Efficient remanufacturing of car parts

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The product life cycle

Legend:
- Yellow arrow = Forward (linear) material flows
- Red arrow with dot = Reverse material flows

Beginning-of-Life
- Part Manufacturer
- New materials
- Recycled materials

Middle-of-Life
- User / Repairer
- Used products (cores)
- Remanufactured products
- Remanufactured parts

End-of-Life
- End-of-Life treatment company
- Landfill / Energy recovery
- Products/Parts for scrapping
- Recycled materials
- New materials
What is remanufacturing?

Remanufacturing (sv. återtillverkning) means that you take a used product and restore it to like-new or better-then-new condition in an industrial process.

This could mean for a whole product or only a part of a product - e.g. a diesel particle filter or brake caliper from a car.
What is remanufacturing?

Product as a Service (PaaS)

Changes in product and component flows

New design requirements:
- More robust
- More easy to repair
- More easy to remanufacture

Changed business focus:
- Smart conditioning monitoring
- More preventive maintenance
- Closer customer relations

Changed car usage:
- More predictive costs
- Higher customer satisfaction
- Higher mileage before scrap
WP-1a – Efficient remanufacturing of car parts

**Goal:** to plan and develop time- and cost-efficient processes and systems

**Existing systems:**
The systems at ECRIS and JB are well-functioning and efficient due to:
- High competence to remanufacture
- Well-established reverse logistics
- Access to original car part drawings
- Good access to spare parts
- Loyal to the original equipment manufacturer (OEM): Volvo Cars
Value Stream Mapping of Link arm

- Reception of cores
- Blasting
- Deacidification
- Milling & Grinding
- Blasting
- Removal of bushings and ball joints
- Crack test, PT 100%?
- Assembly of bushings and ball joints
- Packaging

Flow of information:
- 30 pieces
- 1 h
- 22 min
- 15 min
- 3 h
- 22 min
- 30 min
- 2 h
- 5 min
- 5 min
- 1 h
- 1 min
- 1 week – 5 weeks

Flow of material:
- Order issue Lower Link Arm
- Plan for 3 months

Specifications:
- VOLVO
- ECRIS
- Order issue
- DEACIDIFICATION WITH UV LAMP
- PRESSURE WASH
- WRAPPING IN FILM
- PLACEMENT ON THE CARRING VAGN
- PACKAGING

Time:
- 1 min
- 1 min
- 1 min
- 5 min
- 30 min
- 22 min
- 15 min
- > 5 weeks
- 9 h
- 15 mins → 5 weeks
REMOMETER®
Remanufacturing Readiness Level (RRL)

2 hour-assessment of a manufacturer’s/product owner’s remanufacturing potential/maturity in:
- Business model
- Production system
- Product
- Customer

...to identify strengths and weaknesses to focus on.

REMOMETER®
A decision support tool on how remanufacturing can become a key to a manufacturer’s strategy towards CE by Jelena Kurilova-Palisatiene
jelena.kurilova@liu.se
www.remometer.com
Future electric vehicle remanufactured parts

Attributes for selecting future remanufacturing parts:

**Economic**
- Market
- Price/Value
- Economic lifetime
- Remanufacturing volumes
- Collaboration with:
  - Part supplier (OEM)
  - Insurance company
- Core collection costs

**Technology**
- Remanufacturability:
  - Accessibility
  - Disassemblability
  - Testability
  - Robustness
  - Affinity/Originality
  - Backward compatibility
  
**Environment**
- High quality/Technical lifetime
- Access to spare parts
- Material scarcity
- Material and weight
- Resource efficiency
- Climate impact
- Transport possibilities

### Disassembly of a Volvo XC90 T8 (Hybrid, year 2019)

<table>
<thead>
<tr>
<th>Car part</th>
<th>Economic</th>
<th>Technology</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Engine</td>
<td>High value, need</td>
<td>High quality, possible to disassemble.</td>
<td>Neodym, Energy use(?)</td>
</tr>
<tr>
<td>2. Inverter</td>
<td>High value</td>
<td>High quality, possible to disassemble.</td>
<td>Gold and copper</td>
</tr>
<tr>
<td>3. Charger</td>
<td>OK value</td>
<td>High quality, possible to disassemble.</td>
<td>Gold and copper</td>
</tr>
<tr>
<td>4. Link arm (lower)</td>
<td>OK value</td>
<td>Possible to disassemble</td>
<td>Aluminum</td>
</tr>
<tr>
<td>5. Spindle</td>
<td>OK value, need</td>
<td>Possible to disassemble, NDT</td>
<td>Aluminum</td>
</tr>
<tr>
<td>6. Nave</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Link arm (upper)</td>
<td></td>
<td></td>
<td>Sheet metal</td>
</tr>
<tr>
<td>8. Strut</td>
<td></td>
<td></td>
<td>Sheet metal</td>
</tr>
<tr>
<td>9. Support frame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Console</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Future remanufacturing of engines

Engines have a high value, long lifetime, high volumes which makes them likely to be remanufactured in the future. Aspects to consider:

1. Product development and manufacturing at Volvo Cars needs to consider repairs, disassembly and remanufacturing of electric engines
2. Set remanufacturing requirements on electric engines
3. Cooperation between actors (suppliers, manufacturers, workshops, remanufacturers, dismantlers, insurance companies) in the value network
4. Sharing the responsibility among the actors in the value network to build up an efficient remanufacturing of electric engines
5. Sharing profit and cost among the actors in the value network
6. Study environmental aspects at system level
Open for collaboration regarding remanufacturing

Subjects:

• Starting up remanufacturing
• Making remanufacturing efficient
• Economic evaluations of remanufacturing
• Life cycle assessments of remanufacturing
• Design for remanufacturing

Methods:

• RIFF / RemPro
• REMOMETER
• MiniMIFA
• 5AFIR

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Thanks for listening!

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