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Laboratory report for plastic wheel construction Report no.: 713272952-01

Garching, 2023-08-22
Unit: PS-COM-T-RRW
Page 1 of 6



Customer: FIBRATECH Sp. z o.o
Al. Zwyciestwa 96/98
81-451 GDYNIA
Poland

1. Wheel data

Wheel size:	9,0 J x 20 H2
Offset [mm]:	35
PCD:	112/5
Wheel load	600 kg
Material:	Carbon fibre
Wheel weight [kg]:	10,1
Wheel type	V 2.2

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(Germany) at www.tuv-sud.com/imprint

Aufsichtsrat / Supervisory Board:
Holger Lindner (Vorsitzender / Chairman)
Geschäftsführung / Board of Management:
Walter Reithmaier (Sprecher / CEO)
Patrick van Welij

Phone: +49 89 32950-50
Fax: +49 89 32950-605
www.tuv-sud.com



TÜV SÜD Product Service GmbH
Commercial Products
Daimlerstrasse 11
85748 Garching
Germany

2. Test specification

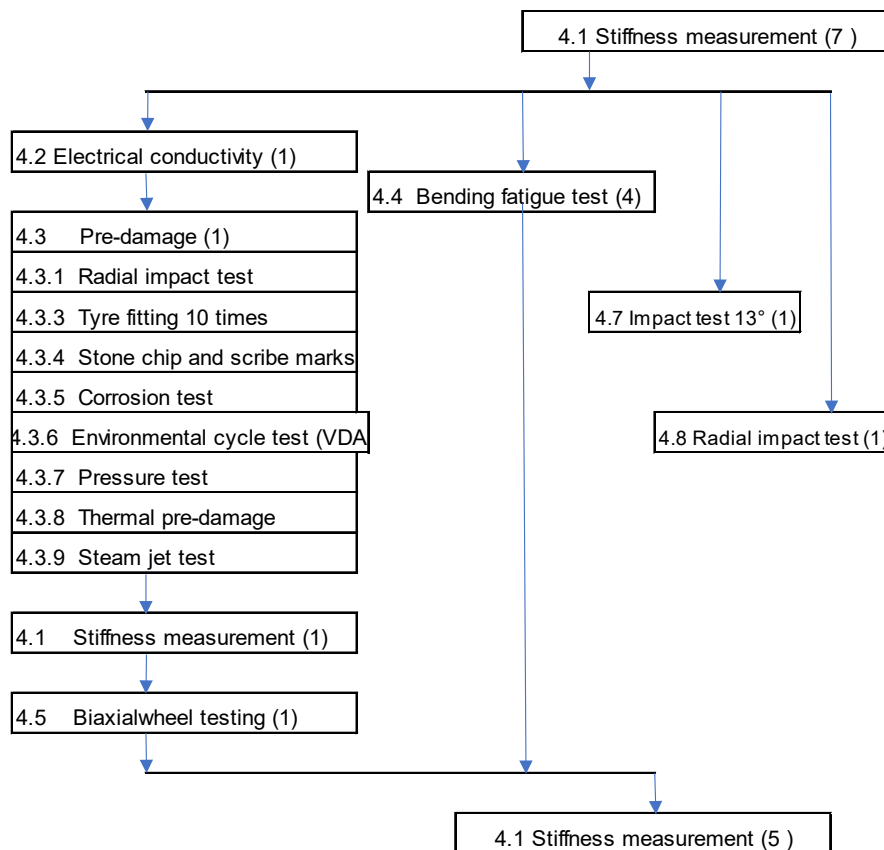
Material-Specific Annex to:

Road Traffic No. 287, Section 30 StVZO; here; Directive for the testing and inspection of custom wheels for motor vehicles and their trailers.

3. Test Laboratory

TÜV SÜD Product Service GmbH
Daimlerstr. 15
85748 Garching

4. Overview about the test program and test laboratory



5. Test program

5.1 Pre-damage

5.1.1 Stiffness measurement

The stiffness measurements were done on one wheel as delivered, after pre-damage and after the biaxial test.

The measuring position were:

In axial direction: on spokes approximately 90° to each other

In radial direction: between 2 spokes, valve hole and at one spoke

Stiffness was given as quotient of the test load (kN) in relation to the maximum deformation path (mm) measured.

The arithmetic mean of the results for each position were calculated, see Annex 1.

Test parameter:

Vehicle categories	M1, M1G and N1, N1G	
Direction of loading	Axial	Radial
Shape of test dolly	d = 24 mm Front side level	d = 20 mm cylinder
Load	0.8 * FR	0.4 * FR
Speed of loading	3 mm/min ± 0.5 mm/min	

5.1.2 Electrical conductivity

Total conductivity was measured on one wheel/tyre combination and the result passed the requirements of WDK 110, as of August 2012, see Annex 2.

5.1.3 Radial impact test

The test was carried out between the spokes 180° from the valve hole and simulates driving over a pothole or obstacle.

Tyre inflation pressure 2.5 bar

$$E = f * F_R$$

$$f = 1.15$$

Tire size: 255/30 R20

5.1.4 10-times tire fitting in succession

The tire size 255/30 R20 was 10-times mounted and inflated on one wheel.

5.1.5 Stone chips and scribe mark

Stone chips: multi-impact testing was performed according to EN ISO 20567-1, edition 2014-11, method B. Scribe marks according to EN ISO 17872, ed. 2007.

