BS ISO/IEC 24735:2021

BSI Standards Publication

Information technology — Office equipment — Method for measuring digital copying productivity

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Full document details: BS ISO/IEC 24735:2021

National foreword

This British Standard is the UK implementation of ISO/IEC 24735:2021. It supersedes BS ISO/IEC 24735:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/3, IT Printers and Cartridges.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Published by BSI Standards Limited 2021

ISBN 978 0 539 02105 9

ICS 37.100.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2021.

Amendments/corrigenda issued since publication

Date	Text affected

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INTERNATIONAL STANDARD

ISO/IEC 24735

Third edition
2021-04

Information technology — Office equipment — Method for measuring digital copying productivity

Technologies de l'information — Équipements de bureau — Méthode de mesure de la productivité d'un photocopieur numérique

Reference number
ISO/IEC 24735:2021(E)

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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.

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 document 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 or www.iec.ch/members_experts/refdocs).

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

This third edition cancels and replaces the second edition (ISO/IEC 24735:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 3 has been modified to add new definitions and removed definitions of terms not used in the text;

— added “ready delay time” requirement to “test measurement” procedures;

— annex structure has been changed to be consistent with other productivity standards;

— added minimum declaration example to Annex A;

— added Annex D for the procedure to determine the “ready delay time”.

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 and www.iec.ch/national-committees.

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Introduction

Many digital copying devices produce copied pages at a different rate than their nominal speed when running with different modes (simplex, duplex, copying quality modes), different substrate grammage and collating and/or finishing options. The degree to which a reduction in productivity is experienced depends significantly on other parameters of the job stream. The most dominant of the parameters of the job stream are: the number of original pages in a set to be printed, whether output pages are single-sided or double-sided, image quality modes selected, B&W and colour reproduction job stream, number of print sets to be produced, substrate size used, run length and finishing options.

This document provides a general method for measuring productivity when the above-mentioned job stream parameters for digital copying devices are taken into consideration. This document also includes instructions for the creation of test charts. It allows manufacturers and buyers of digital copying devices to describe the productivity of various digital copying devices with respect to representative office usage.

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Information technology — Office equipment — Method for measuring digital copying productivity

1 Scope

This document specifies a method for measuring the digital copying productivity of digital copying devices and multifunctional devices with various copying modes. It is applicable to digital copying devices and multifunctional devices equipped with automatic document feeder (ADF) and collating function. This document is intended to be used for black and white (B&W) as well as colour digital copying devices and multifunctional devices of any underlying marking technology. It allows comparison of the throughput copying rates for a machine operated in various available operating modes (simplex, duplex, size of substrates, 2-up, etc.) and various available digital image processing configurations. This document includes test files, test setup procedures, test procedures, and reporting requirements for digital copying productivity measurements.

This document is not intended to be used for devices which are not able to copy on a media size of A4/8,5" × 11", devices that do not have an ADF, or devices which are not able to collate multiple copies of original prints from a test set.

This document is not intended to replace manufacturer's rated speeds.

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.

ISO 536, *Paper and board — Determination of grammage*

ISO 2470-1, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 1: Indoor daylight conditions (ISO brightness)*

ISO/IEC 24734, *Information technology -- Office equipment--Method for measuring digital printing productivity*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 24734 and the following 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
cpm
copies per minute
copying rate, excluding time to first page copied, measured when producing pages in a continuous copying mode for one minute with a single static document using a nominal grammage substrate

Note 1 to entry: Nominal copying speed is expressed in copies per minute or *images per minute (ipm)* (3.5).

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3.2
duplex
duplex copying
two-sided copying
1:2 mode
2:2 mode
<copy> use of a copying device to make a number of copies with the copying being done on both sides of the sheet

Note 1 to entry: 1:2 mode refers to simplex originals that are copied to 2-sided output.

Note 2 to entry: 2:2 mode refers to two sided originals that are copied to 2-sided output.

3.3
feature performance test
<copy> optional test used to evaluate productivity changes with various copying and finishing features enabled

Note 1 to entry: The feature performance test suite is run with default copying system settings to establish a base line, and then with the selected feature (e.g. stapling) ON, for comparison.

