

IEC/PAS 62213

Edition 1.0
2001-02

Specification and characterization methods for nonwoven para-aramid reinforcement

IECNORM.COM: Click to view the full PDF of IEC/PAS 62213:2001
WithoutDrawn

PUBLICLY AVAILABLE SPECIFICATION



INTERNATIONAL
ELECTROTECHNICAL
COMMISSION



Reference number
IEC/PAS 62213

IECNORM.COM: Click to view the full PDF of IEC PAS 62213:2001

Withdrawn



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

IPC-4411

Specification and
Characterization Methods
for Nonwoven Para-Aramid
Reinforcement

IECNORM.COM: Click to view the full PDF file
62213:2001

IPC-4411

April 1999

A standard developed by IPC

IECNORM.COM: Click to view the full PDF of IEC PAS 62213:2001

Withdrawn

INTERNATIONAL ELECTROTECHNICAL COMMISSION

—

SPECIFICATION AND CHARACTERIZATION METHODS FOR NONWOVEN PARA-ARAMID REINFORCEMENT

FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under given procedures.

IEC-PAS 62213 was submitted by the IPC (The Institute for Interconnecting and Packaging Electronic Circuits) and has been processed by IEC technical committee 52: Printed circuits. It will be further processed by IEC TC 91: Electronics assembly technology.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:

Draft PAS	Report on voting
52/871/PAS	52/881/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

An IEC-PAS licence of copyright and assignment of copyright has been signed by the IEC and IPC and is recorded at the Central Office.

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this PAS may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Nonwoven Aramid Reinforcement Task Group (3-12b) of the Strategic Components of Base Materials Subcommittee (3-12) of the Printed Board Base Materials Committee (3-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

Printed Board Base Materials Committee

Chairman
Doug Sober
isolaUSA

Nonwoven Aramid Reinforcement Task Group

Chairman
David J. Powell
E. I. du Pont de Nemours and Co.

Nonwoven Aramid Reinforcement Task Group

Bruce Andrews, Crane & Company, Inc.	Jason W. Gretton, Matsushita/Aromat	Michikage Matsui, Teijin Ltd.
Paul J. Bateman, Nelco Arizona	Masaru Hirasawa, Oji Paper Co. Ltd.	Joel L. Murray, Hexcel-Schwebel, Inc.
Lisa C. Bates, E. I. du Pont de Nemours and Co.	Ulrich W. Kempf, FiberMark, Inc.	Kiyoshi Osaka, Shin-Kobe Electric Machinery Co.
Harvey Beaman, Arlon, Inc.	Rodney S. Komlenic, Ahlstrom Paper Group	David Rooke, Viasystems Canada, Inc.
Jack R. Bramel, Jack Bramel & Associates	Robert J. Konsowitz, GIL Technologies	Lowell Sherman, Defense Supply Center Columbus
Mike Bryant, BGF Industries, Inc.	Stephen Korchynsky, Lockheed Martin Corp.	Grant (Rick) W. Smedley, III, Raytheon Systems Company
Nitin B. Desai, Motorola, Inc.	Dennis G. Lockyer, Crane & Company, Inc.	
Werner Engelmaier, Engelmaier Associates, L.C.	P. Douglas Lyle, Advanced Glassfiber Yarns LLC	
Terry M. Fischer, Hitachi Chemical Co. America		

