# CHAPTER

# 51

# STANDARD PRACTICES

# STRUCTURES

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# CHAPTER 51 - STANDARD PRACTICES STRUCTURES
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# CHAPTER 51 - STANDARD PRACTICES STRUCTURES
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# STRUCTURE - GENERAL

1. General (Ref. Fig. 1)

   A. The airplane structure is manufactured from metal and composite materials. The locations of the metal and composite parts are shown in Fig. 1. This topic gives a general description of the construction and materials of the major sections of the structure.

   B. For the dimensions and areas of the airplane structure refer to Chapter 06-00-00.

   C. For information about access panels and doors refer to Chapter 06-00-00.

2. General Description

   A. Nose Section
   The nose section comprises the forward avionics compartment, forward wing and nose landing gear bay. The avionics compartment comprises a metal equipment platform covered by a fiberglass honeycomb radome/metal nosecone. The equipment platform is supported by the keelbeams and the forward pressure bulkhead. The forward wing is metal-made and is attached to four machined fittings mounted on the keel beams. The forward wing is equipped with metal bonded trailing edge flaps. The nose landing gear is suspended from the structure below the flight compartment floor and retracts forwards into a non-pressurized bay. The nose landing gear bay is enclosed by composite doors. An all metal landing/taxi light panel is located forward of the nose landing gear bay.

   B. Fuselage
   The fuselage comprises the flight compartment, passenger compartment and baggage compartment. The fuselage is of semi-monocoque construction manufactured, in two sections, from 2024 Alclad aluminium alloy. The fuselage is joined at the rear pressure bulkhead which separates the pressurized flight and passenger compartment from the unpressurized baggage compartment. All the compartment floors are constructed of aluminium alloy sheet supported by floor beams.

   C. Wing/Fuselage Intersection
   The wing fuselage intersection is the area to the rear of the rear pressure bulkhead where the wing spars connect to the fuselage bulkheads. The area above the wing between the center bulkhead and rear pressure bulkhead forms the fuselage integral tank. The main landing gear is attached to milled aluminium plates bolted between the center bulkhead and the rear pressure bulkhead. An aluminium alloy structural panel is located between the lower surface of the wing and the landing gear mounting plate. The main landing gear retracts rearwards into unpressurized bays enclosed by composite doors.

   D. Empennage
   The empennage comprises the tailcone, ventral fins, vertical stabilizer and rudder, and horizontal stabilizer and elevators. The tailcone is metal-made except the rear end part that is in fiberglass. The three bulkheads are strengthened along their vertical centerlines to provide support for attaching the vertical stabilizer spars.

The bulkheads also provide support for all composite ventral fins. The vertical stabilizer and the rudder are metal-made. The horizontal stabilizer is a composite structure connected to a hinge mounted at the rear of the vertical stabilizer. The forward part of the horizontal stabilizer is connected to an actuator mounted inside the vertical stabilizer. The elevators are metal-bonded structures constructed from aluminum honeycomb.

E. Main Wing
The main wing is constructed in two halves, left and right, which are permanently joined together inside the fuselage, aft of the rear pressure bulkhead. The main wing upper and lower skins are manufactured from aluminium alloy machined with integral stiffeners in a grid pattern. The forward and aft spars are machined aluminium alloy with integral webs to correspond with the rib stations. The aluminium ribs are rivetted or bolted between the spar webs and the chordwise stiffeners of the skin panels. The complete assembly forms a torsion box which carries all the wing bending, shear and torque loads. Each torsion box is sealed to form the left and right wing tanks. The front and rear spars have machined titanium fittings for installation of the engine mounting frame. A third spar is installed between the nacelle and the fuselage centerline to improve stiffness in the wing root area. Each wing has two aluminium alloy leading edges, one inboard of the nacelle and one outboard of the nacelle. Both leading edges are removeable. Each wing has an aluminium alloy outer trailing edge and a composite center trailing edge. The main wing outboard fowler flaps are metal structures. Each flap is mounted on roller supports which travel in tracks attached to the wing torsion box. The inboard single slotted flaps are metal-bonded, manufactured from aluminium honeycomb with thin aluminium skins. The ailerons are metal-bonded, manufactured from aluminium honeycomb. The right aileron has a trim tab attached with a piano hinge.

F. Engine mounting frame and nacelles
The engine mounting frame is a titanium structure, divided into two subassemblies by a machined stainless-steel fireproof bulkhead. The nacelles are composite structures manufactured in four parts and attached to wing mounting strips and a splice bulkhead on the engine mounting frame.

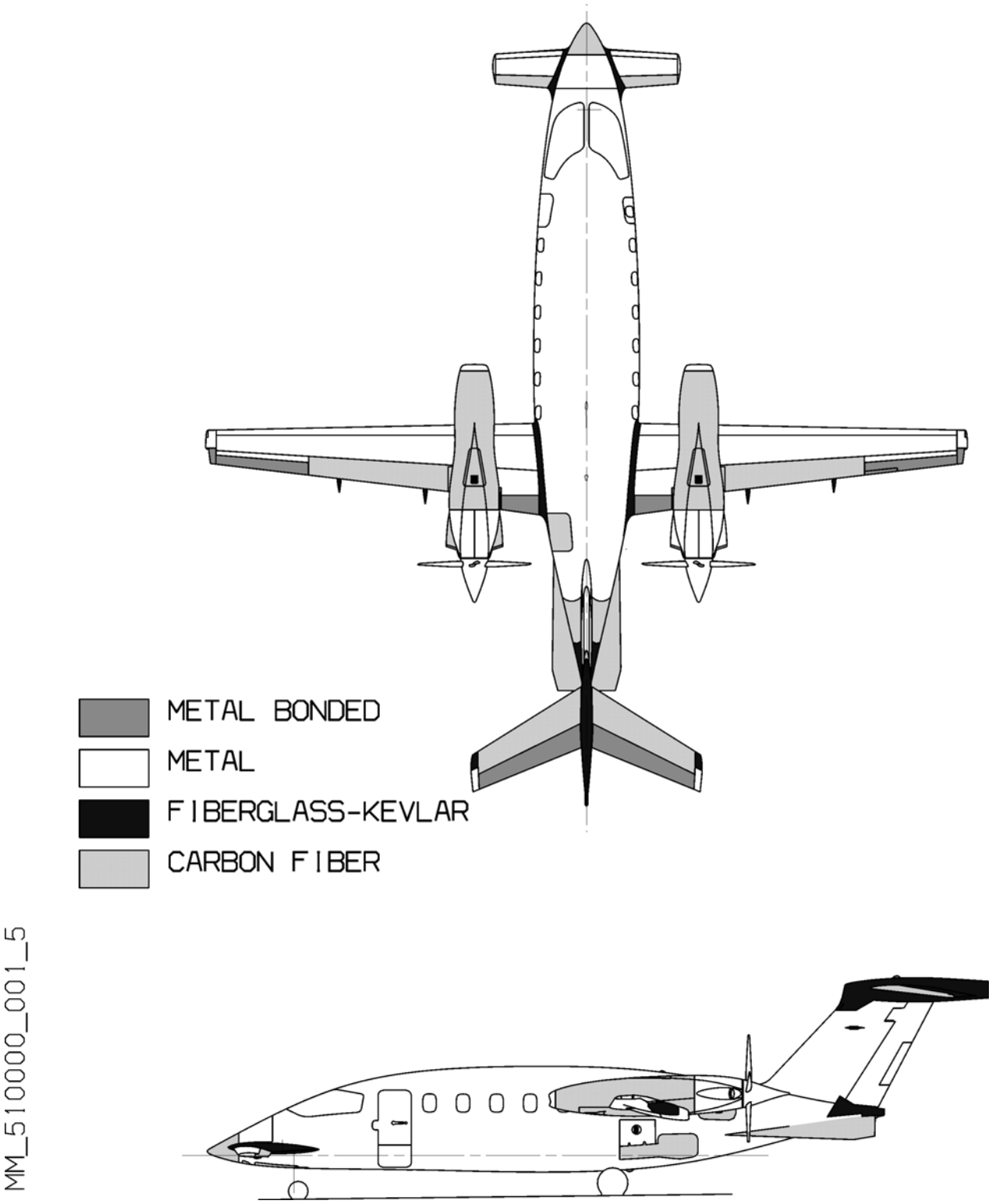


Fig. 1 (Sheet 1 of 2) - Structure - Identification

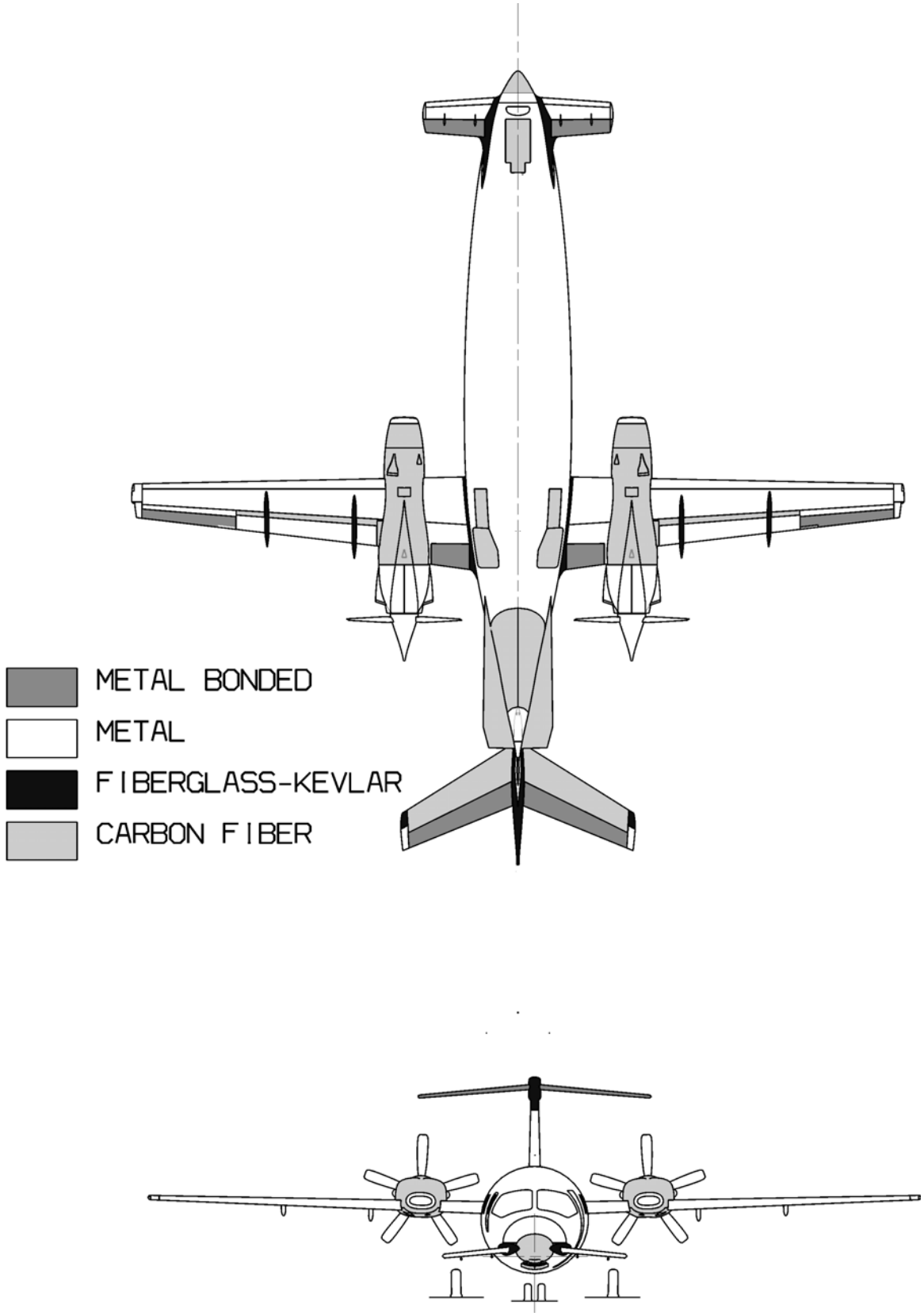


Fig. 2 (Sheet 2 of 2) - Structure - Identification

# STRUCTURE - CLASSIFICATION

## 1. General

A. To assist operators in the determination of the strength standards required for repairs and the urgency with which they must be done, the main structural components are classified to indicate their relative importance. The structural classification of a component must be considered when assessing damage (Refer to 51-11-00).

B. The classification is given by shading on the illustration pages (Refer to Fig. 1) and on the following table. Definitions of the structural classification are as follows:

| | | |
|---|---|---|
| (1) Primary | – | That structure which provides major loads paths for balance of the loads applied to the airplane, or provides essential support necessary to maintain safe operation of the airplane. |
| (2) Secondary | – | That structure which transmits loads paths from their point of application to the primary structure. Secondary structure may be highly stressed parts that do not act as primary structure. |
| (3) Tertiary | – | That structure which does not contribute to the structural strength of the airplane. |

| STRUCTURE CLASSIFICATION | | | | |
|---|---|---|---|---|
| ITEM | STRUCTURE | PRIMARY | SECONDARY | TERTIARY |
| 1 | EMERGENCY DOOR | • | | |
| 2 | FORWARD FUSELAGE | • | | |
| 3 | CABIN DOOR | • | | |
| 4 | FORWARD WING FLAP | | • | |
| 5 | FORWARD WING FLAP | | • | |
| 6 | FORWARD WING TIP | | | • |
| 7 | FORWARD WING | • | | |
| 8 | FORWARD WING TIP | | | • |
| 9 | FORWARD WING FAIRING | | | • |
| 10 | FRONT PRESSURE BULKHEAD | • | | |
| 11 | NLG REAR DOOR | | | • |
| 12 | NLG LEFT DOOR | | | • |
| 13 | LANDING/TAXI LAMPS ASSY | | | • |
| 14 | NLG RIGHT DOOR | | | • |
| 15 | FORWARD WING FAIRING | | | • |
| 16 | RADOME/NOSE CONE | | • | |
| 17 | MAIN WING TIP | | | • |
| 18 | AILERON | • | | |
| 19 | FLAP TRACK COVER | | | • |
| 20 | CENTRAL TRAILING EDGE | | • | |
| 21 | OUTBOARD FLAP | | • | |
| 22 | FLAP TRACK COVER | | | • |
| 23 | INBOARD FLAP | | • | |
| 24 | REAR FUSELAGE | | • | |
| 25 | NACELLE | | • | |
| 26 | BAGGAGE COMP. DOOR | | • | |
| 27 | INBOARD FLAP | | • | |
| 28 | NACELLE | | • | |
| 29 | ENGINE MOUNT | • | | |
| 30 | FLAP TRACK COVER | | | • |
| 31 | CENTRAL TRAILING EDGE | | • | |
| 32 | OUTBOARD FLAP | | • | |
| 33 | FLAP TRACK COVER | | | • |
| 34 | AILERON | • | | |

| STRUCTURE CLASSIFICATION | | | | |
|---|---|---|---|---|
| ITEM | STRUCTURE | PRIMARY | SECONDARY | TERTIARY |
| 35 | MAIN WING | • | | |
| 36 | MAIN WING TIP | | | • |
| 37 | LEADING EDGE OUTBOARD | | • | |
| 38 | FAIRING | | | • |
| 39 | LEADING EDGE INBOARD | | • | |
| 40 | MLG REAR DOOR | | • | |
| 41 | MLG FWD DOOR | | • | |
| 42 | MLG REAR DOOR | | • | |
| 43 | MLG FWD DOOR | | • | |
| 44 | REAR PRESSURE, BULKHEAD | • | | |
| 45 | LEADING EDGE INBOARD | | • | |
| 46 | FAIRING | | | • |
| 47 | ENGINE MOUNT | • | | |
| 48 | LEADING EDGE OUTBOARD | | • | |
| 49 | MAIN WING | • | | |
| 50 | FAIRING | | • | |
| 51 | HORIZONTAL STABILIZER | • | | |
| 52 | ELEVATOR | | • | |
| 53 | ELEVATOR | | • | |
| 54 | RUDDER | | • | |
| 55 | RUDDER TRIM | | • | |
| 56 | VERTICAL FIN/TAIL CONE | • | | |
| 57 | TAILCONE FAIRING | | | • |
| 58 | VENTRAL FIN | | • | |
| 59 | FIN LOWER LEADING EDGE | | • | |
| 60 | VENTRAL FIN | | • | |
| 61 | FLOOR PANELS (ALL) | | | • |
| 62 | FLOOR BEAMS (ALL) | | • | |
| 63 | INTEGRAL FUEL TANK | | • | |

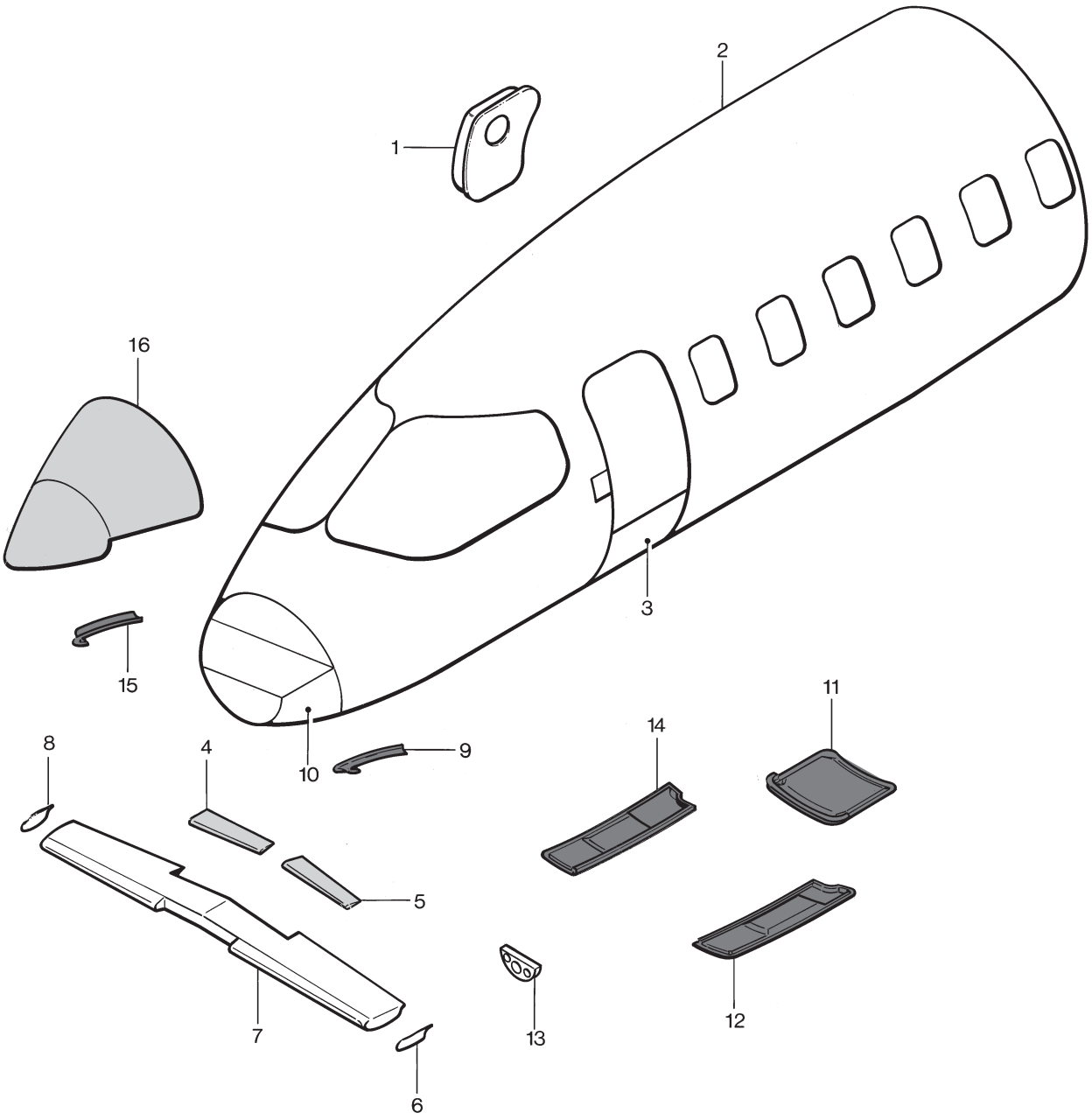


Fig. 1 (Sheet 1) - Structural Classification

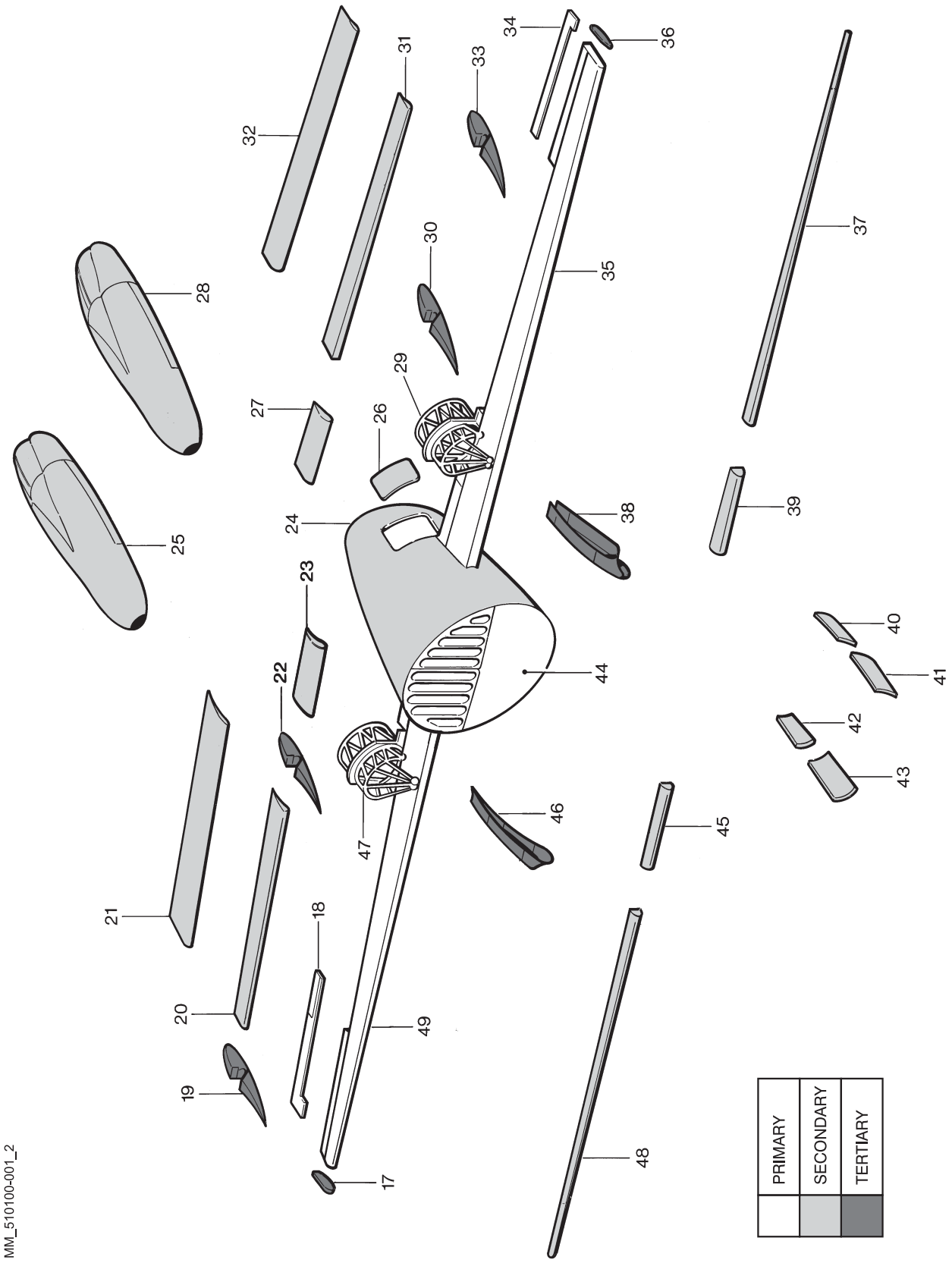


Fig. 2 (Sheet 2) - Structural Classification

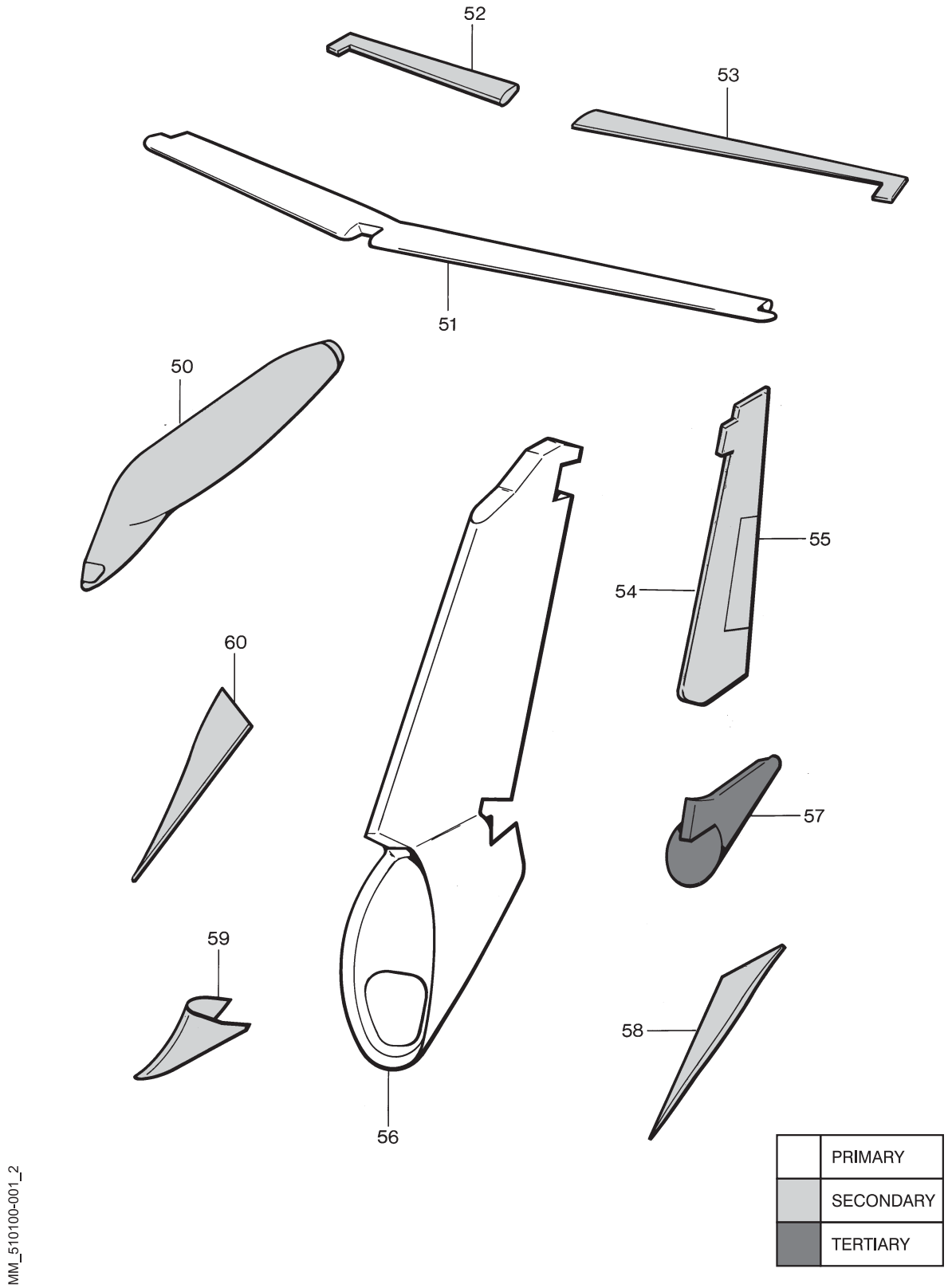


Fig. 3 (Sheet 3) - Structural Classification

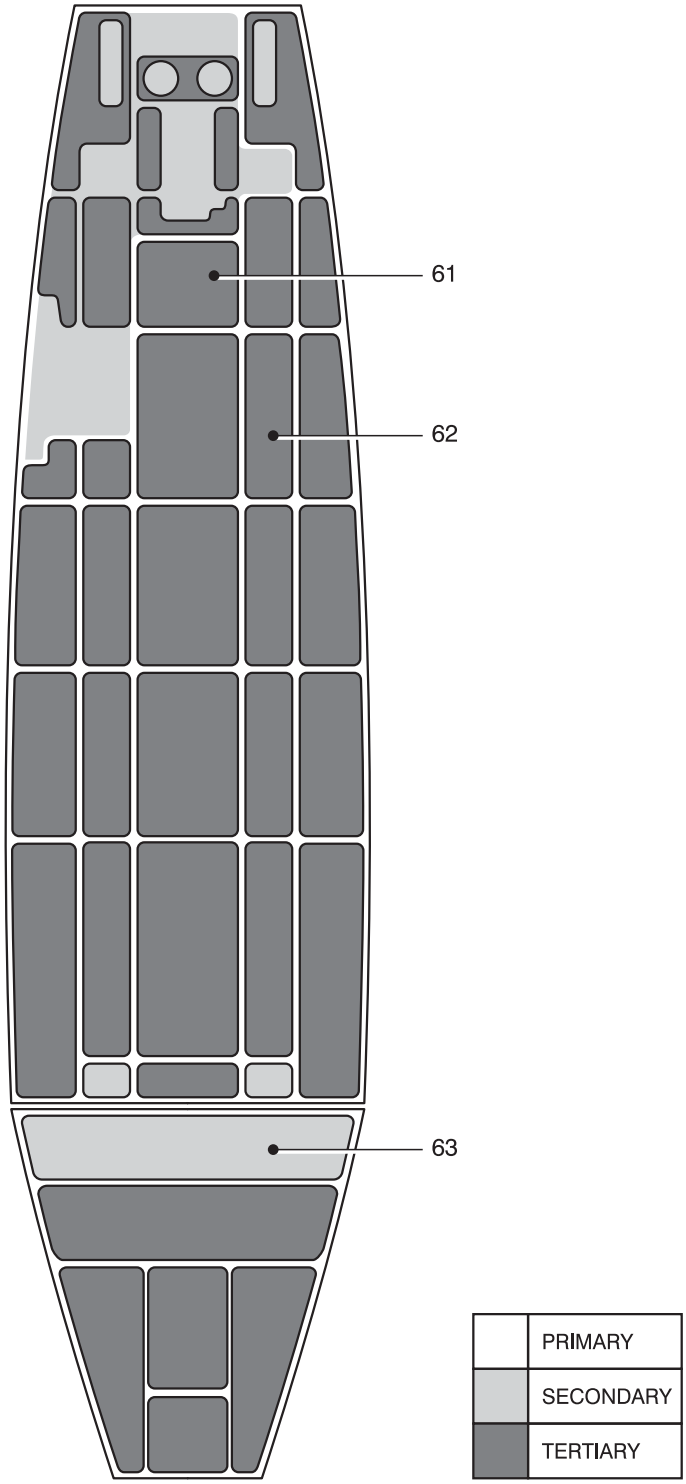


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Fig. 4 (Sheet 4) - Structural Classification

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# STRUCTURE - DIMENSIONS AND AREAS

## 1. General

A. For the dimension and areas of the airplane Structure refer to Chapter 06-00-00.

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# STRUCTURE - ACCESS PANELS AND DOORS

## 1. General

A. For information about access panels and doors refer to Chapter 06-00-00.

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# DAMAGE - GENERAL

## 1. General

A. This topic gives the procedure for assessing damage and selecting a suitable repair scheme. The procedure includes:

- Examination of structure
- Assessment of damage
- Secondary damage
- Protection of adjacent equipment
- Access for repair
- Application of repair schemes.

