

# Analysis of Lotus Europa S2 rear axle design

Includes analysis of TC/TCS models

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## 1) Summary

Many Lotus Europa owners have had problems with the rear stub axle and hub assembly and described their problems on the list, it's a topic that shows up every few months.

Awhile back in response to these problems I started a poll with owners answering many questions. There wasn't unfortunately a light bulb moment, but some things did stand out, notably the following.

20 owners have had problems with both sides of the car

LHS only problems outnumbered RHS 14:1

17 owners have never had a problem, though only a minority had done significant mileage

The poll included an option to add your own question, one such was that a hub assembly developed play despite the nut not having moved [presumably as evidenced by the tab still holding the nut]. Four owners reported this outcome. This is significant since it sheds doubt upon unwinding of the nut as a root cause and instead points the finger of suspicion firmly towards another reason for relaxation of clamping load.

Looking at 'basket case' failed hardware seldom results in diagnosis of the root cause because of secondary damage. The Holy Grail of an investigation is to be able to stop the process near the start of the failure. I went back to look more closely at parts I removed from my own S2 Europa some two years back. It was clear from looking at the hardware that they had never actually come loose during driving but steel was being deformed or worn by assembly and/or driving loads. Analysis of the stress levels within the S1/S2 axle components and also a review of the revised TC and TCS designs showed that Lotus did not understand the reasons for problems that surely must have occurred during the inception of the S1 and S2. They must also not have looked very closely at the components after usage. My car and others have shown the same faults, see this report, found within the Documentation section of lotuseuropa.com.

<http://gglotus.org/ggtech/europa-rearaxle/Eurraxle.htm>

These few words sum the problem up perfectly *"S2 bearings are of unequal size. Often a groove will be worn into the ends of the inner spacer, whereas the hub spacer will be mushroomed from the hub beating upon it. Effectively this shortens the hub spacer"*. So, way back in 1979 the answer was there for all to see, but so much has been written about this issue it's hard to separate speculation from reality, in this report I'm going to set out the case for why author Kiyoshi Hamai was right all those years ago.

This report also includes recommendations for a slightly revised S1/S2 build standard using mainly OE parts to preserve originality, important for some in a machine that is becoming rarer and more valuable. Doubtless better designs exist, but this is all about making the standard hardware fulfil its full potential.

## 2) Recommendations

Here's my recommendation for the stub axle build standard... those who want to know the reasons why should read on beyond.

2.1) Use accredited properly hardened bearing spacers, both inter-bearing and bearing/flange.

2.2) Use new Hillman Imp unsealed inner bearings, part number 6006/31. Also buy new outer bearings and inner grease seals, you don't want to be taking the assembly apart because later it will be assembled with Loctite.

2.3) Make sure your drive flanges and shafts are clean and have absolutely no signs of wear whatsoever, otherwise replace. Worn shafts/hubs will leave you with interminable wheel vibration issues at minimum.

2.4) If the drive shaft UJs have any signs of wear, or are not of the type with greasing points, replace. In the main, properly assembled UJs fail catastrophically because the grease degrades and gets replaced by moisture that corrodes the bearing. Regular use of the grease gun will see them last 100k miles, this I