Engineering White Paper

PREPACKAGES
PENKO ENGINEERING B.V.

INTRODUCTION

This White Paper discusses the challenges, options and solutions for packaging of products for consumers and/or further processing by the process industry. The product can be sold in bulk or packed. For sale, packages can be filled to a certain weight, or the packages can indicate the actual net weight of the contents. This White Paper focuses on the laws and regulations for „small“ packages, up to 10 kg.

Figure 1. The difference between big and small packages

PURPOSE OF WHITE PAPER

……- is to explain why it is important to pack the right amount of material/product, - in individual packages such as boxes, bottles, pots, bags and the like. Overfilling ultimately leads to a loss of profit by giving the product away and underfilled packages cause dissatisfied customers and are in many cases a violation of the law. The opening of European internal borders resulted in international standards and guidelines that guarantee correct, fair and accurately filled prepackages. Directive 76/211/EEC of January 20 1976 “on the approximation of the laws of the Member States relating to the making-up by weight or by volume of certain prepackaged products” and Amendment 78/891/EEC of September 28 1978 allows packaging on the basis of the average weight for packages up to 10 kg. The aforementioned European directives do not deviate from the globally applicable OIML recommendations R79, with the labelling requirements, dated 2015 and R87, for the quantities of product in pre-packages, dated 2016.

The advantages of fast weighing (PENKO instruments measure up to 1600 times per second) are a higher control speed, allowing a higher filling or control speed without loss of accuracy, resulting in a fast return of investment.

BASIC PRINCIPLES

The directive defines in article 2.2 a prepackage as follows:

A product is prepacked when it is placed in a package of whatever nature without the purchaser being present and the quantity of product contained in the package has a predetermined value and cannot be altered without the package either being opened or undergoing a perceptible modification.

The directive also specifies in article 4.2 the units in which the contents of the packages may be declared:

Prepackages containing liquid products shall be marked with their nominal volume and prepackages containing other products shall be marked with their nominal weight, except in the case of trade practice or national regulations which provide otherwise and which are identical in all Member States, or in the case of contrary Community rules.

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BACKGROUND ON THE CONTROL OF PREPACKAGES, ≤ 10KG/

The purpose of the aforementioned directive is to prevent for barriers to trade between the Member States by making checks at European internal borders superfluous. The supplier achieves this by marking his packaging with an "e". With this „e" he declares to pack in accordance with the directive. Before he can place the "e" in many countries a notified body, in the Netherlands NMi-Certin, must check his control system, approve it and grant an authorization. Prepackages should never contain less than the weight printed on the package. More is and was allowed, of course within a certain range.

The essential requirements

Interesting on filling with the "e" sign for the packer is that underweight is permitted, provided that the average filled weight per package is equal to or above what is mentioned on the package.
This does not mean filling can now be (sloppy) as long as under and over weights compensate each other. The extent of the permitted underweight is in fact limited with the so-called T_0 limit. This is shown here in our table 1, out of Annex I, Chapter 2, point 2.4, of the aforementioned amendment.

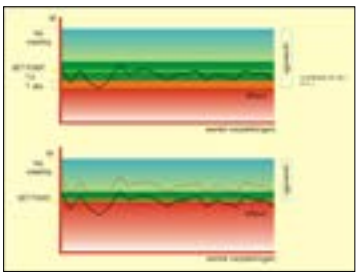

Figure 2. The realized, thanks to the e-mark, product weight savings.

Nominal quantity Qn, in grammes or millilitres	Tolerable fouten	negative error in minus
	as % of Qn	g or ml
from 5 to 50	9	_
from 50 to 100	_	4,5
from 100 to 200	4,5	_
from 200 to 300	_	9
from 300 to 500	3	_
from 500 to 1 000	_	15
from 1 000 to 10 000	1,5	_

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A limited number, 2.5% of the amount of fillings, may be below this T_0 limit, but not below the T_{abs} limit (2 times the maximum permissible error in minus). You must keep track of whether each batch meets the requirements based on filling or checking data. You should also have this information available for verification. This requires a control instrument which is firstly approved and secondly has a suitable scale interval. The maximum measurement error of the weighing system, used for checking the prepackage, may not be more than one fifth of the maximum permissible error, valid for the nominal quantity of the contents of the prepackage (see the previous table).

Scale interval in g	Mass to be controlled in g
0,2	≥ 11,1
0,5	≥ 55,6
1	≥ 111
2	≥ 333
5	≥ 1 667
10	≥ 3 333
20	≥ 6 667

A batch includes the production of filled prepackages during one hour with a maximum of 10,000 pieces. By the way, you do not need to save or print the filling results, you can store them in an electronic memory as well. You may collect the data from the filling controller, check weigher or sample checks. When available, of course it is logical to use the data directly from the first two examples mentioned.

Photo 1. The control on weight of buckets with hard boiled chicken eggs.

That saves you three actions, collecting samples at random, checking them and the registration. In this context we should not ignore an important characteristic of filling controllers, tolerance monitoring. Weights below T_0 can be filled up or removed out of the packaging line.

