Nordic Ecolabelling

Ecolabelling of Light sources

Criteria document
15 June 2000 – 14 December 2007

Version 3.5

This is a translation of the document in Danish: Miljømærkning af Lyskilder.
In any cases of dispute the original document should be taken as authoritative.

Joint Nordic ecolabelling

In November 1989, the Nordic Council of Ministers adopted a measure to implement a voluntary, positive ecolabelling scheme in the Nordic countries. The scheme is administered by national boards, which co-operate through the Nordic Ecolabelling Board. The board among other things chooses product groups and lay down the final criteria. Secretariats in the participating countries are responsible for implementing the scheme on national level.

The objective of ecolabelling is to provide information to consumers to enable them to select products that are the least harmful to the environment. Ecolabelling is intended to stimulate environmental concern in product development.

In its work on ecolabelling Nordic Ecolabelling follows the ISO 14024 standard: "Environmental labels and declarations - Guiding principles". The product groups and environmental and performance requirements selected by Nordic Ecolabelling reflect the objectives, principles, practices and requirements of the standard. ISO 14024 includes the requirements that criteria should be objective, reasonable and verifiable, that interested parties should be given the opportunity to participate and that account should be taken of their comments.

The criteria are based on evaluation of the environmental impacts during the actual products' life cycle. Based on a thorough examination the criteria set requirements towards a number of factors considered environmentally harmful. Upon application all products found to meet the requirements of the criteria are awarded the environmental label.

Due to new knowledge and production methods the criteria must be updated regularly. The period of validity of each set of criteria is 2-3 years. New revised criteria are presented at least 6 months prior to the expiry date. A handling fee is paid upon submission of a complete application. The turnover value of the actual product determines the additional annual fee.

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Ecolabelling of Light sources

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1. Summary

The objective of ecolabelling is to promote the use of the least environmentally harmful products and services. This document discusses light sources for general illumination, i.e. light bulbs and fluorescent tubes.

The product group encompasses fluorescent tubes and light bulbs with electrical fittings at one end or both ends, with built-in or separate ballast and with various bases.

To qualify for an ecolabel light sources must fulfil requirements as to:

- Energy consumption
- Mercury content
- Colour rendering
- Lifetime

Furthermore, ecolabelled light sources must carry information stating that they should be delivered to collection schemes approved by the authorities.

Information on various other matters must also be provided to consumers.

A couple of years ago it was estimated that light sources for general illumination accounted for about 7% of the electricity used in the Nordic countries. Today the share might be increased. Gas discharge tubes, that is to say fluorescent tubes and low energy bulbs, typically use 5 - 8 times less energy to provide a given light emission during the operational phase than incandescent lamps. Energy consumption during the production and disposal phases is low.

There is considerable scope for energy saving by using energy efficient light sources. The advantages of energy savings differ among the Nordic countries. In Denmark the potential energy savings achievable by light sources corresponds to 10% of the goal of the government for CO_2-reductions. In Sweden the saving potential is 180 000 tons CO_2 and in Finland 810 000 CO_2, if all ordinary incandescent lightbulbs were replaced by energy saving light sources. The Norwegian “Naturvernforbund” (Nature Conservancy Association) has calculated that if all households in Norway replaced three light sources often used with good energy saving light sources 2,3 TWh electricity could be saved. This potential energy saving corresponds to the production from a planned gas fired power plant at Kårstø.

Energy saving allows the environmental impact of electricity production to be reduced. Requirements are therefore imposed on the energy efficiency of the light sources measured as luminous efficiency per watt.

Unfortunately it is for technical reasons necessary to use mercury in energy efficient light sources, gas discharge tubes as they are known, to achieve light that is suitable for indoor illumination.

