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COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS

Sub-Committee of Experts on the
Transport of Dangerous Goods

Thirty-first session
Geneva, 2-6 July 2006
Item 2 of the provisional agenda

PERFORMANCE OF PACKAGINGS, INCLUDING IBCs

Testing of aerosol dispensers

Transmitted by the International Organization of Aluminium Aerosol Container Manufacturers (AEROBAL)

This informal document contains annexes 1 to 3 to document ST/SG/AC.10/C.3/2007/33, as follows:

Annex 1: Draft revised text for the Aerosol and Dispenser European Directive 75/324/EEC
Annex 2: Legal expertises commissioned by AEROBAL
Annex 3: “Hot” alternative test methods

Annex 1
Draft revised text for the Aerosol and Dispenser European Directive 75/324/EEC

10. Point 6.1.4 is replaced by the following:

"6.1.4 Final inspection of filled aerosol dispensers

6.1.4.1 Aerosol dispensers shall be subject to one of the following final test methods.

(1) Hot water bath test

Each filled aerosol dispenser shall be immersed in a hot water bath.

(a) The temperature of the water bath and the duration of the test shall be such that the internal pressure reaches that, which would be exerted by its contents at a uniform temperature of 50°C.

(b) Any aerosol dispenser showing visible permanent distortion or a leak must be rejected.

(2) Hot final test methods

Other methods for heating the contents of aerosol dispensers may be used if they guarantee that the pressure and temperature in each filled aerosol dispenser reach the values required for the hot water bath test and distortions and leaks are detected with same precision as in the case of the hot water bath test.

(3) Cold final test methods

An alternative cold final test method may be used if it is in accordance with the provisions of the 'UN Recommendations on the Transport of Dangerous Goods (UN Model Regulations)' on alternative methods to the hot water bath test."

6.1.4.2 Test methods (1) and (2) shall not be applied to aerosol dispensers, the contents of which undergo a physical or chemical transformation before use changing their pressure characteristics.

6.1.4.3 In case of test methods (2) and (3):

– *the test method must be approved by a Competent Authority for the Application of the ADR.*

– *the person responsible for the marketing of aerosol dispensers must for surveillance purposes keep a copy of the approval of the Competent Authority, the technical file describing the method, which was submitted to the Competent Authority for approval, and, if applicable, control reports readily available at the address specified on the label in accordance with Article 8 paragraph 1 a).*

The approval of the Competent Authority and the technical file must be established in a Community language or a certified copy thereof must be available."

Annex 2
Legal expertises commissioned by AEROBAL

DE PARDIEU BROCAS MAFFEI & LEYGONIE

AVOCATS A LA COUR DE PARIS

Paris, April 18, 2001

REVIEW OF THE PROPOSED ALTERNATIVES TO WATER BATH TESTS FOR AEROSOL CANS UNDER FRENCH PRODUCT LIABILITY LAW

EXECUTIVE SUMMARY

1. We are of the opinion that the implementation of the alternative method would increase the overall risk of liability borne by producers in the production process of aluminium aerosol cans as there is no evidence that such method would afford a safety standard as high as that afforded by the hot water bath testing method which has proven to be reliable.

2. In any event, the implementation of the alternative testing method would leave parts of the production process of aerosol cans uncontrolled as against the risks of bursting, such risks being currently monitored with the hot water bath testing method.

3. In this respect, considering the rationale of consumer's protection underlying the Directive 94/1/CE of January 6, 1994, regulating the testing methods to be used for aerosol generators, it does not seem that the alternative method could qualify as reaching an equivalent result to that afforded by the hot water bath testing method.

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DOC ID
OUR REF Mk/KGL
YOUR REF

21 March 2001

Legal opinion regarding the consequences under German Product Liability Law in Connection with the Projected Alternatives to Water Bath Tests for Aerosol Cans

Dear Mr. Spengler,

please find enclosed our above-mentioned legal opinion.

We may summarize the results of this legal opinion as follows:

1. Can manufacturers as well as fillers are producers in the sense of German Product Liability Law which is divided into two general concepts, strict liability (irrespective of negligence) and negligence (based on the law of torts).

2. Producers not only have to meet the generally-accepted rules of technique, but have to take into account the latest accessible technical and scientific know-how and possibilities; they must comply with the requirements of the state-of-science-and-art which is the top level.

3. Alternatives to the hot water bath test which has been used for over forty years and is commonly accepted may only be implemented, if no doubt at all remains as to whether bursting risks of filled aluminium aerosol cans remain.