## 2. Examination of Structure

A. A detailed examination of the structure must be made before assessing damage. The following procedure is given as a general guide.

(1) Examine the structure for:
- Cracks and buckling
- Scores and scratches
- Drawn rivet and bolt holes.

(2) Examine castings and machined parts for cracks, if necessary use a non destructive test method (Refer to 51-90-00).

(3) Check rivets for security. Use a thin feeler gage to locate gaps under rivet heads or between rivetted plates. Cracked or flaking paint is usually a sign of rivet disturbance.

(4) Check all systems and controls near the damage for:
- Fractured or distorted pipes
- Frayed or kinked control cables.

(5) Examine the structure for distortion using a straight edge, clinometer, trammels or other suitable equipment.

**NOTE:** Keep an accurate record of each defect found to make sure no damage is missed during subsequent repair operations.

(6) Support the structure (Refer to 51-50-00).

## 3. Assessment of Damage

A. Locate and identify the area of damage and establish the structural classification (Refer to 51-01-00). Where damage exists in more than one classification area, the highest classification applies.

B. Locate and identify the damaged components and assess the allowable damage limitations (Refer to 51-11-00). If the damage is within limits a suitable repair scheme can be implemented, but consideration should be given to the economic viability of repair or replacement of the components. If the damage is outside the limits the components must be replaced.

4. Secondary Damage

A. Any damage to the airplane, particularly when shock is sustained, is likely to produce secondary damage. A close examination of the structure surrounding the primary damage must be made to find any secondary damage.

B. Secondary damage is caused by the transmission of force and may be located some distance away from the primary damage. The transmission of force can result in structural deformation and drawn rivet and bolt holes. Secondary damage can also occur due to fatigue following weakening of the structure.

5. Protection of Adjacent Equipment

A. All adjacent equipment must be adequately protected or removed to avoid damage during repair operations.

B. For the removal and installation procedures for equipment refer to the appropriate chapter of the maintenance manual.

6. Access for Repair

A. It may be necessary to gain access to a structural member by releasing or removing an area of skin.

B. When an area of skin is released, care must be taken to avoid buckling or kinking of the skin as it is peeled back. When the skin is attached, the fasteners must be the same type as originally installed. If the fasteners holes are enlarged during the drilling out of the original fasteners, oversized fasteners must be used to attach the skin (Refer to 51-41-00).

7. Application of Repair Schemes

A. Where damage is considered repairable, refer to 51-70-00 for a suitable Repair Scheme, or to the Standard Repairs topic in the appropriate chapter of the maintenance manual.

B. For information about materials used for the local manufacture of parts refer to 51-31-00.

C. On completion of the repair, restore the surface treatment in accordance with 51-23-00, and the surface finish in accordance with 51-25-00.

# DAMAGE - CLASSIFICATION

## 1. Allowable Damage

### A. General

(1) Allowable damage is defined as minor structural damage to secondary and tertiary structure that is permitted to exist as it is or which may be corrected by a simple procedure, such as stop drilling cracks or smoothing out nicks. The damage is not considered to be critical in affecting flight safety or reducing the performance of the aircraft below minimum safety standards. Damage to primary structure must be referred to the manufacturer.

(2) No repairs is allowed that may cause permanent deformation, aerodynamic mismatch or affect function and fit of structural elements.

(3) No repair is allowed if it may cause fuel leakage.

(4) No repair is allowed that causes a reduction in net area of more than 20%, including original holes and cutouts.

(5) The maximum number of allowable damages is not to exceed two within 10 inches of a structural member.

(6) All limitations of the extent of damage refers to dimensions after clean up.

**NOTE:** All cracks must be repaired; immediately if they exceed the limits herein, otherwise within 150 hours.

## 2. Allowable Cracks Metallic Structure

### A. Type I, Edge of a Plate (Figure 1)

(1) Limitations

(a) Thickness less than 0.125 inches.

(b) Y/D greater than or equal to 1.5 inches.

(c) X/H less than or equal to 0.05 inches.

(d) Maximum length X = 0.25 inches.

(e) Maximum of one crack at cross section.

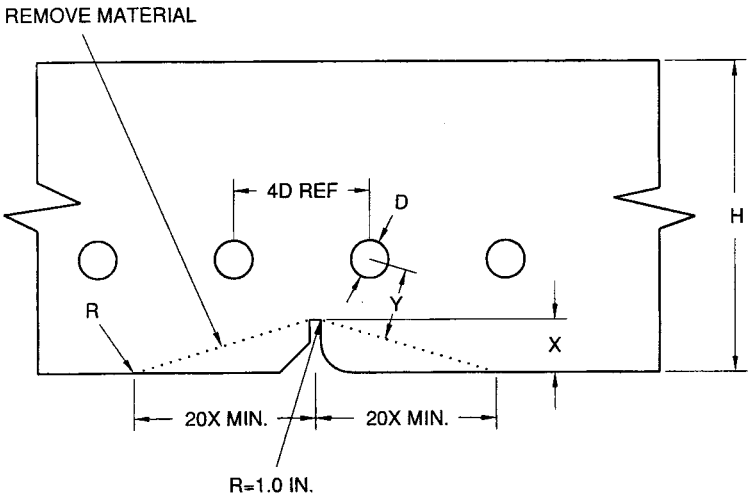


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Fig. 1 - Type I, Edge of a Plate Allowable Damages

B. Type II, Edge of a Rivet Hole (Figure 2)

(1) Limitations

(a) X1, X2, less than 0.015 inches.

(b) @ greater than or equal to 1.5 inches X diameter of reamed up hole.

(c) Y greater than or equal to 3.0 inches X diameter of reamed up hole.

(d) Maximum of one crack at cross section.

C. Type III, Edge of a Lightening Hole (Figure 3)

(1) Limitations

(a) X less than or equal to 0.050 inches.

(b) X/D less than or equal to 0.050 inches.

(c) Maximum of one crack at a hole.

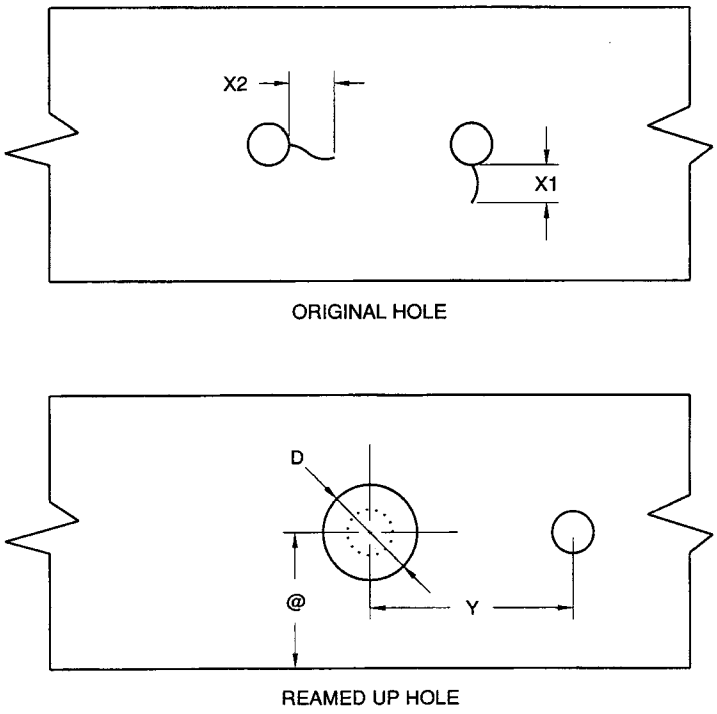


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Fig. 2 - Type II, Edge of a Rivet Hole Allowable Damage

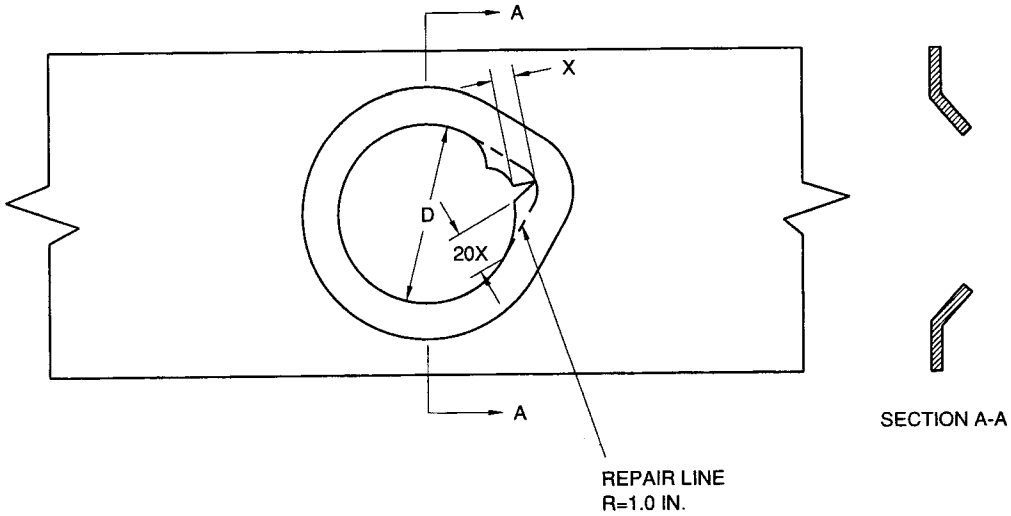


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Fig. 3 - Type III, Edge of a Lightening Hole Allowable Damage

3. Allowable Gouges and Nicks Metallic Structure

A. Type I, Skin, Webs and Leading Edges (Figures 4 and 5)

(1) Limitations

(a) L/H less than 0.5 inches.
(b) X/t less than 0.05 inches.
(c) Y greater than L1, L2 whichever is larger.
(d) Z greater than 20X.
(e) Maximum 2 gouges per cross section.
(f) Maximum length 3 inches.

B. Type II, Skin, Webs and Leading Edges (Figures 4 and 5)

(1) Limitations

(a) L/H less than 0.5 inches.
(b) X/t less than 0.10 inches.
(c) Y greater than L1, L2 whichever is larger.
(d) Z greater than 20X.
(e) Maximum 2 gouges per cross section.
(f) Maximum length 3 inches.

C. Type III, Skin, Webs and Leading Edges (Figures 4 and 5)

(1) Limitations

(a) L/H less than or equal to 0.10 inches.
(b) X/t less than or equal to 0.2 inches.
(c) z/D = 20X.
(d) Maximum one gouge per cross section.
(e) Maximum length 1.5 inches.

D. Type IV, Skin, Webs and Leading Edges (Figures 4 and 5)

(1) Limitations

(a) L/H less than or equal to 0.10 inches.
(b) 0.2 less than or equal to x/t less than 0.5 inches.
(c) L/E less than 2.
(d) L/Z less than 2.
(e) Maximum one gouge per cross section.
(f) Y greater than 5L1, 5L2 whichever is larger.
(g) Maximum length 1.0 inches.

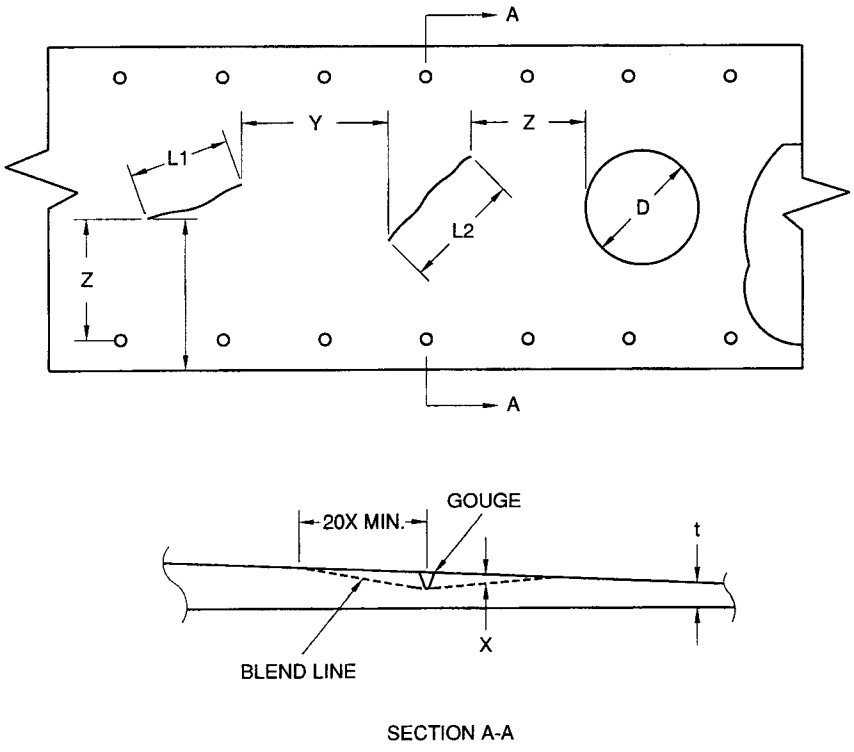


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Fig. 4 - Type I, II, III and IV, Skin and Webs Allowable Damage

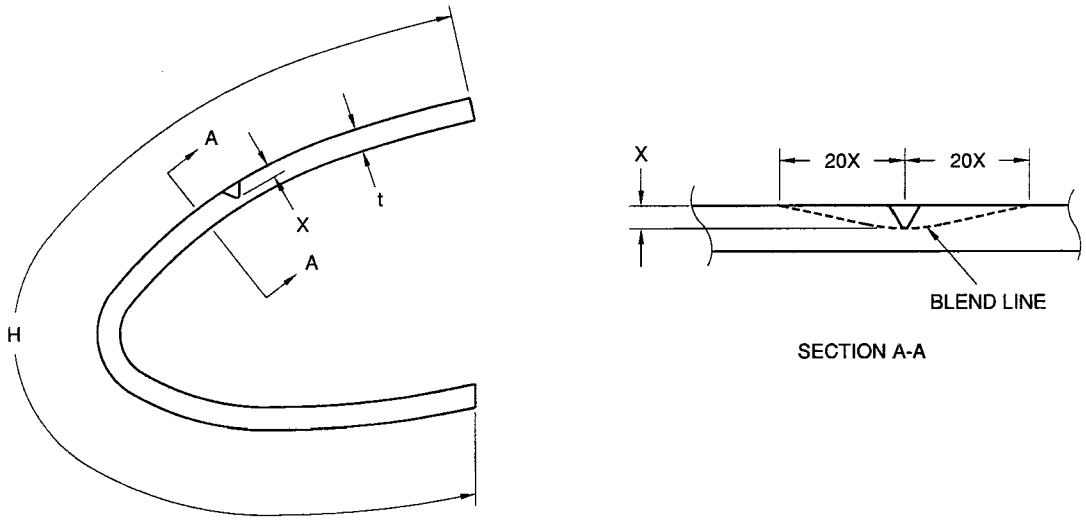


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Fig. 5 - Type I, II, III and IV Skin and Leading Edge Allowable Damage

E. Type VI, Spar Caps and Stiffeners (Figure 6)

(1) Limitations

(a) L/H less than or equal to 0.10 inches.
(b) X/t less than or equal to 0.10 inches.
(c) Z greater than 20X.
(d) Maximum one gouge or nick per cross section.
(e) Y greater than 2L, 2L2, whichever is larger.
(f) Maximum length 0.5 inches.

F. Type VII, Small Deep Niks (Figure 7)

(1) Limitations

(a) t less than or equal to 0.125 inches.
(b) y less than or equal to 0.250 inches.
(c) x no limit
(d) @/y greater than or equal to 2.
(e) Maximum one nick per cross section.
(f) Maximum diameter 0.25 inches.

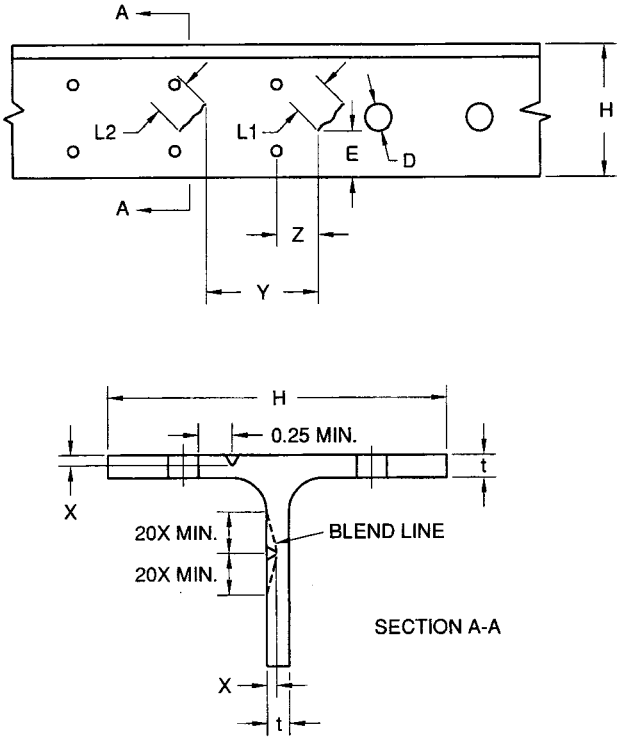


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Fig. 6 - Type VI, Spar Caps and Stiffeners Allowable Damage

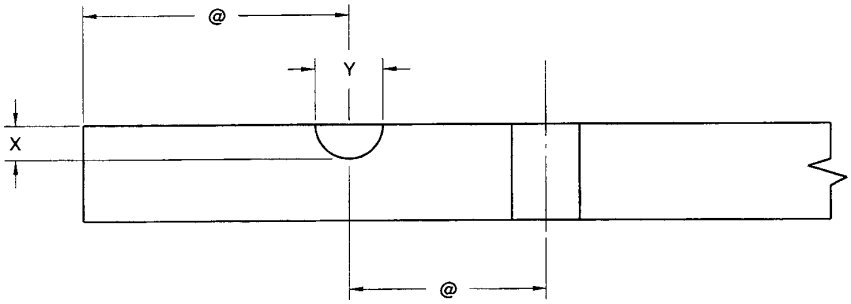


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Fig. 7 - Type VII, Small Deep Nicks Allowable Damage

4. Allowable Dents Metallic Structure

A. Type I, Dents (Figure 8)

(1) Limitations

(a) t less than or equal to 0.125 inches.

(b) X less than or equal to 0.10 inches.

(c) x/R less than 0.03 inches.

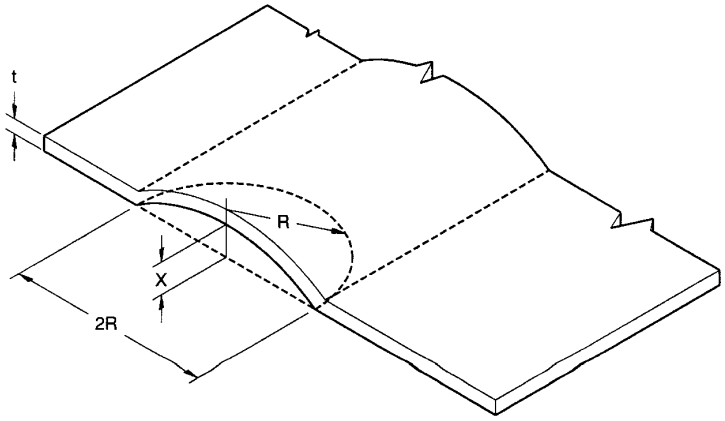


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Fig. 8 - Type I, Dents Allowable Damage

5. Composite Material Allowable

A. Type I, Dent at Edge Member (Figure 9)

(1) Primary Structure

(a) D = less than or equal to 0.30 inch.
(b) e = greater than or equal to .25 inch.
(c) x = less than or equal to 0.10 inch.
(d) @ = less than or equal to 0.5 inch.

**NOTE:** Up to 3 cracked layers.

(2) Secondary Structure

(a) D = less than or equal to 0.50 inch.
(b) e = greater than or equal to .25 inch.
(c) x = less than or equal to 0.20 inch.
(d) @ = less than or equal to 1.0 inch.

**NOTE:** Up to 6 cracked layers.

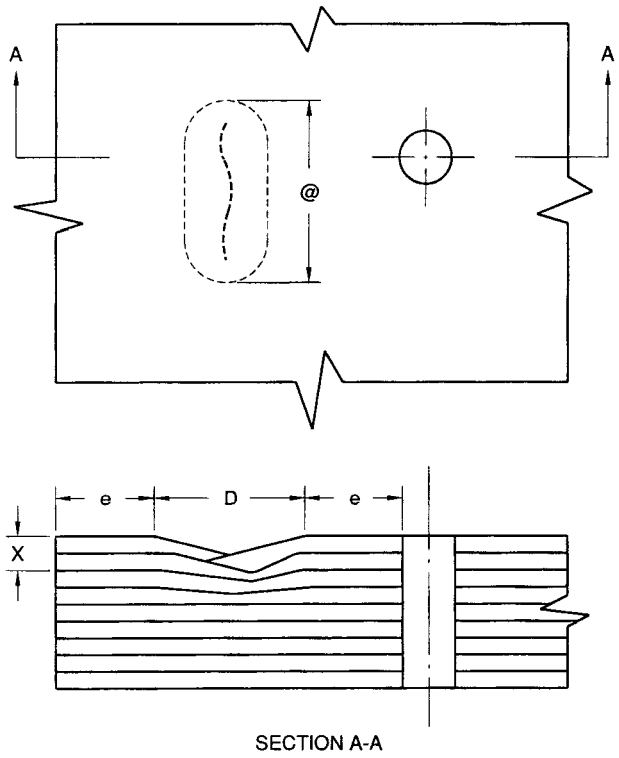


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Fig. 9 - Type I, Dent at Edge Member Allowable Damage

B. Type II, Dent at Mid section (Figure 10)

(1) Primary Structure

(a) D = less than or equal to 0.50 inch.

(b) x = less than or equal to 0.10 inch.

(c) @ = less than or equal to .75 inch.

**NOTE:** One broken layer.

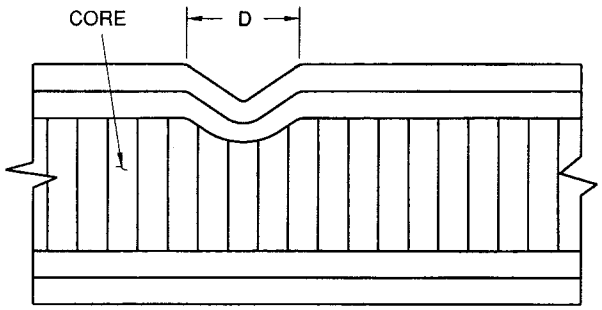
(2) Secondary Structure

(a) D = less than or equal to 0.75 inch.

(b) x = less than or equal to 0.25 inch.

(c) @ = less than or equal to 1.0 inch.

**NOTE:** Two broken layers.




MM_511100-010

Fig. 10 - Type II, Dent at Mid Section Allowable Damage

C. Type III, Delamination or Swelling (Figure 11)

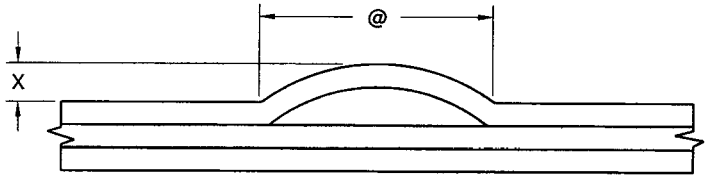
(1) Primary Structure

(a) @ = less than or equal to 0.75 inch.

(b) x = less than or equal to 0.05 inch.

(c) @ = less than or equal to 1.5 inch.

(d) x = less than or equal to 0.10 inch.




MM_511100-011

Fig. 11 - Type III, delamination or Swelling Allowable Damage

# DAMAGE - MINOR REPAIRS

## 1. General

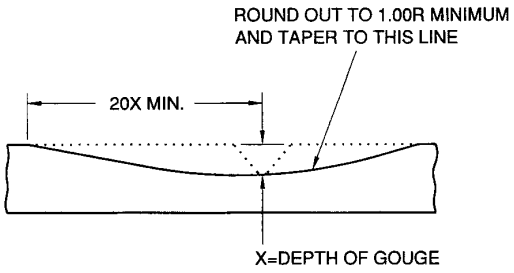
A. The following minor repairs are applicable to secondary and tertiary structure only. Any damage to primary structure (Refer to 51-01-00) must be referred to the manufacturer.

## 2. Repair Procedures

A. The following repair procedures are for metallic structure only. Damage to composite structure must be referred to the manufacturer.

(1) Blending Out of Gouges and Nicks

(a) Blend out of gouges and nicks shall be made as shown in Figure 1.




MM_511300-001

Fig. 1 - Blending Out of Gouges and Nicks

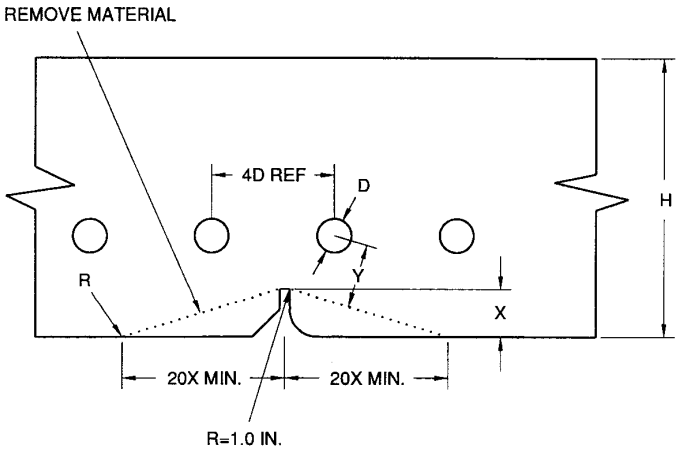
(2) Crack Type I, Edge of a Plate (Figure 2)

(a) Remove material from both side of crack as shown in Figure 2. A minimum of 20X is required.

(b) Perform penetrant inspection.

(c) Finish the repair area (Refer to 51-23-00).

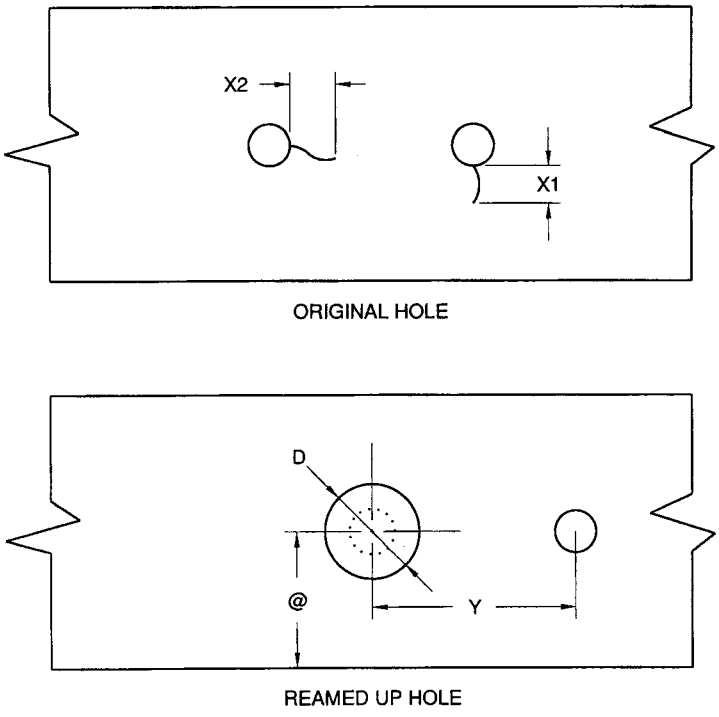
(d) Blend the edges smooth.




MM_511300-002

Fig. 2 - Crack Type 1

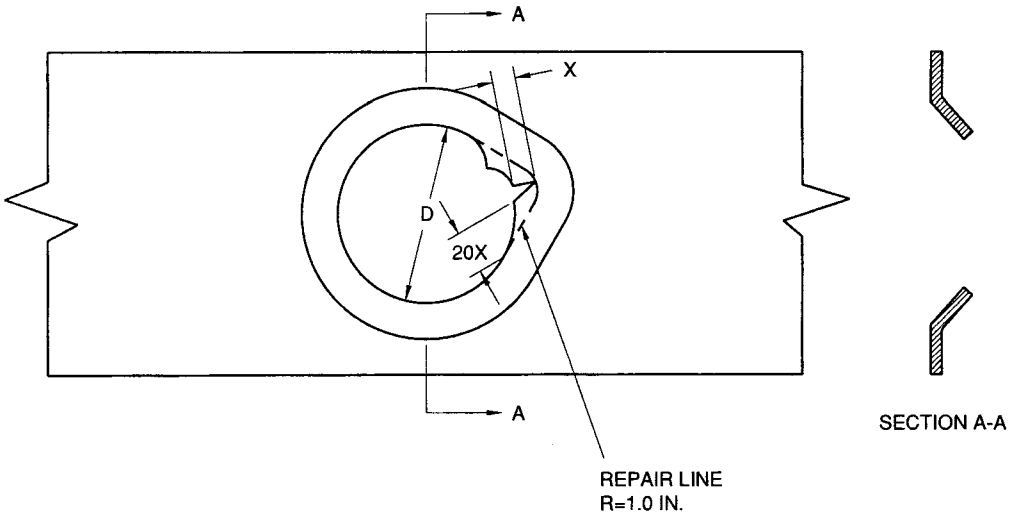
(3) Type II, Edge of a Rivet Hole (Figure 3)
  (a) Remove the crack by reaming hole to next size fastener.
  (b) Perform penetrant inspection.
  (c) Install next size fastener of the same type.