Nordic Ecolabelling therefore accepts the use of a small quantity of mercury in light sources even though the stated objective of the governments of the Nordic countries is to phase out use of this metal. Nordic Ecolabelling is of the view that the quality and useful life of light sources containing mercury is such that it is acceptable to permit the use of

mercury in limited quantities during the coming criteria period. Waste systems for collecting and destroying light sources are being set up in many areas and Nordic Ecolabelling urges manufacturers to provide customers with information on such schemes on the packaging of the light sources. The eco-labelling of light sources thereby helps to increase awareness of sorting at source of light sources. The criteria for information of the consumer is prepared for the possibility that mercury-free and energy-saving light sources could appear on the market during the period of validity for the criteria document.

2. Definition of product group

The product group encompasses light sources for general illumination purposes, i.e. light bulbs and fluorescent tubes.

"General illumination purposes" means general illumination of rooms occupied by people or specific surfaces in such rooms. In other words, light sources for illuminating rooms or surfaces that are used only for very special purposes are not included in the product group.

The product group encompasses fluorescent tubes and light bulbs with electrical fittings at one or both ends, with built-in or separate ballast and with every type of base.

Light sources for illuminating motorways are not included in the product group. Other products that are not included are car lights, projector lamps, grow lights, photographic lighting, solarium tubes and heat lamps. The most common types of decorative lighting are included.

Light sources with and without built-in ballast and with all forms of base are included in the product group, as are fluorescent tubes with fittings at both ends.

3. Market review

A wide variety of gas discharge tubes and incandescent lamps are available on the market. Those used for "general" illumination purposes account for approximately 7% of electricity consumption in the Nordic countries. Sales of light sources in the Nordic countries are approximately as follows:

Incandescent lamps	154 million per year	
Fluorescent tubes	31	"
Fluorescent bulbs	2.5	"
Compact fluorescent lights	4.2	"

Most of the light sources are imported to the Nordic countries from multinational companies but at least one producer is situated in the Nordic country Sweden.

4. Impact on the environment during the product's life cycle

The environmental impact of light sources has been the subject of detailed studies in recent years. Their environmental impact derives from energy consumption, handling of dangerous substances (particularly mercury) and the risks associated with glass when waste is processed.

4.1 Energy

In terms of energy consumption the operational phase dominates. Only about 2% of the energy consumed in the overall life cycle is used for other purposes such as glass production, transport etc. Switching from incandescent lamps to fluorescent tubes or low energy bulbs normally allows 5 - 8 times the quantity of electric energy to be saved. Accordingly there is considerable potential for energy saving in using light sources with low energy consumption for those illumination purposes for which they are suited.

In the Nordic countries electricity is produced by means of a range of different technologies, all of which have a greater or lesser impact on the environment, even though electricity production in the Nordic countries is probably amongst the most efficient and least environmentally harmful in the world.

The main environmental impact of electricity generation includes

- The greenhouse effect
- Acidification of sensitive natural environments
- The disposal of environmentally harmful substances
- Radioactive waste
- Noise

In other words, electricity savings also offer scope for reducing environmental impact.

The advantages of energy savings differ among the Nordic countries. In Denmark the potential energy savings achievable by light sources corresponds to 10% of the goal of the government for CO_2-reductions. In Sweden the saving potential is 180 000 tons CO_2. The goal of the Swedish Government for CO_2-reduction is that the CO_2-emission in year 2000 shall be at the 1990-level. The CO_2-emission in Sweden in 1998 was 2,3 mio. tonnes higher than in 1990, i.e. the saving potential from the light sources accounts for approximately 5 – 10% of the goal of the government if 1998 figures are used. In Finland 810 000 CO_2 could be saved if all ordinary incandescent lightbulbs were replaced by energy saving light sources. The Norwegian “Naturvernforbund” (Nature Conservancy Association) has calculated that if all households in Norway replaced three light sources often used with good energy saving light sources 2,3 TWh electricity could be saved. This potential energy saving corresponds to the production from a planned gas fired power plant at Kårstø. 2,3 TWh electricity produced at a modern gas fired power plant will give a CO_2-emission of app. 1 mio. tonnes of CO_2.

Energy savings reduce impact of environment from electricity production. Requirements are therefore imposed on the energy efficiency of the light sources measured as luminans efficiency per watt.

