SRI LANKA STANDARD 183 : 2013
UDC 663.64.057

SPECIFICATION FOR
CARBONATED BEVERAGES
(Third Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard

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SLS 183 : 2013

(Attached AMD 502)

Gr.12

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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

Sri Lanka Standard
SPECIFICATION FOR CARBONATED BEVERAGES
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FOREWORD

This Standard was approved by the Sectoral Committee on Agricultural and Food Products and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2013-01-22.

Different varieties of carbonated beverages produced in the country, using various ingredients - water, acidulants, sweetening agents, emulsifying agents and stabilizing agents, flavouring substances, colouring substances and carbon dioxide being the most important ones. Due to the vast array of products available in the market, it has not been possible to include in the standard, the exact or even the range of proportions of different ingredients required for the different varieties of the carbonated beverages.

This standard was first published in 1972 and subsequently revised in 1983 and 1997. In this third revision, the scope of this standard has been extended to include high caffeine carbonated beverages, keeping in view the existing trade practices. Several requirements on ingredients have been updated in order to bring the standard in line with existing regulatory requirements and manufacturing practices. In this revision, the advised one-day quantity (only for the formulated caffeinated beverages) calculation has been included for guidance only under Annex **I**.

This standard is subject to the restrictions imposed under the Sri Lanka Food Act No. 26 of 1980 and the regulations framed thereunder, wherever applicable.

For the purpose of deciding whether a particular requirement of this specification is complied with**,** the final value, observed or calculated, expressing the result of a test or an analysis, shall be rounded off in accordance with **SLS 102**. The number of significant places retained in the rounded off value should be the same as that of the specified value in this specification.

In revising this standard, the assistance derived from the General Standards for Food Additives of Codex Alimentarius Commission and the Australia New Zealand Food Authority (ANZFA) standard for Formulated Caffeinated Beverages are gratefully acknowledged.

1 SCOPE

This standard prescribes the requirements and methods of sampling and testing for carbonated beverages, which are intended for consumption without dilution.

2 REFERENCES

SLS 79 Edible common salt
SLS 102 Rules for rounding off numerical values
SLS 143 General principles of food hygiene
SLS 191 White sugar
SLS 291 Glass bottles for aerated water
SLS 398 Crown closures
SLS 428 Random sampling methods
SLS 467 Labelling of prepackaged foods
SLS 464 Bees honey
SLS 516 Microbiological test methods
Part 1 Enumeration of micro-organisms colony count at 30^0C
Part 2 Enumeration of yeasts and moulds
Part 3 Detection and enumeration of coliforms, faecal coliforms and *Escherichia coli*
SLS 614 Potable water
SLS 772 Treacle
SLS 883 Brown sugar
SLS 1332 Methods of test for fruits and vegetable products
Part 2 : Determination of soluble solids – Refractometric method
Part 3 : Determination of benzoic acid and sorbic acid concentrations
Part 5 : Determination of total sulphur dioxide content
Part 6 : Determination of sulphur dioxide content
Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC), 18th Edition, 2nd Revision 2007.

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply :

3.1 caffeine : All caffeine present from whatever source.

3.2 carbonated beverage : A non-alcoholic, water-based beverage which contains dissolved carbon dioxide and may contain one or more of the ingredients given in **5.2**.

3.3 formulated caffeinated beverage : A non-alcoholic, water-based, flavoured beverage which contains caffeine and dissolved carbon dioxide and may contain carbohydrates, amino acids, vitamins and one or more of the ingredients given in **5.2**.

3.4 one day quantity of formulated caffeinated beverages : The maximum amount of that food that shall be recommended to be consumed in one day in accordance with the directions specified in the label, of formulated caffeinated beverages.

4 TYPES

Carbonated beverages shall be of the following types :

4.1 Flavoured and sweetened carbonated beverages
4.2 Carbonated water or Soda water with or without permitted flavours
4.3 Formulated caffeinated beverages

5 INGREDIENTS

All ingredients used shall comply with the Sri Lanka Food Act No. 26 of 1980 and the regulations framed thereunder (as amended from time to time). The limits set for the use of ingredients by the regulations in the said Food Act shall be adhered to.

5.1 Basic ingredients

5.1.1 *Potable water***,** conforming to **SLS 614**

5.1.2 *Carbon dioxide***,** purity not less than 99 per cent

5.2 Optional ingredients

In addition to the ingredients given in **5.1**, one or more of the following may be used.

5.2.1 *Sweeteners*

5.2.1.1 Sugars
White sugar, see **SLS 191**
Brown sugar, see **SLS 883**

5.2.1.2 Non-nutritive sweeteners, only for products labelled as in **8.2 (b)**. The limits given are for the beverage at the point of consumption.

Aspartame	- 600 mg/l(max.)
Acesulfame – K	- 350 mg/l(max.)
Sucralose	- 300 mg/l(max.)
Neotame	- 20 mg/l (max.)

5.2.2 *Syrups* - liquid glucose, invert sugar syrup, fructose , dextrose, liquid cane sugar, isoglucose, high fructose syrup, honey, see **SLS 464** and treacle, see **SLS 772**

5.2.3 *Fruit/vegetable juice***,** comminuted fruit/vegetable and fruit/vegetable bases**,** fresh or preserved

5.2.4 *Flavouring substances*
Natural, nature identical, artificial or a combination of such flavouring substances

5.2.5 *Emulsifying/Stabilizing agents*

(maximum level in 1 litre of product)		
Pectins	(440)	Limited by GMP
Alginates	(403)	
Sodium carboxy methyl cellulose	(466)	
Carrageenan	(407)	
Gum Arabic (Acacia gum)	(414)	
Gellan gum	(418)	
Xanthan gum	(415)	5000 mg/l (max.)
Sodium hexametaphosphate (Sodium polyphosphate)	(452) (i)	1000 mg /l (max.)
Glycerol ester of wood rosin	(445) (iii)	100 mg/l (max.)
Sucrose acetate isobutynalol	(444)	500 mg/l (max.)
Dioctyl sodium sulfosuccinate	(480)	10 mg/l (max.)

