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Prüfbericht - Nr.: *Test Report No.:*	**11025279 001**	**Seite 1 von 17** *Page 1 of 17*

Auftraggeber: *Client:*	**Sun Chang Industry CO., Ltd.** 75, Lane 260, Sec. 1, Chung-Shan Rd., Pei-Tou, Changhua Hsien 521, Taiwan, R.O.C.
Gegenstand der Prüfung: *Test item:*	Brake shoes for mountain-bicycles

Bezeichnung: *Identification:*	913V	**Serien-Nr.:** *Serial No.:*	Engineering samples
Wareneingangs-Nr.: *Receipt No.:*	--	**Eingangsdatum:** *Date of receipt:*	--

Prüfort: *Testing location:*	Cycling & Health Tech Industry R&D Center No.17, 37 Rd., Taichung Industry Park 407, Taichung, Taiwan, R.O.C. TÜV Rheinland Taiwan Ltd., Taichung Laboratory No. 9, Ln. 36, Sec. 3, Minsheng Rd., Daya District, Taichung City 428, Taiwan, R.O.C.
Prüfgrundlage: *Test specification:*	**§4.6.7 & §4.6.8 of EN 14766:2005**
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test item passed the test specification(s).*
Prüflaboratorium: *Testing Laboratory:*	TÜV Rheinland Taiwan Ltd., Taichung Laboratory No. 9, Ln. 36, Sec. 3, Minsheng Rd., Daya District, Taichung City 428, Taiwan, R.O.C.

geprüft/ *tested by:*

Bryan Lee/ Project Engineer
TÜV Rheinland Taiwan Ltd.

27 June. 201

kontrolliert/ *reviewed by:*

2011. 2. 27   Chih-Hao Lien / Manager

Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other Aspects:*

- This report consists of 17 pages of test report and 4 pages of photo documentation as an attachment.

Abkürzungen:	**P(ass)**	**=**	**entspricht Prüfgrundlage**	**Abbreviations:**	**P(ass)**	**=**	**passed**
	F(ail)	**=**	**entspricht nicht Prüfgrundlage**		**F(ail)**	**=**	**failed**
	N/A	**=**	**nicht anwendbar**		**N/A**	**=**	**not applicable**
	N/T	**=**	**nicht getestet**		**N/T**	**=**	**not tested**

Verwendete Messgeräte / Prüfmittel

Measuring Equipment List

Messung *Equipment*	Inventar-Nr. *Inventory no.*	nächste Kalibrierung *next calibration*
Digital tachometer	1151	Apr, 2013
Gauge	1002	Jun, 2012
Braking performance test machine*	D2, S/N: 60380	Apr, 2012
Tachometer*	LINE SEIKI, TM-4000	Oct, 2012
Pressure gauge*	SKON, SDI04-1-1-3-200PSI	Apr, 2012

Note:The measuring equipments with " * " marks belong to Cycling & Health Tech Industry R&D Center that are well -maintained and calibrated by ITRI & CNLA accredited laboratory.

Description of sample:

Dimension (mm)	13.7 x 60 x 38.2

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Clause	Requirements	Remarks - Results	Verdict

4.6	**Brakes**		
4.6.7	**Backing performance**		
4.6.7.1	**General** Braking performance is determined by the distance to stop (the braking distance). Two test methods are specified and experience has shown that either method can be used. One test method is the track test in which braking distance is measured directly with the progressive characteristics of the brakes being self-evident. Then alternative test method is the machine test in which braking force is measured and, from which, braking distance is calculated. The progressive characteristics of the brake are determined by linearity measurements. A final, simple track test checks for smooth, safe, stopping characteristics. Whichever method is used there shall be compliance with 4.6.7.2 and 4.3.7.3.	Machine test was considered.	P
4.6.7.2	**Test bicycle** Conduct the braking-performance test on a fully assembled bicycle after the brakes have been subjected to the strength test detailed in 4.6.6. Before testing the bicycle by either method, inflate the tyres and adjust the brakes all according to the manufacturer's instructions, but in the case of rim-brakes to the maximum clearance specified by the manufacturer.	Tunings are conducted before performance test; the tyres are inflated in accordance with manufacturer's instructions.	P
4.6.7.3	**Secondary brake levers** Where a bicycle is fitted with secondary brake-levers attached to handbrake-levers, bar-ends or aerodynamic extensions, separate tests shall be conducted for the operation of the secondary brake-levers in addition to tests with normal levers.	No secondary brake levers are equipped.	N/A
4.6.7.4	**Requirements**		
4.6.7.4.1	**Braking distance** The bicycle shall fulfill the requirements shown in Table 1.	Braking distance:	P

