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

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National foreword

This British Standard is the UK implementation of ISO/IEC 24734:2021. It supersedes BS ISO/IEC 24734:2014, which is withdrawn.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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Information technology — Office equipment — Method for measuring digital printing productivity

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

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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 24734:2014), which has been technically revised. It also incorporates the Corrigenda ISO/IEC 24734:2014/Cor 1:2016.

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

— added a “Normative references” clause;

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

— “Terms and definitions” clause has been modified to add new definitions and removed definitions of terms not used in the text;

— added a requirement that single copy output shall use the default “output order” setting and the alternate “order output” is an optional test;

— added reporting of the “output order” setting as part of the summary and detailed reports since it has a direct impact on the ability for results to be repeatable;

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

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

— changed paper weight to paper grammage in body and reporting.

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 printing devices produce printed pages at a different rate than their nominal speed when running with different modes (simplex, duplex, print quality modes), different substrate grammage, system environments, applications and file content, and finishing options. The degree to which a reduction in productivity is experienced depends significantly on multiple parameters of the job workflow. The most dominant of the parameters of the job workflow are: system environment, application, and job characteristics such as the number of pages in a set to be printed, single-sided or double-sided output pages, quality mode, number of print sets to be produced, substrate grammage/size used, and finishing options, and job content complexities such as monochrome vs. colour, text/vector vs. raster, page scaling and colour conversion. The existing International Standard (ISO/IEC 10561) only addresses printing throughput for Class 1 and Class 2 printers and, therefore is not suitable for comparing colour printing devices or high-speed page-oriented printing devices with many finishing options and connectivity configurations.

This document provides a general method for measuring the productivity when the above-mentioned job workflow parameters for digital printing devices are taken into consideration. This document also includes a suite of test files, test-platform (hardware and software) setup guidelines, and a procedure to be used for measuring digital printing productivity. It allows manufacturers and buyers of digital printing devices to describe the productivity of various digital printing devices with respect to representative office usage patterns.

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

1 Scope

This document specifies a method for measuring the digital printing productivity of digital printing devices with various office applications and print job characteristics. This document is applicable to digital printing devices, including single-function and multi-function devices, regardless of print technology (e.g. inkjet, laser). Devices can be equipped with a range of paper feed and finishing options either directly connected to the computer system or via a network. It is intended to be used for black and white (B&W) as well as colour digital printing devices. It allows for the comparison of the productivity of machines operating in various available modes (simplex, duplex, size of substrates, etc.) and office applications when the test system environment, operating modes, and job mix for each machine are held identical. This document includes test files, test setup procedure, test runtime procedure, and the reporting requirements for the digital printing productivity measurements.

This document is not intended to be used for devices which are not able to print on a media size of A4/8,5” × 11” or for devices which are not able to collate multiple copies of a print.

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*

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
category test
test pertaining to one of two separate categories: office category, and advertising and graphics category

Note 1 to entry: The office category test is used to test and report *first set out time (FSOT)* (3.10), *estimated saturated throughput (ESAT)* (3.7) and *effective throughput (EFTP)* (3.6) using content from typical office applications and the advertising and graphics category test is used to test and report *FSOT*, *ESAT* and *EFTP* using applications and files representing more complexity, higher coverage and a higher ratio of image and graphic content such as pictures, gradients and embedded elements.

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3.2
collate
collation
device's ability to produce multiple hard copies of an electronic document in repeating original order which may be achieved through either software features or via a hardware finishing device

EXAMPLE Repeating original order 1234, 1234, 1234, etc.

Note 1 to entry: Hard disk drive (HDD) is an example of a device feature that can be used to ensure proper *output order* (3.19) by saving the images to disk then reading the saved pages to output in order.

