ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ ๓๐๗๐ (พ.ศ. ๒๕๔๕)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. ๒๕๑๑

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

แผ่นวงจรพิมพ์

เล่ม ๗ ข้อกำหนดสำหรับแผ่นวงจรพิมพ์หน้าเดียว

และสองหน้าที่อ่อนตัวได้ ไม่มีการเชื่อมต่อทะลุ

อาศัยอำนาจตามความในมาตรา ๑๕ แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. ๒๕๑๑ รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม แผ่นวงจรพิมพ์ เล่ม ๗ ข้อกำหนดสำหรับแผ่นวงจรพิมพ์หน้าเดียวและสองหน้าที่อ่อนตัวได้ ไม่มีการเชื่อมต่อทะลุ มาตรฐานเลขที่ มอก. ๒๐๗๓ - ๒๕๔๔ ไว้ ดังมีรายการละเอียดต่อท้ายประกาศนี้

ประกาศ ณ วันที่ ๒๘ พฤษภาคม พ.ศ. ๒๕๔๕

สุริยะ จึงรุ่งเรืองกิจ

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มอก. 2073-2544
IEC 326-7(1981-01)
(Amendment 1(1989-01))

มาตรฐานผลิตภัณฑ์อุตสาหกรรม

แผ่นวงจรพิมพ์

เล่ม 7 ข้อกำหนดสำหรับแผ่นวงจรพิมพ์หน้าเดียวและสองหน้าที่อ่อนตัวได้ ไม่มีการเชื่อมต่อทะลุ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดขึ้นโดยรับ IEC 326-7 (1981-01) Printed boards-Part 7 : Specification for single and double sided flexible printed boards without through connections มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ IEC ฉบับภาษาอังกฤษเป็นหลัก

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ใช้กับแผ่นวงจรพิมพ์หน้าเดียวและสองหน้าที่อ่อนตัวได้ ไม่มีการเชื่อมต่อทะลุ โดยไม่คำนึงถึงวิธีการผลิต มีจุดมุ่งหมายเพื่อเป็นพื้นฐานในการตกลงกันระหว่างผู้ซื้อและผู้ขาย "ข้อกำหนดที่เกี่ยวข้อง" ให้อ้างถึงข้อตกลงดังกล่าว ข้อกำหนดนี้ไม่สามารถนำไปใช้กับสายเคเบิลชนิดแบน

วัตถุประสงค์เพื่อกำหนดขอบข่ายคุณลักษณะที่กำหนดวิธีทดสอบที่ใช้ และกำหนดรูปแบบคุณลักษณะที่ต้องการสำหรับการตัดสินคุณลักษณะและมิติ เช่น การตรวจสอบทั่วไป ได้แก่ การตรวจพินิจและการตรวจสอบด้านมิติ การทดสอบทางไฟฟ้า ได้แก่ ความต้านทานของฉนวนไฟฟ้า ความต้านทานของตัวนำ ความทนกระแสไฟฟ้า ความทนแรงดันไฟฟ้า และความทนต่อการเปลี่ยนความถี่ การทดสอบทางกล ได้แก่ ความแข็งแรงของผิว ความทนการดึงออก ความเรียบ และการทดสอบเบ็ดเตล็ด ได้แก่ ทดสอบผิวสำเร็จที่เคลือบ ความสามารถในการบัดกรี ความทนต่อตัวทำละลาย และตัวช่วยประสาน และความคงทนต่อความร้อน

รายละเอียดให้เป็นไปตาม IEC 326-7 (1981-01)

PREFACE

This amendment has been prepared by IEC Technical Committee No. 52: Printed circuits.

The text of this amendment is based on the following documents:

Six Months' Rule	Report on Voting
52(CO)318	52(CO)329

Full information on the voting for the approval of this amendment can be found in the Voting Report indicated in the above table.

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Table I

In the second column, replace three times "6a" *by* "6".

CONTENTS

Non. 2073-2544
IEC 326-7(1981-01)
(Amendment 1(1989-01))

PRINTED BOARDS

Part 7: Specification for single and double sided flexible printed boards without through connections

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1. Introduction

IEC Publication 326 is applicable to printed boards, irrespective of their method of manufacture, when they are ready for mounting of the components.

It is divided into separate parts covering information for the designer, recommendations for the specification writer, test methods and requirements for the various types of printed boards, for example, single and double sided, multilayer and flexible printed boards.

