

The Right Tool for the Job

When a gearbox remanufacturer is trying to decide whether to regrind or replace a gear, any number of factors could be running through their head. Here are some remanufacturers' processes on how they reach the conclusions they do, and why you should listen to them.

Alex Cannella, Associate Editor

Any time a gearbox needs to be repaired, the question comes up: do you regrind or replace the damaged gears?

No gearbox remanufacturer answers the question quite the same way. For some, whether to regrind or replace a gear is a case by case problem based on a number of factors, while for others, it comes down to a few simple black and white questions. Some answers are about feasibility, while others look more at practicality. But one thing that did come across from each repair shop was that choosing the correct method to repair a gear is a matter of choosing the right tool for the job.

According to Circle Gear President, Mike McKernin, however, remanufacturers often have to back up a step before they can pick a tool. There are a wealth of considerations to make when deciding whether to regrind or replace, but the first that always needs to be looked at is money.

"It's economics, there's no question," McKernin said.

Repair guys like McKernin can study a gear to decide whether or not a regrind

is feasible until the end of time, but it won't matter if the customer has monetary or time restrictions that force them towards one solution or another or, alternatively, their heart is already set on what they want.

Sometimes, a gearbox remanufacturer will look at a gear and decide it's safe to regrind, but a customer will accept nothing short of a full replacement with brand new gears. Or a gear might be so damaged that the only recourse is replacement, while the customer insists on getting the gear reground in the hopes of saving time or money. There could be any number of reasons behind it, but a disconnect between what a remanufacturer says can be done and what a customer is willing to purchase is not uncommon.

"I think that's your first consideration: would the customer consider a regrind rather than a replace? And then you start looking at the engineering parts of it," McKernin said.

Dick Calvert, senior gear engineer at Chalmers & Kubeck, echoed McKernin's point. Calvert has regularly encountered customers who might benefit from a full

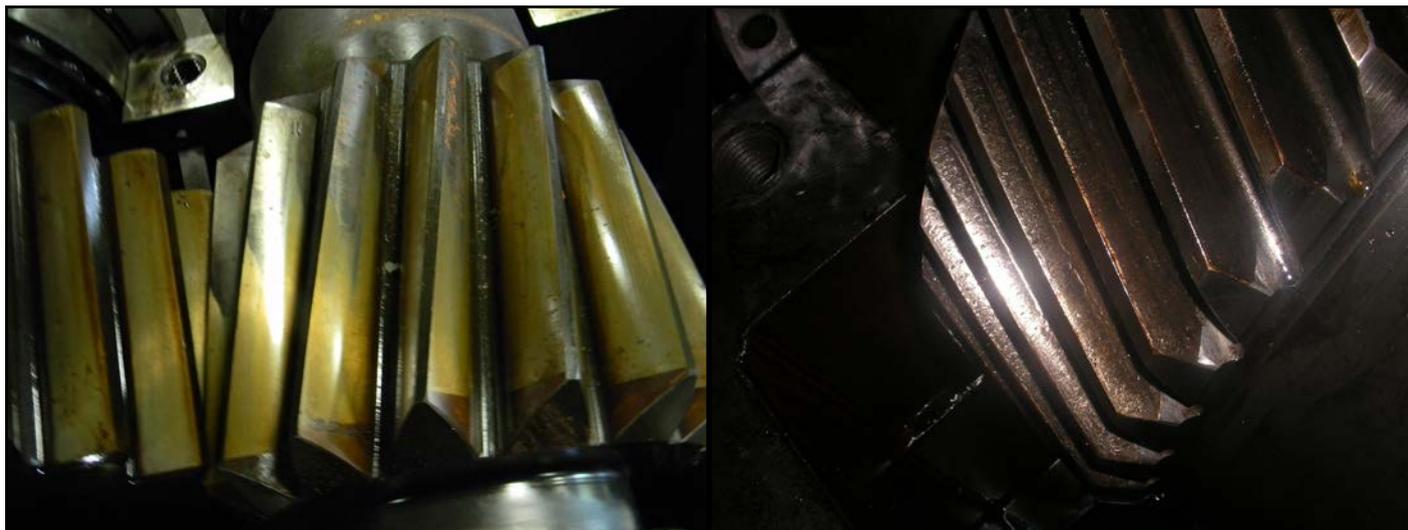
replacement, but because of whatever economic or time factors involved, need- ed just a regrind.

