1 SCOPE

a. This specification establishes the requirements for structural adhesives for service temperatures of –67 F to 180 F.

b. This specification requires qualified products.

c. Adhesives qualified to this specification shall meet the requirements of AMS–A–25463, Type 1, Class 2.

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)

1.1 CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

2 CLASSIFICATION

This specification consists of the following Types:

a. Type I – Reserved for future use.

b. Type II – Adhesive in film form suitable for bonding metal–to–metal and honeycomb assemblies.

(1) Grade 5 – 0.005 inch thick

(2) Grade 10 – 0.010 inch thick

(3) Grade 15 – 0.015 inch thick

c. Type III – A liquid pour–coat material for use in sealing and stabilizing honeycomb core.

d. Type IV – Unsupported film adhesive (Type IV material shall be the same as qualified Type II material except without supporting scrim)

(1) Grade 5 – 0.005 inch thick.

e. Type V – Adhesive in film form for specialty bonding applications (Type V material shall be the same as qualified Type II material except filmed at desired film thickness)

(1) Grade 40 – 0.040 inch thick

3 REFERENCES

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

ASTM D 1582	–	Standard Test Method for Nonvolatile Content of Liquid Phenol, Resorcinol, and Melamine Adhesives
BAC5514	–	Common Bonding Requirements for Structural Adhesives
BAC5514–589	–	Application of Corrosion Inhibiting Adhesive Primer
BAC5555	–	Phosphoric Acid Anodizing of Aluminum for Structural Bonding
BSS7061	–	Time and Temperature Recording Requirements
BSS7101	–	Requirements for PCD System for Suppliers of BMS Materials
BSS7201	–	Fatigue, Lap, Adhesive Bond
BSS7202	–	Shear, Lap, Adhesive Bond
BSS7204	–	Creep, Lap, Adhesive Bonded
BSS7205	–	Tension, Flatwise, Adhesive Bonded
BSS7206	–	Peel, Metal–to–Metal, Adhesive Bonded
BSS7207	–	Peel, Honeycomb, Adhesive Bonded
BSS7208	–	Crack Extension Force, Adhesive Evaluation
BSS7209	–	Environmental Exposure, Humidity, Sustained Stress, Lap, Adhesive Bonded
BSS7210	–	Environmental Exposure, Salt Spray
BSS7211	–	Environmental Exposure, High Humidity
BSS7212	–	Environmental Exposure, Fluids

3 REFERENCES (Continued)

BSS7216	–	Solids Content and Volatiles Content
BSS7286	–	Statistical Process Control of Designated Engineering Characteristics
AMS–A–25463	–	Adhesive, Metallic Structural Sandwich Construction
OSHA 1910.1200	–	Hazard Communication Standard

4 DEFINITIONS

The following definitions apply to terms that are uncommon or have special meaning as used in this specification:

Auxiliary storage facility – A facility external to the supplier's manufacturing location where material is stored under the control of the supplier.

Batch – A homogeneous amount of finished pour coat or adhesive manufactured under controlled conditions in a single manufacturing run.

Date of Manufacture (DOM) – The date that all filming operations on a batch of film adhesive or all mixing operations on a batch of pour coat have been completed.

Date of Shipment (DOS) – The date that a lot of material has been shipped from the supplier's manufacturing location, an authorized distributor, an authorized re–packager, or an authorized auxiliary storage location to the purchaser, whichever occurs later.

Distributor – An intermediate between the supplier and the purchaser who handles, stores, and allocates material without compromising the individual unit packaging.

Key Characteristic (KC) – A feature whose variation has a substantial impact on the fit, performance, service life, or manufacturability of the product from the standpoint of the customer.

Key Process Parameter (KPP) – A process input that is controllable and that has a statistical correlation with the variation in a key characteristic. Key process parameters are most effectively determined by the Supplier through the use of designed experiments.

Lot – All the pour coat or adhesive from one pour coat or adhesive batch received in one shipment.

Lot Size – The total number of units in any one lot irrespective of the volume of the container or the length of the roll.

Process Control Document (PCD) – A document that describes the qualified materials, manufacturing processes, in–process testing, and alternate test methods used to document, and control variation of a Supplier's product.

Re–packager – An intermediate between the supplier and the purchaser who handles, re–packages, stores, and allocates material.

Statistical Process Control (SPC) – A systematic method of tracking, predicting and minimizing variation over time. It shall include tools to monitor the stability of the process over time, and have measures to establish the ability of the process to conform to applicable tolerance limits. This involves the use of control charts and capability indices.

4 DEFINITIONS (Continued)

Supplier Inventory Life (SIL) – The length of time that occurs between Date of Manufacture and Date of Shipment. Supplier Inventory Life begins on DOM and ends on DOS from the supplier's manufacturing location, an authorized distributor, an authorized re–packager, or an authorized auxiliary storage location.

Supplier Out–time – The time that Type II adhesive is exposed to temperatures above 0 F and below 90 F and Type III pour–coat is exposed to temperatures above 40 F and below 90 F at the supplier's manufacturing facility prior to shipping.

Unit – the smallest, single portion of finished product received in any one lot, i.e., a single container of pour coat or a single roll of adhesive.

5 MATERIAL REQUIREMENTS

All adhesive materials shall be capable of being cured at 225 to 260 F within 90 minutes.

5.1 PROPERTIES

5.1.1 TYPE II, TYPE IV, AND TYPE V ADHESIVES

a. Areal weight for Type II (Grade 5, 10 and 15) and Type IV (Grade 5 only), and Type V (Grade 40 only) adhesives shall be as follows:

(1) Grade 5	0.030 lb/ft^2 ± 0.005 lb/ft^2	(0.005 inches thick)
(2) Grade 10	0.060 lb/ft^2 ± 0.005 lb/ft^2	(0.010 inches thick)
(3) Grade 15	0.085 lb/ft^2 ± 0.005 lb/ft^2	(0.015 inches thick)
(4) Grade 40	0.240 lb/ft^2 ± 0.020 lb/ft^2	(0.040 inches thick)

b. The adhesive shall have less than 1.0 percent volatiles when tested in accordance with BSS7216, Type II.

c. Color coding of grades is required as listed in the QPL.

d. Film weight is a Key Characteristic (KC) and requires Statistical Process Control (SPC) in accordance with Section 7.1.1.

