Introduction
Most commonly picking of paper or paper board is defined as the damage of the paper surface during the printing operation. Delamination of paper board can be described as the splitting between the liner at top of the board and the next layer during the printing operation. At the time the printing form is lifted off the paper or paper board the ink is exerting a certain force on the surface. This force is increasing with an increase in the viscosity and tack of the ink and the printing speed. When this force exceeds a certain value, the surface of the paper will be damaged or a delamination between layers of the paper board will occur. The pick and delamination test is very important for papers and boards which are printed in offset or letterpress because these printing techniques use inks with a high viscosity and/or tack. Modern flexo inks (UV) have a higher viscosity and tack than the solvent and water based inks. So this testing method can be used for this printing technique as well.

The pick or delamination resistance is defined as the velocity at which picking or delamination starts at a pick test oil temperature of 23°C. In older publications the pick or delamination resistance is described as the Viscosity Velocity Product (VVP). As the VVP is a constant value for a certain type of paper or paper board the pick or delamination resistance (velocity at 23°C) can be calculated from this VVP. Also it is possible to compare the test results of papers and paperboards obtained with different grades of pick test oil using this VVP.

The determination of the pick velocity and the pick resistance is one of the most widely used tests performed on the IGT printability testers.

There are three methods for the pick/delamination resistance:
W31: The pick test with the aluminium printing disc. This method is standardized internationally in e.g. ISO 3783:2006, Tappi 514 and in many countries as well; in the Netherlands in NEN 3095.
W65/W75: The pick test with a rubber covered printing disc. This method is used specially for internal testing within paper and paperboard mills. The test is carried out with a printing disc with black rubber of 65 resp. 85 Shore A.
W38: The Westvaco method with a grooved disc. No inking unit is used.

Principle
Using the IGT-printability tester a print is made on the paper or paper board to be tested with pick test oil at an increasing speed. The first point of damaging of the print is observed and measured. From a table the speed where picking or delamination begins is read. The pick or delamination resistance is calculated from the VVP.

Method of operation
- It is recommended to execute the test in the standard atmosphere; to most standards it is 23,0 ± 1,0 °C and 50 ± 2% rh.
- For the operation of the AIC2-5T2000, Global Standard Tester, Inking Unit and ink pipette follow the instructions of the manuals, IGT information leaflet W100 and the displays accurately.
- Handle the samples carefully.

Preparation
1. Condition the papers, the pick test oil and the equipment during >6 hours in the standard atmosphere.
2. Cut the paper strips and mark them with top and/or bottom side, machine and/or cross direction and a code for the type of material.
3. Mount the packing on the sector. See W100.
4. For AIC2-5T2000 only:
   4.1. Adjust the printing force of the top printing disc shaft to 350 N and pay attention for the right backlash. See W100.
   4.2. Adjust the desired printing speed in the increasing speed mode. (◢).
5. For GST P/1/1W only:
   5.1. Select the menu “Picking IGT” in the display.
   5.2. Adjust the desired end speed.
6. Fill the ink pipette with the desired IGT pick test oil.
7. Adjust the High Speed Inking Unit 4 with the following settings:
   - Water bath: 23,0 °C
   - Top roller: 4-segmented, rubber for conventional inks
   - Mode: 3
   - Startup time: 5 s
   - Distribution time: 30 s
   - Distribution speed: 0,5 m/s

   NOTE: Due to the temperature sensitivity of the pick test oil it is preferred to use the High Speed Inking Unit 4 with water bath above the inking unit AE FOUR.

Materials / Testing conditions		
1	IGT AIC2-5T2000	710.000.000
	or IGT Global Standard Tester P	470.000.000
	or IGT Global Standard Tester 1	410.000.000
	or IGT Global Standard Tester 1-W	415.000.000
2	IGT High Speed Inking Unit 4	466.000.710
3	Top roller with 4 segments for conventional inks	466.003.003
4	IGT Ink pipette	408.000.200
5	Printing disc, black aluminum, scale, 10 mm (for pick and delamination)	402.301.441.410
	or Printing disc, aluminum, 10 mm (for delamination)	402.301
6	Pick test oil, low viscosity	404.004.010
	or pick test oil medium viscosity	404.004.020
	or pick test oil high viscosity	404.004.030
7	Packing, paper, 55 mm	404.001.005
8	Pick Start Viewer (115 or 230 V)	441.000
	or Delamination viewer V-form for board	441.000.040.090
	or Delamination viewer U-form for paper	441.000.040.180
9	Velocity table	437.005
Strips of paper to be tested, preferable 55*340 mm^2, 5 strips per sample Thermometer, accuracy 0,1°CF Ruler Lint free rags and cleaning naphtha		
Printing force	350 N	
Printing speed	Increasing, end speed at choice	
Pick test oil film thickness (volume)	8,0 µm (0,28 cm^3)	
► The numbers 1 thru 9 are available at IGT Testing Systems.		

