

**FAO SPECIFICATIONS  
FOR PLANT PROTECTION PRODUCTS**

**CARBOSULFAN (AGP:CP/315)**



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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**DISCLAIMER<sup>1</sup>**

FAO specifications are developed with the basic objective of promoting, as far as practicable, the manufacture, distribution and use of pesticides that meet basic quality requirements.

Compliance with the specifications does not constitute an endorsement or warranty of the fitness of a particular pesticide for a particular purpose, including its suitability for the control of any given pest, or its suitability for use in a particular area. Owing to the complexity of the problems involved, the suitability of pesticides for a particular purpose and the content of the labelling instructions must be decided at the national or provincial level.

Furthermore, pesticides which are manufactured to comply with these specifications are not exempted from any safety regulation or other legal or administrative provision applicable to their manufacture, sale, transportation, storage, handling, preparation and/or use.

FAO disclaims any and all liability for any injury, death, loss, damage or other prejudice of any kind that may arise as a result of, or in connection with, the manufacture, sale, transportation, storage, handling, preparation and/or use of pesticides which are found, or are claimed, to have been manufactured to comply with these specifications.

Additionally, FAO wishes to alert users to the fact that improper storage, handling, preparation and/or use of pesticides can result in either a lowering or complete loss of safety and/or efficacy.

FAO is not responsible, and does not accept any liability, for the testing of pesticides for compliance with the specifications, nor for any methods recommended and/or used for testing compliance. As a result, FAO does not in any way warrant or represent that any pesticide claimed to comply with a FAO specification actually does so.

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<sup>1</sup> This disclaimer applies to all specifications published by FAO.

## **INTRODUCTION TO FAO SPECIFICATIONS DEVELOPED UNDER THE OLD PROCEDURE**

Between 1975 and 2000, FAO published booklets of specifications for technical materials and related formulations of plant protection products. Revisions of, and additions to, already published specifications will be issued when necessary. However, all changes and revisions of FAO specifications are now subject to the new procedure described in the *Manual on the development and use of FAO and WHO Specifications for Plant Protection Products*, FAO Plant Production and Protection Paper No. 173, Rome 2002 (*Revised First Edition* available only on the FAO home page of the Internet at: <http://www.fao.org/ag/agp/agpp/pesticid/>)

FAO specifications developed under the old procedure are based on the requirements defined in the Fourth Edition of the *Manual on the development and use of FAO specifications for plant protection products*, Plant Production and Protection Paper No. 128, Rome 1995.

This manual contained detailed definitions and other essential background information on basic procedures and technical principles adopted by the group on Pesticide Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent, such as:

### 1. Categories of Specifications (Section 3.1 of the Manual)

FAO Tentative Specifications (Code 'S/T', formerly 'TS') are those which have been recommended by FAO as preliminary specifications and which are based on minimum requirements. The methods of analysis cited are normally supplied by the manufacturer or may already have been published or be the subject of collaborative work.

FAO Provisional Specifications [Code 'S/P', formerly ('S')] are those for which more evidence of the necessary parameters is available and where some collaborative study of the methods of analysis has been carried out.

FAO (full) Specifications (Code 'S/F', formerly 'S').

Specifications that have all necessary requirements together with CIPAC (full) methods, or other collaboratively studied (proven) methods.<sup>2,3</sup>

Wherever possible, standards for apparatus and common names for pesticides are those approved by the International Organization for Standardization (ISO).

### 2. Expression of active ingredient content (Section 4.2.5 of the Manual)

- for solids, liquid technical materials, volatile liquids (of maximum boiling point 50°C) and viscous liquids (with minimum kinematic viscosity of  $1 \times 10^3 \text{ m}^2/\text{s}$  at 20°C) the FAO Specification shall be based on expression of the content as g/kg;

- for all other liquids the active ingredient content of the product shall be declared in terms of g/kg *or* g/l at 20°C. If the customer requires both g/kg *and* g/l at 20°C, then in case of dispute the analytical results shall be calculated as g/kg.

