

**Introduction:**

There are many factors determining the final quality of the print. Among this roughness, or rather, the degree of smoothness is one of the most important. There are many methods and devices to determine the roughness, however, they all have their limitations. The determination of roughness described in this leaflet is a dynamic method, which is executed while maintaining the conditions of the printing process as closely as possible. This method has been standardized in the Dutch standard NEN 1839.

**Principle:**

On the IGT-printability tester a small drop of water (with an accurately determined volume) is rolled out between two identical paper surfaces at high speed. Due to the high speed only the surface recesses of the paper will be filled. The area of the resulting blot on the paper is measured and the roughness of the paper is calculated as the volume of water per square meter of paper (cm<sup>3</sup>/m<sup>2</sup>). The speed in this test is high, so that the time of contact between the water and the paper is very short and the water cannot penetrate into the paper pores. To prevent initial penetration of the coloured water into the paper, the spot of application is closed using lacquer. The amount of water needed to carry out the test depends on the roughness of the paper to be tested: with very smooth papers 1 mm<sup>3</sup> may be sufficient, while for very rough papers a volume of up to 6 mm<sup>3</sup> may be necessary.

**Method of operation:**

- It is recommended to execute the test in the standard atmosphere; to most standards it is 23.0 ± 1.0 °C (73.4 ± 1.8 °F) and 50 ± 2% rh.
- For the operation of the Global Standard Tester follow the instructions of the manual, IGT information leaflet W100 and the display accurately.
- Handle the samples carefully.

Preparation

1. Condition the papers, the test liquid and the equipment during >6 hours in the standard atmosphere.
2. Cut the paper strips (preferable 55 x 340 mm, 10 strips per sample) 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. Adjust the printing force of the upper printing disc shaft to 1000 N and pay attention for the right backlash. See W100.
5. Adjust the speed to increasing speed (▲), end speed 3 m/s.
6. Check and if needed, move the slide in front of the sector into the increasing speed mode (▲).
7. Fill the micro syringe with trypanblue solution, make sure to avoid air bubbles in the syringe.
8. Check the functioning of the AIC2-5 with the roughness set following the instructions in the chapter "Execution".

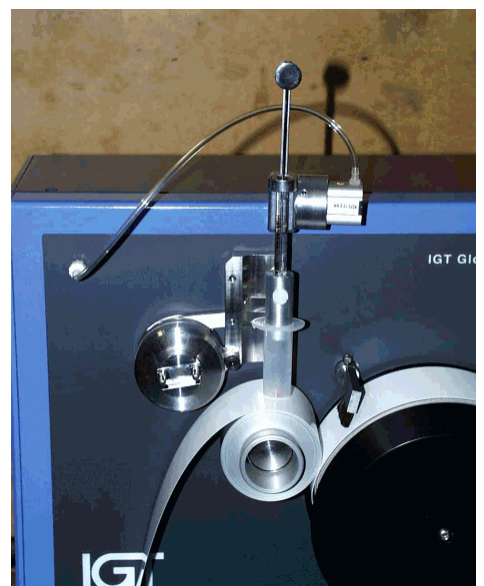
Execution

1. Attach two test strips of the same paper with the sides to be tested facing one another in the front clamp and take care that the one strip is placed over the printing disc and the other strip

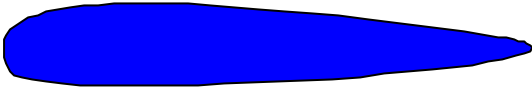
- on the sector.
2. Move the sector into starting position.
3. Move the printing disc into printing position against the test strips.

Materials / testing conditions		
1	IGT AIC2-5 from type AA	414
2	Printing disc, aluminium, 50 mm	402.088
3	Syringe 705N +	409.010.705 +
4	dispenser	409.006.001
5	or Syringe 701N	409.010.701
6	Water with 1% trypan blue	409.004
7	Lacquer	409.005
8	Nomogram	409.007
9	Packing, rubber, 55 mm	404.001.006
10	Ruler	
11	Strips of paper to be tested, preferable 55 x 340 mm, 10 strips per sample	
12	Lint free rags	
13	Ethanol	
Printing force		1000 N
Printing speed		Increasing, end speed 3 m/s
Quantity of test liquid		1 - 6 mm <sup>3</sup>
<p>The numbers 1 thru 9 are available at IGT Testing Systems. The numbers 3, 4 and 6 thru 9 can be obtained as Roughness Set for AIC2-5 from type AA, article number 409.414.006. The numbers 5 thru 9 can be obtained as Roughness Set for AIC2-5 from type AA, article number 409.414.001</p>		

4. With the brush apply a spot of lacquer onto the strip of paper on the printing disc at the place where the drop of test liquid will fall on the paper and allow the lacquer to dry. (This place will be at a distance of 100 - 105 mm from the beginning in the middle of the strip).



