

APPENDIX A — MATERIAL INFORMATION

TABLE OF CONTENTS

Paragraph Number	Title	Page Number
MATERIAL INFORMATION		
A-1	Curing Times for Sealants and Miscellaneous Adhesives	A-3
A-2	Ordering Repair Material.....	A-4
A-2-1	Composite Bond Sheet Metal Repair Stock (Bell Standard 150-021)	A-4
A-2-2	Repair Angle (Bell Standard 151-028).....	A-6
A-2-3	Flanged Hole Repair Material	A-8
A-2-4	Honeycomb Core Repair Material	A-10
A-3	Material Identification	A-12
A-3-1	Identifying Magnetic from Non-magnetic Material	A-14
A-3-2	Identifying Magnetic Materials	A-14
A-3-3	Identifying Non-magnetic Materials	A-14
A-3-3-1	Identifying Magnesium	A-14
A-3-3-2	Identifying 7075 Aluminum Alloy	A-14
A-3-3-3	Identifying 2024 Aluminum Alloy from 6013 Aluminum Alloy	A-15
A-3-3-4	Identifying Corrosion Resistant Steel (CRES)	A-15
A-3-3-5	Identifying Hastalloy X from CRES 321 or N-155	A-15
A-3-3-6	Identifying Cress 321 from CRES N-155	A-15
A-4	Material Specifications	A-16
A-5	Blind Rivets Equivalencies.....	A-18
A-6	Approved Fasteners for Use in Carbon Fiber Reinforced Composite Materials .	A-19
A-7	Materials Compatibility.....	A-21

TABLES

Table Number	Title	Page Number
A-1	Curing Time for Sealants	A-3
A-2	Composite Bond Material.....	A-5
A-3	Preformed Repair Angles.....	A-7
A-4	Flanged Hole Repair Material Data.....	A-8
A-5	Polyamide Honeycomb Core (Basic Number = T1).....	A-10
A-6	Fiberglass Honeycomb Core (Basic Number = T2)	A-11
A-7	Aramid Paper Honeycomb Core (Basic Number = T3).....	A-11
A-8	5052 Aluminum Honeycomb Core (Basic Number = T4).....	A-11
A-9	5056 Aluminum Honeycomb Core (Basic Number = T5(3))	A-11
A-10	Most Common Material Specifications.....	A-16
A-11	Titanium Equivalencies	A-18
A-12	Blind Rivet Alternate Part Numbers	A-18
A-13	Approved Fasteners for Use in Fiber Reinforced Composite Parts	A-20

MATERIAL INFORMATION

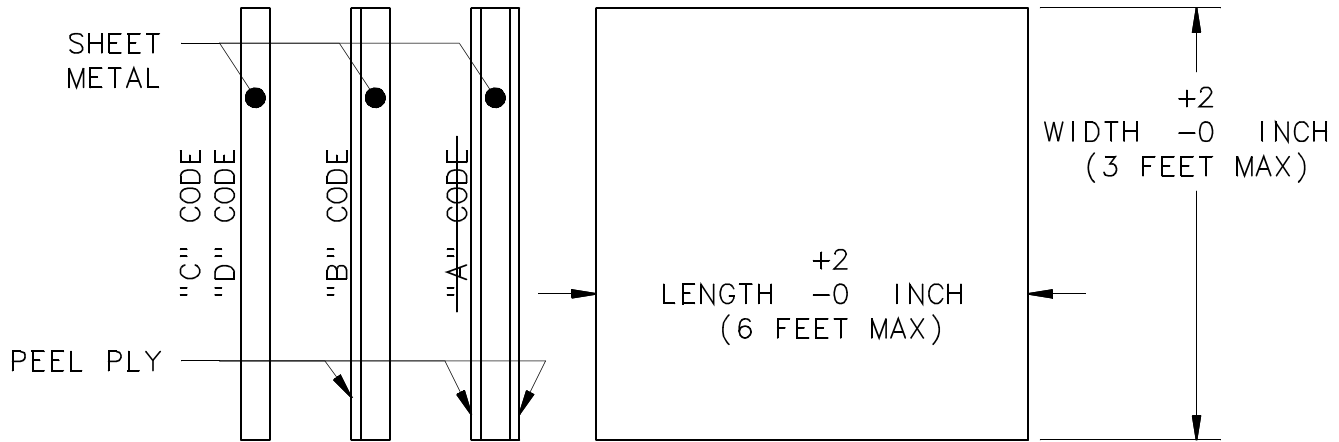
A-1. CURING TIMES FOR SEALANTS AND MISCELLANEOUS ADHESIVES

Table A-1. Curing Time for Sealants

Military Description	Application	Mix Ratio	Pot Life	Curing Time
Pro-Seal 890 B2 MIL-S-8802 B-2, Type I or II, Class B-2	Sealant for semi-permanent joints	10:1	2 hours	75°F/3 days
Pro-Seal 700 MIL-S-38249	Repair sealant of firewall	100:1	12 hours	48 hours to tack free
PR-1436-G MIL-S-81733, Type I or II	Sealant for joints that must be opened periodically	10:1	2 hours	75°F/3 days
EC3549 BHT 299-947-066, Type I	Polycarbonate duct repair with Fiberglass	109:100	35 minutes	160°F/3 hours
PS-30 BHT 299-947-152, Type I, Class 1	Acrylic plastics bonding	Use all of 50 Gram kit	2 hours	75°F/24 hours

A-2. ORDERING REPAIR MATERIAL

A-2-1. COMPOSITE BOND SHEET METAL REPAIR STOCK (BELL STANDARD 150-021)



ALL-SRM-B-02-01-1

Example of Part Number 150-021- () () () -()

Basic Number

Length in 1 foot increment, 4 feet max²

Dash Number from Table B-2

Width in 1 foot increments, 2 feet max²

“A” = Adhesive ply both sides 1

“B” = Adhesive ply one side

“C” = No adhesive ply

“D” = Primed both sides

Examples: 150-021-16B2-4 = 2024-T3 5WL pattern repair sheet, 0.020 inch (0.51 mm) thick, 2 feet (609.60 mm) wide by 4 feet (1219.20 mm) long, adhesive and peel ply on one side.

150-021-58C2-4 = 7075-T6 smooth repair sheet, 0.016 inch (0.41 mm) thick, 2 feet (609.60 mm) wide by 4 feet (1219.20 mm) long, without adhesive and peel ply.