1.1 *Purpose of Part 7*

This part contains fundamental information on characteristics to be assessed and requirements for single and double sided flexible printed boards without through connections.

1.2 *Associated IEC publications*

This standard shall be used in conjunction with the following IEC publications:

68: Basic Environmental Testing Procedures.
97: Grid System for Printed Circuits.
194: Terms and Definitions for Printed Circuits.
249: Metal-clad Base Materials for Printed Circuits.
326-1: Printed Boards, Part 1: Instructions for the Specification Writer (under consideration).
326-2: Part 2: Test Methods.
326-3: Part 3: Design and Use of Printed Boards.
326-4: Part 4: Specification for Single and Double Sided Printed Boards with Plain Holes.
326-5: Part 5: Specification for Single and Double Sided Printed Boards with Plated-through Holes.
326-6: Part 6: Specification for Multilayer Printed Boards.
326-8: Part 8: Specification for Single and Double Sided Flexible Printed Boards with Through Connections.

2. Scope

This standard is applicable to single and double sided flexible printed boards without through connections irrespective of their method of manufacture. It is intended as a basis on which agreements between purchaser and vendor can be made. The term "relevant specification" used herein refers then to such agreements. This specification is not applicable to flat cables.

3. Object

To define the characteristics to be assessed, the test methods to be used and to establish uniform requirements for judging properties and dimensions.

4. **General**

The following tables contain all important characteristics and make reference to the appropriate tests to verify these characteristics.

Unless otherwise specified, all of the tests listed in Table I, page 11, shall be carried out. Where the relevant specification specifically claims additional characteristics which require additional tests, the relevant tests shall be selected from Table II, page 21.

Where additional details for a test must be specified in the relevant specification, this is indicated by an asterisk in the relevant column. These details shall then be specified in accordance with IEC Publication 326-2.

The tables are not intended to prescribe a test sequence, the tests may be carried out in any sequence, unless otherwise specified.

The sample quantity shall also be specified by the relevant specification.

5. **Test specimens**

The tests shall preferably be carried out on production boards.

Where the use of test coupons is agreed, they shall be prepared in accordance with Sub-clause 4.2 of IEC Publication 326-2. A suitable test pattern is shown in Figure 1, pages 26 and 27.

6. **Relevant specification**

The relevant specification shall contain all information necessary to define the printed board clearly and completely. The recommendations given in IEC Publication 326-3 shall be followed.

Care should be taken to avoid unnecessary requirements. Permissible deviations shall be stated where necessary, nominal values without tolerance or simple maxima or minima shall be given where sufficient. Where precise specifications are necessary for certain areas or parts of the printed board only, they shall be applied and restricted to those areas or parts.

If there are several possibilities of presentation, of tolerance classes, etc., the selections given in IEC Publication 326-3 shall be applied.

7. **Characteristics of printed boards**

(Tables I and II.)

TABLE I

Basic characteristics

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
General examination			Complete composite test pattern		
Visual examination					
Conformity and identification	1	*		Pattern, marking, identification and material finishes shall comply with the relevant specification. There shall be no apparent defects	
Appearance and workmanship	1a			The boards shall appear to have been processed in a careful and workmanlike manner, in accordance with good current practice	
Board edges				The edges of the board and internal cutouts shall be clean cut without tears or nicks	
Bonding conductor to substrate				There shall be no separation of the conductors from the substrate by apparent blisters or wrinkles other than those permitted in the material specification	
Bonding coverlayer to substrate and pattern	1a			The bonding shall appear to be complete and uniform. Minor delaminations are permitted in the following positions:	
				a) At random locations away from the conductors. Such delaminations shall have an area not exceeding 5 mm² each and shall be more than 0.5 mm from the edges	Examples of delaminations are shown in Figure 5, page 30
				b) Along conductor edges. Such delaminations shall not infringe upon the design spacing between the conductors by more than 20% of the design width by visual estimation	
				There shall be a minimum continuous bonding width of 0.5 mm between adjacent conductors. There shall be no delamination with conductor spacings less than 0.5 mm	
Conductor defects	1b			There shall be no cracks or breaks. Imperfections such as voids or edge defects are permissible, provided that the conductor width or leakage path between conductors is not reduced by more than that specified in the relevant specification, for example 20% or 35%	Where necessary, this shall be verified by dimensional examination using Test 2a

*See the third paragraph of Clause 4.

