1 SCOPE

a. This specification establishes the requirements for two part resin systems.

b. This specification requires qualified products.

WARNING

WARNINGs may be included throughout this specification. Do not take these WARNINGs to be all inclusive, nor to completely describe hazards or precautionary measures applicable to specific procedures or operating environments.

Non–Boeing personnel must refer to their employer's safety instructions for information concerning hazards which may occur during operations described in this specification.

1.1 CONTENTS

1.1 CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

2 CLASSIFICATION

This specification consists of the following Types:

a. Type I is obsolete for future design and procurement.

b. Type II is obsolete for future design and procurement.

c. Type III is a long work life resin system meeting restrictions on brominated flame retardants.

d. Type IV is a short work life resin system meeting restrictions on brominated flame retardants.

3 REFERENCES

The issue of the following references in effect on the date of invitation for bid forms a part of this specification to the extent indicated herein.

ASTM D 695	–	Compressive Properties of Rigid Plastics
ASTM E 4	–	Standard Practices for Force Verification of Testing Machines
BSS7230	–	Flammability Properties of Aircraft Materials, Determination of
D6–53356	–	Requirements for Process Control Documents for Suppliers of Nonmetallic Raw Materials
OSHA 1910.1200	–	Hazard Communication Standard
SAE–AMS–STD–401	–	Sandwich Constructions and Core Materials: General Test Methods

4 DEFINITIONS

Not applicable to this specification.

5 MATERIAL REQUIREMENTS

5.1 APPEARANCE

Each component of the resin system shall be homogeneous material.

5.2 BLENDING

The manufacturer shall furnish information on the proper blending proportions of Parts A and B with qualification samples. The amount of hardener (Part B) shall be expressed in terms of 100 parts by weight of base material (Part A). Parts A and B shall blend readily to produce a uniform product, with 2 to 3 minutes of hand mixing.

5.3 CURE

The resin systems covered by this specification shall meet the properties in Section 5.5 when blended in accordance with Section 5.2 and cured in accordance with Section 8.1.3.

5.4 STABILITY

Types III and IV component materials shall be stable at 40 to 80 F in unopened containers for a minimum of one year. The stability or storage life for each Type shall be determined from the date of receival at the Purchaser's facility.

5.5 PHYSICAL PROPERTIES

The resin systems covered by this specification shall conform to the applicable requirements in Table I when tested in accordance with Section 8 of this specification.

TABLE I PHYSICAL PROPERTIES

PROPERTY	REQUIREMENT		TEST METHOD SECTION
	TYPE III	TYPE IV	
Laminate Properties			
(1) Compressive Strength, psi, min. avg.	45,000	45,000	8.1.4
(2) Compressive Modulus, psi, min. avg.	2.5×10^6	2.5×10^6	8.1.4
(3) Flammability Properties			
Self–Extinguishing Time, sec. max. avg.	5	5	8.1.4
Burn Length, inches max. avg.	6	6	
Drip Extinguishing Time, sec. max.	1	1	
Sandwich Properties			
(1) Type 120 Fiberglass Panel			
(a) Flatwise Tensile			
psi, min. avg. at 75 ± 5 F	400	400	8.1.5
psi, min. avg. at 160 ± 5 F	45	20	
(b) Long Beam Flexure			
Ult. Load, lbs. at 75 ± 5 F	50	50	8.1.5
P/Y **FL 1** at 75 ± 5 F	28	28	
Ult. Load, lbs. at 160 ± 5 F	4	4	
P/Y **FL 1** at 160 ± 5 F	6	6	
(2) Type 181 Fiberglass Panel			
(a) Flatwise Tensile			
psi, min. avg. at 75 ± 5 F	600	600	8.1.5
psi, min. avg. at 160 ± 5 F	45	45	
(b) Long Beam Flexure			
Ult. Load, lbs. at 75 ± 5 F	105	105	8.1.5
P/Y **FL 1** at 75 ± 5 F	55	55	
Ult. Load, lbs. at 160 ± 5 F	8	8	
P/Y **FL 1** at 160 ± 5 F	15	11	

FL 1 P/Y is expressed in lb./in. and is the slope of the tangent drawn to the initial portion of the load–deflection (stress–strain) curve.

