

Service, Repair & Remanufacture Components of Electrical Vehicles

What's ahead?

An Opportunity and a Challenge!

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Chairman*



YOU CAN SERVICE YOUR VEHICLE

- With **used parts**, which is environmentally sustainable **but less safe**
- With **repaired parts**, which is environmentally sustainable **but not durable**
- With **new parts**, which is expensive and **environmentally not sustainable**
- Or with **remanufactured parts** which is economic, safe, durable and environmentally sustainable



Disassembling



Cleaning



Reconditioning



Inspection



Re-assembling



Testing

Remanufacturing automotive starter motors at R. Bosch

QUALITY ASSURANCE

- 1 Complete Disassembly of the Product
- 2 Thorough Cleaning of all Parts
- 3 Inspection and Sorting of all Parts
- 4 Reconditioning of Parts and/or Replenishment by new Parts
- 5 Product Reassembly
- 6 Testing

Final Testing

What is Remanufacturing?



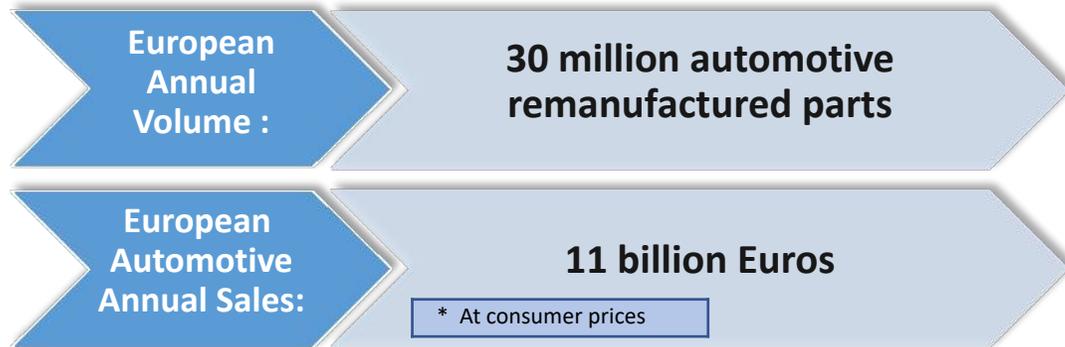
Specifications for Automotive Remanufactured Parts

by assoc. : Apra, Clepa, Firm and ASEA

- **Fulfills a function equivalent to original part**
- **Restored from an existing part (core)**
- **Standardized industrial process**
- **Fulfills technical specifications**
- **Same warranty as new part**
- **Clear identification as remanufactured part**
- **Clear designation of the remanufacturer**
- **Different from reused, repaired, rebuilt, refurbished, reworked or reconditioned part**

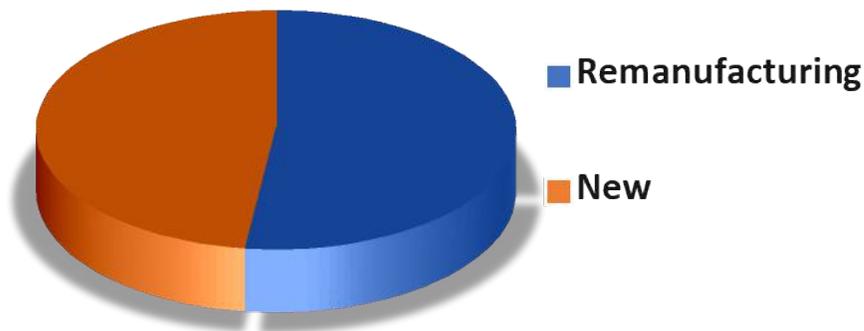


Image: Bosch



European Automotive Remanufacturing a big Industry

Automotive Aftermarket New vs. Remanufactured



- Market share of **remanufacturable components vs. new is ca. 55%**
- **Potential market share is however 80%**

Where are we today?

Traditional Remanufacturing is heavily related to Internal **Combustion Engines** with fuel injection parts, starter-motors, alternators, turbochargers, etc plus steering components, hydraulic brakes etc