Table of Contents

1 SCOPE	1	3.3	Visual Requirements	2
1.1 Purpose.....	1	3.3.1	Visual/Appearance Procedures	2
1.2 Classification	1	3.3.2	Visual/Appearance Defects	2
2 APPLICABLE DOCUMENTS	1	3.3.3	Contamination Requirements	3
2.1 IPC.....	1	3.4	Dimensional Requirements	3
2.2 National Conference of Standards Laboratories (NCSL)	1	3.4.1	Roll Length	3
2.3 TAPPI (Technical Association Pulp & Paper Industry)	1	3.4.2	Roll Width.....	3
2.4 International Standards ⁴	1	3.5	Electrical Requirements	3
2.5 Japanese Industrial Standards (JIS).....	1	3.6	Chemical Requirements	3
3 REQUIREMENTS	1	4 QUALITY ASSURANCE		3
3.1 Terms and Definitions.....	1	4.1	Responsibility for Inspection.....	3
3.1.1 Para-Aramid Fiber	1	4.1.1	Test Equipment and Inspection Facilities	3
3.1.2 Binder	2	4.1.2	Standard Laboratory Conditions.....	3
3.1.3 Bagginess	2	4.2	Preparation of Samples	3
3.1.4 Caliper Variation	2	4.3	Inspection Procedure.....	3
3.1.5 Conducting Particles	2	4.3.1	Classification of Major and Minor Visual Defects	3
3.1.6 Edge Tear/Damaged Roll Edge	2	4.3.2	Sampling Plans	4
3.1.7 Dents	2	4.3.3	Contamination Inspection	4
3.1.8 Foreign Material	2	4.4	Acceptability Quality Level (AQL)	4
3.1.9 Wrinkles/Folds	2	4.5	Statistical Process Control (SPC).....	4
3.1.10 Holes/Thin Spots.....	2	5 PREPARATION FOR DELIVERY		4
3.1.11 Poor Formation	2	5.1	Roll Size.....	4
3.1.12 Bundles.....	2	5.1.1	Roll Length	4
3.1.13 Soft Roll/Telescoping	2	5.1.2	Roll Width.....	4
3.1.14 Weight Variation	2	5.2	Splices	4
3.1.15 Crease	2	5.3	Preservation and Packaging.....	4
3.1.17 Tears	2	5.4	Packing.....	4
3.1.18 Splice.....	2	5.5	Labeling.....	4
3.1.19 High Spots.....	2	6 NOTES		5
3.2 Physical Requirements.....	2	6.1	Ordering Data	5
3.2.1 Product	2	6.2	New Reinforcements.....	5
3.2.2 Filament Diameter	2	Specification sheets		6

IECNORM.COM: Click to view the full PDF of IEC PAS 62213:2001

Withdrawn

Specification and Characterization Methods for Nonwoven Para-Aramid Reinforcement

1 SCOPE

This specification covers the requirements for nonwoven para-aramid reinforcement used in the manufacture of base materials primarily for rigid or multilayer printed boards in electrical and electronic applications.

1.1 Purpose This specification determines the nomenclature, definitions, general comments, and physical requirements for reinforcement made from nonwoven para-aramid fibers.

1.2 Classification This specification provides physical characteristics of the reinforcement required to meet the design and performance requirements of the printed wiring boards (PWBs).

At the end of this document are specification sheets, which provide minimum performance levels for physical characteristics of the reinforcements. These are useful for identifying degrees of precision needed to meet design/performance requirements of the PWB of current commercially available nonwoven para-aramid reinforcements.

In the event of conflict between design requirements and levels as defined in this specification, design requirements take precedence.

2 APPLICABLE DOCUMENTS

2.1 IPC¹

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-PC-90 General Requirements for Implementation of Statistical Process Control

IPC-QL-653 Qualification of Facilities that Inspect/Test Printed Boards, Components, and Materials

2.2 National Conference of Standards Laboratories (NCSL)²

ANSI/NCSL Z540-1-1994 General Requirements for Calibration Laboratories and Measuring Test Equipment

2.3 TAPPI (Technical Association Pulp & Paper Industry)³

T 410 om-83 Grammage of Paper and Paperboard (Weight Per Unit Area)

T 411 om-89 Thickness (Caliper) of Paper, Paperboard, and Combined Board

T 437 om-96 Dirt in Paper and Paperboard

T 456 om-87 Wet Tensile Breaking Strength of Paper and Paperboard

T 1007 om-92 Sample Location

T 1009 om-92 Tensile Strength and Elongation at Break

2.4 International Standards⁴

ISO 10012-1 Quality Assurance Requirements for Measurement Equipment, Part 1 - Meteorological Confirmation System for Measuring Equipment