3.4
full report
<copy> presentation of results including the *first set out time (FSOT)*, *estimated saturated throughput (ESAT)* and *effective throughput (EFTP)* values in *general performance tests* (3.6) or the FSOT and ESAT values in *feature performance tests* (3.3) as well as the calculated averages for each value

3.5
ipm
images per minute
copy rate, excluding time to first page copied, as measured when producing pages in a continuous copy mode for one minute with a single static document using a nominal grammage substrate

Note 1 to entry: Nominal copying speed is expressed in *copies per minute (cpm)* (3.1) or images per minute.

3.6
general performance test
test used to evaluate productivity of default features

3.7
simplex copying
one-sided copying
simplex to simplex
1:1 mode
use of a copying device when only a single side of a sheet is copied on

3.8
summary report
presentation of results, including the average overall *first set out time (FSOT)* and *estimated saturated throughput (ESAT)* in *general performance tests* (3.6) or the ratio of the copying performance such as FSOT and ESAT with the subject feature ON versus the copying device default base line performance (without the subject feature ON) in *feature performance tests* (3.3)

3.9
test file
digital file used for creating *test targets* (3.12)

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3.10
test run
operation of copying all pages of targets from a *test file* (3.9), in a particular system configuration, with a particular set and page count

Note 1 to entry: Copy times are recorded for each test run.

3.11
test set
<copy> all of the pages of targets from a *test target* (3.12)

3.12
test target
test chart
hard copy document used for testing per the test method, and created from a *test file* (3.9)

4 Test parameters and conditions

4.1 Copying device setup

Place the copying device on a horizontal surface and set up the copying device according to the manufacturer's recommendations.

The copying device shall be fully enclosed in its normal exterior cover. All image and copying modes should be at their factory preset configuration for the copying device. It is assumed that the settings listed in Table 1 are common to all copying devices. These listed settings shall be set to the manufacturer's default or preset condition for the device. If a device has settings not listed in Table 1, they too shall be set to default settings. For copying devices that have additional print quality and digital image processing features, those features shall be set to match their normal default condition and included in the result reporting.

Multiple copy output shall be collated. If collated output is not included in the default settings, follow the manufacturer’s recommendation for obtaining collated output. In the case that collation settings do affect performance, the faster of the results should be reported. As with other settings, the test report shall disclose the manner in which collation was achieved.

Single and multiple copy output will be ordered according to “default settings”. It is assumed that “default settings” will yield original order output for a dual output order device that supports both original order and reverse order output. If the default settings on a dual output order device yields reverse order output, then testing using original order output is required for the 1 set + 30 seconds test and the 1 set + 4 minutes test runs, optional for 1 set test.

If not the default and if supported, optional original order output on 1 set test may be done by following the manufacturer’s instructions on how to change the copying device for the result of producing original order output. If other settings change automatically as a result of changing to original order output this shall be noted on the test report.

Disabling manufacturer default installed features, routines or applications, is not allowed.

EXAMPLE 1 Examples of routines that may not be disabled include, but are not limited to the following:

— automatic cleaning;

— calibration cycles;

— energy save settings.

If the system has automatic media detect (automatic paper type selection), it can be disabled, and paper used in the test shall be selected manually. This shall be noted in the full detailed report (see Annex B). The following preset values in the test will be noted on this report format. Additional optional tests with non-default settings or configurations may be run.

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If the copying device is setup with internal or external options such as memory, sorter, or finisher as default, then these options shall be noted on the full detailed report format in the configuration options as shown in Annex B.

EXAMPLE 2 Examples of configuration options to be noted in the full detailed report:

— finisher as default;

— 160GB HDD installed.

Table 1 — Preset settings

	Preset item	Preset value
Mode	Output resolution	Default
	Output quality	Default
	Copying mode	Default
	Auto density adjustment	Default
	Collating function	Activated (tests with copy set count >= 2) Default (tests with copy set count = 1)
Paper	Paper sending direction	Default
	Paper type setting	Default
Paper-path	Paper feeding	Standard cassette
	Paper exit	Standard exit tray
	Face up exit	Default
	Duplex copying unit	Default (used in 1:2 mode and 2:2 mode).
Temporary stop	Fixing capability	Default
	Image quality stability	Default
	Capacity of paper	Default
	Others	Default

4.2 Copying device condition

All supplies used in the test(s), including paper and printing device consumables, shall be only those specified as acceptable for use by the manufacturer (or otherwise noted). If available, the number of pages printed on the engine and printed on the consumables prior to the start of the test shall be recorded and reported. The machine and all of its necessary supplies shall be acclimated in the test environment prior to conducting the test(s) at least 8 h.

