
**Fertilizers and soil conditioners —
Controlled-release fertilizer —
General requirements**

*Matières fertilisantes — Engrais à libération contrôlée — Exigences
générales*



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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 134, *Fertilizers and soil conditioners*.

Fertilizers and soil conditioners — Controlled-release fertilizer — General requirements

1 Scope

This International Standard specifies the requirements for testing methods, sampling and preparation of test sample, marking and labelling, as well as package, transport, and storage of controlled-release fertilizer.

This International Standard is applicable to controlled-release products having one or more primary fertilizer nutrient (nitrogen and/or phosphorous and/or potassium) in a controlled-release form. They can be made by bulk blending (BB) fertilizers or by special processes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5315, *Fertilizers — Determination of total nitrogen content — Titrimetric method after distillation*

ISO 6598, *Fertilizers — Determination of phosphorus content — Quinoline phosphomolybdate gravimetric method*

ISO 7409, *Fertilizers — Marking — Presentation and declarations*

ISO 7410, *Fertilizers and soil conditioners — Final samples — Practical arrangements*

ISO 7742:1988, *Solid fertilizers — Reduction of samples*

ISO 8397, *Solid fertilizers and soil conditioners — Test sieving*

ISO 8633, *Solid fertilizers — Simple sampling method for small lots*

ISO 17319, *Fertilizers and soil conditioners — Determination of water-soluble potassium content — Potassium tetraphenylborate gravimetric method*

EN 13266, *Slow-release fertilizers — Determination of the release of the nutrients — Method for coated fertilizers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

controlled-release fertilizer

fertilizer in which nutrient release is controlled, meeting the stated release rate of nutrient and the stated release time at a specified temperature

Note 1 to entry: Typical examples are coated fertilizers.

[SOURCE: ISO 8157:2015, 2.1.12, modified]

3.2

controlled-release nutrient

one or more of the primary nutrient/s, nitrogen and/or phosphorus and/or potassium, in controlled-release fertilizers with controlled-release characteristics

Note 1 to entry: In quantitative denotation, controlled-release nutrient does not include the parts of nutrients without controlled-release characteristics. For example, if a 15-15-15 compound fertilizer only contains controlled-release nitrogen, and on a mass fraction basis only 10 % of the total mass is controlled-release nitrogen, then the term controlled-release nutrient only applies to the 10 % nitrogen.

3.3

initial release rate of nutrient

ratio of the fraction released within a 24 h time period at 25 °C (or such temperature specified by the manufacturer) in static water, divided by the total controlled release fraction

Note 1 to entry: Sometimes there is a portion of the nutrient in the production of controlled-release fertilizer that does not exhibit controlled-release characteristics, and as such is released ahead of time.

Note 2 to entry: The initial release rates of nutrients of multiple nutrient elements in controlled-release fertilizers shall be denoted with the total nitrogen release rates; if no nitrogen is contained, the initial release rates of nutrient shall be denoted as the release rates of phosphorus and/or potassium.

3.4

cumulative release mass fraction of nutrient

mass ratio of the cumulative released nutrient during a given period to the total of the nutrients, denoted with the mass ratio of the cumulative released nutrients during several consecutive periods as a whole, under condition of 25 °C static water (or such temperature specified by the manufacturer), to the total of the nutrients

Note 1 to entry: The cumulative release mass fraction of multiple nutrient elements in controlled-release fertilizers shall be denoted with the total nitrogen release mass fraction; if no nitrogen is contained, the cumulative release mass fraction of nutrient shall be denoted with release mass fraction of phosphorus or potassium.

3.5

stated release time

release time of a controlled release nutrient, denoted with the time necessary to reach 75 % cumulative release rate since the start of extraction, under the condition of 25 °C static water (or such temperature specified by the manufacturer)

Note 1 to entry: The release time for controlled-release fertilizer must be stated. Different countries/regions may have various numbers of percentages concerning stated release time.

4 Classification

The products shall be classified by core categories, such as controlled-release nitrogenous fertilizer, controlled-release phosphorus fertilizer, controlled-release potash fertilizer, controlled-release compound (N, P, K) fertilizer, controlled-release bulk blend fertilizer (BB fertilizer), and any other primary (N, P, K) nutrient that may be coated as controlled released.

5 Requirements

5.1 Appearance: The product shall be in granules, free flowing, moisture free, and without any foreign matter.

5.2 The controlled-release fertilizer shall be in accordance with the requirements set forth in [Table 1](#), as well as the values declared on containers.

Table 1 — Requirement on controlled release fertilizer

Item 1	Values
Mass fraction of total nutrient (N + P ₂ O ₅ + K ₂ O) ^{a,b,c} , % \geq	20
Particle size ^c (1,00 mm to 4,75 mm), % \geq	90
Nutrient release period ^d /days =	Marked value
Initial release rate of nutrient ^e , % \leq	15
Cumulative release mass fraction of nutrient in 28 d ^e , % \leq	75
Cumulative release mass fraction of nutrient during nutrient release period ^e , % \geq	75
<p>^a The total nutrient content is the sum of the nutrients (P and K in oxides P₂O₅ and K₂O) as stated on the label. For single nutrient fertilizer (N or P₂O₅ or K₂O), the value shall not be lower than 18 %.</p> <p>^b The single nutrient content of three or two elements controlled-release fertilizer shall not be lower than 4,0 %.</p> <p>^c The related requirements specified by the countries or regions shall be followed.</p> <p>^d Nutrient release period shall be marked with a single value with a tolerance of 20 %. If the marked value is 180 d, the time necessary for cumulative release rate of nutrient reaching to 75 % is allowed to be 180 ± 36 d; if the marked value is 90 d, the time necessary for cumulative release rate of nutrient reaching to 75 % is allowed to be 90 ± 18 d.</p> <p>^e The nutrient release mass fraction of three or two elements controlled-release fertilizer shall be denoted with the total release mass fraction of nitrogen; if no nitrogen is contained, the release mass fraction of nutrient shall be denoted with the release mass fraction of potassium or phosphorus.</p>	

6 Testing method

6.1 Appearance

The appearance shall be determined by visual method.