- 1) “A” code designates adhesive and peel ply on both faces of sheet, valid for smooth surfaces only.
 “B” code designates adhesive and peel ply on one face of sheet only, valid for smooth and rigidized surfaces.
 “C” code designates no adhesive and peel ply on both faces of sheet, valid for smooth and rigidized surfaces.
 “D” code designates chemical film and primer without adhesive and peel ply on both faces of sheet, valid for rigidized surfaces only.
- 2) Materials may be available in one of either of the two following sizes: 1 x 2 feet (304.80 x 609.60 mm), 2 x 4 feet (609.60 x 1219.20 mm). Some materials are also available in the following sizes: 1 x 1 feet (304.80 x 304.80 mm), 2 x 2 feet (609.60 x 609.60 mm).

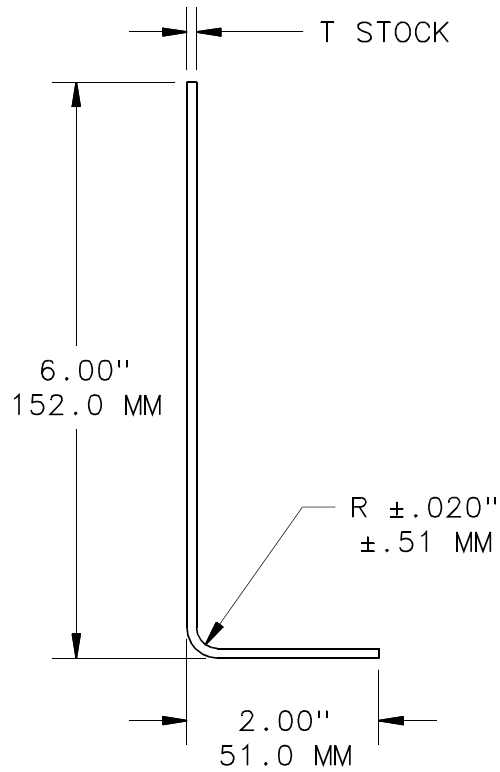
Table A-2. Composite Bond Material

Thickness ⁽¹⁾	MATERIAL TYPE ⁽⁵⁾⁽⁷⁾							
	2024-T3			7075-T6	6013-T6 ⁽⁴⁾	TITANIUM		301 CRES
	SMOOTH	5WL ⁽²⁾ RIGIDIZED	6WL ⁽²⁾ RIGIDIZED	SMOOTH	SMOOTH	SMOOTH	5WL ⁽²⁾ RIGIDIZED	½ HARD SMOOTH
0.008 (0.20)								-69
0.012 (0.30)	-2	-12		-56	-81	-31	-41	-71
0.016 (0.41)	-4		-24	-58	-82	-33	-43	
0.020 (0.51)	-6	-16		-60	-83			-73
0.025 (0.64)	-8	-20	-28	-62	-84			-77
0.032 (0.81)	-10		-80	-64	-85	-39		-79
0.040 (1.02)	-14		-88	-66	-86			-75
0.050 (1.27)	-18			-68	-87			-76
0.063 (1.60)	-21			-72				-70
0.071 (1.80)				-74				

NOTES:

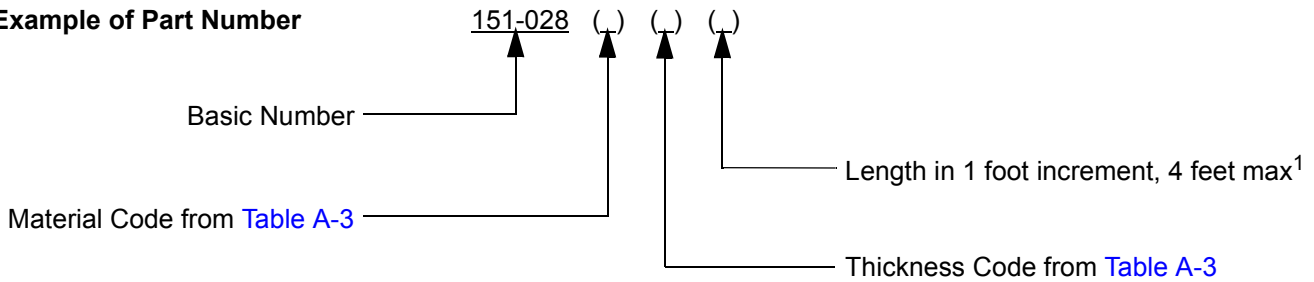
1. Thickness of repair sheet material not including thickness of adhesive. Values are in inches. Values between parentheses are in millimeters (mm).
2. 5WL and 6WL designations are rigidizing pattern numbers of Rigidized Metal Corporation, Buffalo NY.
3. "A" code is no longer available.
4. Use with Bell Helicopter Textron Product Support Engineering approval only.
5. All thicknesses may be ordered, although they may not be actively stocked.
6. Materials may be available in one of either of the two following sizes: 1 X 2 feet (304.80 x 609.60 mm), 2 x 4 feet (609.60 x 1219.20 mm). Some materials are also available in the following sizes: 1 x 1 feet (304.80 x 304.80 mm), 2 x 2 feet (609.60 x 609.60 mm).
7. Material Specifications:
 - Aluminum, 2024-T3 per AMS-QQ-A-250/4,
 - Aluminum, 6013-T6 per AMS 4216,
 - Aluminum, 7075-T6 per AMS-QQ-A-250/12,
 - Titanium, commercially pure per MIL-T-9046, CP-1,
 - Steel, Corrosion Resistant CRES 301 1/2 Hard per 299-947-133, Type II or AMS 5518.

A-2.2. REPAIR ANGLE (BELL STANDARD 151-028)



ALL-SRM-B-02-02-1

Example of Part Number



Examples: 151-028A50324 = 7075-T62 repair angle, 0.032 inch (0.81 mm) thick, 4 feet (1200 mm) long with 0.06 inch (1.52 mm) bend radius.

151-028C10500 = 301 CRES 1/2 HARD repair angle, 0.050 inch (1.27 mm) thick, 4 feet (1200 mm) long with 0.25 inch (6.35 mm) bend radius.