5.1.2 TYPE III – POUR COAT

a. Type III Pour–coat shall have 45 ± 3 percent solids when tested in accordance with Section 8.4. Solids content is a Key Characteristic (KC) and requires Statistical Process Control (SPC) in accordance with Section 7.1.1.

b. Type III Pour–coat shall be of uniform quality and free from foreign materials.

c. Type III Pour–coat shall readily mix into a homogeneous mixture suitable for stabilizing honeycomb by dipping or pour–coating.

d. Type III Pour–coat shall be thermosetting and mutually compatible with Type II adhesives.

e. Type III Pour–coat shall have a viscosity equivalent to 100 to 300 cps as measured by a Brookfield RVF, spindle, 20 rpm at 75 ± 5 F. Other methods of viscosity measurement shall be acceptable upon documentation by Quality Assurance or equivalence.

5.1.3 PROPERTIES OF BONDED SPECIMENS

a. All specimens shall be surface prepared in accordance with BAC5555 or BAC5514, Solution No. 1 and primed with BMS5–89 in accordance with BAC5514–589 prior to testing to the requirements of Table I, Table II and Table III. Adherends for test specimens shall be as specified in Table IV.

b. Minimum requirements are given in Table I, Table II and Table III and are intended for qualification only of Type II and Type III materials. For Type IV materials, minimum requirements are given in Table I, Tests 1, 2, 3, 4, and 13 only. For Type V materials, minimum requirements are given in Table I, Test 14 and 15 only. Acceptance values for purchaser receiving inspection tests and supplier tests are given in Table VII.

c. The calculated minimum individual value for each test shall equal or exceed the minimum individual requirement. The method of calculation is Xmin = Xq – 3.064 Sq where Xq and Sq are the qualification mean and qualification standard deviation of all the individual measurements from all the batches of a particular grade. In addition, each measurement obtained for tests under Table I and Table II shall equal or exceed the minimum requirement.

TABLE I MINIMUM PROPERTIES OF METAL–TO–METAL SPECIMENS

TEST	BSS TEST METHOD	BSS SPECIMEN TYPE	NUMBER OF SPECIMENS REQUIRED		MINIMUM REQUIREMENT
			PER BATCH **FL 1**	TOTAL	
1. Lap Shear at 75 ± 5 F	BSS7202, Type III	– – –	10	30	4200 psi **FL 2**
2. Lap Shear at –67 ± 2 F	BSS7202, Type III	– – –	10	30	4200 psi **FL 2**
3. Lap Shear at 180 ± 5 F	BSS7202, Type III	– – –	10	30	3100 psi **FL 2**
4. Lap Shear at 250 ± 5 F	BSS7202, Type III	– – –	10	30	650 psi **FL 2**
5. Lap Fatigue at 75 ± 5 F **FL 3**	BSS7201	BSS7202, IIIA	3	9	10^7 cycles at 1500 psi
6. Creep–Rupture–Deformation at 75 ± 5 F under 1600 psi load for 192 hours **FL 3**	BSS7204	BSS7202, III	5	15	0.015 in. max.
7. Creep–Rupture–Deformation at 180 ± 5 F under 800 psi load for 192 hours **FL 3**	BSS7204	BSS7202, III	10	30	0.015 in. max.
8. Lap Shear at 75 ± 5 F after 30 days under 100 percent R.H. at 120 ± 5 F **FL 3**	BSS7211, BSS7202	7202, III	10	20	X_{min} from Test 1
9. Lap Shear at 75 ± 5 F after 30 days salt spray exposure at 95 ± 5 F **FL 3**	BSS7210, BSS7202	7202, III	10	30	0.85 times X_{min} from Test 1
10. Lap Shear at 75 ± 5 F after 7 days immersion in JP–4 fuel (MIL–DTL–5624) at 75 ± 5 F **FL 3**	BSS7212, BSS7202	7202, III	10	30	X_{min} from Test 1

5.1.3 PROPERTIES OF BONDED SPECIMENS (Continued)

TABLE I MINIMUM PROPERTIES OF METAL–TO–METAL SPECIMENS (Continued)

	TEST	BSS TEST METHOD	BSS SPECIMEN TYPE	NUMBER OF SPECIMENS REQUIRED		MINIMUM REQUIREMENT
				PER BATCH **FL 1**	TOTAL	
11.	Lap Shear at 75 ± 5 F after 7 days immersion in Type 3 hydrocarbon fluid (ASTM D 471) at 75 ± 5 F **FL 3**	BSS7212, BSS7202	7202, III	10	30	X_{min} from Test 1
12.	Lap Shear at 75 ± 5 F after 7 days immersion in Type III hydraulic fluid (BMS3–11) at 150 ± 5 F **FL 3**	BSS7212, BSS7202	7202, III	10	30	X_{min} from Test 1
13.	Metal–to–Metal Climbing Drum Peel at 75 ± 5 F	BSS7206, Class 1, Type II		10	30	45 lb–in/in (Grade 5) **FL 2** 55 lb–in/in (Grade 10) Not required (Grade 15)
14.	Type V Film Adhesive Lap Shear at 75 ± 5 F **FL 4**	BSS7202, Type IV	Section 8.6.1	10	30	4200 psi **FL 2**
15.	Type V Film Adhesive Metal–to–Metal Climbing Drum Peel at 75 ± 5 F **FL 4**	BSS7206, Class 1, Type II	Section 8.6.2	10	30	55 lb–in/in **FL 2**

FL 1 Per batch for three batches for qualification

FL 2 Determination of Calculated Minimum Value in accordance with Section 5.1.3c.

FL 3 Applies to Type II and Type III materials only

FL 4 Applies to Type V materials only

5.1.3 PROPERTIES OF BONDED SPECIMENS (Continued)

TABLE II MINIMUM PHYSICAL PROPERTIES OF HONEYCOMB SPECIMENS

TEST	BSS TEST METHOD	NUMBER OF SPECIMENS REQUIRED		MINIMUM INDIVIDUAL REQUIREMENTS		
		PER BATCH **FL 1**	TOTAL			
1. Honeycomb Peel at 75 ± 5 F	BSS7207	10	30	Not required (Grade 5) 45 lb–in/3 in (Grade 10) **FL 2** 75 lb–in/3 in (Grade 15) **FL 2**		
2. Honeycomb Peel at 75 ± 5 F after 30 days 100 percent R.H. exposure at 95 ± 5 F	BSS7211, BSS7207, Type II	10	30	0.75 times X_{min} from Test 1		
3. Honeycomb Peel at 75 ± 5 F after 30 days salt spray exposure at 95 ± 5 F	BSS7210, BSS7207, Type II	10	30	0.75 times X_{min} from Test 1		
				Grade		
				5	10	15
4. Flatwise Tensile at 75 ± 5 F	BSS7205, Type I	10	30	– – –	900 psi **FL 2**	1100 psi **FL 2**
5. Flatwise Tensile at 250 ± 5 F	BSS7205, Type II	10	30	– – –	50 psi **FL 2**	50 psi **FL 2**
6. Flatwise Tensile at 180 ± 5 F	BSS7205, Type II	10	30	– – –	500 psi **FL 2**	750 psi **FL 2**

FL 1 Per batch for three batches for qualification.