4. If filled aerosol cans are no longer tested under the same conditions under which an end-consumer makes use of them, we are of the opinion that this leads to a higher product liability risk on the side of each producer involved in the production process compared to the actual situation in which filled aerosol cans are tested in the hot water bath.

5. Since a producer of a component is only responsible for its part in the overall production process, the responsibility under product liability law for the filled aerosol cans remains with the fillers.

6. Several producers are jointly and severally liable unless the responsibility may be allocated to one of them.

7. As to the burden of proof in product liability litigation, one has to recognize that legislation as well as jurisdiction tend to more and more shift the burden of proof onto the producers.

8. Under the projected alternative to the hot water bath test, the fillers involved might have - in case of a damage - problems to prove that the filled can had no defect at the time it was brought onto the market. A plaintiff might therefore have a stronger case than if the filled aerosol cans had undergone a 100% pressure and leakage test at the end of the overall production process.

If you have any queries, please do not hesitate to contact us.

Sincerely yours,

(Dr. Mecklenbrauck)

Enclosure

Annex 3
"Hot" alternative test methods

Warm Water Test Bath/ Alternative Test Methods

Combination Facility
High-performance shower bath/micro-leakage detector

By Bernd V. Braune

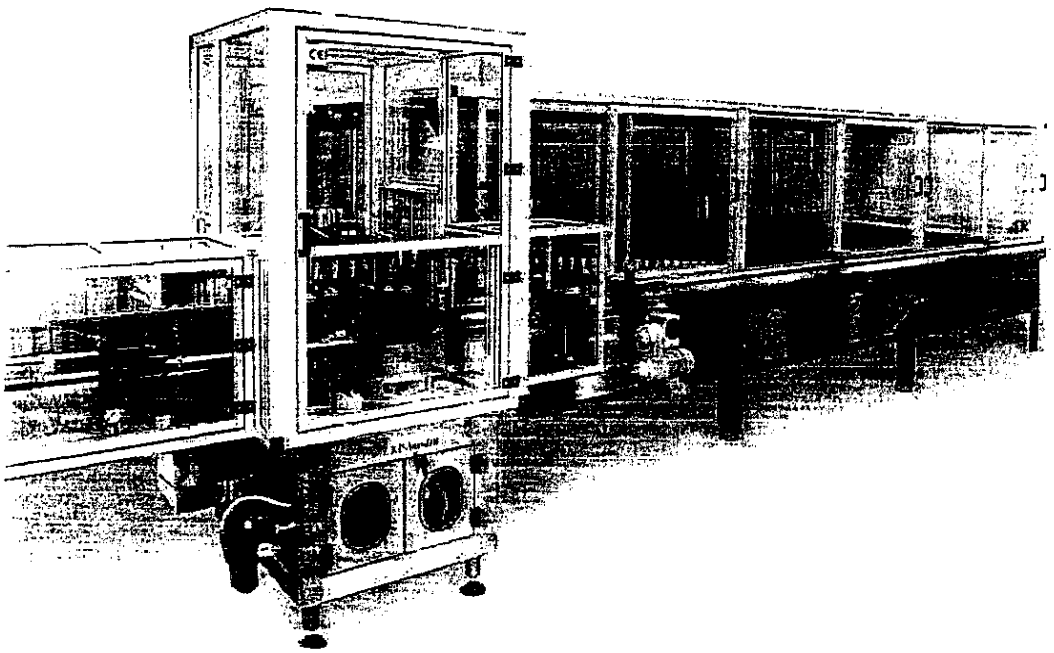
According to the Aerosol Directive 94/1/EC, GGVS/ADR and TRG 403 item 4, each aerosol can put on the market must be tested in a warm water bath. In the present article this test method and possible alternative test methods will be presented.

Background/History

In the 50s, the warm water bath test was developed as aerosol safety test and installed in the aerosol filling lines.
At that time, the aerosol industry was to some extent still in its infancy and neither cans nor valves met the present quality standards.
In order to offer the final consumer a pressure-resistant and leakproof packaging, the finished aerosol cans still pass through a warm water bath within an aerosol production line. This ensures that only pressure-resistant and leakproof aerosol cans are put on the market.

High safety standards

The present quality assurance in the European supplier and manufacturing industry ensures the highest level of production quality. Moreover, the aerosol industry undertook to set higher safety standards in order to make the finished aerosol can still more safe for the final consumer.
This basis, i.e. the highest product quality produced by the suppliers' industry, was the prerequisite for the development – in addition to the warm water bath test – of the alternative test methods, which are presented hereafter.



