

**Determination of the
absorption of paper (set off)****W48**

This test may be carried out with the IGT printability testers A1-3, A2-3 and AIC2-5
with the accompanying inking unit AE.

INTRODUCTION

With absorption the speed is meant with which the ink penetrates into the paper after printing. For the offset process this property is very important. If the ink is absorbed too slowly or too fast, it may be the cause of problems. An absorption which is too slow may result in smearing because the ink does not dry fast enough. An absorption which is too fast may result in a reduction of the dry ink properties; with this the binding agent for the most part penetrates into the paper and mainly the pigments remain at the surface. Because of this, for instance, the abrasion resistance or gloss may be reduced. The varnishability is influenced by the absorption as well. The test is important when using oxidative drying offset inks and varnishes, including the infra-red drying inks. The absorption tests are usually carried out as comparative tests. The chosen absorption times may differ per type of paper. This information leaflet describes the test as recommended by IGT Reptest.

PRINCIPLE

A strip of the paper to be tested will be printed under standard conditions with a penetration ink on an IGT printability tester. After certain times this test strip is brought into contact with a blank strip of set off paper (coated paper). Part of the ink, which is still present at the surface of the printed strip, will smear on the set off strip. The more ink is being absorbed into the printed strip, the less ink will smear on the set off strip. The density of the smeared ink will be a value for the absorption. Since smearing mainly concerns the ink which is at the top of the surface of the paper, the test strip is printed with a hard (aluminium) printing forme.

The recommended set off times are:

- * for A1-3 : 15, 30, 60 and 120 s
- * for A2-3 : 0,5, 5, 10, 15, 30, 60 and 120 s
- * for AIC2-5 : 0,1, 3, 6, 10, 15, 30, 60 and 120 s.

For paper with little absorption, longer times may be of importance.

If the absorption behaviour of ink has to be tested, a standard paper will be printed with the ink to be tested. Further, the test goes as is being described in this information leaflet.

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Research, development and
production of testing equipment
for the printing and allied
industries

Keienbergweg 25, 1101 EX Amsterdam
Postbox 12688, 1100 AR Amsterdam
The Netherlands

tel. + 31 20 40 99 300
fax +31 20 69 74 842
e-mail: info@igt.nl
internet: <http://www.igt.nl>

APPARATUS AND MATERIALS

While ordering materials please be sure to state type and serial number of the printability tester on which the test is to be carried out.

	Description	Article number
1	*IGT printability tester A1-3, A2-3 or AIC2-5	455.001, 455.002 or 414
2	*IGT inking unit AE (starting from type T) with extra distribution mechanism	406+407
3	*IGT ink pipette	408
4	*IGT penetration ink	404.003.02
5	*IGT paper packing for A1-3 and A2-3: 35 mm wide for AIC2-5: 55 mm wide	404.001.09 404.001.05
6	*Aluminium printing disc, with milled edge, 10 mm wide	402.016
7	*Aluminium printing disc, without milled edge, 10 mm wide	402.001
8	*Strips of coated paper, IGT-code Ka for A1-3 and A2-3: 35 mm wide for AIC2-5: 55 mm wide	404.005.04 404.009.04
9	Paper cutter with ruler	
10	Stopwatch	
11	Densitometer	
12	Cleaning rags (lint free)	
13	Cleaning product (cleaning naphta or terpentine)	

The with * marked articles can be obtained through IGT Reptest.

SAFETY REGULATIONS

- 1 For the operation of the printability tester, carefully follow the instructions of the manual of the printability tester and of this information leaflet.
- 2 Avoid wearing free hanging clothing and loose hanging hair to prevent it from coming between running parts of the inking unit or printability tester.
- 3 Avoid skin contact and internal contact with the inks to be used and with the, mostly volatile and flammable, solvents. Wear protective clothing, for instance, a laboratory coat and (disposable) gloves. See to a good ventilation system.
- 4 Open fire and smoking are not allowed.
- 5 Waste, such as cleaning rags with cleaning products, ink remnants, etc. must be considered chemical waste and should be transported or destroyed accordingly.

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PROCEDURE

Because the temperature and/or the relative humidity may be of influence on the properties of paper and ink, it is recommended to execute the test under standard conditions.

The standard atmosphere according to most standards is 23,0°C ± 1,0°C and 50,0% ± 2,0% RV.

