

Test Report

Abrasion Resistance of Bar Code Label

Report No. : H411-08-00028

Issued Date : 2008. 12. 22

Client : TOOTECH

For detail substance of test method and results, please see the attached test report.

**Prepared & Checked by :
For FITI**

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Woo-Jung Shim

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Executive Director**

Sample Code

- Sample 1 : General bar code label
(printing using ribbon of bar code printer)
- Sample 2 : Laser bar code label
(marking using laser light of bar code laser)

Client

- Company : TOOTECH
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Request

Comparison of abrasion resistances between general bar code label and laser bar code label

Test Period

2008. 11. 27 ~ 2008. 12. 12

Test Condition and Tested by

- Test condition :
Temperature : (20 ± 2) °C, Relative Humidity : (65 ± 5) %RH
- Tested by : Gap-Shik Chang
Senior Researcher (gschang@fiti.re.kr)

1. Background


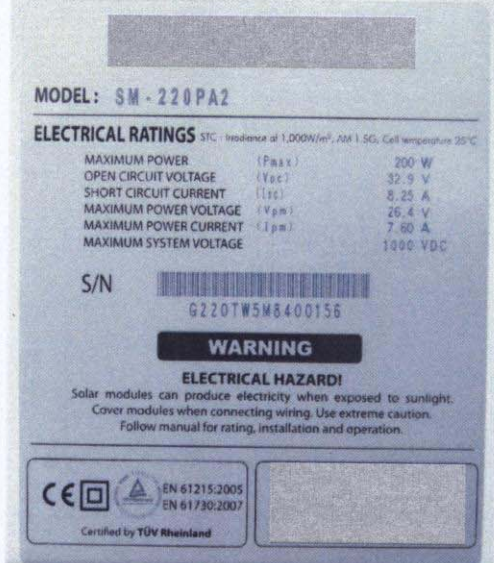
TOOTECK Corporation has asked FITI to measure the surface damage of bar code by performing the abrasion resistance test for 'general bar code label' and 'laser bar code label'.

2. Test Method

2.1 Sample

The general bar code label(sample 1) and laser bar code label(sample 2) requested by the client were shown in table 1. Firstly, the characters are printed on the film sheet using UV ink and then laminated for both labels. The bar code of the general bar code label is printed on the laminated film sheet by printer ribbon while the bar code of laser bar code label is obtained by surface engravings of the film sheet(see figure 1). Therefore, the laser marked bar code is placed under the laminating layer.

Table 1. Samples used in this report

Sample 1 - general bar code label	Sample 2 - laser bar code label												
 <p>⚠ 경고: 과열, 화재, 폭발 위험이 있습니다.</p> <ul style="list-style-type: none"> • 불에 넣거나 가열, 충격, 찌름이 있는 경우 • 어린이, 애완동물이 닿거나 물에 묻어 있을 경우 • 침수 및 배터리 단자에 목질, 금속체 등이 연결된 경우 <p>⚠ 주의: 사용시 주의하십시오.</p> <ul style="list-style-type: none"> • 보관은 실내에서 0~40도 사이에서 보관해 주십시오. • 본 배터리는 소모품입니다. • 배터리에 부풀어 오름이 있을 경우 즉각 사용을 중단해 주십시오. <p>89002Y8902958 4000 mAh 리튬 폴리머</p> <p>※ 배터리의 보증기간은 6개월입니다.</p>	 <p>MODEL: SM-220PA2</p> <p>ELECTRICAL RATINGS <small>STC - Irradiance of 1,000W/m², AM 1.5G, Cell temperature 25°C</small></p> <table border="1"> <tr> <td>MAXIMUM POWER (P_{max})</td> <td>200 W</td> </tr> <tr> <td>OPEN CIRCUIT VOLTAGE (V_{oc})</td> <td>32.9 V</td> </tr> <tr> <td>SHORT CIRCUIT CURRENT (I_{sc})</td> <td>8.25 A</td> </tr> <tr> <td>MAXIMUM POWER VOLTAGE (V_{mp})</td> <td>26.4 V</td> </tr> <tr> <td>MAXIMUM POWER CURRENT (I_{mp})</td> <td>7.60 A</td> </tr> <tr> <td>MAXIMUM SYSTEM VOLTAGE</td> <td>1000 VDC</td> </tr> </table> <p>S/N G220TW5M8400156</p> <p>WARNING</p> <p>ELECTRICAL HAZARD!</p> <p>Solar modules can produce electricity when exposed to sunlight. Cover modules when connecting wiring. Use extreme caution. Follow manual for rating, installation and operation.</p> <p>CE EN 61215:2005 EN 61730:2007 Certified by TÜV Rheinland</p>	MAXIMUM POWER (P _{max})	200 W	OPEN CIRCUIT VOLTAGE (V _{oc})	32.9 V	SHORT CIRCUIT CURRENT (I _{sc})	8.25 A	MAXIMUM POWER VOLTAGE (V _{mp})	26.4 V	MAXIMUM POWER CURRENT (I _{mp})	7.60 A	MAXIMUM SYSTEM VOLTAGE	1000 VDC
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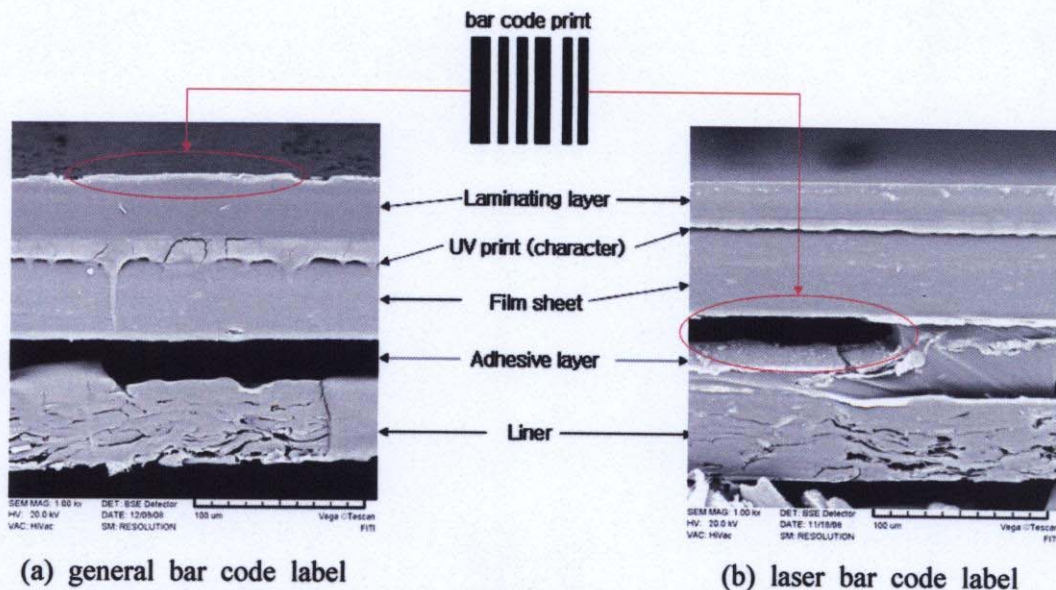