FL 2 Determination of Calculated Minimum Value:

$X_{min} = X_q – 3.064\ S_q$ where X_q and S_q are the qualification mean and qualification standard deviation of all the individual measurements from all the batches of a particular grade.

5.1.3 PROPERTIES OF BONDED SPECIMENS (Continued)

TABLE III ENVIRONMENTAL DURABILITY TESTS

TEST	BSS TEST METHOD	NUMBER OF SPECIMENS REQUIRED		MINIMUM INDIVIDUAL REQUIREMENTS
		PER BATCH **FL 1**	TOTAL	
1. Crack Extension	BSS7208, Type I	2	6	**FL 5** G_{Ic} = 8 lb/in **FL 5** G_{Ia} = 6 lb/in
	BSS7208, Type II	2	6	**FL 5** G_{Iscc} = 3.5 lb/in **FL 2 FL 3**
2. Sustain Stress Loading	BSS7209, Specimen BSS7202, Type III	4	12	No failures in 90 days at 900 psi **FL 4**

FL 1 Per batch for three batches

FL 2 G_{Iscc} after 5 weeks exposure to 140 ± 5 F, 95 to 100 percent R.H.

FL 3 After 15 weeks exposure to 140 ± 5 F, 95 to 100 percent R.H., each specimen shall have a G_{Iscc} equal to or exceeding 70 percent of the G_{Iscc} for that specimen after 5 weeks exposure.

FL 4 Exposure to 140 ± 5 F, 95 to 100 percent R.H.

FL 5 All measurements shall equal or exceed the Minimum Requirement. G_{Ic} and G_{Ia} are the crack extension forces for unexposed adhesive crack initiation and arrest respectively. G_{Iscc} is the crack extension force for crack arrest under aqueous exposure.

TABLE IV TEST SPECIMEN MATERIALS

TEST SPECIMEN		MATERIALS OF CONSTRUCTION
Lap Shear		2024–T3 bare, each adherend 0.063 inch thick
Metal–to–Metal Peel		2024–T3 clad, 0.020 inch thick peeling sheet 0.040 inch thick backing sheet
Honeycomb Peel	– Core	BMS4–4, Type 4–40N
	– Face Sheets	2024–T3 clad, 0.020 inch thick
Flatwise Tension	– Core	BMS4–4, Type 4–40N
Crack Extension		2024–T3 bare, each adherend 0.5 inch thick

5.1.4 PROCESS VARIABLES AND OUT TIME REQUIREMENTS

a. Type II adhesives shall meet all requirements when processed at 90 minute minimum cure time at all combination of the process variables as follows: 225 to 235 F and 250 to 260 F cure temperature, 0.5 to 1.5 F/minute and 8 to 10 F/minute temperature rise, 25 ± 5 psi and 100 ± 5 psi cure pressure, both as received and after 10 days aging at 92.5 ± 2.5 F prior to bonding. The tests required for the process variables study are given in Section 6.2b.

5.1.4 PROCESS VARIABLES AND OUT TIME REQUIREMENTS (Continued)

b. Table IV adhesives shall meet all requirements when processed at 90 minutes minimum cure time as follows: 255 F ± 5 F cure temperature, 5 F ± 1 F/minute temperature rise, 45 psi ± 5 psi cure pressure, as required (no aging).

5.1.5 CHEMICAL CONTROL OF MATERIALS

The critical elements of the adhesive chemistry of composition and its control limits shall be identified in terms of measurable properties in accordance with Section 6.2e.

5.2 STORAGE LIFE

a. BMS5–101, Type II, Type IV, and Type V adhesives shall retain their ability to meet the requirements of Section 5 for a minimum period of 1 year from the date of shipment provided:

(1) The Type II and Type IV, and Type V adhesives remain in sealed containers or airtight wrappers except for one opening to obtain samples for Acceptance tests.

(2) The Type II and Type IV, and Type V adhesive shall be stored at a temperature of 0 F or below.

(3) The Type II and Type IV, and Type V adhesive shall be transported at a temperature of 0 F or below.

b. Type III Pour–coat shall retain its ability to meet the physical property requirements of Section 5.1.2 for a period of 90 days from date of shipment from the manufacturer's facility provided:

(1) The Type III pour–coat remains in sealed containers.

(2) The Type III pour–coat shall be stored at a temperature of 40 F or below.

(3) The Type III pour–coat shall be transported at a temperature of below 90 F.

6 QUALIFICATION

a. Products qualifying to this specification shall meet all requirements given in Section 5.

b. Type IV materials shall be the same as qualified Type II materials except without supporting scrim.

c. Qualification of Type IV materials to this specification may require additional testing such as lightning strike and reticulation evaluation.

d. Type V materials shall have the same formulation and same supporting scrim as an already qualified Type II material, except filmed to the desired Grade.

e. Qualification of Type V materials to this specification may require additional testing such as rheology evaluations.

6.1 REQUESTS

All requests for qualification shall be directed to a Supplier Management department 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 in Section 6.2 for qualification purposes.

Prior to submitting a material for qualification to this specification, the material supplier shall provide a Material Safety Data Sheet for the candidate material. Prior to completing qualification, the material supplier shall provide the detailed chemical formulation, percent composition, and CAS (Chemical Abstract Service) numbers 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 organizations 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 SAMPLES AND TEST REPORTS

a. For Type II and Type III materials, qualification samples submitted for approval shall be accompanied by a test report giving actual data for a minimum of three batches per grade, for all tests of Table I, Table II, and Table III.

   For Type IV materials, qualification samples submitted for approval shall be accompanied by a test report giving actual data for a minimum of three batches per grade, for Tests 1, 2, 3, 4, and 13 of Table I.

   For Type V materials, qualification samples submitted for approval shall be accompanied by a test report giving actual data for a minimum of three batches per grade, for Test 14 and 15 of Table I.

