AFDC 12 (4153) DTZS (Rev. TZS 2330:2019)
ICS 67.120.20

DRAFT TANZANIA STANDARD

Sugar free carbonated soft drinks –Specification

TANZANIA BUREAU OF STANDARDS

Sugar free carbonated soft drinks –specification

0. Foreword

Carbonated soft drinks industry has an important role in our country's economy. Carbonated soft drinks are popular beverages used as refreshment and are presented in different brands/types in the market. Sugar free carbonated soft drinks are artificially sweetened, non-alcoholic carbonated beverages that are marketed to specific group of people, such as dietetic individuals. This Tanzania Standard was prepared in order to ensure that the sugar free carbonated soft drinks produced and imported in the country are safe and of good quality.

This second revision cancel and replace TZS 2330:2019 published by the Tanzania Bureau of Standards.

In reporting the results of test or analysis made in accordance with this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4.

1 Scope

This Tanzania Standard specifies the requirements and methods of sampling and testing for sugar free carbonated soft drinks of which only non-nutritive sweeteners are used as sweetening agent.

2 Normative references

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

CXS 192 *General standard for Food additives*

CAC/GL 66-2008 *Guidelines for the Use of Flavourings*

TZS 4, *Rounding off numerical values*

TZS 59, *Water Distilled Quality Specification*

TZS 109, *Code of hygiene for food processing units*

TZS 114, *Soft drink manufacturing units – Code of hygiene*

TZS 118, *Foodstuffs – General Guidance for the Enumeration of microorganisms by Colony Count Technique at* 30^0C

TZS 119, *Microbiology – General guidance for the enumeration of coliforms by Most probable number technique*

TZS 131, *Microbiology - General guidance for enumeration of yeast and mould by Colony count technique at* 25^0C.

TZS 132, *Edible common salt Specification*

TZS 163, *Processed fruits and vegetable products – Methods of sampling*

TZS 268, *General atomic absorption spectrophotometric method for determination of lead in food stuffs*

TZS 538, Packaging*, marking and labelling of foods*

TZS 789, *Potable (Drinking) water Specification*

TZS 1488, *Fruits and Vegetables – Determination of Titratable Acidity*

TZS 1491, *Fruits and Vegetables – Determination of pH*

TZS 1492, *Fruits and Vegetables – Determination of tin content*

TZS 1493, Fruits and Vegetables – Determination of iron content

TZS 1494, *Fruits and vegetables determination of benzoic acid*

TZS 1495, *Fruits and Vegetables – Determination of copper content*

TZS 1496, Fruits *and Vegetables – Determination of soluble solids*

TZS 1497, Fruits *and Vegetables – Determination of sulphur dioxide*

TZS 1500, Fruits *and Vegetables – Determination of zinc content*

TZS 1501, *Fruits, vegetables and derived products – Determination of mercury content – Flameless atomic absorption method*

TZS 1502, Fruits *and Vegetables – Determination of Arsenic content*

TZS 1504, Fruits *and Vegetables – Determination of Ethanol Content*

TZS 1581-1, *Determination of cadmium content – Method graphite furnace atomic absorption spectrometry*

3. Terms and definitions

For the purpose of this Tanzania Standard, the following terms and definitions shall apply:

3.1 sugar free carbonated soft drink

non-alcoholic beverage without sugar but containing dissolved carbon dioxide; prepared from potable water with or without one of the following ingredients; flavouring materials, colourants, non-nutritive sweetening agents, acidulants, clouding agents, preservatives and other permitted food additives.

3.2 gas (carbonation) volume

given volume of carbon dioxide that can be absorbed by a given volume of water or liquid at atmospheric pressure not less than 1 and temperature of 15.5 °C.

3.3 carbonation

the process of addition of carbon dioxide in a soft drink to achieve its characteristics in terms of flavour and to preserve the product.

3.4 one volume

the liquid is said to be one volume when a given volume of carbon dioxide gas, expressed at standard conditions is dissolved in the same volume of liquid.

3.5 non-nutritive sweeteners

sweeteners that contain no calories at all or contain negligible amount of calories

4 Requirements

4.1 General requirements

4.1.1 Ingredients

The following ingredients may be used in the preparation of sugar free carbonated soft drinks;

a) Caffeine

b) Quinine salts

c) Edible common salt complying to TZS 132

d) Non-nutritive sweeteners not exceeding levels specified in CXS 192 when tested according to method described in Annex C. Nutritive sweeteners shall not be added in this product.

e) Water used in the manufacture of carbonated soft drinks shall be potable water conforming to TZS 789

f) Flavoring materials when used in sugar free carbonated soft drinks shall be in accordance with CAC GL 66.