### 3. Tolerance on content (Section 4.2.7 of the Manual)

A declared content of active ingredient must be included in all specifications, and one of the problems immediately arising is the level of tolerance acceptable about the nominal figure. The tolerance is influenced by (a) the reproducibility of the method of analysis, (b) the sampling error and (c) the manufacturing variance.

Allowable variations in analytical results (i.e. tolerances in content of active ingredient) with respect to specific pesticide consignments are intended to cover reasonable variations in the contents of active ingredients. For examples of such tolerances, see the table in Section 4.2.7 of the Manual.

### 4. Containers/packaging

FAO guidelines are in preparation.

Containers shall comply with pertinent national and international transport and safety regulations.

#### Technical materials, dustable powders and granules

Containers shall be suitable, clean, dry and as specified, and shall not adversely affect, or be affected by, the contents, but shall adequately protect them against external conditions.

#### Wettable powders

The product shall be packed in suitable, clean, dry containers as specified in the order. The container shall provide all necessary protection against compaction, atmospheric moisture, loss by vaporization and/or contamination to ensure that the product suffers no deterioration under normal transit and storage conditions.

The product shall be protected by an adequate moisture barrier. This may be a suitable bag of polyethylene or alternative means of giving equal or better protection.

#### Solutions and emulsifiable concentrates

Containers shall be lined, where necessary, with a suitable material, or the interior surfaces shall be treated to prevent corrosion and/or deterioration of the contents.

Additional information should be given in all specifications where particular pesticides present problems in packaging.

## 5. Biological information

### Phytotoxicity

No test can be specified to cover the possible phytotoxicity of a formulation to all crops. When a crop is not mentioned in the instructions for use, purchasers should check with the supplier that the material is suitable, always provided that such a use is not restricted or legally forbidden.

### Wetting of crops

The dilute spray should satisfactorily wet the leaves of the specified crops when used in accordance with the instructions. Test method MT 53.2, CIPAC F, p.162, may be useful.

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<sup>1</sup> *Should national pesticide specifications developed from these approved FAO specifications deviate from them, the National Authority responsible for making such changes is requested to inform the FAO Plant Protection Service of the nature of, and the reasons for, the modifications.*

<sup>2</sup> *Methods of analysis and miscellaneous techniques referred to in these specifications have been developed and adopted by CIPAC (Collaborative International Pesticides Analytical Council Ltd.). See CIPAC Handbooks 1 (1970), 1A (1980), 1B (1983), 1C (1985), D (1988), E (1993), F (1995), G (1995), CIPAC Proceedings 1980 and 1981, obtainable from Black Bear Press Limited, King's Hedges Road, Cambridge CB4 2PQ, England. The page numbers of specific methods are given in parentheses in the specifications. Copies of methods not yet published can be obtained from the FAO Plant Protection Service.*

<sup>3</sup> *Information on standard waters for laboratory evaluation of pesticidal formulations will be found in CIPAC Monograph 1, Standard Waters and an FAO Survey on Naturally Occurring Waters (1972), Black Bear Press Limited, King's Hedges Road, Cambridge CB4 2PQ, England.*

## **SUBMISSION OF DRAFT SPECIFICATIONS TO FAO**

Any organization, commercial firm or interested individual is encouraged to submit relevant specifications, or proposals for revision of existing specifications, for pesticide products for consideration and possible adoption by FAO. Correspondence should be addressed to the Pesticide Management Group, Plant Production and Protection Division, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy.

General guidelines on preparing draft specifications are given in the *Manual on the development and use of FAO and WHO Specifications for Plant Protection Products*, FAO Plant Production and Protection Paper No. 173, Rome 2002 (Revised First Edition available only on the FAO home page of the Internet at: <http://www.fao.org/ag/agp/agpp/pesticid/>).

Specifications which are considered suitable for further processing are assigned priorities and circulated to appropriate organizations and specialists to comment. Comments, together with other relevant information, are then reviewed in detail by the Group on Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent. The drafts are converted into FAO Provisional Specifications, or full FAO Specifications.

