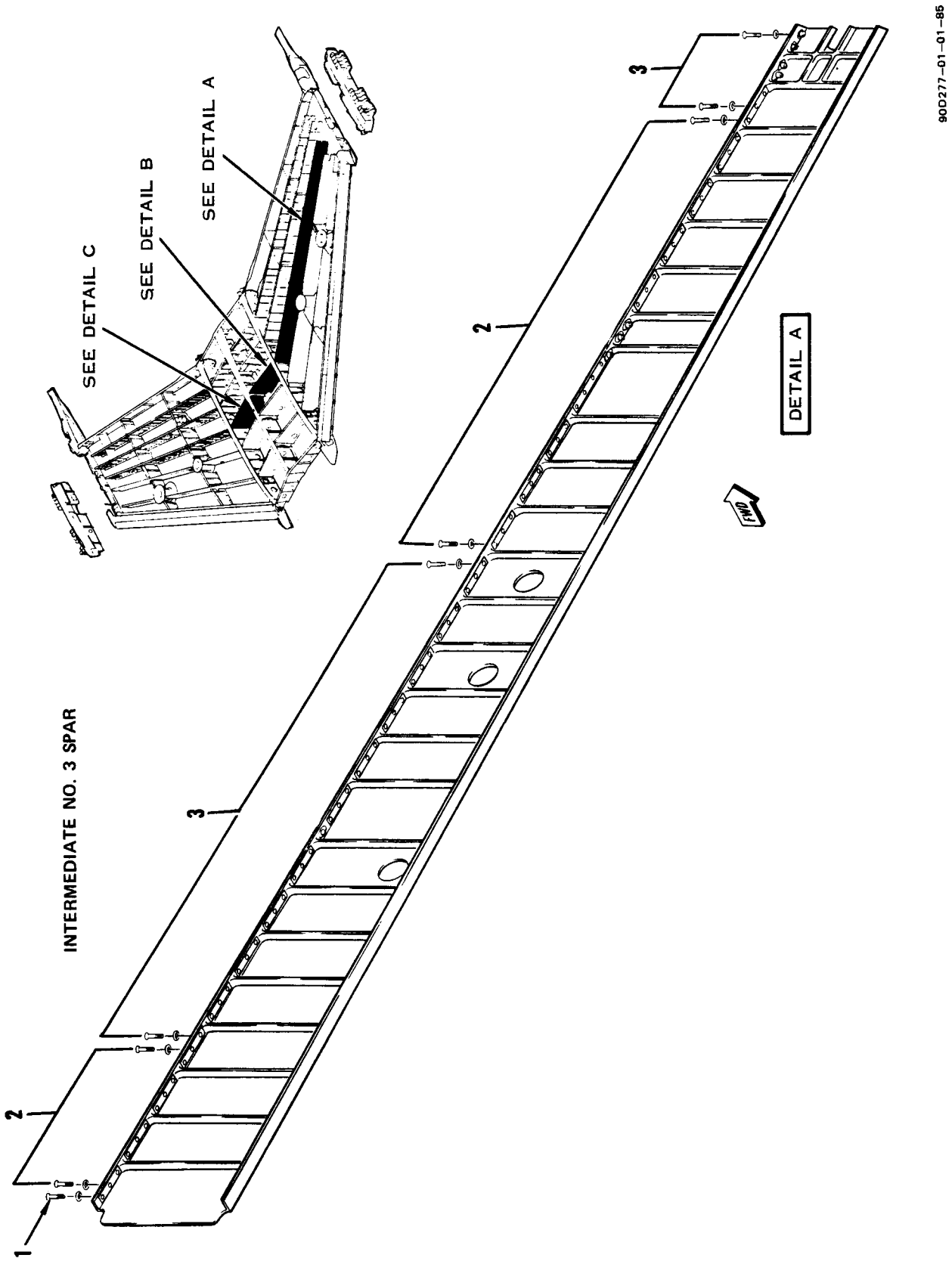