2.5 Japanese Industrial Standards (JIS)

JIS P8113-1998 Paper and Board – Determination of Tensile Properties

JIS P8118-1985 Test Method for Thickness and Bulk Density of Paper and Paperboard

JIS P8124-1976 Determination of Basis Weight of Paper (Reaffirmed:1995)

JIS P8110 Conditioning of Paper for Test

JIS P8145 Testing Method for Dirt in Paper and Paperboard

3 REQUIREMENTS

3.1 Terms and Definitions Terms and definitions shall be in accordance with IPC-T-50, TAPPI, and JIS documents.

3.1.1 Para-Aramid Fiber A continuous filament yarn precision cut to a specified length, which is used for printed wiring board applications. Para-aramid is the generic name

1. IPC, 2215 Sanders Rd, Northbrook, IL, 60062, 847-509-9700, www.ipc.org

2. NCSL, 1800 30th Street, Suite 305B, Boulder, CO 80301, 303-440-3333, www.ncsl-h9.org

3. TAPPI, P.O. Box 105113, Atlanta, GA 30348-5113, 770-209-7303, www.tappi.org

4. ANSI, 11 W. 42nd St., New York, NY 10039, 212-642-4980, www.ansi.org

used to describe fibers made from wholly aromatic polyamides or amide polymers in which at least 70% of the amide linkages are attached directly to two benzene rings at the para position in the polymer chain.

3.1.2 Binder A thermoset, thermoplastic, and/or co-polymer resin or a meta-aramid particle or fiber and/or para-aramid particle or fiber used to hold the para-aramid fibers together.

3.1.3 Bagginess Material that is distorted, stretched, or deformed in the middle or along the edges.

3.1.4 Caliper Variation Variation in sheet thickness in the width and length, exceeding the product's specification.

3.1.5 Conducting Particles Small foreign particles capable of conducting current.

3.1.6 Edge Tear/Damaged Roll Edge Tears and/or damage to the edge of the reinforcement.

3.1.7 Dents Indentations in the surface of the reinforcement or in the edge of the roll.

3.1.8 Foreign Material Particles of foreign origin or other visible contaminants.

3.1.9 Wrinkles/Folds A permanent fold or ridge in the reinforcement, generally in the machine direction, occurring during processing or rewinding.

3.1.10 Holes/Thin Spots An area in the reinforcement where few or no fibers are present.

3.1.11 Poor Formation Very uneven distribution of fibers in the reinforcement, resulting in a rough surface or appearance.

3.1.12 Bundles Undispersed fiber bundles or clumps.

3.1.13 Soft Roll/Telescoping Roll that has been loosely wound, resulting in an uneven side-to-side hardness and/or evenness.

3.1.14 Weight Variation Basis weight variation in the width and length exceeding the product's specification.

3.1.15 Crease A ridge in the reinforcement that is not a permanent fold.

3.1.17 Tears A rip in the sheet.

3.1.18 Splice A location where two ends of the sheet are joined to form a continuous roll.

3.1.19 High Spots An area of the reinforcement that is thicker than the surrounding areas.

3.2 Physical Requirements

3.2.1 Product Typical physical requirements of nonwoven para-aramid reinforcements are provided at the end of this document in the form of specification sheets. The specification sheets may not cover all of the commercially available nonwoven para-aramid used in base material manufacturing. This specification is not designed to preclude their use in these applications, provided the requirements of Section 3 are met. New specification sheets **shall** be added as materials and data are made available.

3.2.2 Filament Diameter Para-aramid fiber length and diameter are specified in the specification sheets of this document. If this information is proprietary for a particular product, fiber length and diameter are identified as agreed between user and supplier (AABUS).

3.3 Visual Requirements

3.3.1 Visual/Appearance Procedures Reinforcements **shall** be inspected across the full width of the sheet. The reinforcement **shall** be of uniform appearance and formation. The lighting source should be mounted behind the viewing surface of the reinforcement so as to illuminate the reinforcement from the back with perpendicular light.

