

Hi all,

I've decided to re-build all the separate differential posts into one thread. Just keep reading:-

cheers Ron

SO WHAT DOES A DIFFERENTIAL DO ?

A differential is needed when turning a corner in order to allow the outside rear wheel to travel faster than the inside rear wheel. The equations that relates the wheel speeds to the tail-shaft speed is:-

$$(Wl + Wr)/2 = Wts/K$$

where

Wl = left wheel speed
Wr = right wheel speed
Wts = tail-shaft speed
K = diff ration

Under normal circumstances, road/tarmac friction ensures that Wl and Wr adjust themselves to the relative speeds of the bitumin surface moving under them (when cornering or not).

SO WHAT'S THE PROBLEM ?

Suppose you raise the left wheel into the air, and leave the right wheel on the ground.

Suppose we set $Wr=0$ (the one on the ground). We now get:-

$$Wl/2 = Wts/K. \text{ OR } Wl = 2 \times Wts/K.$$

i.e. the "off ground wheel" is spinning very fast, but car is going nowhere, since $Wr = 0$.

Thus, if you are cornering very fast, and the inside wheel is tending to lift off the ground, you first get heaps of inside wheel spin, (and consequent bad handling), then (with greater wheel lift) you get total loss of power to the road, and all you can do is coast through the corner.

SO WHAT'S THE SOLUTION ?

What is needed is some way of discouraging excessive difference between Wl and Wr. i.e so that Wl and Wr are approximately equal, but still allow some difference as needed to allow the outside wheel to travel faster when cornering.

The difference between Wl and Wr is called the "slip".

When slip limiting is implemented, the diff is called a "Limited Slip Diff" (LSD), also known in slang terms as a "slippery diff" (even though it slips less).

A normal diff that is not fitted with slip-limiting equipment is called an "open diff".

SO HOW DO WE MAKE AN LSD

There are many approaches to the problem of limiting slip:-

1. THE FACTORY SPOOL

Replace the differential cogs with a solid lump of metal (called a spool) that allows no differential action at all. Great for racing, no-go for street.

2. THE HOMEMADE SPOOL

Take an oxy-acetylene torch to the diff gears and weld them shut. Thus you now have a solid centre. Also called a "CIG" locker or a "BOC" locker.

3. VISCOUS FRICTION

Various Japanese high performance cars use viscous friction to damp the "slip". Thus there is very little resistance to "slip" at low "slip" speeds, but the resistance to "slip" gets bigger and bigger as "slip" gets more and more. (Imagine that you have a hydraulic torque converter mounted between your wheels.) Good for street, not sure about race.

4. CLUTCH PLATE

A clutch limits the amount of "slip". The pressure applied to the plates is derived from the tailshaft torque, and so the slip limiting action is self adjusting. The more you put your foot down, the more "slip" resistant the diff gets. The transitions from "open" to "locked" are smooth and seamless. Good for street and race.

5. TORQUE BIASSING DIFFS

As the diff gets loaded up, and as the "slip" starts to happen, considerable friction is made to occur on the differential cogs themselves, so that the diff becomes rather reluctant to slip. Even so, the stop-slip action is not total, and if the inside wheel were to become airborne, then only a fraction of the tailshaft torque would be transmitted to the grounded wheel. eg say 50%. The exact amount would depend upon the manufacturer of the diff. The transitions from slip to no slip should be (in theory) smooth and seamless. Good for street, offroad, and maybe race.

6. FRICTION CONES

As the diff develops "slip", threaded cones turn and screw themselves tighter and tighter into a fitting "hole" and grab, thus limit the slip. The cones have a notorious habit of wearing rapidly. Good for street, maybe race.

7. DETROIT LOCKER

As relative "slip" progresses, a mechanism comes into play which eventually will

cause the diff to become locked. The transition is rather sudden and jerky, and would be quite dangerous in a circuit-racer, but would be OK for a drag-racer.