Figure 1. SEM cross-sectioned photograph of bar code labels

2.2 Test method of abrasion resistance

Using the abrasion tester as shown in figure 2, the surface of bar code label was rubbed by abrasant 50, 100, 150, 200, 250 and 300 cycles. Then, the surface damage was examined at each abrasion cycles. During the abrasion, an applied load is 500g and the abrasant contact with specimen(bar code label) was wrapped by white cotton fabric dipped in 1st grade methyl alcohol(99.5%) at each test cycle.

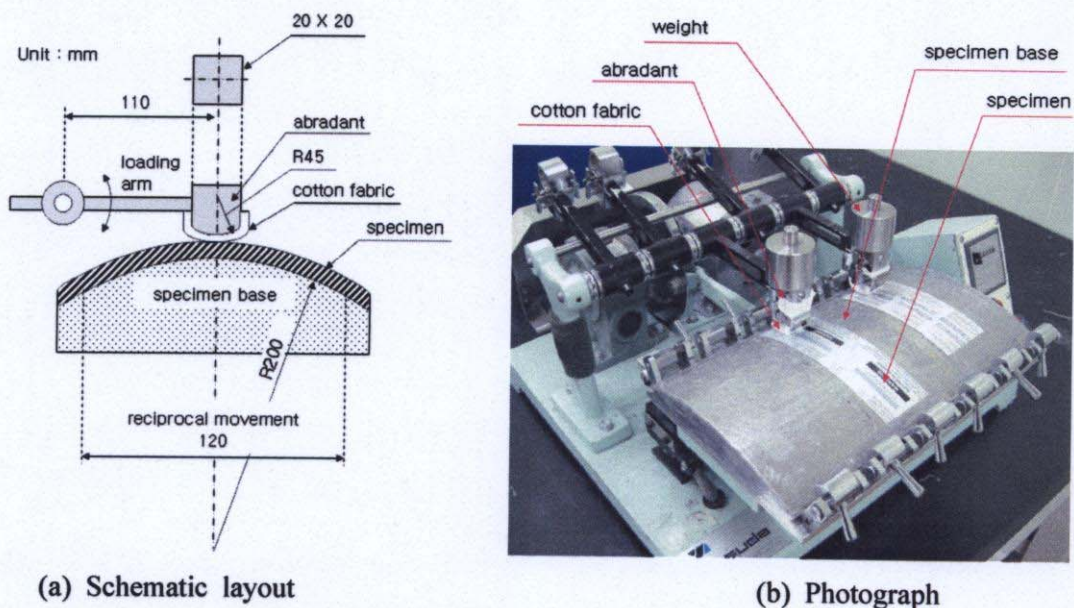


Figure 2. Test equipment of abrasion resistance

3. Results

The test results of abrasion resistance of bar code labels(sample 1 and sample 2) at each abrasion cycle were shown in table 2. In the case of 'general bar code label', the printed bar code was peeled off above 100 abrasion cycles, and the degree of peeling became gradually severe as abrasion cycles increase. However, in the case of 'laser bar code label', the damage on bar code was not observed up to 300 abrasion cycles.

This phenomenon was explained as follows. In general bar code label(sample 1), printed bar code was peel off easily because a bar code was printed on the laminated film sheet. But in laser bar code label(sample 2), the damage of bar code caused by abrasion not occurred by reason that bar code was marked under the laminating layer.

Table 2. Abrasion resistance of bar code label

abrasion cycles	sample 1	sample 2
control		
50 cycles		
100 cycles		

abrasion cycles	sample 1	sample 2
150 cycles		
200 cycles		
250 cycles		
300 cycles		