BS EN 14482:2010

BSI Standards Publication

Postal services — Trays for international letter mail — Test methods and performance requirements

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National foreword

This British Standard is the UK implementation of EN 14482:2010. It supersedes DD CEN/TS 14482:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SVS/4, Postal services.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This European Standard was approved by CEN on 26 September 2010.

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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 14482:2010) has been prepared by Technical Committee CEN/TC 331 “Postal services”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 14482:2003.

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Introduction

The European Union Commission stressed already in its Green paper on postal services in 1992 the need to establish common rules for the development of community postal services and the improvement of quality of service.

Furthermore the Commission has acknowledged the need for technical harmonisation to increase the interoperability of postal networks in the Member States and has given CEN a mandate to define fields where such harmonisation could be useful and suggest priorities and timescales.

1 Scope

This European Standard specifies the performance requirements and testing methods for standard letter mail trays, as specified in the classification below. The trays should be used to facilitate the exchange of international mail. The technical specification of the trays should be such that the performance requirements specified herein are met and tests specified herein successfully completed. The technical specifications of trays as such however, are beyond the scope of this standard.

This standard covers a one-size universal letter mail tray suitable for carrying C4, C5 and C6 mail:

Table 1 — Letters (maximum accepted sizes)

	Height	Width
C4	353 mm	250 mm
C5	173 mm	250 mm
C6	120 mm	250 mm

The trays are suitable for containing C4 mail stacked in a horizontal plane and for stacking C5 and C6 mail vertically.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1005-2, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 22206, *Packaging — Complete, filled transport packages — Identification of parts when testing (ISO 2206:1987)*

EN 22248, *Packaging — Complete, filled transport packages — Vertical impact test by dropping (ISO 2248:1985)*

EN 60695-11-20, *Fire hazard testing — Part 11-20: Test flames — 500 W flame test methods (IEC 60695-11-20:1999)*

EN ISO 2233, *Packaging — Complete, filled transport packages and unit loads — Conditioning for testing (ISO 2233:2000)*

EN ISO 2247, *Packaging — Complete, filled transport packages and unit loads — Vibration tests at fixed low frequency (ISO 2247:2000)*

EN ISO 2875, *Packaging — Complete, filled transport packages and unit loads — Water-spray test (ISO 2875:2000)*

EN ISO 4180, *Packaging — Complete, filled transport packages — General rules for the compilation of performance test schedules (ISO 4180:2009)*

EN ISO 12048, *Packaging — Complete, filled transport packages — Compression and stacking tests using a compression tester (ISO 12048:1994)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
compatibility
ability for trays and closures to fit well onto each other and ability of easy nesting into each other as well as separating of trays and closures from each other

3.2
durability
ability of a tray and closure to withstand conditions to which it is subjected (when tested)

3.3
friction
capacity to prevent sliding on an inclined low friction conveying surface specified as the coefficient of friction

3.4
letter mail
category of postal items classified according to its physical characteristics such as weight and dimensions

3.5
nestability
ability of trays and closures to fit together one partially inside the other (measured as the ratio of the number of trays and closures which can be nested in a stack for one tray (tray and closure) height)

3.6
recyclability
ability to recover the material of a discarded tray (measured as the content of recycled material in a tray)

3.7
stackability
ability to be stacked and fully palletisable when filled with letter mail

3.8
temperature resistance
ability to maintain shape (when conditioned) within a pre-defined temperature range

3.9
tray
primary container with closure for the carriage of letter mail

3.10
weather resistance
ability to remain serviceable (when conditioned) under specific weather conditions

4 Requirements

4.1 General

The mail tray shall meet all the requirements stated in Clause 4.

4.2 Tray size requirements

Minimum internal tray dimensions shall accommodate mail of the following sizes with ease of handling:

Table 2

	Height	Width
C4	353 mm	250 mm
C5	173 mm	250 mm
C6	120 mm	250 mm

4.3 Tray performance requirement

4.3.1 Compatibility

Trays and closures shall fit well onto each other, nest easily into each other and separate well from each other without the use of undue force.

