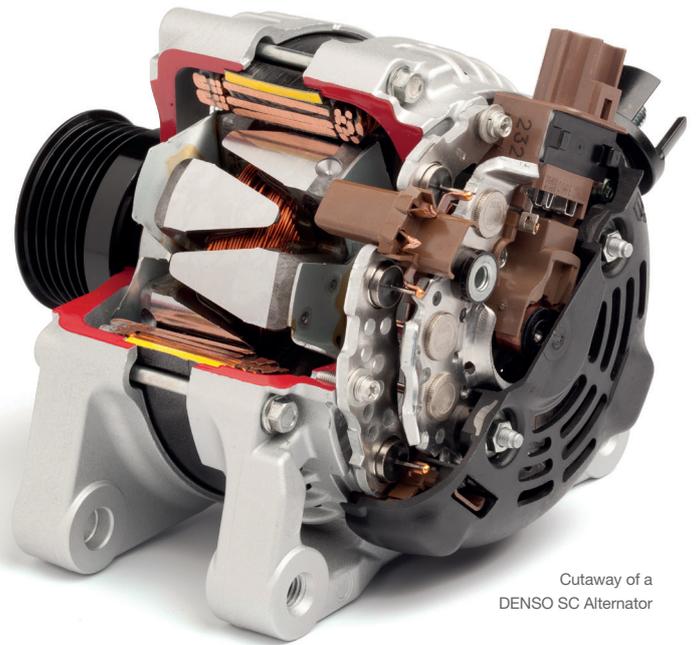


Alternators

Product comparison: Brand X vs. DENSO

- > DENSO has tested an alternator from Brand X (so called to provide anonymity) against the DENSO Design Standards (DDS) adhered to by our own OE quality alternators for the aftermarket.
- > Brand X's alternator is offered as an aftermarket alternative to the DENSO SC Alternator.
- > Three tests were carried out to rigorously examine performance, durability and welding composition.
- > Brand X's alternator failed all three tests.



Cutaway of a
DENSO SC Alternator

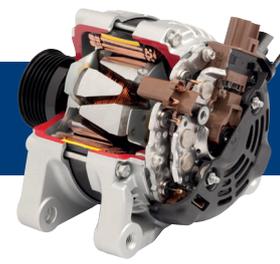
Performance

Test description

The alternator is hot stabilised at 5,000rpm for 30 minutes, then a speed sweep is carried out, from 1,000rpm to 10,000rpm in 60 seconds, at 25°C and 90°C ambient temperatures. Rpm values are related to alternator revs, for which 1,800rpm represents approx. engine idle speed and 5,000rpm represents approx. engine normal driving speed.

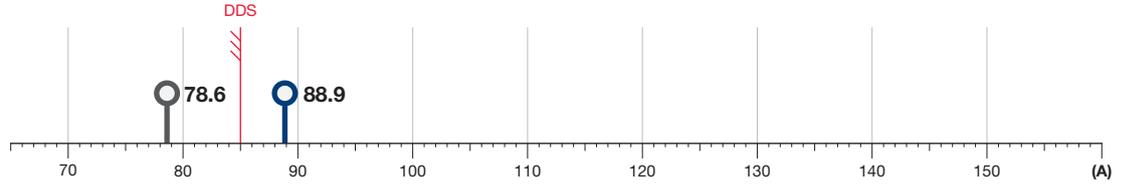
Pass criteria

Meet or exceed the DDS for output amps in each of the four testing scenarios.

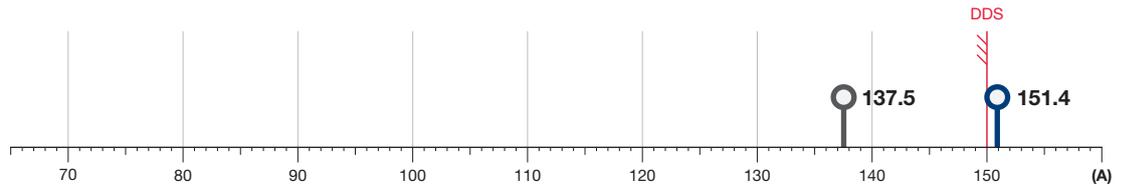


Results

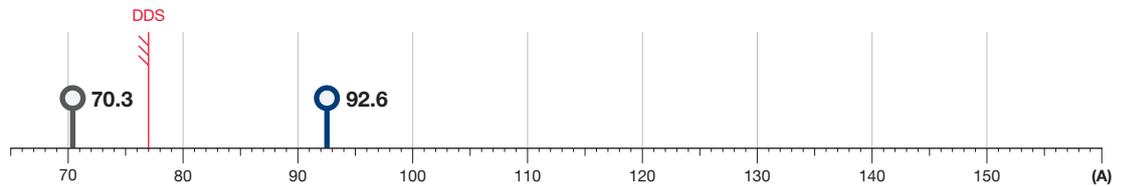
13.5V 1,800rpm
(25°C – hot stabilized)