Images: Bosch, Honda, Gobbi, Continental

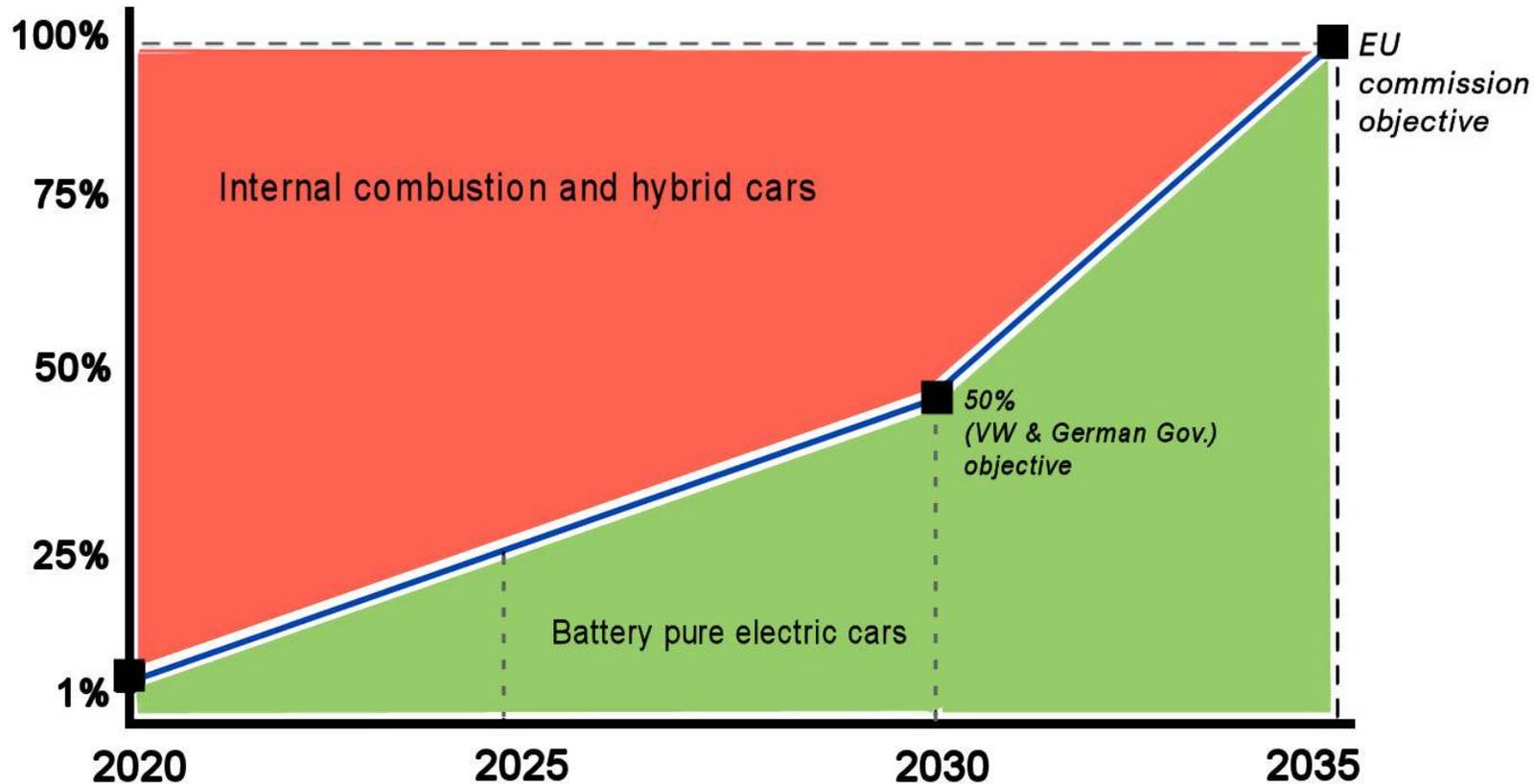


But where will Remanufacturing lead to?

- **Most governments and Vehicle Manufacturers have declared that the vehicles must/will in the future have sustainable zero emission power drives**
- **Therefor the Internal combustion engines will over time be replaced by electrified power drives**
- **This change of technology will significantly affect automotive service, repair and remanufacturing**
- **Not so much in the short but in the medium and long term**

