

UNDERSTANDING EV GEAR REDUCER OIL CONDITION

2017-2021 Hyundai Ioniq and 2018–2023 Kona, 2018–2022 Kia Niro EVs

Rev 2.3, 6 Feb 2025

This short guide describes how the quality of lubrication degrades quickly in these models of EVs, which in my opinion can lead to the infamous “wheel of fortune” noise in some cases.

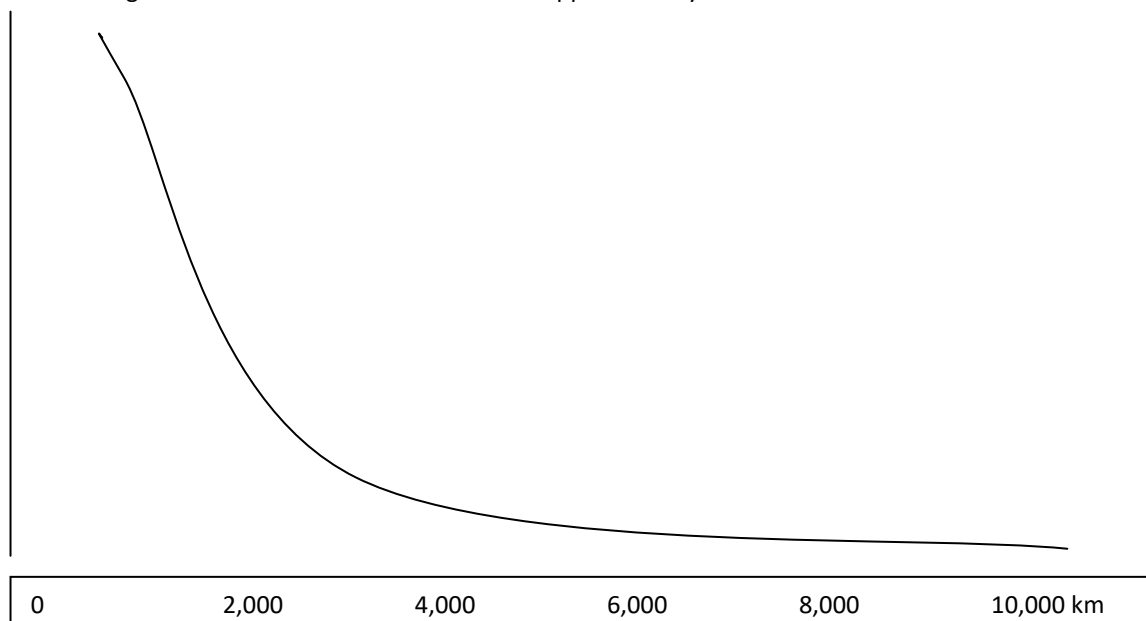
As new ...

- i) The gear reducer unit (GRU) lubrication requirements as called out in the owner’s manual are for a 70W GL-4. The Product Data Sheet for the OEM full-synthetic Hyundai/Kia 70W DCT oil describes it as “clear brown” in colour. 1.05 litre is installed.



Photo of new oil: OzKona

- ii) In general for gears, the rate of steel particle generation due to the initial break-in wear of machined gear tooth surfaces will follow a curve approximately like this:



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140 km (approx 90 miles)

- i) Fresh steel wear particles shed off gears and entering circulation in the oil will have at least a partial attraction to a magnet and should stick to one if passing close by. The oil in this photo was removed from a new Kona with only 142 km, perhaps 4 hours of operation. Note the large dark cluster of particles clustered near the magnet placed against the plastic bottle at the right.



Photo of slightly used oil: KonaAU

- ii) You might wonder why these particles came out in the drained oil rather than remained inside attached to the factory's round internal magnet, located on the floor of the GRU at the yellow arrow in the photo below? This magnet is not intended to be cleaned during the life of the EV.

Ignoring that question for the moment, it's clear that an early oil change at about 500 km would remove those particles, preventing them from causing damage as they circulate.



