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Information technology — Office equipment — Measurement of image quality attributes for hardcopy output — Binary monochrome text and graphic images

Technologies de l'information — Équipement de bureau — Mesurage des attributs de qualité d'image pour copies papier — Texte monochrome binaire et images graphiques

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 13660 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

Annexes A and B form a normative part of this International Standard. Annex C is for information only.

Introduction

This International Standard is designed to help a quality control engineer evaluate the quality of prints from office imaging systems.

In traditional imaging systems (such as ink-on-paper printing), an image is evaluated by comparison to an original or master version of that image. In many electronic imaging systems, however, the image is created digitally within the system. There is no hardcopy master and so there can be no evaluation by comparison in the ordinary way.

Often, those who operate electronic imaging systems ensure good image quality by controlling the imaging process. They use test targets and reference images to evaluate the performance of the system.

If it is not possible to control image quality by controlling the imaging process and if no test target or reference image is available, we can rely only on direct evaluation of properties of the image itself.

To perform intrinsic evaluations of image quality, we must consider the nature of an image that is output. An image is some organization of information in space. We assume that these signals have some purpose or are making some attempt at communication. Good image quality means that the image is legible (the organization and information can be interpreted) and that it has a pleasing appearance.

Our goals in developing this International Standard were to compile a list of image attributes that (taken together) correlate to human perception of print quality and to develop measurement methods for these attributes that can be automated and carried out on a simple system.

Legibility and appearance have several aspects:

- Detail can be detected easily.
- Image elements are well isolated from the background.
- The image has a minimum of gross defects.
- The imaging system has good geometric fidelity.

Not all these factors can be covered by evaluation of intrinsic, quantitative image quality attributes. Many of them have a large psychological or cultural component that is difficult to evaluate.

A print made with large optical reduction or one that is out of focus might still have excellent edge quality (and be totally lacking in gross defects, banding, noise, etc.) and yet be illegible. This could occur primarily because of the high process gamma (contrast) that is characteristic of many xerographic processes. Thus, the process can produce apparently sharp edges in spite of the loss in resolution. Without a resolution target of some kind, the extent of the resolution loss, and hence legibility, may not be known.

The purpose of this International Standard is to present a set of objective, measurable attributes that give some correlation to the perceived quality of an image to a human observer at a standard viewing distance. The standard will allow a user of printed material to sort samples into several groups, from excellent to bad.

The attributes and methods for their assessment are based on several assumptions:

- The image represents an attempt at communication.
- There is uniformity within identifiable image elements.

- Character images, symbols, and graphic elements are regular (that is, they are intended to be identical when they have multiple, similar occurrences).

- Samples with extreme gross defects have been screened out.

This International Standard applies to images made up of text, graphics, and other image objects with two-tone levels of a single colour (typically black image on white paper). This International Standard does not cover halftones or images with more nominal gray levels, continuous tone images, colour images, and so on.

Image quality measurement can be thought of as divided into diagnostic (high resolution), and visual scale (low resolution) procedures. Diagnostic measurements typically use precision test targets and instrumentation and are key to much engineering work. The present procedure, by contrast, is limited to phenomena visible to the naked eye and does not permit test patterns.

The working group has taken the approach of selecting simple and (in our judgment) effective metrics, rather than attempting to prove that our method of doing a given job will always be the most exact.

How will this International Standard actually be implemented? A complete evaluation system has three components: an image capture device, evaluation software, and application-specific quality standards and sampling plan. The end user may choose to develop all these parts himself or he may choose to purchase one or more components from a commercial supplier.

Any equipment capable of gathering data appropriate to these measurements is understood to have a complex instrument function. Rather than attempting to explore the relationship among these instrument functions, the working group has defined reference images, and target values for them. If these target values are achieved by an instrument, calibration will be acceptably good.

This is not an attempt to break new ground in image science. It is an attempt to provide suppliers and customers for copies/prints with a practical and objective way to communicate about basic image quality parameters.