"Which is the best one to use" is a matter of considerable debate. See the individual archive postings on each one to decide for yourself.

cheers Ron

If you are going to use a 1100cc diff I would get the axials shot panned and stress relieved . If you do this the axials will not break , if you have less than 250BHP . I would like hear your comments on a welded diff vs using standard . For using on the track . I was told that a welded diff is a bitch on the track and very hard to get use to .

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Topic: 1100 cc diff (3 of 3), Read 66 times
Conf: Differentials
From: Filip Vandervoort (filipvdv@mail.dma.be)
Date: Sunday, July 23, 2000 03:43 AM

hello

I have driven 3 rallycross races now with the welded diff. We race on a track that has full tarmac and full gravel. We have fast wide turns and short turns.

I started practicing with the welded diff at our house in a field. Immediately you can feel the pressing power of the car when you exit a turn, it just pushes your forwards, it's an amazing difference. On the rallycross track, i don't even notice a difference in handling when i'm racing, only that i have lots of more grip when exiting a corner.

A negative point of the diff is when you have your car parked on a place on the tarmac, and you want to make a short turn at very low speed, say +- 3km/h, one of the wheels has a lot of friction, and if your pushing the car it's hard work. But on the track you(i know i do) won't notice the friction. At first i was a bit afraid how the car would handle in the short tarmac turns, but this is just great. I don't have to mention the difference on the gravel, it's just day and night.

I say when you want to have a lot of more grip at absolutely no cost, weld your diff.

I use a 1300cc diff on a 1600cc engine. I've welded the diff myself with a professional welding machine that i bought. You really have to weld at the maximum power you can to increase the strenght.

Please let me know what you're going to do.

Greetings ! Filip.

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Topic: LSD's (32 of 48), Read 157 times
Conf: Differentials
From: Craig Pethrick (craig4@iinet.net.au)
Date: Sunday, August 13, 2000 02:07 PM

Danny, are spools available for English diffs? I ask because I have reservations about welding up the spider gears in an open diff, sooner or later they are gonna become hard to get!

Craig

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Topic: LSD's (33 of 48), Read 158 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Sunday, August 13, 2000 05:32 PM

Craig there are a couple of spools available in the UK but not really worth the money but you can use planetary gears that have had the teeth torn off as you put in a steel plate to fill the hole anyway

Danny

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Topic: LSD's (34 of 48), Read 148 times
Conf: Differentials
From: Craig Pethrick (craig4@iinet.net.au)
Date: Monday, August 14, 2000 11:25 PM

Thanks Danny,

Looking at my LSD the planetary gears look identical to ones in an open diff except there is 4 of them. Talking to my diff guy, he says a lot of bigger cars only have 2 pinion diffs where as the Escort Salisbury LSD has 4, he reckons they are a excellent tough little diff and if you don't coast through corners and clean them out and change the oil once a year they should last 300 or 400 thousand km's. The question is what is the weak link, is it the planetary gears or the splines on the axle? Can you get billet axles made up for cars that constantly break them ie. Rally cars? Does welding up a diff put extra loads on the axles splines? There must be a way of making a strong English axle!

Craig

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There are several possibilities with the torque biasing diffs, each with its own unique behaviour patterns. The choices are:-

1. The Quaife
2. The Torsen-Gleeson

3. The Detroit True Track (different to the Detroit Locker)

Here are some posts expressing opinions about them:-

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Topic: LSD's (1 of 48), Read 514 times
Conf: Differentials
From: Jeremy Formby (jeremy.formby@finobj.com)
Date: Thursday, August 03, 2000 10:12 PM

Does anyone know how a torque limiting diff (Quaife) behaves differently on a track compared to a speed limiting diff (clutch type) and which is more reliable?

Regards, Jeremy

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Topic: LSD's (2 of 48), Read 227 times
Conf: Differentials
From: Joe Maher (joe@air.net.au)
Date: Friday, August 04, 2000 11:23 AM

A Quaife works on the principle that a worm gear will drive a cog but a cog will not drive a worm gear. Visit (<http://quaife.co.uk>). Quaife is much better!

