FUSELAGE - GENERAL

1. General

A. Chapter 53 describes general repair practices, materials and procedures which are applicable to the Fuselage and Fuselage Structure. Refer to Figure 1 for illustrations of fuselage stations.

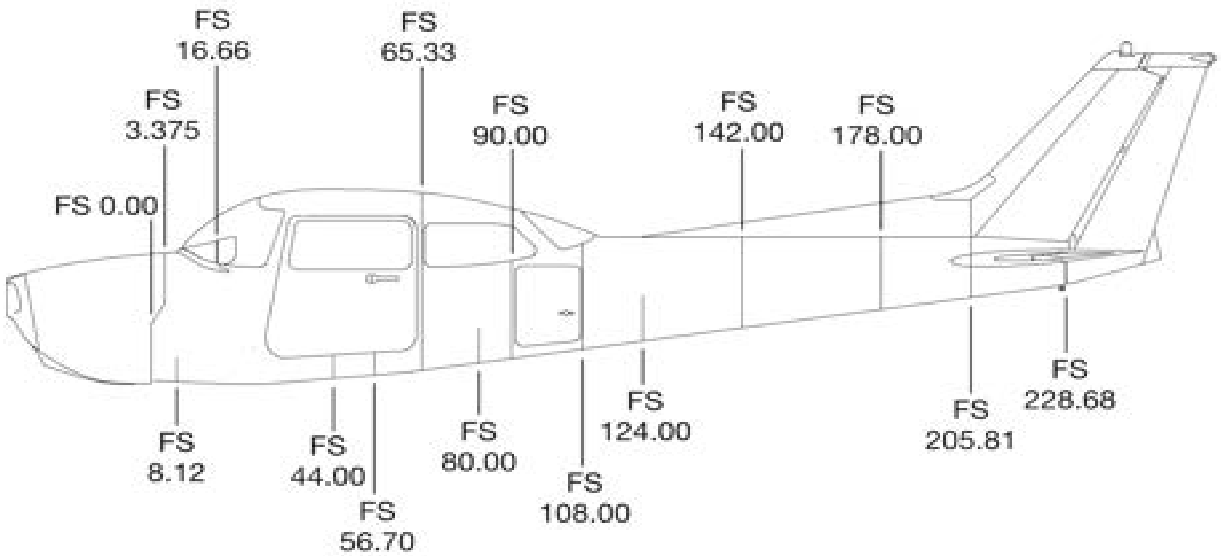
B. For repairs beyond the scope of this chapter, refer to Chapter 51, Typical Skin Repairs.

2. Fuselage

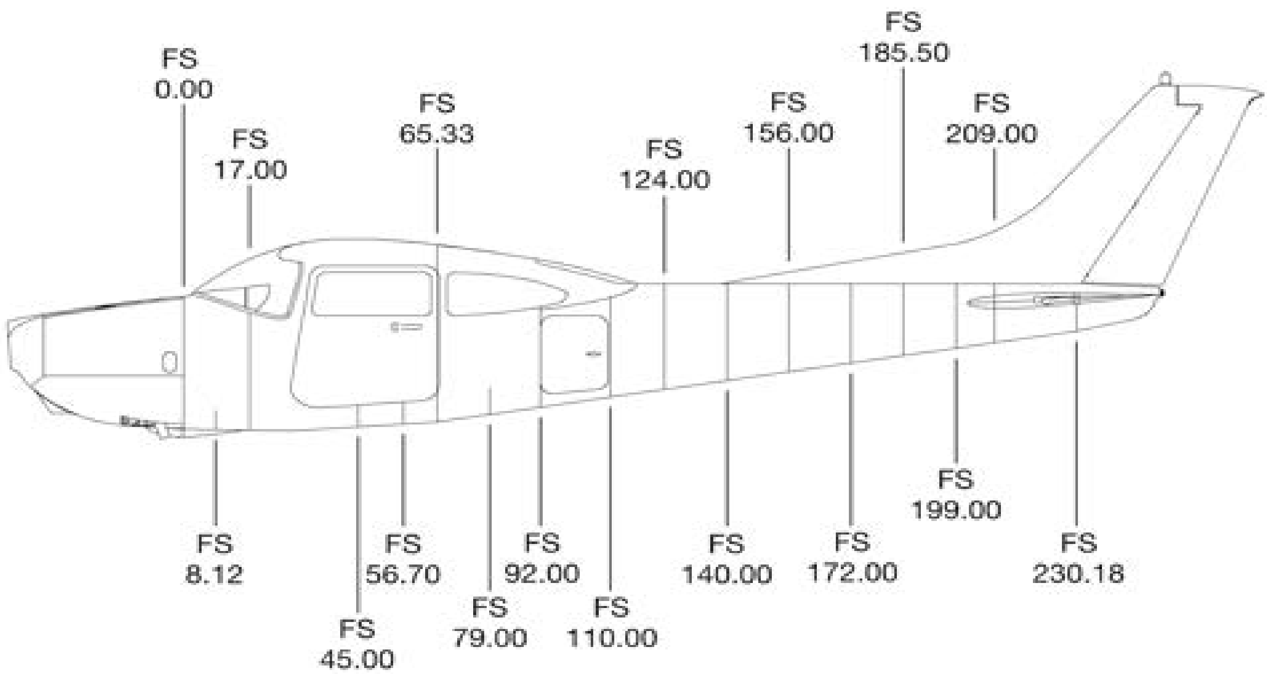
A. The fuselage is of semimonocoque construction and consists of formed bulkheads, longitudinal stringers, reinforcing channels and skin panels.

B. If questions arise concerning approved repairs or for repairs not shown in this section, contact Cessna Propeller Aircraft Product Support.

Figure 1 : Sheet 1 : Fuselage Stations



MODEL 172R/172S FUSELAGE

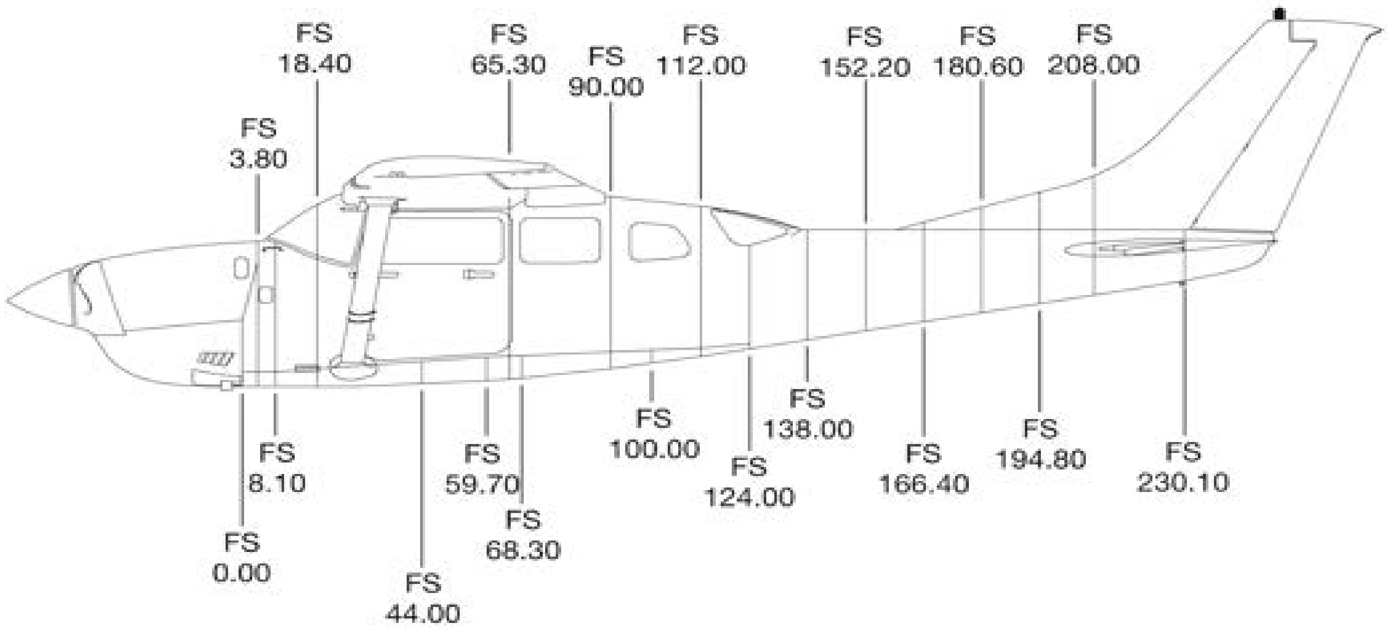


MODEL 182S/182T/T182T FUSELAGE

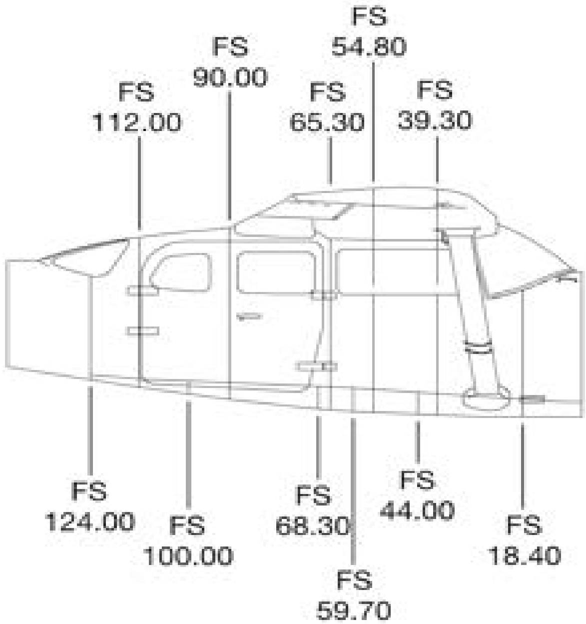
05101008
0710T1008

Figure 1 : Sheet 2 : Fuselage Stations

B171



MODEL 206H/T206H FUSELAGE



CARGO DOORS
(RIGHT SIDE ONLY)
(MODEL 206H/T206H)

1210T1007
1210T1007

FUSELAGE DAMAGE CLASSIFICATION

1. General

A. Damage to the fuselage can be divided into three major categories; negligible damage, repairable damage, and major replacement damage. The categories are provided to assist in determining the extent and criticalness of any damage.

2. Negligible Damage

A. Any smooth dents in the fuselage skin that are free from cracks, abrasions, and sharp corners, and which are not stress wrinkles and do not interfere with any internal structure or mechanism, may be considered as negligible damage. In areas of low stress intensity, cracks, deep scratches, or deep, sharp dents - which after trimming or stop-drilling can be enclosed by a two-inch circle - can be considered negligible if the damaged area is at least one diameter of the enclosing circle away from all existing rivet lines and material edges. Stop drilling is considered a temporary repair and a permanent repair must be made as soon as practical.

B. Mild corrosion appearing upon clad aluminum surfaces does not necessarily indicate incipient failure of the base metal. However, corrosion of all types must be carefully considered, and approved remedial action taken.

C. Small cans appear in the skin structure of all metal airplanes and should not necessarily be a cause for concern. However. It is strongly recommended that wrinkles which appear to have originated from other sources, or which do not follow the general appearance of the remainder of the skin panels, be thoroughly investigated. Except in the landing gear bulkhead areas, wrinkles occurring over stringers which disappear when the rivet pattern is removed, may be considered negligible. However, the stringer rivet holes may not align perfectly with skin holes because of a permanent "set" in the stringer. If this is apparent, replacement of the stringer will usually restore the original strength characteristics of the area.

NOTE: Wrinkles occurring in the skin of the main landing gear bulkhead areas must not be considered negligible. The skin panel must be opened sufficiently to permit a thorough examination of the lower portion of the landing gear bulkhead and its tie-in structure.

D. Wrinkles occurring in open areas which disappear when the rivets at the edge of the sheet are removed, or a wrinkle which is hand removable, may often be repaired by a 1/2 inch x 1/2 inch x 0.050 inch 2024-T42 extruded angle or a heavy “J” section. The angle should be inserted fore and aft across the center of the wrinkle and should extend to within 1/16 inch to 1/8 inch of the fuselage bulkheads comprising the end of the bay. Rivet pattern should be similar to existing manufactured seam at edge of sheet.

E. Negligible damage to stringers, formed skin flanges, bulkhead channel and like parts is similar to that for the wing skin. Refer to Chapter 57, Wing Damage Classification for a definition of negligible damage to these components.

3. Repairable Damage

A. If a skin is badly damaged, repair must be made by replacing an entire skin panel, from one structural member to the next. Repair seams must be made to lie along structural members and each seam must be made exactly the same in regard to rivet size, spacing and pattern as the manufactured seams at the edges of the original sheet. If the manufactured seams are different, the stronger must be copied. If the repair ends at a structural member where no seam is used, enough repair panel must be used to allow an extra row of staggered rivets, with sufficient edge margin to be installed.

B. Typical methods of repair for skins, bulkheads, stringers, and channels are illustrated in Chapter 51, Typical Skin Repairs. Before repairs are attempted, all cracks or deep scratches must be stop-drilled with a No. 30 (0.128 inch) drill and all sharp corners and ragged edges must be trimmed away and deburred.

4. Replacement Damage

A. All forgings and castings of any material and structural parts made of steel must be replaced if damaged. Structural members of a complicated nature that have been distorted or wrenched should be replaced. Seat rails serve as structural parts of the fuselage and must be replaced if damaged.

CABIN BULKHEAD REPAIR

1. General

A. Bulkheads are comprised of formed "C" channel sections. The principal material of construction is 2024-0 Alclad aluminum alloy which, after forming, is heat-treated to a 2024-T42 condition. All bulkheads in the fuselage are of the formed sheet metal or the reinforced formed sheet metal type.

2. Repair of Webs or Flanges

A. The following procedures are for the repair of cracked bulkhead webs or flanges.

(1) Acceptable methods of repairing various types of cracks occurring in service are shown in Figures 801 and 802.

(2) Stop-drill No. 30 (0.128 inch) minimum holes at extreme ends of cracks to prevent further cracking.

(3) Reinforcements should be added to carry stresses across damaged portion and stiffen the joints.

NOTE: The condition causing such cracks to develop at a particular point may be stress concentration at that point, in conjunction with repetition of stress (such as produced by vibration of the structure). The stress concentration may be due to defects such as nicks, scratches, tool marks, and initial stresses or cracks from forming or heat-treating operations. An increase in sheet thickness alone is usually beneficial but does not necessarily remedy the condition leading to the cracking. Patch-type repairs are generally employed and are usually satisfactory in restoring the original material strength characteristics.

3. Repair of Channels

A. The following procedures are for the repair of severely bent, kinked, or torn channels.

(1) If practical, severely bent, kinked, or torn portions of bulkheads should be removed and replacement sections installed and joined at the original splice joint.

(2) If the procedure outlined in the preceding step is not justified, cutting away the damaged portion and inserting a trimmed portion of the original section, adequately reinforced by splice plates or doublers, will prove satisfactory. This is knownas an insertion-type patch.

4. Landing Gear Bulkheads

A. Landing gear bulkheads are highly stressed members, irregularly formed to provide clearance for control cables, fuel and brake lines. Patch type repairs on these bulkheads are, for the most part, impractical. Minor damage, consisting of small nicks or scratches, may be repaired by dressing out the damaged area, or by replacement of fasteners. Any other damage must be repaired by replacing the landing gear support assembly as an aligned unit.

5. Repair After Hard Landing

A. Buckled skin or floor boards, and loose or sheared rivets in the area of the main gear support are indications of damage to structure from an extremely hard landing. When such evidence is present, the entire support structure must be examined and all support forgings must be checked for cracks.

(1) Use fluorescent dye penetrant and magnification to examine for cracks.

B. Bulkheads in the damaged area must be checked for alignment. Deformation of bulkhead webs must be checked using a straightedge.

C. Damaged support structure, buckled floorboards and skins, and damaged or questionable forgings must be replaced.

Figure 801 : Sheet 1 : Typical Cabin Bulkhead Repair

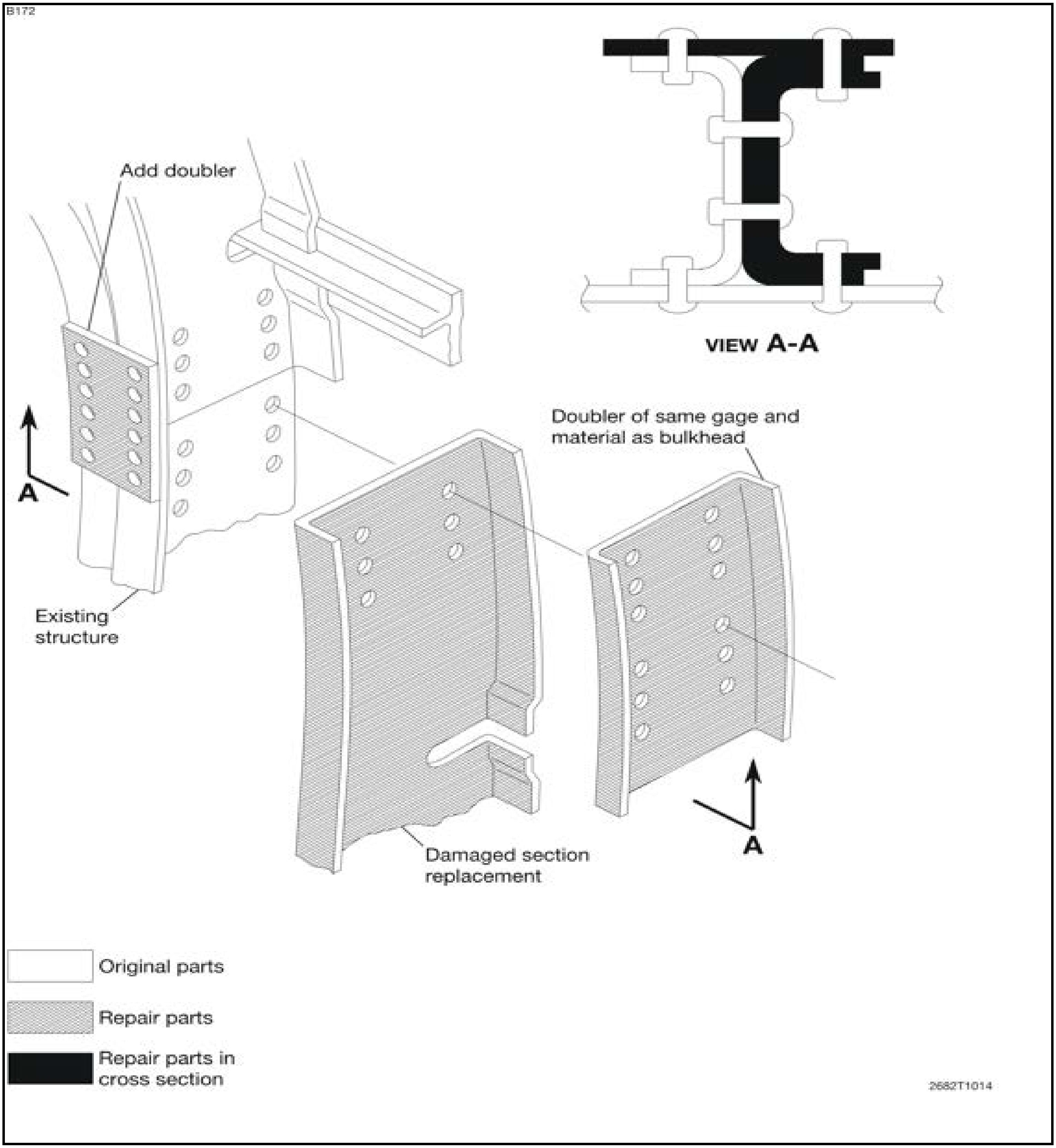


Figure 801 : Sheet 2 : Typical Cabin Bulkhead Repair

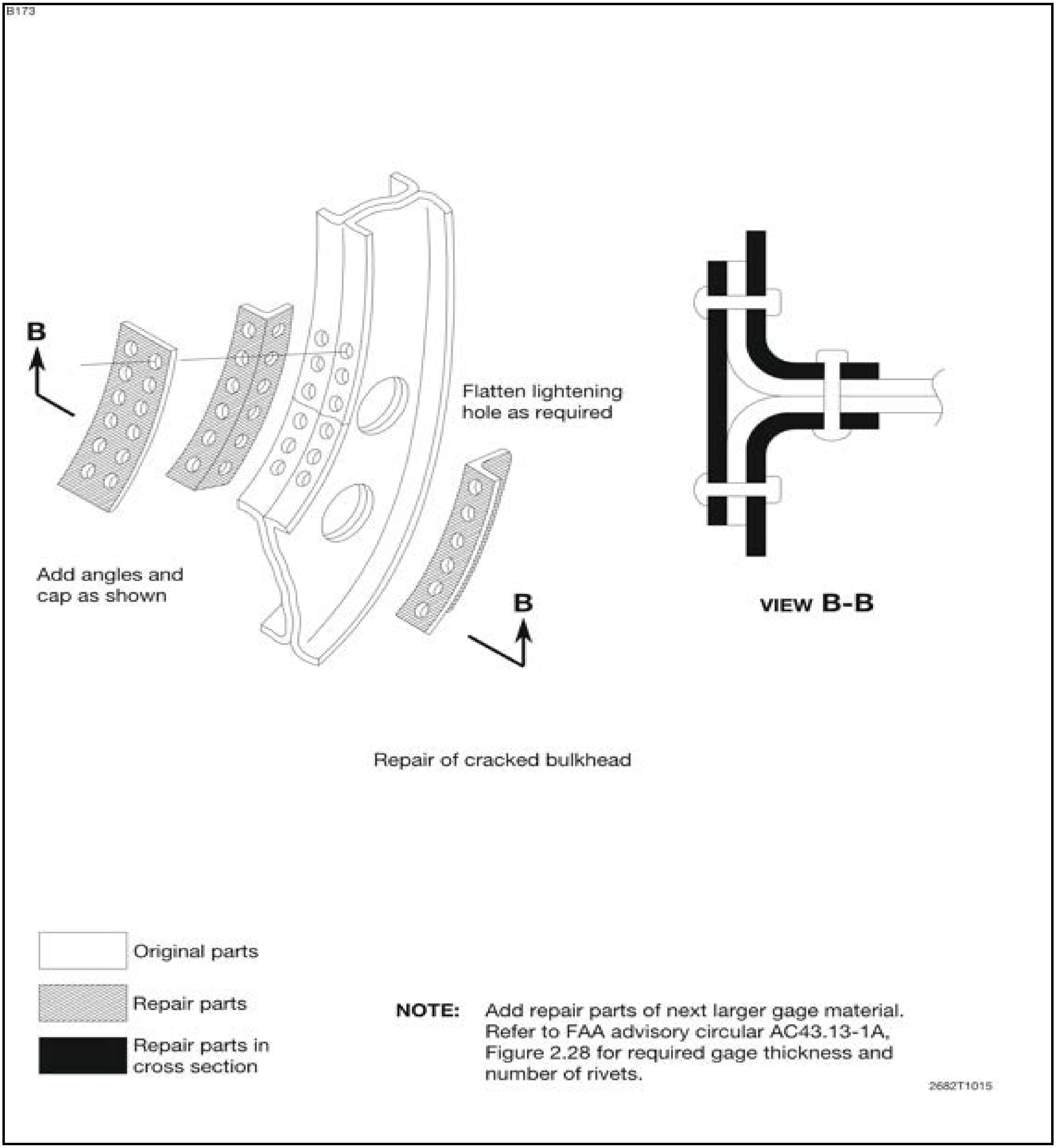


Figure 801 : Sheet 3 : Typical Cabin Bulkhead Repair

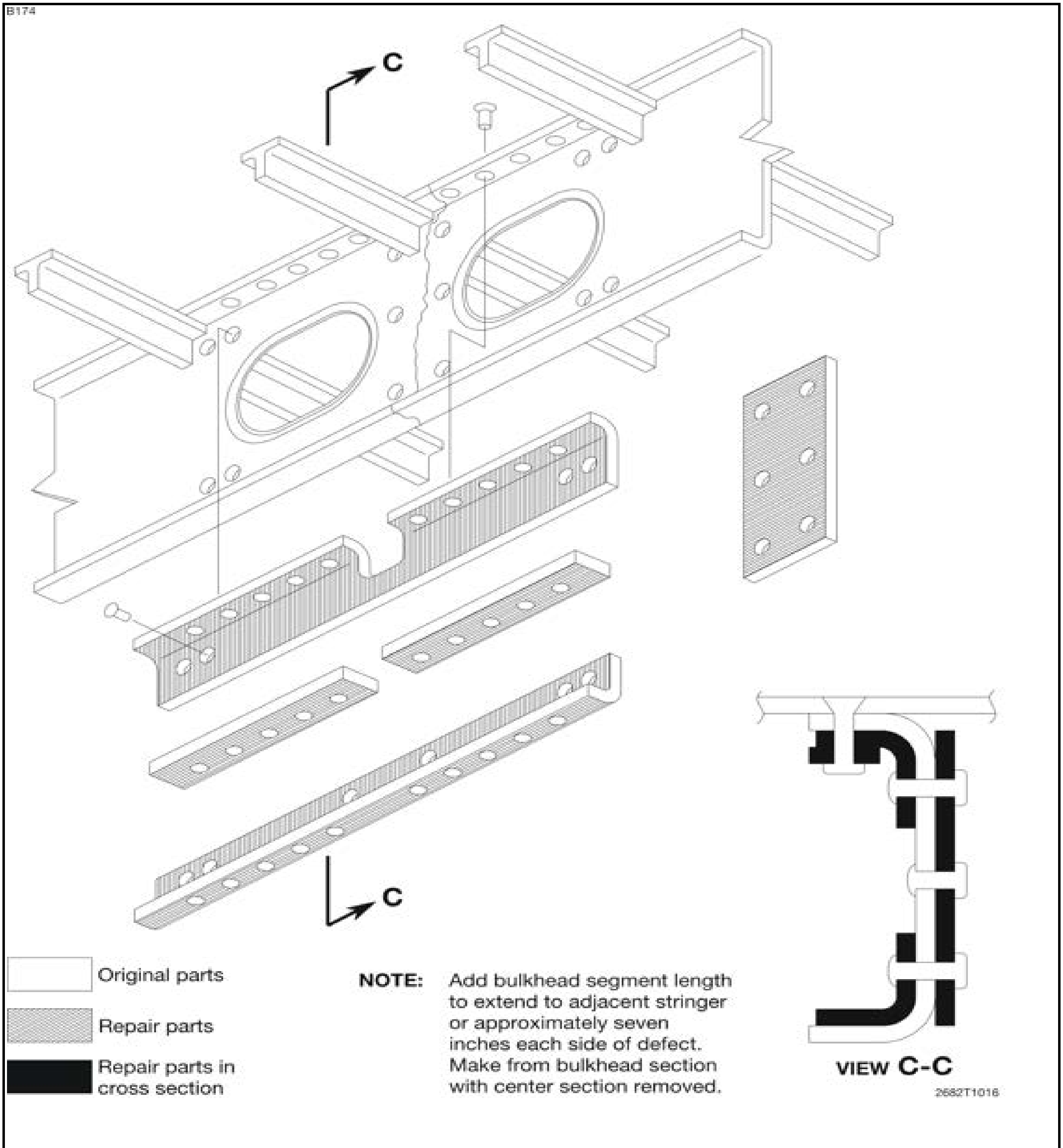
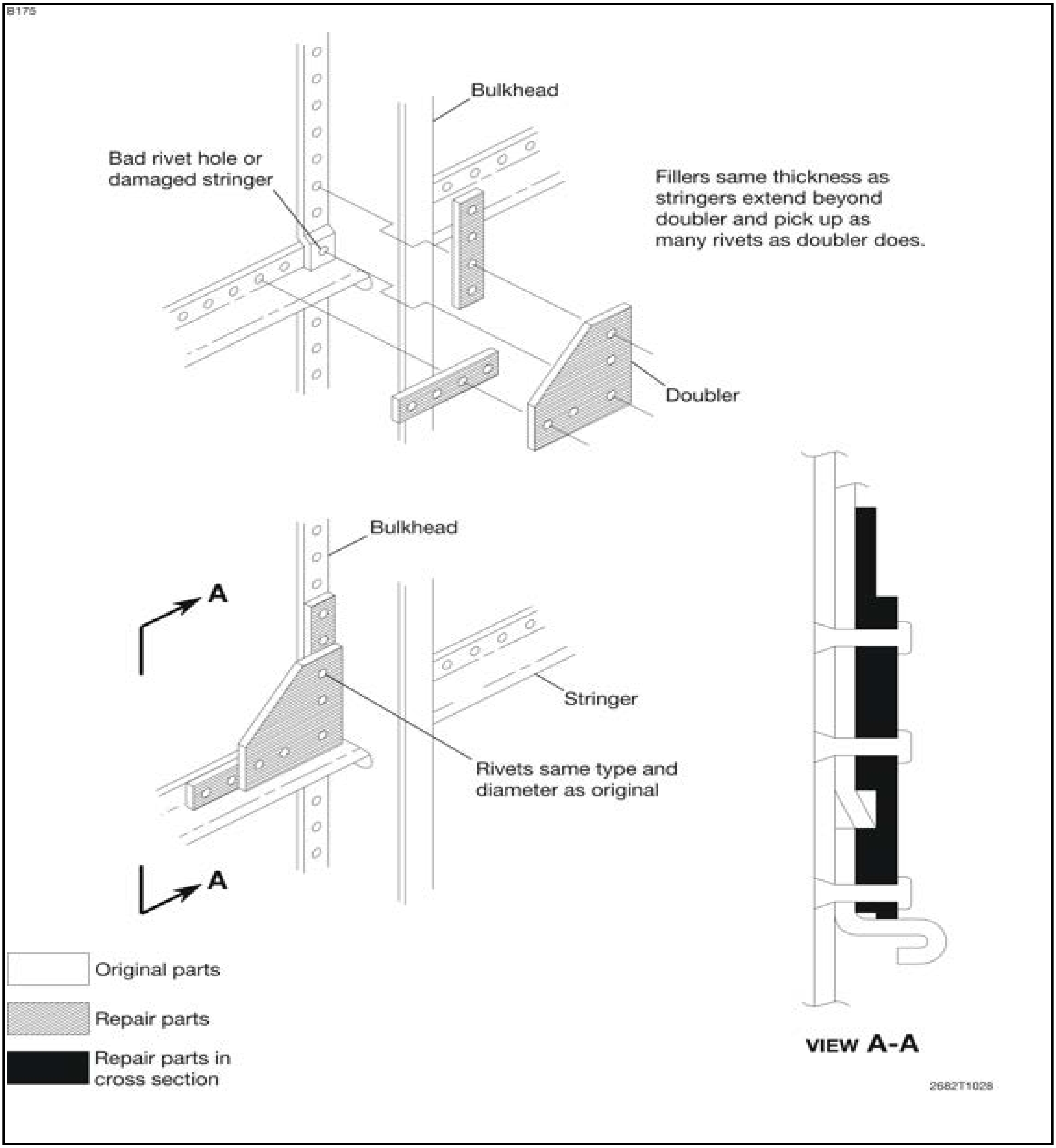


Figure 802 : Sheet 1 : Typical Rib Repair



STRINGER AND CHANNEL REPAIR

1. General

A. Damage to the stringers or channels can be repairable. Refer to Figure 801 for an illustration of typical stringer and channel repairs.

