# GEARBOX REBUILD

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This month we delve into the world of gearbox repair to fix what appear to be worn synchros and flogged bearings in a Honda Integra Type R DC5. The team from The Gearbox Factory runs us through the process, and shows us the problems may not be what were originally suspected.
The pros have done hundreds of these and make it look easy, and it can be done at home if you've got a bit of know-how. However, if you're not sure how to remove the gearbox from the car to begin with, that's probably a pretty good indication you should leave this job to the pros …

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The first step is to split the gearbox casings and pull the internals out. Even if you are having issues with just one or two synchros, both the main shaft and output shaft will need to be pulled out and stripped down. While most of it will come apart easily with normal hand tools, you may find you need a hydraulic press to remove some of the gears from the shafts. A clever tip is to mark any fittings that attached to the outside of the box, so you know where they need to be refitted to. On this box, there were small bolts around the casing as well as a circlip hidden under a cap that needed to be undone before the casings would separate.
The magnet in the bottom of the box is a good indicator of how bad the wear is. Just pray it's not covered in metal filings, as that's a bad sign!

2

As this box appeared to have synchro issues with every gear, the guys from The Gearbox Factory suspected the clutch may have been part of the issue, and they were right. Being the original clutch, and having been in the car for 120,000km, the bulk amount of clutch dust was actually jamming the clutch fingers and not allowing it to engage evenly, putting undue stress on things. You can see here what appear to be heat spots, and on the end of the fingers, uneven wear from the release bearing. If the clutch had more meat on it (this one is about at the end of its life) you'd use an air gun to blow as much dust out as possible and reuse it. This one was beyond saving.
With the box apart, clean and inspect everything to make sure there are no visible signs of damage. Ideally a hot tank is the best way to do this, but if you're at home, you'll need to get seriously busy with either a parts washer or, if you're really keen, a degreaser and a brush of some form.

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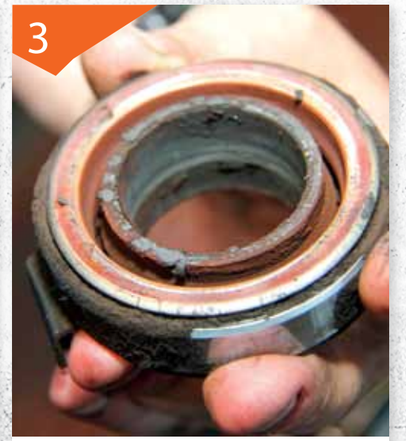

With the box out, the release bearing is easily accessible. Applying pressure onto the bearing, try to spin it, and see if it feels smooth or not. As suspected, this one was well past its best. It's important that pressure is applied before the bearing is tested, as they're designed to work under load and can feel faulty when tested without it, even if they're OK.

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With a press, press the gears off the shafts, making sure to use a block of soft aluminium between the two. This ensures any jolting as things loosen up doesn't cause any of the teeth to be damaged.

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The synchros on this box are three-piece items, and upon turning them by hand, it soon became apparent that they were not binding as they should, which was the main root of our problems. The most likely cause being the use of incorrect oil or the oil not having been changed frequently enough. The good news was they didn't look damaged in any way, so instead of a costly replacement, it was just a matter of servicing them.

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For this, all that's required is either some valve-grinding paste or a light sand. The way three-piece synchros are designed to bind up to match gear speed means any glazing on them will affect how the surfaces come together, so a simple sand to remove any build-up is all that's needed before they can be pieced back together. It's not uncommon for them to warp slightly, so give them a thorough check over.

7



The main bearing noise that could be heard was due to a worn bearing at the end of the main shaft. Due to where first and second gear sit (close to the bearing), the pressure on it, and the therefore noise coming from it, is more notable in those lower gears. Replacement is simply a case of prying the old one out and dropping a new one in. As a pressure fit, it may take a bit of tapping to ensure it's in right. The most important thing is that the bearing sits flat when installed, as any angle on it will create a serious amount of wear. On a bearing like this that is set into the casing, make sure to tap evenly around the edges, whereas with a shaft-mounted bearing, you'd only tap around the inner.

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With the bearings replaced in the casing, it's time to assemble the shafts. On the pinion shaft, it's higher gears before the lower gears, while on the main shaft it's the reverse. While you could replace all the roller bearings, and we would have if needed, in this case it was simply a matter of reassembly. Make sure to apply a bit of machine oil to each part to ensure that when it's run for the first time it's not run dry before oil hits it.

9

With third gear the first to go on, the third-gear synchro follows. All the synchros are keyed, so will only go together one way. The gears may need to be pressed back on, and, of course, plenty of care is needed to make sure they go on straight. After third gear, it's the same again with fourth and the fourth-gear synchro.

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A hub is used between fifth and sixth gears to make sure you get it all in the right order. Taking a photo of the shafts before you pull them apart can help if you get stuck.

