Whitepaper

Remanufacturing

A second life for used products

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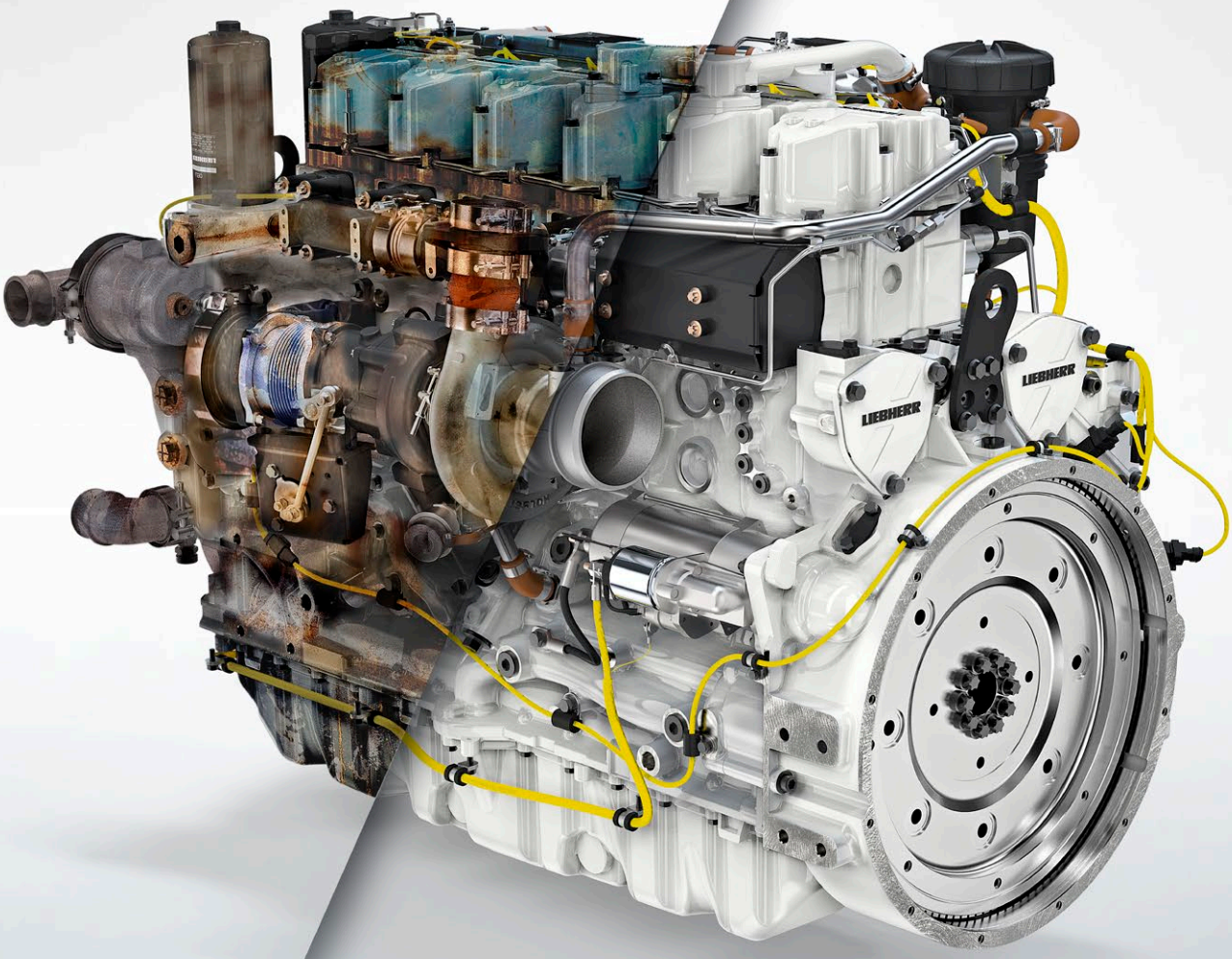

