■ Braking Test

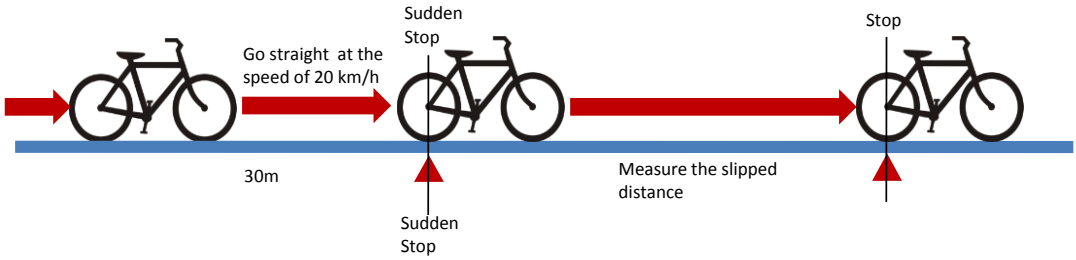
-. Purpose : Check the performance of tire by measuring braking distance in the conditon of riding at a steady speed and sudddenly stop by hitting the rear break

-. Test Method

① Go straight fixed distance of 30m at the speed of 20 km/h on the slippery road condition

② Suddenly stop by hitting the rear break at the fixed point

③ Measure the slipped distance of bicycle

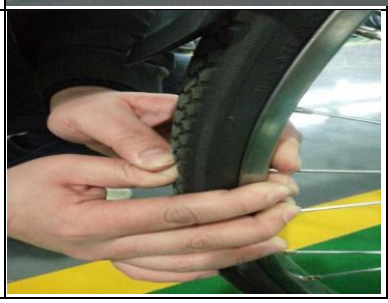


-. Test Bicycles and Tires

① Test Bicycle : Shin Long E-BIKE (Same Bicycles, but only color is different)