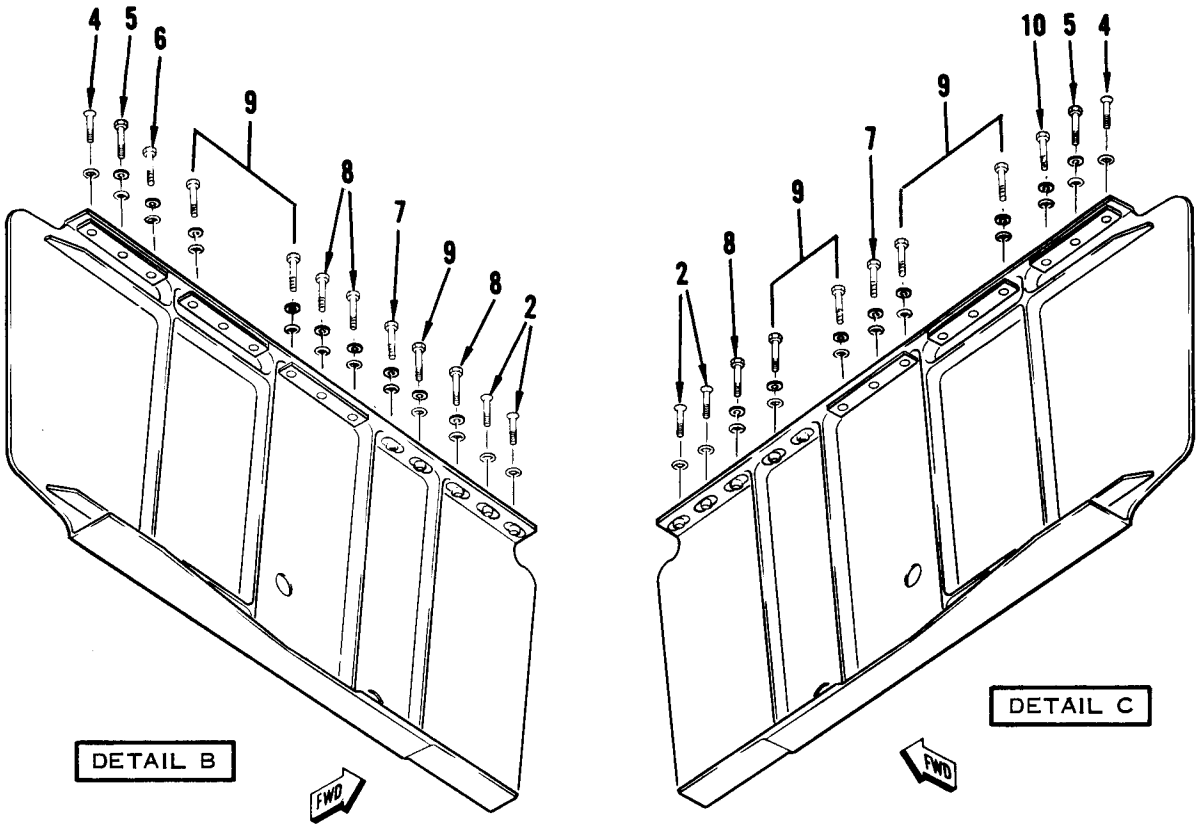