TABLE I *(continued)*

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
Particles between conductors	1b or 1c		F	Residual metallic particles are permissible provided that the leakage path is not reduced by more than 20% or to less than the distance required for the circuit voltages	Where necessary, this shall be verified by dimensional examination using Test 2a
Dimensional examination					
Board dimensions	2			Dimensions and tolerances shall comply with the relevant specification	
				The nominal board thickness shall comply with the relevant specification	
Holes	2			Nominal diameters and tolerances of mounting holes and of component holes shall comply with the relevant specification	A recommended range of hole sizes and tolerances is given in IEC Publication 326-3
Access holes	2		Coverlayer part of complete composite test pattern	Registration of an access hole including influence of adhesive flow in the coverlayer with relation to the relevant land on the base material shall be such that any overlapping will not reduce the effective land dimensions to less than the minimum stated in the relevant specification (see Figure 4, page 29)	Recommended minimum effective land at any point around the hole: 0.15 mm
Slots, notches	2			The dimensions shall comply with the relevant specification	
Conductor width	2		Complete composite test pattern	The width shall comply with any specific dimensions given in the relevant specification	If no tolerances are stated, the coarse deviations given in IEC Publication 326-3 shall apply
	2a			Imperfections such as voids or edge defects are permissible, provided the conductor width is not reduced by more than specified in the relevant specification, for example 20% or 35%. The length L of a defect shall be not greater than the conductor width S, or 5 mm (0.2 in) whichever is the smaller (see Figure 2, page 28)	

TABLE I *(continued)*

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
Spacing between conductors	2		F	The spacing shall comply with any specific dimensions given in the relevant specification	
Misalignment of hole and band	1a 2a		Complete composite test pattern	There shall be no interruption of the land. There shall be no break-out at the junction of the land and the conductor	
Positional tolerance of hole centres				The hole centres shall be within any deviation specified in the relevant specification	
Electrical tests					
Insulation resistance	6a		E	The insulation resistance shall comply with the relevant specification	Insulation resistance shall be measured before and after environmental conditioning and at elevated temperature, as specified in the relevant specification
Pre-conditioning	18a	*			
Measurement at standard atmospheric conditions	6a	*			
Conditioning as specified in IEC Publication 68-2-3: Test Ca: Damp Heat, Steady State, or IEC Publication 68-2-38, Test Z/AD: Composite Temperature / Humidity Cyclic Test		*			Applicable conditioning to be specified in the relevant specification
Measurement at elevated temperature	6a	*			Not applicable to polyester materials
Mechanical tests					
Peel strength Conductor to base material			G	The peel strength shall comply with the relevant specification	Conductors without coverlayer
Measurement at standard atmospheric conditions	10a	*			

*See the third paragraph of Clause 4.

TABLE I *(continued)*

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
Measurement at elevated temperatures	10b	•			Not applicable to polyester materials
Pull-off strength	11a	•	J	The land shall not become detached during soldering operation. The pull-off strength shall be not less than the value specified in the relevant specification	For this test the specimen shall be supported by a rigid board
Flexural fatigue			•	Under consideration	
Miscellaneous tests					
Plating finishes					
Adhesion of plating, tape method	13a		K	There shall be no evidence of plating adhering to the tape after removal from the conductor, other than resulting from overhang	
Thickness of plating (contact areas)	13f	•	K	The thickness shall comply with the relevant specification	
Solderability	14a	•	H, A	The conductors shall be covered with a smooth and bright solder coating with not more than traces (approximately 5%) of scattered imperfections such as pin-holes, unwetted or dewetted areas. The imperfections shall not be concentrated on one area	Not applicable to polyester materials For polyimide materials appropriate drying prior to soldering may be necessary. Testing shall be carried out in the as received condition or after accelerated ageing, as agreed upon between purchaser and vendor
A) When the use of a non-activated flux is agreed between purchaser and vendor As received condition				Wetting: The specimen shall wet within 2 s When temporarily protective coating intended to preserve the wettability is used, the specimen shall wet within 3 s	Non-activated flux, as specified in Subclause 6.6.1 of IEC Publication 68-2-20
				Dewetting: The specimen shall remain in contact with the molten solder for between 5 s and 6 s and shall not have dewetted	

*See the third paragraph of Clause 4.

