KAN Kommission Arbeitsschutz und Normung

KAN position paper on glossiness of computer monitor and VDT casings

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1. Summary

For many years, it has been normal practice to do without glossy surfaces at VDT workstations, because glare from such surfaces is perceived as unpleasant or can reduce visual performance.

The standard EN ISO 9241 **Ergonomics of human-system interaction** demands that "*The design of the visual display screen and surrounding area of the product housing shall not contribute to disturbing glare by the environmental lighting."*. In this respect, it says: *"Matt surfaces typically do not produce glare, whereas glossy surfaces can, depending on design aspects such as shape, colour, size and environmental lighting conditions"*

In the process of revising the series of standards ISO 9241-3XX, the U.S. industry in particular is trying to have these requirements regarding the glossiness of housings removed from the series of standards. This is supported by representatives from the U.S.A. and Japan, but opposed by Germany. In order to be able to fulfil the protective objectives of the European Health & Safety at Work Framework Directive (89/391/EEC) and the Display Screen Directive, as well as the specifications of their corresponding national implementations, we must prevent large numbers of glossy items of equipment (in this case monitor housings) come onto the market merely in order to give more freedom for fashionable design concepts.

The intent of this position paper is to increase awareness among other occupational health and safety experts in Europe and overseas, and encourage them to support the German position.

2. History and current situation

In order to allow people employed at VDT workstations to work without discomfort and in a healthy manner, an ergonomically arranged workplace is needed. One aspect of this is that the workplace should be free of distracting glare and reflections.

However, neither artificial lighting of workplaces nor daylight lighting can be designed so that undisturbed working with equipment is possible if its surfaces are glossy. This leads to reflective glare. For this reason, standards on lighting (such as DIN 5035-1) have recommended matt surfaces for all work equipment since 1969.

As a result, it has been customary for many years to do without glossy surfaces at VDT workstations, because glare from such surfaces is perceived as unpleasant or can diminish visual performance.

Manufacturers are currently attempting to remove the requirements concerning glossiness of monitor housings from the standard ISO 9241 *Ergonomics of human-system interaction — Part 307: Analysis and compliance test methods for electronic visual displays.* This is strongly advocated by the USA and Japan, but rejected by Germany.

If there were no longer any requirements concerning glossiness of monitor housings in this series of standards, the result would be that in future, monitors

with glossy housings would come onto the market which no longer conformed to the Council Directive 90/270/EEC of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment, the "Display Screen Directive". Therefore, the occupational health and safety experts in Germany will try to prevent this deletion. But for an ISO standard, this can only succeed with the support of other European and international occupational health and safety experts. We ask them to study the matter, and support the German position actively, if possible.

3. Statutory specifications, standardization, and research

Only surfaces of work equipment with low gloss can meet the requirements of the European Display Screen Directive (90/270/EEC). In the annex of the Directive, it says:

> *1. EQUIPMENT*
>
> *(b) Display screen*
>
> *The screen shall be free of reflective glare and reflections liable to cause discomfort to the user.*
>
> *2. ENVIRONMENT*
>
> *(b) Lighting*
>
> *Possible disturbing glare and reflections on the screen or other equipment shall be prevented by coordinating workplace and workstation layout with the positioning and technical characteristics of the artificial light sources.*

The standard EN ISO 9241 *Ergonomics of Human-System Interaction* specifies in *Part 303: Requirements for electronic visual displays* and *Part 307: Analysis and compliance test methods for electronic visual displays:* "The design of the visual display screen and surrounding area of the product housing shall not contribute to disturbing glare by the environmental lighting." In this respect, it states: "Matt surfaces typically do not produce glare, whereas glossy surfaces can, depending on design aspects such as shape, colour, size and environmental lighting conditions."

During the revision of the series of standards ISO 9241-3XX, industry representatives in particular are trying to have the requirements concerning glossiness of monitor housings removed from the series of standards. These efforts ignore the fact that these are product standards, the purpose of which is to enhance ergonomic design of work equipment. The standard's function of ensuring comparability of products would also be substantially impaired if there were no requirements concerning glossiness.

The argument is advanced that there is not enough published experience and no validated studies. But well-founded studies of glossiness and review articles are available, some of which are mentioned below.