3.3.2 Visual/Appearance Defects Count all defects except where two or more defects represent a single local condition (all within one linear meter). In this case, count only the more serious defect as one defect. A continuous defect is counted as one defect for each linear meter or fraction thereof in which it appears. Classify the defects as listed in Table 3-1. Table 3-2 lists the test methods and procedures used to determine values found in the applicable specification sheets.

Table 3-1 Defect Classifications

Defect	Major	Minor
Bagginess		•
Weight Variation	•	
Caliper Variation	•	
Conducting Particles	•	
Edge Tears	•	
Dents		•
Foreign Material	•	
Wrinkles/Folds	•	
Holes	•	
Poor Formation	•	
Bundles		•
Soft Roll/Telescoping		•

Table 3-2 TAPPI and JIS Test Methods and Procedures

Test Method	Procedure Number
Sample Location	T 1007 or applicable procedure
Test Conditions	JIS P8110 or applicable procedure
Thickness	T 411 or JIS P8118-1985
Basis Weight	T 410 or JIS P8124-1976
Tensile Strength	T 1009 or JIS P8113-1998
Solvent Tensile ⁵	T 456 or applicable procedure
Contamination	T 437 or JIS P8145
Wet-Out ⁶	See footnote

3.3.3 Contamination Requirements Contaminants **shall** be inspected in accordance with 4.3.3 and **shall not** exceed more than three particles/m².

3.4 Dimensional Requirements

3.4.1 Roll Length The roll length **shall** be measured by the clock method or equivalent. The roll will be measured from beginning to end, and the length **shall** be reported to the nearest meter.

In the clock method, the measuring device consists of a wheel or pair of wheels mounted on a free-running axle, connected to a counting mechanism graduated to read in meters. The surfaces of the wheels are to be covered with a friction material to prevent slippage. The circumference of the wheel is to be known and synchronized with a mechanism to read in meters. The measuring device is to be mounted in such a way that movement of the reinforcement through the machine will turn the wheels.

3.4.2 Roll Width Place the roll of reinforcement in the horizontal position. Measure the width to within 3.2 mm perpendicular to the edges using steel tape.

3.5 Electrical Requirements The sheet **shall** be free of conductive contaminants.

3.6 Chemical Requirements⁷ There are no chemical requirements specified in this document.

4 QUALITY ASSURANCE

4.1 Responsibility for Inspection Unless otherwise specified in the purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. The supplier is responsible for documenting supplier's test methods and sample conditions if they differ from standard TAPPI and JIS test methods. Except as oth-

erwise specified in the purchase order, the supplier may use their own or any other facility suitable for the performance of the inspection requirements herein, unless disapproved by the procuring authority. The procuring authority reserves the right to perform any of the inspections set forth in the specification, where such inspections are deemed necessary, to assure supplies and service are performed to the prescribed requirements.

4.1.1 Test Equipment and Inspection Facilities Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection **shall** be established and maintained by the supplier. The supplier **shall** perform the establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment **shall** be in accordance with ISO 10012-1, ANSI/NCSL Z540-1-1994, or another calibration system agreed upon between the user and supplier.

4.1.2 Standard Laboratory Conditions Unless otherwise specified herein, all inspections **shall** be performed in accordance with the test conditions specified in the general requirements of IPC-QL-653 and the applicable TAPPI or JIS procedures (see Table 3-2). The supplier is responsible for documenting supplier's sample conditions if they differ from standard TAPPI and JIS test methods. If a referee method is required, it **shall** be agreed upon between user and supplier.

4.2 Preparation of Samples Unless otherwise specified herein, samples **shall** be prepared in accordance with standard TAPPI or JIS procedures (see Table 3-2). The supplier is responsible for documenting supplier's sample preparation procedures if they differ from standard TAPPI and JIS test methods. If a referee method is required, it **shall** be as agreed upon between user and supplier.

4.3 Inspection Procedure All rolls **shall** be inspected per 4.3.1. Visual defects are classified in Table 3-1.

4.3.1 Classification of Major and Minor Visual Defects

4.3.1.1 Major Defect A major defect is a defect that is likely to result in failure or materially reduce the usability of the unit of product for its intended purpose (see Table 3-1).