1 PREPARATIONS

- 1.1 Cut test strips of the materials to be tested and mark them with a felt-tip pen to indicate top and/or bottom side, machine direction and/or cross direction and type of material.
The sizes of the test strips are preferably:
for A1-3 and A2-3 : 35 x 270 mm
for AIC2-5 : 55 x 340 mm
- 1.2 Shorten the set off strips to a length of 200 mm.
- 1.3 Fasten a paper packing on the sector and tighten it with the tightening screw(s).
- 1.4 Fasten a test strip on the sector.
- 1.5 Move the sector into starting position.
- 1.6 Place a printing disc onto the printing disc shaft of the A1-3 or onto the upper printing disc shaft of the A2-3 or AIC2-5.
- 1.7 Adjust the printing force to 200 N.
Check the backlash and, if necessary, adjust it.
- 1.8 Remove the printing disc from the printability tester.
- 1.9 For A2-3 only :
 - a) Place a printing disc onto the lower printing disc shaft of the printability tester
 - b) Adjust the printing force to 200 N
 - c) Remove the printing disc from the printability tester
- 1.10 For AIC2-5 only:
 - a) Place a printing disc onto the lower printing disc shaft of the printability tester
 - b) Adjust the printing force to 200 N
Check the backlash and, if necessary, adjust it
 - c) Remove the printing disc from the printability tester
- 1.11 Take the test strip off the sector
- 1.12 Adjust the printing speed
 - * for the A1-3 and A2-3 : pendulum, constant speed (turn by hand)
 - * for AIC2-5 : 0,7 m/s, constant printing speed
- 1.13 Stir the penetration ink well.
- 1.14 Fill the ink pipette with penetration ink.

2 EXECUTION

- 2.1 Apply 4 µm penetration ink on the inking unit or, if necessary, add a little more ink to maintain this layer. See comment 2.
- 2.2 Distribute the ink for at least 60 s when applying ink or for at least 45 s when adding ink, during which the extra distribution mechanism will be on the inking unit.
- 2.3 Place a clean printing disc with milled edge onto the inking unit and ink it for at least 30 s. See comment 3.

- 2.4 Fasten a strip of coated paper with a piece of tape at the beginning and end of the strip straight on the clean printing disc without milled edge.
- 2.5 Fasten a strip of the paper to be tested on the sector, using for the end of the strip a piece of tape.
- 2.6 Move the sector into starting position.
- 2.7 Only for A2-3 using set off times of 0,5, 5 and 10 s:
 - 1) Place the printing disc with the strip of coated paper onto the lower printing disc shaft of the A2-3.
 - b) Move the sector into starting position.
 - c) Turn the printing disc in such a way that the beginning of the strip of coated paper is on the upper side of the printing disc.
 - d) Take the inked printing disc off the inking unit and place it onto the upper printing disc shaft of the A2-3.
 - 5) Move the inked printing disc in printing position against the test strip.
 - 6) Move the printing disc with the strip of coated paper in printing position, that is, move this printing disc up so contact will be made between both strips when the sector passes.
 - 7) Turn the sector by hand with such a speed that a print will be made in 1 s and stop the sector at the point where the printed strip has passed half of the strip of coated paper.

The first part of both strips is now printed and has been set off with a set off time of approximately 0,5 s.
 - 8) Start the stopwatch immediately after the sector has stopped.
 - 9) After 5 or 10 s turn the sector with the same speed so both strips will now roll further against each other. The second part of both strips is now printed and has been set off with an set off time of 5 or 10 s.
 - 10) Take both strips off the tester.
 - 11) Mark the strips with the set off times.
 - 12) Put the strips for 24 hours in a safe and conditioned, preferably according to the standard conditions, place. PAY ATTENTION! Since the ink does not dry, be careful the prints will not get damaged. Therefore, do not put them on top of each other
 - m) Move the printing discs out of printing position.
 - 14) Remove the printing discs from the printability tester.
 - 15) Clean the inked printing disc with cleaning naphtha or terpentine and dry it.
 - 16) Repeat points 2.1 or 2.2 up to and including 2.7.o for following tests. It is recommended to carry out the

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test at least in triplicate per set off time.