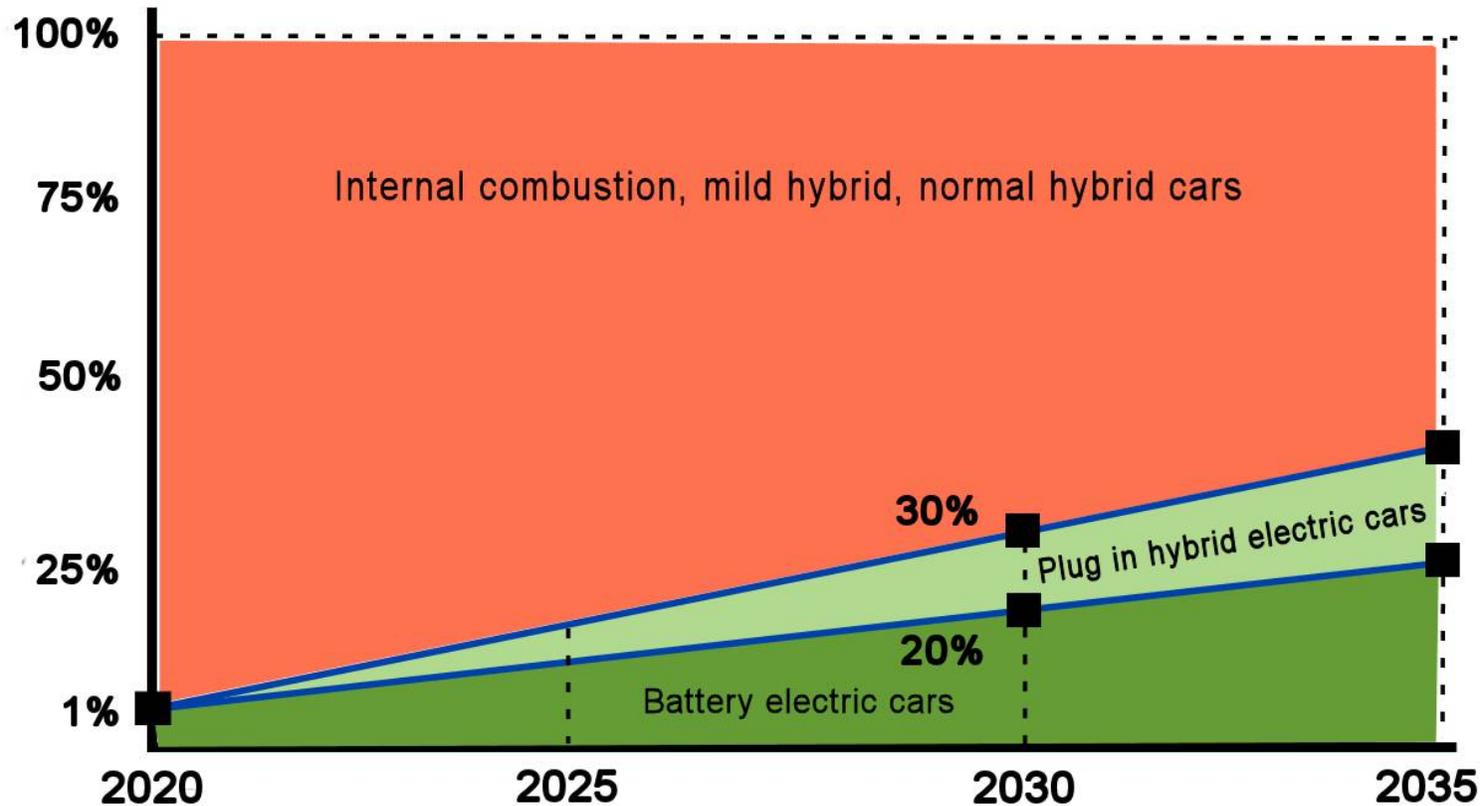


European annual Car Sales 2020-2035



According to the most European governments and car manufacturers the aim is to increase sales of electrical cars to 50% by 2030 and zero internal combustion by 2035

European Car Population for 2020-2035



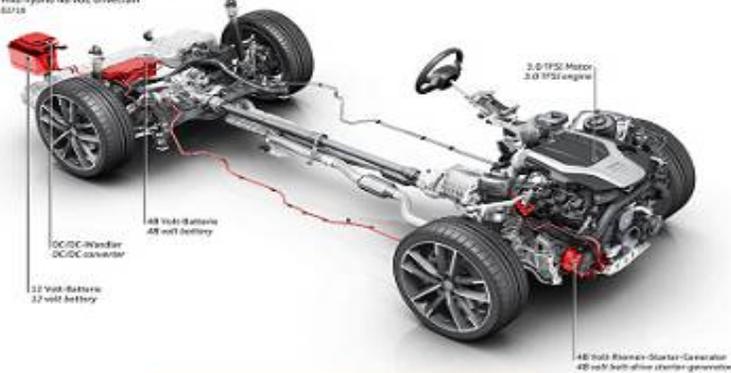
30% of the European car population by 2030 is the equivalent 70 million electric cars.!

According to the German Government the objective is to have on the road 13 million electric vehicles by 2030



