ARTICLE NUMBERING, AND SYMBOL MARKING

KIT FOR THE PREPARATION OF NATIONAL GUIDELINES

3 326451 738857

Rue de la Chancellerie 14 - 1000 Bruxelles

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CHAPTER I

INTRODUCTION, AND GENERAL PRESENTATION OF THE DOCUMENT

1.1. GENERAL PURPOSE OF THIS GUIDE

This document furnishes all the basic technical information needed by all those involved in any way whatsoever in the application of EAN item-coding structures.

- Manufacturers will find in it the necessary instructions for coding their products and marking them at the source.
- Retailers will find here described the various coding and marking formulas which they may encounter or may use to answer their own needs.
- Finally, members of the various professions which take part in the marking operation by furnishing supplies or services (printers, film manufacturers, manufacturers of scanning or marking equipment, ...) will find in the document the basic information they need.

1.2.- AT WHAT LEVELS DO THESE REQUIREMENTS APPLY ? AT WHAT LEVELS MUST THEY BE FOLLOWED ?

Every firm which decides to engage in the marking operation must comply strictly with these requirements ; they constitute an international standard, with the exception of the following paragraphs :

- Paragraphs 4.2.3., 4.3.3. and 4.7.3., which deal with the EAN standard gauge, may be considered as presenting an optional international standard, since certain national authorities may substitute another gauge for this standard EAN gauge.

- Paragraphs 4.2.4., 4.3.4. and 4.7.4., which deal with the gauge developed by your national coding authority (a gauge which must, of course, comply with the international standards explained in paragraphs 4.2.2., 4.3.2. and 4.7.2.), may be considered as presenting an optional national standard, since printers or manufacturers may substitute another gauge (which, of course, must also comply with international standards) for this one.

- Paragraphs 2.3. and 2.4. (and possibly 5.3.), which deal with the rules adopted by your national authority for coding items (and coupons), may be considered as presenting a national standard (these rules must of course comply with the international standards explained in paragraphs 2.1., 2.2., and 5.2.).

- Paragraph 6.2.1., which concerns the formula for in-store marking with code plus price, may (as regards the part that precisely stipulates the coding structure for code plus price) be considered as presenting an optional national standard ; a retailer is of course free to choose, for in-store marking, a different coding structure from the one proposed by his national authority.

- Any firm that respects international or national standards, optional or binding, may of course refer to these standards, as such, in dealing with other persons or firms concerned (in particular, with equipment suppliers).

- Any firm which, in addition, defines requirements that are not included in these standards must consider that these additional requirements are to be applied in the direct and specific dealings which the firm may have with other persons or firms (in particular, equipment suppliers) involved in the application of these requirements (this particularly concerns retailers when they make their choices as regards in-store marking and velocity codes).

1.3.- WHO IS RESPONSIBLE FOR DEFINING THESE REQUIREMENTS ?
WHO IS RESPONSIBLE FOR SEEING THAT THEY ARE FOLLOWED ?

- EAN is responsible for defining the parts of these requirements which are, as explained above, considered to be international standards, optional or not.

  In addition, EAN is responsible for ensuring the compatibility and proper harmonization, within the overall system, of the definitions given by national authorities to the parts of these requirements which are, as explained above, considered to be national standards, optional or not. But each national coding authority is solely responsible for the definition of these national standards, optional or not.

- As for checking on the application of these overall requirements, each national coding authority is solely responsible for this task within its territory.

1.4.- GUARANTEES OFFERED BY THESE REQUIREMENTS TO FIRMS INVOLVED IN MARKING OPERATIONS

- Firms manufacturing equipment (for in-store marking or for scanning, for instance) may go completely by these requirements in drawing up specifications for their equipment.

- Manufacturers who comply with these requirements in source-marking their products may be sure of contributing satisfactorily to the operation, whatever be the territory where these products are distributed.

- Retailers who comply with these regulations, and in particular who use no other flags for in-store marking than those specified for this purpose, may be sure of having a complete and unambiguous system for identifying the items they sell, whatever may be the territory where these items originated or the type of marking used (source-marking or in-store marking).

1.5.- FUTURE DEVELOPMENT OF THESE REQUIREMENTS

These requirements may develop and be supplemented in the future, on the basis of experience acquired in marking and possibly with a view to new fields of application.

These supplementary requirements may take the form of international or national standards, but they will always fit into the framework of international compatibility of the EAN system, to the extent, of course, that they apply, as EAN item source-marking does, to international trade.

1.6.- GENERAL PRESENTATION OF THIS DOCUMENT

- Chapter II presents the principles and rules to be observed in the coding of items for marking at the source.

- Chapter III presents the logical structure and ideal dimensions of the EAN-13 and EAN-8 symbols ; the explanations given in this chapter are valid whatever be the stage at which the symbol is produced (at the source or in the store).

- Chapter IV describes the complete process of working out the symbol when items are marked at the source.

- The result is that chapters II, III and IV together furnish all the information necessary for marking items at the source.

- Chapter V deals with the special case of coupons. Although coupons fall under the particular coding rules specified in Chapter V, they are marked by the same process as items, i.e. the process specified in Chapters III and IV.

- Chapter VI deals with problems which are peculiar to retailers :

  - It furnishes specifications for in-store marking equipment. These specifications refer back to Chapter III, of course, where the logical structure and ideal dimensions of symbols are concerned. However, they do not refer back to Chapter IV, since the process of marking at the source (described in Chapter IV) must be replaced by the setting of standards adapted to this equipment. The latter produces symbols directly, without any intermediary stage. The standards that must be complied with are the tolerances to be respected at the level of the printed symbol. These tolerances are applicable only to the case of in-store marking equipment, and cannot be substituted in any way, in the case of source-marking, for those specified in Chapter IV.

  - It gives the characteristics of the UPC symbols which may be encountered on items imported from the North-American continent. UPC and EAN symbols (and codes) are perfectly compatible.

  - It gives the general rules that must be followed for in-store marking.

- The 18 appendixes to this document have been drawn up in such a way that they contain all the most essential reference information concerning these regulations.

- This DOCUMENT is accompanied by a GLOSSARY which defines all the specific terms used.

1.7.- UTILIZATION OF THIS DOCUMENT

The table below gives the Chapters or paragraphs, and appendixes, of most direct concern to each type of firm or specialist involved in the marking operation.

FIRM OR SPECIALIST	CHAPTERS					APPENDIXES
	II	III	IV	V	VI	
1 PRODUCT MANUFACTURER	X		X	Possibly		0, 1, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17
2 FILM-MASTER MANUFACTURER		X	4.1. 4.2. 4.3. 4.4.			0, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14
3 FILM MASTER CHECKER		X	4.4.			0, 4, 5, 6, 7, 8, 13, 14
4 PACKAGE DESIGNER			4.5. 4.6.			7, 8, 11, 15, 16, 17
5 PRINTER			4.1. 4.2. 4.6. 4.7.			7, 8, 11, 12, 13, 16, 17
6 RETAILER	X			Possibly	X	0, 15, 18
7 MANUFACTURER OF IN-STORE MARKING EQUIPMENT		X			6.2. 6.3.	2, 3, 4, 5, 6, 7, 8, 11, 16, 17, 18
8 MANUFACTURER OF SCANNING EQUIPMENT	2.1. 2.2. 2.5.	X	X	X	X	0, 2 to 18

CHAPTER II

ITEM - CODING FOR MARKING BY THE MANUFACTURER (SOURCE - MARKING)

2.1.- GENERAL CODING STRUCTURE

- Item coding is an exclusively numerical form of coding, which falls into the following general structure :

Flag	Item identification	Check-digit
f1 f2	I1 I2 - - - -	C

Within this structure :

- f1 f2 represents the "flag" (made up of two data characters) which identifies the national coding authority ; each national authority receives one or several f1 f2 flags ; EAN is responsible for assigning these flags.
- Item identification follows the f1 f2 flag, and is made according to rules and procedures defined exclusively by the national coding authority identified by the flag used ; however, these rules must follow certain basic principles, which will be defined in paragraph 2.2.
- The check-digit is calculated according to a single algorithm which will be specified in paragraph 2.5.

- This general structure includes two different versions :

a.- The most generally used version assigns 10 data characters to the "item identification" field ; in this case, the complete item code includes 13 numerical positions ; it will henceforth be referred to as EAN-13.

b.- A short-size version may be used, which assigns 5 data characters to the "item identification" field ; in this case, the complete item code includes 8 numerical positions ; it will henceforth be referred to as EAN-8.

FULL-SIZE VERSION EAN-13	f1	f2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	C
SHORT-SIZE VERSION EAN-8						f1	f2	I1	I2	I3	I4	I5	C

In general, the short-size version is used only for items whose packaging does not include enough available space to permit the EAN-13 symbol to be printed. We shall see later on that, within the limits imposed by printing conditions, the EAN-13 symbol may require only a small surface, which means that, normally, the use of the EAN-8 symbol will be an exceptional case.

However, only the national coding authorities possess the criteria which make it possible to decide whether a given item may possibly be coded (and marked) by using EAN-8.

2.2.- PRINCIPLES AND GENERAL RULES FOR ITEM-CODING UNDER NATIONAL AUTHORITIES

0 Each national authority is solely responsible for defining the precise rules for item-coding, on condition that these rules respect, absolutely, the following six points :

1 An item identified under a national authority, in either the EAN-8 or the EAN-13 version, must have its identification preceded by the f1 f2 flag (or one of the f1 f2 flags) assigned by EAN to this national authority.

2 The item to be identified is the consumer unit, in other words, the unit in which items are regularly presented to consumers at sales outlets and hence the unit in which customers purchase them. Any change in the way the item is presented (size, color, packaging) changes its identification. A product sold in batches must be considered to be a different item from the same basic product sold piece by piece, and must therefore be identified differently. Every item defined in this way must receive one identification and only one.

3 Item identification must necessarily be numerical, and must fit into the format of the international structure (EAN-8 or EAN-13) defined above.

4 The two item identification sequences, EAN-8 and EAN-13, must be considered independent.

5 The coding rules applied by national authorities must make it possible to guarantee that, in each of the two sequences (EAN-8 and EAN-13), two different items will necessarily receive two different numbers.

6 When a coded item disappears, the number by which it was identified cannot be used again until three years after its disappearance.

CHIEF IMPLICATIONS OF THESE PRINCIPLES AND GENERAL RULES

- For manufacturers : the coding structure thus defined is international, which means that it may be applied to products regardless of the territories in which they are distributed.

- For retailers : the coding structure thus defined is completely unambiguous, which means that it always permits two items, whatever their origins, to be distinguished without any possibility of error.

- Note to retailers : in scanning-equipment files, EAN-8 codes are set on the right and completed on the left by zeros to make up a total of 13 positions, so that it may be considered that item codes always have 13 numerical positions. Within the framework of this 13-position structure, no ambiguity can arise between an EAN-13 code and an EAN-8 code.

2.3.- RULES ADOPTED BY THE NATIONAL AUTHORITY FOR CODING ITEMS IN EAN-13

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

2.4.- RULES ADOPTED BY THE NATIONAL AUTHORITY FOR CODING ITEMS IN EAN-8

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

2.5.- ALGORITHM FOR CALCULATING THE CHECK-DIGIT

This algorithm is identical for the EAN-13 and EAN-8 versions.

Important : Digit positions are numbered from right to left in this algorithm (the check-digit is in the first position ; the f1 flag is in the 13th position in EAN-13 and the 8th position in EAN-8).

STEP 1 : Starting from position 2 of the code, add up the values of the digits in even-numbered positions.

STEP 2 : Multiply by 3 the result of step 1 above.

STEP 3 : Starting from position 3 of the code, add up the values of the digits in odd-numbered positions.

STEP 4 : Add up the results of steps 2 and 3.

STEP 5 : The check-digit is the smallest number which, added to the results obtained through step 4, gives a number that is a multiple of 10.

EXAMPLE OF APPLICATION TO EAN-13

	FLAGS		ITEM IDENTIFICATION FIELD										C
DIGIT POSITION	13	12	11	10	9	8	7	6	5	4	3	2	1
EXAMPLE OF CODE	4	2	7	6	2	2	1	3	5	7	4	6	9
EVEN POSITIONS	☒	2	+	6	+	2	+	3	+	7	+	6	= 26 x 3 = 78
ODD POSITIONS	4	+	7	+	2	+	1	+	5	+	4	☒	

STEP 1

STEP 2

STEP 3

78
+
23

STEP 4 → 101

STEP 5 → 110 - 101 = 9

EXAMPLE OF APPLICATION TO EAN-8

	FLAGS		ITEM IDENTIFICATION FIELD										C
DIGIT POSITION	13	12	11	10	9	8	7	6	5	4	3	2	1
EXAMPLE OF CODE	0	0	0	0	0	3	7	1	4	2	7	4	2
EVEN POSITIONS	☒	0	+	0	+	3	+	1	+	2	+	4	= 10 x 3 = 30
ODD POSITIONS	0	+	0	+	0	+	7	+	4	+	7	☒	

STEP 1

STEP 2

STEP 3

30
+
18

STEP 4 → 48

STEP 5 → 50 - 48 = 2

<u>Note to retailers :</u>

This algorithm includes the UPC algorithm for calculating the check-digit and is therefore perfectly compatible with UPC at the scanning-equipment level.

2.6.- TO SUM UP : WHAT SHOULD A MANUFACTURER DO IF HE WISHES TO IDENTIFY HIS PRODUCTS SO THAT THEY CAN BE MARKED AT THE SOURCE ?

1. Get in touch with his national coding authority in order to obtain the technical information furnished here.

2. Find out from his national authority which f1 f2 flag should be used. (See appendix 1 : flags assigned to national authorities).

3. In consultation with his national authorities, define those items which might possibly be coded by using the EAN-8 symbol.

4. Identify his products in accordance with the rules specified under paragraphs 2.3. and 2.4. by his national authority.

5. Calculate the check-digit for each item number by using the algorithm specified in paragraph 2.5.

6. The result will be that each item will be identified by either an EAN-13 or an EAN-8 symbol.

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CHAPTER III

REPRESENTING A CODE BY A SYMBOL: LOGICAL STUCTURE AND IDEAL DIMENSIONS OF THE EAN-13 AND EAN-8 SYMBOLS

3.1.- GENERAL INFORMATION

- EAN symbols are bar symbols in which each character (1) is represented by a particular combination of light and dark modules. These symbols are grouped symmetrically around a center bar pattern, and bounded at each extremity by a guard bar pattern.

  Under paragraph 3.2., we shall see how these combinations of modules, which carry machine-readable information, are associated with an EAN-13 or EAN-8 code.

- EAN-13 and EAN-8 symbols vary in size ; their dimensions (height and width) may vary from 0,8 to 2 times the basic dimensions, which we shall call nominal dimensions. This coefficient, varying from 0,8 to 2, which we call the magnification factor, permits the dimensions of the printed symbol to be adopted to normal printing conditions : the more favorable the printing conditions, the smaller the printed symbol can be. Later, in Chapter IV, we shall study the methods that permit the technical conditions under which the symbol is used to be adapted to normal printing conditions. In paragraph 3.3. of this chapter, we shall present the ideal dimensions (or theoretical dimensions) of the various characters and symbols in nominal dimensions. In addition, we shall see in this paragraph :

  - how each EAN-13 or EAN-8 bar-symbol is associated with its human-readable translation
  - how the symbol must be "protected" by a surrounding light zone or light margin area, which is free of all printing and bounded by "corner marks".

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(1) Except, as we shall see, the f1 flag of the EAN-13 symbol, which is not explicitly coded but is "induced" - i.e. is determined - by the coding of the six following characters.

3.2.- LOGICAL STRUCTURE OF THE EAN-13 AND EAN-8 SYMBOLS

IMPORTANT NOTE : In this Chapter, as in the preceding Chapter and those that follow, the characters are numbered from right to left (1 to 13 in the case of EAN-13, 1 to 8 in the case of EAN-8 ; the first character is therefore the check-digit).

3.2.1.- CODING OF EACH OF THE TYPES OF CHARACTERS USED IN THE EAN-13 AND EAN-8 SYMBOLS

3.2.1.1.- DIFFERENT TYPES OF CHARACTERS USED

As already stated, the symbols are made up of :

- the coded representation of the various data characters (1)
- the coded representation of what we shall call the auxiliary characters : the center bar pattern and the guard bar patterns.

It should be noted that both these types of characters are combinations of the same basic unit, which we shall call the module : each data character has 7 modules ; each of the guard patterns has 3 ; and the center pattern has 5.

3.2.1.2.- CODING OF THE DATA CHARACTERS

The data characters are coded through the use of three number sets, called A, B and C, as follows :

VALUE OF CHARACTER	REPRESENTATION IN SET A	REPRESENTATION IN SET B	REPRESENTATION IN SET C
0	0 0 0 1 1 0 1	0 1 0 0 1 1 1	1 1 1 0 0 1 0
1	0 0 1 1 0 0 1	0 1 1 0 0 1 1	1 1 0 0 1 1 0
2	0 0 1 0 0 1 1	0 0 1 1 0 1 1	1 1 0 1 1 0 0
3	0 1 1 1 1 0 1	0 1 0 0 0 0 1	1 0 0 0 0 1 0
4	0 1 0 0 0 1 1	0 0 1 1 1 0 1	1 0 1 1 1 0 0
5	0 1 1 0 0 0 1	0 1 1 1 0 0 1	1 0 0 1 1 1 0
6	0 1 0 1 1 1 1	0 0 0 0 1 0 1	1 0 1 0 0 0 0
7	0 1 1 1 0 1 1	0 0 1 0 0 0 1	1 0 0 0 1 0 0
8	0 1 1 0 1 1 1	0 0 0 1 0 0 1	1 0 0 1 0 0 0
9	0 0 0 1 0 1 1	0 0 1 0 1 1 1	1 1 1 0 1 0 0

Note : In paragraphs 3.2.2. and 3.2.3. we shall see in what cases each number set is used.

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(1) With the exception, as already noted, of the f1 flag of the EAN-13 symbol, which is not explicitly coded.

In the preceding table, the figure 1 corresponds to a dark module and the figure 0 to a light module. Henceforth, we shall call any continuous succession of dark modules (= 1) a bar, and any continuous succession of light modules (= 0) a space.