4.3 Sample size

Each target shall be tested and measured at least twice for repeatability. All required tests shall be run using one device.

4.4 Paper

The output paper used in this test shall be within the range of, and/or not violate, specific written attribute guidelines and recommendations provided by the copying device manufacturer, which may include but are not limited to: size, grammage, composition, paper manufacturer(s), paper type, part number and other physical characteristics. Care shall be taken to use a paper that conforms to the copying device manufacturers' paper specifications for the default copying device settings. The paper used for the general performance test (5.4) shall be cut sheet, A4 and/or 8,5” × 11” (215,9 mm x 279,4 mm) size. Optional paper sizes may be used in the feature performance tests such as 8,5” × 14”, A3, and/or 11” × 17” (279,4 mm × 431,8 mm) size as appropriate for the test mode. The paper manufacturer, grammage, size and paper type/name used in each test shall be noted on the full detailed report.

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When sheets of paper of the size other than A4/A3 are used, the sizes shall be indicated in the places of A4 and A3 in the measurement results tables. When a comparison needs to be made between the productivity of one machine with that of other machines, the measurement shall be done with the same paper sizes. If the copying device employs "thick paper mode" for copying, then this optional mode shall be noted in the machine setup information of the full detailed report specified in Annex B.

4.5 Maintenance

Copying device maintenance shall be performed throughout testing per the manufacturer's recommendations on an as needed basis.

EXAMPLE Device maintenance examples:

— cleaning routines;

— consumables replacement.

4.6 Preparation of test targets (test charts)

The copying test file is outlined in Annex C.

The test file consists of four single sided pages. When using the test file for the copying productivity test, the test targets shall be created by printing the most recent electronic test file. If the intended machine does not have a printer function, then record the name of printer which is used to print out the actual test targets. The test targets shall be reordered to match the original electronic test file page order.

For preparation method for double sided targets, follow the outline in Annex C.

The quality of test targets may affect the productivity measurement. Test targets should be created according to the following instructions.

a) The test targets shall be printed by the equipment to be tested itself in its default-printing mode.

b) The paper used for creating the test targets shall have a brightness of at least 80 % to eliminate the influence of background.

c) The paper used for creating the test targets shall be 64 g/m^2 or above and sufficiently opaque to prevent copying of images on the backside.

d) The paper used for creating the test targets shall be free of wrinkles or other surface defects.

e) Confirm that there are no defects such as unexpected dots or contamination on the paper.

f) Page scaling shall not be used. Typically, this is done by setting page scaling to "none". Options such as "Fit to printable area" shall not be used.

The brightness shall be measured according to ISO 2470-1. The paper grammage shall be measured according to ISO 536.

4.7 Environment

The test environment, including temperature and humidity, shall be within the ranges recommended by the manufacturer for operating the device. If no recommendation is available, the following ranges shall apply:

— temperature: 18 °C to 25 °C,

— relative humidity: 30 % to 70 %.

The temperature and humidity of the test environment should be recorded in the full detailed report.

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4.8 Voltage

Input line voltage may affect productivity. The copying device shall be connected to a voltage supply within the manufacturer specified operating voltage range for the copying device under test. The voltage should be measured under no-load condition prior to each test suite and recorded in the full detailed report.

NOTE It is possible that devices that utilise a heater have a longer *FSOT* time when the line voltage is at the lower value of the recommended operating range.

5 Test method

5.1 Overview

A single set of each test target is copied and measured to determine $FSOT_{1\text{set}}$.

Multiple, *N* sets, of each test target are measured for the 1 set + 30 seconds test run to calculate $ESAT_{30\text{sec}}$ and $EFTP_{30\text{sec}}$, where *N* is the number of sets needed to meet $LSOT_{30\text{sec}} - FSOT_{30\text{sec}} \geq 30$ s. This method is used to provide varying tests for products across varying segments. This simple approach allows faster products to be tested with more sets and slower products to be tested with fewer sets without defining and categorizing products by segment.

The 1 set + 4 minutes test is a similar concept used to calculate $EFTP_{4\text{min}}$ and is intended to provide a test to illustrate that differences in productivity can occur for longer copying times compared to shorter copying times. It is understood and recognized that 4 min may be a long test for some devices, but a short test for other, higher-end devices. The 4 min time is a compromise to meet the needs of the many products across many segments covered in the scope of this document.