Audi A6 Limousine

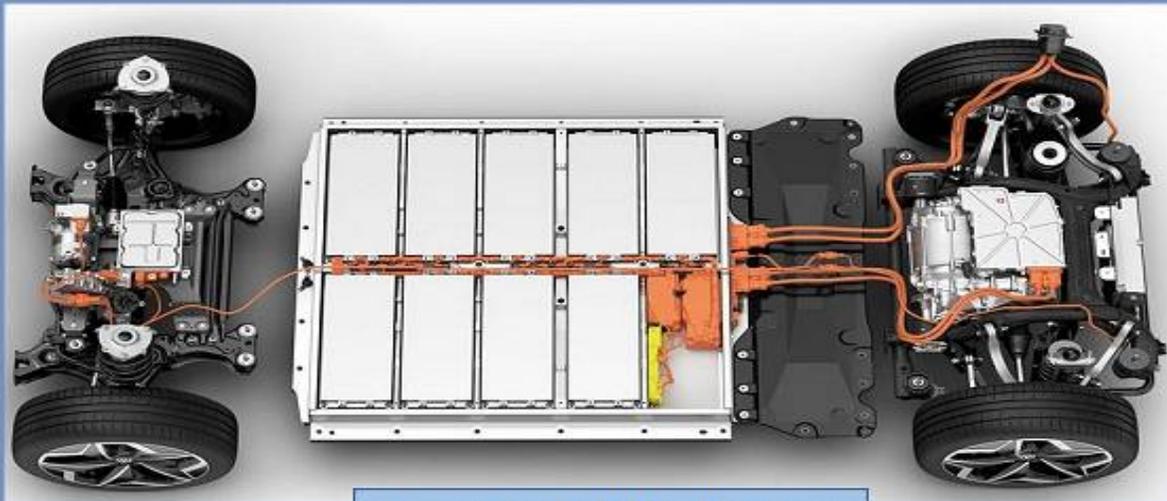
Mild-Hybrid 48 Volt-Antriebsstrang
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Mild Hybrid 48 Volt - Audi



Plug In Hybrid Car - Mercedes



Batterie Car – VW MEB Platform

Electrified Vehicles

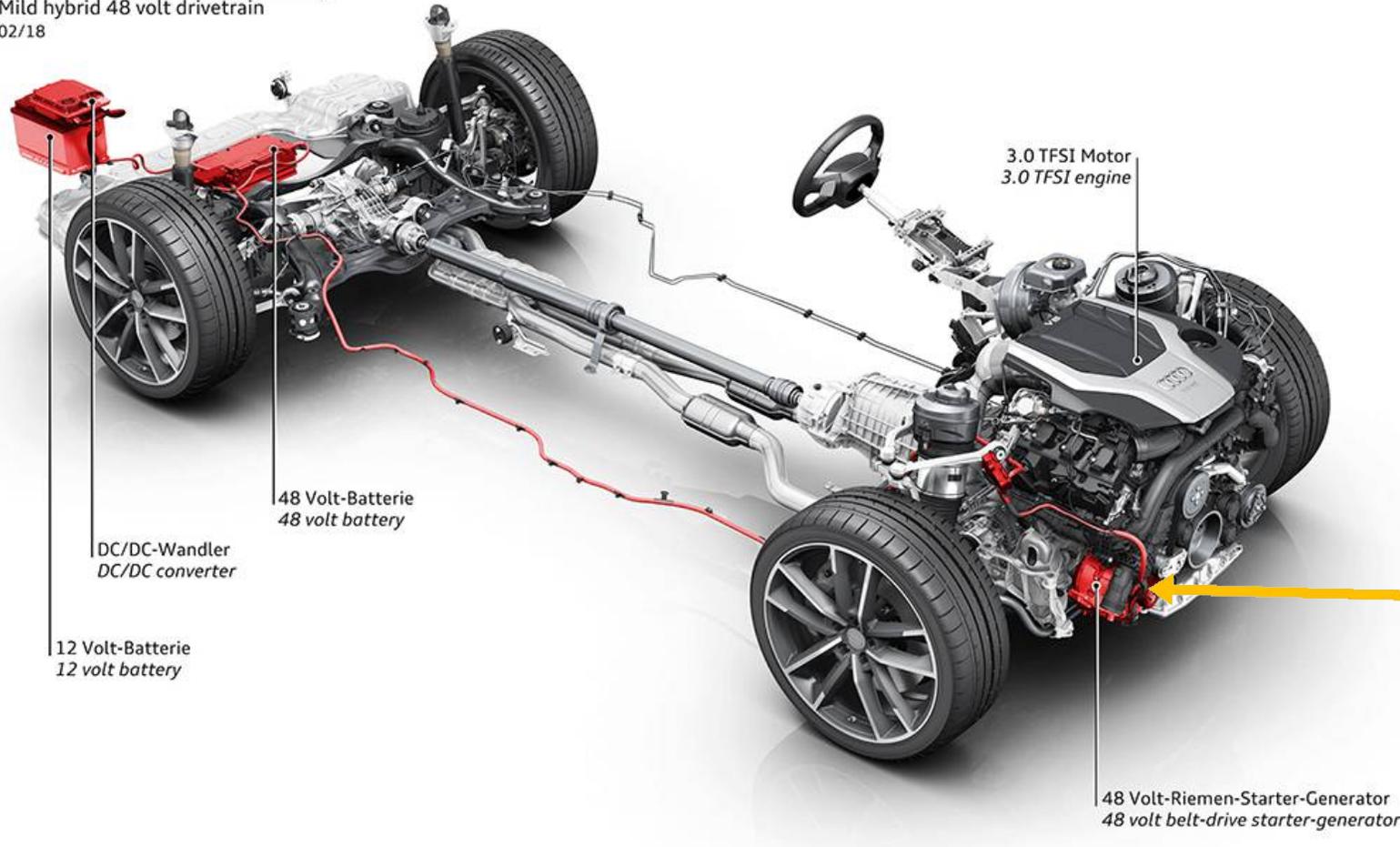
- Mild Hybrid 12-48 Volt battery ca. 1 kWh
- Plug-in-Hybrid up to 400 Volt battery ca. 10 kWh
- Batterie e-vehicle (400-800 Volt) ca. 30-100 kWh