We may make the following comments :

- In every case, the coded form of a character includes two dark bars, whose width and location vary according to the character.
- Number sets A and B always begin with a space and always end with a bar.
- Number set C, on the contrary, always begins with a bar and always ends with a space.
- Number set A always has an odd number of dark modules, whereas sets B and C always have an even number of dark modules ; this is why we say that set A represents odd-parity coding and sets B and C even-parity coding.

Appendix 2 shows how each data character is coded in each number set.

3.2.1.3.- CODING OF THE AUXILIARY CHARACTERS

The auxiliary characters are coded in the following manner (1 = a dark module ; 0 = a light module).

AUXILIARY CHARACTER	NUMBER OF MODULES	CODED REPRESENTATION
GUARD PATTERN	3	101
CENTER PATTERN	5	01010

Appendix 3 illustrates the coding of these characters.

3.2.2.- LOGICAL STRUCTURE OF THE EAN-13 SYMBOL (See diagram in Appendix 4)

The EAN-13 symbol is made up of the following sequence, described from right to left :

1 A guard pattern

2 6 data characters coded according to number set C (characters numbered from 1 to 6), which make up the "right half" of the symbol.

3 A center pattern

4 6 data characters coded according to number set <u>A or B</u> (characters numbered from 7 to 12), which make up the "left half" of the symbol.

5 A guard pattern

It will have been noted that :

- The 13th character (fl flag) is not coded.
- The characters in the left half of the symbol may be coded according to either of two different number sets (A or B).

<u>The value of the 13th character is associated</u> with a given combination of coding (by number set A or B) of characters 7 to 12 in the left half of the symbol.

VALUE OF THE 13th CHARACTER	NUMBER SETS USED FOR CODING <u>CHARACTERS</u> 7 TO 12					
	12	11	10	9	8	7
0	A	A	A	A	A	A
1	A	A	B	A	B	B
2	A	A	B	B	A	B
3	A	A	B	B	B	A
4	A	B	A	A	B	B
5	A	B	B	A	A	B
6	A	B	B	B	A	A
7	A	B	A	B	A	B
8	A	B	A	B	B	A
9	A	B	B	A	B	A

<u>Example</u> : The EAN-13 symbol for : 4014561780123 is coded in the following manner :

CHARACTER CODED BY		GUARD PATTERN	A	B	A	A	B	B	CENTER PATTERN	C	C	C	C	C	C	GUARD PATTERN
VALUE OF DATA CHARACTER	4		0	1	4	5	6	1		7	8	0	1	2	3	

Value of induced character

Combination of number sets used

Check-digit

According to preceding table

Comment

If, in the light of this structure of the EAN-13 symbol, we re-examine the comments made in paragraph 3.2.1.2., we shall note an essential fact : if we look at any two adjacent characters, whether both are data characters or one is a data character and the other an auxiliary character, we shall find that the last module of the left-hand character is always different from the first module of the right-hand character. If one is light, the other is dark.

This means that the boundary between two characters can always be visually distinguished. This is indispensable for decoding ; the point will be taken up again under paragraph 3.3., which specifies the ideal dimensions of symbols and characters.

3.2.3.- LOGICAL STRUCTURE OF THE EAN-8 SYMBOL (See diagram in Appendix 5)

The EAN-8 symbol is made up of the following sequence, described from right to left :

$\boxed{1}$ A guard pattern

$\boxed{2}$ 4 data characters coded according to number set C (characters numbered from 1 to 4), which make up the "right half" of the symbol.

$\boxed{3}$ A center pattern

$\boxed{4}$ 4 data characters coded according to number set A (characters numbered from 5 to 8), which make up the "left half" of the symbol.

$\boxed{5}$ A guard pattern

Comment :

See comment at the end of paragraph 3.2.2.

Example :

The EAN-8 symbol for : 40153476 is coded in the following manner :

CHARACTER CODED BY	GUARD PATTERN	A	A	A	A	CENTER PATTERN	C	C	C	C	GUARD PATTERN
VALUE OF DATA CHARACTER		4	0	1	5		3	4	7	6	

Check-digit

3.3.- COMPLETE DESCRIPTION AND IDEAL DIMENSIONS OF THE EAN-13 AND EAN-8 SYMBOLS

3.3.1.- GENERALITIES

- We have already described (in paragraph 3.2.) the logical structure of the EAN-13 and EAN-8 symbols and their different types of characters. We now propose to stipulate (in paragraph 3.3.2.) the ideal values of the internal dimensions (widths) of these different characters in nominal size.

- The EAN symbols must include their human-readable translation in OCR-B characters ; these are placed directly below the bars, so that there is direct vertical correspondence between each OCR-B character and the seven modules that represent it above. This means that the f1 flag (the 13th character) of the EAN-13 symbol, which is not explicitly coded, is placed outside, and to the left, of the area below the bars.

  The height of the EAN symbols is also an essential factor, even if it does not play a direct part in the logic of decoding the symbols, since omnidirectional scanning of the symbol cannot be properly ensured unless this height has a certain value.

  Finally, it is imperative that each symbol be surrounded by an area free from any printing , in order to make the automatic recognition of the symbol reliable. This light margin area is bounded by corner marks.

  The various dimensions of the symbols, including in particular their height and width, the location of the human-readable translation and the location of the corner marks, will be specified for the EAN-13 and EAN-8 symbols respectively in paragraphs 3.3.3. and 3.3.4.

- It should also be stressed that all the dimensions given in this Chapter are ideal, theoretical dimensions which correspond to the nominal size of the symbols. These dimensions cannot suffice in themselves for any preparation or any checking of symbols ; these aspects of the question will be dealt with in Chapter IV.

3.3.2.- IDEAL DIMENSIONS OF THE DIFFERENT CHARACTERS (NOMINAL SIZE)

The ideal theoretical width of a module is equal to 0,33 mm (in nominal size). This means that the ideal theoretical width of the different types of characters is as follows :

- data character : = 7 modules = 2,31 mm
- auxiliary characters : Center pattern = 5 modules = 1,65 mm
  Guard pattern = 3 modules = 0,99 mm

The dimensions of the characters (whose logical structure is illustrated in appendixes 2 and 3) are given in appendix 6.

We should note that the internal dimensions specified for the characters which have the values of 1, 2, 7 and 8 do not exactly correspond to the multiples of the module (0,33 mm) which one might expect to find. This is not an error ; the differences observed contribute to improving scanning reliability.

In addition, appendix 6 calls for the following comments :

- The width of a character (with the exception of the guard pattern) is always measured between the only visually indicated edge (indicated by a bar) of the character to be measured and the visually indicated edge of the adjacent character. This illustrates the comment made at the end of paragraph 3.2.2.

- The ideal width of a coded data character is always 2,31 mm (1), and is in no way changed by the differences pointed out above where the values 1, 2, 7 and 8 are concerned ; these differences are only internal to the characters.

- As to the guard pattern, appendix 6 specifies its distance from the left and right edges of the coded area (which includes the light margin area) ; this edge is defined by the corner marks. We should note that the distance between the left-hand guard pattern and the left edge is greater for the EAN-13 symbol than for the EAN-8 symbol ; this is explained by the fact that, as we shall see in the following paragraph, the light margin area carries the human-readable translation of the 13th character (f1 flag) of the EAN-13 symbol.

- The notes REF $\boxed{1}$ and REF $\boxed{2}$ which accompany certain dimensions stipulated in appendix 6 will be explained later.

3.3.3.- IDEAL DIMENSIONS OF THE EAN-13 SYMBOL (NOMINAL SIZE)

The ideal dimensions of the EAN-13 symbol are presented in appendix 7.

We may make the following comments :

- The light margin area surrounding the area on which the bars are printed (the printing zone) corresponds to :
  - 7 modules to the right of the symbol
  - 11 modules to the left of the symbol
  - 1 module above the symbol
  - 1 module between the lower edge of the symbol bars and the OCR translation placed below them

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(1) In nominal size

- The center pattern and guard patterns extend down below the lower edge of the bars representing data characters. This difference is equal to 1,65 mm, which corresponds to 5 modules.

3.3.4.- IDEAL DIMENSIONS OF THE EAN-8 SYMBOL (NOMINAL SIZE)

The ideal dimensions of the EAN-8 symbol are presented in appendix 8.

We may make the following comments :

- The light margin area surrounding the area on which the bars are printed corresponds to :
  - 7 modules to the right and left of the symbol
  - 1 module above the symbol
  - 1 module between the lower edge of the symbol bars and the OCR translation placed below them
- The center pattern and guard patterns extend down below the lower edge of the bars representing data characters. This difference is equal to 1,65 mm, which corresponds to 5 modules.

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CHAPTER IV

WORKING OUT A SYMBOL, STAGE BY STAGE

4.1.- THE GENERAL PROCESS OF WORKING OUT SYMBOLS

- To produce a symbol in its final state (the printed symbol) involves going through various stages, each of which contributes to the quality of the result obtained. Hence specifications for working out symbols do not deal with the characteristics of the printed symbol, but with the precise conditions that must be fulfilled, in going from one stage to the next, if one is to be sure of the quality of the finished product.

  Let us look somewhat more closely at this basic principle of specification and the reasons which justify it.

- The two most essential operations in working out a symbol are :

  - The production of a film master representing the symbol
  - The printing of the packaging that includes the symbol, once the film master has been inserted into the plates to be used for printing this packaging.

  Considering that the final objective is to obtain a printed symbol which will have the best chances of being read by scanning equipment, and which will therefore have to respect certain relative tolerances, let us look briefly at these two operations in terms of tolerances.

  - A film master may be made under technical conditions which permit fairly small relative or absolute tolerances to be respected.
  - On the other hand, printing from a plate leads inevitably to ink spread (or print-gain), which varies according to the printing technique, the paper, the ink, and so on, but whose absolute extent, and especially whose absolute variability (comparable to an absolute tolerance) may be very great.

- The coding technique used by EAN was designed to be perfectly adapted to these realities :

- The absolute variability of inkspread is made compatible with the relative tolerances of the symbol by the proper choice of the magnification factor applied to the nominal-size symbol. Thus the printing may be done under absolutely habitual conditions.

- The film master takes the magnification factor into account, and may therefore be made according to tolerances which also correspond perfectly to the constraints which most commonly apply to this type of work.

- The reasons why tolerances are not specified for the finished product are now perfectly clear, as are also the reasons why the assessment of normal printing conditions constitutes a first and basic step. This assessment will be described under paragraph 4.2.

  We shall also see in this paragraph how this assessment permits us to determine, on the one hand, what magnification factor should be applied (in relation to the nominal-size symbol), and, on the other hand, what bar-width reduction may need to be made to compensate for the average inkspread, or print-gain.

- Once these two factors are known (magnification factor and bar-width reduction), it becomes possible to make a film master whose characteristics are adapted to printing conditions. The making of the film master will be described in paragraph 4.3.

- After the film master is made, it must be checked to see that it really meets specifications. This checking of the film will be described in paragraph 4.4.

- Before the film master is inserted into the plate to be used for printing the packaging, the position and orientation of the symbol on the packaging must be determined. This aspect of the problem will be taken up in paragraph 4.5., which deals with the general principles and constraints, but also with the elements of flexibility, involved in placing symbols on packages.

- Before the symbol is printed, a final check must be made to be sure that the materials and inks used respect certain constraints imposed by the scanning equipment. These constraints, which essentially involve color and contrast, will be specified in paragraph 4.6.

- Once the printing of the packages has begun, there is absolutely no further need for the printer to make quality control checks on the symbols themselves ; on the other hand, by using very simple visual means, it is absolutely necessary to make spot checks, periodically, to see that the quality of the printing does not deviate to any marked degree from the normal printing conditions assessed in the first step in the process. (Practically speaking, the aim of this check is to make sure that the quality of the printing does not become worse than the least good quality obtained under normal conditions). The methods and means used for print quality control will be described in paragraph 4.7.

4.2.- ASSESSMENT OF NORMAL PRINTING CONDITIONS

4.2.1.- GENERALITIES

The aims pursued in determining normal printing conditions were explained in paragraph 4.1., where we saw the importance of this operation.

We propose first of all to explain, in paragraph 4.2.2., the theoretical aspects of the measurement of these conditions, as well as their relations with the magnification factor and bar-width reduction to be applied. The process proposed, although of course feasible, nevertheless requires many complex measurements and calculations, which do not make it an efficient operating process. Simple instruments, which printers can use without any special apparatus, should therefore be developed in strict compliance with the norms described in 4.2.2. These instruments are called printing gauges. Once they have been inserted in the printing plates, they permit the printing quality to be determined, precisely, through mere visual examination.

In paragraph 4.2.3., we shall present a gauge which we call the standard EAN gauge (1), which fully corresponds to these objectives and constraints, and whose use therefore seems highly recommendable.

You will find in paragraph 4.2.4. another gauge proposed by your national coding authority, and which serves the same purposes.

4.2.2.- THEORETICAL PROCESS OF ASSESSING NORMAL PRINTING CONDITIONS AND CHARACTERISTICS REQUIRED FOR THE FILM MASTER

(Magnification factor and bar-width reduction)

4.2.2.1.- ASSESSING NORMAL PRINTING CONDITIONS

- If we assume, for example, that on a film master a bar is represented which respects nominal dimensions, and if we assume that the bar is printed on the basis of this film master, then we will find that the printed bar is usually wider than the initial bar on the film master. Many factors contribute to this result : the manufacture of the printing plates, the pressure of the plates on the paper, the capillarity of the ink, the absorption of the ink by the paper, etc...

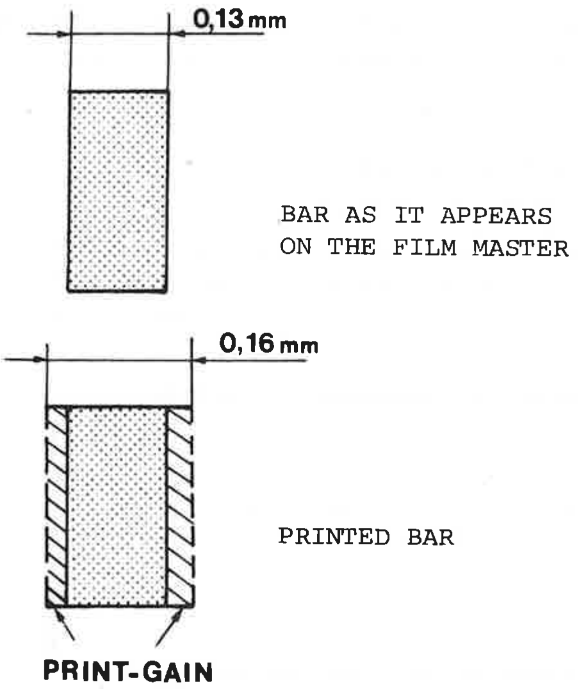
  This difference is what we call the inkspread or print-gain.

  (See diagram on following page)

---

(1) This gauge was developed by UPC in the United States.

EXAMPLE :



THE PRINT-GAIN
IS EQUAL TO :

G =

0,16 mm - 0,13 mm

$\boxed{= 0{,}03\ \text{mm}}$

The aim of assessing normal printing conditions is to measure the print gain and its variations.

- This measurement should be made under the following conditions :

  a.- The test may be carried out by using either the film master of a symbol or a film which serves as a "gauge". The film used must be integrated into the printing plates (See paragraphs 4.2.3. and 4.2.4.).

  b.- The test must be made using qualities of inks and paper (1). comparable to those which will be used in the real printing of the symbol.

  c.- It should permit the gain to be measured in the two cases :

  - when the bars are parallel to the direction of printing (2)
  - when the bars are perpendicular to the direction of printing (2)

  d.- It should bring into play the normal variations of the factors that have a direct influence on the print-gain (pressure of the plates, variations in the quality of ink and paper, location on the paper, etc...), so as to make sure of properly covering the extreme printing conditions that might be encountered.

---

(1) Color and contrast constraints will be specified in paragraph 4.6.

(2) This will contribute, later, to defining the desirable orientation of the symbol on the package (See paragraph 4.5., which deals with the location of symbols on packages).

- After proper sampling, carried out over sufficiently long print runs, this measurement permits us to define :

THE PRINT-GAIN G AND ITS VARIATION V

This means that, if we started out with a bar of width N at the film master level, we obtain a printed bar whose width is equal to :

$$L = N + G \pm V$$

L	N	G	V
↑	↑	↑	↑
Bar width at the printing level	Width at the film master level	Average increase in width at the printing level	Variation of the increase in width at the printing level

The values of G and V will determine the parameters of the remaining stages in the production of the symbol :

- V permits the determination of the magnification factor M, in other words a coefficient, between 0,8 and 2, which will determine the size of the printed symbol in relation to the nominal-size symbol. (For example, M = 2 means that the printed symbol will have dimensions twice as great as those of the nominal symbol).

- G permits the determination of the reduction in the width of the bars which should be made at the film master level to compensate for the print-gain which will occur at the printing level.

4.2.2.2.- DETERMINATION OF THE MAGNIFICATION FACTOR

As already said, the knowledge of V (Variation of the print-gain) determines the magnification factor which should be applied to the nominal-size symbol.

Two tables will be found in appendix 9 :

- The left-hand table is based on a continuous sequence of values of M.

- The right-hand table is based on a continuous sequence of values of V.

It should be noted, however, that any value of M between 0,8 and 2 may be adopted by interpolation of this table. A graph showing the relationship between V and M will be found in appendix 10.

THE VALUE OF M THUS OBTAINED ON THE BASIS OF V MUST ABSOLUTELY BE CONSIDERED AS A MINIMUM THEORETICAL VALUE

If this minimum value is adopted, the result will be, in practice :

- that there will be no margin of security as regards printing conditions,
- and especially that, when the film master is made (see paragraph 4.3.), the ideal theoretical dimensions of the symbol will have to be respected without any margin of error whatsoever, in other words, with a tolerance of 0, which is of course impossible.

In paragraph 4.3., we shall see how, on the basis of this minimum theoretical value, we can select the magnification factor to be actually adopted so that it will fit the tolerances that can be respected in making the film master.

Important comment :

For reasons of printing techniques and reliability, we must consider that the bar of a symbol cannot have a width less than 0,13 mm on the printing plates. Anticipating on paragraph 4.2.2.3., we may complete the rule for using these tables in the following way :

WE CANNOT ADOPT A MAGNIFICATION FACTOR (M) SUCH THAT A IS LESS THAN 0,13 mm

A is calculated in the following manner :

$$A = (\underset{\substack{\uparrow \\ \text{Nominal bar-width}}}{0{,}33} \times \underset{\substack{\uparrow \\ \text{Magnification} \\ \text{factor}}}{M}) - \underset{\substack{\uparrow \\ \text{Average} \\ \text{Print-gain}}}{G}$$

Note :

Appendix 11 gives the dimensions of modules and complete symbols (as bounded by the corner marks) for various values of the magnification factor.

