



Food and Agriculture Organization  
of the United Nations

**FAO SPECIFICATIONS  
FAO PLANT PROTECTION PRODUCTS**

**MANEB  
Manganese ethylenebisdithiocarbamate**

## **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/pest-and-pesticide-management/en/> )

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, Via delle Terme di Caracalla, 00153, Rome, Italy.

General guidelines in 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/pest-and-pesticide-management/en/>).

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.

## MANEB TECHNICAL

FAO Specification Code 61/1/S/16

### .2 DESCRIPTION

The material shall consist of maneb, together with related manufacturing impurities, as a yellow to buff powder. It shall be free from visible extraneous materials and added modifying agents (Note 1).

### .3 ACTIVE INGREDIENT

#### .2.1 *Identity Tests*

Where the identity of the material is in doubt it shall comply with any two of the following tests:

##### .2.1.1 *Colorimetric tests* (CIPAC 1A; MT 130)

The sample shall produce similar spots to those produced from a standard maneb.

##### .2.1.2<sup>1</sup> *Amine* (CIPAC 1C; 61/1/m/1.3.2) – note 2

The majority of the amine produced from the active ingredient shall be ethylenediamine.

##### .2.1.3<sup>1</sup> *Manganese* (-/m/1.3.3) – note 2

The oxine produced from the sample shall be precipitated at the same pH and have the same colour as that from a standard maneb.

#### .2.2 *Maneb content* (CIPAC 1; 61/1/M/1.2)

The maneb content shall be declared (minimum declared: 86%). When the combined carbon disulphide content is determined and expressed as maneb (note 3), the content obtained shall not differ from that declared by more than  $\pm 3$  percentage units.

#### .2.3 *Manganese* (CIPAC 1A; MT 93)

Maximum 20.0%  
Minimum 22.5% } Of the maneb found under .2.2 (note 4)

### .4 IMPURITIES

#### .3.1 *Water* (CIPAC 1; 61/1/M/1.5)

Maximum: 1.5%

#### .3.2 *Zinc* (CIPAC 1A; MT 94)

Maximum 0.5% of the maneb found under .2.2 (note 6)

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<sup>1</sup> For information

## .5 PHYSICAL PROPERTIES

### .4.1<sup>1</sup> *Ignition point* (CIPAC 1A; MT 84.1)

Minimum ignition temperature: 135°C, the time between initial heating and ignition shall be not less than 10 min. (note 7). See also notes on maneb fires at the end of the maneb section.

Note 1: Except that if a stabilizer is included, this shall be stated.

Note 2: These tests are for information pending further analytical work

Note 3: 1.00% carbon disulphide = 1.74% anhydrous maneb.

Note 4: On a result of 90% maneb found, the permitted manganese content would be 18.0 to 20.0%.

Note 5: During the manufacture of maneb technical, a small amount of ethylene thiourea (ETU) is also produced. In good manufacturing practice this should not, at the time of manufacture, exceed 0.5% of the maneb. During storage more ETU may be formed by decomposition. To minimise decomposition all products containing maneb should be stored under cool, dry conditions.

Note 6: On a result of 90% maneb found, the permitted maximum zinc content would be 0.45%. This is included to limit cross contamination with zineb.

Note 7: Accumulation of deposits of powder, due to spillage from damaged packages, can initiate fires in warehouse stock piles, particularly when lying between the surfaces of bags near the base of a pile stored under humid conditions. Avoid any such accumulation.

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<sup>1</sup> For information

# MANEB DUSTS

FAO Specification Code 61/2/S/16

## .1 DESCRIPTION

The product shall consist of a homogeneous mixture containing maneb as the active ingredient together with suitable carriers and any necessary formulants. It shall be a fine, free flowing dustable material, free from visible extraneous materials and hard lumps.

It shall be formulated from maneb technical complying with 61/1/S/16.

## .2 ACTIVE INGREDIENT

### .2.1 *Identity tests*

Where the identity of the material is in doubt it shall comply with any two of the following tests:

#### .2.1.1 *Colorimetric tests* (CIPAC 1A; MT 130)

The sample shall produce similar spots to those produced from a standard maneb.

#### .2.1.2<sup>1</sup> *Amine* (CIPAC 1C; 61/2/m/1.3.2) note 1

The majority of the amine produced from the active ingredient shall be ethylenediamine.

#### .2.1.3<sup>1</sup> *Manganese* (-/m/1.3.3) note 1

The oxine produced from the sample shall be precipitated at the same pH and have the same colour as that from a standard maneb.

### .2.2 *Maneb*

The maneb content shall be declared. When the combined carbon disulphide content is determined and expressed as maneb (note 2), the content obtained shall not differ from that declared by more than  $\pm 15\%$  of the declared content.

### .2.3 *Manganese* (CIPAC 1A; MT 93)

Maximum 20.0%  
Minimum 22.5% } Of the maneb found under .2.2 (note 3)

## .3 IMPURITIES

### .3.1 *Water* (CIPAC 1; 61/2/M/1.5)

Maximum 2.0%

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<sup>1</sup> For information

#### .4 PHYSICAL PROPERTIES

##### .4.1 *Dry sieve test* (-/M/1.6)

Maximum: 2% retained on a 75 um test sieve.