Mercury is deposited in the environment when electricity is generated by means of coal firing, a technology that is particularly widespread in Denmark. Coal contains a small content of mercury, and some of this is released through the chimneys of coal fired power stations, even those using modern treatment technology. The quantity of mercury released per kWh of electricity generated has a bearing on the criteria for the maximum permitted quantity of mercury in ecolabelled light sources, see Section 5.3. This

assessment is based on electricity production in the country in question and the Nordic countries as a whole.

Electricity savings can very roughly be made up to be to 2-3 TWh, which could be achieved if all consumers used Swan labelled light sources.

4.2 Mercury

It is necessary to use mercury in most light sources with low energy consumption and with good colour rendering. Mercury is a highly volatile trace metal that causes problems for health and the environment.

A large proportion of the fluorescent tubes in use today contain less than 10 mg mercury per lamp, although tubes containing more than 10 mg are in use. High-pressure sodium lamps with good colour rendering typically contain about 20 - 30 mg, and some mercury lamps may contain up to 80 mg.

A conventional incandescent lamp contains no mercury, but consumes more energy and has a shorter life than an equivalent light source containing mercury.

Mercury is being phased out in the Nordic countries, and accordingly it will presumably be possible to make the requirements stricter when they are next revised.

If the average mercury content of light sources containing mercury on sale today totals 15 mg; this makes for a total in-flow to the Nordic countries of 0.6 tons per year.

Given the danger of mercury, sources of mercury pollution must be limited irrespective of quantity. Ecolabelling can contribute to this by rewarding light sources with relatively low mercury content or no mercury content at all. This means that even though there is a move in the direction of fluorescent tubes and low energy bulbs the total quantity of mercury contained in these light sources can be reduced. If all light sources containing mercury on sale today contained only 4 mg of mercury, equivalent to the requirements in Chapter 5, the total in-flow to the Nordic countries would be approximately 0.15 tons instead of, as now, approximately 0.6 tons.

If light sources fulfilled the criteria imposed as to mercury content, energy efficiency and useful life, no more mercury would be released in the Nordic countries from energy-efficient light sources than from mercury-free incandescent lamps because an equivalent quantity of mercury would be saved in electricity generation.

In the spring of 2001 the invention of a mercury-free energy-saving light source was made public by Chalmars Institute in Sweden. If the invention lives up to the expectations and if it succeeds in being spread on the market, large benefits for the environment can be achieved because it will be possible to save energy completely without using mercury.

4.3 Life time

It is important to appreciate that there is a connection between mercury content and the length of life of light sources. This is not a linear connection. It means that a small increase in mercury content offers a greater increase in bulb life. A doubling of mercury content may entail a tripling of bulb life. There is therefore no advantage in having very

low mercury content if this is achieved at the expense of bulb life since the total quantity of mercury used to illuminate a room for a specified period of time will be greater.

When one buys a light source one buys a number of light hours. It is the intention that no light source shall have more impact on the environment than others calculated per functional unit (light hours). Therefor the criterion in section 5.3 is that a light source that gives half as many light hours as another may only contain half as much mercury.

The criterion is set as a linear function even though one would not obtain a linear function if one compared light sources that were identical except for the mercury content and measured the number of light hours they could deliver.

4.4 Collection systems

Major consumers and local authorities have to some extent already developed collection systems for fluorescent tubes and other light sources. The mercury in some of the collected light sources is recovered. Mercury recovery and disposal in properly controlled sites is of particular importance in the case of light sources with a high mercury content.

Programmes for phasing out mercury and a few other environmentally harmful metals are being discussed in international forums. In the longer term the use of mercury in products should cease. Fluorescent tubes are one of very few products where it has been accepted that it is for technical reasons not possible to remove all mercury.

4.5 Other environmentally harmful substances

Other environmentally harmful substances present in fluorescent tubes are copper, lead, strontium, tin and zinc. However, here the quantities are so low in relation to what is found in other products that they are regarded as negligible. Antimony, barium, thallium, vanadium and wolfram are also present in very small quantities (<0.05%).

