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Second Edition

DRAFT EAST AFRICAN STANDARD

Packaging — Code of practice — Glass containers

EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS) The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 066, *Packaging*.

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

With regard to the first edition (EAS 935: 2019), the following changes have been made in this Second

edition:

- Numbering of clause 4 appropriately.
- Deletion of “orming” in clause5.4.3 and replacing with “forming” as it appears to be a typo.
- Updating the bibliography.

Packaging — Code of practice — Glass containers

1 Scope

This Draft East African Standard gives guidelines on the manufacture, types, selection and use of glass containers for packaging.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

There are no terms and definitions in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

4 General considerations

4.1 Most solids and liquids can be packaged in glass containers, which are made in a wide variety of shapes, sizes and colours to meet the commercial, marketing and technical requirements of modern retailing. Typical examples are products associated with the food, drinks, cosmetics, pharmaceutical and household products industries.

4.2 The performance of glass container improves with optimized distribution of glass material in the container.

4.3 The use of surface treatments or Hot-end and Coating and Cold-end Coating improves the performance of containers' Glass weight may also be reduced, without sacrificing performance, if the surface of the container is coated with Hot-end and Coating and Cold-end Coating (Polymer based material) at the earliest stage of manufacture that is practicable.

4.4 Leakage or contamination can be avoided by using metallic or plastic closures suitable for vacuum, hermetic and pressure retention.

Improvements in glass containers are being paralleled by work in the complementary closure manufacturing industry. Containment is effected by means of a seal material installed at the edge of the closure and coinciding with the position of the glass finish (i.e. that part of the glass container which supports the closure) permitting the container to be easily opened and resealed many times.

4.5 The satisfactory service performance of a glass container on the filling line and in the market-place depends on the co-ordination of many elements of design. In the filling hall, consideration should be given to handling on the filling line, cleaning, filling, labelling, capping, processing and the application of retail packaging.

Between the glass manufacturing plant and the filling hall, the container should be transported and for this purpose appropriate packaging has to be designed and specified. Beyond the filling line, the filled container has to be transported into the retail distribution system and then perform in the retail and consumer environment. Once empty a refillable container should be returned for filling and a non-refillable container should be recycled.

4.6 In addition to all the handling criteria, it is essential that the requirements of the product to be packed are also incorporated into the designed the shape of the neck, type of finish and closure can be determined by nature of packed product i.e whether liquid or solid

In the case of a liquid, the designer should consider if it is non-carbonated, carbonated or alcoholic or pasteurized. If it is a solid the designer should consider whether it is heat processed i.e. pasteurized or sterilized, hot filled, moisture absorbing, sensitive to ultraviolet light etc.

4.7 The designer should take into account factors that could influence a consumer's purchasing decision. e.g. container shape, product and/or customer image, colour, decoration, embossing. The design should be compatible with the requirements of the glass manufacturing process.

5 Manufacture of glass containers

5.1 Raw materials and glass composition

The main raw materials for glass production include but not limited to, sand of low iron content, limestone, and Soda ash.

The range of glass compositions most commonly used as shown in Table 1.

Table 1 — Range of commonly used glass compositions

S/N	Chemical constituent	Range of compositions %
i.	Silica (SiO_2)	70.0 – 74.0
ii.	Soda(Na_2O)	11.0 – 14.0
iii.	Lime (CaO)	10.0 – 11.5
iv.	Potash (K_2O)	0.2 – 0.5
v.	Magnesia (MgO)	0.2 – 2.0
vi.	Alumina (Al_2O_3)	1.0 – 2.0
vii.	Baria (BaO)	0.0 – 0.5
viii.	Iron oxide (Fe_2O_3)	0.03 – 0.50

NOTE Range of commonly used glass compositions may vary

5.2 Physical and chemical performance of glass containers

To improve the physical and chemical performance of glass containers, other materials such as blast furnace slag, dolomite and calcium sulphate sodium sulphate or sodium nitrate, are added. Selenium and cobalt are added as decolorizers to neutralize the colouring effect of any residual iron, which may be present in the sand.

5.3 Coloured glass

5.3.1 Flint or white glass can be coloured by the addition of suitable materials to the batch. The more common colours are amber (iron oxide and sulphur), green (chromium oxide and iron oxide) and opal (fluorides).Certain products are traditionally linked with glass containers of a particular colour e.g. beer in amber bottles.

5.3.2 Small quantities of coloured containers can be produced by adding oxides (frits) to the fore hearth associated with a particular forming machine or by spraying organic colouring materials, such as polyurethane resins, on to bottles which are then cured.

5.4 Production of glass containers

5.4.1 The production of glass containers starts with unloading of raw materials into silos. The materials are drawn from the silos as required, weighed, mixed and charged mechanically into the glass melting furnace. Attention is given to the accuracy of weighing and consistency of mixing.

In order to melt the glass, the furnace operates at temperatures up to 1 600 °C using instruments that measure and controls the level of the glass and furnace pressure. Glass and furnace temperatures to a high degree of accuracy are used. Instruments linked to the glass level measurement automatically control within limits the rate of batch feed. The firing of the furnace and the draught on the chimney are also automatically controlled. As a result of these furnace operations, refined glass emerges as a stream from an orifice at the end of a feeder channel or forehearth which links the furnace to the bottle forming machinery.

5.4.2 Several forehearths may be associated with one melting furnace. The glass stream passes through an orifice and is automatically cut into lumps of glass, called gobs, of a pre-determined mass, associated with the capacity of the container, by means of water cooled reciprocating shears. The gobs, whose temperature has been established accurately at a pre-determined level, are then fed into parison moulds which are supported on the glass container forming machine located beneath the forehearth. At this stage the bore, neck and finish of the container used for supporting the closure is made whilst the body of the container is only partially formed. The parison shape is then transferred into a second mould on the other side of the machine in which the final shape of the container body is blown.

Narrow neck containers are made traditionally by the blow and blow process in which the parison cavity is formed pneumatically following the moulding of the finish around a plug or plunger. Wide mouth containers such as jars are made by the press and blow process; the parison cavity and the finish are moulded by means of a plunger in one operation. Because the press and blow operation achieves better glass distribution, an adaptation of it is now in use for the production of light weight narrow neck containers of suitable design.

5.4.3 The independent section machine which is almost universally used for forming bottles is a series of individual adjacent sections each concerned with the total manufacturing cycle involving the formation of the glass finish and the final blowing of the bottle. The machine is made up of a series of air operated mechanisms involved in progressing the forming cycle. Each has to be precisely timed in sequence to ensure the conversion of the glass gob into an accurately formed container within each section.

This is achieved by means of studs on a rotating timing drum within each section. The cam action of the studs actuates valves which admit operating air to the mechanisms through a series of latches and levers. More recently, this mechanical system has been replaced by a much simpler electronic system which depends on the use of magnetic valves for controlling the operating air to the mechanism. In this way, more accurate timing has been achieved together with improved operator control since, with the electronic system, machine adjustments are made on a console which is separate from the bottle machine. With the mechanical system stud adjustments are made on the drum.

The number of sections associated with the bottle making machine can vary between 4 and 12; the number of gobs fed simultaneously from the fore hearth is usually 2 (double gob) although triple gob (3 gobs) and quad gob (4 gobs) operation are used where volume markets for particular glass designs exist. Single gob operation is used for the manufacture of larger capacity containers. Further developments of the manufacturing operation involve the addition of a turret on the blow side of the machine to allow additional time within the forming cycle for the formation of the container body resulting in further improvements in glass distribution. After forming is complete, the glass container is transferred on to a moving belt and conveyed to an annealing oven (lehr) where it is reheated to a temperature approaching 600 °C, the annealing point of the glass. Cooling of the glass at a controlled rate removes unacceptable stresses from the container when at room temperature. The cooling rate is dependent on the design and weight of the container.

5.4.4 Before and after annealing, the surfaces of containers are usually given a spray or vapour treatment to protect them by increasing their scratch resistance and by improving their surface lubricity which facilitates handling during subsequent operations in the glass plant, in packaging and on the filling line. A typical treatment is stannic chloride applied at the hot end before entering the lehr. This reacts at the glass surface leaving a thin layer of tin oxide on the surface of the glass. As the bottles emerge from the lehr they are treated, for example, with polyethylene or oleic acid. After surface treatment each glass container is automatically inspected for quality and dimensional accuracy by a series of mechanically and electronically operated inspection devices. The most common method of packaging is an assembly of cardboard trays or boards separating layers of glass containers, supported on pallets and held together with shrink wrap material. This assembly is known as a bulk pallet. Other options are corrugated cases supplied in the flat by the filler, erected at the glass manufacturer's factory and used for the warehousing and transportation of empty containers, or similar service cartons that are the property of the glass manufacturer, crates or packaging used for specialized markets such as cosmetics.

5.5 Semi-automatic methods

A small but important part of the industry is concerned with supplying relatively small quantities of glass containers often in special sizes (particularly larger sizes), shapes or colours. Semi-automatic equipment is used for this type of production, the glass being melted in small pot furnaces and hand gathered on the end of an iron. Molten gobs are then fed into moulds in which the glass is blown by manually controlled compressed air.

5.6 Moulds in which glass containers are made

Because of its ease of machinability and the lack of distortion when in use at elevated temperatures, fine grain cast iron is used for the manufacture of moulds, although occasionally steel or special alloys may be used for certain mould components.

Moulds are machined to fine tolerances and inspected before use and during use to ensure that wear has not changed the dimensions to an extent hereby the overall dimensions and capacity of the glass container are affected. Computer aided mould manufacture is developing rapidly and greater accuracy and repeatability of dimensions between moulds has resulted particularly where the geometry is complex, for example where non-round cross sections are involved. Mould costs are a significant proportion of total production costs and, in some cases, short production runs on automatic equipment may have to bear a surcharge. Small variations, such as a change of finish, can usually be achieved with as mall on-cost if a change of neck ring only is required. Standard designs for particular containers have been agreed at industry level by the British Glass Manufacturers Confederation. With these the buyer has the choice of purchasing from stock exactly the same container from those manufacturers who have budgeted for such a mould availability enabling smaller quantities of containers to be supplied. The incorporation of cooling ducts within the mould structure to effect more uniform temperature distribution during manufacture can improve control but can limit the size of containers which can be made by particular processes.

6 Design

Designing a glass container involves the consideration of a number of factors. The most important are as follows:

a) The container should be capable of being handled and filled on the appropriate filling line which either exists and possesses defined constraints or is to be designed and built. In the latter case, factors involved in the design of the filling line and the container can be made to complement each other;

b) The container should withstand the conditions involved in warehousing, transportation, retailing and ultimate use by the consumer without damage or breakage;

c) The container should protect the contents from deterioration within a defined product specification throughout a specified shelf life ensuring that the product reaches the consumer in a satisfactory condition;

d) The container should meet the appearance and display characteristics required by customer and/or retailer;

e) The consumer should be able to gain access to the glass package. Body and finish dimensions related to the performance of the closure and body surface textures should be considered in relation to consumer convenience; and

f) The container should be capable of being inserted into a bottle bank via the appropriate aperture to facilitate its disposal for recycling. When designing a container, some or all of these factors will interact and the final design will be a compromise. Most glass manufacturers have invested in Computer Aided Design equipment which enables the container to be designed in the presence of the customer and with the aim of obtaining his approval in the shortest possible time. Modern systems enable an image of the new design to be created on a screen in three dimensions, colour and translucency; the image approximates closely to the appearance of the finished empty container. An accurate impression of the filled container can be created by including contained product and closure on the screen image. The screen image may also be modified according to the requirements of the customer and any filling line constraints prior to the commencement of any mould design and manufacture.

7 Attributes of glass

7.1 General

Modern retailing methods and techniques involved in marketing food have resulted in many new requirements for glass packaging. A list of glass packaging attributes is important to those employed in the selection and purchase of packaging materials.

7.2 Transparency

A significant marketing advantage for glass packaging is its transparency enabling the contained product to be seen by the consumer.

7.3 Quality

Many consumers regard products packaged in glass as quality products.

7.4 Strength

Although glass is a brittle material, it possesses considerable strength in terms of head load resistance. Glass is much stronger when in overall compression than in tension, an important factor when considering the warehousing of empty and filled containers. The design of a glass container is important in determining head load resistance in relation to the capping operation, impact resistance and the requirements of the filling line. When designed for the packaging of carbonated beverages, glass containers can withstand internal pressures corresponding to 4.5 volumes of carbonation at ambient temperatures experienced in hot climates. Such bottles are submitted to internal pressure testing on a sampling basis before they are finally approved for dispatch.

7.5 Shape

Glass is a visco-elastic material having no definite melting point. Shape can be induced into the final product because there is a gradual change in the viscosity of glass whilst it is cooling. This property can be used to identify product and customer image.

7.6 Chemical integrity

The glass compositions used for container production are chemically resistant to all food products, both liquid and solid. No additional internal surface protection is required. Closure design, material, and the compounds used to effect the seal between a glass finish and the closure are important factors to consider when designing glass packaging to ensure adequate protection for a particular product. Compatibility between closure material and contained product should also be considered.

Because of their chemical stability, glass containers can be stored for considerable periods in normal warehousing conditions without any surface deterioration. Under certain warehouse conditions condensation can affect, for example, the adhesion of labels and the performance of closures. Substances extracted from glass surfaces are not associated with any known health hazard.

7.7 Resistance to thermal shock

All glass containers are annealed at temperatures up to 600 °C following manufacture to prevent stresses developing in the container as they cool to room temperature. The softening temperature below which the bottle will not deform when it is in a free standing position is a function of its design i.e. of its shape, weight and capacity. Compositions of glass commonly used for containers are capable of resisting a degree of thermal shock consistent with commercial retorting, pasteurizing and hot filling schedules. Glass containers designed to be refilled are usually submitted to thermal shock testing on a sampling basis before they are finally approved for dispatch.

7.8 Impermeability

Glass is virtually impermeable to all gases. Diffusion rates for water vapour, carbon dioxide and the permanent gases, e.g. oxygen, are, for all practical purposes, zero. This is particularly important to the flavour retention and preservation of many foods and beverages.

7.9 Decoration

The appearance of a glass container can be changed by surface decoration; silk screen printing, ceramics pray, coating with plastics and acid etching are current techniques. Silk screen printing in particular is used for labelling refillable milk bottles for advertising purposes. Pre-labelling has been adopted using PVC and polystyrene sleeves for non-refillable beer and soft drinks bottles. Pre-labelling by means of sleeves gives the filler an increase in line efficiency and filled product output as well as a package of reduced weight. Special arrangements need to be made for either creating stocks of pre-labelled empty bottles in the case of a multi-flavour operation or establishing “just-in-time” delivery schedules from the glass supplier.

7.10 Refillable and non-refillable bottles

The economics of distribution is a contributing factor in determining whether a glass container should be designed as a refillable or non-refillable container. Refillable containers are particularly suitable where there is an adequate transport system available for local deliveries to an established market e.g. milk, soft drinks and beer. Non-refillable containers are more suited to retail markets.

7.11 Re-use

Glass containers may be re-used in various ways in the home provided they have been designed for this purpose. An intended re-use for glass containers used for packaging some food products (e.g. storage jars) has been designed into particular packages.

WARNING Pre-labelled bottles should never be refilled with dangerous substances and non-refillable bottles should never be refilled with homemade drinks or other beverages.

7.12 Use in microwave ovens

Glass used for the manufacture of bottles is almost completely transparent to microwave radiation. Heat processed food products packaged in appropriately designed glass containers can be placed in a microwave oven and rapidly reheated prior to serving.

7.13 Tamper evidence

The inherent properties of glass place it high amongst those packaging materials which are difficult to penetrate. Glass packaging should also be equipped with a closure system capable of demonstrating a complementary quality of tamper evidence.

7.14 Recyclability

Glass can be recycled and returned to the glass manufacturer for re-melting, resulting in significant savings in both energy and raw materials. Manufacturers have their own schemes of collection of used and broken glass for recycling. Organizations may also partner to form association that collects used and broken glass for recycling.

7.15 Glass container weight

7.15.1 By reducing the weight of a glass container to a value which is consistent with its service requirements in the glass container factory, during warehousing and transporting to the filler and the retailer, during filling and in the hands of the consumer, several economies are experienced as follows.

a) More containers per tonne of glass are produced resulting in a reduction of cost by reduced consumption of raw material and fuel.

b) The energy content of transportation is reduced which is particularly significant in exported glass packaged products.

c) The recovery of assets used for melting, forming, annealing and inspecting of glass containers is improved; less glass is melted which results in an extended furnace life.

7.15.2 The principles of light weighting are as follows:

a) Bottles of the same capacity and shape which are produced by the same production method will become progressively less strong as the amount of glass used in their manufacture is reduced.

b) Changing the design, however, can produce stronger bottles at lighter weights.

c) By observing certain design principles related to surface shape and area and surface to volume ratio (often at variance with marketing requirements) the amount of glass required to achieve a specified capacity can be minimized.

d) Bottles which are of the same shape, capacity and weight but which have improved glass distribution brought about by improved control, good design, a change in the method of the manufacture, or a combination of these factors will in general be stronger.

e) For any glass bottle design there is a limiting weight below which performance cannot be maintained.

f) The effective strength of a glass container on a filling line or a glassworks conveyor can be maintained by hot end and cold end surface treatment which increases surface lubricity and reduces the effect of glass to glass contact or glass to metal contact (conveyor guides, etc.).

g) The intrinsic strength of glass can be improved by modifying the glass structure so as to produce a thin surface layer of compression as in the chemical strengthening process.

h) By covering the surface of a glass container with a protective material, which can be used as a label, surface damage arising from scuffing can be minimized or largely avoided. Pre-labelling of glass containers in this way at the earliest stage of manufacture will improve strength and facilitate light weighting.

i) Surface damage received by glass containers during handling can be minimized with well designed equipment employing up-to-date engineering principles, a factor which should be taken into account when assessing the degree of light weighting for a particular design for a particular filling line.

8 Types of glass container

8.1 Bottles and jars

Bottles and jars can be round, shaped or multi-faceted, etc. except for bottles for carbonated beverages, which should always be round. Most glass container manufacturers will offer a range of standard lines. Some designs are standard within the industry and are supplied by all glass manufacturers.

8.2 Tubular glass containers

In addition to the more usual types of glass container there is a range of small capacity tubular glass containers that is made from glass tubing. They are all-cylindrical in shape and, with some exceptions, vary between 5 mm and 35 mm in diameter, 20 mm and 200 mm in length and 0.5 ml and 100 ml in capacity. Depending upon the purpose for which the container is required they may be manufactured from borosilicate glass or soda glass tubing.

a) **Borosilicate glass, type I**. Boric oxide increases the thermal shock resistance and chemical resistance of glass. Tubing made from this material, usually termed “neutral glass”, is used where repeated autoclaving is a part of the preparation procedures. Borosilicate glass should on form to the appropriate type I hydrolytic test requirement (see British Pharmacopoeia) which is more stringent than those for soda glass compositions. If the surface of type I glass is spoilt during processing, for example by the application of excess heat, then its surface may be returned to type I by Sulphur treatment.

b) **Soda glass, type II and type III.** The composition of these glasses is similar to that of glass used for the manufacture of bottles. Type II and type III should conform to appropriate hydrolytic test requirements which determine the ability of the glass to resist corrosion and flaking from medicinal liquids. Type II glass is surface treated to give a higher hydrolytic resistance than type III glass. The surface neutrality of type III glass can be improved by a surface treatment with Sulphur so that its hydrolytic resistance is increased to that of type II. Both glass types, borosilicate and soda, are available in either amber or flint (colourless).