Figure 5-72. Wing Center Section Intermediate No. 3 Spar Upper Skin Fasteners (Sheet 1 of 2)



INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-6 Screw	A, Note 2	6	NAS1305-9 Bolt	C
2	NAS1624-7 Screw	A, Note 2	7	NAS1304-9 Bolt	D
3	NAS1624-8 Screw	A, Note 2	8	NAS1304-11 Bolt	D
4	NAS1625-7 Screw	B, Note 2	9	NAS1304-10 Bolt	D
5	NAS1305-11 Bolt	C	10	NAS1305-10 Bolt	C

SEALING DEVICES AND WASHERS (Note 1)

A. MS29513-010 O-Ring.
B. MS29513-011 O-Ring.
C. AN960D516 Washer Under Bolthead and 600-042-5/16 Stat-O-Seal Under Bolthead Washer.
D. AN960D416 Washer Under Bolthead and 600-042-1/4 Stat-O-Seal Under Bolthead Washer.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

90D277-02-01-85

Figure 5-72. Wing Center Section Intermediate No. 3 Spar Upper Skin Fasteners (Sheet 2)

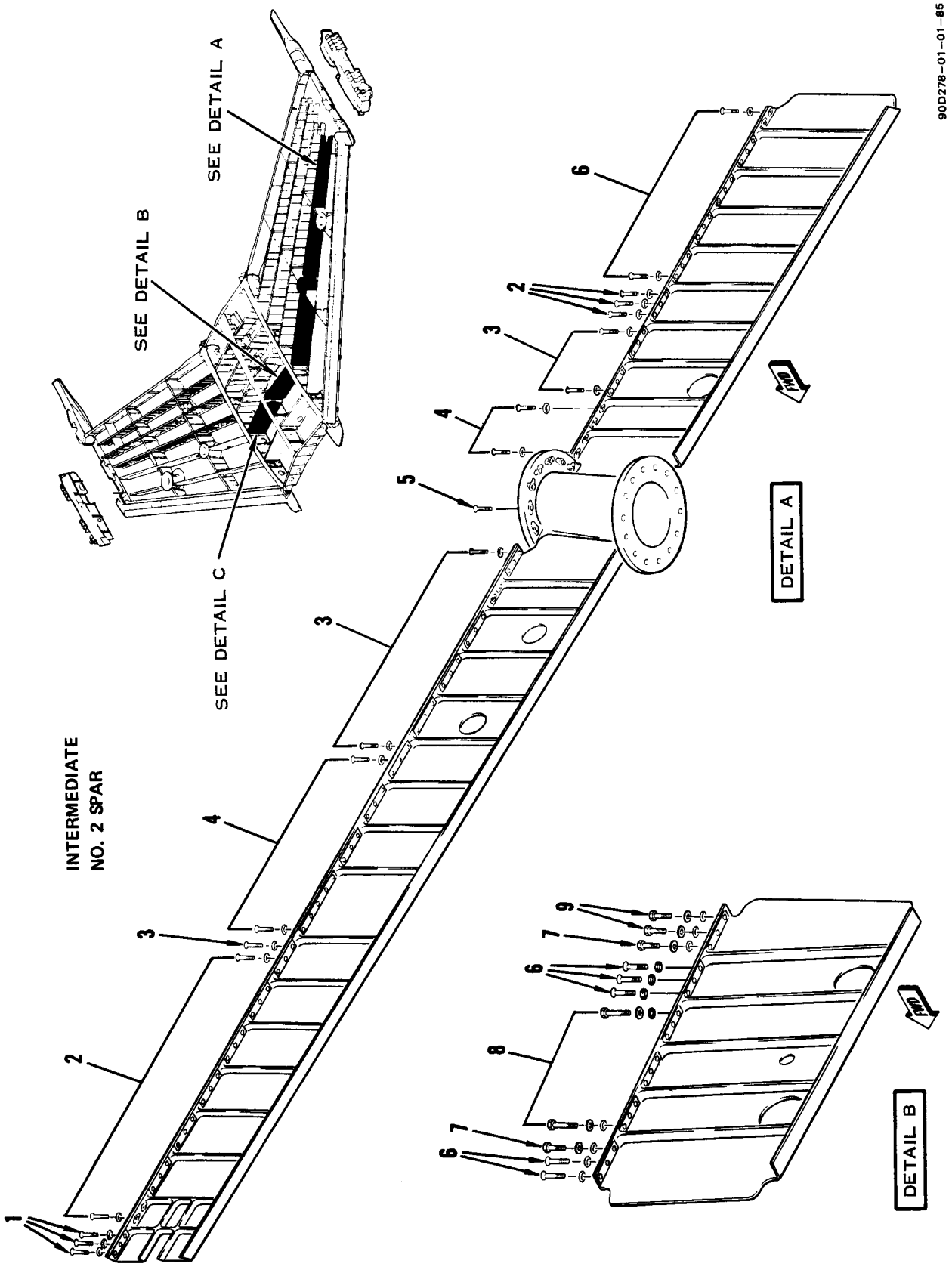
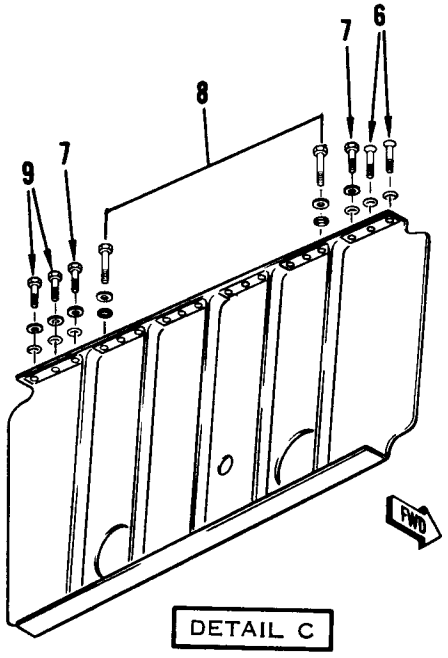


