

# TECHNICAL REPORT



**Packaging of components for automatic handling –  
Part 3-4: Packaging of surface mount components on continuous embossed  
tapes for Auto Loading Feeder**

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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ICS 31.020; 31.240

ISBN 978-2-8322-1041-4

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –****Part 3-4: Packaging of surface mount components  
on continuous embossed tapes for Auto Loading Feeder**

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IEC TR 60286-3-4 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
40/2844/DTR	40/2866/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available

at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in the IEC 60286 series, published under the general title *Packaging of components for automatic handling*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

This Technical Report was developed by the technical committee 40 working group 36 on components packaging, in which the members, such as mounter manufacturers, component manufacturers and packaging material manufacturers, had proposed, considered and discussed the possible standardization of the application of Auto Loading Feeder to enable automatically exchange SMD continuous tapes, using paper carrier tape during mounter operation, aiming to support IEC 60286-3, Edition 6, issued in 2019.

This document includes data expressed in the form of provisions, such as requirements or recommendations. These data, however, do not claim to be provisions and are just suggested as the results of the discussion.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a trademark concerning Auto Loading Feeder given in 3.1.1.

- Trademark ... AUTO LOADING FEEDER™
- Trademark registration number ... No.5983611 (Japan)

IEC takes no position concerning the evidence, validity and scope of this trademark right.

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## PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

### Part 3-4: Packaging of surface mount components on continuous embossed tapes for Auto Loading Feeder

#### 1 Scope

This part of IEC 60286 considers the proposed requirements for emboss taping for the Auto Loading Feeder mechanism to mount electric components without leads or with stump type leads used for electric circuits. This document is applicable to the embossed carrier tape, with single round sprocket holes, with tape pitches of 2 mm or more (nominal tape width: 8 mm only) among the tapes of Type 2a in IEC 60286-3.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes the statement of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60286-3:2019, *Packaging of components for automatic handling – Part 3: Packaging of surface mount components on continuous tapes*

#### 3 Terms, definitions and symbols

##### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Annex B features a Glossary of mounter and feeder related terms.

##### 3.1.1

##### **Auto Loading Feeder**

##### **AUTO LOADING FEEDER™**

tape feeder that can keep supplying components by automatically carrying a tape of re-supplied SMD at the filling-in position into the components supply position, just after the components in the tape of previously supplied SMD are fed up during the assembly production

Note 1 to entry: Auto Loading Feeder has the mechanism that the cover tape of a SMD tape is automatically cut or peeled off to expose the pockets during the operation to supply components.

##### 3.1.2

##### **seal**

bonding of a part of the top cover tape and a part of the carrier tape

Note 1 to entry: The top cover tapes are classified as heat welding type and adhesive type by the way to bond itself on the carrier tape.

**3.1.3 cross-bar**

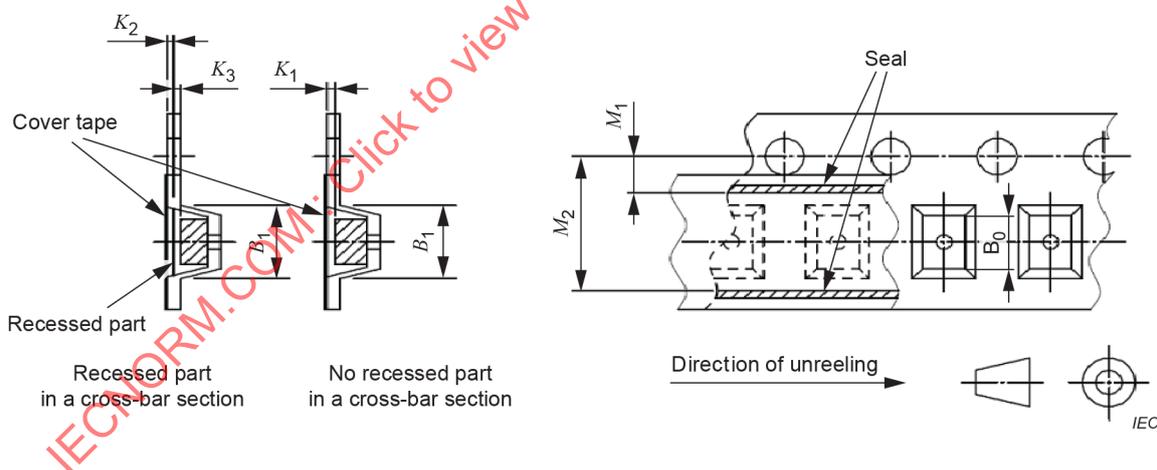
section between openings of the pockets adjacent to each other in the direction of pulling out an embossed carrier tape

**3.2 Symbols**

The symbols used in this document are shown in Table 1 and Figure 1.

**Table 1 – Symbols used in figures and tables**

Symbol	Description	Figures and tables using the symbol
$B_0$	Cross-tape dimension of the bottom surface of a pocket	Figure 1, Table 2, Table 3 and Figure 8
$B_1$	Cross-tape dimension of the opening of a pocket	Figure 1 and Figure 8
$M_1$	Distance between the reference point of the sprocket holes (centre) and the inner side of the seal on the upper end side, which is near the sprocket holes, of the carrier tape	Figure 1 and Table 2
$M_2$	Distance between the reference point of the sprocket holes (centre) and the inner side of the seal on the lower end side, which is far from the sprocket holes, of carrier tape	Figure 1 and Table 2
$K_1$	Distance between the upper side of the carrier tape and the top surface of a component	Figure 1 and Table 3
$K_2$	Distance between the upper side of the carrier tape and the upper side of the recessed part in a cross-bar section	Figure 1, Figure 3 and Table 3
$K_3$	Distance between the upper side of the recessed part in a cross-bar section and the top surface of a component	Figure 1, Figure 3 and Table 3