4.1.2 Physical and organoleptic properties

4.1.2.1 Flavour

Sugar free carbonated soft drinks shall have a well-balanced and pleasant flavour characteristic of the type of drink and be free from off flavours and odours.

4.1.2.2 Appearance

a) Sugar free carbonated soft drinks shall have characteristics of the intended product.

b) Sugar free carbonated soft drinks shall be free from foreign matter visible to the naked eyes

4.2 Specific requirements

4.2.1 Sugar free carbonated soft drinks shall comply with the specific requirements given in Table 1 when tested in accordance with the test methods specified therein.

Table 1 — Specific requirements for sugar free carbonated soft drinks

S/No	Characteristic	Requirement	Test method
i.	Caffeine, mg/kg ,max.	200	Annex D
ii.	Quinine salts as quinine sulphate, mg/kg, max.	100	Annex E
iii.	Degree brix at 20^0C, max...	0.5	TZS 1496.
iv.	pH	2.5-4.0	TZS 1491.

4.2.2 Gas volume

4.2.2.1 Sugar free soft drinks shall be carbonated to a volume in accordance with their character. However, they shall have a minimum of one volume of carbon dioxide. This shall be determined as per Annex B.

4.2.2.2 The carbon dioxide used as raw material shall have a purity of not less than 98.5 percent. It shall be free from hydrogen sulphide, Sulphur dioxide and other noxious gases or foreign odour and shall comply with national standard for carbon dioxide.

5. Food additives

The use of food additives shall be in accordance with CXS 192.

6. Contaminants

6.1 Heavy metals

Sugar free carbonated soft drinks shall not contain heavy metals in excess of levels specified in Table 2 when tested in accordance with the test methods specified therein.

Table 2 — Maximum limits for heavy metal contaminants in sugar free carbonated soft drinks

S/No.	Heavy metal	Maximum mg/kg	Test method
i.	Arsenic (as As)	0.1	TZS 1502
ii.	Tin (as Sn)*	1.5 cross check	TZS 1492
iii.	Lead (as Pb)	0.1	TZS 268
iv.	Cadmium (Cd),	0.003	TZS 1581-1
v.	Mercury (Hg)	0.001	TZS 1501
*Applies to canned packaged products			

6 Hygiene

6.1 Sugar free carbonated soft drinks shall be prepared according to TZS 114

6.2 Sugar free carbonated soft drinks shall not exceed microbiological limits given in Table 3 when tested in accordance with the test methods specified therein.

Table 3—Microbiological Limits in sugar free carbonated soft drinks

S/No	Microorganism	Limit	Test method
i.	Total plate count, cfu/ml, max.	10^3	TZS 118
ii.	Coliform, cfu/ml	Absent	TZS 729
iii.	Yeast and moulds, cfu/ml, max.	10^2	TZS 131

7. Sampling and tests

7.1 Sampling

The method of drawing representative samples of the sugar free carbonated soft drinks shall be as described in Annex A

7.2 Test

Tests shall be carried out as described in relevant clauses and annexes of this standard.

8 Packaging, marking and labeling

8.1 Packaging

8.1.1 Sugar free carbonated soft drinks shall be filled in glass containers, lacquered cans, suitable food grade plastic containers or other food grade dispensing units. The interior on the neck finish of bottles shall be free from chips, cracks and other defects. Cans shall be free from corrosion and internal scratches or other lacquer imperfections. Closures shall be clean at the time of capping and seaming.

8.1.2 The containers shall be filled under strict sanitary conditions.

8.1.3 In case of cans provided with pull tabs, the tabs shall remain intact with the can on opening without littering

8.2 Marking and labelling

8.2.1 Sugar free carbonated soft drinks shall be labelled in accordance with TZS 538. In addition to the requirements specified under TZS 538, Labels if used shall be clean, neat and fixed securely. The following information shall appear delibly and legibly on each container or cap or label;

a) Name of the product; ‘sugar free carbonated soft drink’ or ‘zero sugar carbonated soft drinks’

b) A statement shall prominently feature on the label that the product is not suitable for infant, young children, pregnant and lactating women. The statement shall cover 15% of the label size stating “Haifai kwa matumizi ya watoto, wajawazito na wanaonyonyesha”

c) Brand or trade name, if any

d) Name, physical and postal address of the manufacturer;

e) Date of manufacture;

f) Expiry date;

g) Batch or code number;

h) List of ingredients;

i) Net volume of the contents in ml or litres; and

j) Declaration of the use of non-nutritive sweeteners and type of sweetener used

8.2.2 The language of warning statement on the label shall be “Kiswahili” or Kiswahili and English. A second language may be used depending on the designated market.

