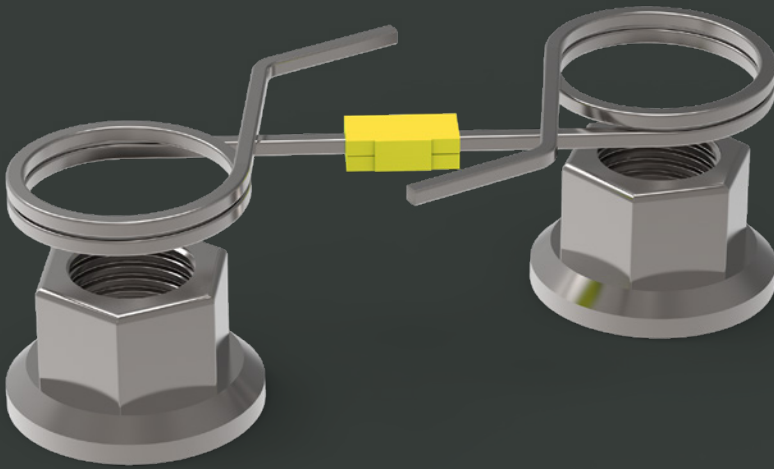


Checklock SQ

TÜV Test Report



Test Specification: PPP 90036A:2019

Test report number: 713178833

Date of testing: 31/01/2020 - 05/08/2020

Test handling and reporting:

Frank Schmidt

Handwritten signature of Frank Schmidt in black ink.

Check test report:

Mr. Stefan Dittmar

Handwritten signature of Mr. Stefan Dittmar in black ink.



Test subject: Checklock SQ Wheel Nut Retainer

	Testing Size No. 1	Testing Size No. 2
Nut size	19mm	32mm
Studs	5	10
PCD	165.1	332

Overview of test results

Test	Passed	Failed
Corrosion/salt spray test	X	
Material test	X	
Vibration test	X	
Biaxial high speed test	X	
Curb test	X	
Material analysis	X	

1. Corrosion test

Purpose of testing

The corrosion test serves as preconditioning and aging test for all test parts for the further stress tests (exception - test parts for material testing and material analysis). All test parts are to be fastened on a screw or nut head during the corrosion test.

Test specification

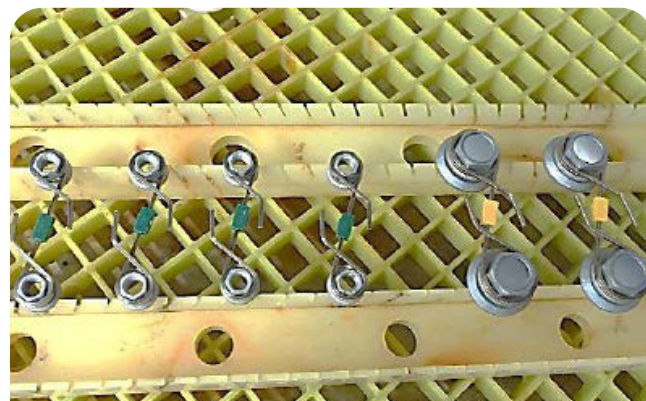
PPP 90036A:2019
DIN EN ISO 9227, Salt spray test

Test conditions

Salines solution: 5% NaCl saline
Temperature: 35°C
Test duration: 240 h

Test results

After the corrosion test, it was localized a slight corrosion layer in the area of the contact surface to the wheel nuts. The corrosion was caused by the wheel nuts. There was no corrosion and no corrosion damage at the metal of the Checklock SO.



BEFORE TESTING



AFTER TESTING

2. Material test

Purpose of testing

Checking the tensile strength (Rm) with the standardized material parameter.