TABLE I *(continued)*

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
After accelerated ageing				Wetting: The specimen shall wet within 4 s Dewetting: The specimen shall remain in contact with the molten solder for between 5 s and 6 s and shall not have dewetted	
B) When the use of an activated flux is agreed between purchaser and vendor					Activated flux (0.2%) as specified in Subclause 6.6.2 of IEC Publication 68-2-20
As received condition and after accelerated ageing				For boards with or without temporarily protective coating intended to preserve wettability: Wetting: The specimen shall wet within 2 s Dewetting: The specimen shall remain in contact with the molten solder for between 5 s and 6 s and shall not have dewetted	
Solvent and flux resistance	17a	*		No sign of: - blistering or delamination - random removal of areas of resist or ink - dissolving - substantial change in colour Accept: *a)* Markings unaffected *b)* Markings reduced but legible Reject: *a)* Marking illegible or destroyed *b)* Markings doubtfully legible, i.e. possible mistaking of similar characters such as R-P-B, E-F, C-G-O	

*See the third paragraph of Clause 4.

TABLE II

Additional characteristics (to be assessed only when specifically required)

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
Dimensional examination					
Position of pattern and holes relative to a datum reference				The position shall comply with any specific dimensions given in the relevant specification	This is normally not measured, as the important feature is the relationship between pattern and hole, which controls the minimum radial land width. When specially called for, the deviations given in IEC Publication 326-3 shall be applied
Electrical tests					
Resistance					
Resistance of conductors	3a	*		The resistance shall comply with the relevant specification	
Current proof					
Current proof, Conductors	5b	*		The conductors shall not burn out (fuse) and there shall be no overheating as apparent by discolouration	
Voltage proof	7a	*		There shall be no disruptive discharge	
Miscellaneous tests					
Plating finishes					
Adhesion of plating, burnish method	13b		K	There shall be no evidence of blistering or detachment of the plating	
Porosity, gas exposure	13c		K	The requirements specified in the relevant specification shall be met	
Porosity, electrographic test	13d 13e	* *	K	The requirements specified in the relevant specifications shall be met	
Thickness of plating (other areas than contact areas)	13f	*	C	The thickness shall comply with the relevant specification	

*See the third paragraph of Clause 4.

TABLE II *(continued)*

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
Thermal endurance					
Long term		*	Y	Storage at maximum operating temperature	Duration and temperature to be as stated in the relevant specification
Visual inspection	1a			There shall be no separation of conductors or of the coverlayer	

*See the third paragraph of Clause 4.

8. Composite test pattern

The composite test pattern of Figure 1a, page 26, permits the majority of type approval tests to be carried out on a test board/test coupon.

Using the single test specimens, the following tests can be made:

Note. — For the purpose of economy, the same test pattern is used for this standard and IEC Publication 326-8.

Specimens

Specimen	Test	Coverlayer access hole diameter (mm)	Nominal land diameter (mm)	Nominal hole diameter (mm)
A	Registration of coverlayer; solderability of plated-through holes of eyelets	2.0 4.2	1.8 4.0[1]	0.8 2.0[2]
C	Microsection, thickness of plating	2.5 2.0	2.5 2.0	1.3 0.8
D	Change in resistance of plated-through holes	2.5	-	0.8
E	Insulation resistance and process contamination	2.0	-	0.8
F	Conductor definition, -spacing, -width, -defects and particles between conductors	-	-	-
G	Peel strength, conductor to base material	-	-	-
H	Solderability of conductors	-	3.0	-
J	Pull-off strength, lands with plain holes	-	4.0	1.3
K	Plating finishes	-	-	-
X	Flexural fatigue	2.5	4.0	1.3
Y	Thermal endurance	-	-	-

[1] Flange diameter of eyelet.
[2] Hole diameter to accommodate the eyelet.