**Figure 1 – Specified dimensions for emboss taping for Auto Loading Feeder**

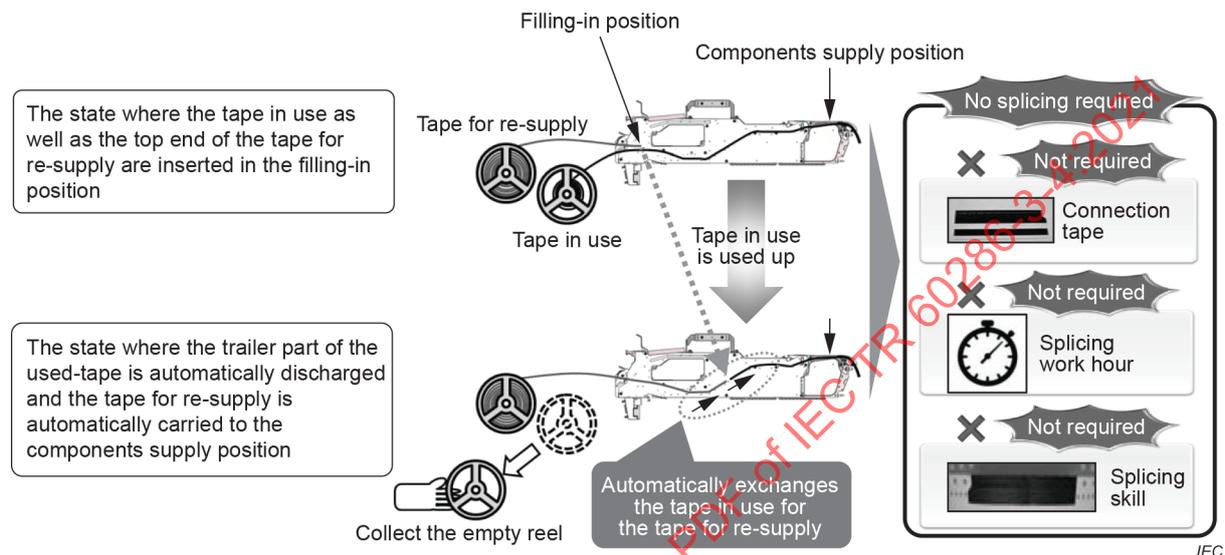
**4 Overview of Auto Loading Feeder**

**4.1 Overview and features of Auto Loading Feeder**

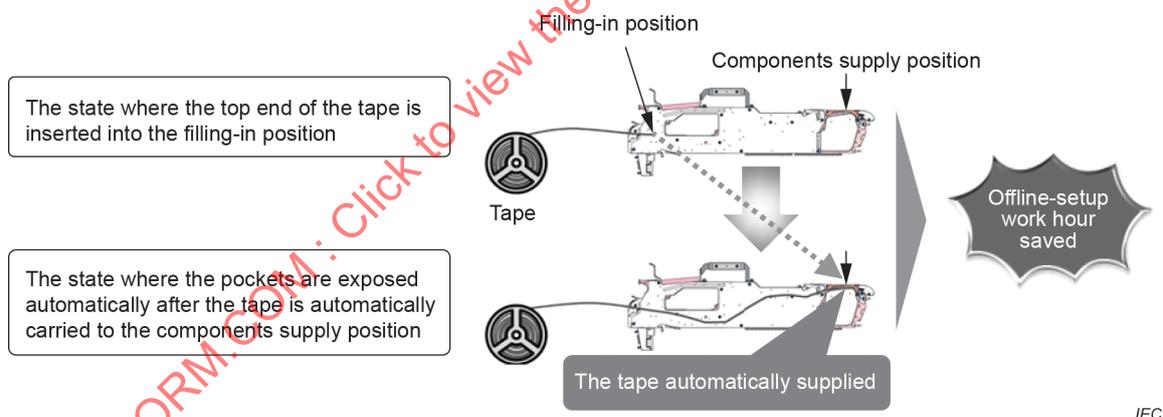
A characteristic example for operation of an Auto Loading Feeder is shown in Figure 2. Just after the components in a SMD tape get used up in the mounting process, another tape for re-supply set at the filling-in position is automatically carried to the components supply position and the pockets are automatically exposed. That results in re-supplying the components automatically. That is to say, this mechanism enables to keep supplying components without the conventional splicing work using a connection tape, which requires man-hours and specific

skills. In addition, it enables to largely reduce work hours during the work at offline setup, because just inserting the top end of the tape in the re-supply position enables to supply the tape automatically in the same way as during supplying components in the mounting process. Auto Loading Feeder enables to boost up operating rate of mounters, save man-power and resource in the components mounting field of electrical and electronic manufactures, and is expected to get more popularization as the next generation supply system.

NOTE The splicing work is to connect the cut-off end of the trailer part of an in-use SMD tape and the cut-off tip of the leader part of a SMD tape for re-supply, by using a connection tape.



#### a) Supplying components during the assemble production



#### b) Supplying tape at offline setup

**Figure 2 – Operation and features when another tape is re-supplied automatically by the Auto Loading Feeder**

### 4.2 Methods and mechanisms of automatically exposing the pockets in using Auto Loading Feeder

The methods and mechanisms of automatically exposing the pockets in using Auto Loading Feeder are classified as follows. See Annex A for details.

- The single-door method with which only one sealed side of the cover tape is peeled off to expose the pockets (see Clause A.2);
- The double-door method with which the centre of the cover tape is cut in to expose the pockets (see Clause A.3).

IEC 60286-3 describes some requirements provided that the cover tape should be peeled off and removed. Auto Loading Feeder mechanism, however, needs other requirements about the sealed position of the cover tape on the carrier tape in order to maintain its stable operation since the mechanism leaves the cover tape on the carrier tape.

## 5 Discussion items for requirements for emboss taping for Auto Loading Feeder

### 5.1 General

New requirements for emboss taping for Auto Loading Feeder are to be considered in addition to the requirements for the embossed carrier tape, with single round sprocket holes, with tape pitches of 2 mm or more (nominal tape width: 8 mm only) among the tapes of Type 2a in IEC 60286-3:

- a) Required dimensions for the cover tape sealed positions (see 5.2);
- b) Required dimensions for the distance between the upper side of the carrier tape and the top surface of a component (see 5.3);
- c) Necessity of  $M_1$  and  $M_2$  as the cover tape sealed positions (see 5.4);
- d) Necessity of  $K_1$  as the distance between the upper side of the carrier tape and the top surface of a component (see 5.5);
- e) Necessity of  $K_2$  as the recessed part in a cross-bar section (see 5.6);
- f) Necessity of  $K_3$  as the distance between the upper side of the recessed part in a cross-bar section and the top surface of a component (see 5.7);
- g) Sealing method for the cover tape (see 5.8);
- h) Dent of the cover tape over the pockets (see 5.9);
- i) Lower limit of the cover tape peel-off strength (see 5.10);
- j) Adhesion of components on the cover tape (see 5.11);
- k) Hole of the bottom of the pockets of the carrier tape (see 5.12);
- l) Maximum length of the trailer (see 5.13);
- m) Fixing the tail end of the carrier tape (see 5.14).