Regards, Joe Maher, www.air.net.au/~joe

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Topic: LSD's (3 of 48), Read 213 times
Conf: Differentials
From: Jeremy Formby (jeremy.formby@finobj.com)
Date: Friday, August 04, 2000 05:57 PM

But I guess with a torque biasing diff, if the rear inside wheel lifts off round corners its going to still spin like crazy like a normal diff as a similar torque is going to be applied to the inside and out side wheels. The only benefit is there is still torque being applied to the outer unlike an open diff.

On the other hand the clutch type will not spin the inside wheel so much so less slipping of tyres - surely must be better in principle?

confused! Jeremy

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Topic: Re: LSD's (4 of 48), Read 210 times
Conf: Differentials
From: John Alderson (jsa@powerup.com.au)
Date: Friday, August 04, 2000 07:56 PM

Jeremy,

Both the Detroit True Trak and Quaife ATB diffs are supposed to provide some drive to the remaining grounded wheel while the other is airborne.

These two diffs are different in detail to the Torsen gear driven diff which does become an open diff when one wheel is airborne.

At some stage in the future when the collection of parts, loosely referred to as an Escort, layed out horizontally about my shed form a collection parts positioned in 3D I will be able to actually test out my True Trak and let you know in more detail.

Cheers, John

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Topic: LSD's (5 of 48), Read 196 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Wednesday, August 09, 2000 08:38 AM

I have used the Quaife and the Torsen-Gleeson torque biasing diffs and I have gotten rid of all of them as they are not worth bothering with, as they are only of real use on a low horsepower road car, or a road FWD car, since they do drive like a standard open diff if one wheel is off the deck and they both wear very quickly.

An example would be that a quaife diff is a full second slower around Mt. Cotton hillclimb compared to a BOC spool, and as far as a race track goes it was 0.7 of a second slower, and if you are worried about understeer [from a spool], don't, because if you can tell the difference you are going too slow.

If you need a diff for a road car then don't consider anything other than a standard [English] Ford clutch plate LSD as they don't spin the unladen wheel and don't wear anything like as quickly as the others and they are easy to rebuild.

Danny

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Topic: Re: LSD's (10 of 48), Read 125 times
Conf: Differentials
From: Ron Pietzel (r.pietzel@qut.edu.au)
Date: Sunday, August 20, 2000 06:24 PM

Hi Danny,

Detroit "claim" that their True Trak diff will conduct about 45% torque to the outside wheel when the inside wheel is up in the air. The other 55% of the torque gets dissipated internally in the diff gears (I guess). I guess that this is OK for hot street, but maybe not for all-out racing.

cheers Ron

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Topic: Re: LSD's (11 of 48), Read 126 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Sunday, August 20, 2000 11:01 PM

Ron,

I don't know about their claim of 45%. When I drove the sport sedan with it in, it drove like a Quaife and spun the inside wheel till it bit, then tried to spit me out, which at 135kph was not fun.

As far as plate diffs go if the wheels start to creep the internal ramps load up and lock the diff like a BOC spool, and give you 100% drive, which is a lot more comforting and easier to drive.

Danny

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Topic: Re: LSD's (12 of 48), Read 127 times
Conf: Differentials
From: John Alderson (jsa@powerup.com.au)
Date: Monday, August 21, 2000 07:55 AM

Danny,

Whose sports sedan did you drive with a true trak ? Are you sure it was a True Trak and not a detroit locker ?

John

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Topic: Re: LSD's (13 of 48), Read 109 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Monday, August 21, 2000 06:22 PM

John,

It was Jeff Barnes'old Chev Monza, and yes, it was a True Trac, and yes, I know the difference as I have driven Detroit's before, and to be honest I wouldn't bother with any of them.

I think it's a case of "if you can't get a plate type Lsd, then fit a BOC spool till you can".

Danny.

There are two LSD's of the clutch variety:-

1. The English Ford diff
2. The TranX

In both cases, all you get is the bare diff centre and housing. You still need to supply your own crown-wheel-and-pinion. But they fit your existing diff axle-tube setup.

