

## 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.

To ink the printing discs in the standard test conditions an inking unit is used to make many tests after each other. The Westvaco method however, is carried out with a grooved disc of a specified depth which is filled with pick test oil with the help of a rod. In this method no inking unit is used and specially for only some tests the Westvaco method is a time saving procedure.

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

The Westvaco Rod Applicator exists of a printing disc with a groove of a depth of 15 µm and a doctor rod in a doctor rod holder. The system can be part of a separate inker or is part of the Global Standard Tester 1W. The doctor rod is pressed against the grooved disc by means of a lever system. By applying a small amount of pick test oil to the disc and subsequently rotating the disc the groove is filled. After inking the disc a print is made with an IGT printability tester on a strip of the paper to be tested at an increasing speed. The first damaging of the print is observed and from a table the speed where picking or delamination begins is read. The pick or delamination resistance is calculated from the VVP.



Fig. 1: Westvaco system on GST1W

## 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 and Global Standard Tester follow the instructions of the manual, IGT information leaflet W100 and the displays accurately.
- Handle the samples carefully.

## Materials / Testing conditions

1	IGT AIC2-5T2000 or IGT Global Standard Tester P or IGT Global Standard Tester 1 or IGT Global Standard Tester 1-W with integrated Westvaco accessory *****	710.000.000 470.000.000 410.000.000 415.000.000
2	For AIC2-5T2000, GST P/1 only: Westvaco inker	413.060.710
3	Printing disc, steel, 20 mm, groove depth 15 µm and groove width 10 mm *****	402.320.710
4	For GST 1W only: Printing disc, steel, 20 mm, groove depth 15 µm and groove width 10 mm, pin	402.320.415
5	Cartridges, empty	160.200
6	Hose and coupling *****	160.300
7	Westvaco rods	413.012
8	Pick test oil, low viscosity or pick test oil medium viscosity or pick test oil high viscosity	404.004.010 404.004.020 404.004.030
9	Packing, paper, 55 mm	404.001.005
10	Pick Start Viewer (115 or 230 V) or Delamination viewer V-form for board or Delamination viewer U-form for paper	441.000 441.000.040.090 441.000.040.180
11	Velocity table	437.005
Thermometer, accuracy of 0,1 °C or F		
Ruler		
Strips of paper to be tested, preferable 55*340 mm <sup>2</sup> , 5 strips per sample		
Lint free rags and cleaning naphtha		
Printing force		700 N
Printing speed		Increasing, end speed at choice
► The numbers 1 thru 11 are available at IGT Testing Systems.		

## Preparation

- Condition the papers, the pick test oil and the equipment during >6 hours in the standard atmosphere.



Fig. 2: Westvaco inker

- 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.
- Mount the packing on the sector. See W100.
- For AIC2-5T2000 with Westvaco inker:
  - Adjust the printing force of the top printing disc shaft to 700 N and pay attention for the right backlash. See W100.
  - Adjust the desired printing speed in the increasing speed mode. (▲).
- For GST P/1 and GST 1-W with separate Westvaco inker:
 

**NOTE: The GST1-W can also be used with the separate Westvaco inker instead of the integrated Westvaco system.**

  - Select the menu "Picking IGT" in the display.
  - Adjust the printing force into 700 N.
  - Adjust the desired end speed.
- For GST1-W with the integrated Westvaco system:
  - Select the menu "Picking Westvaco" in the display.
  - Select the desired end speed.
  - Slide the rod into the rod holder.
  - Slide the rod holder with the rod downward and pointing to the right on the two pins of the mounting plate.
- For continuous working:
  - Fill a cartridge with the desired pick test oil (see W100).
  - Mount the cartridge on the GST 1W (see W100).



7. For all testers with separate Westvaco inker:
  - 7.1. Slide the rod into the rod holder.
  - 7.2. Slide the rod holder with the rod upward and pointing to the right on the pin of the Westvaco inker and fasten it with the screw.
  - 7.3. Move the handle under the rod holder to the left, so that the rod is in the lower position.
  - 7.4. Place the printing disc on the printing disc shaft of the inker.
8. Clean the printing disc with rags and naphtha and let it dry.

#### Execution

1. Adjust the printing speed, if necessary.
2. Attach a test strip in the front clamp of the sector.
3. For all testers with separate Westvaco inker:
  - 3.1. Place the printing disc on the printing disc shaft of the inker.
  - 3.2. Apply some drops of the pick test oil onto the printing disc.
  - 3.3. Lift the weight a little and move the handle of the rod holder to the right so that the rod has contact with the printing disc.
  - 3.4. Place the handle into the grip of the disc and make some rotations of the disc in clockwise direction until the groove is filled with the oil.
  - 3.5. Lift the weight a little and move the handle of the rod holder to the left so that the rod is in the lower position and has no contact with the disc.
  - 3.6. Take the disc from the inker and place it on the top printing disc shaft of the tester with the location with the surplus of pick test oil just under the contact area between the disc and the sector.
  - 3.7. Make a print. See W100.
4. For GST 1W with integrated Westvaco system:
  - 4.1. Place the printing disc on the top printing disc shaft of the tester.
  - 4.2. Press the side buttons to move the sector into the starting position and to move the rod holder downward.
  - 4.3. Press one of the buttons to apply some pick test oil on the disc or apply manually some pick test oil on the disc.
  - 4.4. Press the side buttons to distribute the pick test oil and to make a print.
5. Remove the test strip from the tester.
6. Measure the temperature with an accuracy of 0,1 °C or F.
7. Measure the pick test result immediately after printing as explained in the chapter "Assessment".
8. Take the printing disc from the shaft and clean it with rags and naphtha and let it dry.
9. Repeat points 1 thru 8 for every test strip. It is recommended to perform the test at least 5 times per sample.
10. After having finished the tests, clean and store all parts as described in the manuals and grease the printing disc with acid free Vaseline.
11. Make an accurate record of the conditions and the results of the test and refer to W38.

#### 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.3.



Fig. 3: Pick start viewer PSV

2. For delamination of heavy coated paper or low weight paper board:
  - 2.1. Place the test strip in a 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. 4.
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. 5

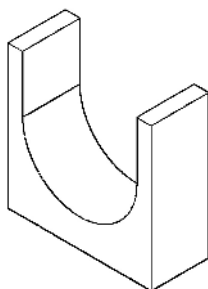


Fig. 4 IGT U-form Delamination viewer

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 begins 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:

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

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:

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

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 picking begins) at the measured temperature

$\eta_t$  = Viscosity in Pa.s at the measured temperature (see table 1)

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

6. Repeat points 1 thru 6 for each test strip.
7. 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.
8. 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 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		

2. 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 <b>AIC2-5T2000</b> only									► Blue figures are valid for <b>GST</b> only								