Re: Exhaust Manifold Gasket

Written by Bill LG45 at Jun 10, 2018 3:40 pm

Agree with Colin :

1. Exhaust manifold studs need to be high tensile steel. A decent HTS should have a UTS (ultimate tensile strength) of about 1100 MN/sq.metre and will be affected less by the heat. Stainless will be only offer about a third of the tensile strength, depending on grade.

If you use ordinary steel studs or stainless it is highly they will stretch when they get hot which will reduce the end load in the stud and of course the face stress of the gasket. If the pressure in the exhaust is more than the minimum face stress on the gasket as it heats up and cools down then it will blow.

2. Brass nuts are good as they will be much easier to get undone. Putting coppaslip or John Crane Thread Guard or similar graphite based compound, as used on steam pipework etc will also help to stop the nuts falling in love with the studs! If you come across any nuts made from Nickel aluminium Bronze or Kmonel (Copper/ Nickel /Aluminium alloy) these are even better but expensive.

The amount of end load you put on the stud for a given torque applied to the nut also varies a lot depending on whether the thread is lubricated.

I did some tests on this once at work using strain gauges to measure the end load in the studs over various sizes...too many years ago now to remember the figures but I do remember that, in general, we found that the end load in a dry, unlubricated thread was about half that of a thread lubricated with thread guard or coppaslip and that threads lubricated by oil of normal multipurpose grease were in between. (Of course the loads also vary with thread diameter and thread form as well as the number of threads per inch and the thread angle, as well as the grade of thread... all have some impact.

As a result of these tests we amended the company's manuals and stated that all threads must be lubricated with thread guard and adjusted the torque settings specified as it was the only way to ensure a consistent result!

I would use new best quality spring washers under the nuts.

Hope the above helps

Bill 

Re: Exhaust Manifold Gasket

Written by H 54 John at Jun 11, 2018 10:18 pm

Colin, Bill many thanks. I think this very educational thread will be of interest to a lot of people.

I've no way of knowing what grade of steel Mr Lagonda used for his studs but I doubt whether it was too fancy in 1927 so perhaps the pressures in the manifold aren't all that great. But it's clearly safest to use HTS. Onwards we go...

John

Re: Exhaust Manifold Gasket

Written by Hugo at Jun 13, 2018 6:37 pm

Interesting - I think you mean you have 5/16 Whit studs, not 1/4 Whit; the confusion arises because Whitworth nuts used to be one size larger across flats than BSF. Then, I think it was in WWII, they 'shrank' the Whitworth nuts to the same size as BSF nuts, in order to save metal. Hence you have dual markings on spanners; 1/4W = 5/16 BSF etc. Except that this is no longer accurate either, since 'modern' 5/16 Whit and 5/16 BSF nuts are the same size across flats. That in itself is a very weird size, 0.513" or some random figure like that.

Anyway, to return to your problem - presumably you have just been tightening the nuts on the (incorrect) threads, rather than pulling the manifold up tight against the block? In a way I'm surprised they still managed to work loose. If it were my car, I think I would try to rescue the threads on the studs if possible. Can you run a die-nut down the studs to retrieve a passable thread? Either BSF or Whit, whichever is most likely to work. Then get some long brass nuts & hope they will tighten up ok. If it doesn't work, you're only back where you are now anyway.

I've just had the job of drilling out all fourteen bolts that hold the water jacket side-plate on. The previous owner had started removing the steering box & dynamo to do this (it had corroded through) but sadly he did not live to complete the job. I pulled the engine out & did it at eye level.

I also had one of the exhaust studs snap off when I pulled the manifold, & I managed to drill it out ok. It had to be a top one too, right up against the

cam housing, and I JUST managed to drill it straight by putting a drill bit in the chuck about 1/4" deep and then the drill bit was JUST long enough to go in there before the chuck fouled the cam housing. It really needs an extra-long drill bit to do the job properly. I got away with it, but more by luck than judgement!

Re: Exhaust Manifold Gasket

Written by Colin M34 at Jun 13, 2018 7:25 pm

Hi Hugo

I think you would agree it's vile job much better done with the engine out! Glad you got all the studs out OK.

By the way Lagonda seldom used Whit, they almost always used BSF on the smaller studs and then 20 TPI on the larger ones.

This equates to either UNF or 20 TPI cycle thread variants. Not sure about the thread angle used by Lagondas on the larger 20 TPI bolts but I think it was 60%. Tracy Tools sells taps and dies in these lovely obscure sizes. You will end up with drawers full of them, just like me...

I think low chassis floor bolts are BSW for some strange reason.

Colin

Re: Exhaust Manifold Gasket

Written by H 54 John at Jun 13, 2018 8:26 pm

Yes I'm debating whether to change the two 5/16 BSF - 1/4 BSW studs to new all BSF ones or just slap a couple of 1/4 BSW brass nuts on them and forget about the whole annoying episode.

Interestingly, the BSF HT bolts readily available on the Internet (following through on Colin's suggestion) are Grade R or 8-8 (seem to be synonymous terms) and, if I have it correctly, will have a UTS of at least 800 Mpa or MN/m^2. This is much less than the 1100 that Bill recommends. Also the stainless studs available are of grade 303 and these have a UTS of about 750 i.e. very little different from the HT ones. I've learnt quite a lot about megapascals but am increasingly of the view that keeping the rogue studs and using BSA nuts is the obvious if cowardly thing to do.
Thanks for the help, this is why this forum is so great.

Re: Exhaust Manifold Gasket

Written by Hugo at Jun 13, 2018 9:00 pm

These studs don't need to be especially high tensile - they only have to hold the manifold on tight enough to stop it leaking.
My 2 litre has UNF threads here & there - head nuts for one. Some are marked UNF (not the head nuts I don't think).
And of course there are UNC threads, which are almost all the same pitch as Whitworth, (one size is different - 11/16" maybe?) but with a slightly different thread angle or profile.
You are assuming that you have 5/16 Whit studs (not 1/4!), but they could be 5/16 UNC for all you know. Frankly, after all they've been through I doubt it would make much difference which nuts you use!
I'm currently in America, where I have a few old cars, including a 1961 Corvette I'm currently rebuilding. GM make their cars out of heavy metal stampings & bent bits of metal held together with UNC bolts. It was such a pleasnt contrast to work on a properly engineered car like the Lagonda. Although I have to say the Chevy is a lot easier & quicker!