"In the long run, you're going to give them what they want," Calvert said.

Economics are an active consideration beyond just the negotiating table. One thing McKernin looks at when deciding whether or not to regrind, for example, is the size of the part being considered. While regrinding is generally considered the "economic" option, McKernin has found that it can actually be cost prohibitive to regrind small gears as opposed to replacing them.

"If it's a little 2 inch diameter part, the cost of regrinding may not be economically sound," McKernin said. "You're just better off replacing a little component. Now if you're dealing with something that's 30 inches, that's a lot of material you're throwing away. So now you're looking at 'can we save some money by doing a regrind on the part?' And in some cases, saving the customer a fair amount of money."

Once it comes time to actually decide if regrinding is feasible, there are a wealth of new factors to consider,



Pictured: one gear that has suffered light wear and can be reground (left) and a gear that will need to be replaced (right).

and every gearbox that McKernin and Calvert look at needs to be judged on a case by case basis.

“I wish I had a real nice sweet little punch list that I could go through, but every situation is different, so you have to look at it based on its own merits,” McKernin said.

The application the gearbox is being used for, which parts need repair, the gear’s existing geometry, how hard the gear is, whether it needs to be recut or reground, the gear’s case depth, the amount of wear already on the gear and how much stock would have to be removed to fix it, and whether the pinion can be replaced or not are all critical factors that McKernin looks at when deciding whether a regrind is possible.

One of the primary deciding factors for Calvert is how hard the gear is. For softer gears that may have only been hobbled, regrinding the gear is a relatively straightforward process: Grind down the OD surface of the gear to smooth

out the imperfections, then make a mating oversized pinion to compensate for the lost material on the gear. Regrinding only becomes a questionable option if the gearbox already has an oversized pinion or the damage is truly severe.

For harder, carburized or induction hardened gears, however, case depth becomes an obvious concern. Damage to a gear can often be bad enough that the gear needs to be ground down past its case depth, in which case the gear’s hardness falls below acceptable levels. The only option in these situations is to replace the gear.

“If you’ve got wear that you’re trying to clean up that exceeds the case depth, you’re wasting your time,” McKernin agreed. “It’s not a good idea. Don’t even consider it.”

Calvert and McKernin have very similar processes when it comes to deciding whether to repair or replace a gear, but there is one point they disagree on: whether regrinding is better than

replacement. While there are often cases where regrinding just isn’t a feasible or safe option, McKernin prefers regrinding to save the customer money. He always likes to at least consider regrinding specifically because of how economic it is compared to the alternative, both in time and money.

“If it’s feasible, I would definitely recommend it because you’re saving the customer money,” McKernin said. “I try to look at a project as if it was my own. If I was the one paying the bill, how would I want to work with it? And it’s a matter of having a feasible economic solution. So if there’s a way to save money and provide the correct quality, that makes perfect sense to me.”

Calvert, on the other hand, prefers to suggest a full replacement to his customers when possible. Though Chalmers & Kubeck splits their work roughly half and half between replacing and regrinding, Calvert thinks there are more advantages to replacing a gear than just

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A cutter drive before being upgraded by Chalmers & Kubeck (left) and one after repair work is complete (right).

repairing it.

Calvert is also such an advocate of replacement because of a value-added service Chalmers & Kubeck offers: If the job calls for gear replacement, the company can often improve a gear's capacity by 15 or 20 percent with small geometry changes at no additional cost while they're at it. When a gear is already in need of replacement, it's a valuable service that the customer loses nothing using, and Calvert urges them to take advantage of it.

"What we tell our customers is: 'listen, this is here because it's failed. If I replace it in kind, guess what's going to happen?'" Calvert said.

Outright replacement, however, isn't always an option. For Calvert, time is one of the strongest motivators to regrind instead of replace. Sometimes, the customer already has a replacement lined up, making the job less time sensitive, but when a production line is down, the repairs need to be as fast as possible, and replacement isn't always a speedy option.

"If it's a spare unit or a unit that's not used much, he can wait maybe a month or a month and a half to get the thing repaired. If it's part of a line, and the line is down, he wants you to do it by tomorrow!" Calvert said.