Certain optical properties of surfaces of equipment housings and keyboards can cause visual problems for users in occupational practice, due to glossiness or reflective glare. The parameters are the reflectance and gloss. Here, the ***reflectance*** determines how "bright" an object seems in a particular lighting situation. If this object appears too bright or too dark in comparison to other near-by visual objects, visual disturbances can result. The ***gloss*** denotes the ratio of the specularly reflected proportion of the light striking a surface to the diffusely reflected proportion. Unwanted glossiness effects on work equipment can lead to errors in information perception or other malfunctions, such as distraction.

The effect of these optical properties of the surfaces of IT products on users was investigated in 2006 in a comprehensive review of the literature (1, 2). The results show "that the specifications of the product features reflectance and gloss in the various sets of rules represent a means of implementing a balanced brightness distribution in the field of vision, which has been demanded for about seventy years in the form of a rule-of-thumb. No literature was found that falsified this rule." (1, 2)

According to CIE 146, 2002 (3), the disturbances occurring can be described as disability glare or discomfort glare.

Disability glare is a glare that impedes vision (CIE, 1987). It arises by scattering of the light in the eye due to the incomplete transparency of the eye's optical components, and to a small extent from diffuse light passing the sclera (sclerotic) and the iris. The scattered light overlays the retinal image of objects by reducing the contrast of the retinal image. Older people are more sensitive to disability glare than younger people, due to existing opacity of the eye's optical components.

Discomfort glare, on the other hand, is disturbing and distracting effects of bright sources of light in the peripheral field of vision that do not necessarily impair vision. It can cause considerable impairment of the general sense of well-being, of work performance, and of the ability to concentrate, and contribute substantially to fatigue, by means of an unwanted and constant deflection of the direction of viewing.

Since it is technically impossible to illuminate VDT workstations so that glossy surfaces are no longer perceived as glossy, thus conforming to the Display Screen Directive, the protective goals of the Display Screen Directive can only be achieved by making the surfaces at the workplace matt.

In Germany, the statutory accident insurance institutions [*Berufsgenossenschaft-en*] have recommended matt work equipment for the last thirty years; the requirements for the German GS mark also specify that they must be matt.

This position is supported by a more recent study of 2007 by M.-C. Béland and B. Andrén (5), dealing with hampering of staff working at video workstations by shiny monitor surrounds. It comes to the following conclusions:

1. Monitor surrounds should have no gloss.
2. Surrounds having gloss levels ≤ 20 were seen as matt.
3. With surrounds having gloss levels ≥ 40, all test subjects perceived disturbing reflections.

4. At a gloss level of 30, 30% of the test subjects found the glossiness to be disturbing.

The US Occupational Safety & Health Administration (OSHA) classifies glossiness as a potential hazard: "Reflected light from polished surfaces, such as keyboards, may cause annoyance, discomfort, or loss in visual performance and visibility. To limit reflection from walls and work surfaces around the screen, paint them with a medium colored, non-reflective paint." (6)

These results and the position taken by the OSHA also support retaining the existing passages on gloss in standard ISO 9241-307.

Sources

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4. *CIE International lighting vocabulary*, CIE 17.4-1987
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7. Béland, Marie-Claude; Andrén, Börje: Effect of gloss and diffuse reflectance of display frames on visual comfort
8. OSHA, 2011 www.osha.gov/SLTC/etools/computerworkstations/wkstation_enviro.html

Rules and standards

- Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work
- Council Directive 90/270/EEC of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment
- BGI 650 *Bildschirm- und Büroarbeitsplätze – Leitfaden für die Gestaltung* ["VDU workstations and office workplaces – Design manual"]
- BGI 856 *Beleuchtung im Büro – Hilfen für die Planung der künstlichen Beleuchtung* ["Office Lighting – Aids for planning artificial lighting"]
- DIN 5035-1:1972-01, Artificial lighting of interiors – Concepts and general requirements (replaced in the meantime by more recent versions, and since 2003 by DIN EN 12464-1)
- DIN 5035-7:1984-08, Artificial Lighting - Part 7: Lighting of interiors with visual display workstations
- EN 12464-1:2003, Light and lighting — Lighting of work places — Part 1: Indoor work places
- ISO 9241-6:1999 Ergonomic requirements for office work with visual display terminals (VDTs)- Part 6: Environmental requirements
- ISO 9241-303:2008 Ergonomics of human-system interaction — Part 303: Requirements for electronic visual displays
- ISO 9241-307:2008 Ergonomics of human-system interaction — Part 307: Analysis and compliance test methods for electronic visual displays