The tests were carried out at the areas of the spokes exposed to maximum stress (position from FE calculation, load case: rotating bending test) and in the outer rim flange, deep scribe mark: ≥ 0.3mm.

5.1.6 Corrosion test

The corrosion test was done over 384 h according NSS EN ISO 9277 on one wheel with mounted brake disc. The wheel was in an upright position and was turned though 90° every 48 h.

5.1.7 Environmental cycle test according to VDA

This test was done according VDA 233-102 (without part A) and the period was 288 h.

5.1.8 Pressure test

The wheel with mounted tire (255/30 ER20) was inflated to a pressure of 8 bar. The wheel had no air loss after 60 seconds at 10 bar, see Annex 3.

5.1.9 Thermal pre-damage

This test was done on the wheel with mounted tire (inflation pressure 2,0 bar). The rim well was heated up to 200°C for 5 minutes, monitored by temperature sensors. Cool down under 50°C and restart heating up, in complete 10-times. The spokes were heated up to 160°C for 10 minutes, also monitored by temperature sensors. Cool down under 50°C and restart heating up, in complete 10-times.

5.1.10 Steam jet test

The test was done with a steam jet which had 11l/min with a pressure of 70 bar at 60°C.

5.2 Rotating bending test

The rotating bending test was performed with the following parameter:

Permissible wheel load	:	600 kg
Coefficient of friction	:	0,9
Dynamic tire radius	:	0,382 (285/50 R20)
Offset	:	35 mm
Gravity	:	9,81 m/s ²
Tightening torque	:	120 Nm

Test results:

Test moment	Target load cycle	Reached load cycle	Result
3.344 Nm	200.000	200.000	positive
2.230 Nm	1.800.000	1.800.000	positive
2.230 Nm	1.800.000	1.800.000	positive
2.230 Nm	1.800.000	1.800.000	positive

5.3 Biaxial wheel test

Tire data:

Tire manufacturer:	Yokohama
Tire type:	Advan Sport v 105
Tire size:	255/30 R20
Tire section height [mm]:	76,5
Tire inflation pressure [bar]:	4,5
Sidewall:	1 Rayon
Tread:	1 Rayon + 2 Steel + 2 Nylon

Test data:

Test rig:	ZF1
Stat. wheel load [kg]:	600
Test speed [km/h]:	105
Tightening torque wheel bolts [Nm]	130



Test program according material specific Annex:

Sequence	F _R [N]	F _S [N]	t [s]
1	3.750	150	53,0
2	11.000	8.000	4,4
3	3.750	150	53,0
4	9.950	5.350	10,0
5	9.500	0	23,0
6	8.300	5.300	17,9
7	4.500	0	47,3
8	7.500	5.000	14,8
9	4.500	0	47,3
10	9.000	4.200	16,4
11	4.500	0	47,3
12	7.850	4.200	13,7
13	4.500	0	47,3
14	9.500	3.000	23,0
15	9.500	-3.000	23,0
16	6.350	4.150	17,5
17	4.500	0	47,3
18	6.000	3.100	14,4
19	4.500	0	47,3
20	5.200	3.350	14,4
21	4.500	0	47,3
22	5.300	2.500	24,7
23	2.500	-1.000	43,6
24	7.300	2.550	14,8
25	2.500	-1.000	43,6
26	4.150	1.650	41,6
27	3.400	-850	50,2
28	6.000	1.000	23,0
29	3.400	-850	50,2
30	3.850	1.000	42,3
31	6.000	-1.000	23,0
32	3.850	1.000	42,3

Test result:

Target distance [km]:	7.500
Passed mileage [km]:	7.500
Result visible check	No cracks

5.4 Impact test 13°

The impact test was done with the following parameter:

Tire size : 255/30 R20

Tire pressure : 2,0 bar

Test load [kg]	Fallhöhe [mm]	Impact position	Result
540	230	Valve hole	no air loss
540	230	Spoke	

The requirements were fulfilled, see Annex 4.

5.5 Radial impact test

Tire data

Manufacturer	:	Pirelli
Type	:	Pzero
Size	:	255/30 R20
Tire pressure	:	2,5 bar

Test parameter

Inclination wheel carrier [°]	1
Permissible wheel load	600 kg
Load factor	4,3
Drop height [mm]	1.385
Striker mass [kg]	190
Impact energy [J]	2.795
Falling velocity [m/s]	5,2
Impact position	Valve hole

Test result

Air loss	After 60 sec 0,8 bar
Visible cracks	Yes
Deformation at the inner flange	7,58 mm

The requirements were fulfilled, see Annex 5.

6. Summary

The hybrid wheel construction of the size 9J x 20 H2 ET35 of the client FIBRATECH, meets the strength requirements of the material-specific appendix, status 27.10.2020, to the guideline for the testing of special wheels for motor vehicles and their trailers (BMV/StV 13/36.25.07-20.01 of 25.11.1998).

The max. wheel load capacity of 600 kg was tested positively.

This report is admissible for applying for a type approval.

7. Annex

Annex 1: Test parameters and results stiffness measurements

Annex 2: Electrical conductivity

Annex 3: Pressure test

Annex 4: Impact test 13°

Annex 5: Radial impact test

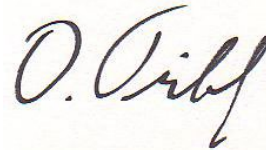
This report including Annexes comprises 16 pages

Project handling:

Technical report checked:



Thomas Tallafuss
Garching, 2023-08-22



Daniel Tinhof
Garching, 2023-08-22