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EVALUATION CENTER

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RENDERED TO

AnHui GuoFeng Wood-Plastic Composite Co., Ltd.  
No.2 Dongliu Rd, Baohe Industrial Park, Hefei, Anhui, China

PRODUCT EVALUATED

Wood plastic composite board

EVALUATION PROPERTY

Physical Properties

Report of testing wood plastic composite board for compliance with the applicable requirements of the following criteria: ASTM D638-2010, ASTM D790-2010, ASTM D6109-2010, ASTM D256-2010, ASTM E831-2012, ASTM D2394-2005(2011), ASTM D4060-2010, ASTM D5116-2010, ASTM D6007-2002(2008) and ROHS Requirement 2002/95/EC .

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## 2 Introduction

Intertek has conducted testing for AnHui GuoFeng Wood-Plastic Composite Co., Ltd, on wood plastic composite board in accordance with recognized international standards. The coefficient of linear thermal expansion testing and VOCs contents were conducted at the Intertek approved external facility. This evaluation began on March 26, 2012 and was completed on May 25, 2012.

## 3 Test Samples

### 3.1. SAMPLE SELECTION

Samples were submitted to Intertek directly from the client. Samples were not independently selected for testing. Samples were received at the Evaluation Center on March 25, 2012.

### 3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The samples were identified as wood plastic composite board. Photographs of samples were presented in Appendix A , Appendix B and Appendix C . The nominal sizes were summarized in Table below.

Table Nominal Dimensions			
Sample ID	Size(Length × Width × Thickness) (mm)	Quantity (pieces)	Colour
S12034038.001~S12034038.015	1200×138×16 <sup>1</sup>	15	Yellow
S12034038.016~S12034038.020	440×140×20 <sup>2</sup>	5	Brown
S12034038.020~S12034038.040	520×150×25 <sup>3</sup>	20	Brown

- Note: 1. The VOCs contents testing and formaldehyde emission testing were conducted on yellow samples which were presented in Appendix A.  
2. The flexural test (ASTM D6109-10) and ROHS test were conducted on brown samples which were presented in Appendix B.  
3. The other tests were conducted on brown samples which were presented in Appendix C.

## 4 Testing and Evaluation Methods

The test specimens were conditioned for at least 48 hours at a temperature of  $23 \pm 2^\circ\text{C}$  and relative humidity of  $50 \pm 5\%$ .

### 4.1. IMPACT RESISTANCE

The test was conducted in accordance with ASTM D256-2010. Ten individual determinations of impact resistance were tested under the conditions. The average Izod impact resistance of the group of specimens was calculated. Values obtained from specimens that did not break in the manner specified were not included in the average.

### 4.2. FLEXURAL STRESS AND MODULUS

The test was conducted per ASTM D790-10, Procedure A. Specimens were prepared in accordance with the standard. Each specimen was simply supported at a span-to-depth ratio of 16:1, and then loaded at a rate of 2.56mm/min. The flexural strength was terminated when the specimen broke. The flexural strength was calculated as follows:

$$S = 3PL / 2bd^2$$

Where:

S = Stress in the outer fibers, MPa

P = Ultimate load, N

L = Support span, mm

b = width of specimen, mm

d = depth of specimen, mm

Flexural Modulus'secant modulus was the ratio of stress to corresponding strain at any selected point on the stress-strain curve that was the slope of the straight line that joins the origin and a selected point on the actual stress-strain curve. The 1% secant modulus of elasticity was reported.

### 4.3. FLEXURAL TEST

The T strength and stiffness were conducted in accordance with ASTM D6109-2010 Method A. The specimen rectangular cross section was tested in flexure as a beam in a flat mode. The beam rested on two supports and was loaded at two points, each an equal distance from the adjacent support point. The distance between the loading noses is one-third of the support span. The specimen was deflected until rupture occurred in the outer fibers.

### 4.4. TENSILE STRENGTH

The test was conducted per ASTM D638-10. Specimens were prepared using a Type I die cutting tool. Each specimen was placed in the tensile testing machine equipped with self-aligning grips and then loaded at a constant rate of 5mm/min. The tensile strength was calculated by dividing the maximum load by the average original cross-sectional area.

#### 4.5. COEFFICIENT OF LINEAR THERMAL EXPANSION

The test was conducted in accordance with ASTM E831-2012. Measure the initial specimen length in the direction of the expansion test to  $\pm 25 \mu\text{m}$  at 20 to 25 °C. Select appropriate ordinate and abscissa range sensitivity settings on the graphical representation. Heat the specimen at a constant heating rate of 5 °C/min over the desired temperature range and record the changes in specimen length and temperature to all available decimal places. Other heating rates may be used but shall be noted in the report. Then the coefficient of linear thermal expansion over the temperature range was calculated in accordance with the requirements in ASTM E831 Section 10.

#### 4.6. SLIP RESISTANCE TEST

The test was conducted in accordance with ASTM D2394-2005(2011). Wet and dry slip resistances were evaluated. Static coefficients of friction were determined by obtaining the force required to move the specimen from a stationary position. To accomplish this, the sliding unit was placed on the specimen and carefully lined up so the line of force coincides with a line through the center of gravity of the mass of the sliding unit. The chain was loaded at a rate of separation of the testing machine heads of 1.27 mm/min. The load required to move the sliding unit divided by the mass of the sliding unit was the static coefficient of friction. Sliding coefficients of friction were determined by measuring the average force required to maintain movement at a rate of separation of the heads of the testing machine of 51 mm/min.

