

Test item : Special steering wheel
Type : 3L450, 4L450
Customer : Victor S.p.A., I-37050 Vago di Lavagno (Verona)

TEST REPORT

ON

SPECIAL STEERING WHEELS

This test report serves to document test results (summary) only.

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1. Introduction

Upon customers request, TÜV Kraftfahrt GmbH has tested a special steering wheel regarding operational and passive safety requirements. The tests were conducted to determine if the special steering wheel meets the requirements specified under section 3.1. of this report.

- 1.1. Name and address of the customer : Victor S.p.A.
Via dell'Industria, 6/8
I-37050 Vago di Lavagno (Verona)

2. Description of the test object

Test object : Special steering wheel for automotive applications
Manufacturer : Victor S.p.A.
Type : 3L450 (3 spokes) and 4L450 (4 spokes)
Technical description : Special steering wheel with 3 or 4 spokes, diameter 450 mm, in two design versions.
Vers. A: steering wheel rim covered with PU-foam
Vers. B: steering wheel rim covered with PU-foam and 2 plastic segments made in ABS-material (injection moulding)

Steering wheel rim sections may be covered with leather. Mentioned plastic segments may be varnished or cubicated like wood. Thumb rest inserts made of plastic material are located in the area where the vertical spokes are connected to the steering wheel rim.

The steering wheel rim is reinforced with an U-shaped steel profile. The spokes star is made of aluminium and is connected to the rim by rivets. The central pad is made of PU-foam and is fixed to the spoke star by screws. The central pad may be covered with leather. The horn control push button is fixed to the central pad. For details see manufacturers technical documentation, attachment 01.

Note: The evaluation of the individual hubs, with or without deformation element, was not objective of the test series. Therefore the technical description does not refer to hubs or steering column adaptors.

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3. Test requirements and test facility

3.1. Test requirement

The test requirement refers to the national Special Steering Wheel Directive § 38 StVZO. Since the test object is intended to be used for heavy vehicles with total weight > 3,5 t mentioned directive was modified regarding the test procedure, the test forces and the test cycles. The test facilities, except the facilities for the temperature cycle (see section 3.1.6.), are documented in attachment 02.

3.1.1. Static deformation test

This test refers to the deformation of the steering wheel rim in case of an accident. The deformation of the steering wheel is simulated by a horizontal force applied in direction of the steering wheel center. The max. deformation refers to 50 % of the steering wheel diameter. Evaluation criteria: no break of the steering wheel structure, no touchable sharp edges on the front side of the test object.

3.1.2. Bending test

Evaluation of structural resistance; static load applied to the weakest section of the steering wheel rim; $F = 1.000 \text{ N}$

Evaluation criteria: max. remaining deformation is limited to 8 % of the steering wheel diameter (here 36 mm for diameter 450 mm).

3.1.3. Vibration test

This test refers to the particular vertical vibrations of the steering column while engine is idling. Based on the individual resonant frequency (1st resonance) of a steering wheel, to be determined first, a vibration test in the frequency range of $\pm 3 \text{ Hz}$ ref. the resonant frequency is performed; $t = 30 \text{ minutes}$, $T = 20 \text{ s}$

Evaluation criteria: no break of the steering wheel structure, no cracks.

3.1.4. Fatigue test

Simulation of steering-wheel torque; $n = 500.000 \text{ cycles}$, test torque = $\pm 200 \text{ Nm}$

Evaluation criteria: no break of the steering wheel structure, no cracks.

3.1.5. Torsion test

Simulation of steering-wheel torque; $n = 1$, test torque = 300 Nm

Evaluation criteria: no break of the steering wheel structure, no cracks, max. remaining distortion $1,0^\circ$.

3.1.6. Temperature cycle

Evaluation of the temperature resistance of the test object; Test cycle has to be passed twice.

Test cycle: -15°C for 16 hours, $+22^\circ\text{C}$ for 0,5 hours, $+80^\circ\text{C}$ for 3 hours, -22°C for 0,5 hours

Evaluation criteria: no deformations that increase the dimensional tolerances, no cracks.

3.2. Test facilities

Test facilities at TÜV Kraftfahrt GmbH, Institute for Traffic Safety, in D-Cologne.

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4. Description of test set-up

- 4.1. Date of tests : July until November 2003
4.2. Test location : D-Cologne
4.3. Description of test set-up : The tests as described in section 3.1. of this test report were conducted on industrial production steering wheels mounted on rigid hubs (hubs without deformation element).
4.4. Tests carried out : All tests as described in section 3.1. have been performed.

5. Test results

The approved special steering wheel as described in section 2. of this report is in correspondence with the test requirement. The test results have been documented in individual test reports; P333006-030704 dated 07.07.2003, P333006-030730 dated 30.07.2003, P333014-030818 dated 18.08.2003 and P333014-031117 dated 17.11.2003. The test result refers to the test objects identified in mentioned test reports only.

6. Marking

The steering wheel is permanently marked (embossing) by the following marking on the rear surface of the right horizontal spoke; the marking shall be legible also when the steering wheel is installed on the vehicle:

- a) manufacturer : VICTOR
b) type : 3L450 resp. 4L450

7. Attachments

- 01 Index of technical description of the manufacturer, 1 page
02 Foto documentation of test facilities, 2 pages

8. Information for official experts in road traffic and motor vehicle standards

This test report is to be used for type approval only. The report may not be used for single approval according to §§ 19(3) and 21 StVZO. The test laboratory is accredited for the approval of automotive steering systems by the accreditation body of the Kraftfahrt-Bundesamt, Federal Republic of Germany, with DAR-registration-no. KBA-P 00010-96

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April 1st, 2004

ps/pc



Dipl.-Ing. P. Scheele

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Index of technical description of the manufacturer

Attachment 1

No.	Description	Drawing-No.	Date
01	Horn control	051/3	-
02	Central pad 3L450	017.00.03/0	-
03	Assembly steering wheel 3L450 "A"	017.00.00/1	-
04	Steering wheel 3L450 "A"	017.00.02/1	-
05	Assembly steering wheel 3L450 "B"	017.01.00/2	-
06	Steering wheel 3L450 "B"	017.01.02/2	-
07	Spoke with rim 3L450	017.00.01/1	-
08	Central pad 4L450	016.00.03/0	-
09	Assembly steering wheel 4L450 "A"	016.00.00/1	-
10	Steering wheel 4L450 "A"	016.00.02/1	-
11	Assembly steering wheel 4L450 "B"	016.01.00/2	-
12	Steering wheel 4L450 "B"	016.01.02/2	-
13	Spoke with rim 4L450	016/00/01/1	-
-	-	-	-

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Foto documentation of test facilities

Attachment 2



Static deformation test (see section 3.1.1.); Test facility



Static deformation test; Steering wheel 4L450 "A" (representative test)



Bending test (see section 3.1.2.); Steering wheel 3L450 "A" (representative test)

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Foto documentation of test facilities

Attachment 2



Vibration test (see section 3.1.3.); Steering wheel 3L450 "A" (representative test)



Fatigue test (see section 3.1.4.); Steering wheels 3/4L450 "A" (representative tests)



Torsion test (see section 3.1.5.); Steering wheel 3L450 "A" (representative test)