8.2.3 The containers or caps or labels may also be marked with the TBS certification mark of quality.

NOTE – The TBS Standards Mark of Quality may be used by manufacturers only under licence from TBS Particulars of conditions under which the licences are granted may be obtained from TBS.

ANNEX A

Normative

Sampling of carbonated beverages

A.1 Scale of sampling

A.1.1 Lot – All bottles/cans in a consignment belonging to the same batch of manufacture shall constitute a lot. If the consignment is declared to consist of different batches of manufacture, bottles/cans of the same batch shall be grouped together and each group so formed shall constitute a separate lot. Samples shall be tested from each lot for ascertaining conformity to the requirements of this Tanzania Standard.

A.1.2 The number of bottles/cans to be selected from a lot for testing for microbiological and other requirements shall depend on the size of the lot and shall be in accordance with Table A.1.

A.1.3 The bottles/cans to be selected for testing shall be chosen at random from the lot by the following procedure. Starting from any bottle/can, count them as 1,2,3 …… up to *r*. Every r^{th} bottle thus counted shall be picked, *r* being the integral part of *N/n*, where *N* is the total number of bottles in the lot and *n* is the total number of bottles to be chosen.

A.2 Test samples and reference samples

A.2.1 Samples for microbiological tests

The sample bottles/cans selected for microbiological test (see col.2 of Table A.1) shall be divided at random into three equal sets and labeled with all particulars of sampling. One of these sets of the sample bottles/cans shall be for the purchaser, another for the vendor and the third set is the reference.

A.2.2 Samples for other tests

The sample bottles/cans selected for other tests (see col.3 of Table A.1) shall be divided at random into three equal sets and labeled with all the particulars of sampling. One of these sets of sample bottles shall be for the purchaser, another for the vendor and the third set is the reference.

Table A.1 —Number of bottles to be sampled

No of bottles/can in the lot	No of bottles/can to be selected	
	Microbiological	Other tests
Up to 1 300 1301 to 3 200 3 201 and above	12 18 24	18 24 30

A.2.3 Referee samples

Referee samples shall consist of a set of sample bottles for microbiological tests (see A.2.1) and a set of sample bottles for other tests (see A.2.2) and shall bear the seals of the purchaser and the vendor as agreed to between the two.

ANNEX B
Normative

Method of measuring gas volume

B.1 Principle

The method involves snifting of the top gas. The pressure reading should drop to 2 psi, to remove the air before testing for carbon dioxide volume. In so doing correction of altitude as per Table B.2 should be considered as pressure is affected by altitude.

The apparatus consists of pressure gauge having a hollow spike with holes in its side. The bottle 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 snift valve on the gauge stem which is kept closed until the needle point of the pressure gauge is forced through the crown cork. The reading is noted on the gauge.

B.2 Procedure

Clamp the bottle in the frame of the gas volume tester. Pierce the crown cork but do not shake the bottle. Snift off the top gas quickly until the gauge reading drops to zero. Make certain to close the valve instantly the needle touches zero in the pressure gauge. Shake the bottle vigorously until the gauge gives the reading that additional shaking does not change. Record the pressure. Note the temperature and record. Obtain the volume of gas from Table B.1.

ANNEX C
Normative

Determination of saccharin

C.1 Reagents

C.1.1 hydrochloric acid - 36.5 % to 38 %.

C.1.2 Nessler reagent – Dissolve 143 g sodium hydroxide in 950 ml of water and filter through asbestos. Add 50 g red mercuric iodide to the filtrate and dilute with water to 1 litre. Mix thoroughly. Let it settle and add 1 g of saccharin.

C.1.3 Ammonium chloride solution (NH_4Cl) – prepare standard ammonium chloride solution equivalent to 100 ppm insoluble form of saccharin on the basis that 0.292 g NH_4Cl is equivalent to 1 g of saccharin.

