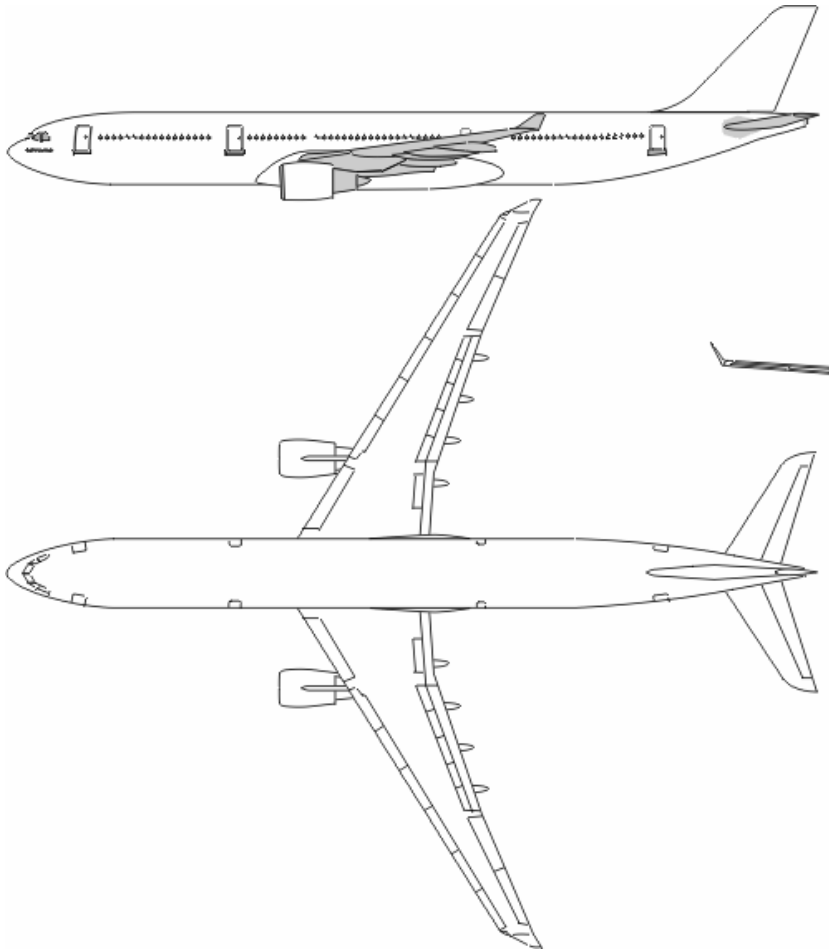
KLM Engineering & Maintenance



A330-200

B1/B2
ATA 51/57 Structures

Version: 1

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ATA 51-57STRUCTURES

51-57 GENERAL

COMPOSITE MATERIALS

Rev: SRM ATA 51-33-00

To reduce the aircraft weight a large number of primary- and secondary structure parts are made of reinforced plastics.

Glass- and Aramid Fibre Reinforced Plastic is used for secondary structure parts.

Abbreviations used in the AMM an SRM (Structure Repair Manual):
CFRP……Carbon Fibre Reinforced Plastic
AFRP……Aramid Fibre Reinforced Plastic
GFPR……Glass Fibre Reinforced Plastic.
GLARE ……Glass Fibre Reinforced Aluminium Laminate

No:	Component	Composite	
		Monolithic	Sandwich
1.	Fin Box	**CFRP/GFRP**	
2.	Rudder		**CFRP/GFRP**
3.	Elevator		**CFRP**
4.	Horizontal Stab. Outer Boxes	**CFRP/GFRP**	
5.	Winglet		**CFRP/GFRP**
6.	Wing Trailing Edge		**CFRP**
7.	Ailerons		**CFRP**
8.	Flap Track Fairing		**CFRP**
9.	Outer Flap	**CFRP**	
10.	Spoilers		**CFRP**
11.	Shroud Box		**CFRP**
12.	Root Fillet fairing		**AFRP**
13.	Belly Fairing / Skin		**CFRP/GFRP**
14.	Radome		**AFRP**
15.	Trailing Edge Upper Panels		**CFRP**
16.	Trailing Edge lower Panels		**CFRP**
17.	Leading Edge Upper Panels		**CFRP/GFRP**
18.	Leading Edge Lower Panels		**CFRP/GFRP**
19.	MLG Leg Fairing / Hinged Doors		**CFRP**
20.	MLG Doors		**CFRP**
21.	Nose Landing Gear Doors		**CFRP**
22.	Pylon Fairings		**AFRP/GFRP**

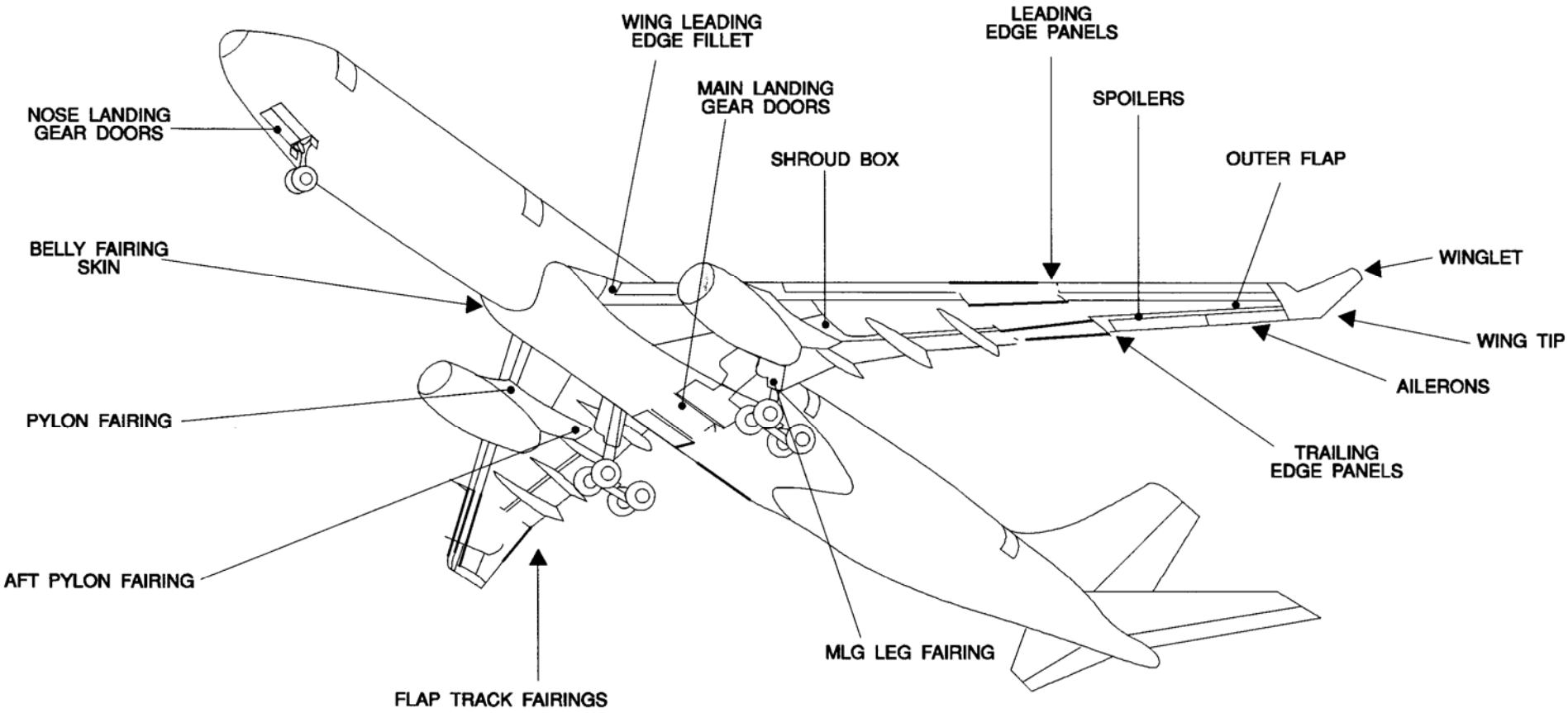

Figure 1 Composite Materials

STRUCTURE SECTIONS

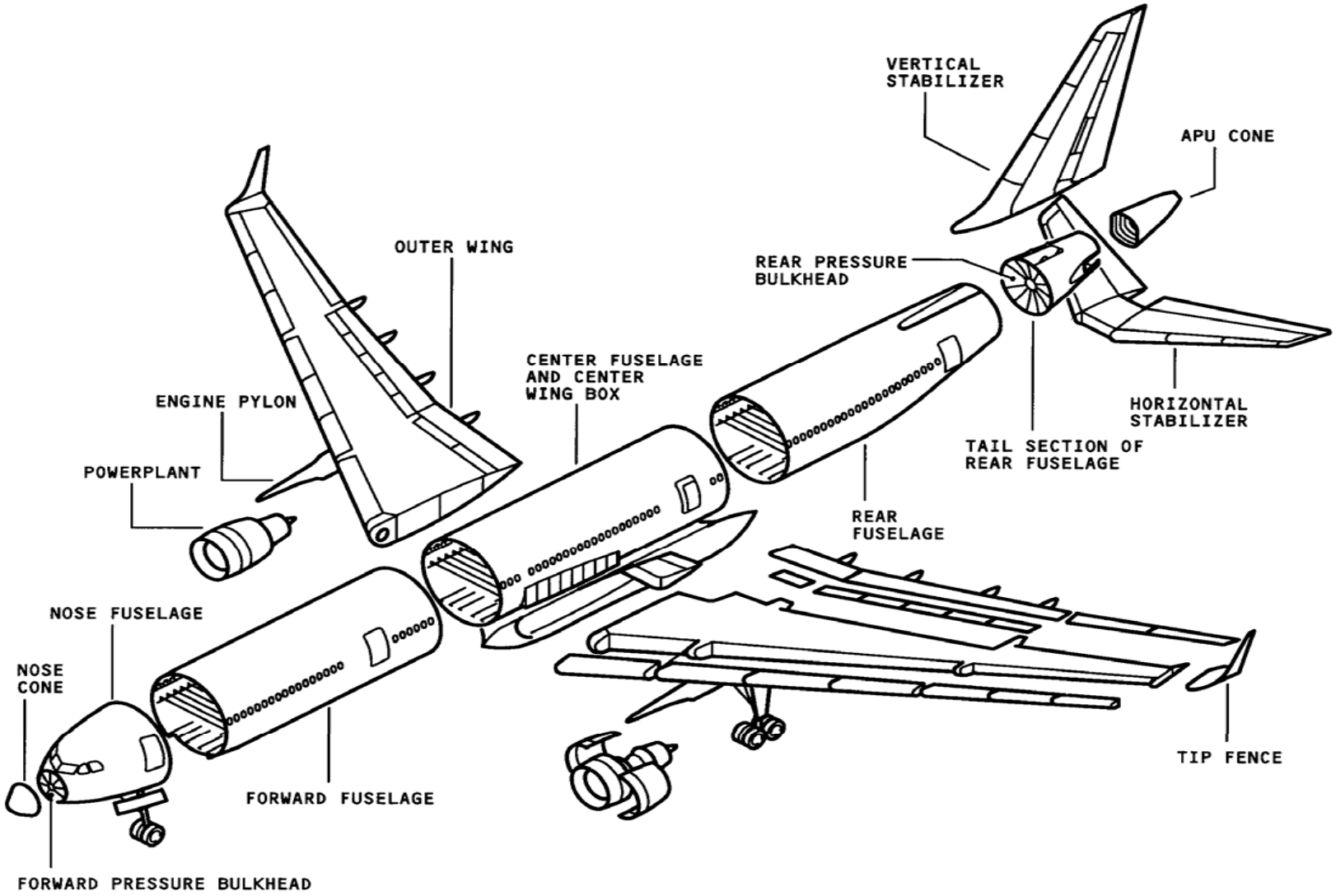

Figure 2 Structure Sections

Fuselage
ATA 53-00

FUSELAGE-GENERAL

The fuselage is a semi-monocoque structure. Light alloy circular frames and longitudinal stringers support and strenghten the main fuselage skin. The fuselage is made of separate assemblies which are riveted together. Frames 18, 38, 54 and 80 make the joints for the assemblies. The cabin floor structure divides the fuselage into two areas, the main deck and the lower deck.
The main deck includes the cockpit and the cabin.

The lower deck includes the avionics compartments, the landing gear bays and the FWD, AFT and BULK cargo compartments. Support struts and crossbeams support the cabin floor structure. Pressure bulkheads separate the pressurized areas of the fuselage from the areas which are not pressurized. The cockpit, the cabin, the avionics compartment and the cargo compartments are pressurized. The radome, the wing centre box, the landing gear bays, the belly fairing and the cone/rear fuselage are not pressurized.

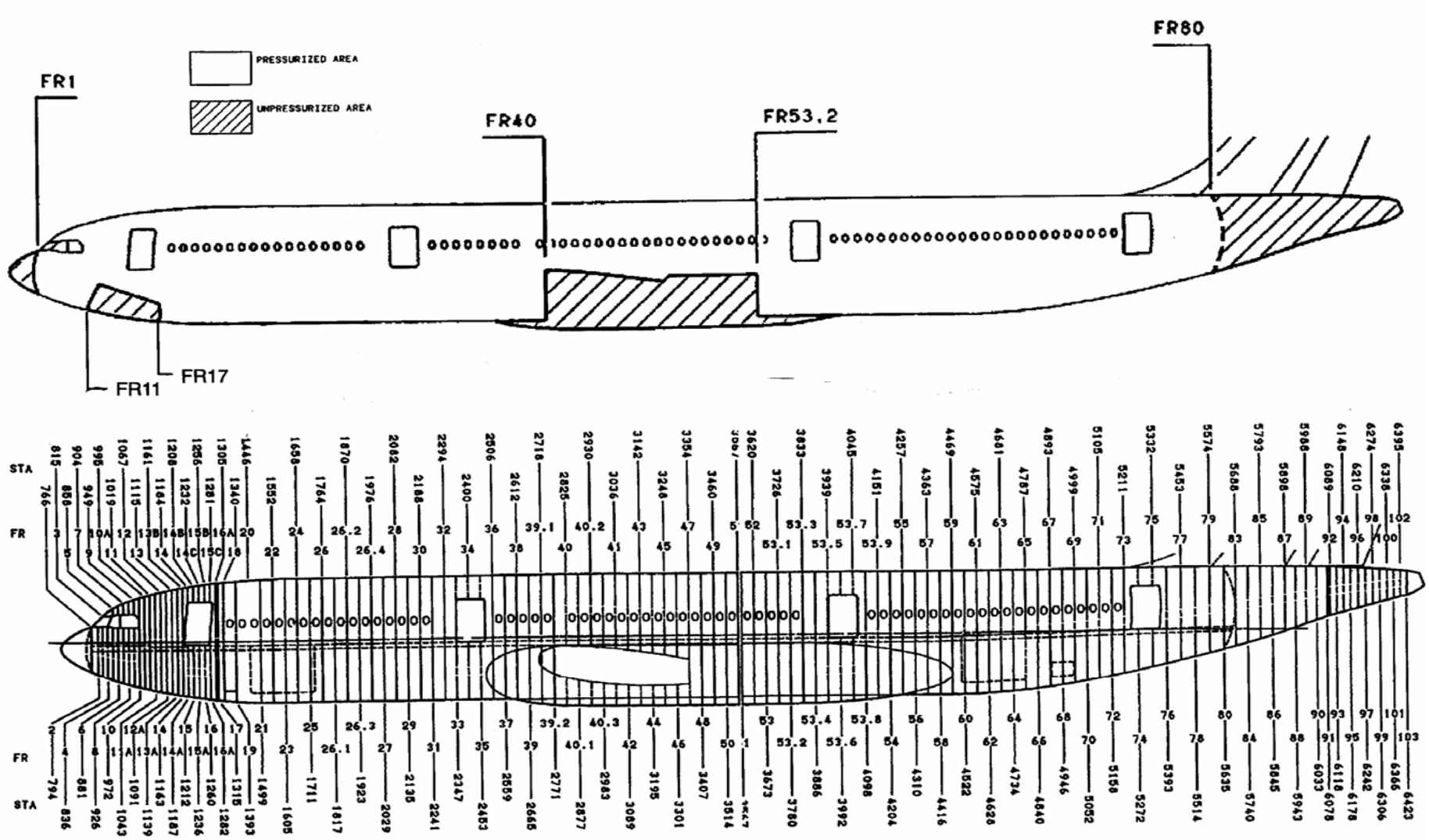

Figure 3 Fuselage Areas and Stations

NOSE FORWARD FUSELAGE
The upper part of the assembly includes the cockpit and part of the cabin. The lower part of the assembly includes the nose landing gear bay and the avionics compartment. The radome is attached on the forward face of FRII.

The cockpit, the cabin and the avionics compartment are in the pressurized zone. The forward pressure bulkhead, which separates the radome from the pressurized zone, is installed at FR1. Pressure resistant walls are installed in the lower part of the nose forward fuselage. They separate the nose landing gear bay from the pressurizedzone.

FORWARD FUSELAGE
The upper part of the assembly contains part of the cabin and the MID passenger/crew door-cutouts. The lower part of the assembly contains the FWD cargo compartment and the FWD cargo-compartment door-cutout. All of the forward fuselage is in the pressurized zone.

CENTRE FUSELAGE
The centre fuselage extends from FR38 to FR54. The upper part of the assembly contains part of the cabin. The wing centre box and the main landing gear bay, with the hydraulics compartment, are in the lower part of the assembly. Only the cabin and the area between the wing centre box, the main landing gear bay and the cabin floor are pressurized.
The wing centre box is installed between FR40 and FR47. The structure extends across the width of the lower fuselage. The main landing gear bay is installed between FR47 and FR53.2.
A keel beam is installed in the bottom of the lower fuselage and extends from FR39 to FR53.5. It keeps the longitudinal structural strength of the lower fuselage and absorbs the fuselage bending loads.
The belly fairing is installed on the outer side of the lower part of the centre fuselage assembly. The structure is an extension to the lower fuselage and contains air-conditioning and hydraulic services equipment.

REAR FUSELAGE
The upper part of the assembly contains part of the cabin and the AFT passenger/crew door-cutouts. The lower part of the assembly contains the AFT cargo compartment, the AFT cargo-compartment door-cutout and the BULK cargo-compartment door-cutout. All of the rear fuselage is in the pressurized zone.

CONE / REAR FUSELAGE
The cone/rear fuselage extends from FR80 to FR1 03. The upper skin panels aft of FR76 are also part of the cone/rear fuselage. The rear pressure bulkhead is installed at FR80. The cone/rear fuselage is part of the area of the fuselage which is not pressurized. The assembly is made of two subassemblies. The joint for the two subassemblies is at FR91.
The subassembly aft of FR91 is referred to as the tail cone. You can remove the tail cone as a unit. The vertical stabilizer attach-fittings are installed on the top of the assembly, between FR79 and FR87. Two maintenance access panels are installed on the top for access to the vertical stabilizer. The horizontal stabilizer is installed between FR87 and FR91. Four tailcone attach fittings are installed at the rear face of FR91.
The Auxiliary Power Unit (APU) is installed in the APU compartment, between FR95 and FR1 01. The APU compartment is a specified fire zone. Firewalls, which are made of titanium sheets, are installed on all sides of the APU compartment. Metal stiffeners separate the firewalls from the outer skin of the tail cone, which is made of aluminium alloy.
The upper part of the APO compartment has a strong ceiling and two longerons, which increase the mechanical strength of the APU compartment. The APU attach fittings are installed at the two longerons. A decompression panel is installed on the upper left side between FR99 and FR1 00.
Maintenance access doors are included in the lower right side of the two subassemblies. The cone/rear fuselage access door is installed between FR84 and FR85, the APU access doors are installed between FR95 and FR101.
The APU air intake is installed between FR92 and FR94.
The rear end of the tail cone, aft of FR1 03, is a fairing for the APU exhaust. The fairing is of a sheet metal construction.

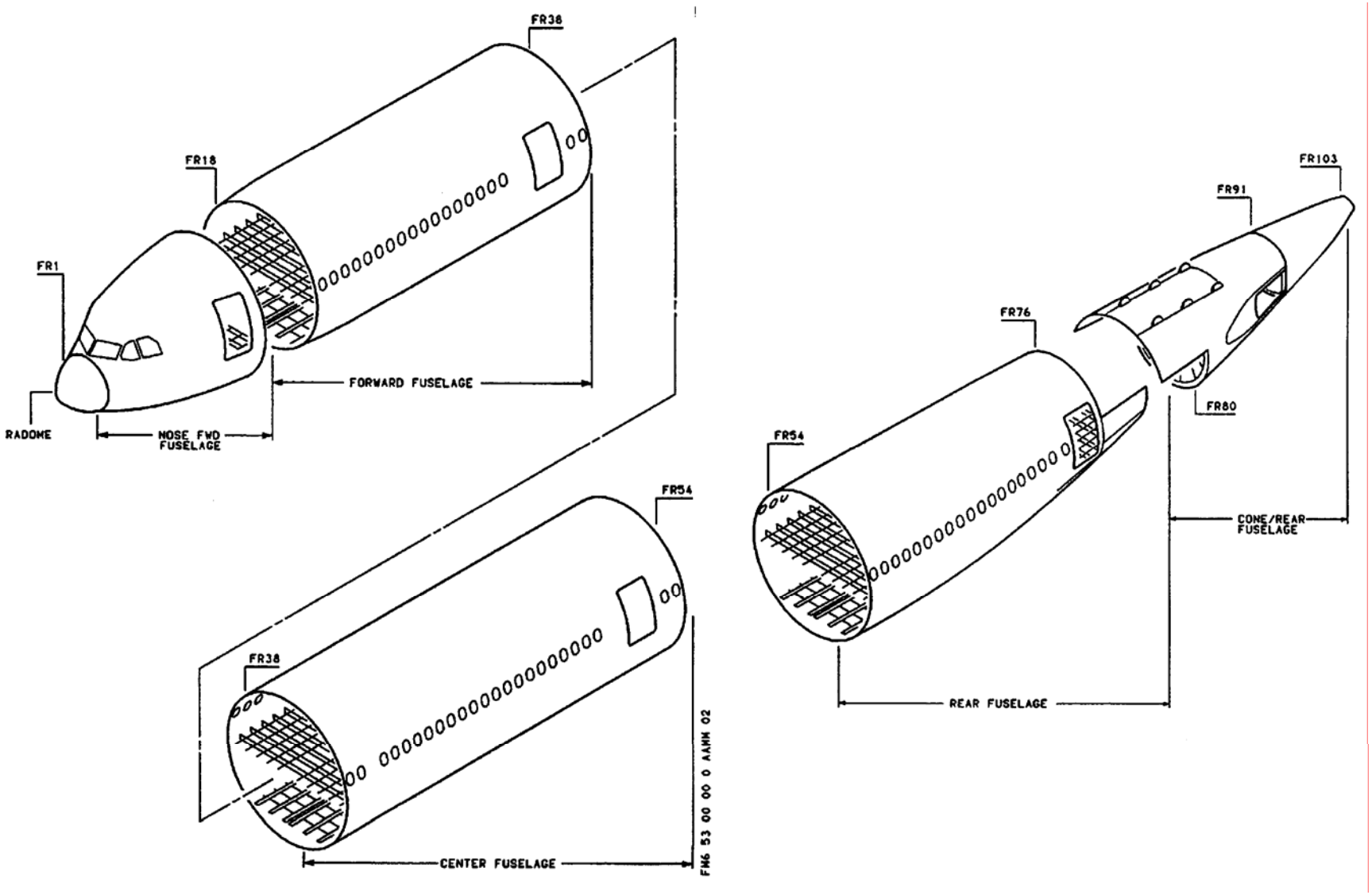

Figure 4 Fuselage Assamblies

RADOM

The radome is the protective cover of the radar antenna. It makes the aerodynamic profile of the nose fuselage. The radome is designed as a sandwich keviar construction.

RADOM OPENING

WARNING: MAKE SURE THAT THE CIRCUIT BREAKERS RELATED TO THE WEATHER RADAR ARE OPENED, SAFETIED AND TAGGED. WARNING: IN THE COCKPIT, PUT A WARNING NOTICE IN POSITION ON THE CENTRE PEDESTAL TO TELL PERSONS NOT TO OPERATE THE RADAR SYSTEM. WARNING: DO NOT OPEN THE RADOME IF THE WIND SPEED IS MORE THAN 35 KNOTS. IF THE RADOME IS OPEN IN WINDS HIGHER THAN 35 KNOTS IT CAN BREAK FROM ITS HINGES AND CAUSE INJURY. Open, safety and tag this (these) circuit breaker(s):

PANEL DESIGNATION	FIN LOCATION	
721VU WXR 1	9SQ1	K03
722VU WXR 2	9SQ2	E49

OPENING OF THE RADOME 110AL

Two persons are necessary to open the radome. - Operate the two handles to release the locks of the radome. - Lift the radome. Make sure that the radome is correctly locked: - The bush is in the maximum low position. - The painted red ring is not in view.

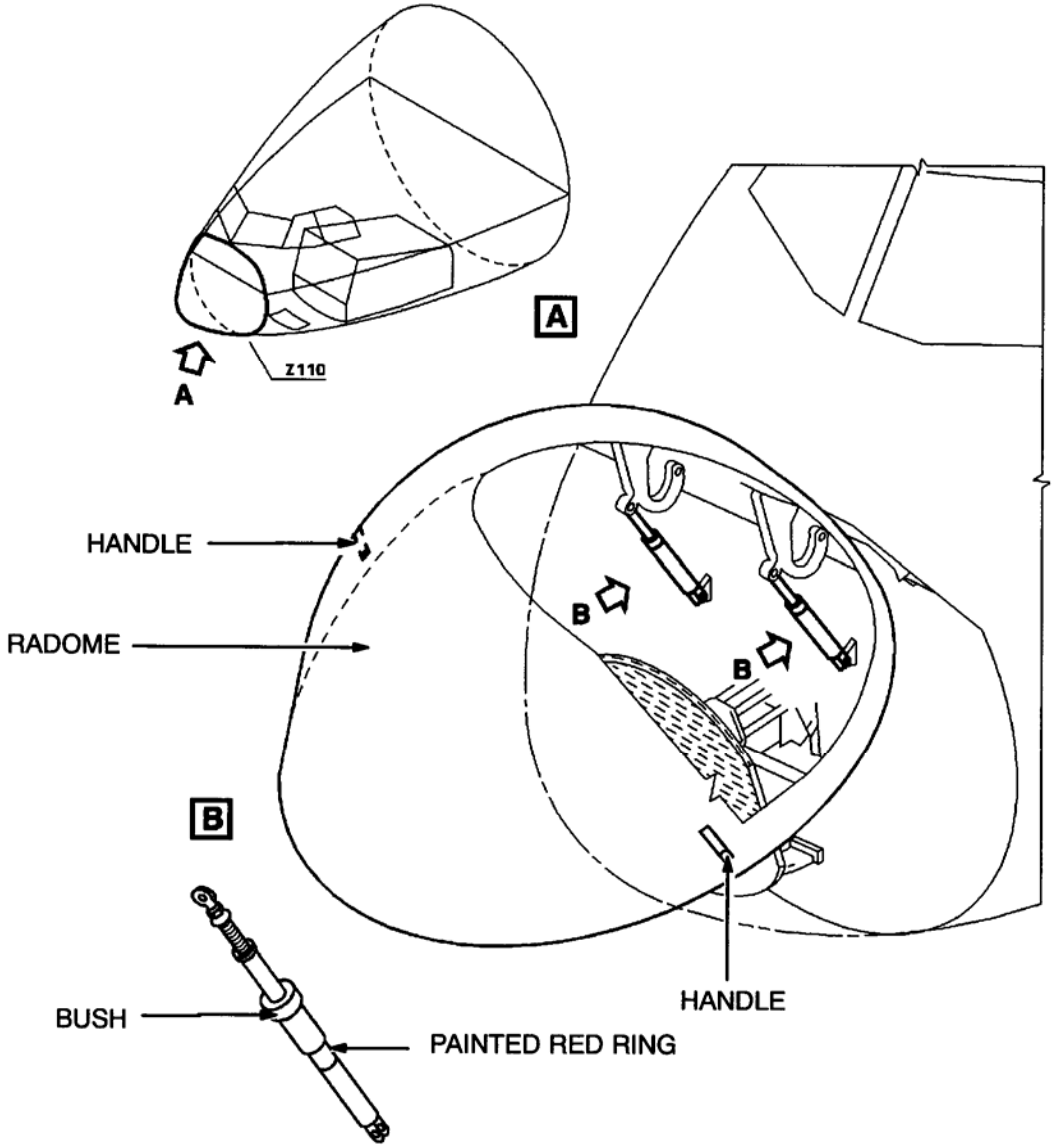

Figure 5 Radome Operation

NOSE-FUSELAGE

The nose fuselage extends from FR-O to FRI 8; it includes section 11 from FRO to FRI 0, section 12 from FRI 0 to FRI 8: The bottom fuselage section extends to FRI 9 The structural complexity of the nose forward fuselage (skin panels curved in both planes) is due to the external shapes and to the great number of openings (Passenger/Crew doors, service doors, windshield, nose landing gear bay).
It includes In the upper fuselage section:
- the cockpit between FRO and X = 3900
- the section of the cabin between X = 3900 and FR18.

In the lower fuselage section (bottom fuselage structure):
- the avionics compartment -the nose landing gear well
- a recess used as a housing for the glide/slope antenna (FR4 to FR7) - a forward jacking adapter.
- electronic bay access door frame.
- ground connection housing.

NOSE- FUSELAGE JUNCTION

The junction of section 11 to section 12 is made at FRI 0 for the upper part of the fuselage.

PRESSURIZED and NON PRESSURIZED ZONES

The pressurized zone extends from FRI to FRI 8.
Non pressurized zone:
- The radome forward of FRI (protection for the ILS and radar antennas).
- The landing gear well between FRI 1 and FRI 7.
- The recess in which the glide/slope antenna is installed: FR4 to FR7.
- The ground connection housing.

MAIN STRUCTURE

The main structure of Sections 11/12 is made of 3 parts:
- the forward upper structure between FRO and FR10
- the aft upper structure between FRI 0 and FRI 8
- the bottom fuselage structure between FRO and FR19.

FWD / AFT UPPER SECTION

The FWD- and AFT Upper Sections are buildup from a number of skin panels. Two titanium panels (windshield lower sill) below the windshield, reinforce the aluminium alloy panel.
A titanium panels above the windshield (FR4 to FR7).

SKIN PANELS

Most of the skin panels are machined from aluminium alloy sheets. In the cockpit three panels are made of titanium. They are reinforced by longitudinal stiffeners in order to provide a better protection against bird impacts.These panels are riveted together with an application of sealant.

FRAMES

The frames consist of: - Machined curved members for main frames. - Formed sheet curved members for the other frames. These frame curved members are jointed by riveted splices.

SKIN STIFFENERS and STRINGERS

The stringers are installed lengthwise and provide stability of the skin panels by carrying compressive and shear loads at level of:
- the nose landing gear well panels
- the upper section panels between FRI 3 and FRI 8
- the bottom fuselage structure panels
- all the longitudinal junction areas.

FLOOR STRUCTURE

The floor structure of section 11 /12 consists of:
- A light alloy crossbeam at FR7.
- Longitudinal beams and crossbeams made of extruded caps and clad sheet webs
- Vertical support struts which join the crossbeams to the bottom fuselage structure and increase the rigidity of the floor.

Aft of FRI 0 the cabin equipment (galleys, lavatories, passenger seats and cabin attendant seats) are secured to longitudinal tracks at Section 12

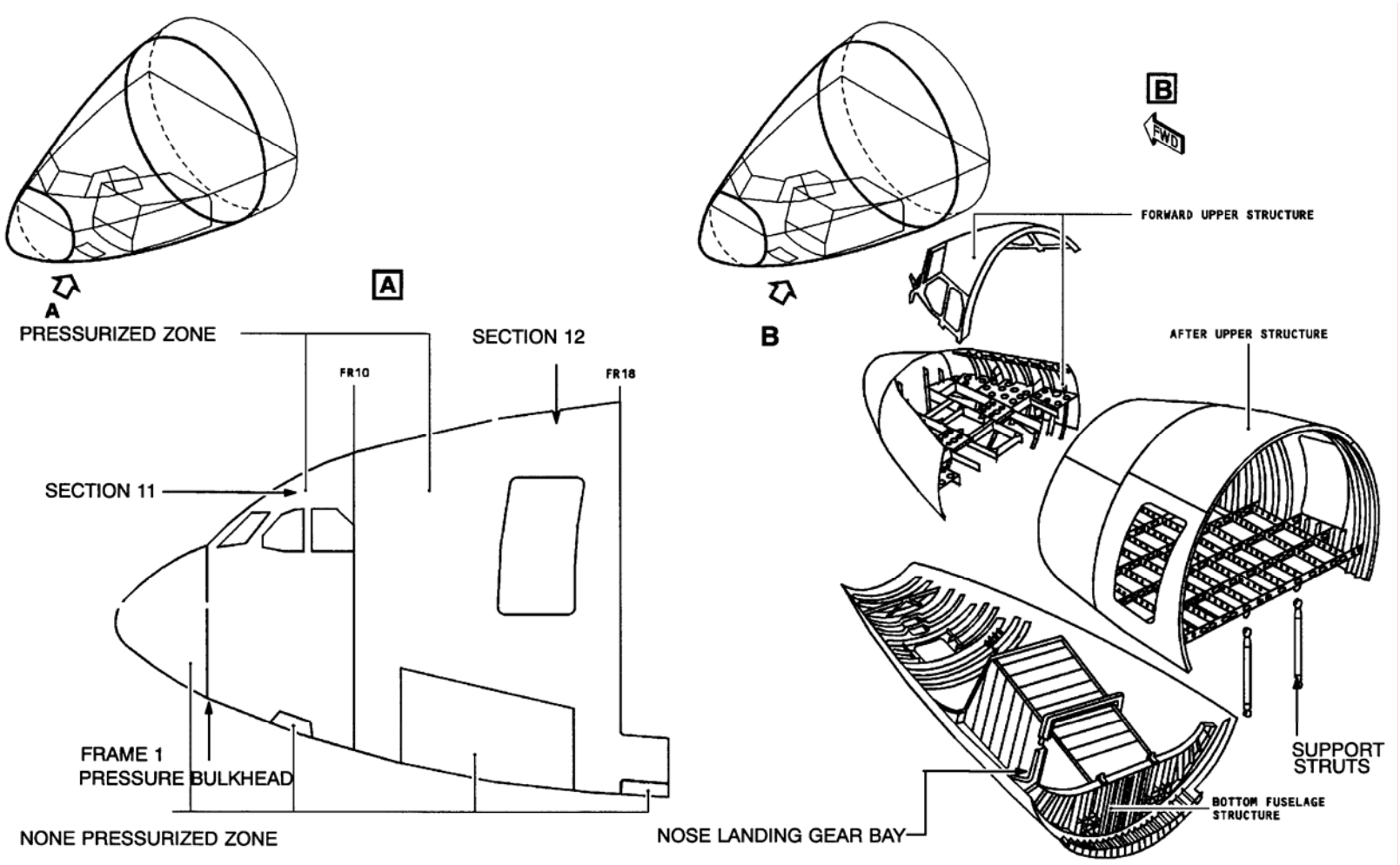

Figure 6 Nose Fuselage Structure

LOWER SECTION
Two lateral panels (left and right) from FRO to FRI 9.
One centre panel from FRO to FRI 9 form the Lower Section.

FWD PRESSURE BULKHEAD
STA766/FR1 forms the forward pressure bulkhead ; a bird impact protective shield made of a honeycomb structure is attached to the front of the pressure bulkhead.

NOSE LANDING GEAR BAY
Between FRI 1 and FRI 7, the landing gear bay forms a pressure bulkhead. The landing gear well is made of panels machined from the solid: - The lateral panels with a bolted fitting incorporating the nose landing gearmain bearing - The upper panel - The forward canted panel stiffened by two vertical members in alignment with the nose landing gear strut pick-up fittings. - frame 17 which incorporates the aft pressure bulkhead. It also includes: - Two nose landing gear strut pick-up fittings -Six canted support struts which provide sidewise stability of the nose landing gear well - Vertical and horizontal members which carry the pressure loads of panels.

SUPPORT STRUTS
Support struts between the floor crossbeam and nose gear bay increase the rigidity and strength of the floor structure, there are at level of frames (7-10-12A-14-15A-17). Nose landing gear bay is reinforced by lateral struts at frame(12A-14-15A-17)

FIXED FITTINGS
Fixed fitting are intented to join equipments or systems directly to the structural parts, these fittings are made of aluminium alloy.

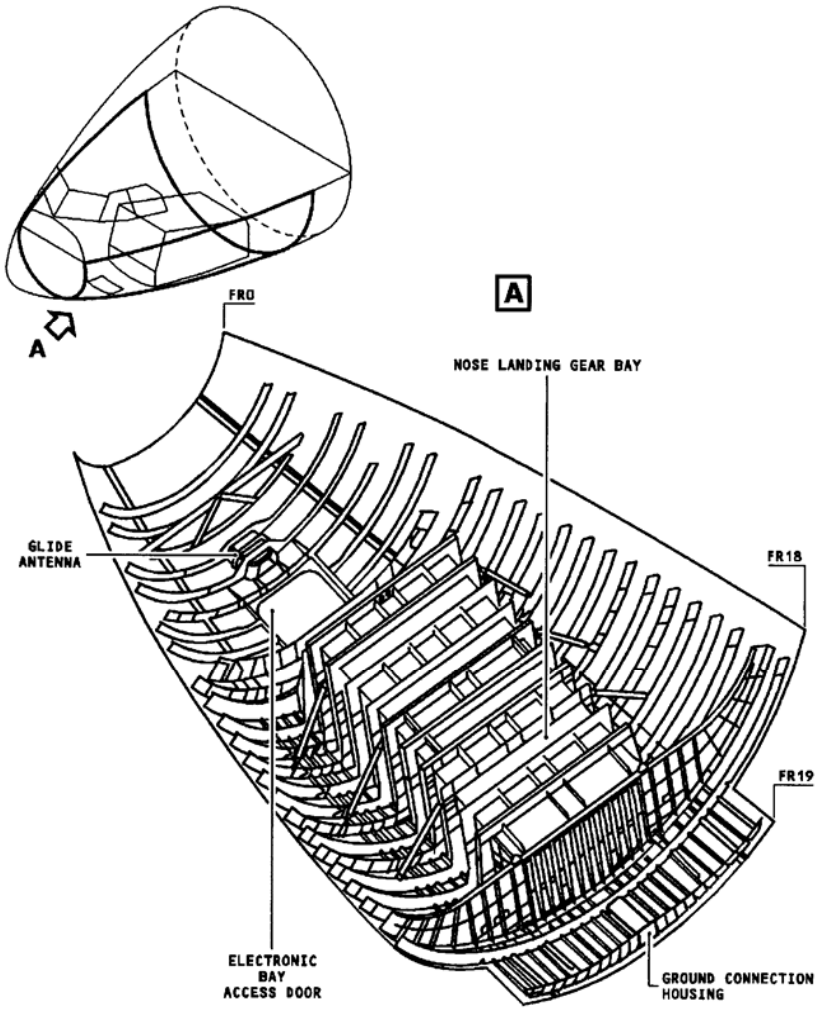

Figure 7 Fuselage Lower Section

FORWARD FUSELAGE

GENERAL
The forward fuselage extends from FR1 8 to FR38. The upper part of the assembly contains part of the cabin and the MID passenger/crew door-cutouts. The lower part of the assembly contains the FWD cargo compartment and the FWD cargo-compartment door-cutout. All of the forward fuselage is in the pressurized zone.