② Test Tire : Pneumatic Tire VS Tannus Tire

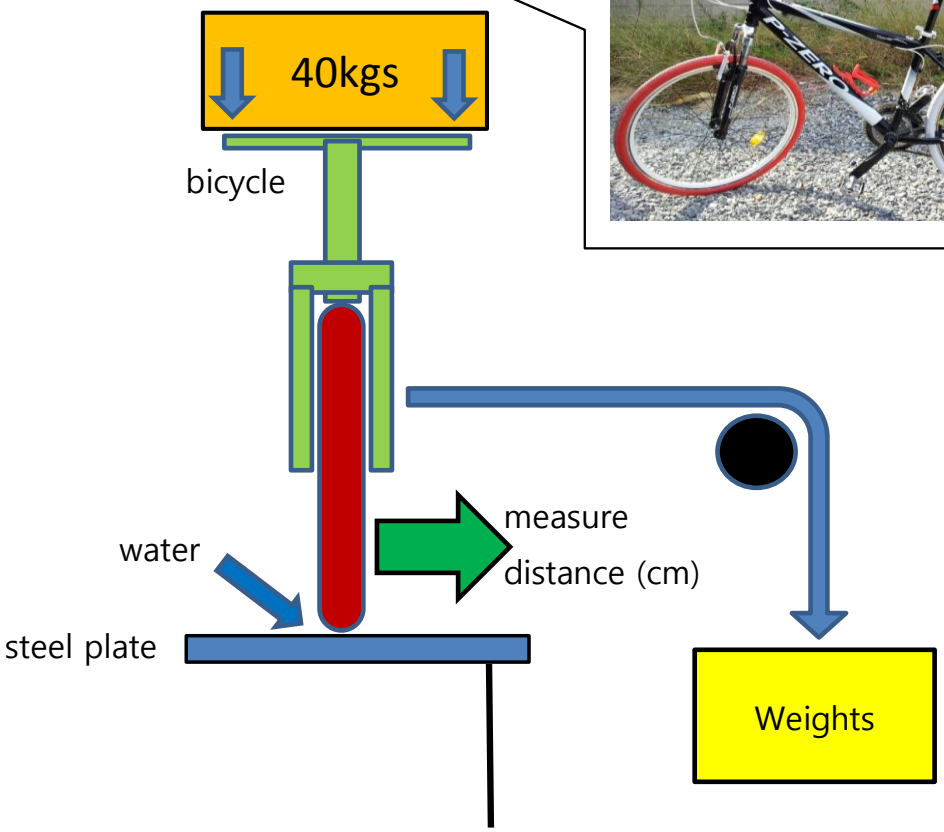
-. Test Result

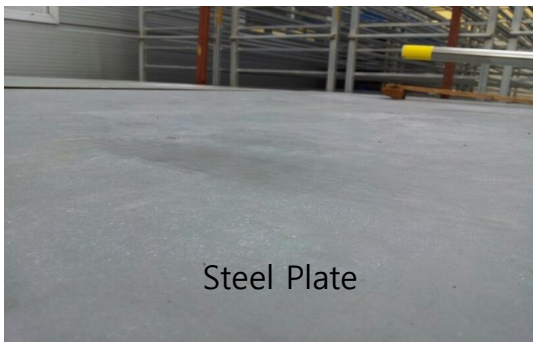
Number	Mileage (m)	Running Speed (km/h)	Braking Distance(m)	
			Pneumatic Tire	**TANNUS**
			26"x1 3/8" (35-590)	
1	30	20	6.3	6.9
2	30	20	6.7	6.5
3	30	20	7.1	7.1
MEAN			6.70	6.83
Figure of Road Condition				
Figure of Tire State				

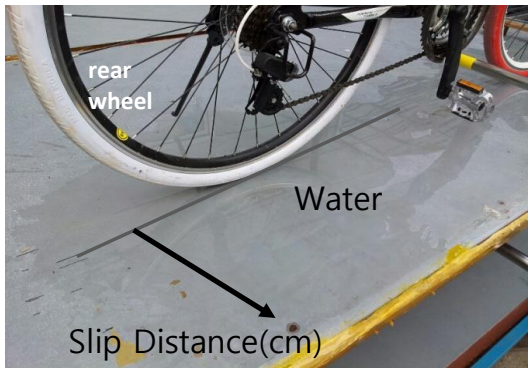
■ Side Slip Test Result

1. Test

-. Test Bicycle : P-Zero
-. Water : 1L







2. Result

-. There occurs no significant slip by both of Thoroki and normal tire

-. Data

Weights	No.	Tannus Tire (Thoroki 26"x1.75)	Rubber Tire (Kenda Small block eight 26"x2.1)
		Slip Distance (cm)	
10kgs		**0**	**0**
20kgs		**0**	**0**
30kgs		**0**	**0**
40kgs	1	0	0
	2	0.5	0
	3	0	0
	4	1	0.5
	5	0	0.5
	6	0	0
	7	0.5	0
	8	0	1
	9	0	0
	10	0	0
	Average	**0.2**	**0.2**
Photo			
			

■ Heat Resistance Test

-. Purpose : Verify that about how much TANNUS tire endures in a very high temperature condition.

-. Test Method : Observe shrinkage and changes of state after storing TANNUS tire for 3 hours in a 90 degrees oven

-. Test Result

Test Items		Before Test(mm)	After Test(mm)	Shrinkage(%)	Test Figures
Width of Tire	1	40.25	39.70	1.37%	
	2	40.25	39.60	1.61%	
	3	40.3	39.65	1.61%	
	4	40.2	39.55	1.62%	
	Mean	40.25	39.63	**1.55%**	
Height of Tire	1	43.5	42.70	1.84%	
	2	43.55	42.70	1.95%	
	3	43.8	43.05	1.71%	
	4	43.4	42.55	1.96%	
	Mean	43.5625	42.75	**1.87%**	
Inner Diameter	1	292	287	1.71%	
	2	291	286	1.72%	
	Mean	291.5	287	**1.72%**	
Changes of state		There was no visible changes such as deformation, distortion and tear			

■ Cold Resistance Test

-. Purpose : Verify that about how much TANNUS tire endures in a very low temperature condition.