5. Substitute solvent for water saturation. The type of solvent should be agreed upon between user and supplier.

6. It is recommended the user request samples of the nonwoven reinforcement from the supplier to evaluate wet-out characteristics and ensure compatibility with current processes and resin systems.

7. Exposure to dimethyl formamide (DMF) and N-methyl-2-pyrrolidone (NMP) solvents are not recommended for nonwoven para-aramid reinforcements that contain a meta-aramid binder. Nonwoven para-aramid reinforcement is compatible with other industry standard solvents and chemicals.

4.3.1.2 Minor Defect A minor defect is a defect that is not likely to materially reduce the usability of the unit of product for its intended purpose (see Table 3-1).

4.3.2 Sampling Plans Sampling plans sufficient to ensure an acceptable quality **shall** be used (see Table 4-1).

Table 4-1 General Inspection

Number of Rolls Shipped	Minimum Number of Rolls Inspected
2-8	2
9-15	4
16-25	6
26-50	16
51-91	23
91-150	38

4.3.3 Contamination Inspection A representative sample **shall** be inspected from each production roll for foreign contamination using TAPPI T437, JIS P8145, or some other suitable test method agreed upon between user and supplier. The supplier is responsible for documenting the supplier's test methods and sample conditions if they differ from standard TAPPI and JIS test methods.

4.4 Acceptability Quality Level (AQL) No one meter will be penalized with more than one major defect. A continuous defect **shall** be counted as one defect for each meter or fraction thereof in which it occurs. Latent defects or defects that appear during and after treating can occur to make the product unacceptable for its intended use. The acceptable level of these defects and the resolution of any rejects arising must be negotiated between user and supplier.

4.5 Statistical Process Control (SPC) SPC utilizes systematic statistical techniques to analyze a process or its outputs. The purpose of these analyses is to take appropriate actions to achieve and maintain a state of statistical control and to assess and improve process capability. The primary goal of SPC is to continually reduce variation in processes, products, or services in order to provide product meeting or exceeding real or important customer requirements.

Implementation of SPC **shall** be in accordance with IPC-PC-90.

Depending on the progress made in implementing SPC on a particular product, an individual supplier may demonstrate compliance to specification with any of the following:

- Quality Conformance Evaluations
- End-Product Control
- In-Process Product Control
- Process Parameter Control

An individual supplier may choose to use a combination of the four assurance techniques listed to prove compliance. For example, a product with 15 characteristics may meet specifications by quality conformance evaluations on two characteristics, in-process evaluations on five characteristics, and process parameter control for five characteristics. The remaining three characteristics meet specifications by a combination of in-process control and quality conformance evaluations. Evidence of compliance to the specification at the level of SPC implementation claimed may be audited by the customer or appointed third party.

Requirements are dynamic in nature and are based on what is accepted in the worldwide market. Requirements may be stated as a reduction of variation around a target value, as opposed to just meeting the specification, drawing, etc.

5 PREPARATION FOR DELIVERY

5.1 Roll Size The outside diameter, width, and core size **shall** conform to the customer's specification.

5.1.1 Roll Length Roll length **shall** be determined in accordance with 3.4.1 and **shall** be as specified on the purchase order (min-max roll length). Roll diameter may be substituted for roll length as a means of specifying roll size.

5.1.2 Roll Width Roll width **shall** be determined in accordance with 3.4.2 and **shall** be as specified on the purchase order. The width of the reinforcement **shall** be within $-0 +6.4$ mm of the value specified or as agreed upon between the user and supplier.

5.2 Splices There **shall** be a maximum of one splice per 500 meters, unless otherwise agreed to or specified per purchase order, with the splice not being within 75 m of the beginning or end of the roll. All splices may be flagged upon agreement between supplier and user and **shall** be compatible with resin solvents. Splices **shall not** lose strength and **shall** withstand greater stresses and temperatures. When two pieces of reinforcement are spliced together, the allowable weight difference per square meter of the two pieces **shall not** be greater than the weight tolerances tested in the appropriate specification sheet.