   The individual specimen and average values for each test shall be reported. Each value reported shall be shown as being for an individually numbered specimen, the numbering of which shall be coded in the report in such a manner as to definitely establish the particular test assembly from which the specimen was cut and the particular batch of adhesive with which the test assembly was bonded, together with the date of bonding. Coded identification of the adhesive batches shall include the respective dates of manufacture and sizes of batch. Dates on which the different tests were performed shall be shown in the test report.

b. In addition to the required tests for Table I, Table II, and Table III, the supplier shall submit a processing variables study that demonstrates that the material to be qualified meets the requirements of Section 5.1.4. As a minimum, the process variables study shall consist of two material batches evaluated for Tests 1, 4, 13 of Table I and Test 1 of Table III for Grade 5, and for Tests 1, 4 and 5 of Table II for Grade 15. The number of specimens for each batch shall be as required in Table I, Table II, and Table III. This processing variables study is not required for Type IV and Type V materials.

c. The material supplier shall have facilities capable of testing in accordance with this specification, or the supplier shall identify a testing facility. Boeing Engineering and Quality Assurance shall verify the adequacy of all test facilities and test procedures.

d. Qualification samples shall be submitted from each of three production batches for each candidate grade.

6.2 SAMPLES AND TEST REPORTS (Continued)

e. The supplier shall document in their PCD (ref. Section 6.3) a plan for the control and analysis of the chemical composition of the adhesive. This plan shall identify critical elements of chemical composition and their control limits.

f. The Boeing Company has the right to conduct any tests deemed necessary prior to qualification, including a manufacturing feasibility tests. Production material shall be capable of meeting all qualification requirements.

g. Qualified Products are listed in the Qualified Products List.

h. An adhesive shall be approved only for the formulation on which the qualification tests are made.

i. No change in approved product formulation, raw materials, basic methods of manufacture, test methods, supplier inventory life, plant site, authorized distributors, authorized re–packagers, or auxiliary storage locations shall be made without notification and prior approval in writing from The Boeing Company. It may be necessary to re–qualify material manufactured with the proposed change, and a revised product designation may be required.

6.3 PROCESS CONTROL DOCUMENT

a. Supplier shall submit a Process Control Document (PCD) for Boeing review and approval prior to qualification audits of production material.

b. The PCD shall document baseline raw material constituents, in–process test procedures and requirements, manufacturing procedures, alternate test methods, and procedures for dealing with issues of non–conformances in accordance with BSS7101. Rationale for the formulation and process parameters shall be supported by historical data and experimentation.

c. The PCD shall document a statistical process control (SPC) program as specified in Section 7.1.1.

d. The Supplier shall maintain a revision controlled list of all authorized distributors, re–packagers, and auxiliary material storage locations (foreign and domestic) for their qualified products. This list shall be either documented as part of the PCD or referenced within the PCD, and shall be made available to purchasers upon request.

e. The Supplier shall have a process for granting and maintaining authorized distributor, re–packager, or auxiliary storage location status documented or referenced in their PCD. This process shall include documentation of all time and temperature exposures during shipping between and storage at authorized distributors, re–packagers, or auxiliary storage locations. In addition, the process shall include a method to ensure that supplier inventory life is not exceeded when the material is handled by an authorized distributor, re–packager, or auxiliary storage location prior to shipment to a purchaser.

f. All qualification data, production records, and test data shall be kept on file for a minimum of seven years and shall be readily available for review.

g. Supplier Inventory Life for each type and class of material shall be established by the Supplier and documented in their PCD.

h. Supplier out–time for each type and class of material shall be established by the supplier based on supporting data and documented in their PCD.

6.4 QUALIFICATION AUDIT

a. Supplier shall submit to an audit of its manufacturing operations, quality control system, raw materials accountability system, product traceability, process records, test results, and quality assurance records.

b. Qualification audits shall be conducted during the manufacture of the qualification batches in accordance with BSS7101.

c. The Boeing Company reserves the right to perform an on–site audit of the manufacturing of any production order after qualification.

7 QUALITY CONTROL

7.1 SUPPLIER QUALITY CONTROL

a. Verify that each batch of material has been manufactured in accordance with an approved PCD. Verify that each lot of adhesive or pour coat is shipped within the supplier inventory life documented in the PCD. If a lot of material will be handled by an authorized distributor, re–packager, or auxiliary storage facility ensure that sufficient Supplier Inventory Life is retained until DOS.

b. Suppliers shall certify that each production shipment meets the requirements of this specification and is chemically and physically equivalent to the supplier's material originally qualified.

c. Suppliers shall furnish actual test data showing conformance with Sections 7.1 and 7.3 for each shipment of material, and shall identify such data with the specification revision letter in effect.

d. All areas of Type II, Type IV and Type V film adhesive which are not suitable for structural adhesive bonding shall be legibly marked by the supplier and deducted from the roll yardage.

e. The tests of Table V except tests (5), (6), and (7) are mandatory on each production batch of Type II and Type IV film.

f. Tests (1) and (5) of Table V are required for Type III pour–coat. Use BSS7202, Type I specimens for Lap Shear testing.

g. Test (4), (6), and (7) of Table V are mandatory on each production batch of Type V film

h. Only 75 $\pm$ 5 F temperature tests are required

7.1 SUPPLIER QUALITY CONTROL (Continued)

TABLE V ASSEMBLIES AND SPECIMEN REQUIREMENTS

TEST		BONDED ASSEMBLIES PER SAMPLE	SPECIMENS PER SAMPLE	TESTS METHOD
(1)	Lap Shear	1	5	BSS7202, Type IV, Section 8.5
(2)	Metal to Metal Peel	1	3	BSS7206, Class 1, Type I
(3)	Honeycomb Peel	1	3	BSS7207, Type I **FL 2**
(4)	Film Weight (for Type II and Type IV, and V) **FL 3**	–	2	Section 8.3 **FL 1**
(5)	Percent Solids (for Type III) **FL 3**	–	2	Section 8.4
(6)	Type V Adhesive Lap Shear **FL 4**	1	5	Section 8.6.1
(7)	Type V Adhesive Metal to Metal Peel **FL 4**	1	3	Section 8.6.2

FL 1 Randomly select two rolls only from the sample selected for the tests performed in accordance with Table V.

FL 2 Not required by purchaser for Type II, Grade 10 adhesive when using facility only does metal–to–metal bonding.

FL 3 Key Characteristic (KC) – SPC required.

FL 4 Applies to Type V materials only

7.1.1 STATISTICAL PROCESS CONTROL (SPC)

a. The supplier shall establish and maintain procedures and requirements for an SPC system based on Key Characteristics (KC) and Key Process Parameters (KPP) in accordance with the requirements of this specification and BSS 7286.

b. KCs are specified in Table V, and are average values only.

c. The process for selecting and documenting KPPs is described in Section 7.1.1.1.