-. Test Method : Observe shrinkage and changes of state after storing TANNUS tire for 24 hours in a freezer(minus 20 degrees) in a condition of loaded heavey object on.

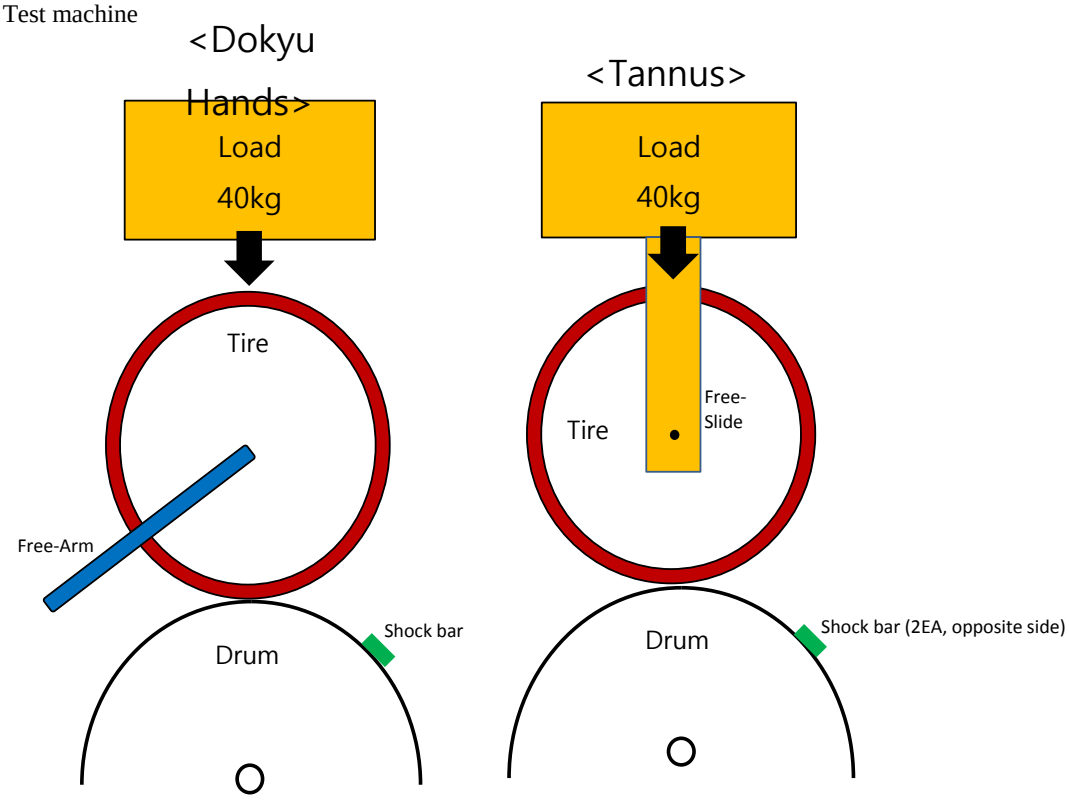
-. Test Result

Test Items		Before Test(mm)	After Test(mm)	Shrinkage(%)	Test Figures
Width of Tire	1	26.85	26.85	0	
	2	27.10	27.05	0.18%	
	3	27.10	27.10	0	
	4	27.20	27.20	0	
	5	27.35	27.30	0.18%	
	6	27.05	27.05	0	
	Mean	27.11	27.09	0.06%	
Height of Tire	1	33.90	33.90	0	
	2	34.45	34.45	0	
	Mean	34.18	34.18	0	
Inner Diameter	1	335	335	0	
	2	334	334	0	
	Mean	335	335	0	
Changes of State	There was no visible changes such as deformation, distortion and tear				