Tubular containers may be divided into three main groups.

a) **Straight sided tubes**. Suitable for all products where it is important that the opening does not restrict the filling of the tube e.g. tablets or powders. Closures used in this type of tube are usually cork, plastics or rubber.

b) **Vials**. Suitable for all products where multi-dosage or small capacity is required. Most neck finishes including sprinkler are available. Closures made of cork, rubber, plastics, metal or Aluminium are in general use; they may be threaded, snap on or crimp closures (as used for injection vials).

c) **Ampoules.** Usually made from neutral (borosilicate) tubing and of two main types i.e. narrow stems for liquids and wide stems for powders. Sometimes, soda lime glass composition is used for the packaging of powders in ampoules. Stems are sealed in or drawn-off by the application of gas burners. Automatic machines are available for washing, filling and sealing the ampoules.

9 Testing and quality control

9.1 Testing

Wherever possible and consistent with the shape of the bottle each will be submitted to some or all of the following tests.

a) Squeeze testing to detect and remove containers which would have obvious failures in terms of cracks or crizzles.

b) Plug and finish testing to check finish dimensions, which relate to the filling and capping operation.

c) Body gauging to check body dimensions in relation to filling line constraints.

d) Detection of checks, cracks and crizzles in sensitive areas of the container using photoelectric techniques.

e) Quality image analysis whereby each container is compared to a stored image of a defect free container primarily used to detect and reject inclusions or contaminants in the glass.

f) Visual testing whereby each container is finally checked by an operator seated in front of an illuminated screen enabling a visual check to take place.

9.2 Quality controls

At every stage of the manufacturing process, starting with the raw materials through to the assessment of the glass and the finished product, samples are taken for checking against agreed specifications. The purchaser of glass containers will be particularly interested in the assessment of the finished product although he will want to know of preceding procedures and their correct implementation.

Typical quality control procedures for the product are as follows.

a) All finished bottles pass through a series of automatic and visual inspections. These concentrate mainly on the functional performance and safety aspects of the container.

b) Each pallet is sampled and the bottles checked for dimensions and quality with particular attention being given to the presence or other wise of cracks and crizzles in the glass.

c) Each mould is sampled at regular intervals and the bottles submitted to checks to confirm annealing, bottle capacity, glass weight, surface treatment, etc.

d) If the containers are subject to heat processing, then samples from each mould are tested for resistance to thermal shock.

e) At regular intervals, samples are taken across the lehr and checked independently for annealing.

f) Wall thickness, body and finish dimensions are measured to confirm they are within the tolerances specified for the bottle

g) In the case of carbonated beverage bottles, internal pressure resistance measurements are made on samples from each mould taken from the lehr belt to confirm that their internal pressure resistance is above the level required for the carbonated product.

10 Specifications

10.1 The glass container specification drawing

The glass container specification is a statement from the manufacturer to the filler giving the dimensional and capacity tolerances to which the bottle has been made. Other details of the bottle, such as weight, are given on the specification, which also describes the position and form of any required engraving. It can advise the conditions of use of the container which the designer took into account when preparing the design.

10.2 The packaging specification

The safe and effective transportation of containers between the factory and warehouse operated by the glass manufacturer and the filler and the subsequent method of feeding the glass on to the filling line imposes a packaging requirement on the glass manufacturer, which also needs to be specified. There is, therefore, an increasing tendency for product specifications to reflect all elements of the complete pack. Most glass containers are supplied to the filler as bulk packs i.e. layers of glass containers separated by boards or trays, standing on pallets and held together by means of shrink wrap material. Other forms of packaging involve service cartons supplied by the glass manufacturer and customer cartons supplied as fiats by the filler, erected by the glass manufacturer and then used as the means of transportation to the filler's plant. Crates are used for soft drinks and beer bottles and specialized packaging is used for cosmetics and toiletry bottles.

11 Storage

Provided the bottles are well packed and stored in clean dry conditions they will retain their initial cleanliness. In many cases it is not necessary to wash bottles before use. Jets of clean high pressure air are sometimes employed to remove dust or any loose particles before filling. For this to be effective the bottles should be completely dry at the time of air cleaning. Alternatively, a rinsing operation to remove any loose particles of dirt and to pre-warm containers about to be hot filled is carried out on-line. Warehouses should undergo regular vermin and infestation surveys to ensure their freedom from rats or other undesirable creatures.

Bibliography

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