

INTERNATIONAL STANDARD



INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Chemistry

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INTERNATIONAL STANDARD



1687

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Sodium and potassium silicates for industrial use — Determination of density at 20 °C of products in solution — Method using density hydrometer and method using pycnometer

*Silicates de sodium et de potassium à usage industriel — Détermination de la masse volumique à 20 °C des produits
en solution — Méthodes à l'aréomètre à masse volumique et au pycnomètre*

First edition — 1976-03-01

UDC 661.83.65 : 542.3

Ref. No. ISO 1687-1976 (E)

Descriptors : sodium silicates, potassium silicates, tests, dissolved matter, density measurement, density (mass/volume), areometric analysis, pycnometric analysis.

Price based on 3 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 47 has reviewed ISO Recommendation R 1687 and found it technically suitable for transformation. International Standard ISO 1687 therefore replaces ISO Recommendation R 1687-1970 to which it is technically identical.

ISO Recommendation R 1687 was approved by the Member Bodies of the following countries :

| | | |
|---------------------|-------------|-----------------------|
| Australia | Hungary | Portugal |
| Austria | India | Romania |
| Belgium | Iran | South Africa, Rep. of |
| Brazil | Israel | Spain |
| Colombia | Italy | Switzerland |
| Czechoslovakia | Japan | Thailand |
| Egypt, Arab Rep. of | Netherlands | Turkey |
| France | New Zealand | United Kingdom |
| Germany | Peru | U.S.S.R. |
| Greece | Poland | Yugoslavia |

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 1687 into an International Standard.

Sodium and potassium silicates for industrial use — Determination of density at 20 °C of products in solution — Method using density hydrometer and method using pycnometer

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies two methods for the determination of the density at 20 °C of sodium and potassium silicates for industrial use. The two methods specified are the method using a density hydrometer and the method using a pycnometer; the latter is to be preferred in the case of dispute or of high viscosity solutions.

2 REFERENCE

ISO 1686, *Sodium and potassium silicates for industrial use — Samples and methods of test — General*.

3 METHOD USING DENSITY HYDROMETER

3.1 Principle

Determination of the density at 20 °C of a test sample by using a hydrometer.

3.2 Apparatus

3.2.1 Measuring cylinders, having an effective capacity of 500 ml and an outside diameter of approximately 50 mm.

3.2.2 Set of density hydrometers, preferably having the following characteristics :

- nominal range of individual scales : 0,100 g/ml;
- scale subdivisions : 50 X 0,002 g/ml;
- maximum scale error at the temperature of test : $\pm 0,002$ g/ml;
- overall length : 250 mm;
- length of scale (overall nominal range) : 85 mm;
- bulb diameter : 18 to 20 mm.

3.2.3 Thermometer, which allows a temperature of 20 °C to be measured to $\pm 0,5$ °C.

3.3 Procedure

Adjust the temperature of approximately 500 ml of the test sample (see ISO 1686) to $20 \pm 0,5$ °C.

Pour this sample into the measuring cylinder (3.2.1), containing the thermometer (3.2.3), and then slowly insert the appropriate hydrometer selected from the set described in 3.2.2.

Ensure that the temperature of the liquid is between 19,5 and 20,5 °C and remove the thermometer.

When the hydrometer has reached its equilibrium position, depress it slightly, wait for its return to the equilibrium position, and record the graduation mark.

3.4 Expression of results

The reading of the hydrometer is the density of the sample, expressed in grams per millilitre.

Express the result to the nearest 0,01 g/ml.

3.5 Accuracy of the method

Experience has shown that the accuracy of this method is within 0,02 g/ml.

4 METHOD USING PYCNOMETER

4.1 Principle

Measurement of the mass, at 20 °C, of the volume of test sample contained in a pycnometer. Determination of this volume by measuring the corresponding mass of water at 20 °C. Calculation of the ratio of the mass of the sample to its volume.

4.2 Apparatus

Ordinary laboratory apparatus and

4.2.1 Ordinary pycnometer (see figure 1), or **wide-neck pycnometer**, (see figure 2) the channel of the stopper not being a capillary tube, of capacity 50 ml.

4.2.2 Water bath, capable of being controlled at $20 \pm 0,5$ °C.

4.3 Procedure

Clean and dry the pycnometer (4.2.1) together with its stopper and weigh the stoppered pycnometer to the nearest 0,001 g.