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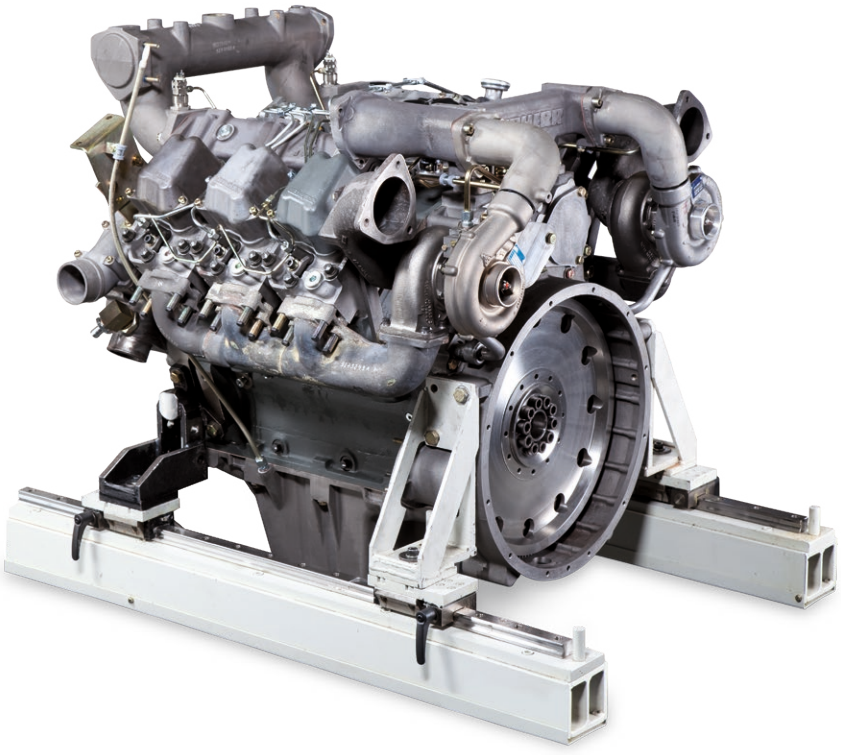


Remanufacturing – better old than new!

From an ecological point of view, consumption of raw materials in industrial production is too high to be sustainable. **Good use of resources is therefore of great importance** to ensure optimal climate protection and efficient use of resources. According to calculations by the German environmental association BUND, **consumption of resources must be reduced to half the 2020 level by 2050.** And production companies play an essential role to meeting this goal as consumers of resources.

In addition to its contribution to economic success, sustainability has been thrust urgently on the agenda of more and more companies, both due to pressure from civil society and changing political priorities.

Yet increased efficiency alone will not be sufficient. Remanufacturing contributes in an important way to the circular economy, acting sustainably in the long term and doing business profitably. It involves recovery of used material (also called “cores”) and then by an industrial process refurbishing and reselling used products in good as new condition at a discounted price. Compared to recycling, where old goods are converted back into raw material in an energy-intensive manner, **the focus in remanufacturing is not on the extraction of raw materials, but on the added value of the used product.** In this way, a large part of the material can be reused.