4.2.2.3.- DETERMINING THE BAR-WIDTH REDUCTION

This reduction, to be made at film master level, should be such as to compensate for the average print-gain G, assessed in paragraph 4.2.2.1.

The value of this bar-width reduction therefore depends on the order in which the operations are carried out :

$\boxed{1}$ Either M is applied first, and the bar-width reduction afterward.

$\boxed{2}$ Or the bar-width reduction is applied first, and M afterward.

The choice should be made in the light of the following technical points :

It may be considered that a bar-width reduction achieved by photographic means (over-exposure of the film) is liable to produce an unsatisfactory result if this bar-width reduction is greater than 0,3 mm.

Consequently :

a.- If the average print-gain G, assessed in paragraph 4.2.2.1., is greater than 0,3 mm, solution $\boxed{2}$ should be preferred (1).

b.- If the average print-gain G is less than 0,3 mm, solution $\boxed{1}$ should be preferred (1).

In both cases $\boxed{1}$ and $\boxed{2}$, the bar-width reduction operation consists of reducing each bar of the symbol symmetrically (on the right and on the left) ; this reduction must be of constant value for all the bars in the symbol, whatever may be the number of modules of each bar. (See paragraph 4.3.)

- In case $\boxed{1}$, the bar-width reduction effected on each bar of the symbol at the level of the reduced or magnified size film master has the exact value of G, as measured in paragraph 4.2.2.1.

- In case $\boxed{2}$, the bar-width reduction effected on each bar of the symbol at the level of the nominal-size film master has the exact value of the result of the following division :

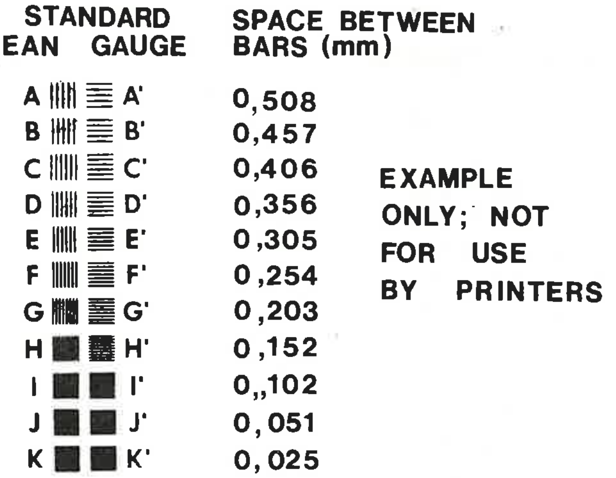
$$\frac{G \text{ (as measured in 4.2.2.1.)}}{M \text{ (as determined in 4.2.2.2.)}}$$

---

(1) In practice, it turns out that solution $\boxed{1}$ can always be applied except in flexography, where solution $\boxed{2}$ should be applied.

4.2.3.- DESCRIPTION AND USE OF THE STANDARD EAN GAUGE FOR ASSESSING PRINTING CONDITIONS

4.2.3.1.- DESCRIPTION OF THE STANDARD EAN GAUGE



EXAMPLE ONLY; NOT FOR USE BY PRINTERS

This gauge, illustrated at left, consists of a very precise screen which is furnished (1) in the form of positive or negative film masters. It is made up of eleven sections, each of which includes two series of parallel lines perpendicular to each other. This makes it possible to judge printing quality in the direction of the presses and perpendicularly to this direction.

The space between the lines ~~in~~decreases gradually and uniformly from one section to the next.The values of the spaces are specified to the right of the gauge but are given as indications only : it is not at all necessary to know the values of these spaces in order to use the gauge.

The widest screen is designated by the letter A, the next by B, and so on down to the finest, which is K.

4.2.3.2.- INSERTION OF THE STANDARD EAN GAUGE INTO THE PRINTING PLATE, AND INTERPRETATION OF THE RESULTS OBTAINED

The gauge is used as furnished, stripped in, emulsion to emulsion, with the final flat used for plate exposure. Any photographic enlargement or reduction of the gauge makes it useless.

Comment :

> For the first assessment of printing conditions, only part of the gauge may be included, provided, of course, that one is sure ahead of time that the printing quality will fall within the sections used (see below).

The observations made on the printed gauge must conform to the principles defined in paragraph 4.2.2.1., in particular :

---

(1) You may obtain these gauges from your national coding authority.

- The qualities of ink and paper used must be comparable to those which will be used for the actual printing of the symbol (1).

- The test run must bring into play the normal variations of all the factors that have a direct influence on the print-gain.

- Sampling must be made over sufficiently long print-runs.

Assuming that we have a sample of the printed gauges, we must interpret each element of this sample in the following way :

- first, we must find the section where the bars begin to touch each other ; we do not take account of ink spots or any other similar type of imperfection that might occur. Where irregular bars are concerned, we consider that two bars touch each other when their contact zone extends over 50 % (or more) of their height. The section of the gauge which corresponds to printing quality may be found simply by using a magnifying glass, or even with the naked eye if one has already acquired the habit of making this type of measurement. Once the section has been identified, the corresponding letter is associated with it : A or B, etc..., or A' or B', etc... depending on the orientation of the symbol, if this has already been decided.

- By analyzing the complete sample of printed gauges, we may find the printability range (for instance, E-G or F-K, etc...).

4.2.3.3.- DEFINING THE MAGNIFICATION FACTOR AND BAR WIDTH REDUCTION

Once we know the printability range, we may directly determine the magnification factor and bar-width reduction to be applied when the film master is made.

- WHEN COMMON PRINTING TECHNIQUES OTHER THAN FLEXOGRAPHY ARE USED

  The left-hand table of appendix 12 shows the magnification factor and bar-width reduction to be applied. Note that the magnification factor must be applied before the bar-width reduction.

---

(1) Color and contrast constraints will be specified in paragraph 4.6.

- WHEN FLEXOGRAPHY IS USED

The right-hand table of appendix 12 shows the bar-width reduction and magnification factor to be applied. In the case of flexography, the bar-width reduction is large, and will be excessive and difficult to make precisely after the film master has been enlarged. This is why the bar-width reduction is made on the nominal-size film master before it is enlarged by the factor decided upon. The data given in appendix 12 naturally take account of this sequence of operations.

- NOTE :

The figures (± -----) given after the value of the bar-width reduction are not tolerances ; they indicate a range within which the bar-width reduction may be freely defined.

4.2.4.- DESCRIPTION AND USE OF THE .... GAUGE

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

4.3.- PRODUCING THE FILM MASTER

4.3.1.- GENERAL DESCRIPTION OF THE PROCESS

- The determination of normal printing conditions (paragraph 4.2.) has permitted us to find :

  - the magnification factor
  - the bar-width reduction

  which should be adopted.

  The film master may now be produced (1). We present below the successive steps in this process. The tolerances to be respected at each step will be specified in paragraphs 4.3.2. and 4.3.3.

- Step 1 : MAKING AN ARTWORK of the symbol (enlarged 10 to 30 times for purposes of convenience). This may be done according to various techniques and on various supports for example :

  - by using a computer-driven drafting machine
  - by using a special assembly kit, in a hard material, provided for the purpose
  - by using an assembly kit made of transparent material for photographing by transparency
  - etc...

  The symbol thus constructed must :

  - of course, represent the EAN-13 and EAN-8 number to be coded

  - in this representation, comply with the logical structure of EAN-13 (see appendix 4) or EAN-8 (see appendix 5)

  - have dimensions which are proportionate in all respects to those stipulated in appendix 6 for the width of the characters, and in appendix 7 (for EAN-13) or appendix 8 (for EAN-8) for the other dimensions, the human-readable translation of the symbol, and the corner marks.

---

(1) We shall see later on how, in the theoretical process of assessing printing conditions (described in 4.2.2.), the definitive (rather than the minimum) magnification factor is determined.

- Step 2 : MAKING THE INITIAL FILM by photographing the artwork

  Case 1 : The bar-width reduction is made before the magnification factor is applied, the initial film is always nominal size.

  Case 2 : In all other cases, this initial film may be either nominal size or definitive size (the size of the symbol after the magnification factor is applied).

- Step 3 : APPLYING BAR-WIDTH REDUCTION (this step is to be taken only in the first case under step 2).

  The bar-width reduction must be applied homogeneously to each of the bars in the nominal-size symbol, whatever may be the number of modules in the bar.

- Step 4 : APPLYING THE MAGNIFICATION FACTOR (this step is to be taken, of course, only if the symbol is not yet in its definitive dimensions) to obtain the modified film.

- Step 5 : APPLYING THE BAR-WIDTH REDUCTION (this step is to be taken only in the second case under step 2)

  As in step 3, the bar-width reduction must be applied homogenously to each of the bars in the symbol, whatever may be the number of modules in the bar. Thus we obtain the film-master.

This process having been described, we must now stipulate the tolerances which must be respected at the level of the initial film (and hence of the artwork) and at the bar-width reduction level.

In connection with the theoretical process of assessing printing conditions, we noted that these tolerances would permit us to define the definitive (rather than the minimum) magnification factor to be applied in the sequence of operations described above. This question will be dealt with in paragraph 4.3.2.

The tolerances to be observed in connection with the use of the standard EAN gauge will be stipulated in paragraph 4.3.3.

Comment :

In practice, the steps described above may be more or less completely integrated. It should be noted in particular that equipment now exists which can produce the film master automatically and directly on the basis of the characteristics which it must have, and the code number to be marked, without going through any intermediate steps.

4.3.2.- WHEN THE THEORETICAL PROCESS IS FOLLOWED IN ASSESSING PRINTING CONDITIONS : DEFINITIVE DETERMINATION OF THE CHARACTERISTICS OF THE FILM MASTER AND THE TOLERANCES TO BE RESPECTED IN PRODUCING IT

- In paragraph 4.2.2.2., we saw how the minimum magnification factor was determined on the basis of the value of the variation in print-gain, which we called V.

- In order for the printed symbol to have exactly the characteristics desired, it is necessary to add to this variation V (which results from the printing phase alone) the variations (i.e., tolerances) which result from the carrying out of two prior operations : the making of the initial film on the one hand and the bar-width reduction on the other.

  - If tl is the absolute tolerance of the initial film, in relation to its ideal dimensions, (this tolerance being reduced to the nominal dimensions of the symbol)

  - If t2 is the absolute tolerance respected in the bar-width reduction operation

  Then these two tolerances result, at the level of the printed symbol, in an absolute tolerance T which has the following value :

  - If the bar-width reduction is made before the magnification factor is applied :

$$\boxed{T = M^{*} \times (tl + t2)}$$

* M = magnification factor

  - If the bar-width reduction is made after the magnification factor is applied :

$$\boxed{T = M^{*} \times tl + t2}$$

* M = magnification factor

  The result is that the total variation in the width of the printed bars with relation to the ideal dimensions is equal to :

Total variation in width of printed bars with relation to ideal dimensions	Print-gain variation	Variation resulting from the tolerances respected in operations prior to printing

$$\boxed{\overset{\downarrow}{V_t} \quad = \quad \overset{\downarrow}{V} \quad + \quad \overset{\downarrow}{T}}$$

In the last analysis, the definitive magnification factor will be determined on the basis of Vt, which results from the addition of V (measured in 4.2.2.) and T (calculated on the basis of the tolerances respected).

The definitive minimum magnification factor which should be applied is the smallest value of M for which the value of V (see appendixes 9 and 10) is higher than or equal to the value of Vt as calculated according to the preceding formula.

Example : The print-gain has been measured and been found equal to 0,147 mm (hence the minimum theoretical value of M = 1,3, according to appendix 9).

The tolerances to be respected are assumed to be the following :

- Initial film : t1 = (±) 0,005 mm
- Bar width reduction (assumed to be made after the magnification factor is applied) : t2 = (±) 0,008 mm

$$T = M \times 0{,}005 + 0{,}008$$

$$Vt = 0{,}147 + M \times 0{,}005 + 0{,}008 = 0{,}155 + M \times 0{,}005$$

If M = 1,35, then V = 0,152, and Vt = 0,162

Hence this value of M is too small

If M = 1,4 , then V = 0,163, and Vt = 0,162

Hence this value of M is satisfactory

- Once the definitive value of M has been determined in this way, the bar-width reduction may be found in all cases :

  - If the bar-width reduction is made before the magnification factor is applied :

$$\boxed{\text{Reduction} = \frac{G}{M} \longleftarrow \text{(average print-gain)}}$$

  - If the bar-width reduction is made after the magnification factor has been applied :

$$\boxed{\text{Reduction} = G \longleftarrow \text{(average print-gain)}}$$

- The tolerances to be respected are those which were used for calculating T and M :

  - Tolerance t1, for the initial film, assumed to be reduced to nominal dimensions
  - Tolerance t2, for the bar-width reduction operation

- The tolerances to be applied to the dimensions other than the internal dimensions of the characters are as follows :

  - for the dimensions marked REF $\boxed{2}$ on appendix 6 :

    Tolerance = $\begin{matrix} +\,0{,}5\ \text{mm} \\ -\,0\ \ \ \ \text{mm} \end{matrix}$ (reduced to nominal dimensions)

  - For all the height dimensions specified in appendixes 7 and 8 :

    Tolerance = ± 0,13 mm (reduced to nominal dimensions)

- Important comment :

  We have now completed the description of the theoretical process of assessing printing conditions and the characteristics of the film master to be used. This theoretical process, which is summarized in appendix 13, cannot of course be considered an efficient operating process : only gauges, such as the standard EAN gauge, are efficient and easy to use. But any gauge that may be developed must necessarily be produced in conformity with this theoretical process, and therefore, in practice, guarantee the same level of quality in the printed symbol as this process does.

4.3.3.- WHEN THE STANDARD EAN GAUGE IS USED : TOLERANCES TO BE RESPECTED IN PRODUCING THE FILM MASTER

- In paragraph 4.2.3. we saw how the standard EAN gauge is used to assess printing conditions.

  Appendix 12 gives the values of the magnification factor and bar-width reduction to be applied within each printability range.

- We should recall that, when flexography is used, the bar-width reduction is made on the initial film (in nominal dimensions), before the magnification factor is applied. When any other printing technique is used, the bar-width reduction is made after the magnification factor has been applied.

- The tolerances to be respected are specified in appendix 14.

4.3.4.- WHEN THE .... GAUGE IS USED : TOLERANCES TO BE RESPECTED IN PRODUCING THE FILM MASTER

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

4.4.- CHECKING THE FILM MASTER

It is indispensable to check the film master before it is used for printing. In particular, the following characteristics should be checked.

- Is the value of the check-digit correct ? (See algorithm in appendix 0)
- Does the code conform to specifications ?
- Do the magnification factor and bar-width reduction conform to specifications ? (normally, these two particulars should be indicated in human-readable language on the film master) ?
- Do the dimensions of the symbol conform to specifications ?

To check on whether the dimensions of the symbol conform to specifications, three steps are necessary, as follows :

Step 1 : CALCULATING THE IDEAL DIMENSIONS OF THE FILM MASTER

Abbreviations : M = Magnification factor
G = Bar-width reduction

SEQUENCE 1 : The magnification factor is applied first, the bar-width reduction afterward

SEQUENCE 2 : The bar-width reduction is applied first (to the nominal-size symbol), the magnification factor afterward

TYPE A DIMENSIONS :

Internal dimensions of the characters (see appendix 6) representing the width of one of the bars, or both bars, of the character.

Example : Coding of 0 in number set A :
Dimensions 0,33 and 1,32

TYPE B DIMENSIONS :

Internal dimensions of the characters (see appendix 6) other than type A dimensions :

Example : Coding of 0 in number set A :
dimension 0,66

TYPE C DIMENSIONS :

Width of a character or other dimensions of the symbol (see appendixes 7 or 8)

Calculations :

TYPE A DIMENSIONS :

If D is the dimension read in appendix 6, then the ideal value of this dimension on the film master is equal to :

- ideal dimension = D x M - G if SEQUENCE 1 is followed
- ideal dimension = (D - G) x M if SEQUENCE 2 is followed

TYPE B or C DIMENSIONS :

If D is the dimension read in appendix 6, then the ideal value of this dimension on the film master is equal to :

- ideal dimension = D x M

Step 2 : MEASURING THE DIMENSIONS OF THE FILM MASTER

All the dimensions calculated in step 1 must be measured.

Step 3 : COMPARING THE DIMENSIONS OF THE FILM MASTER WITH THE IDEAL DIMENSIONS

This comparison permits a check to be made on whether the tolerances have been respected :

- See appendix 13 for the tolerances to be respected in the theoretical process
- See appendix 14 for the tolerances to be respected in the use of the standard EAN gauge

4.5.- LOCATION OF THE SYMBOL ON THE PACKAGING OF SALES UNITS

4.5.1.- PRELIMINARIES

The location (and size) of symbols on packaging is an important problem for many reasons, especially for the two that follow :

- From the retailer's point of view, the location of the symbol has a very great effect on the speed with which items pass through checkstands, and also, in certain cases, even on the reliability of symbol-scanning.

- From the manufacturer's point of view, symbol location must necessarily take account of certain constraints such as package shape, printed or printable areas, printing techniques, etc... in order to avoid excessive additional printing costs and an inordinate blemish on packaging attractiveness.

Symbol location must therefore consider both these aspects of the problem. At times they prove perfectly compatible ; at other times, they are open to compromise so as to allow the interests of all parties to be respected.

We propose to describe in succession :

- the factors which affect checkstand productivity and symbol scanning reliability (paragraph 4.5.2.),
- the constraining or sensitive factors for manufacturers (paragraph 4.5.3.),
- the principles and general rules adopted in order to reach a compromise between the various objectives and the various constraints (paragraph 4.5.4.).

We should stress the fact that, aside from explaining the basic technical constraints, we are only making recommendations here : manufacturers are solely responsible for their choice as regards packaging. However, it is obvious that any manufacturer who adopts item-coding will attempt to ensure that it be usable by retailers under normal circumstances. Consequently, he will abide by the recommendations made to him and will choose and compromise accordingly.

