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AEROSPACE MATERIAL SPECIFICATION

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FABRICATION OF SANDWICH PANELS FOR LIGHT WEIGHT PORTABLE SHELTERS

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of December, 1991. It is recommended, therefore, that this specification not be specified for new designs.

This cover sheet should be attached to the "A" revision of the subject specification.

"NONCURRENT" refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these "NONCURRENT" specifications is available from SAE upon request.

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AEROSPACE MATERIAL SPECIFICATION

AMS 3911A
Superseding AMS 3911

Issued 3-1-74
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FABRICATION OF SANDWICH PANELS FOR LIGHT WEIGHT PORTABLE SHELTERS

1. SCOPE:

1.1 Purpose: This specification establishes the requirements, controls, procedures, and quality assurance requirements for fabrication of flat, adhesive-bonded, aluminum-alloy-faced sandwich structure panels using one of three basic core materials: paper honeycomb, polyurethane foam, or aramid-paper-base honeycomb.

1.2 Application: Primarily for use in fabricating light weight portable shelters.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate
AMS 2205 - Tolerances, Aluminum Alloy and Magnesium Alloy Extrusions
AMS 2350 - Standards and Test Methods
AMS 3107/1 - Primer, Adhesive, Corrosion-Inhibiting, High Durability Epoxy, -55° to +95°C (-67° to +203°F)
AMS 3687 - Adhesive Film, Humidity-Resistant, For Sandwich Panels, -55° to +95°C (-65° to +200°F)
AMS 3688 - Adhesive, Foaming, Honeycomb Core Splice, Structural, -67° to +180°F (-55° to +80°C)
AMS 3711 - Core, Honeycomb, Fibrous Aramid Base, Phenolic Coated

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Specifications:

O-S-595 - Sodium Dichromate, Dihydrate, Technical
O-S-809 - Sulfuric Acid, Technical
TT-M-261 - Methyl Ethyl Ketone, Technical
CCC-C-440 - Cloth, Cheesecloth, Cotton, Bleached and Unbleached

2.3.2 Military Specifications:

MIL-H-21040 - Honeycomb Materials, Water Migration Resistant Type, Structural, Paper Base
MIL-T-81533 - Trichloroethane 1.1.1 (Methylene Chloroform) Inhibited, Vapor Degreasing
MIL-A-83377 - Adhesive Bonding (Structural) For Aerospace and Other Systems, Requirements for
MIL-C-83400 - Core Material for Metal Sandwich Panels for Shelter Construction (Polyurethane Foam)

2.3.3 Military Standards:

MIL-STD-401 - Sandwich Construction and Core Materials, General Test Methods
MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Core Material:

3.1.1.1 Aramid-Paper-Base Honeycomb: Shall conform to AMS 3711, size designation "1/4 - 4.8" (1/4 in. (6.4 mm) cell size and 4.8 lb per cu ft (77 kg/m^3) core density), unless otherwise specified.

3.1.1.2 Paper Honeycomb: Shall conform to MIL-H-21040, for fully cured, resin-treated, water migration-resistant type, structural, paper-base honeycomb, size designation "3/8 - 3.8" (3/8 in. (9.5 mm) cell size and 3.8 lb per cu ft (60 kg/m^3) core density), unless otherwise specified.

3.1.1.3 Polyurethane Foam: Shall conform to MIL-C-83400, Type II (4.0 lb per cu ft (64 kg/m^3) density), unless otherwise specified.

3.1.1.4 Core Controls: Inspection tests and storage of as-received core shall be as follows:

3.1.1.4.1 Honeycomb Core Each sheet of honeycomb core shall be inspected for physical damage prior to bonding. Damaged areas in the core which could result in reduced mechanical properties or impair the water migration characteristics shall be rejected. Three or more cracked or broken core cells in a 12 in. (300 mm) ribbon length shall be cause for rejection. The edges and corners of each sheet of core shall be inspected for damage. There shall be not more than two imperfections, cracks, or breaks and no imperfection shall extend more than 0.250 in. (6.25 mm) from the core edge. One core slice from each package or set shall be measured for thickness and any sheet or slice of core not conforming to the specified tolerance shall be cause for rejection of the entire package. When specified, a honeycomb core sample shall be tested for conformance to the material specification. The lot represented by a nonconforming sample shall be rejected.