Figure 801 : Sheet 1 : Typical Stringer and Channel Repair

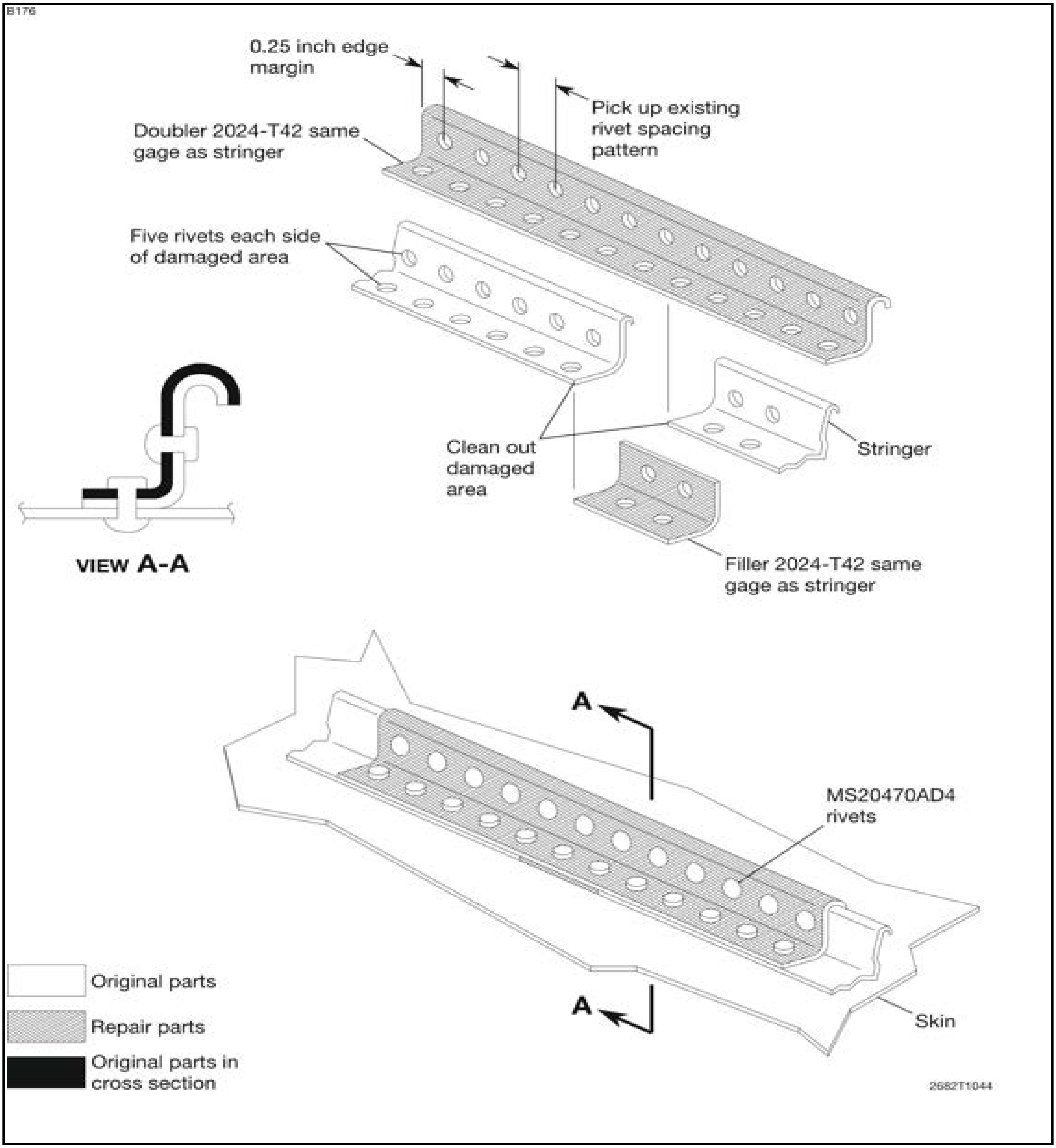


Figure 801 : Sheet 2 : Typical Stringer and Channel Repair

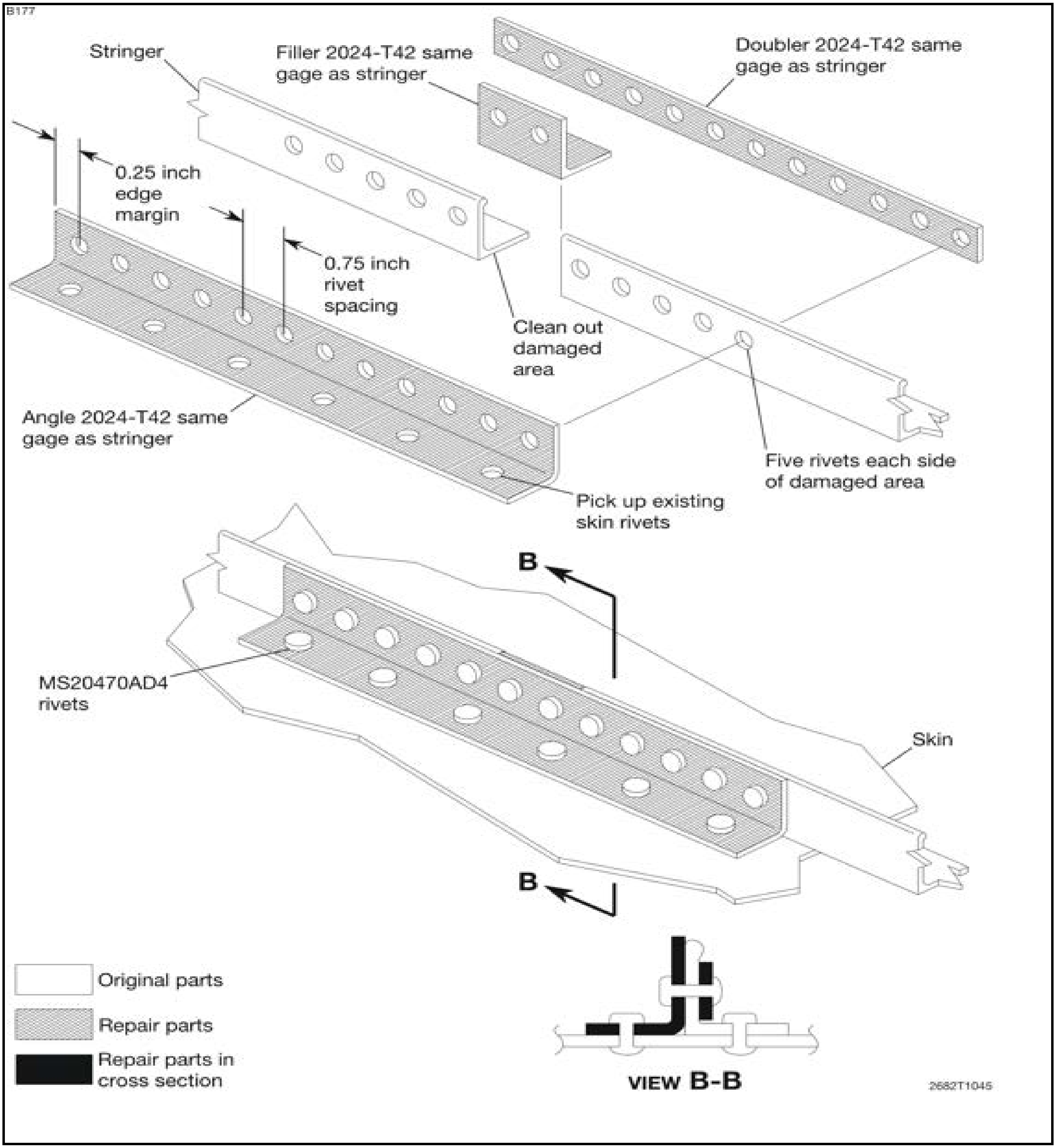


Figure 801 : Sheet 3 : Typical Stringer and Channel Repair

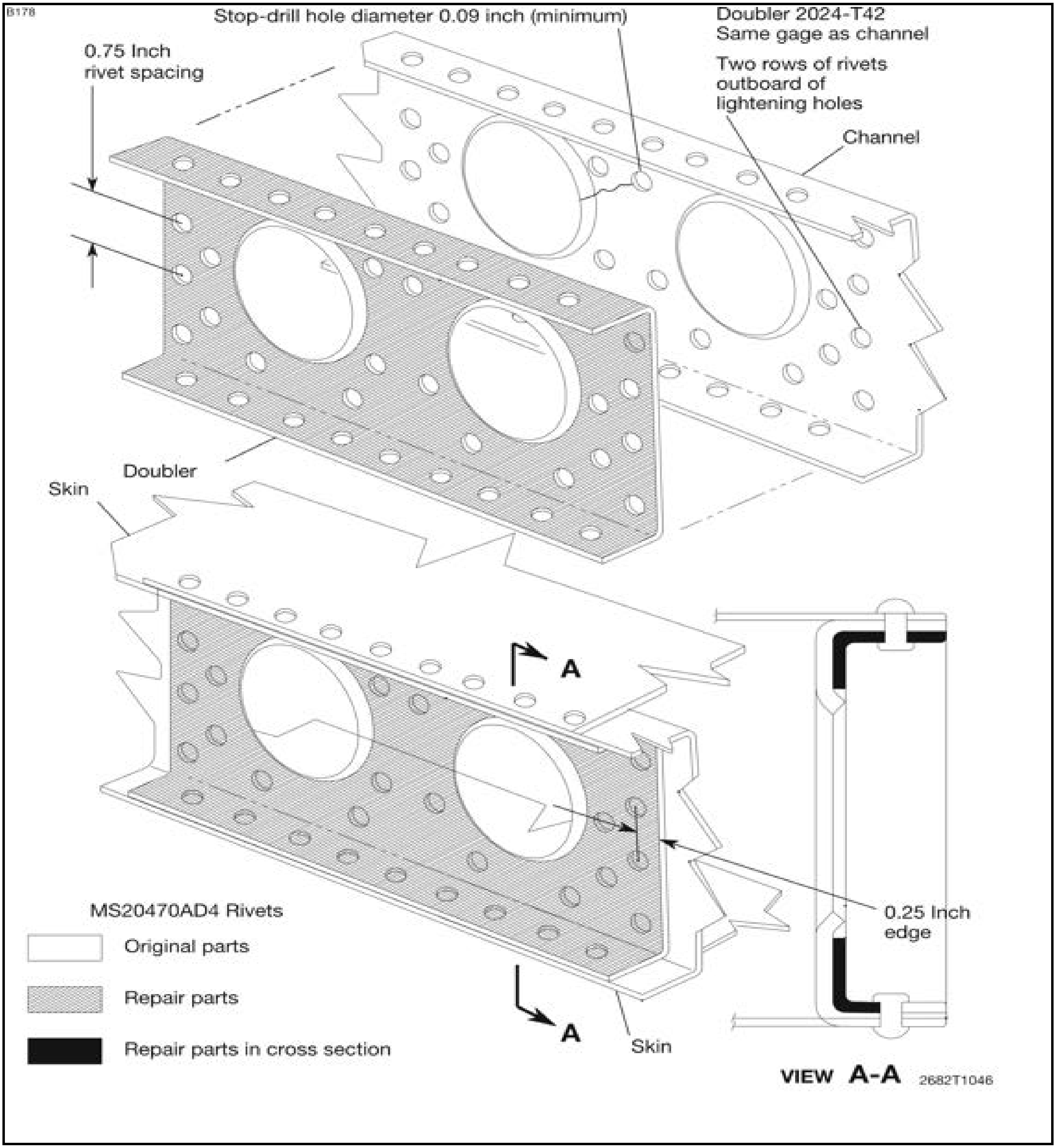


Figure 801 : Sheet 4 : Typical Stringer and Channel Repair

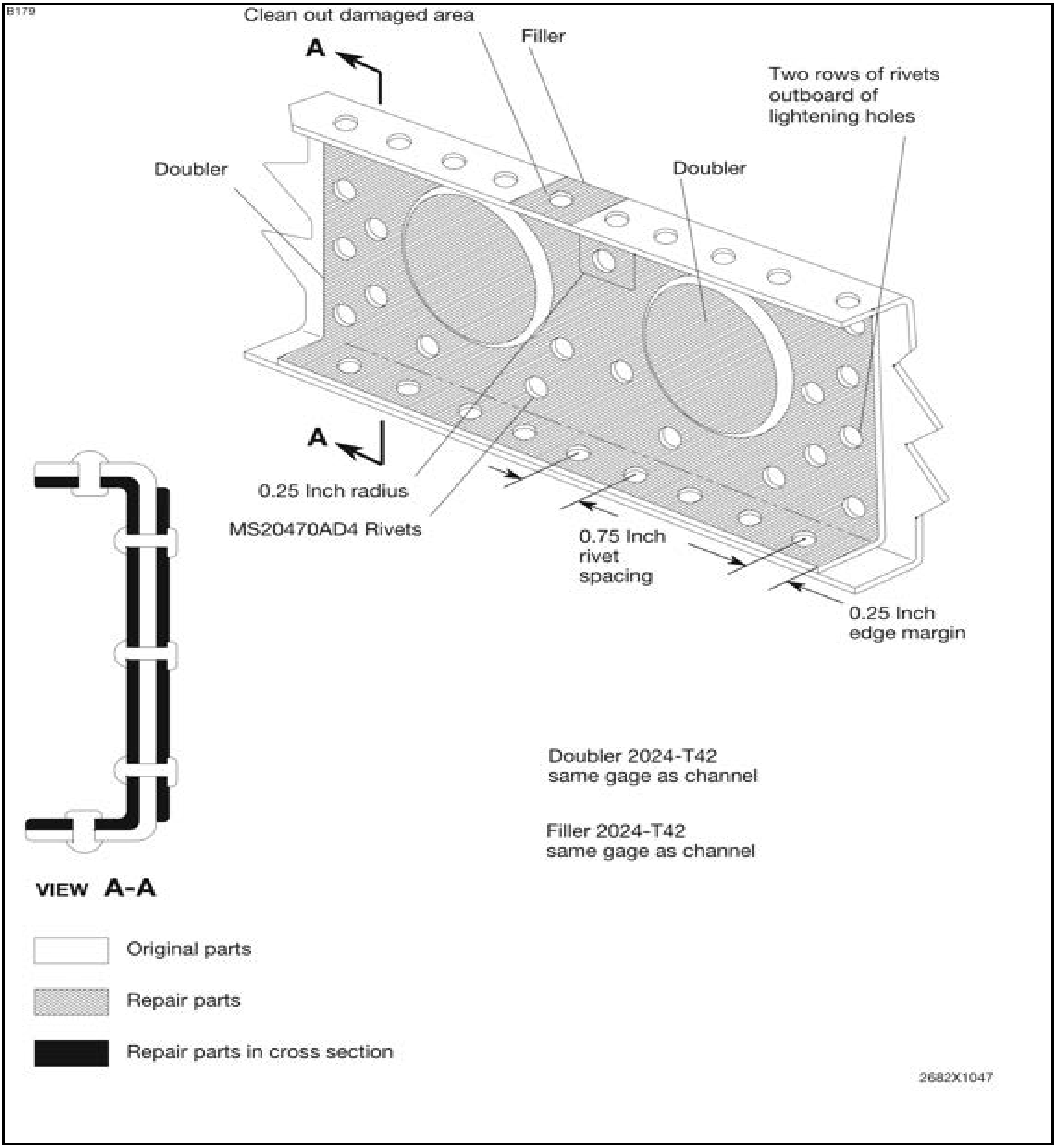
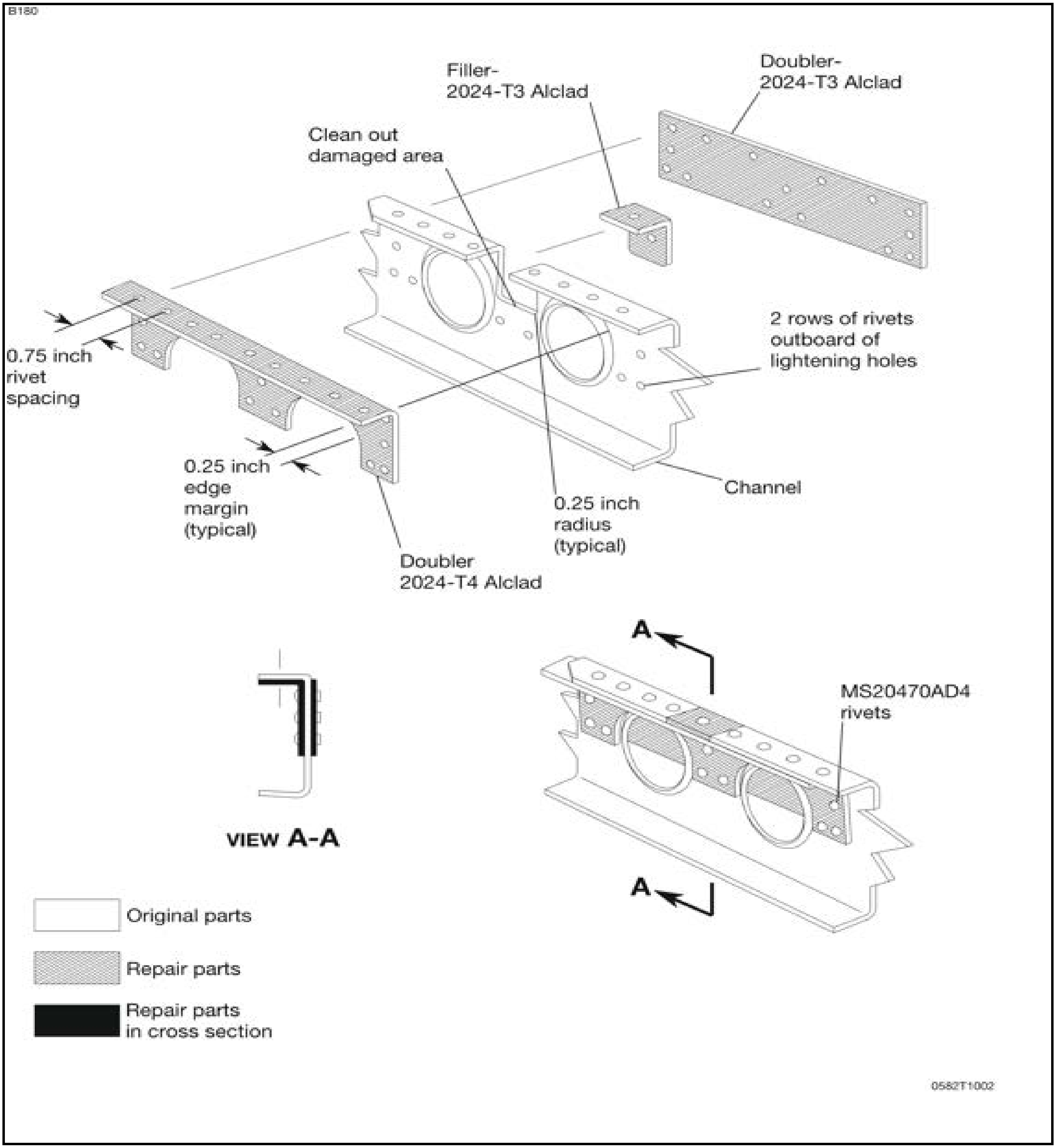


Figure 801 : Sheet 5 : Typical Stringer and Channel Repair



FIREWALL REPAIR

1. General

A. The firewall is constructed of 0.016 inch, 18-8 corrosion resistant, annealed stainless steel sheet.

(1) A typical firewall patch is illustrated in Figure 801.

(2) A typical repair to the interior firewall angle is illustrated in Figure 802.

2. Material

NAME	NUMBER	MANUFACTURER	USE
Firewall Sealant	Dapco 2100	D Aircraft Inc. 1191 Hawk Circle Anaheim, CA 92807	To seal firewall.

3. Repairing the Firewall Assembly

A. Firewall sheets may be repaired by removing damaged material and splicing in a new section. The splice must be lapped over the old material, sealed and secured with steel rivets.

(1) Patches, splices and joints must be repaired using MS20450 steel rivets.

B. Following any repair to the firewall assembly, seal the damaged areas as follows:

(1) Clean area on surface to be sealed with methyl propyl ketone.

(2) Apply sealant to the firewall assembly.

(3) Using a spatula, caulking gun, or flow gun, apply a fillet of sealer along cracks, seams, joints, and rows of rivets.

NOTE: If the sealant is applied before the parts are mated, use enough sealing compound to completely fill the joint, and wipe away excess after parts are mated.

NOTE: If the sealant is applied with a brush or a brush flow gun, more than one coat of sealant will be necessary on very porous material. Sealant should be allowed to air-dry 10 minutes between coats.

Figure 801 : Sheet 1 : Typical Firewall Repair

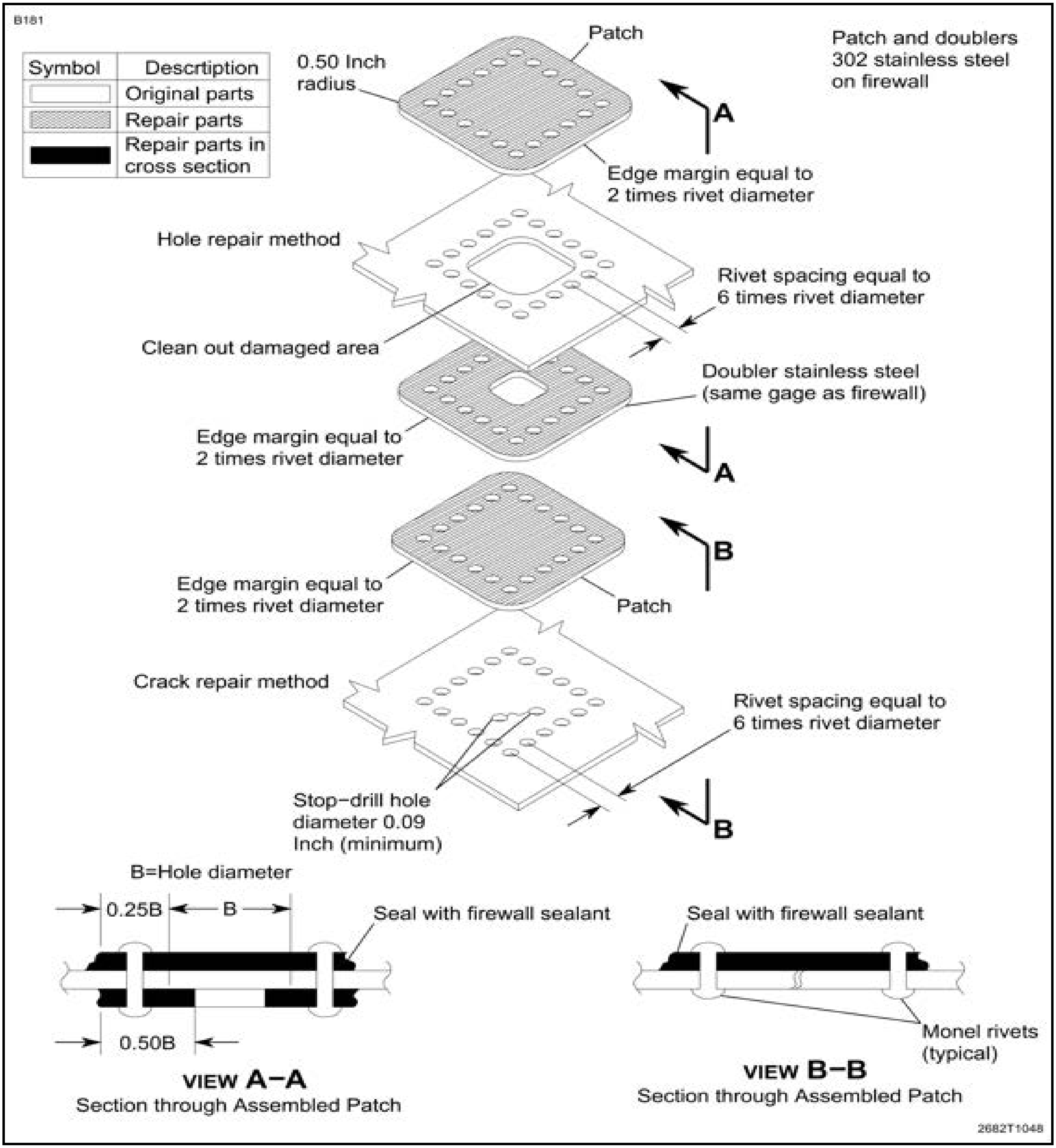
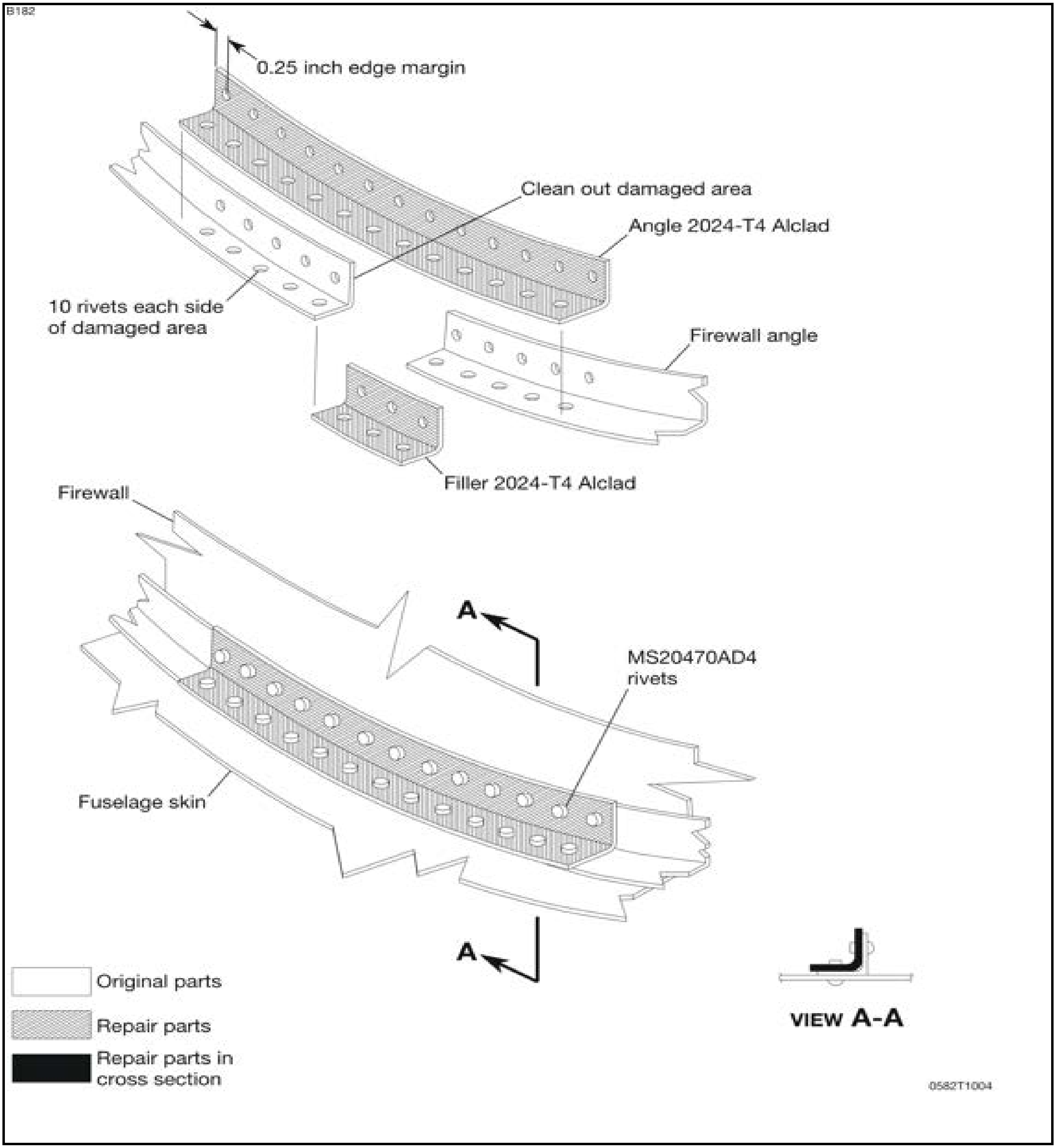


Figure 802 : Sheet 1 : Firewall Angle Repair



WINDOWS - GENERAL

1. General

A. This chapter provides repair information applicable to windshields and windows used on the 1996 and On single engine airplanes. These repairs may be utilized without removing components from the airplane.

B. For windshield/window removal or replacement, refer to the various model Maintenance Manuals, Chapter 56 - Windows.

PLASTIC WINDOW SURFACE REPAIR

1. Repair of Plastic Window Surfaces

A. Damaged window panels and the windshield on the airplane are normally removed and replaced if the damage is extensive. However, certain repairs as described in the following paragraphs can be accomplished without removing the damaged part from the airplane. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly stressed or compound curves or where the repair would be likely to affect the pilots or copilot's field of vision during normal flight or landing operations. Curved areas are more difficult to repair than flat areas, and any repaired area is both structurally and optically inferior to the original surface. Refer to Figure 801 for an illustration of typical windshield and window repair.

NOTE: If temporary repairs are made, operations should be kept to a minimum until replacement of window can be made.

2. Tools and Materials

NAME	NUMBER	MANUFACTURER	USE
Novus 1		Novus Co. Minneapolis, MN 55435	To polish scratches out of windows.
Novus 2		Novus Co.	To polish scratches out of windows.
Methylene Chloride		Commercially Available	Solvent for repair of windows.

3. Stop-Drilling

A. The following procedure should be used when stop-drilling.

(1) When a crack appears in a panel, drill a hole at the end of the crack to prevent further spreading. The hole should be approximately 1/8 inch in diameter, depending on the length of the crack and the thickness of the material. This is a temporary repair.

NOTE: If temporary repairs are made, operations should be kept to a minimum until replacement of window or windshield can be made.

4. Surface Patch

A. The following procedure should be used when preparing a surface patch.

(1) Trim away damaged area and round all corners.

(2) Cut a piece of plastic of sufficient size to cover the damaged area and extend ¾ inch on each side of crack or hole.

(3) Bevel edges as shown in Figure 801.

NOTE: If section to be repaired is curved, shape surface patch to the same contour by heating it in an oil bath at a temperature of 248°F to 302°F, or it may be heated on a hotplate until soft. Boiling water should not be used for heating.

(4) Coat surfaces to be bonded evenly with plastic solvent adhesive (acrylic chips dissolved in methylene chloride) and place immediately over the hole.

(5) Maintain a uniform pressure of 5 to 10 pounds per square inch on the surface patch for a minimum of 3 hours. Allow surface to dry 24 to 36 hours before sanding or polishing is attempted.

5. Insert (Plug) Patch

A. The following procedure should be used when preparing a plug patch.

(1) Trim hole to a perfect circle or oval and bevel edges slightly.

(2) Make plug patch slightly thicker than the material being repaired, and similarly bevel the edges.

(3) Install plug patch as illustrated in Figure 801.

(4) Heat plug patch until it is soft, press into the hole without plastic solvent adhesive, and allow to cool to make a perfect fit.

(5) Remove plug patch, coat surfaces to be bonded with plastic solvent (acrylic chips dissolved in methylene chloride), and insert plug patch in the hole.

(6) Maintain a firm, light pressure until the plastic solvent adhesive has set.

(7) Sand or file edges level with surface; buff and polish. Do not attempt hand polishing until surface is clean. A soft, open-type cotton wheel is suggested.

NOTE: Acrylic and cellulose plastics are thermoplastic. Friction created by buffing or polishing for too long a time in one spot can generate sufficient heat to soften the surface. This will produce visual distortion and is to be guarded against.

6. Minor Scratches

A. The following procedure should be used when repairing minor scratches.

(1) Remove minor scratches by vigorously rubbing the affected area by hand, using a soft, clean cloth dampened with Novus 2 plastic polish, and finish by polishing with Novus 1. Remove polish with a soft dry cloth.

NOTE: Plastics should not be rubbed with a dry cloth, since this is likely to cause scratches, and also builds up an electrostatic charge which attracts dust particles to the surface. If, after removing dirt and grease, no great amount of scratching is visible, finish the plastic with a good grade of commercial wax. Apply the wax in a thin, even coat, and bring to a high polish by rubbing lightly with a soft cloth.

7. Cleaning Plastic

A. The following procedure is the recommended method for cleaning plastic windows.

(1) Clean the plastic by washing with plenty of water and mild soap, using a clean, soft, grit free cloth, sponge, or bare hands.

CAUTION: Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguisher or deicing fluids, lacquer thinners, or window cleaning sprays because they will soften the plastic and cause crazing.

Figure 801 : Sheet 1 : Typical Windshield and Windows Repair

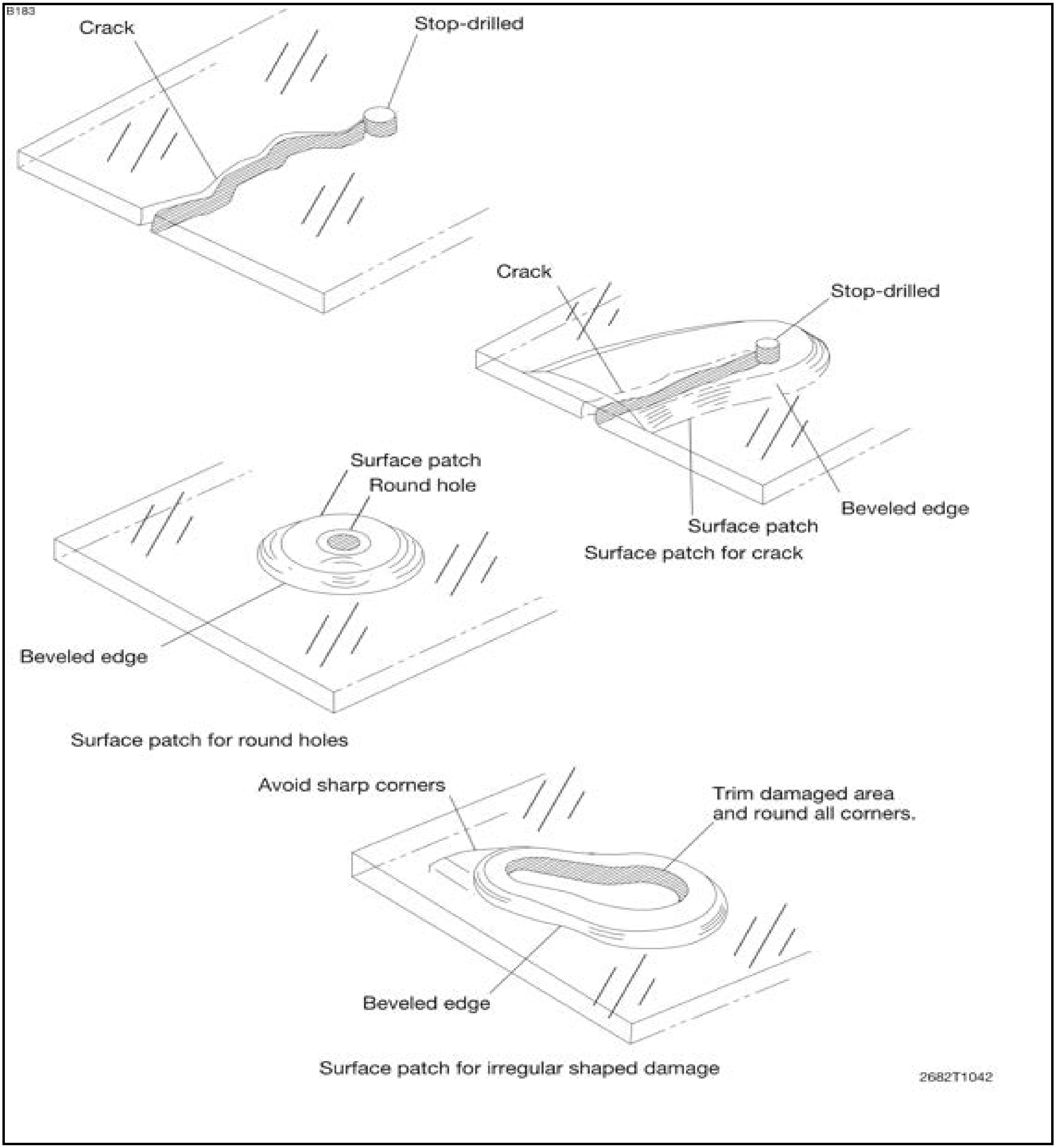
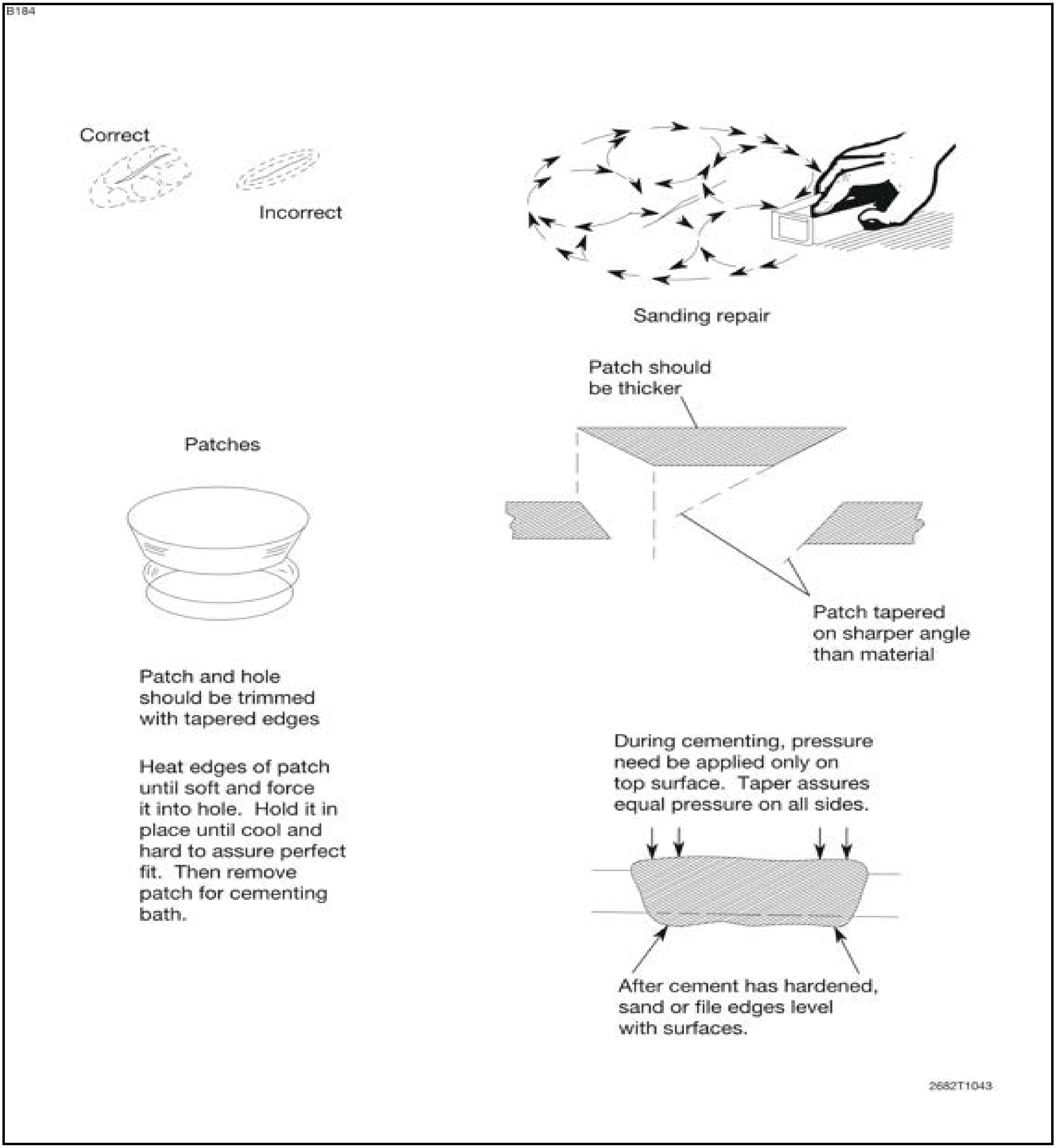


Figure 801 : Sheet 2 : Typical Windshield and Windows Repair



POWERPLANT - GENERAL

1. General

A. Single engine airplanes produced from 1996 and On use Lycoming powerplants. These powerplants are attached to the fuselage by dynafocal mounts (172R, 172S, 182S, 182T and T182T) or by sheet metal bed mounts (206H and T206H).

B. This chapter covers structural repair to the cowlings (172R, 172S, 182S, 182T and T182T), and structural repair to the welded engine mounts (172R, 172S, 182S, 182T and T182T). For repair information not covered in this manual, contact Cessna Propeller Aircraft Product Support, P.O. Box 7706, Wichita, KS 67277. Telephone(316) 517-5800 or Facsimile (316) 942-9006.

ENGINE COWLING REPAIRS

1. General

A. This section provides repair procedures for the cowl skins and reinforcement angles.

2. Repair of Cowling Skins

A. Cowl halves are made of formed aluminum skin. If extensively damaged, complete sections of cowling must be replaced. Standard insert-type skin patches, however, may be used if repair parts are formed to fit. Small cracks may be stop drilled and dents straightened if they are reinforced on the inner side with a doubler of the same material.

3. Repair of Reinforcement Angles

A. Due to their small size, cowl reinforcement angles should be replaced (rather than repaired) if they become damaged.

DYNAFOCAL-TYPE ENGINE MOUNT REPAIRS

1. General

A. The engine mount is fabricated from 4130 chrome-molybdenum steel tubing. The mount attaches to the firewall at four points and to the engine using rubber isolation mounts at four points.

NOTE: Repair by gas welding is acceptable.

2. Engine Mount Repairs

A. The following procedures are to be used when making repairs to the engine mount. Refer to Figure 801.

(1) All welding on the engine mounts should be of the highest quality, since the tendency of vibration will accentuate any minor defect present and cause fatigue cracks. Engine mount members are preferably repaired by using larger diameter replacement tube welds. However, reinforced 30-degree scarf welds in place of the fishmouth welds are considered satisfactory for engine mount repair work.

(2) Minor damage, such as a crack adjacent to an engine attaching lug, may be repaired by rewelding the tube and extending a gusset past the damaged area. Extensively damaged parts must be replaced.

(3) Engine mounting lugs and engine mount-to-fuselage attach fittings should be replaced, not repaired.

(4) For information on damage beyond the scope of these repairs, consult Cessna Propeller Aircraft Product Support, P.O. Box 7706, Wichita, KS 67277 USA, Telephone (316) 517-5800 or Facsimile (316) 942-9006.