4.3.2 Compression

The trays shall meet a minimum compression strength requirement of 180 kg at a deflection of less than 10 mm before failure.

NOTE This represents a five high stack of trays each weighing 10 kg and a safety factor of 4,5, as specified in EN ISO 12048.

4.3.3 Durability

Trays shall withstand drop, vibration and crushing simulations as per the following:

Each tray shall withstand a minimum average of 70 cycles with a standard deviation of maximum 20 %, as specified in EN ISO 2247, EN 22248, EN ISO 4180.

4.3.4 Closure

The closure of the tray is to provide security during transit and handling. The closures shall fit well on the tray to prevent tampering with the content. The closures shall be enclosed tightly to the tray by means of strapping in both directions, once over the width and once over the length of the tray.

4.3.5 Flammability

Trays manufactured from plastic material shall meet requirements as specified in EN 60695-11-20. Trays made from alternative materials shall meet similar requirements when tested with appropriate flammability tests.

4.3.6 Friction

The friction coefficient between tray and conveyor surface as specified in 5.3.6 shall not be lower than 0,31.

4.3.7 Handles/handholds

Handles/handholds shall be designed for ergonomically comfortable handling, with no sharp edges and as referenced in EN 1005-2.

4.3.8 Nestability

Nesting ratio of trays and closures to the one "tray and closure height" shall be a minimum of 1:5. The better the nesting ratio the lower the transport cost for moving empty trays and closures.

4.3.9 Recyclability

Trays should be manufactured from a material which is recyclable as specified in EN 13430.

4.3.10 Stackability

Trays shall be stackable and inter-stackable. Trays that are stacked shall be placed on a flat, horizontal and level surface and remain stable at up to 1,8 m stacking height.

4.3.11 Tare weight

The tray and closure shall meet the tray dimensions and durability requirements specified with a tare weight remaining as light as possible. Because of the impact of tare weight on transport cost, the tare weight shall not be higher than 10 % of the maximum filled weight of the tray. The mail load capacity of the tray is determined by the minimum tray dimensions specified in 4.2. The average tare weight shall not exceed 1 050 g and the standard deviation shall not be higher than 1 % of the average weight.

4.3.12 Temperature resistance

Trays shall be capable of being handled at extreme temperatures, as specified in EN ISO 2233:

— from - 35 °C to 70 °C there shall be materials stability such that the material shall maintain its essential shape for up to 8 h;

— at - 35 °C the trays shall be resistant to the drop test (perform the drop test on the edge of the loaded tray with 10 kg gross weight from 1 m high).

4.3.13 Weather resistance − Water spray exposure

The tray and closure shall be weather resistant with no more than 3 % ingress of water as specified in EN ISO 2875.

5 Test method

5.1 Test methods introduction

The following testing methods were designed to represent simulation of real life usage and handling in an international mail exchange environment. The test methods intend to characterize the functionality, strength and life span of trays used in the exchange of international mail. The tests are laboratory tests.

Life span is expressed as number of cycles successfully completed in the durability test (5.3.10), which is meant to reflect the minimum number of trips the tray can make in real life before failure. The life span expressed as number of cycles is not meant to be an indicator for the economic life span, although in general the higher the number of cycles the higher the economic life span. Economic life span on the one hand is a function of materials / design / manufacture and is defined by the technical specification of the tray, and on the other hand it is a function of the equipment management determining circulation time and number of trays in circulation. These factors are outside the scope of this standard.

The tests can be used as pre-production tests as well as postproduction tests. The test method allows for testing of trays and closures manufactured using different tools and by different manufacturers.

5.2 Test sampling and tray preparation

A minimum of 50 samples, trays and closures, shall be made available to perform the tests. In case of a post-production test, the 50 samples shall be taken at random but in sequence, one from each production tool. The 50 samples shall be picked equally spread over the full production period. The samples supplied shall be marked with an indicator of the production date, the tool number and the name of the manufacturer. In case trays from more than one manufacturer are to be tested, each manufacturer shall provide 50 tray samples.