Here are some posts expressing opinions on the above mentioned diffs:-

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Topic: Re: LSD's (11 of 48), Read 127 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Sunday, August 20, 2000 11:01 PM

Ron,

As far as clutch-plate diffs go, if they start to creep, then the internal ramps load up and lock the diff like a BOC spool, and give you 100% drive which is a lot more comforting and easier to drive [than a True Track].

Danny

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Topic: Re: LSD's (15 of 48), Read 113 times
Conf: Differentials
From: Jeremy Formby (jeremy.formby@finobj.com)
Date: Monday, August 21, 2000 06:26 PM

The clutch type diff requires a slip to occur before it reacts and starts locking- is the delay noticeable if its locking in and out round a corner? The Quaife units bias the torque all the time so there is no such delay therefore smoother on the road?

Jeremy

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Topic: Re: LSD's (16 of 48), Read 108 times
Conf: Differentials
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Monday, August 21, 2000 07:34 PM

A clutch type diff will not require slip to occur to react and start locking. What it will require is torque applied (ie either accel. or decel.) in order to decrease the amount of preset slip.

>From my experience, clutch type diff has smooth and progressive operation and hence will not suddenly lock and snap the car sideways.

Regards, Yavuz.

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Topic: Re: LSD's (17 of 48), Read 106 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Tuesday, August 22, 2000 09:17 AM

Jeremy you don't notice anything, since all the diff requires is for load to be place upon it, and it binds up the clutch plates and locks, and once the load is off (say, when you lift off the throttle) it unloads. And it is totally seamless with no harsh effect, and the only time you really notice it is when you want to provoke it and poke the tail out.

If you lift the car on to two wheels it will still have drive.

The Quaife units do creep an inside wheel and do spin the inside when on two wheels, and to be honest you should consider them a Torque Biasing diff, and NOT a Limiting Slip Diff.

Danny

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Topic: Re: LSD's (19 of 48), Read 181 times
Conf: Differentials
From: John Alderson (jsa@powerup.com.au)
Date: Thursday, August 10, 2000 08:07 PM

Ron,

The clutch pack style of LSD is a speed sensing unit, so by definition slip on one wheel (speed difference) has to occur before it is sensed and the opposing wheel is then fed more torque.

On the other hand, the torque biasing differentials sense which wheel has the most grip, or capacity to transmit torque, and deliver more torque to that wheel without slip first occurring.

The clutch packs are just friction plates, so they will wear to some extent.

Cheers, John

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Topic: Re: LSD's (20 of 48), Read 176 times
Conf: Differentials
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Thursday, August 10, 2000 09:19 PM

I am not an expert on this matter. I am familiar with clutch pack lsds and their operation. So I hope following can answer some questions.

A clutch pack lsd looks and works exactly like the wet multiple clutch pack found in motorcycles, especially in motocrossers, and not too different to any other clutch such as escorts etc.

There is spring tension (which is adjustable) preventing the clutches from slipping, just like the pressure plate in the car clutch. As torque is applied to the diff, due to the separating forces in the differential gears, the clutches are forced together making them harder to slip or even locking them together if enough torque is applied.

Hence if you are accelerating hard enough, the clutch pack will act like a locker, and if you unload a wheel [i.e. it becomes airborne], it won't need to slip for the clutch to act.

When you back off (coasting), the clutches will disengage and only have the spring tension forcing them together.

The spring tension is usually light enough so that the car behaves like an open diff when the power is not applied and gradually locks up as you put your foot

down.

Clutches do wear out as there is rubbing going on, so they can be considered a consumable part. They are usually cheap to replace as they are not expensive to manufacture.

Regards, Yavuz.

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Topic: LSD's (21 of 48), Read 174 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Friday, August 11, 2000 06:46 AM

Ron,

The English Ford clutch pack diff costs usually around 500 pounds so count on A\$1700 to A\$1850.

They are a direct replacement for a standard diff, and no, they were never fitted to any other Aussie spec car.