MM_511300-003

Fig. 3 - Crack Type II

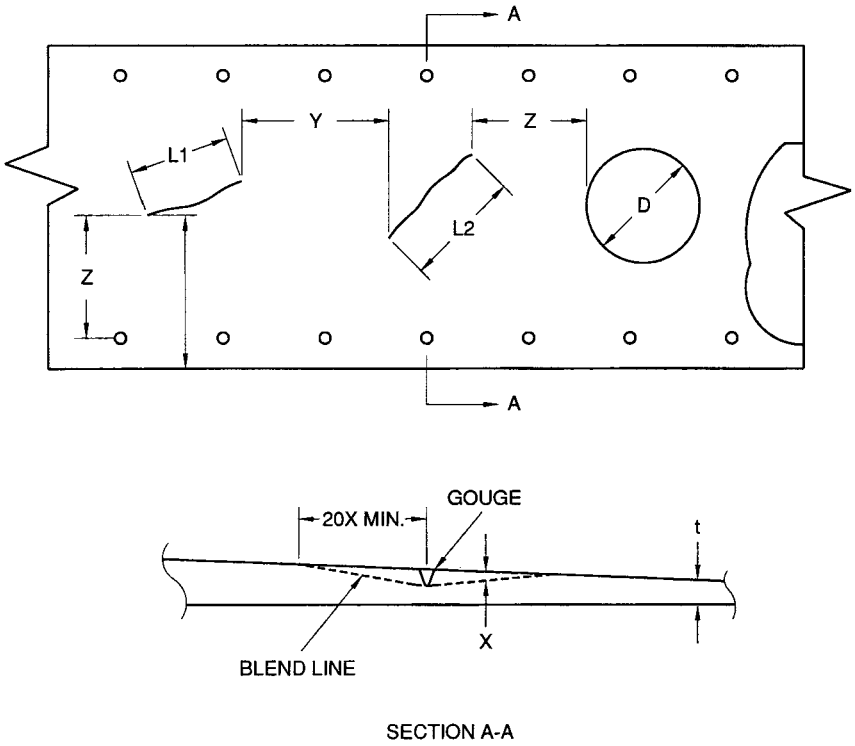
(4) Type III, Edge of a Lightening Hole (Figure 4)
  (a) Remove material from both sides of the crack as shown in Figure 4.
  (b) Blend edges smooth.
  (c) Perform penetrant inspection.
  (d) Finish the repair area.




MM_511300-004

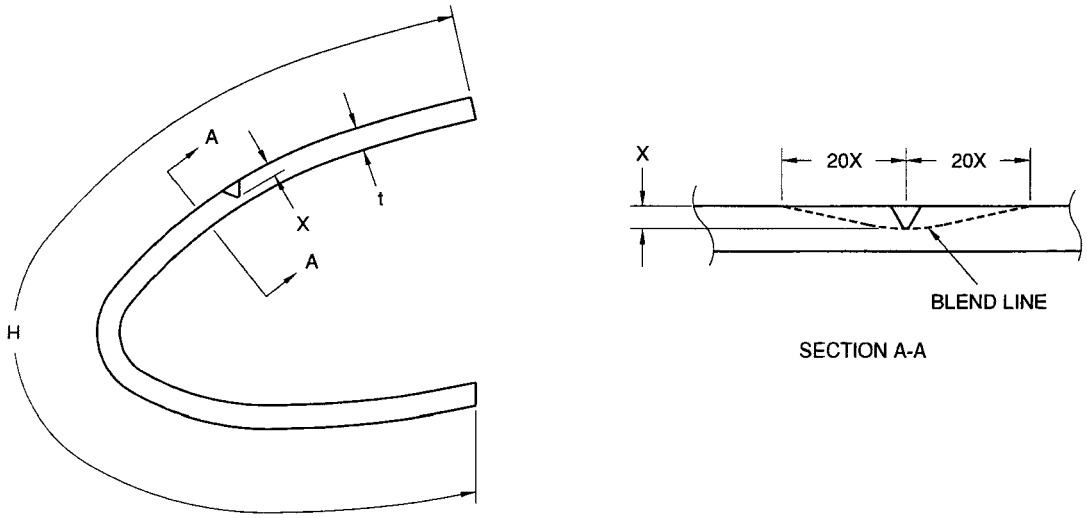
Fig. 4 - Crack Type III

(5) Skin, Webs and Leading Edges (Figures 5 and 6)
  (a) Blend area smoothly making sure not to exceed present depth.
  (b) Perform penetrant inspection.
  (c) Drill stop hole at both sides of gouge D = 0.125 inches.
  (d) Plug holes with aluminum AD rivets.
  (e) Finish repair (Refer to 51-23-00).




MM_511300-005

Fig. 5 - Types I, II, III and IV, Skin and Webs




MM_511300-006

Fig. 6 - Types I, II, III and IV, Skin and Leading Edge

# DAMAGE - AERODYNAMIC SMOOTHNESS

## 1. General

A. Aerodynamic smoothness is essential to maintain correct airflow over the airplane skin. Variations in the skin contour can include:

- Waves (or ripples), dents and depressions
- Steps
- Gaps
- Flushness of fasteners.

B. The limits for contour variations are given in Para. 2. Variations outside the limits can be repaired in accordance with Chapter 51-13-00, or, in the case of steps at panels and doors, adjusted in accordance with the relevant chapter in the Maintenance Manual.

## 2. Contour Variations - Limits (Refer to Fig. 1, 2 and 3)

| Area | Depth | | | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 4 |
| Each 1 in (25 mm) of wave in skin | 0.003 in (0.076 mm) | 0.005 in (0.13 mm) | 0.005 in (0.13 mm) | 0.005 in (0.13 mm) |
| Each 2 in (50 mm) of wave on permanent skin joint | 0.007 in (0.18 mm) | 0.015 in (0.38 mm) | 0.020 in (0.51 mm) | 0.030 in (0.76 mm) |

Table 1 - Waves, Dents and Depressions

| Area | Depth | | | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 4 |
| Doors and panels: | | | | |
| - Forward facing step | 0.004 in (0.10 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |
| - Rearward facing step | none | 0.005 in (0.13 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |
| - Step parallel to airflow | none | 0.005 in (0.13 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |
| Skin joints: | | | | |
| - Forward facing step | 0.004 in (0.10 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |
| - Rearward facing step | none | 0.005 in (0.13 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |
| - Step parallel to airflow | none | 0.005 in (0.13 mm) | 0.030 in (0.76 mm) | 0.030 in (0.76 mm) |

Table 2 - Steps

| Area | Gap | | | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 4 |
| Doors:<br>- Transverse to Airstream<br>- Parallel to Airstream | 0.040 in (1 mm)<br>0.040 in (1 mm) | 0.040 in (1 mm)<br>0.040 in (1 mm) | 0.040 in (1 mm)<br>0.040 in (1 mm) | 0.040 in (1 mm)<br>0.040 in (1 mm) |
| Skin:<br>Transverse to Airstream<br><br>Parallel to Airstream | No gaps permitted, all skin gaps are filled during manufacture. | | | |

Table 3 - Gaps

| Fastener | Flushness | | | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 4 |
| Solid rivets | none | +0.001 in (0.025 mm)<br>to<br>+0.003 in (0.076 mm) | +0.001 in (0.025 mm)<br>to<br>+0.003 in (0.076 mm) | +0.001 in (0.025 mm)<br>to<br>+0.003 in (0.076 mm) |
| Other fasteners | none | +0.003 in (0.076 mm)<br>to<br>-0.005 in (0.13 mm) | +0.003 in (0.076 mm)<br>to<br>-0.005 in (0.13 mm) | +0.003 in (0.076 mm)<br>to<br>-0.005 in (0.13 mm) |

Table 4 - Flushness of Fasteners

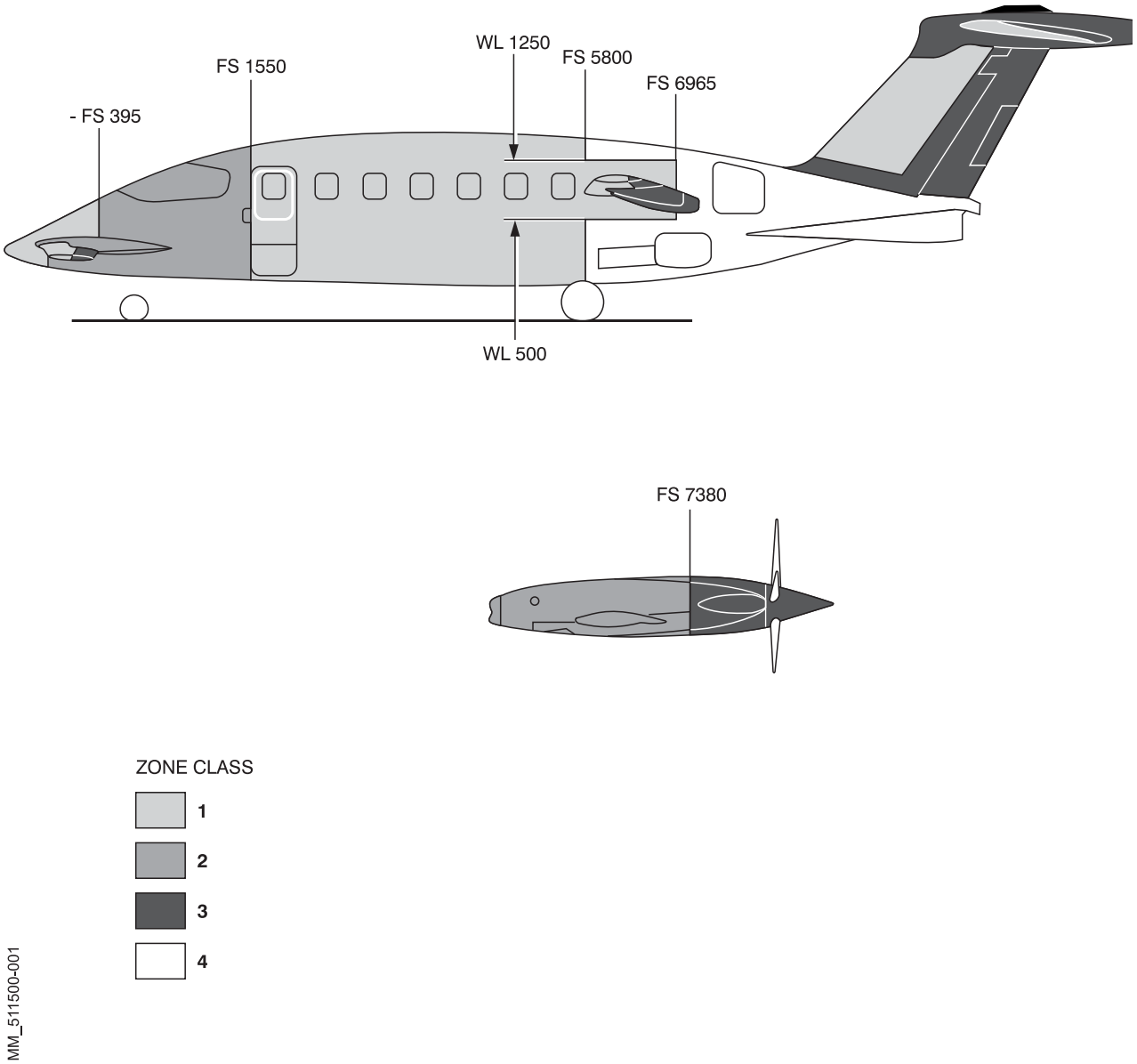



Fig. 1 - Aerodynamic Classification - Side View

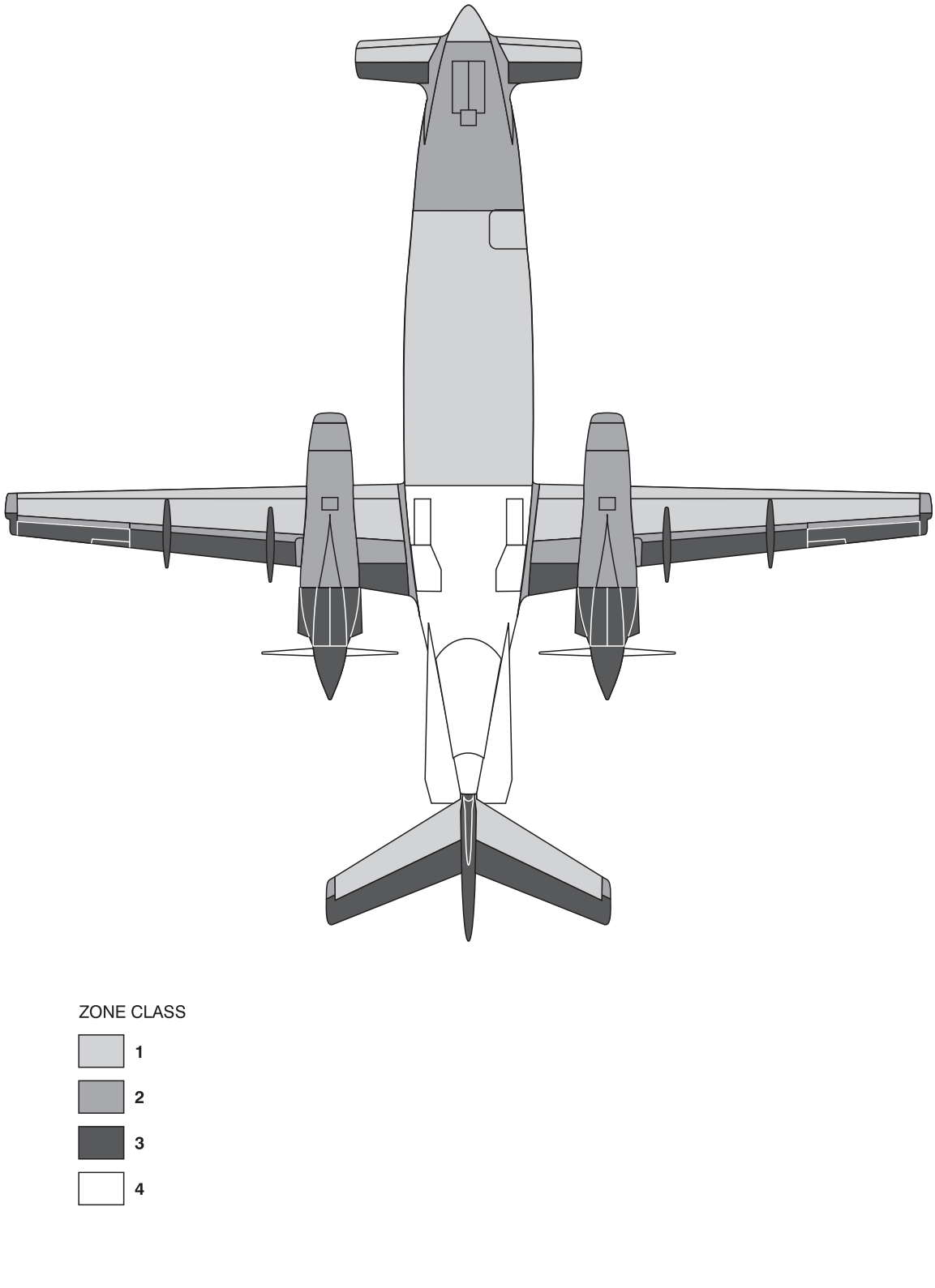



Fig. 2 - Aerodynamic Classification - Lower View

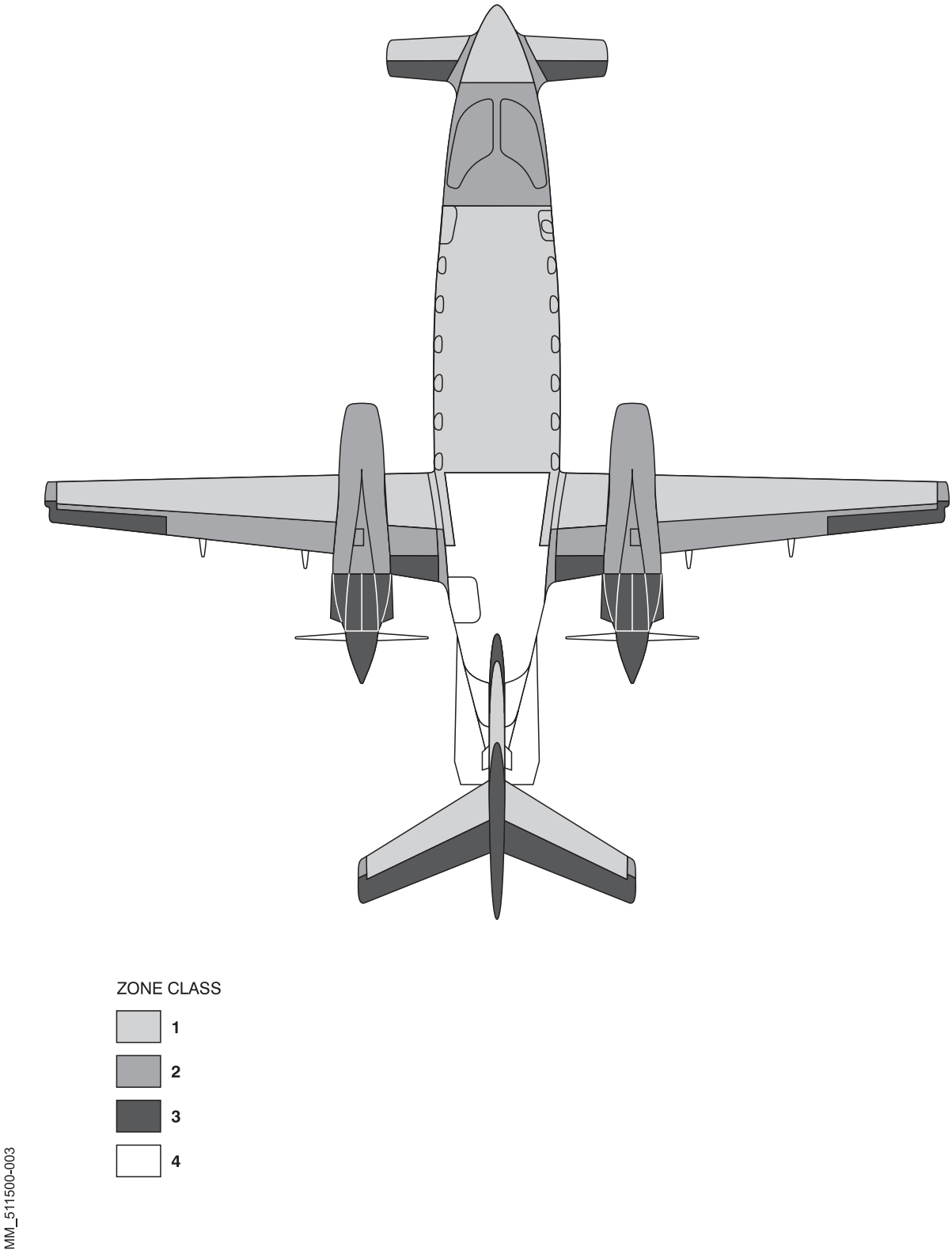



Fig. 3 - Aerodynamic Classification - Top View

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# PROCESSES - GENERAL

## 1. General

A. This topic includes the following processes:

- Solvent Cleaning
- Surface Treatment
- Stripping and Painting

B. Solvent Cleaning is the use of chemicals to dissolve grease and dirt. Solvent Cleaning is used when it is not practical to clean parts by vapor degreasing or immersion in chemical cleaners. Most solvents are toxic and the health and safety instructions given in Chapter 20-00-00 must be obeyed. For information about Solvent Cleaning refer to Chapter 51-21-00.

C. Surface Treatment must be applied to all repairs and surrounding structure where the original finish has been removed. Component parts and assemblies which will become concealed during repair work must first have the appropriate treatment applied. For information about the application of treatments refer to Chapter 51-23-00.

D. Pre-repair paint stripping and post-repair painting of metal or composite parts are essential stages of repair procedures. Stripping is accomplished by mechanical (abrading) or chemical methods. Painting to restore the surface finish is accomplished by brush (touch-up) of small areas or spray painting of large areas. For information about painting and stripping refer to Chapter 51-25-00.

## 2. Surface Finish

A. The metal and composite parts of the airplane, with the exception of the radome/ nosecone, have an identical undercoat (G-8005) and topcoat (Alumigrip) applied over different epoxy primers.

B. The metal parts are coated with epoxy primer S-9001.

C. The composite parts are coated with epoxy primer D-8001.

D. The metal surface of the radome/nosecone is coated with epoxy primer S-9001, undercoat G-8005 and Alumigrip topcoat. The fiberglass surface of the radome/ nosecone is coated with epoxy primer D-8001, Caapcoat fluoroelastometer type II, and then topcoated with Caapcoat fluoroelastometer type III.

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# PROCESSES - SOLVENT CLEANING

## 1. General

A. Liquid solvent cleaners are used to clean and degrease parts when it is impractical to use vapor degreasing or immersion cleaning. Solvents should never be poured or sprayed on to the surface to be cleaned.

B. After cleaning, the surface should be tested for water-break to prove the quality of cleaning and degreasing.

## 2. Cleaning

**WARNING:** BE CAREFUL WHEN YOU USE SOLVENTS. OBEY THE HEALTH AND SAFETY INFORMATION GIVEN IN CHAPTER 20-00-00.

**CAUTION:** DO NOT PUT CHLORINATED SOLVENTS ON TITANIUM ALLOY PARTS.

A. Procedure

(1) Wipe all excess oil and grease from the surface to be cleaned.
(2) Apply the solvent to a clean, white, lint-free cloth until the cloth is well saturated but not dripping.
(3) Wipe the surface with the saturated cloth as required to dissolve or loosen the contamination. Work on small area so that the surface remains wet during cleaning.
(4) Dry the surface with a clean, white lint-free cloth while the surface is still wet. Do not allow the solvent to evaporate.
(5) Repeat steps (2) through (4) until there is no discoloration on the drying cloth.
(6) Do a water-break test for surface impurities (Refer to Para. 3).

**NOTE:** Bonding or priming of the surface should be done immediately after cleaning. Personnel handling surfaces to be bonded should wear clean low-lint gloves to avoid contamination of the surface.

## 3. Water-break Test

A. Procedure

(1) Rinse the surface with clean distilled water.
(2) Examine the surface for continuity of the water film for a minimum time of 25 seconds.

**NOTE:** Formation of droplets or breaks in the water film indicate the presence of oil or grease and the surface must be cleaned again.

(3) Dry the surface with a clean, white lint-free cloth or blow dry with clean, filtered, oil-free air.

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# PROCESSES - SURFACE TREATMENT

## 1. General

A. The surface treatments and finishes provide protection against corrosion and deterioration. All detail parts are alodined and primed or anodized and primed.

B. Interior areas are primed with an epoxy polymide primer. Corrosion prone areas are also protected with a corrosion preventative and water displacing compound. The integral fuel tank is treated with a polyurethane coating.

C. The exterior areas are primed with a fluid resistant primer and painted with a polyurethane top coat. All fasteners have adequate corrosion protection and those through the skin are installed with sealing compound.

## 2. Alodine 1200

A. Description

A chemical treatment for surfaces to be primed and painted. The treatment produces a gold colored film which inhibits corrosion. Alodine is dangerous and the following safety precautions must be observed:

BE CAREFUL WHEN YOU USE THE ALODINE:

- PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.
- DO NOT BREATHE THE GAS OR DUST.
- DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET THE ALODINE IN YOUR EYES OR ON YOUR SKIN:

- FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES.
- GET MEDICAL HELP.

IF YOU ACCIDENTLY DRINK OR EAT THE ALODINE:

- FLUSH YOUR MOUTH WITH WATER.
- DRINK WATER BUT MAKE SURE YOU DO NOT VOMIT.
- PUT YOURSELF IN A HALF SITTING POSITION.
- GET MEDICAL HELP.

IF YOU GET THE ALODINE ON YOUR CLOTHES DISCARD THEM. THE ALODINE IS POISONOUS AND CAN CAUSE CORROSION. KEEP IT AWAY FROM OTHER FLAMMABLE MATERIALS. A FIRE BY CHEMICAL REACTION CAN OCCUR.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN 20-00-00.

(1) Clean the surface with MEK solvent (ASTM D740) and dry with a white, lint-free, cloth before the solvent evaporates.
(2) Abrade the surface with very fine abrasive pads (Scotchbrite A or equivalent).

(3) Wipe the surface dry with a white, lint-free, cloth until the surface is clean.
(4) Rinse the surface with clean cold water.
(5) Examine the surface for water break (Refer to 51-21-00).

C. Mixing

The alodine must be mixed, correctly. For the correct mixing procedure refer to the manufacturer instruction. Mix the alodine in a plastic or acid resistant container.

D. Application

(1) Apply the alodine with a fine natural brush, cellulose sponge or tissues and keep the surface wet for 1-3 minutes.
(2) Rinse with clean cold water using a non-abrasive sponge.
(3) Dry with a lint-free cloth or blow dry with clean air at a temperature not exceeding 158°F (70°C).

**NOTE:** Wear clean white cotton gloves to handle the treated surface.

(4) Make sure the coating is continuous and free from scratches and powdery deposits.
(5) Apply the primer or paint finish as soon as possible and within a maximum of 24 hours.

3. Dow Corning 1200 Primer

A. Description

An air-drying primer is used to improve the adhesion of Silastic 732 RTV to metal and plastic surfaces. The primer is coloured red for easy observation of coverage. The primer is dangerous and the following safety precautions must be observed:

BE CAREFUL WHEN YOU USE THE PRIMER:

– PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
– DO NOT BREATHE THE GAS (OR DUST)
– DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET PRIMER IN YOUR EYES OR ON YOUR SKIN:

– FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
– GET MEDICAL HELP.

IF YOU ACCIDENTLY DRINK OR EAT PRIMER:

– GET MEDICAL HELP.

THE PRIMER IS POISONOUS AND HIGHLY FLAMMABLE.

B. Surface Preparation

**NOTE:** The following procedure is applicable to all materials with the exception of silicone rubber.

**WARNING:** BE CAREFUL WHEN YOU USE THE 1,1,1 TRICHLOROETHANE. OBEY HEALTH AND SAFETY INFORMATION GIVEN IN CHAPTER 20-00-00.

(1) Wipe off excess oil and grease.
(2) Clean the surface with 1,1,1 trichloroethane solvent (0-T-620) and a very fine abrasive pad (Scotchbrite A or equivalent).

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK OR ACETONE. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN 20-00-00.

**CAUTION:** DO NOT PUT ACETONE ON ACETATE PLASTICS.

(3) Rinse the surface with acetone or MEK solvent (ASTM D740) and allow to dry.

C. Mixing

The primer is supplied ready to use and no mixing is required.

D. Application

(1) Apply a coat of primer by dipping, brushing or spraying. A thin coat of primer will give the best adhesion. The thickness of the coat can be estimated by the color, a darker red indicates a thick coat. The correct thickness will show as a pink tinge.
(2) Examine the coating for cracks. If cracks appear, the primer is too thick and it should be removed and re-applied.

E. Curing

The curing time is dependent on temperature and humidity. Low humidity will increase the curing time. Approximate curing time at average humidity is as follows:

| Temperature | Cure |
|---|---|
| 75°F (24°C) | 60-90 minutes |

4. PR-1560-MC and PR-1560-MK

A. Description

Two-part urethane coating used to protect the internal surfaces of integral fuel tanks and fuel bays. PR-1560-MC has chlorobenzene as its main solvent. PR-1560-MK has MEK as its main solvent. The coatings remain flexible at low temperatures and do not cause premature cracking of sealants.
The uncured components are dangerous and the following safety precautions must be observed:

BE CAREFUL WHEN YOU USE THE PR-1560-MC OR PR-1560-MK:

– PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.
– DO NOT BREATHE THE GAS (OR DUST).
– DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET PR-1560-MC OR PR-1560-MK IN YOUR EYES OR ON YOUR SKIN:

– FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
– GET MEDICAL HELP.

IF YOU ACCIDENTLY DRINK OR EAT PR-1560-MC OR PR-1560-MK:

– GET MEDICAL HELP.

PR-1560-MC and PR-1560-MK ARE POISONOUS AND HIGHLY FLAMMABLE.

B. Surface Preparation

**CAUTION:** DO NOT APPLY PR-1560-MC OR PR-1560-MK TO BARE ALUMINIUM. THE ALUMINIUM MUST BE TREATED WITH ALODINE (OR AN EQUIVALENT CHEMICAL TREATMENT) BEFORE APPLICATION OF THE PR-1560-MC OR PR-1560-MK.

(1) Chemically coated or cadmium plated surfaces:

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(a) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

(2) Alclad:

(a) Clean the surface with an inhibited alkaline cleaner (MIL C-87936).
(b) Thoroughly dry with hot air.

(3) Titanium:

**CAUTION:** DO NOT PUT CHLORINATED SOLVENTS ON TITANIUM ALLOY PARTS.

(a) Clean the surface by scouring or chemical etching.
(b) Apply a thin coating of primer PR-1901.
(c) Allow the primer to dry for a minimum of 1 hour and a maximum of 24 hours before application of the PR-1560-MC or PR-1560-MK.

C. Mixing

The PR-1560-MC and PR-1560-MK are supplied in two parts, A (amber) and B (green), and are mixed as follows:

(1) Stir part B thoroughly.
(2) Mix, by volume, 1 part of part A with 2 parts of part B.