6 QUALIFICATION

6.1 REQUESTS

a. All requests for qualification shall be directed to Supply Management and Procurement (SM&P) organization of The Boeing Company. SM&P will forward the request to the appropriate Engineering department for evaluation. After receiving written authorization from SM&P, the manufacturer shall submit the data and samples required for qualification purposes.

b. Prior to submitting a material for qualification to this specification, the supplier shall provide its Material Safety Data Sheet (MSDS) and if requested, its chemical formulation for the candidate material. Agreements for non disclosure and control of proprietary information shall be considered and executed as appropriate. The information provided shall be submitted to the appropriate Boeing Safety, Health and Environmental Affairs organization (SHEA) to perform a health hazard evaluation. These organizations determine whether the information is adequate or whether additional information is necessary to identify and document appropriate precautions for the material's use.

6.2 PROCESS CONTROL DOCUMENT (PCD)

a. Suppliers shall develop and maintain a Boeing approved PCD in accordance with D6–53356 for manufacture of resin materials.

b. The PCD shall define the manufacturing and quality control requirements and procedures for assuring consistent, uniform and compliant products.

c. Suppliers shall define in the PCD the raw materials, controlled process equipment, process flow and the key process parameters (KPP's) which have a significant probability of affecting the consistency and quality of the product.

d. The PCD shall be reviewed by Boeing prior to the qualification audit and at the time of the audit, or other times at Boeing's discretion.

e. The supplier shall not change any major requirement or major procedure in the PCD, as defined in D6–53356, without disclosure to and approval by Boeing prior to implementation. This shall be done through submittal of an Advance Change Notice (ACN) as outlined in the same document. Minor editorial changes may be made to the PCD in accordance with D6–53356.

6.3 SAMPLES AND SUPPLIER TESTING

a. Qualification of each type shall be based upon the manufacture and successful testing of two qualification batches of material.

b. At the time of submission of qualification samples, the supplier shall submit a certified test report. The report shall contain the following information:

(1) Supplier Product designation.

(2) Designation of type, in accordance with this specification and designating latest revision letter of the specification.

(3) Test results on minimum of two batches for all tests specified in Section 8, including all individual tests and actual test values obtained for each type of resin desired for qualification.

(4) Identification of test facilities used for tests in Section 6.3b.(3).

6.4 QUALIFICATION APPROVAL

a. If the vendor data meet the requirements of this specification, SM&P shall request Material and Process Technology (M&PT) to perform all tests in accordance with Section 8. These tests shall meet the requirements of Section 5.

b. After review of supplier data and Boeing's tests of the samples submitted, the supplier will be advised by SM&P as to whether product approval has been granted. The adequacy of the manufacturing facility may be verified, as deemed necessary, by representatives of The Boeing Company by a survey of such facilities. Qualified products will be listed in the Qualified Products List (QPL) showing the supplier's product designation.

c. No changes in the method of manufacture affecting the properties or performance of the product, or in raw materials or plant location shall be made without notification and prior written approval from Boeing. Requalification of the revised material may be required and a revised supplier designation may be requested.

d. All suppliers shall either have test facilities required to test in accordance with this specification or shall utilize the services of certified commercial laboratories with capability to test in accordance with this specification. The adequacy of the test facilities may be verified, as deemed necessary, by a survey of the facilities conducted by representatives of The Boeing Company.

e. Any or all of the qualification tests may be repeated at any time by the purchaser and the material shall pass the qualification requirements.

f. Requalification may be required at any time as deemed necessary by The Boeing Company.

g. Production materials shall be capable of meeting all qualification requirements.

7 QUALITY CONTROL

7.1 SUPPLIER QUALITY CONTROL

Each production shipment of qualified material from a supplier shall be accompanied by a test report (giving actual test data obtained from each batch contained in that production shipment) showing conformance with the following requirements. The supplier shall retain all test reports and other results on file for a minimum of 7 years.

a. Laminate Compressive Strength and Modulus

b. Flammability Properties

7.2 PURCHASER QUALITY CONTROL

a. Purchaser Quality Assurance shall review all supplier test data submitted with shipment and perform any additional inspection or testing necessary to assure that the production material meets all the requirements specified herein.

b. Purchaser Quality Assurance shall verify that packaging and marking are in compliance with Section 10.

c. The purchaser shall retain all test reports and other results on file for a minimum of 7 years.

8 MATERIAL TEST METHODS

WARNING

This specification involves the use of chemical substances which are hazardous. Boeing personnel shall refer to the work area Hazard Communication Handbook for health effect and control measure information contained in the HazCom Info Sheets and Material Safety Data Sheets. For disposition of hazardous waste materials, consult site environmental engineers for proper disposal methods.