5.2.6 *Foaming agents*

Quillaia extract Type I	(999) (i)	50 mg/l (max.)

5.2.7 *Preservatives* - (see Table **1**)
Sulphites, Benzoates, Sorbates of sodium, potassium or calcium

5.2.8 *Colouring substances*

5.2.9 *Caffeine* – (see **6.5**)

5.2.10 *Quinine salts* – (see **6.6**)

5.2.11 *Sodium bicarbonate (Food grade)* – limited by GMP

5.2.12 *Edible common salt*, see **SLS 79**

5.2.13 *Ascorbic acid*

5.2.14 *Acidulants*
Acetic acid, citric acid, tartaric acid, malic acid, fumaric acid, lactic acid, and/or their sodium potassium or calcium salts (GMP)
Orthophosphoric acid, maximum 0.06 per cent by mass.

5.2.15 *Vitamins and Minerals*

5.2.16 *Herbal extracts/Tea extracts/Coffee extracts*

5.2.17 *Inositol*
5.2.18 *Amino acids*
5.2.19 *Carbohydrates/ Malt extracts* — only for Formulated caffeinated beverages
5.2.20 *Glucuronolactone*

6 REQUIREMENTS

6.1 Hygiene

The product shall be processed, packaged, stored and distributed under hygienic conditions as prescribed in **SLS 143**.

6.2 Appearance

Clear product shall have a sparkling clarity under normal conditions of storage. Cloudy beverages shall be stable. Surface film or scum shall not be present in the product. There shall be no rust at the mouth of the bottle.

6.3 Flavour and odour

The flavoured products shall have a pleasant and characteristic flavour. The flavour of the product shall be in accordance with any claim made or implied on the label. The product shall be free from off flavours.

6.4 Carbonation

The product shall have the following carbonation values, when tested in accordance with Appendix **G**.

a) Soda water/Soda - 3.0 gas volumes,(min.)

b) Other beverages - 1.0 gas volume,(min.)

NOTE *The gas volume being the amount of carbon dioxide the water would absorb at normal atmospheric pressure at 15.6 ^{0}C.*

6.5 Caffeine

6.5.1 Carbonated beverages (except Formulated caffeinated beverages) shall not contain more than 150 mg/l of caffeine, when tested in accordance with the method prescribed in **AOAC 979.08** .

6.5.2 Formulated caffeinated beverages shall contain not less than 100 mg/l and not more than 320 mg/l of caffeine, when tested in accordance with the method prescribed in **AOAC 979.08** .

6.6 Quinine salts

Tonic beverages shall not contain more than 100 mg/l quinine salts calculated as quinine sulfate, when tested in accordance with the method prescribed in **Appendix B.**

6.7 Other requirements

6.7.1 All products shall conform to the requirements given in Table **1**, when tested according to the methods given in Column **4** of the Table.

TABLE 1 – Other requirements

Sl No. (1)	Characteristic (2)	Requirement (3)	Method of test (4)
i)	Total soluble solids, per cent by mass, (max.)	16	Appendix C
ii)	Sulphur dioxide content, mg/l, (max.) *+	50	Appendix D
iii)	Benzoic acid content, mg/l, (max.) *	120	Appendix E
iv)	Sorbic acid content, mg/l, (max.) *	300	

NOTE ** When a product contains more than one preservative, the quantity of each preservative expressed as a percentage of the maximum permitted limit of the preservative shall be calculated. The sum of these percentages shall not exceed 100.*

+ Products packed in metal containers shall not contain sulfur dioxide.

6.7.2 Only Formulated caffeinated beverages shall contain the substances given in Column **2** of Table **2**, provided the amount of that substance present in the product is not more than the amount specified in relation to that substance in Column **3** of the Table, when tested according to the relevant AOAC methods.

TABLE 2 –Only for formulated caffeinated beverages

Sl No. (1)	Substance (2)	Maximum amount per one-day quantity (3)
i)	Thiamin	40 mg
ii)	Riboflavin	20 mg
iii)	Niacin	40 mg
iv)	Vitamin B_6	10 mg
v)	Vitamin B_{12}	10 µg
vi)	Pantothenic acid	10 mg
vii)	Taurine	2000 mg
viii)	Glucuronolactone	1200 mg
ix)	Inositol	100 mg

6.8 Microbiological requirements

The product shall conform to the limits given in Table **3,** when tested according to the methods given in Column **4** of the Table.

TABLE 3 - Microbiological limits

SI No. (1)	Test (2)	Limit (3)	Method of test (4)
i)	Aerobic Plate Count, per ml	Less than 50	SLS 516 : Part 1
ii)	Coliforms, per ml	Absent	SLS 516 : Part 3
iii)	Yeast and mould count, per ml	Absent	SLS 516 : Part 2

6.9 Contaminants

6.9.1 *Pesticide residues*

The product shall be prepared with special care under Good Manufacturing Practices, so that residues of those pesticides which may be required in the production, storage or processing of the raw materials or the finished food ingredient do not remain, or, if technically unavoidable, are reduced to the maximum extent possible.

6.9.2 *Heavy metals*

The product shall not exceed the limits for heavy metals given in Table **4,** when tested according to the methods given in Column **4** of the Table.

TABLE 4 - Limits for heavy metals

Sl No. (1)	Heavy metal (2)	Limit (3)	Method of test (4)
i)	Arsenic, (as As), mg/l, max.	0.01	Appendix F
ii)	Cadmium, (as Cd), mg/l, max.	0.003	
iii)	Lead, (as Pb),mg/l, max.	0.01	
iv)	Tin, (as Sn), mg/l, max.*	150	

* Only for canned beverages

7 PACKAGING

7.1 The product shall be filled in glass bottles conforming to **SLS 291**. It may also be filled in cans, food grade plastic containers and dispensing units.