D. Application

Apply with a standard spray gun connected to a clean air supply. The feed tank must have an agitator to keep the components mixed. If a catalyst type spray gun, with two feed tanks, is used, the equipment must be adjusted to provide a flow rate of parts A and B in the correct proportions. Spray several light coats, not one heavy coat. The mixed parts have an application life of 8 hours at 75°F (24°C).

E. Curing

The curing time can be reduced by the application of heat, up to a maximum of 225°F (107°C), twenty minutes after application. Curing times are as follows:

| Temperature | Tack Free | Cure | Maximum Cure |
|---|---|---|---|
| 75°F (24°C) | 15 minutes | 45 minutes | 10 days |
| 225°F (107°C) | 15 minutes | - | 1 hour |

5. Primer S9001 Alumigrip

A. Description

A three-part anti-corrosive epoxy primer which can be applied to aluminium, composites and sandblasted clean cold-rolled steel. Aluminium must be chemically treated with Alodine before application of the primer. When applied, the primer is yellow and can be overpainted without sanding. The primer is dangerous and the following safety precautions must be observed:

BE CAREFUL WHEN YOU USE THE PRIMER:

– PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
– DO NOT BREATHE THE GAS (OR DUST)
– DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET PRIMER IN YOUR EYES OR ON YOUR SKIN:

– FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
– GET MEDICAL HELP

IF YOU ACCIDENTLY DRINK OR EAT PRIMER:

– GET MEDICAL HELP.

THE PRIMER IS POISONOUS AND HIGHLY FLAMMABLE.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.
(2) Aluminium surfaces:
  (a) Chemically treat with Alodine (Refer to Para. 3.)

(3) Steel or composite surfaces:
   (a) Abrade the surface with fine abrasive pads (Scotchbrite A or equivalent).
   (b) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Mixing

(1) Mix together, by volume, each of the following components:
   – 1 part S9001 Yellow Base
   – 1 part S3001 Converter
   – 1 part T0006 Reducer

(2) Allow to stand for 15 minutes before application.

D. Application

Apply using conventional or airless spray equipment. The application time is dependent on temperature as follows:

| Temperature | Application time |
|---|---|
| 77°F (25°C) | 8 hours |
| 100°F (38°C) | 6 hours |

E. Curing

The curing time is as follows:

| Temperature | Dust-free | Tack-free | Re-coat |
|---|---|---|---|
| 77°F (25°C) | 30-45 minutes | 2 hours | 1 hour - 48 hours |

# PROCESSES - STRIPPING AND PAINTING

## 1. General

A. This topic gives information for pre-repair paint stripping and post-repair painting of the airplane structure.

## 2. Chemical Paint Stripping - Turco 5351

**WARNING:** BE CAREFUL WHEN YOU USE THE PAINT STRIPPER:

– PUT ON PROTECTIVE CLOTHING.

THE PAINT STRIPPER IS DANGEROUS. IT CAN CAUSE DAMAGE TO YOUR SKIN.

**WARNING:** DO NOT USE THE PAINT STRIPPER ON COMPOSITE SURFACES. USE ON METALLIC SURFACES ONLY.
DO NOT ALLOW THE PAINT STRIPPER TO CONTACT WINDOWS, WINDSHIELDS, TITANIUM OR PLASTIC PARTS.

A. Description

Turco 5351 is a non acid/non alkaly chemical used for removing organic paint from metallic surfaces. The chemical is supplied ready for use as a thick yellow gel which has good adhesion to vertical surfaces.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surface with MEK solvent (ASTM D740) and dry with a white, lint-free cloth before the solvent evaporates.
(2) Mask the edges of the area to be stripped with aluminium tape. Apply the tape firmly to the surface.

C. Mixing

Turco 5351 is supplied ready to use and no mixing is required.

D. Application

**NOTE:** Refer to the paint stripper manufacturer instructions for the correct method of application. If the manufacturer instructions are not available use the following procedure.

(1) Apply a thick layer of stripper to the surface using a soft bristle brush.
(2) Allow the top surface of the stripper to form a skin to reduce evaporation.
(3) Leave the stripper until the paint is seen to bubble and lift (time is dependant on age and thickness of paint).

(4) Remove the stripper, and paint, by scrubbing the surface with a stiff brush.
(5) If necessary, re-apply stripper to any areas of paint and repeat steps (2) thru (4).
(6) Rinse all traces of stripper from the surface with clean water.
(7) Dry the surface with a white, clean lint-free cloth.

**NOTE:** Before application of any surface treatment, the surface must be cleaned with MEK solvent (ASTM D740) and dried with a white, lint-free cloth.

3. Mechanical Paint Stripping

A. The stripping of paint from composite parts must be done mechanically, by abrading with fine abrasive pads (Scotchbrite A or equivalent) or fine abrasive paper.

B. Procedure

**WARNING:** BE CAREFUL WHEN YOU ABRADE THE SURFACE:

– PUT ON SAFETY GOGGLES, MASK AND PROTECTIVE CLOTHING
– DO NOT BREATHE THE DUST.

USE A SUCTION CLEANER TO REMOVE THE DUST FROM THE AREA OF WORK.

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Mask the area to be abraded.
(2) Clean the area with MEK solvent (ASTM D740) and dry with a white, lint-free cloth before the solvent evaporates.

**CAUTION:** DO NOT DAMAGE THE TOP LAYER OF THE COMPOSITE MATERIAL.

(3) Abrade the area with a fine abrasive pad or fine abrasive paper until the top layer of the composite material can be seen. Use a suction cleaner to remove the dust.
(4) Feather the edges of the stripped area into the surrounding paint finish.
(5) Clean the surface with MEK solvent (ASTM D740) and dry with a white, lint-free cloth before the solvent evaporates.

4. Painting - Alumigrip G8005 Undercoat (Metallic Surfaces)

**WARNING:** BE CAREFUL WHEN YOU USE THE UNDERCOAT:

- PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
- DO NOT BREATHE THE GAS (OR DUST)
- DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET UNDERCOAT IN YOUR EYES OR ON YOUR SKIN:

- FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
- GET MEDICAL HELP.

IF YOU ACCIDENTALLY DRINK OR EAT UNDERCOAT:

- GET MEDICAL HELP.

THE UNDERCOAT IS POISONOUS AND HIGHLY FLAMMABLE.

A. Description

Alumigrip G8005 undercoat is a white, fast drying, polyurethane primer surfacer designed to hide small surface imperfections.

B. Surface Preparation

The surface must be clean, dry and free from all contamination. If the surface treatment has been removed, the surface must be retreated and primed with S9001 Alumigrip (Refer to 51-23-00). Mask the area with tape, as required.

C. Mixing

(1) Mix together, by volume, each of the following components:
- 14 parts G8005 Base
- 7 parts T0003 Converter
- 1 part G3001 Reducer.

(2) The mixed undercoat can be used immediately.

D. Application

Apply one full wet coat using conventional or airless spray equipment.

E. Curing

(1) The curing time is as follows:

| Temperature | Dust-free | Tack-free | Re-coat |
|---|---|---|---|
| 77°F (25°C) | 4 hours | 7 hours | 12-72 hours |

F. Do a measurement and a visual inspection (Refer to Chapter 34-11-00 Page Block 201, Para. 8 and 9).

5. Painting - Composite Surfaces Preparation

A. Materials

Polyurethane Primer D 8001
Converter D 3001
Reducer T 0006

B. Procedure

**WARNING:** MATERIALS IN THIS PROCEDURE ARE DANGEROUS. AVOID INHALATION OF ABRASIVE DUST. WEAR GOGGLE AND PROTECTIVE MASK.

(1) Remove paint from the surface interested area (Refer to Chapte 51-20-00 para. 6 of the Structural Repair Manual).

(2) Material Preparation

(a) Mix 100 parts in volume of D 8001 Polyurethane Primer, 100 parts in volume of D 3001 Converter and 15 parts in volume of T 0006 Reducer to obtain about 22-27 seconds viscosity in Zahn Cup at 25°C temperature.

**NOTE:** Addition always the Converter to the base to avoid the clots formation in the mixture.

(3) Operation

(a) Prepare the surface with abrasive paper 320 grit or finer.

**NOTE:** During this operation take care to not completely remove the resin superficial fasciato avoiding uncover the lower material.

(b) Wash and degrease with T 0006 the surface.

**CAUTION:** THE WASHING MUST BE DONE SIMULTANEOUSLY WITH THE REDUCER DRYING TO AVOID THE AGRESSION OF THE SURFACE RESIN

(c) Before apply the compound, wait 15 minutes. The compound must be applied within 16 hours at 25°C.

(d) Spray one cross coat (2 passes at approx. 90°) until reach 25-50µm thikness dry film.

(4) When you ended the operations procedures the surface must be free of scratched, small blister, dots and other defects.

6. Painting - Alumigrip Topcoat (Metallic and Composite Materials)

**WARNING:** BE CAREFUL WHEN YOU USE THE PAINT:

- PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
- DO NOT BREATHE THE GAS (OR DUST)
- DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET PAINT IN YOUR EYES OR ON YOUR SKIN:

– FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
– GET MEDICAL HELP.

IF YOU ACCIDENTALLY DRINK OR EAT PAINT:

– GET MEDICAL HELP.

THE PAINT IS POISONOUS AND HIGHLY FLAMMABLE.

A. Description

Alumigrip is a polyester-urethane gloss topcoat with excellent resistance to solvents, chemicals and drastic temperature changes. Alumigrip can be applied by spray, brush or roller and is easy to apply as a touch up paint to small areas.

B. Surface Preparation

The surface must be clean, dry and free from all contamination. If the surface treatment has been removed, the surface must be re-treated and primed with S9001 Alumigrip (Refer to 51-23-00). Mask the area with tape, as required.

C. Mixing

(1) Brush or roller application

(a) Mix together, by volume, each of the following components:

– 8 parts Alumigrip Topcoat Base
– 4 parts H3002 Converter
– 1 part T0031 Reducer

(b) The mixed paint can be used immediately.

(2) Spray application

(a) Mix together, by volume, each of the following components:

– 8 parts Alumigrip Topcoat Base
– 4 parts G3010 Converter
– 1 part T0001 Reducer

(b) The mixed paint can be used immediately.

D. Application

Apply using a fine natural brush or polyurethane foam roller, or with conventional or airless spray equipment.

E. Curing

(1) The curing time is as follows:

| Temperature | Dust-free | Tack-free | Re-coat | Full cure |
|---|---|---|---|---|
| 77°F (25°C) | 3 hours | 8 hours | 18-36 hours | 7 days |

(2) To re-coat after 36 hours, sand the surface lightly with a fine abrasive pad (Scotchbrite A or equivalent).

(3) Remove the masking tape.

**CAUTION:** CHECK THAT THE FUSELAGE DRAIN HOLES ARE FREE FROM VARIOUS OBSTRUCTIONS.

# MATERIALS - GENERAL

## 1. Sheet Metal General Information

### A. General

(1) A wide variety of materials are used in the assembly of aircraft. This is a result of the various needs with respect to strength, weight, durability and resistance to deterioration of specific structures or parts. Materials most commonly used in the structure are 2024 and 7075 aluminum. Aluminum 6061, 5052 and 7050 is also used by in lesser amounts. Stainless steel types 301, 304, 321, 347, 17-4PH and 17-7PH are also used in lesser degree than aluminum. Low alloy steels UNI6927, 4130 and 4340 are also used. The P.180 also employs beryllium copper alloy 172 and aluminum bronze alloy 630.

## 2. General Information for Extrusions

### A. General

(1) An extrusion is a structural shape formed to specific cross-sectional and angular dimensions by forcing a material at plastic consistency through a stationary die. Some types of extrusions can be substituted by equivalent formed section, but these substitute sections must not be used if their increased dimensions cause interference and do not meet original specification requirements.

(2) Extrusions are used where cross-sectional strength is needed. Extrusions are usually long and provide strength and stiffness over a certain structural area.

**NOTE:** Extrusions for which no sheet metal equivalent section can be formed must be replaced.

## 3. Composite Materials - General

### A. General

(1) Many components of the aircraft, both internally and externally, are fabricated from composite materials. The repairs outlined herein may be accomplished at approved Service Centers.

**NOTE:** Certain composite parts of the P.180 are not authorized for repair and must be replaced when damaged.

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# MATERIALS - METALLIC

## 1. General

A. A wide variety of metallic materials, in sheet and extruded form, are used in the construction of the airplane. The most common materials used in repairs are as follows:

- Aluminium 2024
- Aluminium 2024 ALCLAD
- Aluminium 6061
- Aluminium 7075

B. Repair components should always be manufactured from the existing material at the same or greater thickness than the original.

## 2. Permitted Substitutes

A. If the original material is not available, a permitted substitute material can be used. Permitted substitute materials are as follows:

| MATERIAL | PERMITTED SUBSTITUTE |
|---|---|
| 2024-T3 | 7075-T6 |
| 2024-T42 | 7075-T6 |
| 6061-T6 | 2219-T81 |
| 7075-T6 | 7178-T6 |

B. The substitute material should be the same thickness as the original material. If the original material is "ALCLAD", the substitute material must also be "ALCLAD".

## 3. Bend Radii

A. The minimum bend radius of sheet material is dependant on specification and thickness. The radius must not be exceeded or cracking at the bend will occur. Table 1 gives the standard and minimum bend radii for the most commonly used materials.

| MATERIAL THICKNESS | 6061-0 | | 2024-0<br>7075-0<br>6061-T4 | |
|---|---|---|---|---|
| | MININUM | STANDARD | MINIMUM | STANDARD |
| 0.016 in (0.41 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) |
| 0.025 in (0.64 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) |
| 0.032 in (0.81 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) |
| 0.040 in (1.00 mm) | 0.06 in (1.52 mm) | 0.12 in (3.05 mm) | 0.06 in (1.52 mm) | 0.19 in (4.83 mm) |
| 0.050 in (1.27 mm) | 0.06 in (1.52 mm) | 0.12 in (3.05 mm) | 0.06 in (1.52 mm) | 0.19 in (4.83 mm) |
| 0.063 in (1.60 mm) | 0.06 in (1.52 mm) | 0.12 in (3.05 mm) | 0.09 in (2.28 mm) | 0.19 in (4.83 mm) |
| 0.071 in (1.80 mm) | 0.09 in (2.28 mm) | 0.19 in (4.83 mm) | 0.12 in (3.05 mm) | 0.19 in (4.83 mm) |
| 0.080 in (2.03 mm) | 0.09 in (2.28 mm) | 0.19 in (4.83 mm) | 0.16 in (4.06 mm) | 0.22 in (5.59 mm) |
| 0.090 in (2.29 mm) | 0.09 in (2.28 mm) | 0.19 in (4.83 mm) | 0.19 in (4.83 mm) | 0.25 in (6.35 mm) |
| 0.100 in (2.54 mm) | 0.12 in (3.05 mm) | 0.22 in (5.59 mm) | 0.22 in (5.59 mm) | 0.25 in (6.35 mm) |
| 0.125 in (3.18 mm) | 0.12 in (3.05 mm) | 0.25 in (6.35 mm) | 0.25 in (6.35 mm) | 0.38 in (9.65 mm) |
| 0.160 in (4.06 mm) | 0.16 in (4.06 mm) | 0.25 in (6.35 mm) | 0.31 in (7.87 mm) | 0.44 in (11.2 mm) |
| 0.190 in (4.83 mm) | 0.19 in (4.83 mm) | 0.38 in (9.65 mm) | 0.38 in (9.65 mm) | 0.50 in (12.7 mm) |
| 0.250 in (6.35 mm) | 0.31 in (7.87 mm) | 0.44 in (11.2 mm) | 0.62 in (15.7 mm) | 0.75 in (19.0 mm) |

| MATERIAL THICKNESS | 6061-T6 | | 2024-T3<br>2024-T42 | |
|---|---|---|---|---|
| | MININUM | STANDARD | MINIMUM | STANDARD |
| 0.016 in (0.41 mm) | 0.03 in (0.76 mm) | 0.12 in (3.05 mm) | 0.09 in (2.28 mm) | 0.12 in (3.05 mm) |
| 0.025 in (0.64 mm) | 0.06 in (1.52 mm) | 0.19 in (4.83 mm) | 0.12 in (3.05 mm) | 0.19 in (4.83 mm) |
| 0.032 in (0.81 mm) | 0.06 in (1.52 mm) | 0.19 in (4.83 mm) | 0.12 in (3.05 mm) | 0.19 in (4.83 mm) |
| 0.040 in (1.00 mm) | 0.09 in (2.28 mm) | 0.19 in (4.83 mm) | 0.16 in (4.06 mm) | 0.19 in (4.83 mm) |
| 0.050 in (1.27 mm) | 0.12 in (3.05 mm) | 0.22 in (5.59 mm) | 0.19 in (4.83 mm) | 0.22 in (5.59 mm) |
| 0.063 in (1.60 mm) | 0.16 in (4.06 mm) | 0.25 in (6.35 mm) | 0.22 in (5.59 mm) | 0.25 in (6.35 mm) |
| 0.071 in (1.80 mm) | 0.16 in (4.06 mm) | 0.31 in (7.87 mm) | 0.25 in (6.35 mm) | 0.31 in (7.87 mm) |
| 0.080 in (2.03 mm) | 0.19 in (4.83 mm) | 0.38 in (9.65 mm) | 0.31 in (7.87 mm) | 0.38 in (9.65 mm) |
| 0.090 in (2.29 mm) | 0.22 in (5.59 mm) | 0.44 in (11.2 mm) | 0.38 in (9.65 mm) | 0.44 in (11.2 mm) |
| 0.100 in (2.54 mm) | 0.25 in (6.35 mm) | 0.50 in (12.7 mm) | 0.44 in (11.2 mm) | 0.50 in (12.7 mm) |
| 0.125 in (3.18 mm) | 0.31 in (7.87 mm) | 0.62 in (15.7 mm) | 0.50 in (12.7 mm) | 0.62 in (15.7 mm) |
| 0.160 in (4.06 mm) | 0.44 in (11.2 mm) | 0.88 in (22.4 mm) | 0.75 in (19.0 mm) | 0.88 in (22.4 mm) |
| 0.190 in (4.83 mm) | 0.56 in (14.2 mm) | 1.25 in (26.0 mm) | 1.00 in (25.4 mm) | 1.25 in (26.0 mm) |
| 0.250 in (6.35 mm) | 0.75 in (19.0 mm) | 1.50 in (38.1 mm) | 1.25 in (26.0 mm) | 1.50 in (38.1mm) |

Table 1 - Minimum Bend Radii

# MATERIALS - NON METALLIC

## 1. Composite Materials - General

### A. General

(1) Many components of the aircraft, both internally and externally, are fabricated from composite materials. The repairs outlined herein may be accomplished at approved Service Centers.

**NOTE:** Certain composite parts of the P.180 are not authorized for repair and must be replaced when damaged.

(2) Repair procedures are developed with the objective of equaling as nearly as possible the electrical and strength properties of the original part with a minimum increase in weight. This can only be accomplished by repairing damaged parts with approved materials and working techniques. In order to eliminate dangerous stress concentration, abrupt changes in cross sectional areas should be avoided by tapering joints, making small patches round or oval shaped instead of rectangular, and by rounding the corners of all repairs. Smoothness of aircraft surface is a necessity for proper performance and consequently, patches that project above the original surface should be avoided. Uniformity in thickness of core, facings, and density and cell size of core are exceedingly important. Repairs of punctured facings, delaminations, oil contamination and fractured cores in all areas necessitate removal of all damaged material followed by replacement with an approved type of material of the same thickness as the original to obtain a void-free laminate or face ply. Repaired area will be carefully inspected to insure uniform thickness, freedom from voids, smoothness and overall good workmanship.

(3) Refer to 51-01-00 for information concerning primary and secondary structure manufactured from composite and sandwich materials.

### B. Materials used for Composite Repairs

(1) The information for composite materials is given in the following tables.

| CLASS | TYPE | GRADE/STYLE | PRODUCT | FIBER | |
|---|---|---|---|---|---|
| 1 | III | Grade 95 | Rigidite 5208-7300-95-37 | T-300 Fiber | |
| | | Grade 145 | Rigidite 5208-T300-145-37 | | |
| | | Grade 190 | Rigidite 5208-T300-190-37 | | |
| | | Grade 95 | Rigidite 5208-C3000-95-37 | | |
| | | Grade 145 | Rigidite 5208-C3000-145-37 | Celion Fiber | |
| | | Grade 190 | Rigidite 5208-C3000-190-37 | | |
| 2 | | Style 3K-70-CSW | Rigidite 5208 Woven T 300 Style 3K-70-CSW-37 | | |
| | | Style 3K-135-8H | Rigidite 5208 Woven T 300 Style 3K-135-8H-37 | T-300 Fiber | |
| | IV | Style 3K-70-PW | Rigidite 5208 Woven T 300 Style 3K-70-PW-40 | | |
| | III | Style 3K-70-CSW | Rigidite 5208 Woven C3000 Style 3K-70-CSW-37 | | |
| | | Style 3K-135-8H | Rigidite 5208 Woven C3000 Style 3K-135-8H-37 | Celion Fiber | |
| | IV | Style 3K-70-CSW | Rigidite 5208 Woven C3000 Style 3K-70-PW-40 | | |
| 1 | III | Grade 95 | HYE-1034C(95)-III | T-300 Fiber | |
| | | Grade 145 | HYE-1034C(145)-III | | |
| | | Grade 190 | HYE-1034C(190)-III | | |
| 2 | | Style 3K-135-8H | HMF-133/34-III | | |
| | IV | Style 3K-70-PW | HMF-322/34C-IV | | |
| | | Style 3K-70-PW | HMF-1322/34C-IV | Celion Fiber | |

| CLASS | TYPE | GRADE/STYLE | PRODUCT | FIBER | |
|---|---|---|---|---|---|
| 1 | III | Grade 95 | T3T95-12-F263-7 | T-300 Fiber | |
| | | Grade 145 | T3T145-12-F263-7 | | |
| | | Grade 190 | T3T190-F263-7 | | |
| | | Grade 145 | T5T145-12-F263-7 | | |
| | | Grade 190 | T5T190-12-F263-7 | | |
| 2 | | Style 3K-135-8H | F3T-584-42-F263-7 | | |
| | IV | Style 3K-70-PW | W3T-282-42-F263-8 | | |
| | | Grade 95 | T6C95-12-F263-7 | Celion Fiber | |
| | | | T2C95-12-F263-7 | | |
| | | Grade 145 | T6C145-12-F263-7 | | |
| | | | T2C145-12-F263-7 | | |
| | | Grade 190 | T6C190-12-F263-7 | | |
| | | | T2C190-12-F263-7 | | |
| 2 | | Style 3K-135-8B | F3C-584-42-F263-7 | | |
| | IV | Style 3K-70-PW | W3C-282-42-F263-8 | | |
| 1 | III | Grade 95 | CYCOM 985GT3095 | Celion Fiber | |
| | | Grade 145 | CYCOM 985GT3145 | | |
| | | Grade 190 | CYCOM 985GT3190 | | |
| 2 | IV | Style 3K-70-PW | CYCOM 985F3070PW | | |
| | III | Style 3K-70-P | CYCOM 985GF3070P | | |
| | | Style 3K-135-8H | CYCOM 985GF3135H8 | | |

(a) Aramid fiber (KEVLAR) Preimpregnated with Epoxy Resin

1) Style 120

| PRODUCT | |
|---|---|
| Kevlar 49-120F161-188 | |
| Cycom 985-K120 | |
| MXM-7880/Kevlar 49-120 | |
| R 9369-120K | |

2) Style 285

| PRODUCT | |
|---|---|
| Kevlar 49-285F161-188 | |
| Cycom 985-K285 | |
| MXM-7880/Kevlar 49-285 | |
| R 9369-120K | |

(b) Woven Glass Fabric Preimpregnated with a High Temperature Epoxy Resin.

1) Class I - This material is not required to possess flammability properties meeting requirements of this specification. When no class is specified, requirements shall be in accordance with Class I.
2) Class II - This materials shall possess flammability properties meeting requirements of this specification.
3) Type 120 - Type D, Style 120
4) Type 1581 - Type B-2, Style 181-50
5) Type 1582 - Type J-2, Style 182-50
6) Type 1584 - Type K-2, Style 184-50
7) Type 1543 - Type F-2, Style 143-50

| TYPE | FABRIC DESIGNATION | WEAVE | YARNS PER INCH NOMINAL (1) | | YARN NUMBER AND PLY | THICKNESS, INCHES |
|---|---|---|---|---|---|---|
| | | | WARP | FILLING | WARP (5) FILLING | |
| A-1 | 80-150 D.E. | 8-ss* | 72 | 70 | ECDE 150 1/0 1.0z-ECDE 150 1/0 1.0z | 0.0065-0.0075 |
| B | 112 | Plain | 40 | 39 | ECD 450 1/2 4.4s-ECD 450 1/2 4.4s | 0.003-0.005 |
| C | 116 | Plain | 60 | 58 | ECD 450 1/2 4.4s-ECD 450 1/2 4.4s | 0.0035-0.0055 |
| D | 120 | 4-ss* | 60 | 58 | ECD 450 1/2 4.4s-ECD 450 1/2 4.4s | 0.0035-0.0055 |
| D-1 | 220 | 4-ss* | 60 | 58 | ECD 225 1/0 ECD 225 1/0 | 0.0035-0.0055 |
| E | 128 | Plain | 42 | 32 | ECE 225 1/3 4.4s-ECE 225 1/3 4.4s | 0.0065-0.0085 |
| E-1 | 128-150 D.E. | Plain | 42 | 32 | ECDE 150 1/2 3.8s-ECDE 150 1/2 3.8s | 0.0065-0.0085 |
| E-2 | 128-150 | Plain | 42 | 32 | ECG 150 1/2 3.8s-ECG 150 1/2 3.8s | 0.0065-0.0085 |
| E-3 | 128-76 | Plain | 44 | 32 | ECG 75 1/0 ECG 75 1/0 | 0.0065-0.0085 |
| F | 143 | 4-ss* | 49 | 30(2) | ECE 225 3/2 4.4s-ECG 450 1/2 4.4s | 0.008-0.012 |
| F-2 | 143-150 | 4-ss* | 49 | 30 | ECG 150 2/2 3.8x-ECD 450 1/2 4.4s | 0.008-0.012 |
| G | 164 | Plain | 20 | 18 | ECE 225 4/3 4.4s-ECE 225 4/3 4.4s | 0.0145-0.0175 |
| H | 181 | 8-ss* | 57 | 54 | ECE 225 1/3 4.4s-ECE 225 1/3 3.8s | 0.008-0.010 |
| H-1 | 181-150 D.E. | 8-ss* | 57 | 54 | ECDE 150 1/2 3.8s-ECDE 150 1/2 3.8s | 0.008-0.011 |
| H-2 | 181-150 | 8-ss* | 57 | 54 | ECG 150 1/2 3.8s-ECG 150 1/2 3.8s | 0.008-0.017 |
| H-3 | 181-77 | 8-ss* | 57 | 54 | ECDE 75 1/0 1.0z-ECDE 75 1/0 1.0z | 0.008-0.011 |
| H-4 | 181-150s | 8-ss* | 57 | 54 | ECB 150 1/2 3.8s-ECB 150 1/2 3.8s | 0.008-0.012 |
| J | 182 | 8-ss* | 60 | 56 | ECE 225 2/2 4.4s-ECE 225 2/2 4.4s | 0.0125-0.0155 |
| J-1 | 182-150 D.E. | 8-ss* | 60 | 56 | ECDE 150 1/3 3.8s-ECDE 150 1/2 3.8s | 0.0135-0.0165 |
| J-2 | 182-150 | 8-ss* | 60 | 56 | ECG 150 1/3 3.8s-ECB 150 1/2 3.8s | 0.0135-0.0165 |
| K | 184 | 8-ss* | 42 | 36 | ECE 225 4/3 4.4s-ECE 225 4/3 4.4s | 0.0255-0.0315 |
| K-2 | 184-150 | 8-ss* | 42 | 36 | ECG 150 4/2 3.8s-ECG 150 4/2 3.8s | 0.0255-0.0315 |
| M | 909 | Hi Mod. | 84 | 54 | ECG 150 1/2 ECG 150 2/2 | 0.0088-0.0108 |
| N | 918 | Hi Mod. | 52 | 56 | ECG 75 2/2 ECG 75 2/2 | 0.0150-0.021 |
| O (3) | 8800 | 1/2 Leno Plain | 8 | 8 | Top Beam ECG 150 1/0 Bottom Beam ECG 75 2/3 ECG 75 1/0 | 0.0175-0.0225 |
| O (4) | 8800 | Leno | 8 | 8 | ECH ECG 75 2/3 | 0.013-0.019 |

*ss = shaft satin

(1) ± 2 yarr.s per inch allowable variation

(2) ECE 225 2/3 3.8s may be substituted

(3) (Fabric Designation -8800)

(4) Yarn twist is for reference only and will vary slightly from stated.

| MATERIAL CLASSIFICATION | | PRODUCT DESIGNATION | |
|---|---|---|---|
| CLASS<br>1 | TYPES<br>120<br>181<br>182<br>184<br>184 | <br>120-F161-108 F50<br>1581-F161-108 F50<br>1582-F161-108 F50<br>1584-F161-108 F50<br>1543-F161-108 F50 | |
| | 120<br>181<br>182<br>184<br>141 | Narmco 588-120<br>Volan A<br>Narmco 588-181<br>Volan A<br>Narmco 588-182<br>Volan A<br>Narmco 588-184<br>Volan A<br>Narmco 588-141<br>Volan A | |
| CLASS<br>2 | TYPES<br>120<br>181<br>182<br>184<br>143 | <br>120-F164-6-F50<br>1581-F164-6-F50<br>1582-F164-6-F50<br>1584-F164-6-F50<br>1543-F164-6-F50 | |

(c) Non-Metallic Honeycomb core for Composite Structures

1) Classes - Temperature values are used to help classify core without naming resins, which are at manufacturer option.