4.5.2.- FACTORS AFFECTING CHECKSTAND PRODUCTIVITY AND SYMBOL SCANNING RELIABILITY

- To begin with, the processing of symbol marked items requires one of the following types of equipment :

  - fixed scanners incorporated within the checkstand surface (1), or
  - fixed lateral reading scanners which are perpendicular to the article displacement area (1), or
  - wand scanners.

  For technical and economic reasons, the first two (and more specifically the first) of these three types of scanners are more sensitive to the choices of symbol location. This, as we shall see, has a bearing on the principles and general rules adopted.

---

(1) Assumes omnidirectional reading of symbols : that is, prior placing of the symbols in relation to the scanner is not normally necessary.

- Checkstand productivity will be improved if the clerk :

  - has fewer reasons to hesitate on symbol location,

  - has fewer movements to make to turn the item over or around from the position in which the customer tends to place it to the correct symbol-reading position.

Therefore, the homogeneity and nature of the rules applied in regard to symbol location are obviously determining factors for such productivity. However, emphasis should be laid on the fact that symbol size may also be a determining factor :

- The size of the available area for symbol printing is sometimes too small to accomodate it, even if the minimum magnification factor corresponding to printing characteristics is applied and/or the short size symbol is used. If will be seen below that further reductions of the top part of the symbol may be envisaged ; it should also be noted that the greater the reduction, the more difficult will be omnidirectional reading, and the greater the chances that the clerk will have to turn the symbol with, of course, a subsequent slowing down of article check-out productivity.

- Symbol reading reliability is directly related to :

  - the curvature of the area carrying the symbol,

  - the distance between the symbol and the scanner, in particular, when the shape of the package and the choice of symbol location preclude the placing of the symbol area directly on the scanner reading surface.

  More specifically, the following constraints must be complied with, in order to ensure normal reading reliability :

  - the curve must be such that, when the center of the symbol is touching the checkstand surface, there will be an angle of not more than 30° between the checkstand surface and the plane tangent to the surface of the package at either extremity of the symbol.

(See figure 1 : next page)

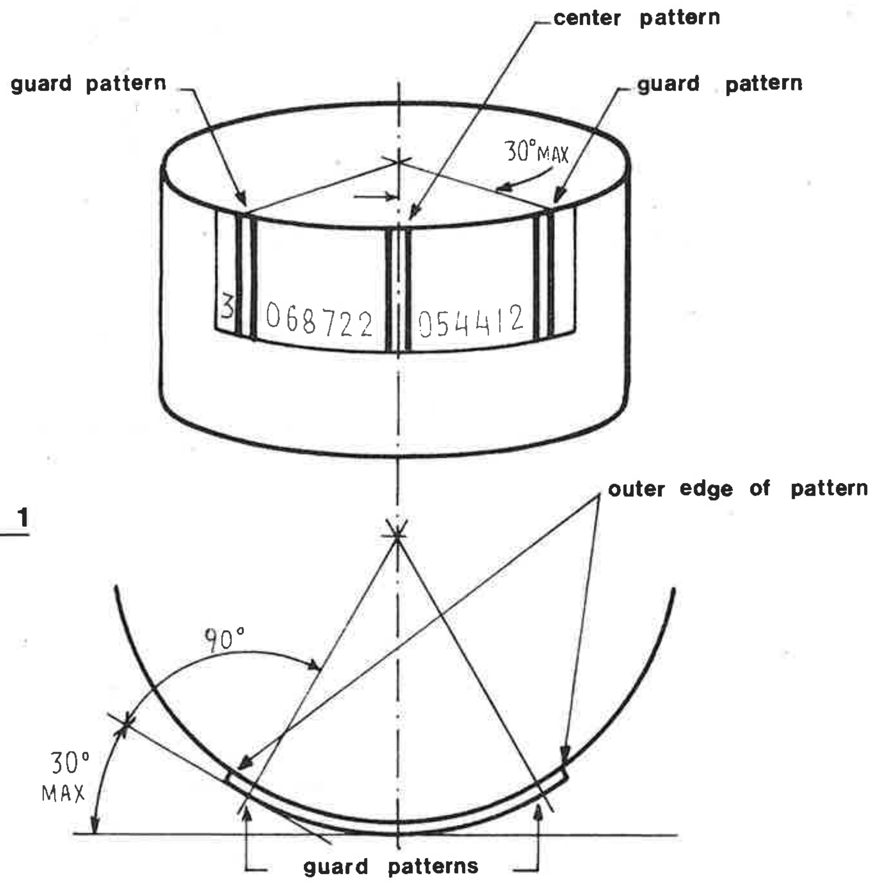


FIGURE 1

- the distance, required by the shape of the package, between the symbol area and the checkstand surface must not exceed 12 mm in order to ensure easy reading.

  (See figure 2 : below)

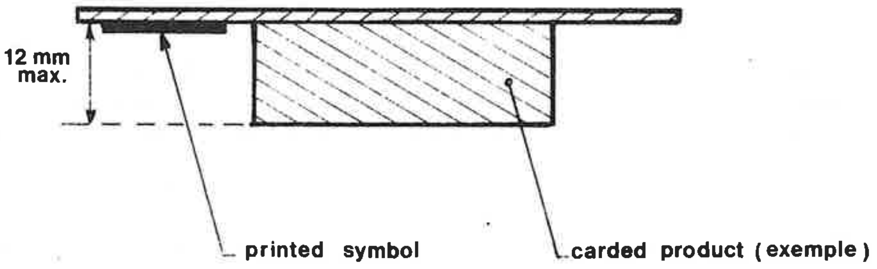


FIGURE 2

4.5.3.- CONSTRAINING OR SENSITIVE SYMBOL LOCATION FACTORS FOR MANUFACTURERS

Cost factors

From an economic viewpoint, symbol printing is normally cheapest when the symbol is placed in areas which already include printed information (whether such areas be on the package itself or on a label).

Specific symbol printing in areas which are printable but which, so far, do not include any information, is generally more expensive.

The addition of a specific label for the symbol is usually so costly that such a solution can be used only in exceptional cases (for source-marking, of course).

Feasibility or esthetic factors

Starting from a symbol of a size consistent with printing requirements (see symbol specification), two kinds of problems are likely to arise, either separately or simultaneously :

- the size of the symbol is too large in relation to the printable area,

- the symbol makes the package particularly unattractive.

Assuming that the size of the symbol is the minimum allowed by printing characteristics (EAN-13 or EAN-8), we shall see below that additional reductions in height may be effected (we have already seen that the more substantial the reductions, the greater the probability that omnidirectional reading capability will be curtailed).

As to symbol location, the placing of the symbol on a face of the package other than the one which might be called "the selling side" is obviously to be preferred from an esthetic viewpoint.

4.5.4.- PRINCIPLES AND GENERAL GUIDELINES FOR SYMBOL LOCATION

The two foregoing paragraphs set forth the symbol location problem as seen from two different points of view : that of the manufacturer and that of the retailer.

The elements of the problem are brought together by presenting general principles and rules to be complied with, and the various options and compromise arrangements which may be adopted at various levels are determined.

A.- Each item must carry only visible symbol, (this applies particularly to multi-packs). It is absolutely essential that any other symbol be concealed.

B.- Whatever face of the package is to be marked, the symbol must be placed as close as possible to the left and to the bottom of such face when looked at in its normal (i.e., readable) position.

C.- The general rule to be applied, whenever feasible, is to print the symbol on the natural bottom of the package. "Natural bottom" means the area of the package resting on the checkstand in the position in which the customer most naturally tends to place the item for checkout purposes.

D.- If rule C) cannot be applied, then, whenever possible, the symbol should be printed on the back of the package. "Back of the package" means the area opposite the main side, i.e. the side on which the most essential information identifying and describing the item to the customer appears, when the package is resting on its natural bottom.

E.- If rules C) and D) cannot be applied, the symbol will be placed on the side of the package.

F.- If rules C), D) and E) cannot be applied, (for instance in the case of packages with only two faces, or with only one printed face, or of which the top of the package constitutes the principal face), then, obviously, the only available face will be used.

G.- If the shape of the package requires some distance between the symbol printing area and the plane of the reading surface, this distance must not exceed 12 mm. (See paragraph 4.5.2. figure 2).If it does, the symbol must be printed on another side of the package (this applies, in particular, to carded items).

H.- If the package shape is not strictly defined, (for instance in the case of flexible bags or small pouches), the symbol will be placed on an area of lesser distortion and, if possible, on the flattest area (See rule I).

I.- If the symbol is printed on a curved surface (as in the case of cylindrical containers, etc...), the direction in which it is turned, especially in relation to the curve of the container, must be chosen with regard to the following factors :

1.- this direction must of course take account of printing requirements ; better quality is usually obtained when the bars are parallel to the direction of printing.

2.- It should be noted, however, that from the point of view of scanning equipment, it is preferable for bars to be perpendicular to the generating lines of the surface of the container (See figure 3, next page).

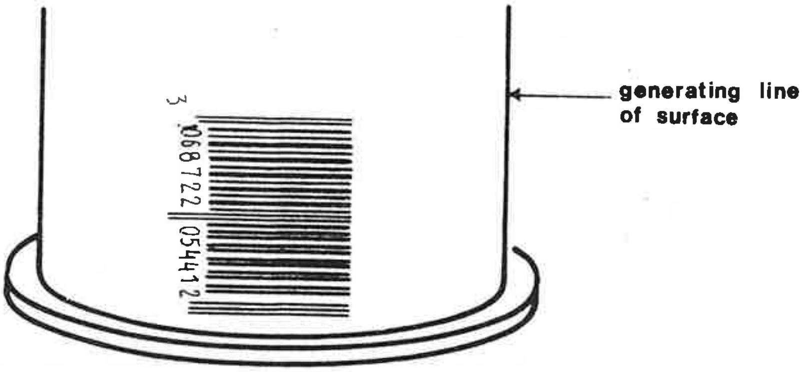


FIGURE 3

3.- If printing conditions do not permit the direction suggested in figure 3, then the symbol may be turned perpendicularly (with the symbol bars parallel to the surface generators), on condition that the constraint described in paragraph 4.5.2. (See figure 1) is respected.

To facilitate interpretation of this constraint, a table is given in appendix 15 which presents the correspondence between the diameter of the container curve and the maximum acceptable magnification factor for the symbol (See appendix 15, table 1).

J.- If the surface of the symbol (EAN-13 or EAN-8) corresponding to normal printing conditions (See appendix 11 : symbol specifications) is too large in relation to the nature and size of the package, various solutions may be adopted. The order in which these solutions are presented below should be considered an absolutely preferential order of choice.

1.- The minimum magnification factor compatible with printing conditions should be adopted.

2.- If the symbol is still too large, a first-step reduction of the height of the symbol may be adopted, by reducing this height from the top. This will be referred to as reduction 1 (See appendix 15, table 2). It should be noted that this reduction in height diminishes the omnidirectional reading capacity of the scanner only to an imperceptible degree.

3.- If this first level of reduction is still insufficient, a further or second level, reduction may be made ; this further reduction, however, has the important disadvantage of not permitting omnidirectional reading, and should therefore be considered only as a last resort (See appendix 15, table 2).

If these various levels or reduction are still insufficient, and if the option to code the item is maintained, then any further reductions should be applied only with the greatest caution, if necessary, consultations should be held between the manufacturer and retailers, and reading tests should be made. It would be absurd indeed for the manufacturer to assume the added costs of affixing symbols which could not be used by retailers.

4.6.- CONSTRAINTS CONCERNING COLORS, CONTRAST AND REFLECTANCE

Operation of the scanners depends on recognition of the contrast between dark and light areas of the symbol. This recognition can be affected by various factors, which are described in this section.

4.6.1.- REFLECTANCE FACTOR AND REFLECTION DENSITY

- The reflectance factor (R) is the ratio of reflected flux Φr to the reference reflected flux Φrs. Reflected flux is the radiant power reflected by the sample and evaluated by a specified kind of receiver. Reference reflected flux is the radiant power reflected by a magnesium oxide or barium sulfate photometric standard (R = 100 %).

Reflexion density (D) is equal to : $D = -\log_{10} R$

The reflexion density required for the dark bars depends on the reflection density of the particular light background being used, in other words, of the light modules in the symbol. Appendixes 16 and 17 show the minimum dark-bar density required for the permissible range of light background density.

All the measurements mentioned in this section 4.6. must be made under the following conditions, and with equipment corresponding to the following specifications :

Geometric conditions for reflection measurements

The incident illumination should be centered at 45° to the normal to the sample and the reflected flux collected by a receiver subtending a solid angle centered on the normal to the sample. The sampling aperture should be a circular area 0,2 mm in diameter.

Spectral conditions for reflection measurements

The sample should be illuminated by light having a spectral power distribution which corresponds to the following specification :
CIE source A, obtained by using a gas-filled, coiled-tungsten filament lamp operating at a correlated color temperature of 2856 K.

The photometric receiver of reflected flux should have a relative spectral sensitivity corresponding to the following specification :

Photomultiplier with an S-4 response as specified by the American Joint Electron Devices Engineering Council, used with a Wratten 26 filter, meeting nominal specifications.

4.6.2.- PRINT CONTRAST

Print contrast (PCS) is defined by the relationship :

$$PCS = \frac{R_L - R_D}{R_L}$$

When R_L is the reflectance factor of the light background (light bars) and R_D is the reflectance factor of the dark bars. Appendixes 16 and 17 indicate the minimum PCS corresponding to the reflection density of the light background.

4.6.3.- COLOR

Any combination of colors that will yield the reflectance and print contrast specified in paragraphs 4.6.1. and 4.6.2. can be used to represent the "dark" bars and "light" background.

As a general guide to color selection, it is the cyan content of a color that yields the "dark" tone when viewed through the Wratten 26 filter ; magenta and yellow correspond to the "light" tone. Inks used in the background area must be of sufficiently low gloss to enable the contrast requirements specified in paragraphs 4.6.1. and 4.6.2. to be met.

4.6.4.- SPECIAL PROBLEMS

- SHOW-THROUGH

In some packages the product or some inside material may show through the light areas to such an extent that the light appears dark to the scanner. Accordingly, in situations with this potential problem, the finished product - not just the outer package - should be subjected to the procedures for measuring contrast given in paragraph 4.6.1.

It has been observed that certain materials reflect light differently according to the dimensions of the bars and spaces. This has been especially evident on transparent and translucent packages where the background (spaces) is not printed.

The EAN symbol contrast specifications should be met when the package is in the form in which it will be sold. Contrast measurements should be made within the parts of the symbols where the bars and spaces are both minimum width : for example : in the center pattern of EAN-13 and EAN-8.

The preferred printing method is to print the background and bars. If this method cannot be followed, it may be possible to meet the contrast specifications by increasing the magnification of the symbol.

- TRANSPARENT WRAPPER

A transparent wrapper over the printed symbol tends to reduce contrast slightly. If a transparent wrapper is used over the printed symbol, the transparent wrapper must be considered to be an integral part of the symbol, and all reflectance measurements must be made with the wrapper over the symbol.

- SPECULARLY REFLECTING MATERIALS

The use of specularly reflecting materials, such as shiny aluminium foil, to directly provide either light or dark areas of the symbol should be avoided. If such material is the substrate for a symbol, the symbol should be formed by overprinting the substrate with two inks of sufficiently different light-absorbing characteristics to meet the print contrast requirements specified in paragraph 4.6.1.

If this condition cannot be met, the spaces should be printed in a light color corresponding to normal specifications and the dark bars should be represented by leaving the substrate bare, or by printing bars with a transparent ink that does not significantly change reflectance. If the dark bars are represented by the bare substrate, it is preferable that the entire symbol surface be varnished. Printing of the symbol in sizes below a magnification factor of 1 is not recommended. It is important that the human-readable translation of the symbol be highly visible.

4.7.- PRINT QUALITY CONTROL

4.7.1.- GENERALITIES

In section 4.2., we saw how normal printing conditions are assessed. In the following section 4.3., we noted the steps involved in producing a film master whose characteristics (magnification factor and bar-width reduction) are adapted to printing conditions.

Once actual printing has begun, no further systematic checking of the symbols themselves is necessary.

The only control necessary consists of making periodic spot checks, especially at the start of the print run, to make sure that the printing conditions which actually apply do not exceed the limits which were assessed in the beginning and which permitted the characteristics of the film master to be determined.

This control is very simple, does not require any special apparatus, and is quite comparable to the usual types of print quality control in jobs which do not include the EAN symbol.

We shall now see what this control consists of and how it can be carried out in practice, in both cases : when the theoretical process is used, and when the EAN gauge is utilized.

4.7.2.- PRINT QUALITY CONTROL WHEN THE THEORITICAL PROCESS IS USED

We have seen that each value of the magnification factor is associated with a maximum variation in the real dimensions of the printed bars (as compared with their ideal dimensions). This maximum variation includes essentially the variation in print-gain, but it also includes the tolerances respected in producing the film-master (making of the initial film, and bar-width reduction).

The aim of print quality control is to make sure that the results obtained in actual printing do not exceed this maximum variation as it was initially determined and as it was used to define the characteristics of the film master.

General example :

Let us consider a film master having the following characteristics :

- magnification factor = M
- bar-width reduction = G

Let us consider any width dimension (of a bar or space) within this symbol.

D_I is the ideal value of this dimension, as calculated on the basis of M, and possibly of G, according to the method stipulated in paragraph 4.4.

D_R is the real value of this dimension, as measured on the printed symbol.

Appendixes 9 and 10 give, for each value of M, the corresponding value of V.

Print quality control consists of checking to find out whether D_R really falls within the range determined by $D_I \pm V$

As thus defined, this type of control seems to justify measurements and calculations. But let us remember that here we are concerned with a theoretical process, and that gauges permit this control to be made without measurements.

We may note, for example, that the guard patterns, which represent a fixed structure of modules (101), are adapted to the use of gauges that can be applied whatever symbol is used (EAN-13 or EAN-8) and whatever code number is expressed by this symbol. For we may assume that the distortions between ideal and real dimensions are homogeneous throughout the symbol, and therefore that the distortions which can be measured in the guard patterns are representative of the overall quality of the work. Here we see the basic principles of simple gauges, which fully answer the requirements of the theoretical process defined.

4.7.3.- PRINT QUALITY CONTROL BY USE OF THE STANDARD EAN GAUGE

When the standard EAN gauge has been used for the initial assessment of normal printing conditions, it is strongly recommended that it be inserted when the packaging is finally printed. This is done in the following way :

- There is no need to include the complete gauge ; all the sections which fall outside the printability range, as originally assessed, are useless for this purpose.