Photo: Ioniqforum.com

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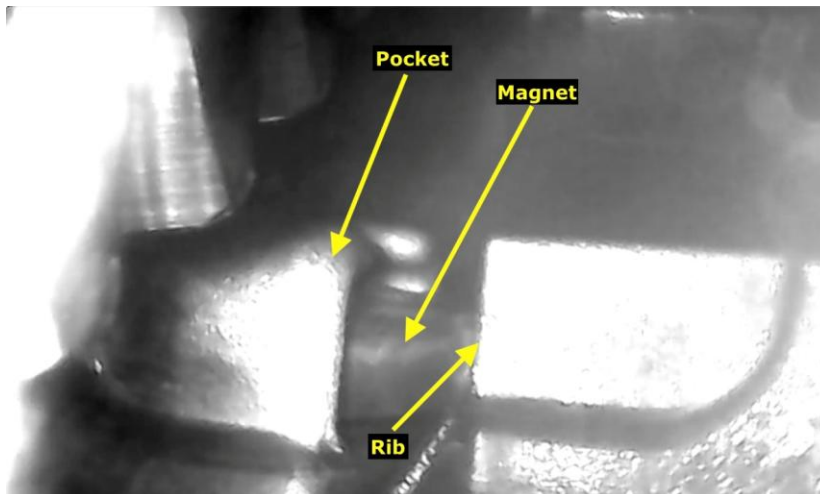


Photo of internal factory magnet using an inspection camera: KiwiME

- iii) Common design practice would have the magnet placed inside the GRU where fresh particles would be most likely to find it quickly and be removed from circulation. Perhaps for ease of installation the magnet has been designed to sit loosely in a pocket on the GRU floor and kept from escaping by a rib feature opposite. As such it can move approx 4mm out of the pocket until it hits the rib. It can also move about 2mm side to side and about 3mm upwards.

Note that the magnet in my Kona at 27,000 km (see photo above) appears free of the particles it was designed to catch. Now why would that be? This evidence is essentially the smoking gun.

For whatever reasons particles are either not being caught, or are caught then worn down and eventually rubbed off during movement of the magnet. Simple tests demonstrated that the magnet does have good, if not excellent magnetic attraction.