C.2 Procedure

Add 2 ml of hydrochloric acid to 50 ml of sample in a separating funnel. Extract with two 50 ml portions of ether. Filter ether extract through cotton and wash combined filtrate with about 5 ml of water containing 1 drop of hydrochloric acid. Separate ether layer and evaporate to dryness on water bath. Add to the residue 5 ml of ammonia free water and 5 ml of hydrochloric acid. Evaporate the solution to about 1 ml on hot plate stirring constantly. Again add 5 ml of ammonia free water and 6 ml of hydrochloric acid and evaporate to about 1 ml. Dilute to 30 ml with ammonia free water and then dilute 2 ml of this solution to 25 ml with ammonia free water. Add 1 ml nessler reagent. Compare this with ammonium chloride solution.

C.3 Calculation

0.292 g ammonium chloride (NH_4Cl) = 1 g insoluble saccharin from toluene sulfamide ($C_7H_5NO_3S$) and 1.317 g of its sodium salt ($C_7H_4NaO_3.2H_2O$).

ANNEX D
Normative

Determination of caffeine content

D.1 Principle

Carbon dioxide is removed from the sample by means of dry air or dry nitrogen. An extraction with chloroform is performed on the decarbonated sample.

By means of a graph of absorbance against concentration of standards, the content of caffeine of the sample is determined.

D.2 Reagents

During analysis use only reagents of recognized analytical grade and only distilled water in accordance with TZS 59: or water of equivalent purity.

a) *Chloroform /dichrolomethane/ethyl acetate*
b) *Ammonia solution,* concentrated
c) *Hydrochloric acid,* approximately molar. Take 100 ml of concentrated hydrochloric acid (Sp.Gr.1. 184) and dilute to a litre.
d) *Standard caffeine solution.* Prepare a solution containing 10 ml using molar hydrochloric acid as solvent.

D.3 Apparatus

A spectrophotometer or photoelectric colorimeter capable of measuring optical density at a wavelength of 227nm

D.4 Procedure

Transfer 25 g of decarbonated sample into a small separating funnel. Make distinctly alkaline with ammonia solution and chloroform, washing each extract with the same 10 ml of water contained in a second separating funnel, and finally with the extract once with 10 ml of chloroform. Filter into a small flask. Evaporate or distill the combined extracts and dry the residue in molar hydrochloric acid and make up to volume in a 50 ml volumetric flask with the same acid. Prepare a series of standards and read the absorption at 272 nm using approximately molar hydrochloric acid for setting the instrument. Set the instrument by means of a blank prepared from water treated in exactly the same manner with the test solution and read absorption of the test solution.

D.5 Expression of results

Plot a graph of concentrations of standard caffeine solutions against their absorbance. From this graph determine the concentration of the alkaloid (caffeine) in the original sample. Report the results as mg/kg of anhydrous caffeine in the original sample.

ANNEX E
Normative

Determination of quinine

E.1 Principle

Carbon dioxide is removed from the sample by passing through it dry air or dry nitrogen. An extraction with ether is performed on the decarbonated sample.

By means of a graph of concentration of a series of standard quinine sulphate solutions against fluorescence, the content of quinine in the test solution is determined.

For low concentration, the fluorescence intensity is directly proportional to the concentration, as well as to the intensity of the incident radiation.

E.2 Reagents

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and only distilled water in accordance with TZS 59: or water of equivalent purity. Reagents should be free from fluorescing impurities.

a) *Sulphuric acid,* 0.05 M
b) *Ammonia solution,* concentrated
c) *Diethyl ether*
d) *Quinine sulphate,* standard stock solution. Dissolve 0.10 g of quinine sulphate in 0.05 M suphuric acid and make up to 1 litre with 0.05 sulphuric acid. This solution contains 100 micrograms of quinine sulphate per milliltre.
e) Quinine sulphate, standard working solution. Dilute 10 ml of the quinine sulphate stock solution to 200 ml with 0.05 M sulphuric acid. This solution contains 1 microgram of quinine sulphate per milliltre.

E.3 Apparatus

A suitable spectrofluorometer. Note that glassware should completely be free from stopcock lubricant as this usually contains fluorescence substances. No detergents shall be used in washing glassware.