- It is feasible to include only those sections of the gauge that correspond to the extremes of the printability range : for instance, if this range as originally measured was G - I, then only the G and I sections will be printed with the symbol (the bars of the gauge being parallel to those of the symbol).

- If printing conditions are stable, only a single section of the gauge may be kept, for example, the one which corresponds to the average of the printability scale or to its most unfavorable extreme.

- The gauge thus included in the packaging should be located as close as possible to the symbol itself.

If this gauge has been inserted into the plate used for printing the packaging, then print quality control requires nothing more than a periodic examination of the gauge, under a 10 X magnifying glass, for example. The only thing necessary is to check to make sure that the result observed does not exceed the limits observed in the first place.

Comment :

The gauge thus inserted into the printing on packaging may not be used in any way by a third party to take exception to the quality of the printing.

4.7.4.- PRINT QUALITY CONTROL BY USE OF THE .... GAUGE

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

4.8.- TO SUM UP : WHAT ARE THE OPERATIONS TO BE CARRIED OUT IN SOURCE MARKING ?

$\boxed{1}$ Know each item number, and the type of symbol to be used : EAN-13 or EAN-8 (see paragraph 2.6.).

$\boxed{2}$ Assess normal printing conditions, using the standard EAN gauge or a gauge of the same type.

$\boxed{3}$ On the basis of these normal printing conditions, determine the characteristics of the film master to be used :

- magnification factor
- bar-width reduction

$\boxed{4}$ Make a mock-up of the symbol (representing the item number) and the film master for this symbol, which must respect the characteristics given under $\boxed{3}$.

$\boxed{5}$ Check the film master before it is turned over to the printer.

$\boxed{6}$ Insert the film master into the printing plates.

Insert also into these plates the portion of the gauge which corresponds to the printability range.

During the print run, make periodic spot checks, by mere visual examination, to make sure that the printing conditions do not exceed the limits assessed in $\boxed{2}$.

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CHAPTER V

COUPONS : A SPECIAL CASE

5.1.- PRELIMINARIES

- The reduction coupons often furnished with widely used items may in some cases be source-marked by the manufacturer, just as the items themselves are. However, coupons have special characteristics as compared to "normal" items.

  - Coupons are subject to specific national legislation ; some countries prohibit their use.

  - The coding of coupons normally includes the amount of the corresponding reduction ; the number of code positions required to express this amount depends on the currency, and therefore on the national territory, concerned.

  - A given coupon is defined for a given national territory ; outside this territory is must not circulate, and, in particular, it must not be accepted at retailer checkstands.

- Within a given national territory, coupons must not be marked at the source unless the coding authority for this territory has issued the necessary guidelines, at the request of the parties involved at the national level. These solutions must fall within the general framework stipulated here.

- We propose to study in succession :

  - The general structure for coding coupons : What is the general framework within which national authorities may deal with coupons ?

  - The particular solution adopted by your national coding authority, within this general framework, for dealing with coupons.

  - The method for marking coupons.

5.2.- GENERAL STRUCTURE FOR CODING COUPONS

Coupons are coded within the framework of the EAN-13 structure (see paragraph 2.1.) :

Flag	Coupon Identification	Check-digit (1)
f1 f2	I1 I2 - - - - - I10	C

The solutions available follow one of two formulas, between which each national authority will, of course, have to make an exclusive choice.

In all cases, the f1 f2 flags used for coding coupons are different from those used for item source-marking (See appendix 1). Coupons may always be recognized, as such, by the f1 f2 flag, and therefore be dealt with in the appropriate manner by scanning equipment.

First formula

This formula includes in the coding of the coupon an identification of the territory in which the coupon originated :

f1 f2 = 98	For any national authority which has adopted this formula
I1 =	Special flag (2) assigned to the national authority by EAN specifically for coding coupons
I2 to I10	Characters at the disposal of this national authority for coding coupons according to its own rules

This formula permits checkstands to make a check on I1, which automatically eliminates any coupon that may accidentally have been imported.

---

(1) The algorithm for calculating this check digit is identical with the one stipulated for item source-marking (See appendix 0).

(2) Independent of the f1 f2 flags assigned for source-marking of items.

Second formula

This formula does not include in the coding of the coupon any identification of the territory in which the coupon originated :

f1 f2 = 99	For any national authority which has adopted this formula
I1 to I10	Characters at the disposal of this national authority for coding coupons according to its own rules

This formula provides one more character than the first formula for coding the coupon according to the rules adopted by the national authority, but it does not permit automatic elimination of any accidentally imported coupon.

Comment

The UPC formula for dealing with coupons may also be used by any national authority that wishes to do so. This formula corresponds to the following coding structure :

f1 f2 = 05 For any national authority which has adopted this formula

I1 to I5 = Identification of the manufacturer issuing the coupon

I6 to I7 = Identification of the group (family) of items to which the reduction coupon may be applied

I8 to I10 = Amount of the reduction

For further information, the reader may refer to UPC specifications and examples of their use.

5.3.- RULES ADOPTED BY THE NATIONAL AUTHORITY FOR THE CODING OF COUPONS

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

5.4.- SOURCE-MARKING OF COUPONS

Coupons are marked in EAN-13 according to exactly the same rules as those specified for item source-marking in Chapter IV.

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CHAPTER VI

IN-STORE MARKING; RETAILERS AND THEIR PARTICULAR PROBLEMS

6.1.- GENERALITIES

In the preceding chapters, we saw how items and coupons are identified and marked at the source within the framework of EAN requirements, completed by the specific regulations issued by your national authority.

Now we propose to study solutions to the problems of in-store marking : in paragraph 6.2. we shall see the various coding formulas available for such use ; these formulas are designed to avoid any confusion (through the f1 f2 flags used) with items marked at the source. In paragraph 6.3. we shall present the marking formulas associated with these coding formulas and also specify the tolerances which must be respected by in-store marking equipment. Since this equipment produces printed symbols directly, without going through the intermediate stage of the film master, it must permit tolerances to be respected at the level of the printed symbol, and in terms adapted to the printing technique used.

In paragraph 6.4. we shall look at the special case of products imported from the North American Continent and marked in a UPC code. Most often they are marked in UPC-A, which is a subset of EAN-13 (f1 f2 = 00). The only difference between the UPC-A and EAN-13 rules concerns the human-readable translation of the code ; it will be explained in paragraph 6.4. However, some articles imported from North America may be marked in UPC-E, which is a half-symbol based on the UPC-A (and thus also EAN-13) symbol, using an artifice involving the elimination of zeros. This symbol is perfectly compatible with EAN and will also be described in 6.4.

Finally, in paragraph 6.5., we shall study the problem of direct key-entries on scanning equipment.

6.2.- CODING FORMULAS AVAILABLE FOR IN-STORE MARKING

6.2.1.- CODE + PRICE FORMULA

This formula fits into the general EAN-13 coding structure (See appendix O).

It uses the flag f1 = 2 ; the f2 flag is free, in other words, available for in-store coding.

EAN-13 STRUCTURE	Flags		Identification	Check-digit
	f1	f2	I1 I2 - - I10	C
EAN IN-STORE FORMULA CODE + PRICE	2	Item code + price (11 positions available)		C(*)

* See algorithm for calculating the check-digit, in appendix O.

The 11 positions of the "item code + price" field are not structured according to a standard ; each retailer is free to adopt whatever length he wishes for the item code and the price code ; he is also free, if he wishes, to introduce an extra check-digit specific to price.

However, your coding authority has developed a structure which is adapted to the currency used in your country and should therefore answer the needs of numerous retailers. This structure does not in any way constitute a standard. However, it has been transmitted to equipment manufacturers, which will make it easier for you to specify your needs to these manufacturers if you adopt this structure.

CODING STRUCTURE (ITEM CODE + PRICE) DEVELOPED BY YOUR NATIONAL AUTHORITY

TO BE DRAWN UP BY THE NATIONAL AUTHORITY

Comment

The coding formula developed by UPC to solve the problem of in-store "item code + price" marking may also be used.

This formula corresponds to the following structure :

EAN-13 STRUCTURE	Flags		Identification										Check-digit
	f1	f2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	C
UPC CODE+PRICE FORMULA	0	2	A1	A2	A3	A4	A5	CP (*)	P1	P2	P3	P4	C (**)
			Item Code					Check-digit for price	Price				

(*) : See algorithm for calculating this check-digit in UPC specifications

(**) : See algorithm for calculating this check-digit in appendix O

It is obvious that a retailer can use the flag f1 f2 = 02 with a different coding structure ; this falls within the specific definition of his system where his equipment suppliers are concerned.

6.2.2.- FORMULA GIVING ITEM CODE ONLY

This formula fits into the general EAN-8 coding structure (See appendix O).

Like the "code + price" formula, it uses the flag f1 = 2 ; flag 2 is free, in other words, available for in-store coding.

EAN-8 STRUCTURE	Flags		Identification					Check-digit
	f1	f2	I1	I2	I3	I4	I5	C
EAN FORMULA IN-STORE CODE ONLY	2	A1	A2	A3	A4	A5	A6	C (*)
		Item Code						

(*) : See algorithm for calculating the check-digit in appendix O.

Comment

The coding and marking formula developed by UPC under the name of UPC-E, Locally Assigned Codes (LAC), to solve this same problem of in-store marking by code only, may be used.

A general description of the UPC-E system is given in paragraph 6.4.

The LAC version is based on the use of only the following sections of the code (1) :

EAN-13 STRUCTURE	Flags		Identification										Check-digit
	f1	f2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	C
UPC-E LAC FORMULA	(0)	0(*)	0	1 à 7	0 à 9	0 à 9	0 à 9	0	0	0	0	5 à 9	C(**)

(*) : This f2 flag is called the NUMBER-SYSTEM in UPC.

(**) : See algorithm for calculating the check-digit in appendix 0.

The result is that only 35.000 values of the code are available.

6.2.3.- VELOCITY CODES

Retailers may use velocity codes, which fit into the EAN-8 coding structure (and use the EAN-8 symbol) in the following way :

EAN-8 STRUCTURE	Flags		Identification					Check-digit
	f1	f2	I1	I2	I3	I4	I5	C
EAN VELOCITY CODE	0	V1	V2	V3	V4	V5	V6	C (*)
		Item Velocity code						

(*) : See algorithm for calculating the check-digit in appendix 0.

The f1 flag is always equal to 0.

The velocity code includes a maximum of 1 to 6 live characters, in addition to the check-digit and the f1 flag.

Insofar as necessary, the velocity code is completed on the left by zeros (V1 = 0, V2 = 0, etc...) if it does not use all the six positions available. (For example, if a velocity code uses four positions, then V1 = V2 = 0).

---

(1) Any use of other sections for in-store marking introduces a risk of confusion with products imported from the North American Continent.

Comment

Velocity codes may of course be used for key entries, without being expressed in symbols.

In this case, it is up to the retailer to decide whether or not to use a check-digit, but if he does decide to use one, it must be calculated according to the algorithm in appendix O. In any case, the velocity code must include a maximum of 7 characters (including the check-digit).

6.3.- MARKING FORMULAS FOR IN-STORE USE

- All the formulas for in-store coding and marking described in paragraph 6.2. (with the exception of the UPC-E LAC formula (1))fit into the standard EAN-13 or EAN-8 structures.

  The result is that everything said in chapter III concerning the logical structure and ideal dimensions of symbols is applicable completely and without restriction to in-store marking.

- On the other hand, it is clear that the process described in chapter IV for the actual production of the symbol is absolutely inapplicable to in-store marking equipment.

- We therefore propose to specify here the tolerances which must be respected by in-store marking equipment ; these tolerances apply to the printed symbols.

  These tolerances cannot in any manner be applied to symbols marked at the source, to replace the process described in chapter IV.

  The tolerances are defined for various module widths, varying between approximately : 0,8 times and 2 times the nominal width of the module (0,33 mm) (2).

- These tolerances are variable, depending on the type of dimension to which they refer.

---

(1) The UPC-E marking formula will be described in paragraph 6.4.

(2) Any intermediate dimension may of course be adopted ; in such cases the corresponding tolerances may be obtained by interpolation of the table furnished in appendix 18.

Four different types of dimensions may be distinguished :

Type 1 dimension

Measurement of a bar or a space inside a character.

Type 2 dimension

Measurement of the width between corresponding edges of bars inside a character. In pratice : width between the front edge of the first bar of a character and the front edge of the second bar of the same character, or width between the back edge of the first bar of a character and the back edge of the second bar of the same character.

Type 3 dimension

Measurement of the character-to-character width. In practice : width between the back edge of the second bar of one character and the back edge of the second bar of the following character, if number set A or B is involved ; or measurement of the width between the front edge of the first bar of one character and the front edge of the first bar of the following character, if number set C is involved (1).

Type 4 dimension

Measurement of the width between the bars of two different characters. In practice : width between the back edge of the last bar of one character and the front edge of the first bar of the next character.

Appendix 18 provides a diagram showing how these measurements are made and a table giving tolerances for type 1, 2 and 3 dimensions.

Type 4 dimensions are not subject to any explicit tolerance, but must not be less than O,2 mm.

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(1) See appendix 6

6.4.- IMPORTED PRODUCTS MARKED IN UPC

6.4.1.- MARKING IN UPC-A

UPC-A marking is strictly compatible with EAN-13 marking. It is, practically speaking, only a variant of EAN-13, a subset of EAN-13 in which the f1 f2 flags are equal to 00.

All the specifications given in chapters III and IV are therefore absolutely respected in UPC-A symbols, except as regards one particular point : the human-readable translation of the code.

UPC-A symbols do not include either the human-readable translation of f1 (= 0) or the value of the check-digit.

This difference with respect to EAN-13 has practically no impact except in the case of a scanning rejection. When the code is normally key-entered. We shall deal with this problem in paragraph 6.5.

6.4.2.- MARKING IN UPC-E

UPC-E marking is what is called a zero-elimination version, which permits a code of normal length (equal to the length of UPC-A) to be expressed through the use of half the UPC-A symbol (or half of EAN-13). Of course, the initial code, which is of normal length, is defined with a large number of zeros whose elimination, carried out through precise rules, permits this contracted marking to be made.

We propose to see first of all how a long code is transformed into a short code, and then to see how this short code is handled in the half-symbol.

6.4.2.1.- TRANSFORMATION OF A LONG CODE INTO A SHORT CODE

The basic structure of a long UPC-A code is as follows :

Flags		MANUFACTURER NUMBER					ITEM NUMBER					C
f1	f2 (*)											
0	0	F1	F2	F3	F4	F5	A1	A2	A3	A4	A5	C (**)

(*) : f2 is called the Number-System in UPC.

(**) : the algorithm for calculating the check-digit is exactly the same as the one used in EAN (See appendix O).

The table below shows how the various long codes available, which include a variable number of zeros, are artificially transformed into a short code with 7 positions (including the check-digit).

LONG CODE → SHORT CODE

Flags		MANUFACTURER NUMBER					ITEM CODE					C	SHORT CODE						C
f1	f2																		
0	0	F1	F2	F3	F4	F5	A1	A2	A3	A4	A5	C	Z1	Z2	Z3	Z4	Z5	Z6	C
0	0	F1	F2	0	0	0	0	0	A3	A4	A5	C	F1	F2	A3	A4	A5	0	C
0	0	F1	F2	1	0	0	0	0	A3	A4	A5	C	F1	F2	A3	A4	A5	1	C
0	0	F1	F2	2	0	0	0	0	A3	A4	A5	C	F1	F2	A3	A4	A5	2	C
0	0	F1	F2	F3	0	0	0	0	0	A4	A5	C	F1	F2	F3	A4	A5	3	C
0	0	F1	F2	F3	F4	0	0	0	0	0	A5	C	F1	F2	F3	F4	A5	4	C
0	0	F1	F2	F3	F4	F5	0	0	0	0	A5 (5-9)	C	F1	F2	F3	F4	F5	A5 (5-9)	C

Example : THE LONG CODE : 00/92200/00457/6 IS TRANSFORMED, BY THE FORMULA INDICATED IN THE THIRD LINE OF THE TABLE, INTO THE FOLLOWING SHORT CODE : 924572/6.

6.4.2.2.- EXPRESSION OF THE SHORT CODE BY THE UPC-E SYMBOL

The logical structure of the UPC-E symbol is as follows :

- Left guard pattern identical with that of the EAN symbol (101) ; (See appendix 3).
- 6 characters of the short code, explicitly symbolized, either by number set A or by number set B (see appendix 2).
- Right guard pattern, different from the preceding and coded 010101.

The value of the check-digit is, like the f1 flag in the EAN-13 symbol, induced by the combination of number sets adopted for marking the 6 characters of the short code.

The table which follows gives the correspondences.

(SEE TABLE, ON FOLLOWING PAGE)

Comment :

The characters are numbered from 1 to 7, starting from the right ; hence the character numbered 1 is the check-digit.

VALUE OF THE 1st CHARACTER (Check-digit)	NUMBER SETS USED FOR MARKING CHARACTERS 2 TO 7 OF THE SHORT CODE					
	7	6	5	4	3	2
0	B	B	B	A	A	A
1	B	B	A	B	A	A
2	B	B	A	A	B	A
3	B	B	A	A	A	B
4	B	A	B	B	A	A
5	B	A	A	B	B	A
6	B	A	A	A	B	B
7	B	A	B	A	B	A
8	B	A	B	A	A	B
9	B	A	A	B	A	B

The complete representation and dimensions of the UPC-E symbol have the following characteristics :

- The nominal width dimensions of bars and characters are identical with those of the EAN symbols (See appendix 6).
- The height and arrangement of the bars representing the data characters and the auxiliary characters are identical with those of the EAN-13 symbol (See appendix 7).
- The human-readable translation of the code is placed below the corresponding bars ; the check-digit is printed and is placed to the left of the left-hand guard pattern.
- The corner marks are placed, with relation to the bars, exactly the same way as in EAN-13.

Comment

This description of the UPC-E symbol concerns retailers in two ways :

- On the one hand, because of the possible use of the UPC-E - LAC version for in-store marking (See the comment at the end of paragraph 6.2.1.).
- On the other hand, because of the possible scanning of UPC-E symbols (on products imported from the United States) at checkstands. In this connection, it should be stressed that when checkstands scan UPC-E symbols they reconstitute the corresponding long code, before elimination of the zeros. It is this long code which constitutes the criterion for access to the item file.