Danny

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Topic: LSD's (31 of 48), Read 178 times
Conf: Differentials
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Thursday, August 10, 2000 08:42 PM

I run a TranX clutch pack 4 pinion LSD in my mk2. Admittedly it is not as strong as the steel english lsd as it has a cast hemisphere. I have not had any problems with the lsd yet, however I am not one who is hard on diffs.

It bolted straight in.

I have been told that they are stronger than quaifes as they [Quaife] are a 2 pinion design. The cost is similar to a quaife, a little over \$1000.

Hope this helps.

Regards, Yavuz.

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Topic: LSD's (22 of 48), Read 163 times
Conf: Differentials
From: Ron Pietzel (r.pietzel@qut.edu.au)
Date: Friday, August 11, 2000 05:02 PM

Hi Danny,

What do you think of Yavuz's diff. i.e. the TranX 4 pinion clutch-pack. At half the price of the English one, its gotta be value for money.

Or have you driven a TranX to death already....????

How many horses do you think a TranX will comfortably cope with.

cheers Ron

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Topic: LSD's (25 of 48), Read 153 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Sunday, August 13, 2000 05:30 PM

Ron,

They [TranX] should be similar to the old cast iron housing Ford diffs and really only should be used with up 170bhp.

If you want a TranX I'll sell you one really cheap! Low mileage, only driven on weekends and two parts for the price of one! [i.e. the cast iron housing is split into two, and totally destroyed and useless.]

Danny.

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Topic: TRX L.S.D opinions (3 of 3), Read 78 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Saturday, August 19, 2000 06:43 PM

Scott,

Last night I was talking to a friend in Britain who remarked that the TranX diff's are now being supplied with a steel housing and end plate, which will stop the problem they had with the housing cracking.

Danny

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OK. Here are a series of posts expressing opinions about diff breakages:-

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Topic: LSD's (28 of 48), Read 154 times
Conf: Differentials
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Sunday, August 13, 2000 11:49 PM

Ron,

I've posed the question of diff strength to a diff specialist that I used to deal with. His reply was that diffs do not break, people break diffs.

He walked me under this datsun 1200. The car had a V8 borg warner diff and a 1.5L (A15 I think) push rod engine. He said that the owner broke the diff gears (spider gears) twice and a full spool was now on the way in.

There was another datsun 1200, with a FJ20 turbo, which ran low 13s and running a rebuilt stock diff, which they never had any problems with.

Basically it comes down to how you treat the diff. Shock loading is responsible for a lot of failures especially for brittle materials such as cast iron. Anyone who is into clutch drops, chirping the tyres into second, or third, or axle tramp, etc is going to get a short life out of the whole drive train especially the diff.

Burnouts and similar behaviour cause overheating on top of the shock loads. Nothing is unbreakable, it is only a matter of time.

A chain is only as strong as its weakest link. Even if you put in the best centre in the escort diff, what about the std size axles, etc? How long are they going to put up with loads above their design limits?

The cheapest and best modification to improve the strength of the drive train is to revise the driving habits.

Regards, Yavuz.

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Topic: LSD's (29 of 48), Read 155 times
Conf: Differentials
From: Glenn Slender (glenn@hollywoodhorns.com)
Date: Monday, August 14, 2000 09:15 AM

I agree with Yavuz.

One of my best mates used to have Escorts and blew up diffs all the time! He would always be doing burnouts and chirpies.

I have had Escorts for about 10 years now and have never blown a diff. Probably because I never drop the clutch. No need to. The car takes off quicker when you don't.

Glenn Slender.

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Topic: LSD's (34 of 48), Read 156 times
Conf: Differentials
From: Craig Pethrick (craig4@iinet.net.au)
Date: Monday, August 14, 2000 11:25 PM

Thanks Danny,

Looking at my LSD, the planetary gears look identical to the ones in an open diff, except there are 4 of them.

Talking to my diff guy, he says a lot of bigger cars only have 2 pinion diffs, whereas the Escort Salisbury LSD has 4.

He reckons they are an excellent, tough little diff, and if you don't coast through corners, and clean them out and change the oil once a year they should last 300 or 400 thousand km's.

