

Draft guideline for  
**LONG-LASTING INSECTICIDAL NET OR NETTING (LN)**

**Preface**

This is a working document, providing a basis for further evaluation and discussion, but it reflects currently available LN technology. The final guideline for specifications is expected to be appropriate for any LN technology, any form of netting and any net type.

For the purposes of this guideline, “netting” refers to an open mesh fabric (whether in bulk or incorporated into a net), whereas “net” refers to a ready-to-use product (usually a bed net) made from netting.

Depending upon the technology used to produce treated netting, it may be impossible to achieve apparent uniformity of active ingredient distribution. Fortunately, mosquitoes usually traverse significant areas of netting in their search for a feeding site and thus efficacy is not diminished by a certain degree of random variation in distribution. However, in the manufacture of netting, systematic variation in distribution must be avoided and the extent of random variation should be kept to the minimum practicable for two reasons. Firstly, the limits to variation which still provide acceptable efficacy are poorly known and, having both spatial and concentration components, such limits are likely to be complex. Secondly, sampling and sub-sampling (to produce test portions) procedures may have a major influence on variation in the test results. That is, if samples and test portions are too small, or if the sample mixing procedure is inadequate, results may be in poor agreement. On the other hand, if the samples or test portions are too large, the results may obscure the fact that the scale of variation in the netting is sufficient to have an adverse effect on efficacy. Sampling and sub-sampling procedures should therefore be optimized by manufacturers to provide meaningful results between these extremes.

Systematic variations in active ingredient content across or along netting could seriously affect efficacy. However, without knowledge of the pattern, routine screening for systematic variation is uneconomic and the note on sampling, given in the guideline, does not address it. If systematic variation is suspected, special sampling procedures should be designed to determine whether or not it is present.

**...[ISO common name] LONG-LASTING INSECTICIDAL NET OR NETTING**

(Note 1)

WHO specification [CIPAC number]/LN

**1 Description (Note 1)**

The product shall be formed from (or in the form of) netting, consisting of .....[denier/decitex, mono-/poly-filament, polymer type] fibres, treated with technical/formulated .....[ISO common name] complying with WHO specification ...[CIPAC number/technical or formulation code (date)], together with any necessary stabilizers, plasticizers, other formulants (Note 2) and/or synergist, if required. The product shall appear clean and shall be free from visible extraneous matter, visible damage (such as splitting or tearing) and visible manufacturing defects (such as poorly made seams or a weave that is either not uniform or too loose to remain uniform in use), and shall be suitable for use as/in an insecticidal net with long lasting activity (Notes 3 & 4).

**2 Active ingredient**

**2.1 Identity tests (Note 5)**

The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.

**2.2 Total content of active ingredient (Notes 5 & 6)**

The .....[ISO common name].... content shall be declared (within the range ..... to .....g/kg) and, when determined, the average content (Note 7) shall not differ from that declared by more than  $\pm$  .....% (Note 8).

**2.3 Isomer ratio of active ingredient (Notes 5 & 9)**

The ratio of ..... isomers shall be .....

**2.4 Initial surface concentration of active ingredient (Notes 6 & 9)**

The initial surface amount of .....[ISO common name] on the netting, determined by the method described in Note 10, shall be not less than ..... g/kg of netting.

## **2.5 Release or retention index of active ingredient** (Notes 6 & 11)

The release or retention index of .....[ISO common name] from the netting, when determined by the method described in Note 12, shall be within the range ..... to .....

## **2.6 Total content of synergist** (Notes 5, 6 & 9)

The .....[common name and/or chemical name and CAS number of synergist].... content shall be declared (within the range ..... to .....g/kg) and, when determined, the average content (Note 6) shall not differ from that declared by more than  $\pm$  .....% (Note 8).

## **3 Relevant impurities**

### **3.1 By-products of manufacture or storage** (Note 9)

....[Common name and/or chemical name of impurity] (CAS number)

Maximum: .....% of the .....[ISO common name of active ingredient]... content found under 2.2.

## **4 Physical properties**

### **4.1 Netting mesh size**

The netting shall have a minimum of .... complete holes per .... cm<sup>2</sup>.

### **4.2 Dimensional stability of netting to washing** (ISO 5077 (1984), Note 13)

Dimensional stability: not exceeding  $\pm$  5% of the initial dimension.

### **4.3 Mass per m<sup>2</sup>** (ISO 3801 (1977), Note 13)

The mass/m<sup>2</sup> shall be declared (..... g/m<sup>2</sup>) and, when determined, shall not differ from that declared by more than  $\pm$  10%.

### **4.4 Bursting strength** (ISO 13938-1 (1999), Note 13)

Minimum bursting strength: ....kPa.

### **4.5 Tearing strength** (ISO 13934-2 (2000), Notes 13 and 14)

Minimum tearing strength: .....[units].