Table A-3. Preformed Repair Angles

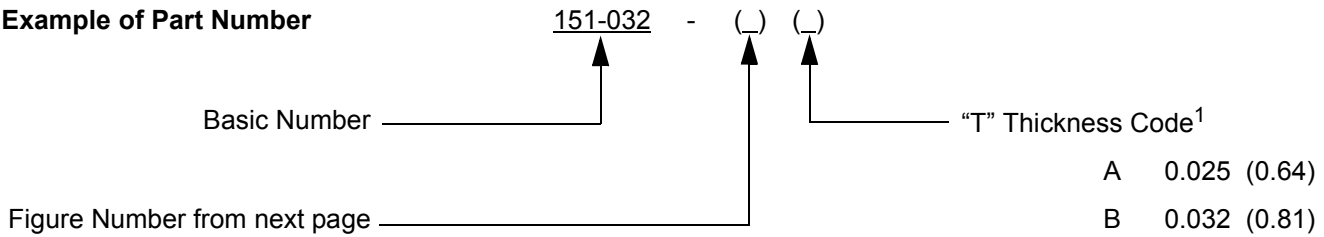
THICKNESS ⁽²⁾ (T)	MATERIAL / BEND RADIUS ⁽²⁾ (BR)			
	ALUMINUM		CRES	TITANIUM ⁽³⁾
	2024-T42	7075-T62	301 1/2 HARD	CP-1
	A4	A5	C1	T1
0.012 (0.30)	0.03 (0.8)	0.06 (1.5)	0.06 (1.5)	0.03 (0.8)
0.016 (0.41)	0.03 (0.8)	0.06 (1.5)	0.09 (2.3)	0.06 (1.5)
0.020 (0.51)	0.06 (1.5)	0.06 (1.5)	0.09 (2.3)	0.06 (1.5)
0.025 (0.64)	0.06 (1.5)	0.06 (1.5)	0.13 (3.3)	0.06 (1.5)
0.032 (0.81)	0.06 (1.5)	0.06 (1.5)	0.16 (4.1)	0.09 (2.3)
0.040 (1.02)	0.09 (2.3)	0.09 (2.3)	0.16 (4.1)	0.13 (3.3)
0.050 (1.27)	0.09 (2.3)	0.09 (2.3)	0.25 (6.4)	0.13 (3.3)
0.063 (1.60)	0.13 (3.3)	0.13 (3.3)	0.25 (6.4)	0.16 (4.1)

NOTES:

1. Material is available in the following length: 4 feet.
Some materials are also available in the following length: 2 feet.
2. Values are in inches. Values between parentheses are in millimeters (mm).
3. These parts are not actively stocked but may be ordered on special order basis.

A-2-3. FLANGED HOLE REPAIR MATERIAL

Example of Part Number



Examples: 151-032-3A = 2024-T42 repair angle, 0.025 inch (0.64 mm) thick, with 5 lightening holes per Figure 3.

151-032-4B = 2024-T42 repair angle, 0.032 inch (0.81 mm) thick, with 14 lightening holes per Figure 4.

- 1) Values are in inches. Values between parentheses are in millimeters (mm).
- 2) Flanged hole repair material only available in 2024-T42 aluminum alloy per AMS-QQ-A-250/4 with chemical film per MIL-C-5541 and primed with epoxy polyamide primer per MIL-PRF-23377.

Table A-4. Flanged Hole Repair Material Data

FIGURE	HOLE	“D” DIA ⁽¹⁾	“C” DIA ⁽¹⁾	H ⁽¹⁾
3	A	6.50 (165.1)	6.00 (152.4)	0.25 (6.4)
	B	6.00 (152.4)	5.50 (139.7)	0.25 (6.4)
	C	4.50 (114.3)	4.00 (101.6)	0.25 (6.4)
	D	4.75 (120.7)	4.25 (108.0)	0.25 (6.4)
	E	4.00 (101.6)	3.50 (88.9)	0.25 (6.4)
4	F	5.00 (127.0)	4.50 (114.3)	0.25 (6.4)
	G	3.50 (88.9)	3.00 (76.2)	0.25 (6.4)
	H	3.25 (82.6)	2.75 (69.9)	0.25 (6.4)
	J	2.75 (69.9)	2.37 (60.2)	0.19 (4.8)
	K	2.25 (57.2)	1.87 (47.5)	0.19 (4.8)
	L	1.75 (44.5)	1.37 (34.8)	0.19 (4.8)
	M	1.25 (31.8)	1.01 (25.7)	0.12 (3.0)
	N	1.00 (25.4)	0.76 (19.3)	0.12 (3.0)
	P	1.50 (38.1)	1.12 (28.4)	0.19 (4.8)
	Q	2.00 (50.8)	1.62 (41.1)	0.19 (4.8)
	R	2.50 (63.5)	2.12 (53.8)	0.19 (4.8)
	S	3.00 (76.2)	2.62 (66.5)	0.19 (4.8)
	T	3.75 (95.3)	3.25 (82.6)	0.25 (6.4)
V	4.25 (108.0)	3.75 (95.3)	0.25 (6.4)	

NOTE:

1. Values are in inches. Values between parentheses are in millimeters (mm).

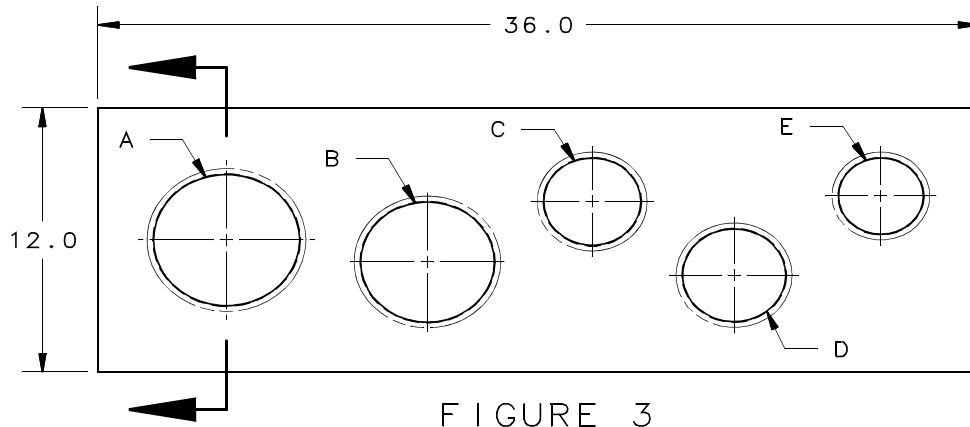


FIGURE 3

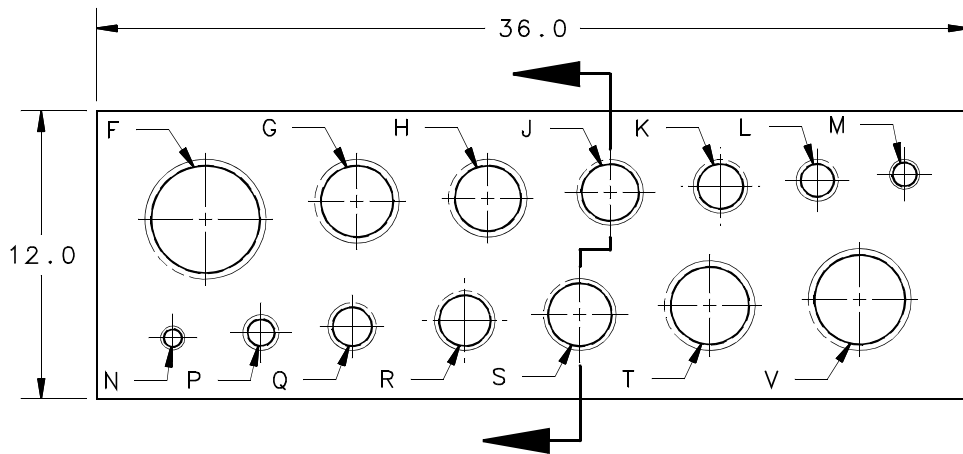
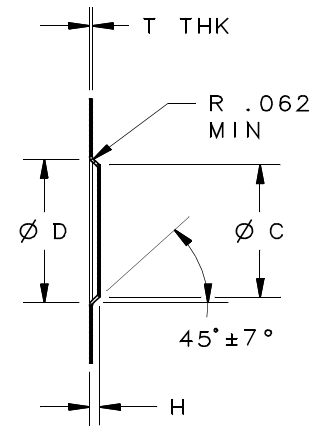
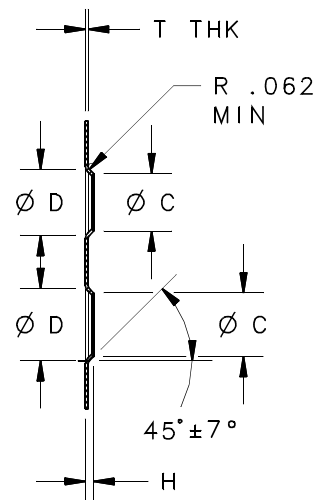
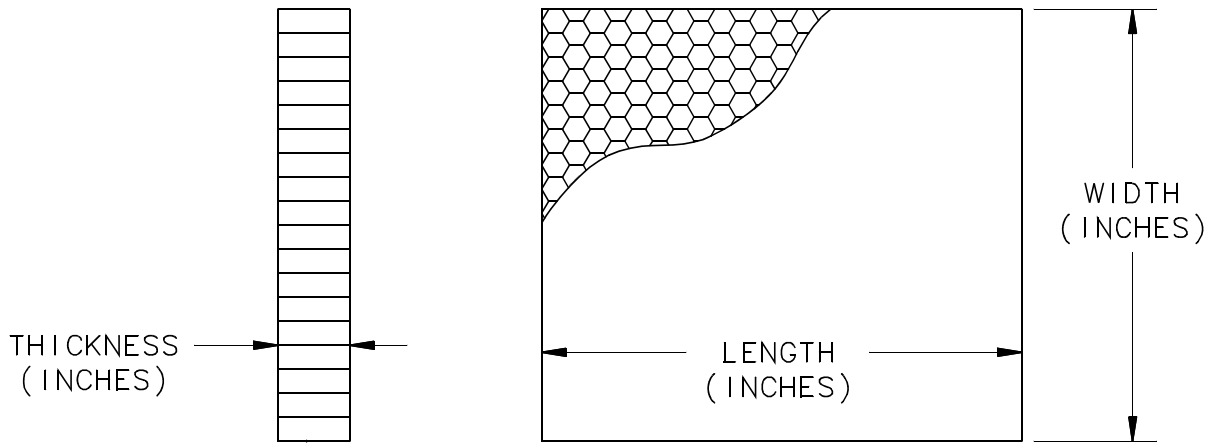


FIGURE 4

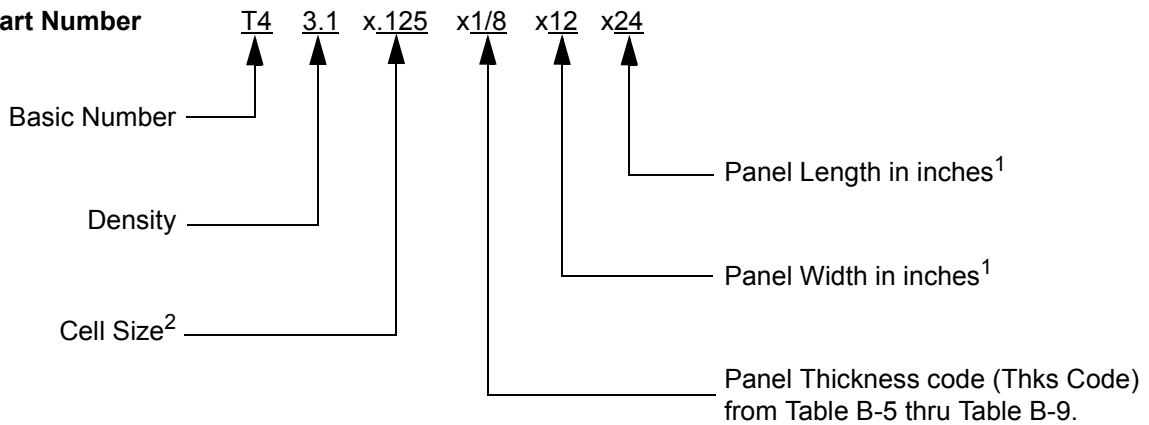


A-2-4. HONEYCOMB CORE REPAIR MATERIAL



ALL-SRM-B-02-03-1

Example of Part Number



Examples: T45.7X.125X1/2X12X24 = 5052 Aluminum honeycomb core, 5.7 lbs/cu.ft, 0.187 inch (4.75 mm) cells, 0.500 inch (12.70 mm) thick, 12 inch (300 mm) wide by 24 inch (600 mm) long.