At arrival on the test site all trays shall be numbered and ten samples shall be separated for the compatibility, nestability and stackability test, five samples shall be separated for the friction test and another five samples for the compression test, two samples shall be separated for the weather resistance test and another two samples for the temperature resistance test. The remaining 26 samples shall be made available for the durability test.

Trays that require to be loaded and packaged, according to the test procedures specification in 5.3, shall be filled with test letter mail. The C4 mail shall be loaded horizontally in the tray. The C5 and C6 test letter mail shall be loaded vertically, parallel with the width of the tray. The tray shall contain sufficient mail to achieve the required gross weight as specified in the test procedures. In case no weight is specified the trays shall be filled to a gross weight of up to but not exceeding 10 kg. The trays filled and packaged before testing shall be in similar condition to trays used in actual shipments and shall be strapped twice, once over the width and once over the length of the trays. The strapping shall be tight, there shall be no stacks in the straps and the strapping force shall not exceed 4,5 kg.

5.3 Test procedures

5.3.1 Test procedures introduction

The tests deal with different types of performance requirements; the functional requirements and the strength and life span requirements. The trays shall meet all performance requirements and pass all tests successfully. The recommended sequence of testing is as follows:

First tests 5.3.2 to 5.3.8 shall be performed to establish whether all functional requirements of the trays have been met, before continuing with tests 5.3.9 and 5.3.10 to establish whether all compression strength and life span requirements are met.

5.3.2 Tare weight

The purpose of this test is to verify that the average tare weight of a tray plus a closure does not exceed the maximum as specified in 4.3.11. All 50 samples, trays and closures, shall be weighed. The average weight of trays shall be established and the average weight of the closures shall be established. Both averages shall be specified in the final report.

5.3.3 Compatibility test

The purpose of this test is to establish that trays and closures are compatible independent from the tool and manufacturer that produced the samples. The ten samples for the test shall be selected from the 50 samples supplied ensuring the selected samples include at least one tray and closure from each production tool used during production.

In case compatibility of trays from more than one manufacturer needs to be established, the compatibility test shall first be performed for each manufacturer separately as described. Secondly five of the ten selected trays and closures from each manufacturer shall be taken at random. The compatibility test shall be performed with the ten trays and closures (five from each manufacturer). This test shall be repeated for each combination of manufacturers. Trays and closures from all manufacturers shall be compatible with each other.

The compatibility test shall be made to establish compatibility of different samples according to the enclosure and nestability requirements. Each of the closures shall be put on each of the trays to check if all closures fit on all trays, ensuring proper closure and removal of the closures without having to use undue force.

Each of the trays shall be nested in each of the other trays and each closure shall be nested in each of the other closures without the use of undue force. In each order of nesting of ten trays and closures, the nesting ratio shall be minimum 1:5 at 3 kg downward pressure. It shall be possible to separate the stack of nested trays and the stack of nested closures without the use of undue force. This means that one person shall be able to separate a tray from another tray or a stack of trays and a closure from another closure or a stack of closures within 5 s without the help of a tool and / or another person.

The trays do not meet the compatibility requirement if they fail to fit and/or fail to ensure proper closure, and/or fail to nest and/or de-nest without the use of undue force.

5.3.4 Nestability test

The purpose of this test is to determine if trays and lids nest well into each other and meet the performance requirement as specified in 4.3.8. For this, ten empty trays and ten closures used in the compatibility test shall be nested into each other at 3 kg downward pressure. The nesting ratio shall be minimum 1:5. The nesting height of five nested trays and closures (not counting the bottom tray and closure) shall not exceed the height of one tray plus the height of one closure.

So if "HS" is the height of the stack of ten nested trays plus the height of the stack of ten nested closures, and "HT" is the height of the tray plus the height of the closure, then:

$$(HS-HT)/10 : HT \geq 1:5$$

5.3.5 Stackability test

The purpose of this test is to determine how stable the tray is when fully loaded and vertically stacked on a flat, horizontal and level surface and whether samples tested meet the requirement as specified in 4.3.10. Filled trays shall be stacked and placed on top of each other to reach a stack height of up to 1,8 m. The stack is placed on a flat, horizontal and level surface. A uniform lateral force is then applied at a height of 1,3 m from the floor until the stack falls. The lateral offset at a height of 1,3 m is determined that initiates the entire stack to become unstable and fall. The minimum requirement for the lateral offset is 150 mm.