(a) Class I - Heat resistant to 163°C (325°F), glass-reinforced core

(b) Class II - OBSOLETE

(c) Class III - OBSOLETE

(d) Class IV - Nomex-reinforced core, heat resistant to 163°C (325°F)

(e) Class IV-A - Nomex-reinforced core, heat resistant to 163°C (32°F), heat forming grade

(f) Class V - Heat resistant to 163°C (325°F), bias weave glass-reinforced core (HFT)

(2) Types - Nonmetallic honeycomb core is classified by type as follows:
  (a) Type I - 3/16 inch hexagonal-shaped core
  (b) Type II - 1/4 inch hexagonal-shaped core
  (c) Type III - 3/8 inch hexagonal-shaped core
  (d) Type IV - 1/4 inch hexagonal core overexpanded in the "W" direction
  (e) Type V - 1/8 inch hexagonal-shaped core
  (f) Type VI - 2/16 inch hexagonal core overexpanded in the "W" direction

(3) Grades - Nonmetallic honeycomb is classified by grade and identification color.

NON METALLIC HONEYCOMB CORE

| GRADE | NOMINAL DENSITY, PCF | DENSITY RANGE, PCF | IDENTIFICATION COLOR |
|---|---|---|---|
| 1.5 | 1.5 | 1.3-1.7 | Green-White |
| 1.8 | 1.8 | 1.6-2.0 | Black-White |
| 2.0 | 2.0 | 1.8-2.2 | Purple-White |
| 2.5 | 2.5 | 2.2-2.8 | Brown |
| 3.0 | 3.0 | 2.7-3.3 | Orange |
| 3.5 | 3.5 | 3.15-3.85 | Blue |
| 4.0 | 4.0 | 3.7-4.3 | Red |
| 4.5 | 4.5 | 4.1-4.9 | Black |
| 5.0 | 5.0 | 4.6-5.4 | Yellow-White |
| 5.5 | 5.5 | 5.0-6.0 | Yellow |
| 6.0 | 6.0 | 5.5-6.5 | Red-White |
| 6.5 | 6.5 | 6.0-7.0 | Purple |
| 8.0 | 8.0 | 7.3-8.7 | Green |
| 9.0 | 9.0 | 8.2-9.8 | White |
| 12.0 | 12.0 | 11.0-13.0 | Pink |

(4) Forms - The material may be supplied in the following forms:
  (a) Block form
  (b) Precut Sheet
  (c) Preformed Sheet
  (d) Detail Parts

(5) CLASSIFICATION

| CLASS | TYPE / GRADE | | PRODUCT | |
|---|---|---|---|---|
| CLASS I | I | 4.0 | HRP 3/16-4.0 | |
| | I | 5.5 | HRP 3/16-5.5 | |
| | I | 8.0 | HRP 3/16-8.0 | |
| | I | 12.0 | HRP 3/16-12.0 | |
| | II | 3.5 | HRP 1/4-3.5 | |
| | II | 4.5 | HRP 1/4-4.5 | |
| | III | 6.0 | HRP 3/8-6.0 | |
| | III | 3.5 | HRP 3/8-3.2 | |
| | III | 3.5 | HRP 3/8-3.5 | |
| | III | 4.5 | HRP 3/8-4.5 | |
| | IV | 4.5 | HRP OX1/4 4.4.5 | |
| | I | 4.0 | HTP-3/16-4.0 | |
| | I | 5.5 | HTP-3/16-5.5 | |
| | I | 8.0 | HTP-3/16-8.0 | |
| | I | 12.0 | HTP-3/16-12.0 | |
| CLASS IV | I | 2.0 | HRH-10-3/16-2.0 | |
| | I | 3.0 | HRH-10-3/16-3.0 | |
| | I | 4.0 | HRH-10-3/16-4.0 | |
| | II | 1.5 | HRH-10-1/4-1.5 | |
| | II | 2.0 | HRH-10-1/4-2.0 | |
| | III | 1.5 | HRH-10-3/8-1.5 | |
| | III | 2.0 | HRH-10-3/8-2.0 | |
| | IV | 3.0 | HRH-10-1/40X-3.0 | |
| | V | 1.8 | HRH-10-1/8-1.8 | |
| | V | 3.0 | HRH-10-1/8-3.0 | |
| | V | 4.0 | HRH-10-1/8-4.0 | |
| | V | 5.0 | HRH-10-1/8-5 | |
| | V | 8.0 | HRH-10-1/8-8 | |
| | V | 9.0 | HRH-10-1/8-9 | |
| | VI | 1.8 | HRH-10-3/160X-1.8 | |
| | VI | 3.0 | HRH-10-3/160X-3.0 | |

# MATERIALS - SEALANTS

## 1. General

A. Sealants are used for the following purposes:

- Sealing of fuel tanks
- Sealing of the pressure cabin
- Weatherproofing
- Aerodynamic smoothness
- Corrosion prevention at structural interfaces.

B. This topic contains information for the types of sealants commonly used on the airplane.

## 2. Safety Precautions

**WARNING:** BE CAREFUL WHEN YOU USE THE SEALANTS:

- PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
- DO NOT BREATHE THE GAS (OR DUST)
- DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET THE SEALANT IN YOUR EYES OR ON YOUR SKIN:

- FLUSH YOUR EYES WITH WATER FOR AT LEAST 15 MINUTES
- CLEAN YOUR SKIN WITH SOAP AND WATER
- GET MEDICAL HELP.

IF YOU ACCIDENTALLY DRINK OR EAT SEALANT:

- GET MEDICAL HELP.

SEALANTS ARE POISONOUS AND HIGHLY FLAMMABLE. THEY GIVE OFF POISONOUS GAS WHEN THEY BECOME HOT.

## 3. PR 1422 A and PR 1422 B

A. Description

A two-part, polysulfide, liquid polymer compound used for sealing integral fuel tanks and pressurized cabins. The cured sealant has excellent adhesion to aluminium, magnesium, titanium, stainless steel and other materials. The cured sealant has excellent resistance to airplane fuels and lubricating oils. The sealant is available with two application times (see Application).

B. Surface Preparation

To obtain good adhesion the surfaces should be cleaned as follows:

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surfaces with an inhibited alkaline cleaner (MIL-C-87936).
(2) Thoroughly dry with hot air.
(3) Clean the surfaces with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Mixing

The two parts of the sealant must be mixed in the correct proportions. For the correct mixing procedure refer to the sealant manufacturers instructions.

D. Application

PR 1422 A – Brush application to interfaces, around metal fasteners and over seams.
PR 1422 B – Extrusion gun with 0.125in (3mm) to 0.25in (6mm) tip to apply sealant fillet into seams or around edges.

The application time is dependent on temperature as follows:

| Temperature | Sealant PR 1422 A/B- ½ | Sealant PR 1422 A/B-2 |
|---|---|---|
| 65°F (18°C) | 1 hour | 4 hours |
| 75°F (24°C) | 30 minutes | 2 hours |
| 85°F (30°C) | 15 minutes | 1 hour |

E. The curing time is dependent on temperature. The application of heat up to a maximum of 130°F (54.5°C) will reduce the curing time. Approximate curing times are as follows:

| Temperature | Cured | Maximum Cure |
|---|---|---|
| 75°F (24°C) | 14 days | 30-50 days |
| 95°F (35°C) | 3½ days | 8-12 days |
| 125°F (52°C) | 10 hours | 1-2 days |

4. PR-1431-G

A. Description

A two-part polysulfide sealant with a soluble chromate content to inhibit corrosion. PR-1431-G is used as an interface sealant in integral fuel tanks and pressurized cabins where long application life and assembly time are required. The cured sealant has excellent adhesion to aluminium, magnesium, titanium, steel and other materials. The cured sealant has excellent resistance to airplane fuels and lubricating oils. PR-1431-G is available in four types with different application and assembly times (see Application).

B. Surface Preparation

To obtain good adhesion the surfaces should be cleaned as follows:

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surfaces with an inhibited alkaline cleaner (MIL C-87936).
(2) Thoroughly dry with hot air.
(3) Clean the surfaces with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Mixing

The two parts of the sealant must be mixed in the correct proportions. For the correct mixing procedure refer to the sealant manufacturer instructions.

D. Application

Brush or roller application to interfaces, all work on the interface must be completed within the assembly time. A small continuous bead of sealant should squeeze out of the interface when the fasteners are installed. The sealant is available in four types with different application and assembly times:

| | Type I | Type II | Type III | Type IV |
|---|---|---|---|---|
| Application life: | 12 hours | 24 hours | 40 hours | 48 hours |
| Assembly time: | 20 hours | 80 hours | 120 hours | 168 hours |

E. Curing

The curing time for each type can be reduced by the application of heat up to a maximum of 130°F (54.5°C) after an initial curing period at 75°F (24°C). The curing times are as follows:

| Temperature | Type I | Type II | Type III | Type IV |
|---|---|---|---|---|
| 75°F (24°C) | 8 days | 10 days | 30 days | 40 days |
| 75°F (24°C) and then 130°F (54.5°C) | 24 hours and then 24 hours | 24 hours and then 48 hours | 24 hours and then 96 hours | 24 hours and then 120 hours |

5. PR 1910

A. Description

A two-part silicone rubber sealant for high temperature zones. PR 1910 is used as an interface or filleting sealant and has excellent resistance to weathering, ozone and humidity. The cured sealant has excellent adhesion to aluminium, titanium, stainless steel, glass and other materials.

B. Surface Preparation

To obtain maximum adhesion the surfaces should be cleaned, and primer applied as follows:

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surfaces with an inhibited alkaline cleaner (MIL C-87936).
(2) Thoroughly dry with hot air.
(3) Clean the surfaces with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Mixing

The two parts of the sealant must be mixed in the correct proportions. For the correct mixing procedure refer to the manufacturers'instructions.

D. Application

Brush or extrusion gun application to interfaces, seams and over metal fasteners. The application time is dependent on the ambient temperature as follows:

| Temperature | Application Time |
|---|---|
| 75°F (24°C) | 2 hours |

E. Curing

The method of curing is dependent on the maximum operating temperature in the zone of application. The method of curing is as follows.

| Temperature Zone | Method |
|---|---|
| (1) Maximum 300°F (150°C) | 24 hours at 75°F (24°C)<br>or<br>6 hours at 170°F (60°C) |
| (2) Maximum 450°F (230°C) | As for (1) and then:<br>Cure for two weeks at 75°F (24°C)<br>or<br>1 hour at 300°F (150°C) and then 4 hours at 400°F (200°C) |
| (3) Maximum 700°F (375°C) | As for (2) and then:<br>Increase the temperature in steps of 85°F (30°C), maintaining each increase for 2 hours until the maximum zone temperature is reached. Maintain the maximum zone temperature for a minimum of 2 hours then allow to cool. |

6. Silastic 732 RTV

A. Description

A one part silicone rubber adhesive/sealant used for general purpose sealing of electrical components and bonding weatherstrips and seals. The cured sealant has good adhesion to a wide variety of insulating materials including etched Teflon, glass braid, silicone rubber and most plastics except polyethylene. The cured sealant has excellent resistance to weathering, moisture and ozone and stays flexible over a wide temperature range. For best results Silastic 732 RTV should be applied over Dow Corning 1200 primer (Refer to 51-23-00).

B. Surface Preparation

To obtain good adhesion the surfaces should be cleaned as follows:

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK AND ACETONE. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean and degrease the surfaces with MEK solvent (ASTM D740) and dry with a lint-free cloth.

**CAUTION:** DO NOT PUT ACETONE ON ACETATE PLASTICS.

(2) Wipe the surfaces (not acetate plastics) with acetone.

**NOTE:** Rubber surfaces should be lightly abraded before wiping with acetone.

(3) Apply a coat of Dow Corning 1200 primer to the surfaces and allow to dry for 30-45 minutes.

**NOTE:** Silastic 732 RTV will bond to most clean surfaces without Dow Corning 1200 primer but bond strength could be inconsistent. Rubber surfaces need not be primed but should be thoroughly clean.

C. Mixing

The sealant is supplied ready to use and no mixing is required.

D. Application

The application time is approximately 10-20 minutes at 75°F (24°C).

(1) Sealing
  (a) Force the sealant into the joint or seam.
  (b) Tool or smooth the sealant within 10 minutes of application.
  (c) Allow to cure.

(2) Bonding
  (a) Apply a coat of sealant approximately 0.02in(0.5mm) thick to the prepared surface.
  (b) Press the other surface into place with enough force to expel the air but not the sealant.
  (c) Leave to cure.

E. Curing

The curing time is dependent on the depth of sealant and the relative humidity in the air. A minimum of 20% relative humidity is required to cure the sealant in 24 hours. Approximate curing time is as follows:

(1) Sealant

| Depth | Cured | Maximum Cure |
|---|---|---|
| 0.125 in (3 mm) | 24 hours | 72 hours |
| 0.25 in (6 mm) | 24 hours | several weeks |

(2) Bonding

| Sealant Thickness | Bond | Maximum Bond |
|---|---|---|
| 0.02 in (0.5 mm) | 6-24 hours | 7 days |

7. PR 1829 Class B

A. Description

PR 1829 Class B is a two-part epoxy cured Permapol P-3 polythioether liquid polymer. The mixed compound is a thixotropic paste, readily applied by extrusion or injection gun, which does not flow from vertical or overhead surfaces. Sealant has excellent adhesion to common aircraft substrates.

B. Surface Preparation

Immediately before applying sealant to primed substrates, the surfaces should be cleaned with solvents. Contaminants such as dirt, grease, and/or processing lubricants must be removed prior to sealant application. A progressive cleaning procedure should be employed using the appropriate solvents and new lint free cloth (reclaimed solvents or tissue paper should not be used).Always pour solvent on the cloth to avoid contaminating the solvent supply. Solvent may craze polycarbonate. Wash one small area at a time.It is important that the surface is dried with a second clean cloth prior to the solvent evaporating to prevent the redeposition of contaminants on the substrate.

Substrate composition can vary greatly. This can affect sealant adhesion. It is recommended that adhesion characteristics to a specific substrate be determined prior to application on production parts or assemblies. For a better adhesion to polysulfide sealant, polycarbonate and acrylic substrates, PR 186 Adhesion Promoter must be used.

C. Mixing

Semkit Two-part Sealant Cartridges

1° Wear safety glasses.

2° Hold cartridge and pull back dasher rod one fourth.

3° Pull back the dasher rod as injecting as proportionnaly as possible the contents accelerator into the base.

4° Mix material, rotate dasher rod 90° in aspiral clockwise motion; with each stroke turn the dasher rod90°.

5° When two-parts are mixed thoroughly, pull dasher rod back to the neck of cartridge, grasp cartridge firmly at neck, unscrew dasher rod counterclockwise and remove.

6° Screw nozzle into cartridge, material is ready for extrusion.

D. Application Instruction

Application life is the period of time that themixed compound remains at a consistency suitable for application with injection or extrusion guns. Application life is always based on standard conditions at 23° C and 50 % relative humidity.

E. Curing

The lenght of the cure depends on the ambient temperature. Refer to product data sheet for detailed information. Cure may hastened by applying heat up to 55° C.

F. Cleaning Equipment

Equipment should be cleaned immediately after use with methylethylketone. Cured material may be removed with commercial product.

G. Storage Life

The storage life of PR 1829 B is 6 months when stored in the original, unopened containers at temperature below 25°C.

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# MATERIALS - ADHESIVES

## 1. General

A. Adhesives are used to bond parts of the airplane together. This topic contains information for the types of adhesive commonly used on the airplane.

## 2. Safety Precautions

**WARNING:** BE CAREFUL WHEN YOU USE THE ADHESIVES:

– PUT ON GOGGLES AND PROTECTIVE CLOTHING.

IF YOU GET THE ADHESIVE IN YOUR EYES OR ON YOUR SKIN:

– FLUSH YOUR EYES WITH WATER FOR AT LEAST 15 MINUTES.
– CLEAN YOUR SKIN WITH SOAP AND WATER.
– GET MEDICAL HELP.

THE ADHESIVES ARE DANGEROUS. THEY CAN CAUSE DAMAGE TO YOUR EYES AND SKIN.

## 3. Hysol EA 934NA

A. Description

A two-part paste adhesive with high shear strength up to 350°F (177°C). The adhesive is used for potting, filling, fairing and shimming. The adhesive has excellent resistance to water, isopropyl alcohol, hydraulic oil, fuel and salt spray.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surfaces with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Mixing

**WARNING:** DO NOT MIX MORE THAN 1LB (450 g) OF THE ADHESIVE. DANGEROUS HEAT BUILDUP CAN OCCUR. THE HOT ADHESIVE GIVES OFF FUMES WHICH ARE POISONOUS.

D. Application

The application time is approximately 40 minutes. Apply pressure to hold the bonded parts in contact until handling strength is achieved.

E. Curing

The curing time is dependant on temperature. The application of heat up to a maximum of 205°F (96°C) will reduce the curing time as follows:

| Temperature | Cured (Handling Strength) | Maximum Cure |
|---|---|---|
| 77°F (25°C) | 8 hours | 7 days |
| 140°F (60°C) | 20 minutes | - |
| 200°F (93°C) | - | 1 hour |
| 205°F (96°C) | 1 minute | - |

4. Loctite 222 (Screwlock) (MIL-S-22473D

A. Description

A purple resin used for the safety locking of screws and bolts.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE 1,1,1, TRICHLOROETHANE. OBEY THE SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Wipe off excess oil and grease.
(2) Clean the surface with 1,1,1 Trichloroethane solvent (0-T-620) and dry with a lint-free cloth before the solvent evaporates.
(3) Blow the surfaces free of solvent with clean oil-free air.

C. Mixing

The adhesive is supplied ready to use and no mixing is required.

D. Application

Apply the adhesive by brushing, dipping or running the applicator nozzle over the threads. For blind hole applications, coat the sides of the blind hole and the first two threads of the screw. Install the screw using the normal torque.

E. Curing

| Temperature | Cure | Maximum Cure |
|---|---|---|
| 75°F (24°C) | 20 minutes | 6 hours |

5. Loctite 242 (Nutlock) (MIL-S-22473D)

A. Description

A blue resin used for the safety locking of nuts.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE 1,1,1 TRICHLOROETHANE. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN 20-00-00.

(1) Wipe off excess oil and grease.

(2) Clean the surfaces with 1,1,1 Trichloroethane solvent (0-T-620) and dry with a lint-free cloth before the solvent evaporates.
(3) Blow the surfaces free of solvent with clean oil-free air.

C. Mixing

The adhesive is supplied ready to use and no mixing is required.

D. Application

Apply the adhesive by brushing or running the applicator nozzle over the threads. Install the nut using normal torque. Excess adhesive may be removed with a rag moistened with 1,1,1 trichloroethane.

E. Curing

| Temperature | Cured | Maximum Cure |
|---|---|---|
| 74°F (24°C) | 20 minutes | 6 hours |

6. Loctite 271 (Studlock)

A. Description

A red resin used for the safety locking of studs.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE 1,1,1 TRICHLOROETHANE. OBEY THE HEALTH AND SAFETY INFORMATION GIVEN IN CHAPTER 20-00-00.

(1) Wipe off excess oil and grease.
(2) Clean the surfaces with 1,1,1 trichloroethane solvent (0-T-620) and dry with a lint-free cloth before the solvent evaporates.
(3) Blow the surfaces free of solvent with clean oil-free air.

C. Mixing

The adhesive is supplied ready to use and no mixing is required.

D. Application

Apply the adhesive by brushing, dipping or running the applicator nozzle over the threads. For blind hole applications, coat the sides of the blind hole and the first two threads of the stud. Install the stud using the normal torque.

E. Curing

| Temperature | Cure | Maximum Cure |
|---|---|---|
| 75°F (24°C) | 20 minutes | 2 hours |

7. Loctite RC 680

A. Description

A green resin used to bond bearings and bushings into housings.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE 1,1,1 TRICHLOROETHANE. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Wipe excess oil and grease from the mating surfaces.

**CAUTION:** DO NOT GET THE SOLVENT INSIDE THE BEARING.

(2) Clean the mating surfaces with 1,1,1 trichloroethane solvent (0-T-620) and dry with a lint-free cloth before the solvent evaporates.

(3) Blow the surfaces dry with clean oil-free air.

C. Mixing

The adhesive is supplied ready to use and no mixing is required.

D. Application

**CAUTION:** DO NOT GET THE ADHESIVE INSIDE THE BEARING.

Apply the adhesive evenly to both mating surfaces. Wipe off any excess adhesive with a rag moistened with 1,1,1 trichloroethane. The bearing should be installed immediately and held in position until the adhesive cures.

E. Curing

The curing time can be reduced by the application of heat as follows:

| Temperature | Cure | Maximum Cure |
|---|---|---|
| 75°F (24°C) | 30 minutes | 6 hours |
| 180°F (82°C) | - | 30 minutes |

# FASTENERS - GENERAL

## 1. General

A. This topic gives general information on the types of fasteners used in repairs, and fastener hole preparation.

B. For information about the installation of specific fasteners refer to 51-41-00.

C. For information about the removal of specific fasteners refer to 51-43-00.

## 2. Types of Fasteners

A. The types of fasteners used in a repair are specified in the applicable Repair Scheme. If no Repair Scheme exists, use the same type and size of fastener as used in the area of repair. Where fasteners are removed for repair purposes, they must be replaced with the same type and size unless the fastener holes are damaged or enlarged. If the fastener holes are damaged or enlarged during removal, they must be drilled to take the next larger size of fastener.

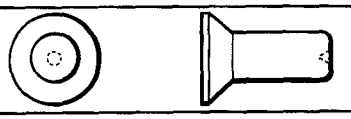
B. The types of fasteners used in repairs are divided into four categories:

- Solid rivets, used where access is available to both sides of the repair.
- Blind rivets, used where access is restricted to one side of the repair.
- Hi-Lok pins, used where high shear strength is required and access is available to both sides of the repair.
- Hi-Lite pins, used where high tensile strength is required and access is available to both sides of the repair.

## 3. Identification

A. Fasteners removed for repair must be identified to make sure that the same size (or oversize) and type of fastener is installed. The following pages give general information about the most common types of fastener used on the airplane and the method of identification.

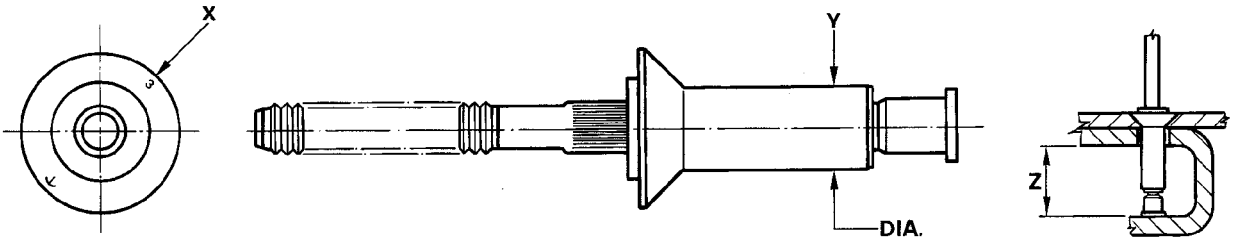
B. Solid Rivets

| RIVET | PART NUMBER | MARKING | MATERIAL | DESCRIPTION |
|---|---|---|---|---|
|  | MS20470A | None | AL1100 | Universal head |
|  | MS20470AD | Dimple in head | AL2117 | Universal head |
|  | MS20426AD | Dimple in head | AL2117 | 100 deg CSK head |
|  | MS20427M | None | Monel | 100 deg CSK head Used in high heat areas |
|  | Allfast AF195 | Dimple in end of shank | AL2117 | 100 deg CSK reduced head |

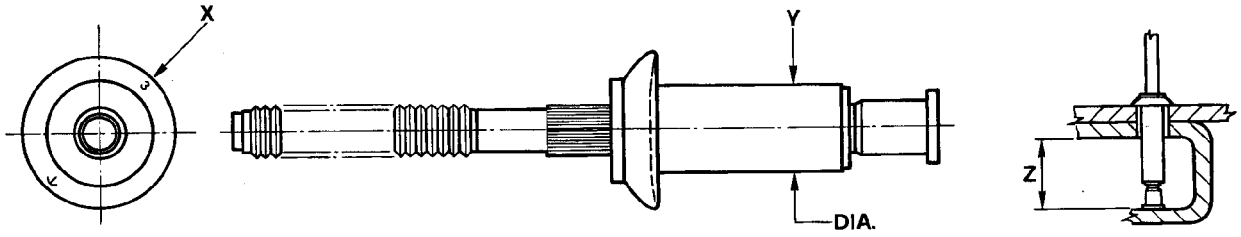
Solid rivets are identified by the basic rivet part number, followed by the diameter code and the length code, for example:

MS20470A 2-4
- 4 — Length x 0.0625 in (1.6 mm) = 0.25 in (6.35 mm)
- 2 — Diameter x 0.031 in (0.8 mm) = 0.062 in (1.6 mm)
- MS20470A — Basic rivet part number.

C. Cherrymax 3212/3213




Cherrymax 3212




Cherrymax 3213

A countersink or universal head rivet used for blind hole applications. The rivet is manufactured from A1 5056 with a steel stem. The rivet is identified by the basic rivet code followed by the diameter code (Y) and the grip range code (X), for example:

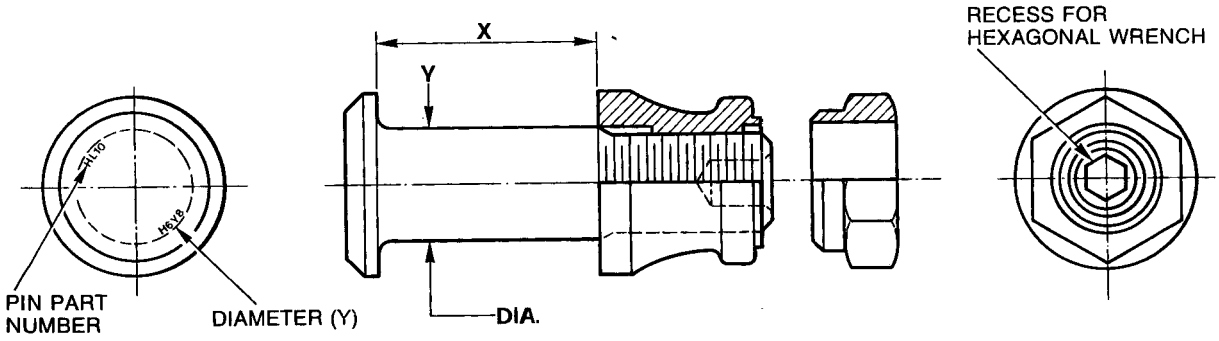
3213 - 4 - 3
- 3 — Grip range code (X)
- 4 — Diameter code (Y)
- 3213 — Basic rivet code.

Data for cherrymax 3212/3213 rivets is given in the following tables:

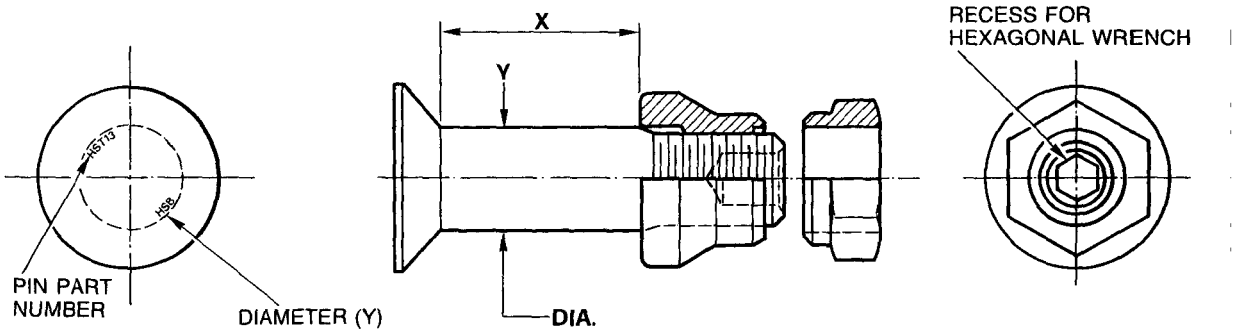
| Diameter code (Y) | Diameter | | Minimum clearance (Z) | |
|---|---|---|---|---|
| | in | mm | in | mm |
| -4 | 0.126 | 3.2 | 0.355 | 9.02 |
| -5 | 0.157 | 4.0 | 0.370 | 9.40 |
| -6 | 0.189 | 4.8 | 0.415 | 10.5 |
| -8 | 0.253 | 6.4 | 0.485 | 12.3 |

| Grip range code (X) | Grip range | | | |
|---|---|---|---|---|
| | in | | mm | |
| | min | max | min | max |
| -3 | 0.126 | 0.187 | 3.20 | 4.75 |
| -4 | 0.188 | 0.250 | 4.78 | 6.35 |
| -5 | 0.251 | 0.312 | 6.38 | 7.92 |
| -6 | 0.313 | 0.375 | 7.95 | 9.53 |
| -7 | 0.376 | 0.437 | 9.55 | 11.1 |
| -8 | 0.438 | 0.500 | 11.1 | 12.7 |

D. Hi-Lok pins




Hi-Lok HL10VAP



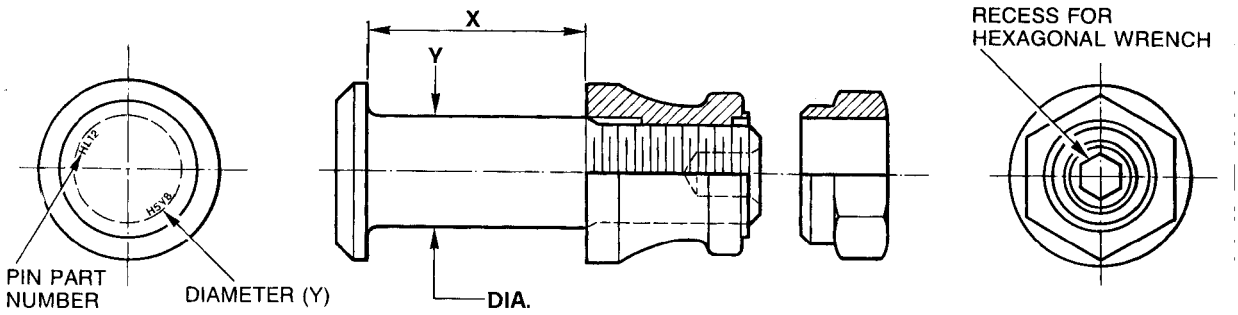

Hi-Lok HL12VAP

Protruding or flush head pins and collars equipped with shear-off nuts. The pins are manufactured from titanium alloy with an aluminium coating and cetyl alcohol lubrication. Refer to the manufacturer data sheet for the correct combinations of pins and collars. The pins are identified by the pin part number, followed by the finish, the diameter code and the maximum grip length code, for example:

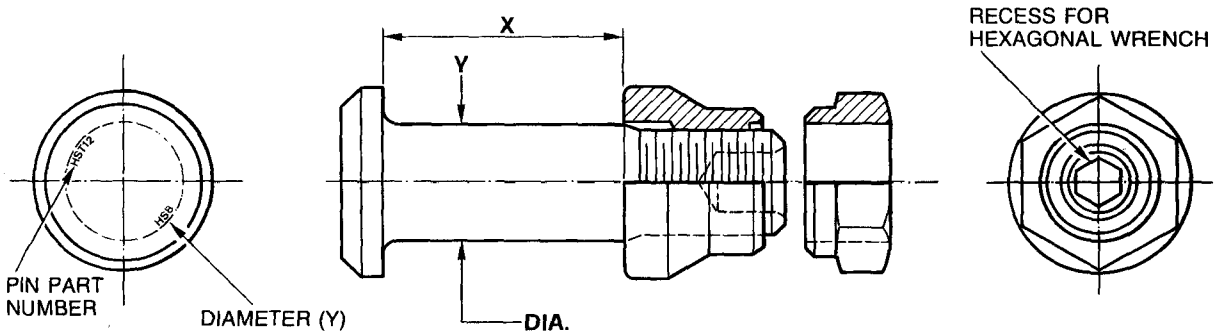
HL10 VAP-8-8

- Maximum grip length code (X) x 0.0625 in (1.6 mm) = 0.5 in (12.7 mm)
- Diameter code (Y) x 0.031in (0.8 mm ) = 0.25 in (6.35 mm)
- Finish (VAP = A1 coating with cetyl alcohol lubrication)
- Pin part number.