3.1.1.4.2 Polyurethane Foam: Samples shall be taken from each lot and checked for density, thickness, and overall appearance.

3.1.1.4.3 Core Storage: Packages of core shall be stored in a dry area in such a manner as to protect the core slices from moisture, dust, contaminants, and damage until moved into the environmentally-controlled layup area for assembly.

3.1.2 Metal Details:

3.1.2.1 Facings: The aluminum facings shall be flat aluminum alloy sheet conforming to ASTM B209 in the alloy, temper, and size specified. Tolerances shall conform to AMS 2202. Facings shall be essentially free from corrosion, oil canning (snap-buckling), dents, scratches, and gouges; depth of scratches shall not exceed one-half the sheet thickness tolerance and dents in facings exceeding the sheet thickness shall be rejected. Facings shall be interleaved, wrapped, and packaged for shipment to protect them from physical damage and corrosion. When specified, a statement of conformance or reports of tests for mechanical properties and chemical composition of the material shall be included with each shipment.

3.1.2.2 Extrusions: Aluminum alloy extrusions to be used as panel edge members or to be integrally bonded into a sandwich panel shall conform to the specified alloy, temper, and material specification. Tolerances shall be in accordance with AMS 2205, unless otherwise specified. Extrusions shall be free of oils, lubricants, and waxes which cannot be readily removed when cleaned in accordance with the suggested procedure of MIL-A-83377. The extrusions shall be identified with a nonetching ink giving the following information: alloy, temper, die or drawing number, and manufacturer. The extrusions shall be prepared for shipment in the same manner as the facings, except that interleaving may be omitted if the extrusions are tightly banded together to prevent chafing and spalling. When specified, reports of tests for mechanical properties and chemical composition of the material shall be included with each shipment.

3.1.2.3 Metal Controls: Aluminum alloy sheet and extrusions shall be stored in an area that will provide maximum protection against corrosion from moisture or industrial contaminants. Sheet issued from storage to production shall be transported on skids or other conveyances which will keep it flat and prevent oil-canning and scratches. All surfaces of skids, shears, routers, priming racks, drying racks, storage bins, taping tables, and other equipment with which the sheet may come in contact shall be constructed to protect the sheet during all phases of the manufacturing processes.

3.1.3 Adhesive Primer:

3.1.3.1 Adhesive Primer: Shall conform to AMS 3107/1. The primer shall be Ø compatible with epoxy-type adhesives and polyurethane coatings.

3.1.3.2 Primer Controls: The adhesive primer shall be stored at 0°F (-18°C) or below for periods not exceeding 6 months, or at 40°F (4°C) or below for periods not exceeding 2 months. When preparing for use, adhesive primer shall be warmed slowly to above the dew point before opening the container.

3.1.4 Adhesives:

3.1.4.1 Adhesive Film: Shall conform to AMS 3687.

3.1.4.2 Foaming Adhesive: Shall conform to AMS 3688.

3.1.4.3 Adhesive Controls: Adhesives shall be stored under the environmental conditions recommended by the adhesive manufacturer in an enclosure set aside for that purpose. Containers shall be protected from physical damage and from deterioration caused by moisture, chemicals, dirt, or other foreign matter. An inventory log shall be kept, indicating pertinent dates regarding storage life for each lot received. Adhesive shall be stored so as to facilitate oldest-issue-first use but no adhesive shall be used beyond the expiration date. The film adhesive and primer used for facing-to-core bonding shall be tested on the day of use for tensile lap shear requirements before being released to production. Minimum lap shear strength for acceptance shall be not lower than 3,000 psi (20 MPa) at room temperature.

