TO: ALL HOLDERS OF REPAIR OF KEVLAR/EPOXY AND GRAPHITE/EPOXY DUCTS COMPONENT MAINTENANCE MANUAL 21-20-15

REVISION NO. 3 DATED NOV 01/00

HIGHLIGHTS

Pages which have been added or revised are outlined below together with the highlights of the revision.

CHAPTER/SECTION AND PAGE NO.	DESCRIPTION OF CHANGE
ALL PAGES	Reissued pages.
TITLE PAGE 1	Edited without technical change.
REVISION RECORD 1	
REPAIR-GEN 603-604,607	

REPAIR OF KEVLAR/EXPOXY AND GRAPHITE/EPOXY DUCTS

NO ASSIGNED PART NUMBER

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

REVISION RECORD

- Retain this record in front of manual. On receipt of revision, insert revised pages in the manual, and enter revision number, date inserted and initial.

REVISION NUMBER	REVISION DATE	DATE FILED	BY	REVISION NUMBER	REVISION DATE	DATE FILED	BY

TEMPORARY REVISION AND SERVICE BULLETIN RECORD

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

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* = REVISED, ADDED OR DELETED

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*[1] Special instructions not required. Use standard industry practices.

INTRODUCTION

The instructions in this manual provide the information necessary to perform maintenance functions ranging from simple checks and replacement to complete shop-type repair.

This manual is divided into separate sections:

1. Title Page
2. Record of Revisions
3. Temporary Revision & Service Bulletin Record
4. List of Effective Pages
5. Table of Contents
6. Introduction
7. Procedures

Refer to the Table of Contents for the page location of applicable sections. An asterisked flagnote *[ ] in place of the page number indicates that no special instructions are provided since the function can be performed using standard industry practices.

All weights and measurements used in the manual are in English units, unless otherwise stated. When metric equivalents are given they will be in parentheses following the English units.

REPAIR OF KEVLAR/EPOXY AND GRAPHITE/EPOXY DUCTS

DESCRIPTION AND OPERATION

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

TESTING AND TROUBLE SHOOTING

1. Duct Classification

A. Determine type, grade, and class of ducts before conducting leakage testing.

B. Types
Type I - Laminate and sandwich air ducts for which the grades and classes listed in Fig. 1 apply.
Type III - Transition duct for APU inlet duct only. Grade B, class 4 only.

C. Grades and Classes

(1) Type I ducts shall meet the leakage rates and maximum internal pressure requirements as shown in Fig. 1, unless otherwise stated.

(2)

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

Figure 1
Grade and Class Specifications for Type I Ducts

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

2. Leakage Testing

A. 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 Fig. 1 for grade specifications). Record leakage rate after it has stabilized and correct rate to standard conditions by the following equation:

$$R = \frac{35.83}{T + 459} (P + 14.7) \frac{V}{A}$$

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.

CHECK

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 - GENERAL

1. Standard Practices

   A. Refer to the following standard practices as applicable, for details of procedures in individual repairs.
      20-30-03 General Cleaning Procedures

2. Materials

   NOTE: Equivalent substitutes may be used.

   A. Abrasive cloth -- 150-grit or finer (Ref 20-60-04)

   B. Thinner -- TL-52 (Ref 20-60-01)

   C. Epoxy Resin -- BMS 8-201 (Ref 20-60-04)

   D. Epoxy preimpregnated Kevlar fabric -- BMS 8-264

   E. Epoxy preimpregnated graphite fabric -- BMS 8-258

   F. Parting film (Ref 20-60-04)

   G. Glass fabric -- BMS 9-3 class 7, types H thru H-4, E thru E-2 (Ref 20-60-04)

   H. Methyl Ethyl Ketone (MEK) thinner -- TT-M-261 (Ref 20-60-01)

   I. QCI-130 resin and additive, Parts A and B -- Quantum Composites, 4702 James Savage Rd., Midland, Michigan 48640

   J. Hetron 92 -- Ashland Chemical Company, Ashland, Ohio

   K. 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

   L. 60 percent Methyl Ethyl Ketone Peroxide in Dimethyl Phthalate liquid such as Lupersol DDM-9 -- Lucidol Division, Pennwalt Corp, Buffalo, NY

   M. 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

3. Surface Preparation

A. Sand area to be repaired using 150-grit or finer abrasive cloth.

B. Wipe off sanding residue with a clean cloth moistened with TL-52 thinner.

4. Repair of Typical Defects or Damages

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

(1) Sand surfaces to remove gloss.

(2) Use brush, squeegee, or hypodermic to work BMS 8-201 epoxy resin into defective area.

(3) Cure in accordance with Fig. 601 or 602.

B. Small bruises, punctures, and holes less than 0.25 inch diameter, or surface voids.

(1) Sand surface surrounding defect to remove gloss.