7.2 All containers shall be clean and free from chips, cracks and any other defects and appropriately sealed. Glass bottles shall be properly sealed with gas tight crown closures conforming to **SLS 398.** Crown closures shall be lined internally with a suitable liner made of food grade material. Plastic containers shall not leak after they are filled and capped. All glass bottles shall be subjected to cleansing and sanitizing process before filling.

8 MARKING AND/OR LABELLING

8.1 The markings and labelling of the containers shall be done either by printing or lithographing on the label of the containers themselves or attaching labels printed on paper or printed on the crown/closure.

8.2 The following shall be marked legibly and indelibly on the label of the container :

a) A product with carbohydrate sweeteners reduced by a minimum of 30% of the comparable product may be named as “Low sugar” or “Lite/Light” or “Sugar reduced”. (Percentage of sugar level shall be declared on the label).

b) When non-nutritive sweeteners are added as substitute for sugars, the statements “with non nutritive sweetener(s)” and “energy reduced” or “Lite/Light” or “with no added sugar” or “sugar free”, as the case may be, shall be included in conjunction with or in close proximity to the product name ;
c) Brand name or trade mark, if any;
d) Name and address of the manufacturer;
e) Name and address of the distributor in Sri Lanka;
f) Food additive’s name or class and INS number, if added;
g) Complete list of ingredients, in descending order of their proportions;
h) Net volume in “ml” or “l”;
j) Date of manufacture;
k) Date of expiry;
m) Batch number or code number;

NOTE : *Date of manufacture /Date of expiry and Batch/Code number may be marked on the bottle/container/can.*

n) A pictorial representation on the label shall not mislead the consumer with respect to the ingredients used;
o) Country of origin, in case of imported products; and
p) Instructions for storage and use, if any.

8.3 In addition to **8.2**, the following information shall also be marked legibly and indelibly on the label of formulated caffeinated beverages :

b) The average quantity of caffeine per 100 ml, expressed in milligrams.
c) The substances listed in Column **2** of Table **2**, where present, expressed in the units included in Column **3** of the Table.
d) The declarations under a) and b) may be adjacent to or follow a nutrition information panel on the label, provided that the declarations are clearly distinguished from the nutrition information.
e) Cautionary statements to the effect that
(i) the food is “not recommended for children under 12 years and pregnant and lactating women”;
(ii) the food “contains caffeine” and “not recommended for individuals sensitive to caffeine”;
e) When formulated caffeinated beverage contains one or more of the substances in the Table **2** shall include an advisory statement to the effect that ‘Consume not more than [amount of one-day quantity (as cans, bottles or ml)] per day’.
f) The label on a package of formulated caffeinated beverage shall not include declarations of the quantities of vitamins present in the food expressed as a proportion or multiple of the ‘Recommended Daily Allowance’ or ‘Nutritive Reference Value’ or ‘Estimated Safe and Adequate Daily Dietary Intakes’ or 'Recommended Dietary Intakes' of that vitamin.

8.4 The marking and labelling shall also be in accordance with **SLS 467**.

9 SAMPLING

Representative samples of the product for ascertaining conformity to the requirements of this standard shall be drawn as prescribed in Appendix **A.**

10 METHODS OF TEST

Tests shall be carried out as prescribed in Appendices **B** to **G** of this standard **, Part 1, 2** , **3** of **SLS 516, Part 2,3,5,6** of **SLS 1332** and **AOAC** methods.

11 CRITERIA FOR CONFORMITY

A lot shall be declared as conforming to the requirements of this standard if the following conditions are satisfied:

11.1 Each container examined as in **A-3.1** satisfies the packaging and marking requirements.

11.2 Each container tested as in **A-3.2** satisfies the microbiological requirements given in **6.8**.

11.3 Each container tested as in **A-3.3** satisfies the requirements given in **6.2, 6.3** and **6.4**.

11.4 The composite sample tested as in **A-3.4** satisfy the requirements given in **6.5, 6.6, 6.7** and **6.9.2**.

APPENDIX A
SAMPLING

A-1 LOT

In any consignment, all the containers of the same size, type and flavours belonging to one batch of manufacture or supply shall constitute a lot.

The sampling scheme given in this Appendix should be applied where compliance of a lot to the requirements of this standard is to be assessed based on statistical sampling and inspection.
Where compliance with this standard is to be assured based on manufacturer's control systems coupled with type testing and check tests or any other procedure, appropriate scheme of sampling and inspection should be adopted.

A-2 SCALE OF SAMPLING

A-2.1 Samples shall be tested from each lot for ascertaining conformity to the requirements of this standard.

A-2.2 The number of containers to be selected from a lot shall be in accordance with Table **5**.

TABLE 5 - Scale of sampling

Number of containers in the lot (1)	Number of containers to be selected (2)	Size of the sub sample (3)
Up to 500	8	4
501 to 1200	10	5
1201 to 3200	12	6
3201 to 10 000	15	8
10 001 and above	20	10

A-2.3 The containers shall be selected at random. In order to ensure randomness of selection, random number tables as given in **SLS 428** shall be used.

A-3 NUMBER OF TESTS

A-3.1 Each container selected as in **A-2.2** shall be examined for packaging and marking requirements.

A-3.2 Each container in the sub sample of size as given in Column **3** of Table **5** shall be individually tested for microbiological requirements (**6.8**).

A-3.3 Each of the remaining containers shall be individually examined/tested for requirements given in **6.2**, **6.3** and **6.4**.

A-3.4 A composite sample shall be prepared from the remaining containers examined as in **A-2.3** and shall be tested for requirements given in **6.5, 6.6, 6.7** and **6.9.2.**

APPENDIX B
DETERMINATION OF QUININE

B.1 Apparatus

B.1.1 *Spectrophotometer*, capable of measuring absorbance at a wavelength of 333 nm.