E.4 Procedure

Transfer 100 g of the decarbonated sample to a separating funnel. Make the sample distinctly alkaline with ammonia solution and extract with the same 10 ml of water contained in a second separating funnel, and finally extract the wash water once with 10 ml of diethyl ether. Combine the ether extracts and remove the ether by distillation. Dry the residue in an air oven at 100°C for a few minutes. Dissolve it in 0.05 M sulphuric acid and make up to 100 ml in a volumetric flask with 0.05 M sulphuric acid. Measure the fluorescence of the solution by means of a spectrofluorometer. Prepare a series of standards containing 0.1, 2.5 and 10 micrograms of quinine sulphate per milliliter and measure the fluorescence.

E.5 Expression of results

Plot the fluorescence results of the series for standards to obtain a curve from which the concentration of quinine in the test solution can be read. Calculate the concentration of quinine as mg/kg of quinine sulphate in the original sample.

Table B.1 – Carbon dioxide chart: volume of carbon dioxide gas dissolved by one volume of water

Gauge pressure ($\times 10^3$) Pa / Temperature °C	0	14	28	42	56	70	84	98	112	127	141	155	169	183	197	211
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	4.7	4.9	5.2
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	4.6	4.8	5.1
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	4.5	4.7	4.9
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	4.4	4.6	4.8
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	4.3	4.5	4.7
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	4.2	4.4	4.6
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	4.1	4.3	4.5
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	4.0	4.3	4.5
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	4.0	4.2	4.3
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	3.9	4.1	4.2
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	3.8	4.0	4.2
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	3.8	3.9	4.1
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	3.7	3.9	4.0
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	3.6	3.8	4.0
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	3.5	3.7	3.9
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	3.5	3.6	3.8
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	3.4	3.6	3.7
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	3.3	3.5	3.7
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	3.3	3.4	3.6
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	3.2	3.4	3.5
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	3.2	3.3	3.5
11.7	1.13	1.3	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	3.1	3.3	3.4
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	3.0	3.2	3.3
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	3.0	3.1	3.3
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	2.9	3.1	3.2
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	2.9	3.0	3.2
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	2.8	3.0	3.1
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	2.8	2.9	3.1
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	2.7	2.9	3.0
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	2.7	2.8	3.0
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	2.6	2.8	2.9
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	2.6	2.7	2.9
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	2.6	2.7	2.8
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	2.5	2.6	2.8
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	2.5	2.6	2.7
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	2.4	2.6	2..7
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	2.4	2.5	2.6
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	2.4	2.5	2.6
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	2.3	2.4	2.5
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	2.3	2.4	2.5
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	2.2	2.4	2.5
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	2.2	2.3	24
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	2.2	2.3	2.4
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	2.2	2.3	2.4
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	2.1	2.2	2.4
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	2.1	2.2	2.3
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	2.1	2.2	2.3
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	2.0	2.1	2.2
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	2.0	2.1	2.2
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	2.0	2.1	2.2
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	1.9	2.0	2.1
28.3	0.70	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	15	1.6	1.7	1.8	1.9	2.0	2.1
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	1.9	2.0	2.1
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	1.9	1.9	2.0
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	1.8	1.9	2.0
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	1.8	1.9	2.0
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	1.8	1.9	1.9
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	1.7	1.8	1.9
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	1.7	1.8	1.9
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	1.7	1.8	1.9
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	1.7	1.8	1.8
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	1.7	1.7	1.8
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	1.6	1.7	1.8
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	1.6	1.7	1.8
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	1.6	1.7	1.8
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	1.6	1.7	1.7
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	1.5	1.6	1.7
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	1.6	1.6	1.7
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	1.5	1.6	1.7

Table B.1 (continued)