6.5.- DIRECT KEY ENTRIES ON SCANNING EQUIPMENT

- If a symbol is rejected on scanning, the corresponding code (human-readable translation of the symbol) can be key-entered at the checkstand according to the following procedures :
  - The human-readable translation of the EAN-13 or EAN-8 symbol is key-entered as it appears on the symbol (13 characters for EAN-13, 8 characters for EAN-8).
  - For a UPC-E symbol, the procedure to be followed is exactly the same as that followed in the United States : the human-readable translation of the symbol is entered as it appears (7 characters, the first being the check-digit), and then a special key on the checkstand is pressed.
  - For a UPC-A symbol, the human-readable translation is key-entered as it appears on the symbol (12 characters, of which the first is f2 = 0), and there is no need to press a special key.
- As for key-entering velocity codes (See comment at the end of paragraph 6.2.3.), it is done by entering the velocity code as it is presented (7 characters at a maximum). There is no need to complete the entry by zeros on the left.

-●-

APPENDIXES

— APPENDIX 0 —

EAN-13 AND EAN-8 ITEM-CODING STRUCTURES ALGORITHM FOR CALCULATING THE CHECK-DIGIT

CODING STUCTURE

FULL-SIZE VERSION EAN-13	f1	f2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	C
SHORT-SIZE VERSION EAN-8						f1	f2	I1	I2	I3	I4	I5	C

When

f1, f2 = flags

I1, I2, etc... = Item identification digits

C = Check-digit

ALGORITHM FOR CALCULATING THE CHECK-DIGIT

(Applicable to EAN-13 and EAN-8)

Digit positions are assumed to be numbered from right to left, the first being that of the check-digit.

STEP 1 : Starting from position 2 of the code, add up the values of the digits in even-numbered positions.

STEP 2 : Multiply by 3 the result of Step 1 above.

STEP 3 : Starting from position 3 of the code, add up the values of the digits in odd-numbered positions.

STEP 4 : Add up the results of Steps 2 and 3.

STEP 5 : The check-digit is the smallest number which, added to the result obtained through Step 4, gives a number that is a multiple of 10.

NOTE : See examples of the application of this algorithm under paragraph 2.5.

— APPENDIX 1 —

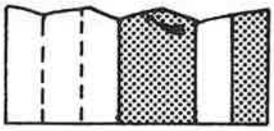
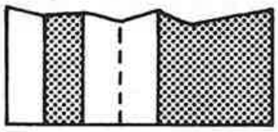
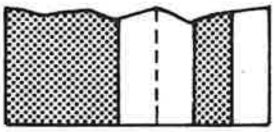
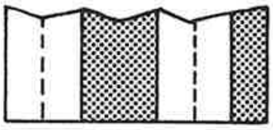
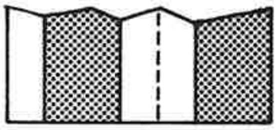
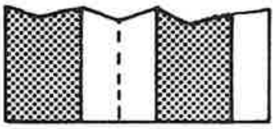
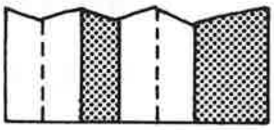
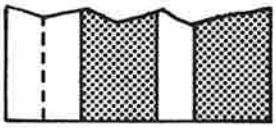
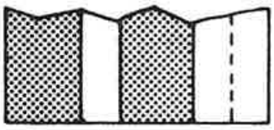
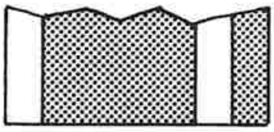
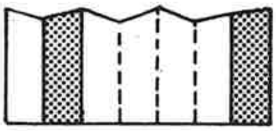
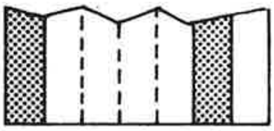
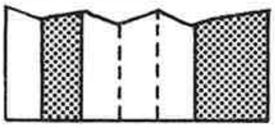
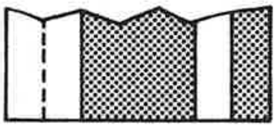
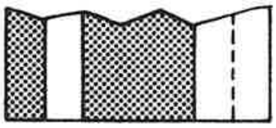
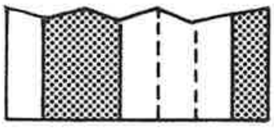
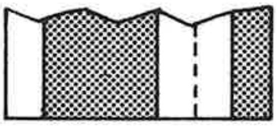
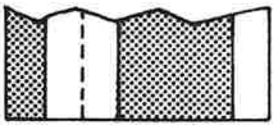
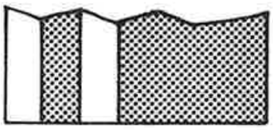
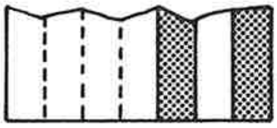
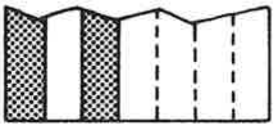
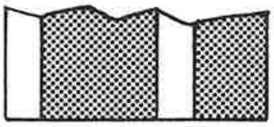
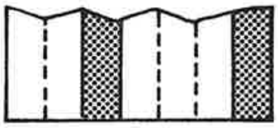
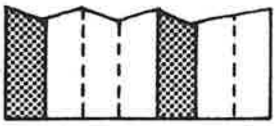
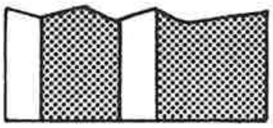
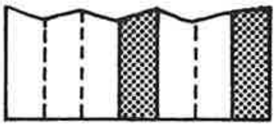
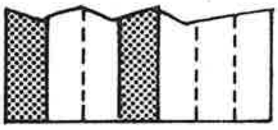
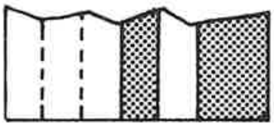
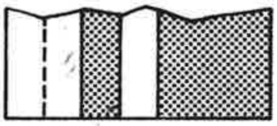
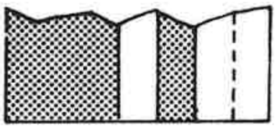
LIST OF FLAGS ASSIGNED TO NATIONAL AUTHORITIES FOR SOURCE MARKING OF ITEMS

updated to 31 december 1976

RESERVED FLAGS	FLAGS ASSIGNED TO CODING AUTHORITIES	HOLDERS AND SOLE USERS OF FLAGS FOR SOURCE-MARKING OF ITEMS
	00, 01, 03, 04 06 09	U.P.C.
10 to 19		Reserved flags
	30 to 37	**GENCOD (FRANCE)**
38 - 39		Reserved flags
	40 to 43	**C.C.G.** (GERMANY)
44 to 49		Reserved flags
	50 to 53	UNITED KINGDOM
	54	BELGIUM
55 - 56		Reserved flags
	57	DENMARK
58 - 59		Reserved flags
	60 - 61	AUSTRIA
62 - 63		Reserved flags
	64	FINLAND
65 - 66		Reserved flags
	67	NETHERLANDS
68 - 69		Reserved flags
	70	NORWAY
71 - 72		Reserved flags
	73	SWEDEN
74 - 75		Reserved flags
	76	SWITZERLAND
77 to 79		Reserved flags
	80 to 83	ITALY
84 to 89		Reserved flags

— APPENDIX 2 —

CODING OF DATA CHARACTERS

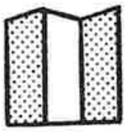
VALUE OF CHARACTER	NUMBER SET **A** (odd)	NUMBER SET **B** (even)	NUMBER SET **C** (even)
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			

– APPENDIX 3 –

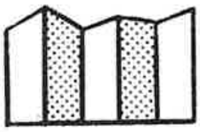
CODING OF AUXILIARY CHARACTERS

GUARD PATTERN

(RIGHT AND LEFT)

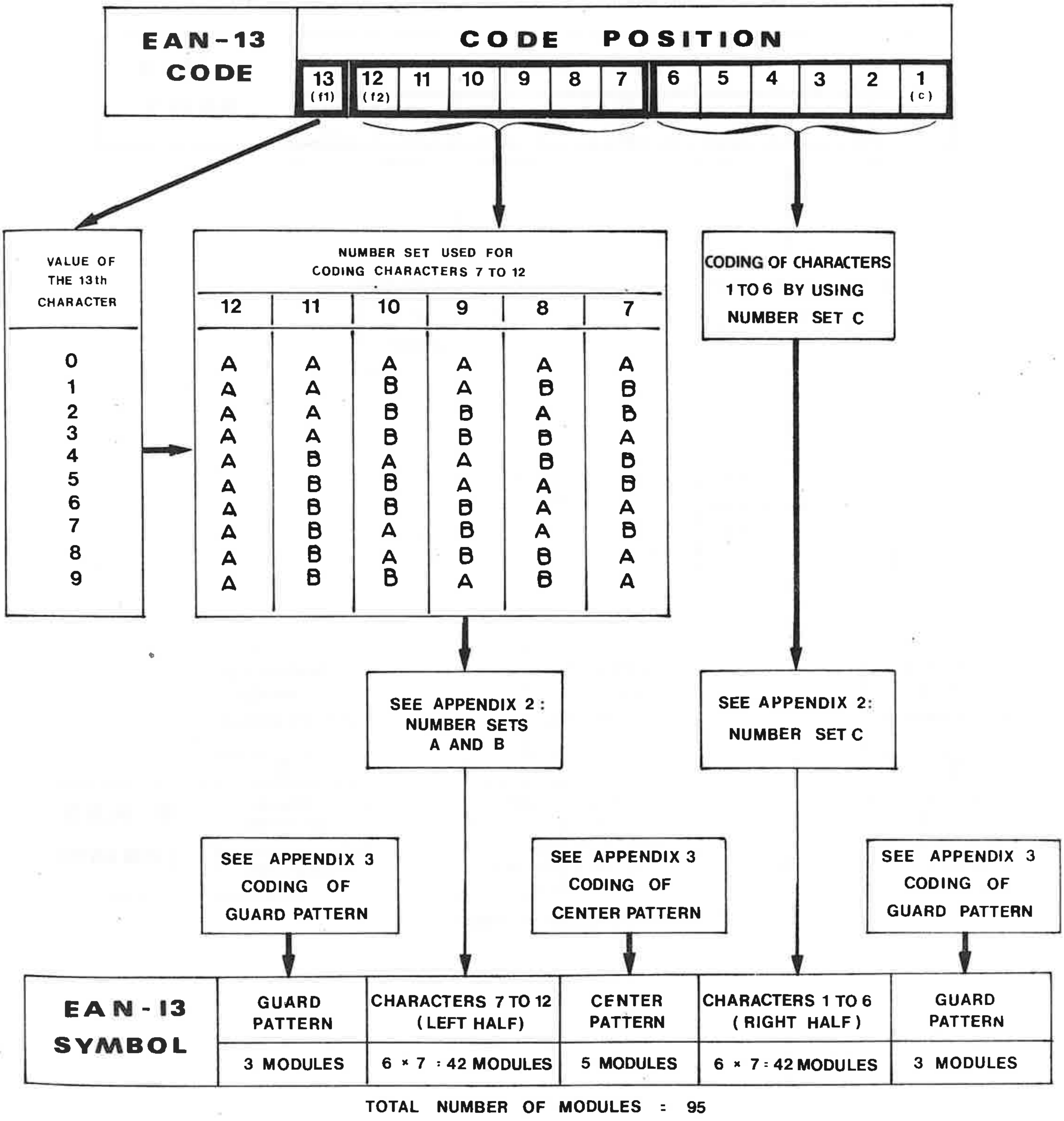


CENTER PATTERN



— APPENDIX 4 —

LOGICAL STRUCTURE OF THE EAN-13 SYMBOL



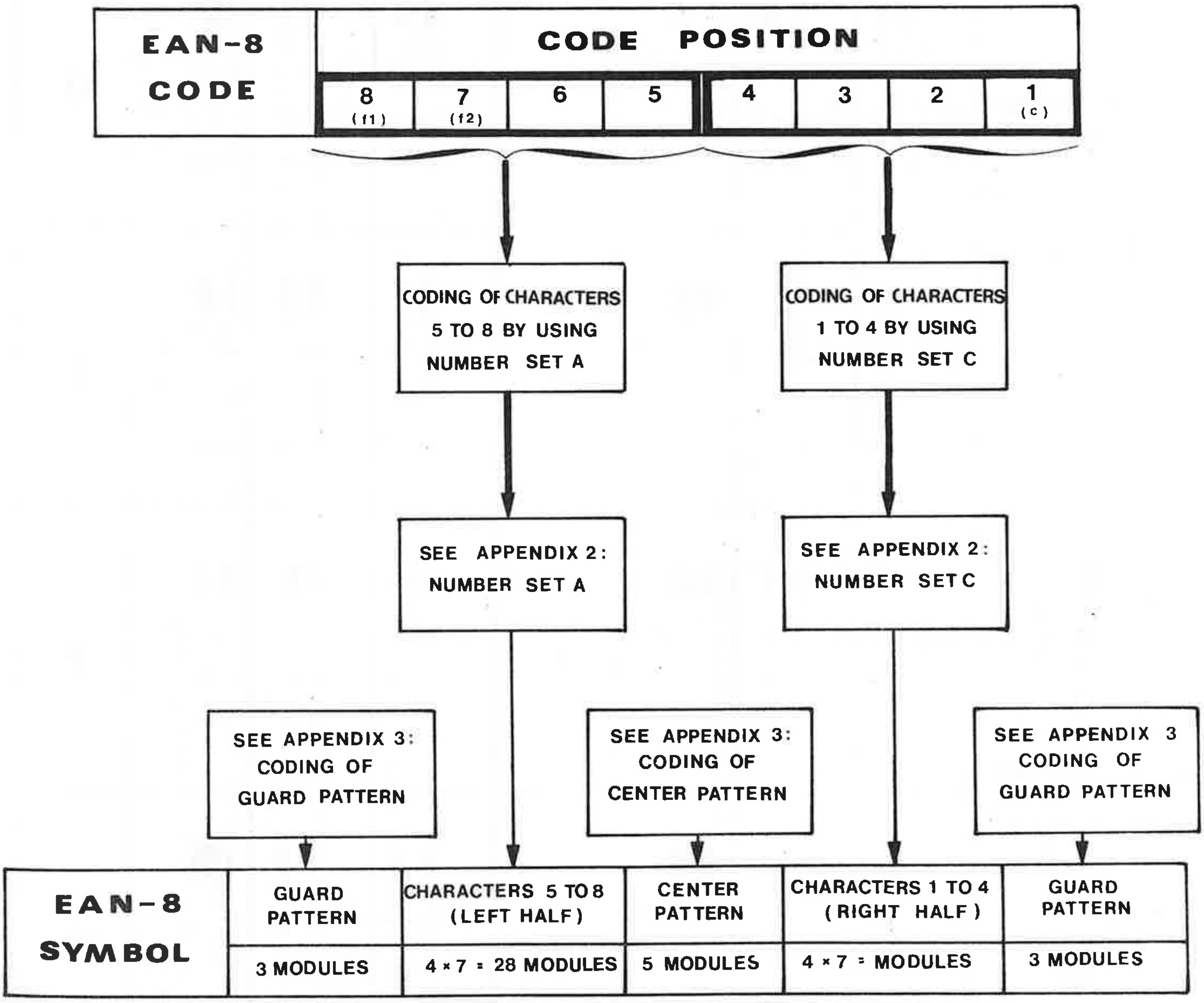
VALUE OF THE 13th CHARACTER	12	11	10	9	8	7
0	A	A	A	A	A	A
1	A	A	B	A	B	B
2	A	A	B	B	A	B
3	A	A	B	B	B	A
4	A	B	A	A	B	B
5	A	B	B	A	A	B
6	A	B	B	B	A	A
7	A	B	A	B	A	B
8	A	B	A	B	B	A
9	A	B	B	A	B	A

EAN - 13 SYMBOL	GUARD PATTERN	CHARACTERS 7 TO 12 (LEFT HALF)	CENTER PATTERN	CHARACTERS 1 TO 6 (RIGHT HALF)	GUARD PATTERN
	3 MODULES	6 × 7 : 42 MODULES	5 MODULES	6 × 7 : 42 MODULES	3 MODULES