PRIMARY STRUCTURE
The fuselage is made of frames, stringers and skin panels which are riveted together. In the fuselage upper section the cabin window frames are installed between stringer 18 and 22 LH and RH. In the fuselage lower section there is a cutout between FR20 and FR26 for the FWD cargo-compartment door. A partition is installed at FR20 between the FWD cargo compartment and the avionics compartment. There are cutouts on both sides of the fuselage between FR33 and FR36 for the MID passenger/crew doors. The primary components of the fuselage structure are: - skin panels, - frames, - stringers, - cabin floor structure, - floor panels cargo-compartment floor structure, support struts, fixed partition, drains, cabin window frames.

SKIN PANELS
In general, the skin panels are made of aluminium alloy sheet. In the fuselage upper section between stringer 22 LH and stringer 22 RH the skin panels are bonded to the stringers. The skin panels are chemically milled in the subsequent areas: - the lower area of the forward fuselage, - the areas adjacent to the doors. Some skin panels are chemically milled in areas to which high loads are applied.

FRAMES
The frames are made of aluminium alloy sheet. In areas to which high loads are applied the frames are machined. The frames give a circular shape to the fuselage. Clips connect the frames to the skin panels and the stringers. The normal distance between the frames is 530 mm (20.8661 in.).

STRINGERS
The fuselage stringers are made of aluminium alloy sheet or aluminium alloy extrusions and are bonded or riveted to the skin panels. They are the longitudinal stiffeners of the fuselage skin panels.

CABIN FLOOR STRUCTURE
Crossbeams, which are attached to the frames, increase the mechanical strength of the assembly. The crossbeams have lightening holes. Longerons and seat tracks are attached to the crossbeams to make the cabin floor structure. The crossbeams and the seat tracks are made of aluminium alloy extrusions.

FLOOR PANELS
The floor panels are made of honeycomb core, which is bonded between sheets made of composite materials. A core filler makes the panels at the edges and the screw hole areas stronger. The floor panels in the cabin aisle and galley areas have a stronger honeycomb core and one more layer of composite materials to make them stronger. Screws attach the floor panels to the floor structures. The floor panels increase the mechanical strength of the cabin floor structure. In door areas the floor panels are covered with a non slip surface.

CARGO COMPARTMENT FLOOR STRUCTURE
The floor structure of the FWD cargo compartment is made of crossbeams which are attached to the frames. Support struts give the cargo-compartment floor structure its mechanical strength. Roller tracks are attached to the crossbeams. The roller tracks increase the mechanical strength of the floor structure

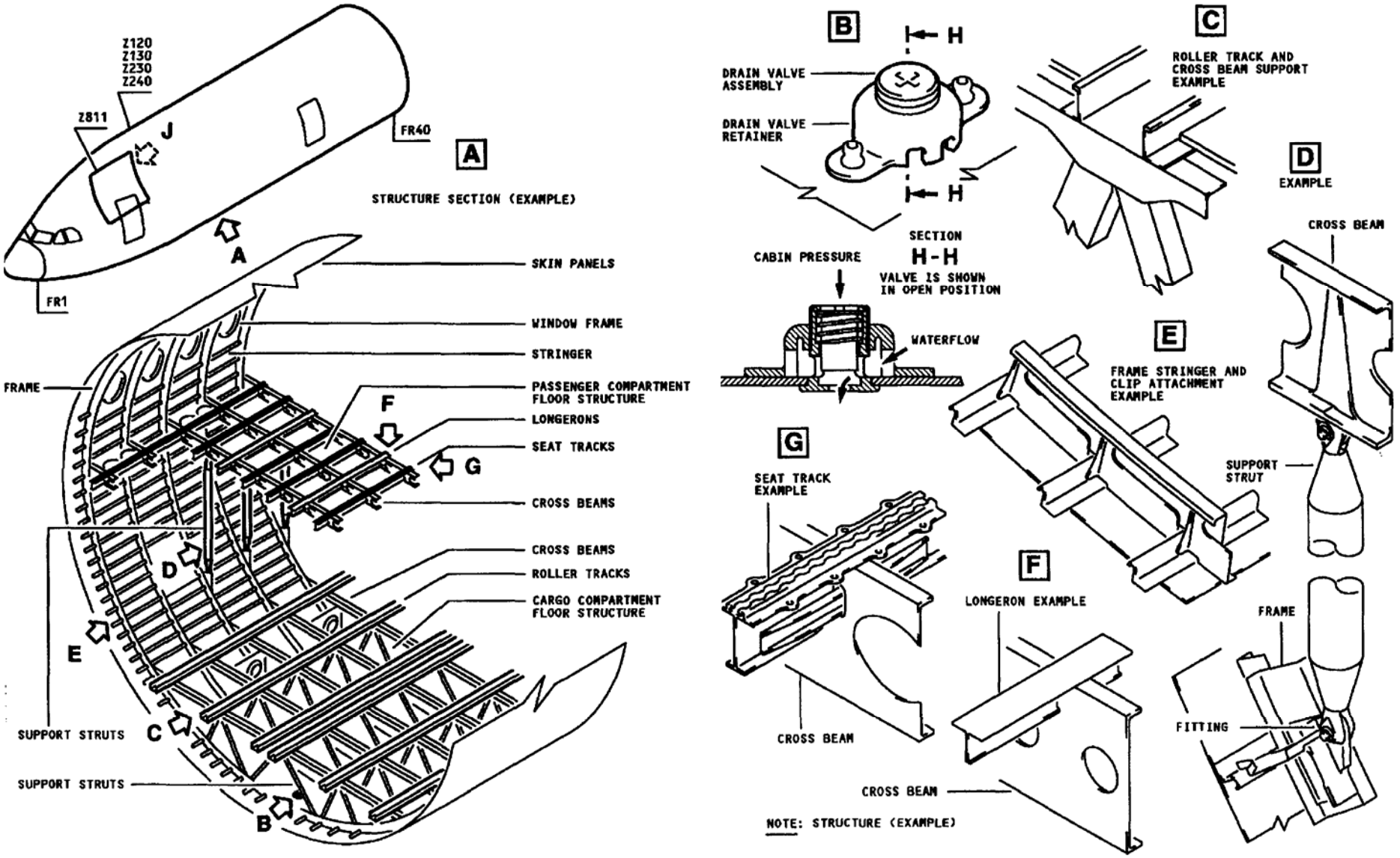

Figure 8 FWD Fuselage Structure Components

SUPPORT STRUTS

The support struts are attached to the ends of the crossbeams and to the frames. They increase the mechanical strength of the cabin floor structure. The support struts are made of Carbon fibre Reinforced Plastic (CFRP) and aluminium-alloy eye end-fittings.

FIXED PORTION

The fixed partition isolates the avionic compartment from the FWD cargo compartment. The fixed partition is made of honeycomb core, which is bonded between sheets made of GFRP. Core filler makes the panels stronger at the edges. The fixed partition is made of five sections. One door is installed for access to the avionics compartment. Six rapid decompression panels are installed on the fixed partition.

DRAINS

Drain valves are installed in the lower fuselage shell. If the cabin pressure is below a given value (the aircraft is near to or on the ground), springs hold the valves open and let the water condensation drain out. The rising cabin pressure closes the drain valves automatically. In other structures (doors, door frame, stringers, brackets and fittings) holes are drilled at the lowest points to make sure that water and condensation drain to the drain valves.

CABIN WINDOW FRAMES

The window frames are made from a drop-forgings which has a T-shaped cross-section. The window frames are riveted to the fuselage skin. A bonded doubler around the window frames ensures the fail safety of the skin. The cabin window frames are installed on both sides of the fuselage. They are installed between the frames and the locations extend the length of the cabin.

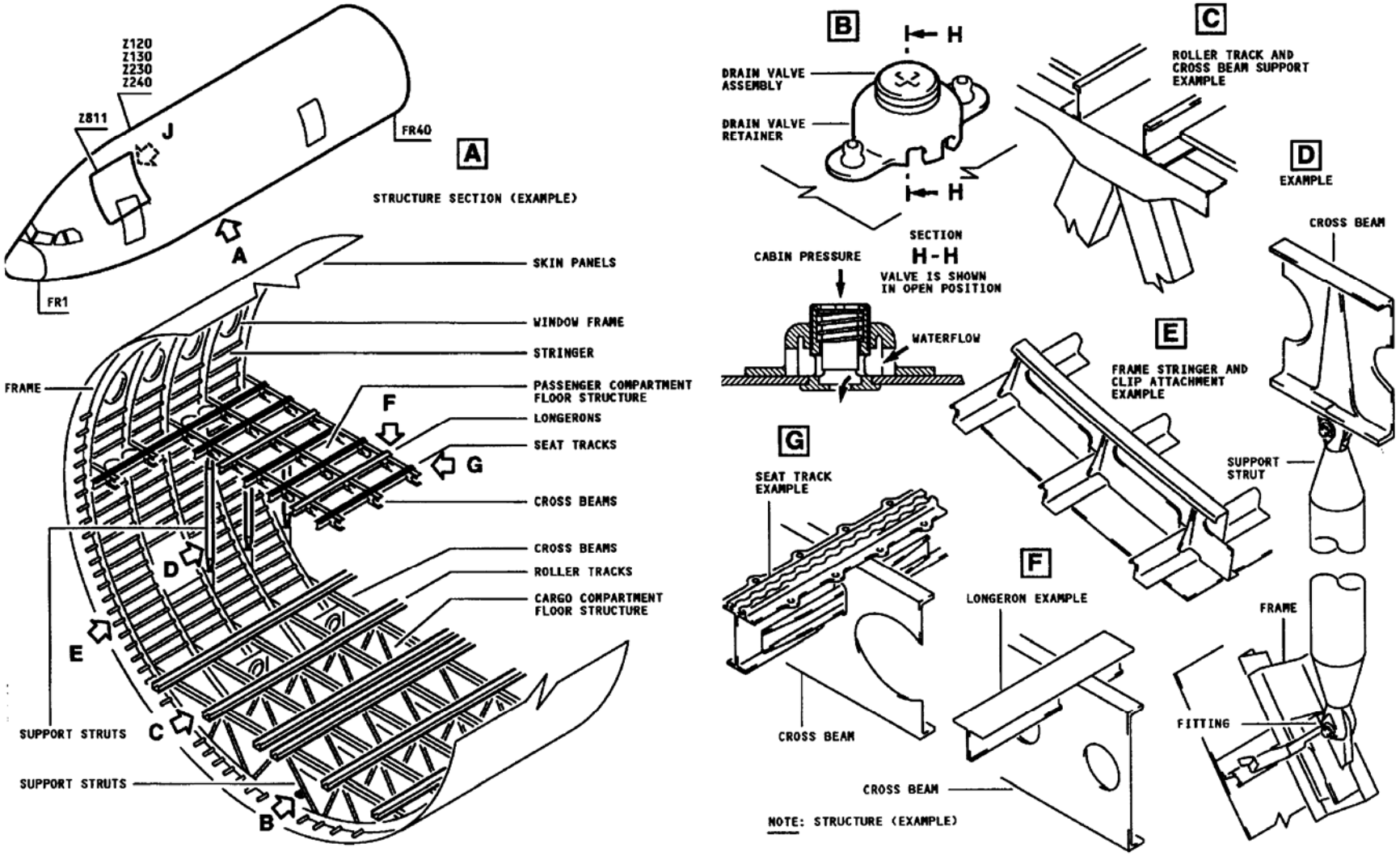

Figure 9 FWD Fuselage Structure Component

CENTRE FUSELAGE

The upper half section includes part of the cabin.
The lower half section includes:
- the wing centre box,
- the keel beam,
- an aft pressure bulkhead,
- an horizontal pressure Gatenary floor,
- two lateral pressure floors,
- a forward lower fuselage section,
- an aft lower fuselage section

The pressurized zones extends:
- from FR38 to FR40,
- from FR40 to FR53.2 in the upper section of the centre fuselage,
- from FF153.2 to FF154.

The non-pressurized zone is the lower section of the centre fuselage fromFR40 to FR53.2

MAIN STRUCTURE
The main structure of the fuselage includes:
- the forward upper section from FR38 to FR45,
- the centre upper section from FR45 to FR53.3,
- the aft upper section from FR53.3 to FR54.

This upper structure consists of:
- frames,
- stringers,
- emergency exit frames between FR53.5 and FR53.8,
- skin panels,
- a floor support structure.

WING CENTRE BOX
The wing centre box is the wing-to-fuselage junction structure. It includes the forward pressure bulkhead (FR40) of the fuselage and the floor support structure.

KEEL BEAM
The keel beam extends between FR40 and FR46/FR53.3. This beam includes two longitudinal boxes, an aft floor and skin panels.

AFT PRESSURE BULKHEAD
The aft pressure bulkhead includes the lower member of FR53.2.

HORIZONTAL PRESURE BULKHEAD
Horizontal pressure bulkhead This horizontal pressure bulkhead extends from the wing centre box FR47 to FR53.2. This bulkhead consists of a catenary floor with longitudinal beams and a floor support structure.

LATERAL PRESSURE FLOORS
These lateral pressure floors extend from FR47 to FR53.2 and consist of:
- lateral skin panels,
- canted frames and frame lower sections,
- pressure floor panels,
- longitunal beams.

FORWARD LOWER FUSELAGE
Forward lower fuselage, the structure of the forward lower fuselage, between FR38 and FR40 includes skin panels, frames, stringers and a support structure for the cargo compartment floor.

AFT LOWER FUSELAGE
The aft lower fuselage structure between FR37.2 and FR54, includes skin panels, frames, stringers and a support structure for the cargo compartment floor.

SUPPORT STRUTS
Support struts are installed to give structural strength and rigidity between the aircraft structures or between the structure and the component assemblies.

The support struts are tubular in shape and made of carbon fibre. They are not adjustable in length.

FLOOR SUPPORT STRUTS
The floor support struts are made of aluminium alloy, they are machined from plates and usually of a set length.

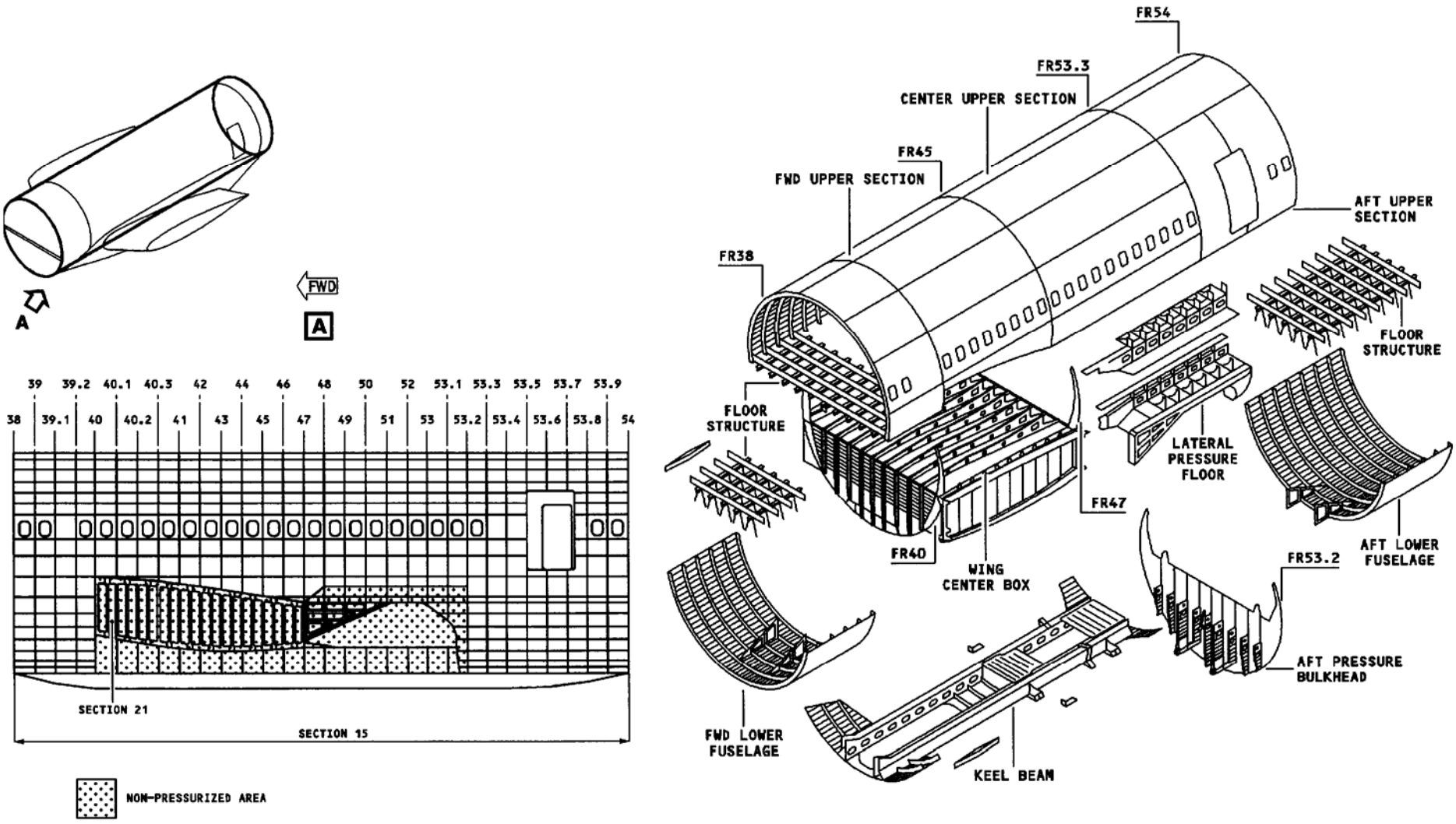

Figure 10 Centre Fuselage Section

FITTINGS
The fittings connect the structural parts directly to the fuselage or to those components that are attached to the fuselage. The fittings are made of aluminium alloy. They are machined from forgings or plates.

SKIN PANELS
The skin panels extend on the whole length of the fuselage. The panels are made from clad aluminium sheets, they contain recesses and over thicknesses obtained by mechanical milling.

FRAMES
The frames are circular stiffeners, they are made of aluminium-alloy curved members joined by splices.

STRINGERS
The fuselage stringers are made of aluminium alloy. They are the longitudinal stiffeners of the fuselage skin panels.

FLOOR STRUCTURE
Between FR38 and FR40 and between FR53.3 and FR54 The crossbeams made of light-alloy extruded sections make the floor structure. The seat tracks are attached to these crossbeams.

On the wing centre box The longitudinal beams are installed on the upper surface of the wing centre box. On these beams, support struts hold the seat tracks, the false tracks and the floor support members.

Over the landing gear well On the upper surface of the landing gear well, support struts hold the seat tracks, the false tracks and the floor support members above the longitudinal beams.

SEATTRACKS
The seats are attached to the seat tracks and the floor panels are attached to the seat track structure. The seat tracks are made of aluminium-alloy extruded sections.

PRESSURE BULKHEADS
The pressure bulkheads are integral with the lower members of FR40 andFR53.2

Forward pressure bulkhead FR40. The pressure bulkhead skin is made of aluminium panels and vertical stiffeners reinforce the pressure bulkhead structure. The forward pressure bulkhead is integral with the wing centre box.

Aft pressure bulkhead FR53.2. The pressure bulkhead skin is made of clad aluminium panel mechanically milled. Machined vertical beams and extruded section horizontal stiffeners reinforce the pressure bulkhead.

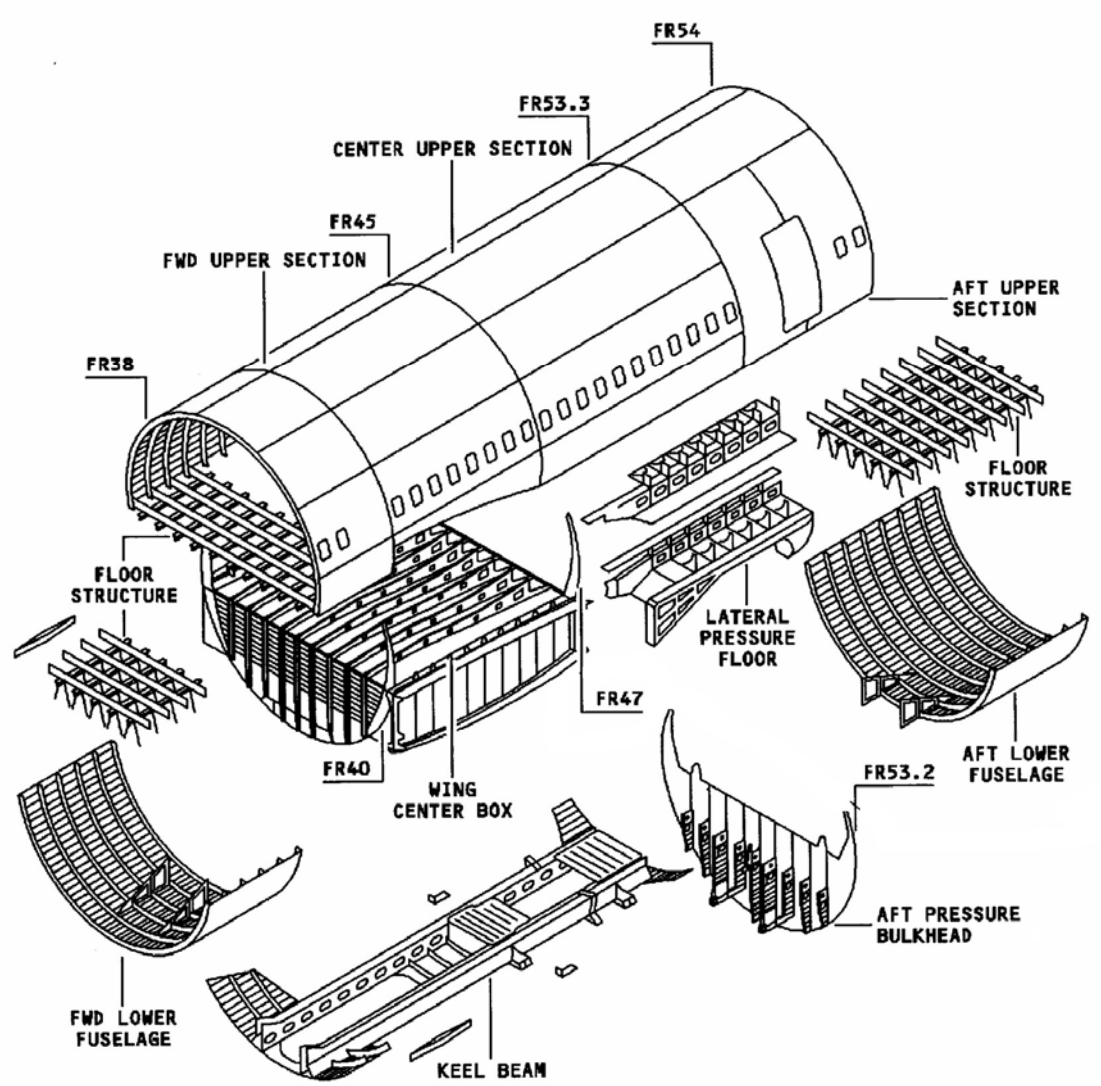

Figure 11 Fuselage Centre Section

BELLY FAIRING

The belly fairing is a permanent extension of the lower fuselage between (FR36/FR37) and FR56. The belly fairing structure extends around the air conditioning compartment and includes the hydraulic services of the aircraft, the wheels of the main landing gear. The extension of the structure around both wing roots completes the wing-to fuselage fairing area. When the landing gear doors are up locked, they complete the belly fairing profile.

The belly fairing structure is made of frames, support struts and skin panels. Rivets attach the frames to the lower structure of the aircraft. Most of the frames are positioned at the same level as the fuselage frames. They are located between FR37.2 and FR55. A keel beam gives the longitudinal structural strength to the lower centre structure of the belly fairing. The skin panels are made of carbon/glass fibre.

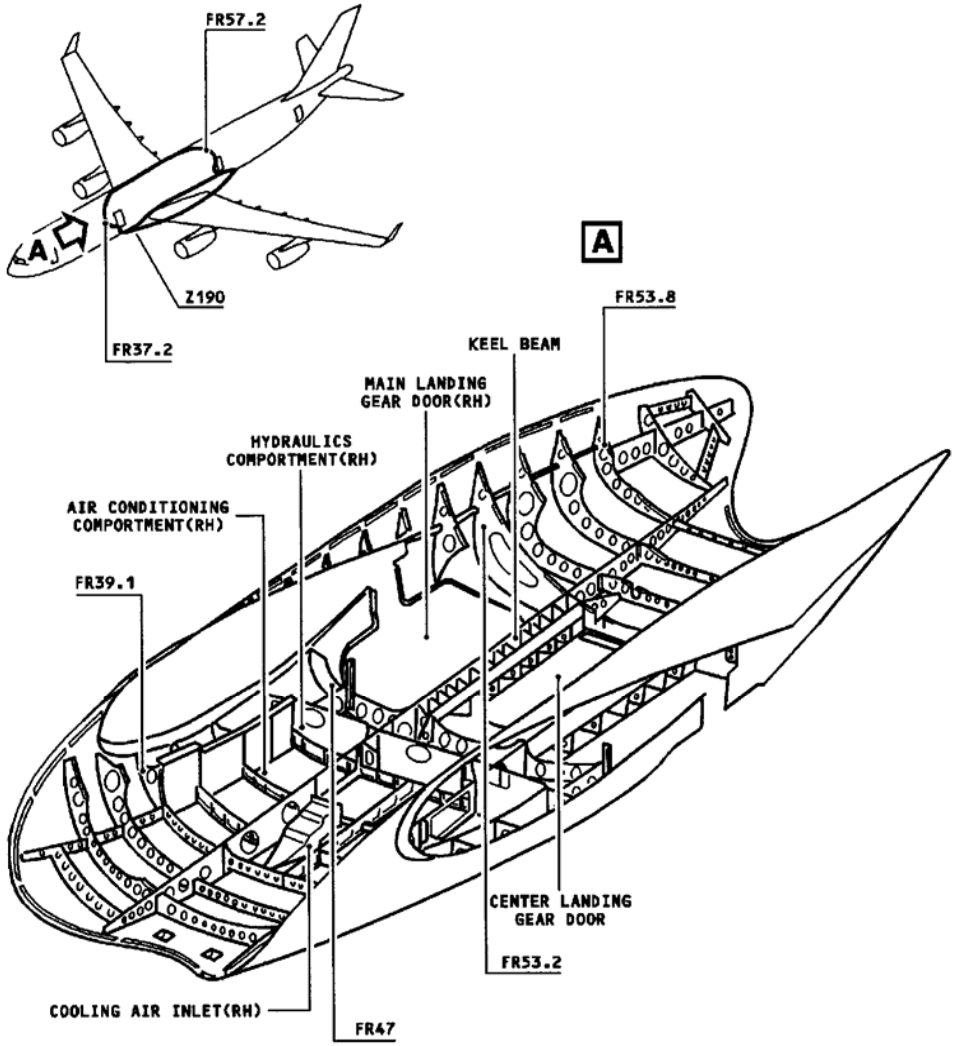

Figure 12 Belly Fairing

REAR FUSELAGE
The rear fuselage extends from FR54 to FR80. The upper part of the assembly contains part of the cabin and the AFT passenger/crew door-cutouts. The lower part of the assembly contains the AFT cargo compartment, the AFTGargo-compartment door-cutout and the BULK cargo-compartment door-cutout. All of the rear fuselage is in the pressurized zone.

MAIN STRUCTURE
The fuselage is made of skin panels which are riveted together. In the fuselage upper section, window frames are installed between stringer 18 and 22 LH and RH. There is a cutout between FR59 and FR65 for the AFT cargo-compartmentdoor, and between FR67 and FR69 for the BULK cargo-compartment door. The main components of the fuselage structure are:
- skin panels,
- frames,
- stringers,
- cabin floor structure,
- floor panels, cargo-compartment floor structure, support struts, drains, cabin window frames.

CABIN FLOOR PANELS
The floor panels are made of honeycomb core, which is bonded betweensheets made of composite materials. A core filler makes the panels at the edges and the screw hole area stronger. The floor panels in the cabin aisle and galley areas have a stronger honeycomb core and one layer of composit materials to make them stronger. Screws or quick-release fasteners attach the panels to the floor structure. The floor panels increase the mechanical strength of the cabin floor structure. In some areas the floor panels are covered with a nonslip surface.

BULK CARGO COMPARTMENT FLOOR PANELS
The floor panels are made of honeycomb core, which is bonded betweensheets made of composite materials. A core filler makes the panels at the edges and the screw hole area stronger. The top of the floor panels is strengthened with aluminium alloy sheet. Screws attach the panels to the floor structure. The floor panels increase the mechanical strength of the floor structure.

CARGO COMPARTMENT FLOOR STRUCTURE
The floor structure of the BULK, FWD and AFT cargo-compartments is made of crossbeams which are attached to the frames. Support struts give the cargo-compartment floor structure its mechanical strength. Roller tracks are attached to the crossbeams.

FIXED PARTITION
The fixed partitions are made of honeycomb core, which is bonded between sheets made of (GFRP). Core filler makes the panels stronger at the edges and the screw hole areas. One door is installed to gain access to the area aft of the BULK cargo compartment. Four decompression panels are installed on the fixed partition. Two decompresion panels are installed on the LH sidewal panels.

DRAINS
Drain valves are installed in the lower fuselage shell. If the cabin pressure is below a given value (the aircraft is near to or on the ground), springs hold the valves open and let the water condensation drain out. The rising cabin pressure closes the drain valves automatically. In other structures (doors, door frame, stringers, brackets and fittings) holes are drilled at the lowest points to make sure that water and condensation drain to the drain valves.

CABIN WINDOW FRAMES
The window frames are made from a drop-forgings which has a T-shaped crosssection. The window frames are riveted to the fuselage skin. A bonded doubler around the window frames ensures the fail safety of the skin. The cabin window frames are installed on both sides of the fuselage. They are installed between the frames and the locations extend the length of the cabin.

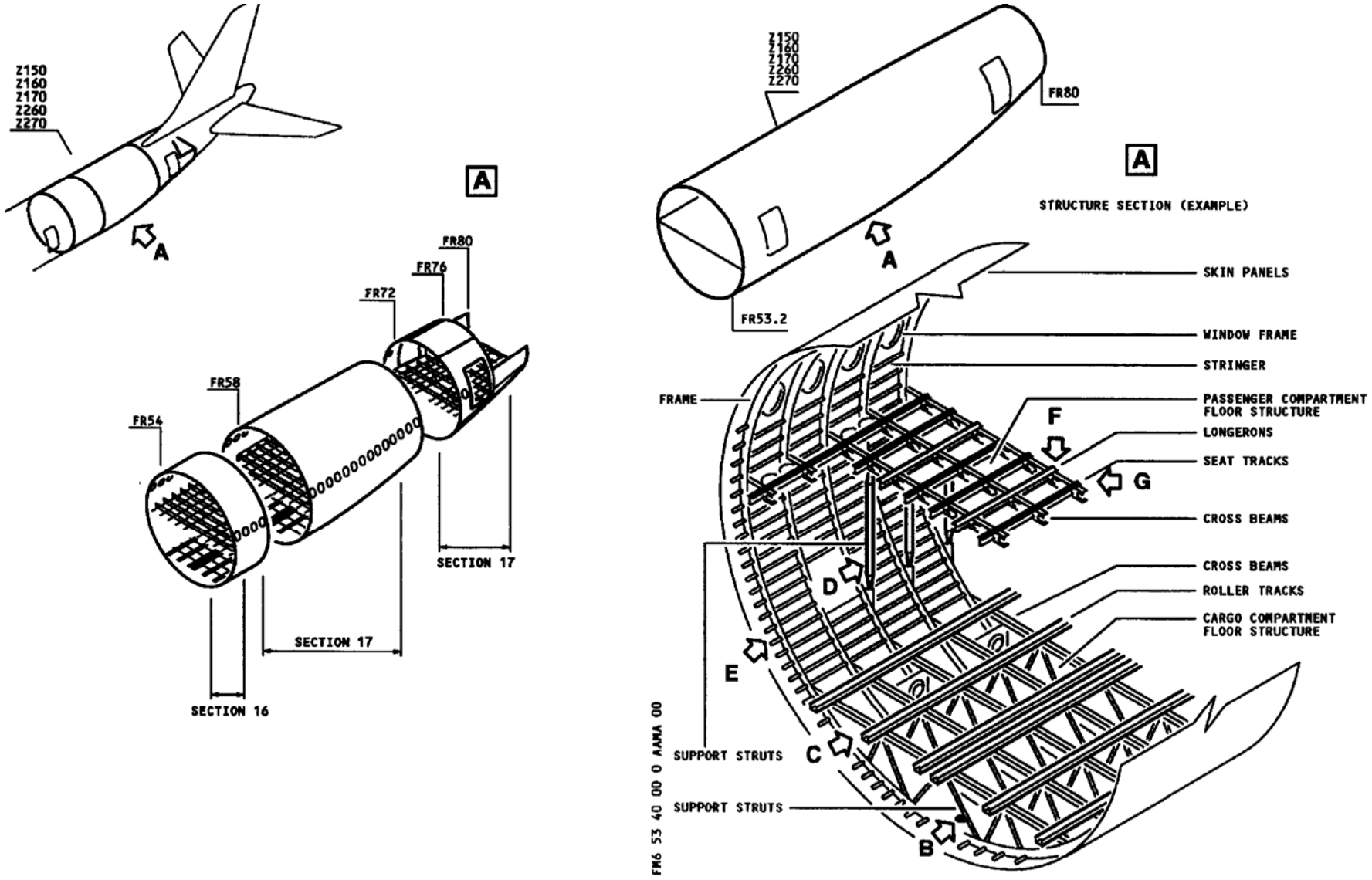

Figure 13 Rear Fuselage

REAR FUSELAGE

The cone/rear fuselage extends from FR80 to FR1 03. The upper skin panels aft of FR76 are also part of the cone/rear fuselage. The rear pressure bulkhead is installed at FR80. The cone/rear fuselage is part of the fuselage which is not pressurized. The tail cone is attached to the cone/rear fuselage at FR91. You can remove the tail cone as a unit. The vertical stabilizer attach-fittings are installed on the top of the assembly, between FR79 and FR87. A ladder and two maintenance access panels are installed on the top between FR83 and FR86 to give you access to the inner (side) of the vertical stabilizer. The horizontal stabilizer is installed between FR87 and FR91. Four tail cone attach fittings are installed at the rear face of FR91. Floor panels (which are used as a platform for maintenance) are installed between FR83 and FR87.

PRIMARY STRUCTURE

Section 19 FR80 to FR103 The fuselage is made of skin panels, stringers and frames which are riveted together. The primary components of the fuselage structure are: - skin panels, - stringers, - frames, - support struts, - rear pressure bulkhead, -fittings.

SUPPORT STRUTS

The support struts and crossbeams are made of aluminium alloy sheet or aluminium alloy extrusions. Support struts, which are attached to the frames, increase the mechanical strength of the assembly. The diagonal support struts at FR91 are adjustable.

REAR PRESSURE BULKHEAD

The rear pressure bulkhead is installed at FR80. It is the diaphragm that divides the pressurized rear fuselage from the cone/rear fuselage which is not pressurized. The rear pressure bulkhead has a centre part and six radial panels with radial stiffeners on the front face. Circumferential stiffeners are installed on the aft face. Titanium doublers are installed to improve damage tolerance. It is attached to the fuselage with a titanium rim angle.

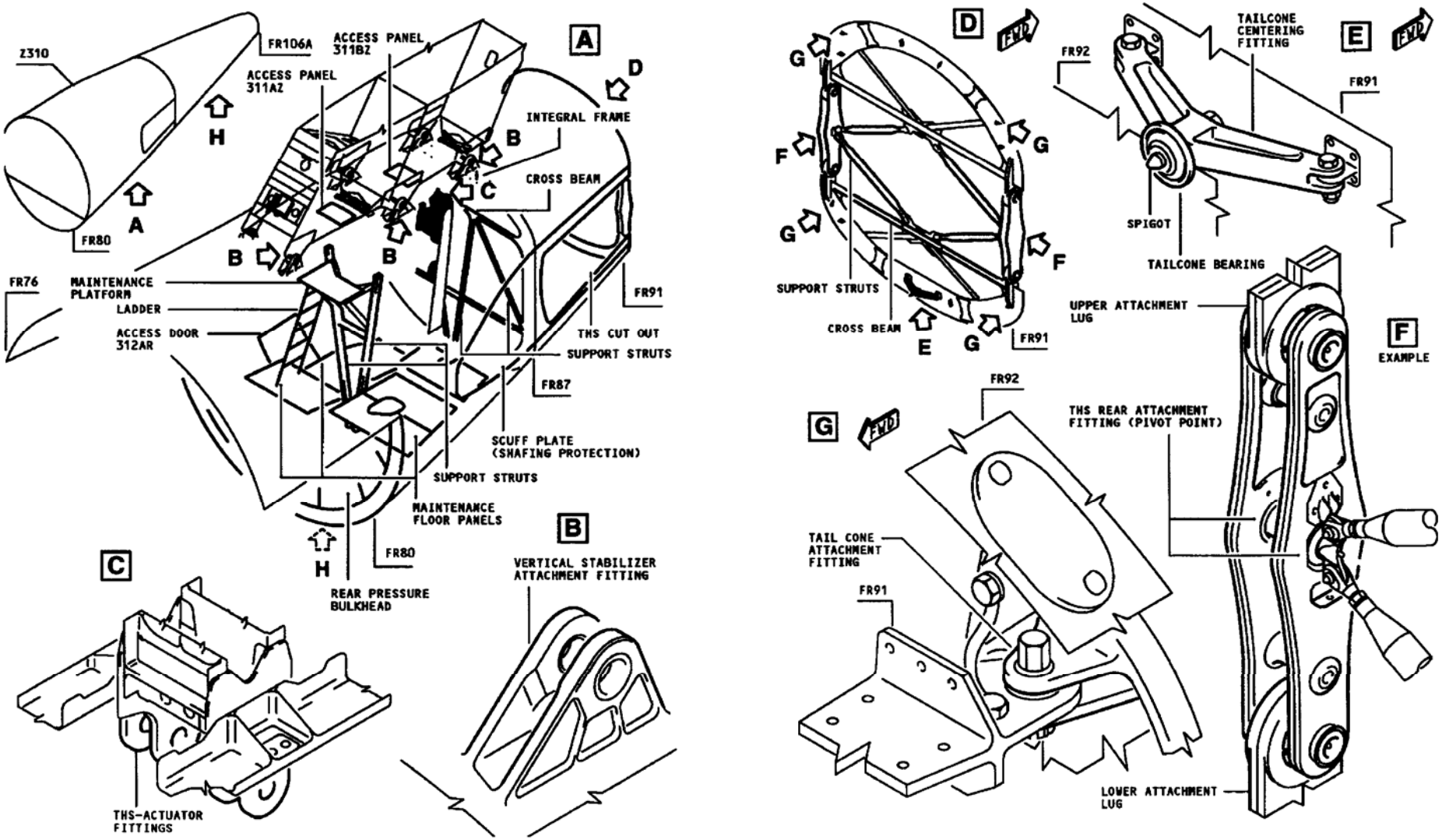

Figure 14 Rear fuselage Components

FUSELAGE CONE

The Auxiliary Power Unit (APU) is installed in the tail cone (APU compartment) between FR95 and FRI 01. The APU air intake is installed between FR92 andFR95. The APU compartment is a specified fire zone. Firewalls, which are made of titanium sheets, are installed on all sides of the APU compartment. Metal stiffeners divide the firewalls from the outer skin of the tail cone, which is made of aluminium alloy. The upper part of the APU compartment has a strong fire prove ceiling and two longerons which increase the mechanical strength of the APU compartment. The APU attach fittings are installed at the two longerons. A decompression panel is installed on the upper left side between FR99 and FR 100 . Maintenance access doors are included in the lower right side of the two subassemblies. The cone/rear fuselage access-door is installed between FR84 and FR85, the APU access doors are installed between FR95 and FRI 01. The rear end of the tail cone, aft of FRI 03, is a fairing for the APU exhaust. The fairing is of a sheet metal construction.

