FOR COMMENT ONLY

PROPOSAL FOR A

TRINIDAD AND TOBAGO STANDARD

SODIUM HYPOCHLORITE SOLUTIONS (LIQUID CHLORINE BLEACHES) – SPECIFICATION

(3rd Revision)

PCTTS 58:20XX
(Replaces TTS 58: 2005)

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GENERAL STATEMENT

The Trinidad and Tobago Bureau of Standards (the Bureau) is a body corporate established under the authority of the Standards Act No. 18 of 1997 (herein after referred to as the Standards Act).

In accordance with the Standards Act, the Bureau shall promote and encourage the development and maintenance of standards and further shall establish standards for the following: to improve goods produced or used in Trinidad and Tobago; to ensure industrial efficiency and development; to promote public and industrial welfare, health and safety; and to protect the environment.

The Bureau develops standards through consultation with relevant interest groups, and public comment is invited on all draft standards before they are declared as Trinidad and Tobago Standards in accordance with the provisions of the Standards Act.

The Bureau is the legal custodian of Trinidad and Tobago Standard Marks, which are issued in accordance with the Standards Act. When a Trinidad and Tobago Standard Mark appears on any product, or in connection with any service, process or practice, it provides assurance that such a product, service, process or practice conforms to a Trinidad and Tobago Standard.

The Bureau's Standards Information Centre maintains a reference library of standards, including local, regional and international standards and is the national node of the International Organization for Standardization Information Network (ISONET). The Centre serves as the WTO/TBT Enquiry Point which disseminates information on standards and technical regulations as it relates to the World Trade Organization, Technical Barrier to Trade Agreement. It also acts as the sales agent for the publications of foreign and international standards organizations.

NOTE In order to keep abreast of progress in the industries concerned, Trinidad and Tobago Standards are subject to periodic review. Suggestions for improvements are welcome.

Committee

The Specification Committee responsible for the formulation of this Trinidad and Tobago Standard is as follows:

Members		**Representing**
Ms Denrica Christopher	**(Chairperson)**	Ministry of Legal Affairs, Consumer Affairs Division
Mr John Ferreira		Furness Chemicals Limited
Mr Vivian George		Ministry of Health, Chemistry, Food and Drugs Division
Ms Sharon Gunness-Balkissoon Ms Anna-Alisa Goindoo		Agostini Marketing
Mr Robert Mohammed Ms Moorlene Haywood		ANSA McAl Chemicals Limited
Mr Val Tobias		Port of Spain General Hospital
Mr Francis Chow		Trinidad and Tobago Bureau of Standards, Certification Division
Ms Reesa Thomas		Trinidad and Tobago Bureau of Standards, Implementation Division
Mr Kester Siewlal		Trinidad and Tobago Bureau of Standards, Laboratory Services Division
Mr Sheva Serrattan	**(Technical Secretary)**	Trinidad and Tobago Bureau of Standards, Standardization Division

Contents

Foreword

This specification was declared a Trinidad and Tobago Standard on _____ after the draft finalized by the Specifications Committee for Liquid Chlorine Bleaches had been approved by the Bureau.

This standard replaces TTS 58: 2005, *Specification for liquid chlorine bleaches (2nd Revision)*.

The Trinidad and Tobago Bureau of Standards has recommended that this standard be declared a compulsory standard to protect the consumer or user against danger to health or safety and to ensure acceptable quality of the product.

This specification will become effective as a compulsory standard on a date to be notified by the Minister responsible for trade and industry in a Notice to be published in the Trinidad and Tobago Gazette, as required by the Standards Act.

This standard was revised to reflect the new format of Trinidad and Tobago Standards and to keep abreast with current practices in the industry. This third revision differs from the original standard in that the length of time the product can remain at the point of retail sale has been reduced.

This national standard is intended for compliance by manufacturers, importers and distributors of sodium hypochlorite solutions.

The test methods and other pertinent information are provided in annexes A, B, C, D, E and F which are normative.

In formulating this standard considerable assistance was derived from the following publication which was still current when this standard was being developed:

Department of Standards Malaysia

MS 647:1999, *Specification for hypochlorite solutions (First revision)*

Annex A outlines a procedure for the determination of the net volume of sodium hypochlorite solution in its container.

Annex B outlines a procedure for the determination of the specific gravity.

Annex C outlines a procedure for the determination of available chlorine.

Annex D outlines a procedure for the determination of free alkali as sodium hydroxide.

Annex E provides an illustration of the warning symbol for the label.

Annex F specifies the requirements for the conspicuousness and legibility of information provided on labels.

Introduction

Sodium hypochlorite solution (liquid chlorine bleach) is a commonly used product in Trinidad and Tobago. It is widely used in homes, schools, hospitals, swimming pools and drinking water supplies to destroy microorganisms. It is particularly important when used in hospitals and other health care facilities, as it is used to disinfect hard surfaces and surgical instruments against pathogens. It is also used as a laundry whitener and stain remover for domestic and institutional laundry.

The most common type of bleach available is sodium hypochlorite solution. It is manufactured by the reaction of molecular chlorine with sodium hydroxide and water. A small excess of sodium hydroxide is required to maintain the pH between 11 and 13 to minimize decomposition.

Sodium hypochlorite disproportionates spontaneously to chloride and chlorate. This disproportionation is accelerated by ionic strength, sunlight, temperature and concentration of the sodium hypochlorite. Metals such as copper, nickel and cobalt also catalyze the decomposition of sodium hypochlorite.

Sodium hypochlorite solutions are highly unstable under elevated conditions of temperature and on exposure to sunlight, solutions that would remain relatively stable under normal conditions of storage and use in a temperate climate, would not do so in a tropical climate. It was found necessary to prepare specifications, to maintain, as far as possible, the stability and strength of the product and to extend the lifespan of the sodium hypochlorite in the tropical environment.

Sodium hypochlorite solutions are corrosive compounds. Provisions are therefore included for adequate labelling for use of such a common and potentially dangerous substance.

Sodium hypochlorite solutions are often referred to as “liquid chlorine bleach”. This arises because of the use of chlorine in its manufacture. This is a misnomer as “chlorine gas” is not present in the product nor is it involved in the product’s mode of action. However, the term liquid chlorine bleach is the common name used by consumers and, as such, is admitted.

Because of the versatility in use and potential dangers associated with sodium hypochlorite, the product has undergone a strict regime of regulation in Trinidad and Tobago. The Implementation Division of the Trinidad and Tobago Bureau of Standards inspects sodium hypochlorite taken from the various ports of entry and the shelves of retail outlets, for compliance with this compulsory national standard. The Trinidad and Tobago Bureau of Standards also offers product certification of sodium hypochlorite solutions.

1 Scope

This standard specifies the requirements and test methods for all sodium hypochlorite solutions (liquid chlorine bleaches), including scented solutions. This standard also specifies the requirements for labelling and characteristics of containers.

This standard does not apply to solid hypochlorite or to cleaners that contain sodium hypochlorite.

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.

ASTM International
ASTM D 1193, *Standard specification for reagent water*

International Organization for Standardization
ISO 6353-1:1982, *Reagents for chemical analysis – Part 1: General test methods*

Trinidad and Tobago Bureau of Standards
TTS 76: Part 15, *Requirements for labelling – Labelling of general household and automotive cleaning chemicals*

3 Terms and definitions

For the purposes of this National Standard, the following terms and definitions shall apply.

3.1
approved
approved by the Trinidad and Tobago Bureau of Standards

3.2
available chlorine
the measure of the oxidizing power of the chlorine present as hypochlorite and is expressed in terms of chlorine with an atomic weight of 35.45

3.3
batch
the material from a single mix or in the case of a continuous production process, the material from a single day's production

3.4
carton
any package intended to protect goods during transport, which is not customarily used to store sodium hypochlorite when displayed for sale

3.5
container
the package in which the sodium hypochlorite is packaged and sold

3.6
date of manufacture
the date at which the sodium hypochlorite is batch tested and approved by the manufacturer

3.7
sodium hypochlorite solution
liquid chlorine bleach
bleach
the product formed by reacting chlorine with an alkali such as caustic soda in water

3.8
strength
the measure of the disinfecting or bleaching capability of the substance, indicated as percentage available chlorine

4 General requirements

4.1 The sodium hypochlorite shall be supplied as a clear liquid, free from visible sediment or suspended matter.

4.2 The sodium hypochlorite shall be protected from sunlight and shall not be stored at temperatures above 35 °C (see also 5.6 and 5.7).

4.3 When tested in accordance with Annex A, the volume of sodium hypochlorite provided in the container should not be less than the volume specified on the label.

4.4 The sodium hypochlorite, when tested in accordance with Annex C, and when stored as recommended, shall have a minimum available chlorine content of 5.25 wt % for a period of three months from the date of manufacture.

4.5 Free alkali content shall not be more than 0.6 g/100 mL or less than 0.1 g/100 mL calculated as sodium hydroxide (NaOH) when tested in accordance with the method detailed in Annex D.

4.6 The raw materials used shall conform to approved specifications so as to not affect the stability of the sodium hypochlorite.

NOTE During manufacture every precaution shall be taken to avoid contact with metals which may destabilize the sodium hypochlorite.

4.7 The sodium hypochlorite shall be removed from the point of retail sale at a date three (3) months from the date of manufacture.

5 Containers

5.1 Containers shall be closed and arranged so as to prevent any loss of the contents.

5.2 The materials used for making the containers and their closures shall be resistant to attack by the sodium hypochlorite and shall not cause the sodium hypochlorite to decompose or form harmful or dangerous substances.

5.3 Containers shall be designed so as to withstand normal transit hazards.

5.3.1 Containers and their closures shall be able to withstand any pressure which may occur in normal handling and transportation.

5.3.2 A free space shall be left within the container to compensate for expansion of the sodium hypochlorite.

5.4 Containers shall be firmly secured in the carton.

5.5 The closure system shall ensure that the container could be tightly resealed after being opened.

NOTE Screw type closures are preferred.

5.6 The container shall be coloured or coated so as to prevent the passage of light to the contents of the container.

5.7 Containers shall be packed in an upright position and shall be stored in a cool place, away from direct sunlight (see 4.2).

6 Labelling

6.1 Each carton of sodium hypochlorite shall be labelled with the following information printed in bold type and securely affixed thereon:

a) the common name of the product;

EXAMPLE The name may be “Liquid Chlorine Bleaches”.

b) the trade name or brand name controlled by the manufacturer;

c) a prominently displayed warning symbol as described in Annex E;

d) an indication of the recommended storage conditions for the sodium hypochlorite;

e) the recommended maximum stack height;

f) the volume of sodium hypochlorite per container; and

g) the number of containers of sodium hypochlorite in the carton.

6.2 On the main panel of the label of the container, the following information shall be printed:

a) The brand name or trade mark of the product;

b) The common name of the product;

c) The net contents of the package in terms of SI units of volume; and

d) The statement “Keep out of reach of children”.

6.3 Each container of sodium hypochlorite shall also be labelled with the following information:

a) the common or chemical name of the hazardous substance or of each component which contributes substantially to the hazard;

EXAMPLE The common name of the chemical can be expessed as “contains sodium hypochlorite and sodium hydroxide (caustic soda)”.

b) a statement of the risks involved in the use of the substance;

c) the strength of the product in accordance with clause 4.4;

d) the date of manufacture;

e) the words “**Better if used within three (3) months of the date of manufacture**";

f) the name and address of the manufacturer or distributor;

g) the country of origin;

h) adequate directions as to the manner of use and storage of the sodium hypochlorite;

i) the main intended use(s) of the product;

j) first aid instructions; and

k) the statement “Read instructions before use”.

NOTE Each container may also be marked with the Trinidad and Tobago Product Certification Mark by arrangements with the Trinidad and Tobago Bureau of Standards, as provided for in the Standards Regulations.

6.4 The warning symbol and warning phrase as shown in Annex E shall be prominently displayed on the main panel of the label.

6.4.1 The warning symbol shall not be less than 15 mm in height. It shall be printed in strong contrast to the rest of the label. Refer to the symbol in Annex E.

6.4.2 The letters shall conform to the requirements outlined in Annex F and shall be printed in black on an orange background or red on a white background.

6.5 Each container and carton of sodium hypochlorite shall comply with the requirements of TTS 76: Part 15.

7 Test methods

7.1 Available chlorine **–** Samples of each batch shall be tested in accordance with the test method specified in Annex C or any other approved test method.

7.2 Free alkali as sodium hydroxide **–** Samples of each batch of sodium hypochlorite shall be tested in accordance with the test method specified in Annex D or any other approved test method.

7.3 All chemical reagents shall be in accordance with specifications outlined in ISO 6353-1:1982.

7.4 Unless otherwise indicated, references to water shall be understood to mean reagent water (distilled water) conforming to ASTM D 1193.

Annex A
(normative)

Determination of volume

A.1 Summary

The volume of sodium hypochlorite in the container is measured using a calibrated measuring cylinder.

A.2 Apparatus

a) Calibrated measuring cylinders of appropriate sizes

b) Retort stand

c) Clamp(s)

d) Timing device

A.3 Procedure

A.3.1 Allow the closed container of sodium hypochlorite and glassware to equilibrate to (20 ± 2) °C. Decant the sodium hypochlorite into a clean, dry measuring cylinder.

NOTE Use the smallest available measuring cylinder that can contain the sodium hypochlorite.

In the event that the sodium hypochlorite cannot be contained in one measuring cylinder, fill the first cylinder then use a second cylinder.

NOTE 1 The last cylinder used should be the smallest available measuring cylinder which can contain the sodium hypochlorite.

NOTE 2 Avoid spilling or splashing of the sodium hypochlorite as this would result in an invalid measurement. This can most easily be done by pouring the sodium hypochlorite down the sides of the cylinder.

A.3.2 Clamp the container vertically over the last measuring cylinder and allow to drain for four minutes.

A.3.3 Record the volume of sodium hypochlorite in the measuring cylinder(s) and obtain a total volume by summing the volumes if more than one cylinder was used.

Annex B
(normative)

Determination of specific gravity

B.1 Summary

The specific gravity of the sodium hypochlorite is determined by weighing a specific volume of sodium hypochlorite.

B.2 Apparatus

a) Calibrated 10 mL volumetric pipettes

b) Calibrated 100 mL volumetric flasks with stoppers

c) Calibrated analytical balance (accuracy of 0.5 mg or better)

B.3 Procedure

B.3.1 With the bottle tightly capped, invert the container of sodium hypochlorite several times.

B.3.2 Weigh accurately a clean, dry, stoppered volumetric flask. Record this mass as *A*.

B.3.3 Pipette 10 mL of sodium hypochlorite into the pre-weighed volumetric flask.

B.3.4 Replace the stopper and weigh the flask and sodium hypochlorite accurately. Record this mass as *B*.

NOTE It is important to maintain the temperature at (20 ± 2) °C.

B.4 Calculations

Calculate the specific gravity of the sodium hypochlorite as follows:

Density of sodium hypochlorite, in g/mL = $(B-A) / V$

Where A = mass, in g, of empty volumetric flask

B = mass, in g, of volumetric flask and sodium hypochlorite

V = volume, in mL, of sodium hypochlorite pipetted

Specific gravity of sodium hypochlorite = Density of sodium hypochlorite / 0.999973

Annex C
(normative)

Determination of available chlorine

C.1 Summary

The sodium hypochlorite solution is treated with an excess of a solution of potassium iodide, and strongly acidified with acetic acid. The equation for the reaction is shown below:

$$OCl^- + 2I^- + 2H^+ \rightarrow Cl^- + I_2 + H_2O$$

The liberated iodine is titrated with standard sodium thiosulphate solution.

C.2 Reagents

C.2.1 Acetic acid (2 N)

Dilute 115 mL of glacial acetic acid to 1 L using distilled water.

C.2.2 Potassium iodide (KI) crystals

C.2.3 Potassium iodate (analytical grade)

C.2.4 Starch indicator solution (0.5 %)

Mix 0.5 g of soluble starch with 5 mL of cold water and add to 95 mL of boiling water. Mix, cool and store in a sterilized bottle. Replace frequently or add 0.1 % salicylic acid to minimize deterioration. Observe and discard when fungal growth appears.

C.2.5 Sodium Thiosulphate (standard solution 0.1 M)

Dissolve approximately 25 g of sodium thiosulphate ($Na_2S_2O_3 \cdot 5H_2O$) crystals in freshly boiled and cooled water and dilute to 1 L. Alternatively, approximately 16 g of anhydrous sodium thiosulphate ($Na_2S_2O_3$) may be used.

NOTE The solution is more stable if the glassware used to prepare the solution is cleaned with sulphuric-chromic acid and thoroughly rinsed with water.

C.2.5.1 Standardize the prepared sodium thiosulphate solution as follows:

Weigh accurately 3.567 g of dry potassium iodate (KIO_3) and transfer quantitatively to a 1 L volumetric flask. Dissolve with distilled water, make up to mark and mix thoroughly. This solution will have a concentration of 0.0167 mol/L. Pipette 25 mL of this solution into a 250 mL Erlenmeyer flask and dilute to 50 mL with water. Add 10 mL of a freshly prepared KI solution of a volume fraction of 10 % or approximately 1 g of KI crystals and shake to allow dissolution. Add 15 mL of 2 M acetic acid and titrate the liberated iodine immediately with the $Na_2S_2O_3$ solution.

When the solution becomes light yellow, add 1 mL (or 10 drops) of starch indicator solution and complete the titration until the disappearance of the blue colour. Record this titre value as C. Standardize at least daily.

The equations of the reaction are as follow:

$$IO_3^- + 5I^- + 6H^+ \rightarrow 3H_2O + 3I_2$$

$$I_2 + 2(S_2O_3)^{2-} \rightarrow (S_4O_6)^{2-} + 2I^-$$

Calculate the molarity of the thiosulphate solution as follows:

Molarity = (M/C) x V x (6/214)

Where M = mass, in g, of iodate in 1000 mL solution

C = volume, in mL, of thiosulphate solution used

V = volume, in mL, of iodate pipetted

NOTE In the equation for molarity:
6 = the number of moles of thiosulphate that reacts with 1 mol of iodate; and
214 = the relative molecular mass of 1 mol of potassium iodate.

C.3 Procedure

C.3.1 If the sodium hypochlorite concentration is to be determined as weight percent, then determine the specific gravity of the solution as outlined in Annex B.

The 10 mL of weighed sodium hypochlorite should then be diluted to volume in a 100 mL volumetric flask. This diluted sodium hypochlorite is to be used in C.3.3 for the titration.

C.3.2 If the sodium hypochlorite concentration is to be determined as g/L then the specific gravity determination need not be performed. The diluted sample used in C.3.3 should be prepared as follows:

a) Pipette 10 mL of the sodium hypochlorite into a 100 mL volumetric flask.
b) Make up to the mark using distilled water.

C.3.3 Dissolve 1 g to 2 g of KI crystals in 50 mL of water in a 250 mL Erlenmeyer flask. Add 15 mL of 2 M acetic acid, then pipette 10 mL of the diluted sodium hypochlorite from C.3.1 or C.3.2 into the solution, keeping the tip of the pipette beneath the surface of the solution, until drained. Titrate at once with 0.1 mol/L $Na_2S_2O_3$ solution until the iodine colour is nearly gone. When the solution becomes light yellow, add 1 mL (or 10 drops) of starch indicator and complete the titration until the disappearance of the blue colour. Record the titre value as D.

NOTE For optimum precision, this procedure should only be carried out within 18 °C to 22 °C.

C.4 Calculations

C.4.1 Calculation of available chlorine concentration

Available chlorine, in g/L = (*DM* x 35.46) / *V*

Available chlorine, in weight % = [(*DM* x 0.03546) / *VS*] x 100

C.4.2 Calculation of sodium hypochlorite concentration

Sodium hypochlorite, in g/L = (*DM* x 37.22) / *V*

Sodium hypochlorite, in weight % = [(*DM* x 0.03722) / *VS*] x 100

Where *D* = volume, in mL, of $Na_2S_2O_3$ required for titration

M = molarity, in mol/L, of $Na_2S_2O_3$ solution

V = volume, in mL, of original undiluted sodium hypochlorite in the aliquot (10 mL) of diluted solution used for titration

S = specific gravity of the sodium hypochlorite (See Annex B)

Annex D
(normative)

Determination of free alkali as sodium hydroxide (NaOH)

D.1 Summary

An aliquot of the product is added to a neutralized, mixed solution of barium chloride and hydrogen peroxide. This precipitates any carbonate and reduces the hypochlorite to chloride. The free alkali is then titrated with standard hydrochloric acid using phenolphthalein as the indicator.

D.2 Reagents

D.2.1 Barium chloride

Dissolve 100 g of barium chloride ($BaCl_2$) in water and dilute to 1 L. Filter if turbid.

D.2.2 Methyl red indicator

Dissolve 0.1 g of methyl red salt in 60 mL of 95 % ethanol and dilute to 100 mL with water.

D.2.3 Hydrochloric acid (0.1 M)

D.2.3.1 Measure 83 mL of concentrated hydrochloric acid (HCl, specific gravity 1.19) into a graduated cylinder and transfer it to a 1 L volumetric flask. Dilute to the mark with water, mix well and store in a tightly stoppered glass container.

NOTE The concentration of this prepared solution is 1 M.

D.2.3.2 Standardization of hydrochloric acid

Weigh accurately, 0.2 g of borax ($Na_2B_4O_7 \cdot 10H_2O$). Transfer quantitatively into a 250 mL Erlenmeyer flask and add 50 mL of water. Shake until dissolution occurs or allow to stand for about 2 h to facilitate dissolution. Titrate against the 0.1 M HCl using 2 to 3 drops of methyl red as indicator.

Calculate the molarity of the standardised HCl as follows:

Molarity = (mass, in g, of borax used) / (0.19072 x volume of HCl titrated in mL)

D.2.4 Hydrogen Peroxide solution (H_2O_2), 3%

D.2.5 Sodium hydroxide solution, 4 g/L

D.2.6 Phenolphthalein indicator solution

Dissolve 0.5 g of phenolphthalein in 60 mL of 95 % ethanol and dilute to 100 mL with distilled water.

D.3 Procedure

Place 50 mL of $BaCl_2$ solution and 30 mL of H_2O_2 solution in a 250 mL Erlenmeyer flask and add 10 drops of phenolphthalein indicator solution. Neutralize by dropwise addition of the NaOH solution. Introduce into this neutral mixture, 10 mL of the product. Shake or stir vigorously for 1 min and titrate the NaOH solution with 0.1 M HCl until the pink colour just disappears. Record this titre value as *E*.

D.4 Calculations

Free alkali as NaOH g/L = (EM_A x 40) / V

Free alkali as NaOH weight % = [(EM_A x 0.04) / VS] x 100

Where E = volume, in mL, of HCl solution required for titration

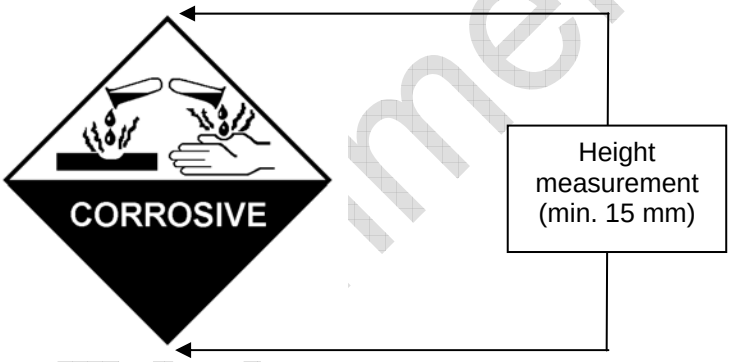
M_A = molarity, in mol/L, of the HCl

V = volume, in mL, of original sample of sodium hypochlorite used for titration

S = specific gravity of the sample (See Annex B)

Annex E
(normative)

Warning symbol for label



Annex F
(normative)

Requirements for conspicuousness and legibility of information provided on labels

F.1 All the information required on labels of sodium hypochlorite as specified in this standard shall be presented on the labels in accordance with the minimum specifications stated in F.2 to F.4.

F.2 The ratio of height to width of the letter shall not exceed a differential of 3 units to 1 unit (that is, no more than 3 times as high as it is wide).

F.3 When fractions are used, each component numeral shall meet one-half the minimum height requirements.

F.4 The letters and numerals shall be in a type size established in relationship to the area of the main panel and shall comply with the following type specifications:

a) not less than 2 mm in height on packages, the main panel of which has an area of 36 cm^2 or less;

b) not less than 3 mm in height on packages, the main panel of which has an area of more than 36 cm^2, but not more than 144 cm^2;

c) not less than 5 mm in height on packages, the main panel of which has an area of more than 144 cm^2, but not more than 625 cm^2;

d) not less than 6 mm in height on packages, the main panel of which has an area of more than 625 cm^2, but not more than 1225 cm^2;

e) not less than 10 mm in height on packages, the main panel of which has an area of more than 1225 cm^2, but not more than 2500 cm^2; and

f) not less than 13 mm in height on packages, the main panel of which has an area greater than 2500 cm^2.