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Grafisk teknik — Beräkning av energiförbrukning i digitaltryckmaskiner inklusive vilo- och andra lägen. (ISO 21632:2018, IDT)

Graphic technology – Determination of the energy consumption of digital printing devices including transitional and related modes (ISO 21632:2018, IDT)

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Den internationella standarden ISO 21632:2018 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 21632:2018.

The International Standard ISO 21632:2018 has the status of a Swedish Standard. This document contains the official English version of ISO 21632:2018.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Grafisk teknik, SIS/TK 434.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The energy requirement of digital production printing devices varies considerably across technologies, output formats, and productivity and quality expectations. Run length influences the overall energy usage, so the energy consumption of devices used for relatively short run lengths is accompanied by the relatively high amounts of transitional energy, including surge power, required to complete the print run. Operating transitions contribute to the overall energy profile throughout the course of operations, with frequent interventions between production printing modes.

As a proportion of the overall energy requirement for short run length jobs, transitional energy, including the surge energy, and waiting energy, including preparatory maintenance, will be substantial. This means that in order for the graphics industry to have accurate energy consumption data, directions are required to assist stakeholders in making accurate calculations for digital production printing devices, whose modes, other than production printing mode, play a significant role in the comprehensive energy consumption. This includes digital printing machines used to produce sign and display work, commemorative prints, photo books and similar high-value, on-demand print in narrow and wide formats.

This document provides directions for measuring any format of digital production press, whose modes, other than production printing mode, play a significant role in the comprehensive energy consumption.

This document can be used to compare the energy efficiency figures for different machine set ups: best-quality (slowest), highest-productivity (fastest) or other alternative combinations.

Application of this document provides the energy efficiency figures that correspond to the energy consumption for a digital printing device. These values can be used to inform the individual production scenarios covering different shifts, printing materials and other factors typical of the graphic arts.

Energy usage is generally estimated according to the connected load of a machine. The connected load is the machine's potential maximum power consumption. But calculated values do not necessarily reflect the machine's energy consumption. Actual energy consumption often differs significantly from estimated values. Power consumption data across devices can therefore not be accurately compared, since the calculations are unlikely to have followed a common framework that takes into account the influence of peripheral equipment such as IR or UV dryers. Nor can they accommodate differences in measurement cycles.

The universal availability of verifiable energy consumption data will enable print machinery buyers, printers and their customers to assess the power consumption of machines. However, the user of this document should understand that the effectiveness of power does not determine acceptable quality levels for the output that customers may require or expect. Power consumption is an important part of all the output requirements and quality expectation. This data can be used in life cycle analyses (LCA) and to calculate the carbon footprint of a printing system and of printed matter. Energy efficiency can be reported in various ways, such as the number of prints printed per kWh. This information can be used to:

— provide data for the LCA of a printing device;

— assess the power consumption and energy efficiency of digital printing production machines and peripheral devices;

— estimate operating costs for investment planning;

— benchmark the energy efficiency of digital production presses;

— calculate the CO_2 footprint of printed matter;

— encourage the energy efficiency improvements of digital printing devices over time;

— provide data to enable companies to claim environmental subsidies;

— provide data for carbon offsetting purposes.

This document defines how to calculate the electrical energy requirements and therefore the energy efficiency of digital printing devices.

This document can be used to determine the energy efficiency of any format of digital production press, whose modes, other than production printing mode, play a significant role in the comprehensive energy consumption.

Care should be taken when comparing the results obtained from this document that the devices being compared were set up to produce the same print quality using comparable types of printing technology, process and device configurations.

Graphic technology — Determination of the energy consumption of digital printing devices including transitional and related modes

1 Scope

This document provides directions for measuring and calculating the electricity consumption of any format of digital production press, whose modes, other than production printing mode, play a significant role in the comprehensive energy consumption. It excludes digital presses designed to print substrates other than paper or plastic and conventional printing presses fitted with digital inkjet printing heads.