B.1.2 *Separating funnels*

B.2 Reagents

B.2.1 *Ammonia solution*, concentrated.

B.2.2 *Chloroform*

B.2.3 *Quinine sulfate dihydrate standard solution*.

Weigh accurately 0.100 7 g of quinine sulphate and dissolve in distilled water. Make up to 1 000 ml in a volumetric flask. This solution contains 100 mg quinine sulfate per 1 000 ml.

B.3 Procedure

Transfer 2.5 ml of the quinine sulfate standard solution (**B.2.3**) into a 250-ml separation funnel and add 25 ml of distilled water. Make the solution alkaline with ammonia (**B.2.1**) and extract quinine using 50 ml of chloroform (**B.2.2**). Measure absorbance of the chloroformic quinine extract at 333 nm. Transfer 50 g of decarbonated sample into another separation funnel and extract quinine with 50 ml chloroform (**B.2.2**) after making the sample alkaline with ammonia (**B.2.1**). Measure absorbance of the chloroformic extract of the sample at 333 nm.

B.4 Calculation

$$\textit{Quinine sulfate in mg/kg} = \frac{A_2 \times 5}{A_1}$$

where,

A_1 is the absorbance, of the chloroformic extract of the quinine sulfate; and
A_2 is the absorbance, of the chloroformic extract of the sample solution.

APPENDIX C
DETERMINATION OF SOLUBLE SOLIDS CONTENT

Determination of soluble solids content shall be carried out according to the method described in **SLS 1332 : Part 2** (Methods of test for Fruit and vegetable products – Determination of Soluble solids - Refractometric method).

APPENDIX D
DETERMINATION OF SULPHUR DIOXIDE CONTENT

Determination of sulphur dioxide content shall be carried out according to the method described in **SLS 1332 : Part 5** (Methods of test for fruits and vegetables products – Determination of total sulphur dioxide content) or **SLS 1332 : Part 6** (Methods of test for fruits and vegetables products – Determination of sulphur dioxide content – Routine method) or AOAC method 962.16.

APPENDIX E
DETERMINATION OF BENZOIC ACID AND SORBIC ACID CONTENTS

Determination of benzoic acid and sorbic acid contents shall be carried out according to the method described in **SLS 1332 : Part 3** (Methods of test for Fruit and vegetable products – Determination of benzoic acid and sorbic acid concentrations – High-performance liquid chromatography method) or AOAC methods 960.38 and 983.16.

APPENDIX F
DETERMINATION OF HEAVY METALS

Determination of heavy metals shall be carried out according to the methods given in the Official Methods of Analysis of the AOAC (Association of Official Analytical Chemist), 18th edition, 2007, as given in Table **6**.

TABLE 6 – Methods for analysis of heavy metals

Sl No. (1)	Heavy metal (2)	Method of analysis (3)
i)	Arsenic	AOAC method 986.15
ii)	Cadmium	AOAC method 999.11
iii)	Lead	AOAC method 999.11
iv)	Tin	AOAC method 999.11

APPENDIX G
DETERMINATION OF CARBON DIOXIDE VOLUME (CARBONATION)

G-1 Apparatus

G-1.1 *Gas volume tester*

The apparatus consists of a pressure gauge having a hollow spike with holes in its side. The container is inserted from the side into the slot provided in the neck of the carbon dioxide tester and is secured in place by tightening with a threaded system. The pressure gauge is inserted until the needle point touches the crown cork. There is a sniff valve on the gauge stem which is kept closed until the needle point of the pressure gauge is forced through the crown cork.

G-2 Procedure

Clamp the container in the frame of the gas volume tester. Pierce the crown cork but do not shake the bottle. Sniff off the top gas quickly until the gauge reading drops to zero. Make certain, to close the valve when the needle touches zero in the pressure gauge. Shake the container vigorously, until the gauge indicates a reading, which is not changed by the additional shaking. Record the pressure. Note the temperature and record it. Obtain the volume of gas from Table **7**.

ANNEX I
(Informative)

CALCULATION OF "ONE-DAY QUANTITY"
(only for the Formulated caffeinated beverages)

The advised one-day quantity is calculated from the permissions in Table **2**, as it relates to the concentration of substances in the product. The substance that yields the lowest equivalent amount will determine the advised consumption limit.

For example:

Column 1	Column 2	Column 3	Column 4
Product X formulation	Concentration (mg/l)	Maximum permitted one-day quantity (refer to Table 2 to sub-clause 6.7.2)	Equivalent amount of product X (ml)
Riboflavin	30	20	666
Niacin	80	40	500
Pantothenic acid	15	10	666
Taurine	2000	2000	1000

The equivalent amount in Column 4 is calculated as: $\frac{\text{Column 3 x 1000}}{\text{Column 2}}$

In this example niacin presents as the most limiting substance, and therefore, the advised consumption limit for product X would be 500 ml. If product X is packaged in 250 ml cans, the advised consumption limit may also be expressed as 'two cans' – for example –
'not more than 500 ml per day' or 'not more than two cans per day'.

TABLE 7 – Carbon dioxide chart – Volumes of Carbon dioxide gas dissolved by one volume of water