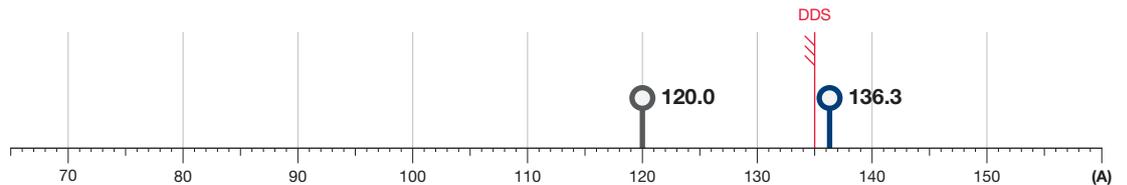
13.5V 5,000rpm
(25°C – hot stabilized)



13.5V 1,800rpm
(90°C – hot stabilized)



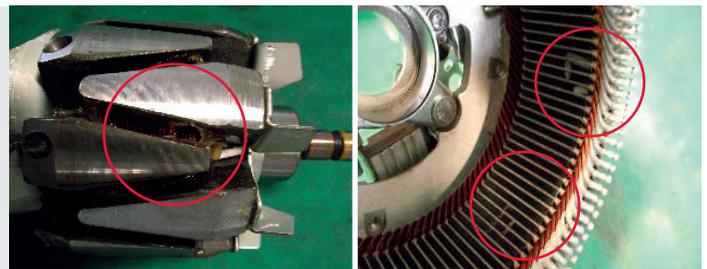
13.5V 5,000rpm
(90°C – hot stabilized)



 Brand X Alternator

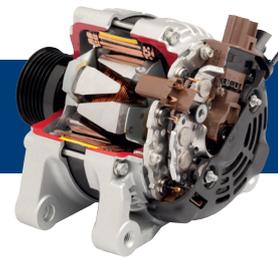
 DENSO SC Alternator

In addition, it was noted that the rotor resin in Brand X's alternator began to melt following the 90°C test.



Conclusion

In each of the four testing scenarios, Brand X's alternator output falls below the DDS, whereas the DENSO alternator exceeds the performance criteria. As well as failing the output test, Brand X's alternator rotor resin melted, a common cause of premature failure.



Durability

Test description

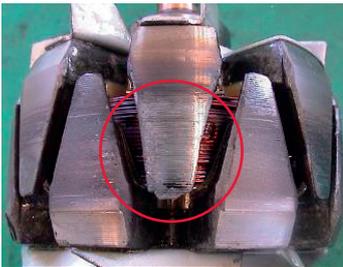
To test durability, DENSO uses 'up and down' analysis, which involves acceleration and deceleration between 0 – 22,500rpm. The alternator is tested at 90°C in 20 second cycles, with 1 second for acceleration, 9 seconds at 22,500rpm, 1 second for deceleration and 9 seconds at 0rpm.

Pass criteria

After 45,000 cycles, the alternator should be electrically operating with a maximum of 10% reduction in output. There should be no mechanical damage such as fan welding detach or crack.

Results

Brand X's alternator electrically failed after 1,227 cycles due to rotor coil wire breakage. Therefore the test could not be completed. After disassembly, interference between the rotor O/D and stator I/D was noted. This was due to rotor claw pole deformation and field coil fusing point resin crack.



Signs of interference between rotor O/D and stator I/D



Rotor coil wire breakage

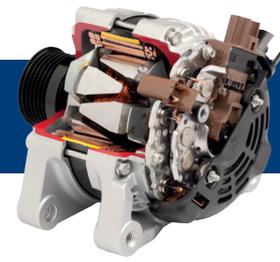


Fusing point resin crack



Conclusion

Brand X's alternator did not meet DDS, failing long before the test could be completed. The faults discovered show that the unit tested has a very short lifetime, the equivalent to approx. 6 months in service. In contrast, DENSO SC Alternators typically show no signs of failure until approx. 90,000 cycles, the equivalent to more than 15 years in service. Mechanical damage may occur after 130,000 cycles due to a failure in the fan welding.



Welding composition

Test description

Brand X's alternator was tested to analyse the chemical composition of the welding alloy using Scanning Electron Microscopy (SEM) and an Energy Dispersive X-Ray Analyser (EDX). SEM provides detailed high resolution images, and EDX is used to identify the elements that make up the sample.

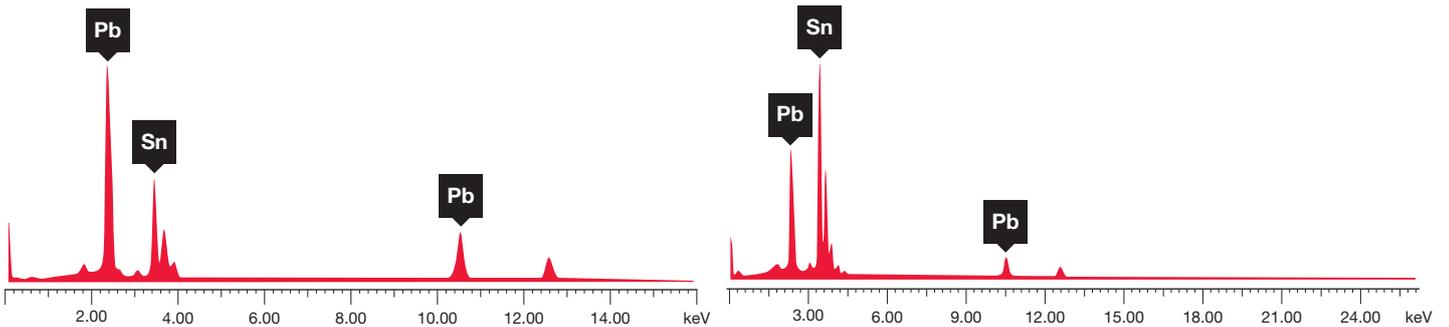
Pass criteria

The welding should be lead-free in order to comply not only with DDS but also with European legislation, as lead is a harmful material.

Results

Анализ припоя в сварном шве рамы регулятора методом EDAX

Анализ припоя в сварном шве фазной обмотки статора методом EDAX



Pb свинец

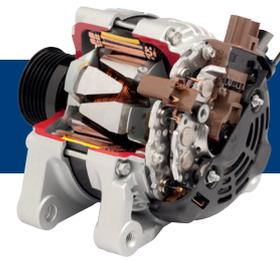
Sn олово

In addition, it was noted that soldering was used to join the stator phase and rectifier terminal as well as the regulator frame.



Conclusion

The test found lead and tin present within the welding alloy of Brand X's alternator. European legislation bans these heavy metals from use in parts such as alternators due to their poor mechanical strength and low melting points which pose a fire hazard. In the past, nearly all welds contained lead, but safety concerns have increasingly dictated the use of lead-free alloys. In addition, the use of soldering to join the stator phase and rectifier terminal as well as the regulator frame reinforces the poor quality of Brand X's alternator. In contrast, DENSO uses tungsten inert gas (TIG) welding for the SC Alternator stator phase and spot welding for the regulator frame, always with lead-free alloys.



DENSO SC Alternators

DENSO introduced its first automotive alternators in the 1960s. Since then we have pioneered a variety of new alternator designs capable of producing more electrical power more efficiently, yet in a smaller, lighter unit. In 2000, for example, DENSO introduced the world's first SC (Segment Conductor) alternator using a rectangular conductor for its stator coil. By raising the winding density (space factor) from 45 percent to 70 percent, we were able to make the DENSO SC Alternator 20 percent lighter and achieve 50 percent higher output than a conventional type.

Features and benefits

- > 100% OE specification: for quality fit, appearance and service life.
- > All 'new in box': no remanufactured units, no core surcharge or return policy.
- > Maximum efficiency: smallest and lightest in the world for their output.
- > Extensive applications list: unique Toyota coverage plus wide range of European marques.
- > Advanced technologies: designed to perform in cold and hot weather conditions; maximum cranking torque under all conditions; fully compatible with sophisticated electronics systems.
- > Rigorous manufacturing and testing: meet highest standards of performance.
- > First choice of the aftermarket: for a trouble-free repair.
- > Optimised stator and rotor sizes: improve magnetic circuit to increase output.
- > Smaller pulley diameter: allows a faster rotor.
- > Two blades integrated with the rotor: reduce fan noise, size and weight.
- > Miniaturised single-chip IC type regulator: enables smart charging.

Further details of DENSO's alternator range are available online at denso-am.eu, on TecDoc or from your local DENSO Aftermarket contact.

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