

## 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 ( $\text{cm}^3/\text{m}^2$ ). 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  $1 \text{ mm}^3$  may be sufficient, while for very rough papers a volume of up to  $6 \text{ mm}^3$  may be necessary.

## Method of operation:

- It is recommended to execute the test in the standard atmosphere; to most standards it is  $23.0 \pm 1.0$  °C ( $73.4 \pm 1.8$  °F) and  $50 \pm 2\%$  rh.
- For the operation of the AIC2-5T2000 and Global Standard Tester follow the instructions of the manuals, IGT information leaflet W100 and the displays accurately.
- Handle the samples carefully.



Fig.1: Roughness on AIC2-5T2000

## 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. For the syringe 705 N only: Mount the syringe into the dispenser/adaptor.
5. Fill the syringe:
  - 5.1 Insert the needle of the syringe with the plunger downwards into the trypan blue solution and fill the syringe with the liquid by moving the plunger upwards, downwards and upwards for several times.
  - 5.2 Clean the needle with rags and ethanol.



Fig.2: Roughness on GST 1/1W

## Materials / testing conditions

1	IGT AIC2-5T2000 or IGT Global Standard Tester 1 or IGT Global Standard Tester 1-W *****	710.000.000 410.000.000 415.000.000
<u>For AIC2-5T2000 only:</u>		
2	Syringe 705N +	409.010.705.414
3	Dispenser BP.600/1 OR Syringe 701N	409.006 409.010.701.414
4	Printing disc, aluminium, 50 mm, ø 65 mm	402.331
5	Water with 1% trypan blue	409.004.000
6	Lacquer	409.005.000
7	Nomogram	409.007
8	Packing, rubber, 55 mm *****	404.001.006
<u>For GST 1/1W only:</u>		
10	Adaptor for micro syringe	409.041
11	Micro syringe 705N 50 mm <sup>3</sup>	409.010.705.410
12	Printing disc, aluminium, 50 mm, ø 65 mm	402.331
13	Water with 1% trypan blue	409.004.000
14	Lacquer	409.005.000
15	Nomogram	409.007
16	Packing, rubber, 55 mm *****	404.001.006
17	Ruler	
18	Strips of paper to be tested, preferable 55 x 340 mm, 10 strips per sample	
19	Lint free rags	
20	Ethanol	

Printing force	1000 N
Printing speed	Increasing, end speed 3 m/s
Quantity of test liquid	1 - 6 mm <sup>3</sup>

- ▶ The numbers 1 thru 20 are available at IGT Testing Systems.
- ▶ The numbers 2,3 and 5 thru 9 can be obtained as Roughness Set for AIC2-5T2000, article number 409.000.705.710.
- ▶ The numbers 4 thru 9 can be obtained as Roughness Set for AIC2-5T2000, article number 409.000.701.710.
- ▶ The numbers 10 thru 16 can be obtained as Roughness Set for Global Standard Tester 1/1W, article number 409.000.705.410.

• This leaflet contains article numbers per January 1st, 2006 •

## 6. For AIC2-5T2000 only

- 6.1 Adjust the printing force of the upper printing disc shaft to 1000 N and pay attention for the right backlash. See W100.
- 6.2 Adjust the printing speed to 3 m/s in the increasing speed mode (▲).

## 7. For GST 1/1W only

- 7.1 Select the menu "Roughness" in the display.
- 7.2 Slide the mounting ring with the ring opening horizontal on the pin of the mounting plate.
- 7.3 Fix the white or black tube connection of the adaptor at the white or black dose air connection of the instrument by rotating or pressing and rotating for only 90 degrees (dependent to the type of connection).
- 7.4 Place the adaptor with the syringe in the mounting ring and fasten it with the screw.