Figure 801 : Sheet 1 : Typical Engine Mount Repairs

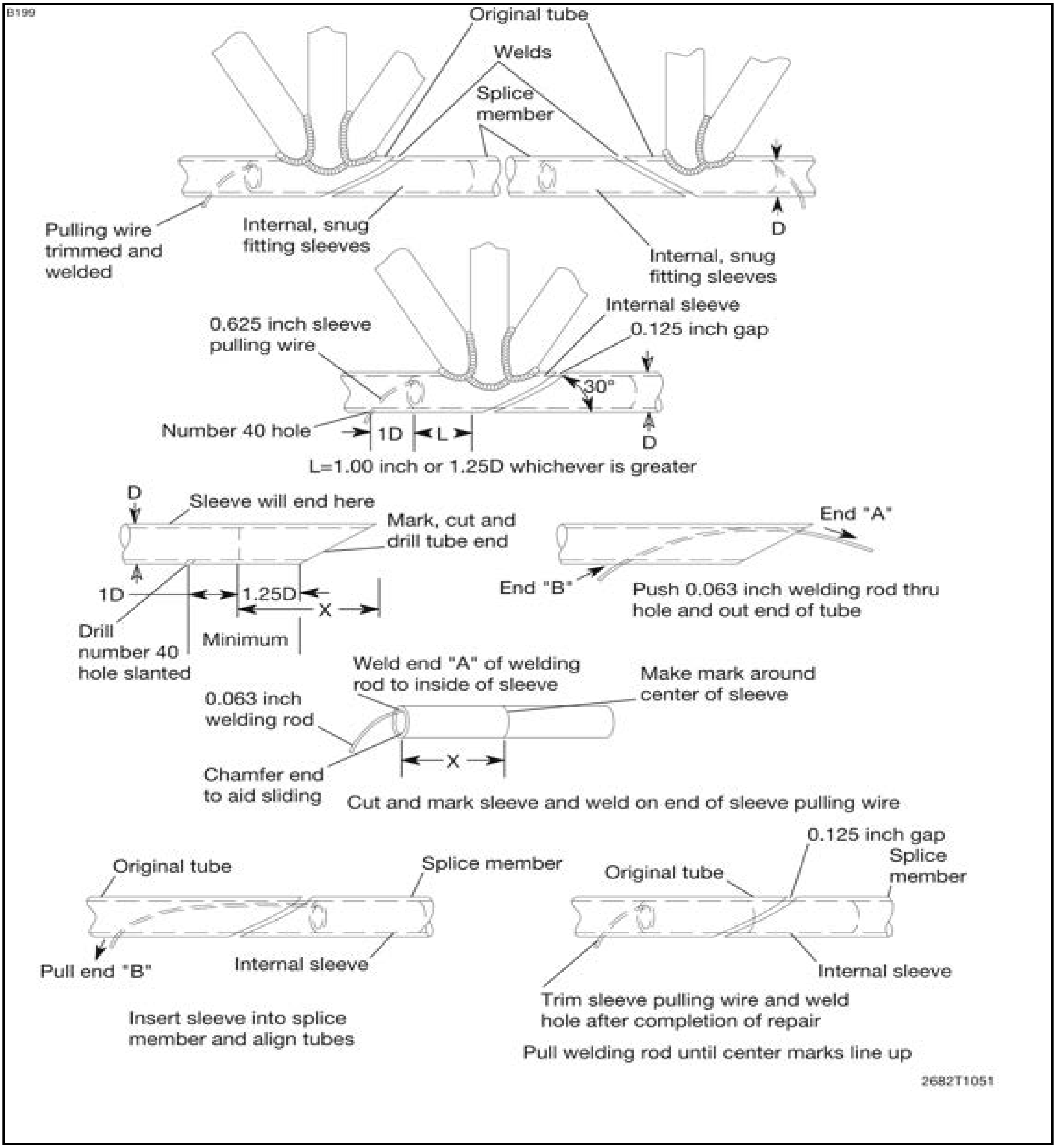


Figure 801 : Sheet 2 : Typical Engine Mount Repairs

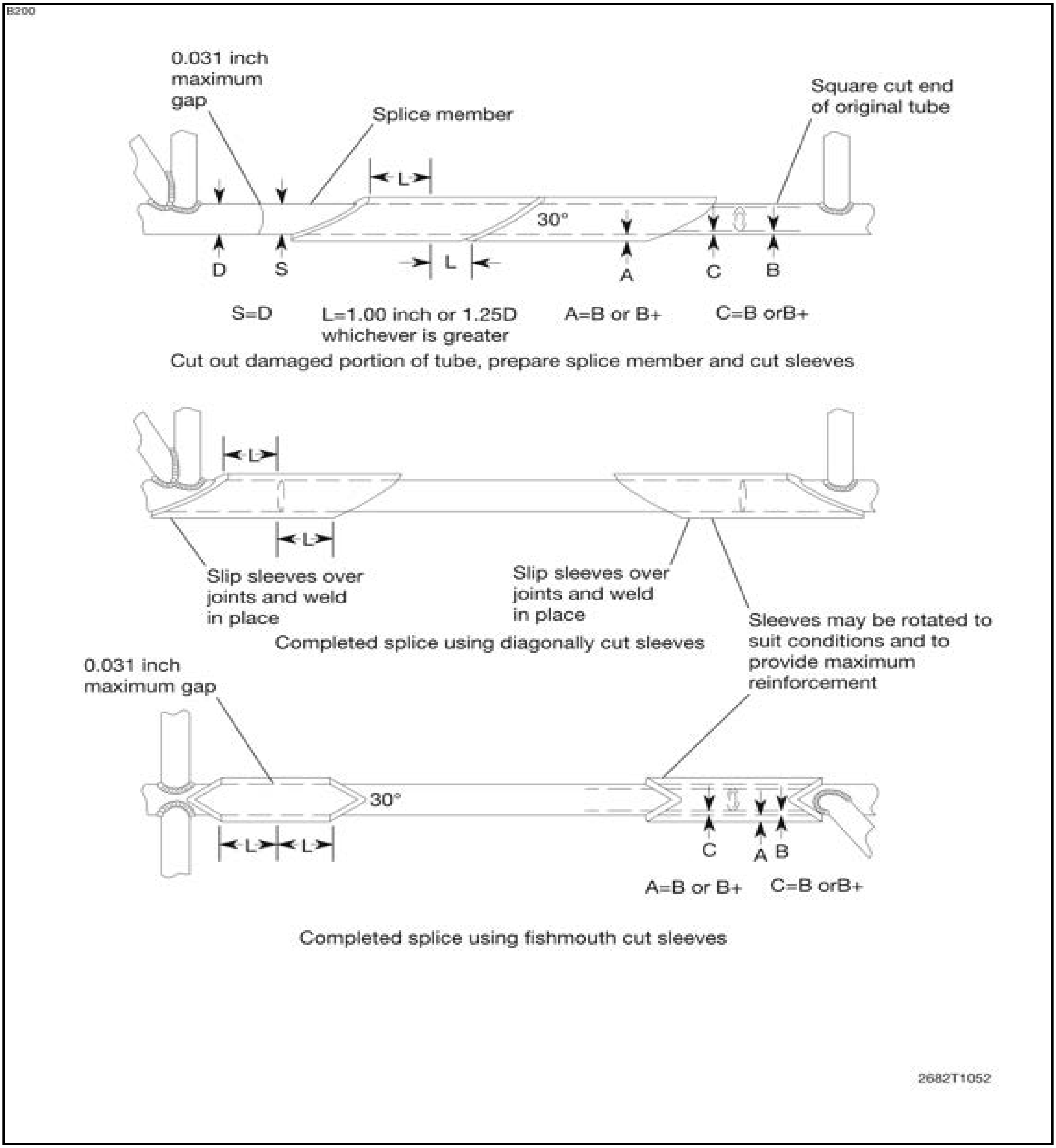
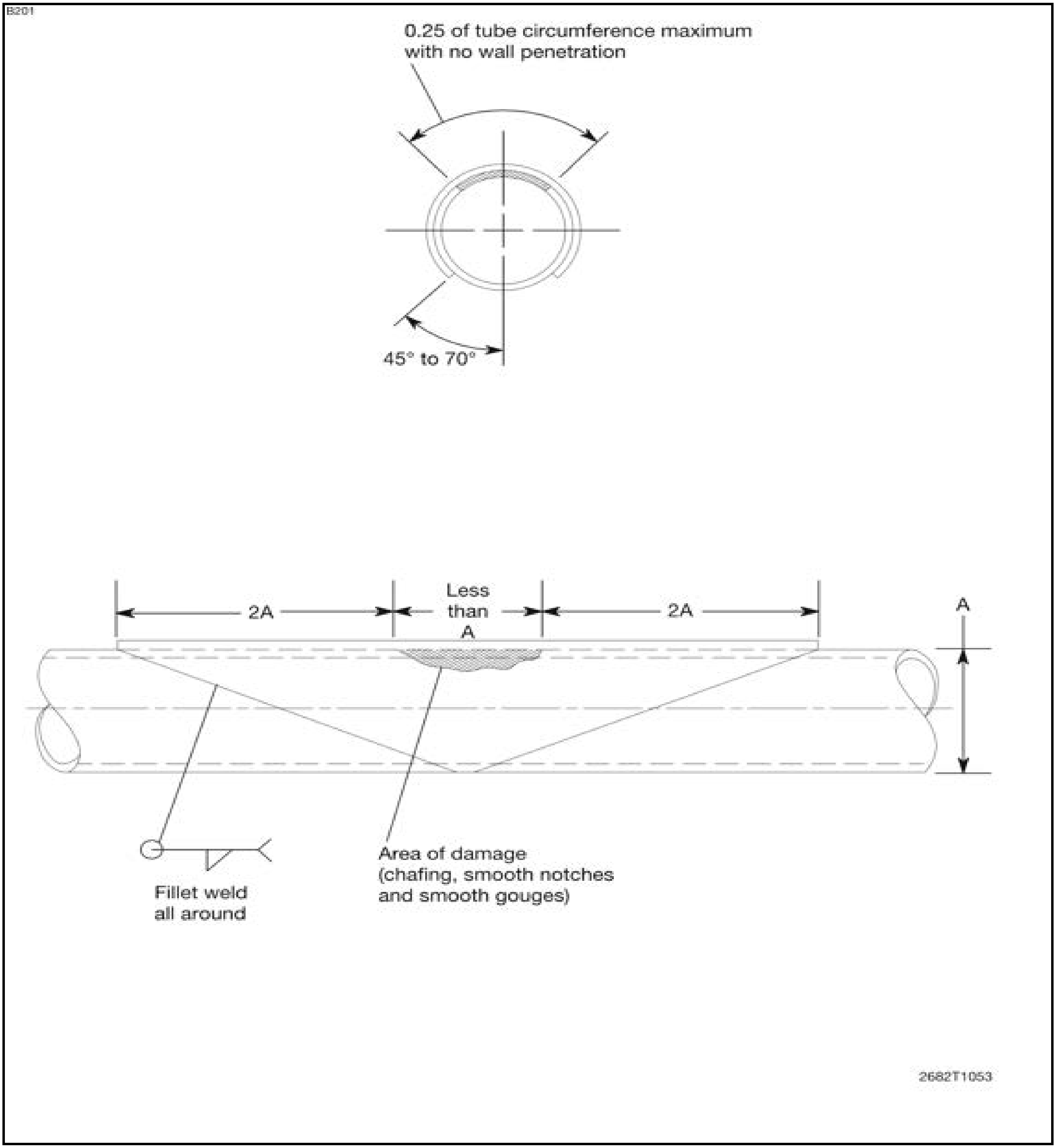


Figure 801 : Sheet 3 : Typical Engine Mount Repairs



HORIZONTAL AND VERTICAL STABILIZERS

1. General

A. Chapter 55 describes general repair practices, materials and procedures which are applicable to the Horizontal and Vertical Stabilizers.

B. The horizontal and vertical stabilizers are of all metal, fully cantilever, semimonocoque design, consisting of spars, stringers, ribs, and skins. Skins are riveted to supporting structure with conventional MS20470AD rivets.

C. If questions arise concerning approved repairs or for repairs not shown in this section, contact Cessna Propeller Aircraft Product Support.

HORIZONTAL STABILIZER

1. Horizontal Stabilizer

A. The horizontal stabilizer is constructed from spars, ribs, stringers, doublers and skins. Refer to applicable Maintenance Manual, Chapter 6, Dimensions and Areas, for horizontal stabilizer station diagram.

2. Negligible Damage

A. The same criteria which is used to define "negligible damage" to the fuselage may be applied to the horizontal stabilizer. Refer to Chapter 53, Fuselage Damage Classification for a complete description of negligible damage.

3. Repairable Damage

A. Skin patches may be used to repair skin damage. These patches are illustrated in Chapter 51, Typical Skin Repairs, Figure 801. For skin damage which includes corrugations, Refer to Chapter 51, Typical Skin Repairs, Figure 802.

B. Access to the internal stabilizer structure may be gained by removing a portion of the rivets along the rear spar and ribs and springing back the skin. By using the proper bucking bars through holes in spar web, skins may by closed with a minimum of blind rivets.

4. Replacement Damage

A. If the damaged area would require a repair which could not be made between adjacent ribs, or the repair would be located in an area with compound curves, compete skin panels must be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where damage is extensive, replacement of the entire assembly is recommended.

5. Model 172 Horizontal Stabilizer Tip Fairing Repair

A. Remove the LH or RH stabilizer tip fairing.

(1) If the damaged stabilizer tip is installed with rivets, do the following:

(a) Carefully drill out the rivets that attach the tip fairing.

(b) Remove the tip fairing from the stabilizer structure.

(2) If the damaged stabilizer tip fairing is installed with sealant, do the following:

CAUTION: Be careful not to damage the underlying structure.

(a) Separate the tip fairing from the structure by carefully cutting the seal using a thin blade spatula.

(b) Remove the tip fairing from the stabilizer structure.

(c) Remove any remaining old sealant. Refer to the applicable Maintenance Manual, Chapter 20, Fuel, Weather and High-Temperature Sealing - Maintenance Practices.

B. Install the LH or RH stabilizer tip fairing.

(1) If the tip fairing was installed with rivets, deburr the existing holes in stabilizer structure.

(2) Pre-fit the new tip fairing.

(a) Adjust the tip fairing as required to achieve a proper fit with an even gap around the interface.

(3) Surfaces must be clean and dry, free from dust, lint, grease, chips, oil condensation or other moisture and all other contaminating substances prior to the application of sealant.

(4) Tape off the surrounding areas as required to cleanly remove any squeeze-out of the sealant.

(5) Apply a thin layer of Type 1, Class B or C sealant to the mating surface of the tip fairing and structure. Refer to the applicable Maintenance Manual, Chapter 20, Fuel, Weather and High-Temperature Sealing - Maintenance Practices.

(6) Carefully put the tip fairing in its position on the stabilizer structure.

NOTE: Use tongue depressor(s) to lift the fairing over the edge of the structure.

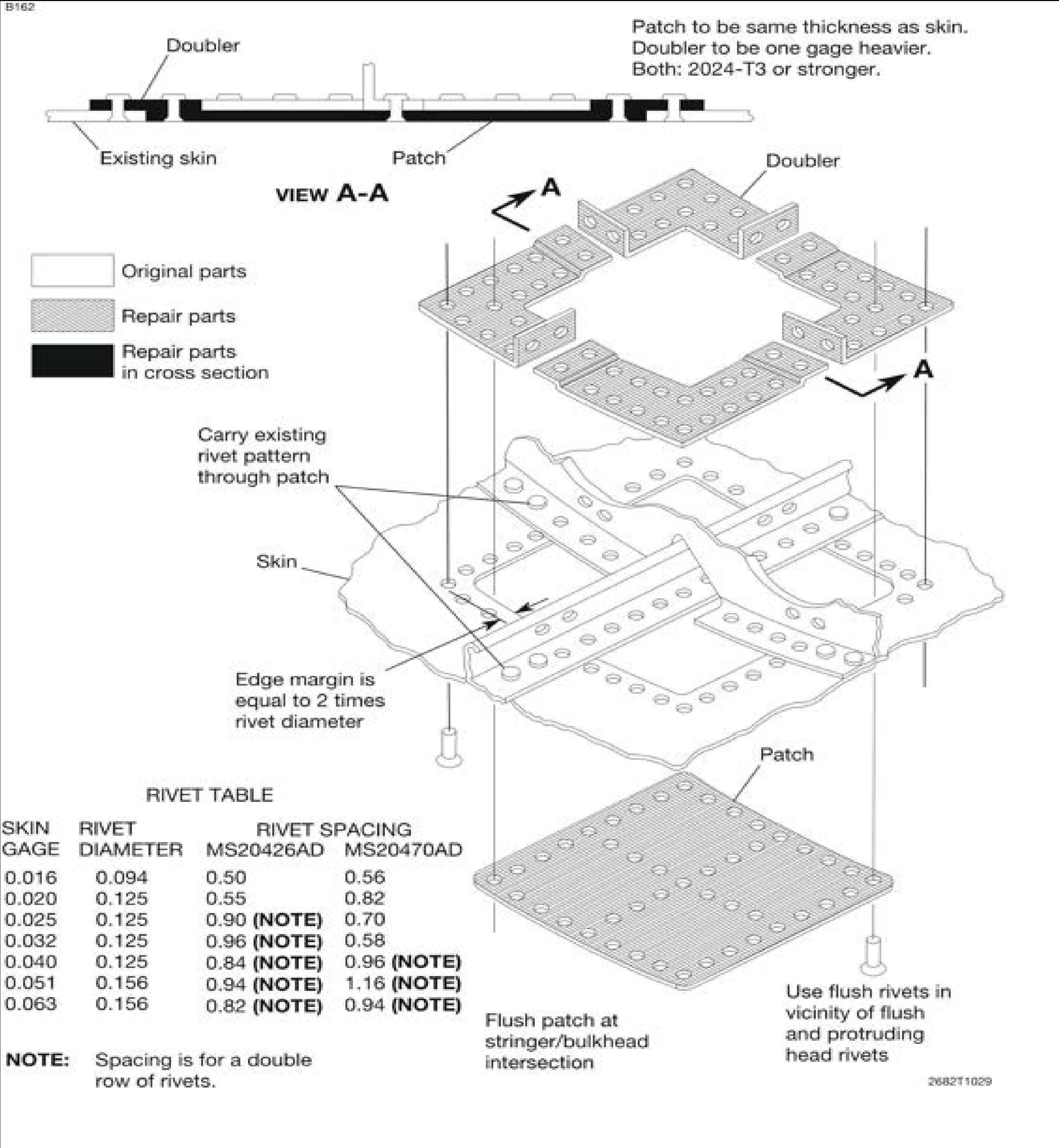
(7) Shift the fairing aft slightly, if necessary, until the leading edges make contact.

(8) Use tape to hold the fairing in place until the sealant is fully cured.

(9) Fill any open pilot holes in the fairing with Type 1, Aerodynamic Filler Compound and sand smooth.

(10) Finish the tip fairing with matching paint. Refer to the applicable Maintenance Manual, Chapter 20, Exterior Finish - Cleaning/Painting for painting procedures.

Figure 801 : Sheet 1 : Skin Repair

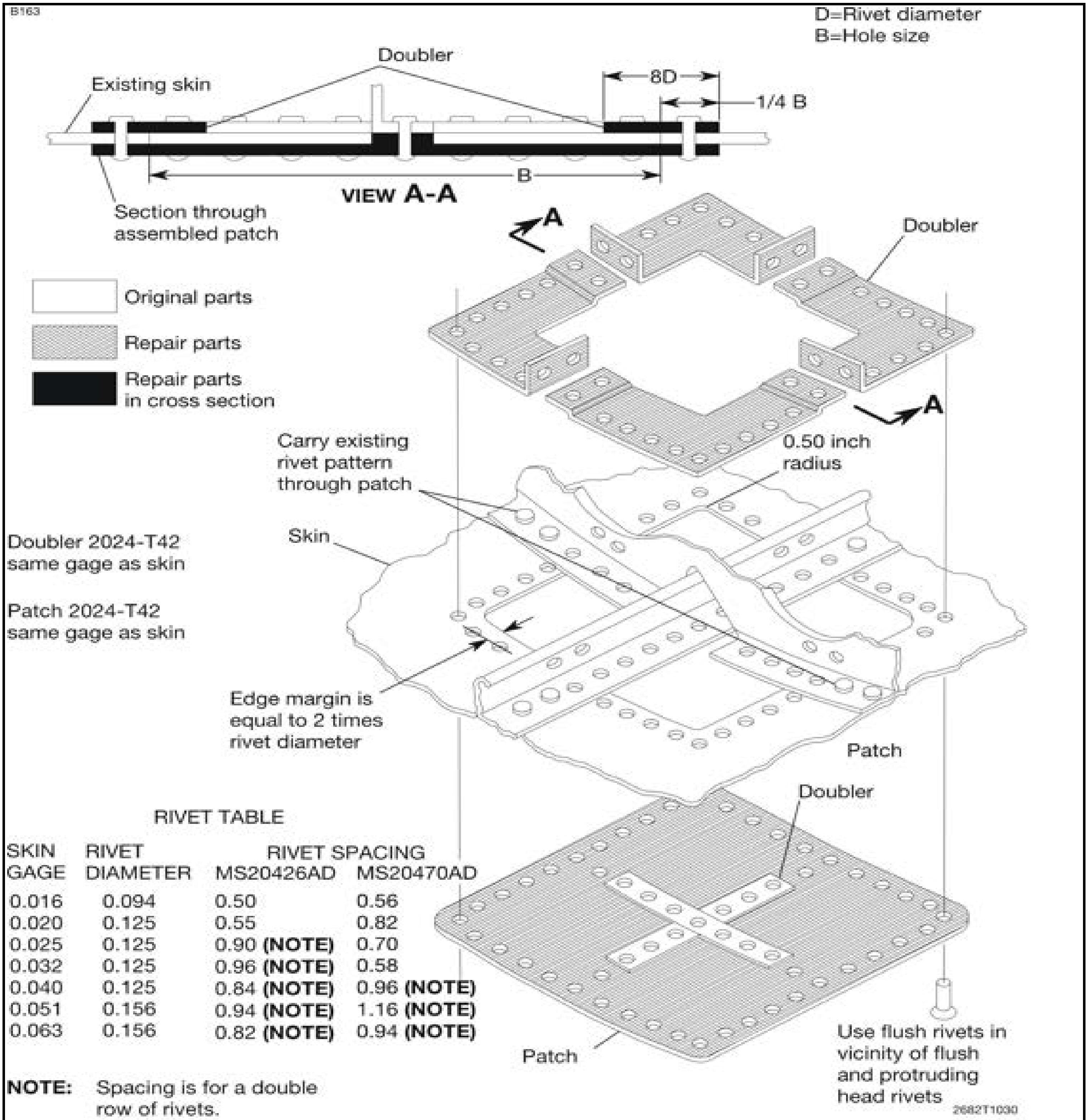


RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 2 : Skin Repair



RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 3 : Skin Repair

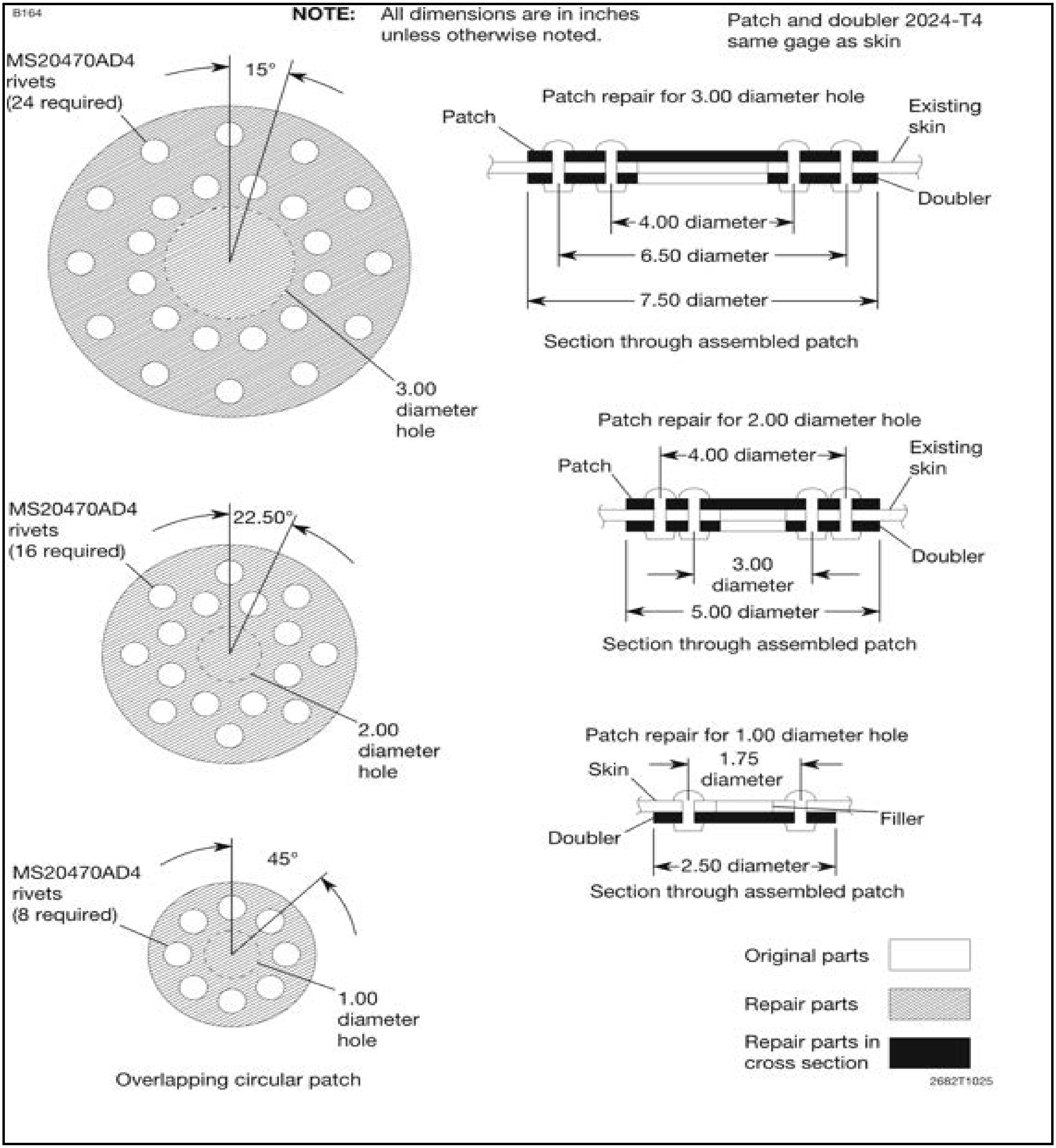


Figure 801 : Sheet 4 : Skin Repair

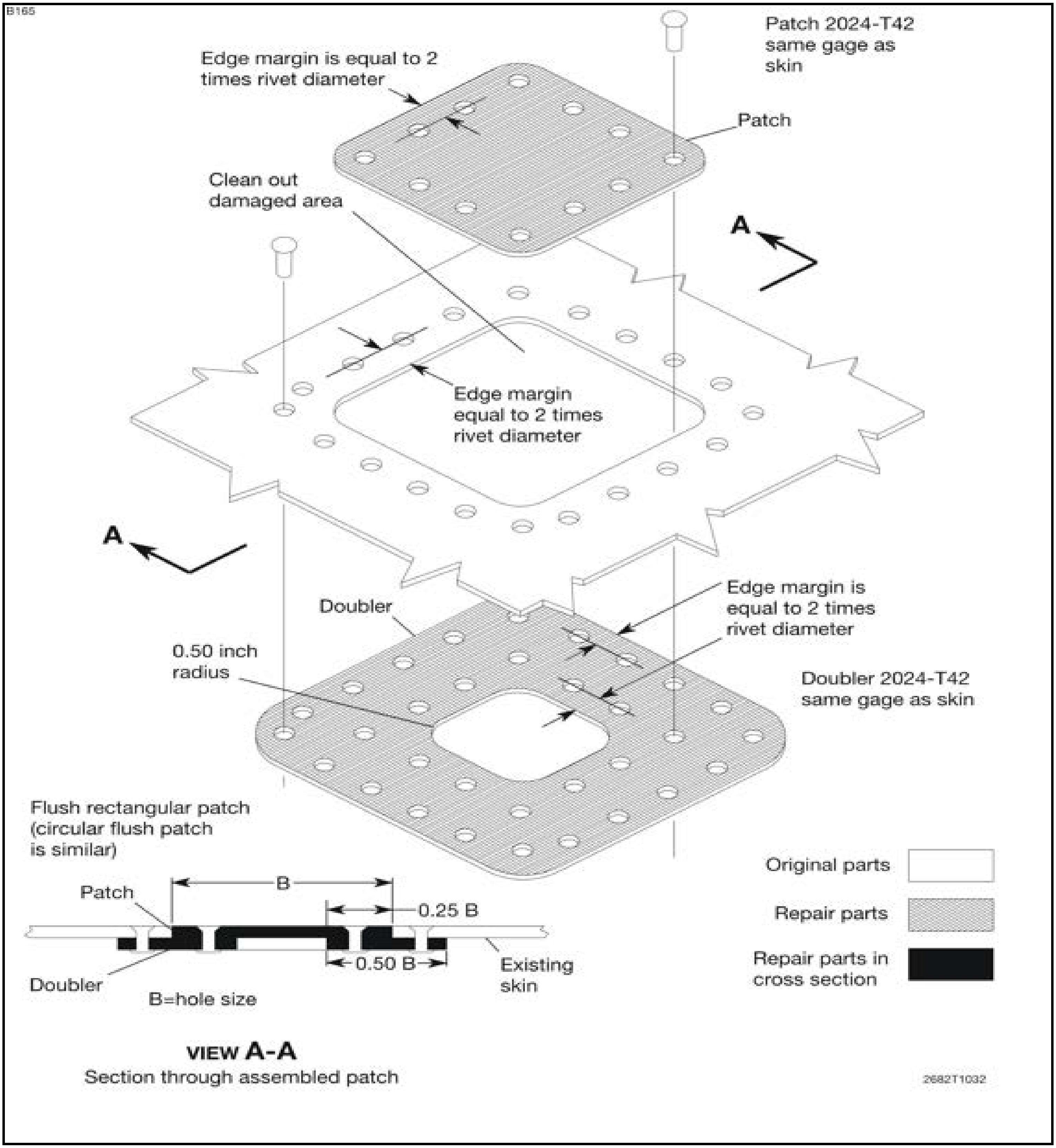


Figure 801 : Sheet 5 : Skin Repair

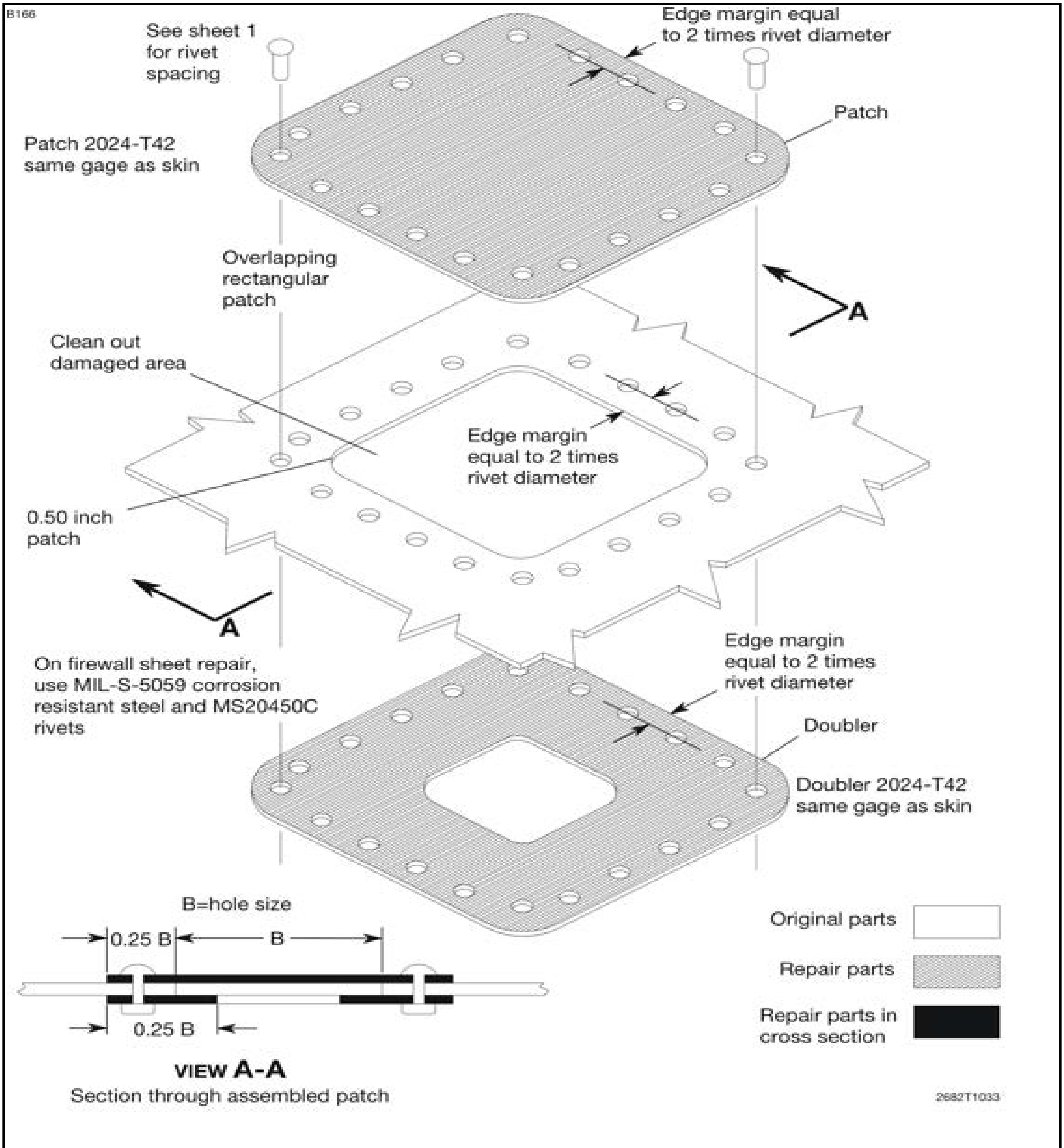
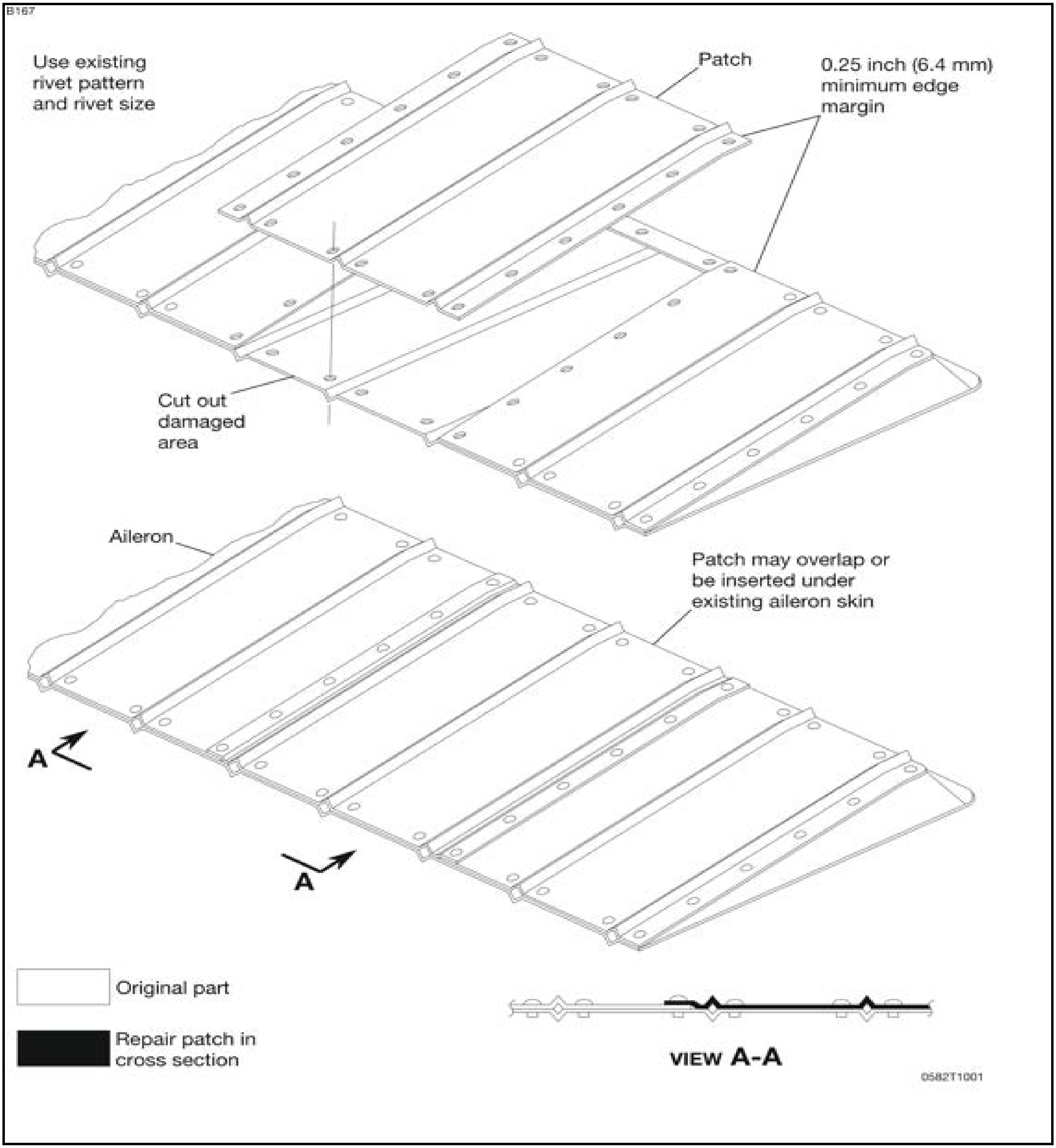


Figure 802 : Sheet 1 : Corrugated Skin Repair



ELEVATOR

1. General

A. The elevator assembly consists of a left and right section bolted together near the airplane centerline by torque tubes. Each section consists of a front and a rear spar, ribs, skins, and a trim tab assembly. A balance weight is bolted to the outboard tip leading edge.

2. Negligible Damage

A. Any smooth skin dents that are free from cracks, abrasions, and sharp corners, and which are not stress wrinkles and do not interfere with any internal structure or mechanism, may be considered as negligible damage. Exception to negligible damage on elevator surfaces is the front spar, cracks appearing in web of hinge fitting or in tip rib which supports overhanging balance weight. Cracks in overhanging tip rib, in the area at the front spar intersection with web of the rib, also cannot be considered negligible.

3. Repairable Damage

A. Skin patches may be used to repair skin damage. These patches are illustrated in Chapter 51, Typical Skin Repairs, Figure 801. For skin damage which includes corrugations, refer to Chapter 51, Typical Skin Repairs, Figure 802.

B. Flight control surfaces must be balanced after repair or painting, in accordance with balancing procedures outlined in Chapter 51, Flight Control Surface Balancing.

4. Replacement Damage

A. Warped and cracked skin, ribs, and hinge brackets are replaceable items. Where damage is extensive, replacement of the entire assembly is recommended.

5. Model 172 Elevator Tip Fairing Repair

A. Remove the LH or RH elevator tip fairing.

(1) Remove the elevator control surface(s). Refer to the applicable Maintenance Manual, Chapter 27, Elevator Control System - Maintenance Practices.

(2) If the damaged elevator tip fairing is installed with rivets, do the following:

(a) Carefully drill out the rivets that attach the tip fairing.

(b) Remove the tip fairing from the elevator structure.

(3) If the damaged elevator tip is installed with sealant, do the following:

CAUTION: Be careful not to damage the underlying structure.

(a) Separate the tip fairing from the structure by carefully cutting the seal using a thin blade spatula.

(b) Remove the tip fairing from the elevator structure.

(c) Remove any remaining old sealant. Refer to the applicable Maintenance Manual, Chapter 20, Fuel, Weather and High-Temperature Sealing - Maintenance Practices.

B. Install the LH or RH elevator tip fairing.

(1) If the tip fairing was installed with rivets, deburr the existing holes in elevator structure.

(2) Pre-fit the new tip fairing.

(a) Adjust the tip fairing as required to achieve a proper fit with an even gap around the interface.

(3) Surfaces must be clean and dry, free from dust, lint, grease, chips, oil condensation or other moisture and all other contaminating substances prior to the application of sealant.

(4) Tape off the surrounding areas as required to cleanly remove any squeeze-out of the sealant.

(5) Apply a thin layer of Type 1, Class B or C sealant to the mating surface of the tip fairing and structure. Refer to the applicable Maintenance Manual, Chapter 20, Fuel, Weather and High-Temperature Sealing - Maintenance Practices.

(6) Carefully put the tip fairing in its position on the elevator structure.

NOTE: Use tongue depressor(s) to lift the fairing over the edge of the structure.

(7) Shift the fairing aft slightly, if necessary, until the leading edges make contact.

(8) Use tape to hold the fairing in place until the sealant is fully cured.

(9) Fill any open pilot holes in the fairing with Type 1, Aerodynamic Filler Compound and sand smooth.

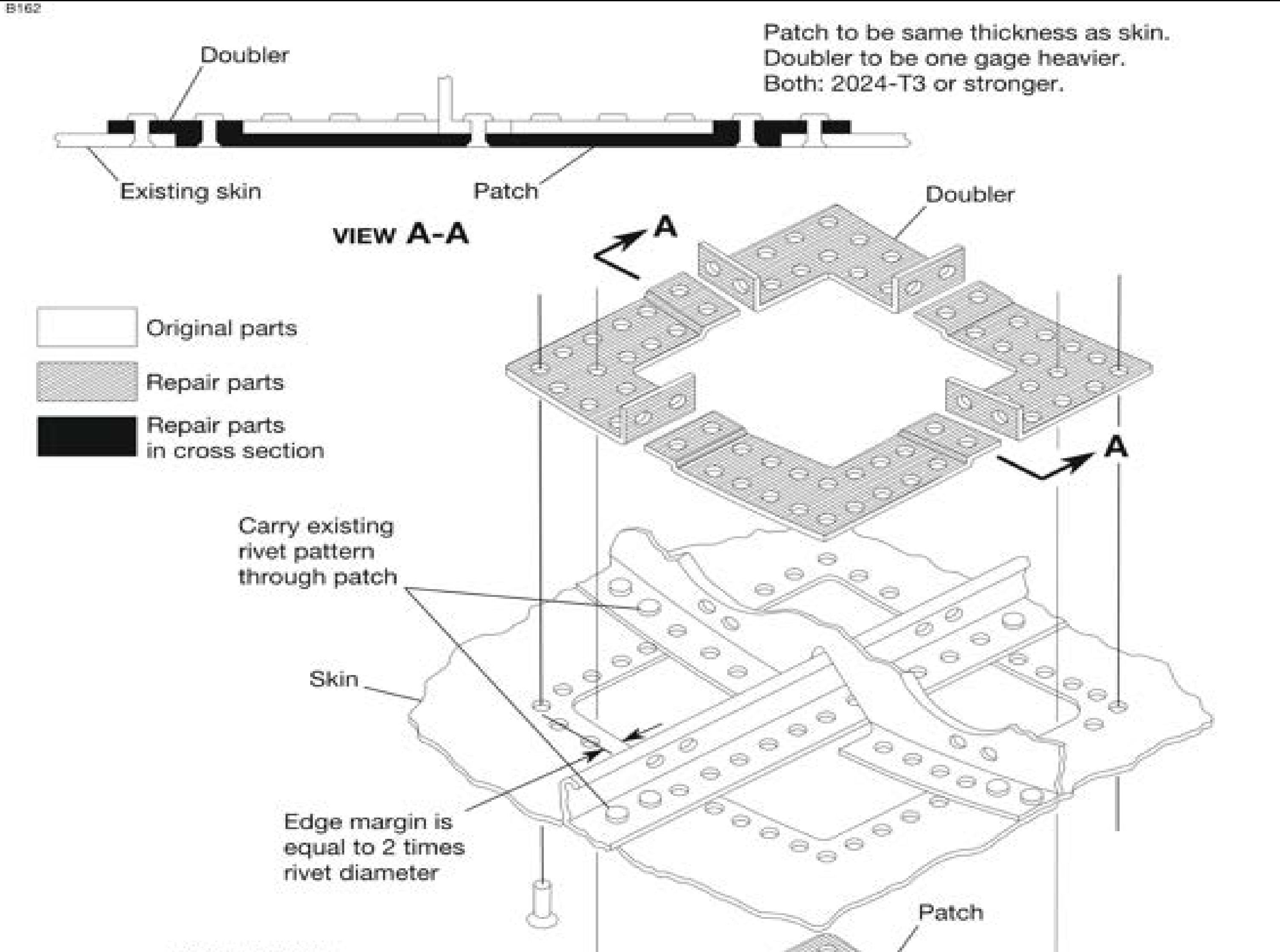
(10) Finish the tip fairing with matching paint. Refer to the applicable Maintenance Manual, Chapter 20, Exterior Finish -

Cleaning/Painting for painting procedures.