### 5.2 Required dimensions for the cover tape sealed positions

Required dimensions for the cover tape sealed positions for Auto Loading Feeder are shown in Table 2.

**Table 2 – The cover tape sealed positions required for emboss taping for Auto Loading Feeder**

*Dimensions in millimetres*

$B_0$		Typical nominal component dimension	Required dimension (design value)	
			$M_1$	$M_2$
> 0	0,5 or less	0402M	2,9 or less	4,1 or more
Over 0,5	0,8 or less	0603M	2,9 or less	4,1 or more
Over 0,8	1,3 or less	1005M	2,6 or less	4,4 or more
Over 1,3	2,1 or less	1608M	2,2 or less	4,8 or more
Over 2,1	2,6 or less	2012M	(2,0 or less) <sup>a</sup>	(5,0 or more) <sup>a</sup>
Over 2,6	3,5 or less	3216M	(1,5 or less) <sup>a</sup>	(5,5 or more) <sup>a</sup>

NOTE 1 The symbols are shown in Table 1 and Figure 1.

NOTE 2 SMD tapes with sealed pockets are not applicable to Auto Loading Feeder.

NOTE 3 Sealing tape should be attached symmetric to the centre of the pocket.

<sup>a</sup> Since the components can be inverted in the pockets and there are some restrictions in the assembly manufacturing, the dimensions are shown as reference values in brackets. If the tapes do not meet these dimensions, persons involved are suggested to discuss in advance whether it is possible to use Auto Loading Feeder or not.

### 5.3 Required dimensions for the distance between the upper side of the carrier tape and the top surface of a component in using Auto Loading Feeder

Required dimensions for the distance between the upper side of the carrier tape and the top surface of a component for Auto Loading Feeder are shown in Table 3.

**Table 3 – Distance between the upper side of the carrier tape and the top surface of a component required for emboss taping for Auto Loading Feeder**

*Dimensions in millimetres*

$B_0$		Typical nominal component dimension	Required dimension (design value)		
			$K_1$	$K_2$	$K_3$
> 0	0,5 or less	0402M	(0,03 or more) <sup>a</sup>	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>
Over 0,5	0,8 or less	0603 M	(0,03 or more) <sup>a</sup>	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>
Over 0,8	1,3 or less	1005 M	0,03 or more	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>
Over 1,3	2,1 or less	1608 M	0,03 or more	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>
Over 2,1	2,6 or less	2012 M	0,03 or more	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>
Over 2,6	3,5 or less	3216 M	0,03 or more	(0,02 or less) <sup>a</sup>	(0,03 or more) <sup>a</sup>

NOTE The symbols are shown in Table 1 and Figure 1.

<sup>a</sup> Since the components can be inverted in the pockets and there are some restrictions in the assembly manufacturing, the dimensions are shown as reference values in brackets. If the tape does not meet this dimension, persons involved are suggested to discuss in advance whether it is possible to use Auto Loading Feeder or not.

### 5.4 Necessity of $M_1$ and $M_2$ as the cover tape sealed positions

Necessity of  $M_1$  and  $M_2$  as the cover tape sealed positions was discussed as follows:

a) Background and discussed items for the requirements

Since  $M_1$  and  $M_2$  are important dimensions for the basic operation of Auto Loading Feeder which automatically exposes components and is impossible to realize to supply components stably without the control of these potential dimensions, the mounter manufacturers proposed  $M_1$  and  $M_2$  as the control values for every  $B_0$  dimension range of the bottom surfaces of the pockets. According to this proposal, the components manufacturers and the packaging material manufacturers discussed if they can deal with the values, reviewing them.

b) Resolved policy

It was decided that the sealed positions required for Auto Loading Feeder are described as the design value for every  $B_0$  dimension range of the bottom surfaces of the pockets. On the other hand, the required dimensions on which the components manufacturers did not agree are described as reference dimensions written in brackets. The notes are added that persons involved should judge in advance if the SMD tape, which does not meet the required dimensions, can be used for Auto Loading Feeder or not.

c) Justification for the policy

IEC 60286-3 describes the cover tape peel-off strength and break strength provided that the cover tape is generally removed by peel-off, but it does not specify any requirement or statement on the sealed positions. The mounter manufacturers explained the Auto Loading Feeder mechanism to the component manufacturers so that the component manufacturers can understand it is most important to control the sealed positions in order to expose the pockets automatically in Auto Loading Feeder. Additionally, it was discussed whether the required sealed positions should be specified as design values or guaranteed values, then the component manufacturers have their opinion that they cannot adopt the dimensions as the guaranteed values, because it is difficult to measure and check the positions. Finally, they adopted the required sealed positions as the design values as a compromise with the mounter manufacturers.

### 5.5 Necessity of $K_1$ as the distance between the upper side of the carrier tape and the top surface of a component

Necessity of  $K_1$  as the distance between the upper side of the carrier tape and the top surface of a component was discussed as follows:

a) Background and discussed items for the requirements

$K_1$  is a distance required to avoid any damage to the components in the relationship between the components and the processing mechanism to expose the pockets in using Auto Loading Feeder, and it is an important dimension in order to judge whether Auto Loading Feeder can be used. Therefore, the values which the mounter manufacturers requested were discussed among the Project Group, checking the control range (guaranteed items) and the restrictions in manufacturing the components.

b) Resolved policy

It was decided that the required values shall be described as the design values, considering the mounter manufacturers request to show the required values as numerical indicators to judge whether Auto Loading Feeder can be used. On the other hand, the required dimensions on which the component manufacturers did not agree are described as reference dimensions in brackets. The note is added showing that persons involved should discuss in advance whether the SMD tape which does not meet the required dimensions can be used for Auto Loading Feeder or not.

c) Justification for the policy

All component manufacturers practice the control in IEC 60286-3 that describes “The component shall not protrude above the top surface of the carrier tape”. The values of the mounter manufacturers meet the required values specified in IEC 60286-3, but a comment was raised that the components can be tilted and rotated largely in the pockets and the distance between the components and the nozzles picking them up becomes longer when a mounter picks up the components, possibly affecting the pick-up rate of small components.