E. Hi-Lite pins




Hi-Lite HST12AZ




Hi-Lite HST13AZ

Protruding or flush head pins and collars equipped with shear-off nuts. Hi-Lite pins are used for high tensile stress applications and are manufactured from titanium alloy with an aluminium coating and cetyl alcohol lubrication. Refer to the manufacturer data sheets for the correct combinations of pins and collars. The pins are identified by the pin part number, followed by the finish, the diameter code and the maximum grip length code, for example:

HST12 AZ-8-8

- Maximum grip length code (X) x 0.0625 in (1.6 mm) = 0.5 in (12.7 mm)
- Diameter code (Y) x 0.031 in (0.8 mm) = 0.25 in (6.35 mm)
- Finish (AZ = A1 coating with cetyl alcohol lubrication)
- Pin part number.

4. Fastener Hole Preparation

A. Solid Rivets - MS20470, MS20426, MS20427.

| Rivet diameter | | Hole size | | Countersink diameter | |
|---|---|---|---|---|---|
| in | mm | in | mm | in | mm |
| 0.0625 | 1,6 | 0.067-0.071 | 1,70-1,80 | 0.100-0.105 | 2,54-2,67 |
| 0.0945 | 2,4 | 0.098-0.106 | 2,49-2,69 | 0.165-0.170 | 4,19-4,32 |
| 0.1260 | 3,2 | 0.129-0.139 | 3,28-3,53 | 0.211-0.216 | 5,36-5,49 |
| 0.1575 | 4,0 | 0.161-0.172 | 4,09-4,37 | 0.272-0.277 | 6,91-7,04 |
| 0.1890 | 4,8 | 0.191-0.204 | 4,85-5,18 | 0.339-0.344 | 8,61-8,74 |
| 0.2520 | 6,4 | 0.257-0.276 | 6,53-7,01 | 0.462-0.467 | 11,73-11,86 |
| 0.3110 | 7,9 | 0.323-0.343 | 8,20-8,71 | 0.550-0.555 | 13,97-14,10 |
| 0.3740 | 9,5 | 0.386-0.406 | 9,80-10,31 | 0.680-0.685 | 17,27-17,40 |

B. Solid Rivet - Allfast AF 195

| Rivet diameter | | Hole size | | Countersink diameter | |
|---|---|---|---|---|---|
| in | mm | in | mm | in | mm |
| 0.1260 | 3,2 | 0.128-0.134 | 3,25-3,40 | 0.175-0.185 | 4,45-4,70 |
| 0.1575 | 4,0 | 0.161-0.165 | 4,10-4,20 | 0.226-0.236 | 5,75-6,00 |

C. Cherrymax 3212/3213

| Rivet diameter | | Hole size | | Countersink diameter | |
|---|---|---|---|---|---|
| in | mm | in | mm | in | mm |
| 0.1260 | 3,2 | 0.129-0.132 | 3,28-3,35 | 0.225-0.229 | 5,71-5,82 |
| 0.1575 | 4,0 | 0.160-0.164 | 4,06-4,17 | 0.286-0.290 | 7,26-7,37 |
| 0.1890 | 4,8 | 0,192-0,196 | 4,88-4,98 | 0.353-0.357 | 8,97-9,07 |
| 0.2530 | 6,4 | 0.256-0.261 | 6,50-6,63 | 0.476-0.480 | 12,09-12,19 |

D. Hi-Lok and Hi-Lite pins

| Pin diameter | | Hole size | | Countersink diameter | |
|---|---|---|---|---|---|
| in | mm | in | mm | in | mm |
| 0.1657 | 4,2 | 0.164-0.165 | 4,153-4,204 | Countersink diameters are dependant on type of pin and head. Refer to manufacturer data sheets. | |
| 0.1890 | 4,8 | 0.189-0.191 | 4,813-4,864 | | |
| 0.2520 | 6,4 | 0.249-0.251 | 6,337-6,388 | | |
| 0.3110 | 7,9 | 0.312-0.314 | 7,925-7,976 | | |
| 0.3740 | 9,5 | 0.375-0.376 | 9,512-9,563 | | |
| 0.4370 | 11,1 | 0.437-0.439 | 11,10-11,51 | | |
| 0.5000 | 12,7 | 0.499-0.501 | 12,69-12,74 | | |

# FASTENERS - INSTALLATION

## 1. General

A. Use the special tools necessary for the correct installation of specific types of fasteners. Make sure tools are maintained in good condition and that the fastener contact areas of tools are clean and smooth.

## 2. Solid Rivets

A. General

(1) Solid rivets are installed using one of the following methods:
- continuous squeeze riveting process
- pneumatic hammering with a rivet gun
- hand hammering.

(2) The squeeze riveting machine forms the upset head of the rivet in one continuous action by using a hydraulically or pneumatically powered mechanism. This avoids work-hardening and cracking of the upset head. Static and portable machines are available.

(3) The pneumatic rivet gun, used with a back-up dolly (or bucking bar) forms the upset head of the rivet by reaction. A suitable rivet set to match the manufactured head of the rivet is installed in the gun and the dolly is held against the end to be upset. The upset head is formed by the dolly reaction to the hammering of the gun.

(4) Hand hammering is the basic method of forming the upset head of the rivet. The manufactured head is supported by a suitable rivet set and the upset head formed by a dolly held against it. Hammer blows must be as heavy and as few as possible to avoid work-hardening and cracking of the rivet.

(5) The rivet head must be formed quickly. Three to four seconds is the recommended time for forming the upset and seven seconds is the maximum to avoid work-hardening and cracking.

B. Installation

(1) Make sure the rivet hole is clean and free from burrs.

(2) Clean the parts as necessary and apply sealing or jointing compound as detailed in the Repair Scheme.

(3) Assemble the parts. Make sure no gaps exist between parts.

(4) Secure the parts together using clamps or pins.

(5) Install the rivet fully into the hole.

(6) Form the rivet upset using one of the methods given in Para. A. Make sure the riveting tools are held at 90 degrees to the rivet.

C. Inspection (Ref. Fig. 1, 2, 3, 4 and 5)

**NOTE:** Inspection of solid rivets after installation is to make sure the rivets are tight, fully seated and correctly formed. The acceptance limits given apply to rivets installed in structural parts of the airplane. The acceptance of rivets used for non-structural purposes eg: attachment of identification plate etc. shall be at the discretion of the inspector.

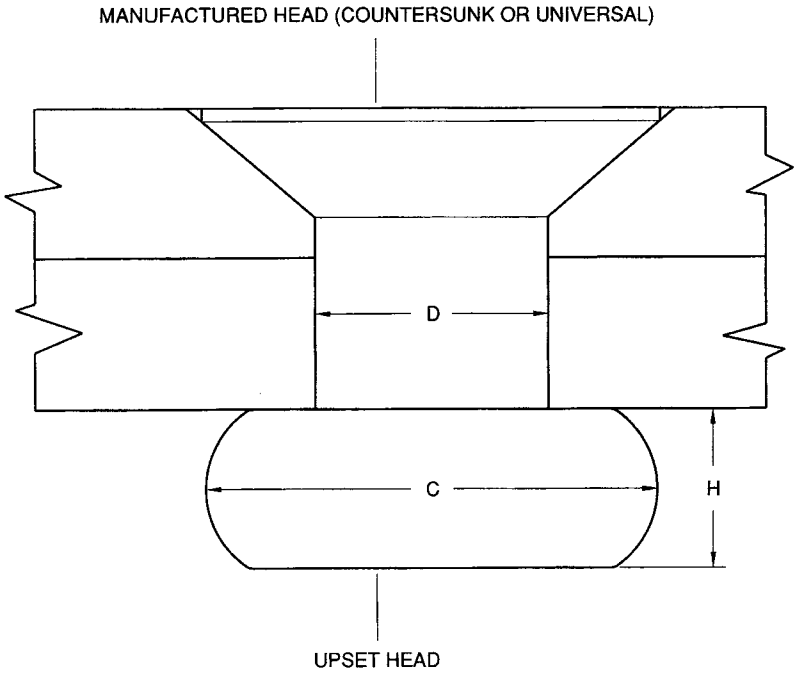
(1) Measure the upset head and make sure the dimensions are within the limits given in Fig. 1 and 2. Ovality of the upset head is acceptable if the dimensions are within the limits.

(2) Examine the upset head for eccentricity. Eccentricity is acceptable if the rivet shank is not visible (Refer to Fig. 3).

(3) Examine the area around the rivet for tool impact damage (Refer to Fig. 3).

(4) Examine the manufactured head and the upset head for cracks (Refer to Fig. 4). Cracks in the material surrounding the head are not acceptable.

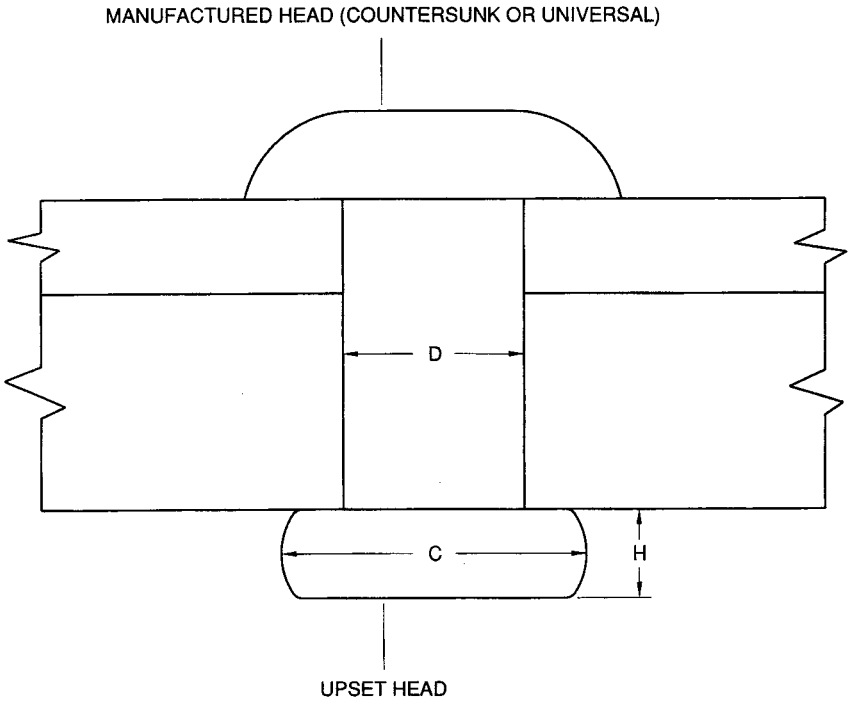
(5) Examine the manufactured head for separation (Refer to Fig. 5).




| RIVET NOMINAL DIA. (D) | | RIVET UPSET DIA. (C) | | | | RIVET UPSET HEIGHT (H) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MAXIMUM | | MINIMUM | | MAXIMUM | | MINIMUM | |
| mm | in. | mm | in. | mm | in. | mm | in. | mm | in. |
| 1.6 | 1/16 (.062) | 3.3 | .130 | 2.3 | .091 | 1.1 | .043 | 0.6 | .024 |
| 2.4 | 3/32 (.094) | 4.8 | .189 | 3.4 | .134 | 1.6 | .063 | 0.8 | .031 |
| 3.2 | 1/8 (.125) | 6.0 | .236 | 4.5 | .177 | 2.1 | .083 | 1.1 | .043 |
| 3.6 | 9/64 (.140) | 6.5 | .256 | 5.0 | .197 | 2.3 | .091 | 1.2 | .047 |
| 4.0 | 5/32 (156) | 7.5 | .295 | 5.6 | .220 | 2.6 | .102 | 1.3 | .051 |
| 4.8 | 3/16 (.187) | 8.7 | .343 | 6.7 | .264 | 3.2 | .126 | 1.6 | .063 |
| 5.6 | 7/32 (.219) | 10.0 | .394 | 8.0 | .315 | 3.7 | .146 | 1.1 | .075 |
| 6.4 | 1/4 (.250) | 11.0 | .433 | 9.0 | .354 | 4.2 | .165 | 2.1 | .083 |
| 8.0 | 5/16 (.312) | 13.5 | .531 | 11.0 | .433 | 5.3 | .209 | 2.6 | .102 |

MM_514100-001

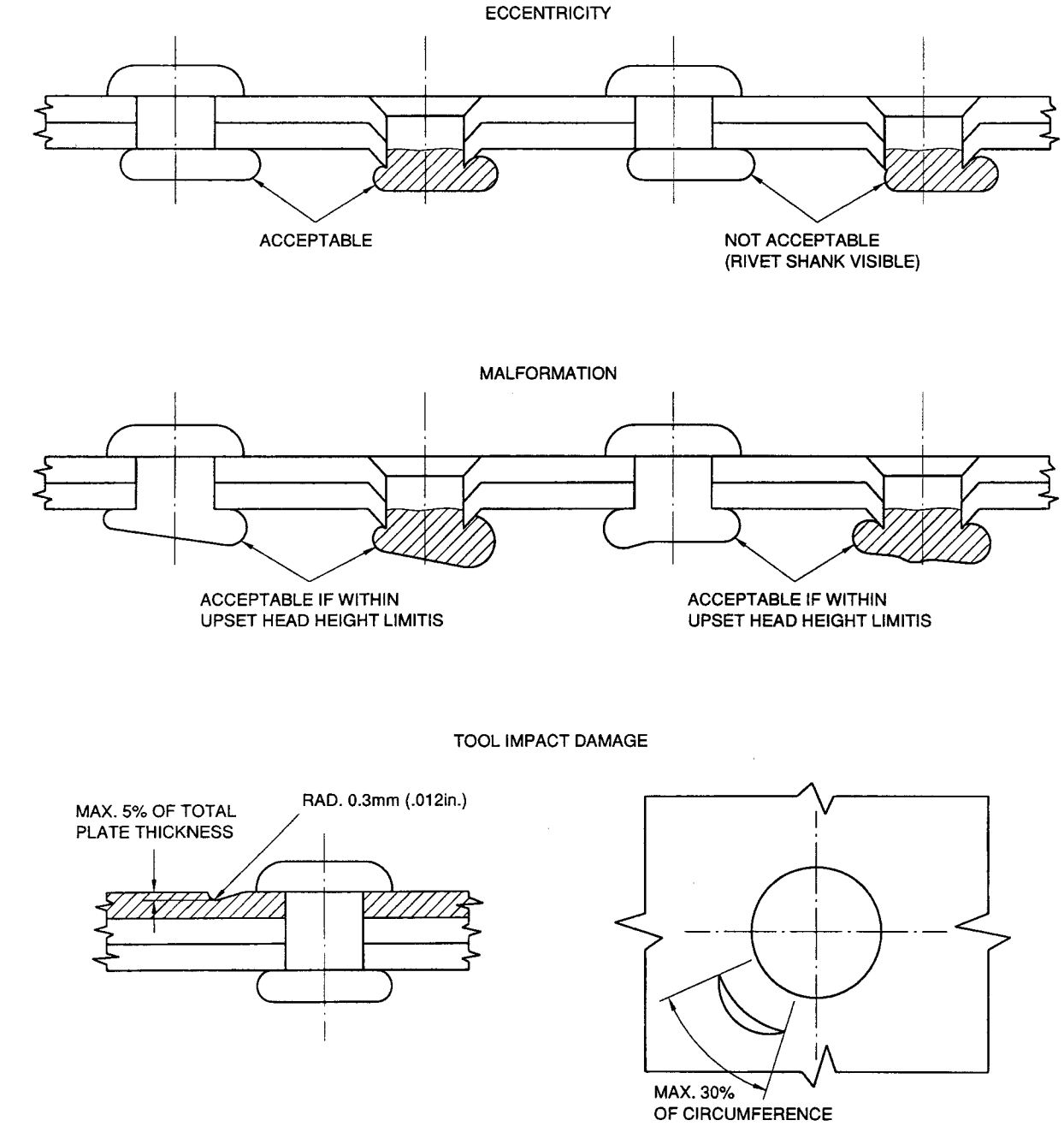
Fig. 1 - Upset Head Dimensions for Aluminum Alloy Solid Rivets




| RIVET NOMINAL DIA. (D) | | RIVET UPSET DIA. (C) | | | | RIVET UPSET HEIGHT (H) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MAXIMUM | | MINIMUM | | MAXIMUM | | MINIMUM | |
| mm | in. | mm | in. | mm | in. | mm | in. | mm | in. |
| 2.4 | 3/32 (.094) | 3.6 | .142 | 3.2 | .126 | 0.9 | .035 | 0.65 | .026 |
| 3.2 | 1/8 (.125) | 4.8 | .189 | 4.3 | .169 | 1.25 | .049 | 0.85 | .033 |
| 3.6 | 9/64 (.140) | 5.4 | .213 | 4.8 | .189 | 1.5 | .059 | 0.95 | .037 |
| 4.0 | 5/32 (.156) | 5.9 | .232 | 5.3 | .209 | 1.7 | .067 | 1.1 | .043 |
| 4.8 | 3/16 (.187) | 7.1 | .280 | 6.4 | .252 | 2.0 | .079 | 1.3 | .051 |
| 5.6 | 7/32 (.219) | 8.2 | .323 | 7.4 | .291 | 2.3 | .091 | 1.5 | .059 |

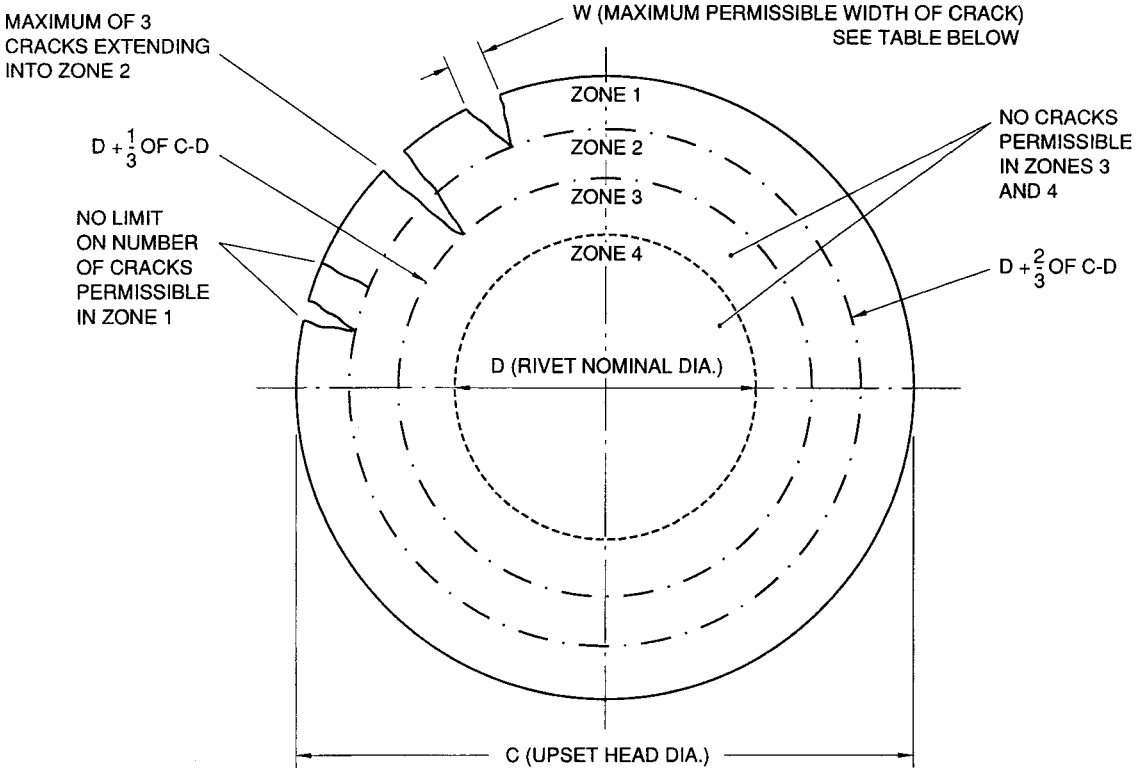
MM_514100-002

Fig. 2 - Upset Head Dimensions for Monel Solid Rivets




MM_514100-003

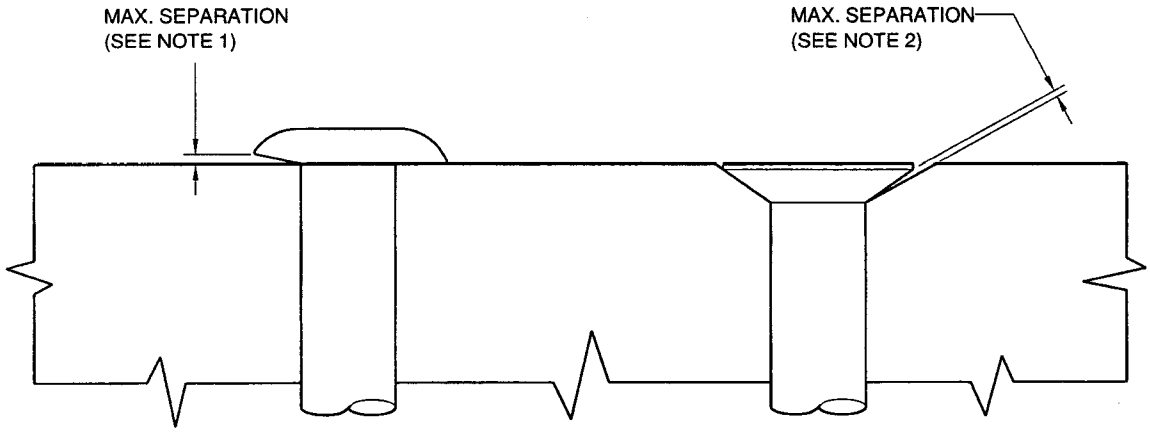
Fig. 3 - Examples of Possible Riveting Defects and Acceptance Limits




| RIVET NOMINAL DIA. (D) | | MAXIMUM WIDTH OF CRACK (W) | |
|---|---|---|---|
| mm | in. | mm | in. |
| 1.6 | 1/16 (.062) | 0.10 | .004 |
| 2.4 | 3/32 (.094) | 0.15 | .006 |
| 3.2 | 1/8 (.125) | 0.20 | .008 |
| 3.6 | 9/64 (.140) | 0.25 | .010 |
| 4.0 | 5/32 (.156) | 0.25 | .010 |
| 4.8 | 3/16 (.187) | 0.30 | .012 |
| 5.6 | 7/32 (.219) | 0.35 | .014 |
| 6.4 | 1/4 (.250) | 0.40 | .016 |
| 8.0 | 5/16 (.312) | 0.50 | .020 |

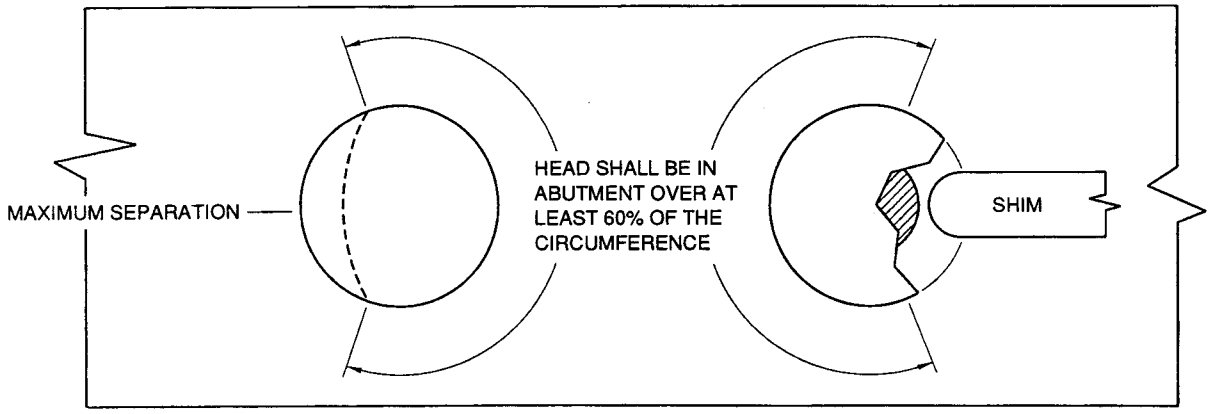
MM_514100-004

Fig. 4 - Acceptance Limits for Cracks




NOTE 1: A 0.1mm (.004in.) SHIM, FOR RIVETS UP TO 5mm (.197in.), OR
A 0.15mm (.006in.) SHIM, FOR RIVETS OVER 5mm (.197in.),
SHALL NOT PENETRATE UP TO THE SHANK.

NOTE 2: A 0.07mm (.003in.) SHIM, FOR RIVETS UP TO 5mm (.197in.), 0R
A 0.10mm (.004in.) SHIM, FOR RIVETS OVER 5mm (.197in.),
SHALL NOT PENETRATE UP TO THE SHANK.




MM_514100-005

Fig. 5 - Rivet Head Separation

3. Cherrymax Rivets

A. General

(1) Cherrymax rivets are installed using a pneumatic-hydraulic power riveting gun.

(2) The riveting gun is supplied with various pulling heads (straight, offset or right-angled) to allow access into areas which are difficult to reach.

B. Installation

(1) Make sure the rivet hole is clean and free from burrs.

(2) Clean the parts as necessary and apply sealing or jointing compound as detailed in the Repair Scheme.

(3) Assemble the parts. Make sure no gaps exist between parts.

(4) Secure the parts together using clamps or pins.

(5) Install the rivet fully into the hole.

(6) Install the rivet gun pulling head on to the rivet stem, press the head firmly against the rivet to prevent gaps.

(7) Hold the rivet gun in line with the axis of the rivet and pull the trigger.

(8) When the rivet is completely installed, release the trigger and the stem will be ejected back through the head of the rivet gun.

C. Inspection

(1) Examine the rivet head for flushness of the break-stem and collar. The break-stem and collar must be within the following limits:

| Diameter Code | Flushness |
|---|---|
| -4 | -0.015 in (0,38 mm) to +0.010 in (0,25 mm) |
| -5 | -0.020 in (0,50 mm) to +0.010 in (0,25 mm) |
| -6 | -0.020 in (0,50 mm) to +0.010 in (0,25 mm) |
| -8 | -0.020 in (0,50 mm) to +0.010 in (0,25 mm) |

4. Hi-Lok/Hi-Lite Pins

A. General

(1) Hi-Lok/Hi-Lite pins are installed using power or hand tools. For minor repairs hand tools are preferred.

B. Installation (Ref. Fig. 6)

(1) Make sure the hole is clean and free from burrs.

(2) Install the pin in the hole. Make sure the head is fully seated against the material.

(3) Install the collar on to the pin by hand. Engage a minimum of two threads to make sure the collar is correctly aligned.

(4) Engage the socket and hexagonal wrench onto the pin and collar.

(5) Hold the hexagonal wrench to stop the pin turning and turn the socket until the shear-off nut shears off.

(6) Disengage the socket and hexagonal wrench from the pin and discard the shear-off nut.

C. Inspection

(1) Examine the pin head for:

– Damage and cracking of the cadmium plating (if applicable)
– Dishing of the head (Refer to Fig. 7)
– Correct seating (Refer to Fig. 8).

(2) Make sure the thread protrusion through the collar is a minimum of 0.031 in (0.8 mm).