Gauge pressure in kg/cm^2 → / Temperature ^{o}C ↘	0	0.14	0.28	0.42	0.56	0.70	0.84	0.98	1.12	1.27	1.41	1.55	1.69
0	1.71	1.9	2.2	2.4	2.6	2.9	3.1	3.3	3.5	3.8	4.0	4.2	4.4
0.6	1.68	1.9	2.1	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3.9	4.1	4.3
1.1	1.64	1.9	2.1	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4.1	4.3
1.8	1.61	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.8	4.0	4.2
2.2	1.57	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.3	3.5	3.7	3.9	4.1
2.8	1.54	1.7	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
3.3	1.51	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9
3.9	1.47	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9
4.4	1.45	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8
5.0	1.42	1.6	1.8	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.3	3.5	3.7
5.6	1.40	1.6	1.8	2.0	2.1	2.3	2.5	2.8	2.9	3.1	3.3	3.5	3.6
6.1	1.37	1.6	1.7	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.6
6.7	1.35	1.5	1.7	1.9	2.1	2.2	2.4	2.6	2.8	3.0	3.1	3.3	3.5
7.2	1.32	1.5	1.7	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	3.4
7.8	1.29	1.5	1.6	1.8	2.0	2.2	2.3	2.5	2.7	2.8	3.0	3.2	3.4
8.3	1.26	1.4	1.6	1.8	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.3
8.9	1.24	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.1	3.2
9.4	1.21	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.5	2.7	2.8	3.0	3.2
10.0	1.19	1.4	1.5	1.7	1.8	2.0	2.2	2.3	2.5	2.6	2.8	2.9	3.1
10.6	1.17	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	3.1
11.1	1.15	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.5	2.7	2.8	3.0
11.7	1.13	1.3	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.5	2.7	2.8	2.9
12.2	1.11	1.3	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9
12.8	1.10	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.8
13.3	1.08	1.2	1.4	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.8
13.9	1.06	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.7
14.4	1.04	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.7
15.0	1.02	1.2	1.3	1.4	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.7
15.6	1.00	1.1	1.3	1.4	1.5	1.7	1.8	1.9	2.1	2.2	2.3	2.5	2.6
16.1	0.98	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.6
16.7	0.97	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.5
17.2	0.95	1.1	1.2	1.3	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5
17.8	0.93	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4
18.3	0.92	1.1	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2	2.3	2.4
18.9	0.90	1.0	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.4
19.4	0.89	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.3
20.0	0.88	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3
20.6	0.86	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2
21.1	0.85	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2
21.7	0.84	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2
22.2	0.83	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1
22.8	0.81	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1
23.3	0.79	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1
23.9	0.78	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
24.4	0.77	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
25.0	0.76	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
25.6	0.75	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0
26.1	0.74	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
26.7	0.73	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
27.2	0.72	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
27.8	0.71	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8
28.3	0.70	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8
28.9	0.69	0.8	0.9	1.0	1.0	1.1	1.2	1.4	1.4	1.5	1.6	1.7	1.8
28.4	0.68	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
30.0	0.67	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7
30.6	0.66	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7
31.1	0.65	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.4	1.4	1.5	1.6	1.7
31.7	0.64	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7
32.2	0.63	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6
32.8	0.62	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6
33.3	0.61	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6
33.9	0.60	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6
34.4	0.60	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.6
35.0	0.59	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.5
35.6	0.58	0.7	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.5
36.1	0.57	0.7	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.5
36.7	0.57	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5
37.2	0.56	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5
37.8	0.56	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.4

Table 7 Continued…

TABLE 7 – Carbon dioxide chart – Volumes of Carbon dioxide gas dissolved by one volume of water

Gauge pressure in kg/cm^2 → / Temperature ^{o}C ↓	1.83	1.97	2.11	2.25	2.39	2.58	2.67	2.81	2.95	3.09	3.23	3.37	3.52
0	4.7	4.9	5.2	5.4	5.6	5.8	6.1	6.3	6.5	6.7	7.0	7.2	7.4
0.6	4.6	4.8	5.1	5.3	5.5	5.7	5.9	6.2	6.4	6.6	6.8	7.1	7.3
1.1	4.5	4.7	4.9	5.2	5.4	5.6	5.8	6.0	6.2	6.5	6.7	7.0	7.2
1.8	4.4	4.6	4.8	5.1	5.2	5.5	5.7	5.9	6.1	6.3	6.6	6.8	7.0
2.2	4.3	4.5	4.7	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.9
2.8	4.2	4.4	4.6	4.9	5.1	5.3	5.5	5.7	5.9	6.1	6.3	6.5	6.7
3.3	4.1	4.3	4.5	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6
3.9	4.0	4.3	4.5	4.7	4.9	5.1	5.3	5.4	5.7	5.9	6.1	6.2	6.4
4.4	4.0	4.2	4.3	4.5	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1	6.3
5.0	3.9	4.1	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2
5.6	3.8	4.0	4.2	4.4	4.6	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1
6.1	3.8	3.9	4.1	4.3	4.5	4.7	4.8	5.0	5.2	5.4	5.6	5.8	6.0
6.7	3.7	3.9	4.0	4.2	4.4	4.6	4.8	5.0	5.1	5.3	5.5	5.7	5.9
7.2	3.6	3.8	4.0	4.1	4.3	4.5	4.7	4.8	5.0	5.2	5.4	5.6	5.7
7.8	3.5	3.7	3.9	4.0	4.2	4.4	4.6	4.7	4.9	5.1	5.3	5.4	5.6
8.3	3.5	3.6	3.8	4.0	4.1	4.3	4.5	4.6	4.8	5.0	5.2	5.3	5.5
8.9	3.4	3.6	3.7	3.9	4.1	4.2	4.4	4.6	4.7	4.9	5.1	5.2	5.4
9.4	3.3	3.5	3.7	3.8	4.0	4.1	4.3	4.5	4.6	4.8	5.0	5.1	5.3
10.0	3.3	3.4	3.6	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.9	5.0	5.2
10.6	3.2	3.4	3.5	3.7	3.8	4.0	4.2	4.3	4.5	4.6	4.8	5.0	5.1
11.1	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.9	5.0
11.7	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.2	4.3	4.4	4.6	4.8	4.9
12.2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.8
12.8	3.0	3.1	3.3	3.4	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.6	4.7
13.3	2.9	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.7
13.9	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.6
14.4	2.8	3.0	3.1	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5
15.0	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.4
15.6	2.7	2.9	3.0	3.1	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3
16.1	2.7	2.8	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.3
16.7	2.6	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2
17.2	2.6	2.7	2.9	3.0	3.1	3.2	3.4	3.5	3.6	3.8	3.9	4.0	4.2
17.8	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.1
18.3	2.5	2.6	2.8	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0
18.9	2.5	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9
19.4	2.4	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.8
20.0	2.4	2.5	2.6	2.7	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8
20.6	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.8
21.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7
21.7	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.6
22.2	2.2	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.4	3.5	3.6
22.8	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
23.3	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.5
23.9	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
24.4	2.1	2.2	2.4	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.3	3.4
25.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
25.6	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.3
26.1	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2
26.7	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2
27.2	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
27.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
28.3	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.0
28.9	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
28.4	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.9
30.0	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.8	2.9
30.6	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.8
31.1	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8
31.7	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8
32.2	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7
32.8	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7
33.3	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7
33.9	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.6
34.4	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6
35.0	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6
35.6	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.5
36.1	1.6	1.7	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5
36.7	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5
37.2	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5
37.8	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4