(11) The elevator control surface must be balanced after repair or painting, in accordance with balancing procedures outlined in Chapter 51, Flight Control Surface Balancing.

(12) Install the elevator(s). Refer to the applicable Maintenance Manual, Chapter 27, Elevator Control System - Maintenance Practices.

Figure 801 : Sheet 1 : Skin Repair

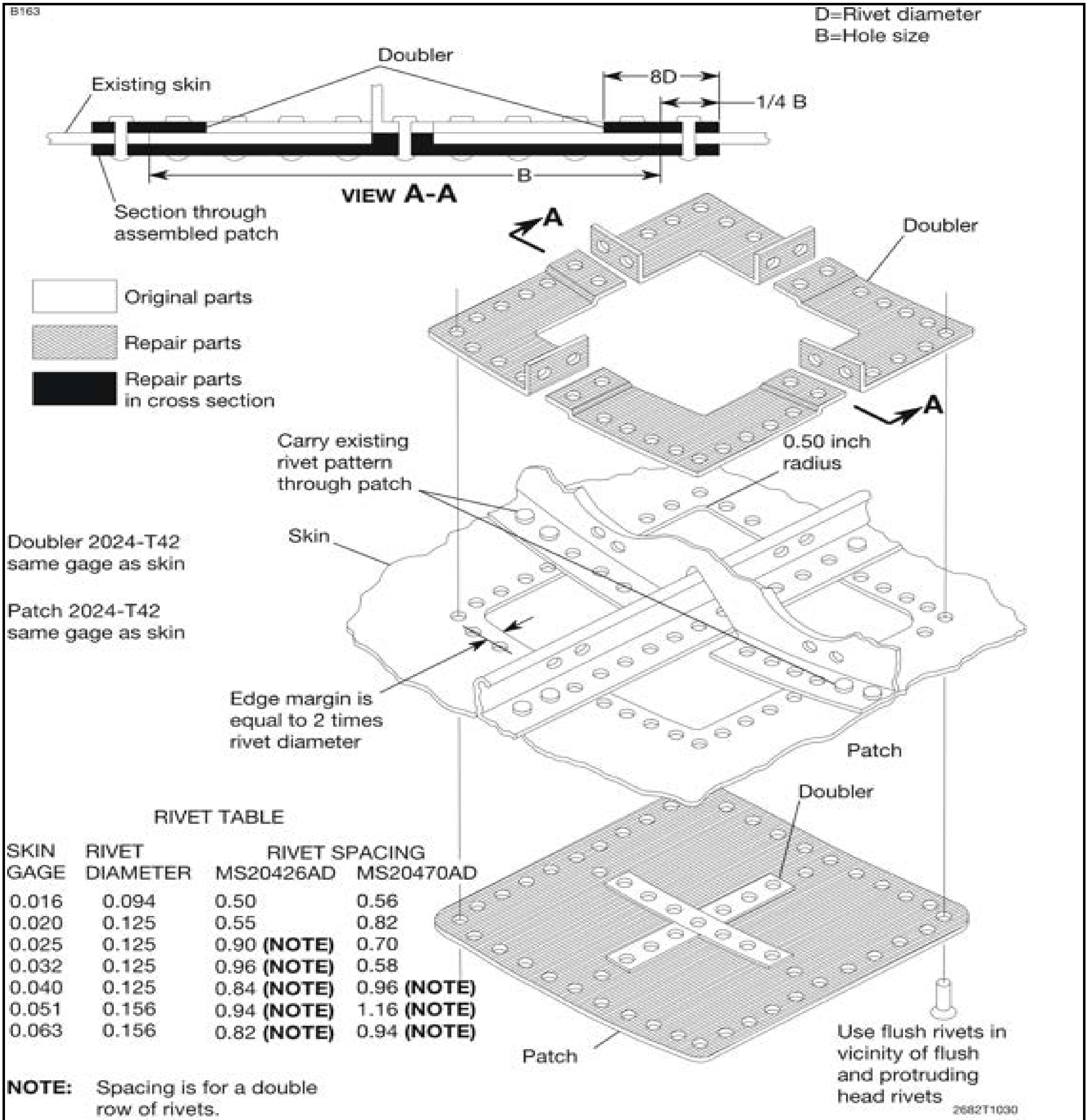


RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 2 : Skin Repair



RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	RIVET SPACING MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
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0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
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0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 3 : Skin Repair

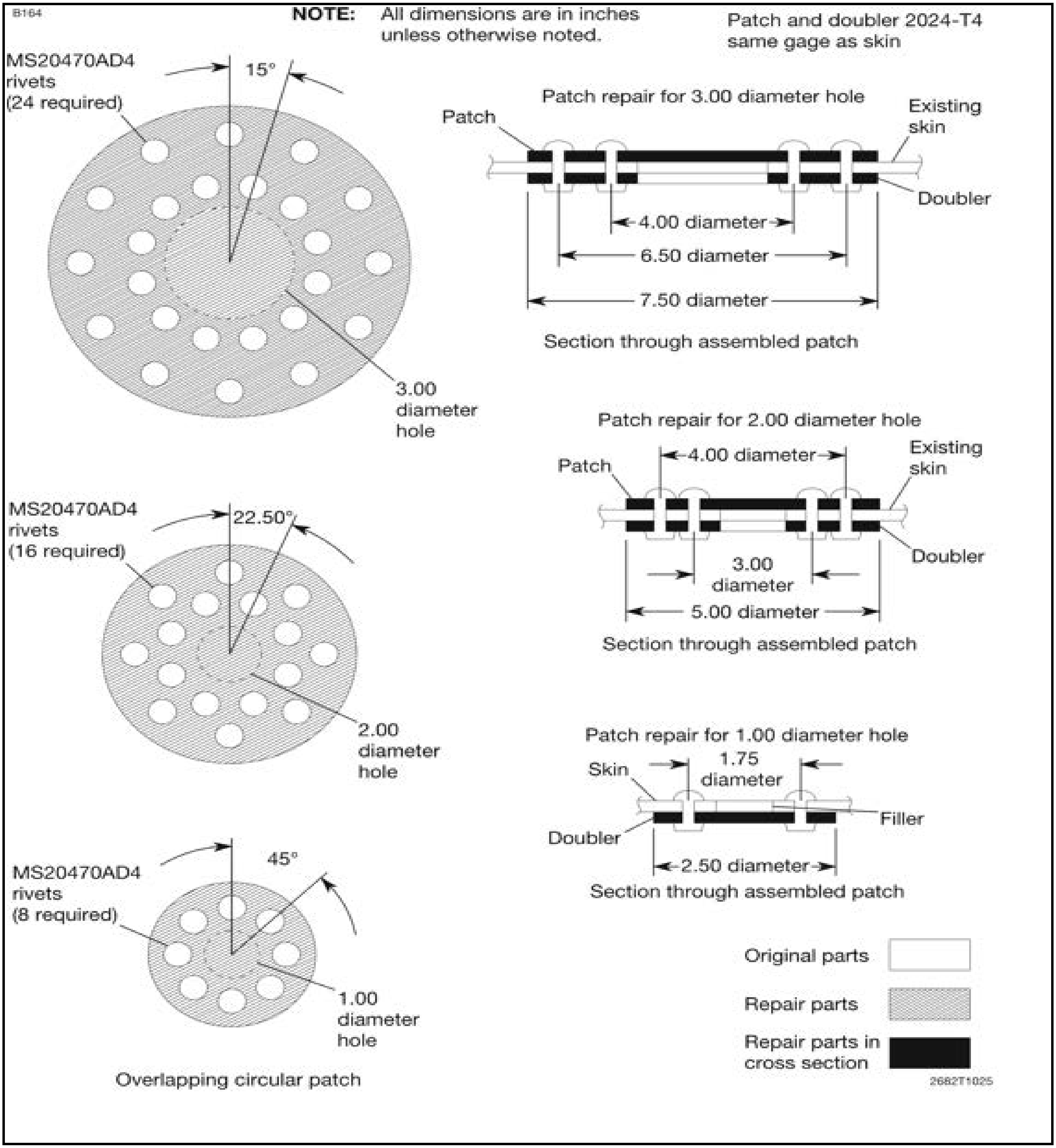


Figure 801 : Sheet 4 : Skin Repair

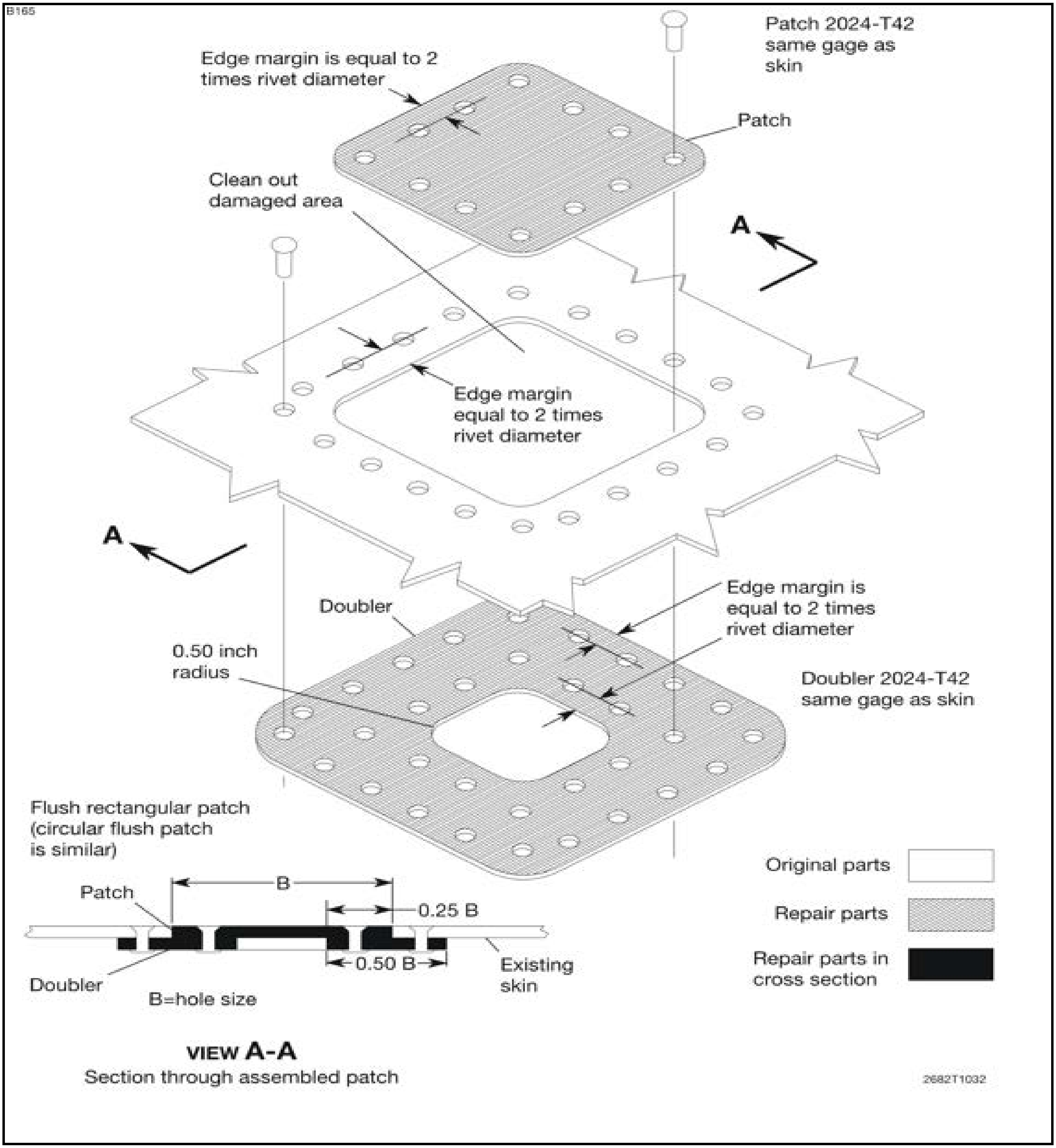


Figure 801 : Sheet 5 : Skin Repair

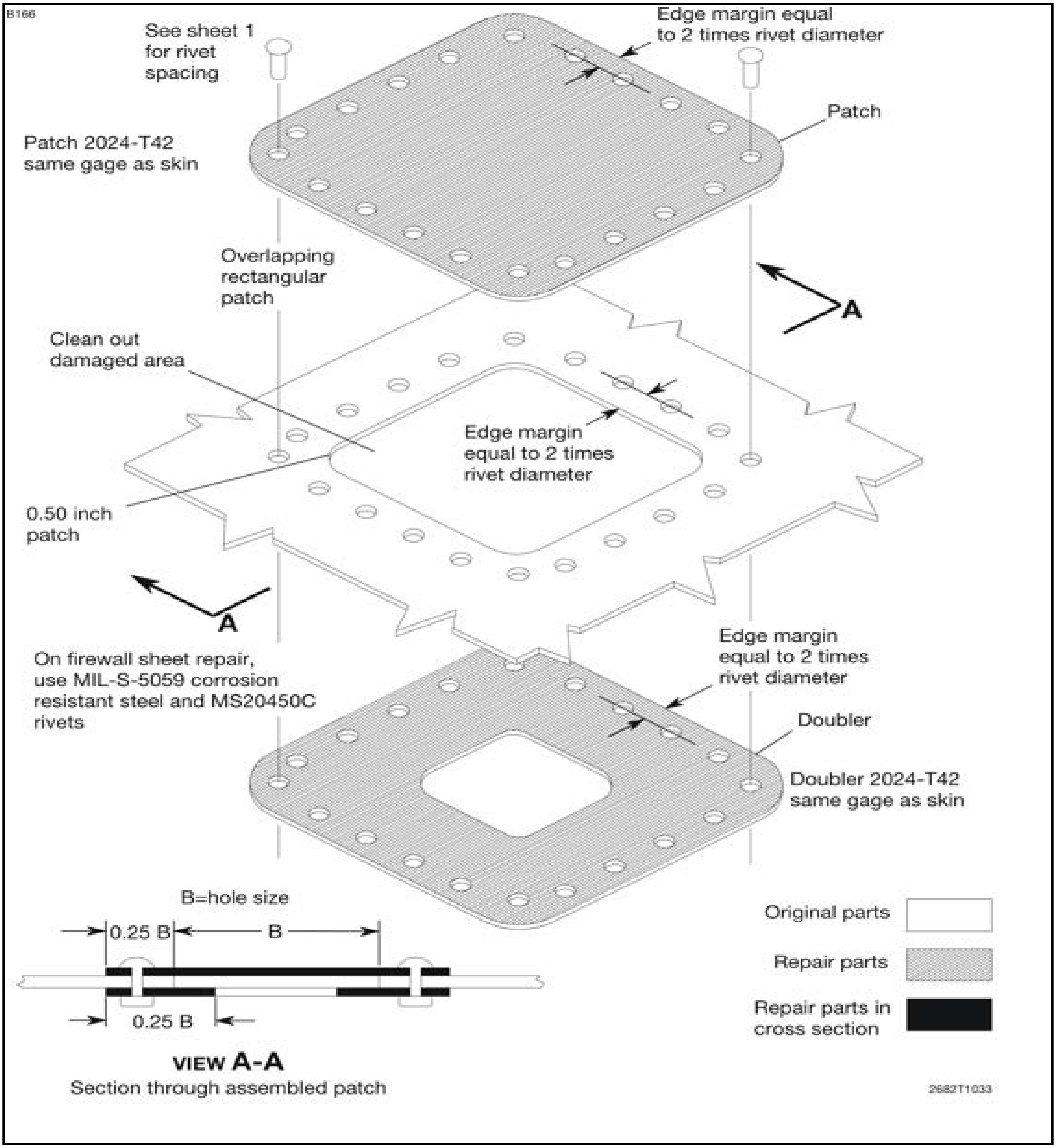
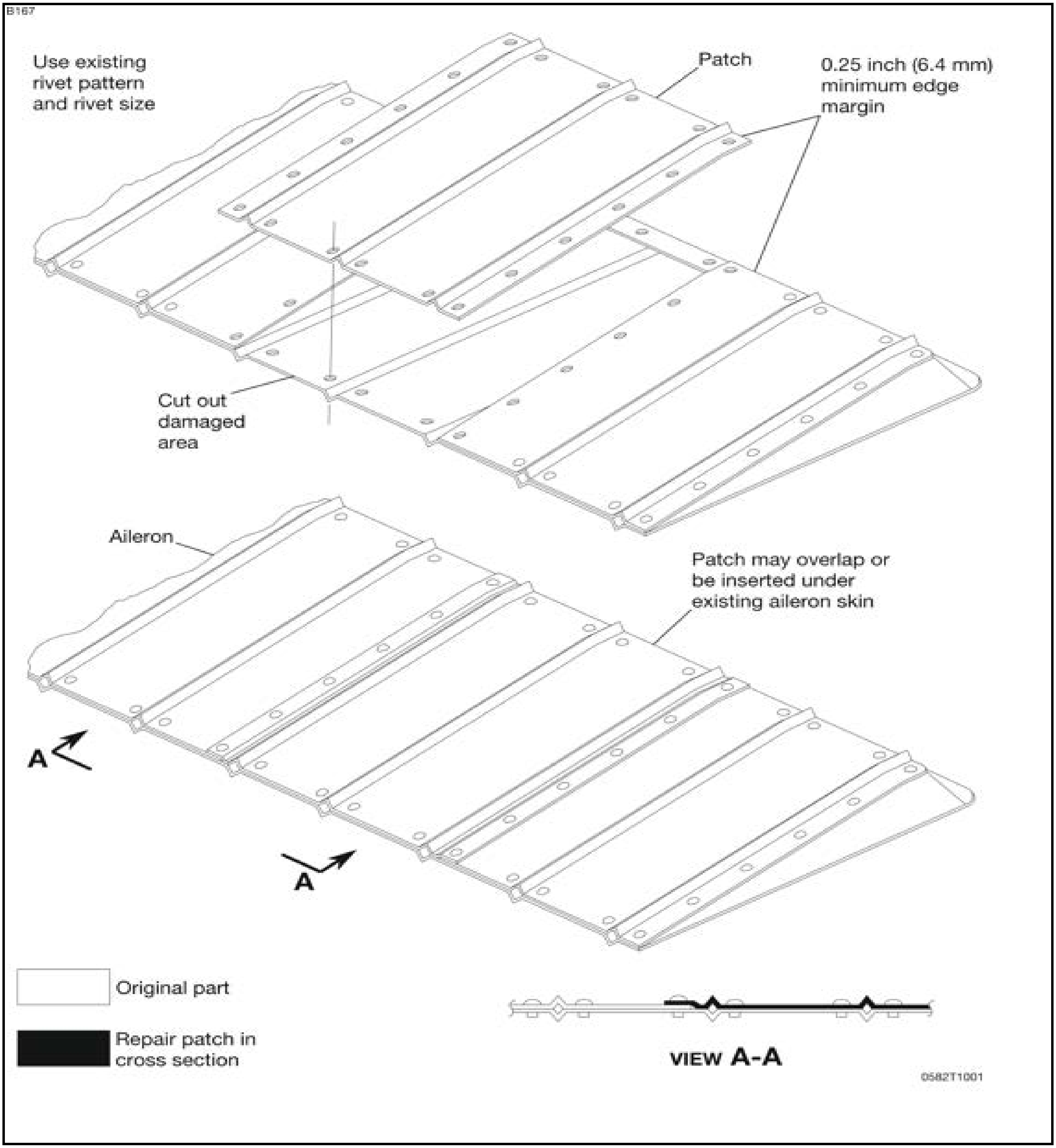


Figure 802 : Sheet 1 : Corrugated Skin Repair



VERTICAL STABILIZER

1. General

A. The vertical stabilizer is of conventional aluminum construction utilizing spars, ribs, and skins.

2. Vertical Stabilizer and Dorsal

A. The vertical stabilizer and dorsal are constructed jointly to form a single unit.

3. Negligible Damage

A. The same criteria which is used to define "negligible damage" to the fuselage may be applied to the vertical stabilizer. Refer to Chapter 53, Fuselage Damage Classification for a complete description of negligible damage.

4. Repairable Damage

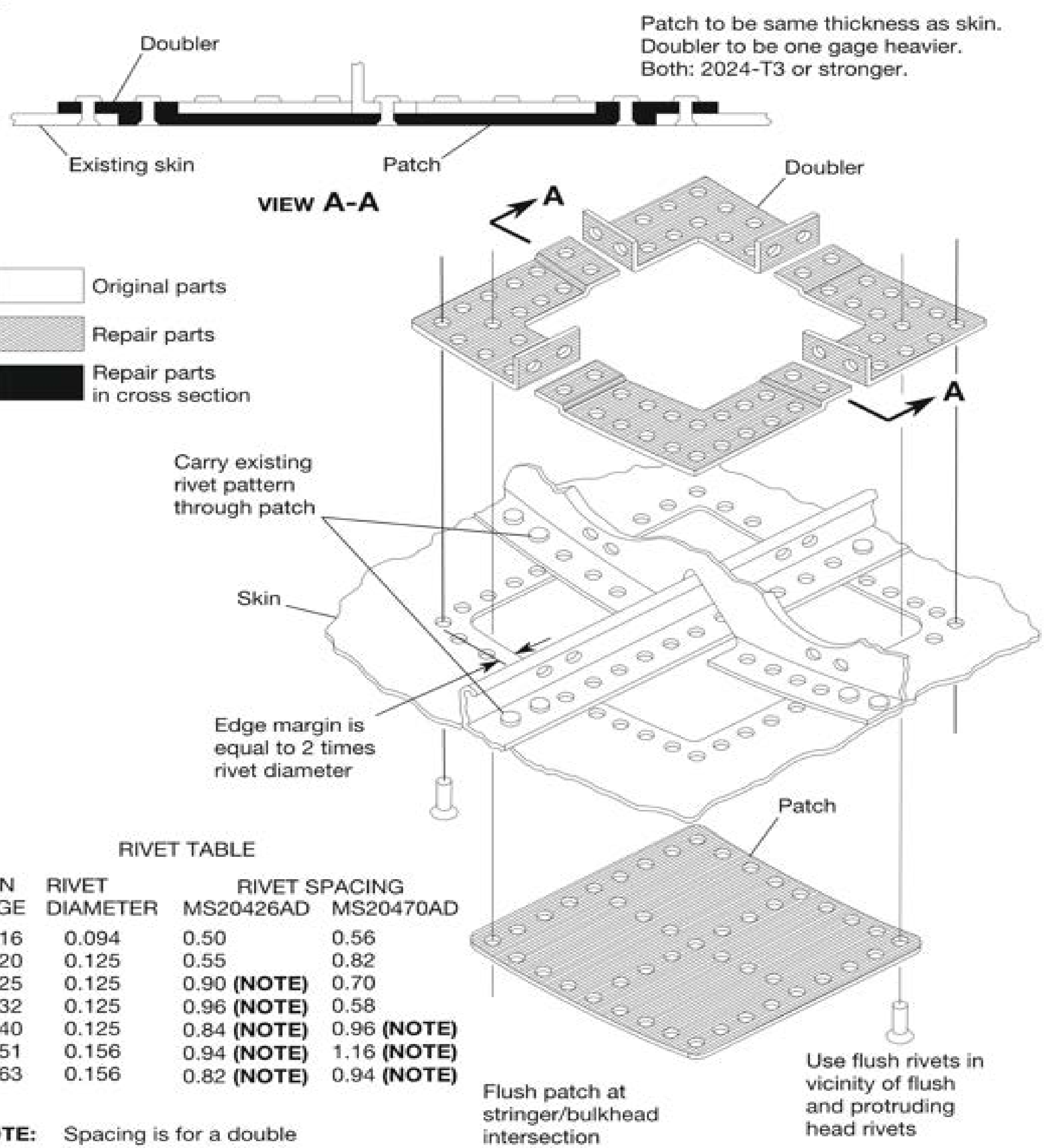
A. Skin damage exceeding that considered negligible that can be repaired as illustrated in Chapter 51, Typical Skin Repairs, Figure 801. For skin damage which includes corrugations, Refer to Chapter 51, Typical Skin Repairs, Figure 802. Access to the internal fin structure is best gained by removing skin attaching rivets on one side of the rear spar and ribs, and springing back the skin. Access to the stabilizer may be gained by removing skin attaching rivets on one side and springing back the skin. If the damaged area would require a repair which could not be made between adjacent ribs, or a repair would be located in an area with compound curves, replacement of parts is recommended.

5. Replacement Damage

A. Hinge brackets and small ribs should be replaced rather than repaired. In general, where parts are available, the easiest and most satisfactory repairs can be accomplished by replacing the damaged parts.

B. If the damaged area would require a repair which would not be made between adjacent ribs, or the repair would be located in an area with compound curves, complete skin panels must be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where damage is extensive, replacement of the entire assembly is recommended.

Figure 801 : Sheet 1 : Skin Repair



RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
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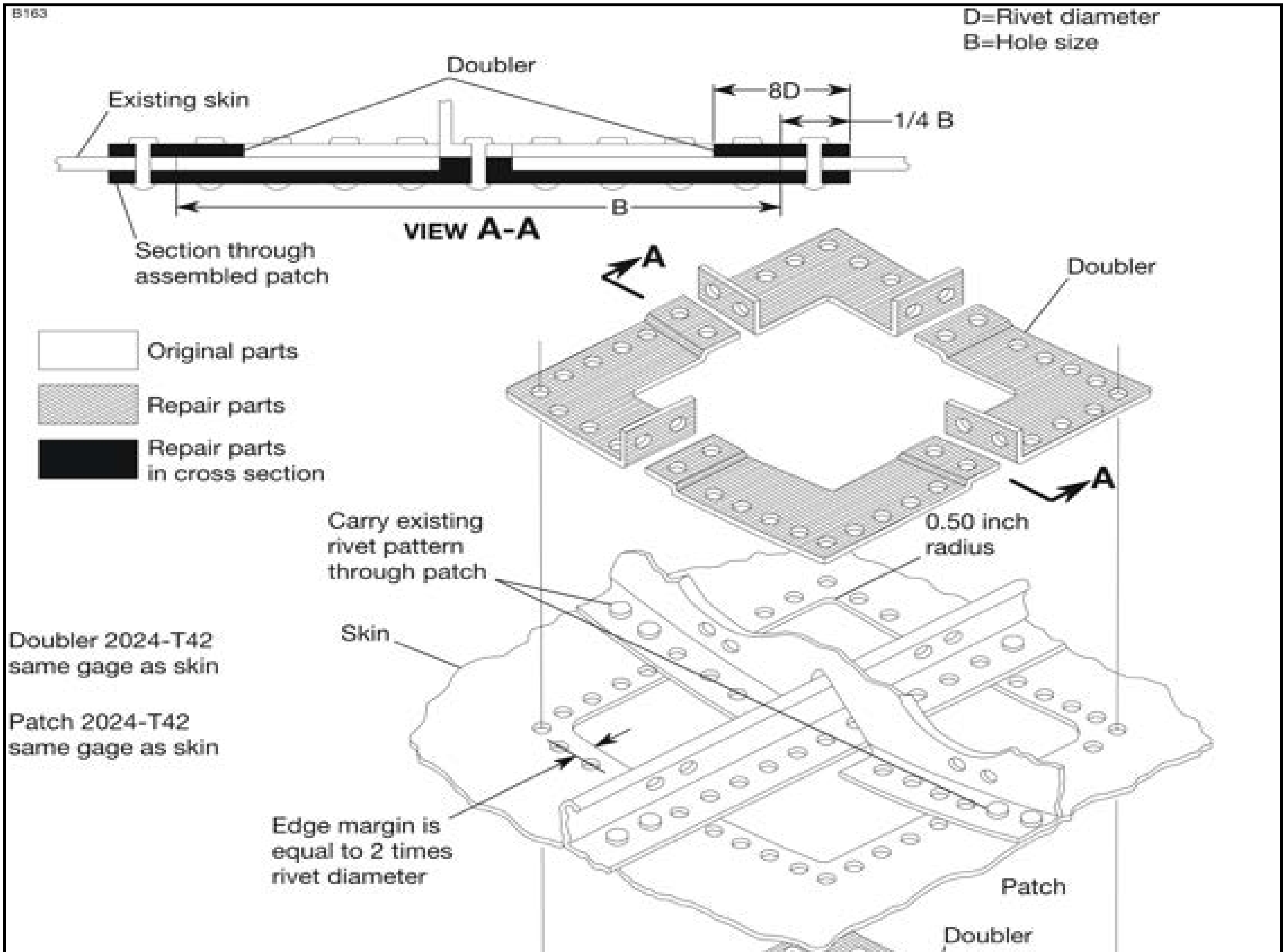
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 2 : Skin Repair



RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
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0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 3 : Skin Repair

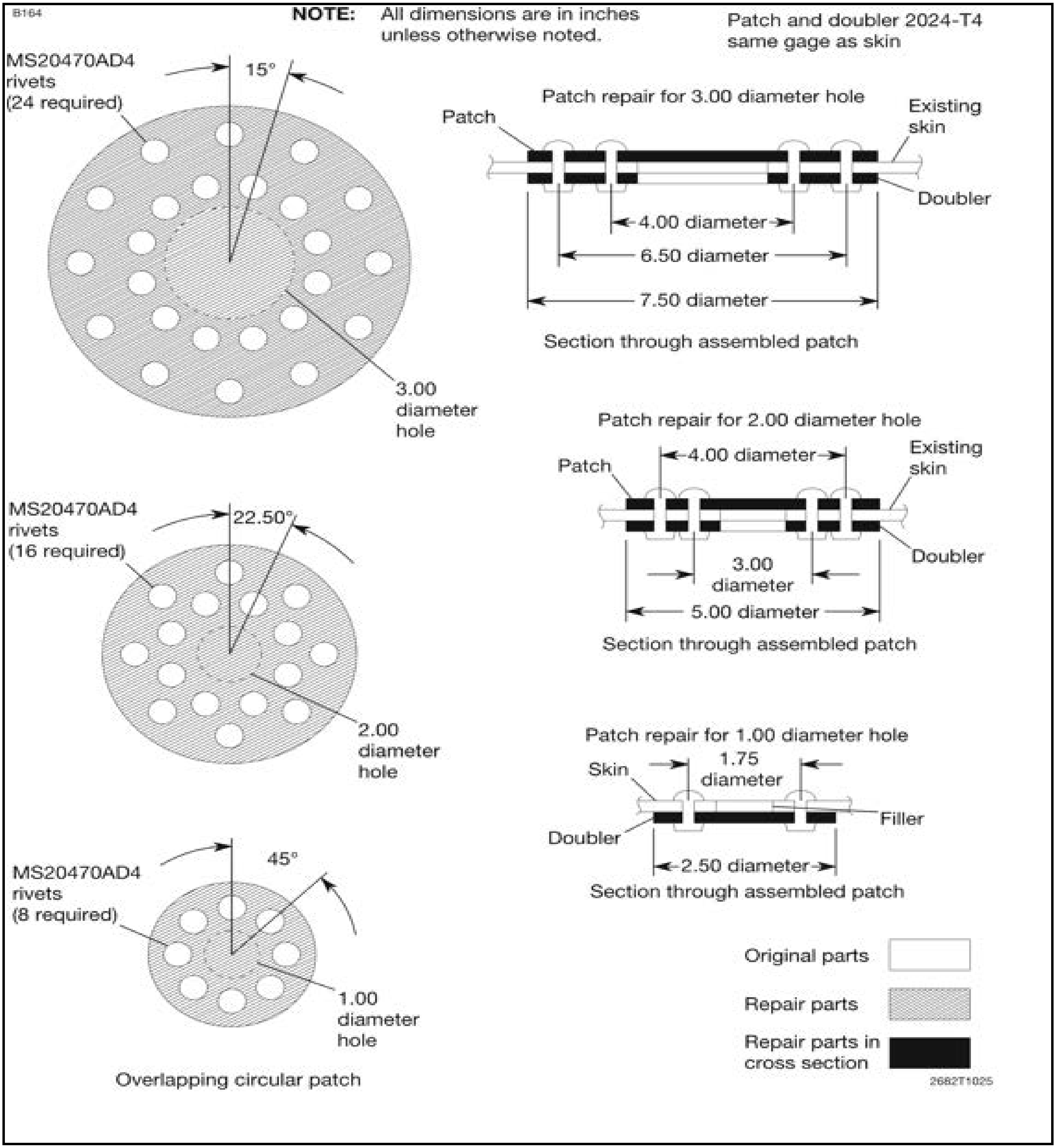


Figure 801 : Sheet 4 : Skin Repair

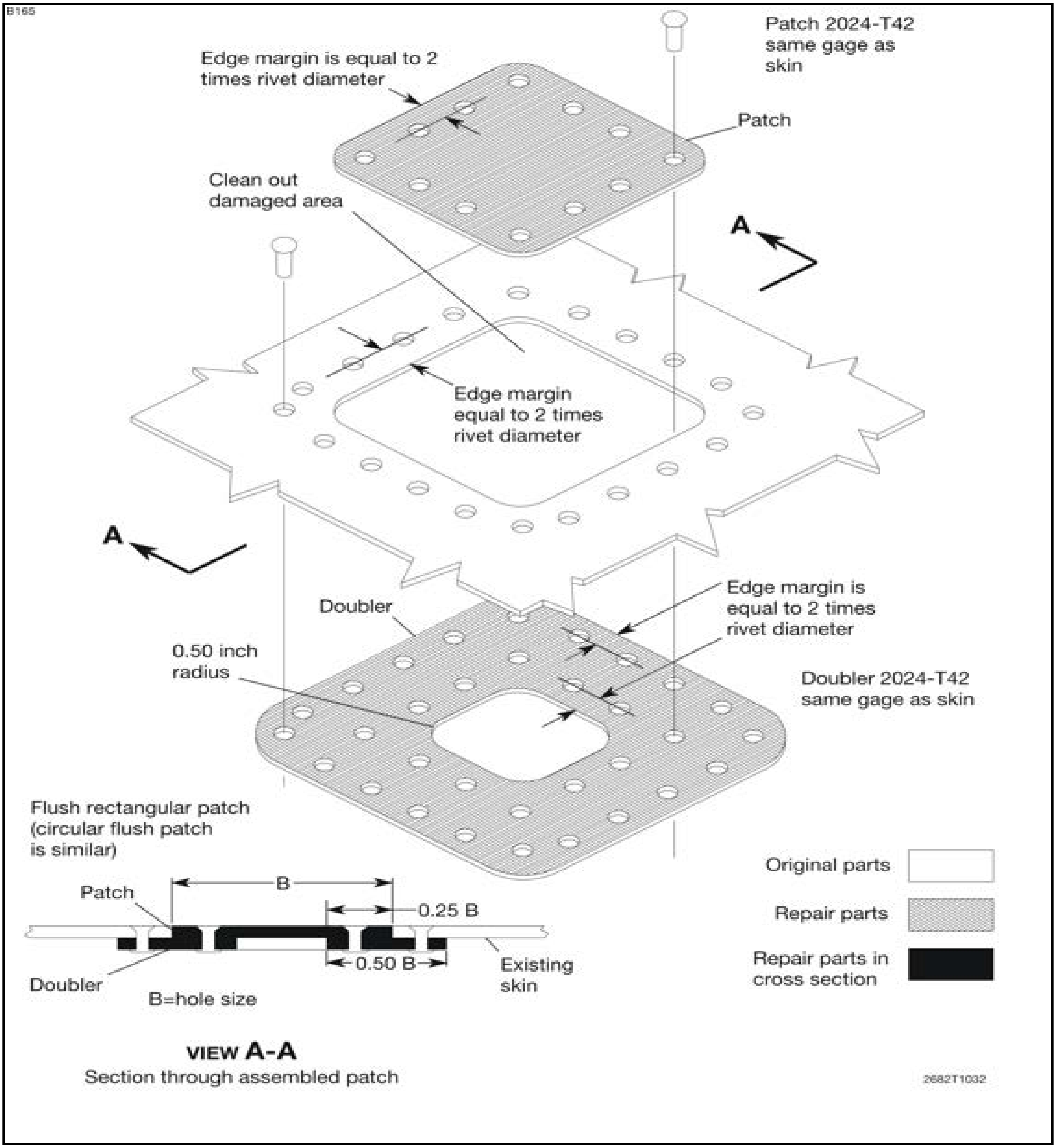


Figure 801 : Sheet 5 : Skin Repair

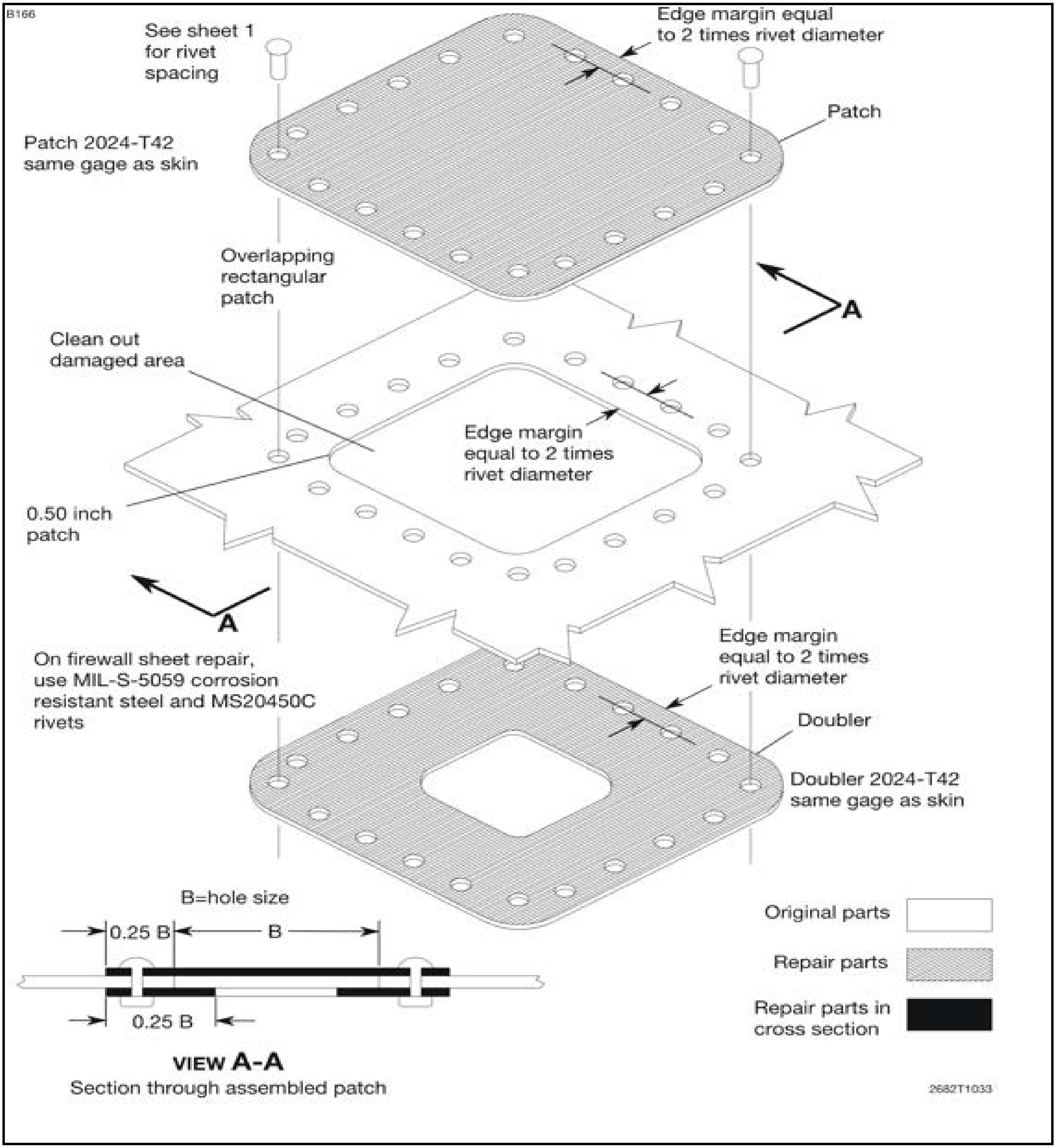
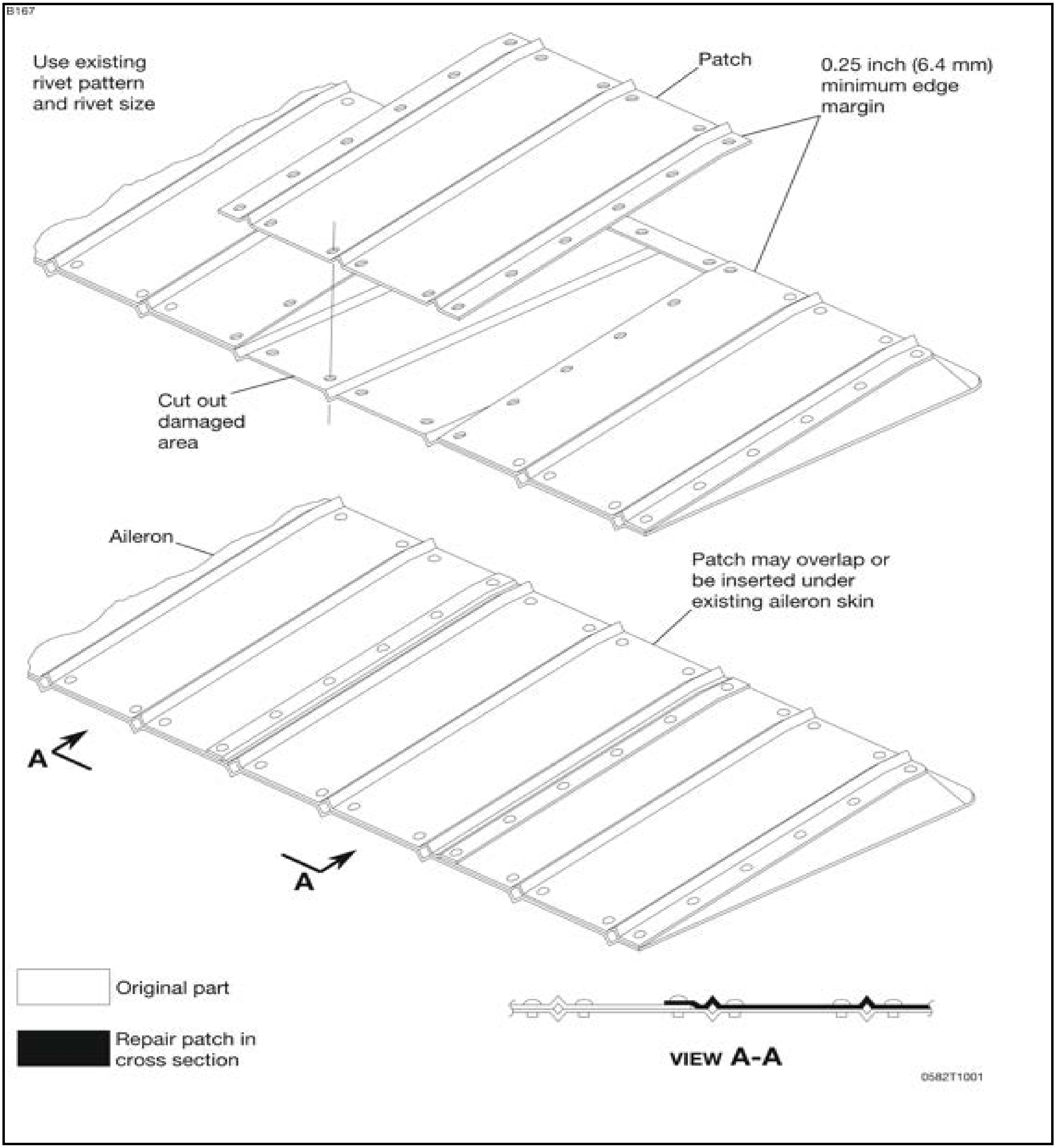


Figure 802 : Sheet 1 : Corrugated Skin Repair



RUDDER

1. Rudder

A. The rudder is constructed of a spar, ribs, and skin. A torque tube, incorporating a lower hinge bracket, is attached to the lower leading edge. A balance weight is bolted to the upper tip leading edge.