Table 1 — Brake test velocities and braking distances

Condition	Velocity km/h	Brakes in use	Braking distance m
Dry	25	Both	6,00
		Rear only	10,00
Wet	16	Both	5,00
		Rear only	10,00

Braking distance:

Dry	Front	5.7 m
	Rear	9.16 m
Wet	Front	4.72 m
	Rear	8.5 m

Remark: In accordance with clause 4.6.7.5.2.7, the brake distance of front wheel shall be compared with the requirement of both brakes in Table 1.

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Clause	**Requirements**	**Remarks - Results**	**Verdict**

4.6.7.4.2	**Smooth, safe-stop characteristics**
	
	The bicycle shall show smooth, safe-stop characteristics.
	
	i) For the track test, smooth, safe-stop characteristics are defined as stopping within the required distances without occurrence of any of the following:
	
	    a) excessive juddering;
	
	    b) front wheel locking;
	
	    c) bicycle overturning (rear wheel lifting uncontrollably);
	
	    d) rider's loss of control;
	
	    e) excessive side-skid causing the rider to put his foot to the ground to retain control.
	
	With certain types of braking system, it may not be possible to avoid entirely some skidding of the rear wheel during braking; this is considered acceptable provided that d) or e) above do not occur as a result.
	
	ii) For the machine test, smooth, safe-stop characteristics are defined by compliance with the linearity requirements specified in 4.6.7.5.2.3 and the simple track test described in 4.6.7.5.2.7 VIII).
		The curves of braking forces with best fitting lie within the ±20 % limit lines.	**P**

4.6.7.4.3	**Ratio between wet and dry braking performance** In order to ensure safety for both wet and dry braking, the ratio of braking performance wet: dry shall be greater than 4:10. The methods for calculating this ratio are given in 4.6.7.5.1.11 III) for the track test and in 4.6.7.5.2.7 VII) for the machine test.	Ratios between wet & dry braking performance at front & rear wheels are greater than 4:10	**P**
4.6.7.5	**Test methods**		
4.6.7.5.1	**Track test method**		

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.1.1	**Test track** a) Use an indoor test-track if possible. If an outdoor test-track is used, pay special attention to ambient conditions throughout the test; b) The gradient of the track shall not exceed 0,5%. If the gradient is less than 0,2% carry out all runs in the same direction. If the gradient lies between 0,2% and 0,5% carry out alternate runs in opposite directions; c) The surface shall be hard, of concrete or fine asphalt free from loose dirt or gravel. The minimum coefficient of friction between the dry surface and the bicycle tyre shall be 0,75; d) The track shall be essentially dry at the commencement of tests. When testing to the method described in 4.6.7.5.1.6, the track shall remain dry throughout the tests; e) The wind speed on the track shall not exceed 3 m/s during the tests.	Machine test was considered.	**N/A**
4.6.7.5.1.2	**Instrumentation** The test bicycle or the test track shall be instrumented to include the following: a) a calibrated speedometer or tachometer (accurate to within ± 5%) to indicate to the *rider* the approximate speed at the commencement of braking (3.11); b) a velocity recording device (accurate to within ± 2 %) to record the velocity at the commencement of braking (3.11); c) a distance recording system (accurate to within ± 1 %) to record the braking distance (3.10); d) a water spray system, to provide wetting of the braking surface, consisting of a water reservoir connected by tubing to pair of nozzles at the front wheel and a pair of nozzles at the rear wheel. A quick-acting on/off valve shall be included for control by the rider. Each nozzle shall provide a flow of water at ambient temperature of not less than 4ml/s; Details of the positions and directions of nozzles for rim-, hub-, band-, and disc-brakes are given in Figures 8 to 13. NOTE: Figures 8 and 9 for rim-brakes show side-pull callipers but the same arrangements apply to centre-pull calipers and cantilever brakes. e) a brake-actuation indicating system, to record independently when each lever is activated.	Machine test was considered.	**N/A**