- 2nd distribution time: 10 s
- 2nd distribution speed: 0,2 m/s
- Inking time printing discs: 20 s

Execution

1. Apply 0,28 cm^3 of pick test oil to a segment of the top roller of the inking unit or add 0,02 cm^3 of pick test oil to maintain this layer and distribute the pick test oil during the preset or desired time.
   NOTE 1: Do not add pick test oil more than 4 times.
   NOTE 2: For another type of top roller see the manual of the inking unit.
2. Place the printing disc on the printing disc shaft of the inking unit and ink the printing disc during the preset or desired time.
3. Adjust the printing speed of the tester, if necessary.
4. Attach a test strip into the front clamp of the sector.
5. Take the printing disc from the inking unit and place it on the top printing disc shaft of the tester.
   NOTE: If the black disc with scale is used, take care that the point 0 is pointing toward the sector.
6. Make a print. See W100.
7. Remove the test strip from the sector.
8. Measure the temperature with an accuracy of 0,1°C.
9. Measure the pick test result immediately after printing as explained in chapter “Assessment”.
10. Take the printing disc from the shaft and clean it with rags and cleaning naphtha and let it dry.
11. Add a little pick test oil or use the next segment for the following test.
12. Repeat points 1 thru 11 for every test strip. It is recommended to perform the test at least 5 times per sample.
13. After having finished the tests, clean and store all parts as described in the manuals.
14. Make an accurate record of the conditions and the results of the tests and refer to W31.

Assessment

1. For picking:
   1.1. Place the test strip under the opening of the pick start viewer.
   1.2. Looking from above into the viewer assess the test strip and mark the point where picking begins. See fig.1.

►►

Fig.1: IGT Pick Start Viewer PSV

1.3. Observe the black aluminum disc on the first point where picking begins and read this point.

2. For delamination of heavy coated paper or low weight paper board:
   2.1. Place the test strip in the U-form delamination viewer with the tested side pointing up.
   2.2. Assess the test strip and mark the point where delamination begins. See fig. 2.

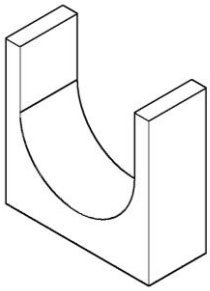

Fig. 2: IGT U-form Delamination viewer

3. For delamination of high weight paper board:
   3.1. Place the test strip in the V-form delamination viewer with the tested side pointing up.
   3.2. Assess the test strip and mark the point where delamination begins. See fig. 3.

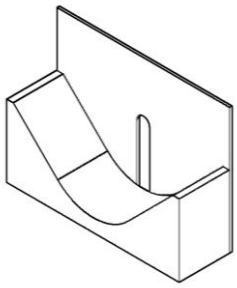

Fig. 3: IGT V-form Delamination viewer

4. Measure the distance between the starting point of the print (= the centre of the initial print contact line) and the point where picking or delamination begins at the test strip.

   NOTE 1: A single damaging >20 mm before the point where picking begin is NOT the first point of picking or delamination.
   NOTE 2: If picking or delamination occurs < 20 mm from the starting point of the print the test has to be repeated at a lower speed. In case the lowest speed has been applied already a change to a lower grade of the pick test oil is necessary.
   NOTE 3: If no picking occurs or the picking occurs >180 mm from the starting point of the print, the test has to be repeated at a higher speed. In case the highest speed has been applied already a change to a higher grade of the pick test oil is necessary.