5.3.6 Friction test

The purpose of the friction test is to establish the resistance of trays to sliding from an inclined low friction conveying material. For this purpose five trays shall be tested.

A test table with a smooth PVC surface (without anti skid layer) shall be placed at an angle of 17° of incidence from a horizontal plane (see Figure 1). Five trays shall be loaded and packaged. The total weight of the filled tray and the enclosure shall be 5 kg ± 25 g for each tray in all five test samples.

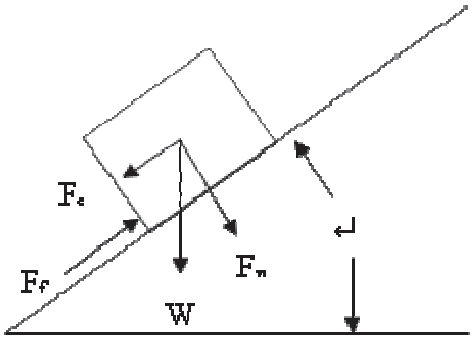

Figure 1 — Friction test

The coefficient of friction of each sample shall be measured by placing the samples one by one on the test table and by establishing the coefficient of friction for each sample separately. The average coefficient shall be established from the five measurements and shall be higher than and or equal to 0,31. The coefficient of friction for each tray shall be calculated according to the following formulae:

Coefficient of friction required to prevent sliding on an inclined surface

Definitions:

F_s is the sliding force generated by the body;

F_n is the force generated by the body against the surface;

F_f is the frictional force generated by the body's contact with the surface;

W is the body's weight;

↵ is the angle of the surface;

cf is the coefficient of friction.

To prevent sliding:

$$F_f \geq F_s$$

Calculation of forces:

$$F_s = \sin ↵ * W$$

$$F_n = \cos ↵ * W$$

$$F_f = F_n * cf = \cos ↵ * W \times cf$$

Derivation of coefficient of friction:

$$F_f \geq F_s \equiv \cos ↵ * W * cf \geq \sin ↵ * W$$

Solving for cf:

$$cf \geq \tan ↵$$

5.3.7 Temperature resistance test

The purpose of this test is to establish material stability under extreme temperatures as specified in 4.3.12. Two trays shall be used for this test. The test shall be performed as specified in EN ISO 2233. From - 35 °C to 70 °C trays shall maintain their essential shape for up to 8 h. At - 35 °C the material shall not fail the resistance to drop test (the drop test shall be performed on the edge of the loaded tray with 10 kg gross weight from 1 m high).

5.3.8 Weather resistance − Water spray test

The purpose of this test is to determine the ability of the tray to protect the mail from moisture when exposed to rainfall. Two trays shall be used. The trays shall be filled with sample letter mail of the appropriate size. The dry mail shall be weighed before the test. The trays shall be closed and stacked one on top of another. The stack shall then be subjected to a water spray for 5 min. The temperature of water shall be (13 ± 2) °C. A flow rate and discharge of 100 l/h/m² shall be used. The spray shall be induced at a top corner of the top stacked tray. The spray shall be projected from the top at a 60° angle of incidence with the horizontal plane, and 45° angle from each of the two edges meeting at a corner. The trays shall be sprayed for 5 min and held for 1 h at (23 ± 2) °C and (50 ± 5) % relative humidity. The mail shall then be weighed again. The amount of percent weight gain is calculated on a dry weight basis. The test shall be done as specified in EN ISO 2875.

5.3.9 Compression test

The purpose of this test is to determine the compression strength of the trays. A compression test shall be performed using five empty trays. A fixed platen as described in EN ISO 12048 shall be used. The load shall be applied at a constant rate as recommended in the standard. This test shall be done to ensure that all trays have sufficient vertical compression strength when filled with mail and stacked five high as specified in 4.3.2. Each tray that is tested should have sufficient compression strength to withstand the combined gross weight of five filled trays on its upper surface. A safety factor of 4,5 is used to calculate the test load.