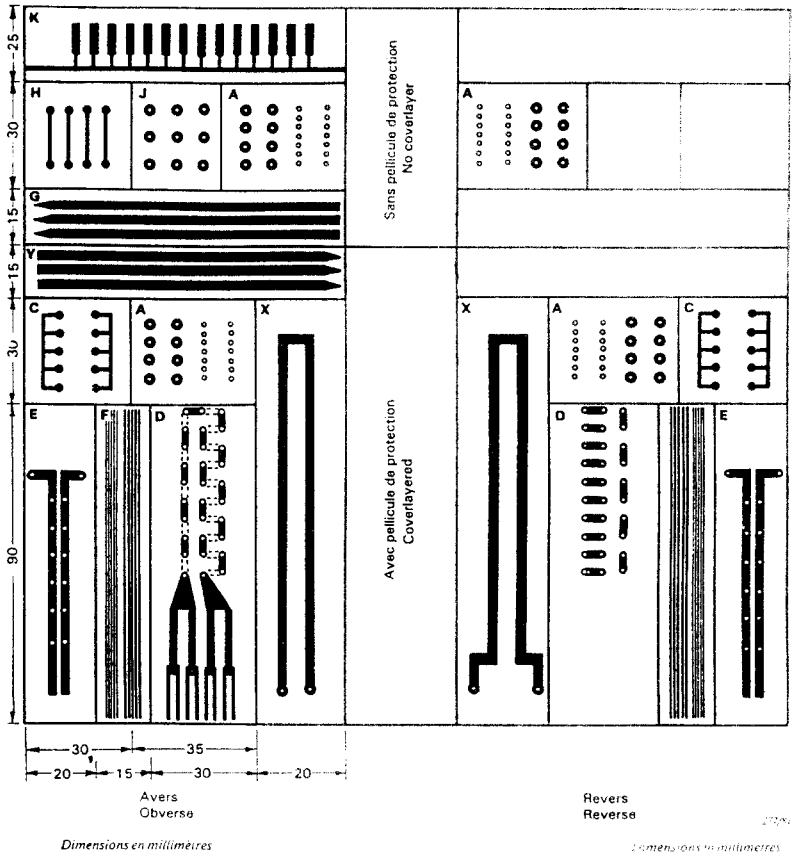

FIG. 1a). — Eprouvette composite pour cartes imprimées souples sans connexions transversales. Détails, voir figure 1b).

Composite test pattern for flexible printed boards without through connections. Details, see Figure 1b).

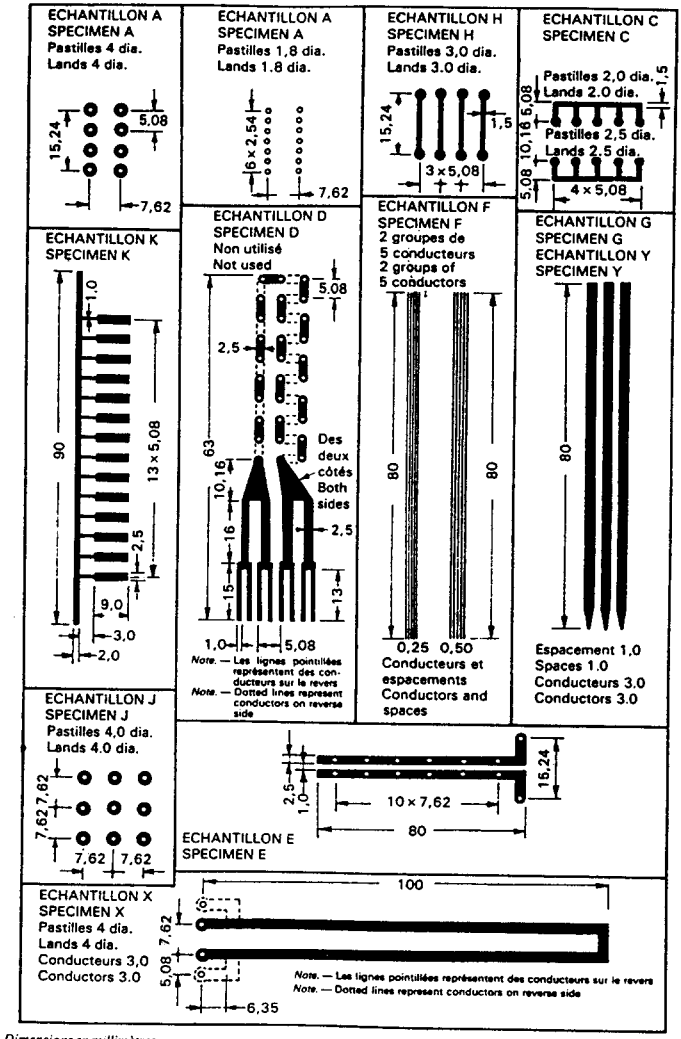

FIG. 1b). — Dimensions détaillées des échantillons de la figure 1a).
Detailed dimensions of specimens shown in Figure 1a).