Electric power train for Mild Hybrid e-Vehicle

Audi A6 Limousine

Mild-Hybrid 48 Volt-Antriebsstrang
Mild hybrid 48 volt drivetrain
02/18

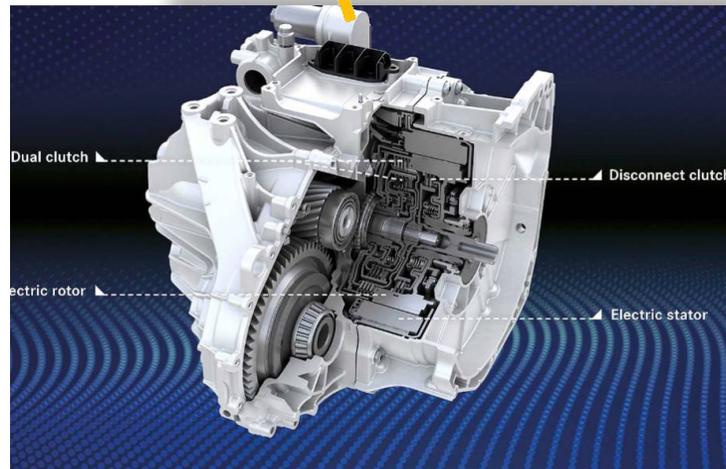


- Starter-generator 48 Volt (a technology remanufacturers control)
- To boost the combustion engine
- To Recover energy during braking
- And to supply energy to the lithium battery



Electric Power-train for Plug-In e-Vehicles

- Challenge for the OEM to connect the electric machine to the gears, to the dual clutches or the automatic transmissions
- These mechanical components are for remanufacturers feasible
- The electric machine is a possible challenge for remanufacturers



Electric Power-train for Battery e-vehicle

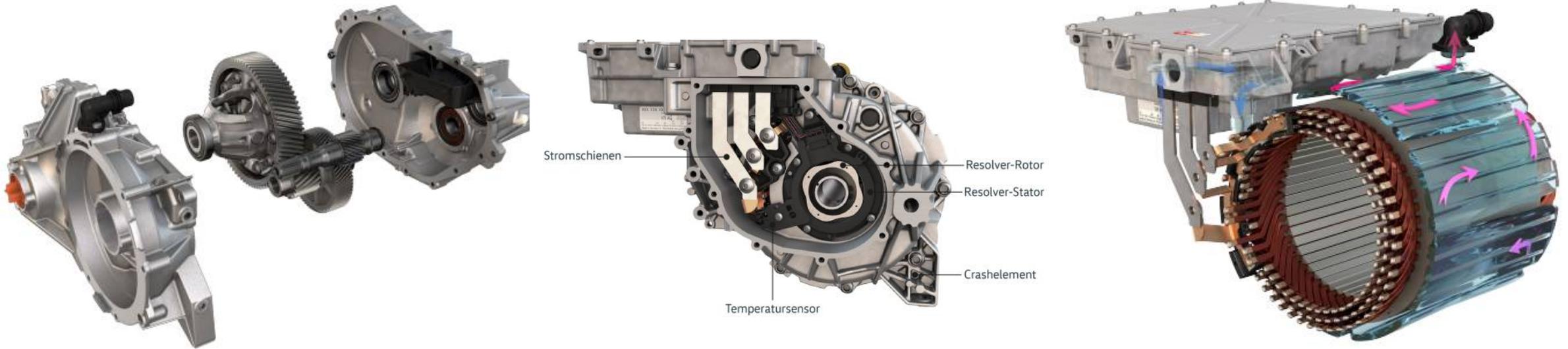
- The electrical 3-phase 400 V machine mostly a synchronous motor-generator
- Fitted either to front or/and rear axle
- Running at ca. 12.000 rpm
- Power from 50 to 200 kW (and more)



Remanufacturers can assume that these components will need over time to be remanufactured

Battery Electric Vehicle Power-train Components

- reduction gear box – electrical resolvers- water cooled electrical machine with power supply