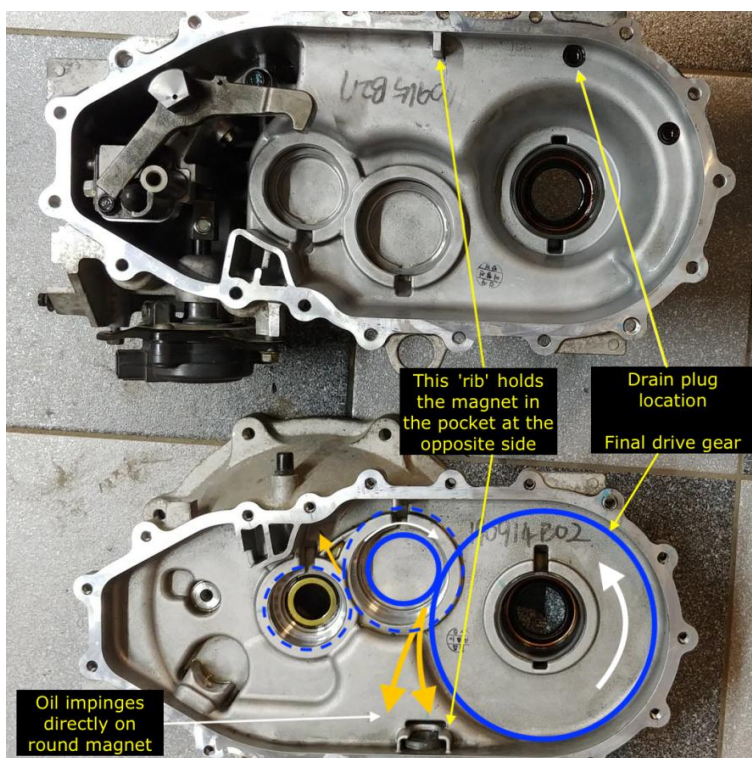


Photo: KiwiME, orig from ioniqforum.com

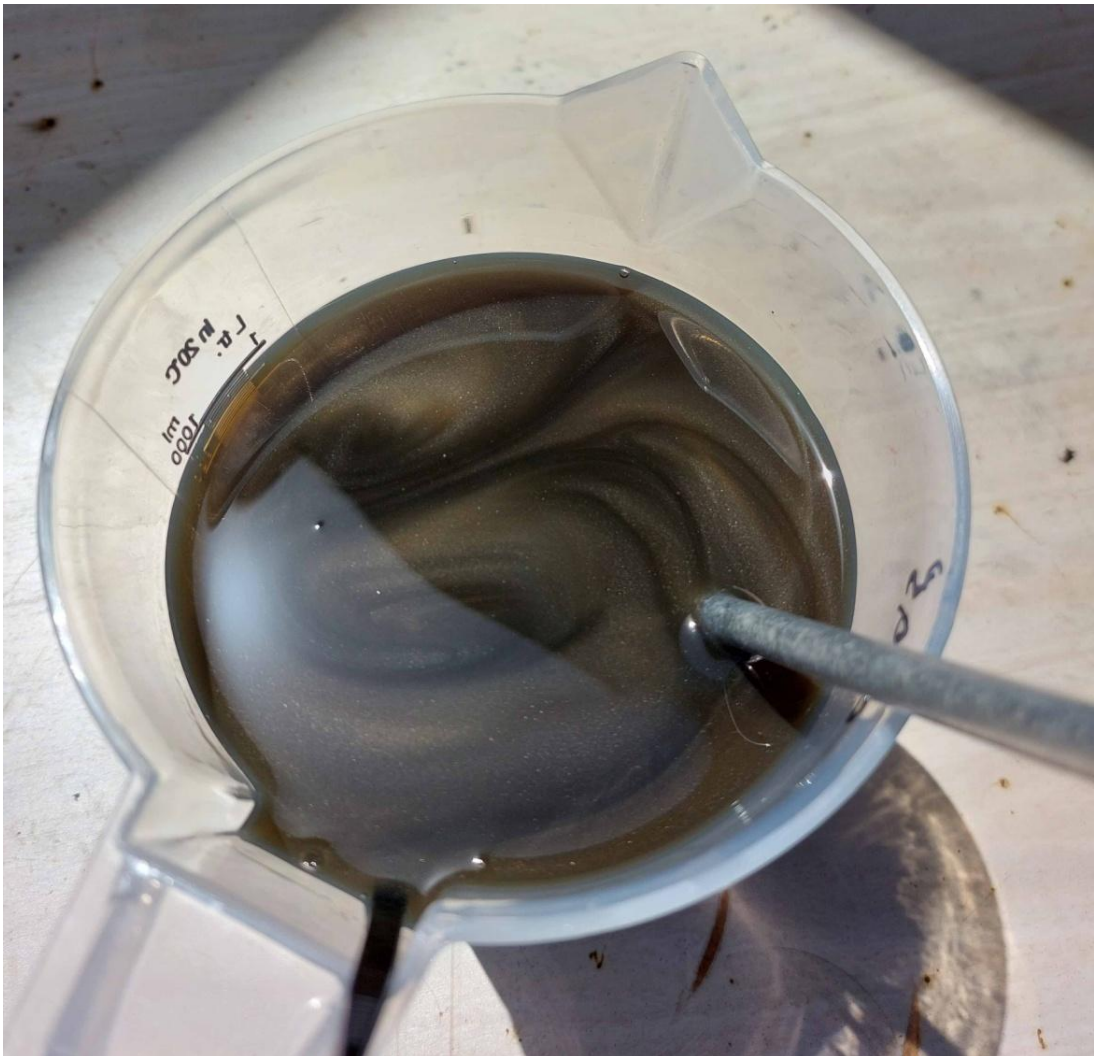
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1,000 – 4,000 km (approx 600 – 2,500 miles)

- i) Any particles present in the oil circulation will be repeatedly ingested and crushed by meshing gear teeth and rolling-element bearings. As a result of that mechanical working particles are not only reduced in size, but turn black in colour due to the localised heating and lose any magnetic attraction remaining.
- ii) The gears themselves incur minimal damage, but this process is detrimental to precision rolling-element bearings and will reduce their overall lifespan. The raceways develop a matte wear pattern as particles caught in the raceways disrupt the rolling motion and result in micro impacts to the surfaces.
- iii) The photos below, taken at 2,000 and 4,000 km respectively, are typical of the oil's reported condition by the *vast majority* of owners who have posted photos, a mixture of visible silver particles and grey or blackened oil. This level of contamination would *not* provide the level of lubrication cleanliness expected by Hyundai's engineers.
- iv) If the critical earlier oil change was missed at 500 km, changing the oil as soon as possible during this period can still reduce further damage. If the oil was found contaminated at 500 km another change at 1,500 km would be beneficial.