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.1.3	**Mass of bicycle, rider and instrumentation** The combined mass of the bicycle, the rider, and the instrumentation shall be 100kg. When, wet-condition braking tests are performed, the combined bass can decrease during the test due to water consumption, but it shall be not less than 99 kg at the end of the valid test runs. Where a manufacturer specifies that his bicycle can carry a mass such that the total of that mass plus that of the bicycle is in excess of 100 kg, the bicycle shall be tested at that greater total mass and it shall meet the specified braking distances. Any extra weight shall be positioned above the rear wheel and in front of the rear axle.	Machine test was considered.	**N/A**

4.6.7.5.1.4	**Force applied to the handbrake-levers**
	
	    I) Magnitude and position of force on handbrake-levers
	
	Apply a handgrip force not exceeding 180 N at the point as specified in 4.6.2.3. Check before and after each series of test runs to verify the lever force.
	
	    II) Optional brake-force application device
	
	It is permissible to use a test mechanism to operate the handbrake-lever, and when such a device is used, it shall meet the requirements of 4.6.7.5.1.4 I) and shall additionally control the rate of application of the handbrake-lever force such that 63% of the maximum force is attained in not less than 0,2 s.
	
	If the operating force on the handbrake lever is applied by means of belt or a wire, ensure that the contact width is not greater than 5 mm if the accuracy requirement above is to be met.
		Machine test was considered.	**N/A**

4.6.7.5.1.5	**Running-in the braking surfaces** A running-in process shall be conducted on every brake before performance testing is carried out. Apply the brakes for not less than three seconds to maintain steady deceleration whilst the bicycle is being ridden at a speed of approximately 16 km/h. Repeat this operation 10 times.	Machine test was considered.	**N/A**
4.6.7.5.1.6	**Test method – test runs under dry conditions** Pedal the test bicycle until the specified test velocity is attained (see table 1). Then stop pedaling and apply the brakes. The bicycle shall be brought to a smooth, safe stop (see 4.6.7.4.2 (i)).	Machine test was considered.	**N/A**

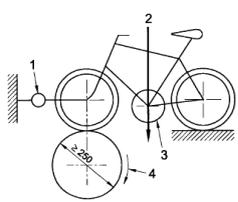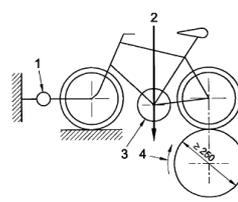| EN 14766:2005			
Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.1.7	**Test method – test runs under wet conditions** The method shall be as given in 4.6.7.5.1.6, with the addition that wetting of the brake system(s) shall commence not less than 25 m prior to the commencement of braking (3.11) and shall continue until the bicycle comes to rest. NOTE: Excessive amounts of water may be swept from the test-track surface between runs.	Machine test was considered.	**N/A**
4.6.7.5.1.8	**Number of valid test runs** I) If the gradient of the track is less than 0,2 %, the following rims shall be made: a) five consecutive valid runs under dry conditions; b) two acclimatization runs under wet conditions (results not recorded); c) five consecutive valid runs under wet conditions. II) If the gradient of the track lies between 0,2 % and 0,5%, the following runs shall be made: a) six consecutive valid runs under dry conditions with alternate runs in opposite directions; b) two acclimatization runs under wet conditions (results not recorded); c) six consecutive valid runs under wet conditions with alternate runs in opposite directions. NOTE: A rest period not exceeding 3 min may be taken between successive runs.	Machine test was considered.	**N/A**
4.6.7.5.1.9	**Velocity / distance correction factor** A correction factor shall be applied to the measured braking distance if the velocity as checked by the timing device is not precisely that specified in 4.6.8.4.1. The corrected braking distance shall be determined from the formula: $$S_c = \left(\frac{V_s}{V_m}\right)^2 x S_m$$ where S_c is the corrected braking distance (m); S_m is the measured braking distance (m); V_s is the specified test velocity (m/s); V_m is the measured test velocity (m/s).	Machine test was considered.	**N/A**

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Clause	**Requirements**	**Remarks - Results**	**Verdict**

4.6.7.5.1.10	**Validity of test runs**
	
	   I) A test run shall be considered invalid if:
	
	      a) excessive side-skid causing the rider to put his foot
	
	      b) loss of control occurs.
	
	With certain types of braking system, it may not be possible to avoid entirely some skidding of the rear wheel during braking: this is considered acceptable provided that a) or b) above do not occur as a result.
	