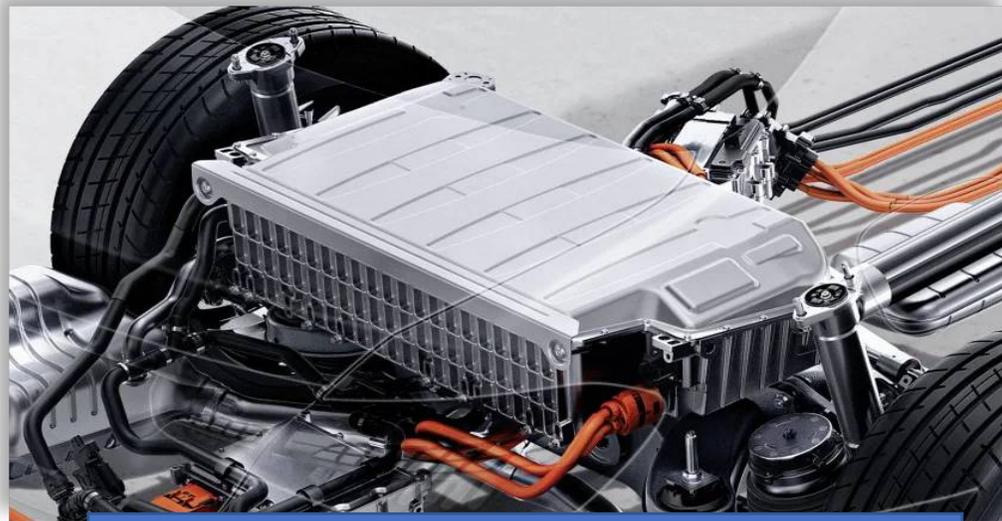


Ein-Ganggetriebe des MEB Hinterachsantriebs

Remanufacturers can assume that these components will need over time to be remanufactured



Toyota Prius Hybrid - NiMH Battery



Mercedes Plug-in Hybrid - Lithium Battery

Battery for Hybrid Vehicles

- Hybrid Vehicles dominated by Toyota NiMH (Nickel Metal Hydrid) batteries
- Capacity ca. 1-1,8 kWh 250 Volt

Batteries for Plug-in Hybrid Vehicles

- Lithium Battery 10-15 kWh 400 Volt

Remanufacturers can assume that these components will need over time to be remanufactured





Jaguar I-Pace Lithium Battery



Nissan Leaf Lithium Battery

Lithium Batteries for Battery e-Vehicles

- Batteries placed at the bottom (surfboard architecture)
- 400 Volt capacity 30-100 kWh
- Packs of average 10-20 (40) modules
- Each Module has 20- 40 Cells
- Cells are round (Tesla) or prismatic
- Battery requires cooling or heating

Remanufacturers can assume that these components will need over time to be remanufactured