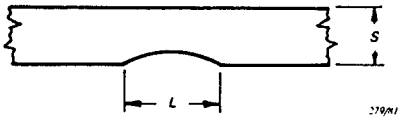

FIG. 2. — Longueur de défaut.
Length of defect.

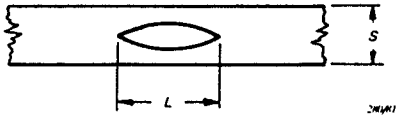

FIG. 3. — Non applicable.
Not applicable.

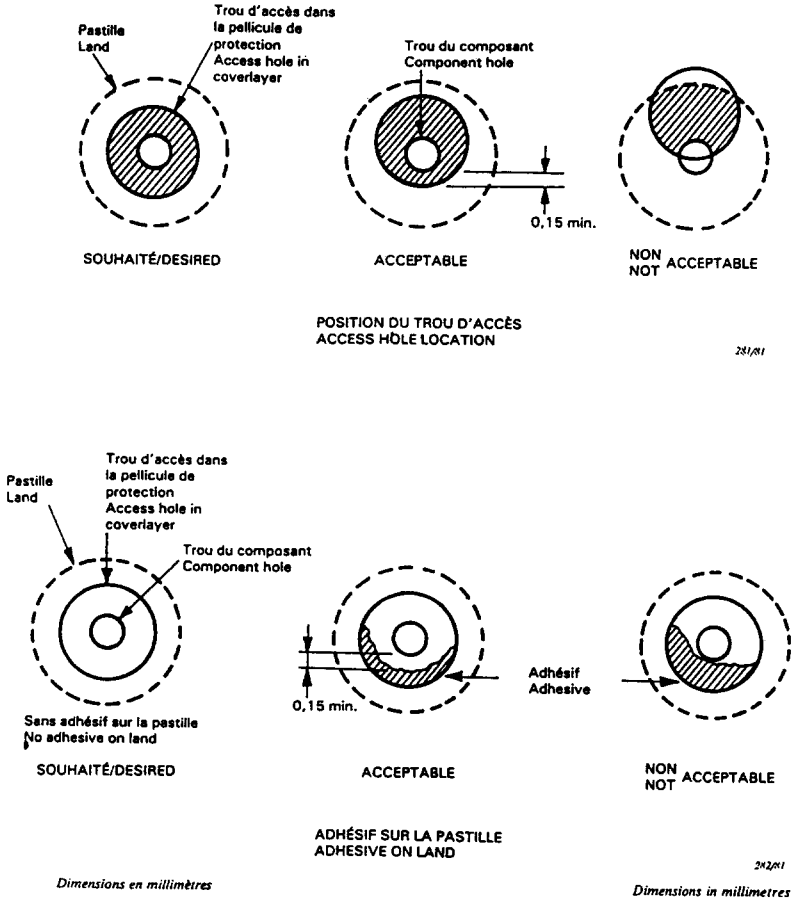

FIG. 4. — Exemples relatifs aux trous d'accès.
Examples related to access holes.

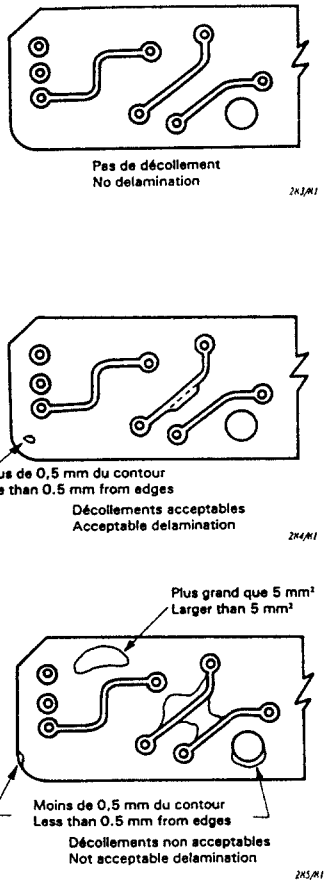

FIG. 5. — Exemples de décollements
Examples of delamination