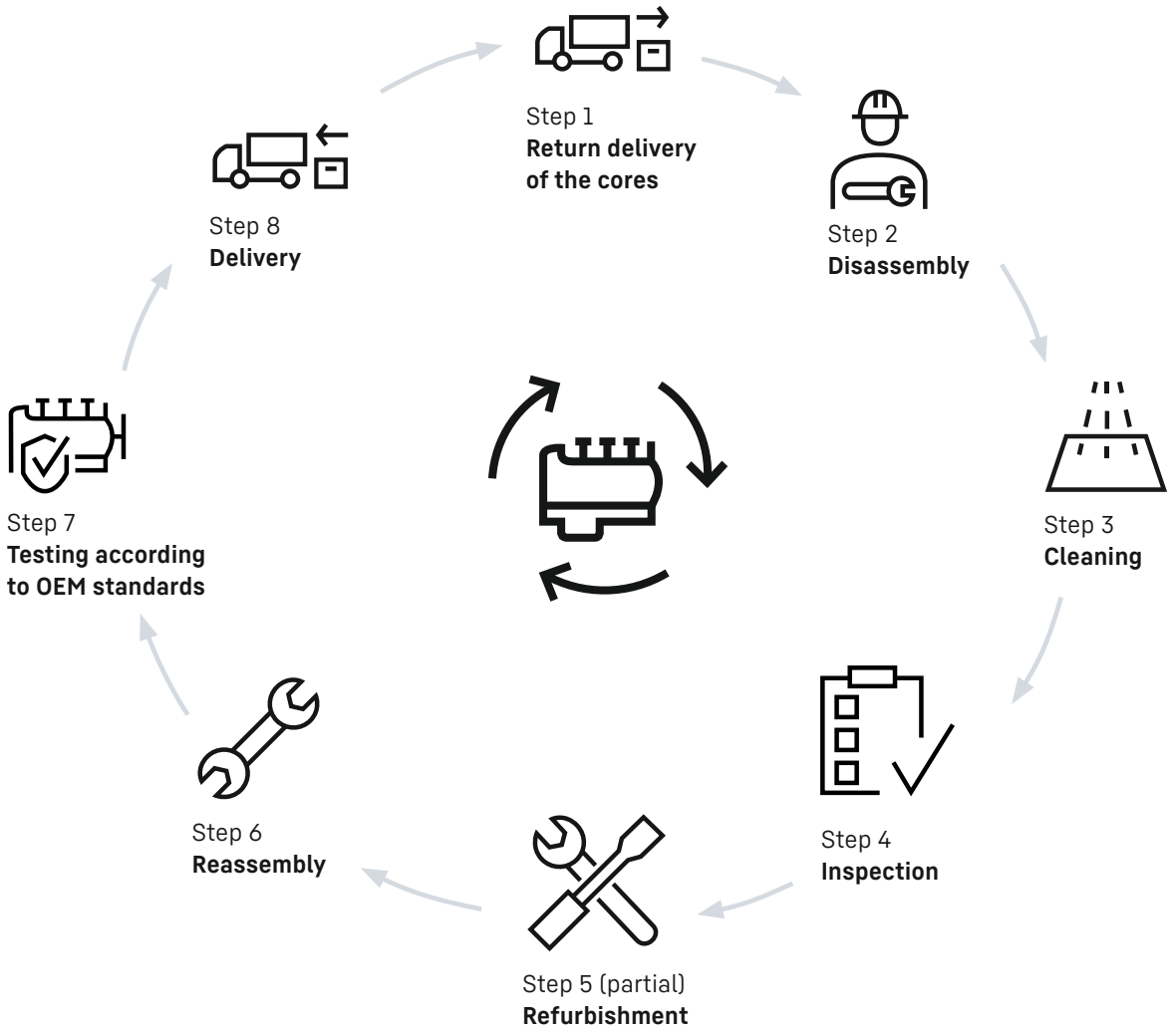
Remanufacturing currently generates around 2% of the entire European manufacturing sector in a wide variety of industries. **In Germany, this corresponds to a turnover of around 8.7 billion euros per year, or about one third of total European turnover.**

The OEM (Original Equipment Manufacturer) itself is often a relevant player in remanufacturing.

Remanufacturing saves resources, energy and costs. Compared to new production, the number of raw materials used decreases significantly.

What is remanufacturing?

The basic steps involved in remanufacturing a product are the same regardless of the industry.
After dismantling into the individual parts, cleaning and a function or suitability test are done for further use.
Some parts may need to be reworked.
The individual parts are then reassembled, checked and put back on the market.



There is a clear distinction between repair and recycling, because:

Remanufacturing ≠ Repair:
During remanufacturing, the product is completely refurbished to new part quality, while during repair only isolated troubleshooting takes place in order to restore the product to a functional state.

Remanufacturing ≠ Recycling:
During recycling, the parts are restored to their raw state in an energy-intensive process. For example, metal is melted down. Remanufacturing reuses the individual parts with as little additional processing as possible.

Where is remanufacturing used?