2. Negligible Damage

A. Minor skin dents and nicks are considered negligible and should be worked out by burnishing.

3. Repairable Damage

A. Skin damage exceeding that considered negligible damage, can be repaired by patching. Typical repairs are illustrated in Chapter 51, Typical Skin Repair and Control Surface Repair.

B. A flight control surface which has been repaired or replaced must be balanced in accordance with the procedures outlined in Chapter 51, Flight Control Surface Balancing.

4. Replacement Damage

A. Assemblies that have been twisted or warped beyond usable limits and parts with extensive corrosion damage are considered replaceable. Small parts which may be easily fabricated from materials available locally should be replaced.

STANDARD PRACTICES AND STRUCTURES - GENERAL

1. General

A. Chapter 51 describes general repair practices, materials and procedures which are applicable throughout the subsequent chapters. This chapter also provides general information for performing any structural repairs.

B. Unless otherwise specified, all dimensions are in inches; forces are in pounds and torques are in inch-pounds.

C. The airplanes are of an all metal, semimonocoque construction, with the skin carrying a portion of all structural loads.

D. To obtain information covering dimensions, areas and stations diagrams, refer to current appropriate Model 172, Model 182 or Model 206 Maintenance Manual, Chapter 6, Dimensions and Areas.

E. For information covering leveling and weighing, refer to current appropriate Model 172, Model 182 or Model 206 Maintenance Manual, Chapter 8, Leveling and Weighing.

2. Description

A. The fuselage is of conventional semimonocoque construction. Construction consists of formed bulkheads, longitudinal stringers, reinforcing channels, and skin panels.

B. The wings are of an all metal, strut-braced, semimonocoque construction, utilizing two spars. Each wing consists of a wing panel with an integral fuel bay, an aileron and a flap.

C. The empennage group is of a fully cantilevered design and consists of a conventional rudder and elevator configuration. The horizontal stabilizer is of one-piece construction, consisting of spars, ribs, and skins. Elevators are constructed of spars, ribs, and skin panels. The skin panels are riveted to the ribs and spars. A balance weight is located in the outboard end of each elevator, forward of the hinge line. An elevator trim tab is attached to the right hand elevator and is constructed of a spar, ribs, and skin, riveted together. The vertical stabilizer is constructed of a forward and aft spar, ribs, and skin. The rudder is constructed of spars, ribs, and skin panels.

D. The main landing gear consists of 6150M alloy spring-steel, cantilevered with attaching parts of high-strength 7075-T73 aluminum alloy forgings. Nose gear components are 4130 alloy steel and 7075-T73 aluminum alloy forgings.

E. The engine mount is constructed of welded 4130 steel tubing on the 172 and 182. The 206 has a built-up aluminum sheet metal engine mount.

F. The removable engine cowling is made of 2024 Alclad secured with quarter turn fasteners.

DAMAGE INVESTIGATION AND CLASSIFICATION

1. General

A. For the purposes of this manual, damage is considered to be a deviation from the original configuration of a structural part that compromises its structural integrity by significantly reducing its strength, significantly decreasing its resistance to fatigue, significantly increasing its susceptibility to corrosion, significantly altering its flutter characteristics, or adversely affecting the flight characteristics of the airplane. This can include - but is not limited to - scratches, dents, dings, gouges, cracks, drill starts, double drilled holes, plastic deformation, reduction in cross-sectional areas, changes in component center-of-gravity, missing or inadequate fasteners, corrosion, dissimilar metal contact, work hardening, temper change due to excessive heat, and so forth.

B. Use good judgment in determining the type of significant change to flat stock structural material. The terms, dent, crease, abrasion, gouge, nick, scratch, crack and corrosion, referred to elsewhere in the manual, are defined below as a guide for this determination, particularly with respect to the external skin of the airplane:

(1) Dent - A dent is normally a damaged area which is depressed with respect to its normal contour. There is no cross sectional area change in the material. Area boundaries are smooth. Its form is generally the result of contact with a relatively smoothly contoured object.

NOTE: A dent-like form of damage to skin may be the result of the peening action of a smoothly contoured object contacting it. If the inner surface of skin shows no contour change, consider that such damage results in a local cross sectional area change.

(2) Crease - A damaged area which is depressed or folded back upon itself in such a manner that its boundaries are sharp or well defined lines or ridges. Consider it to be the equivalent of a crack.

(3) Abrasion - An abrasion is a damaged area of any size which results in a cross sectional area change due to scuffing, rubbing, scraping or other surface erosion. It is usually rough and irregular.

(4) Gouge - A gouge is a damaged area of any size, which results in a cross sectional area change. It is usually caused by contact with a relatively sharp object which produces a continuous, sharp or smooth channel-like groove in the material.

(5) Nick - A nick is a local gouge with sharp edges. Consider a series of nicks, in a line pattern to be the equivalent of a gouge.

(6) Scratch - A scratch is a line of damage of any depth in the material and results in a cross sectional area change. It is usually caused by contact with a very sharp object.

(7) Crack - A crack is a partial fracture or complete break in the material with the most significant cross sectional area change. In appearance, it is usually an irregular line and is normally the result of fatigue failure.

(8) Corrosion - Corrosion, due to a complex electrochemical action, is a damaged area of any size and depth which results in a cross sectional area change. Depth of such pitting damage must be determined by a cleanup operation. Damage of this type may occur on surfaces of structural elements. Refer to Corrosion and Corrosion Control, Section 51-11-00.

C. Use good sense and proper visual measurement in the determination of significant cross sectional area changes of both depth and length of any type (or combinations) of damage mentioned above.

2. Damage Investigation

A. After a thorough cleaning of the damaged area, all structural parts should be carefully examined to determine the extent of damage. Frequently, the force causing the initial damage is transmitted from one member to the next, causing strains and distortions. Abnormal stresses incurred by shock or impact forces on a rib, bulkhead, or similar structure, may be transmitted to the extremity of the structural member, resulting in secondary damage, such as sheared or stretched rivets, elongated bolt holes, or canned skins or bulkheads. Points of attachment should be examined carefully for distortion and security of fastenings in the primary and secondary damaged areas at locations beyond the local damage. This is particularly true with wing tip, horizontal stabilizer tip, or vertical fin tip damage. If the damage is due to an aft load, the rear spars should be checked for indications of compression damage for the full length, including the fuselage components.

3. Damage Classification

A. Damage to the airplane can be divided into three major categories: negligible damage, repairable damage, and major replacement damage. These categories are intended to provide the mechanic with some general guidelines to use in determining the extent and criticalness of any damage. Obviously, there will be some overlapping between categories, and common sense should be used in determining the final action to be taken with regard to any damage.

(1) For damage criteria of specific structure (wings, fuselage, and so forth), refer to applicable chapters within this repair manual.

4. Refinishing Damaged Areas Following Repairs

A. Areas of structure which are damaged and then repaired in the field, must be refinished to restore the original paint and corrosion protectant properties to factory standards. Refer to applicable airplane Maintenance Manual, Chapter 20, Exterior Finish - Cleaning/Painting, for refinishing procedures and required materials.

CORROSION AND CORROSION CONTROL - GENERAL

1. General

A. Corrosion is a natural phenomenon which destroys metal by chemical or electrochemical action and converts it to a metallic compound such as an oxide, hydroxide, or sulfate. All metals used in airplane construction are subject to corrosion. If exposed, attack may take place over an entire metal surface. It may penetrate a surface at random forming deep pits or may follow grain boundaries. Corrosion may be accentuated by stresses from external loads or from lack of homogeneity in the metallic structure or from improper heat treatment. It is promoted by contact between dissimilar metals or with materials which absorb moisture such as wool, rubber, felt, dirt, and so forth.

NOTE: For additional information on corrosion control for aircraft, refer to the FAA Advisory Circular No. 43-4.

(1) Refer to Figure 1 for a simplified illustration of the conditions which must exist for electrochemical corrosion to occur.

(a) There must be a metal that corrodes and acts as the anode.

(b) There must be a less corrodible metal that acts as the cathode

(c) There must be a continuous liquid path between the two metals which acts as the electrolyte, usually condensation and salt or other contamination.

(d) There must be a conductor to carry the flow of electrons from the cathode to the anode. This conductor is usually in the form of a metal-to-metal contact (rivets, bolts, welds, etc.)

(2) The elimination of any one of the four conditions described above will stop the corrosion reaction process as shown in Figure 1.

(3) One of the best ways to eliminate one of the four described conditions is to apply an organic film (such as paint, grease, plastic, etc.) to the surface of the metal affected. This will prevent the electrolyte from connecting the cathode to the anode, and since current cannot flow, it prevents corrosive reaction.

(4) At normal atmospheric temperatures, metals do not corrode appreciably without moisture, but the moisture in the air is usually enough to start corrosive action.

(5) When components and systems constructed of many different types of metals must perform under various climatic conditions, corrosion becomes a complex problem. The presence of salts on metal surfaces (from sea coast operation) greatly increases the electrical conductivity of any moisture present and accelerates corrosion.

(6) Other environmental conditions which contribute to corrosion are:

(a) Moisture collecting on dirt particles.

(b) Moisture collecting in crevices between lap joints, around rivets, bolt, and screws.

2. Types of Corrosion

A. Direct Surface Attack.

(1) The most common type of general surface corrosion results from direct reaction of a metal surface with oxygen in the atmosphere. Unless properly protected, steel will rust and aluminum and magnesium will form oxides. The attack may be accelerated by salt spray or salt bearing air, by industrial gasses, or by engine exhaust gasses.

B. Pitting.

(1) While pitting can occur in any metal, it is particularly characteristic of passive materials such as alloys of aluminum, nickel, and chromium. It is first noticeable as a white or gray powdery deposit similar to dust, which blotches the surface. When the deposits are cleaned away, tiny pits can be seen in the surface.

C. Dissimilar Metal Corrosion.

(1) When two dissimilar metals are in contact and are connected by an electrolyte (continuous liquid or gas path), accelerated corrosion of one of the metals occurs. The most easily oxidized surface becomes the anode and corrodes. The less active member of the couple becomes the cathode of the galvanic cell. The degree of attack depends on the relative activity of the two surfaces; the greater the difference in activity, the more severe the corrosion. Relative activity in descending order is as follows:

(a) Magnesium and its alloys.

(b) Aluminum alloys 1100, 3003, 5052, 6061, 220, 355, 356, cadmium, and zinc.

(c) Aluminum alloys 2014, 2017, 2024, and 7075.

(d) Iron, lead, and their alloys (except stainless steel).

(e) Stainless steels, titanium, chromium, nickel, copper, and their alloys.

(f) Graphite (including dry film lubricants containing graphite).

D. Intergranular Corrosion.

(1) Selective attack along the grain boundaries in metal alloys is referred to as intergranular corrosion. It results from lack of uniformity in the alloy structure. It is particularly characteristic of precipitation hardened alloys of aluminum and some stainless steels. Aluminum extrusions and forgings in general may contain nonuniform areas, which in turn may result in galvanic attack along the grain boundaries. When attack is well advanced, the metal may blister or delaminate which is referred to as exfoliation.

E. Stress Corrosion.

(1) This results from the combined effect of static tensile stresses applied to a surface over a period of time. In general, cracking susceptibility increases with stress, particularly at stresses approaching the yield point, and with increasing temperature, exposure time, and concentration of corrosive ingredients in the surrounding environment. Examples of parts which are susceptible to stress corrosion cracking are aluminum alloy bell cranks, landing gear shock struts with pipe thread-type grease fittings, clevis points, and shrink fits.

F. Corrosion Fatigue.

(1) This is a type of stress corrosion resulting from the cyclic stresses on a metal in corrosive surroundings. Corrosion may start at the bottom of a shallow pit in the stressed area. Once attack begins, the continuous flexing prevents repair of protective surface coating or oxide films and additional corrosion takes place in the area of stress.

3. Typical Corrosion Areas

A. This section lists typical areas of the airplane which are susceptible to corrosion. These areas should be carefully inspected at periodic intervals to detect corrosion as early as possible.

(1) Engine Exhaust Trail Areas.

(a) Gaps, seams, and fairings on the lower fuselage, aft of the engine exhaust pipe(s) are typical areas where deposits may be trapped and not reached by normal cleaning methods.

(b) Around rivet heads, skin laps and inspection covers on the airplane lower fuselage aft of the engine exhaust pipe(s) should be carefully cleaned and inspected.

(2) Battery Box and Battery Vent Opening.

(a) The battery, battery cover, battery box, and adjacent areas, especially areas below the battery box where battery electrolyte may have seeped, are particularly subject to corrosive action. If spilled battery electrolyte is neutralized and cleaned up at the same time of spillage, corrosion can be held to a minimum by using a baking soda solution to neutralize the lead acid-type battery electrolyte. If baking soda is not available, flood the area with water.

(3) Stainless Steel control cables.

(a) Checking for corrosion on control cables is normally accomplished during the preventative maintenance check. During preventative maintenance, broken wire and wear of the control cable is also checked.

(b) If the surface of the cable is corroded, carefully force the cable open by reverse twisting and visually inspect the interior. Corrosion on the interior strands of the cable constitutes failure and the cable must be replaced. If no internal corrosion is detected, remove loose external rust and corrosion with a clean, dry, coarse-weave rag or fiber brush.

NOTE: Do not use metallic wools or solvents to clean installed cables. Use of metallic wool will embed dissimilar metal particles in the cables and create further corrosion. Solvents will remove internal cable lubricant, allowing cable strands to abrade and further corrode.

(c) After thorough cleaning of the exterior cable surface, apply a light coat of lubricant (VV-L-800) to the external cable surface.

4. Corrosion Detection

A. The primary means of corrosion detection is visual, but in situations where visual inspection is not feasible, other techniques must be used. The use of liquid dye penetrants, magnetic particle, X-ray, and ultrasonic devices can be used, but most of these sophisticated techniques are intended for the detection of physical flaws within metal objects rather than the detection of corrosion.

(1) Visual Inspection.

(a) A visual check of the metal surface can reveal the signs of corrosive attack, the most obvious of which is a corrosive deposit. Corrosion deposits of aluminum or magnesium are generally a white or grayish-white powder, while the color of ferrous compounds varies from red to dark reddish-brown.

1 The indications of corrosive attack are small localized discoloration of the metal surface. Surfaces protected by paint or plating may only exhibit indications of more advanced corrosive attack by the presence of blisters or bulges in the protective film. Bulges in lap joints are indications of corrosive buildup which is well advanced.

2 In may cases, because the inspection area is obscured by structural members, equipment installations, or for other reasons, it is awkward to check visually. In such cases, mirrors, boroscopes, or like devices must be used to inspect the obscured areas. Any means which allows a thorough inspection can be used. Magnifying glasses are valuable aids for determining whether or not all corrosion products have been removed during cleanup operations.

(2) Liquid Dye Penetrant Inspection.

(a) Inspection for large stress-corrosion or corrosion fatigue cracks on nonporous or nonferrous metals may be accomplished using dye penetrant processes. The dye applied to a clean metallic surface will enter small openings or cracks by capillary action. After the dye has an opportunity to be absorbed by any surface discontinuities, the excess dye is removed and a developer is applied to the surface. The developer acts like a blotter to draw the dye from cracks or fissures back to the surface, giving visible indication of any fault that is present on the surface. The magnitude of the fault is indicated by the quantity of dye brought back to the surface by the developer.

5. Corrosion Damage Limits

A. Following cleaning and inspection of the corroded area, the actual extent of the damage may be evaluated using the following general guidelines and sound maintenance judgement.

(1) Determine the degree of corrosion damage (light, moderate, or severe) with a dial-type depth gage, if accessibility permits. If the area is inaccessible, clay impressions, or any other means which will give accurate results, should be used. In the event the corrosion damage is severe or worse, contact Cessna Propeller Aircraft Product Support, P.O. Box 7706, Wichita, KS 67277 USA, for assistance.

(2) Light Corrosion.

(a) Characterized by discoloration or pitting to a depth of approximately 0.001 inch maximum.

(3) Moderate Corrosion.

(a) Appears similar to light corrosion except there may be blistering or some evidence of scaling or flaking. Pitting depths may be as deep as 10 percent of the material thickness.

(4) Severe Corrosion.

(a) General appearance may be similar to moderate corrosion with severe blistering exfoliation and scaling or flaking. Pitting depths may be as deep as 15 percent of the material thickness. This type of damage is normally repaired by complete part replacement, but patches or other types of repair may be available. Contact Cessna Propeller Aircraft Product Support, P.O. Box 7706, Wichita, KS 67277 USA, for assistance.

6. Corrosion Removal

A. The following methods are provided as an aid in determining the correct method for corrosion removal.

(1) Standard Methods

(a) Several standard methods are available for corrosion removal. The method normally used to remove corrosion are chemical treatments, hand sanding with aluminum oxide or metal wool that is of similar material to the surface being treated, and mechanical sanding or buffing with abrasive mats or grinding mats. The method used depends on the metal and the degree of corrosion. Select appropriate materials from the abrasives chart as illustrated in Figure 2.

(2) Aluminum and Aluminum Alloys.

(a) Most formed aluminum parts and skins of this airplane consist of various gauges of sheet 2024-T3 and 2024-T42 Alclad. Alclad is formed by laminating a thin layer of relatively pure aluminum, one to five mils thick, over the higher strength base alloy surface. Since pure aluminum has relatively greater corrosion resistance than the stronger alloy, it is imperative the clad surface be maintained intact to the maximum extent possible and to avoid unnecessary mechanical removal of the protective coating. In addition, aluminum parts receive a chemical conversion coating and are then epoxy-primed.

1 Clean area to be reworked. Strip paint as required.

2 To determine the extent of corrosion damage refer to Corrosion Damage Limits.

3 Remove light corrosion by light hand sanding.

4 Mechanically remove moderate or severe corrosion by hand scraping with a carbide-tipped scraper or fine-fluted rotary file.

5 Remove residual corrosion by hand sanding. Select appropriate abrasive from Figure 2.

6 Blend into surrounding surface any depressions resulting from rework and surface finish with 400 grit abrasive paper.

7 Clean reworked area.

8 Determine depth of faired depressions to ensure that rework limits have not been exceeded.

9 Chemically conversion-coat rework area.

10 Restore original finish (epoxy prime).

(3) Steel.

(a) Unlike some other metal oxides, the red oxide of steel (rust) will not protect the underlying base metal. The presence of rust actually promotes additional attack by attracting moisture from the air and acting as a catalyst in causing additional corrosion to take place. Light red rust on bolt heads, hold-down nuts, and other nonstructural hardware is generally not dangerous. However, it is indicative of a general lack of maintenance and possible attack in more critical areas, such as highly stressed steel landing gear components and flight control surface actuating components. When paint failures occur or mechanical damage exposes highly stressed steel surfaces to the atmosphere, even small amounts of rusting are potentially dangerous and must be removed. The most practical means of controlling corrosion of steel is the complete removal of the corrosion products by mechanical means. Except on highly stressed steel surfaces, the use of abrasive papers, small power buffers and buffing compounds, and wire brushes are acceptable for clean up procedures. However, residual rust usually remains in the bottom of small pits and crevices.

1 Clean area to be reworked.

2 Strip paint as required.

3 Remove all degrees of corrosion from steel parts using a stainless steel hand brush or hand operated power tool. Alternatively, use dry abrasive blasting process.

4 Remove residual corrosion by hand sanding.

5 After removing all corrosion visible through a magnifying glass, fair depression resulting from rework and finish with 400-grit abrasive paper.

6 Clean reworked area.

7 Determine depth of rework area to ensure rework limits are not exceeded.

8 Prime using rust-inhibitive primer within one hour of rework.

9 Reapply finish topcoat if required.

7. Control of Corrosion on Landing Gear Springs

A. General

(1) The main landing gear springs are made from high strength steel that is shot peened on the lower surface to increase the fatigue life of the part.

(2) The shot peened layer is between 0.010 and 0.020 inch thick.

(3) If the protective layer of paint is chipped, scratched or worn away the steel may corrode (rust).

(a) If the corrosion pit depth is greater than the thickness of the shot peen layer, the gear spring fatigue life will be greatly reduced.

(4) Operation from unimproved surfaces increases the likelihood of damage.

B. Corrosion removal and repair.

(1) If damage to the paint finish of the landing gear spring is found, examine the damage area for signs of corrosion (red rust).

WARNING: High strength steel parts are very susceptible to hydrogen embrittlement. Acidic solutions, such as rust removers and paint strippers have been found to cause hydrogen embrittlement. Hydrogen embrittlement is an undetectable, time delayed process. Since the process is time delayed, failure may occur after the part is returned to service. The only reliable way to prevent hydrogen embrittlement is not to use chemical rust removers or paint strippers on landing gear springs.

(2) Carefully remove any rust by light sanding.

(a) The sanding should blend the damage into the surrounding area in an approximate 20:1 ratio.

EXAMPLE: An 0.005 inch pit must be blended to a 0.10 inch radius or 0.20 inch diameter.

(b) Make sure the final sanding marks are along an inboard to outboard direction, or along the long dimension of the spring.

(3) After the sanding is complete, measure the depth of the damage removal.

(a) Make sure the depth of the damage is not more than 0.010 to 0.012 inch deep and has not penetrated the shot peen layer.

(4) If the shot peened layer has been penetrated, the gear spring must be removed and sent to an approved facility to be re-shot peened.

(a) The shot peen specification is to be Almen intensity of 0.007C to 0.010C using 330 steel shot.

(b) Shot peen only the repaired area.

(5) After the spring is installed, refinish any damaged or removed finish paint.

NOTE: Additional information regarding corrosion control can be found in AC-43-4, Chapter 6, or AC43.13-1B Chapter 6.

C. Axle bolt hole corrosion.

(1) Operation of an airplane on skis increases the loads on the lower part of the gear spring because of the unsymmetrical and twisting loads.

(a) The increased loads have produced spring fractures that originate from pits in the axle attach holes.

1 Catastrophic failures have occurred from fatigue cracks as small as 0.003 to 0.010 inch long that originated at pits.

(b) Although operation on skis causes more loads, the criteria applies to all airplanes.

(2) There is no acceptable damage depth for pits that develop in the axle bolt holes. If pits or corrosion is found it must be removed by reaming, subject to the following limitations:

(a) Remove the minimum material required to clean up the damage.

(b) Make sure the diameter of the axle attachment holes is 0.383 inches maximum for 3/8 inch bolts.

(c) Make sure the diameter of the axle attachment holes is 0.321 inches maximum for 5/16 inch bolts.

(d) If reaming to the maximum dimension does not remove all signs of corrosion, discard the landing gear spring.

Figure 1 : Sheet 1 : Corrosion Identification

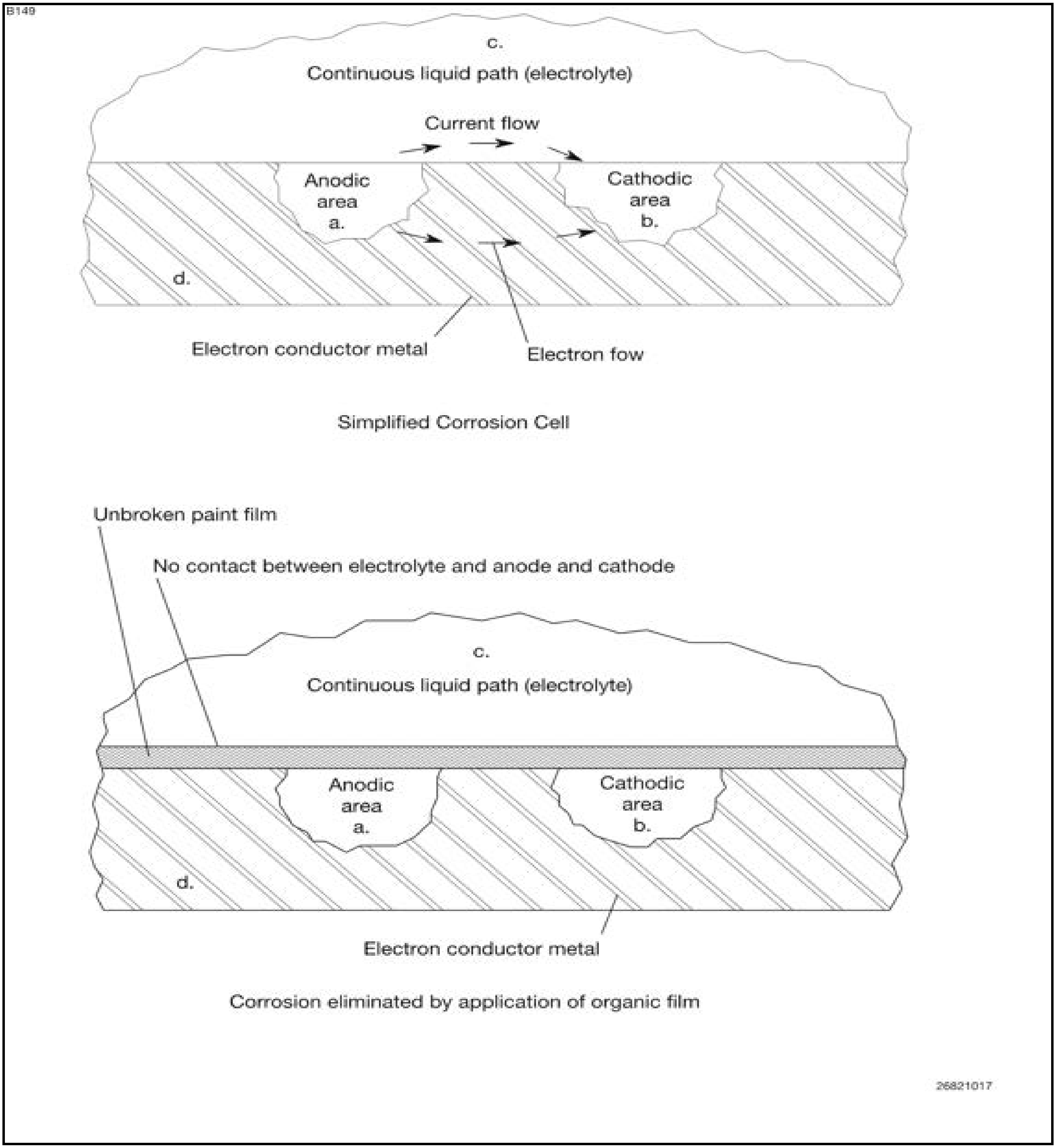


Figure 2 : Sheet 1 : Abrasives for Corrosion Removal

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Metals or Materials to be Processed	Restrictions	Operation	Abrasive Paper or Cloth			Abrasive Fabric or Pad	Aluminum	Stainless Steel	Pumice 350 Mesh or Finer	Abrasive Wheel
			Aluminum Oxide	Silicon Carbide	Garnet					
Ferrous Alloys	Does Not Apply to Steel Heat-Treated to Strengths to 220,000 psi and Above	Corrosion Removal or Fairing	150 Grit or Finer	180 Grit or Finer		Fine to Ultra-Fine	x	x	x	x
		Finishing	400				x	x	x	
Aluminum Alloys Except Clad Aluminum	Do Not Use Silicon Carbide Abrasive	Corrosion Removal or Fairing	150 Grit or Finer		7/0 Grit or Finer	Very Fine and Ultra-Fine	x		x	x
		Finishing	400				x		x	
Clad Aluminum	Sanding Limited to the Removal of Minor Scratches	Corrosion Removal or Fairing	240 Grit or Finer		7/0 Grit or Finer	Very Fine and Ultra-Fine			x	x
		Finishing	400						x	
Magnesium Alloys		Corrosion Removal or Fairing	240 Grit or Finer			Very Fine and Ultra-Fine	x		x	x
		Finishing	400				x		x	

REPAIR MATERIALS

1. General

A. This section provides information covering the materials used for repairs.

2. Repair Materials

A. In general, materials used in the airplane include 2024 and 7075 aluminum alloys. Sheet material requiring little or no forming will generally be of 2024-T3 clad aluminum. Formed parts, such as ribs, bulkheads, etc., will be of 2024-T42 clad aluminum. Forgings are of 7075-T73. Materials used in repairs should be, where possible, of the same material and heat treated to the same temper. The thickness should be equal to or greater than the material being repaired unless otherwise noted. If the type of material cannot be readily determined and the forming required is not severe, 2024-T3 may be used generally, since the strength of -T3 is greater than that of -T4 or -T42 (-T4 and -T42 may be used interchangeably, but they may not be substituted for -T3). When it is necessary to form a part with a smaller bend radius than the standard bend radius for 2024-T3 or 2024-T4, use 2024-0, and then heat treat to 2024-T42 after forming. In the event that the original temper was -T3, it may be necessary to increase the material thickness sufficiently to provide strength equivalent to that of the original part. It is often practical to cut repair pieces from service parts listed in the parts catalog. Steel sheet material for reinforcement is 4130 steel heat treated to a minimum of 90,000 pounds per square inch. The firewall is annealed stainless steel sheet.

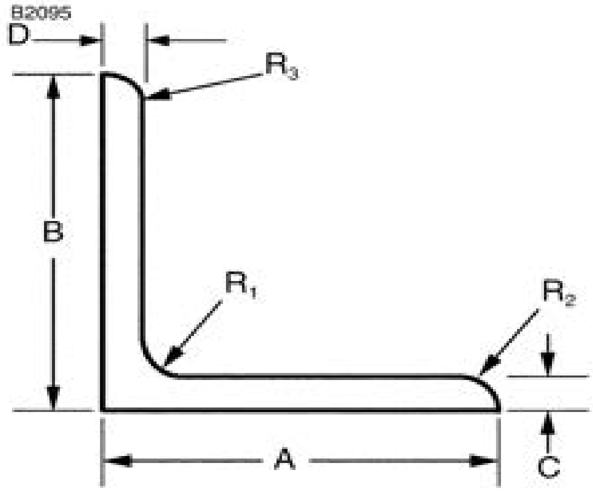
3. Extrusions and Formed Sections

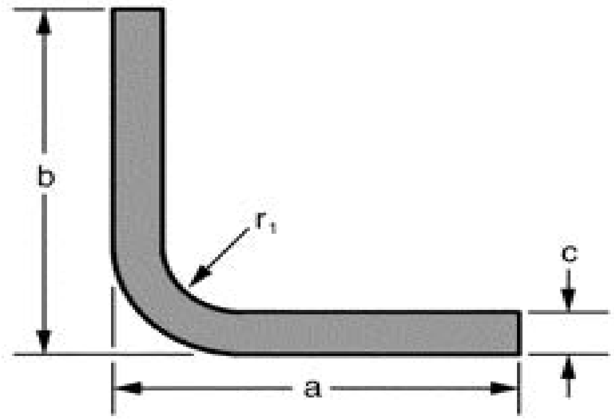
A. (Refer to Figure 1.) This section provides information on extrusions and formed sections. It also provides details of equivalent built up sections for extrusions. Alternative materials are provided for equivalent sections and formed sections.

B. Use of equivalent built up sections for extrusions are to be utilized only when the proper extrusions are not available. They are intended to be cold formed from raw stock in sheet forms that have already been heat treated to the required condition. But when workability is required, the parts may be formed from 2024-0 aluminum and then heat treated to the -T42 condition before installation. When forming the section, care must be taken to ensure that the bend radii and the cross section areas are not reduced below the minimum shown in the diagrams. In some cases, equivalent sections are not given because it is impractical to build them from sheet stock.

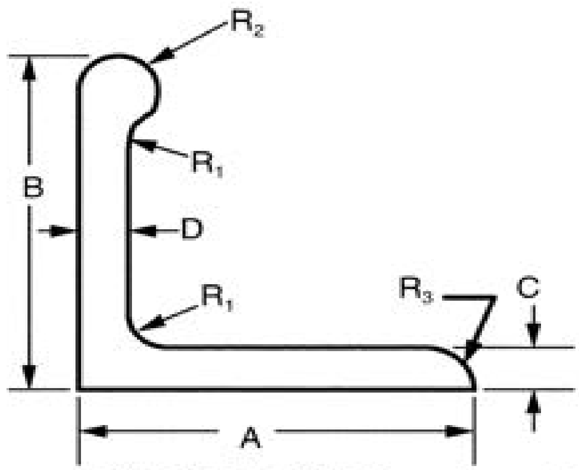
C. Illustrated Parts Catalogs do not identify the standard shape from which parts are fabricated. Detailed measurements of damaged areas are required to determine the standard section from which parts are fabricated.