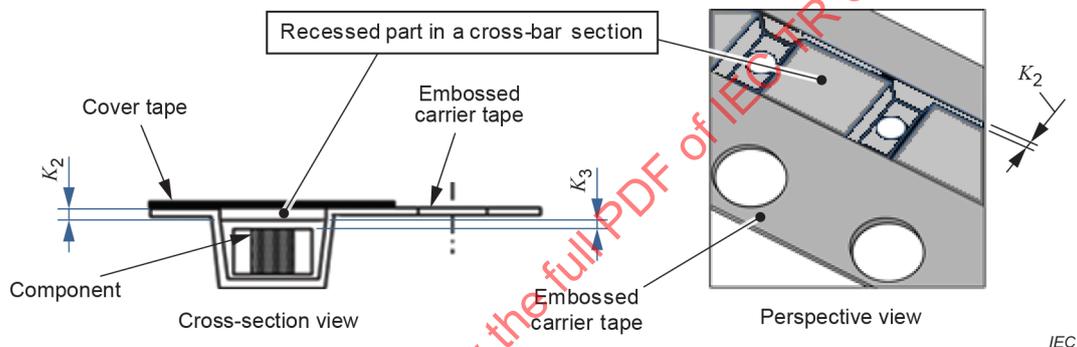
However, it was decided to describe the values which the moulder manufacturers requested, because the moulder manufacturers requested to show the values as indicators to judge whether Auto Loading Feeder can be used.

### 5.6 Necessity of $K_2$ as the recessed part in a cross-bar section

Necessity of  $K_2$  as the recessed part in a cross-bar section was discussed as follows:

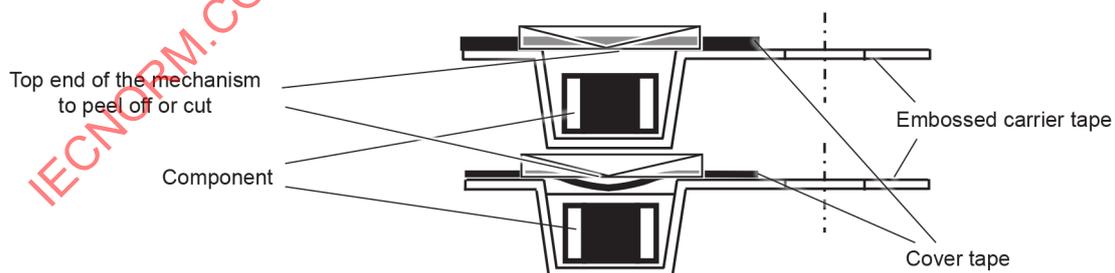
#### a) Background and discussed items for the requirements

In the case that the recessed part in a cross-bar section between adjacent pockets is larger, the cover tape bends downward following the part. Consequently, Auto Loading Feeder fails to insert the top end of the exposure processing mechanism that peels off and cuts off the cover tape, into the boundary between the cover tape and the carrier tape in the top end of the SMD tape. Finally the pocket cannot be exposed automatically. Since this dimension is important to judge whether Auto Loading Feeder can be used, the dimensions which the moulder manufacturers request were discussed. Figure 3 shows an example of an embossed tape with the recessed part in a cross-bar section, and Figure 4 shows the relationship between the cover tape and the insertion of the top end of the exposure processing mechanism into the boundary between the carrier tape and the cover tape.



**Figure 3 – Example of a part of embossed carrier tape with a recessed part in a cross-bar section**

- a) Inserting top end of the mechanism to peel off and cut is possible  
(no recessed part in a cross-bar section and the cover tape is not bent)

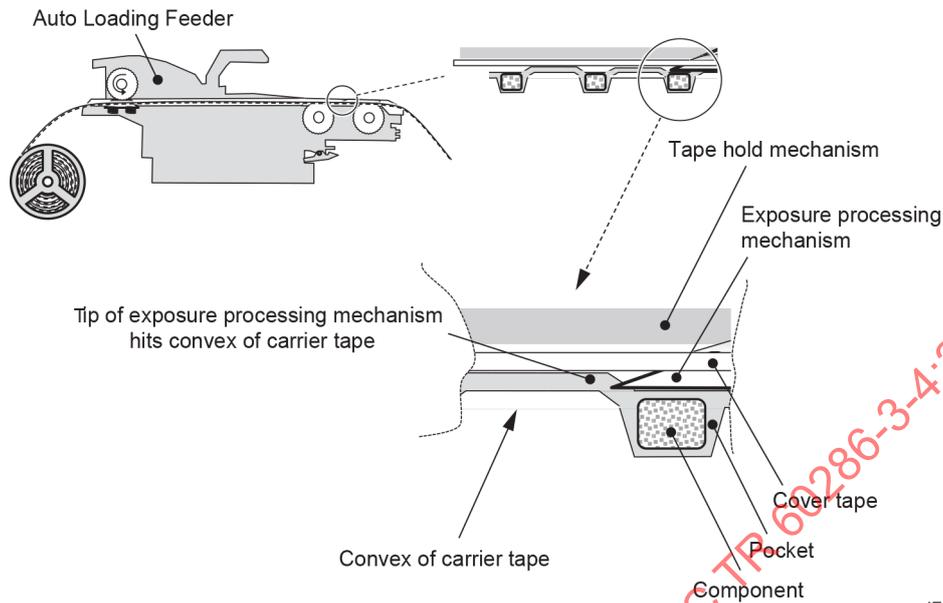


- b) Inserting the top end of the mechanism to peel off and cut is impossible  
(cross-bar has a recess and the cover tape is bent downward)

**Figure 4 – Relationship between the cover tape and the exposure processing mechanism of the pocket**

For the thinner components, the cross-bar section is not often recessed, but rather bent upward to prevent the components from jumping out of the pockets. In this case, as shown in Figure 5, SMD tape with a convex cross-bar section is not applicable for Auto Loading

Feeder, because its convex part collides with the tip of ALF exposure processing mechanism and hinders exposure of the stored component.