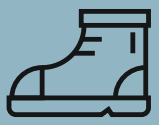
Remanufacturing is already used in a wide variety of industries and for a wide variety of products:

PCs and laptops

- Reduction of CO_2 emissions by 70 % and of material by 80 %
- 97 % of IT products classified as waste could be reused.
- Test methods are mostly optical, then mostly classification into classes
- Finally, professional data deletion and optical processing

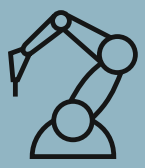
Wood furniture

- Greatest effect with bulky pieces of furniture such as cupboards
- When refurbishing a 2 year-old wardrobe, savings of:
  - 80 % of climate-relevant gases or 68 kg CO_2 equivalent
  - 87 % wood raw material and forest area



Footwear

- For hiking boots: Savings of 75 % of climate-relevant gases or 22 kg CO_2 equivalent per pair
- Additional positive effects through the reduction of chemical treatment processes



Machine construction and automotive

- Depending on the intensity of use, material, processing quality and maintenance, very high savings of raw material, energy and emission are possible.
- For details see >Practical example

Challenges

Upon first glance, remanufacturing is not associated with any obvious disadvantages. Nevertheless, companies face a whole range of challenges if they want to comprehensively integrate remanufacturing into their strategy. These include:

- Convincing all stakeholders involved of the benefits of remanufacturing and integration into a corporate strategy
- Increased investment costs and temporary declines in returns are possible during the transition phase
- Ensuring the reusability of the products
    - Constructive suitability
    - High quality materials and processing
- Avoiding technical changes during series production. Otherwise there is a risk of having to discard qualitatively reusable parts
- Danger of (perceived) „cannibalisation“ of internal business areas: e.g. new parts manufacturer vs remanufacturer → increased communication and possibly restructuring are necessary
- Establishment of reliable and efficient reverse supply chain for core collection
- Standardisation of inspection and refurbishment processes for quality assurance and minimisation of internal throughput time

Practical example

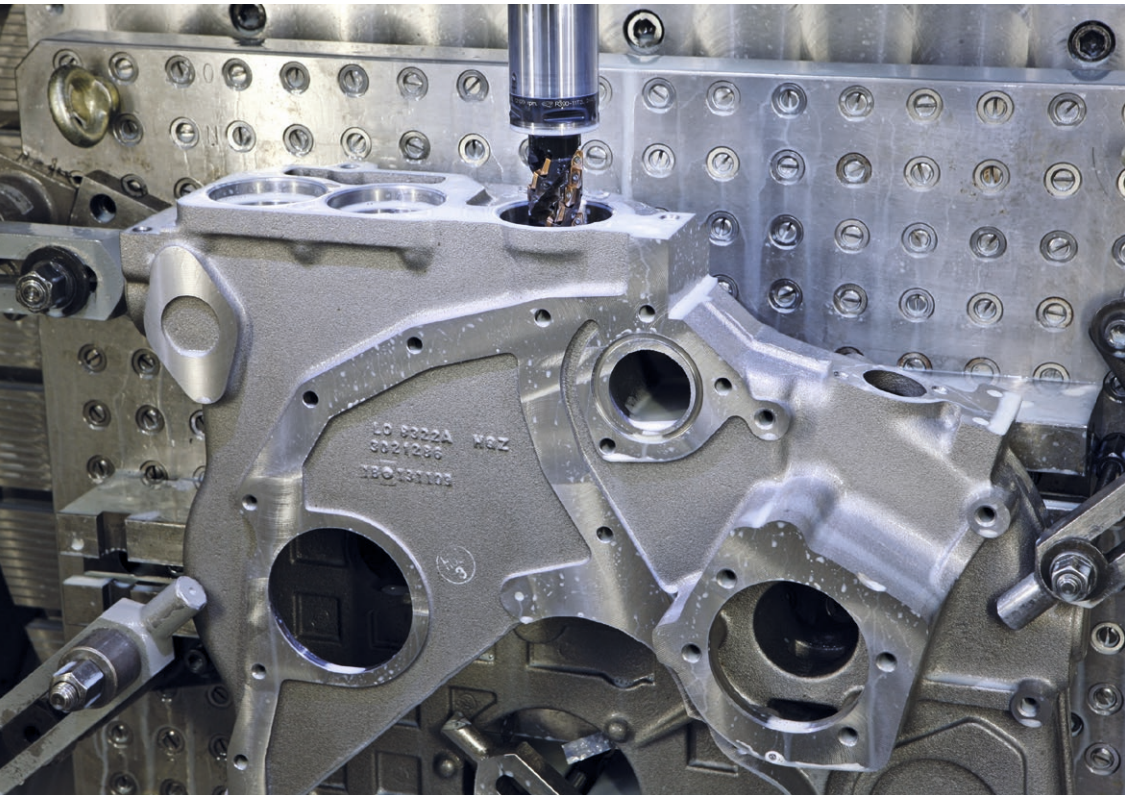
As a global manufacturer of construction and mining machinery, the Liebherr Group manufactures drive components such as hydraulic pumps, gearboxes and engines itself and also reconditions them through remanufacturing. The resulting savings potential in terms of material, energy and CO_2 emissions can be impressively illustrated using the example of a combustion engine.