Fill the pyknometer with distilled water boiled and cooled to $20 \pm 0,5^\circ\text{C}$, and place it in the water bath (4.2.2) controlled at $20 \pm 0,5^\circ\text{C}$.

Allow at least 10 min for the temperature to reach equilibrium and remove the pyknometer from the water bath, holding it by the neck; stopper it, wipe externally and remove the excess water from the upper part of the stopper.

Weigh the filled, stoppered pyknometer to the nearest 0,001 g and determine by difference, the mass of water that it contains.

Empty the pyknometer, rinse it with alcohol or acetone and allow it to dry.

Fill it with the test sample (see ISO 1686) previously adjusted to $20 \pm 0,5^\circ\text{C}$, avoiding the formation of air bubbles, especially when the solution has a high viscosity.

Place the pyknometer in the water bath (4.2.2) and continue the determination as specified from the third to the fifth paragraph, in order to obtain the mass of the sample at 20°C .

If, during the procedure, the pyknometer is externally soiled by the solution under test, it must be washed with water at a temperature slightly below 20°C and then wiped.

4.4 Expression of results

The density, at 20°C , expressed in grams per millilitre, is given by the formula:

$$\frac{m_0}{m_1} \times \rho$$

where

m_0 is the mass, in grams, of the sample;

m_1 is the mass, in grams, of the same volume of water;

ρ is the density, in grams per millilitre, of water, at 20°C ($= 0,998\ 2\ \text{g/ml}$).

Express the result to the nearest 0,001 g/ml.

NOTE — The formula $\frac{m_0}{m_1} \times \rho$ may also be written $\frac{m_0}{V} \times \frac{1}{\rho}$ where V is the volume, in millilitres, at 20°C of the pyknometer ($= \frac{m_1}{\rho}$).

If several determinations are carried out, it is easier not to determine V (i.e. m_1) for each measurement, but simply to check its constancy from time to time.

4.5 Accuracy of the method

Experience has shown that the accuracy of the method is 0,002 g/ml.

5 TEST REPORT

The test report shall include the following particulars:

- the reference of the method used;
- the results and the method of expression used;
- any unusual features noted during the determination;
- any operations not included in this International Standard or the International Standard to which reference is made, or regarded as optional.

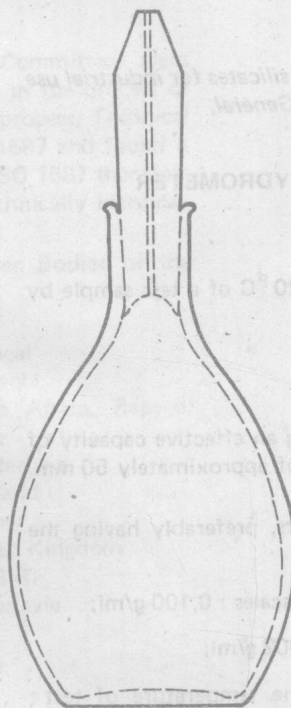


FIGURE 1 — Ordinary pyknometer

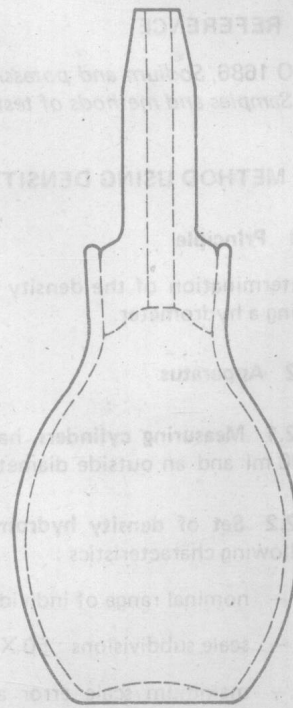


FIGURE 2 — Wide-neck pyknometer

ANNEX

ISO PUBLICATIONS RELATING TO SODIUM AND POTASSIUM SILICATES FOR INDUSTRIAL USE

ISO 1686 – Samples and methods of test – General.

ISO 1687 – Determination of density at 20 °C of products in solution – Method using hydrometer and method using pyknometer.

ISO 1688 – Determination of dry matter – Gravimetric method.

ISO 1689 – Calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$.

ISO 1690 – Determination of silica content – Gravimetric method by insolubilization.

ISO 1691 – Determination of carbonate content – Gas-volumetric method.

ISO 1692 – Determination of total alkalinity – Titrimetric method.