**CARBOSULFAN**

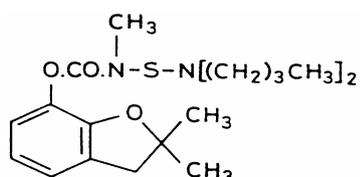
2,3-dihydro-2,2-dimethylbenzofuran-7-yl (dibutylaminothio)methylcarbamate



## INFORMATION

**COMMON NAME:** carbosulfan

**STRUCTURAL FORMULA:**



**EMPIRICAL FORMULA:**  $C_{20}H_{32}N_2O_3S$

**RMM:** 380.5

**CAS REGISTRY NUMBER:** 55285-14-8

**CIPAC CODE NUMBER:** 417

**CHEMICAL NAMES:**

2,3-dihydro-2,2-dimethylbenzofuran-7-yl (dibutylaminothio)methylcarbamate (IUPAC)

2,3-dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino)thio]methylcarbamate (CA)

## CARBOSULFAN TECHNICAL

FAO Specification 417/TC/S/F (1991)

### 1. DESCRIPTION

The material shall consist of carbosulfan together with related manufacturing impurities and shall be a brown viscous liquid free from visible extraneous matter and added modifying agents, other than stabilizers.

### 2. ACTIVE INGREDIENT

#### 2.1 Identity tests (417/TC/M/2, CIPAC E, p.35)

An identity test is required if the identity of the active ingredient is in doubt.

#### 2.2 Carbosulfan (417/TC/M/3, CIPAC E, p.36)

The carbosulfan content shall be declared (not less than 890 g/kg) and, when determined, the content obtained shall not differ from that declared by more than  $\pm 25$  g/kg.

### 3. IMPURITIES

#### 3.1 Carbofuran\*

Maximum: 20 g/kg.

#### 3.2 Water (MT 30.1, CIPAC F, p.91)

Maximum: 2 g/kg.

### 4. PHYSICAL PROPERTIES

#### 4.1 Alkalinity (MT 31, CIPAC F, p.96)

Maximum alkalinity: 0.2 g/kg calculated as NaOH.

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\* The analytical method for determination of the relevant impurity is available from the Pesticide Management Group of the FAO Plant Protection Service, or can be [downloaded here](#)

## CARBOSULFAN EMULSIFIABLE CONCENTRATES

FAO Specification 417/EC/S/F (1991)

### 1. DESCRIPTION

The material shall consist of technical carbosulfan, complying with the requirements of FAO specification 417/TC/S/F (1991), dissolved in suitable solvents together with any other necessary formulants. It shall be in the form of a stable liquid, free from visible suspended matter and sediment.

### 2. ACTIVE INGREDIENT

#### 2.1 Identity tests (417/EC/M/2, CIPAC E, p.40)

An identity test is required if the identity of the active ingredient is in doubt.

#### 2.2 Carbosulfan (417/EC/M/3, CIPAC E, p.40)

The carbosulfan content shall be declared (g/kg or g/l at 20°C)<sup>1</sup> and, when determined, the content obtained shall not differ from that declared by more than the following amounts.

<u>Declared content</u>	<u>Permitted tolerance</u>
Up to 500 g/kg or g/l	± 5% of the declared content

### 3. IMPURITIES

#### 3.1 Carbofuran\*

Maximum: 2% of the carbosulfan content found under 2.2.

#### 3.2 Water (MT 30.1, CIPAC F, p.91)

Maximum: 2 g/kg.

### 4. PHYSICAL PROPERTIES

#### 4.1 Alkalinity (MT 31, CIPAC F, p.96)

Maximum alkalinity: 1 g/kg calculated as NaOH.

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\* The analytical method for determination of the relevant impurity is available from the Pesticide Management Group of the FAO Plant Protection Service, or can be [downloaded here](#)

4.2 Emulsion stability and re-emulsification (MT 173, CIPAC F, p.431. Note 2)

The product, when diluted at 30°C (Notes 3 and 4) with CIPAC Standard Waters A and C, shall comply with the following:

<u>Time after dilution</u>	<u>Limits of stability</u>
0 h	Initial emulsification complete
0.5 h	Minimum: 95%
2.0 h	Minimum: 90%
24 h (Note 5)	Re-emulsification complete
24.5 h (Note 5)	Minimum: 95%

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, then this shall be specified when ordering.