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**Figure 5 – Relationship between the exposure processing mechanism of the pocket and convex of carrier tape**

b) Resolved policy

It was decided that the required values shall be described as design values, considering the moulder manufacturers request to show the required values as the numerical indicator to judge whether Auto Loading Feeder can be used. However, these values are described as reference dimensions in brackets, and persons involved should discuss in advance whether Auto Loading Feeder can be used.

c) Justification for the policy:

Project Group for the study of Auto Loading Feeder has realized in their activity the existence of recessed parts in cross-bar sections, but it is not specified nor illustrated in IEC 60286-3. At present, the features of embossed carrier tape with the recessed parts in the cross-bar sections are not enough perceived. It was confirmed that the study will be continued, following the information about taping given by the component manufacturers and the packaging material manufacturers.

**5.7 Necessity of  $K_3$  as the distance between the upper side of the recessed part in a cross-bar section and the top surface of a component**

Necessity of  $K_3$  as the distance between the upper side of the recessed part in a cross-bar section and the top surface of a component was discussed as follows:

a) Background and discussed items for the requirements

$K_3$  was proposed by the moulder manufacturers for the same reason as in 5.5. These values were decided for recessed part through verification of each Auto Loading Feeder.

b) Resolved policy

It is difficult to describe the absolute values at present. These values are described as reference dimensions in brackets in the same way as  $K_2$ , for the recessed part in a cross-bar section, and persons involved should check the values in advance in order to discuss whether Auto Loading Feeder can be used.

c) Justification for the policy

As in the case of dimension  $K_2$  for the recessed part in a cross-bar section, the distance between the upper side of the recessed part in a cross-bar section and the top surface of a component is not specified nor illustrated in IEC 60286-3. It was confirmed that the study of this dimension would continue with the information of taping given by the component manufacturers and the packaging material manufacturers, as well as the study of  $K_2$ .

### 5.8 Sealing method for the cover tape

The sealing method for the cover tape was discussed as follows:

#### a) Background and discussed items for the requirements

The sealing method for the cover tape which can be used for Auto Loading Feeder was focused on. Auto Loading Feeder with the single-door method (see Clause A.2) has the mechanism to peel off the tape at one side sealing and carry the cover tape together with the carrier tape. Therefore, the cover tape with adhesive seal affects adversely carriage of the SMD tape, because the adhesive part of the seal can adhere to the inside of Auto Loading Feeder. For this reason, the mounter manufacturers requested that embossed tapes sealed with the cover tape of adhesive type should be excluded from of the scope. Their request has been discussed.

#### b) Resolved policy

It was decided that only the embossed tapes sealed with cover tape of heat welding type shall be used for Auto Loading Feeder.

#### c) Justification for the policy

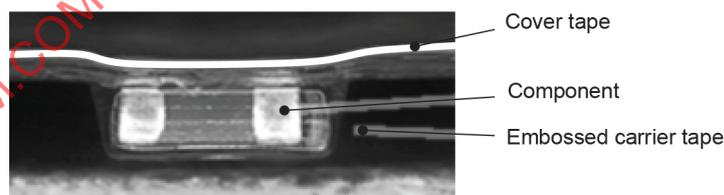
The cover tapes of adhesive type are not applicable for Auto Loading Feeder, because they possibly cause failures in supply, due to the seals adhering to the component exposure mechanism.

### 5.9 Dent of the cover tape over the pockets

A dent of the cover tape over the pockets was discussed as follows:

#### a) Background and discussed items for the requirements

Since a dent of the cover tape over the pockets, including a dent made by winding reels strongly, possibly causes adhesion of components, it was discussed whether the requirement "the cover tape should not have any dent over the pocket" is added or not. An example dent is shown in Figure 6.



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**Figure 6 – Example dent of the cover tape over the pocket**

#### b) Resolved policy

It was decided that such requirement is not specified.

#### c) Justification for the policy

Since such requirement is included in IEC 60286-3 stating that "Component shall not stick to the carrier tape or to the cover tape", it was concluded that the requirement does not need to be described in this document with individual factors.

### 5.10 Lower limit of peel-off strength of the cover tape

The lower limit of peel-off strength of the cover tape was discussed as follows:

a) Background and discussed items for the requirements

Requirements for the lower limit of peel-off strength for Auto Loading Feeder were discussed, because the mounter manufacturers requested to describe limit values applicable for Auto Loading Feeder, in order to prevent seals from peeling away the positions where the seal should not be peeled off, although peel-off strengths of 0,1 N to 1,0 N for the embossed carrier tape with the width: 8 mm are specified in IEC 60286-3.

b) Resolved policy

It was decided that such requirement is not described.

c) Justification for the policy

The lower limit values required for Auto Loading Feeder are not clear and the component manufacturers control different values based on IEC 60286-3 now. Therefore, it is impossible for the component manufacturers to control the specific values individually for Auto Loading Feeder and an opinion was raised that the change of the control values possibly causes unexpected failures.

### 5.11 Adhesion of components on the cover tape

Adhesion of components on the cover tape was discussed as follows:

a) Background and discussed items for the requirements

Adhesion of components on the cover tape possibly causes the adhered components to interfere with the pocket exposure mechanism of Auto Loading Feeder. It was mentioned that static electricity or close stickiness to the cover tape possibly causes the trouble. The mounter manufacturers commented that they will continue to improve Auto Loading Feeder to avoid such trouble and requested the component manufacturers to further improve the quality control to realize "No components are adhered". Therefore, the possible problems were discussed.

b) Resolved policy

It was decided that such requirement is not described.

c) Justification for the policy

Such requirement complies with IEC 60286-3 and it was confirmed that the component manufacturers would keep to design and control quality in order to avoid adhesion of components.

