

Research on the Structure of Non-Tube and Non-Tray Folding Carton

Cheng Sun, Xinni Mou

Printing Engineering Department, Tianjin Vocational Institute Tianjin, China

Email: chengsun55@sina.com, muxinni@126.com

Abstract: Non-tube and non-tray folding carton can usually pack more than one products with dividing walls insides. Its structure, production processes and manufacturing equipment are more complicated than tube, tray and tube-tray cartons. This paper mainly discusses on the structural characteristics of non-tube and non-tray folding carton in respect of forming method, and also analyses on several examples of the structure of non-tube and non-tray cartons.

Keywords: non-tube and non-tray; multipack; folding carton; structure

1. Basic Concept of Non-Tube and Non-Tray Folding Carton

The non-tube and non-tray folding carton is usually of multi-package with dividing walls inside. Its structure is more complicated than the tube, tray and tube-tray cartons, and accordingly, its production processes and manufacturing equipment are also more complicated. It is different from other kinds of cartons in terms of form characteristics and manufacturing technology: the two panels of the main body move a distant relatively according to one cutting line of the main body and are interlocked on some certain positions. It's common points are listed as following:

- (1) The two panels of the main body move towards each other by a distance of B according to one cutting line of the main body when the carton is formed;
- (2) The joint of the bottom panel is the manufacture's joint, which is generally glued with slime;
- (3) The joint of the bottom panel can be glued in a flat status when creasing the creasing line in the middle of the bottom, the cartons can be transported in a flat status, and the bottom can be formed automatically when it is used, so this creasing line is an non-formed working score.

In Figure1(a), the two panels of the main body move by a distance of B relatively according to one cutting line of the main body, and thus, the carton is formed when it is pulled;

In Figure1(b), the red circled part of the main blank creases by 180 degrees according to the double-score line, and meanwhile, moves by a distance of B to the left and then formed;

In Figure1(c), the two sides of the main blank crease by 180 degrees and move by a distance of B relatively. All the above-mentioned 3 examples are 1×2 non-tube and non-tray folding cartons.

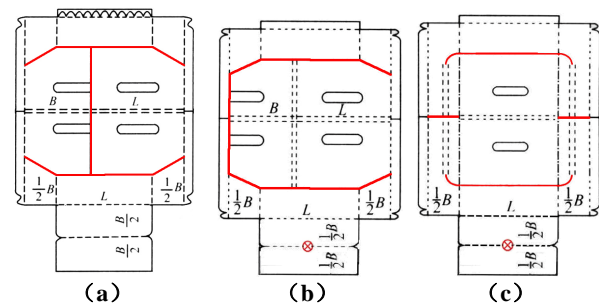


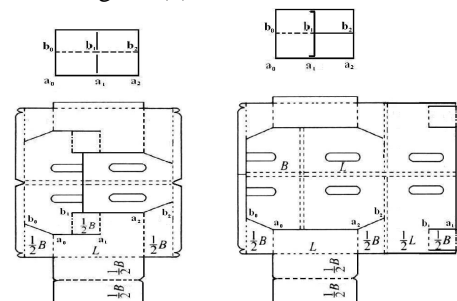
Figure 1. 1×2 Non-tube and Non-tray Folding Carton

2. Non-Tube and Non-Tray Folding Carton of Multipack

Because the limitation of the carton structure, the non-tube and non-tray folding carton of multipack can only adopt $m \times 2$ arrangements. If $L/m = B/n$, the carton can be improved on the basis of Figure1(a) and Figure1(b), if $L/m > B/n$, to save paperboard, only the designs similar to that of Figure1(a) can be adopted.

2.1. 2×2 non-tube and non-tray folding carton

Figure2 shows the 2×2 non-tube and non-tray folding cartons. Figure2(a) is achieved on the basis of Figure1(a) by changing the single cutting line of Figure1(a) into two cutting lines and adding a dividing wall between the two cutting lines, Figure2(b) is achieved on the basis of Figure1(b) by adding a middle dividing wall on the right extend panel of Figure1(b).



(a) (b)

Figure 2. 2×2 Non-tube and Non-tray Folding Carton

2.2. 3×2 non-tube and non-tray folding carton

Figure3 and Figure4 shows the 3×2 non-tube and non-tray folding cartons, the design of dividing wall is the reform of 1×2 non-tube and non-tray folding carton.