	   II) If the corrected braking distance exceeds the braking
	
	      distance specified in Table1, a test run shall be
	
	      considered invalid if the velocity at the
	
	      commencement of the test exceeds the specified test
	
	      Table 1;
	
	   III) If the corrected braking distance is less than the braking distance specified in Table 1, a test run shall be considered invalid if the velocity at the commencement of braking is more than 1,5 km/h below as specified in Table 1.
	
	If the corrected braking distance exceeds the braking distance specified in Table 1, the test run shall be considered valid.
		Machine test was considered.	**N/A**

4.6.7.5.1.11	**Test results** I) Braking under dry conditions Depending on the gradient of the test track, the test result shall be the average value of the corrected baking distance (see 4.6.7.5.1.9) of the test results of either 4.6.7.5.1.8.I) a) or 4.6.7.5.1.8.II) a). For compliance with the requirements of 4.6.7.4.1 the above average values shall not exceed the relevant braking distances specified in Table 1. II) Braking under wet conditions Depending on the gradient of the test track, the test result shall be the average vale of the corrected braking distances (see 4.6.7.5.1.9) of the test results of either 4.6.7.5.1.8.I) c) or 4.6.7.5.1.8 II) c). For compliance with the requirements of 4.6.7.4.1 the above average values shall not exceed the relevant braking distances specified in Table 1.	Machine test was considered.	**N/A**

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
	III) Ratio between wet and dry braking performance	Machine test was considered.	
	Because the wet and dry braking distances are measured at different test velocities, a simple comparison of braking distances is not meaningful. Therefore, a comparison shall be made of equivalent, calculated braking forces. Thus:		
	The ratio between the calculated braking-force in wet conditions $(F^{W}_{Br\ max})$ and the calculated braking-force in dry conditions $(F^{D}_{Br\ max})$ measured at any operating force (F^{D}_{op}) at which the dry test requirements are met shall be greater than 40 %.		N/A
	Based on the terminology and values of the constants as defined in 4.6.7.5.2.3 and 4.6.7.5.2.7, use the following equation to calculate the wet and dry braking forces:		
	$$F_{Br\ max} = K/(D - C)$$		
	Determine whether or not the requirements of the following equation have been met:		
	$$F^{W}_{Br\ max} : F^{D}_{Br\ max} > 4:10$$		
4.6.7.5.2	**Machine test method**		
4.6.7.5.2.1	**General**		
	The test machine enables the braking distances for both brakes or the rear brake alone to be calculated from measurements of the individual braking forces of the front and rear brakes on a drum or belt.	The test machine enabled the front or rear brake alone on a drum as illustrated in Fig.14.	P
4.6.7.5.2.2	**Symbols**		
	F_{Op} = Operating force (i.e. force applied on handbrake lever or pedal)	Please refer to the attached table for reference.	
	$F_{Op\ intend}$ = Intended operating force (e.g. 40 N, 60 N, N. 80)		
	$F_{Op\ rec}$ = Recorded operating force (e.g. 38 N, 61 N, N. 79)		
	F_{Br} = Braking force		
	$F_{Br\ rec}$ = Recorded braking force		
	$F_{Br\ corr}$ = Corrected braking force (Corrected for difference between $F_{Op\ intend}$ and $F_{Op\ rec}$)		P
	$F_{Br\ average}$ = The arithmetic mean of the three $F_{Br\ corr}$ at one level of $F_{Op\ intend}$		
	$F_{Br\ max}$ = The maximum $F_{Br\ average}$		
	F^{D}_{Br} = Dry braking-force		
	F^{W}_{Br} = Wet braking-force		
4.6.7.5.2.3	**Linearity**		
	When tested by the methods described in 4.6.7.5.2.7 III) a) and b), the braking force $F_{Br\ average}$ shall be linearly proportional (within ± 20%) to the progressively increasing intended operating forces $F_{Op\ intend}$. The requirement applies to braking forces $F_{Br\ average}$ equal to and greater than 80 N (see Annex A).	The curves of braking forces with best fitting lie within the ±20 % limit lines.\n\nPlease refer to the attached drawings for reference.	P