7.1.1.1 Key Process Parameters (KPP)

a. The selection of KPPs shall be primarily the responsibility of the supplier and shall be documented in the PCD.

b. KPPs shall include those parameters which have been demonstrated to have the greatest effect on the KCs and the performance of the primer material.

c. The supplier shall establish the nominal target value and tolerance limits for each KPP. The inspection and SPC method for monitoring each KPP shall be documented in the PCD.

7.1.1.2 Analysis and Review of KCs and KPPs

a. The supplier shall conduct SPC analysis of all KCs and KPPs in accordance with BSS7286.

b. The procedures used to establish and calculate control limits shall be documented in the PCD. A minimum of the most recent and consecutive twenty batches of each Type and Grade shall be used to establish the control limits.

c. If statistical analysis determines that a KC or KPP is out of control the supplier shall

(1) investigate the cause(s)

(2) eliminate any special causes of variation and re–establish control

d. If a KC is not capable, the supplier shall take corrective action to establish capability in accordance with BSS7286.

7.1.1.3 Reporting of Data

Suppliers shall provide Boeing SM&P summary reports of SPC data including control charts, nominal value, standard deviation, number of batches, and Cpk for each KC and KC. SPC data must be submitted biannually. If the control limits differ from a previous report, suppliers shall report both the previous and the current control limits.

7.2 PURCHASER QUALITY CONTROL

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

a. Check the packaging, marking, and paperwork to ensure compliance with the appropriate sections of this specification and to ensure that the material was purchased from a QPL designated supplier or an authorized distributor, re–packager, or auxiliary storage facility of a QPL designated supplier.

b. Verify that all records of shipping and storage times and temperatures have been received with each shipment, and that the material meets the shipping requirements of Section 10.3 from the date the material was shipped from the supplier’s manufacturing facility.

c. Each unit of adhesive shall be checked for compliance with the identification requirements of Section 10. All packages incorrectly identified shall not be released for storage or production until the correct information has been marked on the package, as required by Section 10.

d. Receiving inspection testing and sampling shall be in accordance with Table V and Table VII (Table VIII for Type V Grade 40), unless purchaser testing requirements have been eliminated for that product in accordance with Section 7.2e.

e. When a supplier has demonstrated consistent conformance to required testing in accordance with Section 7.1, Boeing SM&P may remove purchaser testing as a requirement for material procurement from that supplier. Boeing Quality Assurance documentation such as the appropriate D1–4426 Supplier Code will indicate which products are exempt from the purchaser testing requirement.

7.2 PURCHASER QUALITY CONTROL (Continued)

f. Unless purchaser testing requirements have been eliminated for that product in accordance with Section 7.2e, tests (1) through (4) of Table V are required for Type II and Type IV film adhesives and tests (1) and (5) of Table V are required for Type III pour–coat, and tests (4), (6), and (7) of Table V are required for Type V film adhesives. Use BSS7202, Type I specimens for Lap Shear testing, unless otherwise noted.

g. Any test described in Section 5 of this specification may be used to assure that production shipments of adhesive conform to the requirements of this specification and are comparable to the material previously qualified.

h. Lot numbers shall be established at the time of receival and marked on each unit of adhesive received in the Lot.

i. When consistent conformance to specification acceptance (receiving) requirements has been demonstrated, Quality Assurance may implement reduced testing in accordance with a suitable sampling plan. Authorization of a reduced testing plan shall be a Boeing Company division basis and shall be documented with Boeing Company documentation.

7.3 SAMPLING, ACCEPTANCE AND REJECTION CRITERIA

a. The sampling unit shall be as follows:

Type II Adhesive – Roll

Type III Pour–coat – Container

Type IV Adhesive – Roll

Type V Adhesive – Roll

b. Each sample shall be taken from different units.

c. The number of units of adhesive (sample size) to be tested from each lot is dependent upon the size of the lot.

TABLE VI ACCEPTANCE SAMPLING PLAN

LOT SIZE (UNITS)	SAMPLE SIZE (UNITS)
1	1
2	2
3	3
4 to 8	4
9 to 40	5
Over 40	6

d. Acceptance of each lot is contingent on test values meeting or exceeding the tabled values of Table VII (Table VIII for Type V Grade 40).

(1) Accept the lot when sample average is equal to or greater than the appropriate value in Table VII or Table VIII.

7.3 SAMPLING, ACCEPTANCE AND REJECTION CRITERIA (Continued)

(2) Reject the lot when either the average or any individual test value is less than the appropriate value of Table VII or Table VIII.

TABLE VII MINIMUM ACCEPTANCE LIMITS

PROPERTY	GRADE 5		GRADE 10		GRADE 15	
	MIN. AVG.	MIN. IND.	MIN. AVG.	MIN. IND.	MIN. AVG.	MIN. IND.
Lap–Shear	4375	4200	4375	4200	4375	4200
Metal–to–Metal Peel	50	45	60	55	– – –	– – –
Honeycomb Peel	– – –	– – –	50	45	80	75

TABLE VIII MINIMUM ACCEPTANCE LIMITS FOR TYPE V GRADE 40 ADHESIVE

PROPERTY	TYPE V GRADE 40	
	MIN. AVG.	MIN. IND.
Type V Adhesive Lap Shear	4375	4200
Type V Adhesive Metal–to–Metal Peel	60	55

e. Adhesive material of rejectable quality or unsatisfactory manufacturing characteristics may be subject to a chemical analysis of the items that were identified in accordance with Section 5.1.5.

f. The percent solids (KC) for Type III pour–coat shall be 45 ± 3.

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 QUALIFICATION TESTS

In accordance with Section 5.

8.2 QUALITY CONTROL TESTS

In accordance with Section 7.

8.3 FILM WEIGHT TESTS – TYPE II AND TYPE IV, AND TYPE V

Perform the following film weigh test on each roll selected.

a. Cut two specimens of material across the width of the film. Cut specimens approximately 6 by 6 inches. Determine the area to the nearest 0.1 square inch.

b. Remove separator sheets from the film and weigh film to nearest 0.1 gram.

c. Report average weights to nearest 0.001 lbs/ft^2.

d. Document according to the requirements for a key characteristic as specified in Section 7.1.1.

8.4 PERCENT SOLIDS TEST – TYPE III

Determine the percent solids either as specified in ASTM D 1582 or by the following equivalent method:

a. For each batch of the adhesive (or lot in the case of Purchaser Inspection) in the qualification sample, two suitable containers shall be tare weighed.