5. Apply 1 to 6 mm<sup>3</sup> trypan blue solution on the lacquered spot by means of the micro syringe (see fig.1).
6. Press one of the two side buttons to start the motor.
7. Press the other side button as well to make a "print"; the drop is spread into a stain.
8. After the sector has stopped, release the side buttons.



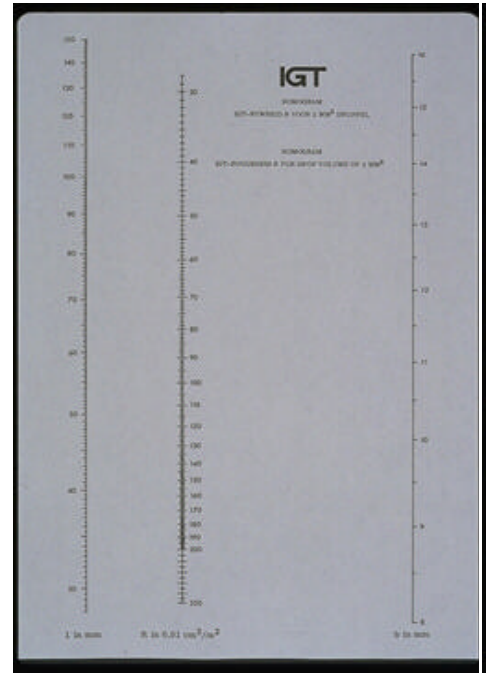
9. Measure the length (l) of the stain to the nearest 0.5 mm. Fig. 2: test result
10. Remove the test strips from the sector.
11. Calculate the roughness as described in the chapter "Assessment".
12. If necessary fill the syringe with the trypan blue solution.  
**W28 for IGT AIC2-5 from type AA**
13. Repeat the points 1 thru 12 for every test strip.
14. After having finished the test clean and store all parts as described in the manual.
15. Make an accurate record of the conditions and the results of the test.

#### Assessment

1. Measure the length (l) of the stain to the nearest 0.5 mm.
2. Measure the width (b) in the centre of the length of the stain to the nearest 0.5 mm.
3. Find the corresponding positions (l) and (b) in the nomogram and connect the two points with a straight line. The intersection with the R-axis gives the roughness in 0.01 cm<sup>3</sup>/m<sup>2</sup> for a drop volume of only 1 mm<sup>3</sup>.
4. Multiply the value of the R-axis with the number of mm<sup>3</sup> of the drop volume used and divide this value by 100. The dimension of the roughness is cm<sup>3</sup>/m<sup>2</sup>.
5. Repeat the points 1 thru 4 for every test strip and calculate the average and if desired the standard deviation. In some cases it may be useful to mention the highest and lowest values as well.

#### Notes

1. The test results of the AIC2-5 and Global Standard Tester 1 and 1-W compare well with one another, on the condition that they have been carried out under the same conditions.
2. Example of calculation for the use of nomogram: Assume a certain paper is tested with a volume  $V = 2 \text{ mm}^3$ . The resulting stain has a length (l) = 70 mm, and a width, measured in the middle of the length, (b) = 13 mm. From the nomogram the value for 100 R at  $1 \text{ mm}^3 = 65$  is found.  
The roughness R is:  
 $R = (V \times 65) : 100 = (2 \times 65) : 100 = 1.3 \text{ cm}^3/\text{m}^2$
3. The area of the stain may be approximated using the formula:  
 $A = 0.85 \times l \times b$   
Herein is:  
A = area of the stain



l = len.  
b = width of the stain Fig. 3: nomogram

In this case the roughness can be calculated with the formula as mentioned for the planimeter in the next point.

4. Sometimes the stain can be irregular. In this case the determination of the roughness from the stain can be carried out by using a the planimeter:
  1. Determine the area of the stain with the planimeter in mm<sup>2</sup>.
  2. Calculate the roughness with the formula:  
 $R = (V \times 1000) : 2 A$   
Herein is:  
V = volume in mm<sup>3</sup> of trypan blue used  
A = area in mm<sup>2</sup> of stain

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 you to send these to IGT Testing Systems, Sales Department.