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.2.4	**Test machine** The test machine shall incorporate a system that drives the wheel under test by tyre contact and a means of measuring the braking-force, and typical examples of two types of machine are illustrated in Figures 14 and 15. Figure 14 shows a machine in which a roller drives the individual wheels, and Figure 15 shows a machine in which a driven belt contacts both wheels. Other types of machine are permitted, provided they meet the specific requirements listed below and those specified in 4.6.7.5.2.5 and 4.6.7.5.2.6. The specific requirements are as follows: a) the linear surface velocity of the tyre shall be 12,5 km/h and shall be controlled within ± 5 % b) a means of laterally restraining the wheel under test shall be provided which does not create any fore/aft restraint; c) a means of laterally applying forces to the hand-brake levers at the point specified in 4.6.2.3 shall be provided, with the width of the contact on the lever not greater than 5 mm. Dimensions in millimetres a) testing the front brake b) testing the rear brake Key 1 Braking-force transducer 2 Applied force or 3 Additional mass 4 Direction of drum rotation **Figure 14 — Braking performance test machine – single drum type**	The test machine is drum type as illustrated in Fig. 14. a) The linear surface velocity is controlled within ± 5 %. b) Lateral restraining rollers are used without creating any fore/aft restraint. c) The contact width is not greater than 5 mm.	**P**

Clause	Requirements	Remarks - Results	Verdict
4.6.7.5.2.5	**Instrumentation** The test machine shall be instrumented to include the following: a) a device to record the surface velocity of the tyre, accurate to within ± 2 %; b) a device to record the braking force (see figures 14 and 15, for example), accurate to within ± 5 %; c) a device to record the force applied to the hand-lever, accurate to within ± 5 %; d) a water spray system, to provide wetting of the brakes of the bicycle, consisting of a water reservoir connected by tubing to a pair of nozzles arranged as shown in Figure 16. Each nozzle shall provide a flow of water at ambient temperature of not less than 4 ml/s. The wheel shall be suitably enclosed to ensure that, in addition to the rim, any hub- or disc-brake is thoroughly wetted before a test begins. e) a system for loading the wheels of the bicycle against the driving mechanism (see 4.6.7.5.2.6).	The test instruments are calibrated by ITRI or other CNLA accredited laboratories on regarding the requirements.	P
4.6.7.5.2.6	**Vertical force on the tested wheel** The wheel to be tested shall be forced vertically downwards so that no skidding of the wheel occurs when tested according to 4.6.7.5.2.7 III) a) and b). NOTE: The necessary force may be applied anywhere on the bicycle (wheel-axle, bottom bracket, seat-post, etc) provided that it is exerted vertically downwards.	Test mass are put on the handlebar & bottom bracket of test sample to prevent from skidding.	P
4.6.7.5.2.7	**Test method** I) General Test the front and rear wheels individually. II) Running-in the braking surfaces Conduct a running –in process on every brake before carrying out the performance test. In order to determine the operating force to be used during the running-in process, mount and load the bicycle on the test machine with the belt or drum running at the specified speed and apply an operating force to the handbrake lever that is high enough to achieve a braking force of 200 N ± 10%. Maintain this operating force for at least 2,5 s, and note the value of the applied	I) Tests are conducted on front & rear wheels individually. II) Running test is performed before performance test.	P

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.2.7	Repeat the procedure (applying the operating force determined as above accurate to within ± 5 %) ten times, or, with more repetitions if necessary, until the mean braking force from anyone of the three latest tests does not deviate by more than ± 10% from the mean braking force from these same three test. III) The performance tests a) Testing under dry conditions With a vertical force applied to the bicycle sufficient to prevent skidding of the tyre on the wheel under test, accelerate the driving mechanism to the specified velocity, then apply the operating-force in a series of 20 N increments from 40 N to either 180 N or to the force necessary to achieve a braking force of at least 700 N, whichever is the lesser. However, if the wheel locks, if any possible brake-overload device is actuated, or if the hand-lever comes into contact with the handlebar, do not increase the force further. For each increment of applied operating force, perform three tests within 1 min. Before applying the next level of operating force, allow the brake to cool for 1 min. The applied operating forces shall lie within ± 10 % of intended operating forces, shall be applied as specified in 4.6.2.2.3 and 4.6.7.5.2.4 c), shall be recorded with an accuracy of ± 1 %, and shall be fully applied with 1 s of the commencement of braking. For each increment of hand-lever force, record the braking force value, $F_{Br\,rec}$, for a period of between 2,0 s and 2,5 s, with measurement starting 0,5 s to 1,0 s after the commencement of braking (see 3.11). Record $F_{Br\,rec}$ as the average braking force during this measurement period. The time at which the measurement of the braking force is started shall be related to the speed at which the operating force is applied. If the operating force is fully applied in less than 0,5 s after the commencement of braking, start the measurement after 0,5 s. However, if the operating force is fully applied between 0,5 s and 1,0 s after the commencement of braking, start the measurement when the operating force is fully applied. b) Testing under wet conditions The method shall be as given in 4.6.7.5.2.8 III) a) with the addition that wetting of the brake system shall commence not less than 5 s before the commencement of braking for each increment of operating force and shall continue until the measurement period has ended. Water nozzles shall be arranged according to Figure 16.	III) a. Weights with different mass were applied on the handbrake lever, the loads are equal to the intended operation forces. b. Test came to a stop when wheels were locked.	P

