COMPONENT MAINTENANCE MANUAL

REPAIR OF KEVLAR/EPOXY AND GRAPHITE/EPOXY DUCTS

PART NUMBER NONE

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COMPONENT MAINTENANCE MANUAL

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To: All holders of REPAIR OF KEVLAR/EPOXY AND GRAPHITE/EPOXY DUCTS 21-20-15.

Attached is the current revision to this COMPONENT MAINTENANCE MANUAL

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For printed manuals, changes are indicated on the List of Effective Pages (LEP). The pages which are revised will be identified on the LEP by an R (Revised), A (Added), O (Overflow, i.e. changes to the document structure and/or page layout), or D (Deleted). Each page in the LEP is identified by Chapter-Section-Subject number, page number and page date.

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Location of Change	Description of Change
	NO HIGHLIGHTS

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A = Added, R = Revised, D = Deleted, O = Overflow

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TEMPORARY REVISION AND SERVICE BULLETIN RECORD

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVE	DATE OF INCORPORATION INTO MANUAL

All revisions to this manual will be accompanied by transmittal sheet bearing the revision number. Enter the revision number in numerical order, together with the revision date, the date filed and the initials of the person filing.

Revision		Filed	
Number	Date	Date	Initials

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Temporary Revision		Inserted		Removed	
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Temporary Revision		Inserted		Removed	
Date	Initials	Number	Date	Date	Initials

Temporary Revision		Inserted		Removed	
Number	Date	Date	Initials	Date	Initials

Temporary Revision		Inserted		Removed	
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INTRODUCTION

1. General

A. The instructions in this manual supply the data necessary to do the maintenance functions together with the test, fault isolation, repair, and replacement of the defective parts.

B. This manual is divided into different parts:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) List of Effective Pages

(5) Table of Contents

(6) Temporary Revision & Service Bulletin Record

(7) Record of Revisions

(8) Record of Temporary Revisions

(9) Introduction

(10) Procedures & IPL Sections

C. Components that can be repaired have a different repair number for each specified repair. To find the repair number location of a component, look in the Repair-General procedure at the beginning of the REPAIR section. The Repair-General procedure also has an explanation of the True Position Dimension symbols used.

D. All dimensions, measures, quantities and weights included are in English units. When metric equivalents are given they will be in the parentheses that follow the English units.

E. The introduction to the Illustrated Parts List (IPL) shows how the IPL data is used.

F. Design changes, optional parts, configuration differences and Service Bulletin modifications may cause different part numbers. These part numbers are identified in the IPL with an alphabetical letter which is added to the end of the basic item number. This new item number is referred to as an alpha-variant. Throughout the manual, IPL basic item number references also apply to alpha-variants unless shown differently.

G. The tool reference numbers found in the individual procedures and in the Special Tools, Fixtures, and Equipment section are used to identify if a tool is a standard tool (STD-XXXX), a commercial tool (COM-XXXX), or a Special Tool (SPL-XXXX). This reference number is also used to distinguish between tools with similar names in the same procedure. These reference numbers are for use in the documentation only. They are not to be used for ordering tools.

REPAIR OF KEVLAR/EPOXY AND GRAPHITE/EPOXY DUCTS - DESCRIPTION & OPERATION

1. Description and Operation

A. This manual covers Boeing recommended procedures for the repair of damaged Kevlar/epoxy and graphite/epoxy ducts that are used in the airplane air conditioning system.

TESTING AND FAULT ISOLATION

1. General

A. This procedure contains the data necessary to do a test of the ducts after an overhaul or for fault isolation.

2. Duct Classification

A. Procedure

(1) Determine type, grade, and class of ducts before conducting leakage testing.

(2) Types

Type I - Laminate and sandwich air ducts for which the grades and classes listed in TESTING AND FAULT ISOLATION, Table 101 apply.

Type III - Transition duct for APU inlet duct only. Grade B, class 4 only.

(3) Grades and Classes

(a) Type I ducts shall meet the leakage rates and maximum internal pressure requirements as shown in TESTING AND FAULT ISOLATION, Table 101, unless otherwise stated.