Figure 5-73. Wing Center Section Intermediate No. 2 Spar Upper Skin Fasteners (Sheet 1 of 2)



INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-10 Screw	A, Note 2	6	NAS1624-6 Screw	A, Note 2
2	NAS1624-7Screw	A, Note 2	7	NAS1304-10 Bolt	B
3	NAS1624-8 Screw	A, Note 2	8	NAS1304-9 Bolt	B
4	NAS1624-9 Screw	A, Note 2	9	NAS1304-8 Bolt	B
5	NAS517-6-15 Screw	Notes 2 & 3			

SEALING DEVICES AND WASHERS (Note 1)

A. MS29513-010 O-Ring

B. AN960D416 Washer Under Bolthead and 600-042-1/4 Stat-O-Seal Under Bolthead Washer.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.
3. Pylon fitting attached with 13 screws.

90D278-02-01-85

Figure 5-73. Wing Center Section Intermediate No. 2 Spar Upper Skin Fasteners (Sheet 2)

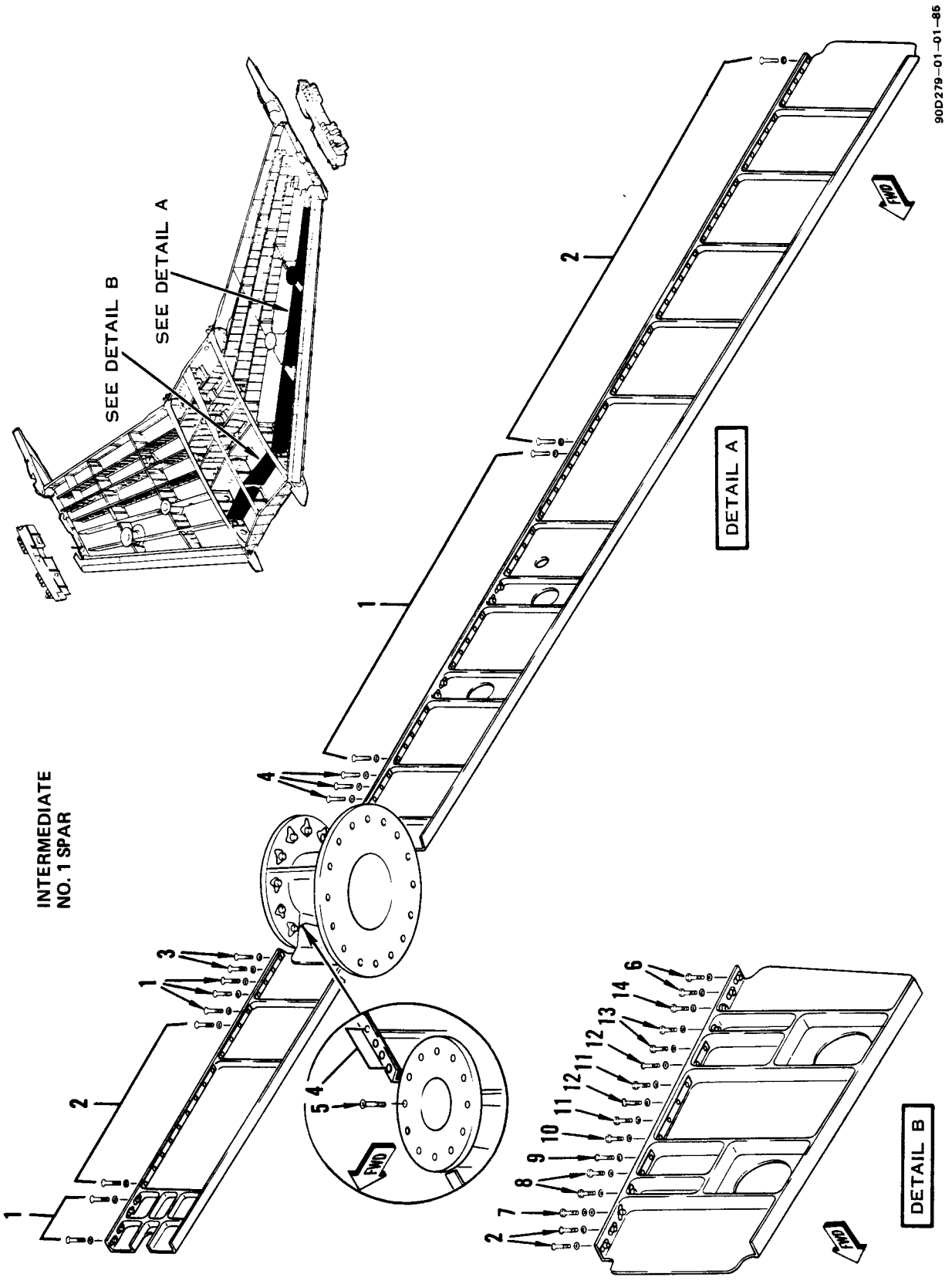


Figure 5-74. Wing Center Section Intermediate No. 1 Spar Upper Skin Fasteners (Sheet 1 of 2)

INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-7 Screw	A, Note 2	8	MS21250-04014 Bolt	C
2	NAS1624-6 Screw	A, Note 2	9	NAS1624-9 Screw	A, Note 2
3	NAS1624-8 Screw	A, Note 2	10	NAS1304-15 Bolt	D
4	NAS517-4-8	A, Note 2	11	NAS1304-16 Bolt	D
5	NAS517-8-16	Note 2	12	NAS1624-10 Screw	A, Note 2
6	NAS1304-10 Bolt	B	13	MS21250-04016 Bolt	C
7	NAS1304-11 Bolt	B	14	NAS1304-12 Bolt	B

SEALING DEVICES AND WASHERS (Note 1)