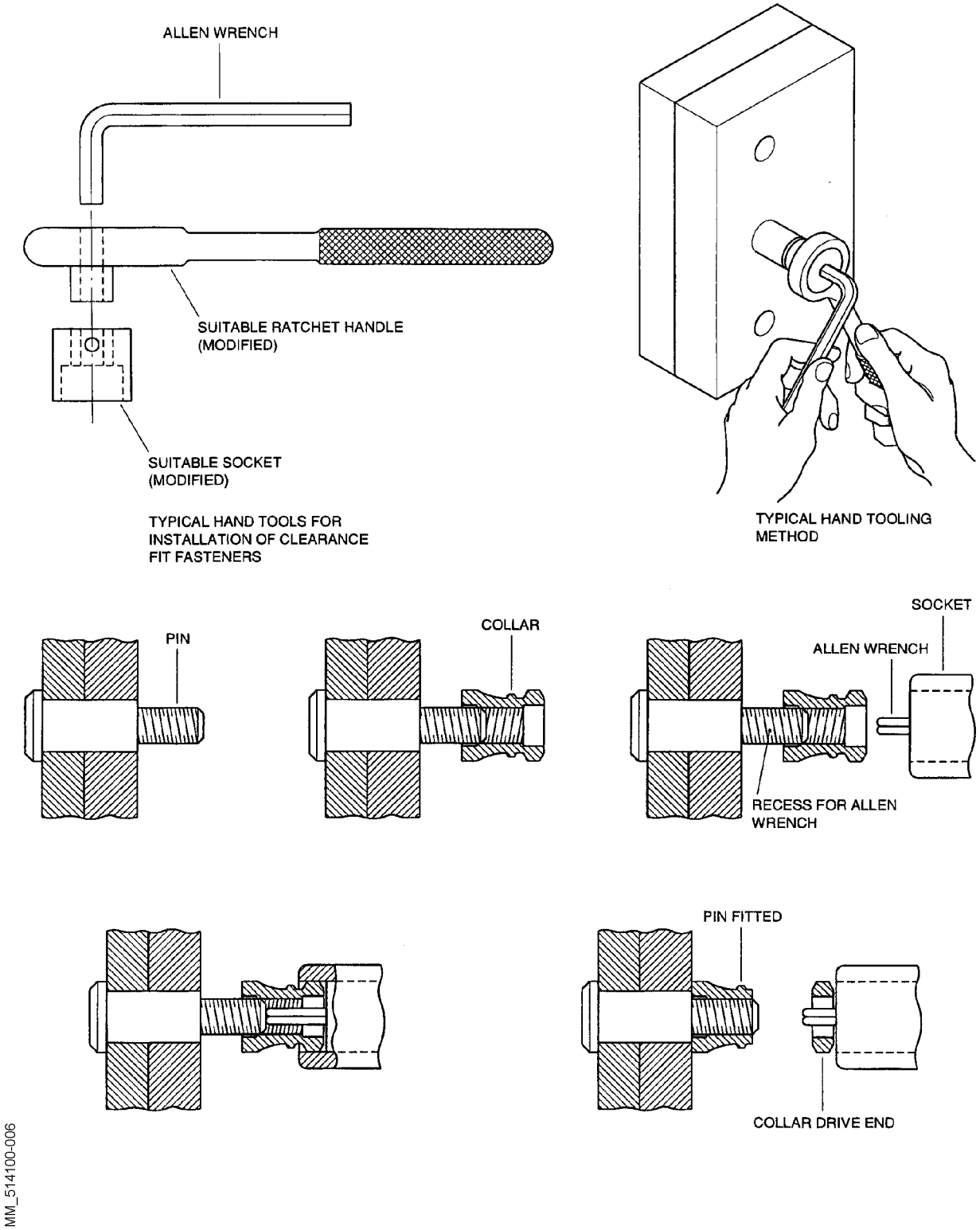



Fig. 6 - Hi-Lk/Hi-Lite Pins - Installation

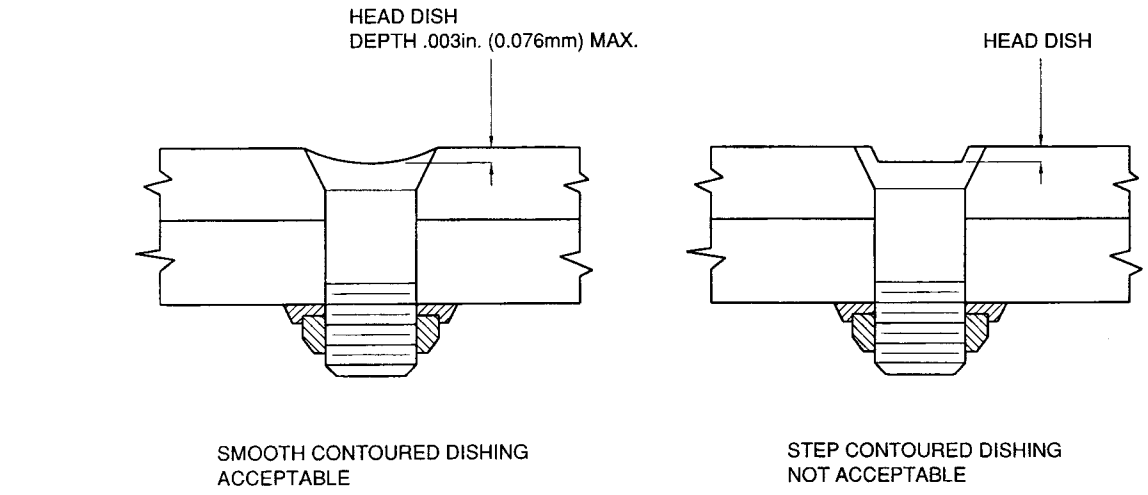



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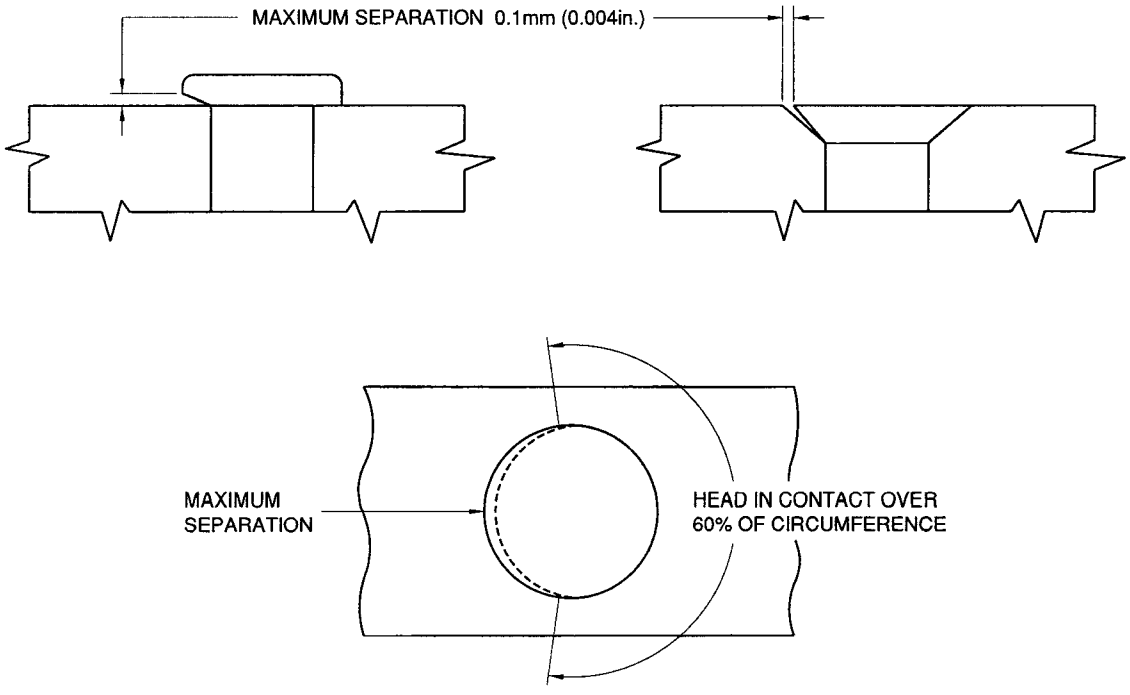
Fig. 7 - Acceptable Limits for Head Dishing of Pins Installed in Interference Fit Holes




MM_514100-008

Fig. 8 - Limits for Pin Head Seat Separation

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# FASTENERS - REMOVAL

1. Solid Rivets

   A. General

      (1) Solid rivets are removed by first removing either the manufactured or upset head and then drifting the rivet out of the hole using a pin punch.

      (2) The manufactured head is usually removed as it is more likely to be concentric with the rivet shaft.

   B. Removal (Ref. Fig. 1)

      (1) Select head to be removed.

      (2) Support the opposite head with a back-up dolly or similar support tool.

      (3) Center punch the head to be removed.

      **CAUTION:** BE CAREFUL WHEN YOU DRILL THE RIVET HEAD. DO NOT CAUSE DAMAGE TO THE SURROUNDING MATERIAL. DO NOT ALLOW THE RIVET TO TURN AS THIS WILL CAUSE DAMAGE AND ENLARGE THE HOLE.

      (4) Using a drill with a slightly smaller diameter than the rivet shank, carefully drill to the depth of the rivet head. Use a mechanical drill stop to prevent drilling too deep.

      **NOTE:** If the rivet starts to turn, grip the opposite head of the rivet with pliers or a similar tool.

      (5) Insert a tight fitting drift or pin punch into the drilled hole and tilt to break off the rivet head.

      (6) Support the material around the rivet and drift the remainder of the rivet out of the hole.

2. Cherrymax Rivets

   A. General

      (1) Cherrymax rivets are removed by drilling off the stem locking collar, drifting out the stem and then removing the rivet using the same method as for a solid rivet.

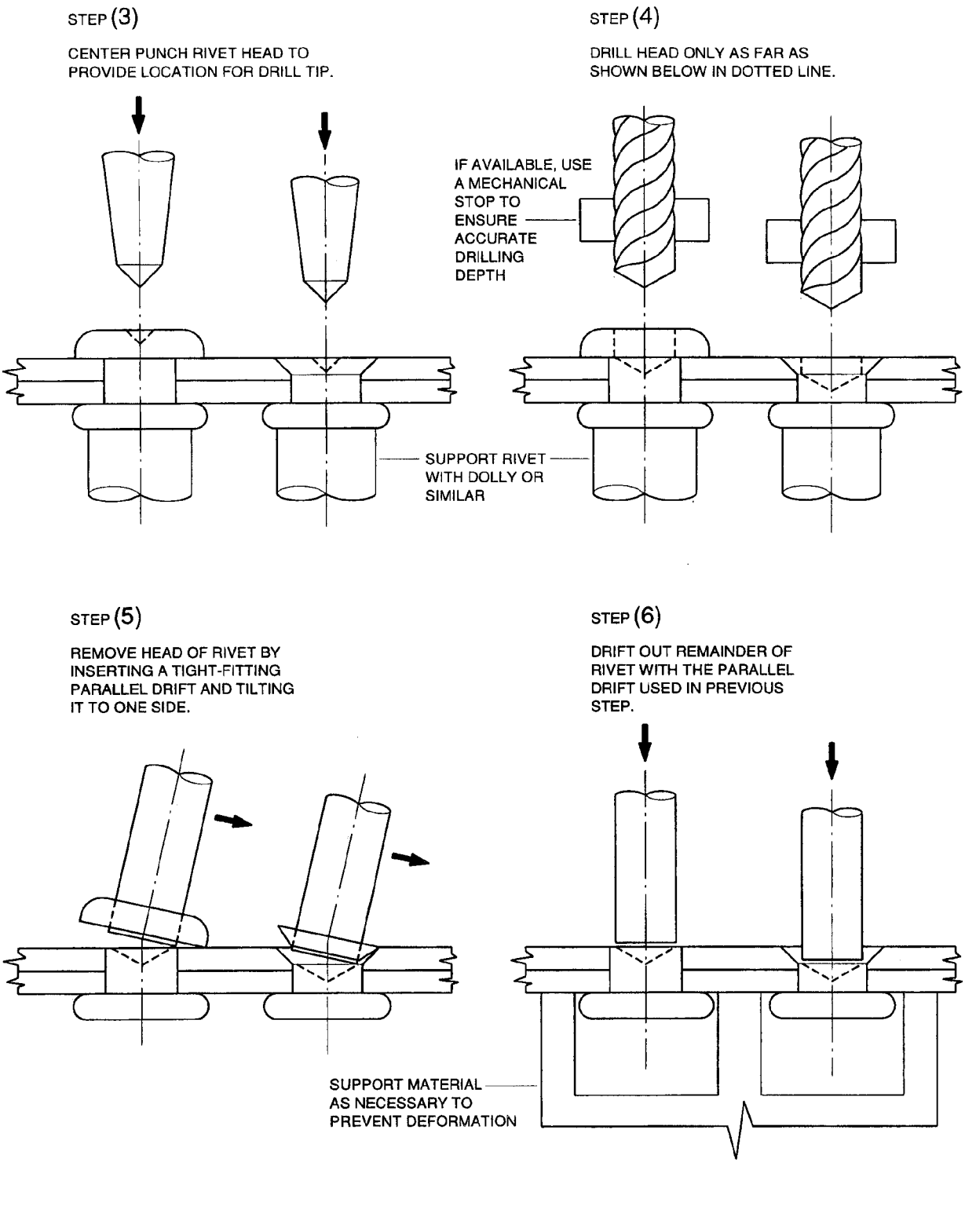


Fig. 1 - Removal of Solid Rivets

B. Removal (Ref. Fig. 2)

(1) Use a small center drill to drill a pilot hole in the top of the rivet stem.

(2) Select a drill of the same diameter as the locking collar and drill off the upper portion of the stem to remove the locking collar.

(3) Support the material around the rivet.

(4) Use a drift or pin punch to drift the rivet stem out of the rivet body.

**CAUTION:** BE CAREFUL WHEN YOU DRILL THE RIVET HEAD. DO NOT CAUSE DAMAGE TO THE SURROUNDING MATERIAL. DO NOT ALLOW THE RIVET TO TURN AS THIS WILL CAUSE DAMAGE AND ENLARGE THE RIVET HOLE.

(5) Drill off the rivet head using a drill of the same diameter as the rivet shank. Use a mechanical drill stop to prevent drilling too deep.

**NOTE:** If the rivet starts to turn, grip the upset head with pliers or a similar tool.

(6) Insert a drift or pin punch into the drilled head and tilt to break off the rivet head.

(7) Support the material around the rivet and drift the remainder of the rivet out of the hole.

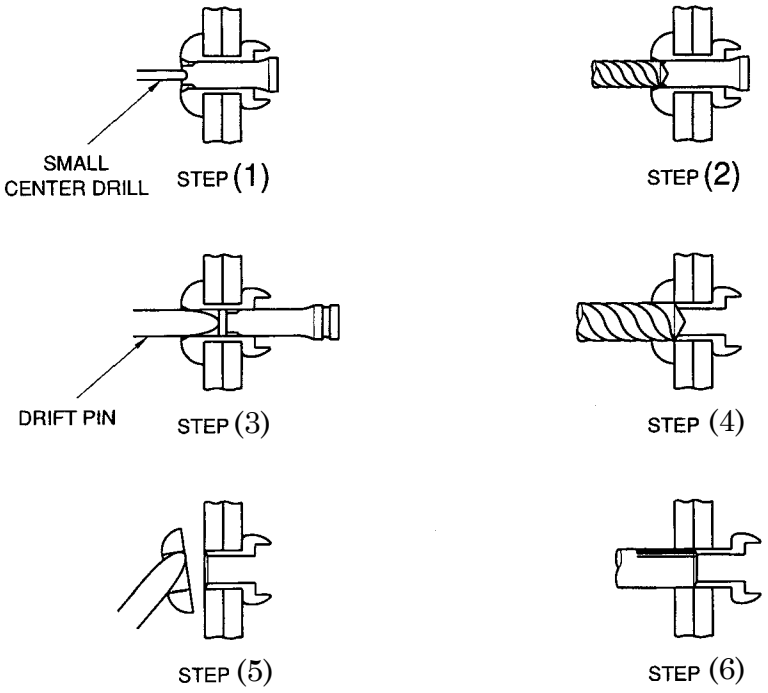


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Fig. 2 - Removal of Cherrymax Rivets

3. Hi-Lok/Hi-Lite Pins

A. General

(1) The removal of Hi-Lok/Hi-Lite pins from clearance fit holes must be done using hand tools only and care must be taken not to damage the hole.

(2) The removal of Hi-Lok/Hi-Lite pins from interference fit holes can be done with power tools, but for minor repairs the use of hand tools is recommended.

B. Removal using hand tools - Clearance fit only (Ref. Fig. 3)

(1) Insert hexagonal wrench in to the recess on the end of the pin to prevent pin rotation.

(2) Turn the collar counterclockwise using pliers or a similar tool until the collar can be removed by hand.

(3) Remove the pin from the hole.

C. Removal using hand tools - Interference fit only (Ref. Fig. 3)

(1) Back off collar flush with end of pin using hand tools.

(2) Support the material around the head of the pin.

(3) Hit the end of the pin with a soft-faced mallet to break the initial stick of the pin.

(4) Use hand tools to remove the collar.

(5) Remove the pin (use a pin punch to lightly tap the pin if necessary).

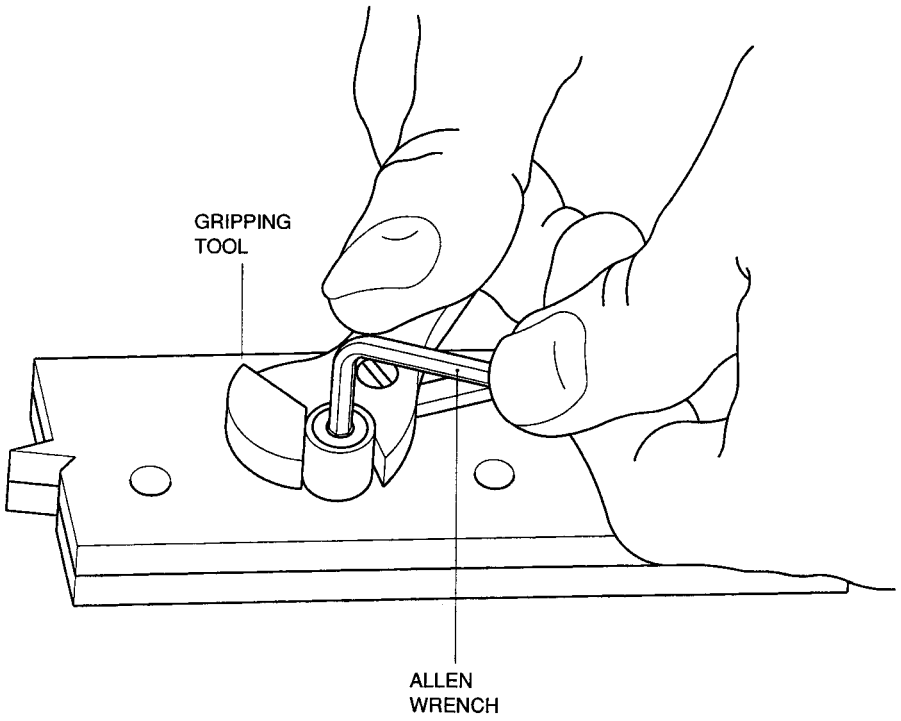


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Fig. 3 - Removal using hand tools

# SUPPORT OF AIRPLANE FOR REPAIR AND ALIGNMENT CHECK PROCEDURE - GENERAL

1. General

   A. If the airplane is damaged, the structure must be supported unless the damage is known to be minor. Information about jacking the airplane is given in Chapter 07-00-00. Additional trestles, wedges, clamps or lengths of timber are to be used to temporarily support the structure around the damaged area before repair.

   B. Alignment checks must be done after the structure has been supported and after repair as described in this section.

2. Description (Ref. Fig. 1)

   A. The airplane simmetry control includes the measurement of the distances among the reference points on the airplane and of the distances among the reference points projected on the floor level from the leveled airplane.
   These reference points are:

      a – Nose landing gear hub center

      b – Rudder trailing edge at the trim lower base

      c – Main landing gear wheel hub center

      d – External hinges of the canard flaps at the rotation axis

      e – Aileron external hinges

      f – Engine spinner ends.

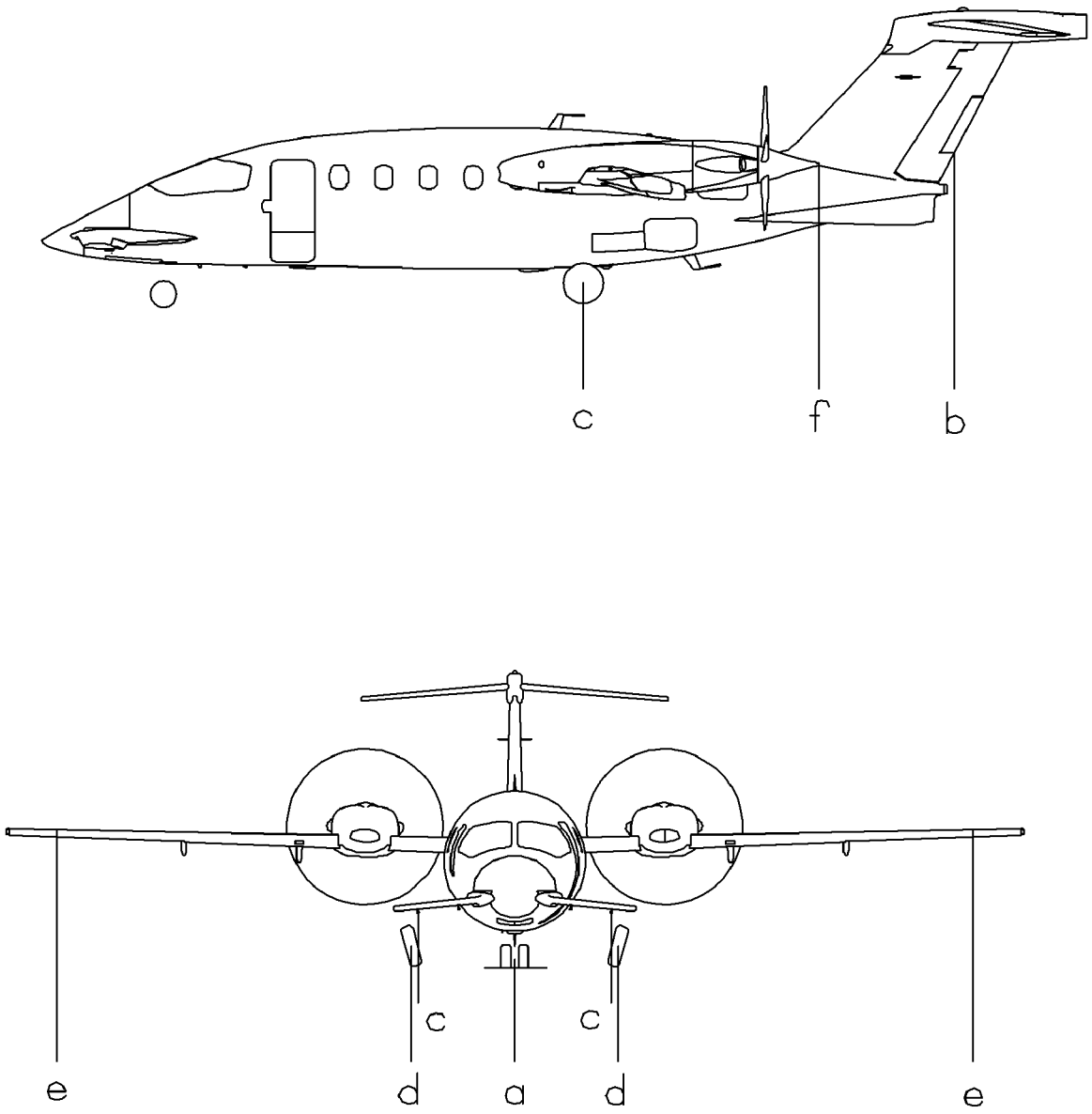


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Fig. 1 - Airplane Simmetry Check Points

# AIRPLANE SUPPORT FOR REPAIR AND ALIGNMENT CHECK - MAINTENANCE PRACTICES

1. Airplane Simmetry Check - Procedure (Ref. Fig. 201)

   A. Fixtures, Test and Support Equipment

| | |
|---|---|
| Plumb Bob | Not Specified |
| String | Not Specified |

   B. Referenced Information

   Maintenance Manual Chapter 07-00-00
   Maintenance Manual Chapter 08-10-00
   Maintenance Manual Chapter

   C. Procedure

   (1) Defuel the airplane (Refer to 12-00-00).
   (2) Lift the airplane on jacks until the wheels are clear of the ground (Refer to 07-00-00).
   (3) Make the airplane level (Refer to 08-10-00).
   (4) Using a suitable line mark out the airplane simmetry axis.

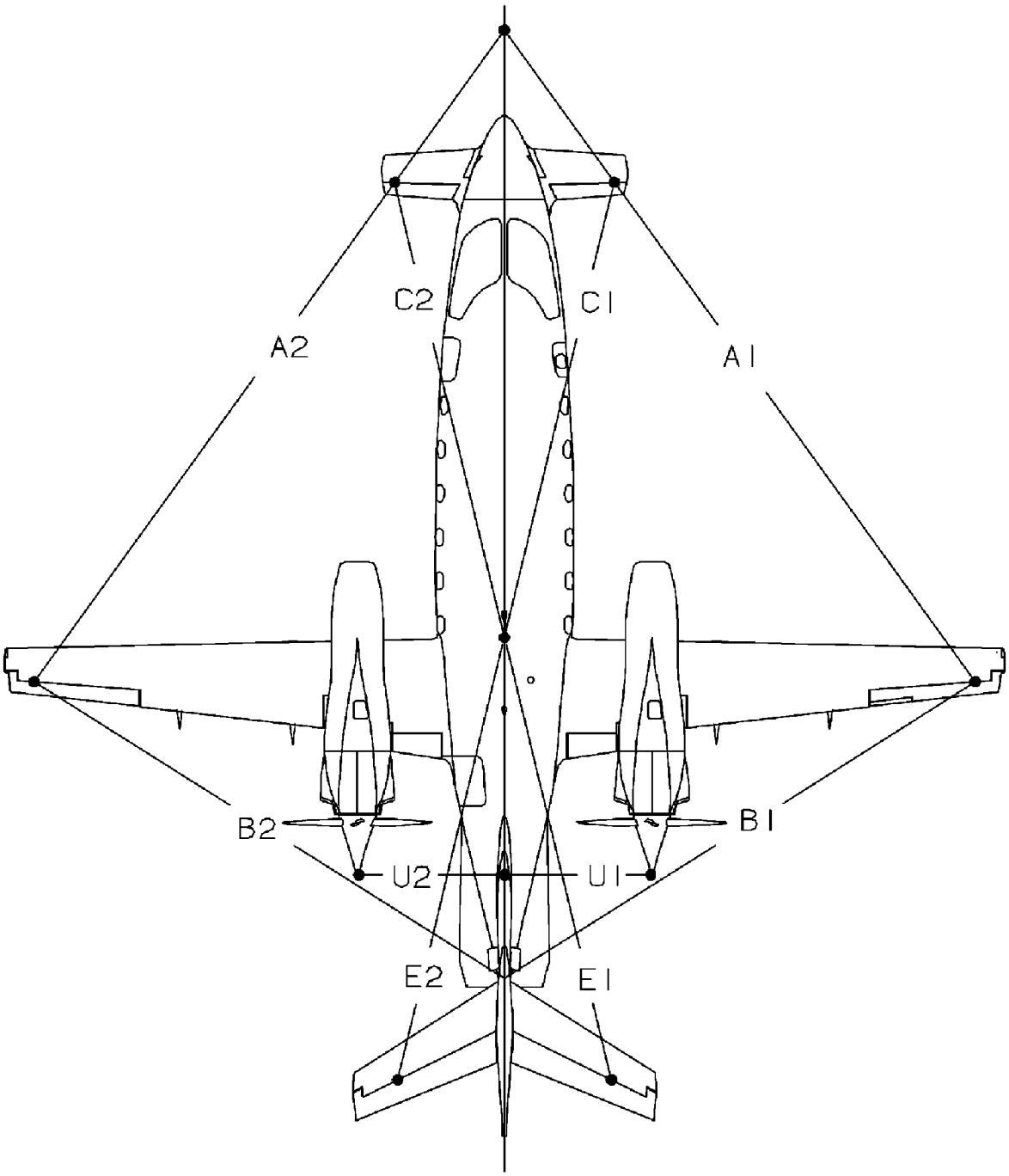
   **NOTE:** With the airplane on jacks it is necessary to move the projection point "a" 1500 mm forward (flight direction) along the marked simmetry axis.

   **NOTE:** The airplane simmetry controls should be performed with the airplane in a still air environment and on a leveled surface.

   (5) Lower plumb bobs from points a, b, c, d, e and f, keeping them about 3 mm above the floor.
   (6) Stick a small piece of adhesive tape on the floor just below the plumb bob and, when the bob is still, let it fall so as to make a mark on the tape.
   (7) Measure the distance among the points projected on the floor and record them on Table 1.
   (8) The airplane simmetries are acceptable and the differences between the noted measurements couples are within the tolerances shown in Table 1.
   (9) The differences which are not within the limits allow to identify the parts of the structures involved in the deformation.

