TEST REPORT

Standard tyres and methods

Test World Ltd
Test report TW201000311

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1. Objective

The objective of the project was to test the performance of standard winter tyres against 8 market tyres, consisting of tyres designed both Nordic and milder winters.

The main targets of the project were to

- find the performance levels of different tyre types
- find the performance limits of premium and low quality tyres
- check the performance on ice, snow and wet asphalt
- test the effect of test conditions, having tests made in a range of different temperatures
- have information about the reproducibility, by repeating the tests also in same temperatures
- calculate the tests results, critical differences and deviation using different calculation methods

2. Tyres

The tyre selection in the project was the following

Code	*Tyre*	*Size*	*Load/Speed*	*DOT*	*Date*
COT	Continental ContiVikingContact 5	205/55R16	94T	CPOF NVXI	4808
FAT	Falken Eurowinter HS439	205/55R16	91T	VW8K	3108
GYQ	Goodyear Ice Navi Zea	205/55R16	89Q	VW8K	3008
MIT	Michelin X-Ice XI2	205/55R16	91T	FUWC 002X	3608
NOR	Nokian Hakkapeliitta R	205/55R16	94R	YLCP	309
DUH	Dunlop SP Winter Sport 3D	205/55R16	91H	N5OF JACR	4208
MIH	Michelin Primacy Alpin	205/55R16	91H	FTWC XPBX	4608
LIH	Linglong Winter-Hero Radial 652	205/55R16	91H	0UAV	4408
S14	Uniroyal SRTT 14	P195/75R14	-	ANKA BBU	1209
S16	Uniroyal Tiger ASTM 16	P225/60R16	97S	ANXO EVUU	4608

- The tyres were purchased and run in by Test World Ltd

3. Tests

The test selection in the project was

3.1. Ice tests

Test	Target temperature range
Braking, test 1	-1 .. -4 °C
Braking, test 2	-1 .. -4 °C
Braking, test 3	-6 .. -9 °C
Braking, test 4	-6 .. -9 °C
Braking, test 5	-12 .. -15 °C
Braking, test 6	-12 .. -15 °C

3.2. Snow tests

Test	Target temperature range
Braking, test 1	-1 .. -4 °C
Braking, test 2	-1 .. -4 °C
Braking, test 3	-6 .. -9 °C
Braking, test 4	-6 .. -9 °C
Braking, test 5	-12 .. -15 °C
Braking, test 6	-12 .. -15 °C

3.3. Wet tests

Test	Target temperature range
Braking, test 1	+0 .. +3 °C
Braking, test 2	+5 .. +8 °C

4. Test cars

The test car fleet consisted of the following cars.

Tests	Car	Engine	Power	Torque	Gearbox
Ice and snow	Ford Focus	2.0 petrol	107 kW / 6000	185 Nm / 4500 rpm	Manual

5. Test tracks

The tests were performed at two locations.

Tests	Track	Test time
Ice and snow	Test World Ltd, Ivalo, Finland	December 2009 / January 2010
Wet and dry	To be done	February 2010

6. Results summary

6.1. Ice tests

6.1.1. Ice braking

	Temperature					
Tyre	**-3.6 / -3.9**	**-1.8 / -2.1**	**-6.6 / -7.1**	**-7.2 / -8.0**	**-12.3 / -13.3**	**-14.6 / -15.4**
Continental ContiVikingContact 5	131.2	117.6	111.2	109.8	112.4	108.8
Dunlop SP Winter Sport 3D	***120.3***	***121.1***	***109.0***	***107.2***	***104.1***	***107.4***
Falken Eurowinter HS439	116.6	103.7	102.0	106.4	101.6	95.2
Goodyear Ice Navi Zea	129.8	110.0	137.4	148.3	141.1	135.9
Linglong Winter-Hero Radial 652	***119.0***	***111.5***	***112.2***	***111.7***	***108.0***	***105.9***
Michelin Primacy Alpin	***115.6***	***114.0***	***106.6***	***118.5***	***97.0***	***99.5***
Michelin X-Ice XI2	134.0	122.9	134.0	134.0	123.0	114.9
Nokian Hakkapeliitta R	144.3	122.2	131.0	137.2	119.0	122.0
Uniroyal ASTM 16	124.3	107.7	107.4	103.9	93.9	93.8
Uniroyal ASTM 16	121.6	107.1	107.3	102.5	92.3	92.6
Uniroyal SRTT 14	100.0	100.0	100.0	100.0	100.0	100.0