Warm water test bath/Universal test bath

Alternatives to the warm water bath test – Conditions of use

Over the last 4 years, the FEA Water Bath Task Force has controversially discussed alternative test methods to the warm water bath test. In the heat of the moment it has been completely disregarded that the experts in Brussels dealt with alternatives in addition to the warm water bath test. This does not at all mean that the filling companies have to give up the warm water bath test if they identify with this test facility. They are free to use alternatives if these methods are classified as equal to the warm water bath test and meet the requirements of the European directives.

The fact is that according to Aerosol Directive 94/1/EC, GGVS/ADR and TRG 403 item 4 each aerosol can must be tested in a warm water bath at 50°C. During this process, pressure stability and tightness of the finished aerosol can are tested.

According to the Burgoyne expertise - warm water bath test versus alternatives - ordered by FEA, if alternative test methods are used it must be ensured that they meet the "Bursting" and "Leakage" safety criteria applied to aerosol cans put on the market. Burgoyne comes to the conclusion that according to the present state of the art both methods can be classified as equal as far as safety is concerned. This will be further specified hereafter.

Warm water bath test at 50°C

In order to ensure that the final consumer, who complies with the safety advice "Pressurised container. Protect against sun rays and temperature over 50°C" is really safe, the finished aerosol cans are tested in a warm water bath test at 50°C. In this way, only pressure-resistant and leakproof aerosols are put on the market. Cans identified as defective are removed.

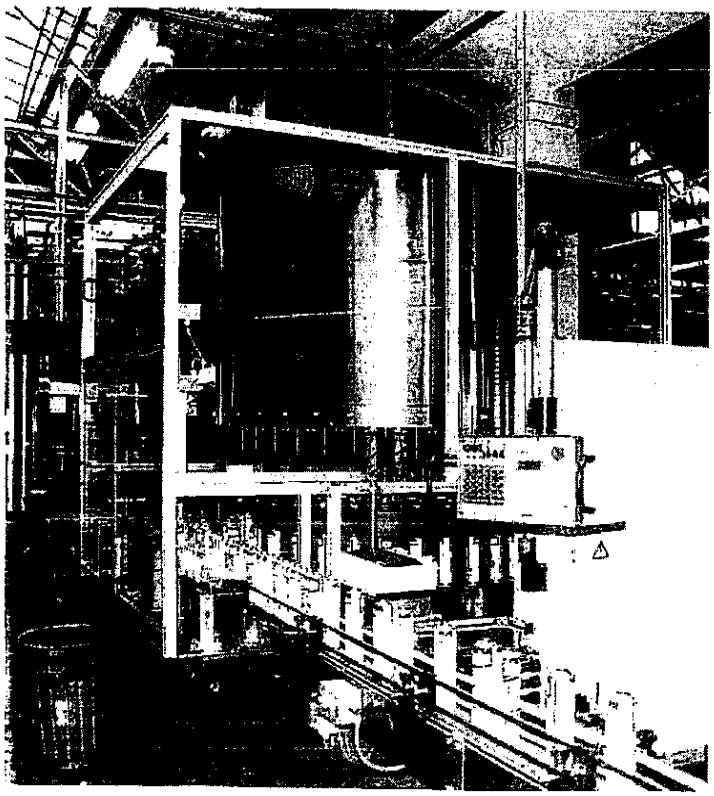
Potential sources of defects at tinplate and aluminium aerosol cans are the clinching (leakages between the valve and the can bead due to incorrect clinch setting, worn-down or defective clinching jaws), defective valve, overfilling, use of wrong propellant, pressure stability variations leading to deformations up to bursting and in the case of tinplate cans additional leakage in the area of the cover, bottom and welding.

The tightness test is carried out either visually or automatically by means of leakage detecting aggregates in or after the warm water bath test.

Alternative test method

The successful use of alternative test methods is based on three technological safety pillars:

- use of certified pressure-resistant and leakproof aerosol cans
- check of possible overfilling (product or propellant) by check weigher
- micro-leakage test of the finished aerosols by means of appropriate appliance.

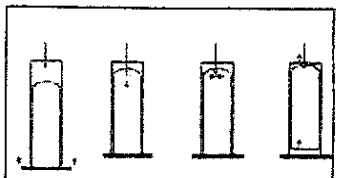


Rotary can tester installed in an aerosol can production line

Certified cans

The basic condition for certifying a can is a reliable quality assurance at the can manufacturer. The essential item is the passing of all manufactured aerosol cans through a rotary can tester where their pressure-resistance and tightness are tested up to 100%. In the case of uncertified cans, pressure-resistance is tested in the warm water bath.