2.8 Only for A1-3 and A2-3 using set off times of 15, 30, 60 and 120 s:

- a) Remove the brush from the printability tester in order to prevent damage to the print.
- 2) Take the inked printing disc off the inking unit and place it onto the printing disc shaft of the A1-3 or onto the upper printing disc shaft of the A2-3.
- 3) Move the printing disc in printing position against the test strip.
- 4) Turn the sector by hand with such a speed that a print will be made in 1 s and stop the sector before its starting position.
- 5) Start the stopwatch immediately after the sector has stopped.
- 6) Take the printing disc out of printing position.
- 7) Remove the printing disc from the printability tester.
- 8) Place the printing disc with the strip of coated paper onto the printing disc shaft of the A1 or onto the upper printing disc shaft of the A2-3.
- 9) Move the sector into starting position.
- 10) Turn the printing disc in such a way that the beginning of the strip of coated paper coincides with the beginning of the printed test strip.
- 11) Move the printing disc in printing position against the printed test strip.
- 12) Turn 15, 30 or 60 s after the beginning of the test the sector by hand with such a speed that both strips will roll against each other in 1 s.
NOTE: It is also possible to turn the sector by hand in four steps of 15, 30, 60 and 120 s. The speed then has to be chosen in such a way that it is consistent with a rolling of a printing disc in 1 s.
- 13) Take both strips off the tester.
- 14) Mark the strips with the set off times.
- 15) Put the strips for 24 hours in a safe and conditioned, preferably according to the standard conditions, place. PAY ATTENTION! Since the ink does not dry, be careful the prints will not get damaged. Therefore, ϕ not put them on top of each other.
- 16) Move the printing disc out of printing position.
- 17) Remove the printing disc from the printability tester.
- 18) Clean the inked printing disc with cleaning naphtha or terpentine and dry it.
- 19) Repeat point 2.1 or 2.2 up to and including 2.6 and 2.8.1 up to and including 2.8.7r for following tests.

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It is recommended to carry out the test at least in triplicate per set off time.

2.9 Only for AIC2-5 using set off times of 0.1 and < 10 s

- 1) Adjust the interval time to the desired time: 2,9, 5,9 or 9,9 s. See comment 4.
- 2) Place the printing disc with the strip of coated paper onto the lower printing disc shaft of the AIC2-5.
- 3) Move the sector into starting position.
- 4) Turn the printing disc in such a way that the beginning of the strip of coated paper is on the upper side of the printing disc.
- 5) Take the inked printing disc off the inking unit and place it onto the upper printing disc shaft of the AIC2-5.
- 6) Move the printing disc in printing position against the test strip.
- 7) Move the printing disc with the strip of coated paper in printing position against the test strip so contact will be made between both strips.
- 8) Start the sector and make a print. The test strip will be printed and will set off against the strip of coated paper. The interval time for the first part of both strips is 0,1 s and for the second part the interval time is 3, 6 or 10 s.
- 9) Take both strips off the tester.
- 10) Mark the strips with the set off times.
- 11) Put the strips for 24 hours in a safe and conditioned, preferably according to standard conditions, place.
PAY ATTENTION!: Since the ink does not dry, be careful the prints will not get damaged. Therefore, do not put them on top of each other.
- 12) Move the printing discs out of printing position.
- 13) Remove the printing disc from the printability tester.
- 14) Clean the printing disc with cleaning naphtha or terpentine and dry it.
- 15) Repeat points 2.1 or 2.2 up to and including 2.6 and 2.9a up to an including 2.9b for following tests. It is recommend to carry out the test at least in triplicate per set off time.

2.10 Only for AIC2-5 using set off times of 15, 30, 60 and 120 s:

- 1) Remove the brush from the printability tester in order to prevent damage to the print.
- 2) Take the inked printing disc off the inking unit and

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place it onto the upper printing disc shaft of the AIC2-5.

- 3) Move the printing disc in printing position against the test strip.
- 4) Start the sector and make a print.
- 5) Start the stopwatch immediately after the sector has stopped.
- 6) Move the printing disc out of printing position.
- 7) Remove the printing disc from the printability tester.
- 8) Place the printing disc with the strip of coated paper onto the upper printing disc shaft of the AIC2-5.
- 9) Move the sector in starting position.
- 10) Turn the printing disc in such way that the beginning of the strip of coated paper coincides with the beginning of the printed test strip.
- 11) Move the printing disc in printing position against the printed test strip.
- 12) Start the sector after 15, 30, 60 or 120 s after the beginning of the test so both strips roll against each other.

NOTE: it is also possible to turn the sector by hand in four steps of 15, 30, 60 and 120 s. The speed then has to be chosen in such a way that it coincides with a rolling of a printing disc of 1 s.

- 13) Take both strips off the tester.
- 14) Mark the strips with the set off times.
- 15) Put the strips for 24 hours in a safe and conditioned, preferably according to standard conditions, place.
PAY ATTENTION: Since the ink does not dry, be careful the prints will not get damaged. Therefore, do not put them on top of each other.
- 16) Move the printing disc out of printing position.
- 17) Remove the printing disc from the printability tester.
- 18) Clean the inked printing disc with cleaning naphtha or terpentine and dry it.
- 19) Repeat point 2.1 or 2.2 up to and including 2.6 and 2.10.1 up to and including 2.10.7r for following tests. It is recommended to carry out the test at least in triplicate per set off time.