Non–Boeing personnel should refer to manufacturer's Material Safety Data Sheet(s) and their employer's safety instructions.

8.1 CURED RESIN TESTS

Unless otherwise specified, the number of specimens for cured resin tests shall be five. Prior to preparation of specimens for mechanical property tests, the combustible resin content of each laminate shall be verified to 28 to 33.6 percent by weight and honeycomb face sheets shall be 33.6 to 41.2 percent by weight. These resin contents can be verified using the burn out method employed for fiberglass reinforced materials in accordance with Section 8.1.6. Panels with combustible resin contents outside these ranges shall not be used for tests.

8.1.1 TEST PANEL PREPARATION

8.1.1.1 Laminate Panel Fabrication

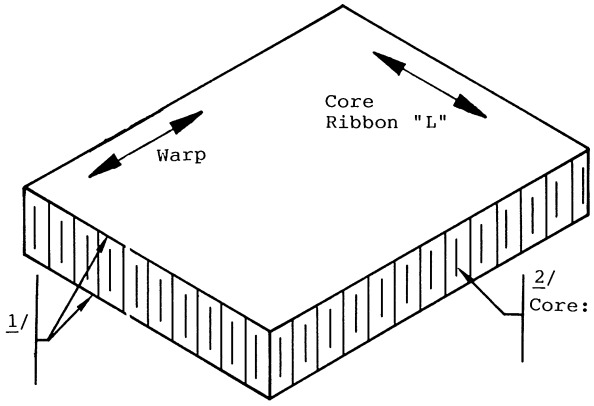
a. The number of plies in the laminate shall be 12 plies of BMS9–3, Type H–2 or H–3 fiberglass fabric for mechanical properties and two plies of BMS9–3, Type H–2 or H–3 fiberglass fabric for flammability testing. Fiberglass fabric prefinish shall be the BMS9–3 Class used for production applications, or Class 7 (Volan–A). Stack the plies with the warp direction the same for each ply.

b. Each laminate shall be of sufficient size that no area tested shall be within 2 inches of any edge bleeder.

8.1.1.2 Sandwich Panel Fabrication

a. Two sandwich panels shall be constructed, one utilizing two plies per face of BMS9–3, Type H–2 or H–3 fiberglass cloth and the other utilizing three plies per face of BMS9–3, Type D fiberglass cloth. Fiberglass fabric prefinish shall be the BMS9–3 class used for production applications or Class 7 (Volan–A). The individual plies shall be impregnated with catalyzed resin prior to assembly of the sandwich panels.

b. The configuration of the sandwich panels shall be as illustrated in Figure 1.



1/ Use 2 plies BMS 9-3, Type H-2 or H-3, or 3 plies BMS 9-3, Type D with the Class to be the same as that used in production or Class 7 (Volan-A). The BMS 9-3 material shall be oriented so that the warp face of the fabric is against the core on both sides.

2/ No splices allowed in test panel core.

FIGURE 1 SANDWICH TEST PANEL CONFIGURATION

8.1.2 IMPREGNATION PROCEDURES

Cut and weigh the required number of plies of dry fabric. The plies shall be large enough to provide 2 inch excess on all sides and resin content specimens. Weigh equal amount of mixed hardener and resin and fabric for an initial resin fabric weight ratio of 1/1.

NOTE: The ply impregnation procedures are guidelines for test panel fabrication.

8.1.2.1 Ply Impregnation

a. Mix resin and hardener in the proportions noted in manufacturer's instruction. Gently blend the two components into a uniform mixture taking care not to whip excessive amounts of air into the resin mix.

b. For ply impregnation, follow the procedure outlined below, using a larger portion of the resin to impregnate the first few plies, so that during vacuum impregnation the up and outward flow of resin can remove the entrapped air from the interior regions of the laminate. As a general rule, use 1/2 of the resin mix for the first 1/3 of the plies, use 2/3 of the remaining resin for the second 1/3 of the plies and use the remaining resin on the last 1/3 of the plies. Remove some of the resin during ply impregnation to achieve the final resin content.

(1) Pour some resin on the prepared surface of the tool, and center the first ply of fabric on top of it.

(2) Allow the resin to flow up through the fabric. Using a squeegee, gently spread the resin until the entire ply is fully saturated.

(3) Pour some more resin over the middle of the first ply, place the second ply on top of it, and gently squeegee the resin around until the second ply is fully saturated.