#### 4.7. ABRASION RESISTANCE

The test was conducted in accordance with ASTM D4060-10. The type of abrasive wheels was CS-17, the test speed was  $60 \pm 2$  r/min, and the attached load was 1000g. Before test, the initial mass of the specimens A were measured. After 1000 cycles, the final mass of the specimens B were measured. Weight Loss was calculated using the following formula:

$$L = A - B$$

#### 4.8. FORMALDEHYDE EMISSION

The test was conducted in accordance with ASTM D6007-2002(2008). Eight 70 mm  $\pm$  2 by 127  $\pm$  2 mm by panel thickness specimens were used for each test. The tests were conducted in a room maintained at  $24 \pm 0.6$  °C. Sample solution was made in the room. Formaldehyde in 4-mL aliquot of sample was read from calibration curve. Formaldehyde concentration in weight per unit volume in the solution was calculated.

#### 4.9. ROHS

The test was conducted in accordance with RoHS. The limits were quoted from 2002/95/EC and amendment 2005/618/EC.

RESTRICTED SUBSTANCES	LIMITS
CADMIUM (Cd)	0.01% (100 ppm)
LEAD (Pb)	0.1% (1000 ppm)
MERCURY (Hg)	0.1% (1000 ppm)
CHROMIUM (VI) (Cr <sup>6+</sup> )	0.1% (1000 ppm)
POLYBROMINATED BIPHENYLS (PBBs)	0.1% (1000 ppm)
POLYBROMINATED DIPHENYL ETHERS (PBDEs)	0.1% (1000 ppm)

#### 4.10. VOCS CONTENTS

The test was conducted in accordance with ASTM D5116-10. Placed a piece of wood plastic composite board (70.0cm\*12.5cm\*1.2cm, total surface area was 0.20m<sup>2</sup>, the loading ratio was 0.2 m<sup>2</sup>/m<sup>3</sup>) in the 1.0 m<sup>3</sup> VOC chamber and hold 24 hours at the 23 ±1 °C, 50%±5% relative humidity conditions. Keep the air change=0.5h<sup>-1</sup>. Then sampling by Tenax TA® sorbent with subsequent thermal desorption and separated by Agilent 6890GC and detected by 5973MSD, Aldehydes gather by DHPH and detected by HPLC.

The range of TVOC is detected between and including n-hexane and n-hexadecane with gas chromatography. The calculated TVOC is converted to the sum of peak areas using the toluene response factor.

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## 5 Testing and Evaluation Results

### 5.1. RESULTS AND OBSERVATIONS

The test results are summarized in Table 1 below.

Table 1

Test Method	Characters	Result		
ASTM D638	Tensile test	18.0 Mpa		
ASTM E831	Coefficient of linear thermal expansion	40.5 $\mu\text{m}/\text{m}\cdot^\circ\text{C}$		
ASTM D256	Impact resistance	33.7 J/m Type of break: Complete Break		
ASTM D6109	Flexural strength	MOR: 29.3 Mpa MOE: 3715 Mpa		
ASTM D790	Flexural properties	MOR: 34.1 Mpa MOE: 2503 Mpa		
ASTM D4060	Abrasion resistance	Weight loss :0.07 g <sup>1</sup>		
ASTM D2394	Slip resistance		Static coefficient of friction	Dynamic coefficient of friction
		Dry surface	0.37	0.34
		Wet surface	0.40	0.36
RoHS	2002/95/EC Cd $\leq$ 0.01% Pb $\leq$ 0.1% Hg $\leq$ 0.1% Cr <sup>6+</sup> $\leq$ 0.1% PBBs $\leq$ 0.1% PBDEs $\leq$ 0.1%	Cd: ND <sup>2</sup> Pb: 53 ppm <sup>3</sup> Hg: ND Cr <sup>6+</sup> : ND PBBs: ND PBDEs: ND		
ASTM D6007 <sup>1</sup>	Formaldehyde test	ND <sup>2</sup>		

Note:

1. The type of abrasive wheels was CS-17, the test speed was  $60 \pm 2$  r/min, the attached load was 1000g and the quantity of test cycles was 1000.
2. ND: Not Detected
3. ppm = mg/kg = MILLIGRAM PER KILOGRAM

Table 2

Table 2 Test Results of Single VOC Compounds (ASTM D5116)				
No.	Retention time, min	Compounds name	CAS NO.	Result: ug/m3
1	7.247	Ethyl acetate	141-78-6	3.08
2	11.123	Toluene	108-88-3	20.00
3	13.003	Ethylbenzene	100-41-4	32.04
4	13.132	m+p-Xylene	—	14.25
5	13.524	styrene	100-42-5	13.37
6	13.572	O-Xylene	95-47-6	10.29
7	14.241	.alpha.-Pinene	80-56-8	22.83
8	14.606	Benzene, 1-ethyl-3-methyl-	620-14-4	3.68
9	15.095	Benzene, 1,2,3-trimethyl-	526-73-8	9.14
10	15.331	3-Carene	13466-78-9	11.80

Note: TVOC: 141.58 ug/m<sup>3</sup> (Toluene response factor)

Compounds Retention Time at 8.936min; 12.737min; 14.087min are internal standards.

Table 3

Table 3 Aldehydes (ASTM D5116)			
No.	Compounds name	CAS NO.	Result: ug/m3
1	Formaldehyde	50-00-0	8.52
2	Acetaldehyde	75-07-0	4.41

#### 5.1.1. Statement of Measurement Uncertainty

When determining the test result, measurement uncertainty has been considered.



## 6 Conclusion

The wood plastic composite board samples identified and evaluated in this report have been tested in accordance with ASTM D638-2010, ASTM D790-2010, ASTM D6109-2010, ASTM D256-2010, ASTM E831-2012, ASTM D2394-2005 (2011), ASTM D4060-2010, ASTM D5116-2010, ASTM D6007-2002(2008) and RoHS Requirement 2002/95/EC. The results were presented in Section 5 of this test report.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

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