8. Check the functioning of the tester following the instructions in the chapter "Execution".

## Execution

1. Place the printing disc on the printing disc shaft.
2. Attach two test strips of the same paper with the sides to be tested facing one another in the front clamp.
3. Move the sector into starting position.
4. Take care that the one strip is placed over the printing disc and the other strip on the sector.
5. For AIC2-5T2000 only: ▶

- 5.1 Move the printing disc into printing position against the test strips .
- 5.2 Apply with the brush a spot of lacquer onto the strip of paper on the printing disc at the place where the drop of test liquid will fall 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).
- 5.3 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. For GST only:
  - 6.1 Select "Make print" in the display.
  - 6.2 Press the side buttons to move the sector into the starting position, to move the printing disc into printing position and to move the syringe downwards. After these movements release the side buttons.
  - 6.3 Press the button "Enter" to move the syringe upwards. Also the printing disc will release from the paper.
  - 6.4 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).
  - 6.5 Select "Make print" in the display.
  - 6.6 Press the side buttons to move the printing disc into the printing position and to move the syringe downwards.
  - 6.7 Release the side buttons.
  - 6.8 Press button 1, 2, 3 or 4 to apply a drop of the test liquid of 1, 2, 3 or 4 mm<sup>3</sup> on the spot of lacquer of the paper strip. These buttons can be pressed more than once for bigger volumes. It is advised not to use more than 6 mm<sup>3</sup>.
7. Make a "print".
8. Remove the test strips from the sector.
9. Calculate the roughness as described in the chapter "Assessment".
10. If necessary fill the syringe with the trypan blue solution.
11. Repeat the points 1 thru 15 for every test strip. It is recommended to perform the test at least 5 times per sample.
12. After having finished the test clean and store all parts as described in the manual.

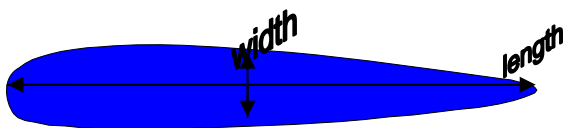


Fig. 3: Test result

13. 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.

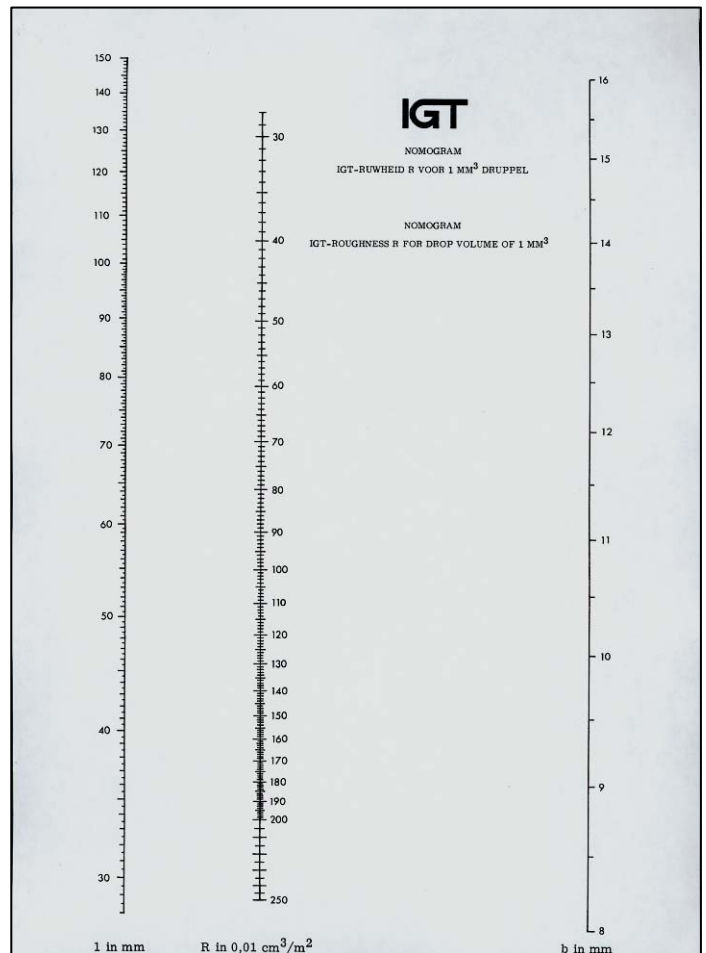


Fig. 4: Nomogram

Length mm      Roughness 0.01 cm<sup>3</sup>/m<sup>2</sup>      Width mm

**Notes**

1. The test results of the AIC2-5T2000, AIC2-5 and the 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 the nomogram:
  - \* Assume a certain paper is tested with a volume V = 2 mm<sup>3</sup>.
  - \* Assume 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 mm<sup>3</sup> = 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 = length of the stain  
 b = width of the stain

The roughness is calculated 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

► In comparison to older IGT leaflets, this leaflet is valid for the AIC2-5T2000 and Global Standard Testers as mentioned

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.