Flame retardants are present in very small quantities in light sources. Compared with other product groups, however, the quantities are very small.

The luminescent material in fluorescent tubes contains yttrium and other rare earths (<0.05%). In general there is little information available on the environmental effects of these substances.

5. Criteria for environmental labelling

To achieve an ecolabelling licence light sources for general illumination purposes must fulfil the following requirements.

5.1 Colour rendering

5.1.1 The Ra Index must be 80 or above.

5.2 Energy consumption

5.2.1 Light sources with two fittings must be classifiable as A if they contain mercury and B if free from mercury.Classification shall be in accordance with the energy label adopted in EU Commission Directive 98/11/EC of 27 January 1998 Annex IV.

5.2.2 Light sources with a single fitting must be classifiable as A or, if they have pin fittings or are free from mercury, as B. Compact fluorescent tubes with magnetic ballast do not qualify for an ecolabel.

The energy label relates energy consumption to light emission, lumen, abbreviated lm. An energy consumption equivalent to category A means that a light source providing 3000 lm may as a maximum consume 37 W.

5.3 Mercury content and life

5.3.1 Mercury content (measured in mg) ≤ Life time (measured in hours) / 2500 yet the mercury content may not exceed 10 mg in double ended fluorescent light sources and 6 mg in single ended fluorescent light sources.

Lifetime is defined in the following way:

Light sources with two fittings: 90% maintenance of light strength (lumen)[1].
Light sources with a single socket: Average life.

Examples on allowed mercury content for different life times are shown in the table.

Life time (hours)	10 000	15 000	18 750	20 000	≥ 25 000
Mercury (mg)	4	6	7,5	8	10

Documentation
Laboratory report showing the testing of mercury content, power consumption, life time and colour rendering in accordance with the methods described in Chapter 7. Documentation showing that the test institutions used perform the analyses in an impartial and competent way, cf. Chapter 7.

5.4 Packaging

The packaging may not contain chlorinated plastic.

Documentation
Statement from the manufacturer that the packaging fulfils the requirements.

[1] Maintenance of light strength is measured on light sources that after the actual amount of hours still are able to light.

5.5 Collection

If the light source contains mercury, the packaging or a note inside the packaging must contain a text or pictogram stating that the light source contains mercury and that the used light source must therefore be deposited for special collection approved by the authorities. If the light source does not contain mercury it is instead allowed to write a text or show a pictogram telling that the light source contains no mercury.

Documentation
An example of the packaging or note containing pictograms.

5.6 Information for the user

5.6.1 For single ended light sources the packaging around each individual light source must contain a sketch showing the size of the light source compared with an incandescent lamp. Double ended light sources shall not fulfil this criterion.

5.6.2 For Double ended light sources each individual light source must be accompanied by instructions on suitable sockets for taking best advantage of its properties, on how the user will know when the light source needs replacing and on the importance of keeping the light source and its lamp fitting clean of dust and dirt.

5.6.3 For light sources containing mercury, the packaging or a note inside the packaging must contain a text with the following heading: "Fluorescent tubes, low energy light bulbs and other low energy light sources contain mercury. Swan labelled light sources of this type have a low mercury content relative to their energy consumption and useful life."

The meaning in the above text should be included in any marketing campaigns for light sources with low energy consumption to ensure that consumers understand the importance of depositing used light sources in special collection schemes and that they must not be discarded together with ordinary household waste.

If the light source does not contain mercury it is allowed to write on the packaging or on a note inside the packaging a text meaning the following: ”Fluorescent tubes, compact fluorescent tubes and other energy-saving light sources often contain mercury. Swan-labelled light sources have a low or no content of mercury. This light source has no content of mercury.”

5.6.4 For light sources containing mercury there shall be, , a label with the letters for Mercury, Hg, and a symbol or pictogram showing a striked out waste bin indicating that the light source shall not be disposed together with the municipal solid waste. This label shall be placed on the light source itself.