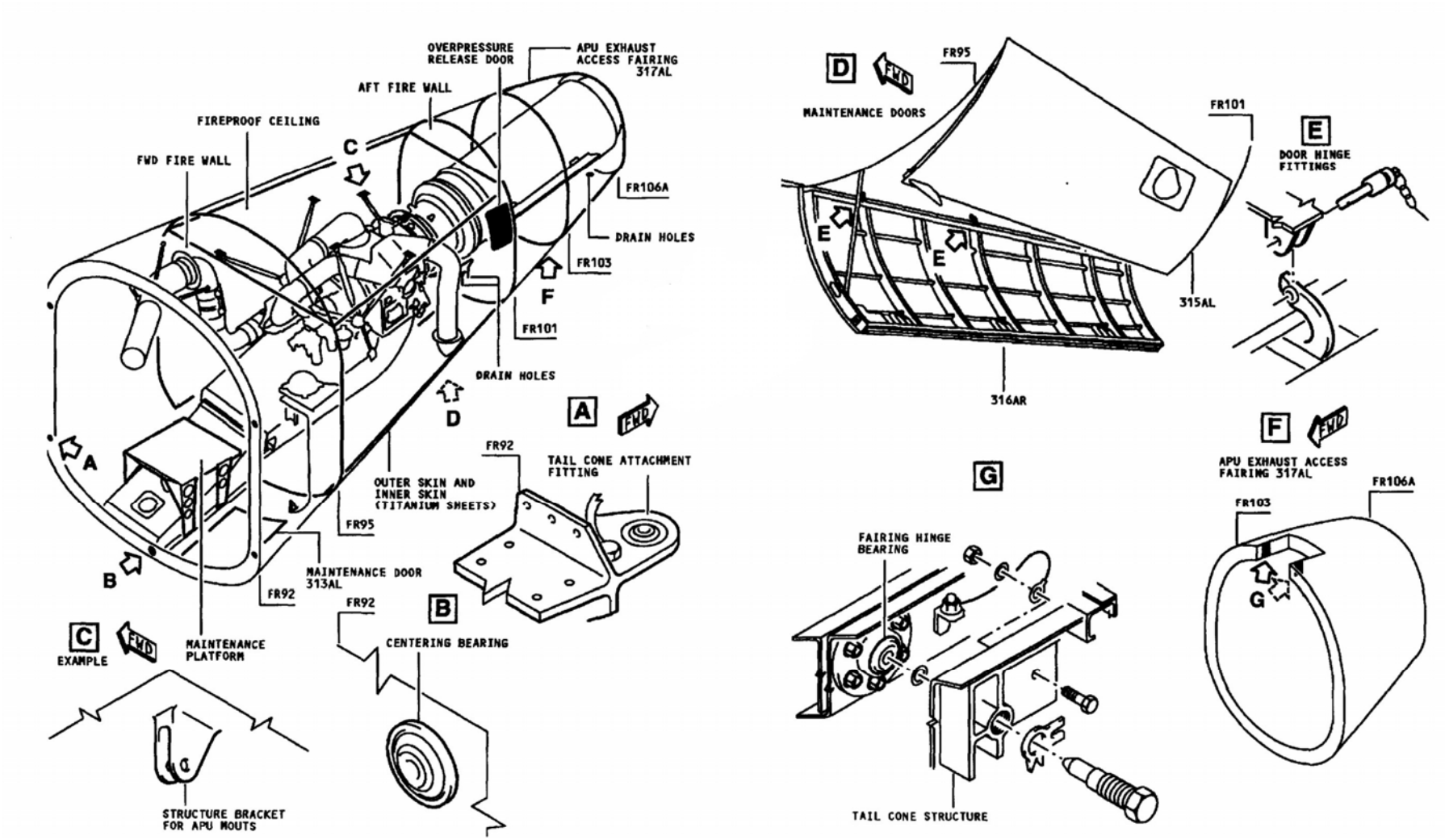

Figure 15 Fuselage

STABILIZERS
ATA 55-00

GENERAL

The tail assembly has a trimmable horizontal stabilizer, two elevator assemblies, a vertical assembly and a rudder assembly.

The primary structural components of the stabilizers (spars, ribs and skin panels) are made of laminations of Carbon Fibre Reinforced Plastic (CFRP). All other components are made of the same material, or Glassfibre Reinforced Plastic (GFRP) or of light alloy. The elevators and the rudder are controlled by three independent hydraulic systems. The horizontal stabilizer and the rudder are trimmable.

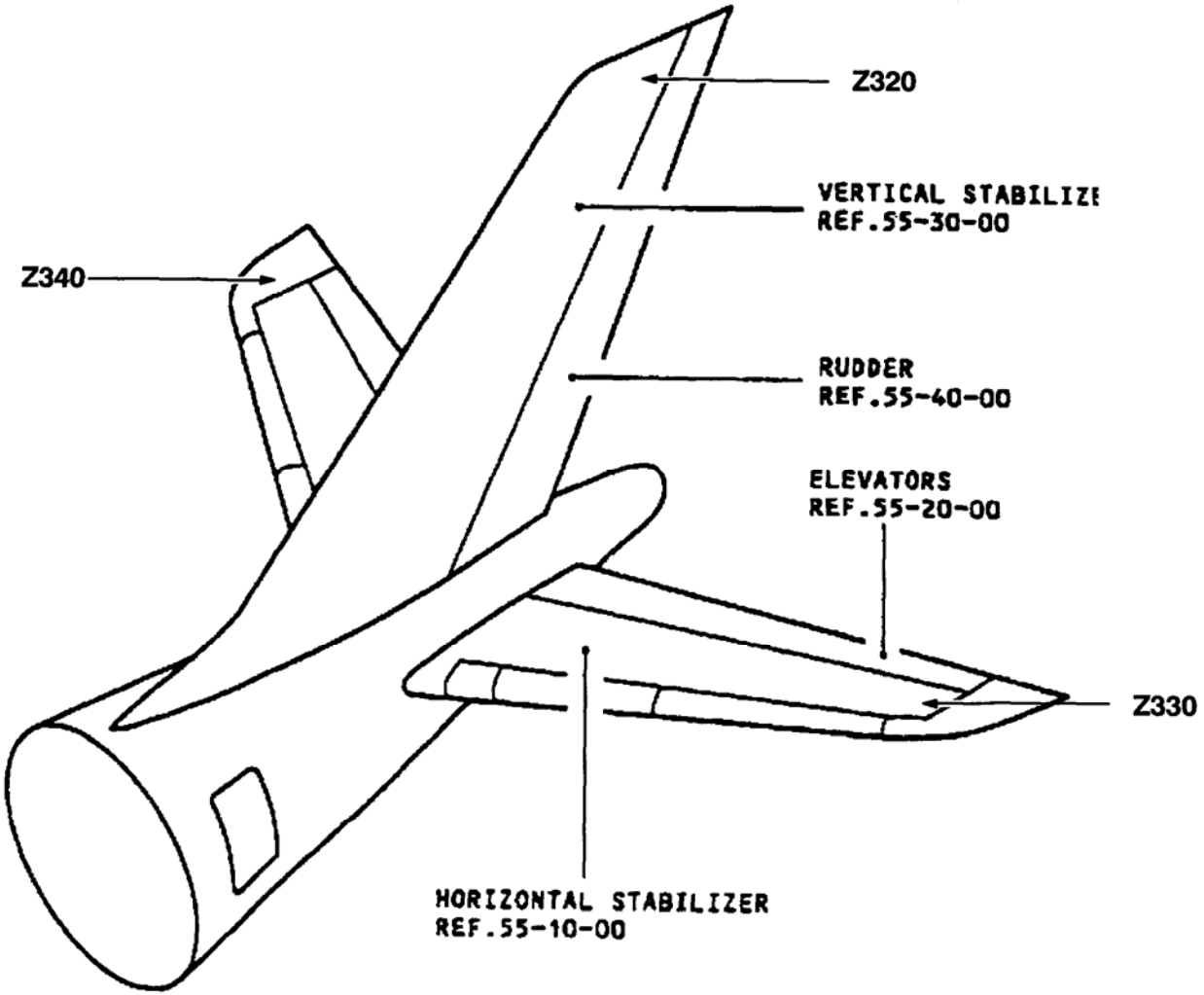

Figure 16 Stabilizers

HORIZONTAL STABILIZER

GENERAL

The trimmable horizontal stabilizer (THS) is a single-piece structure mounted through, and supported by the fuselage tail section. The horizontal stabilizer provides the supporting structure for the LH and the RH elevator.

The angle of incidence of the THS can be mechanically adjusted by means of a trim control wheel located in the flight compartment. Its displacement range is 2.35 degrees aircraft nose down to 15.35 degrees aircraft nose up.

The THS is installed at the tail section in a large cutout, and is attached to the fuselage at three points, by the THS actuator and by the two hinge points on either side of the fuselage.

DESCRIPTION

The THS comprises of a centre spar box, the LH and RH spar boxes, the LH and RH leading edges, the LH and RH trailing edges, the LH and RH stabilizer tips, the LH and RH stabilizer aprons and the stabilizer attach fittings.

The main structural component of the THS is the stabilizer spar box, and allloads on the horizontal stabilizer are transmitted through the centre spar box and its attach fittings.

All other components of the THS are attached to the stabilizer spar boxes, and except for the attach fittings are removable for repair and/or maintenance.

The THS can be removed as a complete unit.

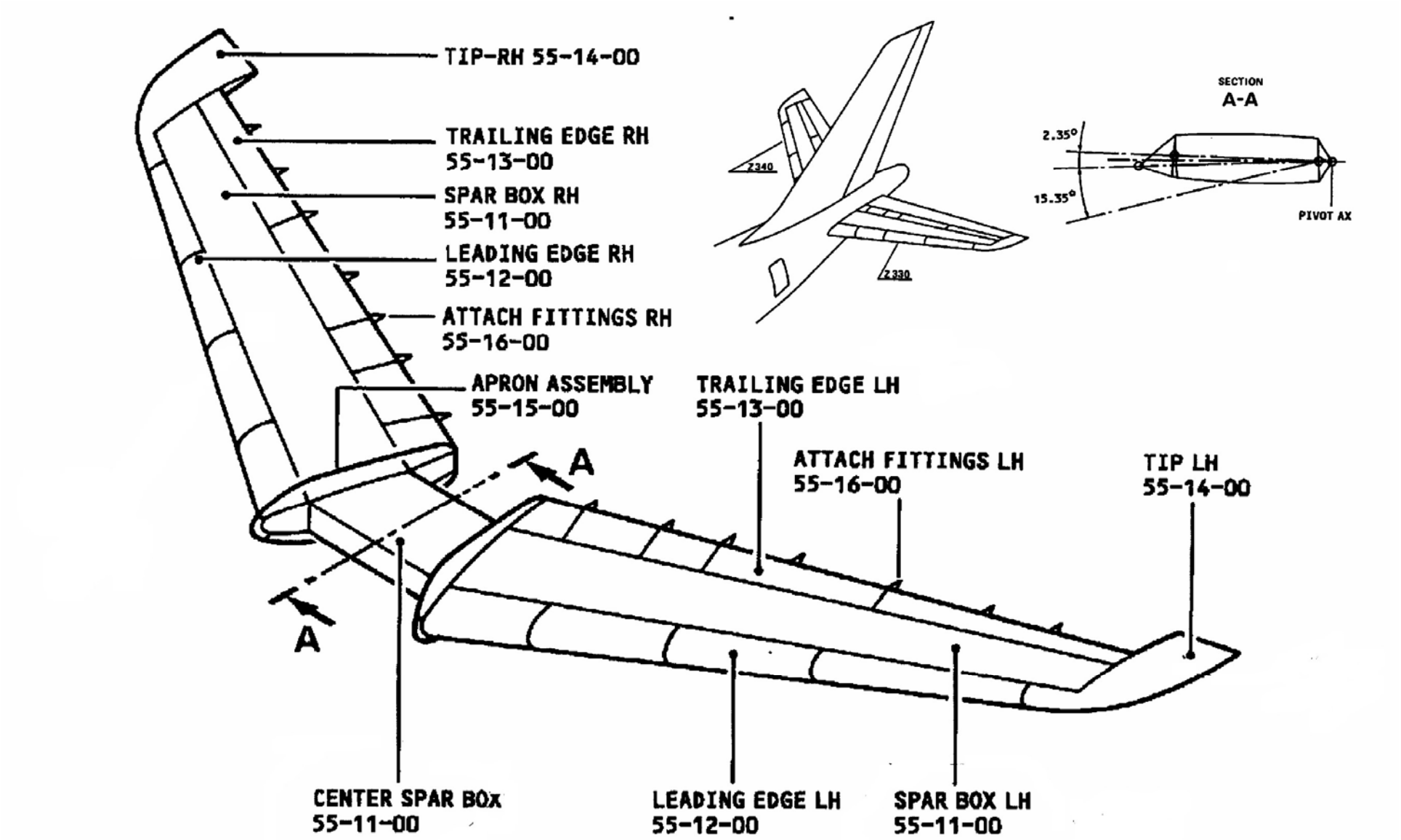

Figure 17 Horizontal Stabilizer

ELEVATORS

The elevators give pitch control to the aircraft. Movement of the elevators is controlled by two servo-control units attached to both the RH and LH elevators.

DESCRIPTION

The left-hand and the right-hand elevators are similar in designand function but are opposite hand. The structure of each elevator has a front spar, an upper and lower skin panel and 11 ribs. all other components are attached to it. Seven hinge fittings attach the elevator to the hinge arms of the THS. Two fittings attach the servo-control units. All leading edge access panels and the inboard end caps are removable. Three hoist points and two static dischargers complete the construction of the elevator.

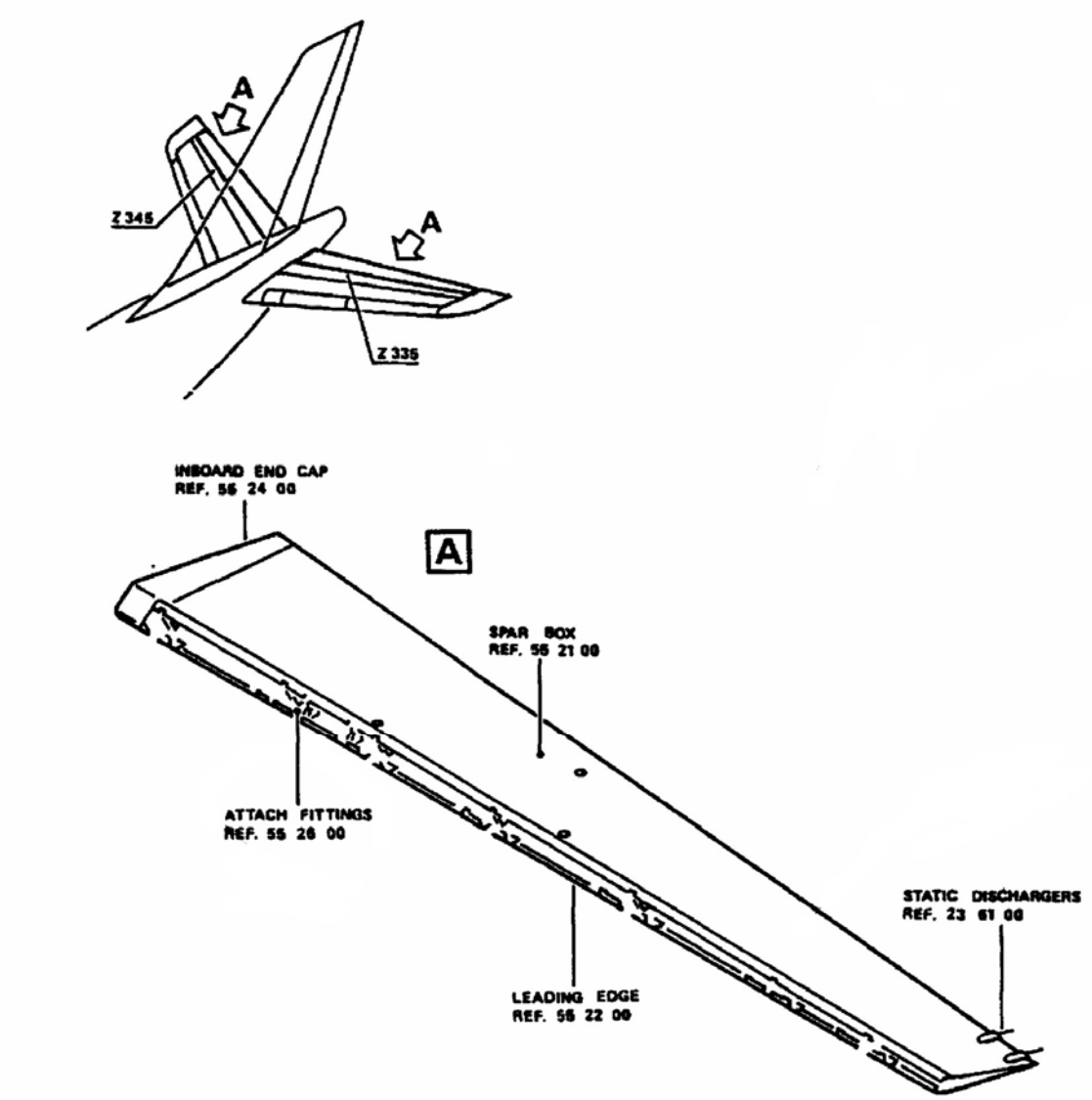

Figure 18 Elevator

HORIZONTAL STABILIZER SPAR BOX

The horizontal stabilizer spar box is the primary structural component of the horizontal stabilizer. All other components of the horizontal stabilizer are attached to it. The complete spar box assembly is made up of the left hand (LH) and right hand (RH) spar boxes and centre spar box. These three components make a single unit which cannot be separated. The LH and the RH spar boxes are made of Carbon Fibre Reinforced Plastic (CFRP). The centre box is made of aluminium machined parts.

LEFT-and RIGHT SPAR BOXES

The primary components of the LH and RH spar boxes are a front spar, a rear spar, 19 ribs (Rib 3 thru Rib 21) and an upper and lower skin shell. Hi-Lok fasteners attach them. Intergrated stringers make the skin shells stronger. Each front spar has four leading edge ribs and five access panels included in the construction. Each rear spar has seven hinge arms and a diagonal strut to hold the elevators, two fittings for the attachment of the elevator servo control actuators and a fitting for the attachment of the elevator position transducer. The rear spars also have the LH and RH aft attach fittings for the installation of the horizon tal stabilizer. The LH and RH spar boxes each have four hoisting points on the upper surface. Each hoisting point has a hoisting plug which is installed in the spar box structure, the hoisting points make a smooth surface with the stabilizer. The LH and RH spar boxes each have two resting points on the lower surface located adjacent to Ribs 7 and 11. Each resting point has a plug which is installed in the spar box structure. The LH and RH spar boxes each have four levelling points on the lower surface adjacent to Ribs 6 and 16. The centre box joins the LH and RH spar boxes to make one unit. It has the forward attach fittings of the horizontal stabilizer. The attach fittings attach the horizontal stabilizer to the trim actuator.

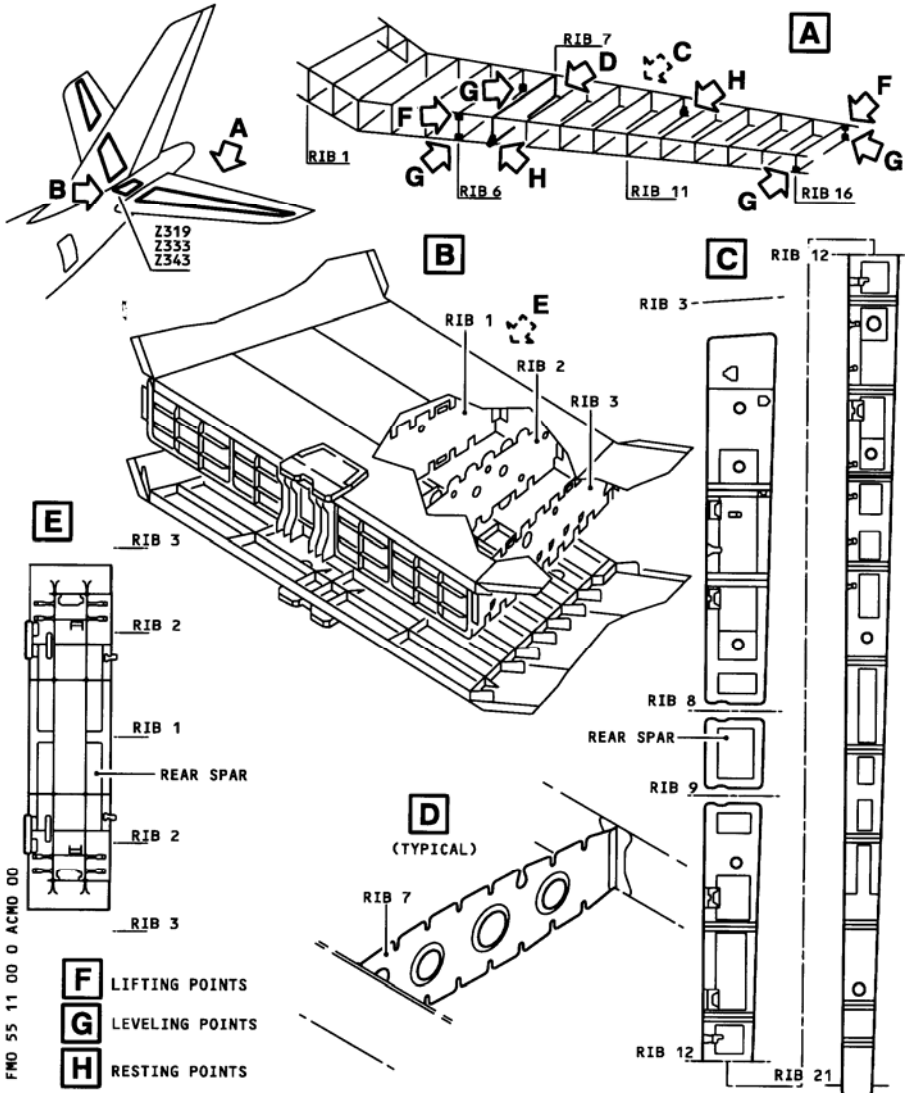

Figure 19 Horizontal Stabilizer Spar Box

HORIZONTAL STABILIZER LEADING EDGES

The leading edge of the trimmable horizontal stabilizer (THS) is in zones 331 (LH) and 341 (131-1). The leading edge is comprised of four removable sections and a leading edge tip supported by ribs. It forms an areodynamic shape to the front of the THS.

The leading edge assembly (left hand and right hand) has; - Five leading edge ribs. -One outboard leading edge section. - One centre leading edge section. - Two inboard leading edge sections. The ribs are made of laminations of Carbon Fibre Reinforced Plastic (CFRP). They are attached to the spar box and the front spar with screws. Each rib has anchor nuts for the installation of the leading-edge sections. The leading edge sections have stainless steel plates bonded to the front part for protection against erosion.

HORIZONTAL STABILIZER TRAILING EDGES

The trailing edge of the trimmable horizontal stabilizer (THS) is in zones 334(LH) and 344(RH). The trailing edge is comprised of removable access panels and panel assemblies supported by ribs and hinge arms. It forms an aerodynamic surface between the stabilizer spar box and the elevators.

On each side of the THS the trailing edge has: -6 ribs -7 hinge arm supports -5 panel assemblies on the upper surface -7 access panels on the lower surface The ribs and hinge arm supports are attached to the THS rear spar and upper and lower skins of the spar box by Hi-Lock fasteners. The ribs and hinge arm supports have anchor nuts for installation of the panel assemblies and access panels. The panel assemblies 334 (3 44) AT, 334 (344) CT are installed on the trailing edge ribs, hinge arm supports and the rear edge of the upper skin with countersunk screws. The remainder of the panel assemblies are attached with rivets.

The panels are constructed from Carbon-Fibre Reinforced Plastic (CFRP) on a honeycomb core. The access panels are installed on the trailing edge ribs, hinge arm supports and the rear edge of the lower skin with countersunk screws.

The panels are constructed from CFRP on a honeycomb core. The access panels are hinged to the rear edge of the lower skin. The panel assemblies and
access panels are fitted with a rubber sealing strip along the trailing edges to prevent the ingress of contaminants. The panel assembly 334DT (LH) and 344DT (RH) have a fitting for the installation of a logo light. The trailing edge panel assembly 334CT (LH) and 344CT (RH) and access panel 334CB (LH) and 344CB (RH) have a bronze mesh bonded to the external surface to provide a Faraday screen around the servo-actuators. A cover of glass fibre completes the outer surface of these panels.

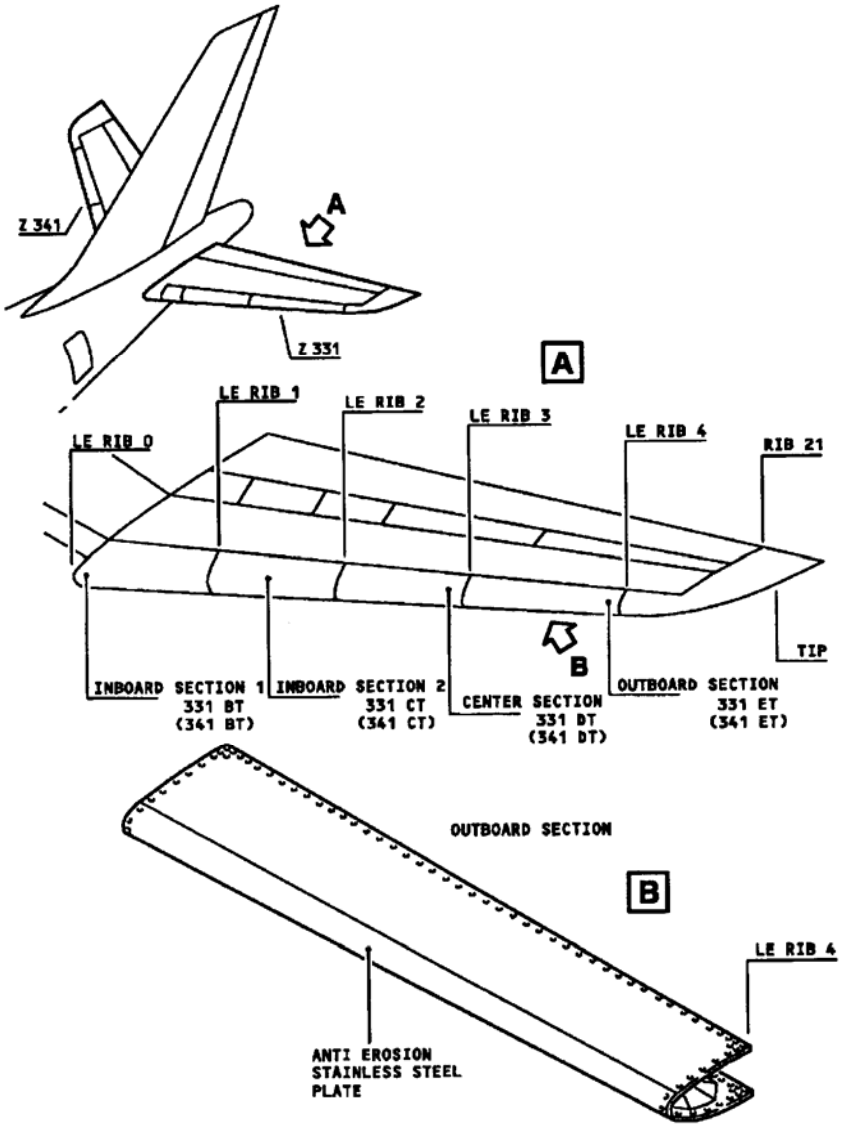

Figure 20 THS Leading Edges, Trailing Edges

HORIZONTAL STABILIZER TIPS

The tips of the trimmable horizontal stabilizer (THS) are the left-hand (LH) and right-hand (RH) outer fairings. The tips complete the aerodynamic shape of the THS leading edge.

The THS tips are made of light alloy reinforced with light alloy ribs for added strength. Attachment points for the tips are at the upper and lower skins of the spar box, leading edge rib 4 and the extremities of the front and rear spar. Countersunk screws, bolts and screws attach them to these components.

Four static dischargers are fitted to each tip.

HORIZONTAL STABILIZER APRON

The horizontal stablizer aprons form an areodynamic seal the horizontal stabilizer and the fuselage. Each apron consists of three sections; an upper, a lower and a forward section. The sections are attached to the apron support fittings by screws.

The aprons are constructed from carbon-fibre reinforced plastic (CFRP). To minimize friction between the aprons and the fuselage, the contact edge of each apron is edged with a segmented lip of polytetrafluorethylene (PTFE) which is attached to the apron by rivets.

The aprons are flexible and are sprung against the fuselage, during movement of the horizontal stabilizer the aprons maintain contact with the fuselage to ensure a smooth airflow.

The apron support fittings are made of aluminium alloy and are removable in the area of the spar box.

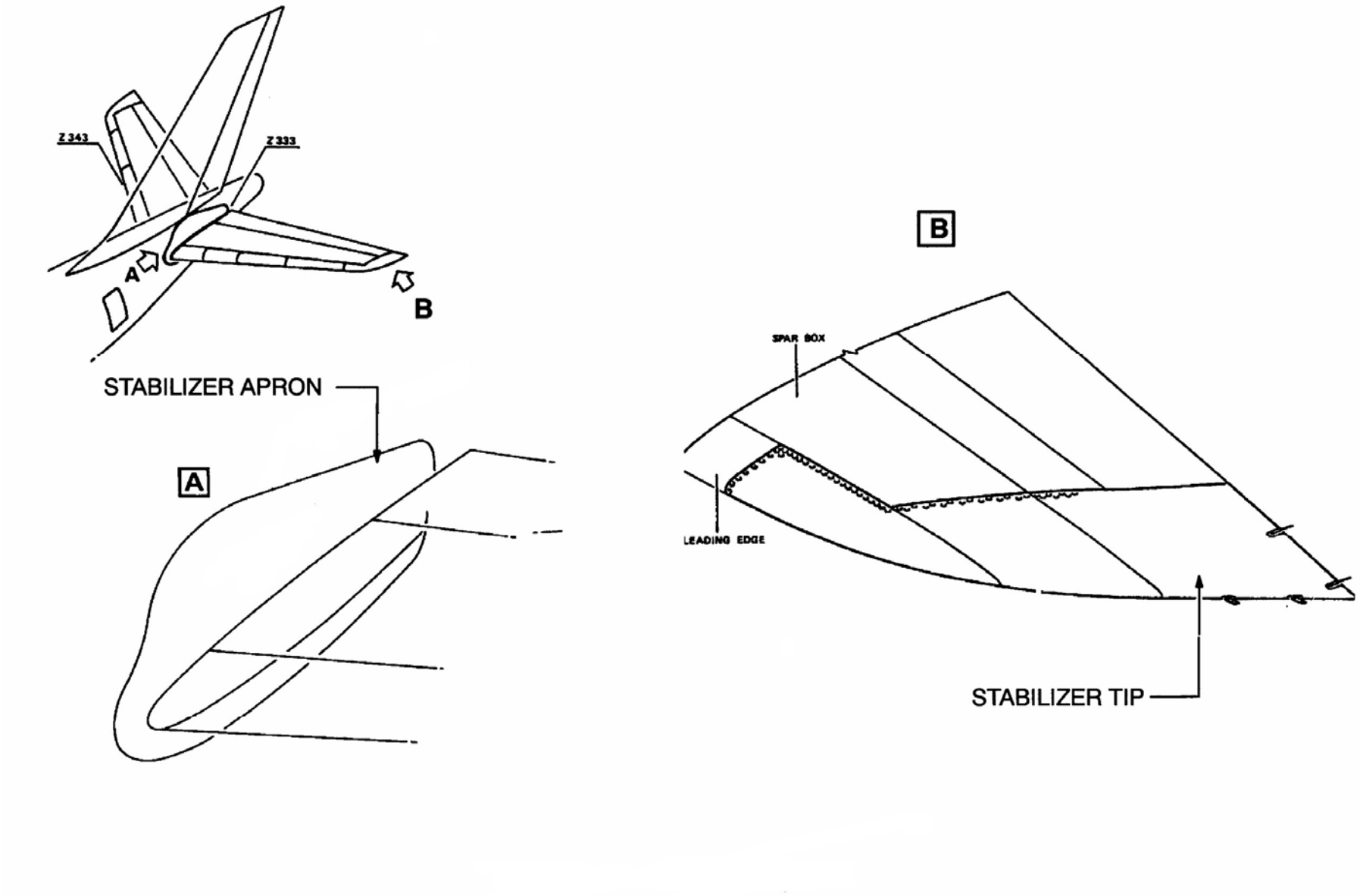

Figure 21 THS Tip, Apron

HORIZONTAL STABILIZER ATTACHMENT FITTINGS

Various fittings are installed on the spar box of the THS for the attachment of the THS to the fuselage, THS servo-control actuator units and the elevators. These are:

- fittings for the attachment of the THS centre spar box to pivot position in the fuselage tail section,
- fittings for the attachment of the horizontal stabilizer to the THS hydro mechanical actuator,
- hinge arms for the attachment of the elevators,
- fittings for the attachment of the elevator support struts,
- fittings for the attachment of the elevator servo-control actuator units,
- fittings to hoist and to support the THS on removal.

THS ATTACHMENT FITTINGS

The THS is attached to the cone rear fuselage structure at two pivot points. The pivot points have attach fittings and support fittings. They are installed on each side of the THS centreline at RIB 3. The upper and lower attach fittings are made of Carbon Fibre Reinforced Plastic (CFRP). Rivets attach them to RIB 3 and to the skin of the spar boxes. They have eye ends for the attachment of the support fittings. The support fittings are made of CFRP and bolts attach them to the eye-ends of the attach fittings. Rivets attach the flanges of the support fittings to the rear spar of the THS. Bearings are fitted in the pivot points of the support fittings. Y-load fittings are installed on RIB 4 of the THS. These keep the primary attach bolts in the correct alignment axis.

THS HINGE ARMS

The LH and the RH spar boxes have 7 hinge arms to hold the elevators. The hinge arms are installed to the rear spars and the upper and lower skin shells. Each hinge arm has a fitting with a bearing at its outer end to attach the elevators. The elevator hinge arms are made of CFRP.

ELEVATOR SUPPORT STRUT

A fitting for the installation of the elevator support strut is installed on the LH and the RH of the rear spar. The attach fittings are made of machined plate.

ELEVATOR SERVOCONTROL ATTACHMENT FITTINGS

Elevator Servo control Attachment Fittings. Fittings for the attachment of the elevator servo controls are installed on the rear spar. The fittings are made of CFRP.

HOISTING AND RESTING POINTS

Hoisting and Resting Points. Hoisting and resting points are installed on the THS to assist in maintenance. The fittings of the hoisting points are installed on the upper surface. The fittings of the resting points are installed on the lower surface.

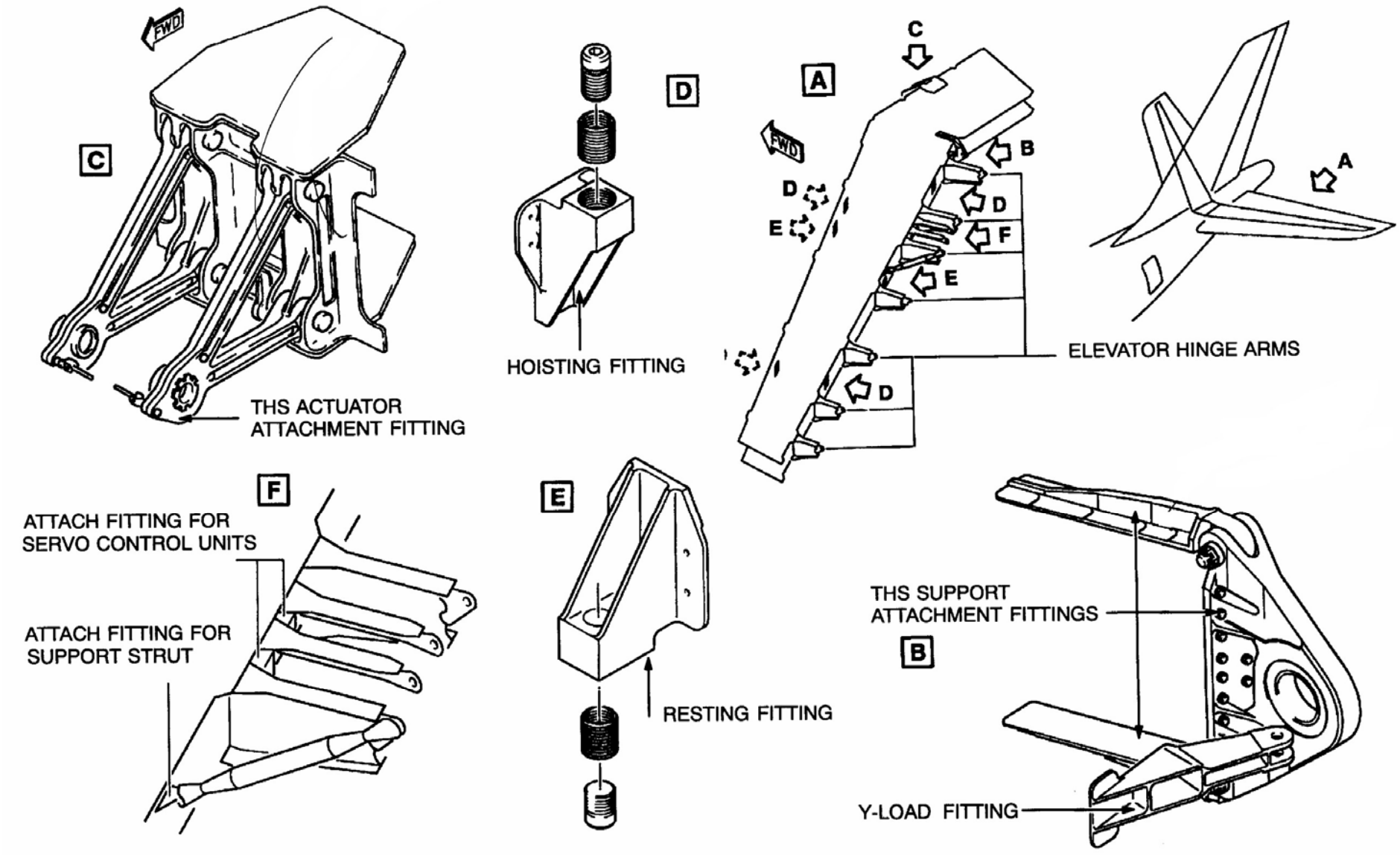

Figure 22 THS Attach Fittings

VERTICAL STABILIZER AND RUDDER

VERTICAL STABILIZER

The vertical stabilizer is attached to the top of the rear fuselage. Its structure has attach fittings for the rudder , and the three servo control units which operate the rudder. The High Frequency (HF) antenna and the Very high frequency Omnibearing Range (VOR) antenna are attached to the vertical stabilizer. You can remove the vertical stabilizer as one unit.