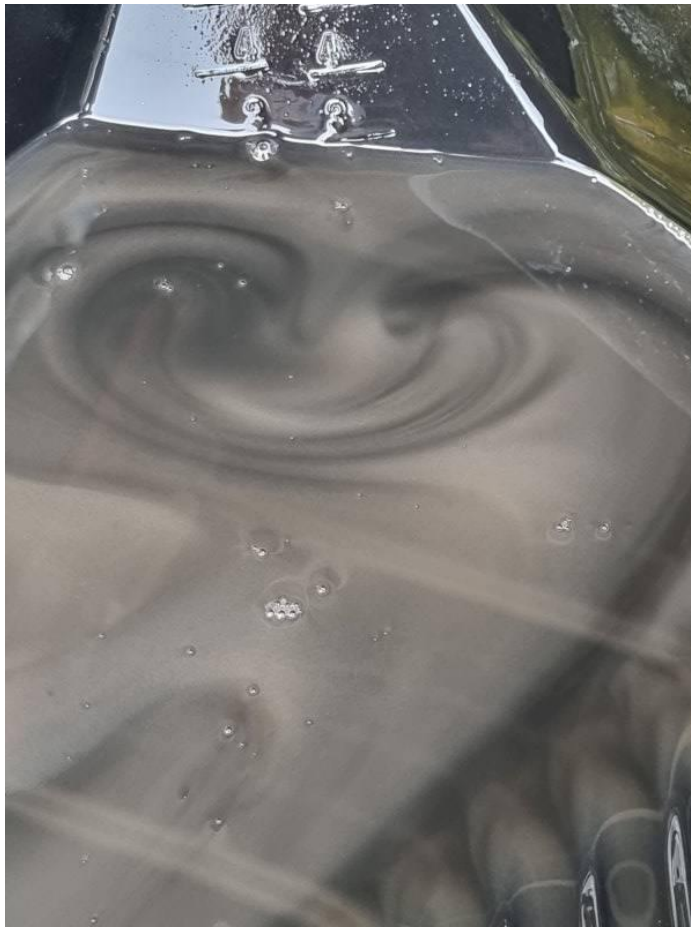


2,000 km, photo: 08crd

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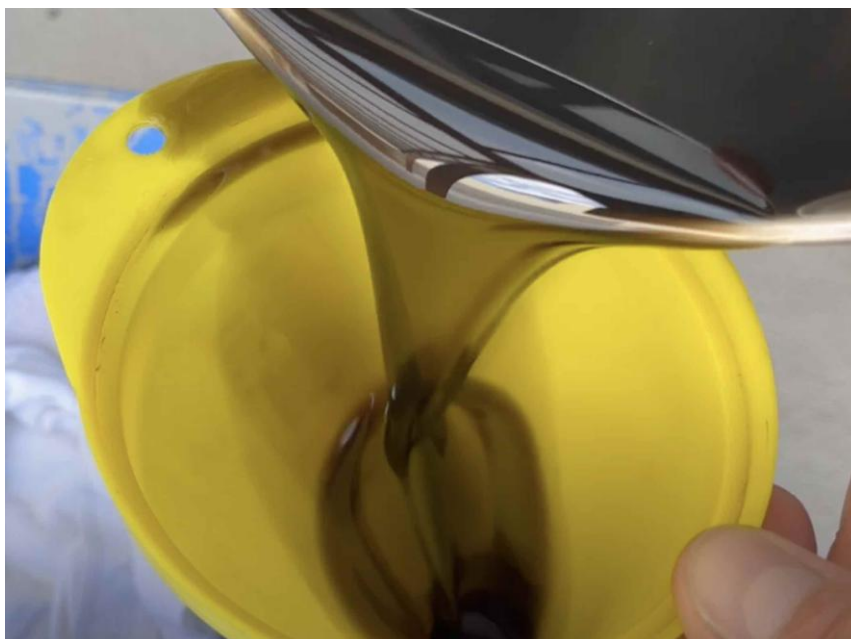
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4,000 km, photo: OzKona

15,000 km (approx 9,000 miles) and ongoing

- i) Eventually new wear particle generation drops to a low level and the process of particle reduction completes, leaving them invisible to the eye. This also leaves the oil in what *appears* to be a relatively-clean state.



19,200 km, photo: KiwiME

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- ii) When placed in a bottle however it looks completely opaque. A used-oil analysis would reveal the moderate iron content and a few tiny black particles might be teased out with a magnet. The effect of the oil on the GRU ongoing may not be any worse than having clean oil and as such carrying out an oil change at this stage is unlikely to have much benefit as the bearing damage has already occurred.



photo: KiwiME

- iii) That early wear sustained by ball and roller bearings may either leave them in a damaged but relatively stable operating condition ongoing, or in other cases deterioration continues leading to an increased operating noise that eventually becomes noticeable to the driver as a tapping or thrumming.
- iv) Affected owners have come to know this as the “wheel of fortune” noise. As a rough estimate based on reporting frequency of about one every 2-3 weeks, it seems to occur in perhaps 1% of these EVs. Both Hyundai and Kia eventually issued TSBs for a “motor rumble”, which additionally recognises a similar noise due to issues present in the early motor revisions.

Conclusion

The lubrication conditions present in this series of gear reducers quickly becomes unacceptable for the good health of rolling-element bearings due to the manufacturer’s failure to provide a working means of wear particle capture and sequestration. This leads to bearing damage that in a few cases results in objectionable noises appearing at some point within the vehicles normal lifetime. Reports of noises have been reported as low as 5,000 km up to over 160,000 km (approx 3,000 to 100,000 miles).

