

## Aluminium can with pull ring

Cylindrical can containing mackerel in tomato sauce. The can has a pull ring. The can has a diameter of 7.5 cm. The ring has a diameter of 1.5 cm.

### Focus area

The opening procedure for this can is to lift and bend the ring in a 90-180° angle before it is pulled in the opposite direction. The angle is continuously adjusted in order to minimise the use need for force.



Figure 1 Aluminium can with a pull ring is studied.

For this type of packaging we estimate the physical force needed to be the main focus area, examined by a mechanical test as well as an end user panel. Furthermore the design is also important to study.

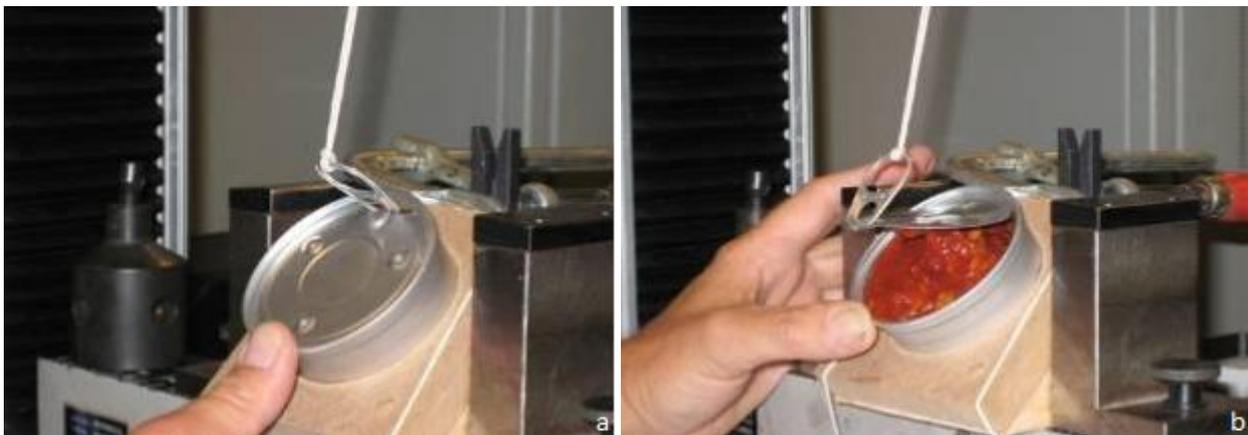
### REFERENCE TO GUIDELINE: Physical force, Design.

### Design

Most end users are familiar with a can with a pull ring and know that they have to pull the ring to open it. However, there is a risk that the ring is not bent sufficiently far before they pull which makes the packaging harder to open. Most end users are also very conscious not to make the contents spurt out during opening which requires a very careful and controlled opening.

### Mechanical test

The mechanical force was measured using a traction bench. As described the can is opened by the ring being lifted and bent in an angle of 90-180°. The starting point for the pulling is to hold the can in a 45° angle when starting the measurement. This is also the case when pulling the ring. The end user will adjust this angle during opening while the can is held continuously in this angle while measuring the mechanical force. This implies that the force measured mechanically is a bit larger than the force actually used by the end user when opening the packaging.



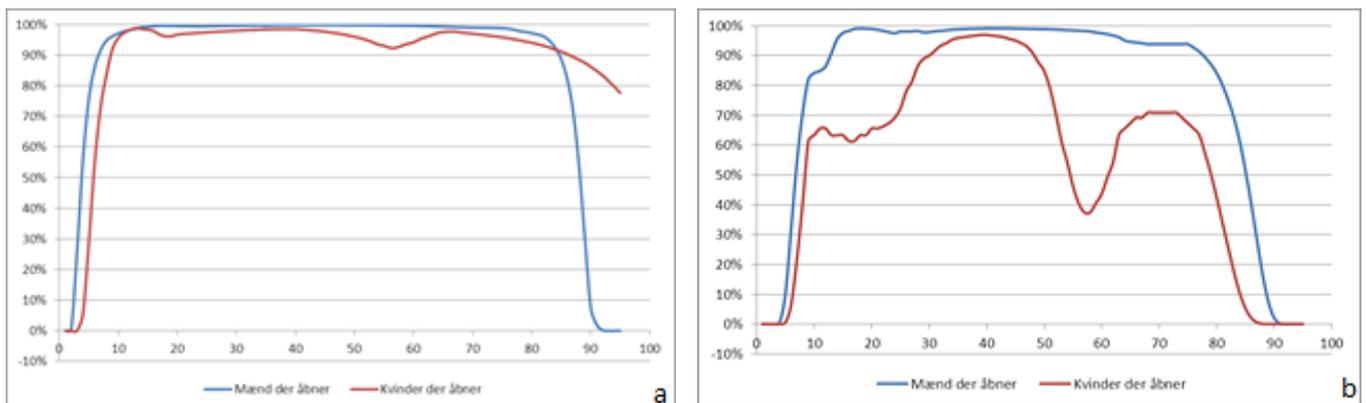
**Figure 2 Mechanical measurement of the pulling force during a) lift of ring (1. step) and b) pulling of ring (2. step) conducted holding a 45° angle between can and pulling direction.**

The pulling force was measured to  $12 \pm 0.3N$  for the lift of the ring and  $49 \pm 1N$  for pulling the ring. The standard deviation is very small which means that the user experience when opening the packaging should be comparable from time to time.

### End user's physical force needed

A calculation model has been developed for the guideline estimating the end user's critical force needed related to different packaging types. Based on dimensions and force measured the model illustrates which people potentially could have difficulties opening the packaging.