2.11 After finishing the tests, clean the inking unit, the ink pipette and the printing disc with terpentine and/or cleaning naphtha.

2.12 Move the printing force of both printing disc shafts back to 0 N.

2.13 Lift the PU-rollers off the inking unit.

2.14 Assess the set off strips after 24 hours as described in

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point 3: ?Assessment?.

2.15 Record the test conditions completely.

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3 ASSESSMENT

3.1 After 24 hours, measure by means of the smeared ink on the strips of coated paper the contrast density. This has to be done for all strips with all set off times. Measure the set off length > 100 mm, then measure in 10 places. Measure the set off length < 100 mm, then measure in 5 places.

PAY ATTENTION: Since the ink does not dry, small damages cannot be avoided. Place the densitometer straight on the strip and do not move it more than necessary.

3.2 Determine per strip the average contrast density.

3.3 Determine per set off time the average contrast density and, if wished for, the spreading and/or standard deviation. Sometimes it may be useful to note the highest or lowest value as well.

3.4 If wished for, put the found values in a table or a graph.

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COMMENTS

- 1 An inking unit AE with distribution mechanism has to be used. These are the apparatus starting from type T, year of construction starting from 1972.
- 2 In order to get a ink-layer thickness of $4 \mu\text{m}$, a certain quantity of ink has to be applied on the inking unit. The chosen quantity is related to the chosen method of working. Then a certain quantity of ink has to be added regularly to maintain the ink-layer thickness. This is presented in the following overview. The given values only apply when the extra distribution mechanism is used on the inking unit.
 - a) When using 1 side of the inking unit with 1 printing disc: 0,49 cm?
After each test add: 0,015 cm?
 - b) When using 1 side of the inking unit with 2 printing discs: 0,50 cm?
After two tests add: 0,015 cm?
 - c) When using both sides of the inking unit in the left-right system, apply on the left side: 0,67 cm? and on the right side: 0,47 cm?
After 38 tests apply on the left side: 0,32 cm?
- 3 When using both sides of the inking unit in the left-right system, it is advised to use three printing discs with milled edge to work continuously: one disc on the left hand side, one disc on the right hand side and one disc on the printability tester.
- 4 For an interval time of 3, 6 or 10 s the interval timer should be adjusted to 0,1 s less. The reason for this is that by 0,7 m/s the interval time between printing and smearing already is 0,1 s.
- 5 The absorption ink does not dry at all. Nevertheless, it is recommended not to keep the ink on the inking unit for longer than 8 hours.
- 6 In order to keep the printed and smeared strips, it is recommend to spray a fixative over them or to cover them with cellotape.
- 7 The storage life of the ink in the original packing is 3 years maximum.
The storage life of the ink in an opened packing is 1 year maximum.
Recommended storage conditions: $23,0^{\circ}\text{C} \pm 1,0^{\circ}\text{C}$ and $50,0\% \pm 2,0\% \text{ RV}$.

This information leaflet has been compiled with the utmost care. However, may you find any inadequacies or if there are any comments, we kindly request of you to send these to IGT Reptest b.v., Sales Department, Postbox 12688, 1100 AR Amsterdam, Fax, 020 697 48, e-mail: info@igt.nl

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SUMMARY TEST CONDITIONS FOR DETERMINING THE ABSORPTION OF PAPER

Printability tester	A1-3	A2-3	AIC2-5
Printing disc	aluminium, with milled edge	aluminium, with milled edge	aluminium, with milled edge
Printing disc width	10 mm	10 mm	10 mm
Printing force	200 N	200 N	200 N
Set off disc	aluminium, without milled edge	aluminium, without milled edge	aluminium, without milled edge
Set off disc width	10 mm	10 mm	10 mm
Set off force	200 N	200 N	200 N
Set off paper	coated, Ka	coated, Ka	coated, Ka
Packing	paper	paper	paper
Speed	0,2 m/s by hand	0,2 m/s by hand	0,7 m/s constant
Ink	IGT penetration ink	IGT penetration ink	IGT penetration ink
Ink-layer thickness	4,0 um	4,0 um	4,0 um
Set off times	15-30-60-120 s	0,5-5-10-15-30-60-120 s	0,1-3-6-10-15-30-60-120 s

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figure 1: printing on A1-3

figure 2: setting-off on A1-3

figure 3: printing and
setting-off
on A2-3

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figure 4: printing and setting-off on AIC2-5

figure 5: printing strip and set off strip
of AIC2-5, short times

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