(4) Continue the procedure for all the plies in the laminate.

(5) Bagging procedure

(a) For 12 ply laminate test panel, apply perforated release film over the laminate, then a single layer of BMS9–3 Type H2 or H3 glass as a surface bleeder ply. Edge bleed maintaining zero to 1 inch gap between the laminate and the edge bleeder. Apply the vacuum bag and pull vacuum. The perforated release film and surface bleeder help remove the air in the uncured resin and glass.

(b) For 2 ply test panel, apply the vacuum bag directly over the laminate without a release film. Edge bleed maintaining a zero to 1 inch gap between the laminate and the edge bleeder. Pull vacuum.

(c) For sandwich test panel face sheets, cover the laminate with a ply of release film then apply the vacuum bag. The release film will be removed after laminate impregnation in order to assemble into a sandwich panel in accordance with section 8.1.2.2. Edge bleed maintaining a zero to 1 inch gap between the laminate and the edge bleeder. Pull vacuum.

(6) Once the vacuum bag is pulled tight without any wrinkles over the laminate and no leak is detected, start the impregnation process by firmly but slowly sweeping the excess resin out of the laminate into the surrounding breather cloth, using a squeegee and radially moving from the middle to the edges. This procedure should be done as slowly as possible without exceeding the resin pot life. To aid in sweeping, a light coating of Vaseline or other suitable lubricant may be applied over the vacuum bag.

8.1.2.2 Sandwich Panel Preparation

Apply the impregnated sandwich panel face sheet to the honeycomb core following the procedure outlined below:

a. For sandwich panel face sheets, remove the vacuum bag and gently peel off the release film from the top of the impregnated laminate. Cut three samples from each sandwich panel face sheet that are approximately one inch square, minimum in size for resin content testing. Do not take samples within 2 inches of the face sheet edge. Cure separately from the sandwich panel.

b. Roller coat the tool side of the honeycomb core detail with 0.5 to 0.6 grams of resin mix per square inch of core surface, mixed with 3.5 percent by weight Cabosil M–5. Pre saturate the roller with the same resin, in order to compensate for the resin that is lost to the roller and is not transferring to the core. Place the core over the impregnated face sheet in proper orientation as noted in Figure 1.

c. Roller coat the bag side of the honeycomb core detail with 0.5 to 0.6 grams of resin mix per square inch of core surface, mixed with 3.5 percent by weight Cabosil M–5. Pre saturate the roller with the same resin, in order to compensate for the resin that is lost to the roller and is not transferring to the core. Place the sandwich panel face sheet over the impregnated core in proper orientation as noted in Figure 1.

8.1.3 CURE

a. For laminates, cure the test panel under the same vacuum bag that was used for impregnation. Removal of the vacuum bag may result in the incorporation of air into the laminate. In case of damage to the bag, apply a second vacuum bag over the first bag. If the bag is removed, resweep the laminate under the new bag to drive out the air.

b. For sandwich panels, apply release film to the sandwich panel, then surface breather and edge breather and a vacuum bag.

c. During cure at 75 ± 5 F, protect laminate and sandwich panels from humidity and fluid moisture using solid FEP. Place the FEP on top of the vacuum bag, securing in place. Maintain minimum 20 inches HG vacuum for minimum 24 hours.

d. Complete the cure using one of the methods described below.

(1) Complete the cure at 75 ± 5 F under minimum 20 inches HG vacuum. Cure time at 75 ± 5 F is 8 days minimum. Moisture protection required during cure.

(2) After 24 hours or more under vacuum at 75 ± 5 F, remove the panel from the vacuum bag, place the panel in a moisture proof bag and complete the cure. Cure time at 75 ± 5 F is 8 days minimum.

(3) After 24 hours or more under vacuum at 75 ± 5 F, remove the panel from the vacuum bag and complete the cure at 170 ± 10 F for 2 to 2.5 hours. No moisture protection required during 170 ± 10 F cure.

(4) After 24 hours or more under vacuum at 75 ± 5 F, complete the cure under minimum 20 inches HG vacuum at 170 ± 10 F for 2 to 2.5 hours. No moisture protection required during 170 ± 10 F cure.

CAUTION Ambient humidity or fluid water moisture delays resin cure. Solid FEP or other moisture barrier prevents water from interfering in the resin cure during 75 ± 5 F cure.