The first rotary can tester was developed by Staehle: in co-operation with the Swiss Wilco AG, Staehle developed the Wilcomat AE/PA, which combines bursting and leakage test.



Introducing, positioning, stopping and suspending of the empty can for the bursting and leakage test

A feed star-wheel puts the aerosol can on the carrousel from which it is lifted by a pneumatic cylinder in the test chamber. By means of a holding device the can is sealed up towards the chamber and is freely suspended. At first, the bursting test is carried out. To this end the can is over-pressurised by 10 bar. Because of the free suspension in the test chamber, the cover or the bottom of a defective can takes off or its longitudinal seam breaks up. The free suspension avoids that weaknesses remain unknown due to the cylindrical fixing of the can.

The bursting test offers the ideal starting point for the subsequent leakage test. The protection chamber serves as test chamber and the (high) bursting pressure as (high) filling pressure. If the can leaks, a pressure rise is measured in the chamber.

Due to the high filling pressure, even small leakages are identified. During a 100%-in-line test, a leakage rate of 10^{-2} mbar x l x s^{-1} can be measured. Experience has shown that more than 99% of all leakages are bigger and that smaller leakages may also be closed by the can contents. By chance, the leakage rate of 10^{-3} mbar x l x s^{-1} corresponds to the rate which the German TÜV has been requiring for several years.

Check weighers

Thanks to the installation of a check weigher after the propellant filling under- and overfilled cans are automatically removed. For all fillings of 20 to 300 cans per minute, the supplier industry offers the appropriate check weigher in all protection classes.

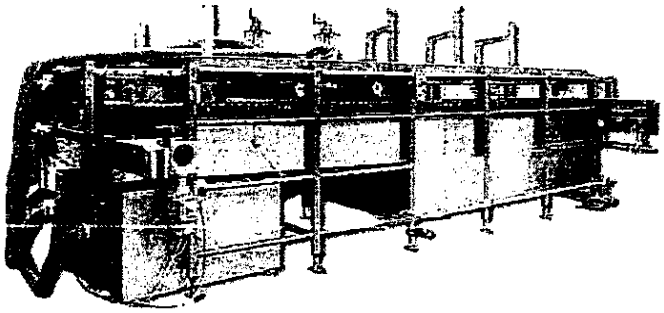
Micro-leakage testing

For the testing of leakages in the clinching, i.e. between valve and can bead, the filler is the only one to be responsible. The micro-leakage testers used to date detected leakages in a performance spectrum of up to 240 cans/min. A leakage rate of 10^{-2} mbar x l x s^{-1} is measured; this corresponds to 5 g expanded LPG per day or 2 bubbles per second.

In one German aerosol manufacturing company, more than 5 million certified aerosol cans have been filled up and - in parallel to the water bath test - they were tested with a 24 head-rotary leakage detector to detect micro-leakages. The leakage detector was clearly better at finding leakages than the warm water bath test.

Conclusion

It must be stressed that both methods - the warm water bath test and the alternative test method based on the certified can, the check weigher



Sholder Bath

Layout combinations Sholder Bath/micro leak detection

and the microleakage test of the finished aerosol – should be considered as technologically equal methods.
In the meantime, a validation procedure is being carried out in order to obtain European approval of the alternative test methods for finished aerosols.

Further development: Combination facility high-performance-warm-water bath-test/micro-leakage test

To date the European legislation still requires a warm water bath test for all filled aerosol cans in order to meet the agreed production, distribution and sale standards.

Since its introduction, the warm water bath test has successively been adapted to the state of the art.

The economically acceptable performance spectrum of the conventional warm water bath tests is between 220 to 250 cans/min.

If the aerosol filling lines produce higher performances (300 cans/min), the dimensions of the warm water bath must be increased.

This would have two disadvantages:

1. For the majority of the aerosol filling companies this would cause a problem of space.

2. Due to the size of the bath, the water part would increase and consequently the energy needed to keep the bath at a constant temperature of 55°C.

The newly developed aerosol test aggregate composed of a shower bath system combined with a micro-leakage detector instead of the conventional warm water bath technology fully meets this performance requirement.

Shower bath

The shower bath was developed for the pressure test of tinplate and aluminium cans at speeds of up to 300 cans per minute and is a direct alternative to the warm water bath test.

In the shower bath the filled aerosol cans are slowly conveyed through the machine by means of an open fine-meshed conveyer band.