6.2. Snow tests

6.2.1. Snow braking

	Temperature					
Tyre	**-2.0 / -2.6**	**-2.9 / 3.1**	**-8.5 / -7.8**	**-8.2 / -8.9**	**-14.3 / -14.2**	**-14.6 / -14.9**
Continental ContiVikingContact 5	113.5	112.8	113.7	131.2	118.8	117.0
Dunlop SP Winter Sport 3D	***108.0***	***108.2***	***109.7***	***125.5***	***110.0***	***108.2***
Falken Eurowinter HS439	107.1	104.1	105.6	115.0	105.6	107.9
Goodyear Ice Navi Zea	114.3	115.2	118.8	137.7	122.8	123.1
Linglong Winter-Hero Radial 652	***109.6***	***110.4***	***113.7***	***131.6***	***112.5***	***115.9***
Michelin Primacy Alpin	***107.0***	***109.4***	***111.3***	***116.5***	***115.4***	***111.0***
Michelin X-Ice XI2	118.0	115.5	116.9	118.3	108.9	118.7
Nokian Hakkapeliitta R	113.2	112.1	116.4	137.9	116.5	119.1
Uniroyal ASTM 16	99.3	100.5	98.2	106.2	96.2	96.0
Uniroyal ASTM 16	98.8	99.8	97.9	105.5	92.8	95.8
Uniroyal SRTT 14	100.0	100.0	100.0	100.0	100.0	100.0

- The results are shown as indexes (percentages) compared to the SRTT 14
- Higher index = lower braking distance = better performance
- H-rated tyres marked as bold italics

6.3. Wet tests

6.3.1. Wet braking

Tyre	Temperature +1.0 / +1.4	+5.3 / +5.5
Continental ContiVikingContact 5	82.5	86.4
Dunlop SP Winter Sport 3D	***117.7***	***120.3***
Falken Eurowinter HS439	106.5	108.1
Goodyear Ice Navi Zea	83.2	82.8
Linglong Winter-Hero Radial 652	***104.9***	***106.7***
Michelin Primacy Alpin	***120.8***	***122.1***
Michelin X-Ice XI2	90.3	91.2
Nokian Hakkapeliitta R	86.2	85.3
Uniroyal ASTM 16	118.4	119.9
Uniroyal ASTM 16	118.1	119.0
Uniroyal SRTT 14	100.0	100.0

7. Test protocols

7.1. Basics

- As the minimum requirement, the ETRTO method for braking efficiency under winter conditions was required

7.2. General preparations

7.2.1. Test methods

- Test protocol checks
- Customer requirements

7.2.2. Tyre preparation

- Tyre preparations
- Information for tyre changing personnel
- Measurement of inflation pressures

7.2.3. Test car preparation

- Measuring equipment installations and checks

7.2.4. Track preparations

- Test track condition checks, requirements for maintenance
- Weather condition and forecast checks before the test
  - Wind
  - Rain and snow
  - Sun

7.3. Braking

7.3.1. Results

- Braking distance for a selected speed interval
- Ice 20-5 km/h
- Snow 30-5 km/h
- Wet asphalt 80-5 km/h

7.3.2. Car systems

- ABS on

7.3.3. Measurements

Ice and snow
- Reference tyre used after two test tires (REF-A-B-REF-C-D-REF)
- 16 brakings per tyre on ice and snow
- 10 brakings per tyre on wet asphalt
- Brakings always on a new spot

Wet and dry
- Reference tyre used in the beginning and at the end (REF-A-B-C-D-REF)
- 8 brakings per tyre
- Brakings always on the same spot

7.3.4. Driving protocol

- Accelerate the vehicle over the chosen speed
- Put the clutch down and let the vehicle roll freely for a short time
- Brake hard, from 2-3 km/h over the target speed
- Steer straight
- Wait for the vehicle to stop
- Check the data after each braking
- Mark and repeat any faulty measurements