8.1.4 LAMINATE TESTING

The laminate prepared in accordance with Section 8.1.1 shall be tested as follows. A minimum of three specimens shall be tested for each property. Perform all mechanical property testing using test machines certified to ASTM E 4.

a. Compression Strength and Modulus – Compression strength and modulus shall be determined in the warp direction in accordance with ASTM D 695.

b. Flammability Properties – Flammability properties shall be determined in accordance with the 60 Second Vertical Ignition Test of BSS7230.

8.1.5 SANDWICH PANEL PROPERTIES

Perform all mechanical property testing using test machines certified to ASTM E 4.

a. Flatwise Tensile Strength – The test specimens shall be 2 in. by 2 in. $\pm$ 0.03 in. A minimum of four tests shall be made from each panel. Determination of flatwise tensile strength shall be in accordance with SAE–AMS–STD–401.

b. Long Beam Flexure Strength – The test specimens shall be 3 $\pm$ 0.03 in. by 24 $\pm$ 0.10 in., with the 24 inch dimension in the warp direction of the panel. All specimens shall be tested bag side up. The test shall be single–point loading on an 18 inch span, employing 1 inch wide steel blocks with a 60D (durometer) rubber pad (1 in. by 3 in. by 1/8 in.) at the center loading point. Except for the above, test procedure shall be in accordance with SAE–AMS–STD–401. Ultimate load, in pounds, shall be reported. P/Y **FL 1** in pounds/inch shall be reported. A minimum of four specimens shall be tested.

FL 1 P/Y is the slope of the tangent to the initial portion of the load–deflection curve.

8.1.6 FIBERGLASS COMBUSTIBLE RESIN SOLIDS CONTENT

a. From fiberglass laminate of fiberglass honeycomb face skins, cut three samples that are approximately 1 square inch minimum in size. Do not take specimens within 2 inches of the panel edge. With honeycomb face skins, be sure to remove all honeycomb material from the skin before weighing. A very small amount of honeycomb residue left on the face sheet, that cannot be removed without damage to the face sheet, is acceptable.

b. Weigh a numbered porcelain or quartz dish or crucible large enough to hold the specimens, on an analytical balance capable of weighing to the nearest 0.001 gram, and record the weight.

c. Weigh the laminate samples to the nearest 0.001 gram (W_1) and place in the tared and numbered dish.

d. Set the temperature of a muffle furnace at 1050 $\pm$ 50 F. Place the charged dishes or crucibles into the muffle furnace and burn out the resin to constant residue weight or until the fiberglass cloth becomes white, with no dark areas. The specimens may be put in the furnace as it is warming up or after it has stabilized at temperature.

NOTE: There may be a noncombustible inorganic content in addition to the fiberglass after burnout, which may impart a light gray color.

e. Following burnout, remove charged dishes or crucibles to a desiccator and cool to 75 $\pm$ 10 F.

8.1.6 FIBERGLASS COMBUSTIBLE RESIN SOLIDS CONTENT (Continued)

f. Reweigh charged dishes or crucibles to the nearest 0.001 gram.

g. Subtract charged dish or crucible weight from the initial dish or crucible weight to obtain burnout weight of fiberglass cloth plus inorganic content (W_2 to the nearest 0.001 gram).

h. Calculate the combustible resin content of each specimen as follows:

$$Resin\ content = \frac{W_1 - W_2}{W_1} \times 100\ ,\ percent$$

where

W_1 = weight of fiberglass plus resin and inorganic content cloth laminate specimen, g.

W_2 = weight of fiberglass cloth plus inorganic content after burnout, g.

Report individual results as well as an average of the three samples.

9 MATERIAL IDENTIFICATION

Each container of a component BMS8–201 material shall be legibly and durably marked with the following information:

a. BMS number, with the latest revision letter, and Type.

b. Manufacturer’s name and material designation.

c. Manufacturer’s batch or lot number.

d. Proportions for blending.

e. Date of Manufacture.

f. Quantity.

g. Recommended storage temperature.

10 PACKAGING AND MARKING

Packaging shall be accomplished in such a manner as to assure delivery of material capable of meeting the requirements of this specification.

a. BMS8–201 shall be furnished in 1 quart kits unless otherwise specified.

b. Each component of each kit shall be packaged in clean, airtight containers of a type that will not contaminate the contents.

c. The exterior packaging shall be of such a nature as to assure safe delivery.

d. Marking shall be as specified in Section 9.

e. All labeling shall conform to OSHA 1910.1200.

f. Mark each package with the purchase order number.