Gauge pressure ($x\ 10^3$) Pa Temperature °C	225	239	253	267	281	295	309	323	337	352	366	380	394
0	5.4	5.6	5.8	6.1	6.3	6.5	6.7	7.0	7.2	7.4	7.7	7.9	8.2
0.6	5.3	5.5	5.7	5.9	6.2	6.4	6.6	6.8	7.1	7.3	7.5	7.8	8.0
1.1	5.2	5.4	5.6	5.8	6.0	6.2	6.5	6.7	7.0	7.2	7.4	7.6	7.8
1.8	5.1	5.2	5.5	5.7	5.9	6.1	6.3	6.6	6.8	7.0	7.2	7.4	7.6
2.2	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.9	7.1	7.3	7.5
2.8	4.9	5.1	5.3	5.5	5.7	5.9	6.1	6.3	6.5	6.7	6.9	7.1	7.4
3.3	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2
3.9	4.7	4.9	5.1	5.3	5.4	5.7	5.9	6.1	6.2	6.4	6.6	6.8	7.0
4.4	4.5	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1	6.3	6.5	6.7	6.9
5.0	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.8
5.6	4.4	4.6	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1	6.3	6.4	6.6
6.1	4.3	4.5	4.7	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.3	6.5
6.7	4.2	4.4	4.6	4.8	5.0	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.4
7.2	4.1	4.3	4.5	4.7	4.8	5.0	5.2	5.4	5.6	5.7	5.9	6.1	6.2
7.8	4.0	4.2	4.4	4.6	4.7	4.9	5.1	5.3	5.4	5.6	5.8	6.0	6.1
8.3	4.0	4.1	4.3	4.5	4.6	4.8	5.0	5.2	5.3	5.5	5.7	5.7	6.0
8.9	3.9	4.1	4.2	4.4	4.6	4.7	4.9	5.1	5.2	5.4	5.6	5.9	5.9
9.4	3.8	4.0	4.1	4.3	4.5	4.6	4.8	5.0	5.1	5.3	5.5	5.6	5.8
10.0	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.9	5.0	5.2	5.4	5.5	5.7
10.6	3.7	3.8	4.0	4.2	4.3	4.5	4.6	4.8	5.0	5.1	5.3	5.4	5.6
11.1	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.9	5.0	5.2	5.3	5.5
11.7	3.6	3.7	3.8	4.0	4.2	4.3	4.4	4.6	4.8	4.9	5.1	5.2	5.4
12.2	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.8	5.0	5.2	5.3
12.8	3.4	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.1	5.2
13.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.8	5.0	5.1
13.9	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.0
14.4	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9
15.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.8
15.6	3.1	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.5	4.6	4.7
16.1	3.1	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.5	4.7
16.7	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.5	4.6
17.2	3.0	3.1	3.2	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.4	4.5
17.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3	4.4
18.3	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.2	4.4
18.9	2.8	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3
19.4	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.8	4.0	4.1	4.2
20.0	2.7	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0	4.2
20.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1
21.1	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0
21.7	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.9	4.0
22.2	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.9
22.8	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8
23.3	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8
23.9	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
24.4	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.7
25.0	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6
25.6	2.4	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.3	3.4	3.5	3.6
26.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
26.7	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
27.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
27.8	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
28.3	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
28.9	2.2	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2
28.4	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.9	3.0	3.1	3.2
30.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2
30.6	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.0	3.1
31.1	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.1
31.7	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9	3.0
32.2	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.9	3.0
32.8	2.0	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.8	2.9	2.9
33.3	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.9
33.9	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9
34.4	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.8
35.0	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6	2.7	2.8
35.6	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8
36.1	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6	2.7
36.7	1.8	1.8	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6	2.7
37.2	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.7
37.8	1.7	1.8	1.9	2.0	20	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6

Table B.1 (continued)