7.3.5. Measuring unit

- Racelogic VBox

7.4. Result calculation and validation methods and criteria

7.4.1. Indexes

- In all tests, the SRTT 14 is given an index of 100%
- Values above 100% = better
- Values below 100% = worse

7.4.2. Temperatures

- The temperature was required to stay within the target range during the whole test

7.4.3. Reference calculation

- In all tests, a reference method is used in calculations
- In the method, a reference tyre is driven at certain intervals to control any change in conditions
- The reference tyre was used just for control, and its results are not relevant and not displayed

7.4.4. Reference tyre changes

- A change of maximum 5% was allowed for the reference tyre within a reference interval (ref-A-B-ref)

7.4.5. Measuring systems

- In all tests, a GPS-based Racelogic VBox was used

8. Conclusions

8.1. Performance of tyres on ice and snow

Generally, the tyre performance on ice was as expected. Tyres from largest companies, designed for Nordic market outperformed the others.

The 107% requirement was not fulfilled in the following cases

- Falken Eurowinter HS439 5 of 6 tests on ice
- Falken Eurowinter HS439 3 of 6 tests on snow
- Dunlop SP Winter Sport 3D 1 of 6 tests on ice
- Michelin Primacy Alpin 3 of 6 tests on ice

8.2. Performance of SRTT 14 against ASTM 16

There was a clear difference in the performance level of the standard tyres.

On ice, in warmer temperatures the ASTM 16 performed clearly better, but in lower temperatures, its relative performance against SRTT 14 dropped significantly.

On snow the same was not found.

On wet

8.3. Effect of conditions

The data and deviation met all criteria, and exceeded the ETRTO requirements by a wide margin.

The relative differences were surprisingly high on ice and snow. Compared to the SRTT 14, the index range for the tyres were

Ice braking

Tyre	Min	Max
Continental ContiVikingContact 5	108.8	131.2
Dunlop SP Winter Sport 3D	104.1	121.1
Falken Eurowinter HS439	95.2	116.6
Goodyear Ice Navi Zea	110.0	148.3
Linglong Winter-Hero Radial 652	105.9	119.0
Michelin Primacy Alpin	97.0	118.5
Michelin X-Ice XI2	114.9	134.0
Nokian Hakkapeliitta R	119.0	144.3
Uniroyal ASTM 16	93.8	124.3

Snow braking

Tyre	Min	Max
Continental ContiVikingContact 5	112.8	131.2
Dunlop SP Winter Sport 3D	108.0	125.5
Falken Eurowinter HS439	104.1	115.0
Goodyear Ice Navi Zea	114.3	137.7
Linglong Winter-Hero Radial 652	109.6	131.6
Michelin Primacy Alpin	107.0	116.5
Michelin X-Ice XI2	108.9	118.7
Nokian Hakkapeliitta R	112.1	137.9
Uniroyal ASTM 16	96.0	106.2

It is important to realize, the all the results are repeatable and that the change is not caused by measurement errors or measurement deviation, but by the effect of conditions.

The problem is that the conditions have a different effect to different tyres. Some tyres perform better in low, some in high temperatures.

On wet the differences were significantly smaller.

8.4. Test methods

The basic test method (speed range, amount of runs) does not have a significant effect on the results, especially when compared to the effect of conditions.

The results and deviation are effectively the same, when calculated for example for

- 20–5 km/h
- 23-8 km/h
- 30-5 km/h
- 8 runs instead of 16 runs

9. Recommendations

According the tests and results, the main recommendation is to require tests in more than one condition and in differing temperatures on different days.

At least two, preferably three different results should be required, all exceeding the required performance level.

10. Warranty

All tests have been executed applying Test World quality systems and requirements for test conditions, deviation, methods and security. Tests were executed using the same test methods as normally for magazines.

Test World Ltd hereby claims that the test results are representative for the tyre selection when tested under outlined conditions, cars, tracks and methods. Test World Ltd does not take responsibility for any liabilities from the conclusions drawn from the test results.

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