Structures of Lithium automotive batteries



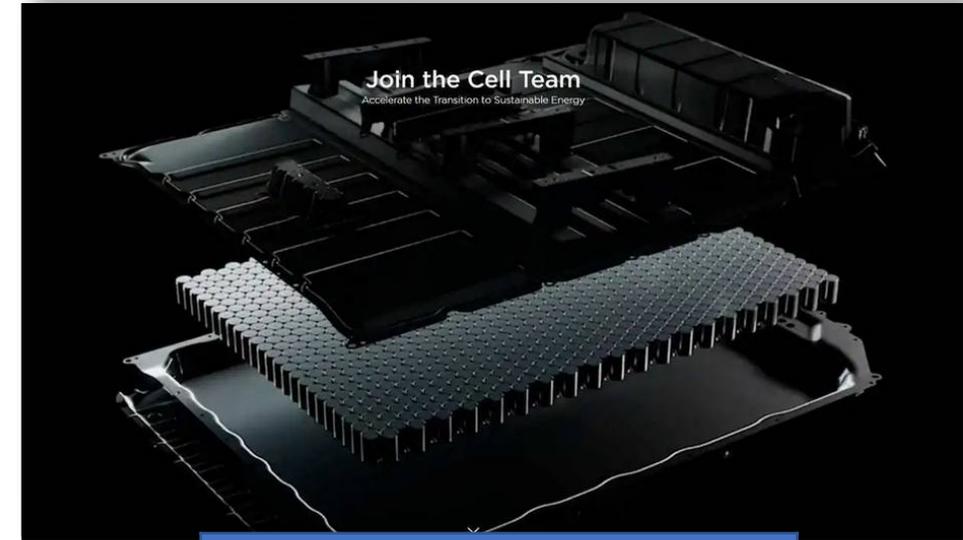
Batterie for BMW Electric Car iX3

Cover

BMS controller

Modules

Base with cooling pipes

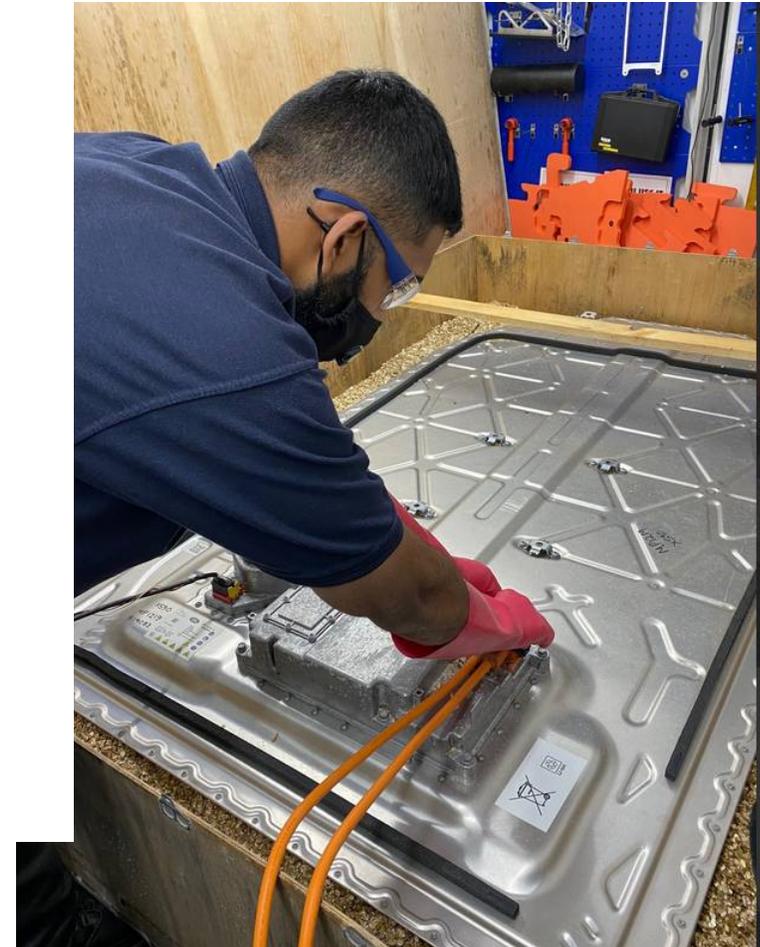


Batterie Tesla 3600 round cells

Remanufacturers can assume that these components will need over time to be remanufactured



Batterie-Remanufacturing at Stellantis/Opel in Germany



Batterie-Remanufacturing at Autocraft in UK



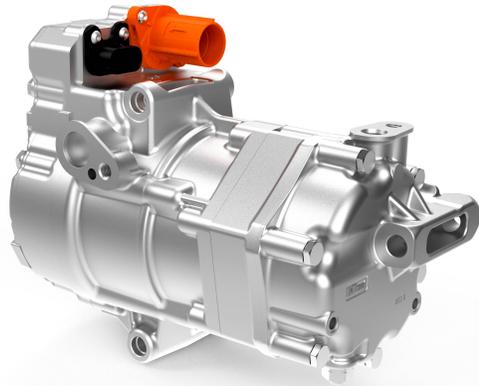
The Challenge of Thermal-management

1. **Cooling the electrical machine**
2. **Cooling the batterie and the inverter**
3. **Heating the batterie**
4. **Cooling the cabin**
5. **Heating the cabin**
6. **Using the heat from the batterie or the electrical machine for heating the cabin**