Gauge pressure ($x10^3$) Pa Temperature °C	408	422	436	450	464	478	492	506	520	534	548	562
0	8.4	8.6	8.8	9.0	9.3	9.5	9.7	10.2	10.2	10.4	10.7	10.9
0.6	8.2	8.4	8.6	8.9	9.1	9.3	9.5	9.8	10.0	10.2	10.4	10.7
1.1	8.0	8.2	8.4	8.7	8.9	9.1	9.3	9.6	9.8	10.0	10.2	10.5
1.8	7.8	8.0	8.3	8.5	8.7	8.9	9.2	9.4	9.6	9.8	10.0	10.3
2.2	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0
2.8	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8
3.3	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6
3.9	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4
4.4	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.5	8.7	8.8	9.0	9.2
5.0	7.0	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.5	8.7	8.9	9.1
5.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.3	8.5	8.7	8.9
6.1	6.7	6.9	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.3	8.5	8.7
6.7	6.6	6.7	6.9	7.1	7.3	7.5	7.6	7.8	8.0	8.2	8.4	8.6
7.2	6.4	6.6	6.8	6.9	7.1	7.3	7.5	7.7	7.8	8.0	8.2	8.4
7.8	6.3	6.4	6.6	6.8	7.0	7.2	7.4	7.5	7.7	7.9	8.0	8.2
8.3	6.2	6.3	6.5	6.7	6.9	7.0	7.2	7.4	7.6	7.7	7.9	8.0
8.9	6.1	6.2	6.4	6.6	6.8	6.9	7.1	7.2	7.4	7.6	7.7	7.9
9.4	6.0	6.1	6.3	6.4	6.6	6.8	6.9	7.1	7.2	7.4	7.6	7.8
10.0	5.9	6.0	6.2	6.3	6.5	6.6	6.8	7.0	7.1	7.3	7.4	7.6
10.6	5.7	5.9	6.1	6.2	6.4	6.5	6.7	6.8	7.0	7.2	7.3	7.5
11.1	5.6	5.8	5.9	6.1	6.3	6.4	6.6	6.7	6.9	7.0	7.2	7.3
11.7	5.5	5.7	5.9	6.0	6.1	6.3	6.4	6.6	6.7	6.9	7.0	7.2
12.2	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1
12.8	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.8	6.9
13.3	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.2	6.4	6.5	6.7	6.8
13.9	5.2	5.3	5.4	5.6	5.7	5.9	6.0	6.1	6.3	6.4	6.6	6.7
14.4	5.1	5.2	5.3	5.5	5.6	5.8	5.9	6.0	6.2	6.3	6.4	6.6
15.0	5.0	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.5
15.6	4.9	5.0	5.2	5.3	5.4	5.5	5.7	5.8	6.0	6.1	6.2	6.3
16.1	4.8	4.9	5.1	5.2	5.3	5.5	5.6	5.7	5.9	6.0	6.1	6.2
16.7	4.7	4.8	5.0	5.1	5.3	5.4	5.5	5.6	5.8	5.9	6.0	6.1
17.2	4.6	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.7	5.8	5.9	6.1
17.8	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4	5.5	5.7	5.8	6.0
18.3	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.4	5.5	5.6	5.7	5.9
18.9	4.4	4.5	4.7	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.6	5.8
19.4	4.3	4.4	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4	5.5	5.7
20.0	4.3	4.4	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.3	5.4	5.6
20.6	4.2	4.3	4.4	4.5	4.7	4.8	4.9	5.0	5.1	5.3	5.4	5.5
21.1	4.1	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4
21.7	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.9	5.0	5.1	5.2	5.3
22.2	4.0	4.1	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.0	5.1	5.2
22.8	3.9	4.0	4.1	4.2	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1
23.3	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
23.9	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.7	4.8	4.9	5.0
24.4	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
25.0	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
25.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
26.1	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7
26.7	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6
27.2	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.3	4.4	4.5
27.8	3.5	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
28.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.4
28.9	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3
28.4	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.1	4.2	4.3
30.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.2
30.6	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2
31.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.1
31.7	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.9	4.0	4.0
32.2	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.9	4.0
32.8	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.9
33.3	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9
33.9	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.8
34.4	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8
35.0	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6	3.7	3.8
35.6	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7
35.1	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.7
36.7	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.5	3.6
37.2	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6
37.8	2.7	2.8	2.9	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.5

Table B.1 (concluded)