■ Hub Damage Test

1. Purpose : Test that how to affects the hubs for cycling with TANNUS tire in comparison with normal tire

2. Test machine

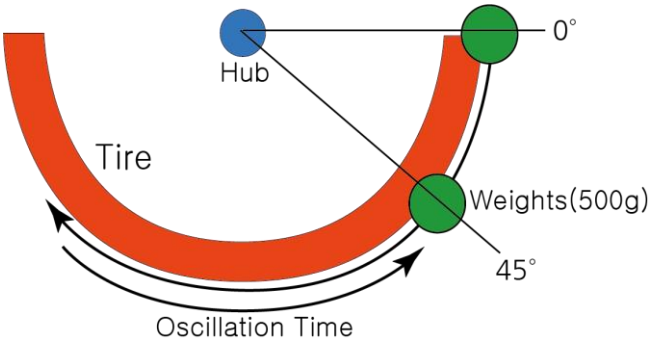


3. Test

a. Load : 40kg
b. Speed : 30km/h
c. Toal cycling distance : 3000km
d. Shock bar : 2mm height × 10mm width × free length
e. Tire : TANNUS Musai 700x23C H1 & Panaracer Race D 700x23C 120psi
f. Vibration check with sensor

4. Results check

a. Visual damage on hub and wheel set
b. Visual balance and regularity of spining wheel
c. Checkpoint : Before and after check of oscillation time between new wheel and tested wheel
d. Range : Starts from 0˚, check when it comes to 45˚
e. Vibration check : Maximum vibration comparison between TANNUS and normal tire



■ Hub Damage Test Result

1. Test
   a. Load : 40kg
   b. Speed : 30km/h
   c. Total cycling distance : 3000km
   d. Shock bar : 2mm height × 10mm width × free length
   e. Tire : Musai 700x23C H1 & Panaracer Race D 700x23C 120psi
   f. Vibration check with sensor

2. Result

   a. Both of Musai and Race D doesn't harm rolling condition of the hub by this test.

   b. Data

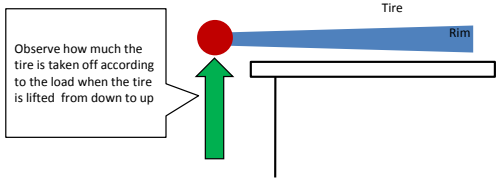
Tire / Article	Panaracer Race D					TANNUS Musai				
Visual Damage on Hub & Wheel after Test	OK					OK				
Visual Balance & Regularity of Spinning Wheel	OK					OK				
Vibration Check	Oscillation Time (sec)					Oscillation Time (sec)				
		Before Test		After Test			Before Test		After Test	
		45˚	Stop	45˚	Stop		45˚	Stop	45˚	Stop
	1th	57	201	61	203	1th	39	106	46	123
	2nd	59	200	62	202	2nd	40	107	47	123
	3rd	59	202	61	203	3rd	38	105	46	121
	Average	**58.3**	**201**	**61.3**	**202.7**	Average	**39**	**106**	**46.3**	**122.3**
Photo										

※ Each Tires use different wheel set

■ Rim-off test

-. Purpose : Observe the process of changes that the tire comes off the rim according to the load change

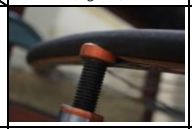
-. Test Method



-. Test Tire

① Tubular Schwallbe Milano 700×23C(23-622)
② Musai 700×23C(23-622)
③ Thoroki 26"×1.75(44-559)
④ Clincher Tire Schwalbe Marathon 26"×1.75(47-559)

-. Test Result

experimental stage	Tire / Load(kg)	Tubular (Air-tire)		Musai (700x23C)		Thoroki (44-559)		Thoroki (35-590))		Clincher (Air-tire)	
		State of Tire (Figures)	Explanation	State of Tire (Figures)	Explanation	State of Tire (Figures)	Explanation	State of Tire (Figures)	Explanation	State of Tire (Figures)	Explanation
1	30		Start to lift the tire		Start to lift the tire		Start to lift the tire		Start to squash the tire		Start to squash the tire
2	50		Lift half the tire		The tire is lifted and see the rim slightly		The tire is lifted and see the rim slightly		The tire is lifted and see the rim slightly		Squashed part is only dented
3	70		Lift the tire competely		The tire is lifted and see half the rim		The tire is lifted and see half the rim		The tire is lifted and see half the rim		Squashed part is only dented as well
4	90				The tire is lifted and see three quarters the rim		The tire is lifted and see three quarters the rim		The tire is lifted and see three quarters the rim		Squashed part is only dented as well
After removing the load			The tire is completely off the rim even by hand.		The tire is restored back again		The tire is restored back again		The tire is restored back again		The tire is restored back again