It can be used to compare the energy efficiency figures for different machine combinations: best-quality (slowest), highest-productivity (fastest) or other alternative combinations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
digital printing machine
digital printing device
digital press
machine used in commercial/industrial applications where the printing image is produced in the machine from data stored in digital form and transferred to the substrate without the use of a printing plate

[SOURCE: ISO 12643-2:2010, 3.9, modified — “digital printing device” and “digital press” have been added to the term.]

3.2
electrical energy
E
electricity converted to other forms of energy (power, light, heat) for the operation of machines and devices

Note 1 to entry: Electricity generated in this way is calculated using the following formula:

$$E = \int_{t1}^{t2} u(t) \times i(t)\, dt$$

where $u(t)$ and $i(t)$ are the instantaneous values of voltage and current.

3.3
energy usage
power required for the operation of a given process over time

Note 1 to entry: Energy usage or electric energy consumption is typically measured in watt-seconds (Ws), kilowatt-hours (kWh) or watt-hours (Wh).

3.4
connected load
theoretically possible maximum power consumption of a machine, which can be expected when components of the printing machine are running at maximum load

Note 1 to entry: The connected load is the power specified by the manufacturer and used to rate the electrical power supply of the printing house (power rating, fuse rating, cable cross section). This ensures fail-safe operation of the machine under any possible operating condition. Determination of the connected load value has not been uniformly regulated so machine manufacturers handle it differently.

Note 2 to entry: The connected load should not be used to calculate a device's actual power consumption. This is always lower and in most applications, it is significantly lower.

[SOURCE: ISO 20690:2018, 3.3]

3.5
operational power consumption
power consumption of a machine in a defined operating condition or operational mode

Note 1 to entry: Typical operating modes are sleep, print-ready and production (also known as active mode).

3.6
active power
P
power available for conversion into other types of power

Note 1 to entry: mechanical, thermal or chemical power. In general, the active power of a consumer in a periodic AC voltage system can be determined with the formula

$$P = 1/T \int_0^T u(t) \times i(t)\, dt$$

where T is the desired period.

Note 2 to entry: Standard units are watts (W) and kilowatts (kW).

3.7
power meter
power analyser, which records voltages and currents as continuous values to determine power parameters

Note 1 to entry: These are high-precision devices designed for industrial use.

3.8
sleep mode
period when a printing machine is switched on, not running and operating with lower power than print-ready mode

Note 1 to entry: A reduced power state that a printing device automatically enters after a set period of inactivity (a.k.a. default delay time). Sleep mode permits operation of all product features (including maintenance of network connectivity), albeit with a possible delay to transition into print-ready or production mode.

3.9
print-ready mode
period when a printing machine is switched on with all assembled components (pre- and post-processing units) prepared to deliver outputs in the shortest time after a print order is given, compared with other waiting modes, such as sleep mode or off mode

3.10
production print mode
steady production print mode
period when a printing machine is printing live jobs

Note 1 to entry: A production print mode is characterized by a stable power consumption, when the printing machine is printing in a representative and typical fashion.

3.11
RIP
raster image processor which converts data into a raster bit stream or bitmap

3.12
machine combination
software, hardware and print media which has a direct influence on the resulting print image quality

EXAMPLE Best-quality combination = device configuration (hardware) + substrate (media) + print mode (software).

Note 1 to entry: RIP and print mode settings are examples of machine combination.

Note 2 to entry: When the settings depend heavily on the RIP and printing technology, the machine combination can also be referred to as the digital printing combination.

3.13
device configuration
physical hardware equipment included in a given production line

[SOURCE: ISO 20690:2018, 3.14]

3.14
basic device configuration
standard hardware equipment configuration as defined by the manufacturer, owner or user of the device for the type of printed products or market for which the press is being used

3.15
alternative device configuration
physical hardware configuration differing from the basic device configuration

[SOURCE: ISO 20690:2018,3.16]

3.16
print mode
collection of settings, that are used to control a given device configuration via software (RIP) to enable, disable or otherwise influence the operation of that device

EXAMPLE Using four colours on a machine capable of seven colours, varying the resolution, changing the speed or enabling duplex printing.

3.17
alternative print mode
collection of settings different from the print modes used for obtaining the best-quality or best-productivity combinations and used for defining additional combinations