The question is "what is the weak link". Is it the planetary gears, or the splines on the axle? Can you get billet axles made up for cars that constantly break them ie. Rally cars?

Does welding up a diff put extra loads on the axles splines? There must be a way of making a strong English axle!

Craig

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Topic: LSD's (35 of 48), Read 150 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Tuesday, August 15, 2000 07:14 PM

Yes, as far as clutch-plate diffs go, the standard Ford diff is a good thing, but the next weak point is the axles and provided you don't get any axle tramp they are usually fine.

As far as getting billet axles made, you are still restricted to the small wheel bearing.

The only way to fix the problem of axle breakage properly is to fit a set of full floating hubs, so that you have a set of tapered roller bearings on the hub holding the car off the ground and a double ended splined axle between the diff centre and the wheel hub, and this is almost idiot proof.

I say "idiot proof" lightly, as a friend recently broke a 35 spline Romac HI TUFF axle at Willowbank Drags in his Fiat 131 Sports Sedan.

Danny

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Topic: LSD's (37 of 48), Read 138 times
Conf: Differentials
From: Scott Waldron (scott77_nz@yahoo.com)
Date: Friday, August 18, 2000 01:21 PM

Craig,

Get the axels shot peined and they will not break .

[Editors note: I think that "peined" is the correct spelling, but its pronounced "peened", as in "ball-pein" hammer.]

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Topic: LSD's (38 of 48), Read 134 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Friday, August 18, 2000 06:53 PM

Scott,

Shot peining the axles wont make much of a difference as they break on the end just after the splines.

This is more of a design flaw, and the other place they break is the other end at the flange where the bearing is, and that is from people using heat to get the bearing off, and no matter how well it is shot-peined it'll still break in both instances.

Danny

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Topic: LSD's (40 of 48), Read 135 times
Conf: Differentials
From: Craig Pethrick (craig4@inet.net.au)
Date: Saturday, August 19, 2000 11:26 AM

Fellas,

I have just installed my LSD, and while I was obtaining the centre from the diff guy, he said that a light car with a LSD should transfer the power into wheel spin(if too much power was applied) which should take the shock loading off the drive-train.

He suggested that the most likely time to break an axle is when you have great grip and plenty of power.

My question is, how easy is it to snap an axle?

I've got a MK1 2ltr, twin carbs and eventually will get a fr32 cam.

Am I gonna break axles all the time doing fast road stuff and the occasional sprint/hillclimb or do they normally only break on full race/rally conditions?

How bad are these axles?

Craig

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Topic: LSD's (41 of 48), Read 137 times
Conf: Differentials
From: Stu Robertson (sturobertson@xtra.co.nz)
Date: Saturday, August 19, 2000 02:04 PM

Well in my opion there is no real problem with these axles.

I agree with 200+ hp you may have major dramas, but how many of us have that sort of hp really.

I've been racing, rallying and hillclimbing small Fords for 15 years, in that time I've only broken 1 axle. Most of that time I was using welded diffs to make it worse.

I admit my motors probably aren't the biggest hp motors out there, but I win my class most of the time, so either I am a bloody good driver, or my engines go ok.

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Topic: LSD's (42 of 48), Read 134 times
Conf: Differentials
From: Danny Mischok (dmischok@bigpond.com.)
Date: Saturday, August 19, 2000 06:47 PM

Craig,

With the horsepower you've got, and an Lsd, the only time you may stuff an axle is if slide into a gutter sideways, but don't worry you'll still have a smile on your face because it's half the fun of having an Lsd.

The only times I've broken an axle is when I've had axle tramp and been doing big launches with a BOC locker. And when I've been doing the same thing with an Lsd they've been fine.

Danny

The Toyota Hilux & Hiace Differentials

The Toyota Hilux and Hiace differentials are all similar in design. They feature an 8" crownwheel, 31 spline axles and large bearings. They have ample capacity for an Escort and a converted Hilux diff will weigh about 60kg.