3.3
default driver
printing device driver that is automatically selected as the default per the manufacturers' installation procedure

3.4
dual output order device
printing devices that support both *original order output* (3.18) and *reverse order output* (3.25)

3.5
duplex
duplex printing
two-sided printing
two-sided perfecting
<print> printing where the printing device can make a number of prints with the printing being done to both sides of the sheet

3.6
EFTP
effective throughput
rate at which a device produces pages measured from the initiation of the job through the complete exit of the last page of the last *test set* (3.32)

Note 1 to entry: *EFTP* is expressed in *images per minute (ipm)* (3.13). *EFTP* can be affected by the digital processing time of the test set as well as the run time of the test set.

3.7
ESAT
estimated saturated throughput
rate at which a device produces pages measured from the complete exit of the last page of the first *test set* (3.32) through the complete exit of the last page of the last test set

Note 1 to entry: *ESAT* is expressed in *images per minute (ipm)* (3.13).

3.8
feature performance ratio
ratio of the device performance [such as *first set out time (FSOT)* (3.10) and *estimated saturated throughput (ESAT)* (3.7)] with the subject feature ON versus the device default baseline performance (without the subject feature ON)

3.9
feature performance test
<print> optional test used to evaluate productivity changes with various printing and finishing features enabled

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

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3.10
FSOT
first set out time
number of seconds between the initiation of the job to the complete exit of the last page of the first *test set* (3.32)

3.11
full detailed report
presentation of information including machine setup and full measured test results

Note 1 to entry: An example of a full detailed report is shown in Annex B.

3.12
full report
<print> presentation of results including the *first set out time (FSOT)* (3.10), *effective throughput (EFTP)* (3.6) and *estimated saturated throughput (ESAT)* (3.7) values for each file tested for a given category or feature test as well as the calculated averages for the overall *FSOT*, *EFTP* and *ESAT* values

3.13
ipm
images per minute
printing rate, excluding time to first page printed, as measured when producing pages in a continuous print mode for one minute with a single static document using a nominal grammage substrate

Note 1 to entry: Nominal printing speed is expressed in pages per minute or images per minute.

3.14
initial installation state
state of the *test platform* (3.30) after the installation and configuration of the operating system and applications but before the installation of unique software, e.g. print driver for the printing device under test

3.15
interface
data transmission between the host and the printing device, such as a direct (via parallel, serial, USB, Firewire, network or wireless) or an indirect (via network router/server) connection

3.16
LSOT
last set out time
number of seconds between the initiation of the job to the complete exit of the last page of the last *test set* (3.32)

3.17
N-up
inclusion of *N* page images on a single side of a single sheet of paper

Note 1 to entry: *N* is typically 1, 2 or 4 original images.

EXAMPLE 2-up copy mode scans two originals and creates one sheet of paper with two originals on it.

3.18
original order output
in-order output
printed document output stack is in the same order as the original electronic document

Note 1 to entry: For a device that prints *simplex* (3.27) imaged media side up, the device would print pages in reverse order 4321 for the output stack to be in the same order 1234 as the original electronic document when viewed by the user.

Note 2 to entry: For a device that prints simplex imaged media side down, the device would print pages in order 1234 for the output stack to be in the same order as the original electronic document when viewed by the user.

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3.19
output order
order of printed pages in the output stack relative to the original electronic document

Note 1 to entry: The original document is ordered 1234, the printed output can be either 1234 or 4321.

3.20
PDL
page description language
commands and data structures that a printing system interprets to produce an intended print page image

3.21
performance test
test used to evaluate productivity by providing *first set out time (FSOT)* (3.10), *effective throughput (EFTP)* (3.6) and *estimated saturated throughput (ESAT)* (3.7) without using any special feature or mode, including both the *simplex* (3.27) printing mode and *duplex* (3.5) printing mode if available

3.22
RIP
raster image processor
component used in a printing system, which produces a bitmap

3.23
ready
ready state
state which a device typically enters after the exit of the last page of the last job and the device is in a stable condition, but fully warmed up and prepared to operate

Note 1 to entry: While in the ready state, systems not directly involved with marking the media are allowed to be in motion.

EXAMPLE Fans may still be spinning and all other motors stopped.

3.24
ready delay time
required delay time from the complete exit of the last page of the previous job to the start of the next job

3.25
reverse order output
printed document output stack is in the reverse order as the original electronic document

Note 1 to entry: For a device that prints *simplex* (3.27) imaged media side up, the device would print pages in order 1234 for the output stack to be in the reverse order 4321 as the original electronic document when viewed by the user.

Note 2 to entry: For a device that prints simplex imaged media side down, the device would print pages in reverse order 4321 for the output stack to be in the reverse order 4321 as the original electronic document when viewed by the user.

3.26
set count
total number of sets printed during a *test run* (3.31), with set count N, and then N (as in N *test sets* (3.32)) × M (number of pages in one *test file* (3.29)) pages will be printed

Note 1 to entry: This is often referred to as copy count in the application or print driver setting.

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3.27
simplex
simplex printing
use of a printing device when only a single side of a sheet is printed on

Note 1 to entry: Single-sided printing mode is similar to the copying modes often referred to as 1:1 mode, simplex to simplex, or single-sided originals to single-sided copies.

3.28
summary report
presentation of results including the average overall *first set out time (FSOT)* (3.10) and *estimated saturated throughput (ESAT)* (3.7) values calculated for a given category or feature test

3.29
test file
individual files used for testing as per the test method

EXAMPLE A single Microsoft® Excel®[1)] file within the office test is a "test file".

3.30
test platform
set of hardware and software system components configured to perform the collection of digital printing productivity tests

Note 1 to entry: The test platform includes, but is not limited to, a computer installed with an operating system and applicable application software, installed printing device software, hardware and software *interfaces* (3.15), and timing devices (stopwatch or automated).

3.31
test run
operation of printing one *test file* (3.29), in a particular system configuration, with a particular set and page count

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

3.32
test set
<print> all of the pages of a single *test file* (3.29)

3.33
test suite
combination of *test files* (3.29) for each *category test* (3.1)

EXAMPLE 1 The office category test suite consists of three test files.

EXAMPLE 2 The advertising and graphics category test suite consists of four test files.

4 Test parameters and conditions

4.1 Test platform

Due to the rapid change of computer technology, a common test platform (hardware and software) that can be used for productivity testing over time is not considered practical. Instead, when a test platform is used, the test platform system parameters that may affect digital printing productivity measurements (see Annex E) shall be recorded.

1) Microsoft Excel is the trademark of a product supplied by Microsoft. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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4.2 Test platform test setup procedures

4.2.1 Initial platform setup

The test platform hardware should be installed as per the manufacturer's instructions. The test platform hardware information shall be recorded as listed in Annex E. The test platform operating system and applications should be installed as per the manufacturer's instructions. The test platform operating system and application information shall be recorded as per Annex E. All settings or selections made during installation that differ from the application's default settings or operating system's default settings shall be recorded.

The test platform should be configured for the appropriate connection environment, such as direct USB connection or network Ethernet connection, and the information shall be recorded as per Annex E along with all settings and selections that differ from the installation default configuration.

It should be verified that the test platform is configured for optimal performance by evaluating system parameters such as hard disk fragmentation and compression, swap memory size, etc. Any settings, changes or optimizations made that differ from the installation default condition shall be recorded.

The test platform is now in the initial installation state. All recorded settings shall be included in the full detailed report.

4.2.2 Creation of disk image of test platform (optional)

Disk imaging software may be used to enable the system to be restored to the initial installation state. Create the disk image after the test platform has been configured and before the print driver for the printing device is installed. Record the disk imaging software used and all settings that differ from the imaging software's installation default condition.

4.2.3 Initial test state

The test platform shall be restored to the initial installation state before beginning the sequence of tests for each new printing device. Products that are of the same distinct print system can share testing and reports. Two or more products or bundles may be part of a distinct print system when they use the same print mechanism and operating points, and there are no differences that might be expected to affect performance. Devices with differences that could affect performance are not part of the same distinct print system, and are different print systems, even if they use the same print mechanism, and shall not share testing and reports. Record the method used to establish the initial installation state.

4.3 Printing device system setup

Place the printing device on a horizontal surface and setup the printing device according to the manufacturer's recommendation. Install the software (driver, port, etc.) recommended by the manufacturer. Use the most recent print driver available from the manufacturer. The driver and driver version shall be recorded on the test report.

The standard test shall be conducted using the manufacturer's default driver for the given printing device. If a default driver is not installed/selected automatically by the manufacturer's installation procedure, consult the manufacturer's documentation and use the recommended driver. All image, print quality, mode and speed modifiers shall be at their factory preset configuration for the printing device and default installed condition for the driver. If the printing device and driver differ, then the driver defaults shall be used. Disabling manufacturer default installed features, routines or applications, is not allowed.

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

— automatic cleaning;

— calibration cycles;

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— energy save settings.

Testing shall be carried out in the specified modes, regardless of whether they are default settings or not.

EXAMPLE 2 If the default driver setting is duplex, the setting is changed to simplex for the simplex tests.

Other modes that may need to be modified for specific tests include B&W mode on colour devices, paper size, paper scaling and collation. It is allowable to disable automatic media detect and select plain paper. All changes to the default settings shall be recorded in the full detailed report.

The file shall be rendered on the page in a size corresponding to the dimensions in the test page description.

EXAMPLE 3 When testing an A4 sized document, the media settings shall be set to A4, and when testing an 8,5" × 11" (215,9 mm × 279,4 mm) sized document, set to 8,5" × 11" and so forth.

Verify that the printing device and print driver default page margin settings are not larger than 12,7 mm (0,5 inches). Adjust the settings as necessary to insure the test page printable area is rendered correctly. Adjust the settings as necessary to insure the test pages printable area is rendered to cover the paper page area as shown in the softcopy display of the test file. Any modifications to the printing device or print driver settings shall be recorded. Page placement modifiers such as page centring and auto-rotation can be used to place the image properly on the page. Any change from the printing device defaults shall be recorded in the full detailed report.

Adjust the settings such as turning off "page scaling" setting to ensure the test page printable area is rendered correctly.

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. If it is not the default and if it is supported, optional original order output may be done by following the manufacturer's instructions on how to change the printing device or driver 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.

For colour and B&W printing devices, printing the three files in the office suite, using default settings is required. The output of the three files on a colour device shall be in colour, whereas the output of the three files on a B&W device shall be in B&W. For colour printing devices, an optional B&W result may be reported by using the same three colour files, changing the printing device or driver to produce B&W output, but maintaining the default quality or resolution setting.

Procedurally, the optional B&W output on a colour device test shall be done as follows: select the printing device or driver options which are intended to produce B&W only output. Follow the manufacturer's instructions on how to change the printing device or driver for the result of producing B&W output utilising only the black toner or ink. If other settings change automatically as a result of changing to B&W mode, such as quality mode, this shall be noted on the test report. If B&W printing is performed by composite black, it should be reported.

NOTE Common means of setting a printing device in B&W include, but are not limited to, selecting a B&W option in the driver. In the driver, it is possible that this appears as: "print in B&W", "print in grayscale" or "print in black only". The selection of B&W printing can occur in several places in the driver and printing device. When the best method to set the printing device to print in B&W only is in question, it is best to contact the manufacturer regarding the best method to change this setting.

Additional tests may be conducted using other, non-default, drivers or printing device description languages provided by the manufacturer for the printing device. Additional tests may also be conducted using other settings available with the device. Such settings may be, but are not limited to, print quality and speed modifier choices available in the driver. The results of such additional tests

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will be documented as having system parameters that differ from the factory defaults and shown in comparison to the default system parameter results.

4.4 Printing device connection

Connection to the test platform should be determined by the manufacturer's targeted usage. A printing device intended to be shared by several users should be connected via the network connection with which the printing device is equipped from the manufacturer. A printing device intended to be personal or desktop should be connected direct to the test computer (such as USB). The connection type, version, and all settings that differ from the system or printing device defaults shall be recorded and reported.

4.5 Printing 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.

4.6 Sample size

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

4.7 Paper

The paper used in this test shall be within the range of, and/or not violate, specific written attribute guidelines and recommendations provided by the printing 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 printing device manufacturer's paper specifications for the default printing settings. The paper manufacturer, grammage, size and paper type/name used in each test shall be noted on the report. The paper grammage shall be measured according to ISO 536.

In all cases the paper size used shall be indicated in the measurement results tables, and the paper feed orientation shall be noted in the test report. When a comparison is made between the productivity of one machine with that of other machines the measurement shall be done with the same paper sizes and paper feed orientation.

4.8 Maintenance

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

EXAMPLE Cleaning routines or consumables replacement.

4.9 Test files, test suites and software applications

The productivity test suites and test files are specified in Annex C. The tests shall be conducted using the standard official electronic test files as the input. Failure to use the exact files as specified in Annex C shall invalidate test results. The versions of the test files and application software used shall be included in the test report.

A single set of each test file is printed and measured to determine *FSOT*. Multiple, *N* sets, of each test file are printed and measured for the 1 set + 30 seconds test run to calculate *ESAT* and *EFTP*, where *N* is the number of sets needed to meet *LSOT* - *FSOT* ≥ 30 s. This method is used to provide varying tests for products across varying segments. This approach allows faster products to be tested with more sets and slower products to be tested with fewer sets without defining and categorizing products

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by segment and weighting some test pages more heavily than others. The 1 set + 4 minutes test is a similar concept used to calculate *EFTP* and is intended to provide a test to illustrate that differences in productivity can occur for longer printing times compared to shorter printing 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.

The office category test is the required test. The advertising and graphics category test is an optional test. If the printing device under test serves more than one market category, or if testing more applications and content is of interest, both category tests can be tested and measured.

The feature performance test is an optional test. The feature performance test is used to compare baseline *FSOT* and *ESAT* (obtained using a default print system configuration) to *FSOT* and *ESAT* obtained using a selected print system feature (e.g. stapling). When such a comparison is desired, the optional feature performance test (see 5.5) can be added to the category test. The selected feature performance test file is run with default print system settings to establish a base line, and then with the subject feature ON, for comparison. The choice of whether "office" or/and "advertising and graphics", or/and "feature performance" test file is used depends on what areas of the market that the printing device under test is intended to be used. The baseline test choice ("office" or "advertising and graphics") shall be noted in the summary and full report (especially important for the feature performance ratio calculation versus the base).

4.10 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 shall be recorded in the full detailed report.

4.11 Voltage

The printing device shall be connected to a voltage supply within the manufacturer specified operating voltage range for the printing 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 (1 set test) of the relevant test file is printed in order to measure first set out time from the 1 set test ($FSOT_{1set}$). Multiple, *N* sets, of each relevant test file are printed and measured for the 1 set + 30 seconds test run to calculate estimated saturated throughput ($ESAT_{30sec}$) and effective throughput ($EFTP_{30sec}$), where *N* is the number of sets needed to meet $LSOT_{30sec}$ - $FSOT_{30sec}$ ≥ 30 s, and $LSOT_{30sec}$ is the last set out time for the 1 set + 30 seconds test. The 1 set + 4 minutes test is a similar concept used to calculate $EFTP_{4min}$.

The 1 set + 30 seconds test is used to provide a test for products across varying segments. Without defining and categorizing products by segments, this simple method allows faster products to be tested with more sets and slower products to be tested with fewer sets, therefore more consistent with their usage.

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The 1 set + 4 minutes test is intended to provide a test to illustrate that differences in productivity can occur for longer printing times compared to shorter printing 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 print job test should be sent only after the last set 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 file, test suite, as applicable for the relevant printing modes on the printing device under test. (See Table 1, Table 2, and/or Table 3.)

5.2 Test measurement procedure

5.2.1 Test setup

Before testing, the following setup activities shall be completed.

a) Install the test platform into the initial installation state per 4.2.1.

b) Install the printing device and driver software following the user's manual and test setup requirements. The default required tests shall be run after the printing device has warmed-up and entered a ready state. Use of warm-up printing (that means at least one page is printed just before testing) to ready the printing device is acceptable.

c) Set the system parameters (such as paper grammage selection, paper size and feed orientation, quality mode, output order) for test. If the system has automatic media detect, it should be disabled and the paper to be used in the test should be selected. Record the printing device model, configuration (options), default condition and any variant if selected.

d) Assemble the files that will be used in the test, identified as described in 4.9. Ensure that the necessary applications are available on the computer that will be used in the test.

e) Printing mode control: configure the printing mode for the current portion of the test. Default printing modes require no changes in the driver of the printing device under test, other than to turn off page scaling, to turn collation ON if it is not ON by default except for 1 set test, to select plain paper, duplex, or for B&W on a colour printing device, set the mode of the print driver to produce B&W output. The test report shall include a record of the printing device modes selected and how they were selected. Some devices support multiple duplex options. The default duplex option should be used and the orientation recorded.

   EXAMPLE Book versus tablet, long edge vs. short edge.

   The manner in which collation, set count and B&W are selected can affect performance test results. Preliminary evaluation of the settings and their impact on performance throughput is recommended. Refer to the product's operator manual for additional information regarding recommended settings.

f) Refer to 5.4 and 5.5 to decide what tests are to be run. Refer to Annex B for an example of how to record test settings.

g) 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 are 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

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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. The ready delay time and whether a ready delay time found with Annex D was used shall be noted in the full report.

NOTE 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.

5.2.2 "1 set" test from ready

Procedure to measure $FSOT_{1set}$ and $EFTP_{1set}$ is defined by the following steps:

a) Open an application and corresponding test file to be used in step b). Print a warm up page prior to starting the test. Start the ready delay timer when the 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) [Start test run] Application and test file control: Open an application and the corresponding test file for that application on the test machine.

c) Select Print from the application. If default document output order is not the correct order, the necessary ordering option may be selected to ensure that the output is in original document order (1234).

d) At the end of the ready delay time, select "OK" and simultaneously start the timing device (watch or otherwise). The time measurement is started when the "OK" button in the printing application window is selected.

e) Record the time in seconds for completion of one set (the last page of the test file has been fully ejected from the machine) to at least two decimal places and start the ready delay timer.

f) [End test run] Close the test file and associated software application after the test file has been printed.

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

h) Determine if the results are consistent within ± 5 % according to 5.3.2 and perform a third test run if required.

i) Calculate the average $FSOT_{1set}$ and $EFTP_{1set}$.

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

5.2.3 "1 set + 30 seconds" test from ready

The procedure to measure $ESAT_{30sec}$ and $EFTP_{30sec}$ is defined by the following steps.

a) Open an application and corresponding test file to be used in step b). Print a warm up page prior to starting the test. Start the ready delay timer when the 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) [Start test run] Application and test file control: open an application and the corresponding test file for that application on the test machine.

c) Select print from the application. Enter print set count = N required for last set out time $LSOT_{30sec} - FSOT_{30sec} \geq 30$ s. Select any necessary collate options to ensure that multiple set runs print the output in collated original order (1234..., 1234, ...). All tests of the same file shall use the same set

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count. For the second and third tests, use the same set count used in the first test. Record where collate and set count settings were made in the driver/application.

NOTE 2 This $FSOT_{30sec}$ is not the same as $FSOT_{1set}$ from the 1 set test. The $FSOT_{30sec}$ measured here is used to verify $LSOT_{30sec} - FSOT_{30sec} \geq 30$ s and to calculate $ESAT_{30sec}$.

d) At the end of the ready delay time, select "OK" and simultaneously start the timing device (watch or otherwise). The time measurement is started when the "OK" button in the printing application window is selected.

e) Record the time in seconds for completion of the first set out time ($FSOT_{30sec}$) to at least two decimal places. This is the time from "OK" until the last page (first test set, first complete print of file pages) of the test file has been fully ejected from the machine.