Table 101: Grade and Class Specifications for Type I Ducts

Grade	Maximum Internal Pressure (Psi)	Class	Maximum Leakage ($ft^3/min/ft^2$)
A	1.5	1	0.005
B	4.0	2	0.05
C	12.0	3	0.20
D	20.0	4	0.50

(b) When no grade, class, or leakage rate is specified, the Grade A, Class 4 requirement shall be assumed.

3. Leakage Testing

A. Procedure

(1) Conduct leakage and pressure tests by plugging ends of duct and determining flow rate with a suitable flow meter at the maximum internal pressure, as indicated by the grade specification of the duct (refer to TESTING AND FAULT ISOLATION, Table 101 for grade specifications). Record leakage rate after it has stabilized and correct rate to standard conditions by the following equation:

$$R = (35.83 / (T + 459)) (P + 14.7) (V / A)$$

where:

R = corrected leakage rate (ft^3/min/ft^2 of duct surface)

T = test temperature (°F)

V = leakage reading at test pressure (ft^3/min)

A = area of interior surface of the duct (ft^2)

P = test gage pressure (psi)

NOTE: Grade A, class 4 ducts need not be tested.

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CHECK

1. General

   A. This procedure contains the data necessary to find defects in the material of the specified parts.

2. Check

   A. Procedure

      (1) Check ducts for cracks, delaminations, voids, resin-starved areas, exposed fibers, soft spots, and/or damaged areas. Correct damaged areas in accordance with the repairs outlined in this manual. Repairs should be limited to 15 percent of the detail area.

REPAIR

1. General

A. Refer to SOPM 20-30-03 for general cleaning procedures in the following repair procedures.

2. Surface Preparation

A. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
G02428	Abrasive - Aluminum Oxide Paper, 150 grit	A-A-1048
G50681	Thinner - Akzo Nobel TL-52 Thinner	

B. References

Reference	Title
SOPM 20-60-01	CLEANING MATERIALS
SOPM 20-60-04	MISCELLANEOUS MATERIALS

C. Procedure

(1) Sand area to be repaired using 150 grit abrasive paper, G02428 (or finer) (SOPM 20-60-04).

(2) Wipe off sanding residue with a clean cloth moistened with Akzo Nobel TL-52 Thinner, G50681 (SOPM 20-60-01).

3. Repair of Typical Defects or Damages

A. Tools/Equipment

NOTE: Equivalent substitutes may be used.

Reference	Description
STD-94	Bag - Vacuum
STD-854	Syringe - Hypodermic

B. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
B50046	Solvent - Methyl Ethyl Ketone, Technical Grade	ASTM D740 (Supersedes TT-M-261)
G00338	Fabric, Woven Prepregnated Graphite, 275F (135C) Cure	BMS8-258
G02135	Fabric, Woven Preimpregnated Kevlar	BMS8-264
G02137	Resin - Polyester - Hetron 92	

Reference	Description	Specification
G50399	Resin - Fiberglass Layup, Long Worklife, Non-Brominated	BMS 8-201, Type III (Supersedes BMS 8-201, Type I)
G50400	Resin - Fiberglass Layup, Short Worklife, Non-Brominated	BMS 8-201, Type IV (Supersedes BMS 8-201, Type II)
G50593	Fabric - Woven Glass Reinforcements For Laminating Plastics	BMS9-3 Type H-2, Class 7

C. References

Reference	Title
SOPM 20-60-01	CLEANING MATERIALS
SOPM 20-60-04	MISCELLANEOUS MATERIALS

D. Procedure

(1) Resin-starved areas, exposed fibers, or impact-damaged soft spots, delaminations, or internal voids.

(a) Sand surfaces to remove gloss.

(b) Use brush, squeegee, or hypodermic syringe, STD-854 to work BMS 8-201 (SOPM 20-60-04) epoxy resin into defective area.

(c) Cure in accordance with REPAIR-GENERAL, Figure 601 or REPAIR-GENERAL, Figure 602.