Table 7 Continued…

TABLE 7 – Carbon dioxide chart – Volumes of Carbon dioxide gas dissolved by one volume of water

Gauge pressure in kg/cm² → / Temperature °C ↓	3.66	3.80	3.94	4.08	4.22	4.36	4.50	4.64	4.78	4.92	5.06	5.20	5.34
0	7.7	7.9	8.2	8.4	8.6	8.8	9.0	9.3	9.5	9.7	10.0	10.2	10.4
0.6	7.5	7.8	8.0	8.2	8.4	8.6	8.9	9.1	9.3	9.5	9.8	10.0	10.2
1.1	7.4	7.6	7.8	8.0	8.2	8.4	8.7	8.9	9.1	9.3	9.6	9.8	10.0
1.8	7.2	7.4	7.6	7.8	8.0	8.3	8.5	8.7	8.9	9.2	9.4	9.6	9.8
2.2	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.2	9.4	9.6
2.8	6.9	7.1	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4
3.3	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2
3.9	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0
4.4	6.5	6.7	6.9	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.5	8.7	8.8
5.0	6.4	6.6	6.8	7.0	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.5	8.7
5.6	6.3	6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.3	8.5
6.1	6.1	6.3	6.5	6.7	6.9	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.3
6.7	6.0	6.2	6.4	6.6	6.7	6.9	7.1	7.3	7.5	7.6	7.8	8.0	8.2
7.2	5.9	6.1	6.2	6.4	6.6	6.8	6.9	7.1	7.3	7.5	7.7	7.8	8.0
7.8	5.8	6.0	6.1	6.3	6.4	6.6	6.8	7.0	7.2	7.4	7.5	7.7	7.9
8.3	5.7	5.7	6.0	6.2	6.3	6.5	6.7	6.9	7.0	7.2	7.4	7.6	7.7
8.9	5.6	5.9	5.9	6.1	6.2	6.4	6.6	6.8	6.9	7.1	7.2	7.4	7.6
9.4	5.5	5.6	5.8	6.0	6.1	6.3	6.4	6.6	6.8	6.9	7.1	7.2	7.4
10.0	5.4	5.5	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	7.0	7.1	7.3
10.6	5.3	5.4	5.6	5.7	5.9	6.1	6.2	6.4	6.5	6.7	6.8	7.0	7.2
11.1	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.3	6.4	6.6	6.7	6.9	7.0
11.7	5.1	5.2	5.4	5.5	5.7	5.9	6.0	6.1	6.3	6.4	6.6	6.7	6.9
12.2	5.0	5.2	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8
12.8	4.9	5.1	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6
13.3	4.8	5.0	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.2	6.4	6.5
13.9	4.7	4.9	5.0	5.2	5.3	5.4	5.6	5.7	5.9	6.0	6.1	6.3	6.4
14.4	4.6	4.7	4.9	5.1	5.2	5.3	5.5	5.6	5.8	5.9	6.0	6.2	6.3
15.0	4.6	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.1	6.2
15.6	4.5	4.6	4.7	4.9	5.0	5.2	5.3	5.4	5.5	5.7	5.8	6.0	6.1
16.1	4.4	4.5	4.7	4.8	4.9	5.1	5.2	5.3	5.5	5.6	5.7	5.9	6.0
16.7	4.3	4.5	4.6	4.7	4.8	5.0	5.1	5.3	5.4	5.5	5.6	5.8	5.9
17.2	4.3	4.4	4.5	4.6	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.7	5.8
17.8	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.1	4.2	5.3	5.4	5.5	5.7
18.3	4.1	4.2	4.4	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.4	5.5	5.6
18.9	4.1	4.2	4.3	4.4	4.5	4.7	4.8	4.9	5.0	5.2	5.3	5.4	5.5
19.4	4.0	4.1	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4
20.0	3.9	4.0	4.2	4.3	4.4	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.3
20.6	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.7	4.8	4.9	5.0	5.1	5.3
21.1	3.8	3.9	4.0	4.1	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.1	5.2
21.7	3.7	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.9	5.0	5.1
22.2	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.0
22.8	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.4	4.5	4.6	4.7	4.8	4.9
23.3	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
23.9	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.7	4.8
24.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7
25.0	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6
25.6	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6
26.1	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
26.7	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4
27.2	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.3
27.8	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3
28.3	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.2
28.9	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2
28.4	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.1
30.0	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.0
30.6	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.0
31.1	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9
31.7	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.9
32.2	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8
32.8	2.8	2.9	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.7	3.8
33.3	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7
33.9	2.7	2.8	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7
34.4	2.7	2.8	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.6
35.0	2.6	2.7	2.8	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6
35.6	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6
36.1	2.6	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.3	3.4	3.5
36.7	2.6	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5
37.2	2.5	2.6	2.7	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.4
37.8	2.5	2.6	2.6	2.7	2.8	2.9	2.9	3.0	3.1	3.2	3.2	3.3	3.4

Table 7 Continued…

TABLE 7 – Carbon dioxide chart – Volumes of Carbon dioxide gas dissolved by one volume of water