In order to ensure clarity between the results of each test and to avoid test result confusion that can be caused by back to back job spooling effect, each copy job test should be started only after the last copy of the previous test has been fully ejected from the machine and the device has returned to a ready state.

Repeat the (1 set test, 1 set + 30 seconds test, and 1 set + 4 minutes test) for each required/optional test target, test suite, as applicable for the relevant copying modes on the device under test. (See 7.2.)

5.2 Test measurement procedure

5.2.1 Test setup

Before testing, the following setup activities shall be completed.

a) Install the copying device following the manufacturer's recommendations.

b) Clean the surface of the image scanning device if needed.

c) The default required tests shall be run after the copying device has warmed up and entered a ready state. Use of warm-up copying (that means at least one page is copied just before testing) to ready the copying device is required in order to establish the job ready delay time.

d) Set the system parameters (such as paper grammage selection, paper size and feed orientation, quality mode, collate) for test. Record the copying device model, configuration (options), default condition and any other variations if selected. If the system has automatic media detect (automatic paper type selection), it can be disabled, and paper used in the test shall be selected manually. This shall be noted in the full detailed report.

e) Refer to Annex B for an example of settings to record. Refer to 5.4 for information on required tests and 5.5 for information on running the optional feature performance tests. Refer to Clause 6 for information on the calculation and treatment of data. Refer to Clause 7 for information on data reporting.

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f) Prepare and set the test targets that will be used in the test, identified as described in 4.6.

g) Refer to 5.4 and 5.5 to decide what tests are to be run.

h) Determine the ready delay time between jobs. The (1 set test, 1 set + 30 seconds test, and 1 set + 4 minutes test) from ready for some devices is sensitive to the ready delay time from the exit of the last page of the previous print job to the initiation of the next job. The ready delay time used shall be no shorter than 20 s and no longer than 50 s; however, care shall be taken to select a ready delay time that places the device in a stable condition. If the tester is unsure of what ready delay time will place the device in a stable condition, the procedure in Annex D shall be used to establish a ready delay time to place the device in a stable condition. The ready delay time used may be different from what Annex D would indicate as long as the (1 set test, 1 set + 30 seconds test, and 1 set + 4 minutes test) result is equivalent to the (1 set test, 1 set + 30 seconds test, and 1 set + 4 minutes test) at the ready delay time that Annex D would have selected. It shall be noted in the full report the ready delay time and whether a ready delay time found with Annex D was used.

NOTE 1 In general electro-photographic devices are in a stable condition at 50 s, although many devices are in a stable condition in less than 50 s. With inkjet devices, an unstable condition happens during a print head capping or servicing routine.

NOTE 2 Measurement of printing productivity in a multi-function device (MFD) is measured according to ISO/IEC 24734. Only copying productivity function can be measured according to this document.

5.2.2 "1 set" test from ready

The procedure to measure $FSOT_{1set}$ and $EFTP_{1set}$ is defined by the following steps.

a) Enter copy set count = 1 and press the copy start button. Start the ready delay timer when the last page has fully exited from the device.

NOTE 1 Step a) is skipped when the ready delay timer is started at the end of a different test.

b) Enter copy set count = 1 required for this specific test run on the copying device operation panel. If original document order is not the default, optionally select any necessary output order options to ensure that the 1 set run copies the output in original document order (ABCD).

c) [Start test run] At the end of the ready delay time, press the copy start button and simultaneously start the timing device (watch or otherwise).

d) Record the time for completion of one set to at least two decimal places and start the ready delay timer.

e) [End test run]

f) Run the "1 set" test, steps b) – e), twice. Calculate the average $FSOT_{1set}$ and $EFTP_{1set}$ for each test run according to Clause 6.

g) Determine if the results are consistent within ±5 % according to 5.3.2 and perform a third test run if required. (The data from the test is average of the individual runs. Three iterations are the maximum and the results from all iterations are averaged to get the required data.)

h) Calculate the average $FSOT_{1set}$ and $EFTP_{1set}$ according to Clause 6.

i) Repeat steps a) – h) for each required copying mode (1:1, 1:2, 2:2) which are available on the copying device under test.

NOTE 2 The average $FSOT_{1set}$ for this test set is reported in the summary report, the full report and the full detailed report as *FSOT*. For details, see Annex A and Annex B for an example of report presentation.

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