ISO 2122 – Preparation of solution of products not easily soluble in boiling water and determination of matter insoluble in water.

ISO 2123 – Determination of dynamic viscosity.

ISO 2124 – Determination of silica content – Titrimetric method.

ISO 3200 – Determination of sulphate content – Barium sulphate gravimetric method.

ISO 3201 – Determination of iron content – 1,10-Phenanthroline photometric method.

INTERNATIONAL STANDARD



1688

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Sodium and potassium silicates for industrial use — Determination of dry matter — Gravimetric method

*Silicates de sodium et de potassium à usage industriel — Détermination de la matière sèche —
Méthode gravimétrique*

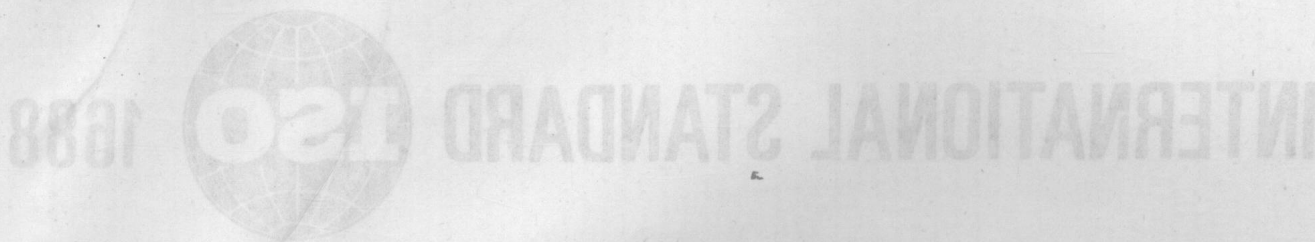
First edition — 1976-02-01

UDC 661.83.65 : 543.714

Ref. No. ISO 1688-1976 (E)

Descriptors: sodium silicates, potassium silicates, chemical analysis, determination of content, dry matter, gravimetric analysis.

Price based on 2 pages



FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

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ISO Recommendation R 1688 was approved by the Member Bodies of the following countries :

| | | |
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| Australia | Hungary | Portugal |
| Austria | India | Romania |
| Belgium | Iran | South Africa, Rep. of |
| Brazil | Israel | Spain |
| Colombia | Italy | Switzerland |
| Czechoslovakia | Japan | Thailand |
| Egypt, Arab Rep. of | Netherlands | Turkey |
| France | New Zealand | United Kingdom |
| Germany | Peru | U.S.S.R. |
| Greece | Poland | Yugoslavia |

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 1688 into an International Standard.

Sodium and potassium silicates for industrial use — Determination of dry matter — Gravimetric method

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a gravimetric method for the determination of dry matter of sodium and potassium silicates for industrial use.

2 REFERENCE

ISO 1686, *Sodium and potassium silicates for industrial use — Samples and methods of test — General*.

3 PRINCIPLE

Drying of a test portion followed by heating to between 600 and 650 °C.

Weighing of the residue.

4 APPARATUS

Ordinary laboratory apparatus and

4.1 Platinum or silica dish, having a capacity of 30 to 35 ml and an upper diameter of approximately 75 mm.

NOTE — Porcelain dishes may also be used, provided they are allowed to cool in a desiccator for at least 45 min before weighing.

4.2 Electric furnace, capable of being controlled at 600 to 650 °C.

NOTE — Use heating apparatus which does not produce carbon dioxide.

5 PROCEDURE

5.1 Test portion

Heat the platinum or silica dish (4.1) for a few minutes in the electric furnace (4.2) controlled between 600 and 650 °C, allow to cool to ambient temperature in a desiccator and weigh to the nearest 0,001 g.

Weigh into the tared dish, to the nearest 0,001 g, a test portion of 1 to 2 g of the test sample (see ISO 1686).

5.2 Determination

First gently heat the dish containing the test portion (5.1) in order to remove most of the water, while avoiding losses of matter due to splashing. For this purpose, use a device which heats the lower part of the vessel (heating plate) or the upper part (infra-red radiation lamp or other source of heat not in contact with the dish).

Gradually increase the temperature to between 600 and 650 °C, and maintain for 10 min.

Allow to cool in a desiccator to ambient temperature and weigh to the nearest 0,001 g.

Repeat the operation until the difference between the results of two successive weighings does not exceed 0,001 g.