T53.1X.125X1/8X12X12 = 5056 Aluminum honeycomb core, 3.1 lbs/cu.ft, 0.125 inch (3.18 mm) cells, 0.125 inch (3.18 mm) thick, 12 inch (300 mm) wide by 12 inch (300 mm) long.

Table A-5. Polyamide Honeycomb Core (Basic Number = T1)

PANEL THICKNESS ⁽¹⁾	Thks Code	MATERIAL DENSITY (lbs/cu.ft)				PANEL SIZE ⁽¹⁾		
		3.0	4.0	6.0	8.0	12x12 (300x300)	12x24 (300x600)	24x48 (600x1219)
0.125 (3.18)	1/8	X						
0.250 (6.35)	1/4	X						
0.375 (9.53)	3/8	X						
0.500 (12.70)	1/2	X						
0.750 (19.05)	3/4	X		X	X			
1.000 (25.40)	1		X	X				

Table A-6. Fiberglass Honeycomb Core (Basic Number = T2)

PANEL THICKNESS ⁽¹⁾	Thks Code	MATERIAL DENSITY (lbs/cu.ft)				PANEL SIZE ⁽¹⁾		
		3.0	4.5	6.0	8.0	12x12 (300x300)	12x24 (300x600)	24x48 (600x1219)
0.375 (9.53)	3/8	X						

Table A-7. Aramid Paper Honeycomb Core (Basic Number = T3)

PANEL THICKNESS ⁽¹⁾	Thks Code	MATERIAL DENSITY (lbs/cu.ft)				PANEL SIZE ⁽¹⁾		
		3.0	4.5	6.0		12x12 (300x300)	12x24 (300x600)	24x48 (600x1219)
0.500 (12.70)	1/2	X						
0.625 (15.88)	5/8	X	X					
0.750 (19.05)	3/4	X	X	X				

Table A-8. 5052 Aluminum Honeycomb Core (Basic Number = T4)

PANEL THICKNESS ⁽¹⁾	Thks Code	MATERIAL DENSITY (lbs/cu.ft)				PANEL SIZE ⁽¹⁾		
		3.1	4.5	5.7	8.1	12x12 (300x300)	12x24 (300x600)	24x48 (600x1219)
0.125 (3.18)	1/8	X	-	-	-	-	X	-
0.250 (6.35)	1/4	X	-	-	-	-	X	X
0.375 (9.53)	3/8	X	-	-	-	-	X	X
0.500 (12.70)	1/2	X	X	X	X	-	X	X
0.563 (14.29)	9/16	X	-	-	-	-	X	-
0.625 (15.88)	5/8	X	-	-	-	X	-	-
0.750 (19.05)	3/4	X	-	-	-	-	X	-
1.000 (25.40)	1	X	-	-	X	X	X	X
1.250 (31.75)	5/4	X	-	-	-	X	X	-
1.500 (38.10)	1.5	-	-	X	X	-	X	-
2.000 (50.80)	2	X	-	-	-	X	-	-

Table A-9. 5056 Aluminum Honeycomb Core (Basic Number = T5⁽³⁾)

PANEL THICKNESS ⁽¹⁾	Thks Code	MATERIAL DENSITY (lbs/cu.ft)				PANEL SIZE ⁽¹⁾		
		3.1	4.5	5.7	8.1	12x12 (300x300)	12x24 (300x600)	24x48 (600x1219)
2.000 (50.80)	2	X				X		

NOTES: (Applicable to [Table A-5](#) through [Table A-9](#))

1. Values are in inches. Values between parentheses are in millimeters (mm).
2. All cell sizes are 0.125 inch (3.18 mm) except for 5.7 lbs/cu.ft core density, which has a cell size of 0.187 inch (4.75 mm).
3. 5056 aluminum honeycomb core (T5) is not to be used unless specifically required by application. Use 5052 aluminum honeycomb core (T4) instead.

A-3. MATERIAL IDENTIFICATION

Correct identification of material being repaired and hence the material to be used in the repair is of vital importance because of the wide range of material strengths.

In order to identify the material from which the damaged part is made, some or all of the following solutions must be prepared:

WARNING

AVOID BODILY CONTACT WITH ANY CHEMICAL OR SOLUTION. WASH HANDS WITH SOAP AND WATER AFTER HANDLING CONTAINERS, APPARATUS, AND WIPING CLOTH.

ENSURE THAT ACIDS ARE ADDED TO WATER, AND NOT WATER TO ACID. STIR OR MIX DURING THE ADDITION.

CAUTION

PREPARATION FOR USE AND USAGE OF CHEMICALS SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

PREPARATION AND MANIPULATION OF CHEMICALS SHALL ALWAYS BE PERFORMED IN A WELL VENTILATED AREA. CAUTION, SUCH AS WEARING A MASK, MUST BE TAKEN NOT TO INHALE VAPORS.

AFTER PERFORMING TEST, THOROUGHLY RINSE TEST AREA WITH WATER.

ALWAYS SAFELY DISPOSE OF ALL TEST SOLUTION WASTE ACCORDING TO LOCAL ENVIRONMENTAL AND HEALTH AND SAFETY REQUIREMENTS.

NOTE

It is recommended that test solutions be transferred to individual, clean medicine-type bottles, incorporating a dropper integral with cap. Affix appropriate labels and keep tightly capped when not in use.

The use of chemical solutions should be performed at a temperature close to room temperature and in good lighting conditions. Unfiltered daylight is preferable.

Metal surfaces that are examined shall be chemically clean. Degrease the surface by swabbing with a degreasing solvent. The metal surface may be polished if required.

SOLUTION 1: Copper Sulfate Solution.

Copper Sulfate Crystals (CuSO₄) is CuSO₄·5 H₂O, Cupric Sulfate reagent A.C.S., CAS 7758-99-8. 98% minimum, blue crystals or blue crystalline granules or powder. 10% sulfuric acid solution.

Slowly add 10 cc of Sulfuric Acid to 90 cc of distilled water. Sulfuric Acid, reagent A.C.S., formula weight 98.08, Sp. Gr. 1.84, CAS 7664-93-9.

Appearance: oily liquid, colorless, very corrosive, battery acid.

Dissolve 0.055 pound (25 g) of copper sulfate crystals (CuSO_4) in 100 cc of distilled water, and add 2 or 3 cc of 10% Sulfuric acid (H_2SO_4).