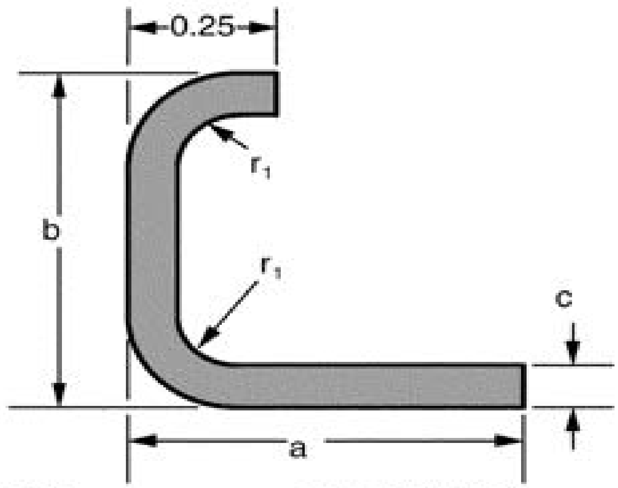
Figure 1 : Sheet 1 : Extrusions and Formed Sections





STD. SHAPE	EXTRUDED ANGLE MATERIAL	ORIGINAL MATERIAL A	B	C	D	R_1	R_2	R_3	SUBSTITUTION 2024 SHEET a	b	c	r_1
S-85	2024-T3511	0.625	0.625	0.045	0.045	0.060	0.045	0.045	0.625	0.625	0.040	0.050
S-97	2024-T3511	0.875	0.875	0.063	0.063	0.094	0.063	0.063	0.875	0.875	0.063	0.125
S-107	2024-T3511	1.000	0.750	0.062	0.062	0.060	0.031	0.031	1.000	0.750	0.063	0.075
S-111	2024-T3511	0.750	0.750	0.094	0.094	0.125	0.094	0.094	0.750	0.750	0.090	0.125
S-125	2024-T3511	0.750	0.625	0.062	0.062	0.062	0.031	0.031	0.750	0.625	0.063	0.100
S-174	2024-T3511	1.000	1.000	0.062	0.062	0.062	0.031	0.031	1.000	1.000	0.063	0.100
S-376	2024-T3511	0.875	0.750	0.063	0.063	0.125	0.063	0.063	0.875	0.750	0.063	0.100
S-1111	2024-T3511	0.750	0.750	0.050	0.050	0.050	0.025	0.025	0.750	0.750	0.050	0.050





STD. SHAPE	EXTRUDED ANGLE MATERIAL	ORIGINAL MATERIAL A	B	C	D	R_1	R_2	R_3	SUBSTITUTION 2024 SHEET a	b	c	r_1
S-81	2024-T3511	0.600	0.650	0.045	0.045	0.060	0.060	0.000	0.600	0.650	0.050	0.120
S-86	2024-T3511	0.750	0.562	0.051	0.051	0.060	0.060	0.000	0.750	0.562	0.063	0.160
S-95	2024-T3511	0.800	0.800	0.050	0.050	0.062	0.060	0.000	0.800	0.800	0.063	0.160
S-1969-1	2024-T3511	0.625	0.813	0.050	0.050	0.075	0.075	0.050	0.625	0.813	0.063	0.160

Figure 1 : Sheet 2 : Extrusions and Formed Sections

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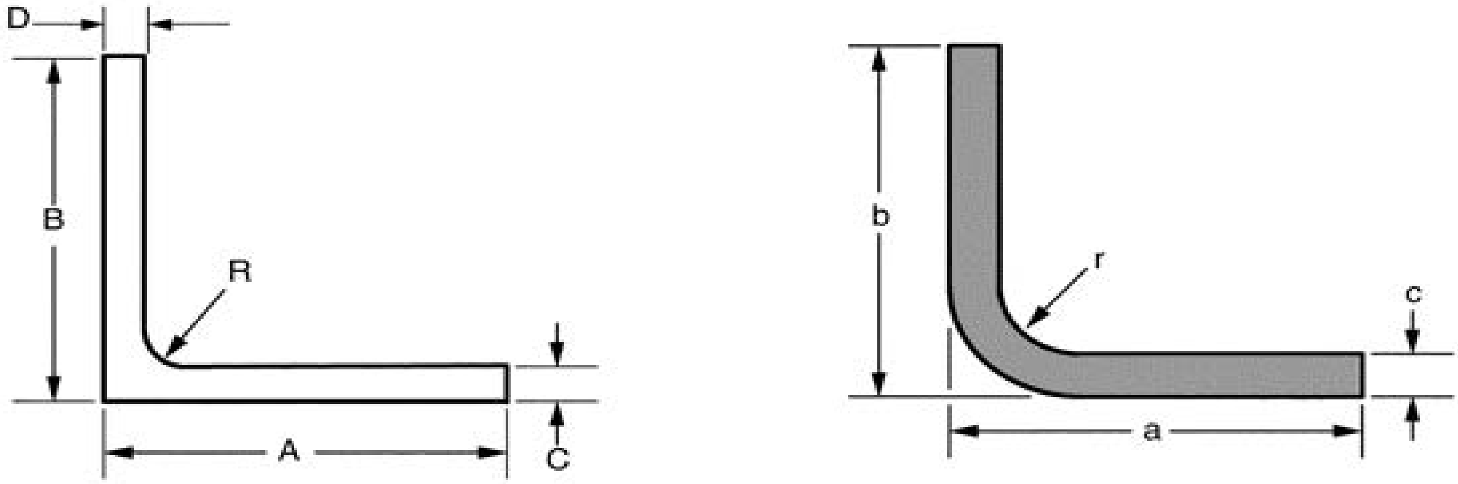
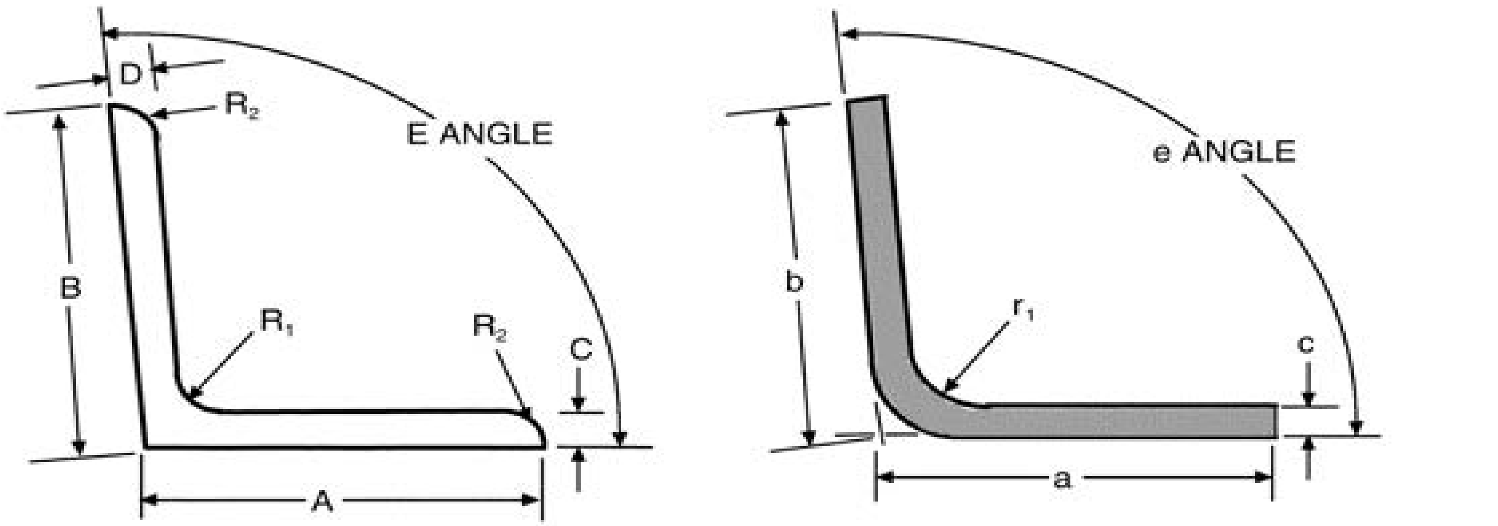


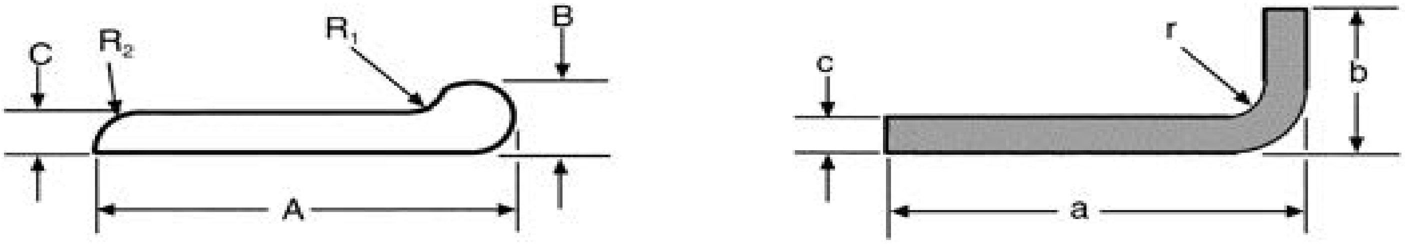
STD. SHAPE	EXTRUDED ANGLE MATERIAL	ORIGINAL MATERIAL A	B	C	D	R	SUBSTITUTION 2024 SHEET a	b	c	r
S-109	2024-T3511	0.500	0.500	0.050	0.050	0.050	0.500	0.500	0.050	0.120



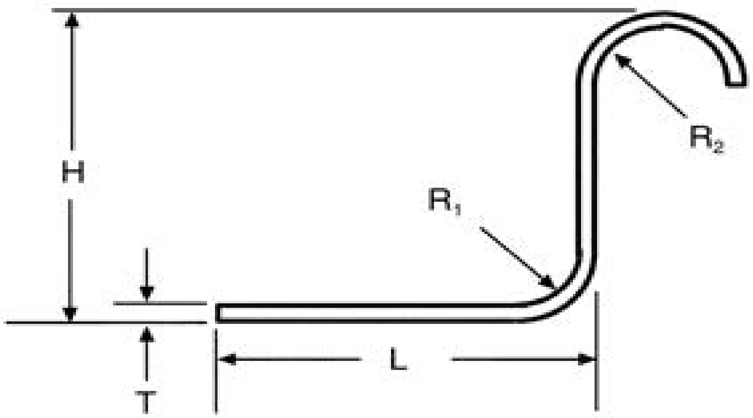
STD. SHAPE	EXTRUDED ANGLE MATERIAL	ORIGINAL MATERIAL A	B	C	D	R_1	R_2	E	SUBSTITUTION 2014 SHEET a	b	c	r_1	e
S-214	2024-T3511	1.000	1.000	0.125	0.125	0.125	0.094	95°45′	1.000	1.000	0.125	0.125	95°45′

Figure 1 : Sheet 3 : Extrusions and Formed Sections

B2097



STD. SHAPE	EXTRUDED BULB BAR MATERIAL	ORIGINAL MATERIAL A	B	C	R_1	R_2	SUBSTITUTION 2024 SHEET a	b	c	r
S-211	2024-T3511	1.450	0.250	0.125	0.125	0.125	1.450	0.250	0.125	0.125

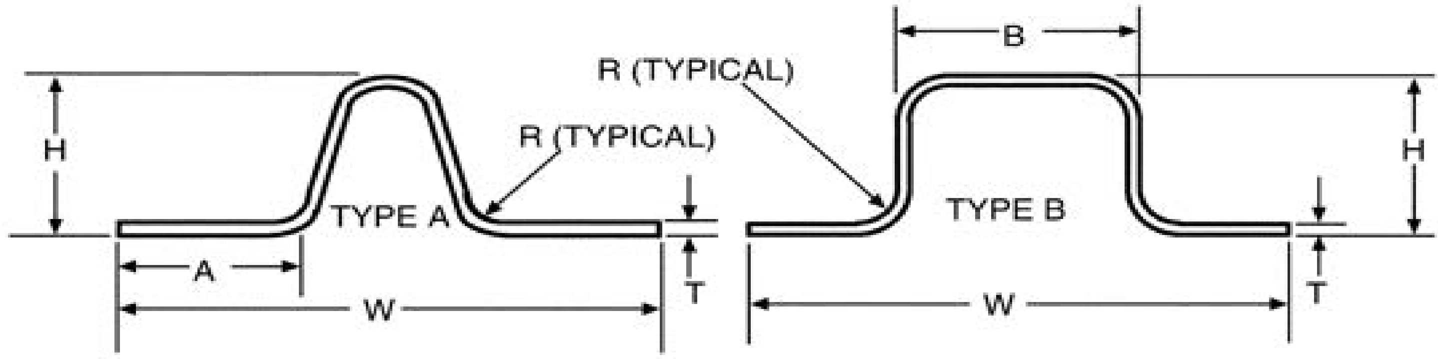


ROLLED J-SECTIONS DIMENSIONS (INCHES) MATERIAL: 2024-T3 OR T4 CLAD ALUMINUM ALLOY

STD. SHAPE	T	L	H	R_1	R_2	AREA (SQ. INCHES)
S-49	0.032	0.750	0.620	0.125	0.125	0.0500
S-282	0.032	0.620	0.620	0.120	0.120	0.0456
S-1113-1	0.020	0.750	0.620	0.125	0.125	0.0314

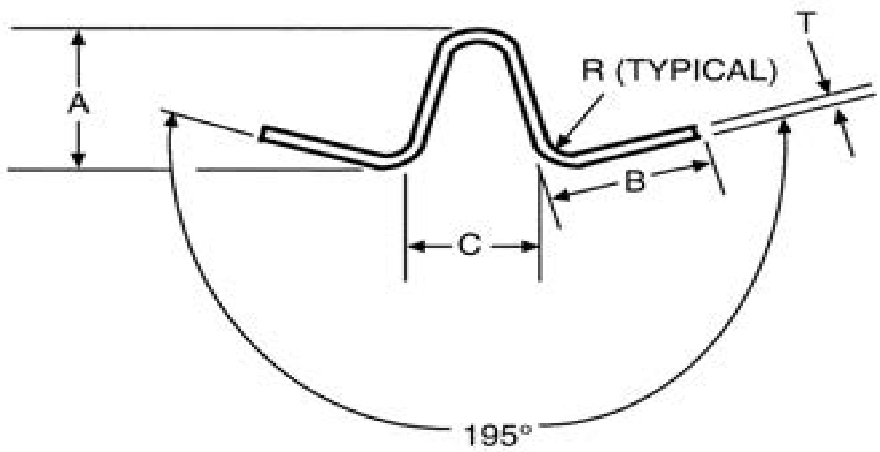
Figure 1 : Sheet 4 : Extrusions and Formed Sections

B2098



ROLLED HAT SECTIONS — DIMENSIONS (INCHES) — MATERIAL: 2024-T3 OR T4 CLAD ALUMINUM ALLOY

STD. SHAPE	TYPE	A	B	W	H	R	T	AREA (SQ. INCHES)
S-370	A	7.000	-	2.000	0.650	0.150	0.032	0.0889
S-1039-1	B	-	0.500	1.500	0.380	0.060	0.032	0.0661
S-1126	B	-	1.050	2.200	0.500	0.090	0.025	0.0744
S-1541-1	B	-	1.060	2.200	0.750	0.090	0.032	0.1106



ROLLED HAT SECTIONS — DIMENSIONS (INCHES) — MATERIAL: 2024-T4 CLAD ALUMINUM ALLOY

STD. SHAPE	A	B	C	R	T	AREA (SQ. INCHES)
S-1162	0.650	0.700	0.600	0.150	0.025	0.0691

FASTENERS

1. General

A. Fasteners used in the airplane are generally solid aluminum rivets, blind rivets, and steel threaded fasteners. Usage of each is primarily a function of the loads to be carried, accessibility and frequency of removal. Rivets used in airplane construction are usually fabricated from aluminum alloys. In special cases, monel, corrosion-resistant steel and mild steel, copper, and iron rivets are used.

2. Rivets

A. Standard solid shank MS rivets are those generally used in airplane construction. They are fabricated in the following head types: roundhead, flathead, countersunk head, and universal head. Flathead rivets are generally used in the airplane interior, where head clearance is required. MS20426 countersunk head rivets are used on the exterior surfaces of the airplane to minimize turbulent airflow. MS20470 universal head rivets are used on the exterior surfaces of the airplane where strength requirements necessitate a stronger rivet head than that of the countersunk head rivet. Hi-Shear rivets are special, patented rivets having a high shear strength equivalent to that of standard NAS bolts. They are used in special cases in locations where high shear loads are present, such as in spars, wings, and in heavy bulkhead ribs. This rivet consists of a cadmium plated pin of alloy steel. Some have a collar of aluminum alloy. Some of these rivets can be readily identified by the presence of the attached collar in place of the formed head on standard rivets. Blind rivets are used, where strength requirements permit, where one side of the structure is inaccessible, making it impossible or impractical to drive standard solid shank rivets.

3. Replacement Of Hi-Shear Rivets

A. Replacement of Hi-Shear rivets with close tolerance bolts or other commercial fasteners of equivalent strength properties is permissible.

(1) The hardware used for the Hi-Shear rivets is determined according to the size of the holes and the grip lengths required.

(2) Bolt grip length should be chosen so that no threads remain in the bearing area.

(3) Holes must not be elongated, and the Hi-Shear substituted must be a smooth, push-fit.

B. Field replacement of main landing gear forgings on bulkheads may be accomplished by using the following hardware:

(1) NAS464P, NAS436P, and either: NAS1103 through NAS1120, NAS1303 through NAS623 or NAS6203 through NAS6220 bolt, and either:

(a) MS21042 nut and AN960/NAS1149 washers in place of Hi-Shear rivets for forgings with machined flat surfaces around the attachment holes.

(b) ESNA2935 mating base washer and ESNA RM52LH2935 self-aligning nut with forgings (with a draft angle of up to a maximum of eight degrees) without machined flat surfaces around the attachment holes.

4. Substitution Of Rivets

A. When adapting the typical repairs shown in this manual to suit actual conditions, it may be necessary to use different fasteners than those originally used. This may be due to non-availability of a particular fastener, restricted access, or other difficulties. When replacing rivets, it is desirable to use rivets identical to the type of rivet removed. Countersunk head rivets are to be replaced by rivets of the same type and degree of countersink. When rivet holes become enlarged, deformed, or otherwise damaged, several options are available.

(1) The simplest solution is to install a 1/32 inch (0.032 inch) larger size rivet as a replacement. This solution uses the designed repairability of the structure, and is the quickest repair.

(2) Repair rivets are available.

(a) Repair rivets have a shank that is 1/64 inch (0.016 inch) larger diameter than a standard rivet but have the same size and shape heads.

(b) NAS1241 repair rivets replace MS20426 rivets if they have the same suffix.

(c) NAS1242 repair rivets replace MS20470 rivets if they have the same suffix.

(d) NAS1738, NAS1939 and some NAS9301 through NAS9311 blind rivets also have oversize shanks.

B. Replacement shall not be made with rivets of lower strength material.

C. Hi-Shear Rivets.

(1) When Hi-Shear rivets are not available, replacement of sizes 3/16 inch or greater rivets shall be made with bolts of equal or greater strength than the rivet being replaced, and with self-locking nuts of the same diameter. It is permissible to replace Hi-Shear rivets with Hi-Lok bolts of the same material, diameter and grip length.

D. Blind Rivets.

(1) Blind rivets have higher deflection rates in shear than standard solid rivets, are more susceptible to fatigue failure and are not as strong as solid rivets in thin sheets. For this reason, it is not advisable to replace any considerable number of solid rivets in a given joint by blind rivets, because this may result in overstressing the remaining solid rivets. The hollow blind rivet shall not be used. The blind rivet shall be of the same or greater strength than the rivet it replaces. In cases of dimpled assemblies (the process of forming the metal around a hole to form a conical indentation to receive the tapered head of a flush rivet or a screw), the rivet holes shall be drilled after the sheets are dimpled. When possible, the exposed end of each clipped plug shall be coated with epoxy primer. Blind rivets shall not be used in fuel bay areas except in cases of absolute necessity, and must be sealed. If blind fasteners other than blind rivets are encountered, it is recommended that replacements be made with identical fasteners.

E. For a list of approved solid shank and Hi-Shear rivet substitutions, refer to Tables 1 and 2.

5. Rivet Diameters

A. Rivet diameters range from 3/32 inch to 3/8 inch. Sizes of 1/8 inch, 5/32 inch, and 3/16 inch are most frequently used. Since smaller diameter rivets lack proper structural qualities and larger diameter rivets dangerously reduce the splice or patch area, extreme care should be exercised before substituting other than the specified sizes of rivet diameter.

6. Rivet Lengths

A. Proper length of rivets is an important part of a repair. Should too long a rivet be used, the formed head will be too large, or the rivet may bend or be forced between the sheets being riveted. Should too short a rivet be used, the formed head will be too small or the riveted material will be damaged. If proper length rivets are not available, longer rivets may be cut off to equal the proper length (not grip). Rivet length is based on the grip.

7. Solid Shank Rivets

A. Removal of Solid Shank Rivets (Refer to Figure 1).

(1) When it becomes necessary to replace a rivet, extreme care should be taken in its removal so that the rivet hole will retain its original size and replacement with a larger size rivet will not be necessary. If the rivet is not removed properly, the strength of the joint may be weakened and the replacement of rivets made more difficult.

(2) When removing a rivet, work on the manufactured head. It is more symmetrical about the shank than the shop head, and there will be less chance of damaging the rivet hole or the material around it. To remove rivets, use hand tools, a power drill or a combination of both. The preferred method is to drill through the rivet head and drive out the remainder of the rivet with a drift punch. First, file a flat area on the head of any round or brazier head rivet, and center punch the flat surface for drilling. On thin metal, back up the rivet on the shop head when center punching to avoid depressing the metal. The dimple in 2117-T3 rivets usually eliminates the necessity of filing and center punching the rivet.

(3) Select a drill one size smaller than the rivet shank and drill out the rivet head. When using a power drill, set the drill on the rivet and rotate the chuck several revolutions by hand before turning on the power. This procedure helps the drill cut a good starting spot and eliminates the chance of the drill slipping off and tracking across the metal. While holding the drill at a 90° angle, drill the rivet to the depth of its head. Be careful not to drill too deep because the rivet shank will turn with the drill and cause a tear. The rivet head will often break away and climb the drill, which is a good signal to withdraw the drill. If the rivet head does not come lose of its own accord, insert a drift punch into the hole and twist slightly to either side until the head comes off.

(4) Drive out the shank of the rivet with a drift punch slightly smaller than the diameter of the shank. On thin metal or unsupported structures, support the sheet with a bucking bar while driving out the shank. If the shank is exceptionally tight after the rivet head is removed, drill the rivet about two-thirds of the way through the thickness of the material and then drive out the remainder of the rivet with a drift punch.

(5) The removal of flush rivets is the same as that just described except that no filing of the manufactured head is required before center punching. Be very careful to avoid elongation of the dimpled or the countersunk holes. The rivet head should be drilled to approximately one-half the thickness of the top sheet.

Table 1. Approved Replacement Fasteners Chart

REPLACE	Inch thickness (or thicker)	WITH
MS20470AD3	0.025	NAS1398B4, NAS1398D4
	0.020	NAS1738B4, NAS1738D4
MS20470AD4	0.050	NAS1398B4, NAS1398D5

	0.040	NAS1398B5, NAS1398D5, NAS9301B5, NAS1738B4, NAS1738E4, NAS1738D4, NAS9301B4
	0.032	NAS1738B5, NAS1738E5, NAS1738D5, NAS9301B5
MS20470AD5	0.063	NAS1398B5, NAS1398D5
	0.050	NAS1398B6, NAS1398D6, NAS1738B5, NAS1738E5, CR3213-5
	0.040	NAS1738B6, NAS1738E6, NAS1738D5, CR3213-6
MS20470AD6	0.080	NAS1398B6, NAS1398D6
	0.071	NAS1398D6
	0.063	NAS1738B6, NAS1738E6, NAS1738D, CR3213-6
MS20426AD3 (Countersunk) (Refer to Note 1)	0.063	NAS1398B4, NAS1399D4
	0.040	NAS1739D4
MS20426AD4 (Countersunk)	0.080	NAS1399B4, NAS1399D4, CR3213-4
	0.050	NAS1739D4
MS20426AD4 (Dimpled)	0.063	NAS1739B4, NAS1739E4
MS20426AD5 (Countersunk)	0.063	NAS1739D5, NAS1739B5, NAS1739E5
	0.050	CR3242-5
MS20426AD5 (Dimpled)	0.071	NAS1739B5, NAS1739E5

NOTE 1:

Rework Required. Countersink oversize to accommodate oversize rivet.

NOTE 2:

GENERAL NOTE: Do not use blind rivets in any portion of the engine air induction system structure.

Table 2. Approved Fastener Substitutions

Fastener	Collar	DIAMETER	Fastener	Collar
REPLACE			**WITH**	
NAS178	NAS179	(Refer to Notes 1, 2, 6, 7)	HL18	HL70, HL82
		(Refer to Notes 1, 4)	NAS1054	NAS179, NAS528
		(Refer to Notes 1, 4)	NAS14XX	NAS1080C, NAS1080E, NAS1080G, NAS1080AG
		(Refer to Notes 1, 3, 4)	NAS529	NAS528, NAS179
		(Refer to Notes 1, 2, 5)	NAS1146	NAS1080C, NAS1080E, NAS1080G, NAS1080AG
		(Refer to Notes 1, 5)	NAS7034	NAS1080K
		(Refer to Notes 1, 6)	NAS464	MIL-S-7742
		(Refer to Notes 1, 6)	NAS1103-NAS1116	MIL-S-7742
		(Refer to Notes 1, 6)	NAS1303-NAS1316	MIL-S-7742
		(Refer to Notes 1, 6)	NAS6203-NAS6216	MIL-S-7742

		(Refer to Notes 1, 6)	NAS6603-NAS6616	MIL-S-7742
		(Refer to Notes 1, 6)	AN173	AN305, MS20305, MS21044, MS21045
NAS1054	NAS179, NAS528	(Refer to Notes 1, 4)	NAS14XX	NAS1080C, NAS1080E, NAS1080G, NAS1080AG
		(Refer to Notes 1, 3, 4)	NAS529	NAS528, NAS179
		(Refer to Notes 1, 2, 5)	NAS1446	NAS1080C, NAS1080E, NAS1080G, NAS1080AG
		(Refer to Notes 1, 5)	NAS7034	NAS1080K
		(Refer to Notes 1, 6)	NAS464	(Refer to Note 8)
		(Refer to Notes 1, 6)	NAS1103-NAS1106	(Refer to Note 8)
		(Refer to Notes 1, 6)	NAS1303-NAS1306	(Refer to Note 8)
		(Refer to Notes 1, 6)	NAS6203-NAS6206	(Refer to Note 8)
		(Refer to Notes 1, 6)	NAS6603-NAS6606	(Refer to Note 8)

NOTE 1:

Refer to appropriate tables for nominal diameters available.

NOTE 2:

Available in oversize for repair of elongated holes. Ream holes to provide a 0.001 inch interference fit.

NOTE 3:

NAS529-4 thru -12 take NAS528 same dash number. NAS529-14 thru -20 take NAS179.

NOTE 4:

Steel shank fastener designated for drive-on collars. Choose protruding head only.

NOTE 5:

Steel shank fastener designated for squeeze-on collars. Installation requires sufficient space for the tool and extended shank of the fastener. Choose protruding head only.

NOTE 6:

Threaded fastener.

NOTE 7:

Preferred substitute fastener.

NOTE 8:

When you substitute a threaded fastener for a high strength steel shank rivet, use one of these steel nuts: AN365/MS20365, MS17825, MS21044, MS21045, MS51943 or NAS1079. Approval of the use of these nuts in this application does not constitute a general approval to use these nut on high strength bolts.

NOTE 9:

GENERAL NOTE: These fastener substitutions address shear strength and hole tolerances only. The specific application may not allow all of these substitutions because of space considerations.

B. The United States Department of Defense no longer maintains MS and NAS standards. Identical parts may have MS, NASM or AIA/NAS part numbers.

EXAMPLE: MS20470AD4-6 rivets may also be identified as NASM20470AD4-6. NAS1738M4-4 rivets may be identified as AIA/NAS1738M4-4.

C. Installation of Solid Shank Rivets.

(1) A large percentage of riveting of airplane structure is accomplished on thin gauge aluminum alloy, and the work must be accomplished without distorting or damaging the material with hammer blows or riveting tools. All airplane power riveting is accomplished by upsetting the rivets against a bucking bar instead of striking the shank with a hammer. To prevent deforming the rivet head, a rivet set must be selected to fit each type of rivet. The depth of this set must not touch material being riveted. Parts requiring heat treatment should be heat treated before riveting, since heat treating process after rivet installation causes warping. Assemblies that require heat treatment in a salt bath must be treated prior to assembly, as the salt cannot be entirely washed out of the joints.

(2) The use of hollow rivets in joining highly stressed parts is not permitted. To determine if blind rivets may be substituted, refer to Tables 1 and 2. Selection of the proper rivet and the proper number of rivets is very important. Rivets must be of the proper length for the total thickness of the parts being riveted. Ordinarily, from 1-1/2 to 2 times the diameter of the rivet is the correct amount for the rivet shank to protrude through the material to form the head. For heavy material, such as plates or fittings, from 2 to 2-1/2 times the rivet diameter may be used. The rivet should not be excessively loose in the hole, as this condition will cause the rivet to bend over while being driven, and the shank will not be sufficiently expanded to completely fill the hole. A drill from 0.002 inch to 0.004 inch larger than the rivet shank should be used for sheet and plate riveting. Parts should be held firmly together by clamps, screws, or bolts while they are being drilled or riveted. The bucking bar is to be held against the end of the rivet shank. Exercise care while accomplishing this operation to prevent unseating the rivet by too much pressure. For the first few blows, the bucking bar should be held lightly against the rivet shank so it will receive the impact of the blow through the rivet. The bucking bar must be held square with the rivet to produce uniform upsets. As few blows as possible should be struck to properly upset rivet. Blows must be as uniform as possible.

D. Loose Or Working Solid Shank Rivets.

(1) Rivets which appear to be loose shall be checked with a 0.002 inch feeler gauge by inserting the gauge around the head of the rivet in question. If the feeler gauge can be inserted to the shank of the rivet, it shall be classified as a loose rivet and it shall be replaced. If the feeler gauge can be inserted approximately halfway to the shank for less than 30 percent of the circumference of the rivet head, it shall not be classified as a loose rivet. The feeler gauge shall be used to check the shear section between the riveted members (such as skin to spar or different sections of skins) in a similar manner to that used around the rivet head. If the skin around the brazier head or countersunk rivet can be moved by depressing the skin with finger pressure around the rivet, the rivet shall be replaced. If a rivet is found which turns by applying a rotating load to the head of the rivet, it should be replaced.

(2) In areas where exterior paint has been applied to rivet heads, the paint may harden due to aging processes and show hairline cracks around the edge of the rivet heads. This should not be used as a basis for determining whether or not the rivet is loose. The hardened paint may crack at times and collect dirt or exhaust fumes which will appear as discoloration. It is not possible to detect loose rivets visually. Replacement rivets should be of like size and type. In some instances, however, it will be necessary to use the next size larger diameter. For general repair practices, the spacing between the centerlines of adjacent rivet holes shall be four diameters or greater. In some areas where the spacing between rivets prohibits the use of the next larger rivets, special repair instructions and procedures shall be followed. Contact Cessna Single Engine Support.

8. Blind Rivets

A. General.

(1) Blind rivets are intended for use where access is available to only one side of the work.

(2) Replacement of solid rivets with blind rivets should only be accomplished within the guidelines of Table 1, when the installation of a solid shank rivet is not possible. Blind rivets do not have the same resistance to corrosion and fatigue as solid shank rivets, and should not be considered a universal replacement for solid shank rivets.

B. Removal of Blind Rivets.

CAUTION: Do not drill completely through the rivet sleeve. This method of removing a rivet will tend to enlarge the hole.

(1) Use a small center drill to provide a guide for a larger drill on top of the rivet stem, and drill away the tapered portion of the stem to destroy the lock.

(2) Pry the remainder of the locking collar out of the rivet head with a drift punch.

(3) Drill nearly through the head of the rivet using a drill the same size as the rivet shank.

(4) Break off rivet head, using drift pin inserted into the drilled hole as a pry.

(5) Drive out remaining rivet shank with a pin having a diameter equal to the rivet shank.

C. Installation of Blind Rivets.

(1) Refer to Figure 2, for an illustration of installation procedures.

(2) Check that rivet hole size and rivet are compatible.

(3) Check that proper pulling head is installed on rivet gun.

(4) Adjustment of pulling head must be made in accordance with manufacturers instructions.

(5) Check that proper operating air pressure is available to rivet gun.

NOTE: Blind rivets may be installed using pneumatic or mechanical guns, whichever is available.

(6) Check that holes in parts to be fastened are properly aligned.

(7) In blind clearance applications, check the minimum blind clearance (BK) dimension if the manufactured head of blind rivet is protruding above the top sheet. The rivet will pull down the sheet as the stem is pulled if the BK dimension is met or exceeded.

(8) The minimum blind clearance is the BK dimension, and is listed in the manufacturers standard sheets.

NOTE: When installing a blind rivet (pull-type rivet) in a hole where the previous blind rivet was removed by drilling and punching the rivet out, inspect the drilled hole to assure all metal sheets are in place and not separated prior to pulling rivet. It may be necessary to insert a stiff wire in adjacent hole to hold metal in position while pulling rivet.

(9) When placing pulling head on rivet stem, hold riveter and pulling head in line with axis of rivet while holding tool in a light and flexible manner.

(10) When tool is actuated, pulling head will pull down and seat against rivet head.

(11) Clamping action will pull sheets together and seat rivet when tool is actuated.

(12) When tool is actuated, action of rivet will automatically assist in bringing tool and pulling head into proper alignment with rivet axis.

NOTE: Pressing down with force will not allow rivet and tool to align themselves with hole and could limit head setting of rivet, however, enough force to seat the head against the skin is necessary.

(13) Hold tool in line with rivet as accurately as possible, and allow a steady but light pressure; pull trigger and let the rivet align itself.

(14) When rivet is completely installed, release trigger and pulling head will eject pulling portion of stem through forward end.

(15) Rivet must break within these limits.

Fastener	Dash number	Stem Flushness
NAS1738 or NAS1739	All	+0.010 or -0.020 inch
Cherry Max	-4	+0.010 or -0.015 inch
Cherry Max	-5, -6	+0.010 or -0.020 inch

(16) Protruding stems usually indicate incorrect grip length or oversize holes.

D. Loose or Working Blind Rivets.

(1) Blind rivets which are found to be loose or show evidence of working must be replaced with rivets of like size and type. In some instances, it may be necessary to use the next larger size rivet. Loose fasteners may be indicated by the following situation:

(a) The fastened material moves relative to the fastener. Skin deflection is evident.

(b) Tipping of the fastener head may indicate its looseness or slippage. Rivet head periphery rolled upward also indicates looseness.

(c) A black or dark gray stain is found adjacent to or around the fastener head. Generally, it takes the form of a dirt or oily streak aft of the loose rivet.

(d) Mark a red line across the fastener head and the adjacent material. Check the line at the next inspection. Any loosening of the fastener will break the line as indicated in Figure 3.

9. Spacing Of Rivets

A. There are no specific rules which are applicable to every case or type of riveting. There are, however, certain general rules which should be understood and followed. Edge distance of rivets should not be less than two diameters of the rivet, measured from the edge of the sheet or plate to the center of the rivet hole. Spacing between rivets, when in rows, depends upon several factors, principally the thickness of the sheet, the diameter of the rivets, and the manner in which the sheet will be stressed. This spacing is seldom less than four diameters of the rivet, measured between the centers of the rivet holes. Rivets, spaced four diameters apart, are found in certain seams of semimonocoque fuselages, webs or built up spars, and various plates or fittings. Where there are two rows of rivets, they are usually staggered. The transverse pitch or distance between rows should be slightly less than the pitch of the rivets, with 75 percent of the rivet pitch being the usual practice. An average spacing or pitch of rivets in the cover or skin of most structures, except at highly stressed points, will be from 6 to 12 diameters of the rivet. The best practice in repair is to make pitch of rivets equal to those in the original structure.

10. Threaded Fasteners Bolt Torques

A. The importance of correct application cannot be overemphasized. Refer to appropriate Maintenance Manual, Chapter 20, Torque Data - Maintenance Practices, for additional information covering torque values. Under torque can result in unnecessary wear of nuts and bolts as well as parts they are holding together. When insufficient pressures are applied, uneven loads will be transmitted throughout assembly, which may result in excessive wear or premature failure due to fatigue. Over torque can be equally damaging because of failure of a bolt or nut from overstressing threaded areas. There are a few simple, but very important, procedures that should be followed to assure that correct torque is applied:

(1) Calibrate torque wrench periodically to assure accuracy, and recheck frequently.

(2) Be sure that bolt and nut threads are clean and dry unless otherwise specified.

(3) Run nut down to near contact with washer or bearing surface and check friction drag torque required to turn nut.

(4) Add friction drag torque to desired torque recommended. Refer to appropriate Maintenance Manual, Chapter 20, Torque Data - Maintenance Practices to obtain complete torque calculating procedures. This is referred to as final torque which should register on indicator or setting for a snap over-type wrench.

(5) Apply a smooth even pull when applying torque pressure. If chattering or a jerking motion occurs during final torque, back off and re-torque.

(6) When installing a castellated nut, start alignment with cotter pin hole at minimum recommended torque plus friction drag torque, and do not exceed maximum torque plus friction drag. If hole and nut castellation do not align, change washers or nut and try again. Exceeding maximum recommended torque is not recommended unless specifically allowed or recommended for that particular installation.

11. Rivets for Plastic or Composite Parts

A. Unlike rivets in metallic joints, blind rivets are often the rivet of choice for riveting non-metallic materials because they may be installed without the hammering necessary to install solid rivets. If the tail end of the rivet is adjacent to the non-metal side, install a washer over the shank to prevent the "hole filling" action built into blind rivets from overloading the non-metal hole. The hole in the washer should match the specified installation hole for the fastener. If the tail end of the rivet is installed through metal substructure, the washer is not necessary.

B. Soft ("A" 1100 aluminum shank rivets or "B" 5056 aluminum shank) rivets are also used to install non-metallic parts. Original equipment soft rivets will be either red or green colored under the paint. If the butt or driven end of the rivet is adjacent to the non-metallic part, it is preferable to install a washer over the shank to prevent the rivet shank, which swells during driving, from overloading the non-metallic hole. The hole in the washer should match the specified installation hole for the fastener. If the tail end of the rivet is installed through metal substructure, the washer is not necessary. Take care when driving rivets through non-metal to not overdrive the rivet. If the rivet is overdriven, the shank will swell even with the washer in place. The rivet butt should be driven to no more than necessary to retain the part, never more than 1.4 times the shank diameter.

C. If the original equipment rivet provided connection between metal parts as well as non-metallic parts, it may be a standard (AD) rivet. Original equipment AD rivets are colored gold or uncolored. Replace original equipment AD rivets with AD rivets.