(2) Small bruises, punctures, and holes less than 0.25 inch diameter, or surface voids.

(a) Sand surface surrounding defect to remove gloss.

(b) Use same fabric thickness as original duct.

1) Hot Patch - Use fabric, G02135 for Type I ducts and fabric, G00338 for Type III ducts.

2) Cold Patch - Use glass fabric (BMS 9-3 class 7, types H, fabric, G50593, H-3, E, E-1, E-2 (SOPM 20-60-04)) with BMS 8-201 (SOPM 20-60-04) resin mix.

(c) Cut patches to fit defective area, extending a minimum of 0.50 inch past the damaged area. All patch corners must be rounded.

(d) Place one or more plies on detail covering damaged area and cover with parting film (SOPM 20-60-04).

(e) Secure layer of parting film over patch area with tape. Apply a vacuum bag, STD-94 layup for applying pressure to the repair. Use of other pressure application methods, such as clamps or weights, is acceptable provided they do not distort the part or the repair.

(f) Cure patch in accordance with the applicable method in REPAIR-GENERAL, Figure 601 or REPAIR-GENERAL, Figure 602. Use of vacuum bags, STD-94 is preferred.

(3) Holes, cuts, fractures, or punctures 0.25 inch diameter or larger.

(a) Cut back material as required to ascertain extent of damage.

(b) Trim or scarf back plies to a smooth oval.

(c) Replace on a ply for ply plus one basis using procedures outlined in REPAIR-GENERAL, Paragraph 3.D.(2), overlapping 0.50 inch minimum on each succeeding ply.

(4) Gel coat repair.

(a) Abrade surface to remove cracked or damaged gel coat.

(b) Prepare the QCI 130 gel coat mixture (QCI-130 resin and additive, Parts A and B – Quantum Composites, 4702 James Savage Rd., Midland, Michigan 48640) as follows or prepare the alternative material, resin, G50399 or resin, G50400 as indicated by the vendor:

Table 601:

Ingredient	Parts by Weight
QCI 130A Resin	2000
technical grade methyl ethyl ketone, B50046 (SOPM 20-60-01)	1500
QCI 130B Hardener	300

1) Add thinner to Part A, stir to dissolve and strain two times. Weigh Part B hardener in separate can and add just prior to use. Shake well and strain.

(c) Spray or spread over surface, fairing edges.

(d) Cure gel coat correction as follows:

1) For QCI 130, cure for four hours at room temperature.

2) For resin, G50399, cure for 16 to 24 hours at 70 to 80°F.

3) For resin, G50400, cure for 8 to 16 hours at 70 to 80°F.

(e) Sand to smooth patched surface.

(5) Surface resin ridges and edges.

(a) Sand ridges and edges until excess is removed.

(b) If fabric is removed during sanding, replace on a ply for ply plus one basis using procedures outlined in REPAIR-GENERAL, Paragraph 3.D.(2).

(6) Lamination of Kevlar plies to duct ends.

(a) If required to improve the fit, extra Kevlar plies (2 inches wide) may be laminated to the duct ends.

1) Sand and clean duct ends.

2) Wrap extra Kevlar plies to duct ends.

3) Process using the procedures outlined in REPAIR-GENERAL, Paragraph 3.D.(3)(b) and REPAIR-GENERAL, Paragraph 3.D.(3)(c).

4) Cure at 260°F for approximately 90 minutes.