SOLUTION 2: Hydrochloric (C-431) Solution.

Hydrochloric Acid. Reagent A.C.S. formula weight 36.46, CAS 7647-01-0. Hydrogen chloride 38% in an aqueous solution.

Appearance: colorless or slightly yellow, fuming pungent liquid.

Slowly add 50 cc of hydrochloric acid (HCl) to 50 cc of distilled water. Stir during acid addition.

SOLUTION 3: Cadmium Sulfate Solution.

Cadmium sulfate, CdSO_4 , Anhydrous, Reagent, A.C.S. Grade, CAS 10124-36-4.

Appearance: Colorless, odorless, crystals.

Mix 0.011 pound (5 g) of cadmium sulfate (CdSO_4), 5 cc of concentrated hydrochloric acid (HCl), and 0.007 pound (3 g) of sodium chloride (NaCl). Dissolve and dilute with distilled water to make 100 cc.

SOLUTION 4: Scratch Test Solution.

Potassium Nitrate KNO_3 . Crystals, Reagent, A.C.S., CAS 7757-79-1, formula weight 101.10. Appearance: colorless or white crystalline powder or crystals, slightly hygroscopic, pungent saline taste.

Slowly add 0.044 pound (20 g) of potassium nitrate (KNO_3) and 0.022 pound (10 g) of sodium hydroxide pellets (NaOH) in 100 cc of distilled water. Do not allow pellets to stick to bottom of mixing container.

SOLUTION 5: Sodium Hydroxide (C-118) Solution

Sodium Hydroxide, Pellets, Reagent A.C.S., CAS 1310-73-2.

Appearance: White deliquescent solid, in white pellets form, highly absorbs water.

Slowly add and dissolve, 0.055 pound (25 g) of sodium hydroxide pellets (NaOH) to 100 cc of distilled water. Do not allow pellets to stick to bottom of mixing container.

SOLUTION 6: Sulfuric Acid Solution.

Sulfuric Acid, reagent A.C.S., Sp. Gr. 1.84, CAS 7664-93-9, formula weight 98.08.

Appearance: oily liquid, colorless, very corrosive, battery acid.

25% sulfuric acid solution. Slowly add 25 cc of Sulfuric acid (H_2SO_4) to 75 cc of distilled water. Stir during addition of acid.

SOLUTION 7: Silver Nitrate Solution.

Silver Nitrate Ag NO_3 . Crystals, Reagent, A.C.S., CAS 7761-88-8, formula weight 169.87. Appearance: colorless transparent crystals.

Dissolve 0.002 pound (1 g) of silver nitrate in 100 cc of distilled water. To prevent degrading the solution, wrap the reagent bottle with opaque tape. The shelf life of the solution is 6 months.

SOLUTION 8: Sodium Thiosulfate Solution.

Mix 0.035 pound (16 g) of anhydrous sodium thiosulfate (C-243) with 1000 cc of demineralized water. However, this ratio does not account for the additional 5H₂O content if the crystals form is procured. Then, a concentration of 0.055 pound (25 g) per 1000 cc is recommended. A 0.1 Normal Sodium Thiosulfate solution can be procured and mixed at 50% with demineralized water.

SOLUTION 9: Diluted Copper Sulfate Solution.

Dissolve 0.002 pound (1 g) of copper sulfate crystals (CuSO₄·5H₂O) in 25 cc of 1 Normal Sulfuric Acid. Normal sulfuric acid (H₂SO₄) is used in chemical laboratories for analysis. Concentrated 98% sulfuric acid is 36 Normal.

A-3-1. IDENTIFYING MAGNETIC FROM NON-MAGNETIC MATERIAL

1.0 Approach part with a magnet. If an attraction force is felt, then part is magnetic. If no attraction force is felt, part is non-magnetic. Some materials may only have a slight magnetic response.

A-3-2. IDENTIFYING MAGNETIC MATERIALS

1.0 Apply a droplet of copper sulfate solution (Solution 1) on metal surface; a reaction (red copper deposit) indicates low carbon steel such as 4130, 4340, 8630 or 8730 steel. Copper sulfate will not react with chromium nickel steel such as 17-4 PH or 17-7 PH steel.

A-3-3. IDENTIFYING NON-MAGNETIC MATERIALS**A-3-3-1. IDENTIFYING MAGNESIUM**

1.0 Cut two or three small chips from edge of metal surface and drop chips on a clean glass surface.

2.0 Apply a droplet of hydrochloric acid solution (Solution 2) to chips; a violent reaction indicates magnesium. Since hydrochloric acid will also react with aluminum, use silver nitrate solution (Solution 7) to differentiate magnesium from aluminum.

3.0 Apply a droplet of silver nitrate solution (Solution 7) on a clean surface; a reaction (drop turns black and there is a black deposit on part when reactant is absorbed on an absorbing media) indicates magnesium.

A-3-3-2. IDENTIFYING 7075 ALUMINUM ALLOY

1.0 Apply a droplet of cadmium sulfate solution (Solution 3) on metal surface; a reaction (black deposit), within 2 minutes, indicates bare or CLAD 7075 aluminum alloy. Cadmium sulfate solution will not react with other material.

2.0 To identify if the 7075 is bare or CLAD, apply a droplet of scratch test solution (Solution 4) on cleaned surface; a reaction (black deposit) indicates bare 7075 aluminum alloy. Scratch test solution will not react with CLAD 7075 aluminum alloy.

A-3-3-3. IDENTIFYING 2024 ALUMINUM ALLOY FROM 6013 ALUMINUM ALLOY

- 1.0 Apply a droplet of sodium hydroxide solution (Solution 5) on metal surface; a reaction (black deposit) indicates bare 2024 aluminum alloy. If a white deposit appears, the following step 2.0 must be performed to differentiate CLAD 2024 aluminum alloy from 6013 aluminum alloy. Sodium hydroxide solution will not react with other material.
- 2.0 The following steps must be performed to differentiate CLAD 2024 aluminum alloy from 6013 aluminum alloy.
 - 2.1 Sand material to remove cladding from surface (can be up to 5% of light gauge sheet thickness).
 - 2.2 Apply a droplet of sodium hydroxide solution (Solution 5) on cleaned surface; a reaction (black deposit) indicates CLAD 2024 aluminum alloy. A white deposit indicates 6013 aluminum alloy.