5.3.10 Durability test

The purpose of the test is to measure the ability of the loaded tray to withstand drops, vibrations and crushing with the superior tray being the tray which best protects the mail. The test shall establish if the samples tested meet the durability requirement as specified in 4.3.3. The test methods and protocol were selected based on recommended levels from EN ISO 4180.

A total of 20 tray samples shall be tested for drop and impact resistance to compare them for durability. The trays shall be identified according to EN 22206. The six additional samples held available for the durability test as well as the samples used in the compatibility test and friction test, will be held available as dummy samples to replace those trays that fail after a test cycle. The samples shall be loaded and packaged with sample letter mail. The tray samples shall then be subjected to a vibration test. The test shall be conducted on an electro-hydraulic vibration table using an input acceleration of 1,1 *g* for 40 min. The test shall be conducted at a frequency of 4 Hz. On completion of the vibration test a sequence of drops (vertical impacts) shall be performed as recommended in EN 22248 using a sequence recommended by International Safe Transit Association Test Method: Project 1A.

Each tray shall be subjected to ten drops using the following sequence:

a) the 2-3-5 corner;

b) the shortest edge radiating from that corner;

c) the next longest edge radiating from that corner;

d) the longest edge radiating from that corner;

e) flat on one of the smallest faces;

f) flat on the opposite small face;

g) flat on one of the medium faces;

h) flat on the opposite medium face;

i) flat on one of the largest faces;

j) flat on the opposite large face.

The drop tests shall be performed from a height of 800 mm, determined from EN ISO 4180. The combined testing of the trays to one sequence of vibration and ten drops constitutes a test cycle. The trays shall be inspected on completion of this test cycle. The entire test cycle shall be repeated if no failure is observed. The number of completed test cycles that each tray survives before getting damaged shall be determined. The location of damage shall be identified according to EN 22206.

Then ten tested trays shall withstand a minimum average of 70 cycles with a standard deviation of maximum 20 %.

A is the average (A) number of trip life cycles that the trays survive without failure and S is the associated standard deviation (S). In order to make sure that the trays pass the tests, the average number of trips shall be higher than 70 (A > 70) and the minimum 1 sigma deviation from the mean should also exceed the 1 sigma variation of 20 % of the average cycles.

Mathematically (A-S) > (70 - 0,2(70)) or A-S > 56.

In short: A > 70 and A-S > 56.

In case of buckling of the walls (as specified in 5.3.10) or deformation (failure to retain basic shape) of any of the trays before 60 cycles have been completed, the durability test shall be interrupted for 24 h after the sixtieth cycle has been completed. This is to check the capability of buckled or deformed trays to restore basic shape in a situation simulating storage. After the vibration test is stopped, the top load shall be removed and the buckled or deformed trays shall be emptied. 4 h after the vibration test is stopped the emptied buckled or deformed trays shall be nested on top of a stack of ten nested trays (back-up samples) and shall be left for 20 h in the stack. After 20 h the top ten trays (including the buckled or deformed trays) shall be removed from the stack and the compatibility test (specified in 5.3.3) shall be applied. Those (buckled or deformed) trays that fail shall be identified and those (buckled or deformed) trays that recovered basic shape and that have not failed shall be packaged again to continue the durability test.

If after 100 test cycles no trays have failed according to the durability failure criteria specified in below, the test may be stopped as trays have at that stage exceeded significantly the durability requirements.

The following failure criteria shall be used to evaluate the trays after testing each "test cycle" described in 5.3.10. The presence of any type of failure described in this clause would result in stopping the sequential cycle of the durability test. The failure criteria may be selectively applicable to different methods of construction/manufacture. If after 100 test cycles the trays have not failed according to the following criteria the test can be stopped.

a) Tears/Cuts/Cracks/Holes

   Any break or crack through all layers of material larger than 20 mm.