(7) Sealing

(a) Type I, Grades A, B, C, and D ducts may be sealed internally by sloshing, using sloshing resin mix prepared as follows:

1) Prepare resin mix R109 in the following proportions:

Table 602:

Material	Parts by Weight
Hetron 92 resin, G02137 (Ashland Chemical Company, Ashland, Ohio)	100 ±2
Benzoyl Peroxide in Tricresyl Phosphate Paste such as Luperco ATC or AFR Paste Catalyst (Lucidol Division, Pennwalt Corp, 1740 Military Rd, Buffalo, NY 14240, or Garox BZP – Ram Chemicals, Division of The Whittaker Corp, 210 East Alandra Blvd, Gardena, California)	2.0 ±0.2

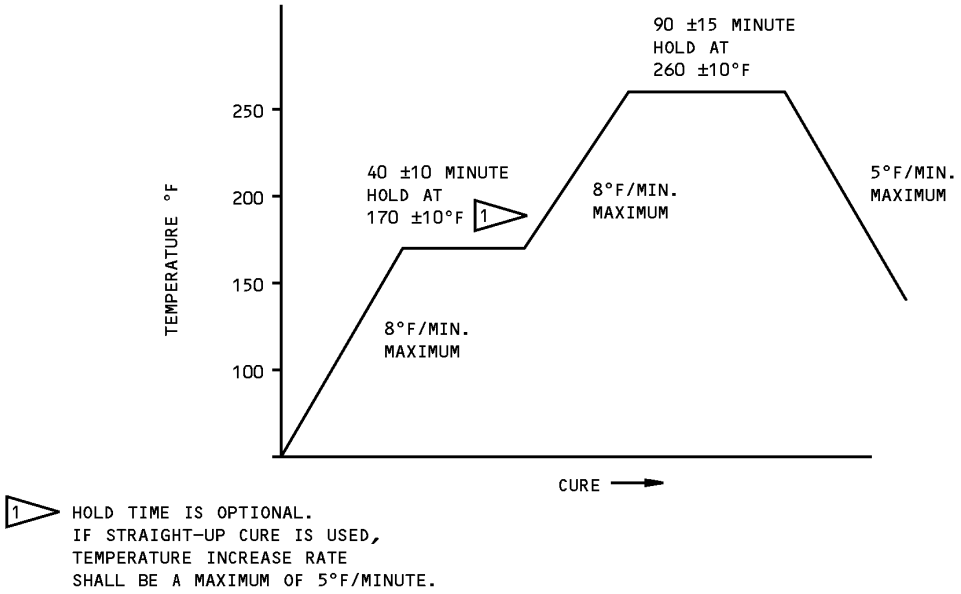
2) Prepare sloshing resin mix by combining the R109 resin mix with the following materials in the proportions indicated:

Table 603:

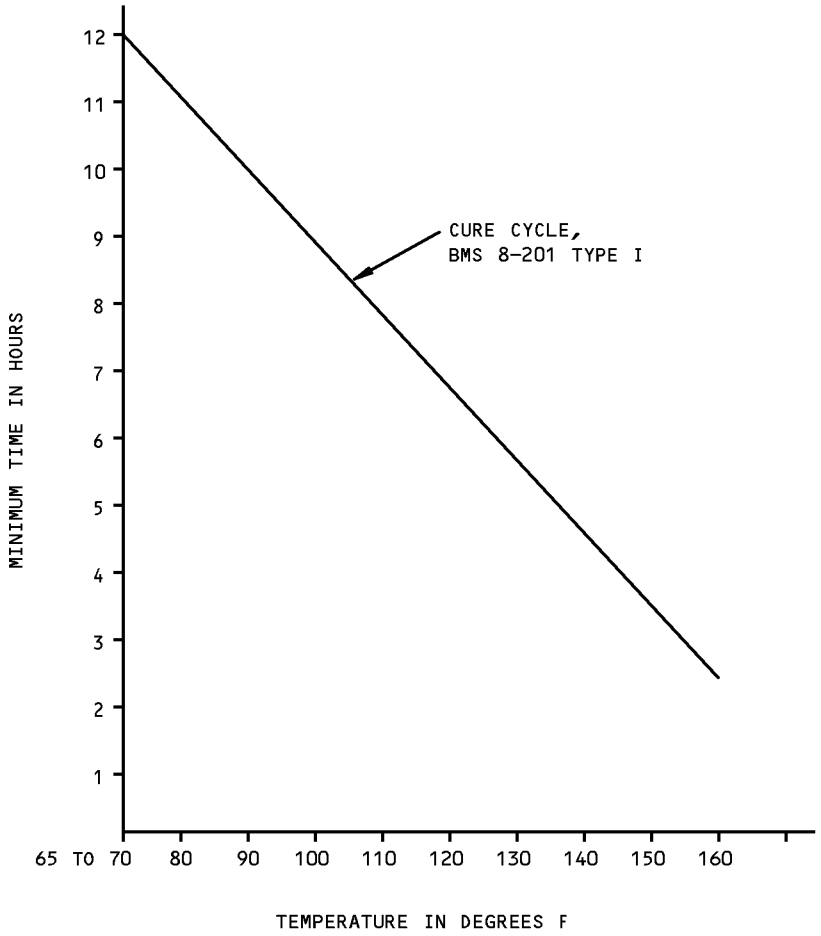
Material	Parts by Weight
Resin Mix R109	50 ±2.0
60 percent Methyl Ethyl Ketone Peroxide in Dimethyl Phthalate liquid such as Lupersol DDM-9 (Lucidol Division, Pennwalt Corp, Buffalo, NY)	1.0 ±0.2
Styrene Monomer resin mix such as styrene Monomer 120 (Monsanto Co., St. Louis,Mo, or Styrene 12T – Dow Chemical Co., Bennington, VT, or Styrene Monomer-Rubber Grade – Dexter Corp, Pittsburgh, California)	49 ±2.0