5.3 Preservation and Packaging Preservation and packaging **shall** be in such a manner as to ensure delivery in a condition that will pass the requirements of this specification.

5.4 Packing Packing **shall** be as specified.

5.5 Labeling In addition to any special labeling required by the contract or order, each roll **shall** be labeled clearly to assure product identity. The label **shall** be located on the

box, roll, and core to assure product identity. The label should include a lot number to maintain traceability.

6 NOTES

6.1 Ordering Data The purchase order should specify the following:

- (a) Product grade code designation (from specification sheet)
- (b) Basis weight required
- (c) Roll size: outside diameter, width, and length
- (d) Core inside diameter size (i.e., 76.2 mm or 152.4 mm I.D.)
- (e) Customer purchase order number
- (f) Special labeling instructions
- (g) Special packing instructions

- (h) Ship-to address
- (i) Purchaser's part number, if required
- (j) Quantity: total weight and/or length
- (k) Any deviations from this specification

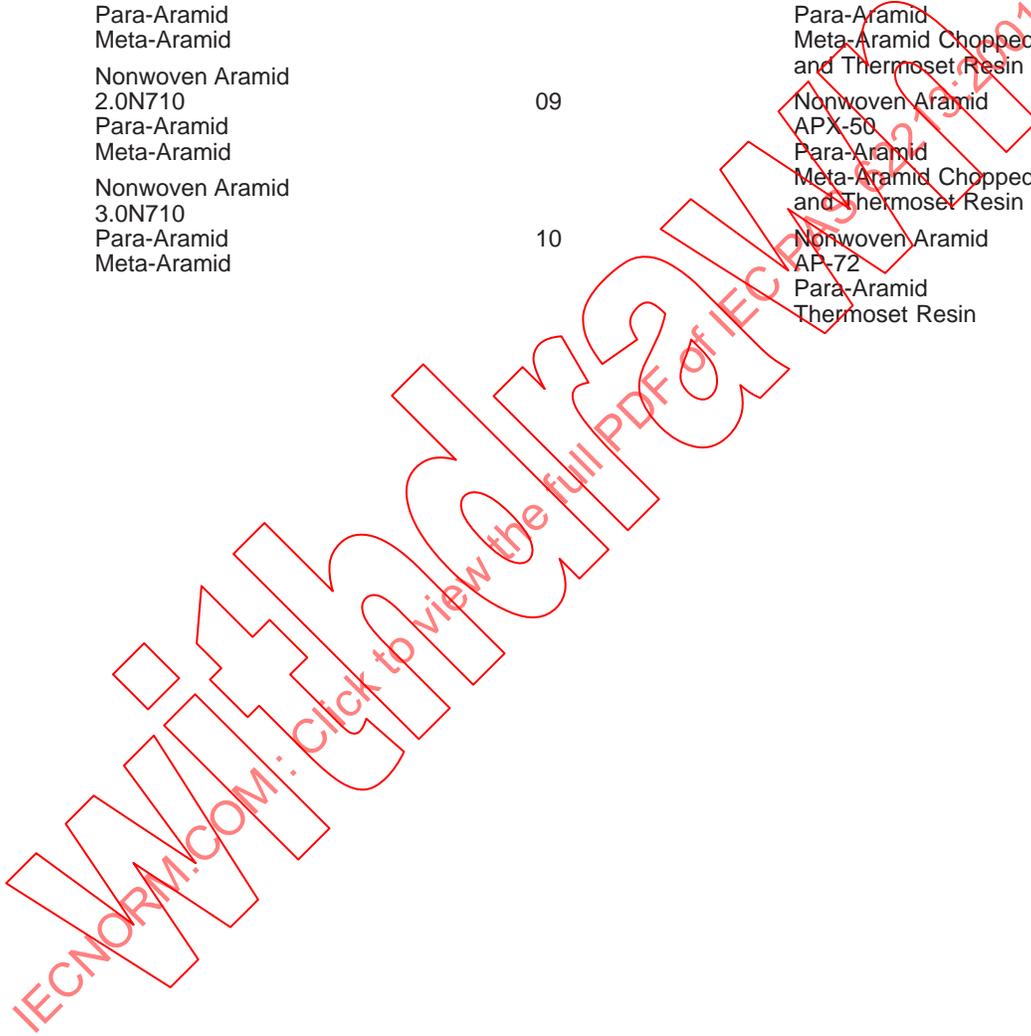
6.2 New Reinforcements A new or altered nonwoven para-aramid reinforcement **shall** be considered for addition to IPC-4411 when the appropriate designations are listed in specification sheets and submitted to the IPC office. The IPC office and Nonwoven Aramid Reinforcement Task Group chairman **shall** make the determination to approve the request and ballot the task group. If approved, the new reinforcement **shall** be in the next printing of IPC-4411, and a written notification **shall** be made to the Nonwoven Aramid Reinforcement Task Group members of record of the addition.