### 5.12 Bottom hole of pockets of the carrier tape

Generally, colored and non-transparent embossed tapes have holes at the bottom of their pockets in order to detect components in the pockets. Holes at the bottom of pockets in the carrier tape were discussed as follows:

a) Background and discussed items for the requirements

Holes at the bottom of pockets in the carrier tape enable to detect presence or absence of the components in the pockets, so that operating rate of Auto Loading Feeder can increase with cueing the tape and early detection of the tail of the tape. Therefore, the mounter manufacturers requested to introduce the requirement "Pockets shall have each bottom hole". That was discussed.

b) Resolved policy

It was decided that such requirement is not described.

c) Justification for the policy

It was reported that carrier tapes with holes at the bottom in the pockets tend to be reduced in the components market, because of possibly affecting the quality of taping. Comments were raised that, for example, it is difficult to maintain the flatness of the bottom surfaces of

the pockets for burrs, etc., and it possibly causes contamination. Therefore, such requirement was decided not to be specified.

### 5.13 Maximum trailer length

The maximum trailer length was discussed as follows:

#### a) Background and discussed items for the requirements

IEC 60286-3 states “Trailer length is the tape part sealed with the cover tape of the length with 160 mm or more without containing components”, but does not specify any upper limit value. Auto Loading Feeder detects the tail end of the tape and exchanges the tape in use for the tape for re-supply by itself, but cannot detect the tail end of the tape with the trailer length over 300 mm due to the mechanism of Auto Loading Feeder, that can make errors in picking up at empty pockets that do not contain components. Therefore, the mounter manufacturers requested to introduce the requirement “Trailer length shall be 300 mm or less”. That was discussed.

#### b) Resolved policy

It was decided to introduce the requirement “Trailer length should be 300 mm or less” for the value proposed by the mounter manufacturers in order to realize the advantage of Auto Loading Feeder.

#### c) Justification for the policy

Although the component manufacturers commented that they control the operation with the minimum length 160 mm or more, defining no maximum length, and the trailer length can be 500 mm due to the factory issues, it was decided to specify the values recommended by the mounter manufacturers so that the operating rate can improve by detecting the tail end of the tape.

### 5.14 Fixing the tail end of the carrier tape

Fixing the tail end of the carrier tape was discussed as follows:

#### a) Background and discussed items for the requirements

If the tail end of the tape cannot be released from the reel hub, Auto Loading Feeder pulls the reel in and stops operating due to the overload and then the tape in use cannot be exchanged for the tape for re-supply. Therefore, the mounter manufacturers requested to propose the requirement to control so that “The tail end of the tape can be released easily from the reel (e.g. an empty reel can be removed by its weight)”. That was discussed.

#### b) Resolved policy

It was decided that such requirement is not described.

#### c) Justification for the policy

IEC 60286-3 states “The carrier tape shall be released from the reel hub as the last portion of the carrier tape unwinds from the reel”, meaning “not fixed, not taped with adhesive tape and releasable”. It was concluded that the mounter manufacturers proposal “easily releasable, and releasable by its own weight”, which is the new expression of requirement, needs other specifications of the control values and the evaluation methods.

## 6 Summary of the discussions: considered requirements and dimensions for emboss taping for Auto Loading Feeder

### 6.1 General

The discussion and its outcomes described in Clause 5 are summarized as follows.

For emboss taping for Auto Loading Feeder some requirements as described in 6.2 to 6.5 are needed in addition to the specifications about 2 mm or 4 mm pitch of the pockets of the embossed carrier tape, with single round sprocket holes, with tape pitches of 2 mm or more (nominal tape width: 8 mm only) among the tapes of Type 2a in IEC 60286-3.

## 6.2 Required dimensions for the cover tape sealed positions

The cover tape sealed positions shall be in the range of  $M_1$  and  $M_2$ . See Figure 1 and Table 2 for details.

## 6.3 Required dimensions for the distance between the upper side of the carrier tape and the top surface of a component

The distance between the upper side of the carrier tape and the top surface of a component shall be in the range of  $K_1$ . See Figure 1 and Table 3 for details.

## 6.4 Required specifications for the sealing method of the cover tape

Only the cover tape sealed by heat welding is supposed to be used for Auto Loading Feeder.

## 6.5 Required specifications for maximum trailer length

Trailer length should be 300 mm or less, see Figure 7.