Common [ratios](#) to be found at wreckers in Australia are from 4.110:1 to 4.875:1. The taller [ratio](#) of 3.7:1 was delivered with V6 vehicles in the USA. Aftermarket suppliers in Australia have gear sets of 3.5:1, 3.7:1 etc. available new.

The closest fit for an Escort is the Hilux 2WD diff from RN10, RN15, RN20 & RN25 models manufactured during the first half of the 70's. Each of these has the same spring centres (940mm) and overall width (1350mm) as an Escort. The spring platform width is equal to the MkII Escort at 60mm but wider than a MkI which has 50mm width springs.

What needs to be modified ?

Axle Shafts and Flanges

These axles have five M12x1.5mm studs on a 4.5" PCD and will require restudding to match the MkII Escort pattern of four M12x1.5mm studs on a 4.25" PCD. The Hilux studs are longer than Escort studs. The MkI Escort has 7/16"UNF studs on a 4.25" PCD.

The drum/wheel location boss on the Hilux axle is Ø67mm compared to the Escorts Ø63mm. If Escort drum brakes are to be used then the boss must be machined down. If an upgrade to larger drums or disc brakes is chosen then the boss may need changing in size to suit the alternate drum or disc centre hole.

Some Escort mag wheels may fit over the Hilux boss but standard wheels and some mags will require the boss to be Ø63mm where it protrudes out further than the drum or disc and into the wheel.

If alternate discs are fitted over the axle flange this will increase the overall width of the diff by the thickness of the disc bell on each side of the diff. So if discs with a bell thickness 7.5mm are fitted then the overall diff width will be $1350+7.5+7.5=1365$ mm. Check your tire clearance to the guards and track width requirements. Most of the axle shaft fitted to the RN10-25 models have sufficient spline length for the axle to be shortened a small without the need for resplining, but work out what you need and measure the axles before purchase.

Brakes

The Escort drum brake backing plates will need the centre hole size and bolt pattern changed to fit over the Hilux bearing carrier. The backing plate will need a spacer behind it so that the drum properly covers the brake shoes.

Upgrading the brakes to discs is a has been done and reuse of the Hilux drum system may be possible.

Differential Centre

The [ratio](#) and type of the [centre](#) that is factory fitted to RN10-25 Hilux may not be suitable or serviceable considering the age. Options are to fit a diff [centre](#) from another later model Hilux or Hiace that has a suitable [ratio](#) or Limited Slip [centre](#) for example.

Other options are to fit aftermarket [ratios](#) or Limited Slip Differential [centres](#) and new bearing and seals.

If the chosen [ratio](#) is different to standard and an accurate speedo is required, the speedo accuracy will need checking and correcting.

Differential Housing

If Escort drum brakes are retained the the handbrake linkage brackets and hydraulic line bracket will need fitting to the Hilux housing.

If the factory style anti tramp rods are to fitted then these will need fitting to the Hilux housing at the correct angle relative to the spring platforms.

For originality sway brackets would also need fitting to the Hilux housing at the correct angle relative to the spring platforms.

If discs, tyre clearance etc. dictate shorter axles then the housing will also have to be shortened by an equal amount on each side.

With the exception of tramp rods, the brackets can normally be cut from a donor Escort housing.

Shackles and Shackle Plates

The RN10 - 25 Hilux housing axle tubes are Ø65mm and 5.5mm thick compared to an Escort axle tube at Ø63mm and 3.2mm thick. The Escort shackles fit over this housing, alternatively the slightly larger diameter Hilux shackles will fit through the Escort shackle plate.

The MkII Escort shackle plates will not require modification to use this Hilux diff housing.

Spring Platforms

To prevent rapid universal joint wear and tailshaft vibration, the operating angles of front and rear universal joints need to be similar, eg: less that 1° difference in operating angle.

The angle required will varies depending on whether anti tramp rods are fitted and the curvature/rating/ride height of the leaf springs. Anti tramp rods and stiffer leaf springs reduce the amount the diff nose lifts under power where as leaf spring curvature and ride height alter the static position of the diff nose.

