

## "TCO'03 Displays" – International Standard for Ergonomics, Safety, and the Environment

### 1. Outline

In January 2003, TCO'99, which was widely regarded as the strictest international standard for environment, ergonomics and safety for computer monitors, was updated as "TCO'03 Flat Panel Displays" (TCO'03 FPD) and "TCO'03 CRT Displays." Three EIZO monitors, the FlexScan L367, L767, and L985EX, were among the first products in the world to receive TCO'03 certification.



### 2. About TCO

TCO is an international standard covering the areas of safety, ergonomics, emissions, energy and ecology for office equipment. TCO Development of the Swedish Confederation of Professional Employees oversees this labeling system. Since the end of the 1980's, TCO Development has been working with the development of IT equipment, particularly computer monitors, in a more user-friendly direction to establish this labeling standard. TCO 1992 was established in 1992, followed by TCO'95 and TCO'99, each subsequent version setting stricter requirements. This standard has been become stricter.

EIZO has collaborated with TCO Development in the formulation of the standards since TCO Development was launched. We have been developing our activities by making several proposals at the draft stage. In the creation of "TCO'03 FPD", we have participated in a "Reference Group" consisting of some manufactures and affiliate organizations to evaluate the standard under development. We have made several comments and proposals among the Reference Group.

### 3. New Requirements in TCO'03 FPD

TCO'03 FPD covers the same areas as TCO'99. Additionally TCO'03 FPD includes the following new requirements:

- Visual Ergonomics  
Stricter requirements in luminance and contrast. Added new requirements in resolution, color characteristics (color reproduction, viewing angle and color uniformity) and portrait mode
- Work Load Ergonomics  
Requirements regarding vertical tilt and height adjustment
- Ecology  
Banned environmentally hazardous substances such as cadmium, mercury, lead, brominated or chlorinated flame-retardants. Preparation for recycling such as material coding of plastics
- Design for recycling  
Easy detachment of the mercury lamps in the LCD monitors
- Disclosure of recalling and recycling information for customers

For details about new requirements and the TCO'03 declaration statement, please refer to the document on the following pages:

Document A: Requirements in TCO'03 FPD (Differences between TCO'99 and TCO'03 FPD)

Document B: TCO Document for TCO'03

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**Document A: Requirements in TCO'03 FPD (Differences between TCO'99 and TCO'03 FPD)**

		TCO'99	TCO'03
A2. Visual Ergonomics	A2.1.1 Pixel array	* Different in the name of requirement	15/16" $\geq 1024 \times 768$ 17/18/19" $\geq 1280 \times 1024$ 21" $\geq 1600 \times 1200$ Or the VDU shall have a pixel density $\geq 30$ pixel/degree at 50 cm viewing distance
	A2.3.1 Luminance	Maximum luminance $\geq 125 \text{ cd/m}^2$	Maximum luminance $\geq 150 \text{ cd/m}^2$
	A2.3.2 Luminance uniformity	$L_{\text{max}} : L_{\text{min}} = 1.7 : 1$	$L_{\text{max}} : L_{\text{min}} = 1.5 : 1$
	A2.3.4 Luminance uniformity - angular-dependence	1.7 : 1 (in the horizontal direction at +/-30°)	<ul style="list-style-type: none"> <li>• In landscape mode: 1.7 : 1 (at +/-30° horizontally)</li> <li>• For pivot displays, in the portrait mode: 1.7 : 1 (at +/-15° horizontally)</li> <li>• For non pivot displays, in landscape mode: 1.7 : 1 (at +15° vertically)</li> </ul>
	A2.4.2 Luminance contrast - angular-dependence	$C_m \geq 0.5$ (at +/-30° horizontally)	$C_m \geq 0.8$ (at +/-30° horizontally)
	A2.4.3 Luminance contrast - characters	$C_m \geq 0.5$ (at 90° in the front)	$C_m \geq 0.7$ (at 90° in the front)
	A2.5.1 Front frame diffuse reflectance	No requirements	Diffuse reflectance value between 80% and 20%
	A2.6.1 Color temperature variation	No requirements	At least two preset possibilities with their color tolerance which should be as follows: $\Delta u'v' \leq 0.01$ (*1)
	A2.6.2 Color temperature uniformity	No requirements	$\Delta u'v' \leq 0.01$
	A2.6.3 RGB settings	No requirements	Red: $u' \geq 0.411, v' \geq 0.503$ Green: $u' \geq 0.140, v' \geq 0.548$ Blue: $u' \geq 0.150, v' \geq 0.224$
	A2.6.4 Color temperature uniformity – angular-dependence	No requirements	$\Delta u'v' \leq 0.025$ between areas at the left and right sides horizontally at +/- 30° angles to the screen
	A2.6.5 Grayscale linearity	No requirements	$\Delta u'v' \leq 0.020$ between each following step in the grayscale: 255, 225, 195, 165, 135, and 105

\*1. The "u'v'" is chromaticity according to CIELUV 1976 color space.