(2) Use same fabric thickness as original duct.

(a) Hot Patch - Use BMS 8-264 for Type I ducts and BMS 8-258 for Type III ducts.

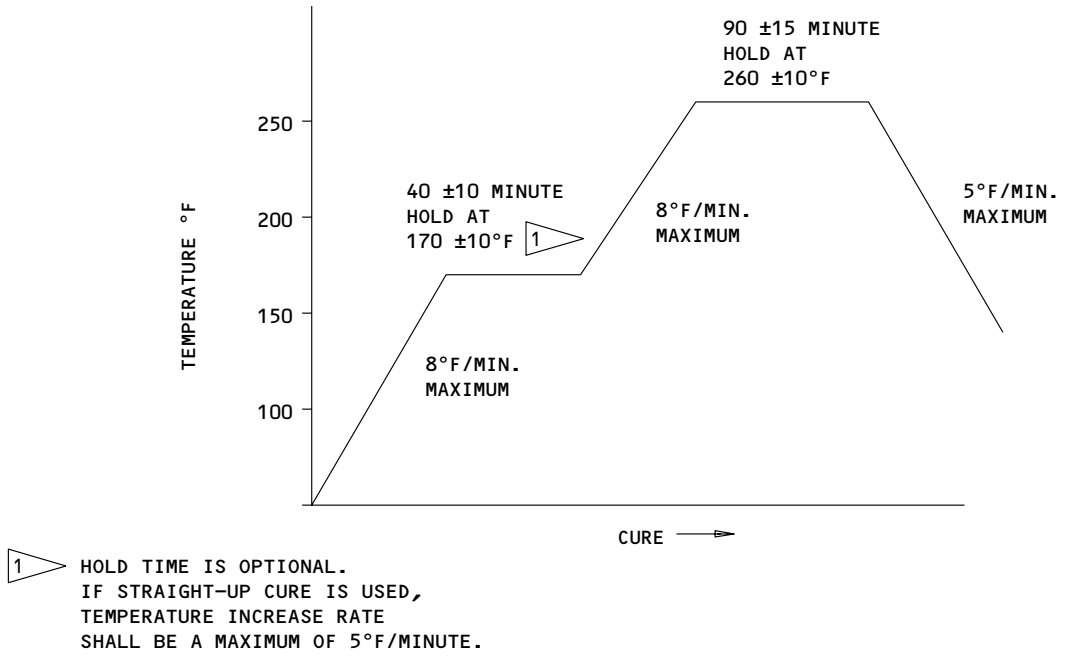
(b) Cold Patch - Use glass fabric (BMS 9-3 class 7, types H, H-2, H-3, E, E-1, E-2) with BMS 8-201 resin mix.

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

(4) Place one or more plies on detail covering damaged area and cover with parting film.

(5) Secure layer of parting film over patch area with tape. Apply a vacuum bag 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.

(6) Cure patch in accordance with the applicable method in Fig. 601 or 602. Use of vacuum bags is preferred.



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

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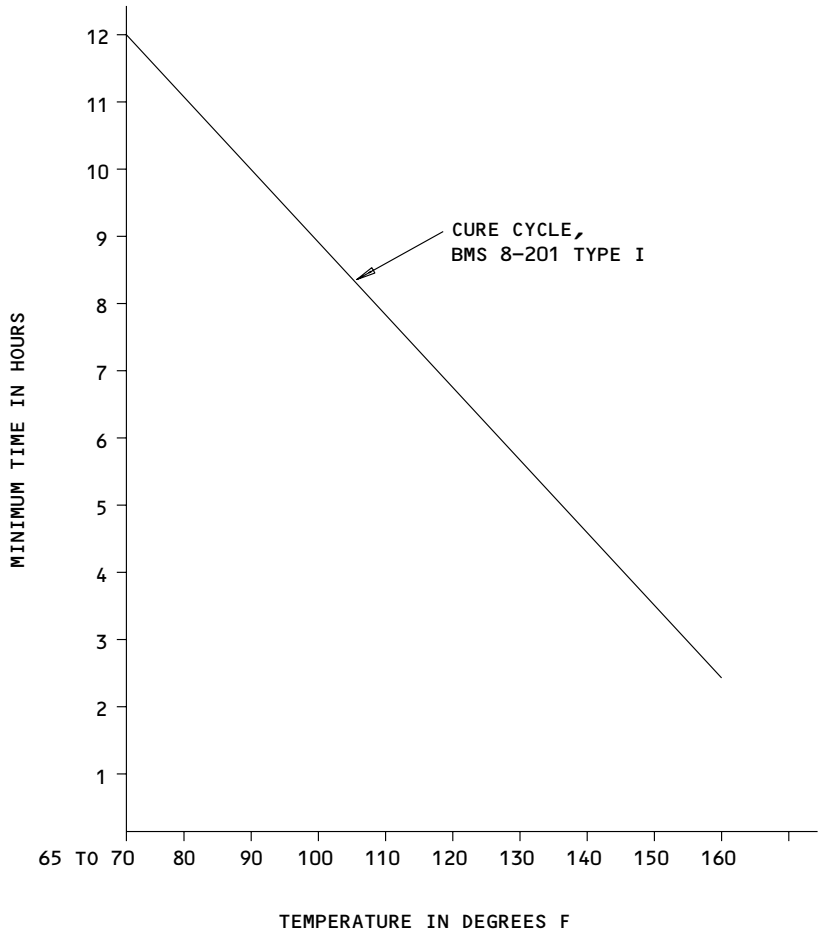