A. MS29513-010 O-Ring.

B. AN960D416 Washer Under Bolthead and 600-04-2-1/4 Stat-O-Seal Under Head Washer.

C. MS20002C4 Washer.

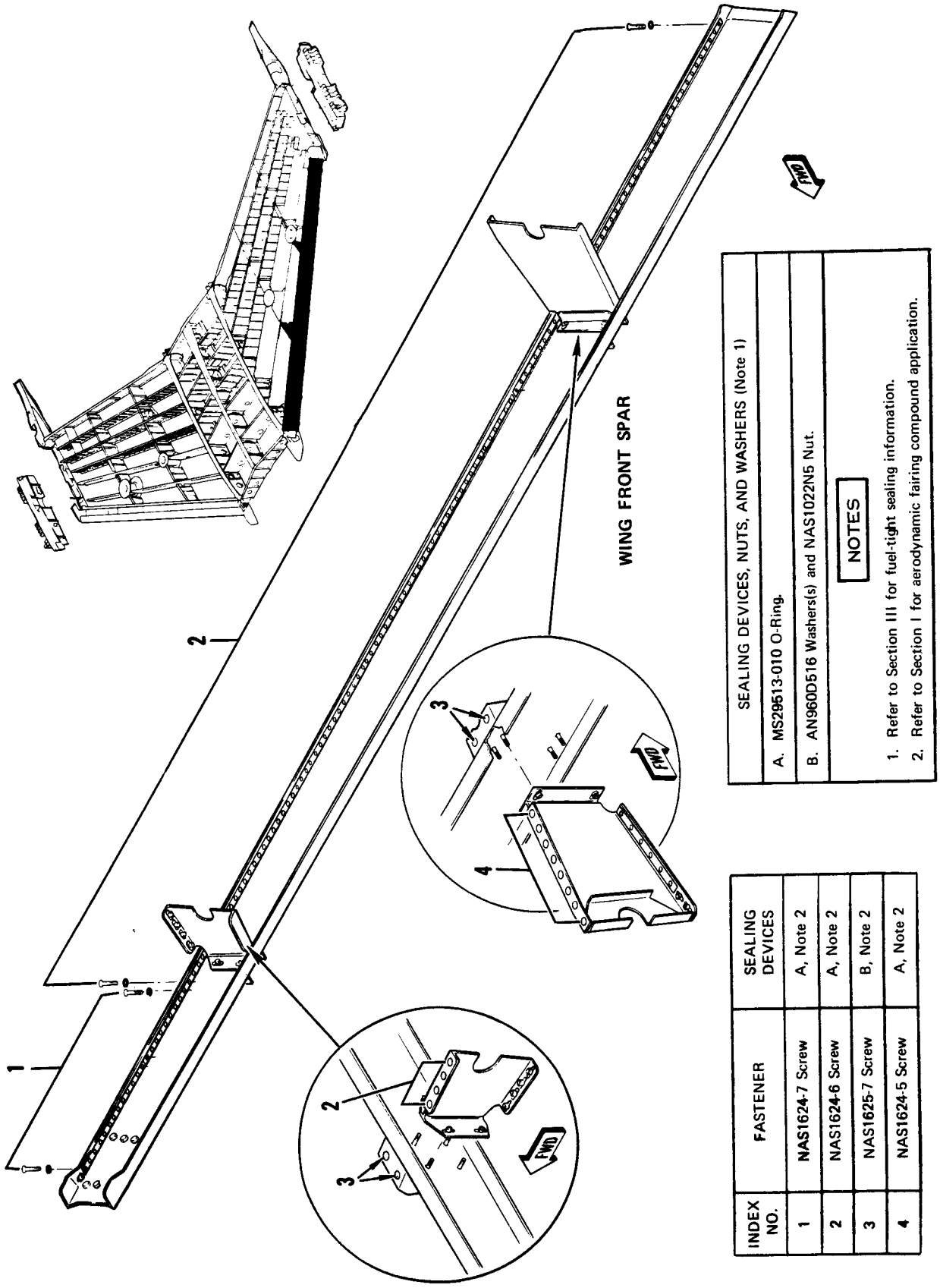
D. AN960D416 Washer.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application

90D279-02-01-85

Figure 5-74. Wing Center Section Intermediate No. 1 Spar Upper Skin Fasteners (Sheet 2)



INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-7 Screw	A, Note 2
2	NAS1624-6 Screw	A, Note 2
3	NAS1625-7 Screw	B, Note 2
4	NAS1624-5 Screw	A, Note 2

SEALING DEVICES, NUTS, AND WASHERS (Note 1)
A. MS29513-010 O-Ring.
B. AN960D516 Washer(s) and NAS1022N5 Nut.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