Setup

For this purpose, the most massive components of the engine, and in particular the crankcase and crankshaft, were examined in greater detail. Together, these parts account for approximately 41% of the engine's total weight excluding operating fluids. The crankcase and crankshaft alone account for around 32%.

Built structures, materials and reuse rate

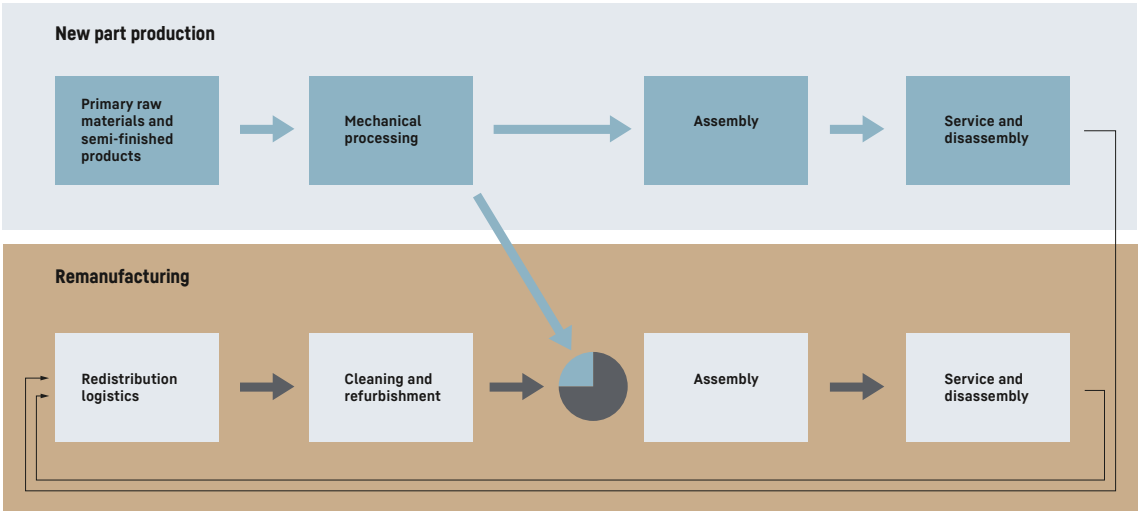
Component	Raw material	Weight (kg)	Weight	Reuse rate
Crankcase	Lamellar graphite cast iron	223,0	23%	78%
Crankshaft	Micro-alloyed pearlitic steel	84,4	9%	75%
Flywheel housing	Ductile iron	62,4	7%	85%
Oil sump	Near eutectic cast aluminium alloy	13,0	1%	81%
Control unit	Die-cast aluminium	5,4	< 1%	75%
Diesel engine, total		950	approx. 41%	



First of all, the energy requirements and CO_2 emissions for the production of new parts for the entire engine, by individual suppliers and in the company‘s own plants, were determined. Material specifications, supply chains and manufacturing processes (country-specific transport modes and electricity mixes) were taken into account.

This was compared with the energy requirements and emissions for (re)transporting the core, then cleaning, mechanical processing and reassembly during remanufacturing. Because not all parts can be reused, the remaining parts must be added using new parts when the same production quantity is produced. These additional parts must be included in the energy requirements and emissions as new production.