The main components of the vertical stabilizer are:
- the spar box,
- the leading edge,
- the trailing edge,
- the tip,

The main components of the vertical stabilizer are made of Carbon Fibre Reinforced Plastic (CFRP). The main attach fittings and the transverse load fittings attach the vertical stabilizer to the rear fuselage.You can remove the leading edge, the trailing edge panels and the tip independently.
A lightning conductor is installed to the tip of the vertical stabilizer.

The spar box is the primary structural component of the vertical stabilizer. It is the part of the vertical stabilizer which is attached to the fuselage. All the other components of the vertical stabilizer are attached to the spar box.

The vertical stabilizer-leading edge has three sections that you can remove.
They are attached to the front of the spar box. The lower section gives you access to the High Frequency (HF) antenna.

The trailing edge is attached to the rear of the vertical stabilizer. It has a basic framework and fifteen access panels. The panels give you access to the rudder hydraulics, the servo controls, the control rods and the hinge fittings.

The tip is the upper fairing of the vertical stabilizer. It is attached to the top of the spar box and to the front spar. The lightning conductor for the vertical stabilizer is installed to the tip.

The rudder is one of the primary controls of the aircraft. Seven hinge arms attach it to the rear of the vertical stabilizer. The rudder is a one piece unit which you can remove.

The main components of the rudder are:
- the rudder main structure,
- the rudder leading edge,
- the rudder tip,
- the rudder attach fittings.

The main components of the rudder are made of resin-fibre composite (which is bonded to a honeycomb core) and aluminium alloy.
The rudder main structure is the primary structural component of the rudder. All the other components of the rudder are attached to the rudder main structure.
The rudder leading edge has sections and access panels which you Gan remove to give you access to thehinge fittings.

The top fairing of the rudder is the rudder tip. The lightning conductor of the rudder is part of the rudder tip. Four static dischargers are installed to the upper part of the rudder trailing edge. They let static electricity discharge from theaircraft. The rudder has a maximum travel range of 30 degrees to each side.

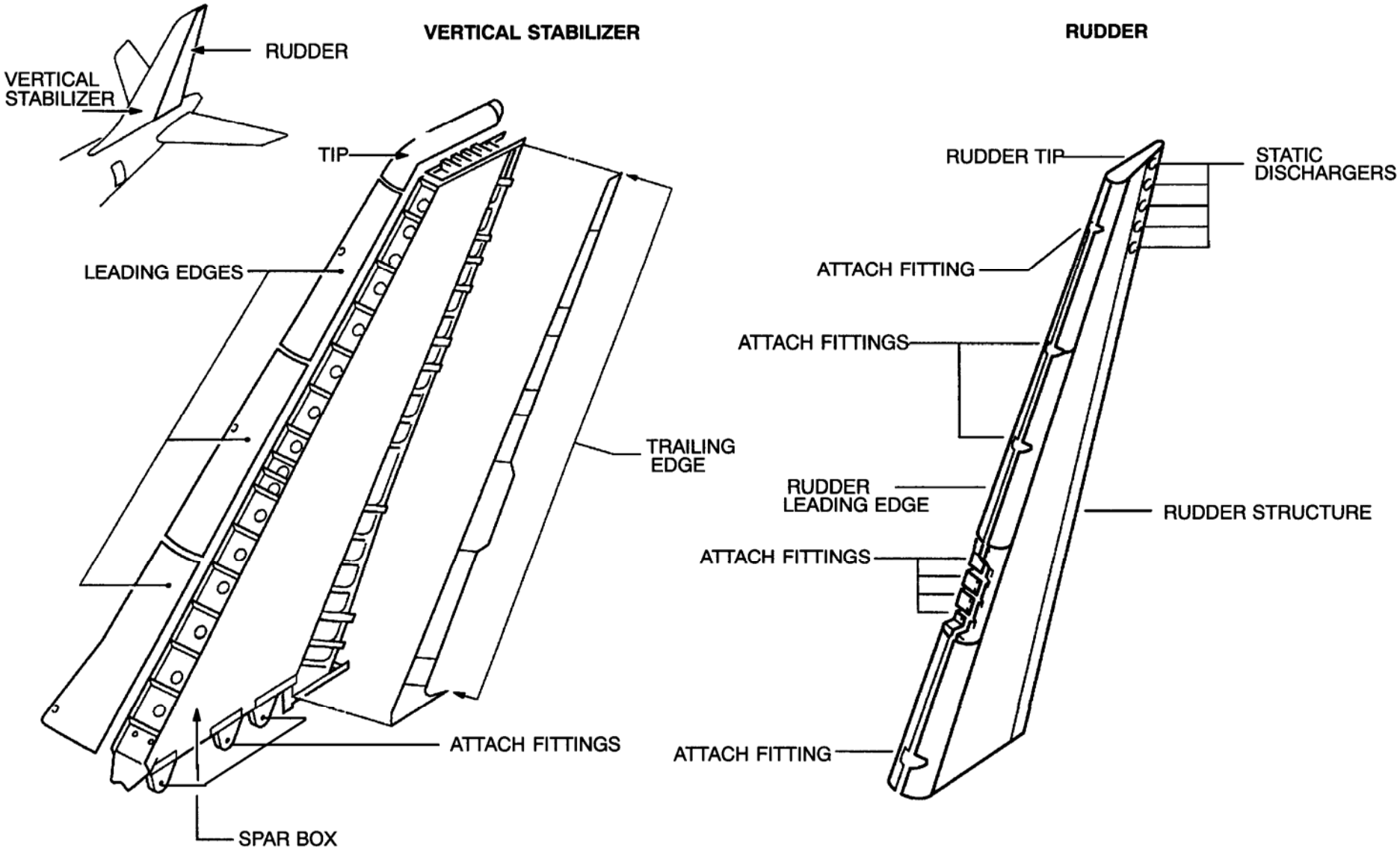

Figure 23 Vertical Stabilizer / Rudder

VERTICAL STABILIZER
The vertical stabilizer is attached to the top of the rear fuselage. Its structure has attach fittings for the rudder, and the three servo control units which operate the rudder. The High Frequency (HF) antenna and the Very high frequency Omni bearing Range (VOR) antenna are attached to the vertical stabilizer. You The main components of the vertical stabilizer are made of Carbon Fibre Reinforced Plastic (CFRP). The main attach fittings and the transverse load fittings attach the vertical stabilizer to the rear fuselage. You can remove the leading edge, the trailing edge panels and the tip independently can remove the vertical stabilizer as one unit.

The main components of the vertical stabilizer are:
- the spar box,
- the leading edge,
- the trailing edge,
- the tip,
- the attach fittings.

SPAR BOX
The spar box is the primary structural component of the vertical stabilizer. It is the part of the vertical stabilizer which is attached to the fuselage. All the other components of the vertical stabilizer are attached to the spar box.
The main components of the spar box are: - the front spar, - the centre spar, - the rear spar, - the ribs, - the skin panels. These main components are made of Carbon Fibre Reinforced Plastic (CFRP), with intergrated stiffeners in a monolith design.

LEADING EDGE
The vertical stabilizer-leading edge has three sections that you can remove. They are attached to the front of the spar box. The lower section gives you access to the High Frequency (HF) antenna. The three sections give an aerodynamic shape to the front of the vertical stabilizer.
The three sections are made of Glass Fibre Reinforced Plastic (GFRP), which are bonded to a honeycomb core. All of the leading edge sections have hoisting points.

TRAILING EDGE
The trailing edge is attached to the rear of the vertical stabilizer. It has a basic framework and fifteen access panels. The panels give you access to the rudder hydraulics, the servo controls, the control rods and the hinge fittings.

TIP
The tip is the upper fairing of the vertical stabilizer. It is attached with screws to the top of the spar box and to the front spar.
The tip is made of Glass Fibre Reinforced Plastic (GFRP), which is bonded to a honeycomb core. An aluminium alloy strip is bonded to the top of the tip. This is the lightning conductor for the vertical stabilizer. Two retainers, for the installation of static dischargers, are attached to the lightning conductor. The tip has two hoisting points.

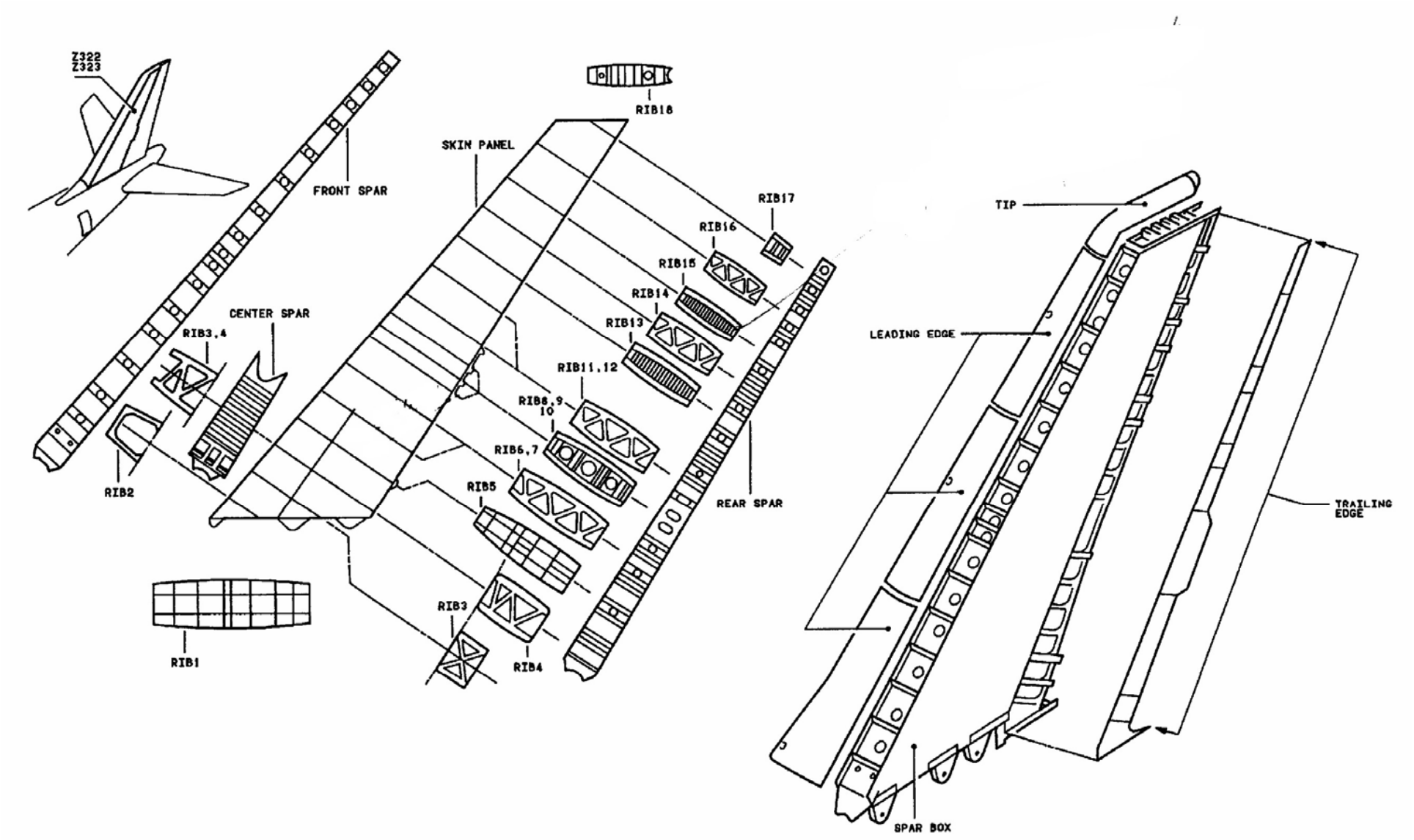

Figure 24 Vertical Stabilizer Structures

ATTACH FITTINGS

The vertical stabilizer has:
- main attach fittings and transverse load fittings, which attach the vertical stabilizer to the rear fuselage.
- hinge attach fittings, which attach the hinge arms and the rudder servo controls to the rear spar
- an attach fitting for a support strut between the rear spar and hinge arm No.4

MAIN ATTACHMENT FITTINGS

Three pairs of main attach fittings and three transverse load fittings attach the vertical stabilizer to the fuselage. Seven hinge attach fittings are installed at the rear spar. They attach the hinge arms and the rudder servo controls to the vertical stabilizer. The support strut fitting attaches a rudder support strut to the rear spar.

The vertical stabilizer has six main attach fittings. They are made of Carbon Fibre Reinforced Plastic (CFRP) and are bonded to the lower end of the skin panels. The fittings are installed in pairs at the front, the centre and the rear spar. Bolts attach them to the related fittings on the fuselage.

TRANSVERSE LOAD FITTINGS

The three transverse load fittings are made of CFRP. They are bonded to the lower end of the front, the centre and the rear spar. The transverse load fittings transmit the transverse loads of the vertical stabilizer to the fuselage. Two attach arms are connected to each transverse load fitting and to the related fittings on the fuselage.

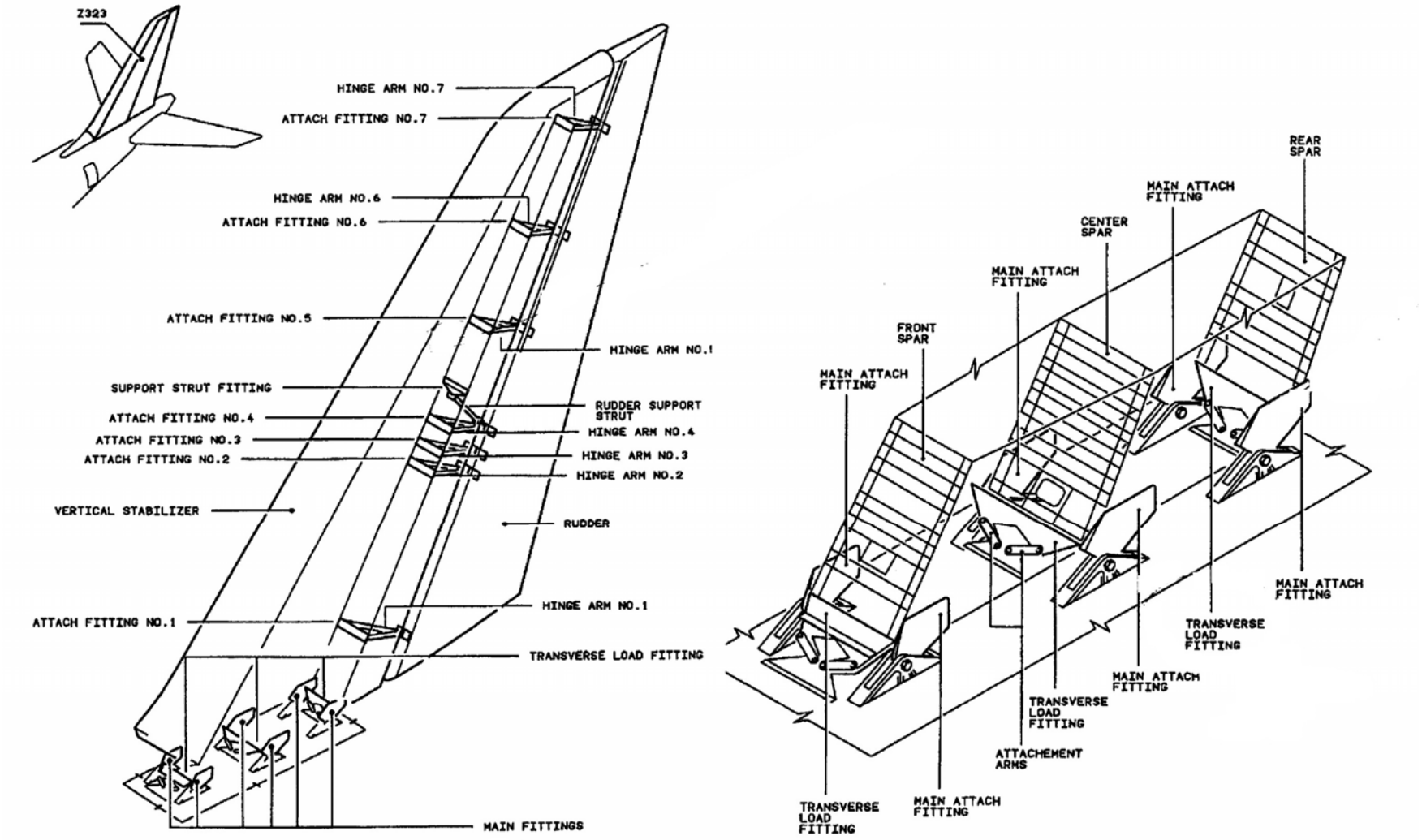

Figure 25 Vertical Stabilizer Main Attach Fittings

HINGE ATTACHMENT FITTINGS

The vertical stabilizer has seven hinge attach fittings. They are solid-resin components. Bolts attach them to the rear spar, adjacent to the ribs. The location of the hinge fittings are:
- Hinge No. 1 at RIB5
- Hinge No. 2 at RIB8 (with rudder servo control)
- Hinge No. 3 at RIB9 (with rudder servo control)
- Hinge No. 4 at RIB10 (with rudder servo control)
- Hinge No. 5 at RIB13
- Hinge No. 6 at RIB15
- Hinge No. 7 at RIB1 7

Each hinge arm has three self-aligning bearings. Bolts attach them to the hinge arm fittings and the hinge points of the rudder. The hinge arms 1,5,6 and 7 are made of two aluminium alloy U-sections. Rivets attach them together to make an H-section. The hinge arms 2,3 and 4 are made of tubular steel and have steel bearing housings. A bracket and a support strut are attached to the hinge arms 2 and 3. The support struts are attached to their related fittings on the trailing edge panel 325 DL.

A support strut fitting which is made of aluminium alloy, is attached to the rear spar at Rl B1 1. A support strut is installed between this fitting and its related fitting at the hinge arm No.4. The support strut keeps the vertical alignment of the rudder.

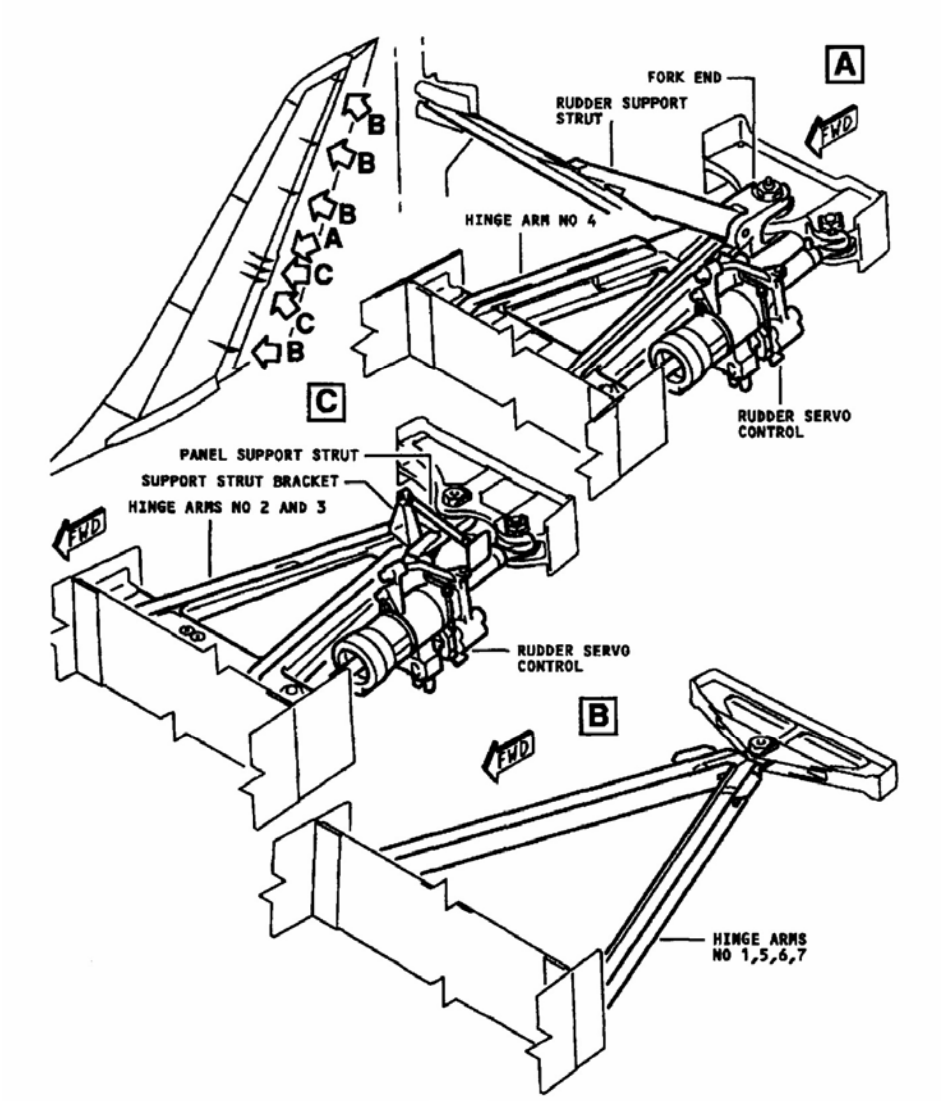

Figure 26 Hinge Attachment Fittings

WINGS
ATA 57-00

WINGS GENERAL

The aircraft wing is a continuous structure which goes through the fuselage between Frames 40 and 47. It is made in three parts: - the centre wing (Zone 140) - the left outer wing (Zone 500) - the right outer wing (Zone 600). The centre wing is part of the fuselage and gives attachment points for the outer wings. Each outer wing has leading and trailing edges and a wing tip. The leading edge has attachments for the slats and the trailing edge has attachments for the main landing gear, flaps, spoilers and ailerons. A winglet is installed on the wingtip. Raceways contain some electrical cables in the leading and trailing edges. The raceways (which are U-sections made from aluminium alloy with a nylon coating) attach to mounting brackets which are also made from aluminium alloy. The mounting brackets are installed on the forward face of the front spar and the aft face of the rear spar.

The main components of the wing are: - the centre wing (Ref 57-10-00)
- the outer wing (wing box) (Ref 57-20-00) - the wing tip (Ref 57-30-00)
- the leading edge and leading edge devices (Ref 57-40-00)
- the trailing edge and trailing edge devices (Ref 57-50-00)
- the ailerons (Ref 57-60-00) - the spoilers (Ref 57-70-00).

CENTRE WING SECTION

The centre wing is installed in the centre fuselage between Frames 40 and 47 and includes: the front, centre and rear spars (at Frames 40, 42 and 47 respectively) the upper and lower skin-panels the two main frames (Frames 40 and 47) a set of 54 integral carbon-fibre rods the left Rib 1 and the right Rib 1. The centre wing has attachments for the left and the right outer wings at the left Rib 1 and the right Rib 1. On some aircraft the centre wing-box is also an integral fuel tank.

OUTER WING

Each outer wing includes: - the outer wing (wing box) - the wing tip - the leading edge and leading edge devices - the trailing edge and trailing edge devices.

WING BOX

The main structure of each outer wing is the wing box which tapers from the wing root to the wing tip. Its front and rear spars extend from STAO/R1131 to STA2557/RIB39 and are made in three parts. The front spar has joints at STA822/RIB12 and STA1798/RIB27 and the rear spar has joints at STA568/111139 and STA1798/1111327. The centre spar extends from STAO/RIB 1 to STA757/131 1311 and is made as one part.

The wing box has 39 ribs. Although the ribs are continuous between spars, the Ribs 2 thru 11 are made in two parts (to permit the installation of the centre spar). The top and bottom surfaces of the wing box each have four skin panels which extend forward of the front spar and aft of the rear spar. The leading and trailing edge structures attach to these projections and to the front and rear spars. Stringers give strength to the top and bottom skin panels.

The wing box makes two integral fuel tanks and a vent/surge tank. Thirty three panels in the lower skin panels give access to the tanks. The wing box also has attachments for:

- the leading edge and leading edge devices
- the wing tip and winglet assembly
- the trailing edge and trailing edge devices
- the engine mounting pylons - the main landing gear.

WING TIP

The wing tip and winglet assembly is installed at Rib 39. The main part of the wing tip is the box structure, on which the leading edge (corner) and the trailing edge are installed. The winglet attaches to the outboard end of the wing tip. There are two access panels installed under the wing-tip-to-winglet join

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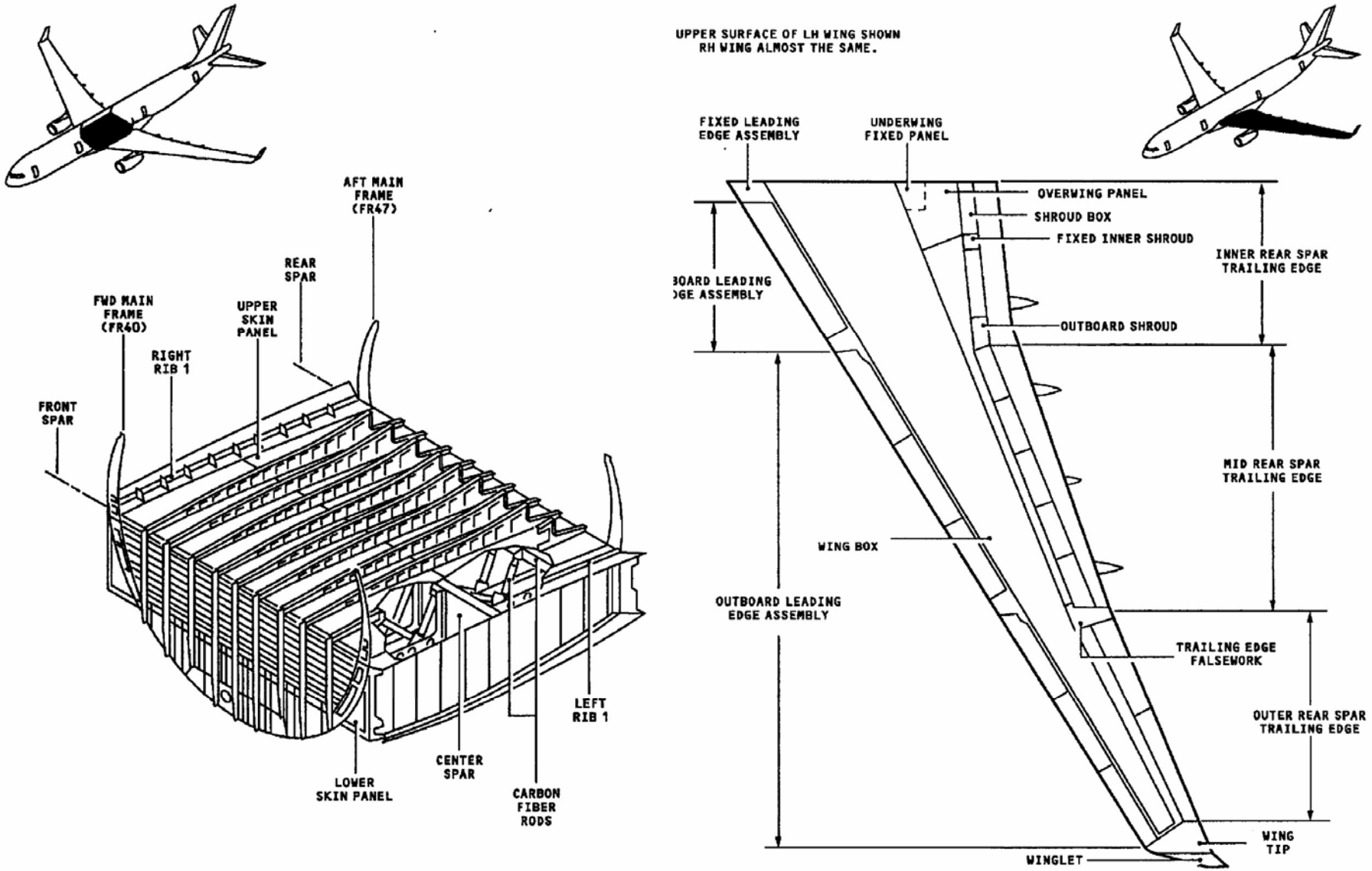

Figure 27 Centre Wing / Outer Wing Section

LEADING EDGE DIVISES
The leading edge assembly is located forward of the front-spar of the wing box. It includes the inboard and the outboard leading-edge assemblies and the top and bottom panels. The inboard and outboard leading-edge assemblies have their D-noses and panels installed on ribs which attach to the front spar. The hold-down devices and the rotary actuators (for Slat 1 tracks 2 and 3) are installed on other ribs. The leading edge devices are the seven leading edge slats.

TRAILING EDGE DEVICES
The trailing edge structure is aft of the rear spar of the wing box and includes the inner, mid and outer rear-spar trailing-edges.

TRAILING EDGE FLAPS
The inboard and outboard flaps are installed on the trailing edge of the wing. The inboard flap is between STA0/RIB1 and STA757/RIB11 and the outboard flap is between STA757/R1B1 I and STA1 798/RIB27.

AILERONS
The inboard and outboard ailerons are installed on the trailing edge of the wing. The inboard aileron is between STA1 798/RI B27 and STA2190/RIB33 and the outboard aileron is between STA2190/RIB33 and STA2557/RIB39.

SPOILERS
There are six spoilers installed on the upper surface of each wing, forward of the trailing edge flaps. Spoiler 1 is installed between STA291 /RI B5 and STA568/RIB9. Spoilers 2 thru 6 are installed between STA757/RIB11 and STA1734/RIB26.

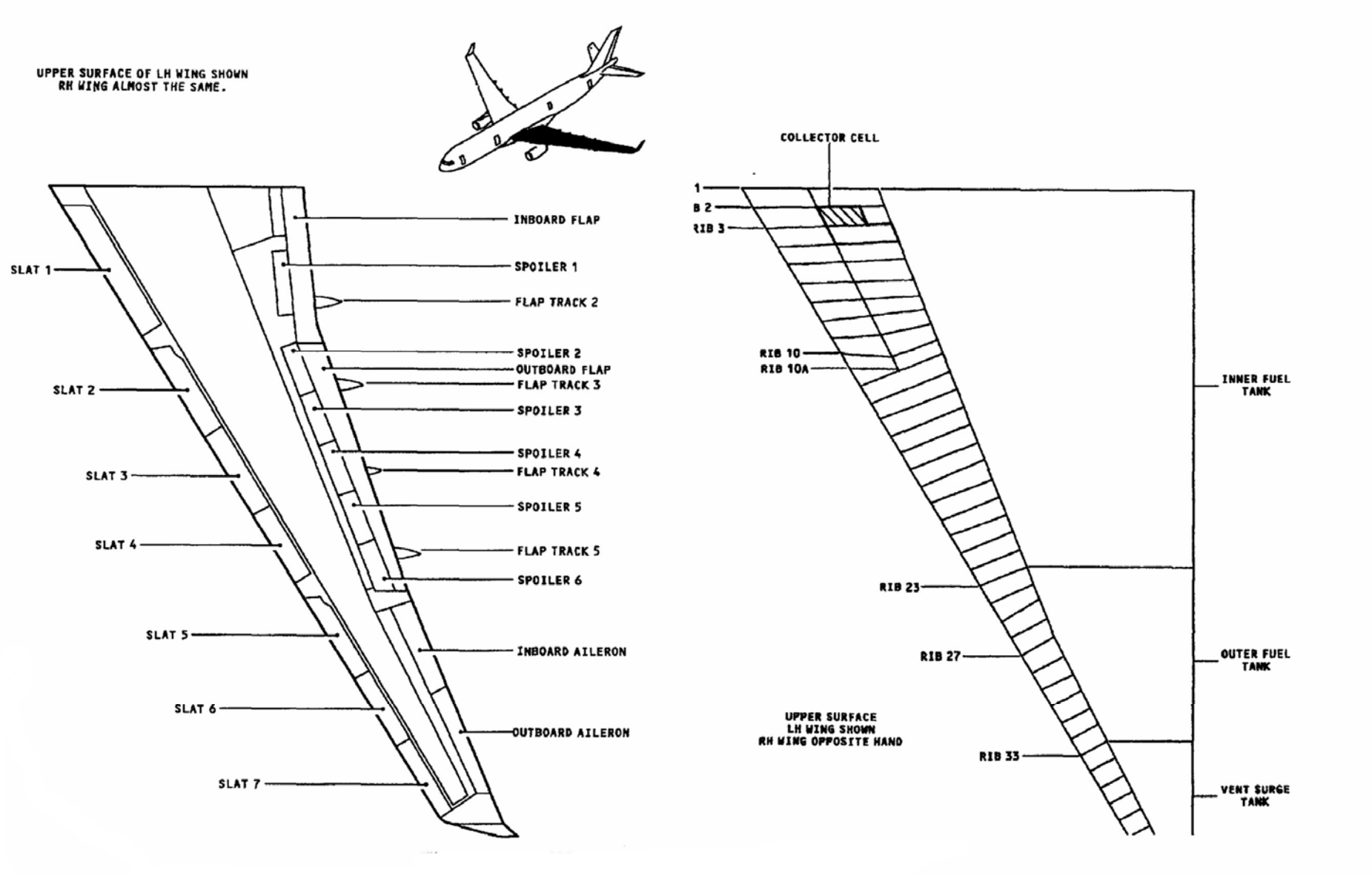

Figure 28 Wig Stations and Wing Devices

OUTER WING

The cantilever outer wings connect to the centre wing to make a continuous structure. The main structure of the outer wing is the wing box, which has:

- a front spar - a centre spar
- a rear spar - ribs and stringers
- top and bottom skin panels.

There are attachments on the wing box for:

- the leading and the trailing edge assemblies
- the wing tip)
- the engine pylons the trailing-edge flap tracks the ailerons and the spoilers the Main Landing Gear (MLG).

Each wing box also makes the integral fuel tanks and the vent surge tanks. Access into the wing box is through the openings (manholes) in the bottom skin panels. Attached to the wing box are: - the fixed partitions (slat cans) - the attachment fittings -the access panels - the jack point.

WING BOX

The wing box tapers from STAO/RIBI (the wing root) to STA2557/RIB39 and includes: -the wing spars (front, centre and rear)

- the ribs
- the top and bottom skin-panels the top and bottom stringers the wing-root joint.

WING SPARS

The wing spars are machined from aluminium alloy. They give strength to the wing box. The front and the rear spars extend from STA0/RIB1 to STA2557/13113 39. The centre spar extends from STAO/RIBI to outboard of STA757/1111311.

The front and the rear spars are made from three parts. These are the inner, the middle and the outer spars. Joint plates connect these spars together to make a continuous structure.

The joints are made for:

- the front spar at STA822,/RIBI 2 and STA1 798/RIB27
- the rear spar at STA568/RIB9 and STA1 798/RIB27.
- The centre spar is made as one part.

RIBS

There are thirty-eight ribs, machined from aluminium alloy, installed in the wing box of each outer wing (Ribs 2 thru 39). The centre wing-to-outer wing joint is made at Rib 1. Rib 1 is the rib that closes the centre wing box.

SKIN PANELS and STRINGERS

The top and the bottom surfaces of the wing box are made of skin panels machined from aluminium alloy. There are four panels on each surface. To increase their strength, the panels have stringers machined from aluminium alloy extrusions. Joint straps, made of aluminium alloy, connect the panels. Interference bolts attach the panels to the ribs and the spars.

The top and the bottom skin panels continue a short distance forward of the front spar. The leading edge structure attaches to these projections.

There are thirty three openings (manholes), in the No. 2 and No. 4 bottom skin panels, which give access into the wing box. To make the bottom skin panels stronger, the panels are thicker in the area around the manholes (and the holes for the fuel pumps (Ref. 28-21-00)).

There is one opening in the top skin between STA1 465/RIB22 andSTA1 530/RIB23, for the over wing refuel adaptor.

FALSE REAR SPAR

The false rear spar is attached to the rear spar of the wing box at Rib 8. It is made from aluminium alloy and supports the MLG support rib at its aft end.