Photo 2. Machine for filling of sacks with potatoes.

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Weights below T_0 can be filled up or removed out of the packaging line. The advantage of this method is, you do not have to compensate by means of extra overweight or adjust a party afterwards. For the information about filling controllers and checkweighers, please refer to the relevant white papers.

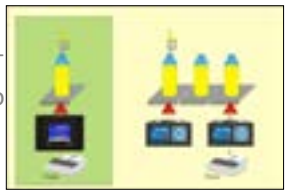

Figure 3. The registration, directly out of the controller, of the filling weight information.

Sample checks.

If you decide in spite of that to take samples, these should be statistically relevant. The required number of samples is laid down in the schedule for non-destructive testing, amendment 78/891EU, Annex II, Chapter 2, point 2.2.1. The approval and rejection criterion relates to the number of prepackages whose weight is between the T_0 and the T_{abs} limit, package contents below the T_{abs} limit are not permitted.

Photo 3. Build in weighing system for sample checks.

Furthermore, the average weight of the complete batch must be determined. This must be equal to or above the weight mentioned. For a sample, you will find the size and the approval and rejection criteria in table 3:

Number of packages	Samples			Number of faulty prepackages	
	Sequence	Sample size	Sample size after addition	Approval criterium	Disapproval criterium
100 t/m 500	1st	30	30	1	3
	2nd	30	60	4	5
500 t/m 3200	1st	50	50	2	5
	2nd	50	100	6	7
3201 and over	1st	80	80	3	7
	2nd	80	160	8	9

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Destructive sample checks.

In certain occasions it may be necessary to check the prepackages destructively. The criteria for this are found in table 4, derived from amendment 78/891EU, Annex II, chapter 2, point 2.2.2.

Number in batch	Number in sample	Number of defective units	
		Acceptance criterium	Rejection criterium
Whatever the number (≥ 100)	20	1	2

PRODUCT SOLUTIONS

The filling data, obtained by means of sample checks or from the entire batch, can be transferred into a PENKO processing system by your weighing system, filling controller or checkweigher. With today's state of technology, this will be a personal computer, if necessary with a printer. For an entire batch an "e" mark protocol includes:

* the date with the start and end time of the period.
* the product and machine code, to be entered on the personal computer.
* the pre-set net weight.
* the number of filled packages.
* the average weight and the standard deviation over all packages during the period or the number.
* the number of packages, below the T_0 and T_{abs} limits.
* an alarm message on the personal computer if after a number of packages or a certain time the average appears to be equal to or below the pre-set weight respectively a package contains a weight below the T_{abs} limit.

When operating with sample checks, the first three data must be entered manually. Furthermore it consists of the number of approved and rejected packages with the average weight. You must have this information available until the expiry date of your product. To conclude, we show you an "e" mark protocol, automatically generated over the entire batch. Interesting for you is that similar information can be generated without any objection for package weights above 10 kg. Certainly this is relevant information in the context of your quality assurance system, it offers you continuous control over the quality of the filling process.

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Date:	8-11-2017
Start time	11h04
End time	12h04
Product code:	Strawberry jam
Machine code:	3A
Party size	3 200
Nominal weight:	450 g
T1-limit:	443,25 g
T2-limit:	436,5 g
BelowT1:	1
Below T2:	0
Pushed out:	2
Average weight:	450,5 g
Standard deviation:	0,2 g

CONCLUSION

PENKO weighing instruments, filling controllers and checkweighing instruments transfer the data of the packages directly to a processing system that calculates and stores the legally required information about the entire batch.

All instruments, intended for filling and check weighing purposes, are designed and build for an accuracy of 10 000 d. The combination of measuring at high speed (1 600 conversions/s) with a high internal resolution (16 777 216), smart filters and sufficient computing capacity make the instruments suitable for any filling and check weighing application. The combination of the high internal resolution and conversion speed guarantees the best attainable weighing accuracy, even when operating at high speed. This prevents for wastage due to rejected batches of packages.

Photo 4. Filling of buckets with granulate.

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Determining and processing the data of batches of packages as quickly and efficiently as possible, also within the requirements of a quality assurance system, remains a challenge for the processing and packaging industry and will vary from company to company. Attention must not only be paid to the challenge of avoiding wrong batches of prepackages, but also reducing excess weight per package requires attention.

For the selection of the most efficient way for data processing per type of package, product or company there is no "one-size-fits-all" solution. Engineers at PENKO work out the best and most effective way this can be done for you. Following White Paper will discuss Load Cells, the installation of Load Cells, Non Automatic Weighing Systems, Maritime Weighing Applications, Check Weighing Systems, Filling Systems, continuous totalizing with Belt Weighing, continuous totalizing with Loss-in-Weight, discontinuous totalizing with Hopper Weighers, Grading Systems by means of Weight and Batch Control on Weight for Mixing Plants.

For information: www.penko.com

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