6 EXPRESSION OF RESULTS

The dry matter content, expressed as a percentage by mass, is given by the formula

$$m_1 \times \frac{100}{m_0}$$

where

m_0 is the mass, in grams, of the test portion (5.1);

m_1 is the mass, in grams, of the weighed dry residue.

7 ACCURACY OF THE METHOD

Practice has shown that the maximum deviation between results obtained using this method is 0,6 % (m/m) in absolute value.

8 TEST REPORT

The test report shall include the following particulars :

- the reference of the method used;
- the results and the method of expression used;
- any unusual features noted during the determination;
- any operations not included in this International Standard or the International Standard to which reference is made, or regarded as optional.

ANNEX

ISO PUBLICATIONS RELATING TO SODIUM AND POTASSIUM SILICATES
FOR INDUSTRIAL USE

ISO 1686 — Samples and methods of test — General.

ISO 1687 — Determination of density at 20 °C of samples in solution — Method using density hydrometer and method using pycnometer.

ISO 1688 — Determination of dry matter — Gravimetric method.

ISO 1689 — Calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$.

ISO 1690 — Determination of silica content — Gravimetric method by insolubilization.

ISO 1691 — Determination of carbonate content — Gas-volumetric method.

ISO 1692 — Determination of total alkalinity — Titrimetric method.

ISO 2122 — Preparation of solution of products not easily soluble in boiling water and determination of matter insoluble in water.

ISO 2123 — Determination of dynamic viscosity.

ISO 2124 — Determination of silica content — Titrimetric method.

ISO 3200 — Determination of sulphate content — Barium sulphate gravimetric method.

ISO 3201 — Determination of iron content — 1,10-Phenanthroline photometric method.

INTERNATIONAL STANDARD



1689

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Sodium and potassium silicates for industrial use —

Calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$

Silicates de sodium et de potassium à usage industriel — Calcul du rapport $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ ou $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$

First edition — 1976-02-01

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| Algeria | Algeria | Algeria |
| Argentina | Argentina | Argentina |
| Australia | Australia | Australia |
| Austria | Austria | Austria |
| Bahrain | Bahrain | Bahrain |
| Belgium | Belgium | Belgium |
| Brazil | Brazil | Brazil |
| Canada | Canada | Canada |
| Chad | Chad | Chad |
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| Great Britain | Great Britain | Great Britain |
| Hungary | Hungary | Hungary |
| India | India | India |
| Indonesia | Indonesia | Indonesia |
| Iran | Iran | Iran |
| Italy | Italy | Italy |
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| Korea | Korea | Korea |
| Libya | Libya | Libya |
| Madagascar | Madagascar | Madagascar |
| Malaysia | Malaysia | Malaysia |
| Mali | Mali | Mali |
| Mexico | Mexico | Mexico |
| Morocco | Morocco | Morocco |
| Netherlands | Netherlands | Netherlands |
| Nigeria | Nigeria | Nigeria |
| Poland | Poland | Poland |
| Portugal | Portugal | Portugal |
| Romania | Romania | Romania |
| Russia | Russia | Russia |
| South Africa | South Africa | South Africa |
| Spain | Spain | Spain |
| Sweden | Sweden | Sweden |
| Switzerland | Switzerland | Switzerland |
| Taiwan | Taiwan | Taiwan |
| Tanzania | Tanzania | Tanzania |
| Togo | Togo | Togo |
| Tunisia | Tunisia | Tunisia |
| U.S.A. | U.S.A. | U.S.A. |
| Uganda | Uganda | Uganda |

UDC 661.83.65 : 543

Ref. No. ISO 1689-1976 (E)

Descriptors : sodium silicates, potassium silicates, chemical analysis, determination of content, ratios, silicon dioxide, sodium oxide, potassium oxide

1689



INTERNATIONAL STANDARD

RECOMMENDATION R 1689
RELATING TO SODIUM AND POTASSIUM SILICATES
FOR INDUSTRIAL USE

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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ISO Recommendation R 1689 was approved by the Member Bodies of the following countries:

| | | |
|---------------------|-------------|-----------------------|
| Australia | India | Romania |
| Austria | Iran | South Africa, Rep. of |
| Belgium | Israel | Spain |
| Brazil | Italy | Switzerland |
| Czechoslovakia | Japan | Thailand |
| Egypt, Arab Rep. of | Netherlands | Turkey |
| France | New Zealand | U.S.S.R. |
| Germany | Peru | Yugoslavia |
| Greece | Poland | |
| Hungary | Portugal | |

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds:

United Kingdom

The Member Body of the following country disapproved the transformation of ISO/R 1689 into an International Standard:

United Kingdom

Sodium and potassium silicates for industrial use —

Calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the formula for the calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$ for sodium silicates and potassium silicates for industrial use, respectively.