3.1.5 Solutions for Chemically Cleaning Aluminum Alloy Parts: The water used in the make-up of cleaning solutions shall be either tap water having a pH of 7.5 ± 0.3 (unless compensation is accomplished through chemical adjustment) or demineralized water having a pH no higher than 7.5.

3.1.5.1 Vapor Degreaser: The vapor degreasing solvent shall be stabilized 1,1,1, trichloroethane conforming to MIL-T-81533 or other suitable degreasing solvent.

3.1.5.2 Cleaning Solution: The cleaning solution shall be prepared in accordance with the manufacturer's recommendations (See 8.2).

3.1.5.3 Acid Etch: The composition of the acid etch shall be:

Sodium Dichromate, Technical Grade (O-S-595)	2 parts by weight
Concentrated Sulphuric Acid, (O-S-809)	5 parts by weight
Water, as in 3.1.5	15 parts by weight

3.1.5.4 Cleaning Solution Controls: The cleaning solutions shall be monitored daily for temperature; tanks shall be equipped with continuous temperature recorders. The vapor degreasing solution, the cleaning solution, and the acid etch solution shall be checked three times a week to ensure proper chemical balance. If any of the cleaning solutions are out of the required limits, corrections shall be made and the solutions retested before production continues. Aluminum alloy lap shear test plates shall be cleaned in the solution daily, bonded, and tested to further ensure proper cleaning.

3.2 Equipment:

3.2.1 Cleaning Equipment: The tanks for cleaning aluminum alloy parts shall consist of corrosion-resistant steel or shall be corrosion-resistant-steel-lined for most acid solutions or lead-lined for hydrofluoric or sulphuric acid solutions. The cleaning tank line shall consist of a vapor degreaser, an acid preclean or an alkaline cleaning tank, a spray rinse tank, immersion rinse tank, acid etch tank, immersion rinse tank, and drying oven.

3.2.1.1 The tanks shall be equipped with heaters to regulate the temperature of the baths for the cleaning solutions.

3.2.1.2 Auxiliary cleaning equipment such as cleaning racks, baskets, and overhead cranes shall be used as required to protect the parts against damage during the cleaning operation.

3.2.1.3 The cleaning tanks shall be equipped with continuous recorders and timers.

3.2.2 Priming Equipment: The priming equipment shall include a tank, pump, and spray gun equipped with mixing, agitation, and recirculation features to produce a uniform sprayed coat of primer on applicable surfaces.

3.2.3 Priming Booths:

3.2.3.1 The priming booths used in applying primer to cleaned metal parts or core material shall be equipped with air filters, filtered air lines, and exhaust systems. The air filters shall maintain a dust count of less than 100,000 particles per cu ft (3,500,000 particles/m^3) of 1 micron (m) and larger. The air handling equipment shall provide a minimum of 10 air changes per hour. All fresh and recirculated air entering the priming booths shall be filtered. The air lines used with the priming equipment shall be equipped with filters and regulators. The air line filters shall remove all moisture and contaminants from the air. The air regulators should provide the complete range of air pressures required by the priming equipment.

3.2.3.2 The lighting equipment used in the priming booths shall be explosion proof and equipped with clear glass or plastic covers which can be easily removed and cleaned.

3.2.3.3 The priming booths should have doors equipped with limit switches which render the priming equipment inoperable when the doors are open.

3.2.4 Curing Presses: The presses used for curing the sandwich panels shall be capable of applying not less than 40 psig (275 kPag) and 290°F (145°C) over the entire platen surface. The platens shall be flat within a total indicator reading (TIR) of 0.010 in. (0.25 mm). The press shall be equipped with time, temperature, and pressure recorders. It is desirable that the presses be equipped with automatic programmers to control accurately heat-up rate, pressure application, dwell time, cool down, and pressure removal. The press should also be equipped with suitable aluminum "pull in" plates which will facilitate moving the sandwich panel layup into the press without misaligning the layup.

3.2.5 Mechanical Handling Equipment: The equipment for handling panels after curing shall not damage the panel, such as overhead cranes with fabric slings, skids, or conveyances. The skids or conveyances should provide flat, soft surfaces which will not scratch or dent the panels.