■ Weather resistance test of TANNUS tire

1. Purpose : Physical properties of TANNUS tire by environmental changes

2. Test :

1) Physical properties test - Tensile strength, Tear strength, Elongation

2) Accelerated weathering test

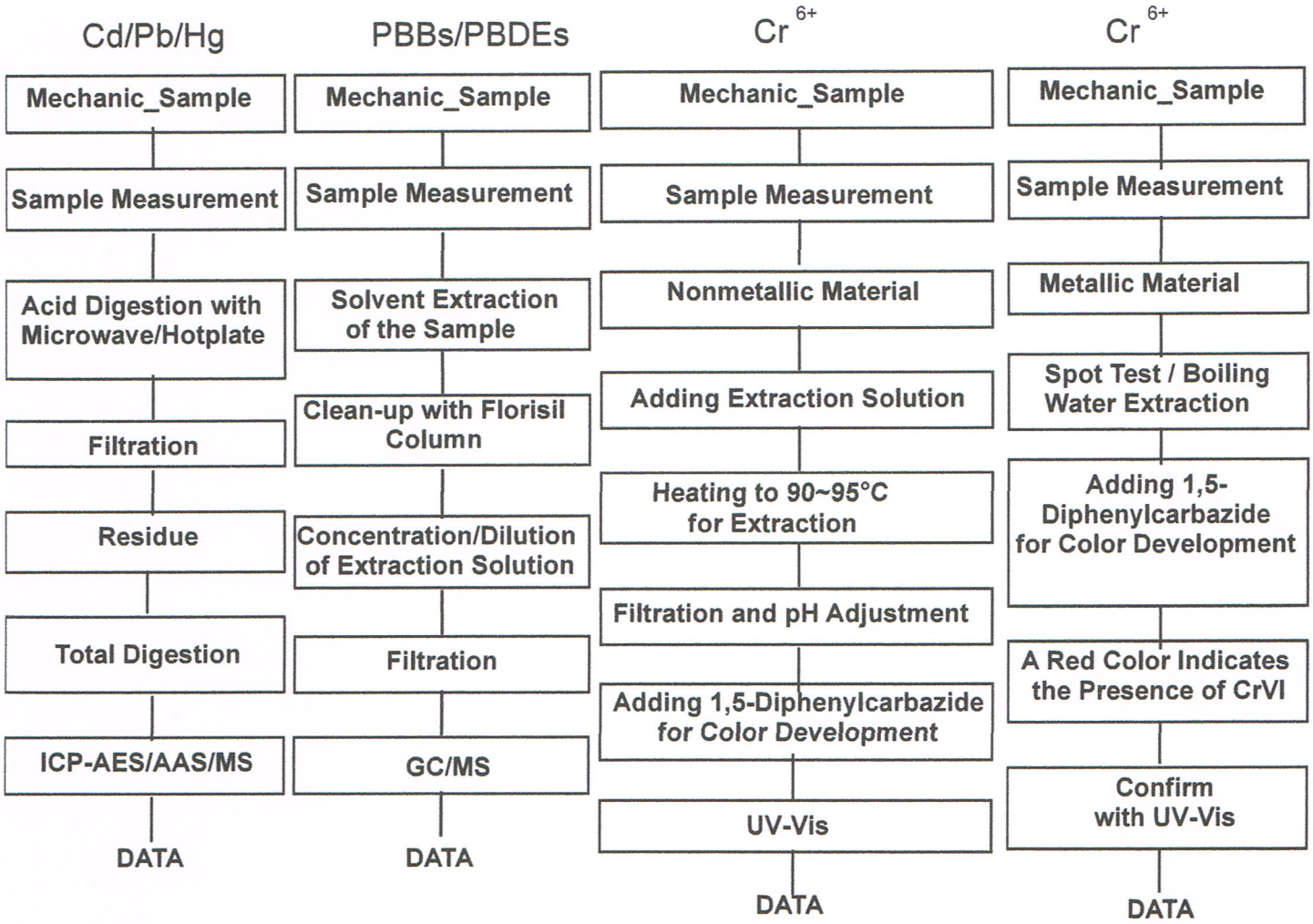
-. Xenon arc type
-. Irradiance : 0.35W/m²(340nm)
-. 63±3℃ black panel tempertaure
-. 50±5% relative humidity
-. 100 hour
-. Cycle : 102min Light only & 18min Light and spray