Gauge pressure in kg/cm^2 → / Temperature ^{o}C ↓	5.48	5.62	5.76	5.91	6.05	6.19	6.33	6.47	6.61	6.75	6.89	7.03
0	10.7	10.9	11.2	11.5	11.7	12.0	12.2	12.4	12.7	12.9	13.2	13.4
0.6	10.4	10.7	11.0	11.3	11.5	11.7	11.9	12.2	12.4	12.6	12.9	13.1
1.1	10.2	10.5	10.8	11.0	11.2	11.5	11.7	11.9	12.2	12.4	12.6	12.8
1.8	10.0	10.3	10.6	10.8	11.0	11.3	11.5	11.7	11.9	12.1	12.3	12.5
2.2	9.8	10.0	10.4	10.6	10.8	11.0	11.2	11.4	11.7	11.9	12.1	12.3
2.8	9.6	9.8	10.1	10.3	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.0
3.3	9.4	9.6	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.4	11.6	11.8
3.9	9.2	9.4	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.3	11.5
4.4	9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.3
5.0	8.9	9.1	9.4	9.6	9.8	10.0	10.2	10.3	10.5	10.7	10.9	11.1
5.6	8.7	8.9	9.2	9.4	9.6	9.8	10.0	10.1	10.3	10.5	10.7	10.9
6.1	8.5	8.7	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.6	10.7
6.7	8.4	8.6	8.8	9.1	9.2	9.5	9.6	9.8	10.0	10.2	10.3	10.5
7.2	8.2	8.4	8.7	8.9	9.0	9.3	9.4	9.6	9.8	10.0	10.1	10.3
7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.7	9.9	10.1
8.3	7.9	8.0	8.3	8.5	8.7	8.9	9.0	9.2	9.4	9.5	9.7	9.9
8.9	7.7	7.9	8.1	8.3	8.5	8.7	8.8	9.0	9.2	9.3	9.5	9.7
9.4	7.6	7.8	8.0	8.2	8.3	8.5	8.7	8.9	9.0	9.2	9.3	9.5
10.0	7.4	7.6	7.9	8.0	8.2	8.4	8.5	8.7	8.9	9.0	9.2	9.3
10.6	7.3	7.5	7.7	7.9	8.0	8.2	8.4	8.5	8.7	8.8	9.0	9.2
11.1	7.2	7.3	7.6	7.8	7.9	8.1	8.2	8.4	8.5	8.7	8.9	9.0
11.7	7.0	7.2	7.4	7.6	7.8	7.9	8.1	8.2	8.4	8.5	8.7	8.9
12.2	6.9	7.1	7.3	7.5	7.6	7.8	8.0	8.1	8.3	8.4	8.6	8.7
12.8	6.8	6.9	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6
13.3	6.7	6.8	7.0	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4
13.9	6.5	6.7	6.9	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3
14.4	6.4	6.6	6.8	7.0	7.1	7.3	7.4	7.5	7.7	7.8	8.0	8.1
15.0	6.3	6.5	6.7	6.8	7.0	7.1	7.3	7.4	7.5	7.7	7.8	8.0
15.6	6.2	6.3	6.6	6.7	6.8	7.0	7.1	7.2	7.4	7.5	7.7	7.8
16.1	6.1	6.2	6.4	6.6	6.7	6.9	7.0	7.1	7.3	7.4	7.6	7.7
16.7	6.0	6.1	6.3	6.5	6.6	6.8	6.9	7.0	7.2	7.3	7.4	7.5
17.2	5.9	6.1	6.2	6.4	6.5	6.7	6.8	6.9	7.0	7.2	7.3	7.4
17.8	5.8	6.0	6.1	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.2	7.3
18.3	5.7	5.9	6.0	6.2	6.3	6.4	6.5	6.7	6.8	6.9	7.0	7.2
18.9	5.6	5.8	5.9	6.1	6.2	6.3	6.4	6.5	6.7	6.8	6.9	7.0
19.4	5.5	5.7	5.8	6.0	6.1	6.2	6.3	6.5	6.6	6.7	6.8	6.9
20.0	5.4	5.6	5.7	5.9	6.0	6.1	6.2	6.4	6.5	6.6	6.7	6.8
20.6	5.4	5.5	5.7	5.8	5.9	6.0	6.1	6.3	6.4	6.5	6.6	6.7
21.1	5.3	5.4	5.6	5.7	5.8	6.0	6.1	6.2	6.3	6.4	6.5	6.6
21.7	5.2	5.3	5.5	5.6	5.7	5.9	6.0	6.1	6.2	6.3	6.4	6.5
22.2	5.1	5.2	5.4	5.5	5.6	5.8	5.9	6.0	6.1	6.2	6.3	6.4
22.8	5.0	5.1	5.3	5.4	5.5	5.7	5.8	5.9	6.0	6.1	6.2	6.3
23.3	4.9	5.0	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1
23.9	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
24.4	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
25.0	4.7	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
25.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
26.1	4.6	4.7	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
26.7	4.5	4.6	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7
27.2	4.4	4.5	4.7	4.8	4.9	5.1	5.2	5.3	5.3	5.4	5.5	5.6
27.8	4.4	4.5	4.6	4.7	4.8	4.9	5.1	5.2	5.2	5.3	5.4	5.5
28.3	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
28.9	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
28.4	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
30.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2
0.6	4.1	4.2	4.3	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1
31.1	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9	5.0
31.7	4.0	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9
32.2	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9
32.8	3.9	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7	4.8
33.3	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8
33.9	3.8	3.8	4.0	4.1	4.1	4.2	4.4	4.4	4.4	4.6	4.7	4.7
34.4	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7
35.0	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.6	4.6
35.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6
36.1	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.3	4.4	4.4	4.5
36.7	3.5	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.3	4.3	4.4
37.2	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.4
37.8	3.5	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.2	4.2	4.3

Amendment No: 1 Approved on 2017-12-04 to SLS 183: 2013

AMENDMENT NO: 1 TO SLS 183: 2013
SPECIFICATION FOR CARBONATED BEVERAGES (THIRD REVISION)

EXPLANATORY NOTE

This amendment is issued after a decision taken by the Working group on Carbonated Beverages in order to include the INS numbers of the food additives given under basic and optional ingredients and amend the list of optional ingredients and their limits as per CODEX General Standard on Food Additives (GSFA)**.**

Amendment No: 1 Approved on 2017-12-04 to SLS 183: 2013

AMENDMENT NO: 1 TO SLS 183: 2013
SPECIFICATION FOR CARBONATED BEVERAGES (THIRD REVISION)

Page 3
Foreword, Paragraph 4, Line 2
Delete the words "wherever applicable".