A3 Work load Ergonomics	A3.1 Vertical tilt	No requirements	It should be possible to tilt the monitor in the range of 20 degrees or more
	A3.3 Vertical height adjustment	No requirements	The monitor should have a height adjustment function or a VESA-compliant mounting feature.
A4. Emissions	A4.2 Alternating electric fields	5Hz ~ 2kHz: $\leq 10\text{V/m}$ measured at 30/50cm in the front of monitor 2kHz ~ 400kHz: $\leq 10\text{V/m}$ measured at 30cm in the front of monitor and 50cm around monitor	Same values as in the left However, monitors with pivot or height adjustment function should be measured in both bands.
	A4.3 Alternating magnetic fields	5Hz ~ 2kHz: $\leq 200\text{nT}$ measured at 30/50cm in the front of monitor 2kHz ~ 400kHz: $\leq 25\text{nT}$ measured at 30cm in the front of monitor and 50cm around monitor	
A6. Ecology	A6.2.1 Cadmium and mercury	<ol style="list-style-type: none"> <li>The batteries should not contain cadmium or mercury.</li> <li>The electric parts should not contain cadmium or mercury.</li> <li>The CRT should not contain cadmium.</li> </ol>	<p>The paint, lacquer, contacts and solder in the monitor should not contain cadmium or mercury.</p> <p>The threshold value per each part should be 2 ppm per weight for mercury and 5 ppm per weight for cadmium.</p>
	A6.2.2 Lead	No requirements	<p>The batteries, paint, lacquer, external cables, plastic parts and external adapters should not contain lead. Exceptions are made for solder.</p> <p>The threshold value should be 50 ppm per weight per each part.</p>
	A6.3.2 Mercury lamps	The amount of mercury in the backlight is stipulated.	<p>The amount of mercury in the backlight is stipulated.</p> <p>The backlight unit should be easily disassembled.</p>
	A6.3.5 Recycling information for customers	The manufacturer should have entered into a contract with at least one professional electronics recycling company anywhere in the world.	<p>The manufacture should inform its customers in the following countries of recycling information.</p> <ol style="list-style-type: none"> <li>Europe: at least three countries where the monitor is sold</li> <li>Asia: at least one country</li> <li>North and South America: at least one country or USA</li> </ol>
	Attachment of TCO Document	TCO Document for TCO'99	TCO Document for TCO'03

< New ECO Document >

## TCO Development

Congratulations!

The display you have just purchased carries the TCO'03 Displays label. This means that your display is designed, manufactured and tested according to some of the strictest quality and environmental requirements in the world. This makes for a high performance product, designed with the user in focus that also minimizes the impact on our natural environment. Some of the features of the TCO'03 Display requirements:

### *Ergonomics*

- Good visual ergonomics and image quality in order to improve the working environment for the user and to reduce sight and strain problems. Important parameters are luminance, contrast, resolution, reflectance, colour rendition and image stability.

### *Energy*

- Energy-saving mode after a certain time – beneficial both for the user and environment
- Electrical safety

### *Emissions*

- Electromagnetic fields
- Noise emissions



### *Ecology*

- The products must be prepared for recycling and the manufacturer must have a certified environmental management system such as EMAS or ISO 14000
- Restrictions on
  - Chlorinated and brominated flame retardants and polymers
  - Heavy metals such as cadmium, mercury and lead.

The requirements included in this label have been developed by TCO Development in cooperation with scientists, experts, users as well as manufacturers all over the world. Since the end of the 1980s TCO has been involved in influencing the development of IT equipment in a more user-friendly direction. Our labeling system with displays in 1992 and is now requested by users and IT-manufacturers all over the world.

For more information, please visit  
[www.tcodevelopment.com](http://www.tcodevelopment.com)