NOTE: Only one sloshing seal treatment per duct is allowed.

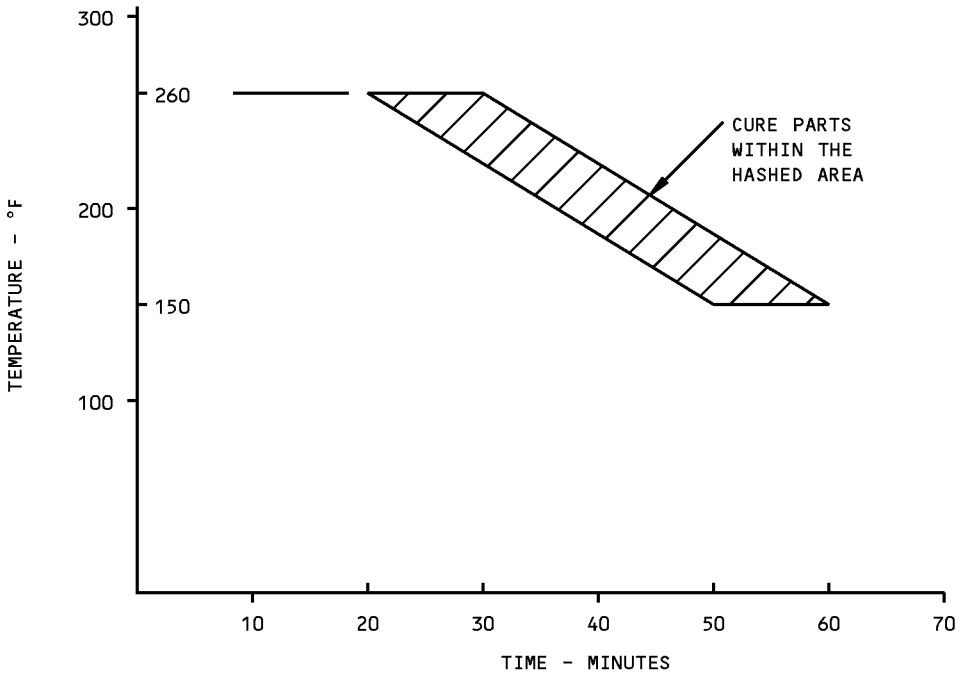
(b) Cure sloshed parts in accordance with REPAIR-GENERAL, Figure 603.



Cure Cycle for BMS 8-264 and BMS 8-258
Figure 601



Cure Temperature Chart - BMS 8-201
Figure 602



Cure Cycle for Sloshed Parts
Figure 603

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FITS AND CLEARANCES

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ILLUSTRATED PARTS LIST

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