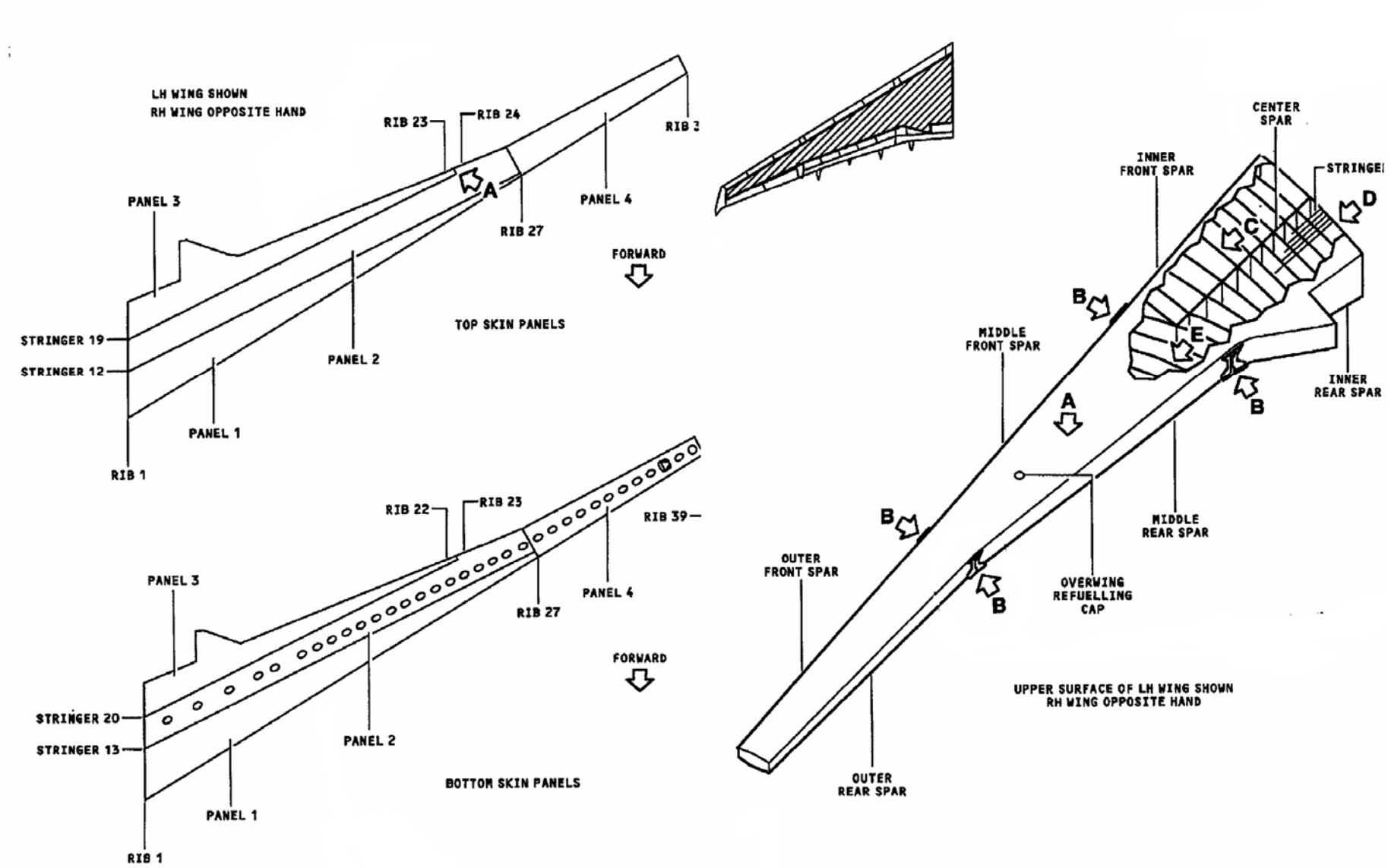

Figure 29 Wing Box

ATTACHMENT FITTINGS

SLAT TRACK CANS

The leading-edge slat tracks go through holes in the front spar and into the fuel tanks. To isolate the slat tracks from the fuel, cylindrical partitions (slat track cans) are attached to the inner face of the front spar at these holes.

The slat track cans are made from pressed aluminium alloy and aluminium alloy plate welded together. Drain pipes are attached to the cans to release any fluid.

ATTACHMENT FITTINGS

There are attachment fittings on the wing box for: - the wing tip - the pylons - the pylon fairings - the IVILG - the plastron fairing - the flap track beam - the flap track fairing - the jacking pad.

WING TIP ATTACHMENT FITTING

There is a butt strap attached to the top skin of the wing tip and another butt strap attached to the No. 4 bottom skin panel at its outboard edge next to Rib 39.

PYLON ATTACHMENT FITTING

There are forward and rear attachment fittings on the wing box for each engine pylon. The forward attachment fittings are at the front spar between the Ribs 10 and 1 OA. The forward attachment for the pylon has:

- a bracket assembly that absorbs the vertical loads
- a thrust fitting that absorbs the thrust and the side loads from the engine.

The bracket assembly, made of titanium alloy, is a double fail-safe design. The thrust fitting is made of titanium and has a steel pin of a fail-safe design. Bolts attach the fitting to the bottom face of the bracket assembly through the reinforcing and the bottom skin.

The rear attachment fittings are between the Ribs 10 and 1 OA at the Stringer 10.
The rear attachment is a single-lug bracket attached with bolts through the bottom skin.

ATTACHMENT FITTINGS FOR PYLON FAIRINGS

Brackets made from aluminium alloy attach the rear of the pylon fairings to the bottom panels of the wing box. The brackets are on the No. 2 skin panel, forward of the rear spar.

ATTACHMENT FITTINGS FOR THE MLG

Fittings attach the IVILG to the aft face of the rear spar. These include: - the gear support rib (the Gear Rib 6) - the pintle fitting - the fitting for the side stay - the jack fitting for the IVILG actuating cylinder.

Gear Support Rib The aft attachment point for the IVILG is the gear support rib (Gear Rib 6). The rib is machined from an aluminium alloy forging and is attached to: - the aft face of the rear spar at STA362/RIB6 - the extended top and bottom wing skins (the cruciform box) - the false rear spar.

Pintle Fitting The forward attachment point for the IVILG is the pintle fitting. The pintle fitting is made from titanium alloy and is attached to the aft face of the rear spar at STA291/RIB5.

Side-Stay Fitting The side-stay fitting is made from aluminium alloy. It is attached to the aft face of the rear spar between STA73/RIB2 and STA147/RIB3.

Jack Fitting for the MLG Actuating Cylinder The fitting for the IVILG actuating cylinder is made from titanium alloy. It is attached to the aft face of the rear spar, inboard of the Gear Rib 6.

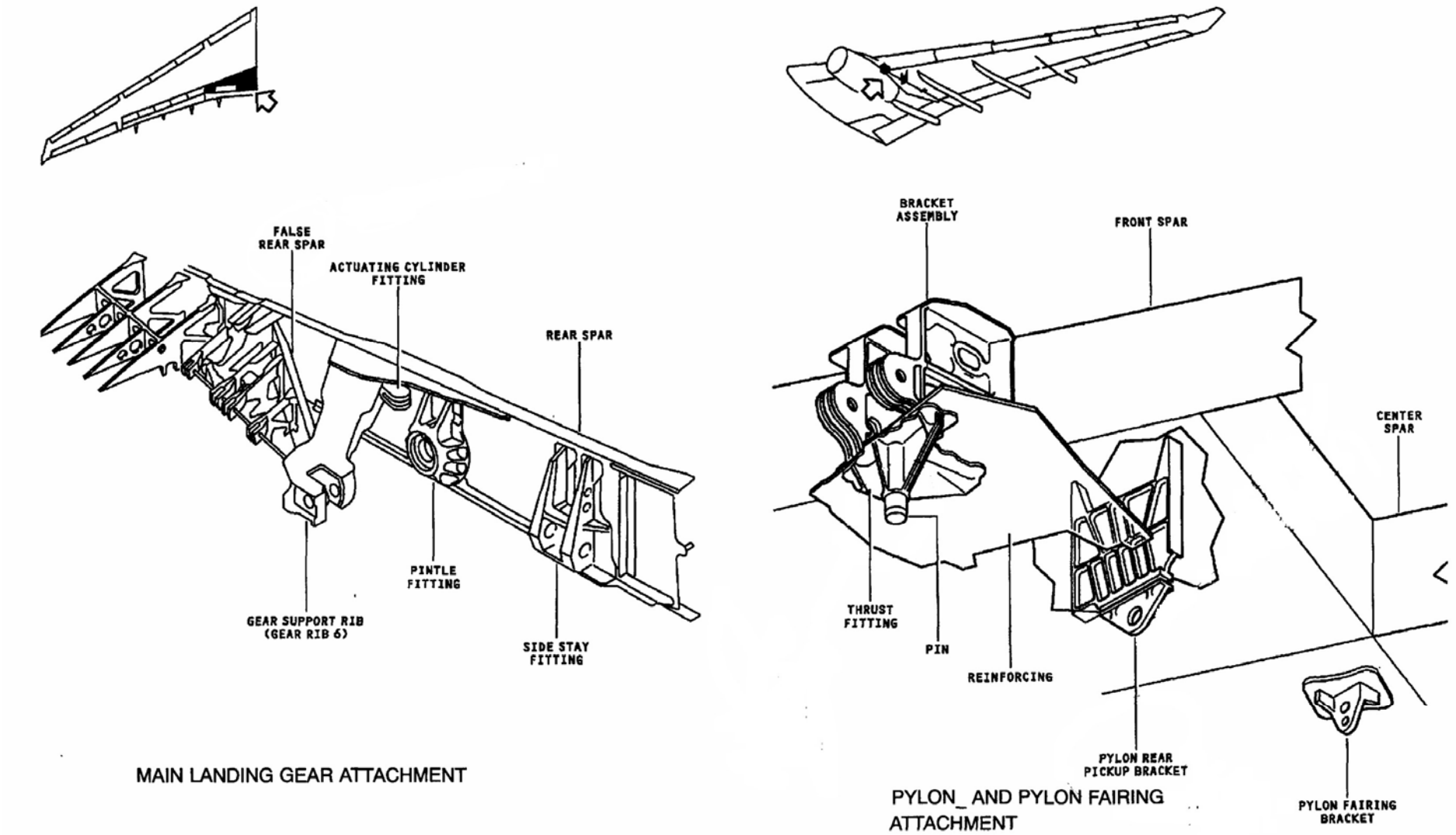

Figure 30 Pylon and MLG Attachment Fittings

FLAP TRACK ATTACHMENTS

There are five flap tracks for each outer wing:
- the flap tracks 1 and 2 hold the inboard flap
- the flap tracks 3 thru 5 hold the outboard flap. The flap track 1 is attached at the fuselage side through 3 bearing brackets.

The forward attachment for flap tracks 2 thru 5 is through mounting brackets of aluminium alloy. Bolts attach the brackets through the wing bottom skin to the ribs in the wing box. The aft attachment for flap track 2 is through a spigot fitting which locates in a spherical bearing. The spherical bearing is installed in a pair of titanium ribs These ribs make a cantilever structure off the rear spar. The aft attachment of the flap tracks 3 thru 5 is through spigot fittings attached to the rear spar. All the track-to-wing attachment fittings include titanium spigots of a fail-safe design.

JACK POINT FITTINGS

A jack point fitting is attached to the rear spar and to the outer surface of the bottom skin at STA626/RIB10. The fitting is machined from aluminium alloy and transmits the jacking loads into the wing structure.

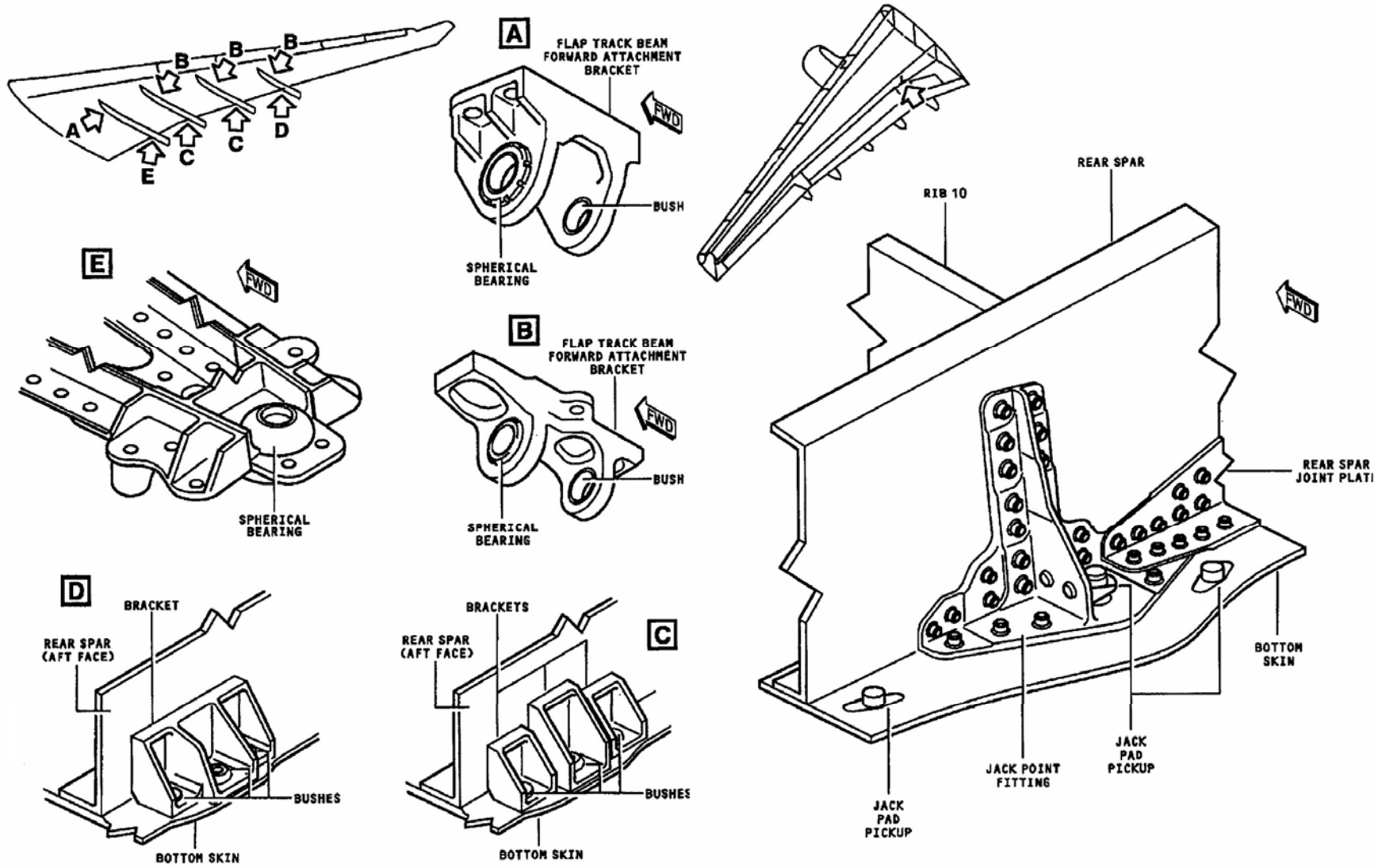

Figure 31 Flap Track Attachment and Jack Point Fittings

ACCESS PANELS

There are thirty-three access covers (panels) installed in the bottom skin panels of the wing box. This number includes the NACA duct door and the bursting disc panel. All the panels close the openings that give access into the wing box. Bolts attach the load-carrying access panels to the bottom skin panels of the wing. Bolts and clamp rings attach the non-load carrying panels to the bottom skin panels of the wing.

There are also doors for access: - in the centre spar between Ribs 2 and 3 541 AZ(641 AZ) - in Rib 2 541 BZ(641 BZ) - in Rib 3 541 DZ(641 DZ) - in Rib 4 541 CZ(461 CZ) and 541 EZ(641 EZ). These doors are attached with bolts. Access to the rear of the collector cell is through three panels between Ribs 2 and 3.

Access Panels from Rib 1 to 27
The panels installed from Ribs 1 thru 27 are non load-carrying access panels. They are super-plastic-formed from titanium alloy and are filled with polyurethane foam.

Bolts go through the clamp ring into blind nuts (installed in the panel) to attach the panel to the bottom skin of the wing. Each panel is symmetrical about the centre line except for two lobes machined on the edge of each panel. These lobes locate each type of panel in specific positions on the bottom skin of the wing box.

Access Panels Outboard of Rib 27
Eleven load-carrying access panels are installed between RIB 27 and RIB39. The panels are the Types 2, 3, 4, 5, 6 and 7. The Type 2 panel is made from aluminium alloy and the other panels (and the NACA duct door) are made from an aluminium-lithium alloy. All these panels attach from outside the wing box. There are anchor nuts installed in gang channels which are attached to the inner surface of the bottom wing skin. Bolts go through the panels into these anchor nuts to attach the panels to the bottom skin. The Type 6 panel (installed between Ribs 37 and 38) includes the bursting disc (Ref. 28-12-00) for the vent surge tank. The Type 7 panel is round, the NACA duct door is square and all the other panels are elliptical.

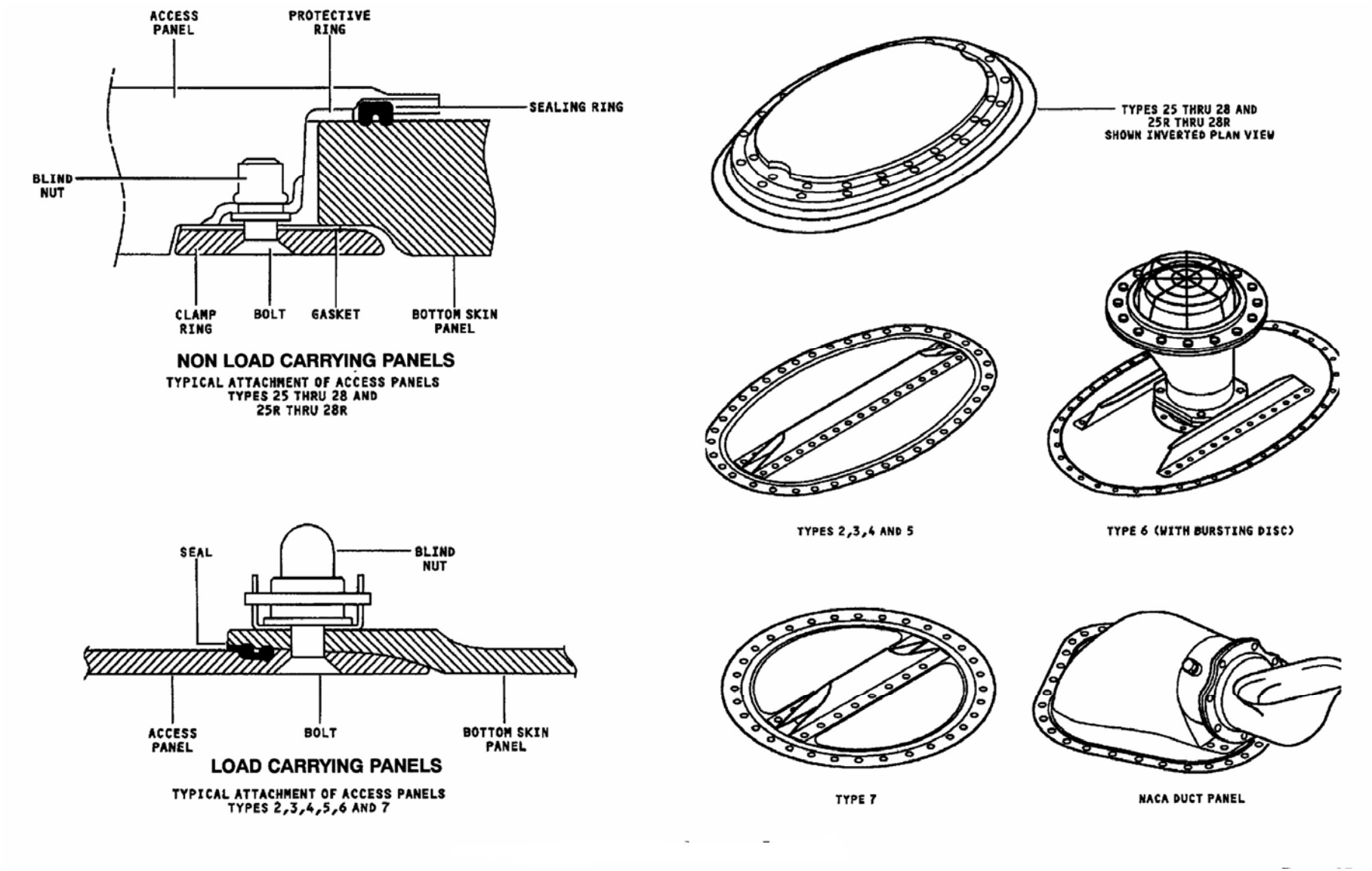

Figure 32 Access Panels

WING LEADING EDGE STRUCTURES

The leading edge and leading edge devices are: the fixed leading-edge assembly the leading edge assembly the leading edge slats.

FIXED LEADING EDGE ASSEMBLY

The fixed LE assembly (A) is the area between the fuselage and the inboard LE assembly (STAO/RIB1 to STA73/RIB2). It has structural parts of aluminium and aluminium-lithium alloys. The D-nose skin is made from aluminium-lithium alloy and the top and bottom skins are made from glass-fibre-composite material. Three adjustable rods attach the fixed LE assembly to the fuselage. Bolts attach this assembly to the inboard LE assembly and to the top and bottom skins of the wing box. Lifting spigots can be fitted to anchor nuts installed at two places on the sub-spar and one on the leading edge stringer.

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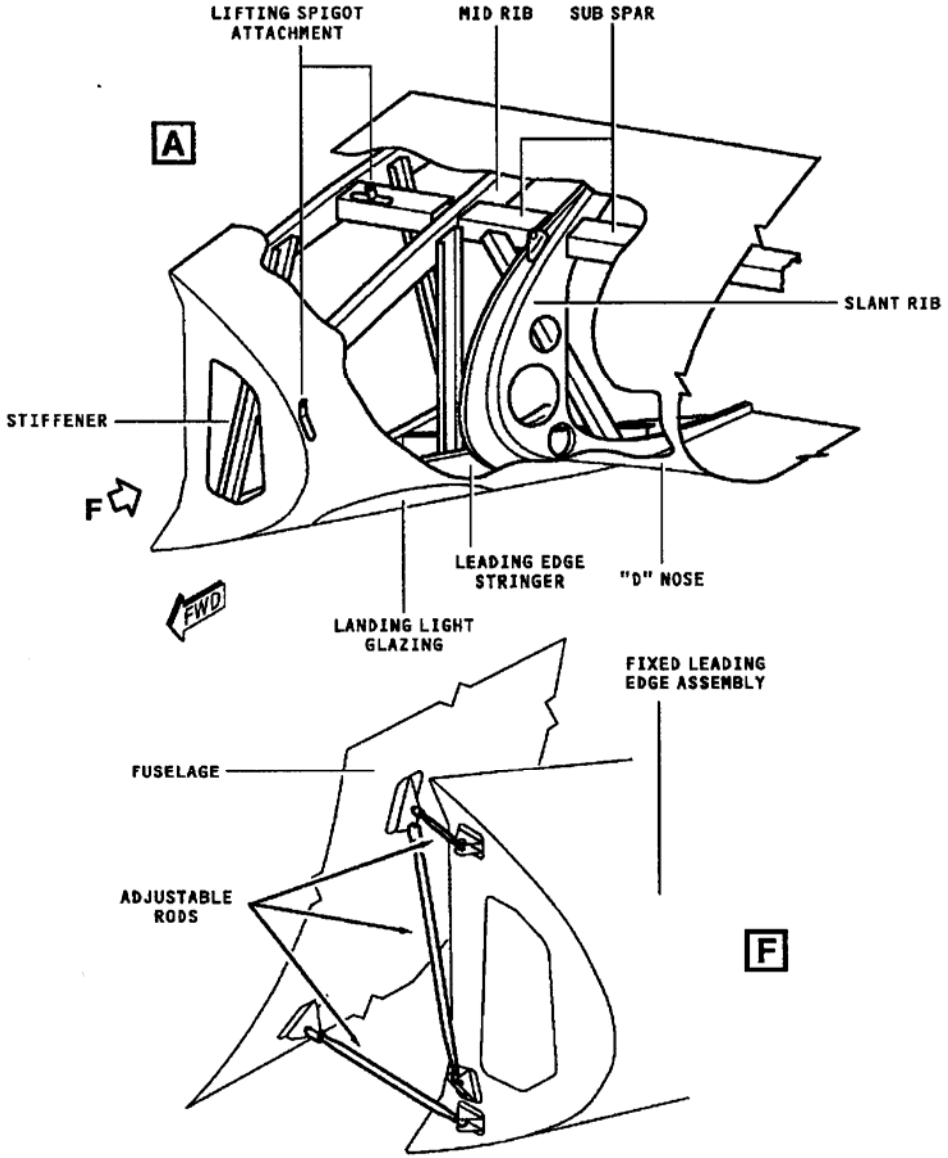

Figure 33 Fixed Leading Edge Assembly

LEADING EDGE ASSEMBLY

The LE assembly is made from:
- the inboard LE assembly (STAO/111131 to STA626/RIB10)
- the outboard LE assembly (STA626/R11310 to STA2557/RIB39).

The Leading Edge Assembly includes: the support ribs the D-nose assembly the top and the bottom panels.

SUPPORT RIBS
The support ribs are machined from aluminium alloy and are attached to the wing box at the front spar. The support ribs which are installed inboard of the pylon (STA73/RIB2 to STA626/13113110) are:
- the ramp rib at STA73/R1132
- the track ribs 1 thru 4 (made from a pair of ribs)
- the two intermediate ribs a hold-down rib the closing rib at STA626/1311310.

The support ribs installed between STA684/1`111310A thru STA1601/RIB24 are:
- the closing rib at STA684/RIB10A
- the track ribs 5 thru 10 (made from a pair of ribs) the three hold-down ribs
- an intermediate rib.

The support ribs which are installed (STAII 734/1311326 thru STA2557/1311339) are: the track ribs 11 thru 16 (made from a pair of ribs) the three hold-down ribs an intermediate rib the closing rib at STA2557/RIB39.

RAMP RIB
The ramp rib makes the connection between the fixed LE assembly (A) and the leading edge assembly (13). The top access panel is also attached to the ramp rib.

TRACK RIBS
There is a track-rib assembly installed on the front spar at each slat track hole. The track rib assemblies hold the slat tracks. The inboard slat (slat 1) is held on four slat tracks (tracks 1 thru 4). The slats 2 thru 7 are each held on two tracks (tracks 5 thrull 6). Each track-rib assembly has an inboard and an outboard rib. Plates and straps connect them to each other at the top and the bottom. There are four support rollers installed between the inboard and the outboard ribs (two above and two below each slat track). The slat tracks move between the pairs of ribs and are held on the rollers. The track ribs 1 thru 16 have two side-load rollers or pads installed on the slat track faces of each inboard and outboard rib. The tracks 1 thru 5, 10, 11 and 16 have rollers and the tracks 6 thru 9 and 12 thru 15 have pads. All the track ribs give attachment for: the D-nose assembly the top and the bottom access panels.

INTERMEDIATE RIBS
The intermediate ribs are installed between the other support ribs and also give attachment for: the D-nose assembly. the top and the bottom access panels.

HOLD DOWN RIBS
There is a hold-down rib attached to the front spar at each slat position (slats 1 thru 7). At the slat 1, the rib is installed between the slat ribs 2 and 3. At the slats 2 thru 7 the hold-down rib is installed between the two slat rib assemblies. A slat hold-down device is installed on each hold-down rib. The device makes sure that the wing leading edge keeps a good aerodynamic shape when the slat is retracted.

DE ICE RIBS
The de-ice ribs are installed in pairs at the bleed-air supply duct for the wing ice-protection system (Ref. 30-11 -00). The ribs are installed one on each side of the telescopic duct. This duct supplies the hot air to the picolo tubes inside the slats.

CLOSING RIBS
The closing ribs are the end ribs in a section of the leading edge structure. These ribs are installed inboard and outboard of the pylon and at the wing tip

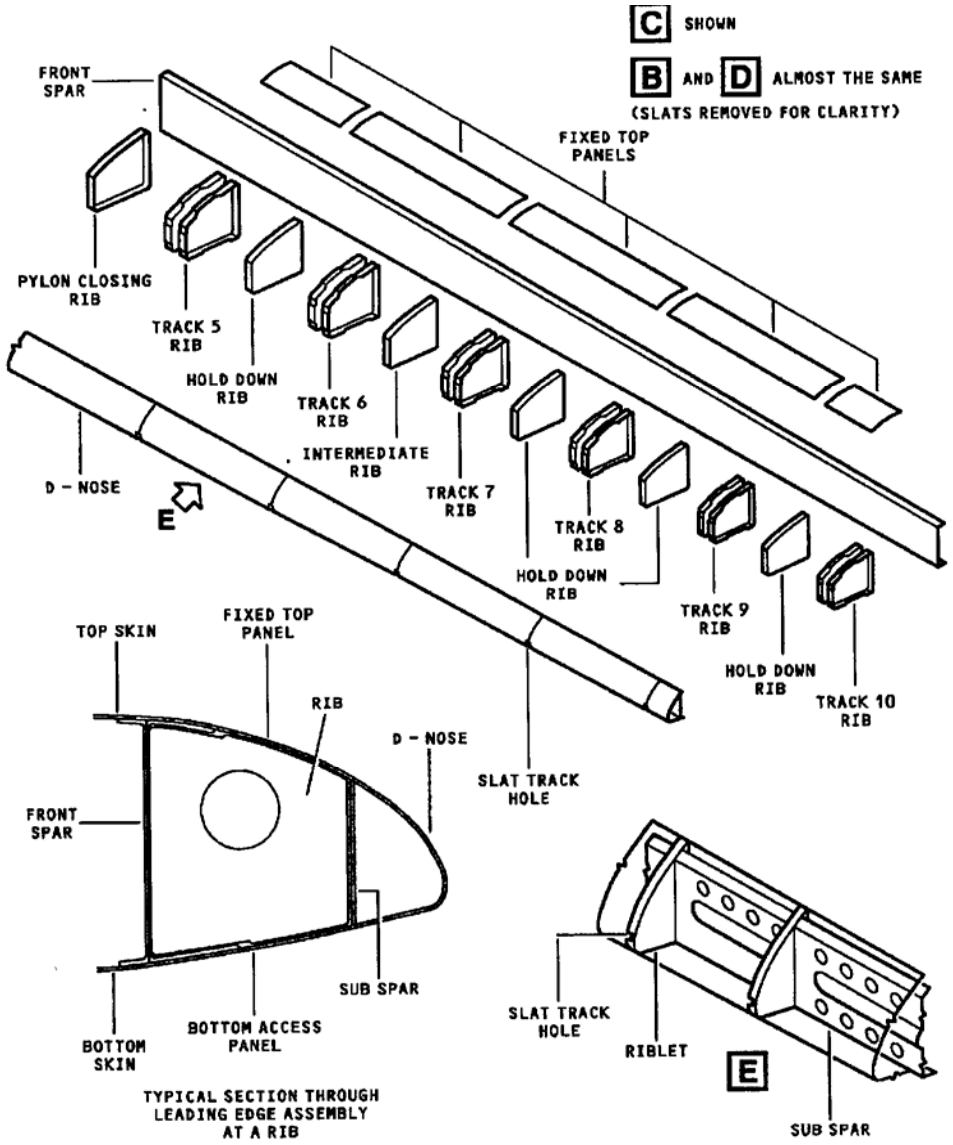

Figure 34 Leading Edge Assemblies

D-NOSE ASSEMBLY

The D-nose assembly makes the aerodynamic shape for the front of the leading edge. Bolts attach it to the forward part of the support ribs. It is made from aluminium-lithium alloy and is in three sections. The sections are between:
- STA73/RIB2 and STA626/RIB10
- STA684/RIB10A and STA2557/RIB39.

The D-nose assembly includes: the outer skin (which makes the shape of the D-nose) the sub-spar (which makes the aft face of the D-nose) the riblets (which are attached to the inside of the D-nose to strengthen the structure). There are cut-outs in the bottom half of the D-nose assembly at the slat track position. These cut-outs permit the slat tracks to clear the D-nose.

PANELS
There are fixed top panels and removable bottom panels installed between STA73/131132 and STA2557/RIB39. The panels attach between the extended portions of the wing box skin and the D-nose of the leading edge assembly.
Most of the top panels are made from a glass-fibre material with an aramid honeycomb core. The top panels over the pylons are made from aluminium lithium alloy. Most of the bottom panels are made from carbon-fibre composite material with an aramid-honeycomb core. The bottom panels near the inboard and outboard pylons are made from aluminium-lithium alloy.

TOP PANELS
Rivets attach the top panels to the skin of the wing box and to the skin of the D-nose. In some areas these rivets are replaced with bolts. Bolts also attach the top panels to the support ribs.

BOTTOM PANELS
The bottom access panels attach with quick release fasteners to: - the extended portions of the wing skin panels -the D-nose.
Nine of the bottom access panels are known as blow-down panels. If a hot-air duct leaks or has a failure, the blow-down panels release the pressure from the leading edge. For this function shear rivets connect two landings. One landing is attached to the skin of the wing box. Quick-release fasteners attach the blow-down panel to the other landing. If a hot-air duct leaks or has a failure and the pressure in the leading edge increases:
- the shear rivets which connect the two landings break
- the blow-down panel opens at its rear edge and a lanyard controls the size of the opening (the lanyard also prevents loss of the panel and damage to other structure).

INSPECTION COVERS
There are circular inspection covers in the bottom panels adjacent to the slat actuators. These inspection holes give access to the torque-limit indicators on the slat actuators.

NACA DUCT PANELS
There are three NACA duct panels which supply air for the environment protection system (Ref. 36-14-00). The panels are installed:
- between STA147/RIB3 and STA220/RIB4
- between STA822/RIB12 and STA886/RIB13
-between STA1401/RIB21 and STA1465/RIB22.

REFUEL PANEL
A refuel panel between STA951/RIB14 and STA1015/RIB15 gives access to the refuel/de-fuel coupling. It is hinged at its forward edge and is closed with 4 pushbutton latches at the aft edge. A folding strut holds the panel in the locked position when the panel is open.

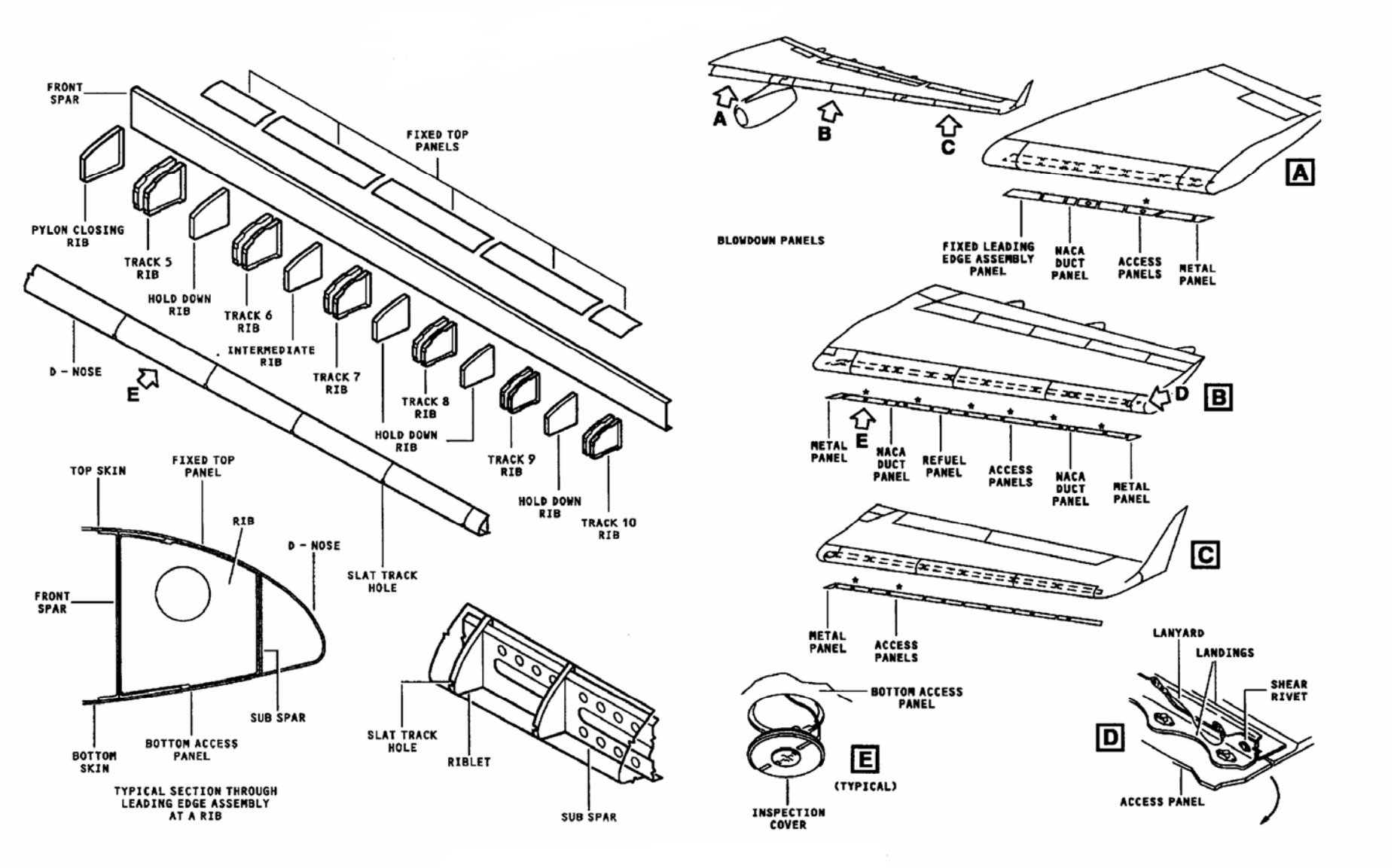

Figure 35 D-Nose Assembly and Panels

LEADING EDGE SLATS

There are seven LE slats installed on the outer wing. Slat 1 is on the inboard LE assembly and slats 2 thru 7 are on the outboard LE assembly. Each slat is held on slat tracks. The track ribs support the slat tracks at the front spar of the wing box. The actuators which move the slat tracks are connected through a system of torque shafts and swivel joints (Ref. 27-80-00).

Each leading edge slat is made from:
- the front spar or the stringer(s)
- - the rear spar
- - the ribs
- - the top and bottom skins - the trailing edge assembly.

The front and rear spars, the stringers, the ribs and the top and bottom skins are made of aluminium alloy. The trailing edge assembly is made from a composite material with a honeycomb core and has a trailing-edge extrusion of aluminium alloy. Because the slats 4 thru 7 have an ice protection system, some of the structure is made from a heat resistant alloy.

INBOARD SLAT

The Slat 1 is installed on the leading edge of the wing between STA73/111132 and STA626/131131 0. It is held on four slat tracks (tracks 1 thru 4). Slat track actuators (Type A) are installed on the track support ribs 2 and 3. Slat tracks 1 and 4 are not connected to the torque shaft assembly. These two tracks are moved, through the slat, with the actuators at slat tracks 2 and 3.

OUTBOARD SLATS

Slats 2 thru 7 are each held on two tracks. Each of the tracks is moved through an actuator (Type B) installed on its track rib. The slats are installed along the leading edge of the wing at these positions:
- the Slat 2 (STA684/RIB1 OA to STA951 /RIB1 4)
- - the Slat 3 (STA951 /RI 1314 to STA1 337/111 B20)
- - the Slat 4 (STA1 337/RI B20 to STAI 601 /R1 B24)
- - the Slat 5 (STA1671/RIB25 to STA20OO/RIB30)
- - the Slat 6 (STA2000/1311330 to STA2316/RIB35)
- - the Slat 7 (STA2316/RIB35 to STA2557/RIB39).