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Clause	Requirements	Remarks - Results	Verdict
4.6.7.5.2.7	IV) Correction of braking force	IV) The recorded braking forces are the same with the intended operating force.	P

4.6.7.5.2.7 · IV) Correction of braking force

Each recorded braking force, $F_{Br\ rec}$, shall be corrected for any difference between the recorded operating force and the intended operating force. The corrected braking force shall be calculated by multiplying the recorded braking force, $F_{Br\ rec}$, with a correction factor which is the ratio between the intended operating force, $F_{Op\ intend}$, and the recorded operating force, $F_{Br\ rec}$.

EXAMPLE

Recorded braking force $F_{Br\ rec}$ = 225 N

Intended operating force $F_{Op\ intend}$ = 180 N

Recorded operating force $F_{Op\ rec}$ = 184 N

Correction factor = 180/184

Corrected braking force $F_{Br\ corr}$ = 225 x (180/184)

V) Test results

Select from the record the maximum output braking force, $F_{Br\ max}$, for each combination of wheel (front or rear) and each test condition (wet or dry).

Calculate the average braking force $F_{Br\ average}$ as the arithmetic mean of three corrected brake force measurements $F_{Br\ corr}$.

Calculate the braking distance, D, for each combination with the following equation:

$$D = (K/F_{Br\ max}) + C$$

where

D is the calculated braking distance (m);

$F_{Br\ max}$ is the maximum $F_{Br\ average}$ (N);

K is the braking specific test constant (Nm);

C is the delay specific test constant (m).

Values for the constant are given in Table 2.

Where a manufacturer specifies that his bicycle can carry a mass such that the sum of that mass plus the mass of the bicycle is in excess of 100 kg to some value M, increase the factors K in the ratio M/100.

Table 2 — Constants for calculation of braking distances, D, from braking forces, F_{Br}

Condition	Brake in use	Constant, K	Constant, C
Dry	Front only	1 955	1,40
	Rear only	2 408	1,40
Wet	Front only	605	2,25
	Rear only	980	3,00

V) Please refer to the attached table for reference.

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.7.5.2.7	After calculating the braking distance, compare the results for the front brake tests with the requirements for both brakes in Table 1, and compare the results for the rear brake only with the requirements for the rear brake only in Table 1 to determine whether or not the requirements have been met. VI) Linearity Plot the calculated $F_{Br\ average}$ values (the arithmetic mean of the three corrected braking forces at each level of operating force) against the equivalent operating force values, $F_{Op\ intend}$, in order to assess the linearity against the requirement in 4.6.7.5.2.4. Plot the results on a graph, showing the line of best fit and the ± 20% limit lines obtained by the method of least squares outlined (see Annex A). VII) Ratio between wet and dry braking For any operating force (F_{Op}) for which the measured dry braking-force $(F^{D}_{Br\ average})$ is greater than 200 N, the ratio between the measured braking-force in wet conditions $(F^{W}_{Br\ average})$ and the measured braking-force in dry conditions $(F^{D}_{Br\ average})$ shall be greater than 40 %. For each F_{Op} where $F^{D}_{Br\ average}$ is > 200N, determine (using the following equation) whether or not the requirements of have been met: $F^{W}_{Br\ average} : F^{D}_{Br\ average} > 4{:}10$ For symbols see 4.6.7.5.2.3. VIII) Simple track test (see 4.20) After completion of the machine test, conduct a brief, simple track test with progressively increasing operating forces to determine whether or not the brakes bring the bicycle to a smooth, safe stop. NOTE: This test can be combined with the test on the fully assembled bicycle.	VI) Please refer to the attached drawing for reference. VII) Please refer to the attached table for reference. VIII) The braking system brings the bicycle to a smooth, safe stop after a completion of machine test.	P
4.6.8	**Brakes – heat-resistance test**		
4.6.8.1	**General** This test applies to all disc- and hub-brakes but to rim-brakes only where they are known or suspected to be manufactured form or include thermoplastic materials. Each brake on the bicycle shall be tested individually, but where the front and rear brakes are identical only one brake need be tested.	Identical hydraulic disc brakes are equipped on front& rear wheels, front hand brake was tested against heat-resistance test.	P