3.3 Environmentally-Controlled Layup Areas: The application of adhesives to the prepared facings or core and the storage of all cleaned or prepared materials shall take place in an enclosed area environmentally-controlled continuously for temperature, humidity, dust, and other airborne contaminants. This environmentally-controlled area shall be maintained at 75°F ± 9 (23°C ± 5) and not more than 50% relative humidity. The area shall be conspicuously identified at all entrances as a "white glove clean area." Unnecessary traffic within the area shall not be permitted. Signs on entrances shall prohibit eating and smoking. All materials, clothing, tools, and equipment entering the area shall be of low-shed material and be clean. The entry or use of oil, grease, mold-release agents, or other contaminants within the area shall be prohibited. The interior, exposed surfaces of the area shall be smooth, hard, and easily cleaned. The floor shall be sealed with suitable material and shall be wet mopped daily. A positive air pressure shall be maintained at a minimum of 0.015 in. (0.38 mm) Hg such that air movement is outwards when all doors are open. Air locks for doors are required. The air-handling equipment shall provide at least 10 air changes per hour. All fresh and recirculated air entering the room shall be filtered. The filters shall ensure that the particulate count within the area will not exceed 100,000 particles per cu ft (3,500,000 particles/m^3) of a size 1 micron (µm) and larger. The dust particle count shall be monitored at least once daily with a suitable dust counting instrument which will provide a printed readout. The temperature, humidity, and pressure shall be recorded continuously and the recorders shall be calibrated monthly.

3.4 Panel Preparation Cleaning: Nonanodized surfaces to be bonded shall be cleaned in accordance with the following sequence of operations.

NOTE. Clean, white gloves shall be worn by personnel handling parts during the cleaning operation. Care shall be exercised to avoid scratching of parts.

3.4.1 Vapor Degreasing: Aluminum alloy skins and detail parts shall be vapor degreased as follows:

3.4.1.1 The tank shall be filled to at least 2 in. (50 mm) above the heating coils with MIL-I-81533 stabilized 1,1,1, trichloroethane.

3.4.1.2 The condenser water shall be adjusted to control its discharge temperature at 100° - 120°F (38° - 50°C), the optimum range to minimize water condensation without losing excessive solvent vapors.

3.4.1.3 The amount of stabilizing agent in redistilled solvent (sampled from the spray pump) shall be maintained at a minimum acid acceptance of 0.03% by weight (calculated as NaOH). The acid acceptance value shall be determined weekly, or more often if necessary to ensure trouble-free operation.

3.4.1.4 Work shall be placed in racks or baskets and properly positioned to prevent entrapment of solvents in pockets and to allow for complete drainage. Sheets shall be separated.

3.4.1.5 Care shall be taken to avoid excessive amounts of entrapped water entering the tank along with parts.

3.4.1.6 Work shall be lowered and withdrawn from the vapor degreaser tank at a speed not greater than 11 ft per min. (55 mm/s).

3.4.1.7 Parts shall not be removed from the degreaser until they are heated to vapor temperature. To check parts for proper temperature, immerse them in vapor for at least one minute. If solvent drips from parts while being removed from the vapor, the parts are not properly heated and should be returned to the vapor for an additional period.

3.4.1.8 Parts shall be vapor degreased for not less than 4 min. or until condensation run-off ceases, and not more than 10 minutes. If longer times are required, the necessary corrections shall be made before production continues.

3.4.1.9 Parts shall not be immersed in the vapor degreaser liquid.

3.4.2 Acid Precleaning: After vapor degreasing, parts shall be immersed in the acid precleaning solution for 4 - 6 minutes.

3.4.2.1 After removal from the cleaning bath, parts shall be spray rinsed for at least 40 sec, then immersed for not less than 2 min. in an overflow rinse tank of clean tap water, as in 3.1.5, maintained at 120°F ± 9 (50°C ± 5). Inspect the parts for water film continuity. If there is a "water break," the parts shall be recleaned for 2 min. and rinsed as above.