Figure 1 : Sheet 1 : Rivet Removal and Rivet Edge Distance

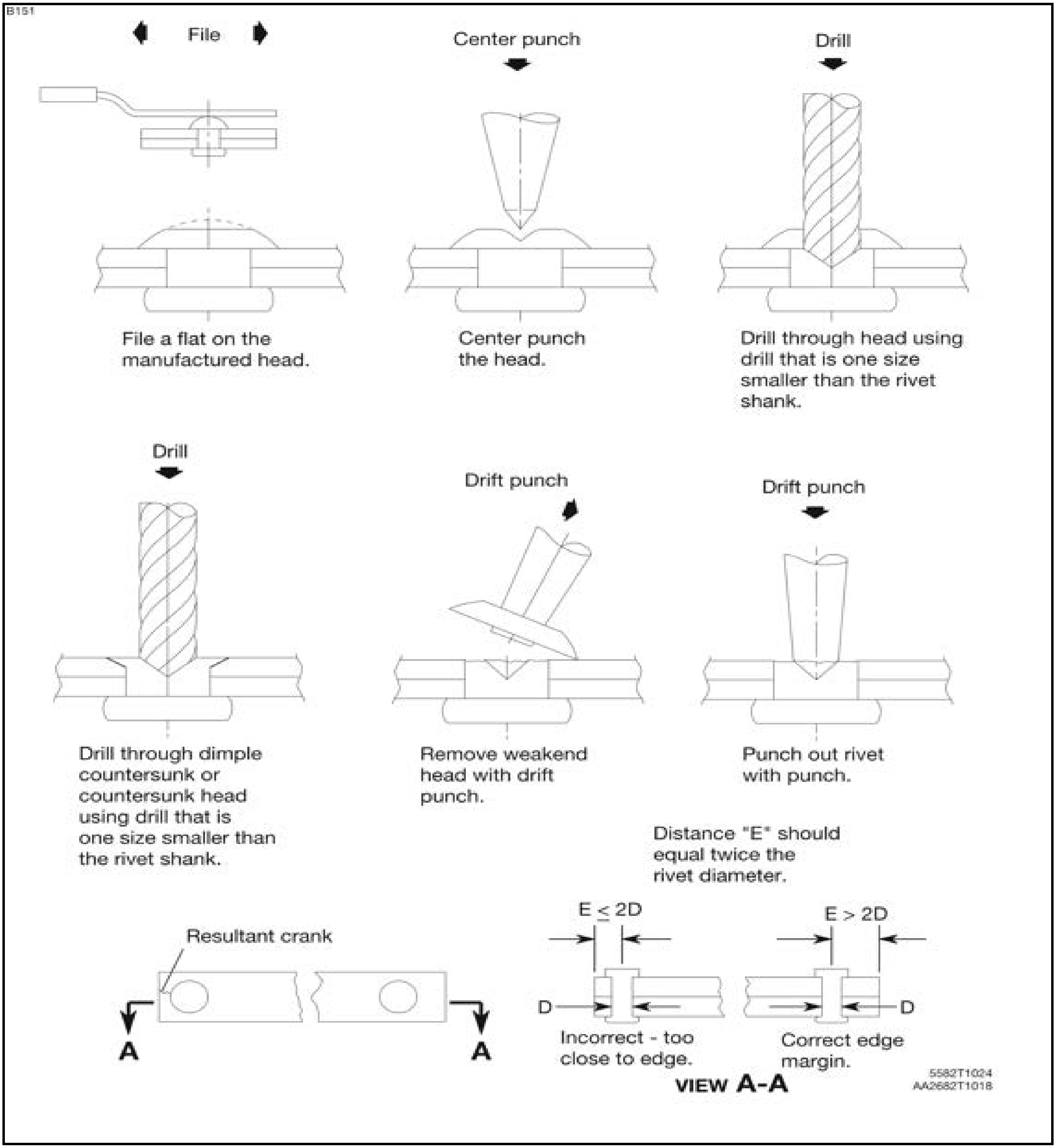


Figure 2 : Sheet 1 : Installation of Blind Rivets

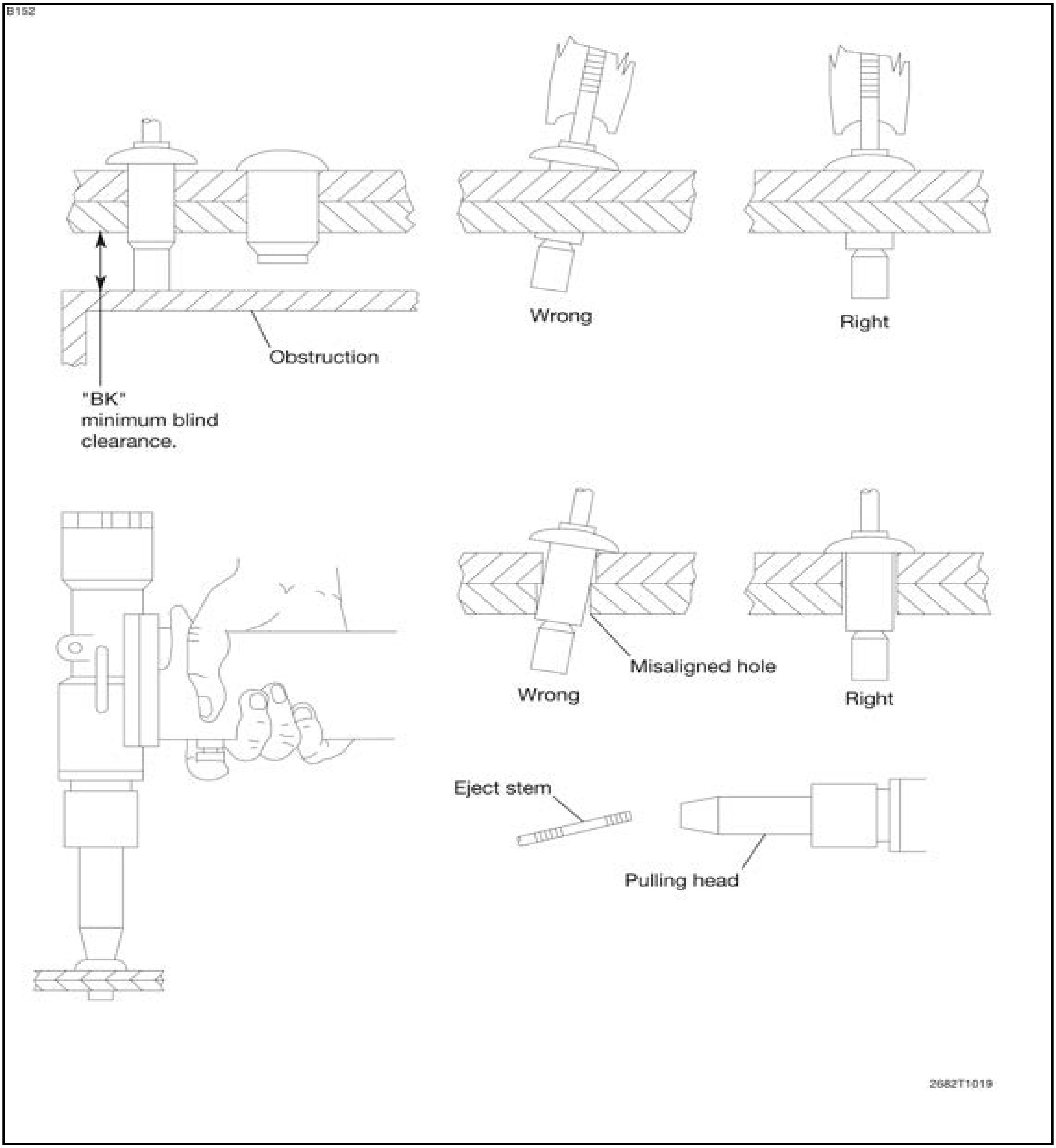
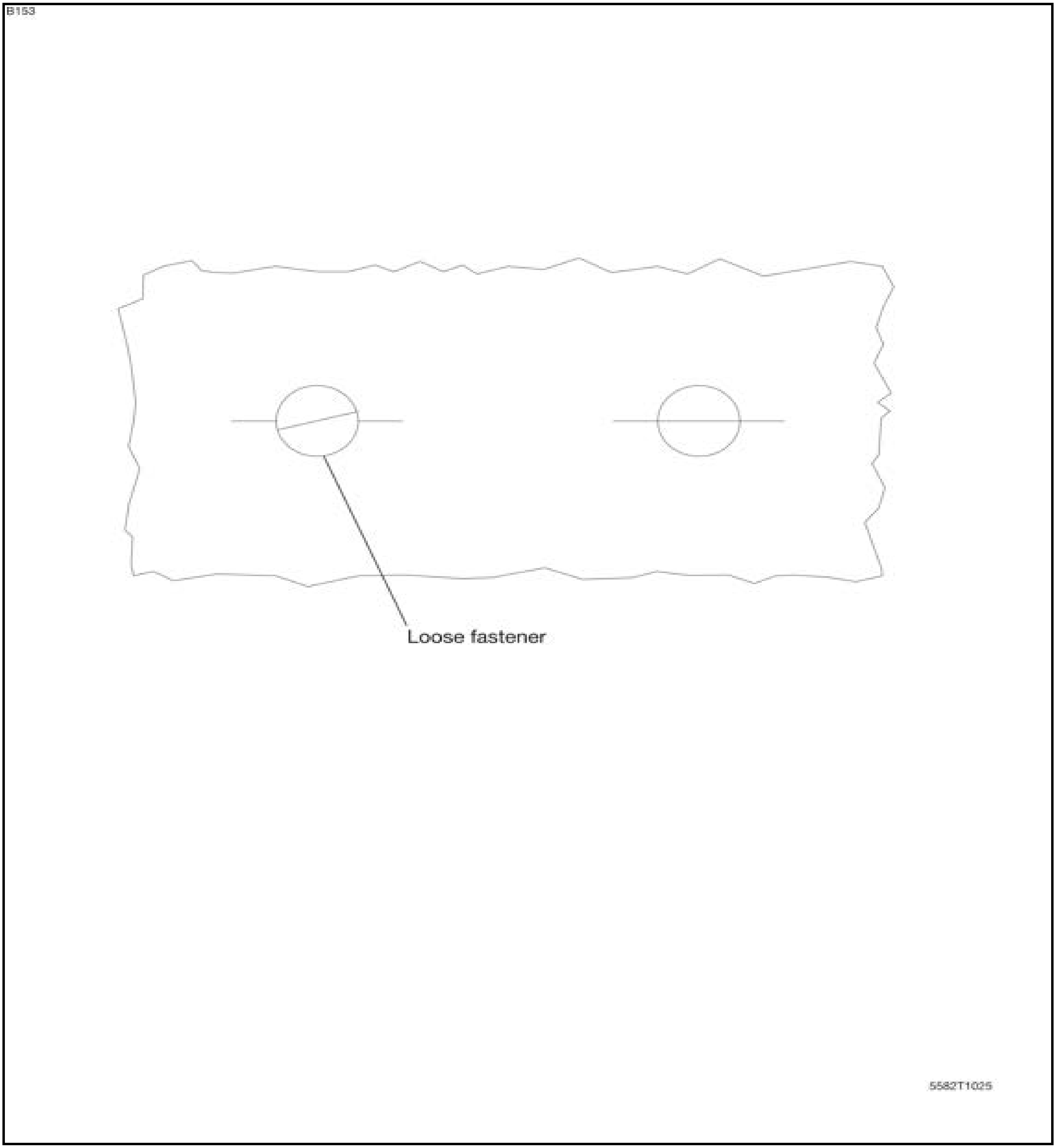


Figure 3 : Sheet 1 : Red Lining of Fasteners



FLIGHT CONTROL SURFACE BALANCING

1. General

A. This section applies to the balancing of the ailerons, elevators, and rudder. Control surface balance must be verified after repair or painting.

B. Proper balance of control surfaces is critical to prevent flutter during normal operating conditions.

2. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
Control Surface Balance Fixture Kit	5180002–1	Cessna Aircraft Co. Cessna Part Distribution 5800 E. Pawnee P.O. Box 1521 Wichita, KS 67218	Balance elevator and aileron.
Scale 0-10 Pounds in 0.01 Pound increments		Commercially Available	Balance rudder

3. Procedures for Balancing Control Surfaces

A. The flight control surface balancing fixture kit (part number 5180002-1) is shown in Figure 1.

(1) Balance of control surfaces must be accomplished in a draft free room or area.

(2) Place hinge bolts through control surface hinges and position on knife edge balancing mandrels, refer to Figure 2 for positioning of balancing control surfaces.

(3) Make sure all control surfaces are in their approved flight configuration; painted (if applicable), trim tabs installed, static wicks, and all tips installed.

(4) Place balancing mandrels on a table or other suitable flat surface.

(5) Adjust trailing edge support to fit control surface being balanced while center of balancing beam is directly over hinge line. Remove balancing beam and balance the beam itself by adding washers or nuts required at end opposite the trailing edge support.

(6) When positioning balancing beam on control surface, avoid rivets to provide a smooth surface for the beam and keep the beam 90 degrees to the hinge line of control surface.

(7) Paint is a considerable weight factor. In order to keep balance weight to a minimum, it is recommended that existing paint be removed before adding paint to a control surface. Increase in balance weight will also be limited by the amount of space available and clearance with adjacent parts. Good workmanship and standard repair practices should not result in unreasonable balance weight.

(8) The approximate amount of weight needed may be determined by taping loose weight at the balance weight area.

(9) Lighten balance weight by drilling off part of weight.

(10) Make balance weight heavier by fusing bar stock solder to weight after removal from control surface. The ailerons should have balance weight increased by ordering additional weight and gang channel, listed in applicable Parts Catalog, and installing next to existing inboard weight the minimum length necessary for correct balance, except that a length which contains at least two attaching screws must be used. If necessary, lighten new weight or existing weights for correct balance.

4. Balancing Definitions

A. Overbalance (refer to Figure 3) is defined as the condition that exists when surface is leading edge heavy and is defined by symbol (-). If the balance beam uses a sliding weight, the weight must be on the trailing edge side of the hinge line (to balance the control surface), the control surface is considered to be overbalanced.

B159

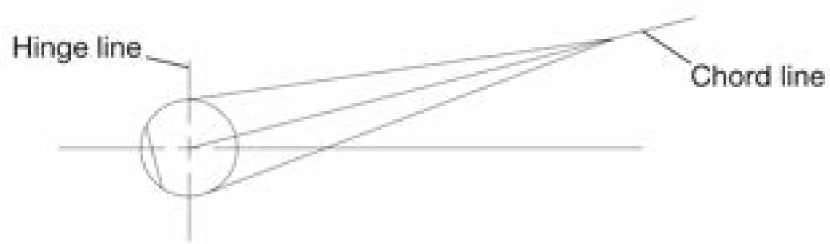


Figure 3

B. Underbalance (refer to Figure 4) is defined as the condition that exists when surface is trailing edge heavy and is defined by symbol (+). If the balance beam uses a sliding weight, the weight must be on the leading edge side of the hinge line (to balance the control surface), is considered to be under balanced.

B160

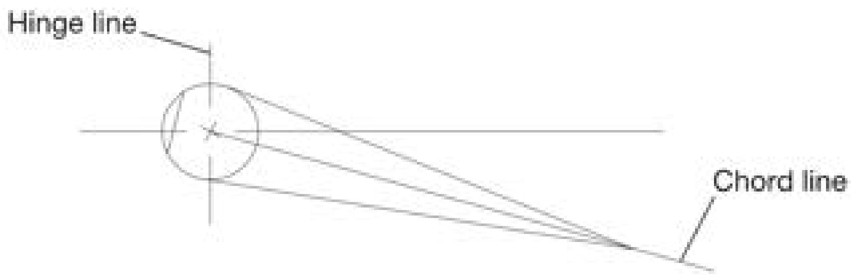


Figure 4

5. Control Surface Balance Requirements

NOTE: "Approved Flight" must never be exceeded when the surface is in its final configuration for flight.

A. Refer to Tables 1, 2 and 3 for balance limits of the various airplane control surfaces. These approved flight limits must take into account all items which may be attached and/or applied to the various control surfaces (static wicks, trim tabs, paint, decorative trim stripes, and so forth).

Table 1. Model 172 Static Balance Limits.

CONTROL SURFACE	STATIC BALANCE LIMITS APPROVED FOR FLIGHT CONFIGURATION (INCH-LBS).
AILERON	0.0 TO +11.31
RUDDER	0.0 TO +9.0
LEFT ELEVATOR	0.0 TO +18.5
RIGHT ELEVATOR	0.0 TO +24.5

Table 2. Model 182 Static Balance Limits.

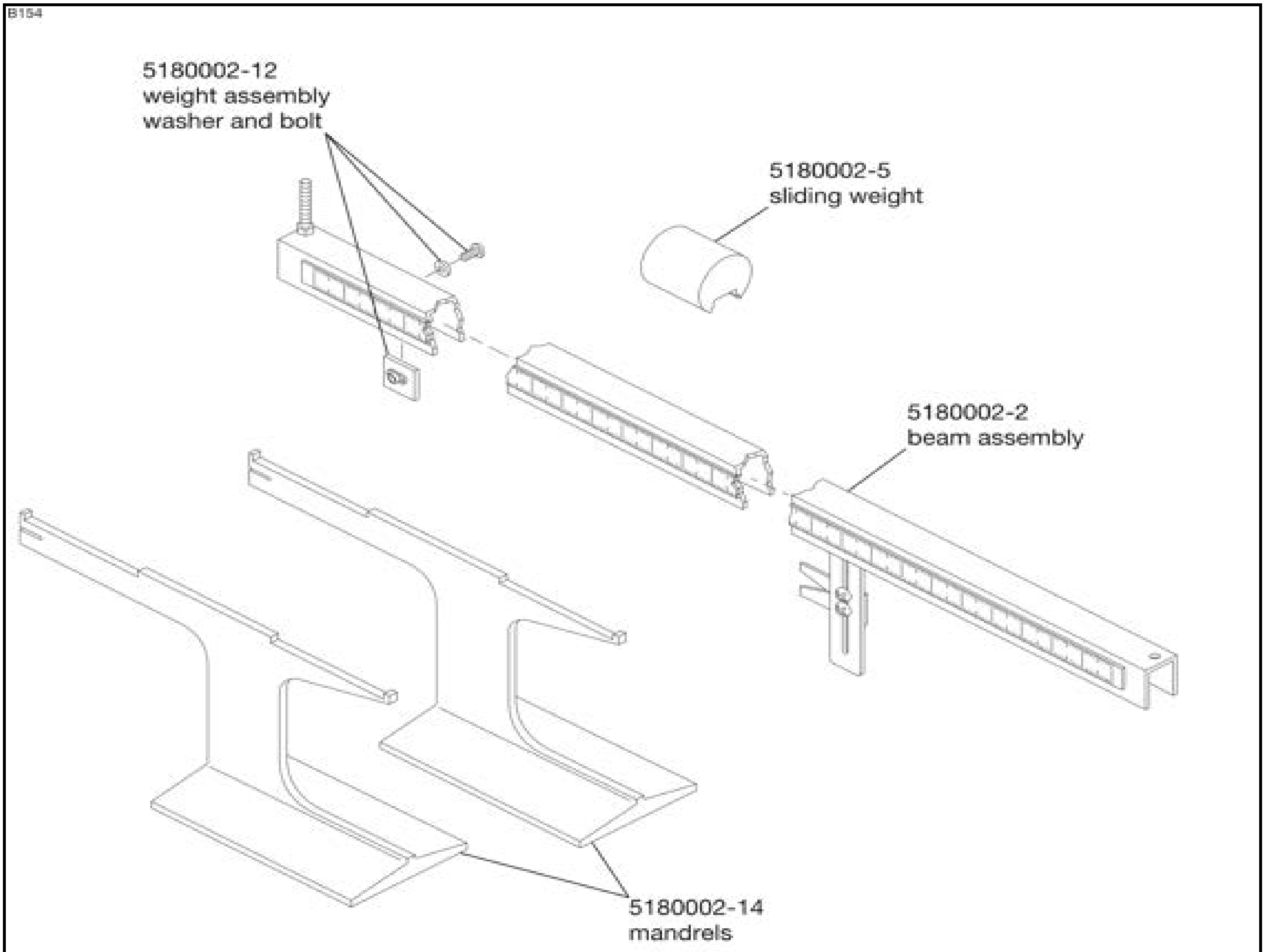
CONTROL SURFACE	STATIC BALANCE LIMITS APPROVED FOR FLIGHT CONFIGURATION (INCH-LBS).
AILERON	0.0 TO +9.64
RUDDER	0.0 TO +6.0
LEFT ELEVATOR	0.0 TO +20.47
RIGHT ELEVATOR	0.0 TO +20.47

Table 3. Model 206 Static Balance Limits.

CONTROL SURFACE	STATIC BALANCE LIMITS APPROVED FOR FLIGHT CONFIGURATION (INCH-LBS).
AILERON	0.0 TO +3.0
RUDDER (Landplane)	-4.0 TO +3.0

LEFT ELEVATOR	0.0 TO +12.1
RIGHT ELEVATOR	0.0 TO +12.1

Figure 1 : Sheet 1 : Flight Control Surface Balancing Fixture Kit



NOTE: Included in 5180002-1 flight control surface balancing fixture kit.

Figure 2 : Sheet 1 : Balancing Control Surfaces

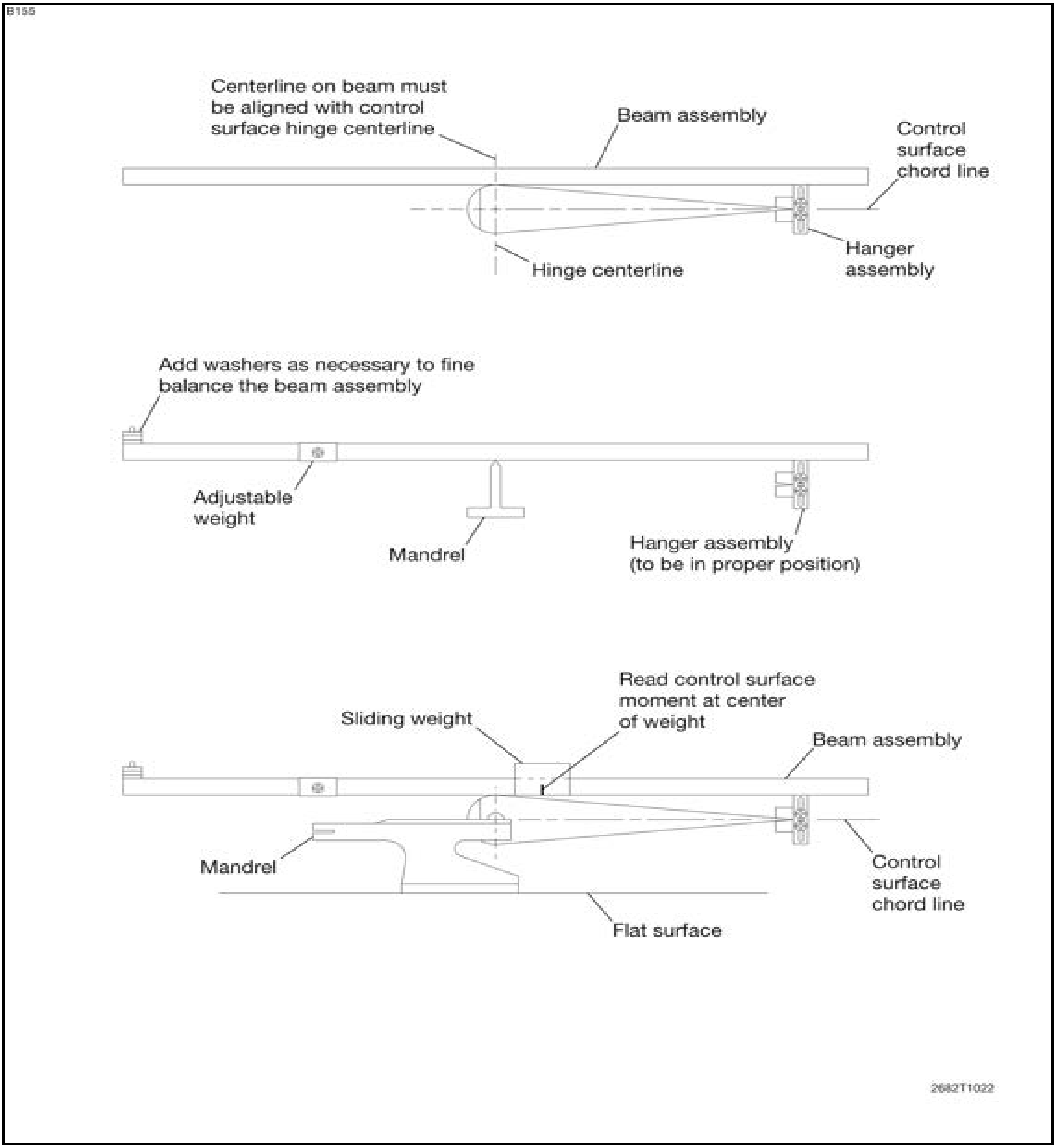


Figure 2 : Sheet 2 : Balancing Control Surfaces

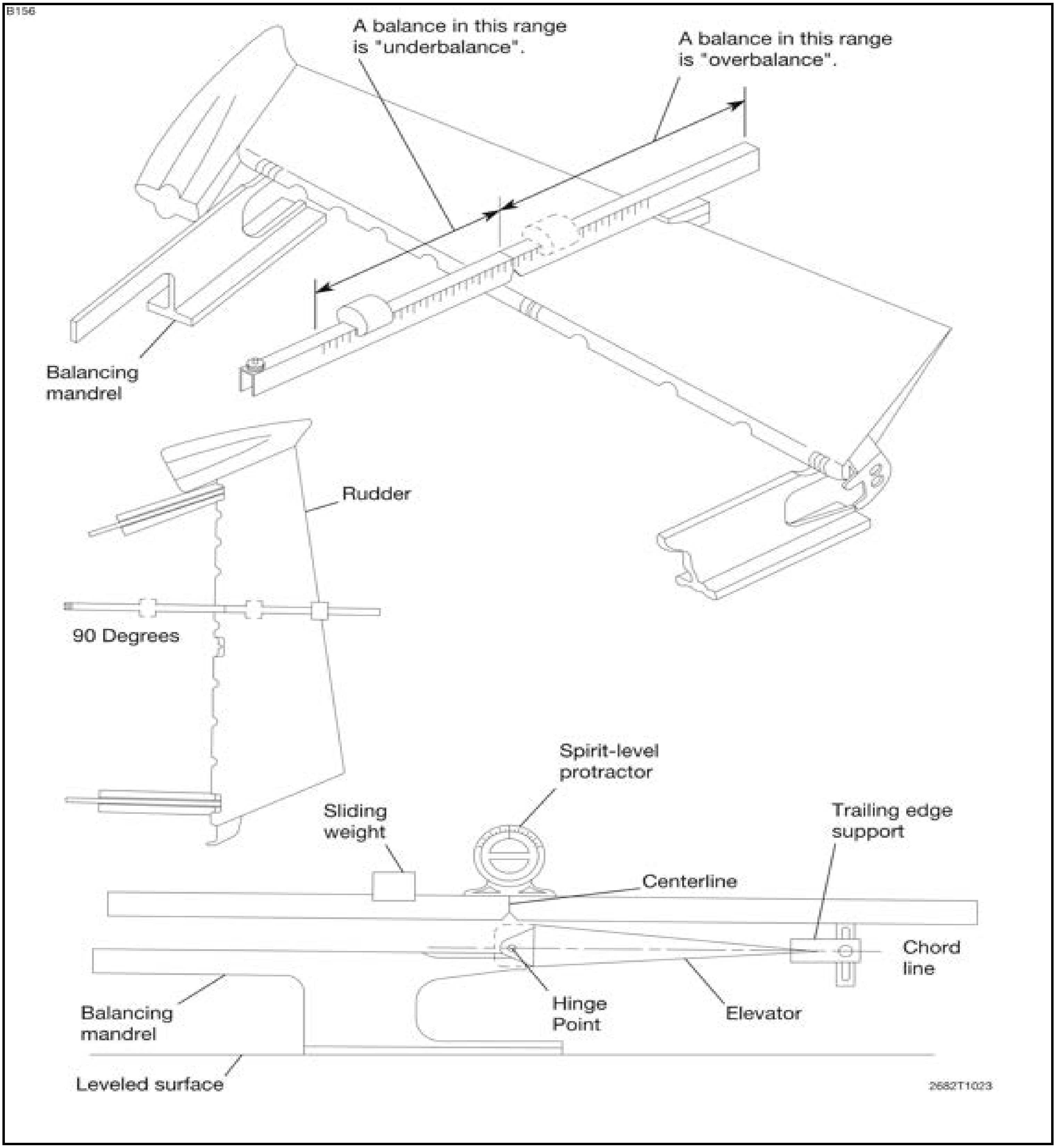


Figure 2 : Sheet 3 : Balancing Control Surfaces

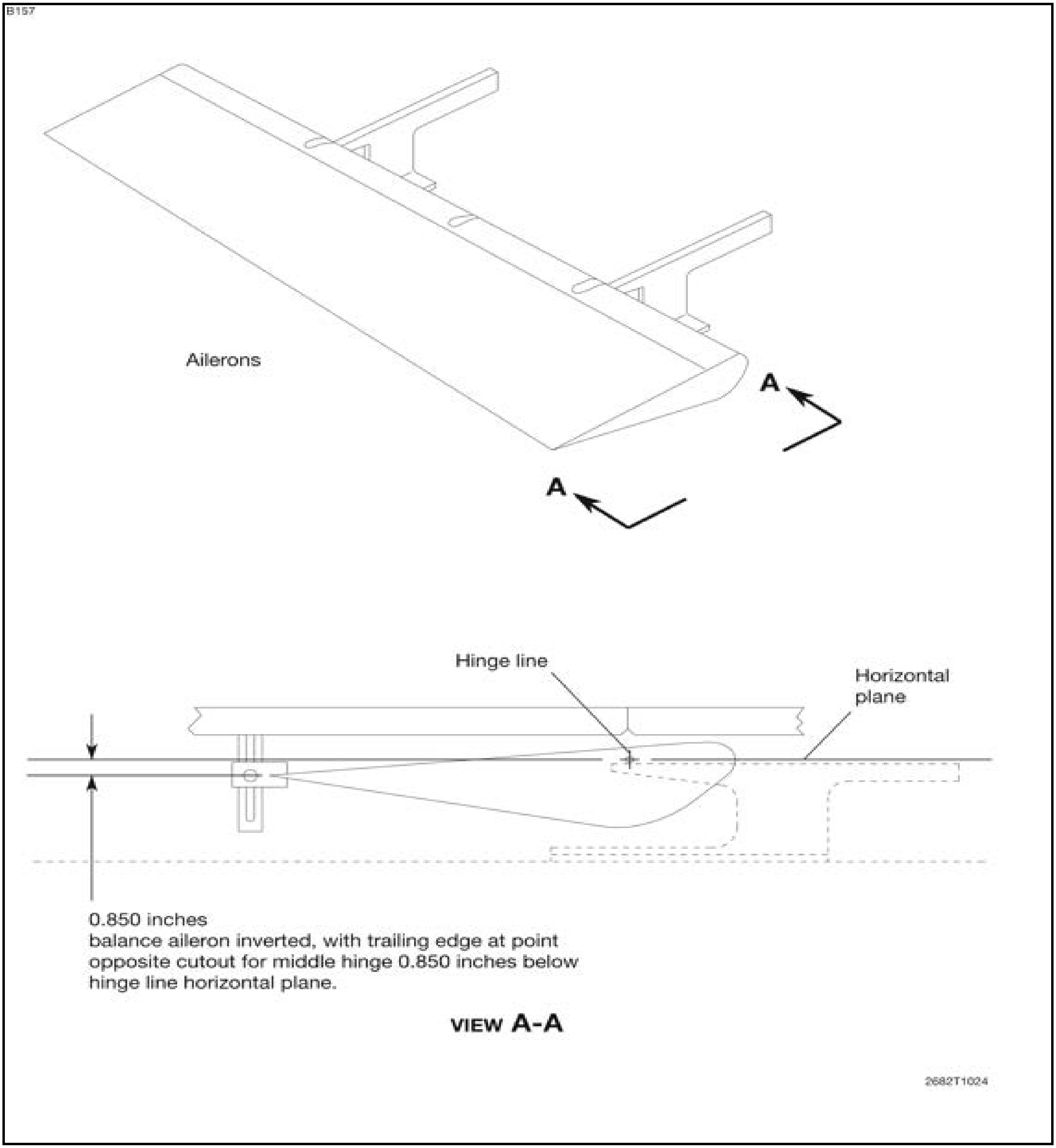
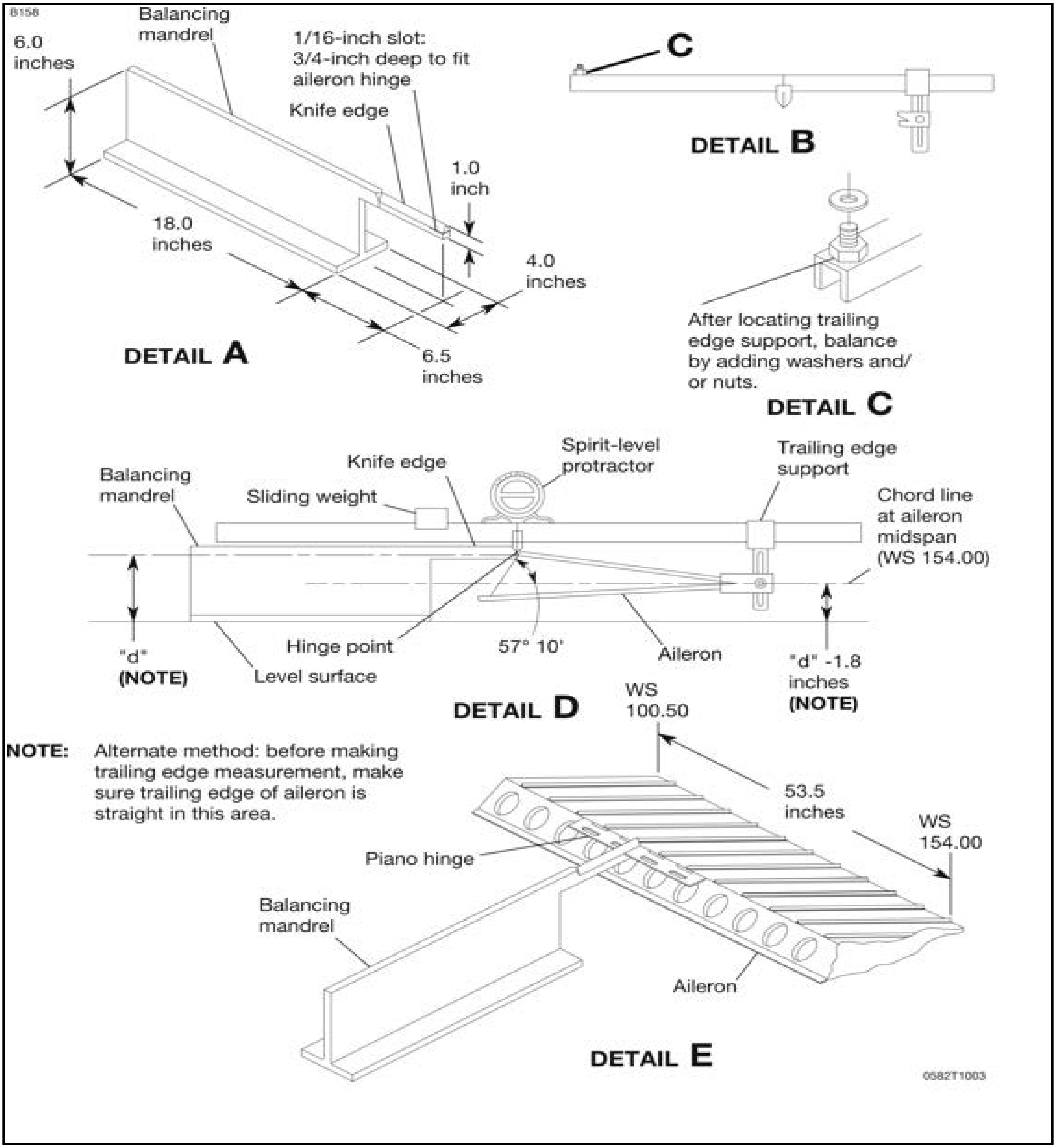


Figure 2 : Sheet 4 : Balancing Control Surfaces



REPAIRS - GENERAL

1. Introduction

A. Many components of the airframe structure are similar in design and fabrication. Examples of such items are sheet metal webs, formed structural shapes and extrusions.

B. Typical repairs to these and other items have been compiled in this section to eliminate the duplication of repairs under each applicable component. Repairs in this section apply to the member shown, regardless of location on the airplane structure (except as limited), and will include only those parts or members necessary to show the typical situation.

2. Usage

A. Typical repairs may be accomplished individually, or combined with other repairs for a major repair. Technique and material variation is permissible only so far as to facilitate fabrication and ensure the original strength and usefulness of the affected component.

3. Preparation for Repair

A. The airplane should be located in an area where, once positioned, minimum movement or relocation is required. The airplane should be leveled and supported as necessary. Refer to appropriate Maintenance Manual, Chapter 7, Jacking - Maintenance Practices and Chapter 8, Leveling - Maintenance Practices.

RIVETED ALUMINUM STRUCTURE REPAIR

1. Preparing Riveted Aluminum Structure For Repair

A. To prepare an area for repair, examine and classify the damage. Make a thorough check before beginning repairs. In some cases, a damaged part may be classified as needing replacement; however, after removal, closer inspection indicates the part may be repaired.

(1) Remove all ragged edges, dents, tears, cracks, punctures, and similar damages.

(2) Stop-drill all cracks using a No. 30 (0.128 inch) drill.

(3) Leave edges, after removal of damaged area, parallel to any square or rectangular edges of the unit.

(4) Round all corners

(5) Smooth out abrasions and dents

(6) Deburr all edges of repair and ensure that no nicks or scratches remain

(7) Brush all aluminum parts having rough edges with a solution of Iridite or alodine mixed in a ratio of one ounce of Iridite or alodine to one gallon of water, and rinse thoroughly.

(8) To restore original paint and corrosion protectant properties to factory standards, refer to appropriate Maintenance Manual, Chapter 20, Exterior Finish - Cleaning/Painting for refinishing procedures and required materials.

NOTE: Damage adjacent to a previous repair requires removal of the old repair and inclusion of the entire area in the new repair.

GLASS FABRIC REPAIR

1. General

A. The following procedures are for parts which are constructed of epoxy prepreg glass fabric.

2. Tools and Materials

NOTE: Equivalent substitutes may be used for the following:

NAME	NUMBER	MANUFACTURER	USE
Fiberglass	181 weight	Hexcel	Repair composite structures.
Polyethylene sheet		Commercially available	Cover patches while curing.
Adhesive	EA9394	Loctite Aerospace Bay Point, CA 94565	Adhesive resin.
Adhesive	EA9396	Loctite Aerospace	Adhesive resin.
Adhesive	Epon 815	Loctite Aerospace	Adhesive resin.
Methyl Propyl Ketone		Commercially available	Cleaning solvent.
Sandpaper	Various grits	Commercially available	Abrading, smoothing.
Rubber sheet		Commercially available	Cover patches when applying pressure.

3. Repair Of Glass Fabric Parts

A. The procedures listed below are for repairing of glass fabric parts. Refer to Figure 801 for an illustration of a typical glass fabric repair.

(1) Cut and trim area immediately beyond damage. If parts were painted, remove paint and sand clean an area at least 1-1/2 inches larger in diameter than the cut out section.

(2) Prepare necessary size and number of patches of glass fabric style No. 181.

WARNING: Always follow manufacturer's mixing instructions carefully to ensure proper cure and prevent a spontaneous fire.

(3) Mix sufficient amount of resin in accordance with manufacturers instructions.

(4) Ensure that hands are free from oil, grease, and dirt, and apply an even coat of resin on sanded area.

(5) Impregnate all the glass fabric patches by laying them on a polyethylene sheet and working the resin through the glass fabric with a small brush.

(6) Place larger patch over cutout area, working out all air bubbles and wrinkles.

(7) If cutout is large enough to cause the patch to sag, place a suitable support behind repair area.