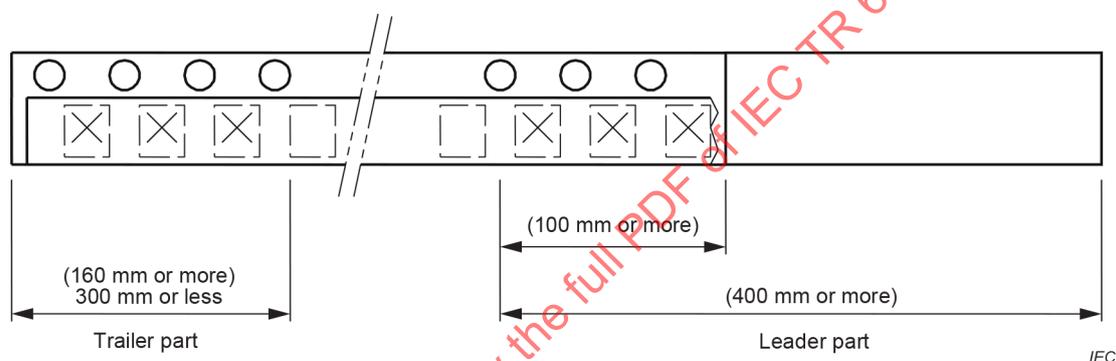


Figure 7 – Leader part and trailer part

## 7 Possible problems for emboss taping for Auto Loading Feeder

### 7.1 General

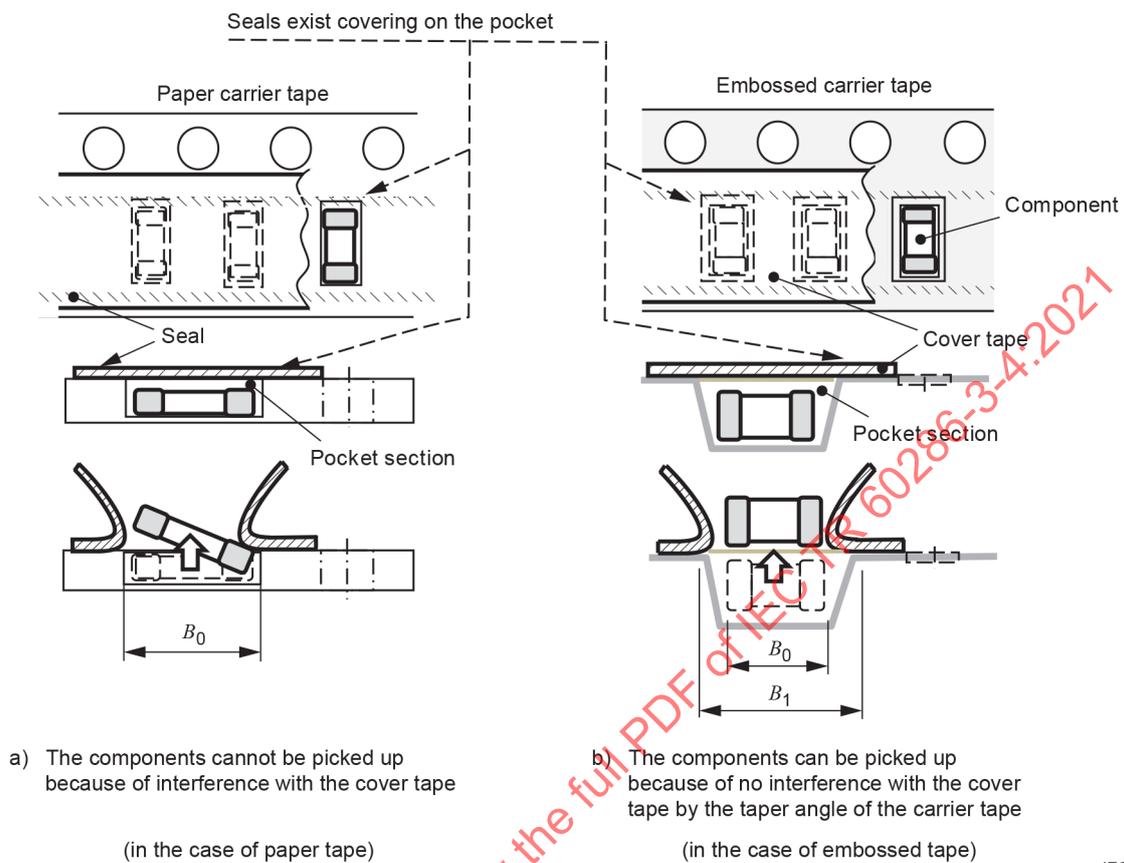
Possible problems for emboss taping for Auto Loading Feeder are listed as follows. See 5.2 to 5.14 for the details of the background of each item:

- The relationship between sealed positions of the cover tape and openings of the pockets (see 7.2);
- The recessed part in a cross-bar section (see 7.3);
- Dot seals (see 7.4);
- Thickness of embossed carrier tape (see 7.5);
- The relationship between Auto Loading Feeder and warps of the tape specified in IEC 60286-3 (see 7.6).

### 7.2 Relationship between sealed positions of the cover tape and openings of the pockets

For some types of large components there are tapes whose seal reaches the inside of the pockets in order to ensure the seal strength. In this case, mostly such tape can prevent Auto Loading Feeder from exposing pockets in the tape, but the problem would not occur depending

on the taper angle in the depth of the pocket. Therefore, the relationship between  $B_0$ ,  $B_1$  and the taper angle should be studied in the future. See Figure 8.



**Figure 8 – Dimension  $B_1$  and sealed positions**

### 7.3 Recessed part in a cross-bar section

The causes of recessed parts in cross-bar sections are listed as follows:

- In the case that a packaging material manufacturer adopts the production methods suitable for mass-production, the recessed parts in cross-bar sections can be often generated unexpectedly.
- In the case that a packaging material manufacturer adopts the production methods to control recessed parts in cross-bar sections, its production efficiency decreases to cause higher cost.
- It is impossible to form pockets for components with large thickness, unless recessed parts in the cross-bar sections are generated.

Recessed parts in cross-bar sections are always generated and it is hard to control the precise dimensions on the production of embossed carrier tapes. Therefore, it is required to develop improved methods for Auto Loading Feeder, in order to expand the tolerance of  $K_2$  as the dimension of the recessed part.

### 7.4 Dot seals

For some types of thin components there are SMD tapes that have dot seals on cross-bar sections, as shown in Figure 9, so that the components do not move between the pockets when the tape is pulled out or wound in. In many cases such tapes cannot be used for Auto Loading

Feeder. They, however, can be used if the tapes have their dot seal positions specified. It is required to develop methods to specify the dot seal positions and to judge whether they can be used for Auto Loading Feeder.