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Clause	**Requirements**	**Remarks - Results**	**Verdict**
4.6.8.2	**Requirement** Throughout the test described in 4.6.8.3, a gap of at least 10 mm shall remain between the hand-brake lever and the handlebar-grip, the operating force shall not exceed 180 N, and the braking force shall not deviate outside the range 60 N – 115 N. Immediately after having been subjected to the test described in 4.6.8.3, the brakes shall achieve at least 60 % of the braking performance which was recorded at the highest operating force used during the performance tests 4.6.7.5.2.7 III) a) and b).	The gap between lever and handlebar is 52 mm > 10 mm. The braking force after tested against §4.6.8.3 achieve at least 60% of records. See attached table for reference.	**P**
4.6.8.3	**Test method** Drive the wheel and tyre assembly with the brake applied on a machine such as those described in 4.6.7.5.2.4 at a velocity of 12,5 km/h ± 5% with a rearward, cooling air-velocity of 12,5 km/h ± 10%, so that a total braking energy of 75 Wh ± 5% is developed for a period of 15 min ± 2 min. Allow the brake to cool to ambient temperature and then repeat the test cycle. A maximum of ten interruptions pre test cycle is permitted, each with a maximum duration of ten seconds. When the test has been carried out, subject the brakes to the applicable parts of the tests described in 4.6.7.5.2.7 III) a) and b). Calculate the braking energy from the following equation: $E = F_{Br} \, x \, V_{Br} \, x \, T \, (Wh)$ Where: F_{Br} is the braking force (N); V_{Br} is the linear velocity of the periphery of the tyre (m/s) (i.e. 12,5 km/h = 3,472 m/s) T is the duration of each test cycle (h) (excluding interruptions) (i.e. 15 min = 0,25 h)	Dry average: Operating force: 100 N Brake performance: 456 N Heat resistance: 416 N 416/456=0.91 (91%) Wet average: Operating force: 120 N Brake performance: 245 N Heat resistance: 254 N 254/245=1.03 (103%) Remark: Test was conducted with 10 interruptions for each test cycles for duration of 10 seconds.	**P**

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Clause	**Requirements**	**Remarks - Results**	**Verdict**

Test results table of braking performance before & after heat resistance test:

Tested before heat resistance test									
Braking force $F_{Op,intend}$ [N]		40	60	80	100	120	140	160	180
Front wheel	Max. dry braking- force $F^D_{Br\ max}$ [N]	234	343	414	456	*	*	*	*
	Max. wet braking force $F^W_{Br\ max}$ [N]	104	149	176	208	245	*	*	*
	Ratio ($F^W_{Br\ max}/F^D_{Br\ max}$)	0.44	0.43	0.43	0.46	*	--	--	--
Rear wheel	Max. dry braking- force $F^D_{Br\ max}$ [N]	228	310	*	*	*	*	*	*
	Max. wet braking force $F^W_{Br\ max}$ [N]	115	145	178	*	*	*	*	*
	Ratio ($F^W_{Br\ max}/F^D_{Br\ max}$)	0.50	0.47	--	--	--	--	--	--

Tested after heat resistance test									
Braking force $F_{Op,intend}$ [N]		40	60	80	100	120	140	160	180
Front wheel	Max. dry braking- force $F^D_{Br\ max}$ [N]	--	--	--	416	--	--	--	--
	Max. wet braking force $F^W_{Br\ max}$ [N]	--	--	--	--	254	--	--	--
	Percentage compared with braking forces measured before heat resistance test	--	--	--	91%	103%	--	--	--

Remark: The "*" marks mean the test was suspended due to skidding of wheel occurred.