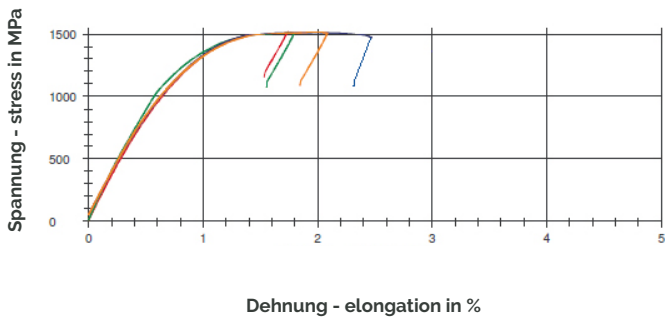
Test specification

PPP 90036A:2019
DIN EN ISO 6892-1:2017-02 / B, Tensile test

Test results

The determined tensile strength is within the required standardized material parameter.

Samples	Rm (Specification MPa)	Rm (Actual MPa)
No.1	1500-1840	1,530
No.2		1,520
No.3		1,520
No.1		1,520



3. Vibration test

Purpose of testing

The vibration test simulates the vibration loads of the parts during the vehicle drive.

Test specification

PPP 90036A:2019
DIN EN 60068-2-64:2008 Vibration and broad-band random
ISO 16750-3:2012 Chapter 4.1.2.5

Test requirements

- No loosening or sliding down of the Checklock SO retainer from the nut head.
- No loosening or twisting of the hand-tightened wheel nut.

Test results

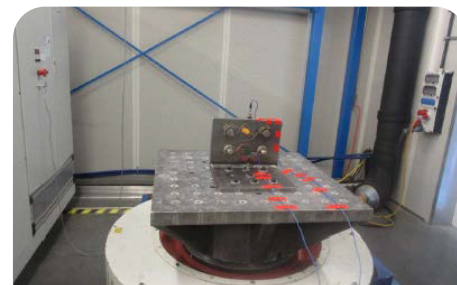
No loosening or sliding down of the Checklock SO retainer from the nut head and no loosening or twisting of the hand-tightened wheel nut in every space axis.



VIBRATION SYSTEM - Y AXIS



VIBRATION SYSTEM - X AXIS



VIBRATION SYSTEM - Z AXIS

4. Biaxial high-speed test

Test requirements

- No loosening or sliding down of the Checklock SO retainer from the bolt head.
- No loosening or twisting of the hand-tightened wheel nut due to dynamic axial and radial forces acting while driving.

Test specification

PPP 90036A:2019

Testing machine

Biaxial test rig for passenger car wheels.



Testing programme

Two hour high-speed biaxial driving programme simulating the Nurburgring circuit. Maximum speed: 180 km/h

Test result

No loosening or sliding down of the Checklock SO retainer from the nut head and no loosening or twisting of the hand-tightened wheel nut in every space axis.



5. Curb test

Purpose of testing

The curb test simulates shocks due to driving over road obstacles and driving through potholes.

Test specification

PPP 90036A:2019

Test requirements

- No loosening or sliding down of the Checklock SO retainer from the nut head.
- No loosening or twisting of the hand-tightened wheel nut.

Testing machine

Rim rolling test rig with 30mm mounted curb.
Testing programme Speed: 90 km/h
Test duration: 6 hours

Test results

No loosening or sliding down of the Checklock SO retainer from the nut head and no loosening or twisting of the hand-tightened wheel nut in every space axis.



6. Material analysis

Purpose of testing

Determination of material components (Pb, Cd, Hg and Cr(VI)) according to the requirements of the directive 2000/53/EC.

Test and analytical method

- Spark spectrum analysis
- X-ray fluorescence analysis
- Photometric chromium determination

Test requirement and test results according to directive 2000/53/EC

Material component	Target value	Actual value	
Lead (Pb)	max. 0.1%	0.0012% ⁽¹⁾	<0.0005% ⁽²⁾
Cadmium (Cd)	max. 0.1%	<0.0005%	
Quicksilver (Hg)	max. 0.1%	<0.0005%	
Hexavalent Chromium Cr(VI)	max. 0.1%	<0.1%	

(1) Value determined by spark spectrum analysis

(2) Value determined by x-ray fluorescence analysis

7. Summary

The Checklock SQ Wheel Nut Retainer meets the requirements according to the TÜV-mark test program PPP 90036A:2019.

A certification of the Checklock SQ is possible regarding to the passed product tests.