A-3-3-4. IDENTIFYING CORROSION RESISTANT STEEL (CRES)

- 1.0 Cut six to eight small shavings from edge of metal surface and drop shavings into a clean, 50 cc beaker.
- 2.0 Cover shavings with Sulfuric acid solution (Solution 6) then boil until shavings dissolves.
- 3.0 Add a drop of copper sulfate solution (Solution 1) to content of beaker; absence of coloration indicates corrosion resistant steel such as 301 or 302 steel.

A-3-3-5. IDENTIFYING HASTALLOY X FROM CRES 321 OR N-155

- 1.0 Lightly abrade surface to be tested using abrasive pad (C-407) or 400 grit abrasive paper (C-423).
- 2.0 Apply a droplet of hydrochloric acid (Solution 2) on metal surface ensuring the test area is horizontal.
- 3.0 Apply a droplet of sodium thiosulfate solution (Solution 8) directly on top of the droplet of hydrochloric acid.
- 4.0 Allow to react between 2 to 5 minutes then check the color of the stain; a reaction (dark color stain) indicates material is CRES 321 or N-155 while a reaction producing a milky white color stain or no reaction indicates material is Hastalloy X.

A-3-3-6. IDENTIFYING CRES 321 FROM CRES N-155

- 1.0 Lightly abrade surface to be tested using abrasive pad (C-407) or 400 grit abrasive paper (C-423).
- 2.0 Apply a droplet of hydrochloric acid (Solution 2) on metal surface ensuring the test area is horizontal.
- 3.0 Allow to react between 2 to 5 minutes.
- 4.0 Apply a droplet of diluted copper sulfate solution (Solution 9) directly on top of droplet of hydrochloric acid; a reaction (bright copper stain) indicates CRES 321. Copper sulfate solution will not react with CRES N-155.

A-4. MATERIAL SPECIFICATIONS

The following tables contain listings of the most common material specifications used at Bell Helicopter Textron.

Table A-10. Most Common Material Specifications

FORM	MATERIAL	ALLOY	TEMPER OR AS PURCHASED CONDITION	SPECIFICATION
Bar	Aluminum	2024	O, T351, T4	AMS-QQ-A-225/6
			O, T3510, T3511, T4	AMS-QQ-A-200/3
		6061	O, T4, T6, T651	AMS-QQ-A-225/8
			O, T4, T6, T6510, T6511	AMS-QQ-A-200/8
		7075	O, T6, T651, T73, T7351	AMS-QQ-A-225/9
			O, T6, T6510, T6511, T73, T73510, T73511	AMS-QQ-A-200/11
Casting	Aluminum	356	T6	AMS-QQ-A-596, AMS-QQ-A-601, AMS 4217 or AMS 4260
		A356	T6	AMS-A-21180 or AMS 4218
		A357	T6	AMS-A-21180 or AMS 4219
		D357	T6	AMS 4241
	Magnesium	AZ91C	T6	AMS-QQ-M-56
Extrusion	Aluminum	2024	O, T3510, T3511, T4	AMS-QQ-A-200/3
		6061	O, T4, T6, T6510, T6511	AMS-QQ-A-200/8
		7075	O, T6, T6510, T6511, T73, T73510, T73511	AMS-QQ-A-200/11
Forging	Aluminum	2014	T6	AMS-QQ-A-367 or MIL-A-22771
		6061	T6	AMS-QQ-A-367 or MIL-A-22771
		7050	T7452	AMS 4108
		7075	T6, T73	AMS-QQ-A-367 or MIL-A-22771

Table A-10. Most Common Material Specifications (Cont)

FORM	MATERIAL	ALLOY	TEMPER OR AS PURCHASED CONDITION	SPECIFICATION	
Sheet and Plate	Aluminum	2024 CLAD ⁽¹⁾	O, T3, T351, T4	AMS-QQ-A-250/5	
		2024	O, T3, T351, T4	AMS-QQ-A-250/4	
		6013	T4	AMS 4347	
			T6	AMS 4216	
		7050	T7451	AMS 4050	
		7075 CLAD ⁽¹⁾	O, T6, T651	AMS-QQ-A-250/13	
		7075	O, T6, T651, T73	AMS-QQ-A-250/12	
	Steel	301 CRES	Annealed	AMS 5901 (previously MIL-S-5059 Annealed)	
			1/4 Hard	AMS 5517 (previously MIL-S-5059 1/4 Hard)	
			1/2 Hard	AMS 5518 (previously MIL-S-5059 1/2 Hard)	
			3/4 Hard	AMS 5902 (previously MIL-S-5059 3/4 Hard)	
			Full Hard	AMS 5519 (previously MIL-S-5059 Full Hard)	
	Titanium		Annealed	AMS-T-9046 or MIL-T-9046 (See Table B-11 for more details)	
	Tubing	Aluminum	2024	O, T3	AMS-WW-T-700/3
				O, T3510, T3511, T4	AMS-QQ-A-200/3
5052			O	AMS-WW-T-700/4	
6061			O, T4, T6	AMS-WW-T-700/6	
			O, T4, T6, T6510, T6511	AMS-QQ-A-200/8	

NOTE:

1. Bell Helicopter Textron has not used CLAD material since 1997. Non-CLAD repair material shall be used instead.

Table A-11. Titanium Equivalencies

MIL-T-9046J or AMS-T-9046	MIL-T-9046H	
CP-3	Commercially Pure Type I	Comp. A
CP-1		Comp. B
CP-2		Comp. C
CP-4		N/A
AB-1	Alpha-Beta (6Al-4V) Type III	Comp. C
AB-2		Comp. D

A-5. BLIND RIVETS EQUIVALENCIES

The following table contains alternate part numbers for blind rivets.