Based on the model there are hardly any people regardless of age and sex who would experience difficulties lifting the ring on the can (Figure 3a). Pulling the ring on the contrary (Figure 3b) it is expected that only about 35 % of women between 10 and 30 yrs and 30-50 % of women of 60-80 yrs old will find it difficult to open the can. Men are not considered as having any trouble pulling the ring on the can and thereby opening it. The graph based on the model for pulling the ring seem surprising but can be due to culturally based reasons in the study group the model is based on. Further information on the model and background data can be found in the guideline under "Calculation of critical force".



**Figure 3 Share of men and women who can a) lift a ring on a can requiring 12N and b) pull a ring on a can requiring a force of 49N. The ring diameter is 15 mm (Model based on data from DTI, UK 2002).**

### End user test

In relation to an evaluation of the new technical specification "DD CEN/TS 15945:2011 Packaging. Ease of opening. Criteria and test methods for evaluating consumer packaging" user tests were conducted in 2008 at Danish Technological Institute with an aluminium can with a lift/pull ring. Test users consisted of 29 randomly chosen elderly people in the age group of 50-90 yrs. Of these 1/3 was men and 2/3 were women. Half of the group had a physical ailment, e.g. arthritis in the hands. The group was asked to open the packaging and then evaluate how easy or difficult they found it on at scale from 1 to 5 where 1 is very easy and 5 is very difficult or impossible to open. The result is depicted in Table 1.

If the results from the end user study are compared with the estimated graphs of the end users' critical strength they are consistent. 88 % of the group MN (healthy men) in the end user study felt that the

packaging was easy to open while the model estimates that 80-100 % at the age of 50-80 yrs old can open the packaging. As for the women 75 % in the end user study felt that the packaging was easy to open, while the model estimates that 40-80 % of the women at the age of 50-80 yrs can open it. Doing this comparison however, it is essential to distinguish between a packaging which is perceived as easy to open and one which requires a low amount of strength to open. These two concepts are not quite the same but nevertheless give a good indication as the factors are correlated. In this case the packaging is estimated to be easier to open than the model predicts based on the force needed. This could suggest that the force needed to open the can is easy to transfer which means that the can is perceived as easy to open. Generally the can is evaluated easy to open by fewer women than men, especially women with a physical ailment in their hands. Whether a packaging is perceived as difficult or easy to open depends on each single individual and therefore is biased and relates to expectations and experience. Thus such an end user study has to be evaluated with care. In the end user study of this can it was evident that the respondents probably rated the can diversely. It was furthermore observed that the end users from time to time don't respond personally but try to give an evaluation of which problems they think other people experience when opening this particular packaging. Several of the arthritis-stricken persons expressed that this can was easier to open than they had expected even though they generally don't like to open cans with their hands. Especially lifting the ring is difficult and a lot of them use a spoon or a knife to do it. See the questionnaire on using tools in "User-friendly packaging - Guideline for the industry".

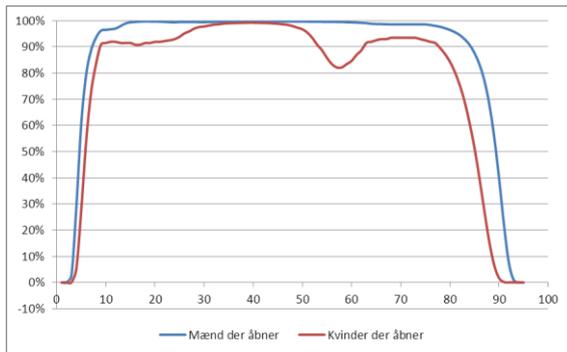
In a similar end user study a panel evaluated a medicine container with an inner opening formed as a pull ring of plastic (ring diameter 25 mm, opening force needed 56N). The medicine container were by 34 % of the entire group consisting of 30 persons thought difficult to open. In comparison only 7 % of a similar group thought that an aluminium can was difficult to open. The can required 49N to open and has a ring diameter of 15 mm. It is therefore seen that a change in the physical force are of great significance to how easy to open a packaging is perceived.

**Table 1 End user test of how easy the aluminium can with pull ring was to open on a scale from 1-5, where 1-2 is easy to open and 4-5 is difficult or impossible to open. The test group consisted of 30 persons, men (M), women (F), with (D) or without (N) physical ailments affecting their hands. Number of persons in the group is given in parentheses.**

<b>End user's evaluation of the aluminium can</b>	MD (4)	FD (9)	MN (8)	FN (8)	total (29)
Difficult to open	25 %	11 %	13 %	0 %	7 %
Easy to open	75 %	44 %	88 %	75 %	69 %

## Conclusion

In spite of the fact that the aluminium can is perceived as relatively easy to open there are still 30 % who find it difficult to open. If an even smaller share of people finding the packaging difficult to open is desired the calculation model can be used by initially defining a success criterion related to the target group. An example could be "90 % of all test persons shall be able to open the packaging". By inserting this in the model it can be seen that the best result can be obtained by both reducing the necessary force needed and increasing the ring diameter. In order to obtain the success criterion 50 mm is used as ring diameter and 40N as opening force needed (Figure 4). Another suggestion to improvement of the opening friendliness would be to change to an entirely different packaging type.



**Figure 4 Share of men and women able to open cans by pulling a ring when the ring diameter is 50 mm and the opening force needed is 40 N (Model based on data from DTI, UK 2002).**

These suggestions to improvements are pretty obvious. If the company requires more unorthodox or innovative solutions we suggest that a workshop for idea generation is held (see User-friendly Packaging - Guideline for the industry).