3.4.2.2 Parts which still show a "water break" after having been processed a total of three times shall be rejected.

3.4.3 Acid Cleaning: The parts shall be immersed for not less than 8 min. in the sodium dichromate-sulphuric acid bath (3.1.5.3) maintained at 150°F ± 9 (66°C ± 5).

3.4.4 Final Rinsing: The parts shall be spray rinsed for not less than 30 sec followed by immersion for not less than 2 min. in clean tap water, as in 3.1.5, maintained at 110° - 130°F (43° - 54°C). Inspect for water film continuity. If a "water break" is observed, tha parts shall be cleaned for an additional 2 min., rinsed, and reinspected. The parts shall have a "water-break-free" surface before further processing.

3.4.5 Drying: The parts shall be air dried for not less than 30 min. or force dried in an oven for 10 - 20 min. at 140°F ± 9 (60°C ± 5).

3.4.6 Identification: Immediately after drying, parts shall be identified by date and hour of cleaning by some suitable method, such as part stamping, part tagging, or stamping of process card.

3.4.7 Storage:

3.4.7.1 Cleaned parts shall be moved immediately into the environmentally-controlled room and shall be primed within 12 hr of cleaning.

3.4.7.2 Aluminum alloy parts not coated with adhesive primer after cleaning within the time limits specified herein shall be reprocessed in accordance with 3.4.1 through 3.4.5.

3.4.7.3 Parts to be used in secondary bonding operations are those which are ordinarily not press cured and the bond, although supplemented by other means of fastening, furnishes the major portion of the required adhesion. These parts can be stored for up to 60 days prior to use when properly protected such as by polyethylene wrapping. The parts may then be used without further cleaning, unless contaminated with dirt or oil during assembly. If such a condition occurs, the parts may be solvent wiped with TT-M-261 methyl ethyl ketone (MEK), or equivalent, prior to bonding.

3.5 Primer Application: The primer shall be shipped and stored under refrigeration, maintaining the time and temperature specified in 3.1.3.2. Containers removed from refrigeration and allowed to reach room temperature and the contents mixed and used for priming but not completely used shall not be returned to refrigeration. Likewise, a container allowed to reach room temperature, but the contents not mixed or any portion used, shall be rejected and discarded.

3.5.1 Mixing:

3.5.1.1 The primer, upon reaching room temperature, shall be thoroughly and continuously mixed to produce and maintain a homogeneous solution.

3.5.1.2 Immediately prior to use, thoroughly mix the contents of each container of primer. The contents of 1-gal (3.8-L) or larger containers shall be stirred or mixed for not less than 5 min. before using.

3.5.1.3 The spray equipment shall provide continuous agitation in the container and recirculation in the hose during use. If agitation ceases for more than 10 min., the primer shall be mixed again for not less than 2 min. prior to further use.

3.5.2 Application and Cure: The various steps in the application and cure of adhesive primer are diagrammed in Fig. 1.

3.5.2.1 Apply primer by spraying a uniform coat 0.0001 - 0.0007 in. (3 - 18 m) thick on all surfaces to be bonded (See 8.3). Proper spray technique shall yield a smooth, continuous, uniform, glossy coat of primer which possesses a definite pigmented color.

3.5.2.2 The primer thickness shall be in accordance with manufacturer's recommendations but within the range specified in 3.5.2.1.

3.5.2.3 Dry for not less than 30 min. at 75°F ± 9 (23°C ± 5).

3.5.2.4 Cure the primer by heating to 230° - 250°F (110° - 120°C) for 75 - 90 minutes.

3.5.3 Storage of Primed Parts: Primed and cured detail parts may be stored up to 60 days when packaged as in 3.4.7.3 and stored in an environmentally-controlled area.