3) Variation check of physical properies test after accelerated weathering test

3. Result

Article						Method
Before accelerated weathering test			After accelerated weathering test			
Tensile Strength (MPa)	Elongation (%)	Tear Strength (kN/m)	Tensile Strength (MPa)	Elongation (%)	Tear Strength (kN/m)	KS M 6518 : 2006 ASTM G 155 : 2005
5.0	**460**	**31**	**5.8**	**370**	**29**	

Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+} /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

Picture of Sample as Received:

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

Sample No. : AYAA12-31183.001
Sample Description : TANNUS TIRE
Item No./Part No. : AITHER I
Materials : Polymers

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

Test Report No. F690101/LF-CTSAYAA12-31183

To: **FINE CHEMICAL CO., LTD.**
7-1 Jukgok-ri
Jinyoung-eup
Gimhae-si
Gyeongsangnam-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA12-31183
Product Name	: TANNUS TIRE
Item No./Part No.	: AITHER I
Received Date	: 2012. 08. 23
Test Period	: 2012. 08. 24 to 2012. 08. 28
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

Certificate of Test

36 Goeyeon-Dong, Yeongcheon, Gyeongbuk 770-170, S. KOREA GYEONGBUK HYBRID TECHNOLOGY INSTITUTE (Tel: +82-54-330-8000, Fax: +82-54-330-8039)	Certificate No. : T12-0031 Page (1)/(2)Pages	

1. Client

- Name : TANUS Tire
- Address : 1678 Bonsan-ri, Jinyeong-eup, Gimhae-si, Gyeongsangnam-do, Korea
- Date of Receipt : September 3, 2011

2. Use of Report : Reference

3. Test Sample : T590-1 (# 1EA)

4. Date of Test : September 25, 2011 ~ September 26, 2011

5. Test Method Used : EN 14764:2005 Annex C : Structural intergrity of fully assembled bicycle

6. Testing Environment : Temperature : (23 ± 2) ℃ , Relative Humidity : (28 ± 2) % R.H.

7. Test Results :

Test Sample	Requirement	Result
T590-1	There shall be no visible cracks or fractures in any part of bike.	Pass

Affirmation	Tested by Name : Shin, Dong-woo	Technical Manager Name : Jeong, Hui Jin

September 28, 2012

KOLAS **GYEONGBUK HYBRID TECHNOLOGY INSTITUTE**

It is a Certificate of test bring out MRA(Mutual Recognition Arrangement) of ILAC (International Laboratory Accreditation Cooperation) agreement with KOLAS(Korea Laboratory Accreditation Scheme).

Certificate of Test	Certificate No. : T12-0031 Page (2)/(2)Pages	

▣ T590-1 (# 1 EA)

1. Test Figure

<Fig.1>

2. Test condition

Classification	Unit	Value	Remark
Speed	km/h	8	-
Period	h	6	-
Weight Seat pillar	kg	36	-
Weight R/H pedal	kg	18	-
Weight L/H pedal	kg	18	-
Weight R/H handlebar	kg	6.75	-
Weight L/H handlebar	kg	6.75	-
Weight Luggage-carrier	kg	10	-