Figure3(a) and Figure3(b) are in the condition of $L/m = B/n$, Figure3(c) shows the pattern Q in the condition of $L/m < B/n$, Figure3(d) shows the pattern P in the condition of $L/m > B/n$.

Design procedures are shown in Table 1.

Table.1 Design Procedures of non-tube and non-tray folding carton of multipack

Ordinal number	Procedures	Level distant	P ar-range-ment	Q ar-rangeme
1	Determine the length of level double-score lines of the blank	$ b_0 b_m $	$L+B$	nt
2	Determine the horizontal coordinate of $a_0 \sim a_m$ points	$ a_{m-1} a_m $	l	b
3	Determine the horizontal coordinate of $b_0 \sim b_m$ points	$ a_m b_m $	b	l
4	Finish the design of m - l dividing walls	—	—	—

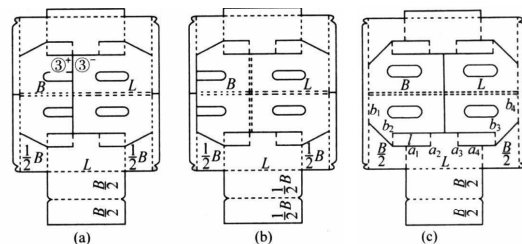


Figure 3. 3×2 Non-tube and Non-tray Folding Carton (1/2)

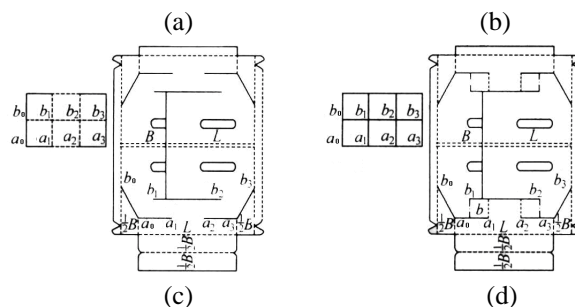
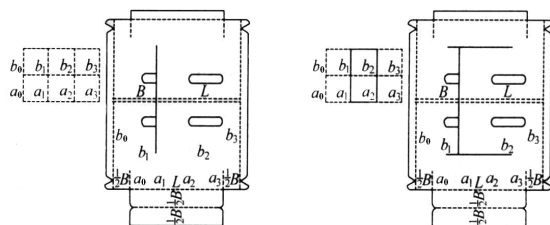


Figure 4. Design Procedures of Dividing Walls of 3×2 Non-tube and Non-tray Folding Carton (1/2)

Take Figure4 carton for an example, the forth step of Table 1 is as following:

(1) Determine the horizontal coordinate of every point [Figure4(a)];

(2) Connect point b_1 and b_2 to form a cutting line, which goes through the four points as b_1 , a_1 , a_2 and b_2 [Figure 4(b)];

(3) Connect $b_0 - a_0 - a_1$ and $a_2 - a_3 - b_3$ separately to form the cutting lines [Figure4(c)];

(4) Between the two cutting lines in the last step, draw inward bend creasing line upward from a_1 , a_2 points separately, outward bend creasing line downward from b_1 , b_2 points separately, to finish this design [Figure 4(d)].

But if the design procedures of Figure4 are changed into the following:

(1) Connect $b_0 - a_0 - a_1$ and $b_1 - a_1 - a_2$ separately to form the cutting lines [Figure5(a)~(b)];

(2) Connect $b_2 - a_2 - a_3 - b_3$ to form the cutting line [Figure5(c)].

This non-tube and non-tray folding carton can be designed as the one showed in Figure5(d), which uses less paperboard, no matter m is an odd number or an even number.

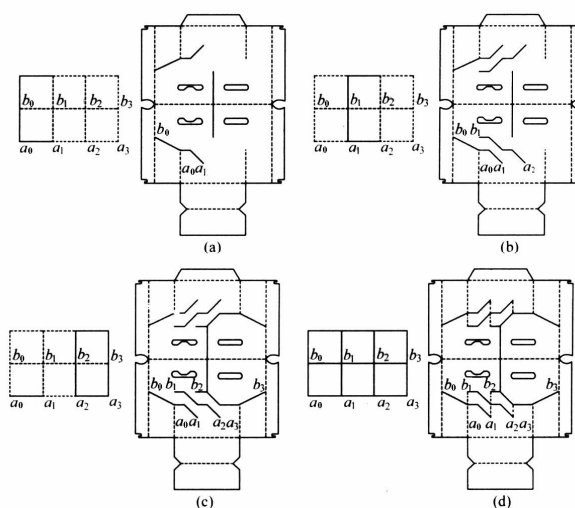


Figure 5. Design Procedures of Dividing Walls of 3×2 Non-tube and Non-tray Folding Carton (2/2)

The three cartons showed in Figure 6 are also non-tube and non-tray folding cartons, which use more paperboard than those in Figure 4 and Figure 5.