Table A-12. Blind Rivet Alternate Part Numbers

Rivet Description			Rivet Part Number or Specification				
Sleeve Material	Diameter	Head Type	M7885	Cherry Aerospace	(Alcoa) Huck Rivets	Allfast	NAS
Aluminum	Nominal	Protruding	M7885/2	CR3213	HC3213	AF3213	NAS9301B
		Flush	M7885/3	CR3212	HC3212	Not Approved	NAS9302B
		Flush Shallow Head	M7885/27	CR3214	HC3214	Not Approved	NAS9303B
	Oversize	Protruding	M7885/6	CR3243	HC3243	AF3243	NAS9304B
		Flush	M7885/7	CR3242	HC3242	Not Approved	NAS9305B
Monel	Nominal	Protruding	M7885/4	CR3523	HR3523	AF3523	NAS9307M
			M7885/17	CR3523P	HR3523P	AF3523F	NAS9307ML
		Flush	M7885/5	CR3522	HR3522	Not Approved	NAS9308M
			M7885/18	CR3522P	HR3522P	Not Approved	NAS9308ML
			Flush Shallow Head	M7885/19	CR3524	HR3524	Not Approved
	M7885/20	CR3524P		HR3524P	Not Approved	NAS9309ML	
	Oversize	Protruding	M7885/8	CR3553	HR3553	AF3553	NAS9310M
			M7885/21	CR3553P	HR3553P	AF3553F	NAS9310ML
		Flush	M7885/9	CR3552	HR3552	Not Approved	NAS9311M
			M7885/23	CR3552P	HR3552P	Not Approved	NAS9311ML

A-6. APPROVED FASTENERS FOR USE IN CARBON FIBER REINFORCED COMPOSITE MATERIALS

[Table A-13](#) contains a list of fasteners approved by Bell Helicopter Textron for joints involving parts made from carbon fiber reinforced composite materials.

Table A-13. Approved Fasteners for Use in Fiber Reinforced Composite Parts

Near-Side Material	Far-Side Material	Fastener Type	Head Type	Material	Finish	Part Number		
Aluminum	Carbon	Blind Bolt	Protruding	Titanium	Aluminum Coating	110-223-() CR7771S-()-()		
			Flush 100°	Titanium	Aluminum Coating	110-229-() CR7770S-()-()EE		
			Flush 130°	Titanium	Aluminum Coating	110-225-() CR7774S-()-()EE		
			Pin Collar	Protruding, Shear	Titanium	Aluminum Coating	100-159-() 30-296-()W or 30-298-()	
				Flush 100°, Tension	Titanium	Aluminum Coating	100-160-() 30-296-()W or 30-297-()W	
				Flush 130°, Shear	Titanium	Aluminum Coating	100-158-() 30-296-()W or 30-298-()	
		Carbon	Aluminum	Blind Rivet	Protruding	Monel	Aluminum Coating	IVD NAS9310M-()
								NAS9307M-()
				Blind Bolt	Protruding	Titanium	Aluminum Coating	110-223-()
Flush 100°	Titanium				Aluminum Coating	110-229-()		
Flush 130°	Titanium				Aluminum Coating	110-225-() CR7774S-()-()EE		
Pin Collar	Protruding, Shear			Titanium	Aluminum Coating	100-159-() 30-295-() or 30-298-()		
	Protruding, Tension			Titanium	Aluminum Coating	100-161-() 30-296-()W or 30-297-()W		
	Flush 100°, Tension			Titanium	Aluminum Coating	100-160-() 30-296-()W or 30-297-()W		
	Flush 130°, Shear			Titanium	Aluminum Coating	100-158-() 30-295-() or 30-298-()		
Steel 1/4 Hard	Blind Rivet			Flush 100°	A286 CRES	DFL	110-151-()	
Carbon	Carbon			Blind Bolt	Protruding	Titanium	Aluminum Coating	110-223-()
								110-216-()
			CR7771S-()-()					
			Flush 130°		Titanium	Aluminum Coating	110-225-()	
							110-220-() CR7774S-()-()EE	
			Solid Rivet	Flush 100°	Titanium	Phosphate Fluoride	CSR90433-()F	
			Pin Collar	Protruding, Shear	Titanium	Aluminum Coating	100-159-() 30-296-()W or 30-298-()	
				Protruding, Tension	Titanium	Aluminum Coating	100-161-() 30-296-()W or 30-297-()W	
				Flush 100°, Tension	Titanium	Aluminum Coating	100-160-() 30-296-()W or 30-297-()W	
				Flush 130°, Shear	Titanium	Aluminum Coating	100-158-() 30-296-()W or 30-298-()	

A-7. MATERIALS COMPATIBILITY

This table shows the galvanic compatibilities of the following materials.

Material	Magnesium	Cadmium or Cadmium Plated	Zinc or Zinc Plated	Aluminum or Aluminum Coating	Beryllium Alloys except Copper Beryllium	Carbon or Alloy Steel	400 Series Stainless Steel	Copper or Brass	Nickel or Nickel Plated	300 Series Stainless Steel	PH S Tainless Steel	Inconel, Monel, or Hastalloy	Titanium	Silver and Noble Metals	Carbon (Graphite)
Magnesium	*	*	*	*	*	*	*	*	*	*	*	*	*	*	X
Cadmium or Cadmium Plated		S	S	S	S	S/D	D	D	D	D	D	D	X	D	*
Zinc or Zinc Plated			S	S	S	S/D	D	D	D	D	D	D	D	D	*
Aluminum or Aluminum Coating				S	S	S/D	D	D	D	D	D	D	D	D	*
Beryllium Alloys except Copper Beryllium					S	S/D	D	D	D	D	D	D	D	D	*
Carbon or Alloy Steel						S	S/D	S/D	S/D	D	D	D	D	D	*
400 Series Stainless Steel							S	S/D	S/D	S/D	S/D	S/D	S/D	D	*
Copper or Brass								S	S	S/D	S/D	S/D	S/D	D	*
Nickel or Nickel Plated									S	S	S/D	S/D	S/D	D	*
300 Series Stainless Steel										S	S	S	S	D	*
PH Stainless Steel											S	S	S	D	*
Inconel, Monel, or Hastalloy												S	S	D	*
Titanium													S	D ⁽¹⁾	*
Silver and Noble Metals														S	*
Carbon (Graphite)															*

NOTE:

1. Couple not permitted where temperature exceeds 350°F (176.7°C).

X	=	Combination not permitted.
*	=	Magnesium and carbon (graphite) are special cases. For additional information, please contact PSE.
S	=	Similar for interior and exterior faying surfaces.
D	=	Dissimilar for interior and exterior faying surfaces.
S/D	=	Similar for interior faying surfaces. Dissimilar for exterior faying surfaces.

Exterior surfaces: All surfaces that are normally exposed to the external environment during flight and while on the ground, and all those inner surfaces that may be wetted with water when doors and access panels have been closed, or those areas wetted during washing of helicopter.

Interior surfaces: All surfaces not considered to be exterior surfaces.