The angle of the spring platform to the pinion needs to be checked and altered, if necessary, by relocating the spring platforms around the axle.

If this diff is fitted to Mk1 leaf springs, the 50mm wide Mk1 Escort spring platforms will need to be fitted to the Hilux Diff.

Tailshaft

The 1 peice Escort tailshaft that has replaceable universals has the same universal as most of the Hilux/Hiace units, but the tailshaft will need shortening and a Hilux flange fitted to the universal.

Other Hilux & Hiace Diffs

Later Model Hilux 2WD

The later model, particularly 80's on, 2WD hilux diffs are to wide to be useful in an Escort fitted with wider tyres. The axles do not suit resplicing as they are machined down behind the existing spline for too great a distance.

They may provide the [ratio](#) you are looking for though.

Hilux 4WD

The Hilux 4WD diffs are generally 20mm narrower than an equivalent year 2WD diff. Some of the axles have an extra length spline that may be shortened without the need for resplicing, in particular check out the RN46 manufactured around 4/83. All 4WD axles have 6 wheel studs and can be re-drilled for an Escort stud pattern without the need for welding up the old stud holes.

The 4WD housings are the least suitable as they are step up in diameter toward the centre and will cause mounting hassles for brackets and shackles.

The 4WD [centres](#) will in some cases be Limited slip units and may contain suitable [ratios](#).

Hiace

The Hiace diffs are all to wide for an Escort. The housings are the same style as the 2WD Hilux but the axle tube dimension is 68mm x 62mm oval and 4.5mm wall thickness. Use of this housing represents a small weight saving which may be cost effective if the 2WD housing for your application requires shortening and other alterations.

The Hiace centres may also have the [ratio](#) you are looking for.

The mid 90's Hiace is fitted with a wheel stud that has extra spline length. These may prove useful for a disc brake setup.

Identifying Toyota Hilux & Hiace Differentials

The Toyota Hilux has ID plates fitted in the engine bay, while the Hiace has them fitted near the base of the front seats. In each case one of the plates will have the 'Axle' code *originally* fitted to the vehicle.

As an example a RN25 Hilux manufactured during the 2/74 has the 'Axle' code "G142".

The letter "G" signifies it has a "G" series differential and therefore an 8" diametre crownwheel.

The next two digits, "14", nominate the ratio, which according the ratio table below is 4.875:1. Many of the ratios have not been fitted to Australian vehicles nor are they all sold here as an aftermarket item. The 4.875 and above ratio centres have a slightly different crownwheel position on the centre. So if ratios below 4.875 are to be fitted then select a diff with a ratio below 4.875 or vice verca if shorter ratios are to be used.

Two suppliers who have crownwheel & pinion sets are Sunstate 4WD & Jack McNamarra Diffs.

The last digit, "2", is for the type of centre, in this case 2 Pinion & Open centre as per the centre table below. The factory LSD is a clutch pack type, while aftermarket suppliers offer these, plus a wide range of other types.

How about an air locker for your Jeckyl & Hide, roady - weekend warrior.

RATIO TABLE

Code	Ratio	Code	Ratio	Code	Ratio	Code	Ratio	Code	Ratio	Code	Ratio	Code	Ratio
01	3.300	07	3.900	13	4.790	19	5.833	25	4.556	31	3.909	37	3.583
02	3.360	08	4.110	14	4.875	20	6.167	26	5.571	32	6.591 or 4.807	38	3.417
03	3.545	09	4.222	15	5.125	21	6.667	27	3.364	33	7.503 or 5.583	39	3.154
04	3.556	10	4.375	16	5.286	22	6.780	28	4.300	34	6.781	40	5.375

											or 4.786		
05	3.700	11	4.444	17	5.600	23	6.833	29	4.100	35	7.636 or 5.600	41	3.308
06	3.889	12	4.625	18	5.714	24	7.640	30	3.727	36	4.778		

CENTRE TABLE

Code	Centre Type
2	2 pinion open centre
3	2 pinion limited slip centre
4	4 pinion open centre
5	4 pinion limited slip centre

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