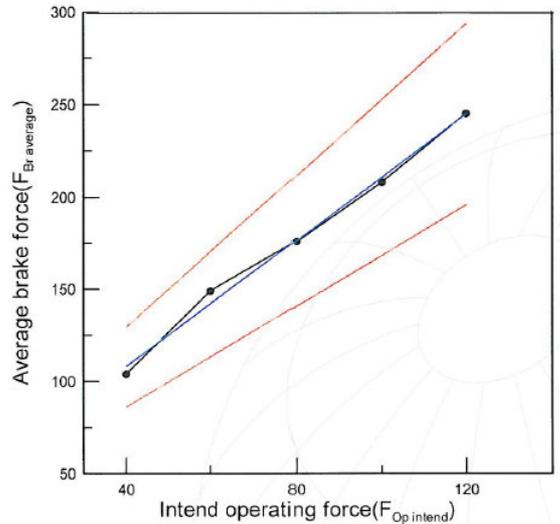The "--" mark means it is not applicable in this item.

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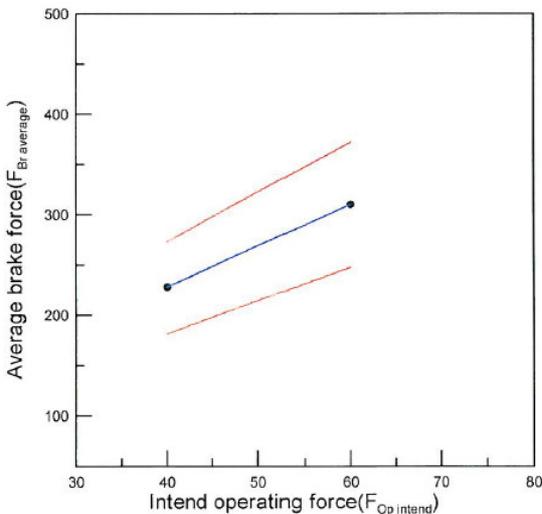| Clause	Requirements	Remarks - Results	Verdict

Curves of input force against braking force:
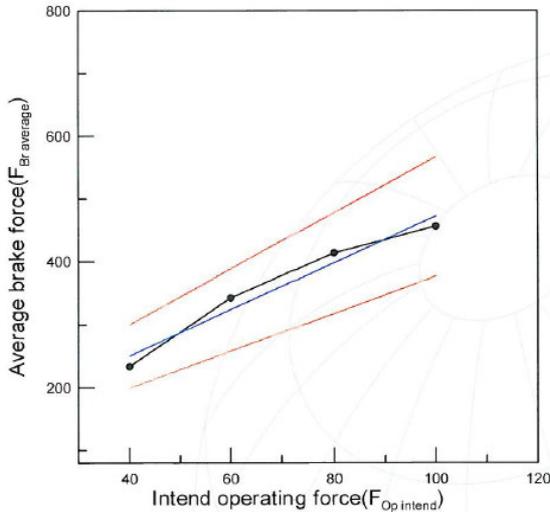
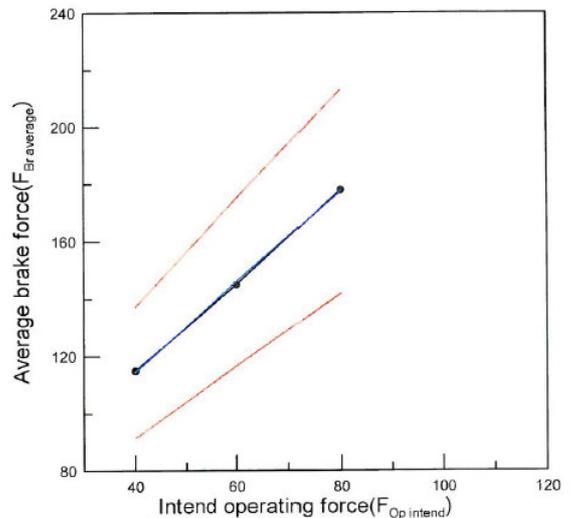(a) Frontal brake –Dry condition

Front wheel- Dry condition

(c) Frontal brake-Wet condition

Front wheel- Wet condition

(b) Rear brake-Dry condition

Rear wheel- Dry condition

(d) Rear brake-Wet condition

Fig. 3 Braking performance- Linearity curve

Rear wheel- Wet condition

-- End of Report --