6.2 Determination of total nitrogen

Determine the total nitrogen content in accordance with ISO 5315.

NOTE If the total nitrogen content is low, the analyst can also refer to the Bibliography for an alternative method.

6.3 Determination of available phosphorus

Determine the phosphorus content in accordance with ISO 6598.

6.4 Determination of potassium

Determine the potassium content in accordance with ISO 17319.

6.5 Determination of grain size

Determine the grain size in accordance with ISO 8397.

6.6 Determination of nutrient release rate/mass fraction

Determine the nutrient release rate/mass fraction in accordance with EN 13266.

7 Sampling and preparation of test sample

7.1 Sampling method

7.1.1 Products in bags

Carry out sampling operation by following the procedure described in ISO 8633. Care should be taken to avoid any damage to, or destruction of, the coating.

7.1.2 Products in bulk

Carry out sampling operation by following the procedure described in ISO 8633.

7.2 Reduction of samples

Mix all the increments (collected as in [7.1](#)) uniformly and promptly to form a single aggregate sample using a device or by hand. The aggregate sample is reduced to about 1 kg by the riffle sample divider method (see ISO 7742:1988, A.2) or the quartering method (see ISO 7742:1988, A.3). Next, divide into two parts for final laboratory samples. The two laboratory samples are put into two clean and dry glass or plastic containers or any other inert material of adequate resistance capable of maintaining the sample in its original condition. The containers shall be fitted with airtight closures. Carry out all the operations described earlier as rapidly as possible to avoid loss or gain of moisture. Each container shall be secured and sealed following the instruction given in ISO 7410. Each laboratory sample shall be labelled following the instructions given in ISO 7410. The label shall, at minimum, carry the following information:

- a) the name of manufacturer;
- b) the name of product and type;
- c) the manufacturer's reference and batch number or production date (if available);
- d) the lot size;
- e) the date of sampling;
- f) the place of sampling;
- g) the signature of the sampler;
- h) the signature and name of the person or his representative on whose premises the sample was taken;
- i) the stated release period (days) and temperature (°C) defined by appropriate test procedures.

One of the containers is used for further quality analysis, while the other is kept for additional analysis in 6 months.

7.3 Test sample preparation

Select one of the laboratory samples from the two containers obtained in [7.2](#). Mix the content of the container according to the procedure in ISO 7742:1988. The test sample used for determining the mass fraction of total nutrient, mass fraction of water-soluble P to effective P, particle size, nutrient release period, initial release rate of nutrient, cumulative release rate of nutrient in 28 d, and cumulative release rate of nutrient during nutrient release period should be reduced to an appropriate amount. All of the test samples are put into clean and dry bottles to be used for further analysis.

8 Marking and labelling

8.1 For marking and labelling, the relevant national (or regional) legislation needs to be followed. Also, for the classification of health, safety, environment, storage, and transport, the appropriate legislation needs to be followed. The following (8.2 to 8.8) are the guidelines.

8.2 The product name shall be the name of the core fertilizer prescribed in the existing national or industrial standard with the prefix of “controlled-release” or “coated controlled-release”.

8.3 The package should be marked with total nutrient content, fertilizer formula, and the release period at specified temperature.

8.4 The package can be marked with the practical/simulated controlled-release curve of the as-produced fertilizer, if possible, to help the consumers to better understand and utilize the controlled-release fertilizers.

NOTE The requirements for temperature and the nutrient-simulating release curve under this temperature can be marked on the package according to the laws and regulations of countries or regions.

8.5 The product description shall be printed on the package or accompanying document and it shall include the product name, nutrient content marked in the form of fertilizer formula, nutrient release period, and instructions for storage and usage. Some of the information can be placed on an accompanying data sheet. This is not a requirement and should be left up to the manufacturer.

8.6 Partly controlled-release fertilizer with package marked with controlled release shall state the kind/s of controlled-release nutrient/s and the corresponding controlled-release nutrient content/s. Other marks shall also conform to 8.3 and 8.4.

8.7 The single mass value of each container shall be declared (e.g. 50 kg).

8.8 All other information required by national and regional regulations and ISO 7409.

9 Package, transport, and storage

9.1 The net mass of each package can be determined by negotiation.

9.2 During transportation, the packaged products should be handled with care to avoid moisture, sunlight, and damage.

9.3 The products should be stored in a dry, cool place away from sunlight and moisture.

Bibliography

- [1] ISO 8157:2015, *Fertilizers and soil conditioners — Vocabulary*
- [2] AOAC 955.04, *Determination nitrogen (total) Kjeldahl method*
- [3] AOAC 958.01, *Phosphorus (Total) in fertilizers. Spectrophotometric molybdovanadophosphate method*
- [4] AOAC 958.02, *Potassium in fertilizers. Volumetric sodium tetraphenylboron method I*