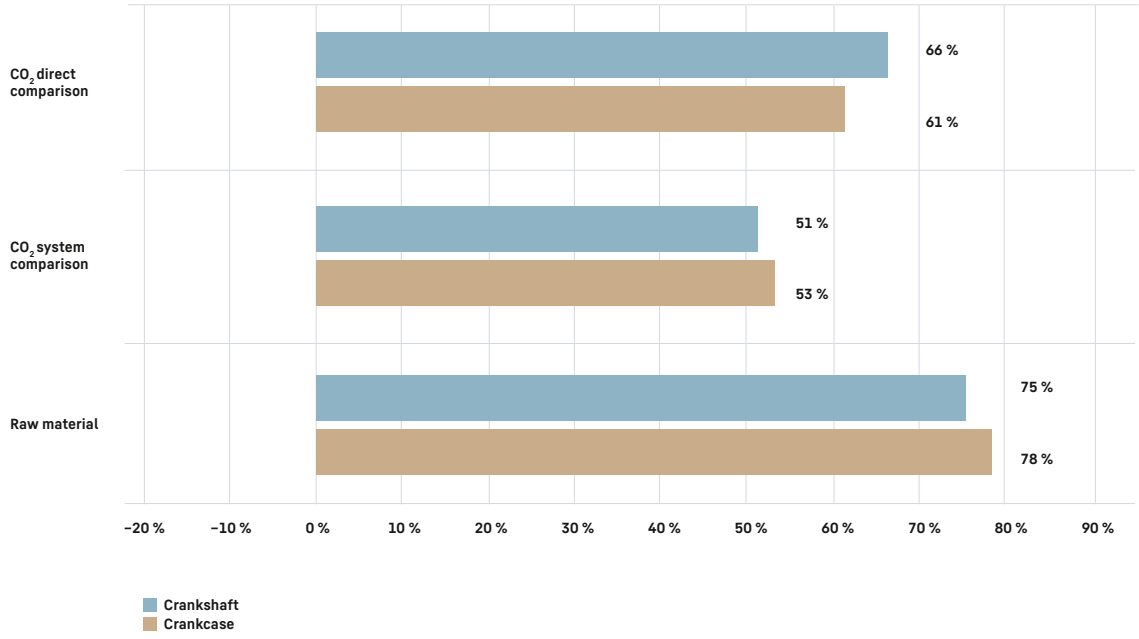
Remanufacturing and additional parts



Results:

- Savings in material of 75 % to 78 % are achieved through remanufacturing. The quantities below 100 % are due to technical rejects (dimensions outside the tolerances, damaged parts).
- The direct comparison of new part production vs remanufacturing results in a reduction of the CO_2 footprint by 61 % (crankcase) and 66 % (crankshaft).
- Taking into account the rejects, the saving in the carbon footprint is still just over 50 %.

Savings



Conclusion

Remanufacturing opens up amazing possibilities to save material and energy and thus reduce the CO_2 footprint. These savings also have a positive effect on manufacturing costs as well as on total owning and operating costs for equipment, without compromise on quality. The bulkier heavier and more numerous the reused components are, the greater the potential.

Since the claim of remanufacturing is to produce new parts of the same quality, the challenges already lie in the design, in the quality of the material and in the processing of new parts production: The product must be designed for many years of use so that, ideally, after dismantling and cleaning, only typical parts subject to wear and tear need to be replaced. Likewise, after the start of series production, as few technical design changes as possible should be made so that the parts in the field are still technically state-of-the-art or so up-to-date that they can be reused when they are returned for remanufacturing as a core.

If the savings are also adequately passed on to the customer, the result is a win-win-win situation: For manufacturers, customers and the environment.

Remanufacturing carried out at large scale leads to a reduction in (primary) raw material requirements and processing, which has socio-economic effects on the relevant industries and their employees. If an OEM is active as a remanufacturer, there may also be shifts in demand within the company itself, as the demand for new spare parts tends to be lower. This development must be anticipated and anchored accordingly in the corporate strategy. In preparation for this, the advantages of remanufacturing must be clearly communicated to all stakeholders or appropriate persuasive arguments must be given.

Are you interested in our remanufacturing solutions?
Christoph Ochs will be happy to answer your requests
E-mail: Christoph.Ochs@liebherr.com

Liebherr-Components AG · Post box 222 · 5415 Nussbaumen, Switzerland
+41 56 296 43 00 · components@liebherr.com · www.liebherr.com

Appendix

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