While the cans are transported through the machine, they are showered by steadily recirculating water of approx. 55°C. This lasts approx. 3 minutes.

Compared with the conventional warm water bath test, this system is – with regard to its container conveying performance – smaller and more efficient, which is especially important for high-speed lines.

Practical tests at the operator's have shown that if 300 cans are conveyed per minute, a balanced pressure/50°C can be achieved in less than 3 minutes. This applies both to 250 ml as to 300 ml cans.

The machine has drying sections, which are fitted with air nozzles that eliminate the remaining water from the valve cup and dry the can sides.

As part of the concept a danger and risk analysis was carried out which ensured that the necessary safety measures have been taken, i.e.

- Design and manufacture of the machine were carried out in compliance with the European standards including the requirements of the B.S. *(British Standard) – Health and Safety at Works Act BS 5304.*

- Moreover, tests were carried out at KP Aerofill in Hayes/GB which ensure that the safety enclosure resists exploding aerosol cans.

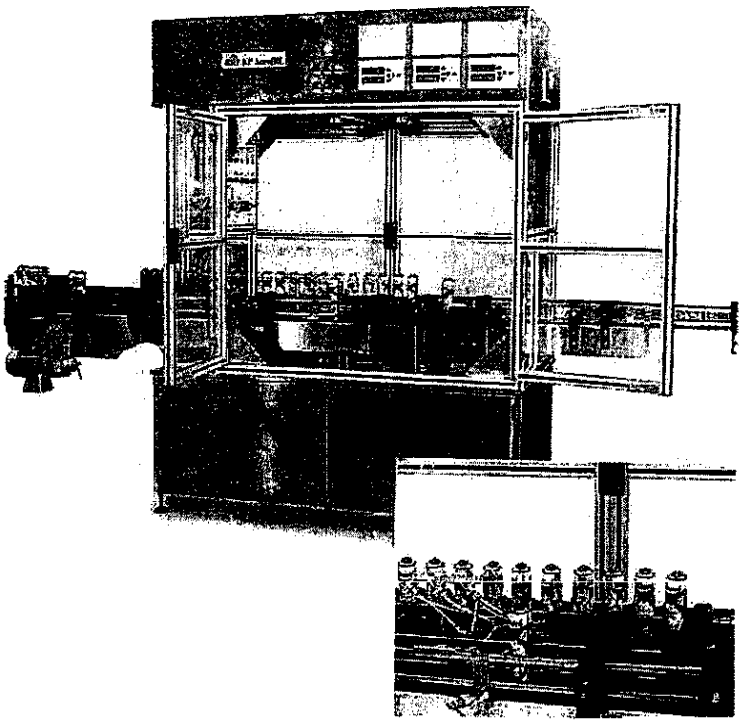
GLDS 300 Micro-leakage detector

The dried and pressure-resistant aerosol cans filled with product and propellant, which passed through the shower bath, are conveyed to a high-performance micro-leakage tester, which has especially been developed for tinplate and aluminium aerosol cans.

This new technology is equipped with 6 robust and ultrasensitive ceramic gas sensors which extract at strategically defined positions a defined quantity of air of the can and the valve to analyse them.

The ceramic sensors measure the difference of the oxygen content between the air sample taken from the can and a reference air sample of the ambient air. The air sample is analysed while it passes the sensor. The gas-product mixture in the air sample, which is to be analysed, reacts in the sensor and reduces the oxygen content in the air sample.

The resulting EMK signal is proportional to the gas content of the sample. Therefore, the system can detect in the case of a balanced pressure, microleakages of up to 1-2 bubbles per second, which at ambient temperature are much lower.



GLDS 300, micro leak detector

During the air extraction the aerosol cans filled with product and propellant are coveyed in line in a screw and simultaneously rotated on their axes. This ensures e.g. that in the case of a tinplate aerosol can, valve, can bead, cover bead, welding seam, bottom bead of up to 300 cans/min. are reliably tested.

Leakages are detected with precision. Defective cans with a leackage rate exceeding 10^{-2} mbar x l x s^{-1} (this corresponds to 5 g gas loss per package per 24 hours at 50°C or approx. 2 bubbles per second) are automatically removed by means of a vacuum star-wheel via a removal conveyer integrated in the machine.

Conclusion

The shower bath / micro-leakage test developed by KP Aerofill/GB, meets the can bursting & leakage test criteria, in a performance spectrum of 300 cans/min. This type of finished can test is another alternative to the conventional warm water bath test especially in the high performance field.