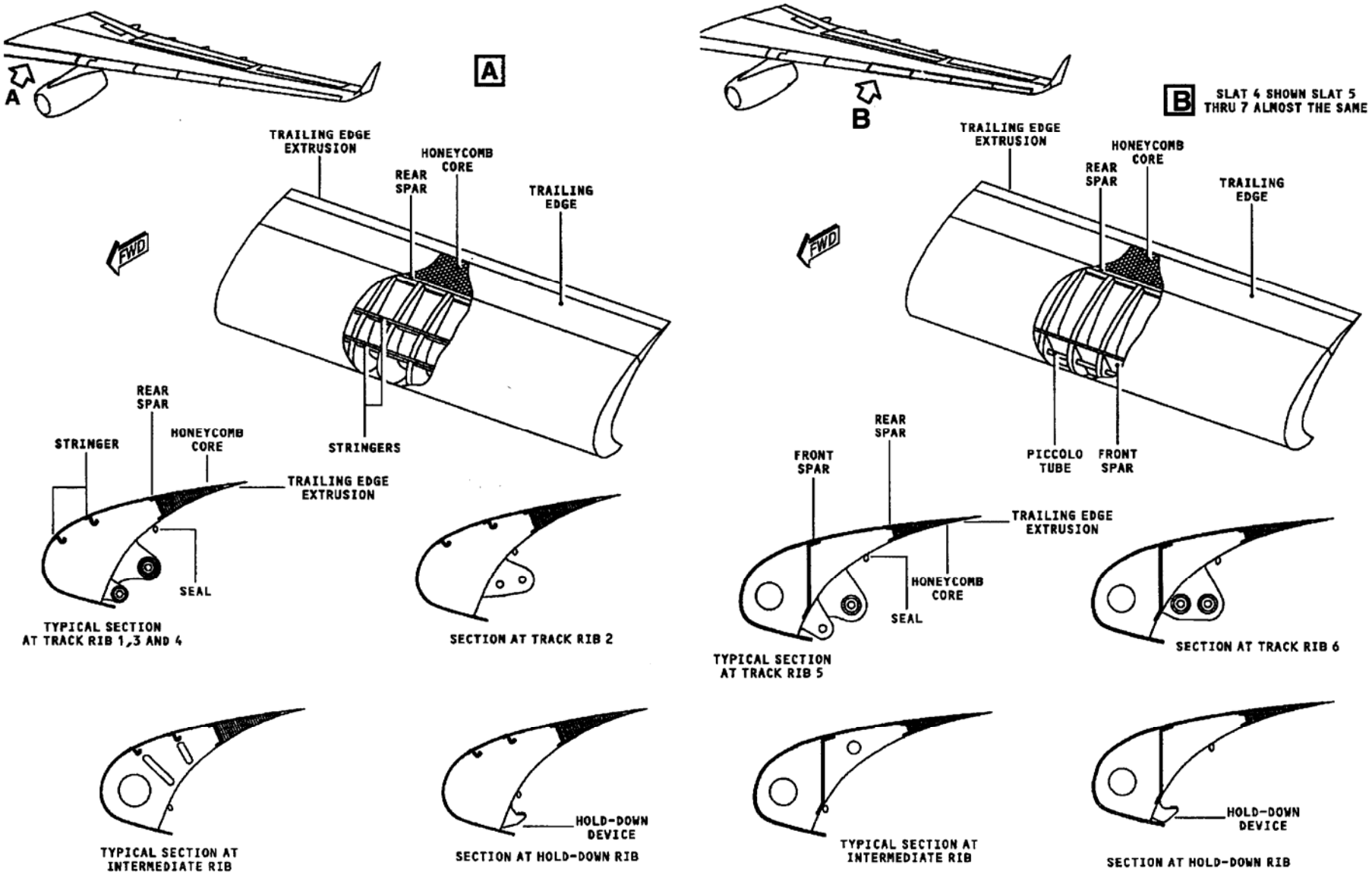

Figure 36 Slats

SLAT TRACKS I THRU 4

The slat tracks 1 thru 4 are made of titanium and are of an T section shape. These tracks support the inboard slat (Slat 1). Each slat track is installed between the inboard and the outboard ribs of its track-rib assembly. Bolts and links attach each slat track assembly to lugs on its slat track rib. The track is held between: two support rollers above and two support rollers below the track two side-load rollers on each side of the track.

SLAT TRACKS 5 THRU 16

The slat tracks 5 thru 16 are made of steel and hold the slats 2 thru 7. Each track is installed between the inboard and the outboard ribs of its track-rib assembly and is held between: two support rollers above and two support rollers below the track two side-load rollers (tracks 5, 10, 11 and 16) or pads (tracks 6 thru 9 and 12 thru 15) on each side of the track.

Each slat track assembly includes: - the track - the gear rack. The track is an inverted U section and is open at the bottom. The gear rack is installed inside the bottom of the track. The gear rack engages a pinion that is installed: - below the slat track - between the inboard and the outboard ribs of the track rib. Bolts and links attach each slat track assembly to lugs on its slat track rib.

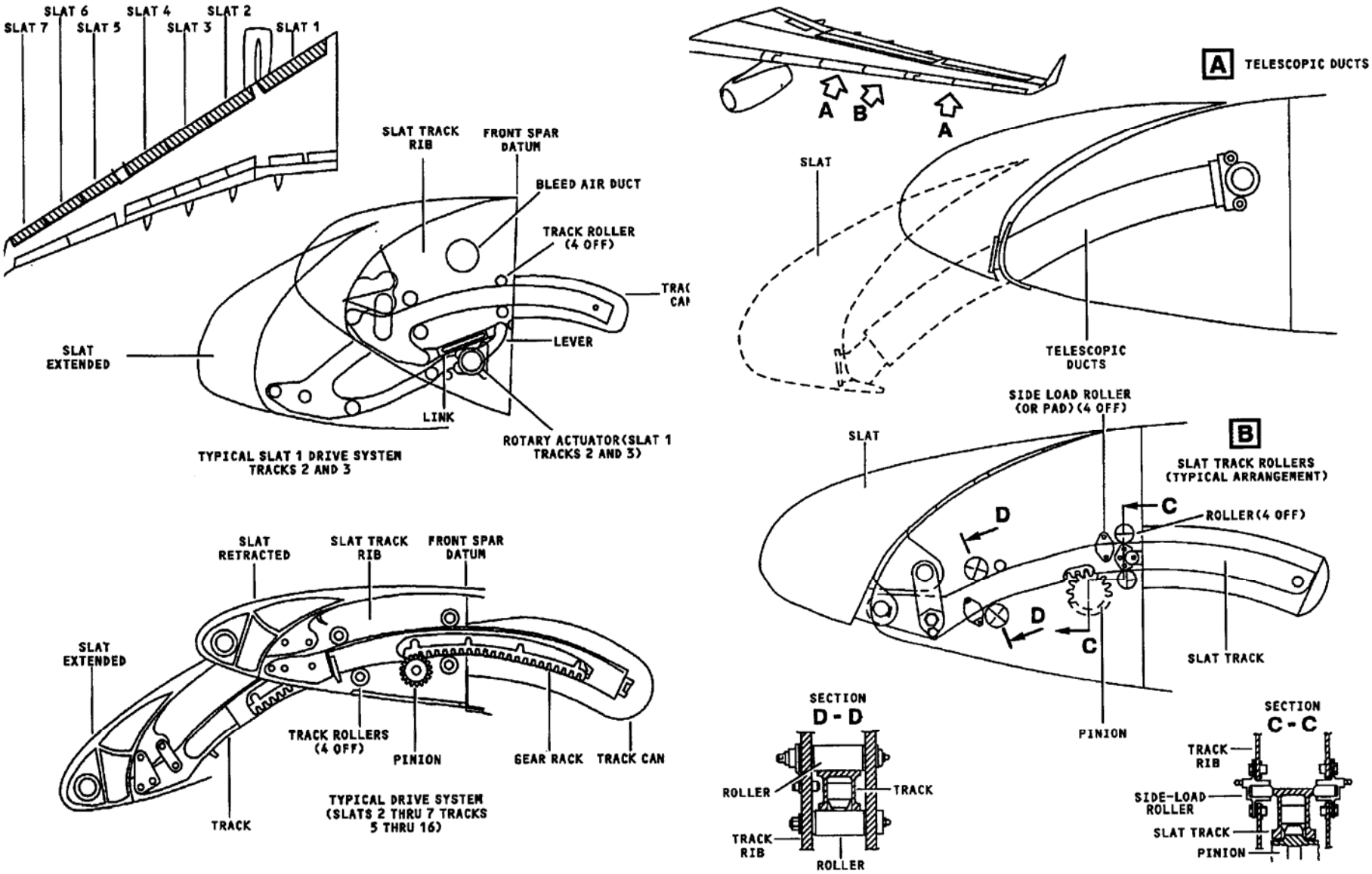

Figure 37 Slat Tracks

WING TRAILING EDGE STRUCTURES

TRAILING EDGE DEVISES

The TE and TE devices are: - the fixed TE - the TE control surfaces. The fixed TE is that part of the wing structure which is aft of the wing rear spar. It is divided into three sections:

- -the inner rear-spar TE (STAO/RIBI to inboard of STA822/RIB12)
- - the mid rear-spar TE (inboard of STA822/Rl BI 2 to STA1 798/RIB27)
- - the outer rear-spar TE (STA1798/RIB27 to STA2557/1311339).

The TE control surfaces are:

- -the inboard flap - the outboard flap
- - the two ailerons (Ref. 57-60-00)
- - the six spoilers (Ref. 57-70-00).

=Bolts attach the different parts of the TE structure to the rear spar, the skin panels of the wing and/or each other.

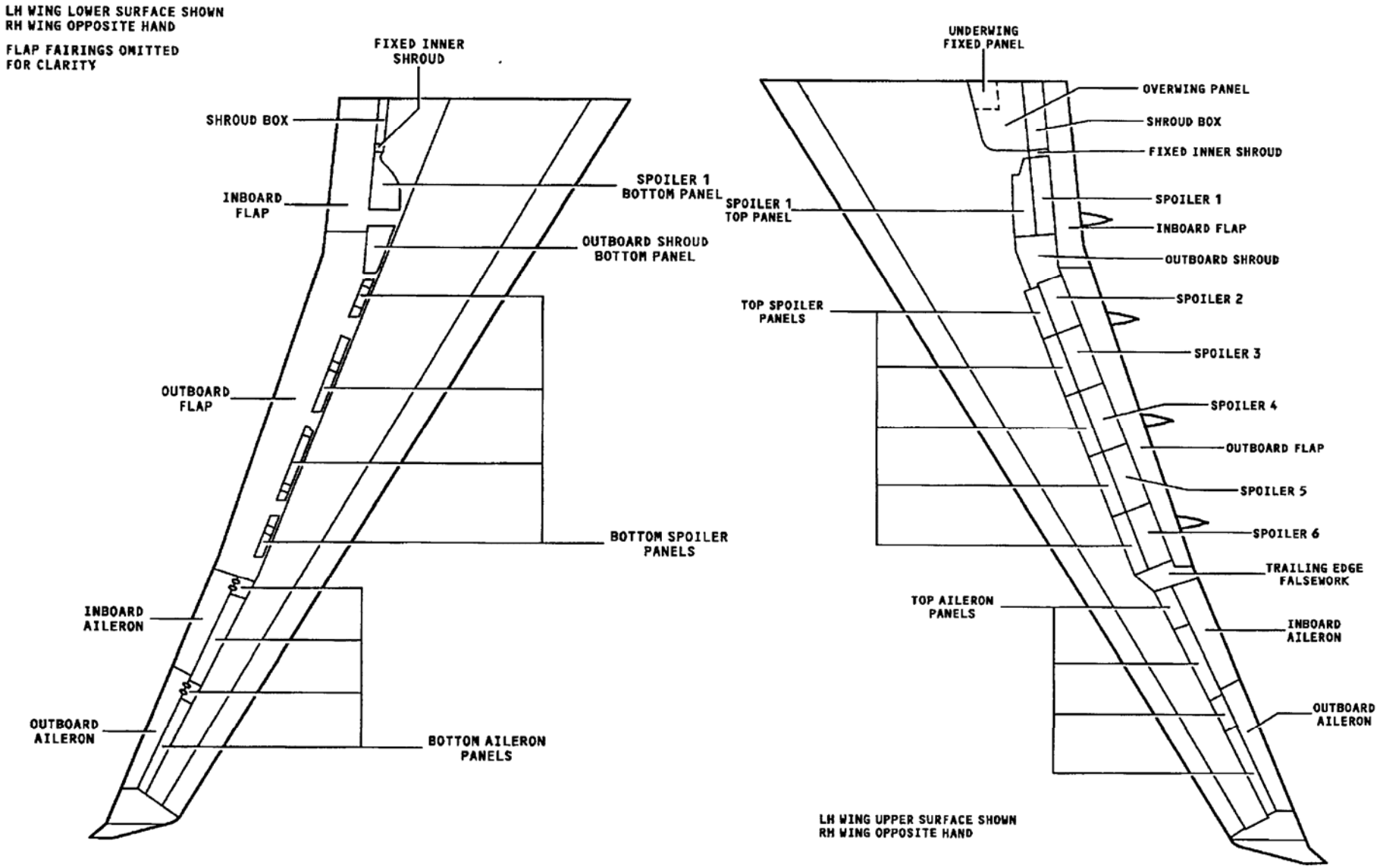

Figure 38 Upper- and Lower Wing Surfaces

INNER SPAR TRAILING EDGE

The structure of the inner rear spar includes: - the shroud box - the over wing panel -the fixed inner shroud - the structure between the fixed inner shroud and the outboard shroud - the outboard shroud - the under wing fixed panel.

SHROUD BOX

The shroud box is installed between the fuselage and the fixed inner shroud. It makes the upper TE structure aft of the over wing panel. It also makes the lower TE structure aft of the opening for the fixed-fairing door of the Main Landing Gear (MLG). Most of the shroud box is made from composite material, but it has 5 ribs of aluminium alloy. These ribs are the inboard rib, the outboard rib, the flap-drive support-rib and the 2 intermediate support-ribs. The trailing edge of the shroud box has a honeycomb core and a rubbing strip.

Debris shields are installed to keep debris out of the bottom of the shroud box. These are made from aluminium alloy and attached with bolts.

The shroud box has a closure panel installed on the bottom. The closure panel has three panels installed on it which give access to the flap drive system. A small inspection cover is installed in the largest panel (the centre panel) to permit servicing of the flap drive system. This inspection cover is made from aluminium alloy.

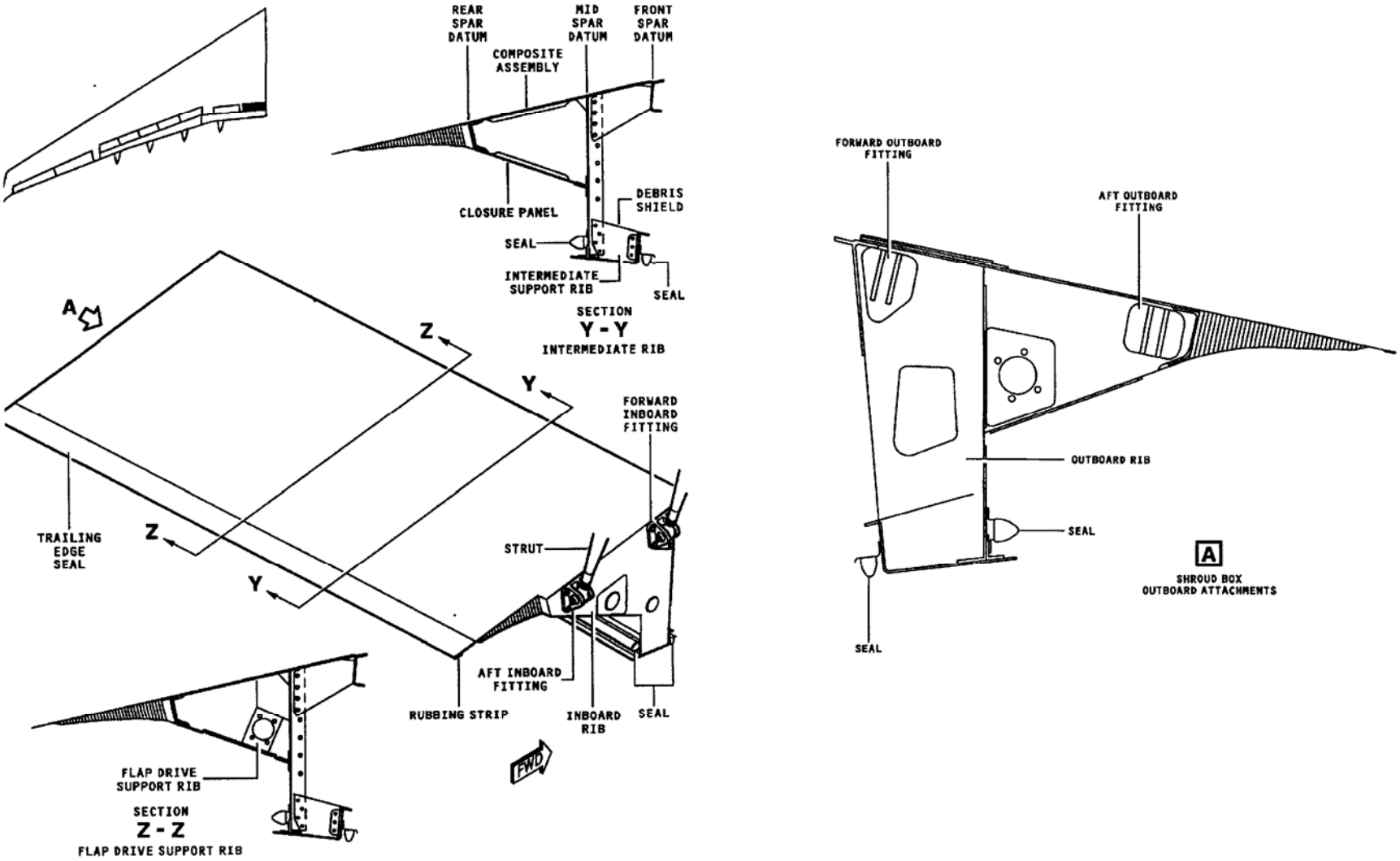

Figure 39 Trailing Edge Shroud Box

FIXED INNER SHROUD

The fixed inner shroud makes the TE structure between the shroud box and the Spoiler 1. It is made from aluminium alloy and has a TE seal made from titanium alloy covered with a rubber and polyester fabric.

The Ribs 0 and 1 attach to the gear support rib at the top and the bottom of their forward edges. There are lugs installed at the top forward edge of each rib and at the top edge of Rib 0 (at the aft cross-member datum). The lugs on the Rib 0 attach the shroud to the shroud box. The lug on Rib 1 attaches the shroud to the wing box structure. The forward edge of the shroud attaches to the aft edge of the top skin-panel of the wing (through the butt strap and the gusset plate). The lugs are made from aluminium alloy.

INBOARD HINGE FITTING

The inboard hinge fitting for Spoiler 1 attaches to Rib 1 near its top forward edge (aft of the forward cross-member). This fitting is made from aluminium alloy. A hinged access panel is installed in the bottom panel, near the inboard hinge, to get access to Spoiler 1.

OVERWING PANEL

The over wing panel makes the top surface of the TE structure between the rear spar and the shroud box. It is made from a carbon-fibre composite material with an aramid honeycomb core and has 3 integral beams along its span. A chordwise beam made from a carbon-fibre composite material is installed at the inboard edge of the panel. Aluminium alloy fittings are installed at the inboard and outboard ends of the beams along the span.

The over wing panel attaches to: - the fuselage through 3 struts and the fittings - the wing structure through 3 links and the fittings - the aft edge of the top skin panel of the wing - the forward edge of the shroud box.

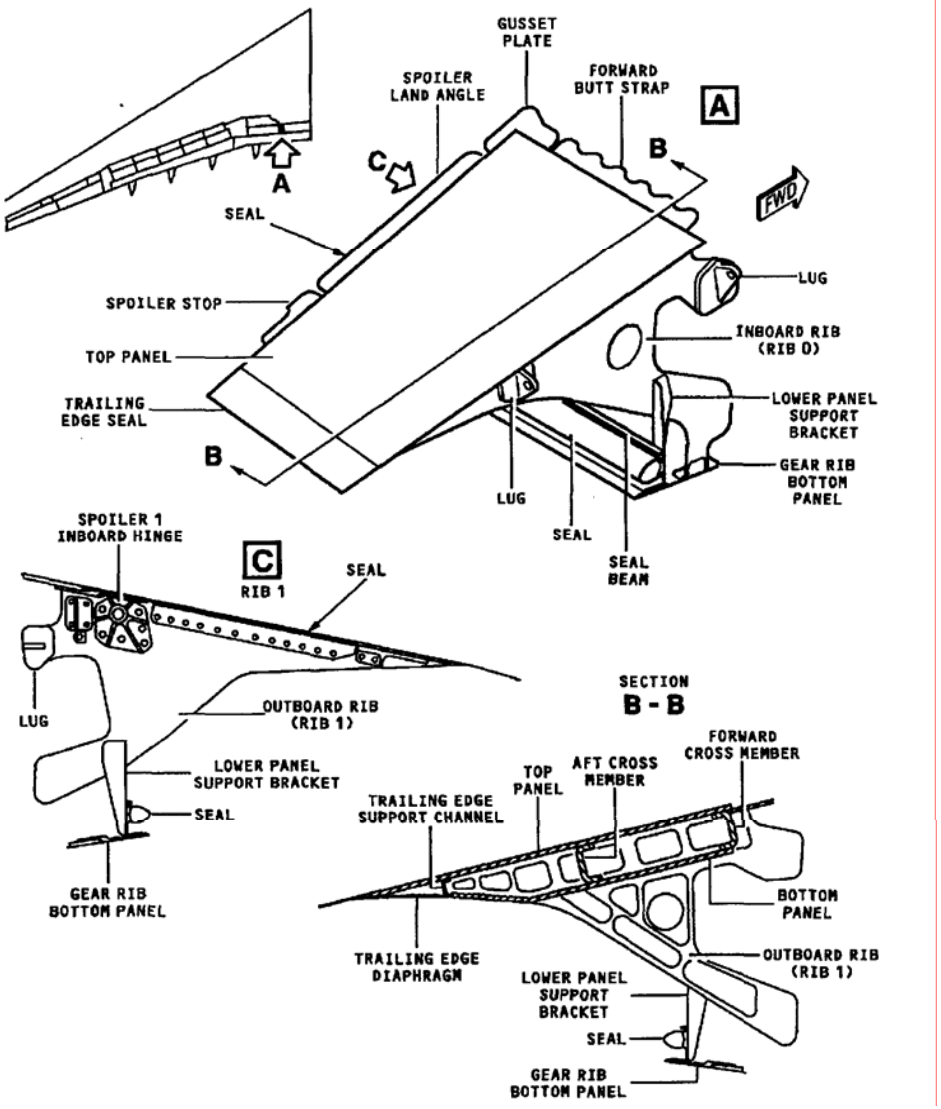

Figure 40 Fixed Inner Shroud

OUTBOARD SHROUD

The outboard shroud assembly makes the TE structure aft of the rear spar between Spoilers 1 and 2. The assembly includes: five TE ribs made from aluminium alloy (Ribs 6 thru 10) a diaphragm made from aluminium-lithium alloy an outboard top panel (and an outboard (bottom) access panel) made from a carbon-fibre composite material with an aramid honey comb core a beam panel installation, which includes a hinge access panel, made from aluminium alloy a TE seal made from titanium alloy covered with a rubber and polyester fabric the inboard and outboard strakes made from aluminium alloy.

The TE Ribs 6, 8 and 10 extend from the rear spar to the aft edge of the outboard shroud. The TE Ribs 7 and 9 are shorter and only extend from the diaphragm (which is installed on the intercostal datum line) to the aft edge of the outboard shroud. The inboard and the outboard strake beams are installed parallel to(and on each side o~ the lower section of the TE Rib 10. The bottom aft surface of each beam makes the guides for the flap cruise-rollers.

The outboard shroud (bottom) access panel is installed from inboard of the TE Rib 6 to the inboard strake beam (inboard of the TE Rib 10). An aluminium-lithium alloy panel is also rivetted between the inboard and the outboard strake beams. These panels make the TE structure between the aft edge of the bottom skin of the wing and the flap seal. The hinge fitting for the outboard hinge of Spoiler 1 attaches to Rib 6 near its top edge (aft of the diaphragm datum). This fitting is made from aluminium alloy.

The TE Ribs 6, 8 and 10 attach to the rear spar. The diaphragm is rivetted to these ribs and TE Ribs 7 and 9 are rivetted to the aft face of the diaphragm. The outboard top panel attaches to the ribs, the diaphragm and the aft edge of the top skin panel of the wing (through butt straps). The (bottom) outboard access panel attaches to the ribs, the aft edge of the bottom skin panel of the wing (through butt straps) and the panel support beam. The beam panel installation is rivetted to the ribs and to the diaphragm. The TE seal is rivetted to the top outboard panel. A strut holds the aft edge of the small extension to the top outboard panel near

its outboard edge. The strut attaches the top outboard panel to the outboard strake beam through fittings.

A roller bearing is installed (in a beam channel) on the outboard panel of the beam panel installation, between the trailing edge of Ribs 9 and 10. An extension and Unicorn are installed on the leading edge of the inboard flap. The roller bearing (together with the extension and the Unicorn) controls the clearance between the flaps and the trailing edge structure during the operation of the flaps. The Unicorn touches the roller and enters the split seal as the flap retracts. The split seal closes the gap in the outboard panel below the roller when the flap is extended.

UNDERWING FIXED PANEL

The under wing fixed panel is installed aft of the rear spar near the fuselage. It is made from a carbon-fibre composite material with a honeycomb core and has a silicone rubber seal at its inboard and aft edges (where it touches the fixed fairing, door of the MLG). The seal is installed in a seal retainer which is made from aluminium alloy and is rivetted to the panel. The forward edge of the panel attaches to the aft edge of the bottom skin panel of the wing. Two struts hold the aft part of the panel. The struts attach to fittings on the panel and the aft face of the rear spar.

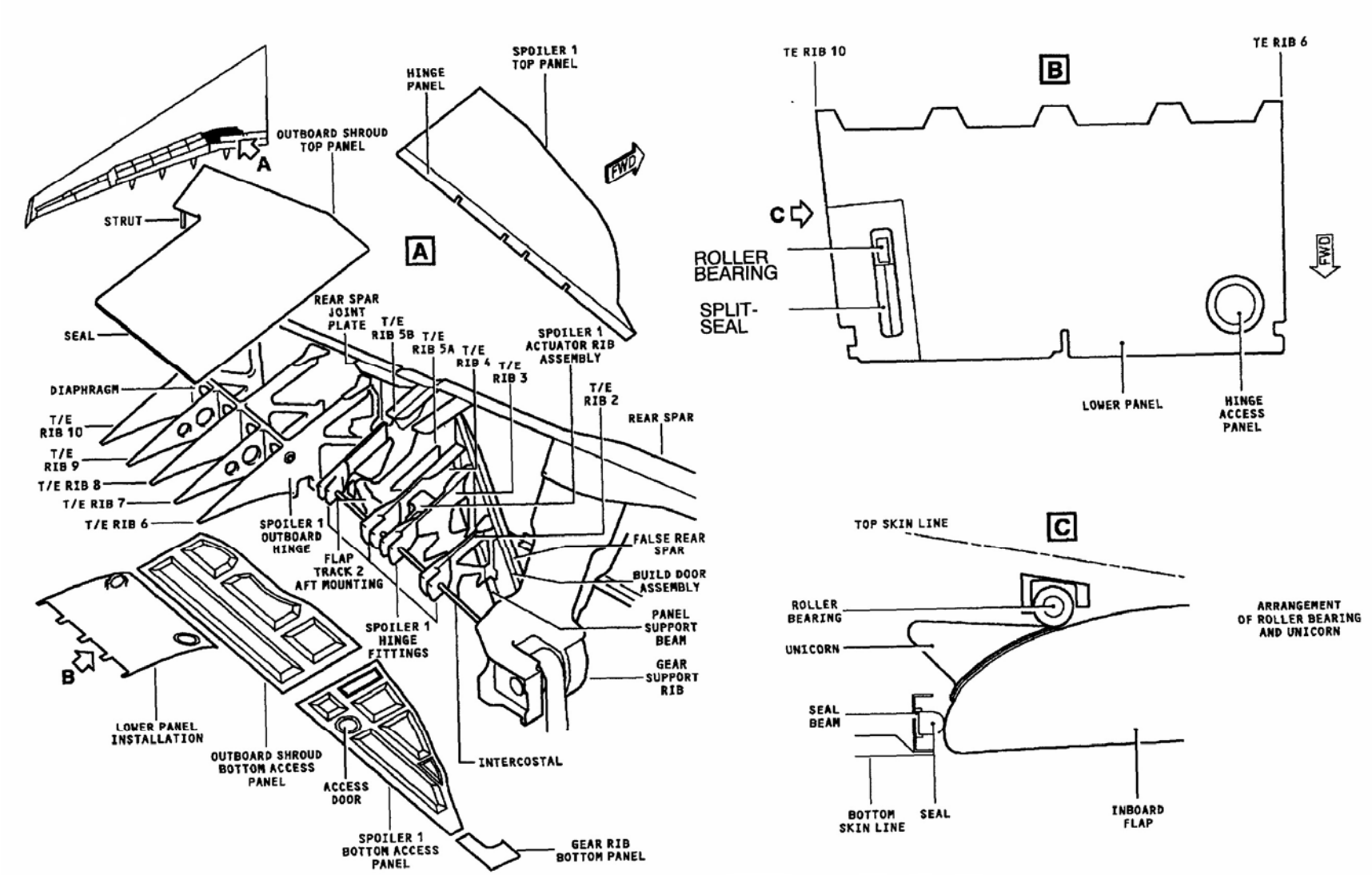

Figure 41 Outboard Shroud and Spoiler Panel1

MID SPAR TRAILING EDGE

SPOILER HINGE RIBS

Hinge Ribs, Common Hinge Ribs and Intermediate Ribs The hinge ribs and the common hinge ribs for Spoilers 2 thru 6 are made from aluminium alloy. All of the ribs attach to the rear spar. Most of them also attach to the aft edges of the top and bottom skin panels of the wing. But the outboard intermediate rib for Spoiler 2 and the inboard intermediate rib for Spoiler 4, attach to the aft edge

of the top skin panel.

Each spoiler is installed on hinge ribs through bearings in the aft end of each rib. There are four common hinge ribs made from aluminium alloy installed between Spoilers 2 and 6. Each one makes the inboard hinge point for one spoiler and the outboard hinge point for the next spoiler. The ribs also give attachment points for the top and the bottom panels. The intermediate ribs, which are made from aluminium alloy, are installed between the hinge ribs and give more attachment points for the panels. They also attach to the rear spar and the aft edges of the top and the bottom skin panels of the wing.

ACTUATING CYLINDER BRACKEDS

Each of the spoilers 2 thru 6 has an actuating-cylinder which attaches to a bracket installed on the rear spar. The brackets are made from aluminium alloy and attach to the aft edges of the top and bottom skin panels of the wing.

TOP AND BOTTOM PANELS

The 5 top and the 13 bottom panels are installed along the span between the outboard shroud and the trailing edge falsework. They extend aft from the rear spar to the leading edge of the spoilers. The panels are made from a carbon-fibre composite material and have an aramid honeycomb core. The top panels attach to the hinge ribs, the intermediate ribs and the aft edge of the top skin panel of the wing (through butt straps). The bottom panels attach to the ribs and to the aft edge of the bottom skin panel of the wing (through butt straps). Struts attach the aft edge of the bottom panels to the ribs.

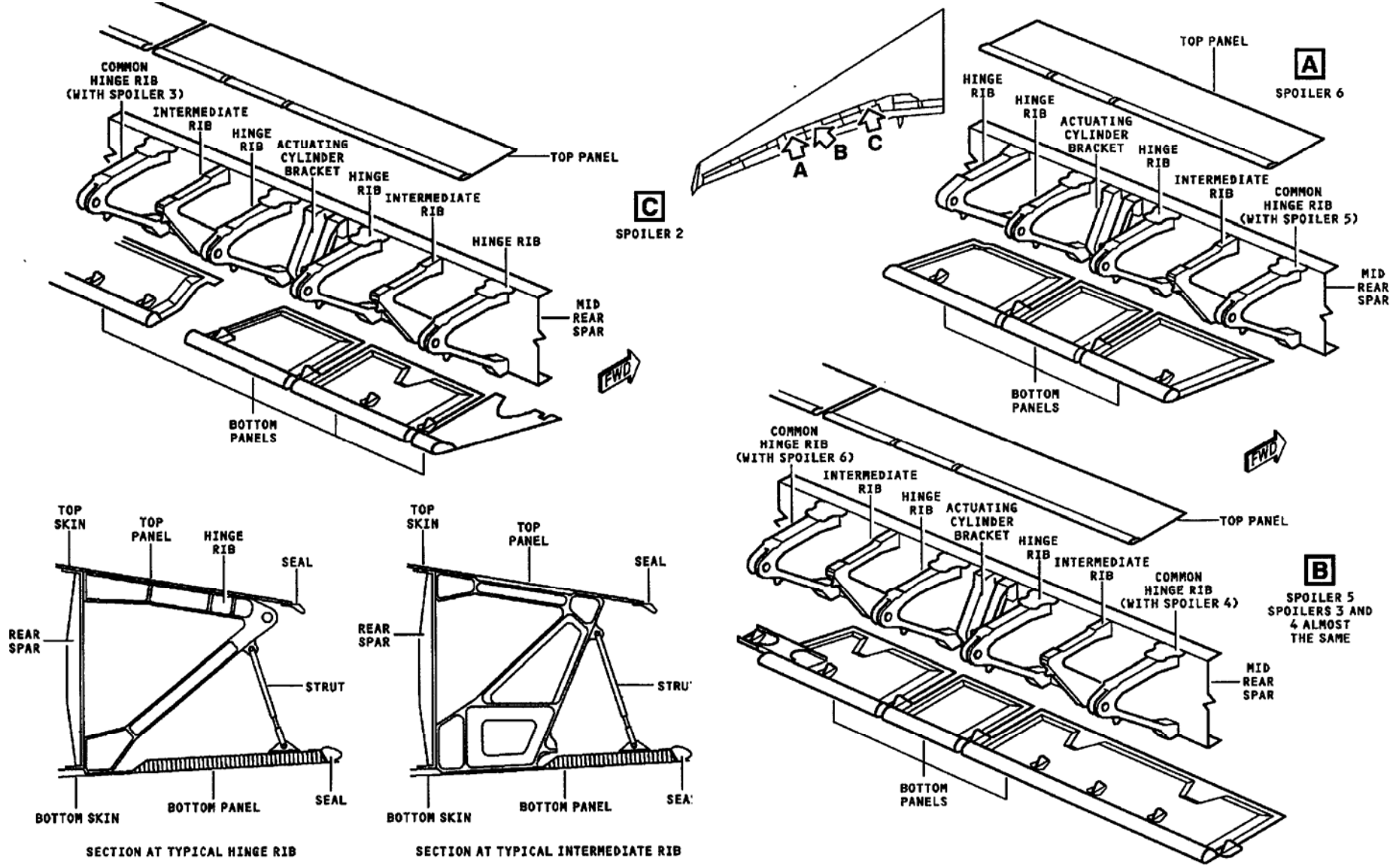

Figure 42 Mid Spar Trailing Edge

TRAILING EDGE FALSEWORK

The TE falsework makes the TE structure aft of the rear spar between the outboard spoiler and the inboard aileron. It includes the inner and outer closing ribs, an intercostal, a trailing edge tip and the top and bottom panels. The inner and outer closing ribs and the intercostal are made from aluminium-lithium alloy. The trailing edge tip and the top and bottom panels are made from a carbon-fibre composite material with an aramid honeycomb core.

The intercostal is installed between the inner and outer closing ribs. The top and bottom panels attach to the closing ribs and the intercostal. The trailing edge tip attaches to the aft edge of the top and bottom panels. An access panel (which is also made from a carbon-fibre composite material with an aramid honeycomb core) is installed at the forward edge of the top panel. There is an opening in the bottom panel at the systems interface between the outboard pylon and the TE of the wing.

The TE falsework attaches through butt straps to the aft edges of the top and bottom skin panels of the wing. The inner and outer closing ribs attach to the ribs (made from aluminium alloy) which are installed on the rear spar.

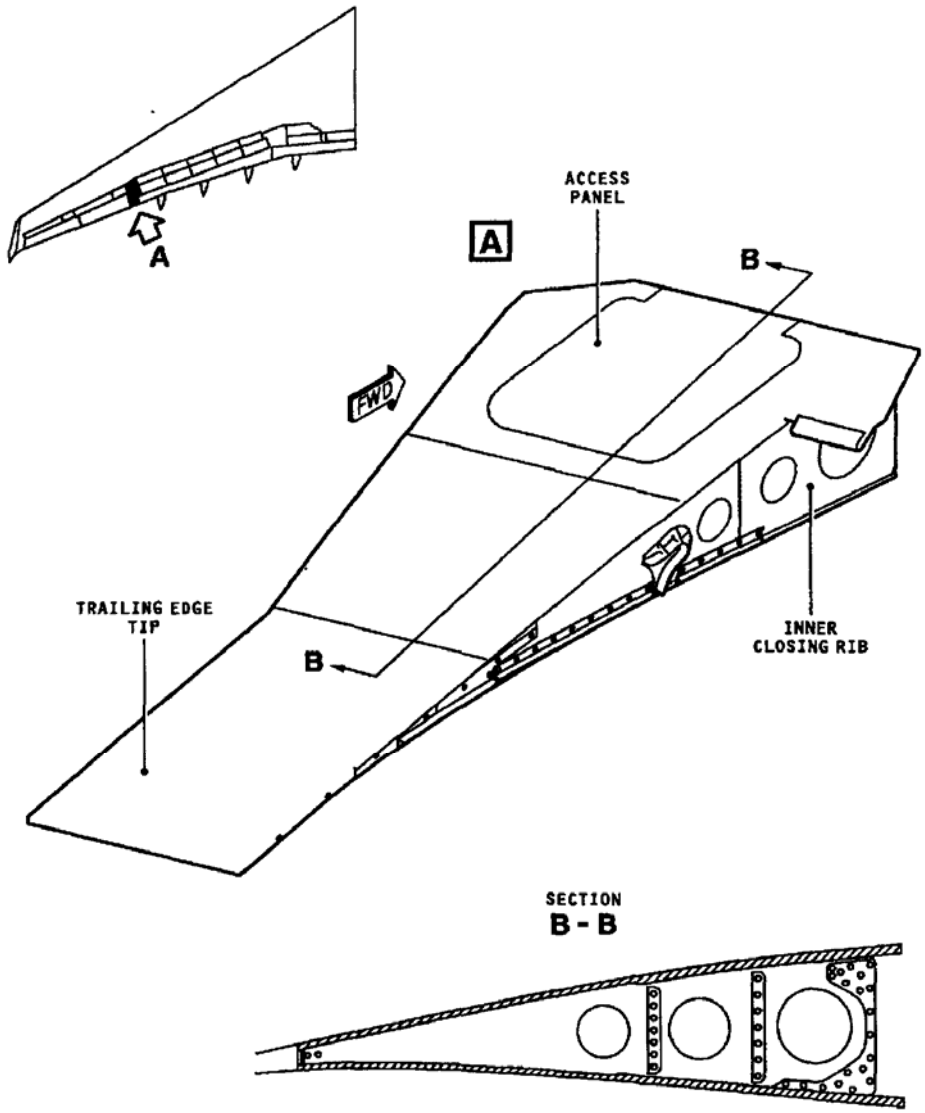

Figure 43 Trailing Edge Falsework

OUTER REAR SPAR TRAILING EDGE

RIBS and FRAMES

Each aileron is installed on five hinges through bearings in the aft end of each hinge rib and A-frame. The hinge ribs, A-frames and hinge posts for the inner and outer ailerons are made from aluminium alloy. The hinge ribs attach to the rear spar and to the aft edges of the top and bot

tom skin panels of the wing. The hinges 4 and 5 for each aileron are made from an A-frame and a hinge post. Each A-frame attaches to its hinge post which is installed on the rear spar. The hinge ribs also give attachment points for the top and bottom panels.