If the light source does not contain mercury it is allowed instead to place a label on the light source itself with the letters for mercury, Hg, either striked out or followed by a colon and “0 mg”.

Documentation
Example of the packaging and/or note and light source containing instructions and information. See also Section 5.5, which requires the same form of documentation.

6 Other requirements

6.1 Requirements from authorities

6.1.1 The licensee shall ensure that the manufacturing of environmentally labelled products meet all regulations currently in force, concerning the protection of the natural and working environment as determined by legislation and the authorities in the respective countries and at the location in question.

6.1.2 Producers or importers of ecolabelled products shall ensure that the finished products and their packaging meets the requirements set by the authorities in the country where the products are intended to be sold.

The licence for environmental labelling can be withdrawn if it appears that the regulations in force, concerning the working environment or concessions based on environmental legislation, are not complied with at the location and in the country of manufacturing.

Documentation
No documentation except signed application scheme

7. Testing, reporting and control

The documentation requirements are described in the individual criteria.

7.1 Test methods

The cost of analysis will be borne by the applicant.

Testing encompasses power consumption, luminous efficiency, length of life and colour rendering.

Energy efficiency, luminous efficiency and life are tested as provided for in EU Commission Directive 98/1/EC of 27 January 1998, Annex IV. If lifetime testing has not been completed at the time of submission of the application, documentation must be provided by the test laboratory showing that light sources have been submitted for testing of this type.

Colour rendering is measured in accordance with the current IEC norm. The current IEC norm at June 2000 is CIE-standard/publication 13.3-1995.

Mercury content is measured by means of the method described in Appendix 1.

A laboratory report outlining the testing of mercury content using the method described in Appendix 1. The mercury content of fluorescent tubes and fluorescent lamps is measured

using ten light sources of the type in question, randomly selected under the control of an impartial body. The mercury content of each individual fluorescent tube or fluorescent lamp is tested using the method described in the appendix. The content is then determined by deleting the highest and lowest values and ascertaining the arithmetic average for the remaining eight.

7.2 Testing laboratory

Samples shall be taken in a competent manner.

The testing laboratory shall be impartial and competent.

The testing laboratory shall meet the general requirements of the standard EN 45001 or ISO-IEC Guide 25, or posses an official GLP-approval. The applicant is responsible for documentation and costs of analysis.

A laboratory of the manufacturer can be approved for analysing manufacturing emissions if the authorities supervise the sampling and analyse or if the manufacturer has a quality system that includes sampling and analysis and is certified according to ISO 9001 or 9002, or if the laboratory is officially GLP-approved.

8. Application

The licence for ecolabelling can be applied for using a form according to the regulations in the document “Regulations for Nordic Ecolabelling of products”. In connection with the application, the information mentioned below shall be sent to the ecolabelling organisation. If necessary, the ecolabelling organisation may request additional information.

The applicant shall provide information on

- trade mark/trade name of the product, and type definition,
- annual sales of the product and volume of sales in each Nordic country,
- a technical description of the product and the production process, including steps taken to reduce emissions of dust and gases (including mercury gases) to the working and outer environment

The licensee shall get approval from the ecolabelling organisation before changes are made in the product that can affect conditions regulated by this criteria document (e.g. changes in raw materials, production methods or cleaning methods).

9. Registration

Ecolabelled products to be sold in the Nordic region but outside the country where they are licensed, must be registered in the country of sale. When the license is registered in another Nordic country the following shall be documented and will be controlled by the Ecolabelling body:

- Marketing material

Documentation
Declaration that the person responsible for marketing knows the “Rules on the Nordic Ecolabelling of Products”. Information on the spreading of responsibility by marketing of Ecolabelled products.

10. Design of the environmental label

The environmental labelling symbol and its assigned identification number (expressed as 000-000) for light sources is designed as follows:

Besides this the product shall be labelled in a durable way with the producers name or company logo and the name of the product.