   Any break or crack through one layer of the material larger than 50 mm in length or 0,012 m² in area.

b) Closure integrity failure

   Failure to retain basic shape at a point such that the closure will not secure to the tray or would lose mail.

c) Delamination

Edges of tray delaminated in excess of two flutes and more than 150 mm in length.

Any delamination in excess of 0,06 m².

d) Buckling of the walls of the tray

Failure of side wall to maintain its shape and height during the vibration test to the extent that it reduces the height of the side wall with more than 30 % and failure to recover basic shape to the extent that within 5 min after the vibration test has stopped the side wall shall be recovered to minimally 85 % of the original height of the side wall.

e) Failure to recover basic shape

If buckled or deformed trays fail to recover basic shape (as described in 5.3.10.).

f) Excessive creasing of material

Creases in material along bottom edges of tray resulting in cracks and tears.

g) Handles/handholes failure

Any break in the handle/handholes or material around the handle/handholes, twisted material that would result in injury, or a tear in the hand-hold area.

5.4 Test report

The test report shall include the following particulars:

a) name and address of test laboratories;

b) reference to this European Standard;

c) number of trays tested for each individual test;

d) full description of trays and closures, including dimensions, structural and material specifications, mail packing configuration and visual aids;

e) name of the manufacturer, tool number and production date indicator of each tray and closure;

f) gross weight of each tray and closure in kilograms;

g) relative humidity temperature and time of conditioning, temperature and relative humidity of the test area at the time of test;

h) any deviations from the test method described in this standard;

i) a record of the results, with any observations which may assist in correct interpretations, describing mode of failure;

j) date of the test;

k) signature of tester.

It is recommended to use the Test Report format enclosed.

Annex A
(informative)

Sample test report

5.3.2	TARE WEIGHT
Requirement met	YES/NO

MANUFACTURER							
TRAYS				CLOSURES			
Number	Weight	Tool	Date	Number	Weight	Tool	Date
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
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37				37			
38				38			
39				39			
40				40			
41				41			
42				42			
43				43			
44				44			
45				45			
46				46			
47				47			
48				48			
49				49			
50				50			
Avg.				**Avg.**			

Sum of Avgs.	
Standard Deviation	

5.3.3 COMPATIBILITY	
Requirement met	**YES/NO**

NUMBER TRAY	TOOL	DATE	NUMBER CLOSURE	TOOL	DATE	MANU FACTURER

Mode of failure

5.3.4	NESTABILITY
Requirement met	YES/NO

NUMBER TRAY	NUMBER CLOSURE

NESTING HEIGHT 10 TRAYS	
NESTING HEIGHT 10 CLOSURES	
HEIGHT ONE TRAY PLUS CLOSURE	
NESTING RATIO	

5.3.5	STACKABILITY
Requirement met	YES/NO

NUMBER TRAY	NUMBER CLOSURE

NUMBER OF TRAYS IN STACK < 1,80 m	
STACKING HEIGHT	
LATERAL OFFSET	

5.3.6	**FRICTION**	
Requirement met		**YES/NO**

NUMBER TRAY	**FRICTION**
Avg.	

5.3.7 TEMPERATURE RESISTANCE	
Requirement met	**YES/NO**

NUMBER TRAY	NUMBER CLOSURE

MAINTAIN SHAPE	**YES/NO**
RESIST DROP	**YES/NO**

5.3.8 WEATHER RESISTANCE	
Requirement met	**YES/NO**

NUMBER TRAY	NUMBER CLOSURE

5.3.9 COMPRESSION	
Requirement met	YES/NO

NUMBER TRAY	PEAK FORCE	DEFLECTION
Avg.		

5.3.10	DURABILITY
Requirement met	YES/NO

NUMBER TRAY	CYCLES	MODE OF FAILURE	NUMBER CLOSURE	CYCLES	MODE OF FAILURE	FILLED WEIGHT TRAY UNIT

AVERAGE			**AVERAGE**			
STANDARD DEVIATION			**STANDARD DEVIATION**			

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ISTA 1A, Project 1 A: Pre-shipment Test Procedures[1)]

1) Available from: International Safe Transit Association, 1400 Abbott Road, Suite 310, East Lansing, MI 48823, USA.

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