Figure 5-75. Wing Center Section Front Spar Upper Skin Fasteners

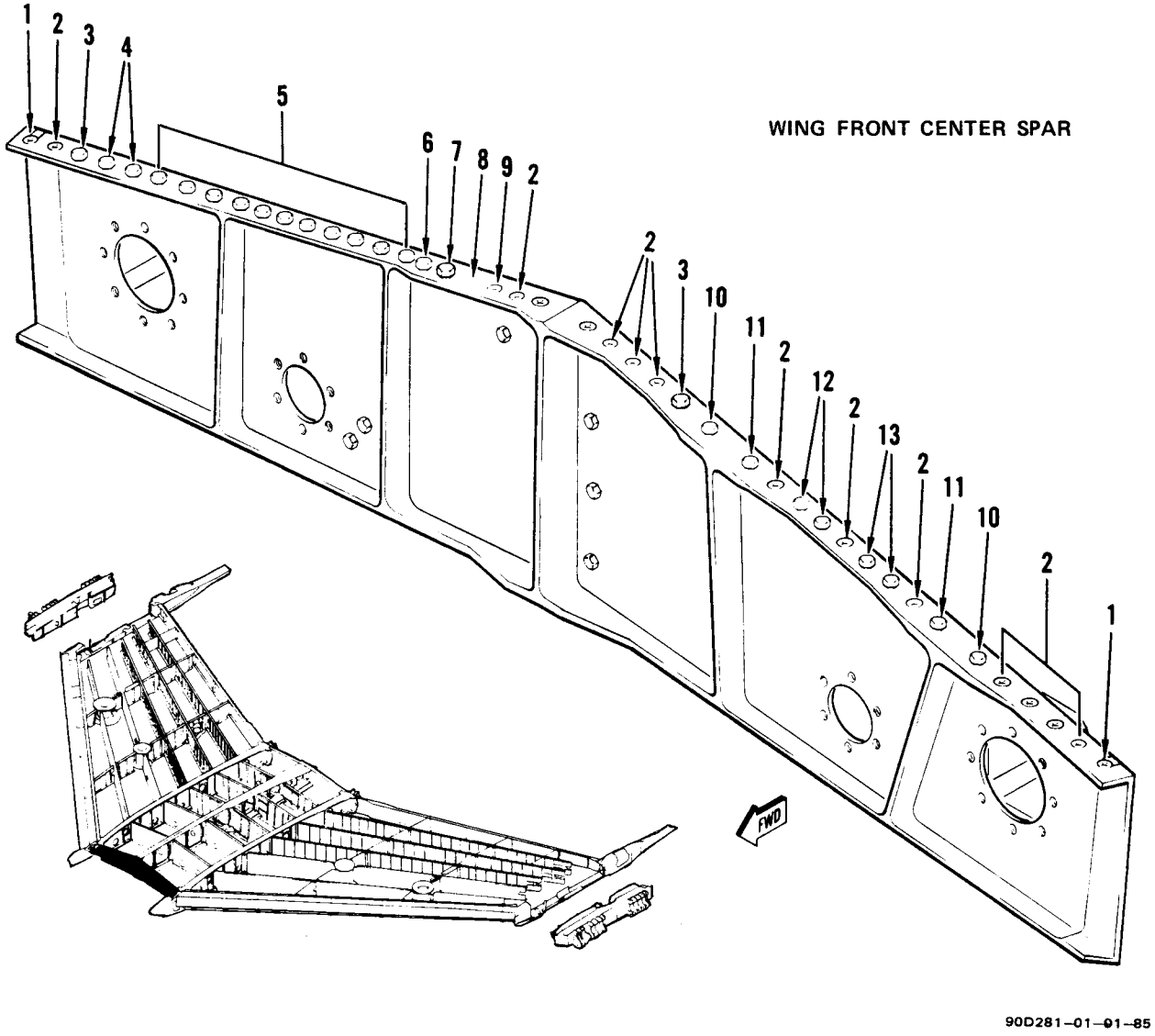


Figure 5-76. Wing Center Section Center Front Spar Upper Skin Fasteners (Sheet 1 of 2)

INDEX NO.	FASTENER	SEALING DEVICES	INDEX NO.	FASTENER	SEALING DEVICES
1	NAS1624-8 Screw	A, Note 2	8	NAS1624-10 Screw	A, Note 2
2	NAS1624-7 Screw	A, Note 2	9	NAS1624-20 Screw	A, Note 2
3	NAS464P4A11 Bolt	A	10	MS21250-05020 Bolt	B
4	NAS464P4A9 Bolt	A	11	MS21250-05016 Bolt	B
5	NAS464P4A8 Bolt	A	12	NAS464P4A14 Bolt	C
6	NAS464P4A19 Bolt	A	13	NAS464P4A15 Bolt	C
7	NAS464P4A14 Bolt	A			

SEALING DEVICES, NUTS, AND WASHERS (Note 1)

A. AN960D416 Washers(s) and MS21042L4 Nut.

B. MS20002C5 Washer Under Bolthead, 600-042-5/16 Stat-O-Seal Under Bolthead Washer, AN960D516 Washer Under Nut, and MS21042L5 Nut.

C. AN960D416 Washer Under Bolthead, 600-042-1/4OS Stat-O-Seal Under Bolthead Washer, AN960D416 Washer Under Nut, and MS21042L4 Nut.

NOTES

1. Refer to Section III for fuel-tight sealing information.
2. Refer to Section I for aerodynamic fairing compound application.

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Figure 5-76. Wing Center Section Center Front Spar Upper Skin Fasteners (Sheet 2)