TOTAL NUMBER OF MODULES : 95

— APPENDIX 5 —

LOGICAL STRUCTURE OF THE EAN-8 SYMBOL

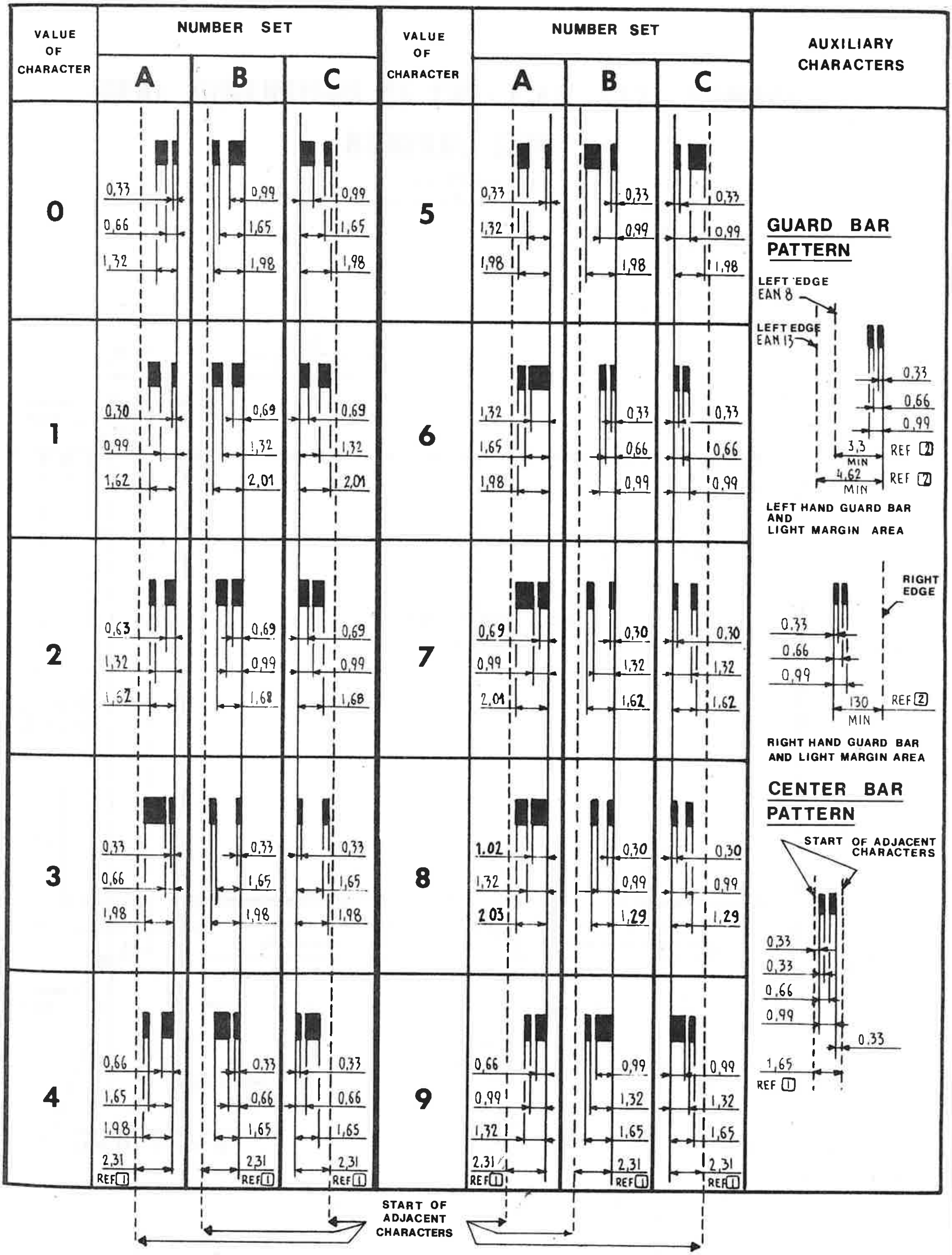


TOTAL NUMBER OF MODULES : 67

— APPENDIX 6 —

IDEAL DIMENSIONS OF NOMINAL SIZE CHARACTERS USED IN EAN SYMBOLS

in millimeters

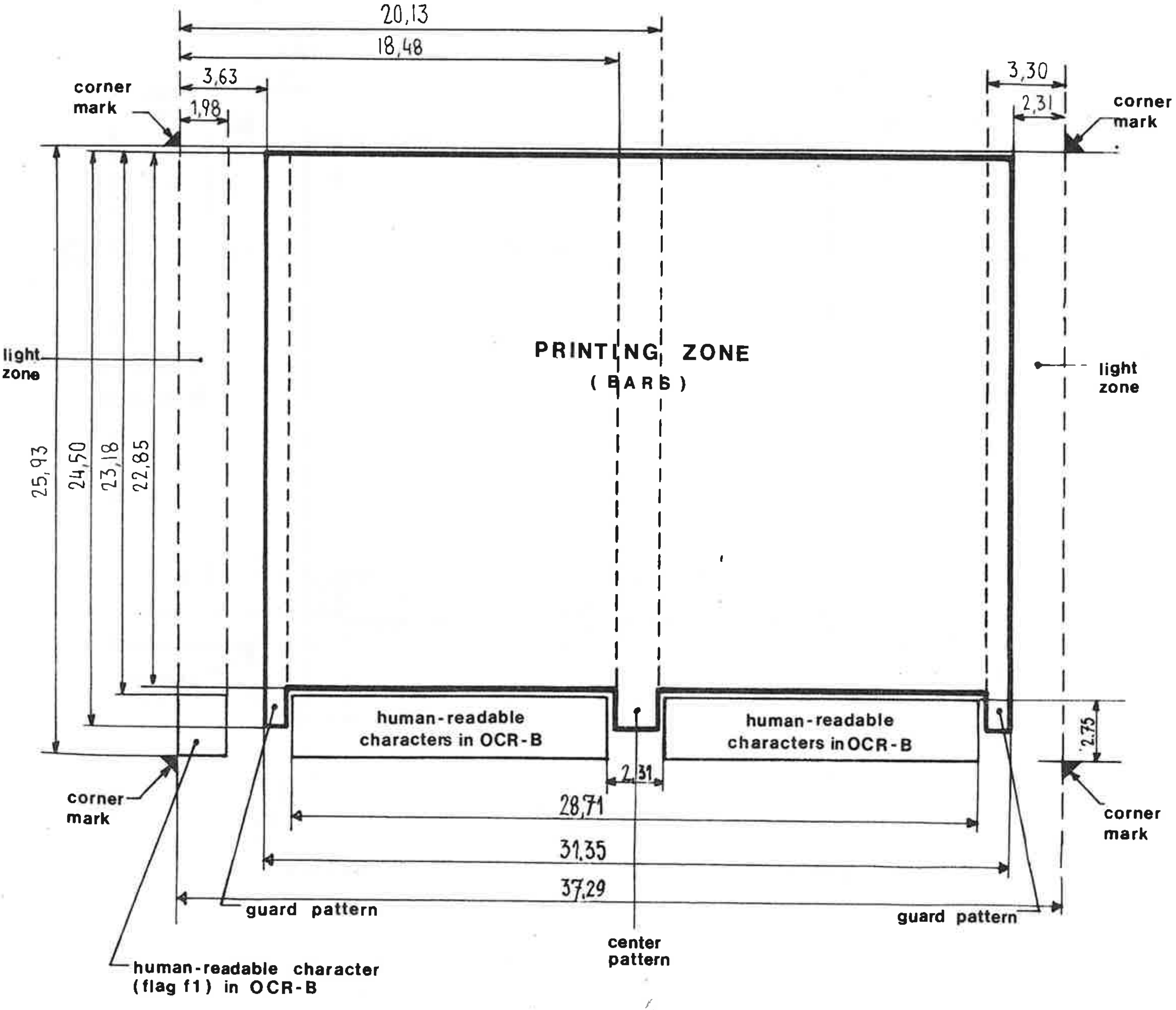


— APPENDIX 7 —

IDEAL DIMENSIONS OF THE EAN – 13 SYMBOL
NOMINAL SIZE

IN MILLIMETERS

(1 MODULE = 0,33MM WIDE)

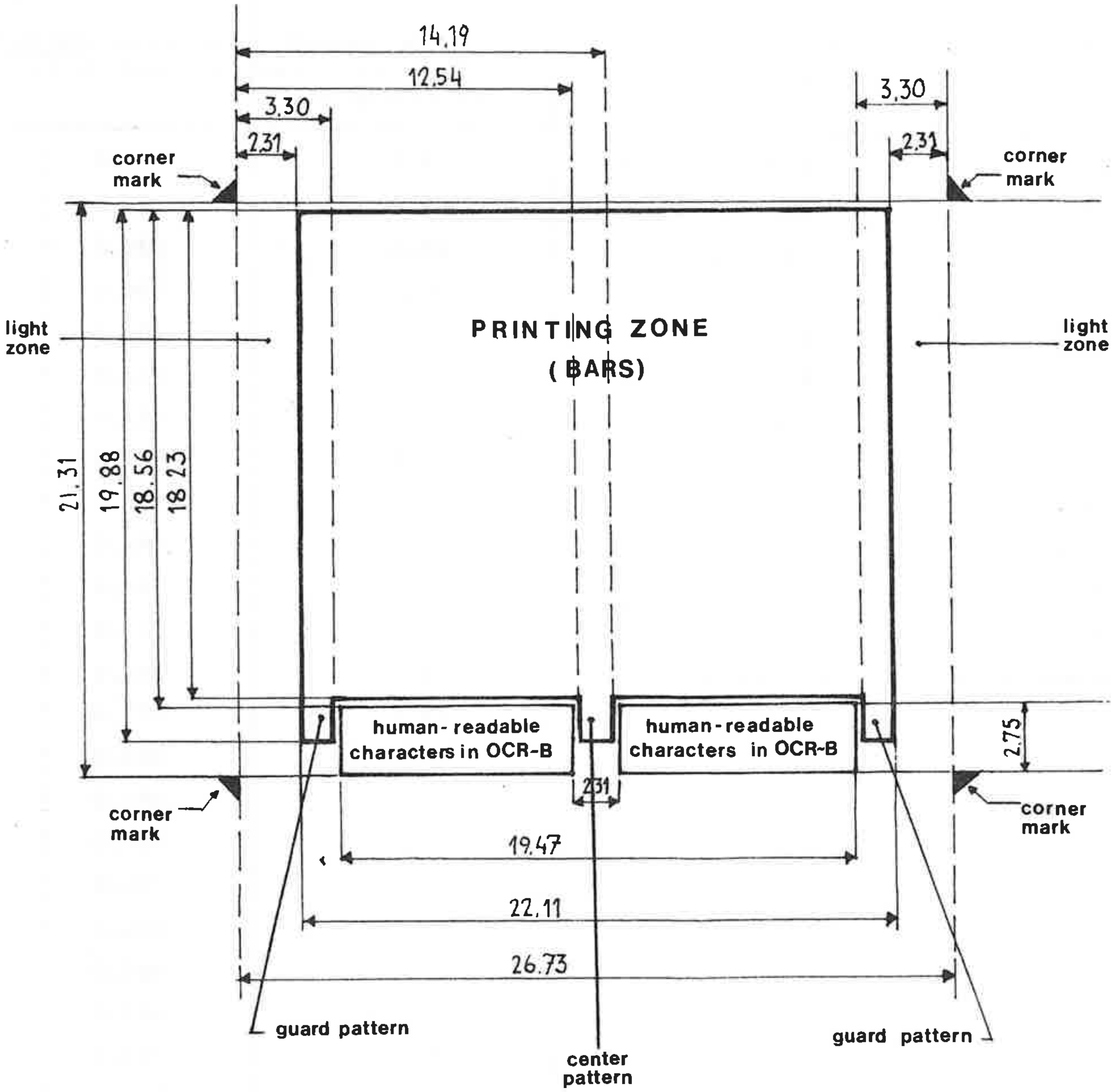


— APPENDIX 8 —

IDEAL DIMENSIONS OF THE EAN – 8 SYMBOL
NOMINAL SIZE

IN MILLIMETERS

(1 MODULE = 0.33MM WIDE)



— APPENDIX 9 —

CORRESPONDENCE TABLES SHOWING RELATION BETWEEN MAXIMUM PRINT-GAIN VARIATION AND MINIMUM MAGNIFICATION FACTOR TO BE APPLIED

CONTINUOUS SEQUENCE
VALUES OF M

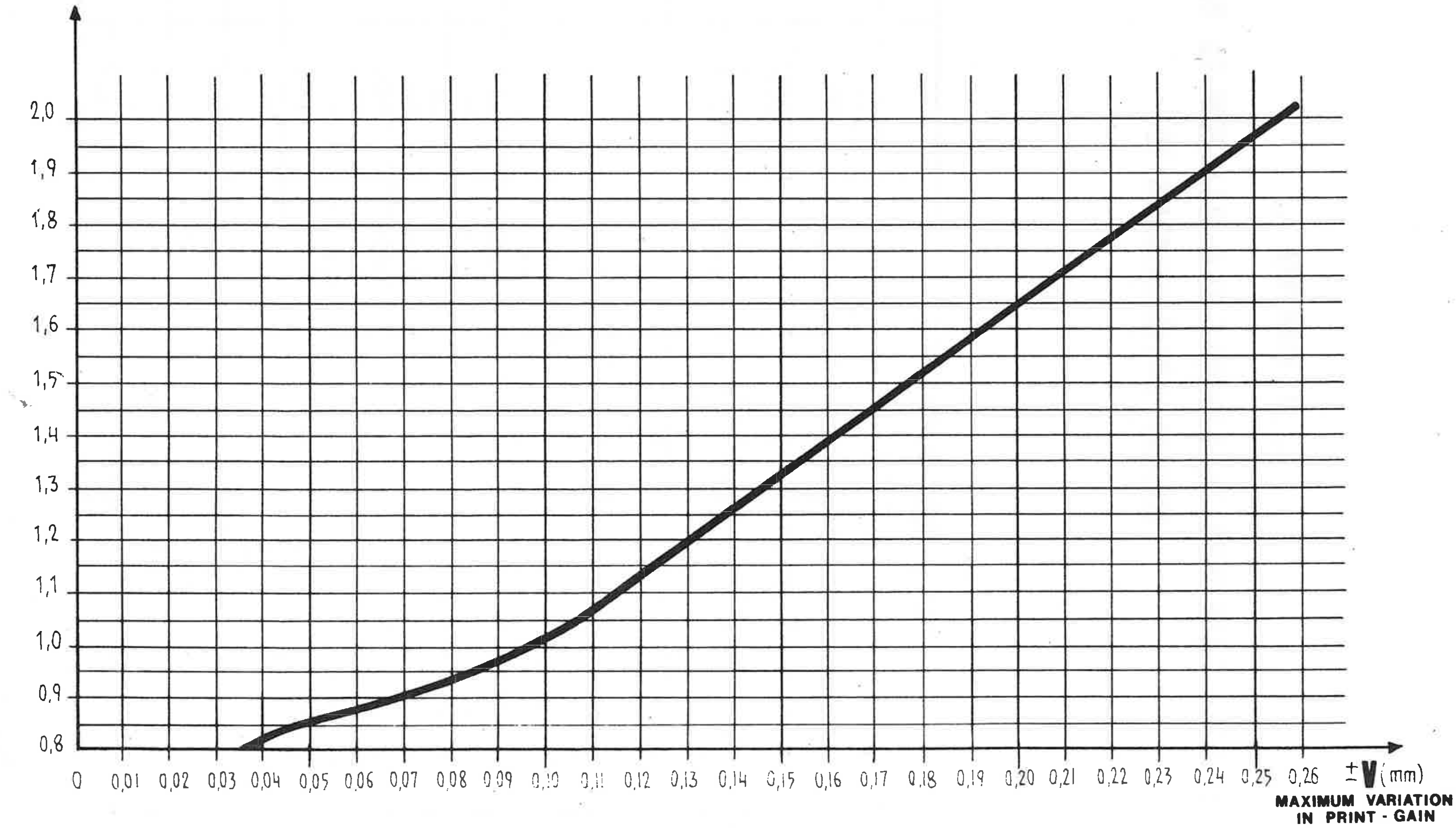
V Maximum variation of print-gain (mm)	M Minimum value of magnification factor to be applied
± 0,035	0,8
± 0,051	0,85
± 0,069	0,90
± 0,085	0,95
± 0,101	1
± 0,108	1,05
± 0,115	1,1
± 0,124	1,15
± 0,132	1,20
± 0,140	1,25
± 0,147	1,30
± 0,152	1,35
± 0,163	1,40
± 0,171	1,45
± 0,178	1,50
± 0,184	1,55
± 0,192	1,60
± 0,201	1,65
± 0,209	1,70
± 0,216	1,75
± 0,224	1,80
± 0,233	1,85
± 0,241	1,90
± 0,250	1,95
± 0,256	2

CONTINUOUS SEQUENCE
VALUES OF V

V Maximum variation of print-gain (mm)	M Minimum value of magnification factor to be applied
± 0,04	0,82
± 0,06	0,88
± 0,08	0,94
± 0,1	1,00
± 0,12	1,14
± 0,14	1,25
± 0,16	1,39
± 0,18	1,52
± 0,20	1,65
± 0,22	1,78
± 0,24	1,90
± 0,26	2,00

— APPENDIX 10 —

GRAPH SHOWING CORRESPONDENCE BETWEEN MAXIMUM PRINT-GAIN VARIATION AND MINIMUM MAGNIFICATION FACTOR TO BE APPLIED



— APPENDIX 11 —

DIMENSIONS OF MODULES AND SYMBOLS AT DIFFERENT LEVELS OF MAGNIFICATION FACTOR

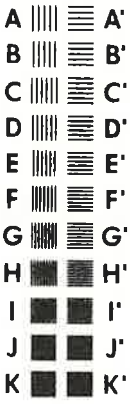
in millimeters

MAGNIFICATION FACTOR	MODULE WIDTH (IDEAL) (mm)	DIMENSIONS OF SYMBOLS ~~(Between corner marks)~~ (mm)			
		EAN-13		EAN-8	
		Width ①	Height ②	Width ①	Height ②
0,8	0,264	29,83	20,74	21,38	17,05
0,85	0,281	31,70	22,04	22,72	18,11
0,9	0,297	33,56	23,34	24,06	19,18
0,95	0,313	35,43	24,63	25,39	20,24
1	0,330	37,29	25,93	26,73	21,31
1,05	0,346	39,15	27,23	28,07	22,38
1,1	0,363	41,02	28,52	29,40	23,44
1,15	0,379	42,88	29,82	30,74	24,51
1,20	0,396	44,75	31,12	32,08	25,57
1,25	0,412	46,61	32,41	33,41	26,64
1,30	0,429	48,48	33,71	34,75	27,70
1,35	0,445	50,34	35,01	36,09	28,77
1,40	0,462	52,21	36,30	37,42	29,83
1,45	0,478	54,07	37,60	38,76	30,90
1,50	0,495	55,94	38,90	40,10	31,97
1,55	0,511	57,80	40,19	41,43	33,03
1,60	0,528	59,66	41,49	42,77	34,10
1,65	0,544	61,53	42,78	44,10	35,16
1,70	0,561	63,39	44,08	45,44	36,23
1,75	0,577	65,26	45,38	46,78	37,29
1,80	0,594	67,12	46,67	48,11	38,36
1,85	0,610	68,99	47,97	49,45	39,42
1,90	0,627	70,85	49,27	50,79	40,49
1,95	0,643	72,72	50,56	52,12	41,55
2	0,660	74,58	51,86	53,46	42,62

(1) Between corner-marks.
(2) Between the lower corner-marks and the upper-top of the bars.