In general, Chalmers & Kubeck can replace a pinion in a week and a soft gear in three. Calvert refers to soft gear replacements as the company's "bread and butter." But for harder gears that require heat treatment, that number can turn to 8 to 10 weeks. That's understandably hard for a manufacturer with

a downed line to swallow, and so it's in these situations that Chalmers & Kubeck turns to regrinding. In extremely rare and special cases, Chalmers & Kubeck will even make a soft gear to serve as a temporary replacement while a hardened gear is put through the longer carburizing process. While the temporary gear will likely only last a month or two before breaking, it can last long enough to get a proper replacement while maintaining profitability.

One method that Chalmers & Kubeck does not employ is to grind a little from both the gear and its matching pinion. Calvert strongly disagrees with this viewpoint because of the increased backlash it puts on the gear.

"Everybody will tell you that if the loading on the gears is not reversing, a little bit of extra backlash doesn't matter," Calvert said. "And sometimes that's right, but sometimes it's not right. In steel rolling applications, for instance, TAF [Torque Amplification Factor] is a big thing. The sudden impact that occurs when a slab or bar enters the rolls, creates very high dynamic loads, loads that can be many times normal running loads. All of this is aggravated by backlash, so you can't just go increasing backlash arbitrarily. If you know the application and the nature of the loading, you may be able to convince yourself that extra backlash will not be a problem. However, in most cases, we find that may not be the best solution...not because of what we know, but because of what we don't know."

Gearbox Express, on the other hand, takes an entirely different approach from

Circle Gear and Chalmers & Kubeck. At Gearbox Express, replacement is almost always the option. According to CEO Bruce Neumiller, roughly 80 percent of the work they do is replacement. The company makes their decisions on the best way to repair a gearbox based on factors such as the type of gears that need to be replaced and the quality of their material. And unlike other remanufacturers that might bend on whether a gear needs a full replacement, Gearbox Express's decisions are final and non-negotiable.

That all might sound like a hard-line stance to some, but according to Neumiller, Gearbox Express has good reason. They exclusively repair gearboxes for the wind power industry, and gearboxes for wind turbines have a lot less wiggle room than other industrial applications, which makes regrinding a more difficult option to recommend and leads to the company's skewed balance of replacement to regrind work.

"With an industrial gearbox, there is a lot more safety factor in the design, so you can get away with a lot more than you can in wind," Neumiller said.

The tight specifications of the wind industry aren't the only cause for Gearbox Express's disproportionate amount of replacements. Damaged gearboxes regularly come to the remanufacturer with gears made with poor materials, a problem Neumiller describes as "fairly prevalent" in the wind industry. Often, they're forced to throw out and replace gears because the base materials originally used to make them aren't up to the company's specifications.

Express Gear (not to be confused with Gearbox Express) finds that on the opposite side of the spectrum, steel and sugar mills are the customers that often lean more towards regrinding. However, according to Sam King, CEO of Express Gear, the company still splits their regrind and replace work 50/50. Express Gear primarily decides between the two by looking at a gear's wall thickness. According to King, if damage has gone beyond a certain threshold, the company replaces, and if not, regrinds.

However, Express Gear adds an extra step to their regrinding process that sets them apart from their peers. After grinding down imperfections in the gear, the remanufacturer welds on new material to return the gear to its original dimensions. No need for oversize pinions or increased backlash. According to King, Express Gear can return these gears back to the customer "like they came from the OEM."

If there's one thing that's clear between each of these different companies' accounts, it's that no one remanufacturer's process or opinion is ever quite the same. One universal truth, however, is that these are professionals who have often been working in the field for decades, and they've each formed these opinions based on countless prior jobs and established best practices.

From the customer's standpoint, there's very little to be "done" in the remanufacturing process. The best thing they can do is find a remanufacturer they can trust and make sure they listen to them. Gearbox remanufacturers aren't the car repair shop technician that mysteriously finds three things wrong with your car when you bring it in for a routine oil change; when they give recommendations, it's after considering a broad range of factors often unique to that individual case and are giving their best advice on which solution they

believe will make the longest lasting gears at the best price.

It may be painful to hear that you're going to have to wait a few weeks to get a gear replaced, or you may be dubious about the merits of regrinding to keep a gear from breaking back down in a year, but at the end of the day, these guys are the experts and they know best. The best advice the customer can take away is to listen to them and value their opinion.



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