In this ratio, only the Na_2O or the K_2O combined in the form of silicates is considered.

2 REFERENCES

ISO 1690, *Sodium and potassium silicates for industrial use — Determination of silica content — Gravimetric method by insolubilization.*

ISO 1691, *Sodium and potassium silicates for industrial use — Determination of carbonate content — Gas-volumetric method.*

ISO 1692, *Sodium and potassium silicates for industrial use — Determination of total alkalinity — Titrimetric method.*

3 SODIUM SILICATES

a = total alkalinity, expressed in Na_2O , % (m/m) (see ISO 1692)

b = silica (SiO_2), % (m/m) (see ISO 1690)

c = sodium carbonate (Na_2CO_3), % (m/m) (see ISO 1691)

d = Na_2O combined in the carbonate form, % (m/m)
 $= c \times \frac{62}{106} = 0,585 c$

e = Na_2O combined in the silicate form, % (m/m) = $a - d$
 $= a - 0,585 c$

f = ratio by mass $\frac{\text{SiO}_2}{\text{Na}_2\text{O}} = \frac{b}{e} = \frac{b}{a - 0,585 c}$

g = molar ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}} = f \times 1,032$

4 POTASSIUM SILICATES

a = total alkalinity, expressed in K_2O , % (m/m) (see ISO 1692)

b = silica (SiO_2), % (m/m) (see ISO 1690)

c = potassium carbonate (K_2CO_3), % (m/m) (see ISO 1691)

d = K_2O combined in the carbonate form, % (m/m)
 $= c \times \frac{94,2}{138,2} = 0,682 c$

e = K_2O combined in the silicate form, % (m/m) = $a - d$
 $= a - 0,682 c$

f = ratio by mass $\frac{\text{SiO}_2}{\text{K}_2\text{O}} = \frac{b}{e} = \frac{b}{a - 0,682 c}$

g = molar ratio $\frac{\text{SiO}_2}{\text{K}_2\text{O}} = f \times 1,568$

5 TEST REPORT

The test report shall include the following particulars:

- the reference of the methods used for the determination and for the calculation;
- the results, and the method of expression used;
- any unusual features noted during the determinations;
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ISO 1688 — Determination of dry matter — Gravimetric method.

ISO 1689 — Calculation of the ratio $\frac{\text{SiO}_2}{\text{Na}_2\text{O}}$ or $\frac{\text{SiO}_2}{\text{K}_2\text{O}}$.

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ISO 2122 — Preparation of solution of products not easily soluble in boiling water and determination of matter insoluble in water.

ISO 2123 — Determination of dynamic viscosity.

ISO 2124 — Determination of silica content — Titrimetric method.

ISO 3200 — Determination of sulphate content — Barium sulphate gravimetric method.

ISO 3201 — Determination of iron content — 1,10-Phenanthroline photometric method.

INTERNATIONAL STANDARD



1690

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Sodium and potassium silicates for industrial use — Determination of silica content — Gravimetric method by insolubilization

*Silicates de sodium et de potassium à usage industriel — Dosage de la silice — Méthode gravimétrique
par insolubilisation*

First edition — 1976-02-15

UDC 661.83.65 : 546.28 : 543.21

Ref. No. ISO 1690-1976 (E)

Descriptors : sodium silicates, potassium silicates, chemical analysis, determination of content, silicon dioxide, gravimetric analysis.

Price based on 3 pages



INTERNATIONAL STANDARD

ISO 1690:1976
SILICATES
FOR INDUSTRIAL USE

FOREWORD

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ISO Recommendation R 1690 was approved by the Member Bodies of the following countries:

| | | |
|---------------------|-------------|-----------------------|
| Australia | Hungary | Portugal |
| Austria | India | Romania |
| Belgium | Iran | South Africa, Rep. of |
| Brazil | Israel | Spain |
| Colombia | Italy | Switzerland |
| Czechoslovakia | Japan | Thailand |
| Egypt, Arab Rep. of | Netherlands | Turkey |
| France | New Zealand | United Kingdom |
| Germany | Peru | U.S.S.R. |
| Greece | Poland | Yugoslavia |

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 19760 into an International Standard.