Cure Temperature Chart - BMS 8-201
Figure 602

C. Holes, cuts, fractures, or punctures 0.25 inch diameter or larger.

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

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

(3) Replace on a ply for ply plus one basis using procedures outlined in par. 4.B., overlapping 0.50 inch minimum on each succeeding ply.

D. Gel coat repair.

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

(2) Prepare the QCI 130 gel coat mixture as follows or prepare the alternative material, BMS 8-201, Type 1 or 2 resin as indicated by the vendor:

Ingredient	Parts by Weight
QCI 130A Resin	2000
MEK thinner	1500
QCI 130B Hardener	300

(a) 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.

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

(4) Cure gel coat correction as follows:

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

(b) For BMS 8-201, Type 1 resin, cure for 16 to 24 hours at 70 to 80°F.

(c) For BMS 8-201, Type 2 resin, cure for 8 to 16 hours at 70 to 80°F.

(5) Sand to smooth patched surface.

E. Surface resin ridges and edges.

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

(2) If fabric is removed during sanding, replace on a ply for ply plus one basis using procedures outlined in Repair 4.B.

F. Lamination of Kevlar plies to duct ends.

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

(a) Sand and clean duct ends.

(b) Wrap extra Kevlar plies to duct ends.

(c) Process using the procedures outlined in par. 4.C.(2) and 4.C.(3).

(d) Cure at 260°F for approximately 90 minutes.

G. Sealing

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

(a) Prepare resin mix R109 in the following proportions:

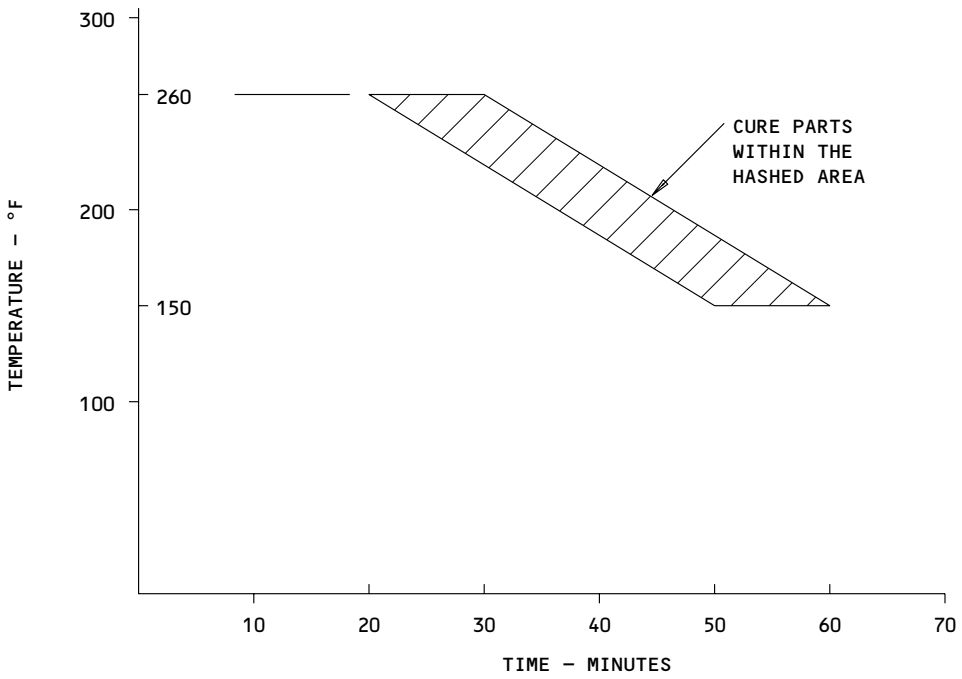
Material	Parts by Weight
Hetron 92	100 ±2
Benzoyl Peroxide	2.0 ±0.2

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

Material	Parts by Weight
Resin Mix R109	50 ±2.0
MEK Peroxide	1.0 ±0.2
Styrene Monomer	49 ±2.0

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

(2) Cure sloshed parts in accordance with Fig. 603.



Cure Cycle for Sloshed Parts
Figure 603