11. The validity of the criteria document

This criteria document was adopted by the Nordic Ecolabelling Board on 15 June 2000 and is valid till 14 June 2003. During the period of validity Nordic Ecolabelling Board can take decisions on adjustments, clarifications and/or prolongation of the criteria, by which a new version is published. This does normally not lead to any renewed testing of granted licenses.

At the meeting of the Nordic Ecolabelling Board the 6 June 2001 the document was changed to version 3.1, adjusting the criteria document to energy-saving light sources without any content of mercury. In addition the text in certain criteria was clarified.

At the meeting of the Nordic Ecolabelling Board 12 December 2001 the document was changed to version 3.2. The criterion on energy was adjusted, so that the energy demand will not be more restrictive for mercury free light sources than for pin based light sources.

Furthermore the number on a test standard was corrected. Finally it was decided to prolong the period of validity until 14 December 2004.

At the meeting 14 March 2002 of the Nordic Ecolabelling Board a criterion for single ended light sources was removed. It was the demand on information to the consumer about the importance of keeping the light source and its lamp fitting clean. The document was changed to version 3.3.

It is the duty of the organisation for ecolabelling at the latest 12 months before the expiration of the validity period of the criteria document to inform the licensees about the ecolabelling criteria that will be valid after the expiration date.

At the meeting 17 December 2002 of the Nordic Ecolabelling Board it was decided to prolong the period of validity until 14 December 2005. The document was changed to version 3.4.

The Secretariat's managers meeting decided 17 November 2004 to prolong the validity of the criteria document until 14 December 2007. The new version is called 3.5.

12. Future criteria

At the next revision of the criteria the question of whether the mercury content at that time can be further reduced or totally avoided will be looked at. This may be possible by means of new technologies as fusion lamps and light-emitting diode technique, if these are sufficiently developed at the moment for the revision. The mercury content and its effect on the life of the light source and the light quality will also be assessed. Requirements that might further improve the percentage of discarded light sources that are collected will be considered.

An assessment of the content of environmentally harmful substances, other than mercury, may be carried out. Furthermore, the possibility of separating electronic parts from the glass part in order to better utilise the life time of the individual parts may also be assessed.

Appendix 1 Method to Test Mercury Content

From the EC Eco-labelling Criteria for double-ended light bulbs

The arc tube is first separated from its plastic surrounds and associated electronics. The associated lead wires are cut as close to the glass seal as possible.

The arc tube is taken to a fume cupboard and is cut into segments. The segments are placed in a suitably sized robust screw capped plastic bottle to which is added a 1 inch diameter porcelain ball and 25 ml of high purity concentrated nitric acid (70%). The bottle is sealed and shaken for a few minutes to reduce the arc tube to fine particle size, the stopper is periodically loosened to eliminate any possibility of pressure build-up. The contents of the bottle are allowed to react for 30 minutes during which time the contents are periodically agitated.

The contents of the bottle are then filtered through an acid resistant filter paper and collected in a 100 ml graduated volumetric flask. Potassium dichromate is then added to the flask so that the final concentration is 1000 ppm with respect to chromium. The flask is then made up to volume with pure water.

Matched standards are made up on a concentration range up to 200 ppm mercury. The solutions are analysed using Flame Atomic Absorption at a wavelength of 253.7 nm with background correction on. From the result obtained and knowledge of the solution volume, the original mercury content of the lamp can be computed.

Appendix 2 The marketing of the ecolabelled products for which a licence is sought

We hereby confirm that we are familiar with the rules ("Rules on the Nordic Ecolabelling of Products") of the marketing of ecolabelled products with respect to the use of the Nordic Ecolabel.

We assure the marking comply with the rules mentioned above.

We confirm that we are familiar with the criteria document for light sources.

We also confirm that personnel in our company responsible for marketing the ecolabelled products will receive information about the contents of the above stated documents.

…… ……..
Place/date Company

……. ……..
Contact person's signature Telephone

…… ……..
The signature of the responsible person for marketing Telephone

If the contact person or the person responsible for marketing is replaced during the valid period of the licence, a new certificate must be send to the ecolabelling body.