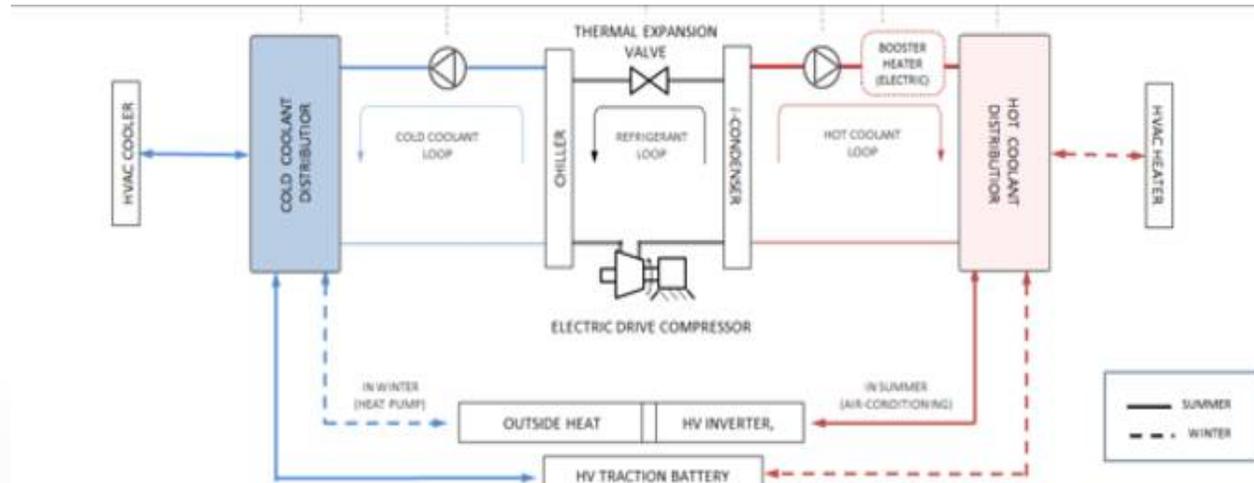


The complex Thermal-management of electric cars

Which requires compressors, coolant-pumps, flow-control valves, condensers, heaters, blower-motors and many pipes

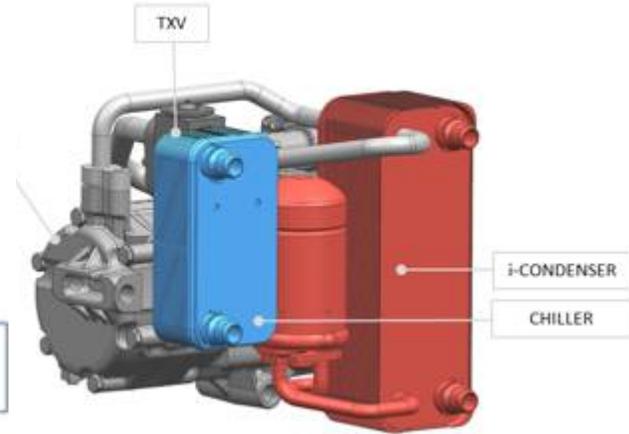


Electrical Air Condition
Compressor



Images M A H L E

Thermal-management
Batterie Electric Car



Electrical Heat-pump

Remanufacturers can assume that these components will need over time to be remanufactured

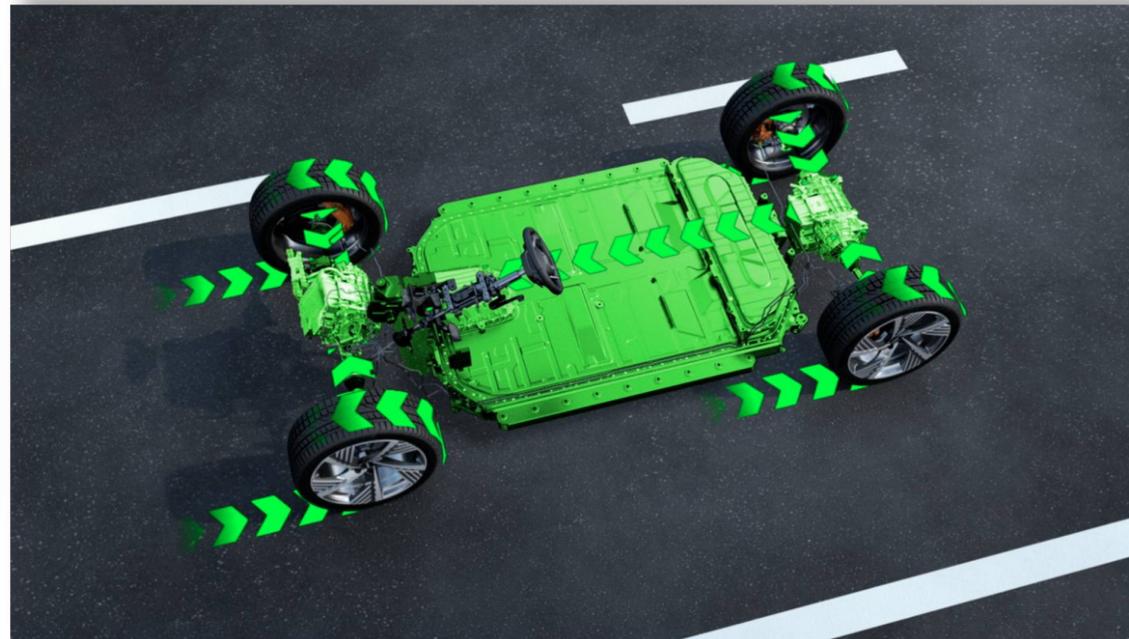
The New Electrical Braking

A Paradigm change !



Images Continental

Electric Parking-
Drumbrake



Braking by Electrical
Recuperation



Images ZF / TRW

Electronic Brake
Booster

Remanufacturers can assume that these components will need over time to be remanufactured



THANK YOU



Automechanika - Remanufacturing Day - Sept. 2022

FJW Consulting
Remanufacturing is our Business