Not more than  $0.06 \times x$ )% of the sample used for the determination shall be present in the residue on the sieve, where  $x$  is the percentage maneb content declared under .2.2 (note 5).

##### .4.2<sup>1</sup> *Flowability* (CIPAC 1A; MT 44)

Maximum flow number: 12

##### .4.3<sup>1</sup> *Ignition point* (CIPAC 1A; MT 84.1)

Minimum ignition temperature: 135°C; the time between initial heating and ignition shall be not less than 10 min (note 6). See also note on maneb fires at the end of the maneb section.

#### .5 STORAGE STABILITY

##### .5.1 *Stability at 54 °C* (CIPAC 1; 61/2/M/1.8)

After storage at  $54 \pm 2^\circ\text{C}$  for 14 days the product shall continue to comply with .2.2 (except that the permitted minimum content of maneb shall be 90% of that found under .2.2) and .4.1.

#### .6 CONTAINERS

They shall be suitable, clean, dry and as specified in the order and shall not adversely affect or be affected by the product but shall adequately protect it from external conditions.

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

#### .7 BIOLOGICAL PROPERTY

##### .7.1<sup>1</sup> *Phytotoxicity*

At the present stage of our knowledge, no test can be specified to cover phytotoxicity of formulations to crops. When a crop is not mentioned in the directions 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.

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<sup>1</sup> For information

## NOTES

Note 1: These tests are for information pending further analytical work.

Note 2: 1.00% carbon disulphide = 1.74% maneb anhydrous.

Note 3: On a result of 5% maneb the permitted manganese content should be 1.00 to 1.13%

Note 4: During the manufacture of maneb, a small amount of ethylene thiourea (ETU) is also produced. In good manufacturing practice this should not, at the time of manufacture, exceed 0.5% of the maneb. During storage ETU may be formed by decomposition. To minimize decomposition all products containing maneb should be stored under cool, dry conditions.

Note 5: If the dust contains a declared content of 5% maneb and 20 g of sample is used in the test, then the amount of maneb in the residue on the sieve should not exceed 0.06 g, i.e.,

$$\frac{(0.06 \times x) \times \text{weight of sample}}{100} \text{ g}$$

Note 6: Accumulation of deposits of powder, due to spillage from damage packages, can initiate fires in warehouse stock piles, particularly when lying between the surfaces of bags near the base of a pile stored under humid conditions. Avoid any such accumulation.

# MANEB DISPERSIBLE POWDERS

FAO Specification Code 61/3/S/17

## .1 DESCRIPTION

The product shall consist of a homogeneous mixture containing maneb as the active ingredient, together with fillers and any necessary formulants. It shall be a fine powder, free from visible extraneous materials and hard lumps.

It shall be formulated from maneb technical complying with 61/1/S/16.

## .2 ACTIVE INGREDIENT

### .2.1 *Identity tests*

Where the identity of the material is in doubt it shall comply with any two of the following tests:

#### .2.1.1 *Colorimetric tests* (CIPAC 1A; MT 130)

The sample shall produce similar spots to those produced from a standard maneb.

#### .2.1.2<sup>1</sup> *Amine* (CIPAC 1C; 61/6/m/1.3.2) – note 1

The majority of the amine produced from the active ingredient shall be ethylenediamine.

#### .2.1.3<sup>1</sup> *Manganese* (-/m/1.3.3) – note 1

The oxine produced from the sample shall be precipitated at the same pH and have the same colour as that from a standard maneb.

### .2.2 *Maneb* (CIPAC 1; 61/1/M/1.2)

The maneb content shall be declared (Note 2). When the content of the combined carbon disulphide is determined and expressed as maneb (Note 3), the content obtained shall not differ from that declared by more than  $\pm 3$  percentage units.

### .2.3 *Manganese* (CIPAC 1A; MT 93)

Maximum 20.0%  
Minimum 22.5% } Of the maneb found under .2.2 (note 4)

## .3 IMPURITIES (Note 5)

### .3.1 *Water* (CIPAC 1; 61/3/M/1.5)

Maximum: 2.0%.

### .3.2 *Zinc* (CIPAC 1A; MT 94)

Maximum: 0.5% of the maneb found under .2.2 (Note 6).

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<sup>1</sup> For information

#### .4 PHYSICAL PROPERTIES

##### .4.1 *Wet sieve test* (CIPAC 1; 61/3/M/1.6)

Maximum: 2% retained on a 75 um test sieve.

##### .4.2 *Suspensibility* (-/M/1.8)

A minimum of 60% of the maneb content declared under .2.2 shall be in suspension after 30 min in CIPAC Standard Water A when determined on the sample as received, and not less than 50% in CIPAC Standard Water C after the Heat stability test .5.1.

##### .4.3 *pH range of 1% aqueous dispersion* (-/M/1.9)

5.0 to 9.0.