ACTUATING CYLINDER BRACKEDS

There are two hydraulic actuating-cylinders for each aileron. The cylinders are installed on brackets made from aluminium alloy. The brackets attach to the rear spar and to the aft edges of the top and bottom skin panels of the wing.

TOP and BOTTOM PANELS

The 4 top and the 4 bottom panels are installed along the span between the trailing edge falsework and the wing tip. They extend aft from the rear spar to the leading edge of the ailerons. The panels are made from a carbon-fibre composite and have an aramid honeycomb core.

The intermediate ribs, which are made from aluminium-lithium alloy, give more attachment points for the panels. They attach (between the hinge ribs and the A-frames) to the rear spar and to the aft edges ofthe top and bottom skin panels. The closing rib is the outer rib of the TE structure and is made from aluminium-lithium alloy. It attaches to the rear spar and to the aft edges of the top and bottom skin panels. The rib gives the outer attachment points for the top and bottom panels.

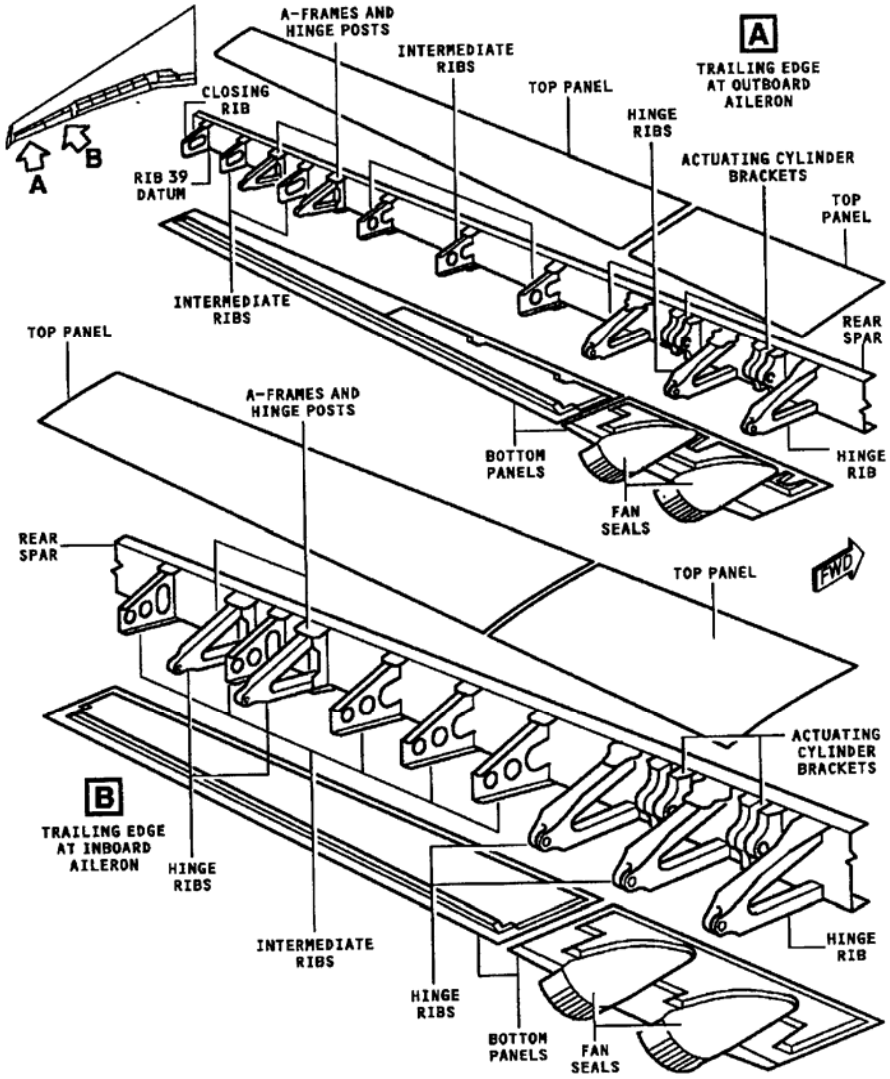

Figure 44 Outer Rear Spar Trailing Edge

INBOARD FLAP

The inboard flap is installed between STA0/RIB1 and STA757/1311311.

The inboard flap is a rivetted structure of aluminium alloy which includes: - the top and bottom skins - the ribs and stringers - the Track 2 (a machined part installed in the flap structure) - the drive rod and track link brackets (installed on Track 2) - the front and rear spars - the leading and trailing edges - an extension on the leading edge (the Unicorn). A rubbing strip made of stainless steel is bonded to the outer surface of the top skin above stringers 5 and 6. A steel trunnion is installed in a titanium casting attached to the inboard end of the flap.

INBOARD FLAP SUPPORTS and ATTACHMENTS

The beam of the flap support assembly (Track 1) for the inboard flap is machined from titanium. The roller tracks are part of the flap support assembly.

The flap support assembly (Track 1) attaches to the fuselage through Y braces and links. A trunnion on the inboard end of the flap attaches to the spherical bearing of the flap carriage. A strut assembly attaches the lower forward part of the carriage to an arm on the outer casting of the trunnion assembly. The flap support assembly (Track 2) has a beam made from aluminium alloy and a roller track made from titanium.

The forward end of the flap support assembly (Track 2) attaches, through a stainless steel main bolt, to an aluminium alloy bracket. Bolts attach the bracket, through the bottom skin of the wing, to the ribs of the wing box. The aft attachment of the flap support assembly (Track 2) is through bolts and spigot bolts to a pair of titanium ribs. These ribs are installed on the aft face of the rear spar. A cruise-roller is installed on the outboard end of the flap to hold the flap in the cruise position.

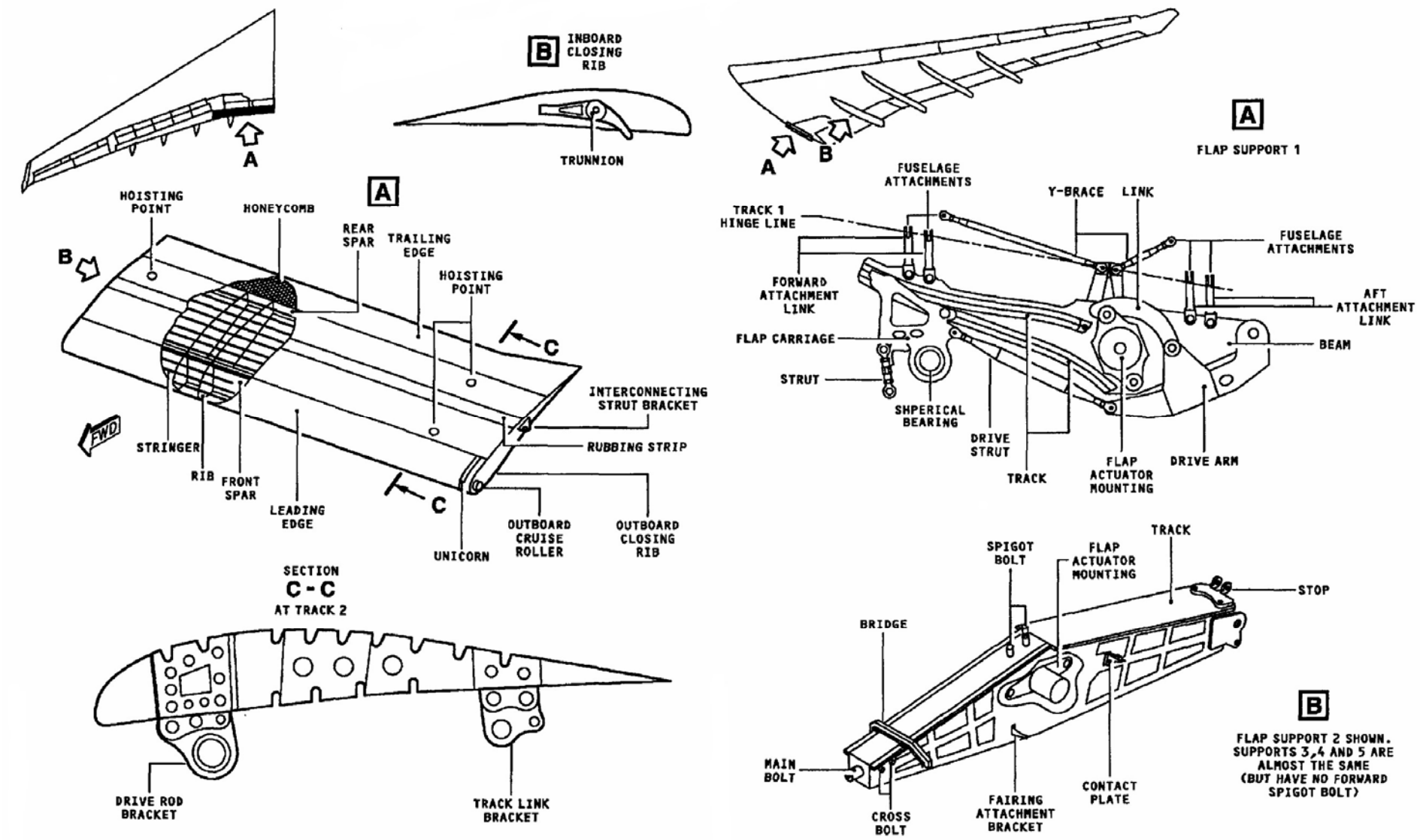

Figure 45 Inboard Flap and Flap Tracks 1-2

OUTBOARD FLAP

The outboard flap is installed between STA757/RlBl 1 and STA1 798/RIB27.

The outboard flap has top and bottom skin panels, and internal ribs, made from a carbon-fibre composite material. The Tracks 3 thru 5 (which are machined parts installed in the flap structure) and the two closing ribs are made from aluminium alloy. The leading edge of the flap is made from a carbon-fibre composite material. The trailing edge is made from aluminium alloy and has a honeycomb core which is also made from aluminium alloy. The stringers are part of the top and bottom skin panels. The top skin panel attaches to the ribs, and to the leading and trailing edges, with rivets and Hi-lok fasteners. The bottom skin attaches to the ribs, and to the leading and trailing edges, with Hi-lock fasteners only. The Tracks 3 thru 5 are also attached through rivets and Hi-lok fasteners. The swing link and the aft external fitting are made from aluminium alloy. These attach to the tracks 3 thru 5.

A rubbing strip made of stainless steel is bonded to the outer surface of the top skin.

A beam assembly made from aluminium alloy is installed at Track 4 between the flap and the flap support beam. A sensor strut (Ref. 27-51 -00) attaches between the flap and the beam assembly. This monitors the position of the flap and the beam relative to each other.

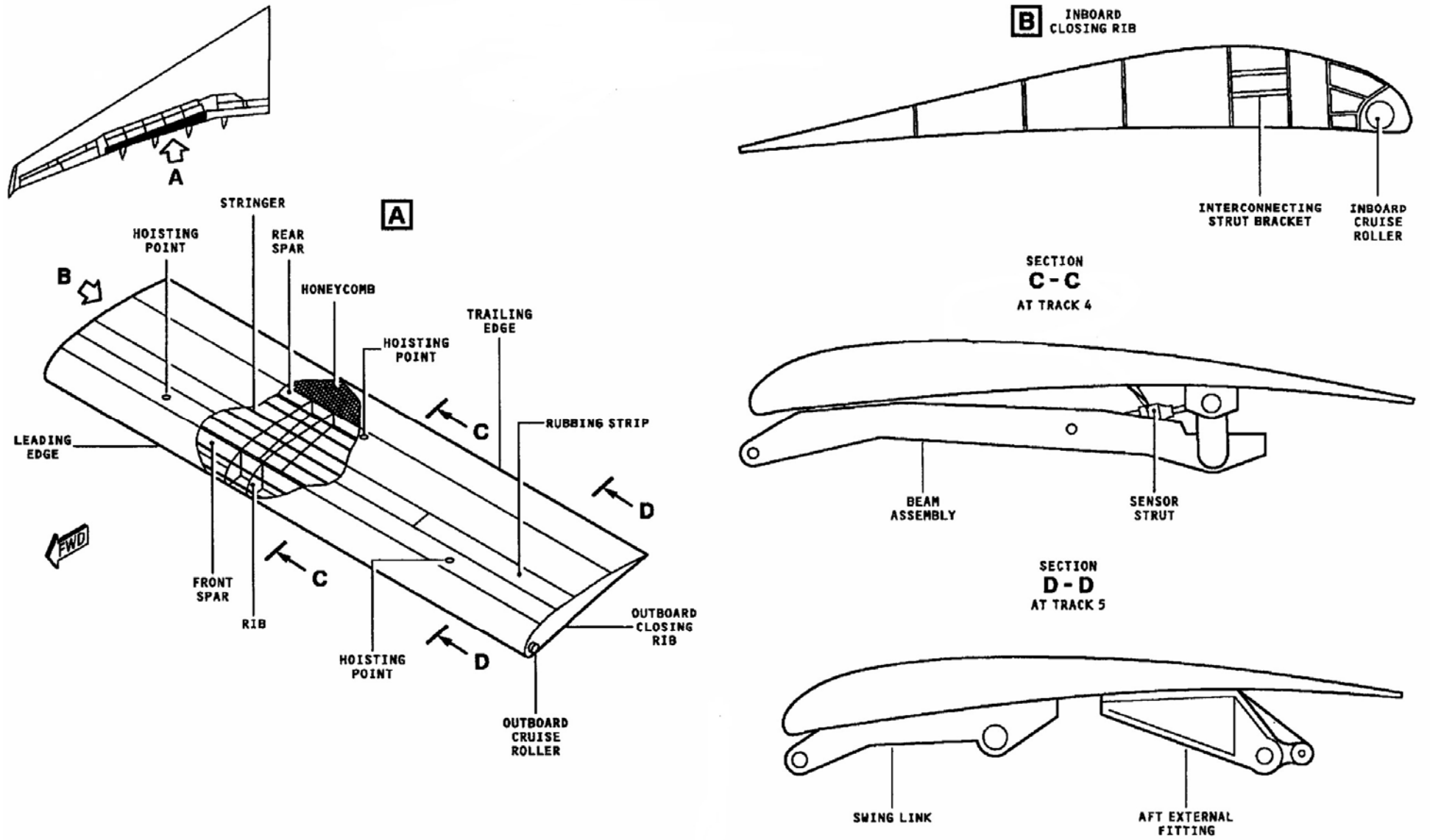

Figure 46 Outboard Flap

FLAP INTERCONNECTING STRUT

Two single-element Fowler flaps are installed on the TE of the outer wing. They are connected to each other through an interconnecting strut (Ref. 27-51-00). The inboard flap is installed on a flap support assembly (flap-track assembly) attached to the fuselage and another support assembly below the wing. The outboard flap is installed on three flap support assemblies attached below the wing.

The cushion seals, and the upper and lower seal plates, are made from silicon rubber. These enclose the area between the inboard and the outboard flaps.

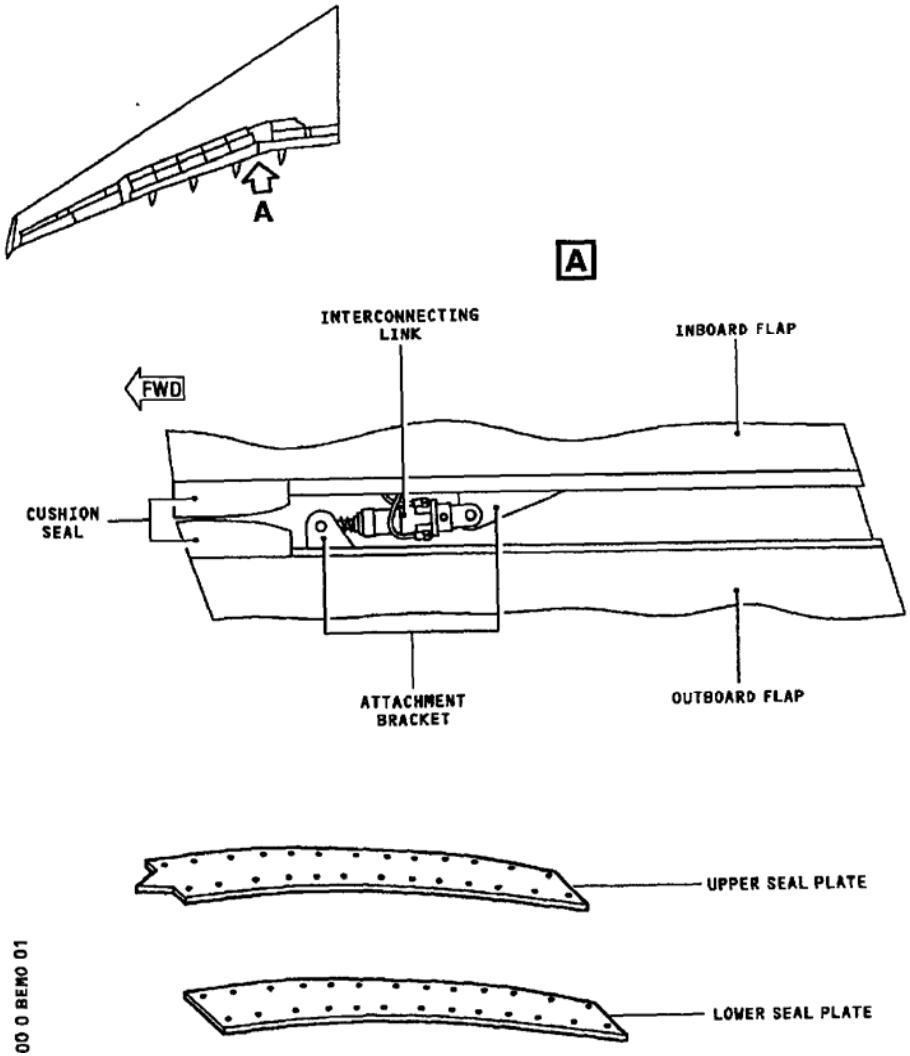

Figure 47 Flap Interconnecting Strut

FLAP SUPPORT ASSEMBLIES

The flap support assemblies (Tracks 3 thru 5) have beams made from aluminium alloy and roller tracks made from titanium. Each assembly includes: - the beam - the track - the rotary actuator (Ref. 27-54-00) - the main bolt - the spigot bolt.

The forward ends of the outer flap support assemblies (Tracks 3 to 5) attach, through the stainless-steel main bolts, to aluminium-alloy brackets. Bolts attach the brackets, through the bottom skin of the wing, to the ribs of the wing box.

Bolts and spigot bolts make the aft attachment of the flap support assemblies (through the bottom skin of the wing) to brackets installed on the aft face of the rear spar. A cruise-roller is installed on each end of the outboard flap to hold the flap in the cruise position.

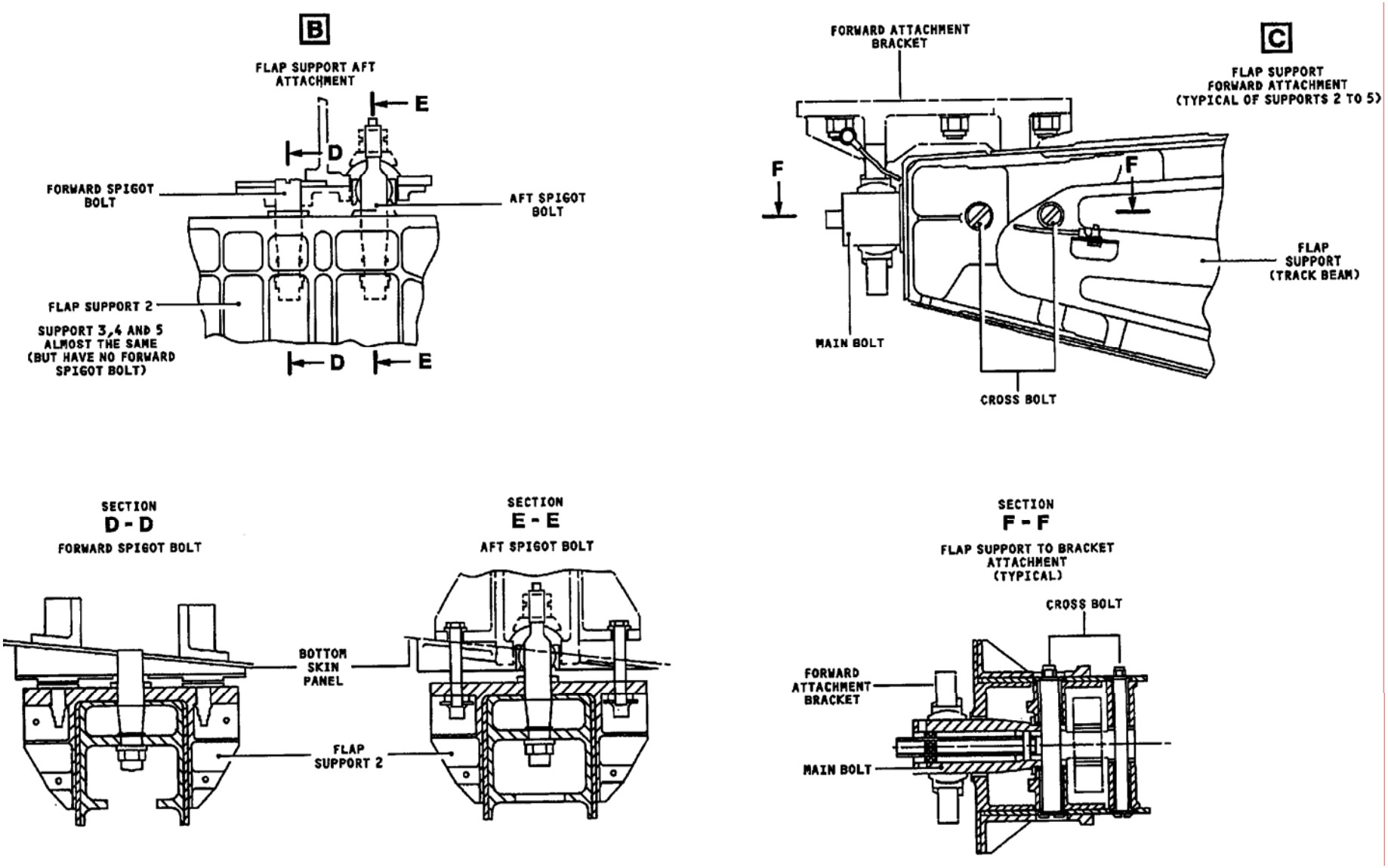

Figure 48 Flap Track Attachment

FLAP ROTARY ACTUATOR

A rotary actuator is attached to each flap support assembly. The actuators are joined to each other and to a central power-control-unit through a transmission system (Ref. 27-54-00).

FLAP FAIRINGS

Each flap support assembly (installed below the wing) is enclosed by fixed and movable fairings made from a glass-fibre material.

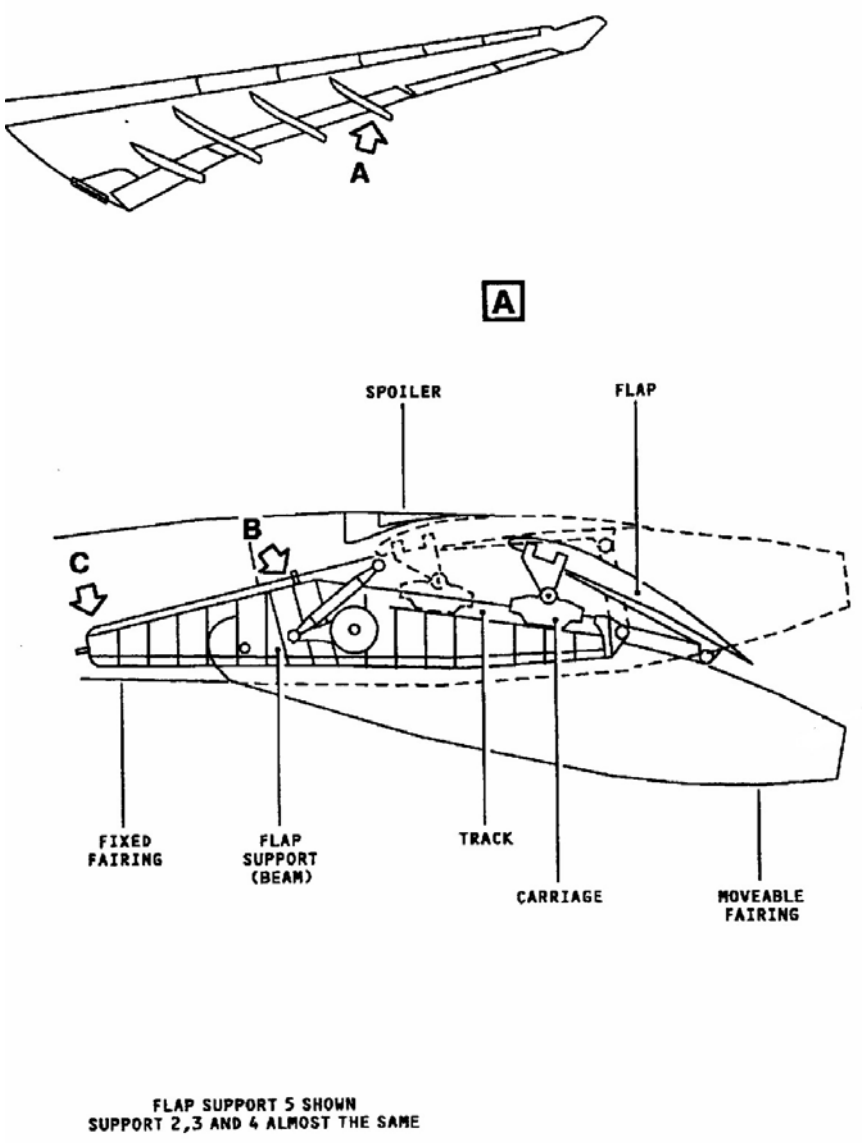

Figure 49 Flap Track and Drive Stations 3-5

WING TIP / WINGLET

GENERAL

The wing tip and winglet are in Zone 535(635).

The wing tip is attached with bolts to the outer wing . Mountings are included in the wing tip for navigation lights and strobe lights. The winglet is attached to the outboard end of the wing tip. One bolt through the forward fitting assembly and two bolts through the rear fitting assembly attach the winglet to the wing tip. The retainers for four static dischargers are installed on the wing tip and winglet rear edges. The aluminium and aluminiumlithium-alloy parts of the structure give electrical continuity. Fairings installed between the winglet and the wing tip gives a smooth aerodynamic profile.

WING TIP

The wing tip has three parts: - a box structure - a leading edge corner - a trailing edge. The box structure has these aluminium-alloy parts: - the front and rear spars -the mid rib and the vapour-seal plate attached to it - the outboard rib - the top and bottom skins and stringers - a buttstrap - two attachment fittings. A life-line fitting is installed on the top skin.

The leading edge corner has a glazing panel, an aluminium-alloy skin-fairing and an aluminium-lithium alloy landing. The leading edge corner is attached with bolts to the box structure. The polycarbonate glazing-panel is installed in front of the lights and is attached with bolts. There is a seal of silicone rubber between the glazing panel and the landing. The trailing edge top and bottom panels and the trailing-edge wedge are made from carbon-fibre with a nomex-honeycomb core. The trailing edge also has: -aluminium-alloy inboard and outboard ribs, spigots and rabbet plates - a conductivity section made from aluminium-lithium alloy - closing ribs and a rubbing plate made from carbon-fibre reinforced-plastic.

Two carbon-fibre-composite panels 535AB(635AB) and 535BB(635BB) (with impregnated aramid cores) are installed under the wing-tip-to-winglet joint.

WINGLET

The winglet has four parts: - a box structure - a trailing edge - a leading edge - a top tip. Aluminium-alloy fittings are included in the box structure to attach the winglet to the wing tip.

The box structure has: - front and rear spars of carbon-fibre with impregnated-aramid cores - top and bottom panels of carbon-fibre with nomex-honeycomb cores - an outer closing rib of carbon-fibre reinforced-plastic - a two-part inner closing rib of aluminium and alum inu m-lithium-alloys. The leading edge assembly has an aluminium-alloy skin with aluminium-lithium alloy riblets.. The trailing edge assembly is a carbon-fibre structure with a nomex-honeycomb core. Rivets attach a protective plate of aluminium-lithium alloy at the rear of the winglet trailing edge. The top tip is a machined casting of aluminium-lithium alloy. There are fairings between the wing tip and the winglet. The leading edge fairings are of aluminium alloy. The aft fairing is made of carbon-fibre reinforcedplastic with a trailing edge section made of aluminium-lithiumalloy.

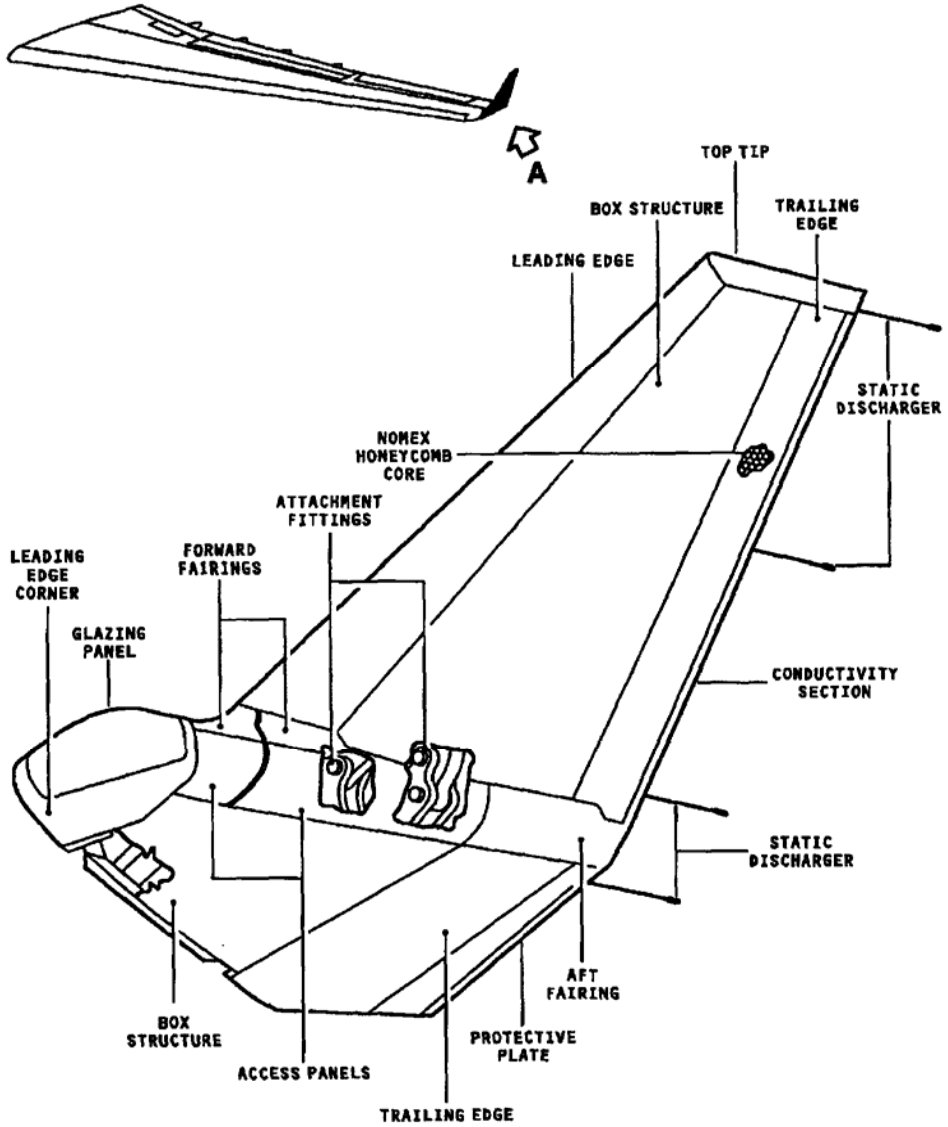

Figure 50 Wing Tip and Winglet

AILERONS / SPOILER PANELS

AILERONS

The ailerons are located at the ends of the wings between the RIB39 and the RIB33 for the outboard aileron, and between the RIB33 and the RIB27 for the inboard aileron.

Each aileron is made of:

Resin-impregnated carbon fibre parts.

- upper and lower panels with honeycomb core in typical section and monolithic structure in way of ribs and spars
- an outer and inner spars
- 9 ribs at hinge fittings and jack attachment fittings. These ribs are made of two half-ribs joined together at the webs
- a fixed leading edge
- removable leading edge panels at hinge brackets
- a fairing on the lower panel at the inner and outer jacks.

Metallic parts :

- a titanium inner spar
- 2 end ribs, 1 centre rib and 12 leading-edge aluminium-alloy ribs
- a channel section on the trailing edge
- Aluminium-alloy machined brackets attached to the spar assembly. Two of these brackets connect the jacks and the other 5 brackets are used as hinges
- a lightning and static electricity protection assembly made of five static dischargers (on the trailing edge of the outboard aileron only) and bonding strips.

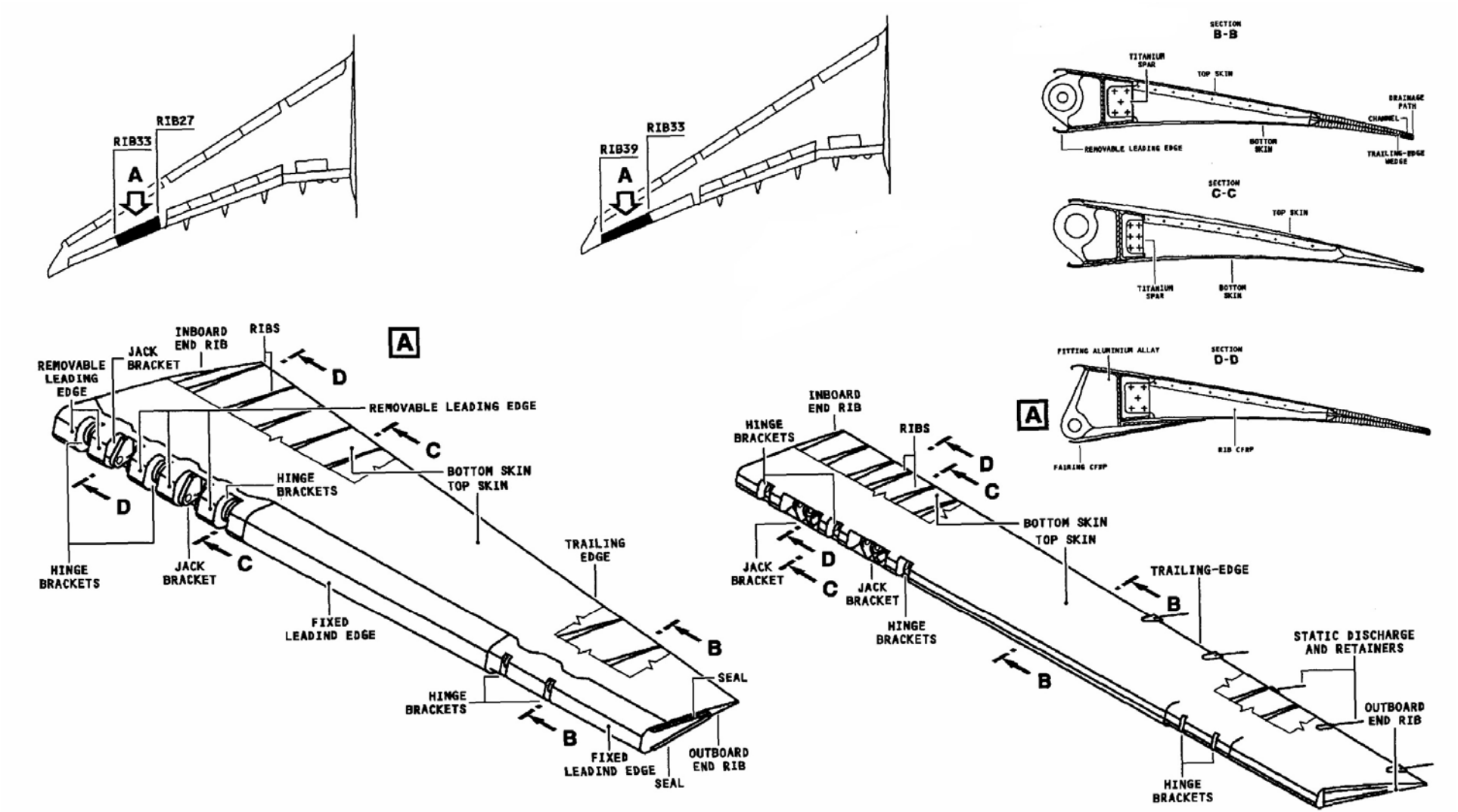

Figure 51 Ailerons

SPOILER PANELS

There are six spoilers installed in the upper surface of the trailing edge of each wing . Hinges attach each spoiler to the rear spar or the false rear spar. The spoiler actuators are installed between the actuator attachment-fittings and the rear spar or the false rear spar.

PRIMARY STRUCTURE :
The spoilers are a sandwich construction. The primary components are: - the spoiler structure, - the fittings.

Spoiler Structure The spoilers are a wedge-shaped structure. The top and bottom skins, the sides and the trailing edge profile of the spoilers are made of carbon fibre. They are bonded to a honeycomb core.

FITTINGS
The spoiler hinges and the spoiler actuator attachment-fittings are machined from aluminium alloy plates. Bolts attach the hinges and the fittings to the spoiler.