3.5.4 In-Process Corrections:

3.5.4.1 Contamination of Primed Surfaces Prior to Primer Cure:

3.5.4.1.1 Remove all primer with methly ethyl ketone (MEK) or equivalent.

3.5.4.1.2 Clean by reprocessing in accordance with 3.4.1 through 3.4.5.

3.5.4.1.3 Apply adhesive primer.

3.5.4.2 Minor Surface Damage After Primer Cure:

3.5.4.2.1 Clean areas to be bonded, using CCC-C-440 cheesecloth or other clean soft cloth(see 8.4); wipe minor scratches twice using MEK or equivalent

3.5.4.2.2 Touch up minor scratches using well-stired primer. Cure reprimed area with a heat gun or other suitable means.

3.5.4.3 Extensive Surface Damage After Primer Cure: Detail parts with extensive damage in areas to be bonded shall be withdrawn from production. The disposition to repair damaged areas and salvage the part shall include the requirements for cleaning and reapplication of primer.

3.6 Layup Procedure:

3.6.1 The cleaned and primed aluminum alloy face sheet shall be placed on a smooth, clean table in the environmentally-controlled room.

3.6.2 The adhesive film shall be removed from refrigeration and allowed to warm to room temperature before the roll is unpackaged. The elapsed time between removal from refrigeration and curing shall be not more than 120 hours.

3.6.3 The adhesive film shall be stripped of its protective coating on one side which shall then be applied to the primed metal parts (face sheets and edge members) and firmly hand pressed into place. The protective film shall remain on the other side until just prior to assembly.

3.6.4 The core segments shall be removed from the protective boxes in the environmentally-controlled room and visually inspected for edge, corner, and surface damage. Damaged pieces shall be rejected.

3.6.5 The protective film on the first face sheet shall be removed from the surface of the adhesve film and the core segments and edge members positioned on the surface of the adhesive.

3.6.6 Core segments shall be joined by bonding with an epoxy foaming adhesive conforming to AMS 3688.

3.6.7 Apply adhesive to the top face sheet as in 3.6.3. Carefully examine the core blanket (joined core segments assembled to metal parts), remove the protective film from the adhesive, align the top skin with the core blanket, and firmly press in place. Cover the sandwich panel with a protective covering and transport to the press.

3.7 Panel Curing Operations: Press cure the panel as follows (or equivalent autoclave procedure):

3.7.1 Place a polytetrafluoroethylene sheet 0.004 - 0.006 in. (0.10 - 0.15 mm) thick or other suitable release material on the pull-in sheet.

3.7.2 Place the sandwich panel on the covered pull-in sheet.

3.7.3 Place a layer of polytetrafluoroethylene 0.004 - 0.006 in. (0.10 - 0.15 mm) thick over the top face of the panel layup.

3.7.4 Cover the panel with a pressure pad of glass fiber cloth or cotton duck approximately 0.032 in. (0.80 mm) thick to take out any possible core or press platen irregularities.

3.7.5 Place spacer bars 0.005 in. (0.13 mm) thinner than the nominal panel thickness around the periphery of the panel.

3.7.6 Place a top caul sheet over the panel equal in thickness to the pull-in sheet to balance the temperature of the top and bottom face skins during the cure.

3.7.7 Place thermocouple leads in the top and bottom bond lines and connect them to a continuous print out recorder.

3.7.8 Position the panel in the press platen.

3.7.9 Close the press and hold under contact pressure at 275° - 290°F (135° - 145°C) for 2 - 4 minutes.

3.7.10 Apply 30 - 40 psig (205 - 275 kPag) pressure and hold at 285°F ± 9 (140°C ± 5) for 30 - 40 minutes.

3.7.11 Remove assembly from press. The assembly may be removed hot or may be cooled in the press to facilitate handling and minimize warpage if necessary.

3.7.12 Record the complete cure cycle, date, time, temperature, and pressure. Records shall include part numbers cured each day.

3.8 Final Operations:

3.8.1 Place panel on a padded conveyance.

3.8.2 Visually inspect for adhesive flow, surface flaws or irregularities, and general appearance.

3.8.3 Turn panel over and visually examine opposite surface.

3.8.4 Place panel on panelment saw or router and trim to width and length dimensions. Deburr trimmed edges.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of panels shall supply all samples ø for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.7. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the panels conform to the requirements of this specification.