Page 4
Clause **3**
Insert new clauses as follows after the clause **3.4**.
"**3.5 sweetener:** Any food additive that is used or intended to be used to impart a sweet taste or as a tabletop sweetener, and does not include carbohydrate sugars

3.6 energy reduced: Product to which it refers has an energy value reduced by at least thirty per cent as compared with the original or a similar preparation"

3.7 sugar free: Product which contains sugar not more than 0.5 g per 100 g (solids) or not more than 0.5 g per 100 ml (liquids)

3.8 no added sugar: Product which does not contain any added mono or disaccharides or any other food used for sweetening properties. If sugars are naturally present in the food, state "Naturally occurring sugars present" on label

Page 5
Delete the title of **5.2.1** and substitute by "*Sugars and sweeteners"*

Insert the word "AND/ OR" between clauses **5.2.1.1** and **5.2.1.2**.

Clause **5.2.1.2**
Replace the clause **5.2.1.2** by following.
"5.2.1.2 Sweeteners
Only for products which are identified as "energy reduced" or with "no added sugar".

Aspartame	INS 951 (600 mg/ l, max)
Acesulfame K	INS 950 (350 mg/ l, max)
Sucralose	INS 955 (300 mg/ l, max)
Neotame	INS 961 (20 mg/ l, max)
Steviol glycoside	INS 960 (80 mg/ l, max as Steviol equivalents)"

Page 6

Delete the clause **5.2.5** and substitute by the following.

"**5.2.5** *Emulsifying/ stabilizing agents*

Pectins	INS 440	Limited by GMP
Alginic acid	INS 400	
Sodium alginate	INS 401	
Potassium alginate	INS 402	
Ammonium alginate	INS 403	
Calcium alginate	INS 404	
Sodium carboxymethyl cellulose (Cellulose gum)	INS 466	
Xanthan gum	INS 415	
Carrageenan	INS 407	
Guar gum	INS 412	
Gum Arabic (Acacia gum)	INS 414	
Gellan gum	INS 418	
Polydextrose	INS 1200	
Starch sodium octenyl succinate	INS 1450	
Sodium polyphosphate	INS 452 (i)	** (*see **NOTE** under* **5.2.14**)
Glycerol ester of wood rosin	INS 445 (iii)	(150 mg/ kg, max)
Sucrose acetate isobutyrate	INS 444	(500 mg/ kg, max)"

Clause **5.2.8**

Insert the word "Permitted" before the word "colouring".

Delete the clause **5.2.13** and substitute by the following.

"**5.2.13**

Ascorbic acid*	INS 300	Limited by GMP
Sodium ascorbate*	INS 301	
Calcium ascorbate*	INS 302	

*** NOTE**

Not to be added if benzoic acid is used as a preservative"

Delete the clause **5.2.14** and substitute by the following.

"**5.2.14** *Acidity regulators*

Acetic acid	INS 260		
Potassium acetate	INS 261 (i)		
Sodium acetate	INS 262 (i)		
Calcium acetate	INS 263		
Citric acid	INS 330		
Potassium dihydrogen citrate	INS 332 (i)		
Tri-potassium citrate	INS 332 (ii)		
Sodium dihydrogen citrate	INS 331 (i)		
Tri-sodium citrate	INS 331 (iii)		
Tri-calcium citrate	INS 333 (iii)		Limited by GMP
Malic acid DL	INS 296		
Calcium malate	INS 352 (ii)		
Sodium hydrogen DL malate	INS 350 (i)		
Sodium DL malate	INS 350 (ii)		
Fumaric acid	INS 297		
Sodium fumarate~~s~~	INS 365		
Lactic acid	INS 270		
Calcium lactate	INS 327		
Sodium lactate	INS 325		
Potassium lactate	INS 326		
Phosphoric acid	INS 338	**	

**** NOTE**

Collectively, 1000 mg/ kg, max, as Phosphorus"

Insert new clause after **5.2.20** as follows.

"**5.2.21** *Dietary fibers"*

Insert a new clause as follows.

"**5.2.22** *Sequestrants*, 200 mg/ kg, max

Calcium disodium ethelenediaminetetraacetate	INS 385
Disodium ethelenediaminetetraacetate	INS 386"

Page 10

Clause **8.2**

Delete "item (b)" on page 10 and insert following.

" b) When sweeteners are added as substitutes for sugars, the statements:
"CONTAINS PERMITTED SWEETENER "X" where "X" denotes the name(s) of any permitted sweetener(s) used and "NO ADDED SUGAR" or " SUGAR FREE" or "ENERGY REDUCED" as the case may be, shall be included;"

Clause **8.3**

Delete the serial letters of sub clauses. Start the first sub clause with "a)" and change the other sub clauses accordingly up to "f)".

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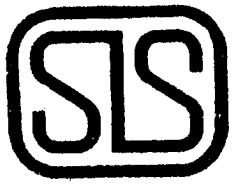

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The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and Administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the sectoral committees which in return are appointed by the Council. The Sectoral committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of Standardization as are of special interest to Sri Lanka.

Printed at the Sri Lanka Standards Institution, 17, Victoria place, Elvitigala Mawatha, Colombo 08.