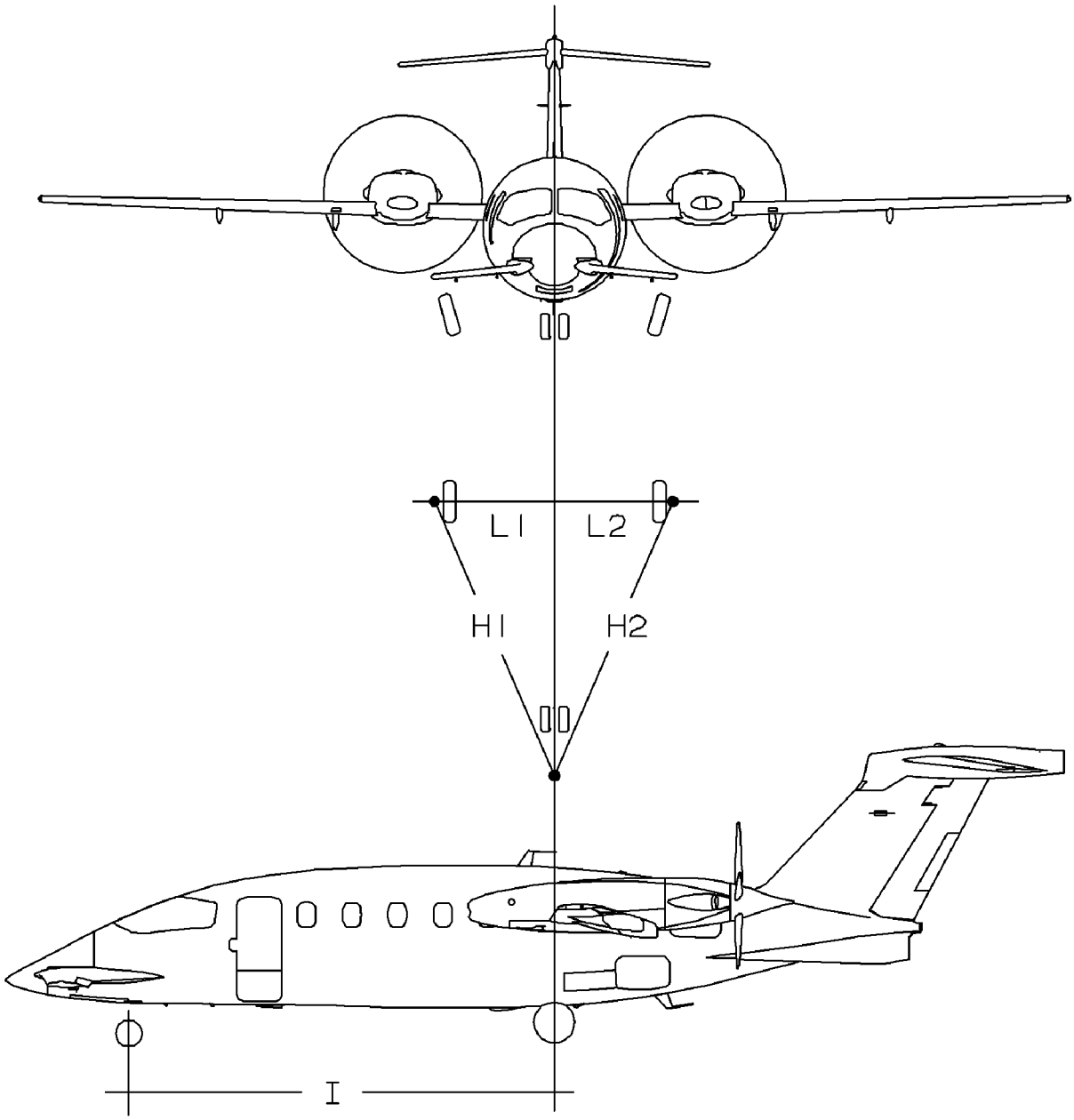
Table 1

| QUOTE (mm) | DIFF. (mm) | TOLL. (mm) | QUOTE (mm) | DIFF. (mm) | TOLL. (mm) |
|---|---|---|---|---|---|
| A1 = | | | B1 = | | |
| A2 = | | | B2 = | | |
| C1 = | | | E1 = | | |
| C2 = | | | E2 = | | |
| H1 = | | | L1 = | | |
| H2 = | | | L2 = | | |
| U1 = | | | I = | | |
| U2 = | | | | | |




MM_515000-201_1

Fig. 201 - Airplane Simmetry Measurements (Sheet 1 of 2)




MM_515000-201_2

Fig. 201 - Airplane Simmetry Measurements (Sheet 2 of 2)

# CONTROL SURFACE BALANCING - GENERAL

## 1. General

A. Each of the flight control surfaces is mass balanced when the airplane is assembled. The surface must be re-balanced after repair or re-paint. Each surface must be balanced with all components (e.g. trim tabs and connecting rods, and static dischargers) installed. The nominal static balancing for the various surfaces is:

- aileron: 100%
- rudder: 80%
- elevator: 70%

B. For the aileron mass balancing procedure refer to Chapter 51-61-00.

C. For the rudder mass balancing procedure refer to Chapter 51-62-00.

D. For the elevator mass balancing procedure refer to Chapter 51-63-00.

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# CONTROL SURFACE BALANCING - AILERONS

1. Ailerons - Mass Balancing (Ref. Fig. 1)

A. Fixtures, Test and Support Equipment

| | |
|---|---|
| Balance equipment | D-719-99-300 |
| Weighing scales (0 - 10 kg) | Not specified |
| Wax pencil | Not specified |
| Level | Not specified |

B. Materials

| | |
|---|---|
| Balance weights (minimum 1 g) | Not specified |

C. Procedure

**NOTE:** This procedure is applicable to the LH and RH ailerons. The RH aileron is balanced with the trim tab and connecting rods installed.

**NOTE:** The nominal static balancing for the aileron is 100% (with ± 2% tolerance).

(1) Make a table as shown below (Table 1).
(2) Install the aileron (1) to the balancing stand (2).
(3) Make sure the aileron (1) has free movement, and the hinge axis is horizontal.
(4) Remove the bolts (5) and the cover (9) from the aileron horn.
(5) Remove the bolts (4), nuts (7), washers (8) and balance weights (6) from the cover (9).
(6) Temporarily install the cover (9) using the bolts (5).
(7) Mark the centerline of the cover (9) using a wax pencil as shown in Fig. 1.
(8) Mark the chord line on the end rib of the aileron (1) using a wax pencil as shown in Fig. 1.
(9) Attach a container (3) to the aileron (1) using a clip and string as shown in Fig. 1.
(10) Add balance weights to the container (3) until the chord line marked on the end rib is horizontal. Use a level to check the angle of the chord line.
(11) Remove and weigh the container (3) complete with balance weights. Make a note of the weight in Table 1, box A.
(12) Calculate 2 percent of the weight at step (11). Make a note of the calculated weight in Table 1, box B.
(13) Add the weight calculated at step (12) to the weight at step (11). Make a note of the result in Table 1, box C.
(14) Attach the container (3) to the aileron (1) and add balance weights to give the total weight calculated at step (13).
(15) The chord line will not be horizontal. Add balance weights to the trailing edge (Fig. 1, position x) until the chord line is horizontal. Make a note of the weight in Table 1, box D.
(16) Remove the bolts (5) and cover (9) from the aileron (1).

(17) Install the balance weights (6) removed at step (5) to the cover (9) with the bolts (4), nuts (7) and washers (8).

(18) Install the cover (9) complete with balance weights, to the aileron (1) with the bolts (5).

(19) Make a check of the angle of the chord line. The balance is correct if one of the following is true:

(a) The chord line is horizontal.

(b) The chord line is horizontal with a weight of no more than that noted in Table 1, box B, attached to the aileron horn.

(c) The chord line is horizontal with a weight of no more than that noted in Table 1, box D, on the aileron trailing edge (Fig. 1, position x).

(20) If the balance is not correct and the aileron is nose-up:

(a) Attach the container (3) to the aileron (1) using the clip and string.

(b) Add balance weights to the container (3) until the chord line is horizontal.

(c) Remove and weigh the container (3) complete with balance weights. Make a note of the weight in Table 1, box E.

(d) Install balance weights equivalent to the weight noted in box E plus 20 percent to the cover (9).

(21) If the balance is not correct and the aileron is nose-down:

(a) Remove balance weights equivalent to the weight noted in Table 1, box B, from the cover (9).

(22) If the balance is still not correct repeat the procedure.

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| TOTAL | 2% of TOTAL | A + B | TRAILING EDGE | CORRECTION | E + 20% |
| | | | | | |

Table 1

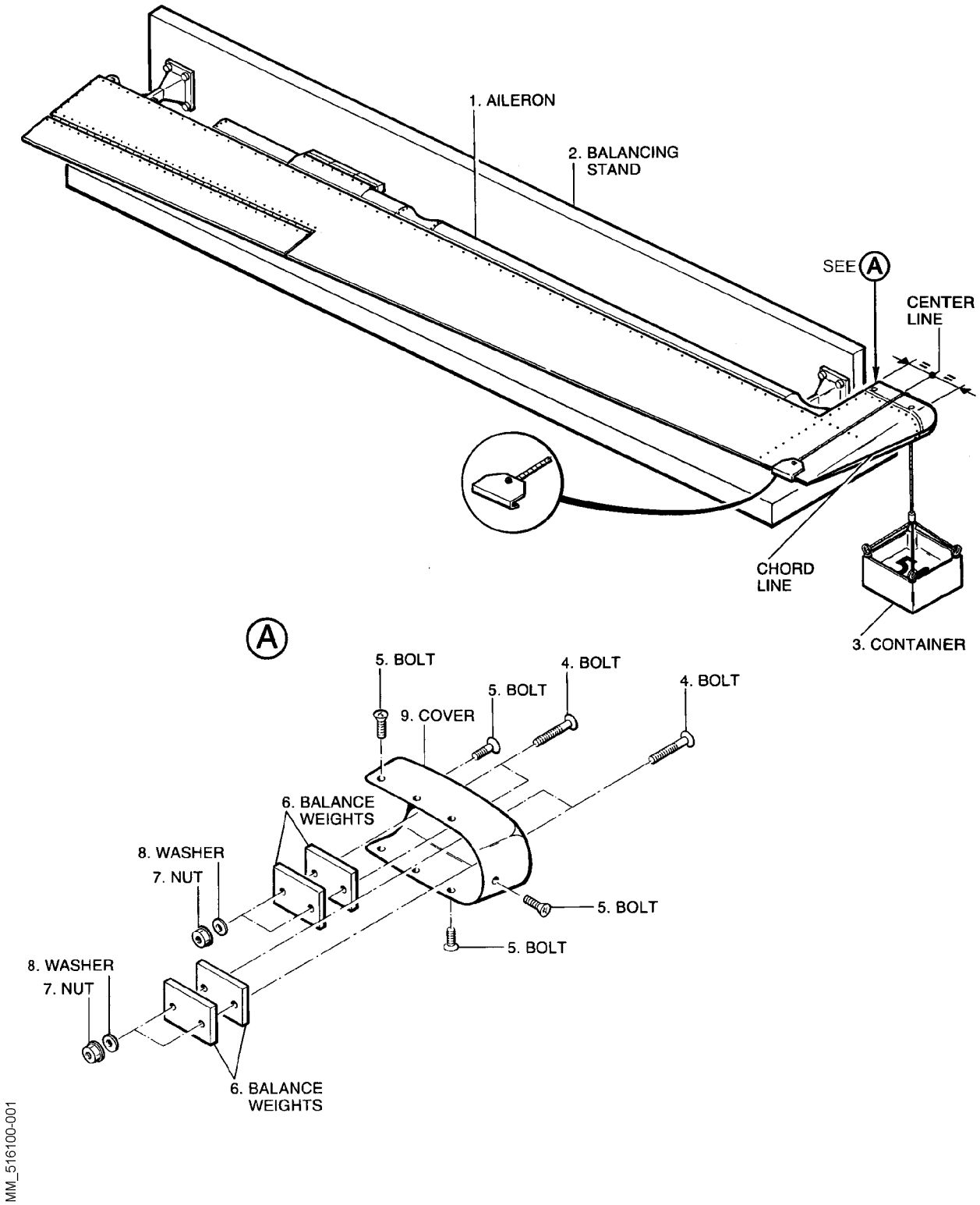


Fig. 1 - Control Surface Balancing - Ailerons

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# CONTROL SURFACE BALANCING - RUDDER

1. Rudder - Mass Balancing (Ref. Fig. 1)

A. Fixtures, Test and Support Equipment

| | |
|---|---|
| Balance equipment | D-719-99-300 |
| Weighing scales (0 - 10 kg) | Not specified |
| Wax pencil | Not specified |
| Level | Not specified |

B. Materials

| | |
|---|---|
| Balance weights (minimum 1 g) | Not specified |

C. Procedure

**NOTE:** The nominal static balancing for the rudder is 80% (with ± 2% tolerance).

(1) Make a table as shown below (Table 1).
(2) Install the rudder (2) to the balancing stand (1).
(3) Make sure the rudder (2) has free movement, and the hinge axis is horizontal.
(4) Remove the bolts (4) and the cover (8) from the rudder (2).
(5) Remove the bolts (9), nuts (5), washers (6) and balance weights (7) from the cover (8).
(6) Temporarily install the cover (8) using the bolts (4).
(7) Mark the centerline of the cover (8) using a wax pencil as shown in Fig. 1.
(8) Mark the chord line on the end rib of the rudder (2) using a wax pencil, as shown in Fig. 1.
(9) Attach a container (3) to the rudder (2) using a clip and string as shown in Fig. 1.
(10) Add balance weights to the container (3) until the chord line marked on the end rib is horizontal. Use a level to check the angle of the chord line.
(11) Remove and weigh the container (3) complete with the balance weights. Make a note of the weight in Table 1, box A.
(12) Remove the bolts (4) and cover (8).
(13) Install the balance weights (7) removed at step (5) to the cover (8) using the bolts (9), nuts (5) and washers (6).
(14) Install the cover (8) to the rudder (2) using the bolts (4).
(15) Attach the container (3) to the rudder (2) and re-balance until the chord line is horizontal.
(16) Remove and weigh the container (3) complete with weights. Make a note of the weight in Table 1, box B.
(17) Divide the value in Table 1, box B by the value in Table 1, box A. Make a note of the result in Table 1, box C.
(18) If the value of C is between 0.18 and 0.22 the balance is correct.

(19) If the balance is not correct, work out the following equation to find the weight required to correct the balance:

Value in Table 1, box A multiplied by 0.2 = X
Value in Table 1, box B minus X = Y

Make a note of the result Y in Table 1, box D.

(20) Remove the bolts (4) and cover (8) from the rudder (2).

(21) If the value of Y is positive:

Add balance weights to the value noted in box D plus 13 percent to the weights (7) installed in the cover (8).

If the value of Y is negative:

Remove balance weights to the value noted in box D plus 13 percent from the weights (7) installed in the cover (8).

(22) Install the cover (8) to the rudder (2) with the bolts (4).

(23) Do steps (15) thru (18) again. If the condition of step (18) is not met repeat the procedure.

| A | B | C | D |
|---|---|---|---|
| TOTAL | ADDITIONAL | B ÷ A | CORRECTION Y |
| | | | |

Table 1

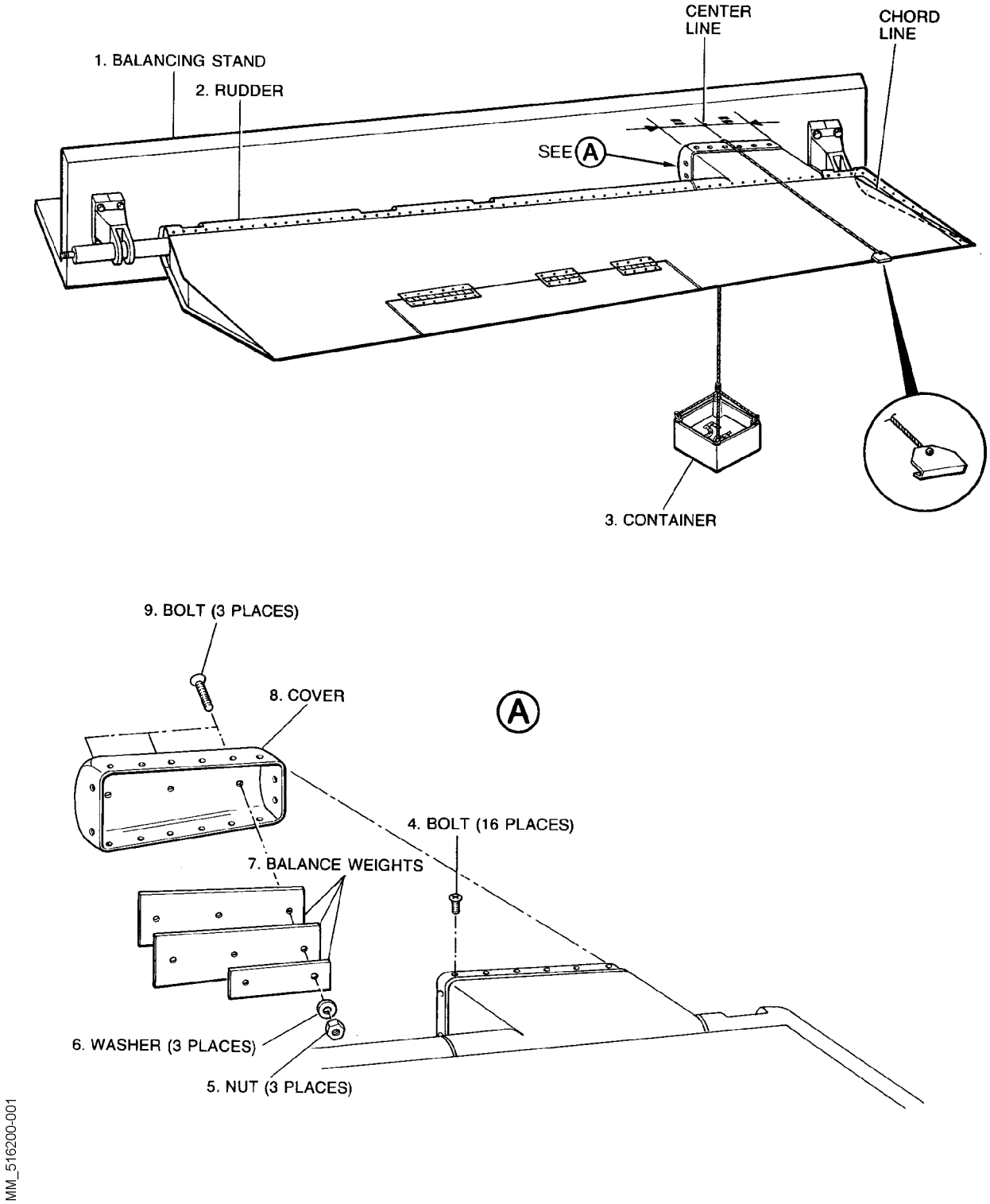


Fig. 1 - Control Surface Balancing - Rudder

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# CONTROL SURFACE BALANCING - ELEVATORS

1. Elevators - Mass Balancing (Ref. Fig. 1)

   A. Fixtures, Test and Support Equipment

| | |
|---|---|
| Balance equipment | D-719-99-300 |
| Weighing scales (0 - 10 kg) | Not specified |
| Wax pencil | Not specified |
| Level | Not specified |

   B. Materials

| | |
|---|---|
| Balance weights (minimum 1 g) | Not specified |

   C. Procedure

**NOTE:** The nominal static balancing for the elevator is 70% (with ± 2% tolerance).

(1) Make a table as shown below (Table 1).
(2) Install the elevator (2) to the balancing stand (1).
(3) Make sure the elevator (2) has free movement, and the hinge axis is horizontal.
(4) Remove the bolts (3) and the cover (7) from the elevator (2).
(5) Remove the bolts (8), nuts (6), washers (5) and balance weights (4) from the cover (7).
(6) Temporarily install the cover (7) using the bolts (3).
(7) Mark the centerline of the cover (7) using a wax pencil as shown in Fig. 1.
(8) Mark the chord line on the end rib of the elevator (2) using a wax pencil, as shown in Fig. 1.
(9) Attach a container (9) to the elevator (2) using a clip and string as shown in Fig. 1.
(10) Add balance weights to the container (9) until the chord line marked on the end rib is horizontal. Use a level to check the angle of the chord line.
(11) Remove and weigh the container (9) complete with the balance weights. Make a note of the weight in Table 1, box A.
(12) Remove the bolts (3) and cover (7).
(13) Install the balance weights (4) removed at step (5) to the cover (7) using the bolts (8), nuts (6) and washers (5).
(14) Install the cover (7) to the elevator (2) using the bolts (3).
(15) Attach the container (9) to the elevator (2) and re-balance until the chord line is horizontal.
(16) Remove and weigh the container (9) complete with weights. Make a note of the weight in Table 1, box B.
(17) Divide the value in Table 1, box B by the value in Table 1, box A. Make a note of the result in Table 1, box C.
(18) If the value of C is between 0.28 and 0.32 the balance is correct.

(19) If the balance is not correct work out the following equation to find the weight required to correct the balance:

Value in Table 1, box A multiplied by 0.3 = X
Value in Table 1, box B minus X = Y

Make a note of the result Y in Table 1, box D.

(20) Remove the bolts (3) and cover (7) from the elevator (2).

(21) If the value of Y is positive:

Add balance weights to the value noted in box D plus 17 percent to the weights (4) installed in the cover (7).

If the value of Y is negative:

Remove balance weights to the value noted in box D plus 17 percent from the weights (4) installed in the cover (7).

(22) Install the cover (7) to the elevator (2) with the bolts (3).

(23) Do steps (15) thru (18) again. If the balance is not correct repeat the procedure.

| A | B | C | D |
|---|---|---|---|
| TOTAL | ADDITIONAL | B ÷ A | CORRECTION Y |
| | | | |

Table 1

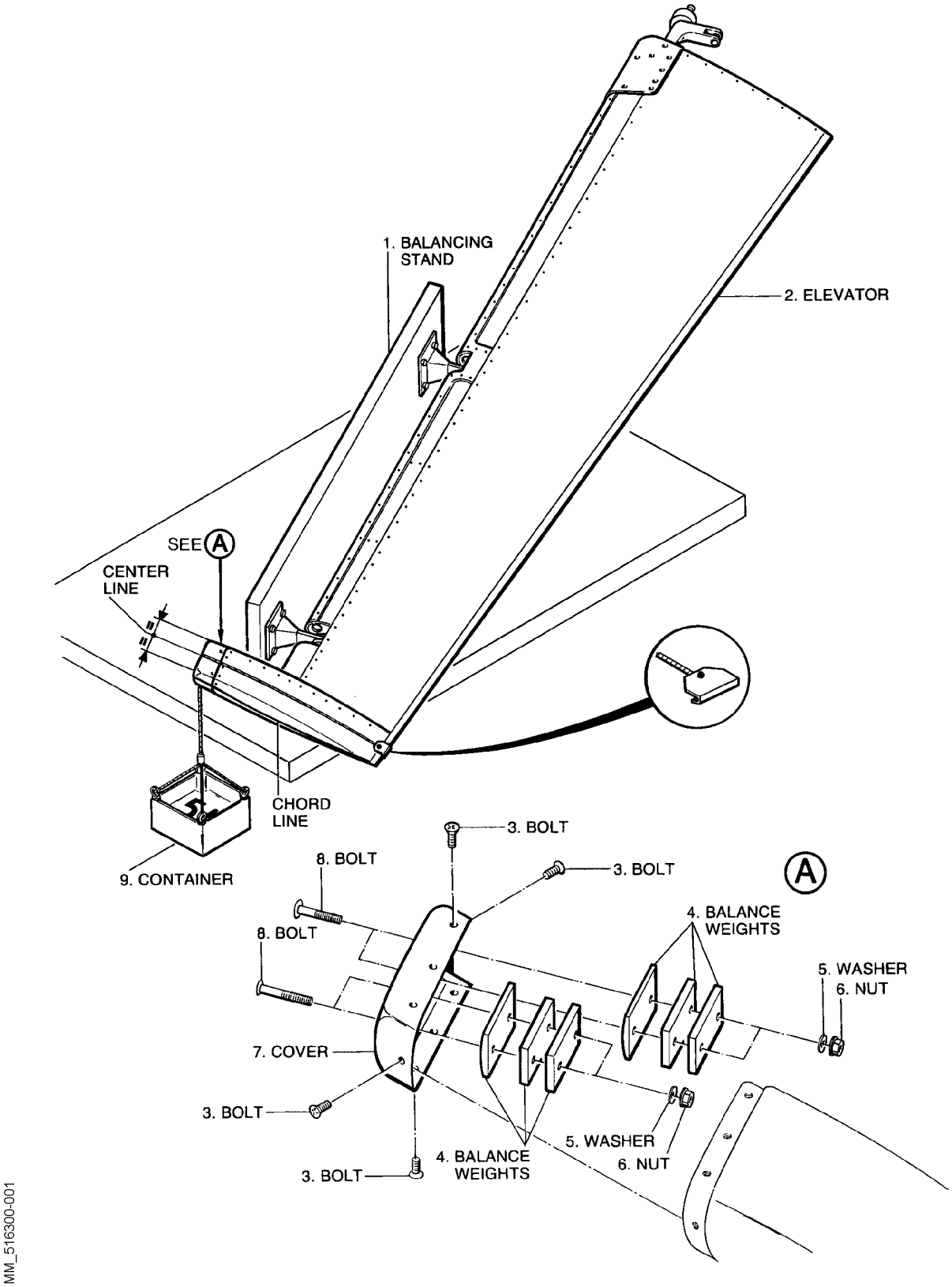


Fig. 1 - Control Surface Balancing - Elevators

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# REPAIRS - GENERAL

## 1. General

A. This topic gives general repair information applicable to more than one part of the airplane structure. Specific Repair Schemes are provided in the appropriate chapters of the Structural Repair Manual where applicable.

## 2. Standard Repair Data

A. The following procedures must be followed during all repair operations unless the Repair Scheme gives alternative instructions.

- Mark out repairs with a sharp-pointed non-indelible pencil. Do not use a metal scriber unless the scribed marks will be removed during cutting or trimming operations.
- Drill holes in repair parts accurately to pick up existing fastener holes in the structure. Misaligned holes must be drilled to accept oversize fasteners (Refer to 51-41-00). Do not force fasteners through misaligned holes.
- Remove all burrs from the edges of drilled holes and the edges of repair parts. A minimum amount of metal must be removed to give edges which are smooth to the touch.
- When a skin repair plate is attached, install the corner fasteners first, followed by the center fasteners. Continue to install the fasteners by halving the space each time until the correct fastener pitch is achieved.
- Jointing compound must be applied between all mating surfaces of the repair parts unless the Repair Scheme gives alternative instructions. The jointing compound must be sufficient in quantity to produce a fillet at each joint or seam. Fasteners must be dipped in the jointing compound before installation (Refer to 51-35-00).
- Drain holes obstructed by repair parts must be re-drilled unless this would cause structural weakness. If necessary, drill a new drain hole as near as possible to the original.
- Bonding jumpers or ground plates which are removed or damaged during repair operations must be replaced or restored to their original condition.
- Where repairs are made to the pressurized area of the airplane, including the cabin door and emergency exit door, a post-repair pressurization test must be done (Refer to 21-00-00).
- If, during repair operations, identification marks or labels are cut away, hidden or obliterated, they must be restored after repair.

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# ELECTRICAL BONDING OF STRUCTURE - GENERAL

1. Bonding Surface Preparation

   A. Make sure that all mating surfaces which affect the electrical bonding are clean and free from corrosion.

   B. Clean steel and aluminium surfaces as follows:

   – Remove heavy to mild deposits with 400 - 600 grade emery cloth or equivalent sand paper
   – Remove mild or medium deposits with abrasive pads
   – For mild deposits on steel surfaces use aluminium oxide, paper or cloth, steel wool or a steel or monel wire brush
   – Use aluminium wool on aluminium surfaces only
   – Clean with solvent (PD 680) and a lint free cloth.

   C. Clean magnesium surfaces as follows:

   **CAUTION:** DO NOT USE STEEL WOOL, STAINLESS STEEL WOOL OR ALUMINIUM WOOL TO CLEAN MAGNESIUM ALLOYS. PARTICLES OF THESE PRODUCTS CAN CAUSE CORROSION OF THE ALLOYS.

   – Remove deposits with abrasive pads (Plastic)
   – Remove heavy deposits with a stainless steel or monel wire brush
   – Remove medium to mild deposits with 400 - 600 grade emery cloth or an equivalent fine sandpaper and/or aluminium oxide paper or cloth.
   – Clean the areas with solvent (PD 680) and a lint free cloth.

2. Surface Finish

   A. Replace all surface finish in accordance with the instructions given in Chapter 51-00-00.

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# NON-DESTRUCTIVE TESTING - GENERAL

## 1. General

A. Non-destructive testing includes the following processes:
- Coin Tapping
- Dye penetrant
- Eddy Current
- Ultrasonic
- Magnetic Particle
- Radiographic.

## 2. Coin Tapping

A. Description

A test used to detect delaminations and voids in composite parts.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Procedure

(1) Use a calibrated coin to tap the area lightly.
(2) Listen for differences in the sound produced, a sharp clear sound indicates no damage, a dull flat sound indicates delamination or a void.
(3) If damage is found, tap the area in a grid pattern to determine the boundary of the damage.
(4) Mark the boundary and assess the damage in accordance with Chapter 51-10-00 Damage Limitations.

## 3. Dye Penetrant

A. Description

A test used to detect small cracks open to the surface which may not be evident to normal visual examination.

B. Surface Preparation

(1) Remove the finish from the surface to be tested (Refer to 51-25-00).

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(2) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Procedure

**NOTE:** The following procedure is general for most dye penetrant kits. Each kit contains specific instructions for use.

(1) Apply the penetrant to the surface and leave for a minimum of one minute to allow the penetrant to enter cracks.
(2) Remove excess penetrant using penetrant remover.
(3) Apply the developer.
(4) Watch for indication of cracks shown by contrast of penetrant against developer, or by fluorescence under black light.
(5) If necessary, repair or replace defective parts.
(6) Clean the surface and restore the surface treatment (Refer to 51-23-00).

4. Eddy Current

A. Description

A test used to detect surface or near surface cracks in metals by inducing an electrical current and observing the changes, or eddies, in the electrical field.

B. Surface Preparation

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(1) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Procedure

(1) The test is to be done by an approved NDT technician as specialist training is required.

5. Ultrasonic

A. Description

A test used to detect surface or subsurface defects in metals, plastics and ceramics. The process involves the use of an ultrasound probe connected to an oscilloscope and requires specialist training.

B. Surface Preparation

(1) Remove excess oil and grease from the surface to be tested.

C. Procedure

(1) The test is to be done by an approved NDT technician as specialist training is required.

6. Magnetic Particle

A. Description

A test used to detect surface and near surface defects in ferromagnetic parts. The test involves inducing a magnetic field in the part and applying a solution containing iron oxide particles. Any defects in the part form magnetic poles which attract the particles. The particle formations can then be viewed by color contrast or fluorescence under black light.

**CAUTION:** DO NOT USE THE TEST IN AREAS WHERE A STRONG MAGNETIC FIELD CAN DAMAGE INSTRUMENTS.

B. Surface Preparation

(1) Remove the finish from the surface to be tested (Refer to 51-25-00).

**WARNING:** BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

(2) Clean the surface with MEK solvent (ASTM D740) and dry with a lint-free cloth before the solvent evaporates.

C. Procedure

(1) The procedure depends upon the equipment/kit used and the manufacturer's instructions must be followed.

7. Radiographic

A. Description

A test used to show internal and external defects in all materials. The test involves the use of ionizing radiation to expose a radiographic film and requires specialist training. The test is normally used on parts of the airplane structure which are inaccessible to other types of non-destructive test, or on structurally critical components which required thorough examination.

**WARNING:** IONIZING RADIATIONS ARE DANGEROUS. THEY CAN KILL OR SERIOUSLY INJURE PERSONNEL. THE TEST MUST BE DONE BY TRAINED PERSONNEL. OBEY ALL THE RELEVANT SAFETY PRECAUTIONS AS DIRECTED BY THE NDT TEAM.

B. Surface Preparation

(1) No surface preparation is necessary other than removal of furnishings or parts for access.

C. Procedure

(1) The test must be done by an approved NDT technician as specialist training is required.

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