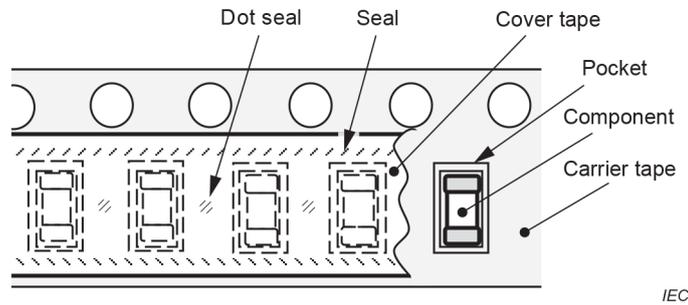
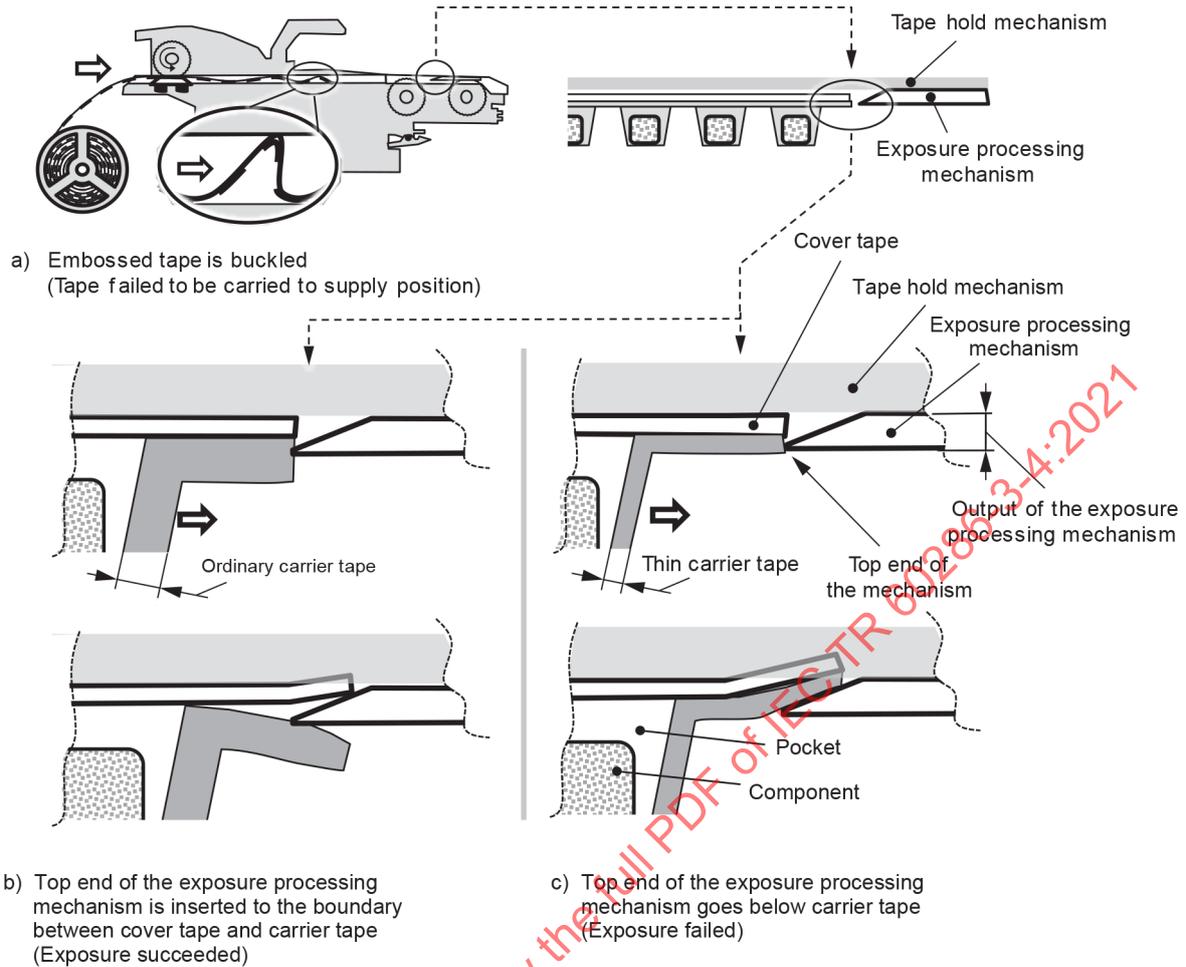


Figure 9 – Example of dot seal

### 7.5 Thickness of embossed carrier tape

Embossed carrier tapes have gotten thinner due to the saving of materials in recent years. If the tapes are getting thinner, insufficient strength of tape possibly causes the tapes to be buckled when the SMD tape is being fed and the components are exposed. Additionally, in some cases, the top end of the exposure processing mechanism cannot be inserted to the boundary between the cover tape and the carrier tape when the carrier tape hits the output of the exposure processing mechanism part toward the pockets, then it is necessary to examine the minimum tape thickness, as shown in Figure 10.

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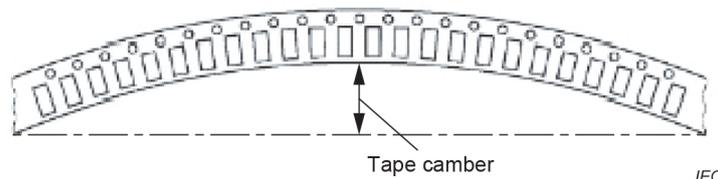


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**Figure 10 – Relationship between embossed carrier tape thickness and component exposure process**

**7.6 Relationship between Auto Loading Feeder and tape camber specified in IEC 60286-3**

Currently, IEC 60286-3 is being revised. However, if the embossed carrier tape cambers largely as shown in Figure 11, it is necessary to judge whether it can be applied for Auto Loading Feeder, because it possibly affects how to carry and expose the components.



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**Figure 11 – Tape camber (top view)**

## Annex A (informative)

### Methods and mechanisms of automatically exposing pockets in using Auto Loading Feeder

#### A.1 General

The methods and mechanisms of automatically exposing pockets in using Auto Loading Feeder are classified with some explanation as follows, but they are not specified as requirements. If any of the following methods is applied to Auto Loading Feeder, attention is drawn to the industrial property rights:

- a) Single-door method with which only one sealed side on the cover tape is peeled off to expose pockets (see Clause A.2);
- b) Double-door method with which the cover tape is cut in its centre to expose pockets (see Clause A.3).

#### A.2 Single-door method

The overview of the single-door method with which only one sealed side of the cover tape is peeled off to expose the pockets is shown in Figure A.1.

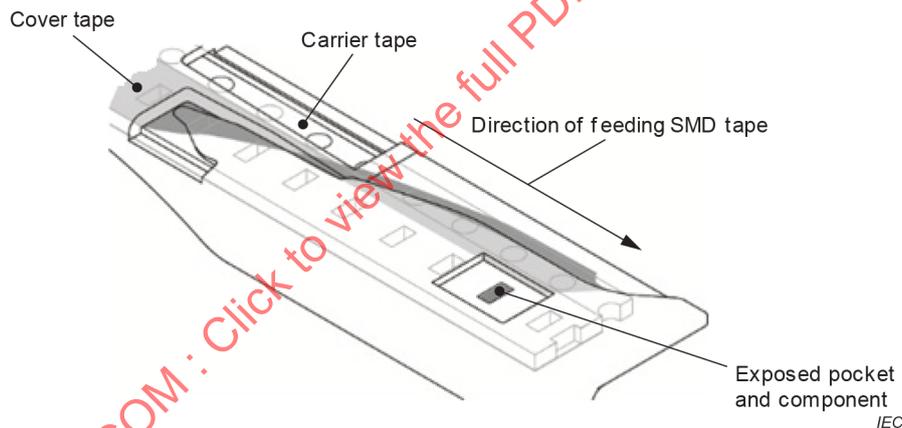


Figure A.1 – Overview of the single-door method

#### A.3 Double-door method

The overview of the double-door method with which the cover tape is cut in its centre to expose the pockets is shown in Figure A.2.