3. Test Result

Requirement	Result
There shall be no visible cracks or fractures in any part of bike.	Pass

- The end -

MATERIAL SAFETY DATA SHEET

PRODUCTION IDENTIFICATION

MANUFACTURER'S NAME	:	Tannus Co.,Ltd.
ADDRESS	:	1687 Bonsan-Li Jinyoung-Eup Kimhae-City Korea
PRODUCT NAME	:	**TANNUS TIRE**
CHEMICAL IDENFICATION	:	Ethylene alphaolefin elastomer blend

SECTION 1 HAZARDOUS INGREDIENTS

Not applicable for this product

SECTION 2 PHYSICAL DATA

BOILING POINT	:	Not applicable
SOLUBILITY IN WATER	:	None, Insoluble
APPEARANCE & ODOR	:	Colored skin & Mild odor
SPECIFIC GRAVITY	:	0.35-0.50
VAPOR DENSITY	:	Not applicable
VAPOR PRESSURE	:	Not applicable
PERCENT VOLITLE BY VOLUME	:	None

SECTION 3 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT	:	Not applicable
EXTINGUISHING MEDIA	:	Water, Carbon dioxide, Dry powder, Sand
FIRE AND EXPLOSION HAZARDS	:	Carbon monoxide, ammonia and other toxic gases may be liberated when it is burned.

SECTION 4 HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE : Not available

EFFECTS OF OVEREXPOSURE :

At the temperature 180℃, fumes irritating to the eyes, nose and throat may be produced. Exposure may result in redness and itching in the eyes together with soreness in the nose.

EMERGENCY AND FIRST AID PROCEDURES : In case of contact with eyes and skin, rinse with plenty of water immediately.

SECTION5. REACTIVITY DATA

STABILITY : Stable at normal temperature and storage conditions

MATERIALS TO AVOID : Strong oxidizers, acids, bases

HAZARDOUS POLYMERIZATION : will not occur

THERMAL DECOMPOSITION : Carbon monoxide and other toxic vapors generated with combustion

SECTION 6 SPILL OR LEAK PROCEDURES

WASTE DISPOSAL : Dispose in accordance with local, state and federal regulations.

SECTION 7 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION : Suitable respirator

VENTILATION PROCEDURE : Mechanical ventilation recommended

EYE PROTECTION : Standard safety goggles

PROTECTIVE GLOVES : None required

SECTION 8 SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

: Store below 50℃

the way to trust KCL

시험성적서

1. 성적서번호 : CT11-38763
2. 의뢰자
   - ㅇ 업 체 명 : 화인케미칼(주)
   - ㅇ 주　　소 : 경남 김해시 진영읍 죽곡리 7-1
   - ㅇ 의뢰일자 : 2011.08.18
   - ㅇ 시험발급일 : 2011.08.25
3. 시험성적서의 용 도 : 품질관리
4. 시료명 : Aither I Compound 시편(A~D)
5. 시험결과 541D GG HG HG-G

시 험 항 목		단위	시 험 결 과				시 험 방 법
			A	B	C	D	
촉진내후성 (100 h)후	색차(⊿E*ab)	-	27.2	32.3	31.3	1.7	ASTM D 2565:2008

▶ 촉진내후성 조건
- Weather - O - Meter, Xenon Arc Type
- Irradiance : 0.35 W/㎡ (340 nm)
- Black Panel Temperature : (65±3) ℃
- Relative Humidity : (50±5) %
- Cycle : 102 min Light only & 18 min Light and spray

----- 이 하 여 백 -----

확 인	시험자 박재철	승인자 이인우

비고: 1. 이성적서는 의뢰자가 제시한 시료 및 시료 명으로 시험한 결과로서 전체제품에 대한 품질을 보증하지는 않습니다.
2. 이 성적서는 홍보, 선전, 광고 및 소송용으로 사용될 수 없으며, 용도 이외의 사용을 금합니다.

한국건설생활환경시험연구원장

부산울산경남지원 : 618-230 부산 강서구 지사동 1276번지 051-941-8790
결과문의 : ☎(051)941-8790