5. If desired derive the pick velocity in m/s from the velocity table (table 2) or with the formula:

$$V_p = 0{,}005 * V_e * d_p \quad or \quad V_d = 0{,}005 * V_e * d_d$$

Herein is:

V_p = velocity at point d (in m/s)

V_d = delamination at point d (in m/s)

V_e = set end speed (in m/s)

d_p = distance from beginning of the print to beginning of picking (in mm)

d_d = distance from beginning of the print to beginning of delamination (in mm)

6. If desired, calculate the pick or delamination resistance from the Velocity Viscosity Product (VVP) in N/m with the formula:

$$P_{23} = V_p * \eta_t / \eta_{23} \quad or \quad D_{23} = V_d * \eta_t / \eta_{23}$$

Herein is:

P_{23} = Pick resistance at 23 °C in m/s

D_{23} = Delamination resistance at 23 °C in m/s

V_p = Pick velocity in m/s (velocity at the point where picking begins) at the measured temperature

V_d = Delamination velocity in m/s (velocity at the point where delamination begins) at the measured temperature

η_t = Viscosity in Pa.s at the measured temperature (see table 1)

η_{23} = Viscosity in Pa.s at 23 °C (see table 1)

7. Repeat points 1 thru 6 for each test strip.
8. Calculate the average and if required the standard deviation. In some cases it may be useful to mention the highest and lowest value as well.
9. Describe the appearance of the type of picking.
   NOTE: It may be useful to describe the point where picking begins. Especially in coated papers and cardboards there may occur initial deformation or delamination in the test strip, followed by loosened coating particles or fibres before the actual overall damaging of the paper surface takes place.

Notes:

1. The black aluminum printing disc is specially used for (uncoated) papers at which the beginning of picking can be difficult and for other papers it can give additional information.
2. Due to the accuracy of this test it is advised to use the IGT High Speed Inking Unit 4 with water bath.
3. The viscosity of the pick test oils is temperature dependent. The Velocity Viscosity Product (VVP) may be used to compensate these differences. See table 1.

Table 1: Viscosity (Pa.s) of pick test oils

°C	lv	mv	hv
20	22.5	68	145
20,5	21.7	65,3	139,2
21	20.8	62,7	133,9
21,5	20	60	127,5
22	19.2	57,4	121,7
22,5	18.3	54,7	115,9
23	17,5	52	110
23,5	16,8	50	105,5
24	16	48	101
24,5	15,3	46	96,5
25	14,5	44	92
lv	= low viscosity		
mv	= medium viscosity		
hv	= high viscosity		

4. The maximum storage life of the pick test oil in the original packing is 3 years, in an opened packing 1 year.

► *2006: In comparison to the older IGT leaflets, a new velocity table is included; this leaflet is valid for the AIC2-5T2000 and Global Standard Testers as mentioned.*
► *2012: This leaflet is valid for the AMSTERDAM as well and contains some small text corrections; the U-form for the assessment of delamination has been introduced.*
► *2017: This leaflet is valid for AIC2-5T2000 and GST P/1/1W only; a new description of pick resistance is introduced and the leaflet contains text corrections.*

Table 2: Velocity table

▼End speed in m/s	Distance in mm																	
	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
	Velocity in m/s																	
0.5	0,08	0,10	0,13	0,15	0,18	0,20	0,23	0,25	0,28	0,30	0,33	0,35	0,38	0,40	0,43	0,45	0,48	0,50
1.0	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1,00
1.5	0,23	0,30	0,38	0,45	0,53	0,60	0,68	0,75	0,83	0,90	0,98	1,05	1,13	1,20	1,28	1,35	1,43	1,50
2.0	0,30	0,40	0,50	0,60	0,70	0,80	0,90	1,00	1,10	1,20	1,30	1,40	1,50	1,60	1,70	1,80	1,90	2,00
3.0	0,45	0,60	0,75	0,90	1,05	1,20	1,35	1,50	1,65	1,80	1,95	2,10	2,25	2,40	2,55	2,70	2,85	3,00
4.0	0,60	0,80	1,00	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60	3,80	4,00
5,0			1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,75	5,00
6,0				1,80	2,10	2,40	2,70	3,00	3,30	3,60	3,90	4,20	4,50	4,80	5,10	5,40	5,70	6,00
7,0				2,10	2,45	2,80	3,15	3,50	3,85	4,20	4,55	4,90	5,25	5,60	5,95	6,30	6,65	7,00

Remark: ► Yellow back ground is valid for **AIC2-5T2000** only ► Blue figures are valid for **GST** only

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