NOTE: To minimize evaporation of the adhesive solvent until and during weighing, the container should be provided with a cover. One or two ounce ointment tins are recommended as suitable containers. The cover shall be removed while drying the sample.

b. Pour approximately 1 to 2 grams of the thoroughly mixed adhesive in each container and weigh.

c. All weighing shall be made to the nearest 0.001 gram.

d. Dry the samples at 217 ± 5 F for 60 to 65 minutes. When cooling the sample, desiccate until 75 ± 5 F is reached.

e. The average solids content shall be reported as weight percentage of the original sample weight:

$$Percent\ Total\ Solids\ =\ \frac{Weight\ of\ Residue}{Weight\ of\ Sample}\ X\ 100$$

f. Report all test data and average of each sample.

g. Document according to the requirements for a key characteristic as specified in Section 7.1.1.

8.5 LAP SHEAR TESTING – TYPE III POUR–COAT

a. Apply a brush or spray coat of Type III Pour–coat 0.0005 to 0.002 inch thick to the unprimed surfaces.

b. Air dry 30 minutes, minimum, and bake at 180 ± 10 F for 25 to 35 minutes.

c. Use qualified Type II film adhesive to complete the assembly.

8.6 TYPE V GRADE 40 TESTING

8.6.1 TYPE V GRADE 40 LAP SHEAR TEST

a. Specimen configuration and testing shall be in accordance with BSS7202 Type IV, except width shall be 5.75 to 8.25 inches. Adherends for test specimens shall be 2024–T3 bare aluminum, each adherend 0.063 inch thick nominal. All test panels shall be surface prepared in accordance with BAC5555 and primed with BMS5–89 in accordance with BAC5514–589 prior to bonding.

b. Bond using one strip of Type V grade 40 adhesive, 2.00 ± 0.05 inch wide placed within ± 0.20 inches of center of the faying surface. Also place one strip 1.00 ± 0.05 inch wide 0.50 ± 0.05 inch from each edge of the faying surface, in accordance with Figure 1 and Figure 2.

c. Place 0.5 to 1.0 inch wide by 0.135 ± 0.002 inch thick aluminum spacers around the periphery of the test panel in accordance with Figure 3.

d. Pre–heat cure press to 250 ± 10 F. Place a thermocouple at one edge of the panel. Place the panel and spacers in the cure press. Cure between 225 F and 260 F for a minimum of 90 minutes using 45 ± 5 psi cure pressure.

e. Machine and test specimens in accordance with BSS7202 Type IV.