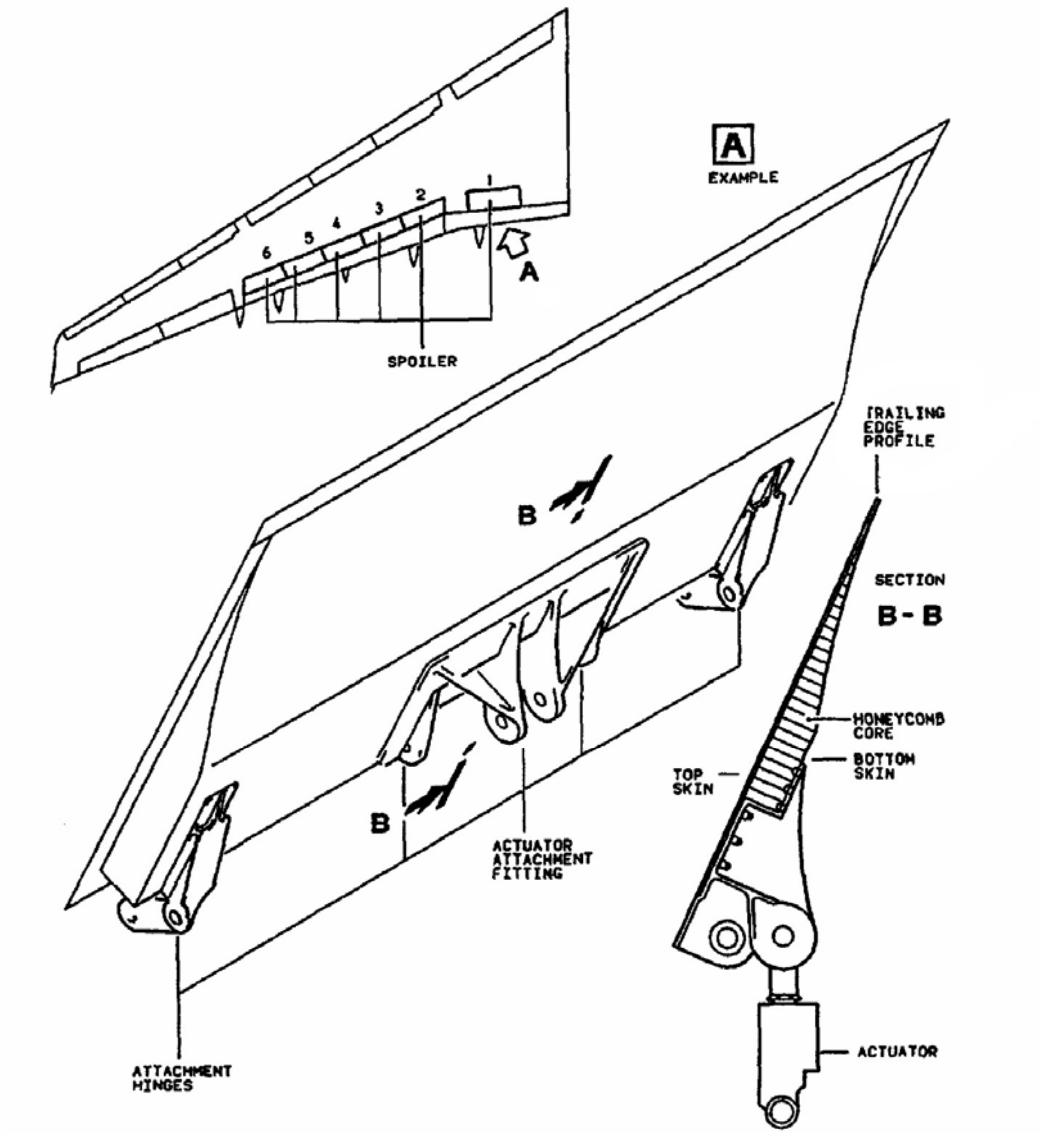

Figure 52 Spoiler Panel

WINDOWS
ATA 56-00

56-10 COCKPIT WINDOWS

GENERAL
There are four fixed windows installed in the cockpit: - two windshields - two fixed side windows between FR7 and FR10. The left and right windows are symmetrical. The windows are mounted in a frame which enables them to be removed and installed externally.

WINDSHIELDS
The windshield panels are made up of several layers of different materials.

Anti-icing and defogging system The anti-icing and defogging system consists of: An almost invisible electrical conductor continuous film which heats the windshield panels when an electrical current flows through it. This film is installed on the inner face of the outer sheet of glass. The temperature is controlled by two probes. An icing indicator is installed on the outer face of the windshield post to indicate the presence of ice.

FRAME
The windshield panels are mounted in a frame integrated in the nose structure. The panels are held in position by three retainers bolted to the outer face of the frame.

FIXED SIDE WINDOWS
The fixed side windows are made up of several layers of different materials.

Defogging system The fixed side windows are fitted with an integral defogging system. The heating element consist of parallel wires. The fixed windows include 2 temperature sensors for the temperature control. Only one is used, the other one is for spare.

Frames The window panels are held in position on a removable frame, by a retainer. The frame assembly is also bolted on to the aircraft frame and is sealed using a sealing compound.

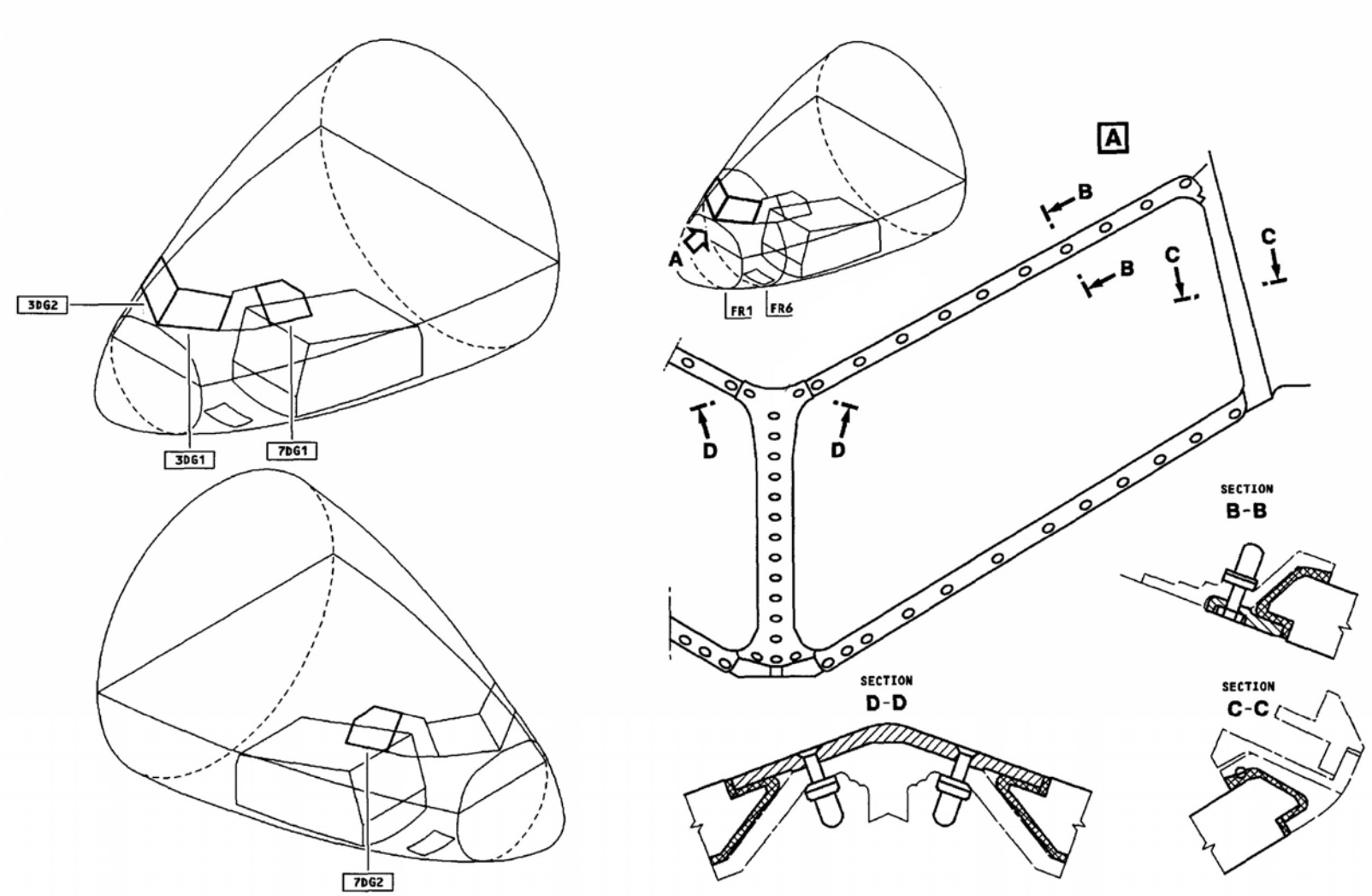

Figure 53 Fixed Cockpit Windows

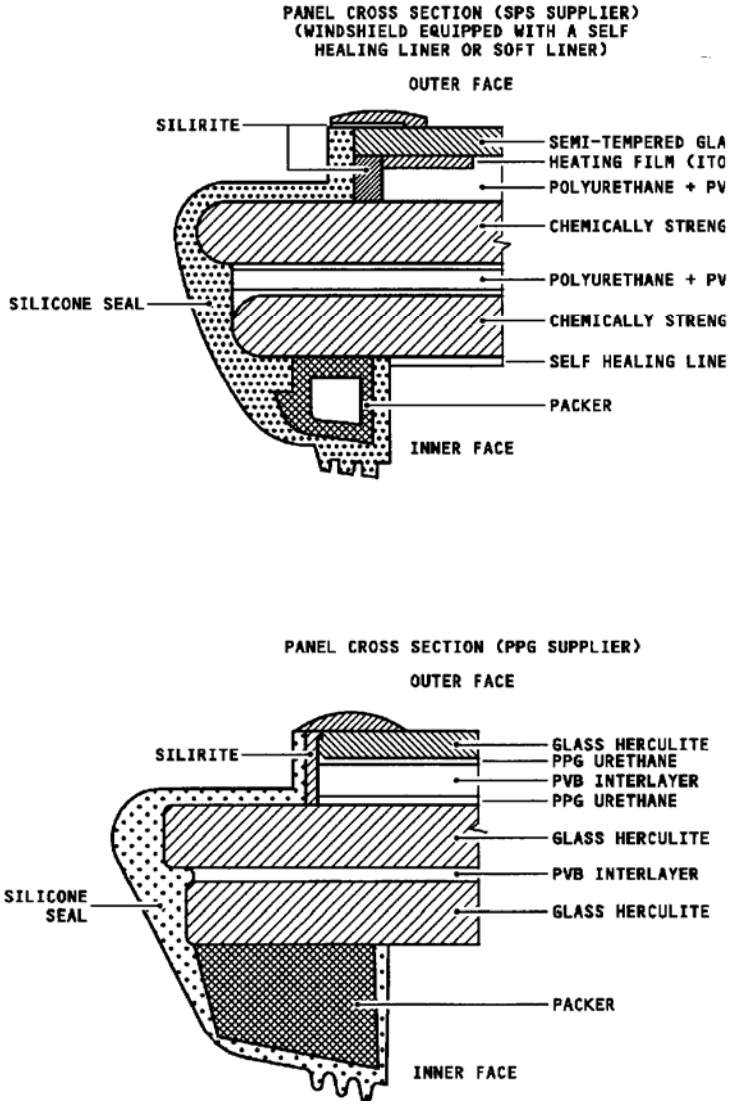

Figure 54 Cockpit Windows

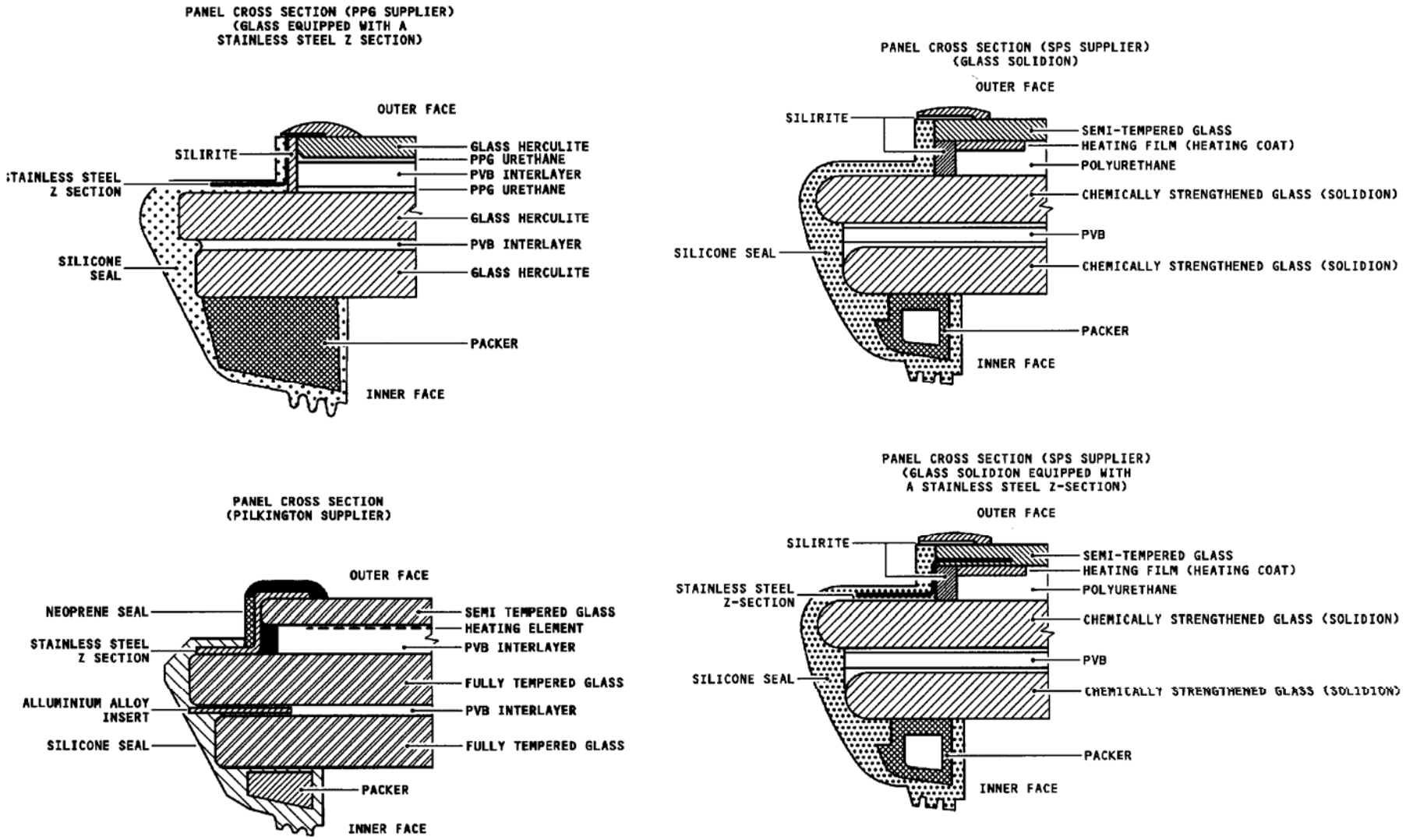

Figure 55 Windshield Panels

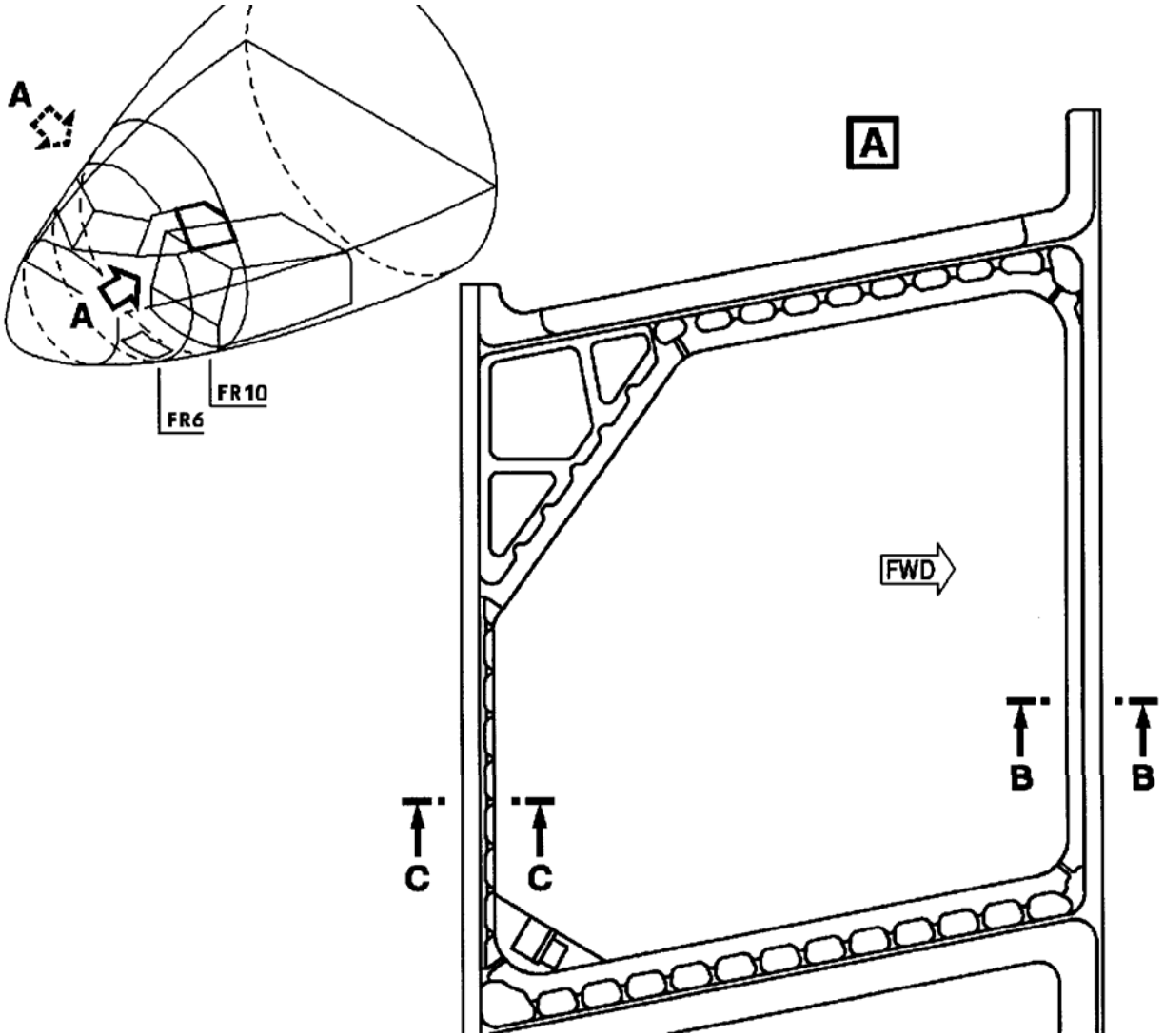

Figure 56 Fixed Side Windows

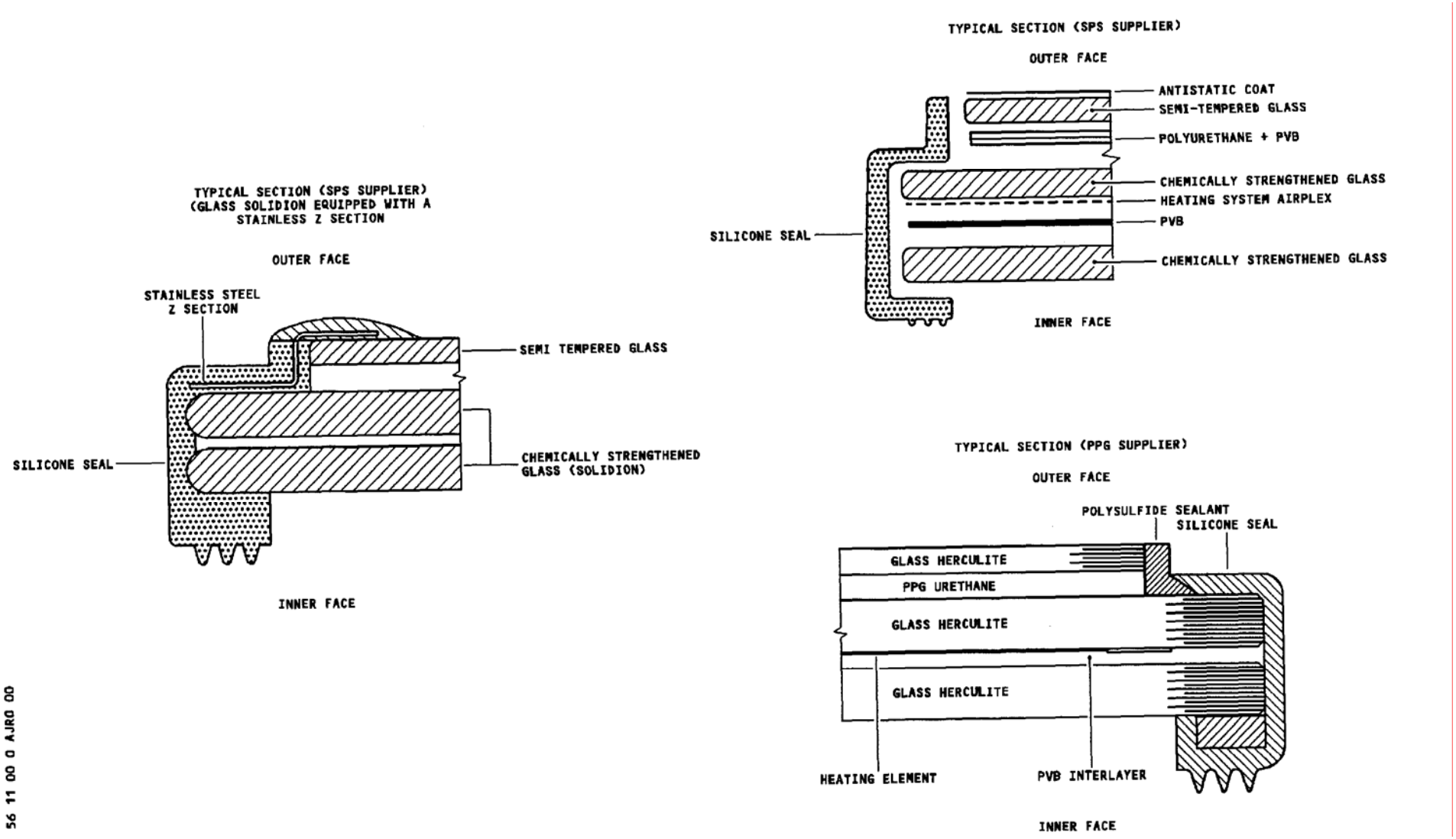

Figure 57 Fixed Side Window Panels

SLIDING WINDOWS

GENERAL
The cockpit includes two sliding windows (left and right) installed between **STA836/FR4 and STA904/FR7.** The crew can use these sliding windows as emergency exits. Each panel is installed in a frame. The frame permits the panels to move on the rails which are fixed to the aircraft structure.

DESCRIPTION
Each sliding window includes:

- A panel which has an anti-icing and defogging system. This panel is installed in a frame.
- The opening/closing mechanism.
- Defogging System The windows are equipped with a defogging system. This system includes a heating element. The electrical connections are made by a connector installed on the panel
- Sliding Frame (Ref. Fig. 004

WINDOW ASSEMBLY:
- The window panels are made up of several layers of different materials.
- The lower section of the sliding frame is equipped with a rack. This rack holds the window in its different positions when it is open.
- The panel is held in the sliding frame with bolts and nuts.
- A peripheral seal made of silicone elastomer ensures the sealing between the panel and the sliding frame

OPERATION:
Opening Fully depressing operating handle disengages the locking pins from their latches. Rotation of the operating lever, aft, frees the window panel from its fixed frame (structure). When end of travel of the operating lever is reached, pull backwards to slide the window panel aft.

Closing Move lock Open assembly control lever aft (unlocking of rack). Push operations lever forward until the panel is in position opposite its fixed frame.

Rotation of the operating lever forward moves the panel into its frame and engages the locking pins in their latches.

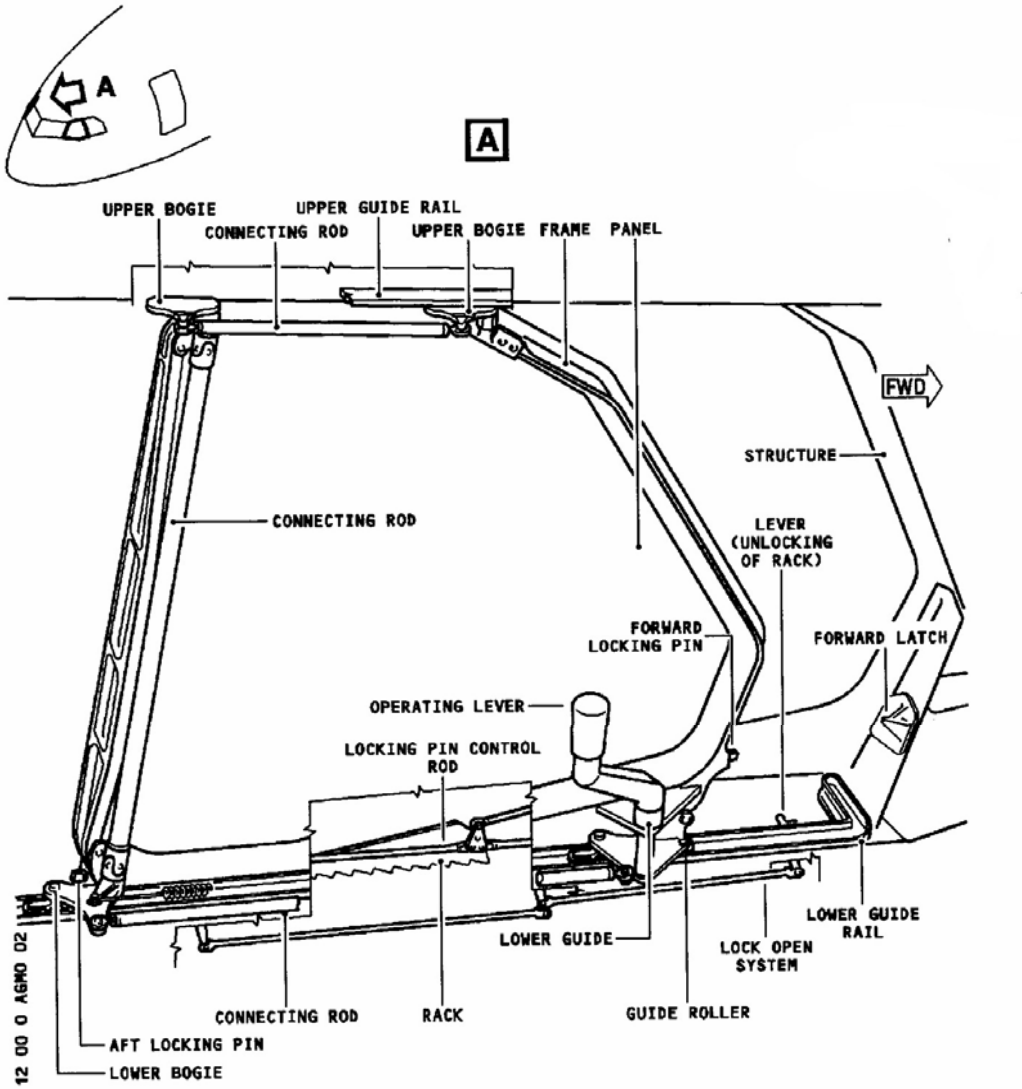

Figure 58 Sliding Window Operating Mechanism

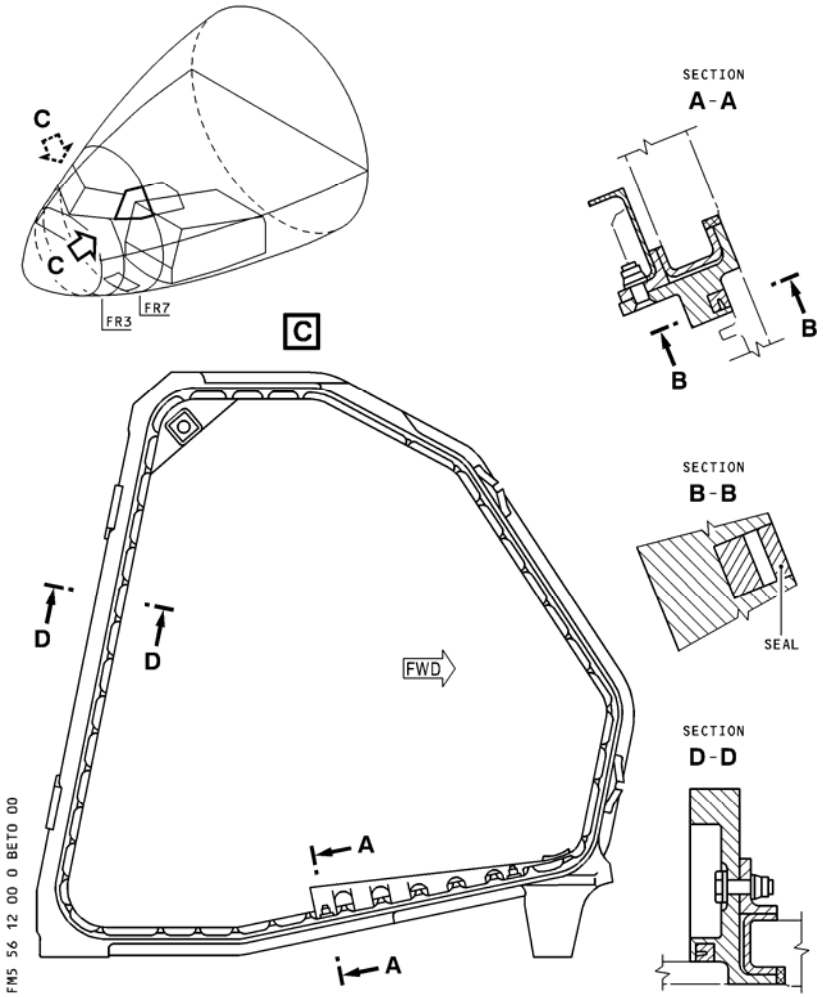

Figure 59 Sliding window Panel Assembly

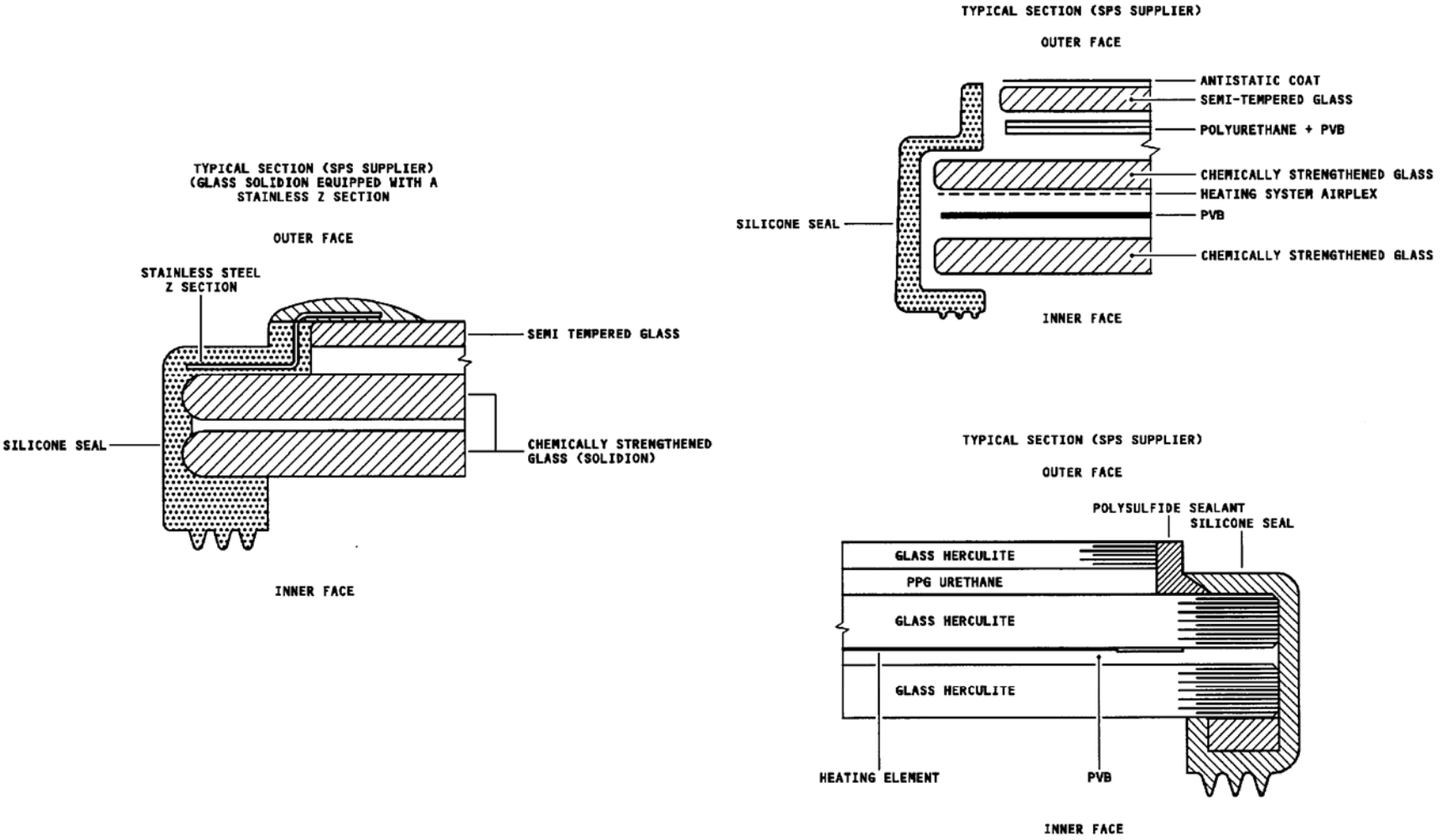

Figure 60 Sliding Window Panes

56-20 CABIN WINDOWS

CABIN WINDOW DESCRIPTION

The cabin windows are installed in the seating areas of the cabin. A retainer ring, eye-bolts and nuts, hold each cabin window in a window frame.

The cabin windows are 250 mm (9.8425 in.) wide and 350 mm (13.7795 in.) in height. They are installed in window frames which are attached to the fuselage skin. In general, the distance between the window frames is 530 mm (20.8661 in.). The cabin windows are installed from inside the aircraft. The main components of the cabin windows are: - window assembly, - retainer ring.

WINDOW ASSEMBLY

The window assembly is installed between the retainer ring and the window frame. Each window assembly has an inner pane and an outer pane which are made of stretched acrylic-resin. A silicon-rubber sealing ring holds the two panes together. The sealing ring makes sure that the cabin window is pressure-tight when it is installed in a window frame. There is a small hole in the bottom part of the inner pane. This lets the pressure between the two panes stay the same as that in the cabin.

RETAINER RING

The retainer ring is made of aluminium alloy plate which is pressed. Six eyebolts (which are attached to the window frame) and six nuts, attach the retainer ring to the window frame.

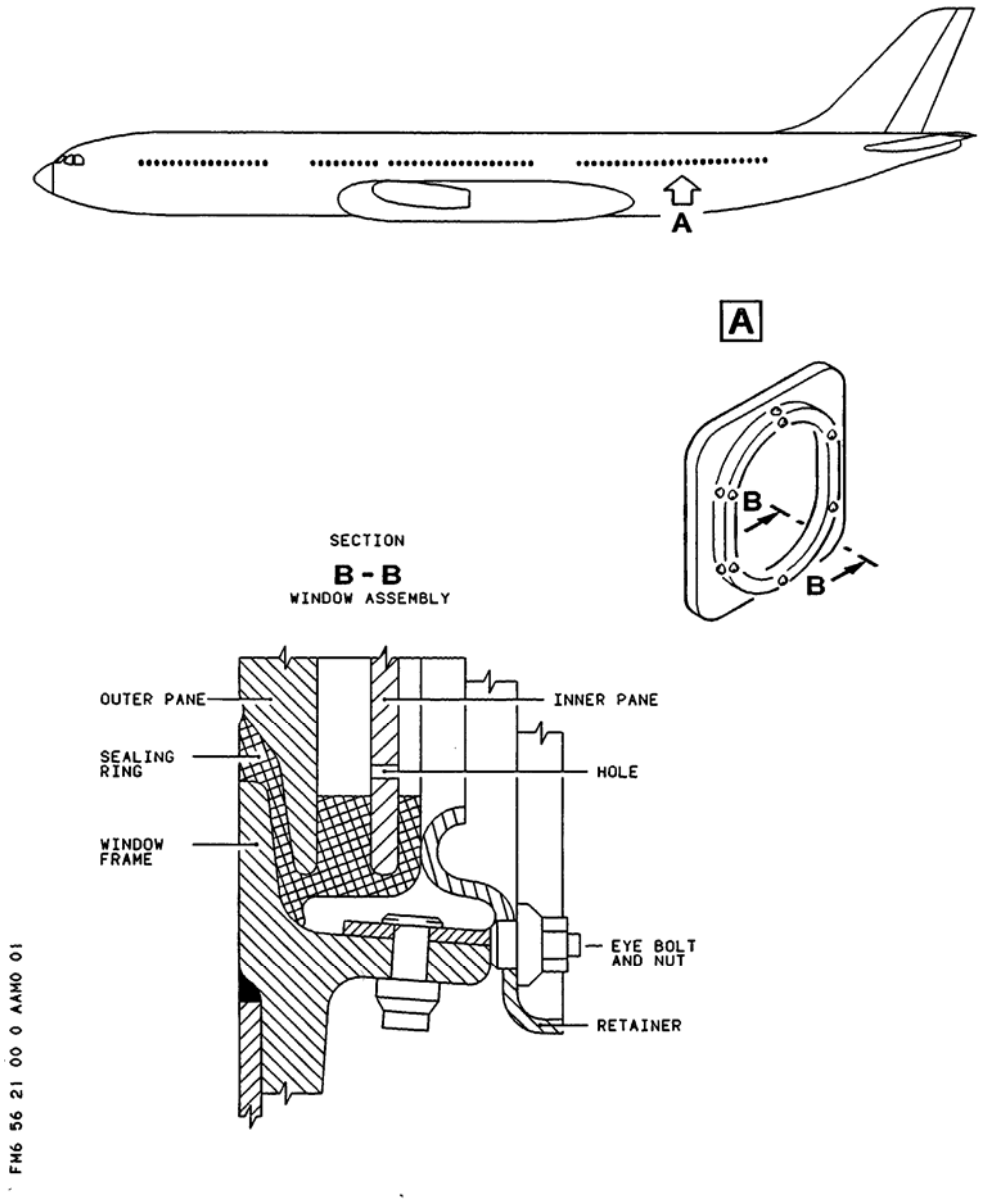

Figure 61 Cabin Widow