IECNORM.COM: Click to view the full PDF of IEC PAS 622:2001

Withheld

Specification Sheets for Nonwoven Para-Aramid Reinforcements

Specification Sheet #	Description	Specification Sheet #	Description
01	Nonwoven Aramid E-210 Para-Aramid Meta-Aramid	06	Nonwoven Aramid 4.0N710 Para-Aramid Meta-Aramid
02	Nonwoven Aramid E-220 Para-Aramid Meta-Aramid	07	Nonwoven Aramid N718 Para-Aramid Meta-Aramid
03	Nonwoven Aramid E-230 Para-Aramid Meta-Aramid	08	Nonwoven Aramid APX-72 Para-Aramid Meta-Aramid Chopped Strand and Thermoset Resin
04	Nonwoven Aramid 2.0N710 Para-Aramid Meta-Aramid	09	Nonwoven Aramid APX-50 Para-Aramid Meta-Aramid Chopped Strand and Thermoset Resin
05	Nonwoven Aramid 3.0N710 Para-Aramid Meta-Aramid	10	Nonwoven Aramid AP-72 Para-Aramid Thermoset Resin



 IECNORM.COM: Click to view the full PDF of IEC 60321-21-1

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/01		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	E-210		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 31 28 34	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 43 37 50	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 0.3 0.3	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/02		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	E-220		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 54 50 59	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 73 62 83	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 0.82 0.82	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/03		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	E-230		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 68 63 73	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 90 80 100	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 1.3 1.3	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/04		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	2.0N710		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	31 28 34	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 51 44 58	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 0.76 0.76	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/05		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	3.0N710		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 50 45 54	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 74 62 85	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 1.4 1.4	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/06		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	4.0N710		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 68 63 73	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 102 87 116	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	: IPC-4411/07			
Reinforcement Type	: Nonwoven Aramid			
Reinforcement Designation	: N718			
Fiber Identification	: Para-Aramid			
Binder Identification	: Meta-Aramid			
Fiber Identification	: AABUS			
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 72.0 70.0 74.0	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 115 108 123	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	: IPC-4411/08			
Reinforcement Type	: Nonwoven Aramid			
Reinforcement Designation	: APX-72			
Fiber Identification	: Para-Aramid			
Binder Identification	: Meta-Aramid Chopped Strand and Thermoset Resin			
Fiber Identification	: AABUS			
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	72.0 69.5 74.5	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 117 102 132	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/09		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	APX-50		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Meta-Aramid Chopped Strand and Thermoset Resin		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 50.0 48.0 52.0	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 83.3 72.5 94.2	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 1.4 1.4	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet				
Specification Sheet #	:	IPC-4411/10		
Reinforcement Type	:	Nonwoven Aramid		
Reinforcement Designation	:	AP-72		
Fiber Identification	:	Para-Aramid		
Binder Identification	:	Thermoset Resin		
Fiber Identification	:	AABUS		
Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 72.0 69.5 74.5	g/m ²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 117 102 132	μm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier

Specifications may be updated to suit users' needs as technology requirements change over time.