4.2 Classification of Tests:
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4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed as follows:

Requirement	Test Frequency	Test Method
Process Control of Equipment	Periodic, established by quality assurance personnel	4.5.1
Process Control of Materials and Fabrication Procedures	Periodic, established by quality assurance personnel	4.5.2
Vapor Degreasing	Weekly	4.5.3
Primer Application	Continuous during fabrication	4.6.1
Tap Test	All panels	4.6.2.1
Flexure Test	One panel, each production work day or production lot	4.6.2.2
Tensile Shear Strength	One test panel, each production work day or production lot	4.6.2.3

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of panels to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Each lot of panels shall be sampled at random to provide sufficient material to perform all required tests. The number of specimens for each test shall be as noted in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all panels of the same configuration produced during one work shift, unless otherwise agreed upon by purchaser and vendor.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) for Ø the panels have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.7 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample panels shall be approved by purchaser before panels for production Ø use are supplied, unless such approval be waived by purchaser. Results of tests on production panels shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, and methods of Ø inspection on production panels which are essentially the same as those used on the approved sample panels. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material or processing, or both, and, when requested, sample panels. Production panels made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Process Control Procedures:

4.5.1 Monitoring Procedures for Equipment Used in Process:

4.5.1.1 Quality assurance personnel shall monitor all temperature recorders and cure records.

4.5.1.2 Inspection and operating personnel shall verify that the calibration check of test instruments and recording instruments has been made within the required period. All pressure gauges pertinent to dissemination of primer shall be inspected daily by cognizant operators or quality assurance personnel.

4.5.2 Monitoring Procedures for Materials and Fabrication Procedures: Quality assurance personnel shall:

4.5.2.1 Ensure that all materials and parts used in fabricating sandwich panels are in accordance with the applicable drawings and specifications.

4.5.2.2 Monitor elapsed time requirements between cleaning, priming, layup, and curing operations.

4.5.2.3 Monitor test panel manufacture and test.

4.5.2.4 Monitor time adhesive is out of reduced temperature storage.

4.5.3 Monitoring Procedures for Vapor Degreasing:

4.5.3.1 The vapor degreasing liquid shall be checked weekly for:

4.5.3.1.1 0.03% min acid acceptance (as NaOH).

4.5.3.1.2 3% max nonvolatile material in sump.

4.5.3.2 Periodic maintenance is required to limit contamination of the sump and to ensure adequate vapor generation. Soluble contaminants will increase the boiling temperature and insoluble materials will interfere with heat transfer.

4.5.3.2.1 The solvent shall be redistilled and the tank cleaned at least once a month, or more often if the sump temperature should reach 195°F (90°C).

4.5.3.2.1.1 The monthly cleaning may be extended providing the sump liquid does not contain more than 3% nonvolatile residues and that the temperature and acid acceptance conditions are met.

4.5.3.2.2 Concentrate the sump residue by distilling off as much as possible into a storage tank.

4.5.3.2.3 With the heat off, drain the liquid portion of the sump waste and send it to the solvent recovery still for reclaim. Reclaimed solvent that meets the acid acceptance requirement is acceptable for reuse.

4.5.3.3 Safety: The following safety requirements shall be strictly enforced:

4.5.3.3.1 No worker shall be allowed to enter the tank for clean-out except under constant observation by a second person with facilities available for instant rescue.

4.5.3.3.2 Before entering, the tank should be thoroughly cleared of liquid and vapor under forced ventilation.

4.5.3.3.3 Safety dictates that operators shall avoid skin contact with the solvent and prolonged inhalation of the vapor.

4.5.3.3.4 Smoking in the area shall be prohibited.

4.6 Test Methods:

4.6.1 Primer Application Inspection: Visually examine to determine that a uniform, glossy appearance is achieved. Periodic thickness checks shall be made to aid inspection and operating personnel in judging thickness by color of primer. Primer thickness shall be monitored by use of an Isometer 2.082 film thickness gauge or equivalent.

4.6.2 Sandwich Panel Tests: