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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

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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 document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 24734 was prepared by Technical Committee ISO/TC JTC1, *Information technology*, Subcommittee SC 28, *Office equipment*.

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 weight, 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 weight/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 Standards (ISO/IEC 10561) only address printing throughput for Class 1 and Class 2 printers and (ISO/IEC 14545) only addresses analog copier productivity, therefore both are not suitable for comparing colour printing devices or high-speed page-oriented printing devices with many finishing options and connectivity configurations.

This International Standard provides a general method for measuring the productivity when the above-mentioned job workflow parameters for digital printing devices are taken into consideration. This International Standard 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.

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

1 Scope

This International Standard specifies a method for measuring the productivity of digital printing devices with various office applications and print job characteristics. This International Standard 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 International Standard includes test files, test setup procedure, test runtime procedure, and the reporting requirements for the digital printing productivity measurements.

This International Standard is not intended to be used for devices which are not able to print on a media size of A4/8.5”x11” or for devices, which are not able to collate multiple copies of a print.

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

The productivity of a digital printing device depends on factors other than the printing device itself. These include, but are not limited to, computer manufacturer and model, central processor type and speed, RAM and hard disk memory capacity and speed, software driver, version of the application being used, operating system, and the type and speed of the communication path from computer to printing device, etc. Because of this, in order to make useful and accurate direct comparisons of printing productivity with this International Standard, the same computer system hardware and software shall be used for measuring the printing devices if for the purpose of being directly compared one to another. For every printing productivity measurement, the basic specifications of the computer hardware and software shall be included with the results of the printing productivity measurement.

NOTE Important note for the use of this International Standard. There are other factors that influence the number of prints that a person can make on a printing device within a defined time period. These factors include typical job portfolio that is printed on a particular printing device, reliability of the system, downtime due to a service call, ease-of-use, (un)load paper during printing, routine maintenance, interaction with other users of the printing device and the network, etc. Such productivity items are not taken into account within the scope or methods of this International Standard.

2 Terms and definitions

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

2.1
category test
test pertaining to one of two separate categories; Office category and Advertising and Graphics category, whereby the Office Category test is used to test and report FSOT, ESAT and EFTP 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

2.2
collation
printing device's ability to produce multiple hard copies of an electronic document in repeating original order, such as 1234, 1234, 1234.etc, which may be achieved through either software features that ensure proper output order or via a hardware finishing device

2.3
default driver
printing device driver that is automatically selected as the default per the manufacturers' installation procedure

2.4
duplex printing
printing where the printing device can make a number of prints with the printing being done to both sides of the sheet

NOTE Other equivalent terms are "two-sided printing" or "two-sided perfecting".

2.5
EFTP
effective throughput
average speed 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

NOTE EFTP is expressed in images per minute (ipm). EFTP can be affected by the digital processing time of the test set as well as the run time of the test set.

2.6
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 through the complete exit of the last page of the last test set

NOTE ESAT is expressed in images per minute (ipm).

2.7
feature performance percentage
ratio of the printing performance (such as FSOT and ESAT) with the subject feature ON versus the printing device default baseline performance (without the subject feature ON)

2.8
feature performance test
optional test used to evaluate productivity changes with various printing and finishing features enabled

NOTE 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.

2.9
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

2.10
full detailed report
presentation of information including machine setup and measured test results

2.11
full report
presentation of results including the FSOT, EFTP and ESAT 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

2.12
host-based controller
⟨printing devices with a host-based controller⟩ page description interpreter and RIP reside in the host computer and these processes convert the PDL into a simplified format such as a raster bitmap, and the simplified data are then sent to the printing device

NOTE Most of the data and images processing is done on the host computer side. The performance of the printing device depends upon the whole system — the host computer, the data transfer, and the printing device.

2.13
initial installation state
state of the test platform 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

2.14
input image equivalent
number of original electronic input images printed independent of the number of hardcopy output sheets the images are printed on

NOTE Input image equivalent is expressed in terms of the equivalent number of images input from the source test file. For example, if two A4-sized input images from the test file are printed on one-side of an A3 page in simplex printing, the output printed on this A3 page is 2 A4 input image equivalent. For another example, if four A4-sized input images from the test file are printed in reduction on one-side of an A4 page in a 4-up mode in simplex printing, the output printed on this A4 page is 4 A4 input image equivalent.

2.15
interface/network
interface between the host and the printing device, such as a direct (via parallel, serial, USB, Firewire or wireless) or an indirect (via network router/server) connection

2.16
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

2.17
nominal printing speed
printing rate, excluding time to first page printed, and measured when producing pages in a continuous printing mode with a single static data page using a nominal weight substrate

NOTE Nominal printing speed is expressed in pages per minute or images per minute.

2.18
PDL
page description language
specifies commands and data structures that a printing system interprets to produce an intended print page image

2.19
PDL-based controller
⟨printing devices that include a PDL-based controller (such as a Postscript RIP)⟩ host computer processes the page information via a software application into a standardized or well-known format (with embedded PDL and compression) and the standardized/well-known page data is sent to the printing device via an interface/network

NOTE The printing device's controller has its own decompressor, PDL Interpreter and RIP, with job storage and the required large amount of processing power. Most of the final page data processing, images processing, job and file management is done on the printing device side. However, the performance of the printing device still depends upon the whole system - the host computer, the data transfer, and the printing device.

2.20
printing device
produces hard copy output, or prints on media such as paper, from digital electronic documents

NOTE The function of the device is not limited to printing only, such as is the case with multi-function devices, which have the ability to print and perform other functions such as copy, scan and/or digital send.

2.21
RIP
raster image processor
component used in a printing system, which produces a bitmap

2.22
set count
the total number of sets printed during a test run, with set count N, and then N (as in N test sets) x M (number of pages in one test file) pages will be printed.

NOTE This is often referred to as copy count in the application or print driver setting.

2.23
simplex printing
use of a printing device when only a single side of a sheet is printed on

NOTE 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.

2.24
summary report
presentation of results including the average overall FSOT and ESAT values calculated for a given category or feature test

2.25
test file
refers to individual files used for testing as per the test method

EXAMPLE A single Microsoft Excel file within the Office test is a “test file”.

2.26
test platform
set of hardware and software system components configured to perform the collection of digital printing productivity tests, including, but not limited to a computer installed with an operating system and applicable application software, installed printing device software, hardware and software interfaces, and timing devices (stopwatch or automated)

2.27
test run
refers to the operation of printing one test file, in a particular system configuration, with a particular set and page count

NOTE Print times are recorded for each test run.

2.28
test set
all of the pages of a single test file

2.29
test suite
refers to the combination of test files for each individual test

EXAMPLE The Office Category test suite consists of three test files.

3 Test Parameters and Conditions

3.1 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 considered to be not practical. Instead, when a test platform is used, the test platform system parameters that may affect digital printing productivity measurements (see Annex A) shall be recorded.

3.2 Test Platform Test Setup Procedures

The test platform test setup procedure includes sections for setting up the test platform computer and the printing device to be tested.

3.2.1 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 A. 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 A. All settings or selections made during installation that differs 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 A 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.

3.2.2 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.

3.2.3 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. Each printing device product bundle or printing device hardware configuration should be considered a "new printing device". Record the method used to establish the Initial Installation State.

3.3 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 specified 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 pre-set 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. Examples include, but are not limited to the following: automatic cleaning or calibration cycles, bi-directional communications and energy save settings. It is allowable to disable automatic media detect and select plain paper.

The file shall be rendered on the page in a size corresponding to the dimensions in the test page description. For example, when testing an A4 sized document, the media settings shall be set to A4, and when testing a 8.5”x11” size document, set to 8.5”x11”, and so forth. Verify 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 centering 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.

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

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.

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 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 manufacture's instructions on how to change the printing device or driver for the result of producing B&W output utilizing only the black cartridge. 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, this might appear 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 will be documented as having system parameters that differ from the factory defaults and shown in comparison to the default system parameter results.

3.4 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.

3.5 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). 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.

3.6 Sample Size

Each file shall be tested and measured at least twice for repeatability.

3.7 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, weight, composition, paper manufacturer(s), paper type, part number and other physical characteristics. Care must be taken to use a paper that conforms to the printing device manufacturers' paper specifications for the default printing devices settings. The paper used for the Category tests [section 5.1] shall be cut-sheet, A4 and/or 8.5"x11" size. Optional paper sizes may be used in the Feature Test such as 8.5"x14", A3, and/or 11"x17" size as appropriate for the test mode. The paper manufacturer, weight, size and paper type/name used in each test shall be noted on the report.

3.8 Maintenance

Print engine maintenance shall be performed throughout testing per the manufacturer's recommendations on an as needed basis. (For example, cleaning routines or consumables replacement).

3.9 Test Files, Test Suites and Software Applications

The productivity test suites and test files are specified in Annex B.1-3. The tests shall be conducted using the standard official electronic test files as the input. The most recent official files can be located at http://www.iso.org/jtc1/sc28. Failure to use the exact files as specified 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 Seconds. 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 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 minutes may be a long test for some devices, but a short test for other, higher end devices. The 4 minutes time is a compromise to meet the needs of the many products across many segments covered in the scope of this International Standard.

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 (defined in section 4.4) can be added to the category test. The Feature Performance test suite 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 "Complex" "Feature Performance" test suites are 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 "Complex") shall be noted in the Summary and Full Report (especially important for the feature performance ratio calculation versus the base).

Refer to Annex B to determine the necessary test files to be used for the specific test to be run. Locate the source files at http://www.iso.org/jtc1/sc28.

3.10 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 %

NOTE The temperature and humidity ranges of the test environment should be recorded in the Full Detailed Report.

3.11 Voltage

The printing device shall be connected to a voltage supply within the manufacturer specified operating voltage range for the printing device under test.

NOTE The measurement should be made under no-load condition prior to each test.

4 Test Method

This section defines the test methods.

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 $LSOT_{30sec}$ - $FSOT_{30sec} \geqslant 30$ seconds, 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.

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 minutes may be a long test for some devices, but a short test for other, higher end devices. The 4 minutes time is a compromise to meet the needs of the many products across many segments covered in the scope of this International Standard.

In order to ensure clarity between the results of each tests 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 fully ejected from the machine and the device has returned to a ready state.

4.1 Test Measurement Procedure

Before testing:

1) Install the test computer and a clean code image per the test setup requirements.

2) Install the printing device, driver and application 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.

3) Set the system parameters (such as paper weight selection, paper size and feed orientation, quality mode) 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.

4) Assemble the files that will be used in the test, identified as described in Section 3.9. Ensure that the necessary applications are available on the computer that will be used in the test.

5) 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, 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 it was selected.

NOTE Some devices support multiple duplex options (for example, book versus tablet, long edge vs. short edge). The default duplex option should be used and the orientation recorded.

NOTE The manner in which collation, set count and B&W is 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.

6) Refer to sections 4.3 and 4.4 to decide what tests are to be run. Refer to Annex D for an example of how to record test settings.

1 Set Test Procedure to measure $FSOT_{1set}$ and $EFTP_{1set}$:

1) Application and test file control: [Start Test run] Open an application and the corresponding test file for that application on the test machine.

2) Select Print from the application.

3) 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.

4) Record the time in seconds for completion of one set (the last page of the test file has fully ejected from the machine) to at least two decimal places.

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

6) Run the 1 Set Test [steps 1 – 5] twice. Calculate $FSOT_{1set}$ and $EFTP_{1set}$ for each test run according to section 5.

7) Determine if the results are consistent within ± 5% according to section 4.2.3, and perform a third test run if required.

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

NOTE 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 (consists of many test sets) is reported in the Category Test Summary Report as FSOT. For detail, see Annex C and Annex E for an example of report presentation.

1 Set + 30 Seconds Test Procedure to measure $ESAT_{30sec}$ and $EFTP_{30sec}$:

1) Application and test file control: [Start Test run] Open an application and the corresponding test file for that application on the test machine.

2) Select Print from the application. Enter Print Set count = N required for Last Set Out Time $LSOT_{30sec} - FSOT_{30sec} \geqslant 30$ Seconds. Select any necessary collate options to insure that multiple set runs print the output in collated order (1234..., 1234, ...). All tests of the same file must 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.

NOTE This $FSOT_{30sec}$ should not be confused with the $FSOT_{1set}$ from the 1 Set Test. The $FSOT_{30sec}$ measured here is used to verify $LSOT_{30sec} - FSOT_{30sec} \geqslant 30$ seconds and to calculate $ESAT_{30sec}$.

3) 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.

4) 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 fully ejected from the machine.

NOTE If the output paper tray size is less than the number of pages to be printed, remove the output paper during the test.

NOTE Each test set of the Category test has four pages. Each test set of the Feature Performance Adobe Reader file has eight pages.

5) Record the time in seconds for completion of the Last Page Out Time (LSOT) 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 fully ejected from the device.

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

7) Run the 1 Set + 30 Seconds Test [steps 1 – 6] twice. Calculate $ESAT_{30sec}$ and $EFTP_{30sec}$ for each Test run according to section 5.

8) Determine if the results are consistent within ±5% according to section 4.2.3 and perform a third test run if required.

9) Calculate the average $ESAT_{30sec}$ and $EFTP_{30sec}$ according to section 5.

NOTE 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 (consists of many test sets) is reported in the Category Test Summary Report as ESAT. For detail, see Annex C and Annex E for an example of report presentation.

1 Set + 4 Minutes Test Procedure to measure $EFTP_{4min}$:

1) Application and test file control: [Start Test run] Open an application and the corresponding test file for that application on the test machine.

2) Select Print from the application. Enter Print Set count = N required to for Last Set Out Time $LSOT_{4min} - FSOT_{4min} \geqslant 4$ Minutes. Select any necessary collate options to insure that multiple set runs print the output in collated order (1234..., 1234, ...). All tests of the same file must 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.

NOTE This $FSOT_{4min}$ should not be confused with the $FSOT_{1set}$ 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 $LSOT_{4min}$-$FSOT_{4min} \geqslant 4$ minutes.

3) 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.

4) 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 fully ejected from the machine.

NOTE If the output paper tray size is less than the number of pages to be printed, remove the output paper during the test.

NOTE Each test set of the Category test has four pages. Each test set of the Feature Performance Adobe Reader file has eight pages.

5) Record the time in seconds for completion of the Last Page 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 fully ejected from the machine.

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

7) Run the 1 Set + 4 Minutes Test [steps 1 – 6] twice. Calculate $EFTP_{4min}$ for each test run according to section 5.

8) Determine if the results are consistent within ±5% according to section 4.2.3, and perform a third test run if required.

9) Calculate the average $EFTP_{4min}$ according to section 5.

Repeat the (1 Set Test, 1 Set + 30 Seconds Test, and 1 Set + 4 Minutes Test) for each required test sets, test suites and printing mode that are available on the printing device under test.

4.2 Test Method Process

4.2.1 Suggested Test Method

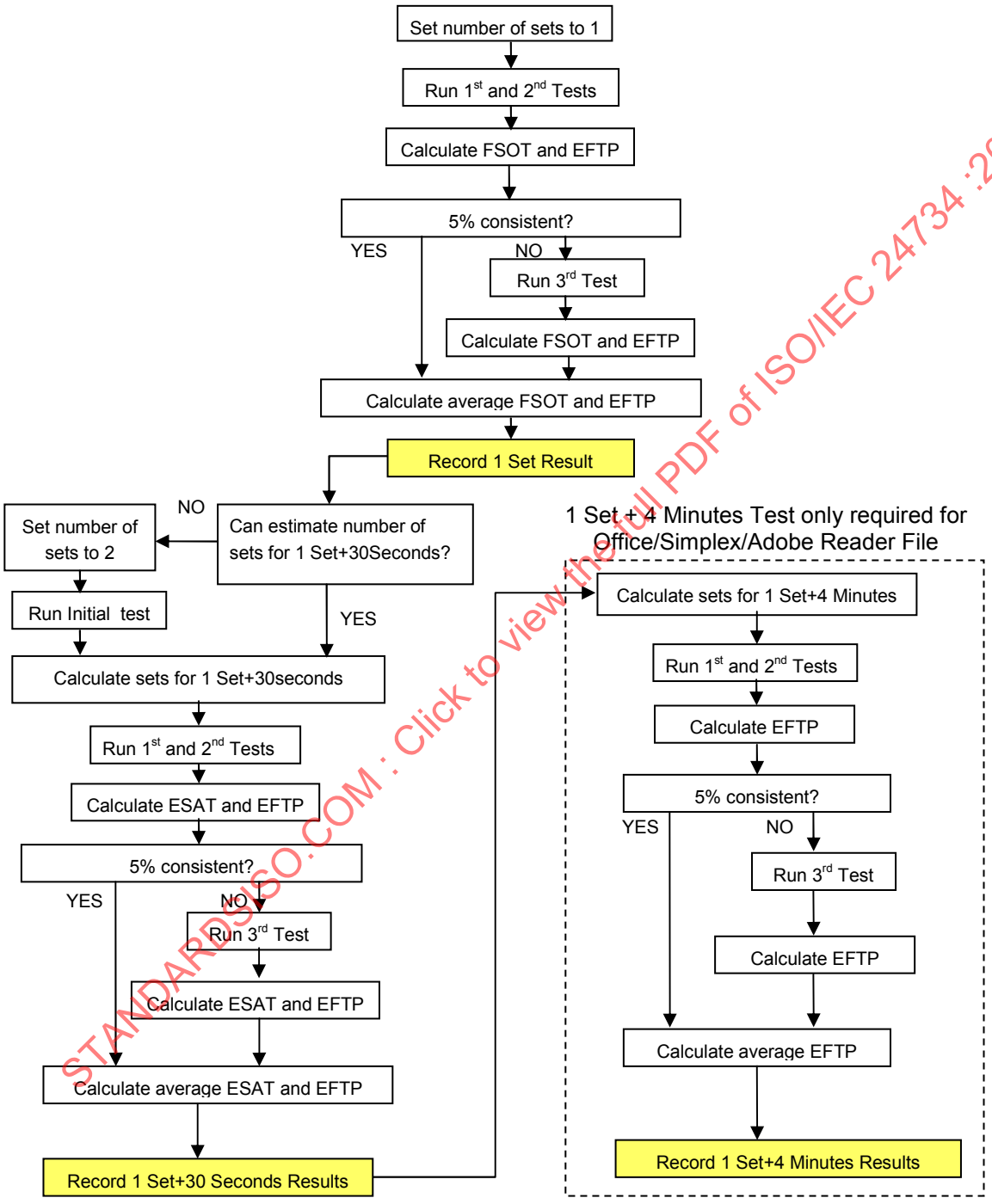


Figure 1 — Test Method Process Flow Chart

4.2.2 Estimating the Set Count

1 Set + 30 Seconds Test:

The test may begin with an initial set count $N_{initial}$ = 2 or by estimating the number of sets needed, provided that the tester has sufficient information for estimation beforehand. If the N = 2 test result did not meet the LSOT-FSOT $\geqslant$ 30 seconds requirement, then calculate necessary set count N_{30sec} as follows and test using the newest N_{30sec} as the set count. The following equation can be used to estimate then number of sets needed:

$$estN30\,\text{sec} = RoundUp\left[\frac{30\times\left(Ninitial-1\right)}{LSOTinitial-FSOTinitial}+1\right]$$

The number of sets tested should result in $LSOT_{30sec}$-$FSOT_{30sec}$ $\geqslant$ 30 seconds as close as possible. If the results of a test run gives $LSOT_{30sec}$ - $FSOT_{30sec}$ < 30 seconds the number of sets shall be increased and all runs re-tested.

NOTE The 1 Set + 30 Seconds Test is devised to make $LSOT_{30sec}$ - $FSOT_{30sec}$ long enough to minimize measurement error of ESAT and short enough to avoid stop caused by calibration etc.

1 Set + 4 Minutes Test:

The 1 Set + 4 Minutes Test is only required for the Adobe Reader test file. Calculate necessary set count N_{4min} for the 1 Set + 4 Minutes Test as follows by using the results of the 1 Set + 30 Seconds test:

$$estN4\,\text{min} = RoundUp\left[\frac{240\times\left(N30\,\text{sec}-1\right)}{LSOT30\,\text{sec}-FSOT30\,\text{sec}}+1\right]$$

The number of sets tested should result in $LSOT_{4min}$ -$FSOT_{4min}$ $\geqslant$ 4 minutes. If the results of a test run give $LSOT_{4min}$ -$FSOT_{4min}$ < 4 minutes the number of sets shall be increased and all runs re-tested.

4.2.3 5% Consistency Criteria

If the first two test runs are not consistent within ±5%, then a third test run is required. Equations for ESAT and EFTP can be found in section 5.

$$Consistency = \frac{2\times FSOT1}{FSOT1+FSOT2}-1$$

$$Consistency = \frac{2\times ESAT1}{ESAT1+ESAT2}-1$$

$$Consistency = \frac{2\times EFTP1}{EFTP1+EFTP2}-1$$

4.3 Category Tests

The two Category Tests are 1) Office and 2) Advertising and Graphics (see Annex B1-2 for detail of these test suites). Testing the Office Category Test is required for all devices adhering to this International Standard and is the test used to measure FSOT, ESAT and EFTP. The Advertising and Graphics Category Test files represent more complexity, higher coverage, and a higher ratio of image and graphic content such as pictures, gradients and embedded elements. The Advertising and Graphics Category test is optional and may be used to measure FSOT, ESAT and EFTP values for specific comparison in this category.

4.3.1 Office Test

The Office Test is required for all devices adhering to this International Standard. Test using the test files outlined in Annex B for this test suite and using the modes and set count requirements shown in Table 1 below. The test method and measurement procedures are described in Section 4.1-4.2. Only A4/8.5"X11" size media is used for Category Tests. To test other media sizes, use the Feature Performance Test.

Complete the 1 Set Test, the 1 Set + 30 Seconds Test and the 1 Set + 4 Minutes Test runs for the files and modes marked “R” (Required) as outlined in Table 1. Files, set counts and modes marked “O” are optional.

It is assumed that “Default Settings” will yield black and white (B&W) output for a B&W only printing device and colour output for a colour printing device. If the Default Settings on a colour device yield B&W output, then testing using a colour output mode is also required.

Table 1 — Office Test Matrix

Set Count	Printing Modes	Application Test files		
		Word File	Adobe Reader File	Excel FIle
Single Set Run Set Count = 1	Simplex with Default Settings	R	R	R
	If Colour Printing device, Simplex with B&W mode	O	O	O
	Duplex with Default Settings	R	R	R
	If Colour Printing device, Duplex with B&W mode	O	O	O
Two Set Run Set Count = 2 (optional to test to aid in calculating N for FSOT+30 run if N can't be estimated)	Simplex with Default Settings	O	O	O
	If Colour Printing device, Simplex with B&W mode	O	O	O
	Duplex with Default Settings	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O
1 Set + 30 Seconds Run Set Count = N	Simplex with Default Settings	R	R	R
	If Colour Printing device, Simplex with B&W mode	O	O	O
	Duplex with Default Settings	R	R	R
	If Colour Printing device, Duplex with B&W mode	O	O	O
1 Set + 4 Minutes Run Set Count = N	Simplex with Default Settings	O	R	O
	If Colour Printing device, Simplex with B&W mode	O	O	O
	Duplex with Default Settings	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O

4.3.2 Advertising and Graphics Test

The Advertising and Graphics test is optional for all devices adhering to this International Standard. It is intended to give further information when comparing the performance of devices using different applications and files having higher coverage and more complex content.

Complete the 1 Set Test and the 1 Set + 30 Seconds Test runs for the files and modes marked “R*” (Required if testing the Optional Advertising and Graphics Test) as outlined in Table 2. Files, set counts and modes marked “O” are optional.

It is assumed that “Default Settings” will yield black and white (B&W) output for a B&W only printing device and colour output for a colour printing device. If the Default Settings on a colour device yield B&W output, then testing using a colour output mode is also required. Before commencing Advertising and Graphics tests, the tester should confirm the file contents from within the applications (such as InDesign and QuarkXPress) to ensure all original data components such as fonts, placed graphics such as illustrations, bitmaps and images etc are properly linked in the test platform directories and/or included in the file. The manner in which this can be confirmed, and corrected if required, will vary according to application. Refer to the application's user guide for instructions. Failure of the application to recognize and include all original data components and quality attributes as provided by this International Standard will affect performance and invalidate the results.

Table 2 — Advertising and Graphics Test Matrix

Set Count	Printing Modes	Application Test files			
		InDesign	QuarkXPress	PowerPoint	Adobe Reader
Single Set Run Set Count = 1	Simplex with Default Settings	R*	R*	R*	R*
	If Colour Printing device, Simplex with B&W mode	O	O	O	O
	Duplex with Default Settings	O	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O	O
Two Set Run Set Count = 2 (optional to test to aid in calculating N for FSOT+30 run if N can't be estimated)	Simplex with Default Settings	O	O	O	O
	If Colour Printing device, Simplex with B&W mode	O	O	O	O
	Duplex with Default Settings	O	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O	O
1 Set + 30 Seconds Run Set Count = N	Simplex with Default Settings	R*	R*	R*	R*
	If Colour Printing device, Simplex with B&W mode	O	O	O	O
	Duplex with Default Settings	O	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O	O
1 Set + 4 Minutes Run Set Count = N	Simplex with Default Settings	O	O	O	O
	If Colour Printing device, Simplex with B&W mode	O	O	O	O
	Duplex with Default Settings	O	O	O	O
	If Colour Printing device, Duplex with B&W mode	O	O	O	O

4.4 Feature Performance Test

An optional Feature Performance Test is provided as a convenient means to evaluate productivity differences with various printing and finishing features enabled. Examples of such features may include but are not limited to various RIP configurations, different paper weights, different paper sizes, stapling, hole punching, saddle stitching, etc. The results when printing with a feature enabled shall be reported as a comparison to the performance when printing from a printing device and driver in the default state with simplex selected and the feature disabled.

Two 8-page Feature Performance Test files are provided (for many printing features, test file longer than 4 pages is needed. As a compromise to balance test time and the ability to test a broad range of features, 8-page test file is used). The Adobe Reader-Office Feature Performance file is composed of content from the Office category test and the Adobe Reader-Complex Feature Performance file is composed of content from the Advertising and Graphics category test. (See Annex B.3 for details of these test files.)

NOTE The Adobe Reader-Complex Feature Performance test file should be selected when evaluating performance-enhancing features such as RIP and memory configurations. The Adobe Reader-Complex Feature Performance test file should also be selected for feature testing if printing device under test has chosen to use the Advertising and Graphics category test suite.

Feature Performance Test Procedure

The Feature Tests require testing the Feature Performance Test file using the 1 Set Test and 1 Set + 30 Seconds Test procedures in section 4.1.

First, complete the test using the manufacturer's default printing device and driver settings, (the Base Printing Mode Test). The Base Printing Mode Test is tested in simplex, A4/8.5"X11", using the appropriate Feature Performance Test file, without the feature and may be conducted only once (consisting of 2 or 3 runs as needed to satisfy the 5% consistency criteria), and the result can be used for comparison for all feature tests using the same test file. Next, complete the tests for each feature printing mode selected (the Feature Mode Test).

The set count used in Feature Performance Test shall be determined based on the requirement to satisfy the 1 Set + 30 Seconds Test procedure for the Base Printing Mode Test and each Feature Printing Mode Test independently. Features which use the same number of pages in a set only require the Base Printing Mode Test be conducted once.

NOTE The set counts used for the Base Printing Mode Test and each feature may be different.

The number of sets tested should result in $LSOT_{30sec}$-$FSOT_{30sec} \geqslant 30$ seconds as close as possible. If the results of a test run gives $LSOT_{30sec}$ - $FSOT_{30sec} < 30$ seconds the number of sets shall be increased and all runs re-tested.

If a feature test is performed on large size media (A3/11"x17") then the test should be done by printing the A4/8.5"x11" feature test files 2-up on these large output media sizes. Specifically, use two A4 size images on a A3 sheet or two 8.5"x11" size images on a 11"x17" sheet. Printing 2-up simplex with larger size media means that 2 A4/8.5"x11" sized images are printed on one side of the larger sheet (A3/11"x17"). In the case of 2-up simplex printing with A4/8.5"X11" sized media, two of the A4/8.5"X11" size images are resized (by the printing device driver) and print on one side of the A4/8.5"X11" sized media.

If the A3/11"x17" feature test is run with the A4/8.5"X11" test files as the base printing mode for comparison, one needs to report the A3/11"x17" result as in A4/8.5"X11" input image equivalent. If features such as 2-up, 4-up, image magnification, mixed paper etc are tested, results shall be reported according to A4/8.5"X11" input image equivalent.

If a feature requires a file consisting of more than 8 pages, a larger file can be created by concatenating 2 or more 8-page feature test files as required as long as the pages in the resulting file is an integer multiple of the 8-page original. If a feature needs to use more than 8 pages in a set, FSOT and ESAT for the Base Printing Mode shall be measured using the same number of pages in the set as the Feature Printing Mode. Change of this nature shall be clearly recorded in the test reports.

NOTE Due to current limitations (image size scaling, image margin requirement, mixed image layout on different pages, some combination of mixed paper sizes) in some printing device drivers, some potential feature performance tests (for example, first page 1-up, later pages 2-up) are not supported by the current test file set in the current printing productivity International Standard.

Feature Printing Mode “Staple”, is shown as example only in the following test matrix. Which feature(s) to test is determined by the tester performing the testing and only a clear description of the feature is required. If there is more than one staple option for a given device, clearly report which was tested.

Table 3 — Feature Performance Test Set

Set Count	Base Printing Mode	Feature Printing Mode	Application Test file
Single Set Run Set Count = 1	Simplex with Default Settings	Staple	8 Page 'Office' Feature Performance Adobe Reader file
1 Set + 30 Seconds Run Set Count = N	Simplex with Default Settings	Staple	8 Page 'Office' Feature Performance Adobe Reader file

4.5 Optional Special Tests

In addition to the regular and required tests under default conditions, optional special tests can be run per the methods outlined in this International Standard [using either a Category Test or the Feature Performance Adobe Reader Test Suite]. Examples are tests run under special (non-default) print and image quality settings, e.g. Printing device Manufacturer Fast Print Mode or High Quality Mode, tests using non-default drivers or using various printing features.

5 Calculations and Treatment of Data

The time intervals for each test run are recorded during the test operation. A spreadsheet format that records the time for the tests run is useful for this purpose but is not required.

The measured intervals of time in seconds should be recorded to 2 decimal places. The figure of average results is rounded at 2 decimal place to the final results of FSOT, ESAT and EFTP. Dropping fractions is allowed, but rounding to a faster time or rate is not allowed.

Averages are calculated by averaging the results (FSOT, ESAT, EFTP), not by averaging the times, and then calculating a result. For example, calculate ESAT of test run one and ESAT from test run two (and of test run three if required), and then average $ESAT_1$ and $ESAT_2$ (and $ESAT_3$) to yield $ESAT_{ave}$.

The number of ESAT and EFTP is expressed in ipm as follows.

A) Less than 10 ipm: Round down at two decimal places and express as two significant figures (X.X).

B) 10 ipm to 99 ipm: Express with either of the methods below:

   1) Round down at one decimal place and express as two significant figures (XX).

   2) Round down at two decimal place and express as three significant figures (XX.X).

C) 100 ipm or more: Round down at one decimal place and express as three significant figures (XXX).

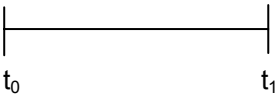
For example, if 34,99 is the measured and calculated average of ESAT, then a report could record 34,9 or 34 ipm, but NOT 35 ipm.

5.1 Category Tests

5.1.1 '1 Set Test'

$FSOT_{1set}$ and $EFTP_{1set}$ shall be calculated using data from a single set test run.

For test runs using 4-pages file and 1 set count test run:



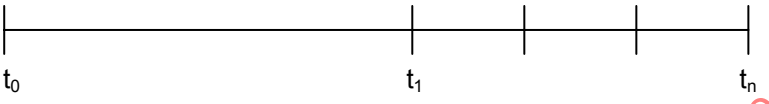
$FSOT_{1set} = t_1$ (seconds)

$$EFTP1_{set} = \frac{240}{LSOT1_{set}} \quad \text{(ipm)}$$

5.1.2 '1 Set + 30 Seconds Test'

$ESAT_{30sec}$ and $EFTP_{30sec}$ shall be calculated using the data of 1 Set + 30 Seconds Test.

For test runs using 4-pages file and N_{30sec} set count test run:



First Set Out Time = $FSOT_{30sec} = t_1$ (seconds)

Last Set Out Time = $LSOT_{30sec} = t_n$ (seconds)

N_{30sec} = Set Count

240 = 4 pages*60 seconds

$ESAT_{30sec}$ and $EFTP_{30sec}$ shall be calculated from the 1 Set + 30 Seconds Test data from the following equation.

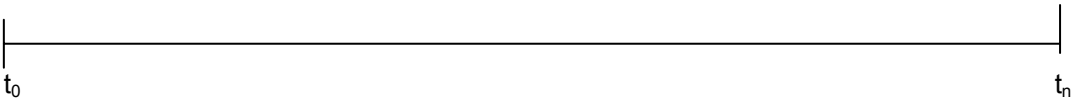
$$ESAT30\,\text{sec} = \frac{240 \times (N30\,\text{sec} - 1)}{LSOT30\,\text{sec} - FSOT30\,\text{sec}} \quad \text{(ipm)}$$

$$EFTP30\,\text{sec} = \frac{240 \times N30\,\text{sec}}{LSOT30\,\text{sec}} \quad \text{(ipm)}$$

5.1.3 '1 Set + 4 Minutes Test'

$EFTP_{4min}$ shall be calculated using the data of 1 Set + 4 Minutes Test.

For test runs using 4-pages file and N_{4min} set count test run:



Last Set Out Time = $LSOT_{4min}$ = t_n (seconds)

N_{4min} = Set Count

240 = 4pages*60seconds

$$EFTP_{4\,\min} = \frac{240 \times N_{4\,\min}}{LSOT_{4\,\min}} \quad \text{(ipm)}$$

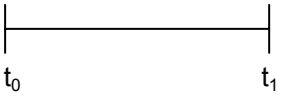
5.2 Feature Performance Test

Feature Performance Test itself is optional. However, when conducted, the 1 Set Test and the 1 Set + 30 Seconds Test are required for the Base Printing Mode and for each Feature Performance Test.

5.2.1 '1 Set Test'

$FSOT_{1set}$ shall be calculated using data from a single set test run.

For test runs using 8-pages file and 1 set count test run:

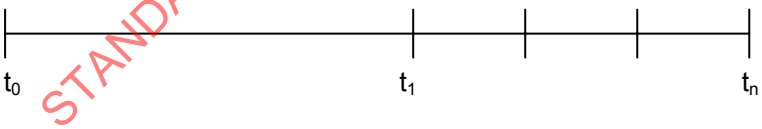


$FSOT_{1set}$ = t_1 (seconds)

5.2.2 '1 Set + 30 Seconds Test'

$ESAT_{30sec}$ shall be calculated using the data of 1 Set + 30 Seconds Test.

For test runs using 8-pages file and N_{30sec} set count test run:



First Set Out Time = $FSOT_{30sec}$ = t_1 (seconds)

Last Set Out Time = $LSOT_{30sec}$ = t_n (seconds)

N_{30sec} =Set Count

480 = 8 pages*60 seconds

$ESAT_{30sec}$ shall be calculated from the 1 Set + 30 Seconds Test data from the following equation.

$$ESAT_{30\,\mathrm{sec}} = \frac{480 \times (N_{30\,\mathrm{sec}} - 1)}{LSOT_{30\,\mathrm{sec}} - FSOT_{30\,\mathrm{sec}}} \quad \text{(ipm)}$$

NOTE The units above are images per minute. Therefore, even when more than one image per page is printed, as in 2-up reduction image on A4/8.5"x11" size output or 2-up A4/8.5"x11" size image on A3/11"x17" size output, the above equation remains unchanged.

For each feature tested, the percentage of the Feature Printing Mode to Base Printing Mode is calculated as follows:

$$\text{Feature Percentage ESAT} = \frac{ESAT_{feature}}{ESAT_{base}} \times 100 \ (\%)$$

$$\text{Feature Percentage FSOT} = \frac{FSOT_{base}}{FSOT_{feature}} \times 100 \ (\%)$$

NOTE For FSOT percentage, the base time is in the numerator so that a slower feature FSOT results in a % <100. This maintains consistency with the percentage of ESAT. The $FSOT_{base}$ and $ESAT_{base}$ come from the data of the baseline test using simplex A4/8.5"x11" sized paper.

Information that is required to be recorded includes the file used, namely 'Office' (or 'Complex'), as well as the paper size used, namely required A4/8.5"x11" (and optional A3/11"x17").

6 Presentation of Results

6.1 Category Tests

The minimum required presentation of results shall include a Summary Report as displayed in Table 4. A Summary Report includes the averages of FSOT and ESAT for all files in a given Category or Feature Performance test for each print mode tested. The system setting for the printing modes shall be identified (default and all non-default and optional test mode settings identified). For a colour printing device, include a description of the printing device settings used for the B&W print mode data. This is the Summary Report. In a Full Report, the FSOT, ESAT and EFTP numbers for each of the individual test files shall be reported as displayed in Table 5. The test platform system parameters shall be reported as shown in Annex A.

If a required test file was not tested, or failed to print, reporting per this International Standard is not allowed. Data from the results of all files in a given Category test shall be used to calculate averages of FSOT, ESAT and EFTP. For example, the average FSOT and ESAT numbers reported in an Office Category Summary are the averages from the Office Word, Office Excel and Office Adobe Reader test file results. Omitting results from one of these files, such as the Excel test file, and using the averages of only the Word and Adobe Reader test file results is not allowed.

The Summary Report should be the "declaration" used in marketing materials or packaging. Declaration of the whole Summary Report is recommended. Abbreviated test reporting is allowed, including the reporting of the results from individual application testing as long as the report includes the corresponding Averages of FSOT, ESAT, or EFTP, a pointer to the Full Detailed Report or contact information, and statement that the productivity has been determined in accordance with ISO/IEC 24734.

However, the minimum requirement of "declaration" shall include the following three items.

(1) Description that the productivity has been determined in accordance with ISO/IEC 24734

(2) The average of ESAT from the Office Category Test for default simplex mode

(3) Pointer to the Full Detailed Report or contact information

All reporting including Summary and Full Report tables shall include a pointer to the Full Detailed Report or contact information to obtain the report. An example of a Summary Report and Full Report is shown below. Optionally reported data are shown as “O”, required as “R” for the Office Category test and “R*” for the optional Advertising and Graphics and Feature Performance tests. An example of the Full Detailed Report is included in Annex E. A typical example of printing device settings that are recorded is shown in Annex D.

When appropriate, rows may be deleted from the Summary Report. Specifically, if a device does not have the ability to duplex, the duplex rows may be deleted or NA may be used when no data are available. Similarly, a monochrome only printing device does not need to report data for a colour printing mode.

The Summary and Full Reports report averages for the test results. Averages are calculated by adding the totals (of FSOT or ESAT) and dividing by the number of tests. Reported numbers may include as many decimal places as desired. Dropping fractions is allowed, but rounding to a faster time or rate is not allowed. Recorded and reported numbers shall never be better than actual measurement (higher for ESAT and EFTP or lower for FSOT). For example, if 34.99 is the measured and calculated average ESAT, then a report could record 34.9 OR 34ppm, but NOT 35ppm.

Table 4 — Office Category Summary Report

Office Category Test		FSOT (Seconds)	ESAT (ipm))
Defaults (Colour for colour device, B&W for monochrome device)	Simplex	R	R
	Duplex	R	R
B&W mode (optional for colour device)	Simplex	O	O
	Duplex	O	O
1) Record printing device and driver settings 2) Record printing device settings used for B&W output mode on colour device 3) Record location to find Full Detailed Report or contact information Where "R" is required to report when available on the printing device "O" is optional to report			

Table 5 — Office Category Full Report

	Office Category Test Files	FSOT (seconds)	EFTP (ipm)			ESAT (ipm)
			1 Set	1 set +30Seconds (N=_)	1 set +4Minutes (N=_)	
Defaults (Colour for colour device, B&W for monochrome device)	Simplex--Adobe Reader	R	R	R # sets	R # sets	R
	Simplex--Word	R	O	O # sets	O # sets	R
	Simplex--Excel	R	O	O # sets	O # sets	R
	Simplex Average	R				R
	Duplex--Adobe Reader	R	R	R # sets	O # sets	R
	Duplex--Word	R	O	O # sets	O # sets	R
	Duplex--Excel	R	O	O # sets	O # sets	R
	Duplex Average	R				R
B&W mode (optional for colour device)	Simplex--Adobe Reader	R*	R*	R* # sets	R* # sets	R*
	Simplex--Word	R*	O	O # sets	O # sets	R*
	Simplex--Excel	R*	O	O # sets	O # sets	R*
	Simplex Average	R*				R*
	Duplex--Adobe Reader	R*	R*	R* # sets	O # sets	R*
	Duplex--Word	R*	O	O # sets	O # sets	R*
	Duplex--Excel	R*	O	O # sets	O # sets	R*
	Duplex Average	R*				R*

1) Record Printing Device and Driver Settings.
2) Record printing device settings used for B&W output mode on colour device
3) Record location to find Full Detailed Report or contact information
Where "R" is Required to report when available on the Printing device
R* Required test if optional B&W mode is run on colour device
"O" is optional to report

Table 6 — Advertising and Graphics Category Summary Report

Advertising/Graphics Category Test		FSOT (seconds)	ESAT (ipm)
Defaults (Colour for colour device, B&W for monochrome device)	Simplex	R*	R*
	Duplex	O	O
B&W mode (optional for colour device)	Simplex	O	O
	Duplex	O	O

1) Record Printing Device and Driver Settings.
2) Record printing device settings used for B&W output mode on colour device
3) Record location to find Full Detailed Report or contact information
Where "R" is Required to report when available on the Printing device
R* Required test if optional B&W mode is run on colour device
"O" is optional to report

Table 7 — Advertising and Graphics Category Full Report

	Advertising and Graphics Category Test Files	FSOT (seconds)	EFTP (ipm)			ESAT (ipm)
			1 Set	1 Set +30Seconds (N=_)	1 Set +4 Minutes (N=_)	
Defaults (Colour for colour device, B&W for monochrome device)	Simplex--Adobe Reader	R*	R*	R* # sets	O # sets	R*
	Simplex--PowerPoint	R*	O	O # sets	O # sets	R*
	Simplex--QuarkXpress	R*	O	O # sets	O # sets	R*
	Simplex--InDesign	R*	O	O # sets	O # sets	R*
	Simplex Average	R*				R*
	Duplex--Adobe Reader	O	O	O # sets	O # sets	O
	Duplex--PowerPoint	O	O	O # sets	O # sets	O
	Duplex--QuarkXpress	O	O	O # sets	O # sets	O
	Duplex--InDesign	O	O	O # sets	O # sets	O
	Duplex Average	O				O
B&W mode (optional for colour device)	Simplex--Adobe Reader	R*	R*	R* # sets	O # sets	R*
	Simplex--PowerPoint	R*	O	O # sets	O # sets	R*
	Simplex--QuarkXpress	R*	O	O # sets	O # sets	R*
	Simplex--InDesign	R*	O	O # sets	O # sets	R*
	Simplex Average	R*				R*
	Duplex--Adobe Reader	O	O	O # sets	O # sets	O
	Duplex--PowerPoint	O	O	O # sets	O # sets	O
	Duplex--QuarkXpress	O	O	O # sets	O # sets	O
	Duplex--InDesign	O	O	O # sets	O # sets	O
	Duplex Average	O				O

1) Record Printing Device and Driver Settings.
2) Record printing device settings used for B&W output mode on colour device
3) Record start date and end date and time
Where "R" is Required to report when available on the Printing device
R* Required test if optional B&W mode is run on colour device
"O" is optional to report

6.2 Feature Performance Tests

The minimum required presentation of results shall include data showing the ratio of Base Printing Mode to Feature Printing Mode test results, as displayed in the Summary Report, Table 8. The base printing reference data points $FSOT_{base}$ and $ESAT_{base}$ that are used for the Feature Performance ratio calculation are from the default simplex A4 or 8.5"x11"-sized test (not from the duplex A4 or 8.5"x11"-sized test). The system setting for the printing modes shall be identified (default and all non-default and optional test mode settings identified). For a colour printing device, include a description of the printing device settings used for the B&W print mode data. This is the Summary Report. In a Full Report, the FSOT and ESAT numbers as well as the ratio for each of the individual test files shall be reported as displayed in Table 9. The test platform system parameters shall be reported as shown in Annex A.

All presentations of results shall include a pointer to the Full Detailed Report or contact information to obtain the report. An example of a Summary Report and Full Report table is shown below. An example of the Summary Report and the Full Report is included in Annex C. A typical example of printing device settings that are recorded is shown in Annex D.

Table 8 — Feature Performance test Summary Report (showing staple as one example, Feature Modes may vary)

Printing Modes (Feature Adobe Reader-Office test file)		Feature Performance Ratio	
		Staple	
		$\frac{FSOT_{base}}{FSOT_{feature}}$	$\frac{ESAT_{feature}}{ESAT_{base}}$
Defaults (Colour for colour device, B&W for monochrome device)	Simplex	R*	R*
1) Record Printing device and Driver Settings. 2) Record printing device settings used for B&W output mode on colour device 3) Record location to find Full Detailed Report or contact information "R*" is Required to report for feature test "O" is optional to report			

Table 9 — Feature Performance test Full Report (showing staple as one example with Adobe Reader-Office Feature Performance test file. Feature Modes may vary)

Printing Modes Feature Adobe Reader-Office test file (8-page)		Base Printing Mode		Feature Performance			
				Staple			
		$FSOT_{base}$	$ESAT_{base}$	$FSOT_{feature}$	$ESAT_{feature}$	$\frac{FSOT_{base}}{FSOT_{feature}}$	$\frac{ESAT_{feature}}{ESAT_{base}}$
Defaults (Colour for colour device, B&W for monochrome device)	Simplex	R*	R*	R*	R*	R*	R*
1) Record printing device and driver settings. 2) Record printing device settings used for B&W output mode on colour device 3) Record start date and time and end data and time "R*" is Required to report for feature test "O" is optional to report							

Annex A
(normative)

Test platform system parameters that may affect digital printing productivity measurements

Scope

The purpose of Annex A is two-fold. The first is to provide a general awareness of the contribution of the test platform to the overall digital printing device productivity measurement. The second is to provide a list of those test platform parameters that can be easily identified and subsequently recorded, which will help to reduce inter-testing variability.

Test Platform Parameter List

A1.0 Hardware

a. Testing platform hardware shall be comprised solely of a dedicated Computer system (computer, monitor, keyboard, mouse) with direct connectivity to the printing device being tested.

b. Record the following attributes:

b.1. **COMPUTER**

- manufacturer
- model

b.2. **Processor**

- manufacturer
- name
- family
- model number

b.3. **System chip set**

- manufacturer
- model number

b.4. **System board**

- manufacturer
- model number
- BIOS with revision level

b.5. **System memory**

- manufacturer
- type
- total size
- speed
- part number

b.6. **Hard drive and subsystem**

- manufacturer
- model number
- total disk size
- total number of disks
- rotational speed

- if controller is an adapter card, then record manufacturer and model

b.7. **Video controller**

- manufacturer
- model
- memory size (identify: shared or dedicated)

b.8. **Optical drive**

- manufacturer
- model
- interface

b.9. **Keyboard / Mouse connection**

A2.0 Software

a. Testing platform software shall be limited to the operating system, required printing applications for the test suites, and printing device driver of the device being tested.

b. Record the following attributes

b.1. **Operating system**

- manufacturer
- name and version number
- service pack or patch level

b.2. For each **printing application** installed

- manufacturer
- name and version number
- service pack or patch level

b.3. For each **printing driver** installed

- manufacturer
- name and version number
- service pack or patch level

b.4. **Location of test files** (e.g. hard drive or optical drive)

A3.0 Connectivity of Test Platform to Printing Device

a. Testing platform shall be directly connected to the printing device being tested (e.g. USB or Ethernet). There shall be no other printing devices or devices connected to the testing platform via this connection.

b. Record the following attributes

b.1. **Interface type**

b.2. **Identify if connectivity is through system board or adapter card**

- (if adapter card, record manufacturer and model)

b.3. **If USB**, record:

- USB level (e.g. 1.1 or 2.0)
- other devices on the same USB channel

b.4. **If Ethernet**, record:

- speed and topology
- MTU setting
- hub (manufacturer, model, and configuration)
- TCP/IP parameters (connection protocol and TCP receive window size)

A4.0 Example Documentation

a. USB attached printing device

Computer: white box system (no model number)
Processor: Intel Pentium 4 540
System Chip Set: Intel 945P Express
System Board: Intel D945PSN, Intel BIOS SN94510J.86A
System Memory: 1 GB 533 MHz DDR2 Kingston p/n KVR533D2N4/1G
Hard Drive & Subsystem: Seagate Barracuda 7200.9, 250 MB, 7200 RPM, 8MB cache, SATA/300 (system board controller)
Video Processor: Connect 3D Radeon X300, 256 MB, PCI Express (dedicated controller / memory)
Optical Drive: Pioneer 16x DVDRW DVR-R1A5PK
Keyboard / Mouse Connection: PS/2
USB: System board USB controller, USB 2.0, no other USB devices

b. Ethernet attached printing device

Computer: white box system (no model number)
Processor: Intel Pentium 4 540
System Chip Set: Intel 945P Express
System Board: Intel D945PSN, Intel BIOS SN94510J.86A
System Memory: 1 GB 533 MHz DDR2 Kingston p/n KVR533D2N4/1G
Hard Drive & Subsystem: Seagate Barracuda 7200.9, 250 MB, 7200 RPM, 8MB cache, SATA/300 (system board controller)
Video Processor: Connect 3D Radeon X300, 256 MB, PCI Express (dedicated controller / memory)
Optical Drive: Pioneer 16x DVDRW DVR-R1A5PK
Keyboard / Mouse Connection: PS/2
Ethernet: System board Ethernet controller, 100BaseTX, MTU=1500

Network Topology: 3Com SuperStack 3 Switch 4226T, full duplex,
TCP Port 9100, receive window size = 128

c. Software

Operating System: Microsoft Windows XP SP2
(all performance settings at default)

Printing Applications:

Microsoft Office Word 2003 SP2

Microsoft Office Excel 2003 SP2

Microsoft Office PowerPoint 2003 SP2

Adobe Reader 7.0.1

Printing device Drivers: PCL XT-6200 v8.3.1

Test Files Location: Hard drive

Annex B
(normative)

Test Suites

B.1 Office test suite

- Applications include Microsoft Office and similar (Word, Excel) as well as Adobe Reader.
- Files have a mix of text, images and graphics and reflect common applications in the office environment. Files may include application clip art, embedded charts, imported images, large or multi-coloured gradient files and text wrapped around graphics or images.
- Files shall not include transparent objects or high resolution images/photos.
- Each file within the Office test suite has four A4/8.5"x11" sized pages. The image size (with printable information) for each of A4/8.5"x11" size page is ⩽ 254 mm x 184,4 mm (10 inches x 7,26 inches) in order to print similar sized images on A4 or 8.5"x11" sized paper (without being cropped). In the printing device setup, care need to be taken to ensure that the margin setting should not be set too large to crop the printable images.
- The test suite consists of 2 sets of files, one set suitable for A4 size paper and one set suitable for 8.5"x11" size paper.
- The three files within the Office Category test suite are
    - 4-page Word file (colour)
    - 4-page Excel file (colour), included graphs set to 600dpi
    - 4-page Adobe Reader file (colour)

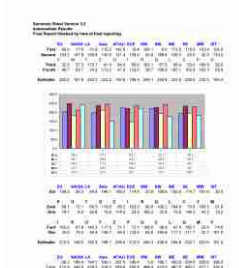
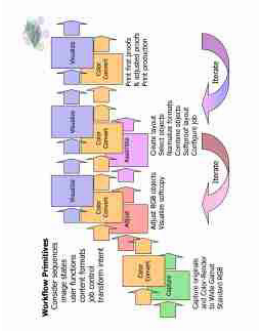
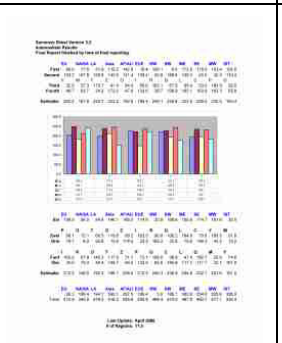
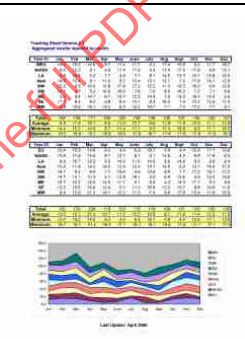
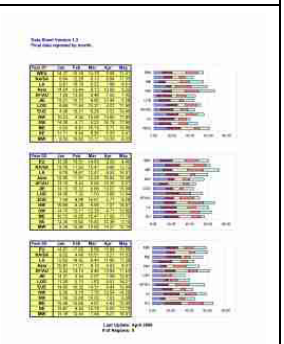
Adobe Reader File				
Word File				
Excel file				

Figure B.1 — Office test suite

B.2 Advertising and graphics test suite

- Applications include Microsoft PowerPoint and similar, Adobe Reader file, document design applications such as Adobe InDesign, QuarkXPress that can be used to create documents for printing in the office. In general, the Advertising and Graphics Category test suite has more complexity, coverage, and more image elements than the Office test suite. It reflects some of the more demanding applications used in office printing.
- Files have a mix of text, images and graphics
- Files may include application clip art, embedded charts, imported images, large or multi-coloured gradient files and text wrapped around graphics or images, transparent objects or high resolution images/photos.
- There is no limit on graphical content. Image elements, including high resolution photos, can be full page (within margin tolerance) in size.
- Each file within the Advertising and Graphics Category test has 4 A4/8.5"x11" sized pages. The image size (with printable information) for each of A4/8.5"x11" size page is ⩽ 254 mm x 184,4 mm (10 inches x 7,26 inches) in order to print similar sized images on A4 or 8.5"x11" sized paper (without

being cropped). In the printing device setup, care need to be taken to ensure that the margin setting should not be set too large to crop the printable images.

- The test suite consists of 2 sets of files, one set suitable for A4 size paper and one set suitable for 8.5"x11" size paper.
- The four files within the Advertising and Graphics test suite are
  - 4-page PowerPoint file (colour)
  - 4-page QuarkXpress file (colour)
  - 4-page InDesign file (colour)
  - 4-page Adobe Reader file (colour)

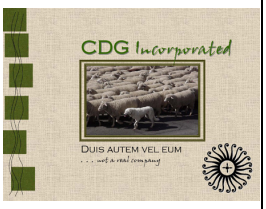
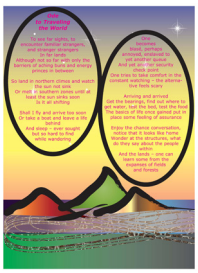
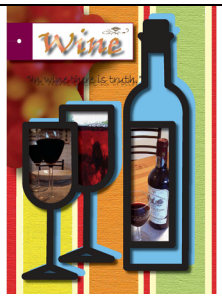
AdGraphics PowerPoint file				
AdGraphics QuarkXPress file				
AdGraphics InDesign file				
AdGraphics Adobe Reader file				

Figure B.2 — Advertising and graphics test suite

B.3 Feature performance Adobe Reader test suite

- This test suite combines print files created by various applications (Word, Excel, PowerPoint, InDesign and QuarkXPress), converted to a common Adobe Reader file.

- In general, the content is similar to a mixture of the Office Category and Advertising and Graphics Category test files. It is however only used in an Adobe Reader file to enable relative comparison of the effect of different features (including but not limited to A3/11x17 sized paper, different weight/type paper, duplex, 2-up printing, 4-up printing, stapler, hole puncher, saddle stitcher, folder, cutters, stackers, booklet makers, various input paper feeders, different RIP and driver configurations, and their feature combinations, etc.) on printing device productivity.

- Each of the two files within the Feature Performance Test has 8 A4/8.5"x11" sized pages. The image size (with printable information) for each of A4/8.5"x11" size page is $\leqslant$ 254 mm x 184,4 mm (10 inches x 7,26 inches) in order to print similar sized images on A4 or 8.5"x11" sized paper (without being cropped). In the printing device setup, care need to be taken to ensure that the margin setting should not be set too large to crop the printable images.

- The test suite consists of 2 sets of files, one set suitable for A4 size paper and one set suitable for 8.5"x11" size paper.

- The two files within the Feature Performance test suite are:

    - 8-page Adobe Reader-Office Feature Performance file created by repeating the Office Category 4-page Adobe Reader file twice into a single file

    - 8-page Adobe Reader-Complex Feature Performance file created by combining the Advertising and Graphics Category 4-page Adobe Reader file with two pages from the Advertising and Graphics PowerPoint file, one page from the InDesign file and one page from the QuarkXPress file.

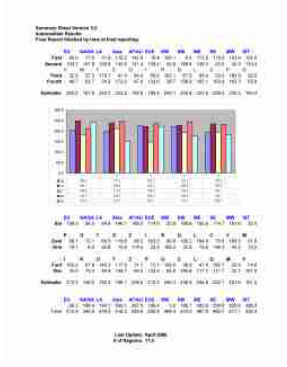
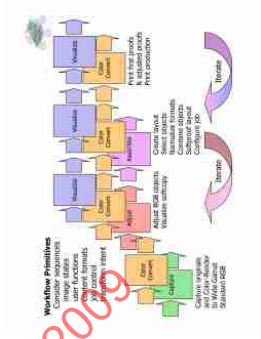
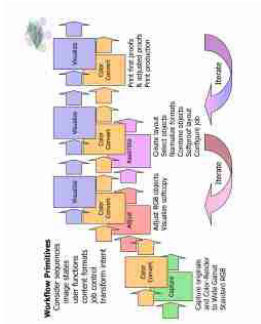
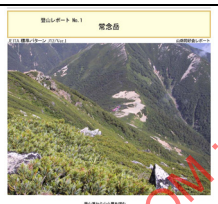
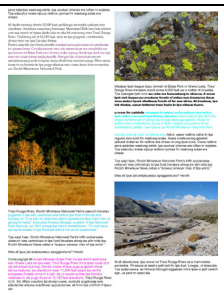
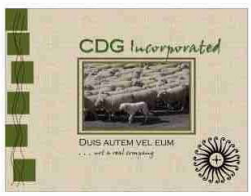
Adobe Reader Office Feature Performance File				
				
Adobe Reader Complex Feature Performance File				
				

Figure B.3 — Feature performance Adobe Reader test suite