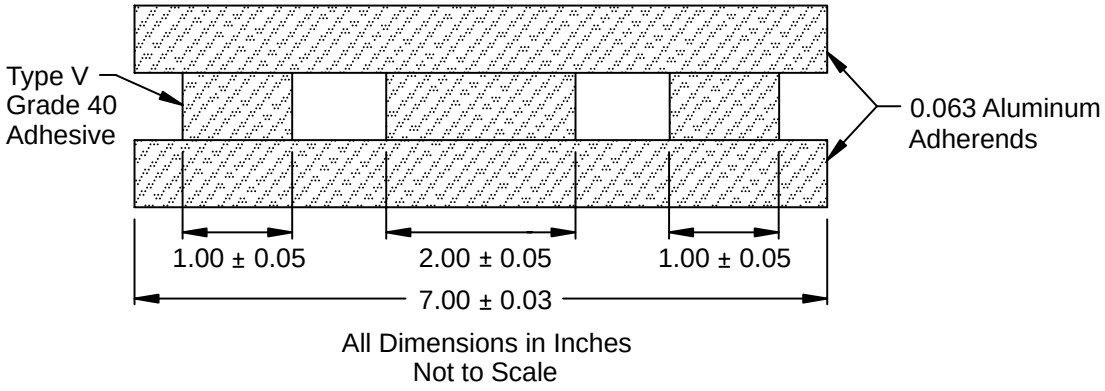


FIGURE 1 CROSS–SECTION VIEW OF TYPE V GRADE 40 ADHESIVE PLACEMENT ON LAP SHEAR PANEL

8.6.1 TYPE V GRADE 40 LAP SHEAR TEST (Continued)

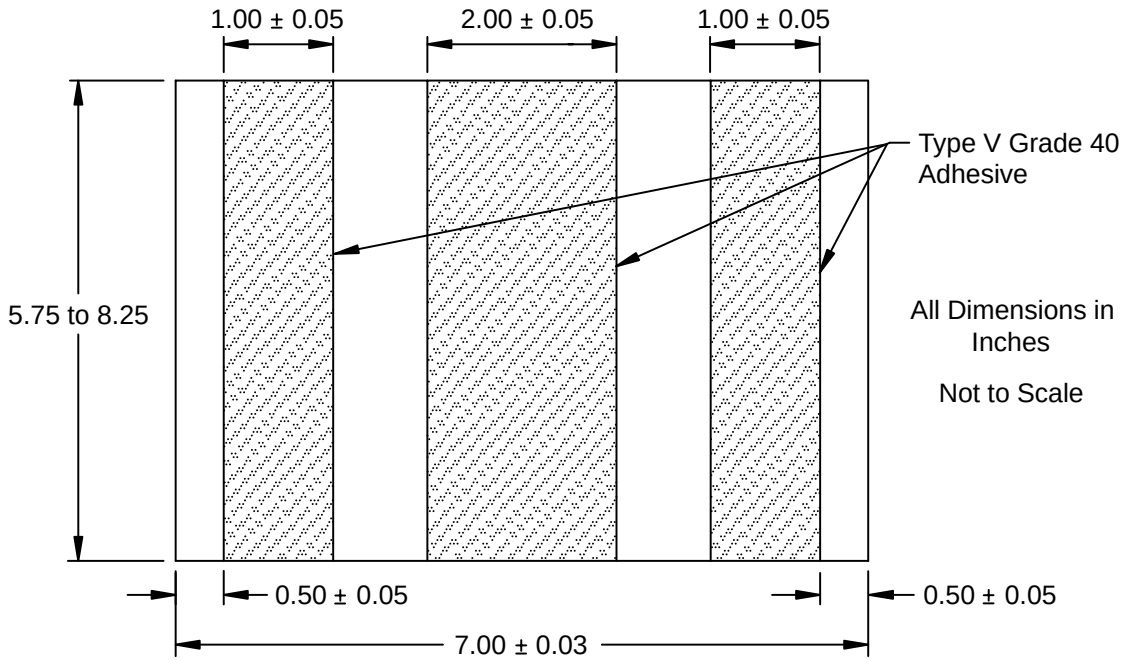


FIGURE 2 TOP VIEW OF TYPE V GRADE 40 ADHESIVE PLACEMENT ON LAP SHEAR PANEL

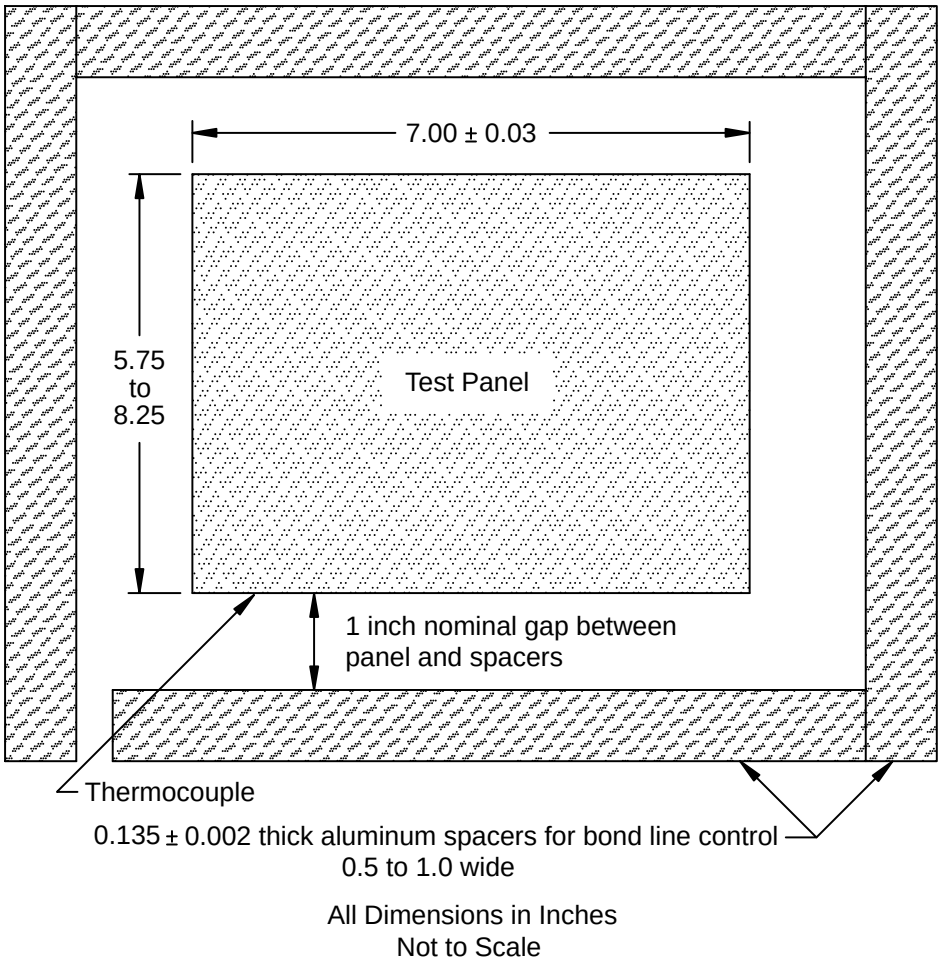


FIGURE 3 ALUMINUM SPACERS FOR BOND LINE CONTROL FOR LAP SHEAR TEST

8.6.2 TYPE V GRADE 40 METAL–TO–METAL PEEL TEST

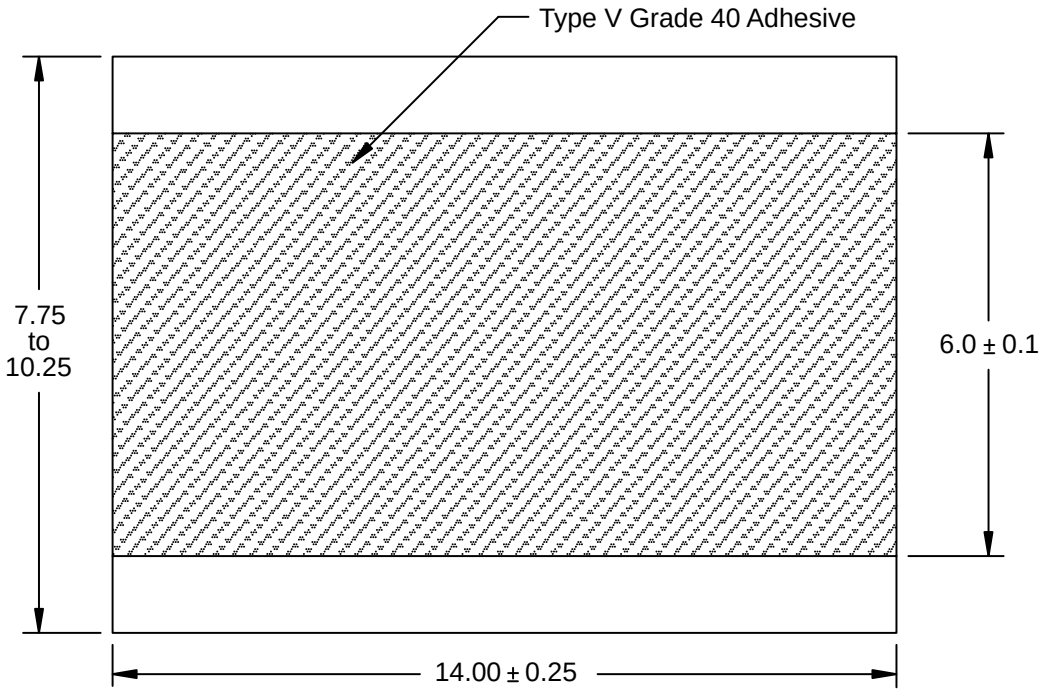
a. Specimen configuration and testing shall be accordance with BSS7206 Class 1, Type II, except width shall be 7.75 to 10.25 inches. Recommended length is 14.00 ± 0.25 inches. All test panels shall be surface prepared in accordance with BAC5555 and primed with BMS5–89 in accordance with BAC5514–589 prior to bonding.

b. Bond using one strip of Type V Grade 40 adhesive, 6.0 ± 0.1 inch wide placed within ± 0.2 inches of the center of the faying surface, parallel to the test direction, in accordance with Figure 4.

c. Place 0.5 to 1.0 inch wide by 0.070 ± 0.002 inch thick aluminum spacers around the periphery of the test panel in accordance with Figure 5.

d. Pre–heat cure press to 250 ± 10 F. Place a thermocouple at one edge of the panel. Place the panel and spacers in the cure press, then cure between 225 F and 260 F for a minimum of 90 minutes using 45 ± 5 psi cure pressure.

e. Cut five 1.00 ± 0.03 inch wide specimens from the middle of the bonded test panel within the area where the adhesive was placed, and discard the edge trim material. Test specimens in accordance with BSS7206 Class 1.