NOTE 3 If the output paper bin capacity is less than the number of pages to be printed, the output paper is removed during the test.

NOTE 4 Each test file of the category test has four pages. Each test file of the feature performance Adobe® Reader®[2)] file has eight pages.

f) Record the time in seconds for completion of the last set out time ($LSOT_{30sec}$) to at least two decimal places. This is the time from pressing "OK" in the printing application window until the last page of the file set count (last page of the last test set) has been fully ejected from the device and start the ready delay timer.

g) [End test run] Close the test file and associated software application after the test file has been printed.

h) Run the 1 set + 30 seconds test steps b) – g) twice. Calculate $ESAT_{30sec}$ and $EFTP_{30sec}$ for each Test run according to Clause 6.

i) Determine if the results are consistent within ±5 % according to 5.3.2 and perform a third test run if required.

j) Calculate the average $ESAT_{30sec}$ and $EFTP_{30sec}$ according to Clause 6.

NOTE 5 The average $ESAT_{30sec}$ for this test set is reported in the category test full report and the full detailed report as *ESAT*. The average $ESAT_{30sec}$ for the test suite is reported in the category test summary report as *ESAT*. For detail, see Annex A and Annex B for an example of report presentation.

5.2.4 "1 set + 4 minutes" test from ready

The procedure to measure $EFTP_{4min}$ is defined by the following steps.

a) Open an application and corresponding test file to be used in step b). Print a warm up page prior to starting the test. Start the ready delay timer when the 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) [Start test run] Application and test file control: open an application and the corresponding test file for that application on the test machine.

c) Select print from the application. Enter print set count = *N* required to for last set out time $LSOT_{4min} - FSOT_{4min} \geq 4$ min. Select any necessary collate options to ensure that multiple set runs print the output in collated original order (1234..., 1234, ...). All tests of the same file shall use the same set count. For the second and third tests, use the same set count used in the first test. Record where collate and set count settings were made in the driver/application.

2) Adobe Reader is the trade name of a product supplied by Adobe Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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NOTE 2 This $FSOT_{4min}$ is not the same as $FSOT_{1set}$ from the 1 set test or the $FSOT_{30sec}$ from the 1 set + 30 seconds test. The $FSOT_{4min}$ measured here is only used to verify $LSOT_{4min}$-$FSOT_{4min}$ ≥ 4 min.

d) At the end of the ready delay time, select "OK" and simultaneously start the timing device (watch or otherwise). The time measurement is started when the "OK" button in the printing application window is selected.

e) Record the time in seconds for completion of the first set out time ($FSOT_{4min}$) to at least two decimal places. This is the time from "OK" until the last page (first test set, first complete print of file pages) of the test file has been fully ejected from the machine.

NOTE 3 If the output paper bin capacity is less than the number of pages to be printed, remove the output paper during the test.

NOTE 4 Each test file of the category test has four pages. Each test file of the feature performance Adobe Reader file has eight pages.

f) Record the time in seconds for completion of the last set out time ($LSOT_{4min}$) to at least two decimal places. This is the time from pressing "OK" in the printing application window until the last page of the file set count (last page of the last test set) has been fully ejected from the machine and start the ready delay timer.

g) [End test run] Close the test file and associated software application after the test file has been printed.

h) Run the 1 set + 4 minutes test steps b) – g) twice. Calculate $EFTP_{4min}$ for each test run according to Clause 6.

i) Determine if the results are consistent within ±5 % according to 5.3.2 and perform a third test run if required.

j) Calculate the average $EFTP_{4min}$ according to Clause 6.

5.3 Test method process

5.3.1 Suggested flow chart

The suggested test execution flow is shown in Figure 1.

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