4.3 Flash point (MT 12, CIPAC F, p.31. Note 6)

If required, the flash point of the product shall not be lower than the minimum declared flash point. A closed cup method shall be used and the method stated.

**5. STORAGE STABILITY**

5.1 Stability at 0°C (MT 39.1, CIPAC F, p.128)

After storage at  $0 \pm 1^\circ\text{C}$  for 7 days, the volume of solid and/or liquid which separates shall not be more than 0.3 ml.

5.2 Stability at 54°C (MT 46.1.3, CIPAC F, p.150)

After storage at  $54 \pm 2^\circ\text{C}$  for 14 days, the determined average active ingredient content must not be lower than 97% relative to the determined average content found before storage (Note 7) and the product shall continue to comply with 4.1 and 4.2.

*NOTES*

- If the buyer requires both g/kg and g/l at 20°C, then in case of dispute the analytical results shall be calculated as g/kg.*
- This test will normally be carried out only after the heat stability test 5.2.*
- Unless another temperature is specified.*
- The product should be tested at the highest and lowest rates of use recommended by the supplier.*

5. *These tests need be carried out only in case of doubt as to the result of the 2-hour emulsion stability test.*
6. *Attention is drawn to the appropriate national and/or international regulations on the handling and transport of flammable materials.*
7. *Samples of the product taken before and after the storage stability test should be analysed together after the test to reduce the analytical error.*

## **CARBOSULFAN GRANULES**

(For application by mechanical equipment)

FAO Specification 417/GR/S/F (1991)

### **1. DESCRIPTION**

The material shall consist of granules containing technical carbosulfan complying with the requirements of FAO specification 417/TC/S/F (1991) together with suitable carriers and any other necessary formulants. It shall be dry, free from visible extraneous matter and hard lumps, free-flowing, essentially non-dusty and intended for application by machine.

### **2. ACTIVE INGREDIENT**

#### 2.1 Identity tests (417/GR/M/2, CIPAC E, p.41)

An identity test is required if the identity of the active ingredient is in doubt.

#### 2.2 Carbosulfan (417/GR/M/3, CIPAC E, p.41)

The carbosulfan content shall be declared (g/kg) and, when determined, the content obtained shall not differ from that declared by more than the following amount.

Declared content

Permitted tolerance

Up to 100 g/kg

± 10% of the declared content

### **3. IMPURITIES**

#### 3.1 Carbofuran\*

Maximum: 2% of the carbosulfan content found under 2.2.

### **4. PHYSICAL PROPERTIES**

#### 4.1 Acidity (MT 31, CIPAC F, p.96)

Maximum acidity: 0.5 g/kg calculated as H<sub>2</sub>SO<sub>4</sub>.

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\* The analytical method for determination of the relevant impurity is available from the Pesticide Management Group of the FAO Plant Protection Service, or can be [downloaded here](#)

4.2 Apparent density after compaction (MT 159, CIPAC F, p.390)

The apparent density of the product after compaction shall be declared, where required, and shall be not less than 1.5 g/ml.

4.3 Nominal size range (MT 58.2, CIPAC F, p.173)

The nominal size range of the product shall be declared. The ratio of the lower to the upper limit shall not normally exceed 1:4 (Note 1). Not less than 90% of the product shall be within the declared nominal size range.

4.4 Material retained on a 125 µm test sieve (MT 58.2, CIPAC F, p.173. Note 2)

Minimum: 995 g/kg retained on a 125 µm test sieve.

The carbosulfan content of the material retained on the sieve shall not be less than 95% of that found under 2.2 (Note 3).

## 5. STORAGE STABILITY

5.1 Stability at 54°C (MT 46.1.1, CIPAC F, p.149)

After storage at  $54 \pm 2^\circ\text{C}$  for 14 days, the determined average active ingredient content must not be lower than 97% relative to the determined average content found before storage (Note 4) and the product shall continue to comply with 4.1, 4.3 and 4.4.

### NOTES

1. *Higher ratios may increase the risk of segregation which may adversely affect the flow rate. This should be checked with the machine to be used. The purchaser should check that the nominal size range is suitable for his requirements, since the size range may affect the biological activity.*
2. *This requirement is only valid for granules having a lower limit of the size range of at least 300 µm. For microgranules having a lower limit of less than 300 µm, the mass percent of material passing a 63 µm test sieve shall be declared.*
3. *For example, if the carbosulfan content of the product determined under 2.2 is 100 g/kg, the proportion of the product retained on the 125 µm test sieve is used in the test, then the amount of active ingredient should be not less than 95% of (0.995 x 10) g, i.e. 9.45 g.*
4. *Samples of the product taken before and after the storage stability test should be analysed together after the test to reduce the analytical error.*

## CARBOSULFAN ULTRA LOW VOLUME LIQUIDS

FAO Provisional Specification 417/UL/S/P (1993)

### 1. DESCRIPTION

The material shall consist of technical carbosulfan, complying with the requirements of FAO specification 417/TC/S/F (1991), together with any necessary formulants. It shall be in the form of a stable liquid, free from visible suspended matter and sediment.

### 2. ACTIVE INGREDIENT

#### 2.1 Identity tests (417/TC/M/2, CIPAC E, p.35)

An identity test is required if the identity of the active ingredient is in doubt.

#### 2.2 Carbosulfan (417/EC/M/3, CIPAC E, p.40. Note 1)

The carbosulfan content shall be declared (g/kg or g/l at 20°C, Note 2), and, when determined, the content obtained shall not differ from that declared by more than the following amounts.

<u>Declared content</u> (g/kg or g/l)	<u>Permitted tolerance</u>
Up to 25	± 15% of the declared content
Above 25 up to 100	± 10% of the declared content
Above 100 up to 250	± 6% of the declared content
Above 250 up to 500	± 5% of the declared content

### 3. IMPURITIES

#### 3.1 Carbofuran\*

Maximum: 2% of the carbosulfan content found under 2.2.

#### 3.2 Water (MT 30.1, CIPAC F, p.91)

Maximum: 2 g/kg.

### 4. PHYSICAL PROPERTIES

#### 4.1 Alkalinity (MT 31, CIPAC F, p.96)

Maximum alkalinity: 1 g/kg calculated as NaOH.

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\* The analytical method for determination of the relevant impurity is available from the Pesticide Management Group of the FAO Plant Protection Service, or can be [downloaded here](#)

4.2 Flash point (MT 12, CIPAC F, p.31. Note 3)

The flash point of the product shall not be lower than 22.8°C. A closed cup method shall be used and the method stated.

4.3 Kinematic viscosity range (MT 22, CIPAC F, p.75)

The kinematic viscosity determined at 30°C shall be in the range 1 to 10 mm<sup>2</sup>/s.

4.4 Volatility (MT 56.2, CIPAC F, p.170)

The measured volatility of the product shall not exceed 100 g/kg.

**5. STORAGE STABILITY**

5.1 Stability at 0°C (MT 39.1, CIPAC F, p.128)

After storage at 0 ± 1°C for 7 days, the volume of solid and/or liquid which separates shall not be more than 0.3 ml.

5.2 Stability at 54°C (MT 46.1.3, CIPAC F, p.150. Note 4)

After storage at 54 ± 2°C for 14 days, the determined average active ingredient content must not be lower than 97% relative to the determined average content found before storage (Note 5) and the product shall continue to comply with 4.1 and 4.3.

*NOTES*

- 1. The CIPAC method 417/EC/M/3 for EC formulations may be used for the UL formulation.*
- 2. If the buyer requires both g/kg and g/l at 20°C, then in case of dispute the analytical results shall be calculated as g/kg.*
- 3. Attention is drawn to the appropriate national and/or international regulations on the handling and transport of flammable materials.*
- 4. The samples should be stored in sealed glass ampoules.*
- 5. Samples of the product taken before and after the storage stability test should be analysed together after the test to reduce the analytical error.*