— APPENDIX 12 —

STANDARD EAN GAUGE — DETERMINING THE MAGNIFICATION FACTOR AND BAR-WIDTH REDUCTION ON THE BASIS OF THE PRINTABILITY RANGE



STANDARD EAN GAUGE	SPACE BETWEEN BARS (mm)
A A'	0,508
B B'	0,457
C C'	0,406
D D'	0,356
E E'	0,305
F F'	0,254
G G'	0,203
H H'	0,152
I I'	0,102
J J'	0,051
K K'	0,025

EXAMPLE ONLY; NOT FOR USE BY PRINTERS

OTHER PRINTING TECHNIQUES THAN FLEXOGRAPHY

NOMINAL SIZE FILM MASTER → APPLICATION OF MAGNIFICATION FACTOR → BAR-WIDTH REDUCTION

PRINTABILITY RANGE	MAGNIFICATION FACTOR	BAR-WIDTH REDUCTION mm
E - F	1,00	0,28 (+ 0 - 0,08)
E - G	1,00	0,25 (+ 0,02 - 0,05)
E - H	1,20	0,23 (+ 0,05 - 0,02)
E - I	1,30	0,2 (± 0,05)
E - J	1,40	0,18 (± 0,02)
E - K	1,50	0,16 (+ 0,05 - 0,02)
F - G	0,90	0,23 (+ 0,01 - 0,05)
F - H	1,00	0,2 (± 0,05)
F - I	1,20	0,18 (+ 0,05 - 0,02)
F - J	1,25	0,15 (± 0,02)
F - K	1,30	0,14 (± 0,02)
G - H	0,90	0,18 (+ 0,02 - 0,05)
G - I	1,00	0,15 (± 0,05)
G - J	1,10	0,13 (+ 0,02 - 0,05)
G - K	1,20	0,11 (+ 0,05 - 0,02)
H - I	0,90	0,13 (+ 0,02 - 0,05)
H - J	0,95	0,10 (± 0,02)
H - K	1,00	0,09 (± 0,02)
I - J	0,90	0,08 (± 0,02)
I - K	0,90	0,06 (± 0,02)
J - K	0,80	0,04 (± 0,02)

FLEXOGRAPHY

NOMINAL SIZE FILM MASTER → BAR-WIDTH REDUCTION → APPLICATION OF MAGNIFICATION FACTOR

PRINTABILITY RANGE	BAR-WIDTH REDUCTION (mm)	MAGNIFICATION FACTOR
A - B	0,2 (± 0,05)	2,00
A - C	0,2 (± 0,05)	1,90
A - D	0,2 (± 0,05)	1,85
A - E	0,2 (± 0,05)	1,80
A - F	0,23 (± 0,02)	1,70
A - G	0,2 (± 0,02)	1,60
A - H	0,18 (± 0,02)	1,80
A - I	0,15 (± 0,02)	2,00
B - C	0,2 (± 0,05)	1,85
B - D	0,2 (± 0,05)	1,80
B - E	0,2 (± 0,05)	1,70
B - F	0,2 (± 0,02)	1,60
B - G	0,2 (± 0,02)	1,55
B - H	0,18 (± 0,02)	1,60
B - I	0,15 (± 0,02)	1,80
C - D	0,2 (± 0,05)	1,70
C - E	0,18 (± 0,05)	1,60
C - F	0,18 (± 0,05)	1,55
C - G	0,18 (± 0,05)	1,45
C - H	0,18 (± 0,02)	1,45
C - I	0,15 (± 0,02)	1,60
D - E	0,18 (± 0,05)	1,55
D - F	0,18 (± 0,05)	1,45
D - G	0,18 (± 0,05)	1,40
D - H	0,2 (± 0,02)	1,30
D - I	0,15 (± 0,02)	1,45
E - F	0,18 (± 0,05)	1,40
E - G	0,18 (± 0,05)	1,30
E - H	0,18 (± 0,02)	1,20
E - I	0,15 (± 0,02)	1,30
F - G	0,15 (± 0,05)	1,20
F - H	0,15 (± 0,05)	1,15
F - I	0,15 (± 0,02)	1,15
G - H	0,15 (± 0,05)	1,10
G - I	0,15 (± 0,05)	1,00
H - I	0,15 (± 0,02)	0,90

— APPENDIX 13 —

THEORETICAL PROCESS OF DETERMINING PRINTING CONDITIONS, FILM MASTER CHARACTERISTICS, AND TOLERANCES

- ASSESSMENT OF NORMAL PRINTING CONDITIONS : PERMITS G AND V TO BE DETERMINED

$$\underset{\substack{\uparrow \\ \text{Width of} \\ \text{printed bar}}}{L} = \underset{\substack{\uparrow \\ \text{Width of bar on} \\ \text{film master}}}{N} + \underset{\substack{\uparrow \\ \text{Average print-gain}}}{G} \pm \underset{\substack{\uparrow \\ \text{Variation in print-gain}}}{V}$$

- DECIDING ON THE ORDER OF OPERATIONS

  - If $G \leqslant 0,3$ mm, apply the magnification factor first, then the bar-width reduction (SEQUENCE 1)
  - If $G > 0,3$ mm, apply the bar-width reduction first, then the magnification factor (SEQUENCE 2)

- DETERMINING BAR-WIDTH TOLERANCES

  - $t1$ = absolute tolerance with relation to the ideal dimensions of the initial film (tolerance reduced to nominal dimensions)
  - $t2$ = absolute tolerance respected in the bar-width reduction operation

- DETERMINING THE TOTAL VARIATION IN BAR-WIDTH BETWEEN THE PRINTED SYMBOL AND ITS IDEAL DIMENSIONS

$$Vt = V + T \quad \text{when} \quad T = \begin{matrix} M \times t1 + t2 & \text{if SEQUENCE 1 is followed} \\ M \times (t1 + t2) & \text{if SEQUENCE 2 is followed} \end{matrix}$$

- DETERMINING THE DEFINITIVE MINIMUM MAGNIFICATION FACTOR

  This is the smallest value of M for which the value of V (see appendixes 9 and 10) is greater than or equal to the value of Vt as calculated earlier (1)

- DETERMINING THE BAR-WIDTH REDUCTION TO BE APPLIED

  - If SEQUENCE 1 is followed : bar-width reduction $= G$
  - If SEQUENCE 2 is followed : bar-width reduction $= \dfrac{G}{M}$

- TOLERANCES OTHER THAN t1 AND t2 WHICH MUST BE RESPECTED

  - Dimensions with REF $\boxed{2}$ on appendix 6 :

    Tolerance = $\begin{matrix} +\,0,5 \text{ mm} \\ -\,0 \text{ mm} \end{matrix}$ (reduced to nominal dimensions)

  - All the height dimensions specified on appendixes 7 and 8 :

    Tolerance = ± 0,13 mm (reduced to nominal dimensions)

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(1) The value of M definitely adopted must be such that the width of a module will be greater than or equal to 0,13 mm (width of a module = 0,33 x M - G), on the printing plates.

— APPENDIX 14 —

USE OF THE STANDARD EAN GAUGE : TOLERANCES TO BE APPLIED IN MAKING THE FILM MASTER

- WORKING OUT THE ORIGINAL FILM MASTER :

- WIDTH OF THE CHARACTERS, AS SPECIFIED IN APPENDIX 6

Noted REF $\boxed{1}$: Tolerance* = ± 0,013 mm

Noted REF $\boxed{2}$: Tolerance* = $^{+\,0,5\text{ mm}}_{-\,0\text{ mm}}$

Other dimensions : Tolerance* = ± 0,005 mm

- DIMENSIONS OF THE OVERALL SYMBOL, AS SPECIFIED IN APPENDIXES 7 AND 8

Tolerance* = ± 0,13 mm

- BAR-WIDTH REDUCTION :

This operation should be carried out with a

Minimum tolerance** = ± 0,008 mm

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* : These tolerances are reduced to nominal dimensions.

** : This tolerance is reduced to the definitive dimensions of the symbol. This means that, if the bar-width reduction is made before applying the magnification factor, the tolerance to be respected is equal to : $\pm \frac{0,008 \text{ mm}}{M}$

— APPENDIX 15 —

POSITIONING THE SYMBOL ON PACKAGES

– CONSTRAINTS REGARDING CURVE DIAMETER

(table 1)

– POSSIBLE HEIGHT REDUCTIONS

(table 2)

TABLE 1

CURVE DIAMETER OF CONTAINER (cm)	MAXIMUM VALUE OF MAGNIFICATION FACTOR	
	FULL-SIZE SYMBOL EAN-13	SHORT-SIZE SYMBOL EAN-8
3 cm et -	*	*
3,5 cm	*	0,83
4 cm	*	0,95
4,5 cm	*	1,07
5 cm	0,83	1,18
5,5 cm	0,92	1,30
6 cm	1	1,42
6,5 cm	1,08	1,54
7 cm	1,17	1,66
7,5 cm	1,25	1,78
8 cm	1,34	1,90
8,5 cm	1,42	2
9 cm	1,5	2
9,5 cm	1,59	2
10 cm	1,67	2
10,5 cm	1,75	2
11 cm	1,84	2
11,5 cm	1,92	2
12 cm et +	2	2

*

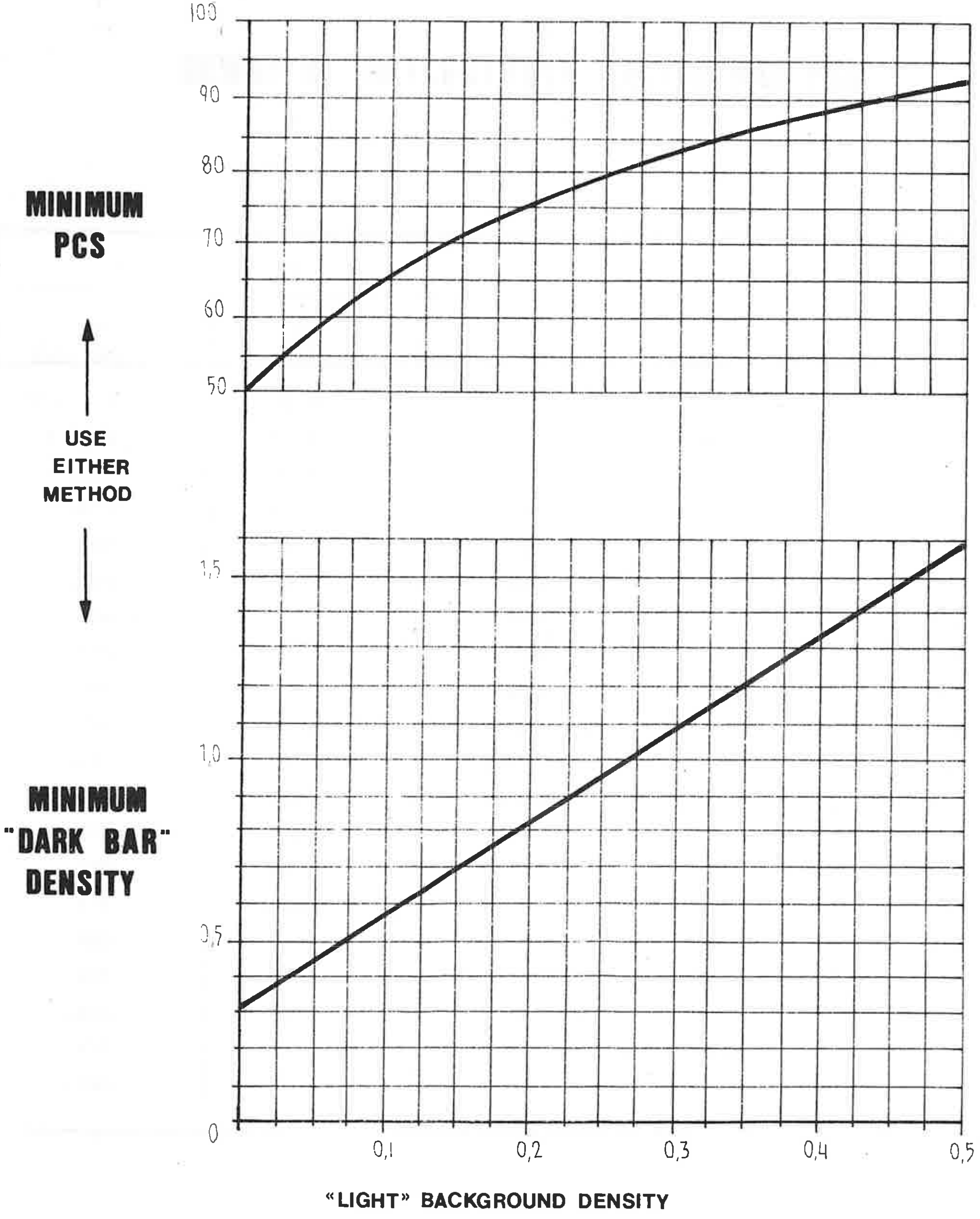
The magnification factor necessary for the 30° constraint to be respected is smaller than acceptable standards permit (less than 0,8).
Hence the symbol will have to be pivoted through an angle of 90° or be printed in another location.

TABLE 2

MAGNIFICATION FACTOR ADOPTED	HEIGHT REDUCTIONS (mm) EAN-13 and EAN-8 symbols		
	Level 1	Level 2	Level 1 + 2
Less than 1	0,0	0,0	0,0
1	0,0	3,8	3,8
1,1	0,8	3,8	4,6
1,2	1,5	3,8	5,3
1,3	2,3	3,8	6,1
1,4	3,0	3,8	6,8
1,5	3,8	3,8	7,6
1,6	4,6	3,8	8,4
1,7	5,3	3,8	9,1
1,8	6,1	3,8	9,9
1,9	6,9	3,8	10,7
2	7,6	3,8	11,4

— APPENDIX 16 —

DENSITY AND PCS



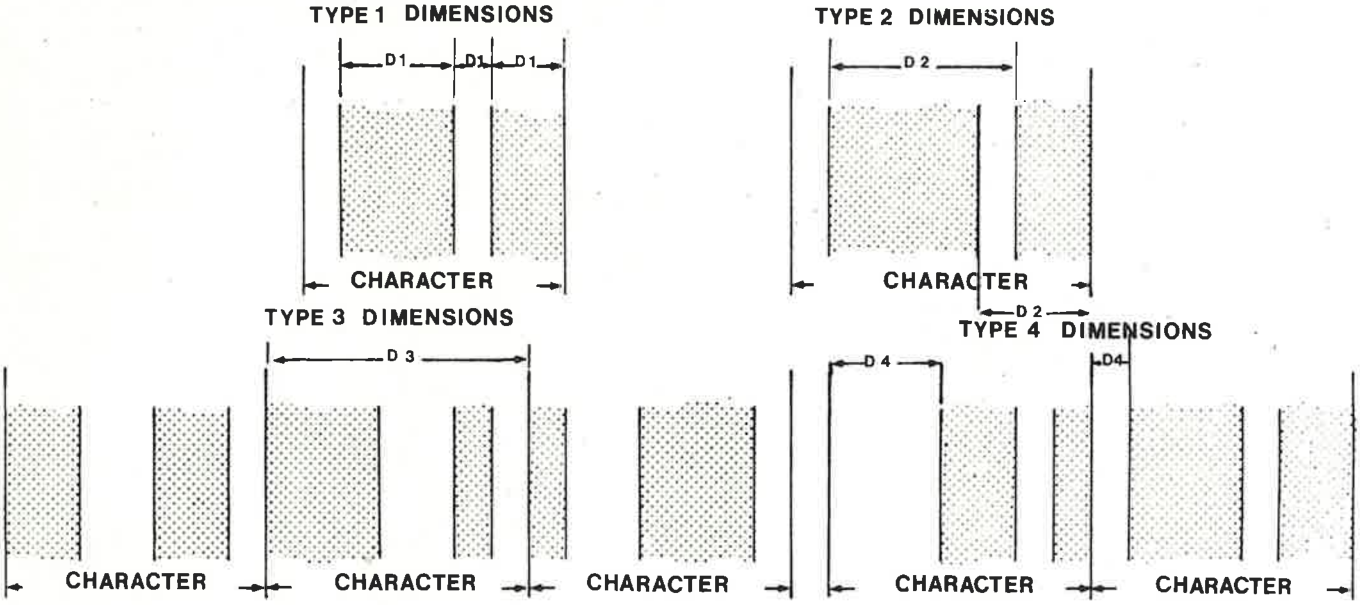
– APPENDIX 17 –

DENSITY , REFLECTANCE FACTOR AND PCS

LIGHT BACKGROUND		DARK BARS		MINIMUM PCS $\frac{R_L - R_D}{R_L}$
D	R_L	D	R_D	
0	100.0	.300	50,1	.499
.025	94.4	.365	43.1	.543
.050	89.1	.430	37.1	.583
.075	84.1	.495	32.0	.619
.100	79.4	.560	27.6	.653
.125	74.9	.625	23.7	.683
.150	70.8	.690	20.4	.712
.175	66.8	.755	17.6	.737
.200	63.1	.820	15.1	.760
.250	56.2	.950	11.2	.801
.275	53.1	1.015	9.6	.818
.300	50.1	1.080	8.3	.834
.325	47.3	1.145	7.2	.849
.350	44.7	1.210	6.2	.862
.375	42.2	1.275	5.3	.874
.400	39.9	1.340	4.6	.886
.425	37.5	1.405	3.9	.896
.450	35.5	1.470	3.4	.904
.475	33.5	1.535	2.9	.914
.500	31.6	1.600	2.5	.921

— APPENDIX 18 —

TOLERANCES TO BE RESPECTED BY IN-STORE MARKING EQUIPMENT



DIMENSION TOLERANCES - TYPES 1, 2 AND 3

MODULE WIDTH (mm)	TOLERANCE D1 (mm)	TOLERANCE D2 (mm)	TOLERANCE D3 (mm)
0,26 0,28	± 0,03 ± 0,05	± 0,03 ± 0,04	± 0,07 ± 0,08
0,30 0,32	± 0,07 ± 0,09	± 0,04 ± 0,04	± 0,08 ± 0,09
0,33	± 0,10	± 0,04	± 0,09
0,34 0,36	± 0,10 ± 0,11	± 0,05 ± 0,05	± 0,09 ± 0,10
0,38 0,40	± 0,12 ± 0,13	± 0,05 ± 0,05	± 0,11 ± 0,11
0,42 0,44	± 0,14 ± 0,15	± 0,06 ± 0,06	± 0,12 ± 0,12
0,46 0,48	± 0,16 ± 0,17	± 0,06 ± 0,07	± 0,13 ± 0,13
0,50 0,52	± 0,18 ± 0,19	± 0,07 ± 0,07	± 0,14 ± 0,15
0,54 0,56	± 0,20 ± 0,20	± 0,08 ± 0,08	± 0,15 ± 0,16
0,58 0,60	± 0,21 ± 0,22	± 0,08 ± 0,08	± 0,16 ± 0,17
0,62 0,64	± 0,23 ± 0,24	± 0,09 ± 0,09	± 0,18 ± 0,18