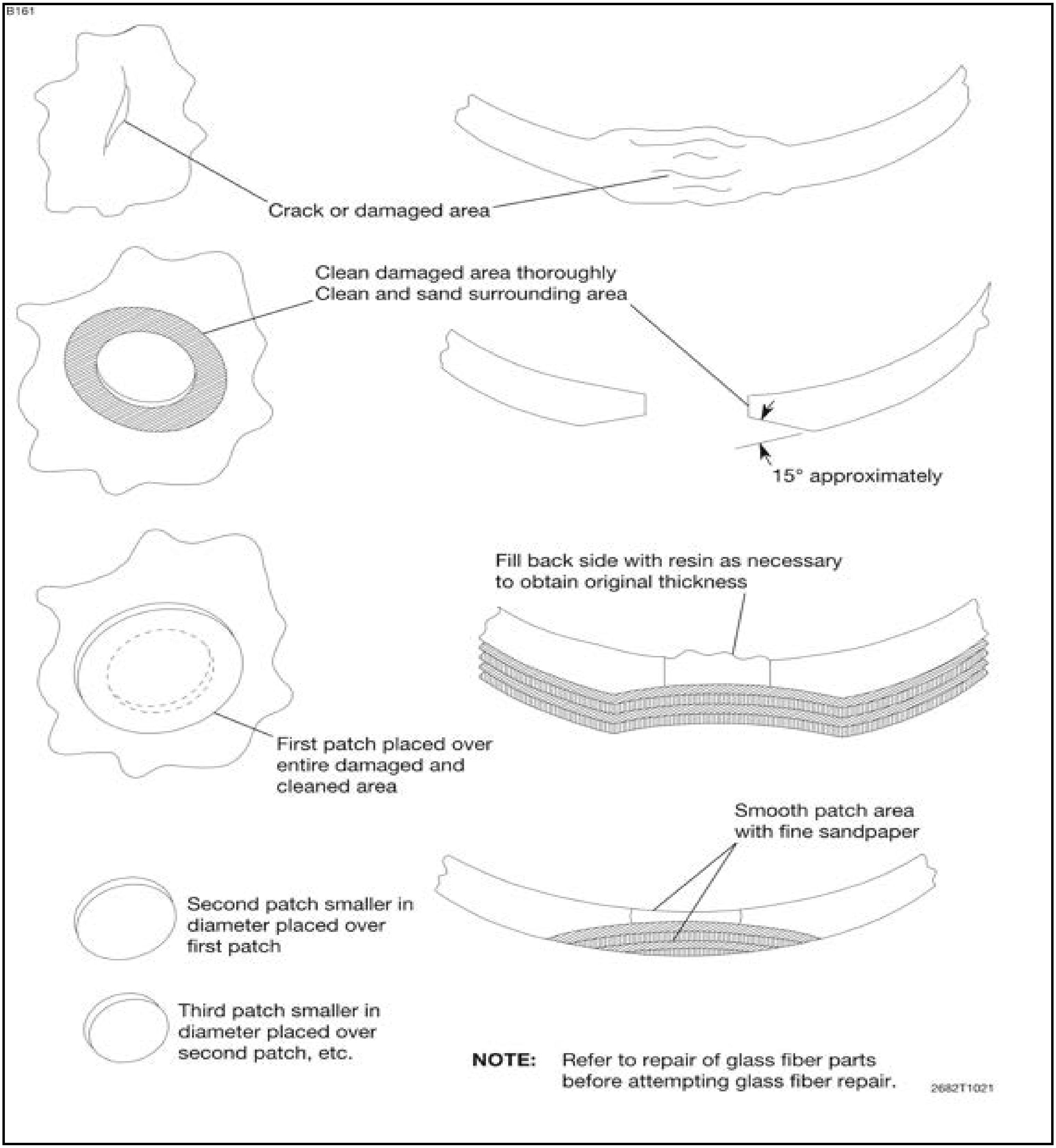
(8) Apply a second patch over the first patch, working out all wrinkles and air bubbles.

(9) After all patches have been applied, brush the area with an even coat of resin and allow to cure. Curing time is 24 hours at 77°F.

(10) Smooth patched area with 600-grit sandpaper until desired finish is obtained.

(11) Repaint finished area with matching paint. Refer to the applicable Maintenance Manual, Chapter 20, Exterior Finish - Cleaning/Painting for painting procedures.

Figure 801 : Sheet 1 : Typical Glass Fiber Panel Repair



REPAIR OF THERMO-FORMED THERMO PLASTIC COMPONENTS

1. Thermo-formed Thermo Plastic Repair

A. Repair of puncture or holes in thermo-formed plastics can be made by trimming out the damaged area, removing any paint in the area, and installing an overlapping, beveled, or flush patch of identical material. Doublers may be installed behind the patch where additional strength is desired. MPK, or any commercially available solvent that will soften and dissolve the plastic, may be used as the bonding agent. Dissolving some of the plastic shavings in the solvent will furnish additional working time. Moderate pressure is recommended for best results. Curing time will vary with the agent used, but repairs should not be strained until fully cured. Cracks can be repaired by saturating the crack itself with the solvent, then filling with an epoxy filler or a paste made of the plastic shavings and the solvent. Again, the crack may be reinforced with a doubler on the back side for additional strength. After the repair has been made, the area may be sanded smooth and painted. Parts that are extensively damaged should be replaced instead of repaired.

2. Temporary Repairs

A. Crack Repair

(1) It is permissible to stop drill crack(s) that originate at the edge of a fairing if the crack is less than 2 inches (50 mm) in length.

(a) Stop drill the crack with a Number 30 (0.128 inch diameter) drill bit.

(b) A crack may be stop drilled only once.

NOTE: A crack that passes through a fastener hole and does not extend to the edge of the part, may be stop drilled at both ends of the crack.

(c) Any fairing that has a crack that progresses past a stop drilled hole must be repaired or replaced.

(d) A fairing that has any of the following conditions must have a repair made as soon as practical:

1 A crack that is longer than 2 inches (50 mm).

2 Cracks in more than 10 percent of the attach fastener locations per fairing.

(2) Fairings, with a stop drilled crack that does not extend past the stop drilled hole, may remain in service until the next 100 hour or equivalent inspection.

TYPICAL SKIN REPAIRS

1. General

A. Damage which would involve a typical skin repair can be described as damage that requires modification, such as material replacement or patching. Skin damage in the form of dents, scratches, or punctures requires a patch. Refer to Figure 801, for an illustration of typical skin repairs. Refer to Figure 802 for corrugated skin repairs.

2. Guidelines for Corrugated Skin Crack Repairs

A. Corrugated Aileron Skin Repair:

(1) It is permissible to stop drill crack(s) that originate at the trailing edge of the control surface provided the crack(s) is(are) not more than 2 inches in length.

(2) Stop dill crack(s) using a Number 30 (0.128 inch diameter) drill.

(3) A crack may only be stop dilled once.

NOTE: A crack that passes through a trailing edge rivet and does not extend to the trailing edge of the skin may be stop drilled at both ends of the crack.

(4) Any control surface that has a crack that progresses past a stop drilled hole shall be repaired or replaced.

(5) A control surface that has any of the following conditions shall have a repair made as soon as practical:

(a) A crack that is longer than 2 inches.

(b) A crack that does not originate from the trailing edge or a trailing edge rivet.

(c) Cracks in more than six trailing edge rivet locations per skin.

(6) Affected control surfaces with corrugated skins and having a stop drilled crack that does not extend past the stop drilled hole, may remain in service without additional repair.

(7) Refer to Figure 802 as applicable for repair information.

B. Corrugated Flap Skin Repair:

(1) It is permissible to stop drill crack(s) that originate at the trailing edge of the control surface provided the crack(s) is(are) not more than 2 inches in length.

(2) Stop dill crack(s) using a Number 30 (0.128 inch diameter) drill.

(3) A crack may only be stop dilled once.

NOTE: A crack that passes through a trailing edge rivet and does not extend to the trailing edge of the skin may be stop drilled at both ends of the crack.

(4) Any control surface that has a crack that progresses past a stop drilled hole shall be repaired or replaced.

(5) A control surface that has any of the following conditions shall have a repair made as soon as practical:

(a) A crack that is longer than 2 inches.

(b) A crack that does not originate from the trailing edge or a trailing edge rivet.

(c) Cracks in more than six trailing edge rivet locations per skin.

(6) Affected control surfaces with corrugated skins and having a stop drilled crack that does not extend past the stop drilled hole, may remain in service without additional repair.

(7) Refer to Figure 802 as applicable for repair information.

C. Corrugated Elevator Skin Repair:

(1) It is permissible to stop drill crack(s) that originate at the trailing edge of the control surface provided the crack(s) is(are) not more than 2 inches in length.

(2) Stop dill crack(s) using a Number 30 (0.128 inch diameter) drill.

(3) A crack may only be stop dilled once.

NOTE: A crack that passes through a trailing edge rivet and does not extend to the trailing edge of the skin may be stop drilled at both ends of the crack.

(4) Any control surface that has a crack that progresses past a stop drilled hole shall be repaired or replaced.

(5) A control surface that has any of the following conditions shall have a repair made as soon as practical:

(a) A crack that is longer than 2 inches.

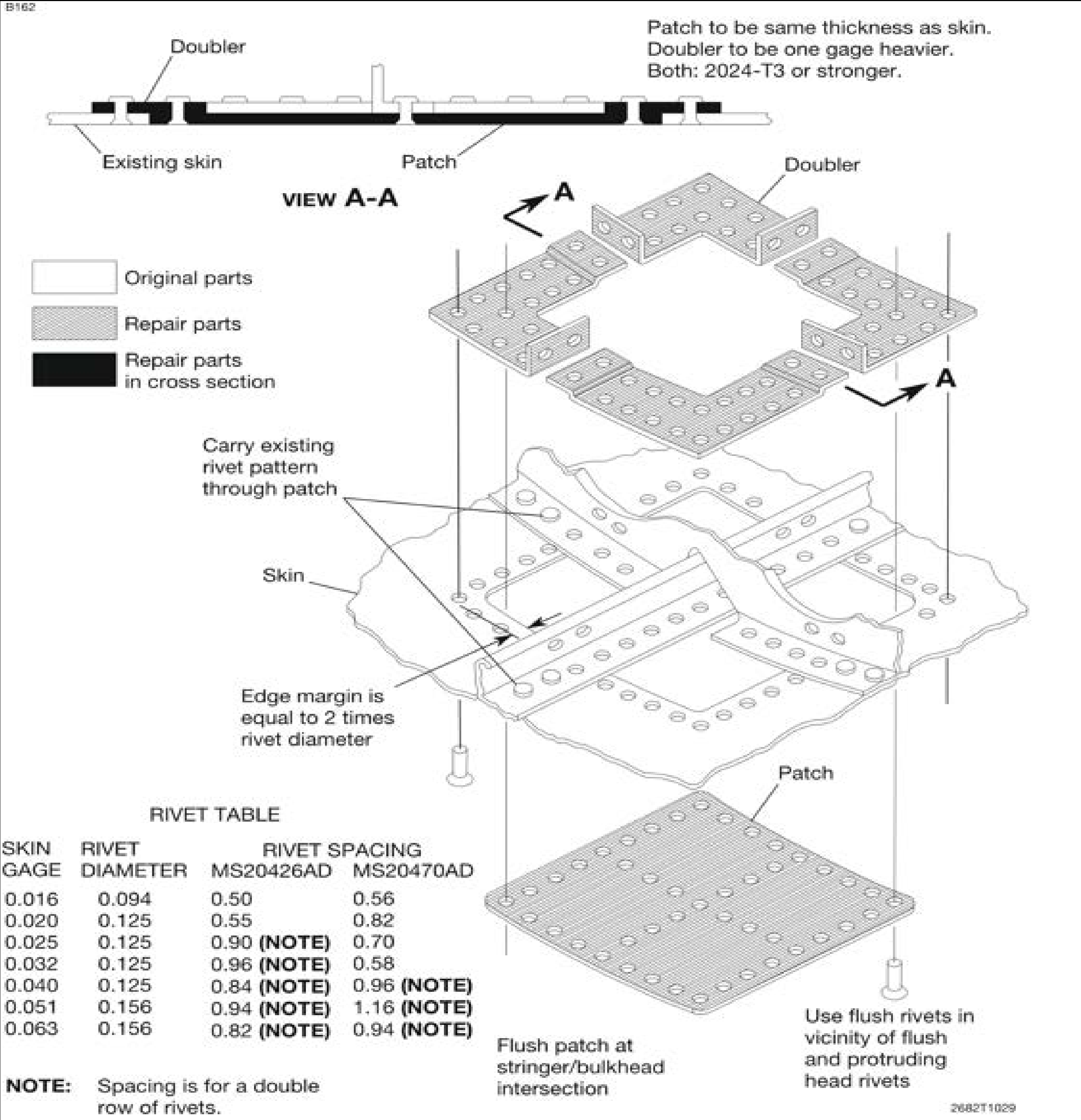
(b) A crack that does not originate from the trailing edge or a trailing edge rivet.

(c) Cracks in more than six trailing edge rivet locations per skin.

(6) Affected control surfaces with corrugated skins and having a stop drilled crack that does not extend past the stop drilled hole, may remain in service without additional repair.

(7) Refer to Figure 802 as applicable for repair information.

Figure 801 : Sheet 1 : Skin Repair

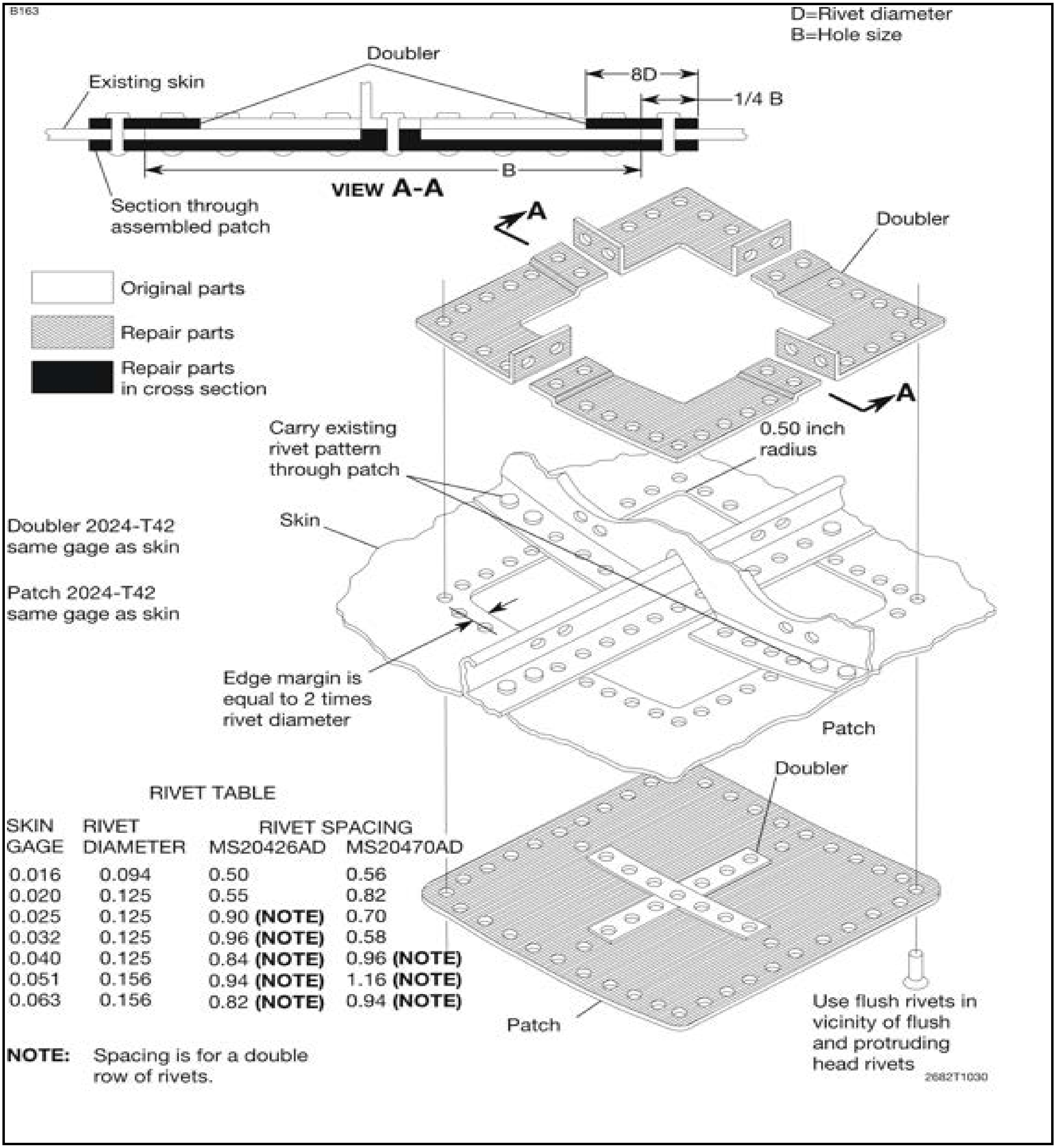


RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 2 : Skin Repair



RIVET TABLE

SKIN GAGE	RIVET DIAMETER	RIVET SPACING MS20426AD	MS20470AD
0.016	0.094	0.50	0.56
0.020	0.125	0.55	0.82
0.025	0.125	0.90 **(NOTE)**	0.70
0.032	0.125	0.96 **(NOTE)**	0.58
0.040	0.125	0.84 **(NOTE)**	0.96 **(NOTE)**
0.051	0.156	0.94 **(NOTE)**	1.16 **(NOTE)**
0.063	0.156	0.82 **(NOTE)**	0.94 **(NOTE)**

NOTE: Spacing is for a double row of rivets.

Figure 801 : Sheet 3 : Skin Repair

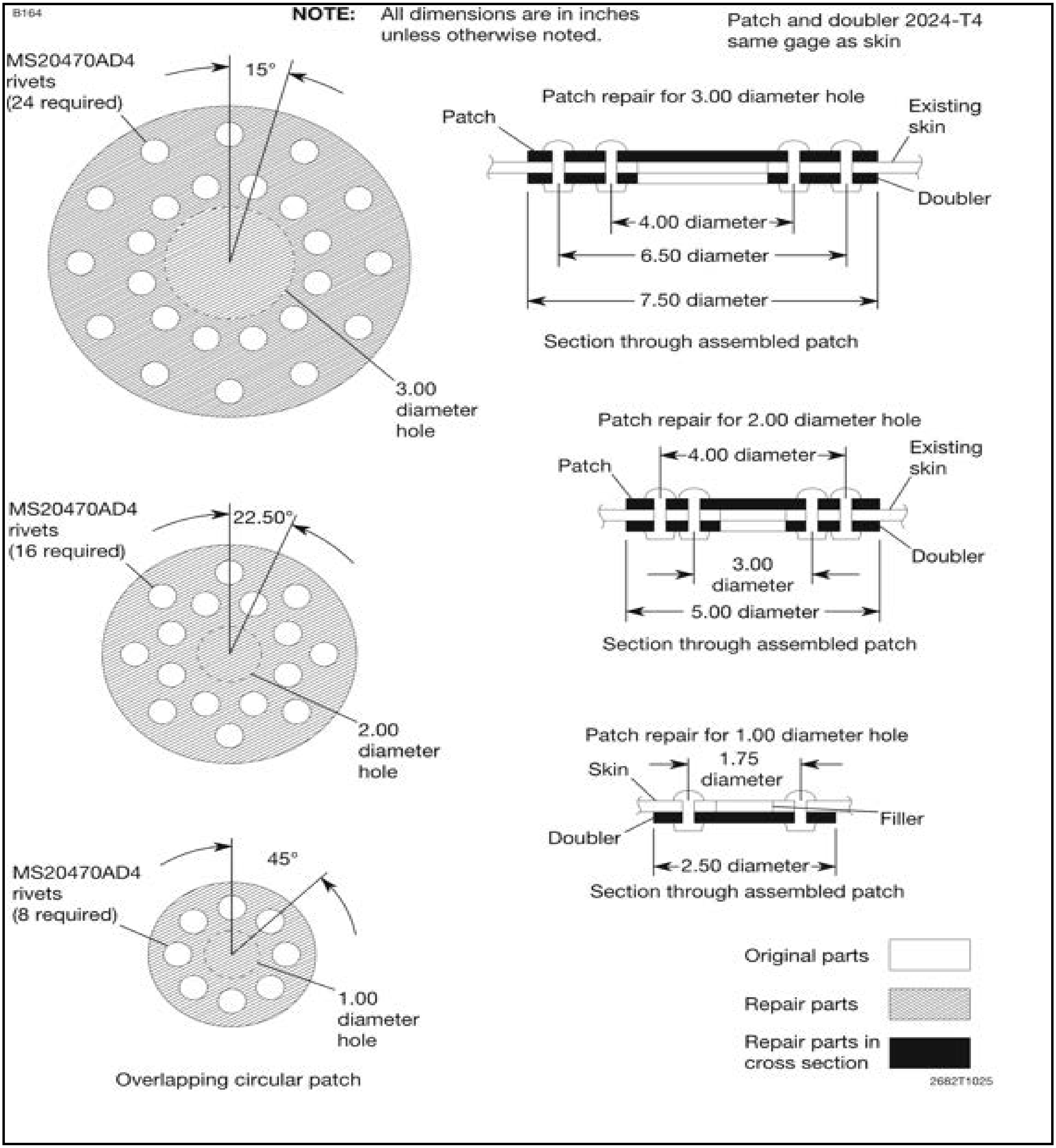


Figure 801 : Sheet 4 : Skin Repair

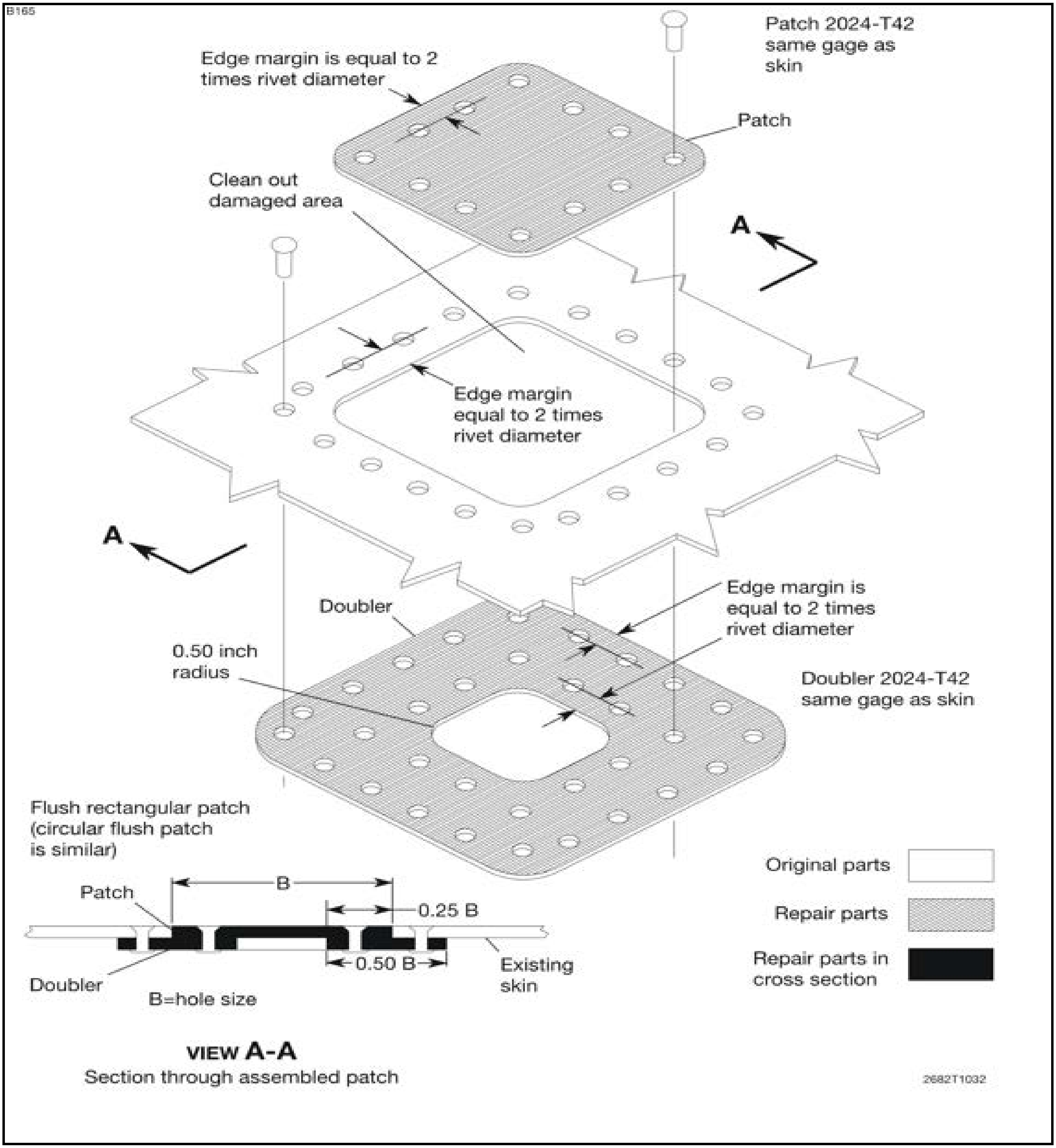


Figure 801 : Sheet 5 : Skin Repair

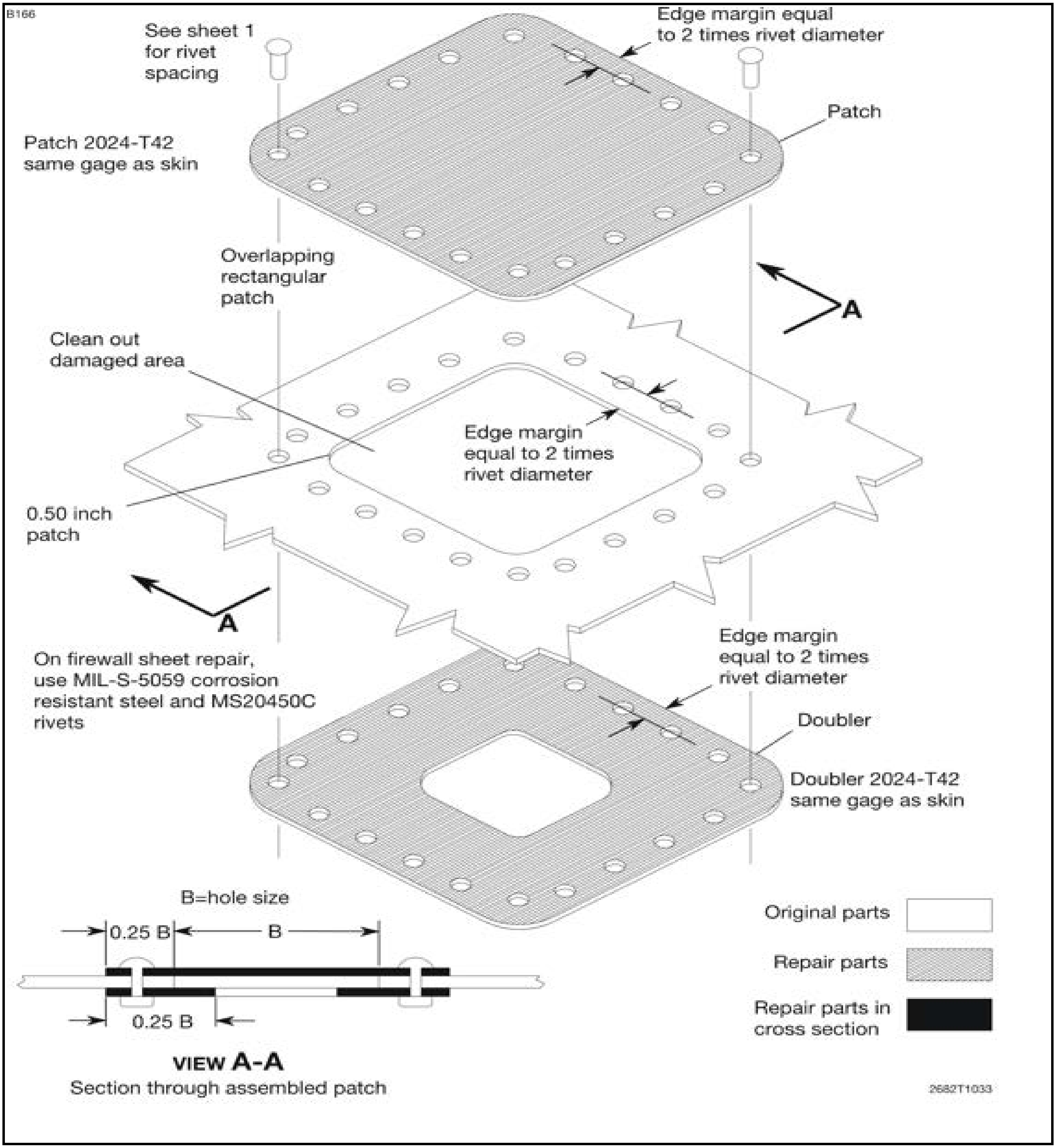
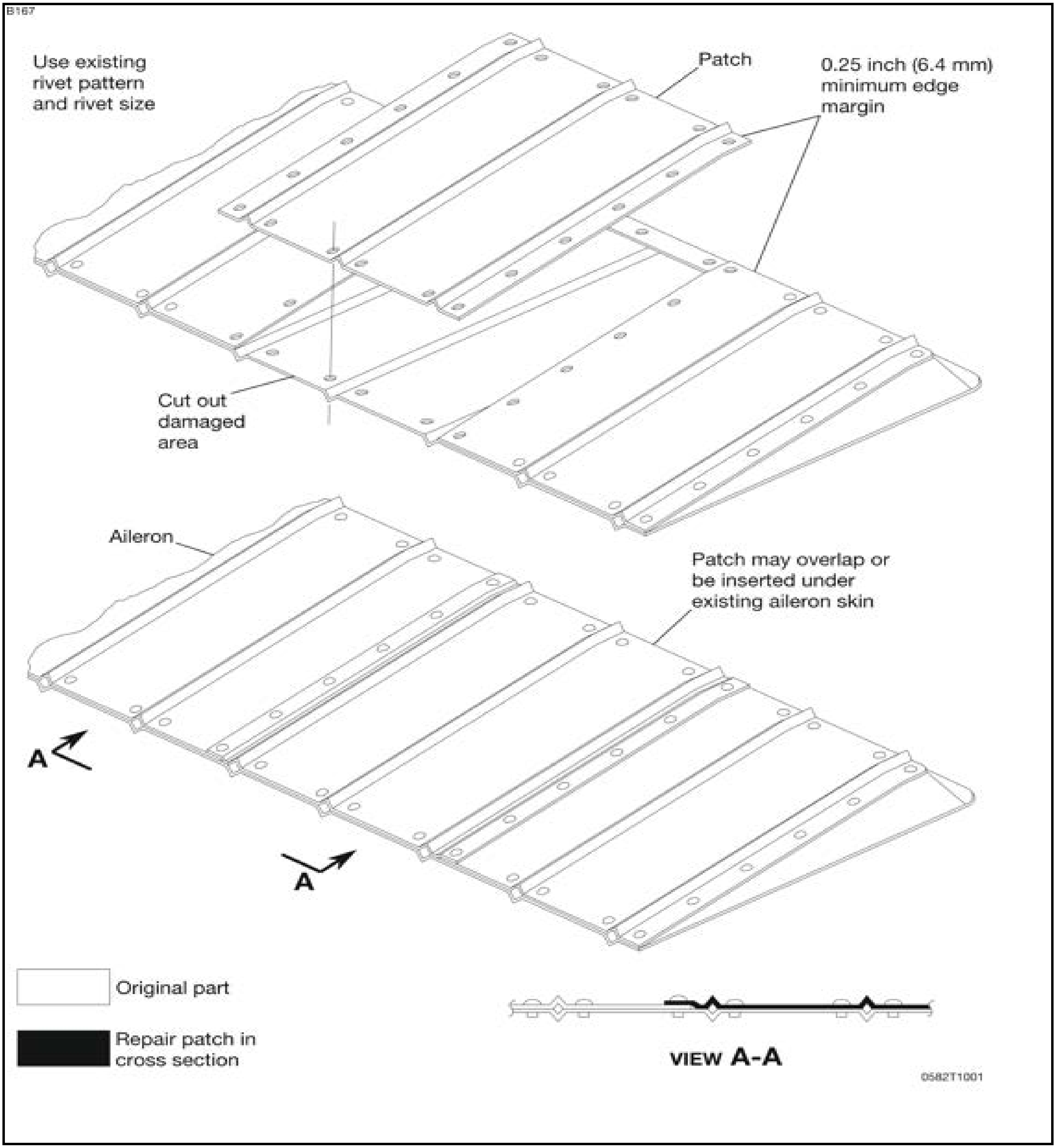


Figure 802 : Sheet 1 : Corrugated Skin Repair



CONTROL SURFACE REPAIR

1. General

A. Damage which would involve a control surface repair: After the repair is completed, the control surface balance must be checked as described in Flight Control Surface Balancing. Refer to Figures 801 and 802 which illustrate typical control surface repairs.

Figure 801 : Sheet 1 : Typical Control Surface Rib Repair

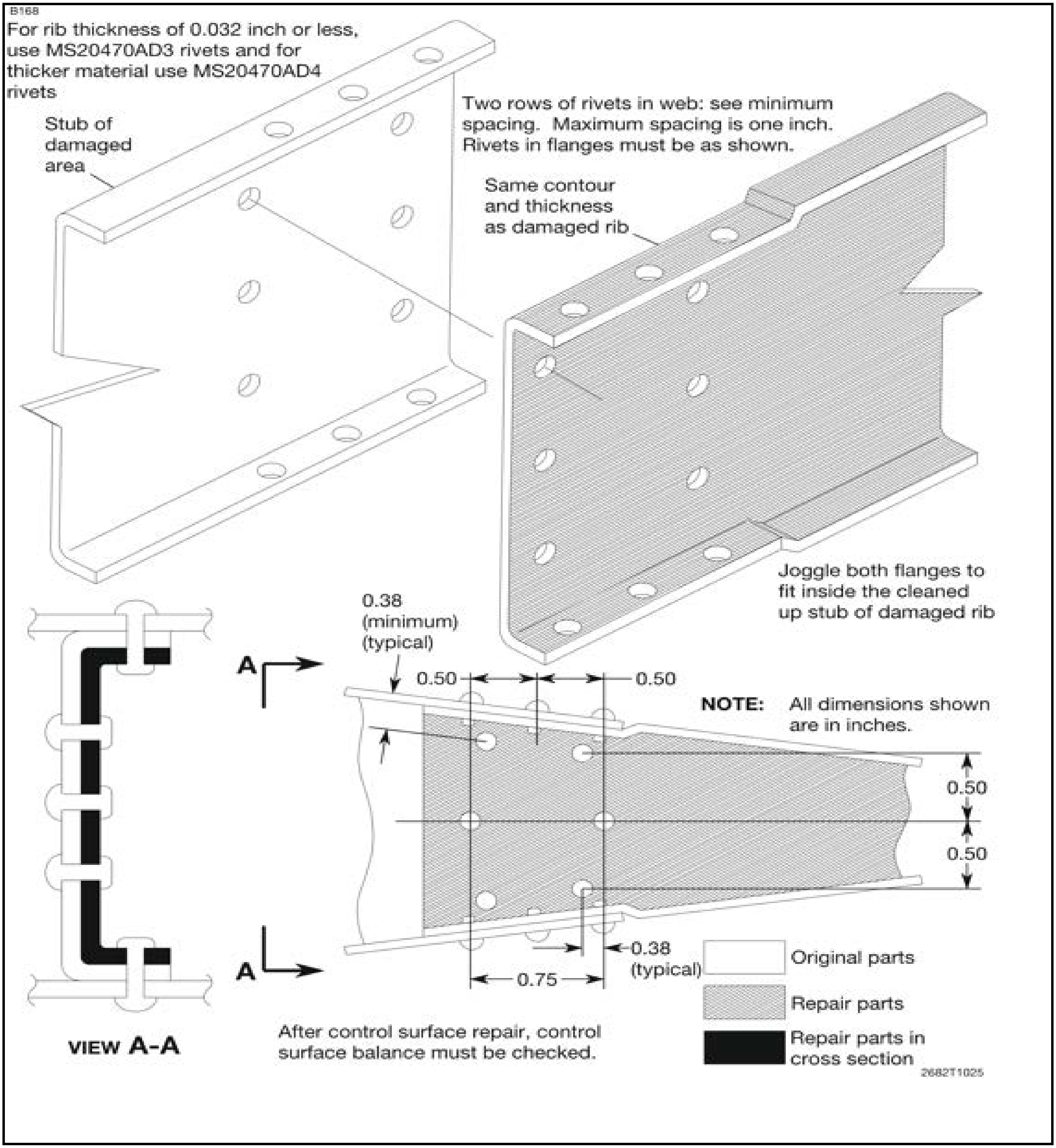
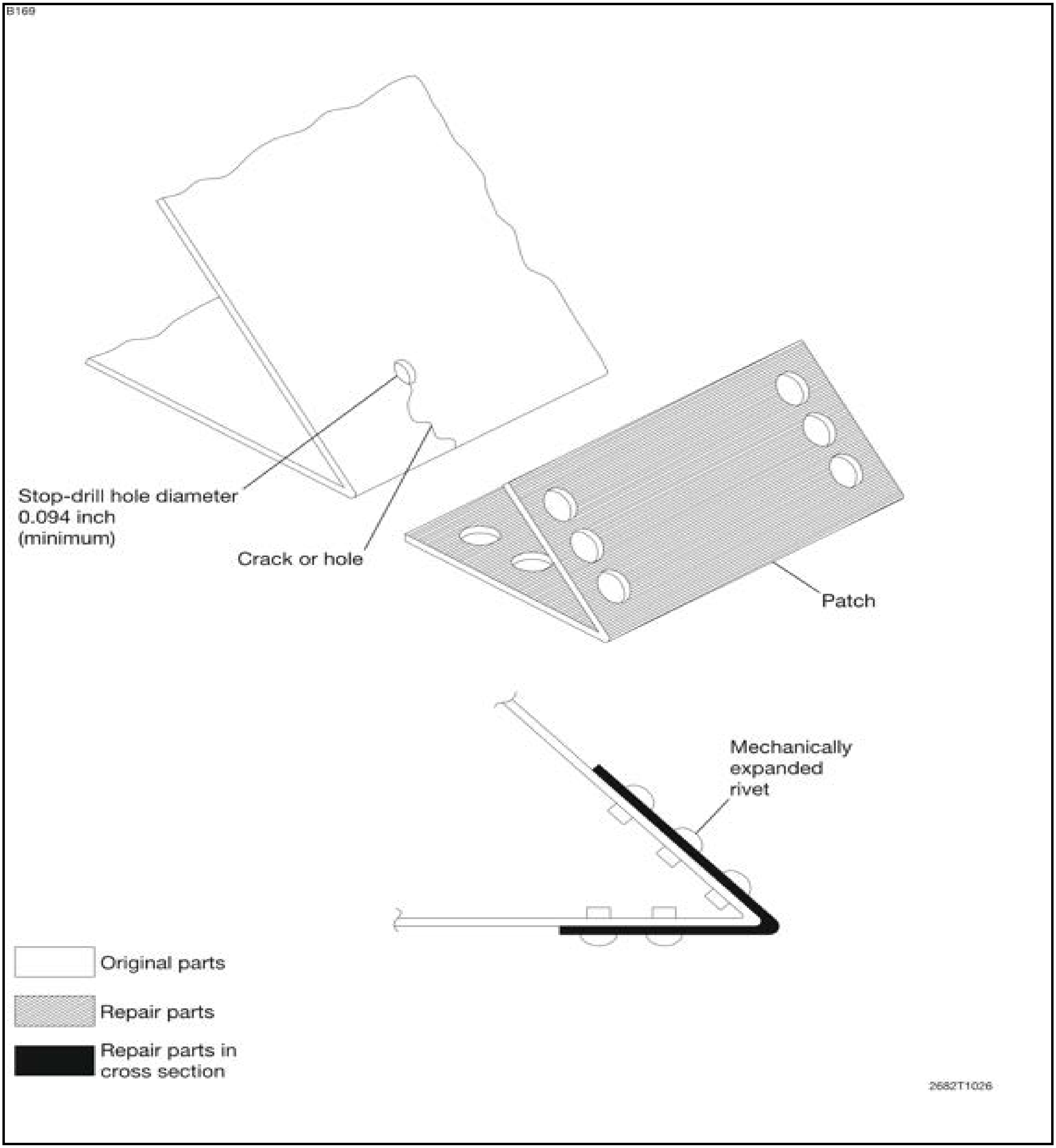


Figure 802 : Sheet 1 : Typical Control Surface Trailing Edge Repair



DOORS - GENERAL

1. General

A. Chapter 52 describes general repair practices, materials and procedures which are applicable to the doors and door structure.

B. If questions arise concerning approved repairs or for repairs not shown in this section, contact Cessna Propeller Aircraft Product Support.

DOOR DAMAGE CLASSIFICATION

1. Repairable Damage

A. Bonded doors may be repaired by the same methods used for riveted structure. Rivets are a satisfactory substitute for bonded seams on these assemblies. The strength of the bonded seams in doors may be replaced by a single 3/32, 2117-AD rivet per running inch of bond seam. The standard repair procedures outlined in AC43.13-1b are also applicable to bonded doors.