## 5 Storage stability

### 5.1 Stability at elevated temperature (MT 46.3)

After storage at  $54 \pm 2^\circ\text{C}$  for 2 weeks (Note 15), the determined total active ingredient content shall not be lower than .....%, and the determined total synergist content shall not be lower than .... % (Note 9), relative to the determined average content found before storage (Note 16) and the product shall continue to comply with the clauses for:

- initial surface concentration (2.4) (Note 9 & 17);
- release or retention index (2.5) (Note 11 & 17);
- dimensional stability (4.2);
- bursting strength (4.4);
- tearing strength (4.5) (Note 14).

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Note 1 A specification may apply to manufactured nets only, to bulk netting only or to both, as required, and its title and description (clause 1) should be modified appropriately.

Note 2 If a specific UV-stabilizer is required, its identity and minimum concentration should be given in a Note, together with details of a validated analytical method. If necessary, the maximum concentration may also be stated.

Note 3 Long-lasting insecticidal netting is expected to retain its insecticidal activity during its lifespan and through a number of washes.

Note 4 Flammability of the product is not part of the specification but it should be measured by the manufacturer, according to 16CFR Part 1610, and the result presented on the package.

Note 5 Methods must be CIPAC, AOAC or equivalent. If the methods have not yet been published then full details, with appropriate method validation data, must be provided.

Note 6 The method of sampling LN products can have a major influence on test results but, at present, definitive methods cannot be given. Samples must be sufficiently large to conduct all tests required and must be taken by a method designed to make them representative of the net or netting. Use sharp scissors, or equivalent, to minimize damage to the fibres and fabric and thus avoid any consequential bias in the results of certain tests.

Suggested method 1. Cut full-width strips, 20-30 cm wide, across the netting. In the case of a rectangular net, cut such strips from halfway along the roof and each side.

Suggested method 2. Cut sixteen 30 x 30 cm squares along diagonals in the net or netting. In the case of a rectangular net, take 4 squares along a diagonal across the roof and 3 squares along a diagonal across each side.

Roll up the strips or squares and place them in labelled, new, clean aluminum foil prior to analysis. Representative portions (sub-samples) for testing should be taken as described in each test method.

Note 7 As with sampling, the method of sub-sampling LN products can have a major influence on test results. The size of portions analyzed, the sample cutting (use sharp scissors or equivalent) and mixing procedures and the analytical method should be designed to provide results with a relative standard deviation (RSD)  $\leq 5\%$ . Normally, duplicate portions should be analyzed. If the higher result is 107.5-110% of the lower result, a third portion should be analyzed. If the higher result is  $>110\%$  of the lower result, larger portions should be analyzed and/or an improved sub-sampling procedure should be used.

Note 8 The tolerance should be based on the table of tolerances in section 4.3.2 of the FAO/WHO manual (1<sup>st</sup> edition, 2002) and therefore the maximum normally acceptable for LN containing up to 25 g active ingredient or synergist per kg is  $\pm 15\%$  or  $\pm 25\%$ , according to the expected heterogeneity of the product.

Note 9 This clause or sub-clause is required only if appropriate to the product specified. Isomer ratio is specified only where the active ingredient is defined as a particular isomer ratio. A synergist is specified only where required. Initial surface concentration is specified only where the nature of the product is such that it could be too low for good efficacy. An impurity is specified only where it is relevant, as defined in the glossary of the FAO/WHO manual (1<sup>st</sup> edition, appendix B).

Note 10A full description of the method for determination of initial surface concentration must be provided or the reference quoted if it has been published. Validation data, or published evidence of adequate validation must also be provided. The method is expected to distinguish good and bad fabrics of the same type, using an extraction procedure designed for the type of fabric. For this reason, the method may be specific to a particular type of fabric.

Note 11 Release or retention index should be specified, according to the specific type of LN technology used. The units of measurement are likely to be specific to the method and type of fabric.

Note 12A full description of the method for release or retention index must be provided or the reference quoted if it has been published. Critical parameters in the method must be characterized and well-defined. Validation data, or published evidence of adequate validation must be provided. The method is expected to distinguish good and bad fabrics of the same type, using a release or washing procedure designed for the type of fabric. For this reason, the method may be specific to a particular active ingredient and/or type of fabric.

Note 13 An alternative or supposedly equivalent method is acceptable only in justifiable cases and it must have been subjected to acceptable validation. Either an appropriate literature reference for, or a full description of, the alternative method must be provided. Where the ISO standard includes two or more methods and/or various options (such as test sample size, measurement of moisture content and so on), the exact requirements must be defined in a Note to the specification.

Note 14 If bursting and tearing strengths of the specified fabric are shown to be closely correlated, the clause or sub-clause for tearing strength may be omitted.

Note 15 Unless other temperatures and times are specified. Refer to section 4.6.2 of the FAO/WHO manual (1<sup>st</sup> edition) for alternative storage conditions.

Note 16 Samples of the product taken before and after the storage stability test should be analyzed concurrently in order to reduce the analytical error.

Note 17 If justifiable, a permitted increase or decrease in the limit(s) applying after the storage stability test should be specified in the sub-clause.