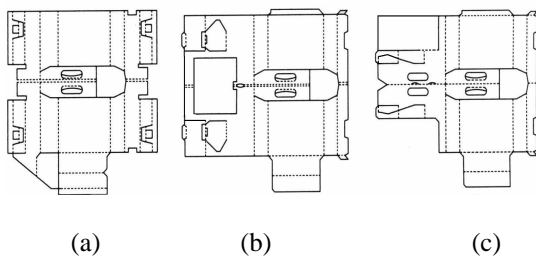


Figure 6. 3×2 Non-tube and Non-tray Folding Carton (2/2)

2.3. 4×2 non-tube and non-tray folding carton

If m is an even number, the non-tube and non-tray folding carton can be designed in two ways as shown in Figure 7 and Figure 8.

The carton in Figure 7(d) has two more dividing units than that in Figure 4(b) and is a 4×2 non-tube and non-tray folding carton, thus there are 4 additional vertical creasing lines on it, but its forming principle is still the same. The following is the forming process of it:

- (1) Connect $b_1 - b_3$ to form a cutting line, which goes through the four points as b_1 , a_1 , a_3 and b_3 [Figure 7(a)];
- (2) Connect $b_0 - a_0 - a_1$ and $a_3 - a_4 - b_4$ separately to form the cutting lines [Figure 7(b)];
- (3) Draw inward bend creasing line upward from a_1 , a_3 points separately, outward bend creasing line downward from b_1 , b_3 points separately, then form one left and one right dividing units [Figure 7(c)];
- (4) Make a middle dividing wall in the extend panel, in which, b_2 is inward bend creasing line, a_2 is outward bend creasing line, and the level distance of b_2 , a_2 is $B/2$. This is the final step of the design [Figure 7(d)].

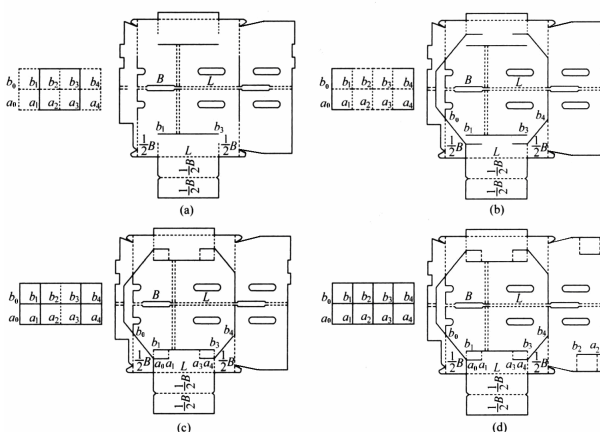


Figure 7. Forming Process of 4×2 Non-tube and Non-tray Folding Carton

The form of the main part of carton in Figure 8 is the same as that in Figure 1(b), but it uses more paperboard than that in Figure 7.

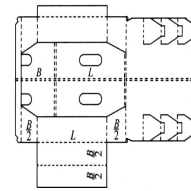


Figure 8. 4×2 Non-tube and Non-tray Folding Carton

3. Conclusion

The following are three ways of designing $m \times 2$ non-tube and non-tray folding carton:

- (1) If $m > 1$ and m is an odd number, the design of the carton can be carried out as shown in Figure 4 which saves material, if $m > 1$ and m is an even number, the design of the carton can be carried out as shown in Figure 7, namely, make the dividing walls at the two sides directly on the body of the carton, and make the middle dividing walls on the extend panel;
- (2) Whenever m is an odd number or an even number, all the dividing walls, as shown in Figure 8, can be made on a same extend panel at one side of the carton;
- (3) Whenever m is an odd number or an even number, all the dividing walls, as shown in Figure 2(b) and Figure 5 can be made on the body of the carton to minimize the use of paperboard. However, the appearance of the dividing walls of Figure 5 is better than that of Figure 2(b).

References

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