All Dimensions in Inches
Not to Scale

FIGURE 4 TOP VIEW OF TYPE V GRADE 40 ADHESIVE PLACEMENT ON METAL–TO–METAL PEEL PANEL

8.6.2 TYPE V GRADE 40 METAL–TO–METAL PEEL TEST (Continued)

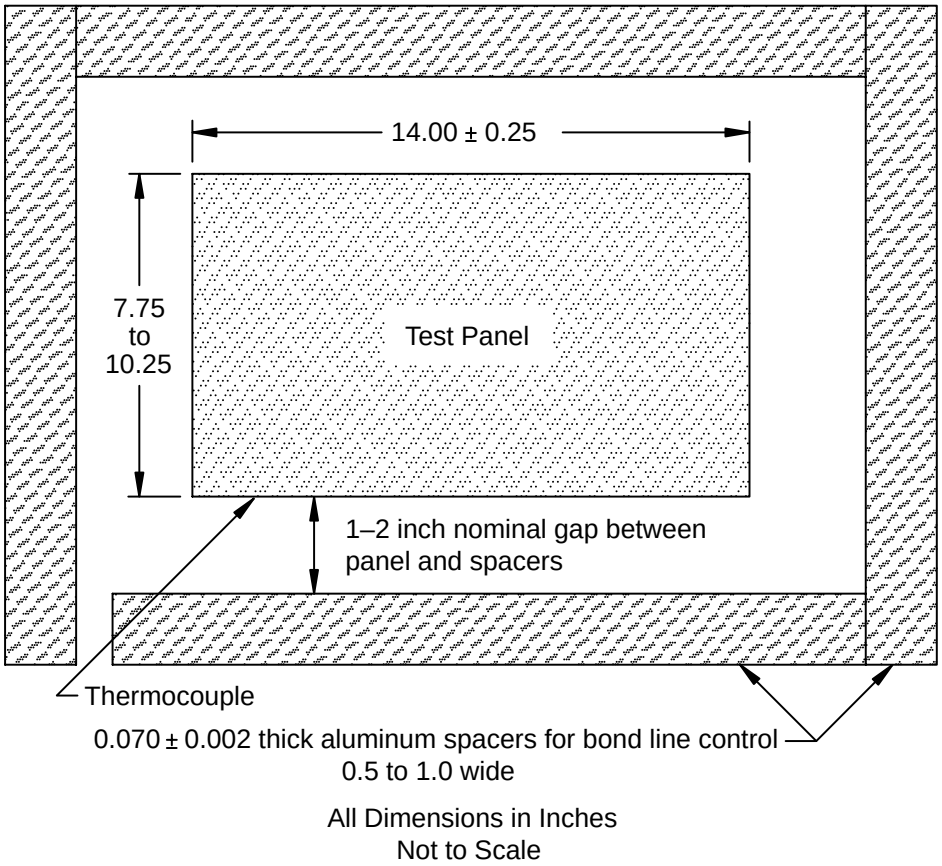


FIGURE 5 ALUMINUM SPACERS FOR BONDLINE CONTROL FOR PEEL TEST

9 MATERIAL IDENTIFICATION

Each package of pour coat or roll of adhesive shall be legibly identified and labelled with the items of information listed below.

a. BMS5–101 (including the latest revision letter), Type and Grade.

b. Supplier’s name, address, and product designation.

c. Supplier’s Batch Number

d. Date of Manufacture

e. Unit Number of pour coat package or adhesive roll

f. Storage / shipment requirements (state temperature limitations when refrigeration is required)

g. Name and address of distributor, re–packager, or auxiliary storage facility if applicable.

h. Date of Shipment from the supplier, distributor, re–packager, or auxiliary storage facility if applicable, whichever occurs last (required on shipping package only)

10 PACKAGING, MARKING, AND SHIPPING

10.1 PACKAGING

a. Packaging shall be accomplished in such a manner as to assure delivery of material capable of meeting the requirements of this specification. Each roll of Type II and Type IV, and Type V adhesive shall be sealed in a clean, defect–free bag. Defects are considered to be visually detectable discontinuities such as holes, cuts, tears, etc. which allow free passage of air, moisture or other contaminates. Bags shall either be a minimum of 0.006 inch polyethylene or a Boeing approved alternate.

b. Type III pour–coat shall be packaged in clean, airtight containers, as specified in the purchase order.

c. The exterior packaging shall be of such a nature as to prevent physical damage or contamination by foreign substances. Each package shall be suitably insulated and refrigerated, when necessary, to ensure maintenance of the shipping temperature requirements.

10.2 MARKING

a. Both ends of the exterior (shipping) package shall be legibly and durably marked on the outside with the following information:

(1) BMS5–101 (including the latest revision letter), Type and Grade

(2) Supplier’s Name, Address, and Product Designation

(3) Supplier’s Batch Number

(4) Date of Manufacture

(5) Unit Number of Pour Coat Package or Adhesive Roll

(6) Quantity in the Shipment

(7) Quantity in the Package

(8) Handling and Refrigeration Requirements. (State temperature limitations both shipping and storage when refrigeration is required.)

(9) Name and address of distributor, re–packager, or auxiliary storage facility if applicable.

(10) Date of Shipment from the supplier, distributor, re–packager, or auxiliary storage facility if applicable, whichever occurs last (required on shipping package only)

(11) Purchase Order Number

b. Labeling shall conform to OSHA 1910.1200.

10.3 SHIPPING

a. Ship and store all film adhesives and pour coat materials according to the requirements of Section 5.2.

b. Temperature recorders are required with each lot of film adhesive or pour coat to be shipped from the supplier's manufacturing facility or from a supplier authorized distributor, re–packager, or auxiliary warehouse. Include sufficient temperature recorders with each lot shipped to ensure that all temperature excursions above the ranges noted in Section 5.2 and this Section are recorded.

c. The use and placement of temperature recorders shall be in accordance with BSS7061.

d. A system for material out–time tracking and control shall be implemented and maintained at all supplier authorized distributors, re–packagers, and auxiliary warehouses. This system must be capable of recording all out–time consumed at each facility for each lot of adhesive or primer stored or shipped.

e. During shipment and handling at authorized distributors, re–packagers, or auxiliary storage facilities, the material is allowed to accumulate a total of 16 hours of exposure at temperatures in excess of the requirements in Section 5.2, but not exceeding 90 F.