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Keep following this process, pressing each component onto the shaft and applying lubrication to all moving parts. Soon you'll have your freshly assembled main shaft ready to go. Make sure to shift each outer hub to ensure they're correctly engaging before adding the next layer, as the last thing you want to do is undo everything.

12

The final piece of the main shaft is a bearing. As with the bearing in the casing itself, it pays to double-check part numbers and make sure you're buying quality. Specialist workshops such as The Gearbox Factory can supply these for you. As you can see here, the bearing needs a bit of assistance to go on the shaft. A socket with the same diameter is a great way to ensure you're getting even pressure across the whole bearing.

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The pinion shaft will come together in much the same way it came apart.

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Reverse gear is straight cut, so great care must be taken to fit it on the shaft facing the correct way. If need be, line the shafts up to double-check.

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Make sure to spin each gear as it goes on, to check that nothing is binding, and that the synchro engages as it should. A few minutes of double-checking now may save you a major headache later on.

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Once all gears are pressed back on, refit the pinion nut to keep them all together. A big trap with this is that 90 per cent of the time these nuts are left-hand thread. Of course, this catches people out more when pulling them apart. Don't forget to add some Loctite either. When tightening this nut is the only time the shaft should ever be put in the vice by one of the gears. Make sure to use alloy teeth in the vice, and only tighten as much as necessary to avoid any damage.

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With both shafts reassembled, it's time to bring the whole lot back together and refit to the case. The first step is to fit new bearings to the diff, again using the press, ensuring they go on straight. Apply grease to the speedo drive, as often plastic teeth are working with metal ones, and, if run dry, even for a short while, damage may occur. Give the speedo drive a spin by hand also, to make sure it moves freely.

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When reassembling the selector forks, double-check there's no damage or burrs on them. If so, these can be sanded out or replaced if need be.

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Here's the hard part, lining all three selector forks up with the two shafts. You'll know you're in the right spot when all the forks line up together. When these three are in the same place, the box will be in neutral.

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After the diff is dropped in place, all three forks need to drop back into the correct holes all at the same time, which can require a serious amount of juggling … and swearing.

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If the forks are lining up, you know you're in the right place.

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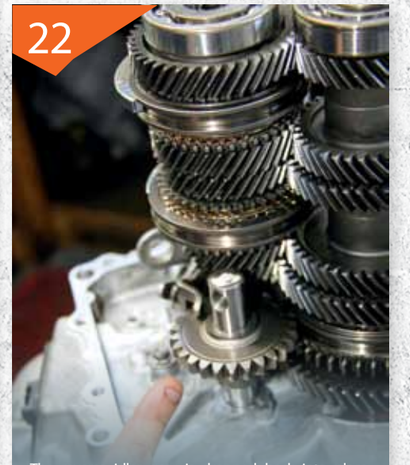

The reverse idler gear is dropped back into place, but make sure you line the hole in the shaft up with the hole in the casing, as a bolt needs to go through to hold it in place. If you're lucky, you may be able to twist it slightly when the casings are together, but there's a high chance that it won't want to move.

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Before dropping the main casings together, run a bead of high-temp sealant around, and smear it out with your finger. Make sure to go around both sides of the locating dowels.

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The two halves should go together without too much drama, but if need be, you can give the selector forks a bit of a wriggle. Once in the right place, a gentle tap around the edges should see it all slot into place. If you have to force it, something is probably not right.

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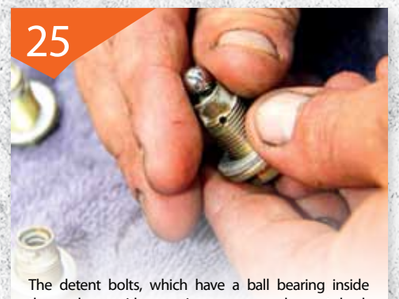

The detent bolts, which have a ball bearing inside them along with a spring, can now be put back together and installed, helping to give a positive gear feel as well as helping to hold the shifter in gear.

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The selector mechanism can now be reattached, making sure the same high-temp sealant used with the casings is employed again. Once it's all bolted up, shift it through the gears to make sure everything works, as it's far easier to double-check now than find out when it's in the car that you've made a mastake along the way.

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The reverse sensor bolt can then go back in, again with some high-temp sealant.

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The final check is to see if the diff turns when the input shaft is turned. Success!

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Add some grease to the clutch fork before fitting it back in — both onto the pivot point and where the forks hit the bearing. Grease up the shaft the release bearing sits on too, before sliding the new bearing into place.

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The final step is to make sure the drain bolt is tight. To make life easy for yourself, ensure the filler bolt is cracked open. It's far easier to do it now than when the box is in the car, and you're on the ground struggling to reach it. Now you can chuck the box back in the car, fill with oil (the right oil), and be away, crunch- and groan-free! ■