##### .4.4<sup>1</sup> *Ignition point* (CIPAC 1A; MT 84.1)

Minimum ignition temperature: 135°C; the time between initial heating and ignition shall not be less than 10 min (note 7). See also note on maneb fires at the end of the maneb section.

##### .4.5 *Wettability of the powder* (CIPAC 1; 61/3/M/1.10)

Shall be completely wetted in 1 min. without swirling.

##### .4.6 *Persistent foaming* (-/M/1.11)

Maximum: 25 ml after 1 min.

#### .5 STORAGE STABILITY

##### .5.1 *Stability at 54 °C* (-/M/1.12)

After storage at  $54 \pm 2^\circ\text{C}$  for 14 days the product shall continue to comply with: .2.2 (except that the minimum permitted maneb content shall be 90% of that found under .2.2), .4.1, .4.2, .4.4<sup>1</sup> (note 8) and .4.5.

#### .6 CONTAINERS

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, oxidation, loss by evaporation, 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 an inner bag of polyethylene (note 9), or alternative means of giving equal or better protection.

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

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<sup>1</sup> For information

## .7 BIOLOGICAL PROPERTIES

### .7.1<sup>1</sup> *Phytotoxicity*

At the present stage of our knowledge, no test can be specified to cover the phytotoxicity of formulations to 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.

### .7.2<sup>1</sup> *Wetting of crops (-M/1.13)*

The dilute spray should satisfactorily wet the leaves of the specified crops when used in accordance with the instructions. The test described may be useful.

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<sup>1</sup> For information

## NOTES

- Note 1: These tests are for information pending further analytical work.
- Note 2: The maneb content deteriorates at the rate of between 0.3 and 1.0% per month, e.g., a product containing 80% maneb when manufactured may assay 70.0% at the end of 12 months. In very bad storage conditions or when unsuitable containers have been used, the deterioration is accelerated.
- Note 3: 1.00% carbon disulphide = 1.74% anhydrous maneb.
- Note 4: On a result of 80% maneb the permitted manganese content would be 16.0 to 18.0%.
- Note 5: During the manufacture of maneb, a small amount of ethylene thiourea (ETU) is also produced. In good manufacturing practice this should not, at the time of manufacture, exceed 0.5% of the maneb. During storage ETU may be formed by decomposition. To minimize decomposition all products containing maneb should be stored under cool, dry conditions.
- Note 6: On a result of 80% maneb the maximum permitted zinc content would be 0.40%.
- Note 7: Accumulation of deposits of powder, due to spillage from damaged packages, can initiate fires in warehouse stock piles, particularly when lying between the surface of bags near the base of a stock pile stored under humid conditions. Avoid any such accumulation.
- Note 8: Products, which fail this test may present a fire hazard in transit and/or storage.
- Note 9: Because of the variation in the nature and size of the container, its destination and other factors, it is not possible to specify the thickness of the polyethylene, but as a guideline for a container with 50 kg of product, the inner liner might be for example at least 0.075 mm thick.

## MANEB FIRES

### INTRODUCTION

Of all the dithiocarbamates used in agriculture, maneb is by far, the most prone to spontaneous heating in storage and, in earlier years, gained some notoriety in this respect.

Improvements in manufacturing methods and packages have very greatly reduced the incidence of fires so caused, but they can still occur if any spontaneous heating effects go unnoticed and unchecked.

Usually a maneb fire is confined to localised smouldering within one or two bags of a stockpile and rarely is there active conflagration. Thus, there is ample time between discovery and the necessary action and *no need for panic!*

### PREVENTION OF FIRES

Accumulation of deposits, due to spillage from damaged packages can initiate fires in warehouse stockpiles, particularly where lying between the surfaces of bags near the base of a pile stored under humid or wet conditions.

Good housekeeping precautions are necessary to avoid any such accumulations.

### DETECTION OF FIRES

Sometimes where a stockpile is sited within a closed warehouse (or the hold of a ship) early warning of an incident is given by the presence of strong, faintly “onion-like” acrid odours which may give rise of mild eye irritation with some operators. The odours, in particular, may be observable for some days before active ignition takes place, and if detected, a careful inspection of the stockpile should be made as far as is possible.

Heating within bags can often be found by carefully running the hands between the surface of bags, or by insertion of thermometers etc – although in the latter case care has to be taken not to damage satisfactory bags. Any ‘hot’ bags should be *carefully* segregated from the pile taking care that the bag does not split open during the operation.

*Beware of intensely smouldering masses, started at active centres, within the bag.*

### DEALING WITH FIRES

Any obvious fire area can be attacked with either water or foam – but *avoid directing water just directly at the centre of the fire* – always well swamp the surrounding edges.

In confined spaces, breathing apparatus is advisable as sulphur dioxide is a product of combustion.

Any smouldering bags should be segregated and well swamped with water, and then dispersed. Beware of fires restarting as wet stock dries out, and keep the site under observation for several days.

Frequently, the bulk of the stock can be saved.