As of late 2024 there has been no evidence indicating that the factory has resolved this. Not only are reports on owner’s forums still appearing every two or three weeks but some are now on their *third* gear reducer. In two cases the replaced unit was found defective soon after installation.

The new generation of the Kona (2024+) and Niro (2023+) models have a different gear reducer design and have been free of this issue, despite that the internal magnet appears much the same. Not only is the oil volume 3x the amount but there is a filter screen installed.

21 of 22 used-oil lab reports submitted (of a first oil change) indicate very high levels of iron and in some cases, aluminium. Noting that there are *no* normal aluminium wear surfaces present in the GRU, it’s possible that this is a result of the magnet’s movement wearing against the aluminium housing.

As factory warranties expire, I’d encourage owners who encounter noise issues to press their Hyundai or Kia dealers and importers to cover the costs of repair. Designing a gear reducer that provides a reasonable

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lifetime for a motor vehicle was the responsibility of the manufacturer and repair costs should not be deferred to owners.

A simple solution for the manufacturer may have been to simply delete the internal magnet in production and install a conventional magnetic drain plug. A suitable preventative action for dealers would have been to carry out at least one oil change shortly after new-vehicle delivery.

References

Demo video of internal magnet looseness (KiwIME)	https://youtu.be/YquYZPTkcmI
Test video on several magnetic drain plug options (KiwIME)	https://youtu.be/ldBNDGbjWqc
Diagnosis and repair video of GRU and motor (Car Repair Videos)	https://youtu.be/NaXCbnr3cV0?si=tGaWm5pDUYQTRC2t
Hyundai's TSB	https://static.nhtsa.gov/odi/tsbs/2022/MC-10211676-0001.pdf
Kia's TSB	https://static.nhtsa.gov/odi/tsbs/2021/MC-10191531-0001.pdf

Magnetic Drain Plug recommendations

There is some advantage to installing a magnetic drain plug, especially from new. This Votex plug has been proven reliable by dozens of Kona owners since 2020 and is available from Amazon. Generally two are installed to avoid confusion as the tightening torque of 22 lb-ft is lower than the stock 30 lb-ft. [Votex - Made in USA - M18 x 1.5MM Magnetic Engine Magnetic Oil Drain Plug DP007](#)

This alternative part is from Toyota and looks nearly identical to the original plug Hyundai used from 2018 to 2022. It can be purchased from any Toyota dealer or 4WD shop. Tightening torque is the same as the original, 30 lb-ft. [Toyota part number 90341-18057](#).

I would strongly advise that owner's stick precisely to these recommendations and especially avoid aluminium-body plugs that are inexpensively sold online. Should the magnet separate from the plug body during driving, the result would be an instantaneous and catastrophic GRU failure. Needless to say, in all cases installing a magnetic plug is done entirely at your own risk.

Gear Oil recommendations

Suitable alternatives to the OEM gear oil are as follows. The fill requirement is specified as 1.0 – 1.1 litre, which places the oil level at the bottom of the filler opening when the car is on flat ground.

[Redline MT-LV 70W-75 GL-4 or Redline D-6 ATF \(North America\)](#)

[Liqui Moly MTF 5300 70W-75 GL-4, RAVENOL MTF-4 SAE 70W, Comma MVMTF Plus 75W, Granville MTF FS 70W \(Ireland, UK, Europe, Asia\)](#)

[Penrite Pro Gear 70W-75 GL-4 \(Australia, New Zealand\)](#)

Credits

About 100 Ioniq, Kona and Niro EV owners worldwide have contributed to the knowledge we have today of this issue. I'd like to thank all of them and in particular those who paid for and submitted used-oil lab reports. As a note regarding that, I do have sufficient UOA data at this time so no more are required. The resulting graphs are on page 8, but there haven't been any surprises – iron (Fe) is not being adequately sequestered by the internal magnet and that design defect results in higher than normal levels that increase with the distance driven until the first oil change.

About the author

This document has been written by KiwIME, a 2018 Kona owner in New Zealand and represents my personal opinion of the detrimental events that unfold in this consumer product. Gearbox technology is within my professional engineering training and work experience.

Since late 2021 I've been encouraging owners of the affected EVs to change their gear oil due to the filthy condition it's often found in, while researching the design and collecting information on reported problems. I concluded in 2022 that wheel-of-fortune reports were most likely due to the inadequate sequestration of iron wear particles caused by failing to tightly secure the internal magnet.

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