Gauge pressure ($x 10^3$) Pa Temperature°C	576	591	605	619	633	647	661	675	689	703
0	11.2	11.5	11.7	12.0	12.2	12.4	12.7	12.9	13.2	13.4
0.6	11.0	11.3	11.5	11.7	11.9	12.2	12.4	12.6	12.9	13.1
1.1	10.8	11.0	11.2	11.5	11.7	11.9	12.2	12.4	12.6	12.8
1.8	10.6	10.8	11.0	11.3	11.5	11.7	11.9	12.1	12.3	12.5
2.2	10.4	10.6	10.8	11.0	11.2	11.4	11.7	11.9	12.1	12.3
2.8	10.1	10.3	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.0
3.3	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.4	11.6	11.8
3.9	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.3	11.5
4.4	9.5	9.7	9.9	10.1	10.3	20.5	10.7	10.9	11.1	11.3
5.0	9.4	9.6	9.8	10.0	10.2	10.3	10.5	10.7	10.9	11.1
5.6	9.2	9.4	9.6	9.8	10.0	10.1	10.3	10.5	10.7	10.9
6.1	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.6	10.7
6.7	8.8	9.1	9.2	9.5	9.6	9.8	10.0	10.2	10.3	10.5
7.2	8.7	8.9	9.0	9.3	9.4	9.6	9.8	10.0	10.1	10.3
7.8	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.7	9.9	10.1
8.3	8.3	8.5	8.7	8.9	9.0	9.2	9.4	9.5	9.7	9.9
8.9	8.1	8.3	8.5	8.7	8.8	9.0	9.2	9.3	9.5	9.7
9.4	8.0	8.2	8.3	8.5	8.7	8.9	9.0	9.2	9.3	9.5
10.0	7.9	8.0	8.2	8.4	8.5	8.7	8.9	9.0	9.2	9.3
10.6	7.7	7.9	8.0	8.2	8.4	8.5	8.7	8.8	9.0	9.2
11.1	7.6	7.8	7.9	8.1	8.2	8.4	8.5	8.7	8.9	9.0
11.7	7.4	7.6	7.8	7.9	8.1	8.2	8.4	8.5	8.7	8.9
12.2	7.3	7.5	7.6	7.8	8.0	8.1	8.3	8.4	8.6	8.7
12.8	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6
13.3	7.0	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4
13.9	6.9	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.3
14.4	6.8	7.0	7.1	7.3	7.4	7.5	7.7	7.8	8.0	8.1
15.0	6.7	6.8	7.0	7.1	7.3	7.4	7.5	7.7	7.8	8.0
15.6	6.6	6.7	6.8	7.0	7.1	7.2	7.4	7.5	7.7	7.8
16.1	6.4	6.6	6.7	6.9	7.0	7.1	7.3	7.4	7.6	7.7
16.7	6.3	6.5	6.6	6.8	6.9	7.0	7.2	7.3	7.4	7.5
17.2	6.2	6.4	6.5	6.7	6.8	6.9	7.0	7.2	7.3	7.4
17.8	6.1	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.2	7.3
18.3	6.0	6.2	6.3	6.4	6.5	6.7	6.8	6.9	7.0	7.2
18.9	5.9	6.1	6.2	6.3	6.4	6.5	6.7	6.8	6.9	7.0
19.4	5.8	6.0	6.1	6.2	6.3	6.5	6.6	6.7	6.8	6.9
20.0	5.7	5.9	6.0	6.1	6.2	6.4	6.5	6.6	6.7	6.8
20.6	5.7	5.8	5.9	6.0	6.1	6.3	6.4	6.5	6.6	6.7
21.1	5.6	5.7	5.8	6.0	6.1	6.2	6.3	6.4	6.5	6.6
21.7	5.5	5.6	5.7	5.9	6.0	6.1	6.2	6.3	6.4	6.5
22.2	5.4	5.5	5.6	5.8	5.9	6.0	6.1	6.2	6.3	6.4
22.8	5.3	5.4	5.5	5.7	5.8	5.9	6.0	6.1	6.2	6.3
23.3	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1
23.9	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
24.4	5.0	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
25.0	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
25.6	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
26.1	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
26.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7
27.2	4.7	4.8	4.9	5.1	5.2	5.3	5.3	5.4	5.5	5.6
27.8	4.6	4.7	4.8	4.9	5.1	5.2	5.2	5.3	5.4	5.5
28.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
28.9	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
28.4	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
30.0	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2
30.6	4.3	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1
31.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9	5.0
31.7	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9
32.2	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8	4.9
32.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7	4.8
33.3	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.8
33.9	4.0	4.1	4.1	4.2	4.4	4.4	4.4	4.6	4.7	4.7
33.4	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7
35.0	3.9	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.6	4.6
35.6	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6
36.1	3.8	3.9	4.0	4.0	4.1	4.2	4.3	4.4	4.4	4.5
36.7	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.3	4.3	4.4
37.2	3.7	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.4
37.8	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.2	4.2	4.3

Table B.2 - Altitude correction factors for measuring gas volume

Altitude (meters)	Pressure correction factor (kg/cm^2)
0	0.00
250	0.030
500	0.060
750	0.088
1000	0.116
1250	0.143
1500	0.169
1750	0.195
2000	0.220
2250	0.244
2500	0.267
2750	0.289
3000	0.310
3250	0.331

NOTE – Target snift pressure is equal to 0.14 kg /cm^2 plus altitude correction factor

Altitude (feet)	Pressure correction factor (psi)
0	0
500	0.26
1000	0.52
1500	0.78
2000	1.03
2500	1.28
3000	1.52
4000	1.99
5000	2.45
6000	2.89
7000	3.31
8000	3.71
9000	4.10
10000	4.47