

AVL



D I T E S T

A 3D wireframe model of a car chassis, rendered in a light blue color, showing the internal structure of the vehicle including the frame, suspension, and drivetrain components.

ELEKTROFAHRZEUG – UND WIE REPARIERE ICH DAS JETZT?

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Gollob, Peter
peter.gollob@avl.com

AVL DiTEST GmbH

Public

ELEKTROFAHRZEUG – UND WIE REPARIERE ICH DAS JETZT?



D I T E S T

Der Inhalt des Vortrages:

Nachdem wir uns die letzten Jahre intensive um die Entwicklung der Elektrofahrzeuge gekümmert haben, kommen wir jetzt in die Phase, uns um den Betrieb und den Service der Fahrzeuge zu kümmern.

Das wurde bisher vernachlässigt.

Die Prozesse und die Tools um E-Fahrzeuge zu reparieren werden jetzt definiert und entwickelt.

Bisher war es wenigen Spezialisten vorbehalten, etwas tiefer in die Reparatur zu gehen. Mit der zunehmenden Marktdurchdringung müssen sich mehr und mehr Werkstätten mit dem Thema beschäftigen.

Dabei taucht ein Thema auf, dass wir bei traditionellen Fahrzeugen bisher nicht hatten. Sicherheit beim Arbeiten an hohen elektrischen Spannungen. Da fehlt uns in der Fahrzeugbranche noch die Erfahrung.

Ich zeige hier den aktuellen Stand und die aktuellen Entwicklungen des Service von Fahrzeugen mit Elektroantrieb.

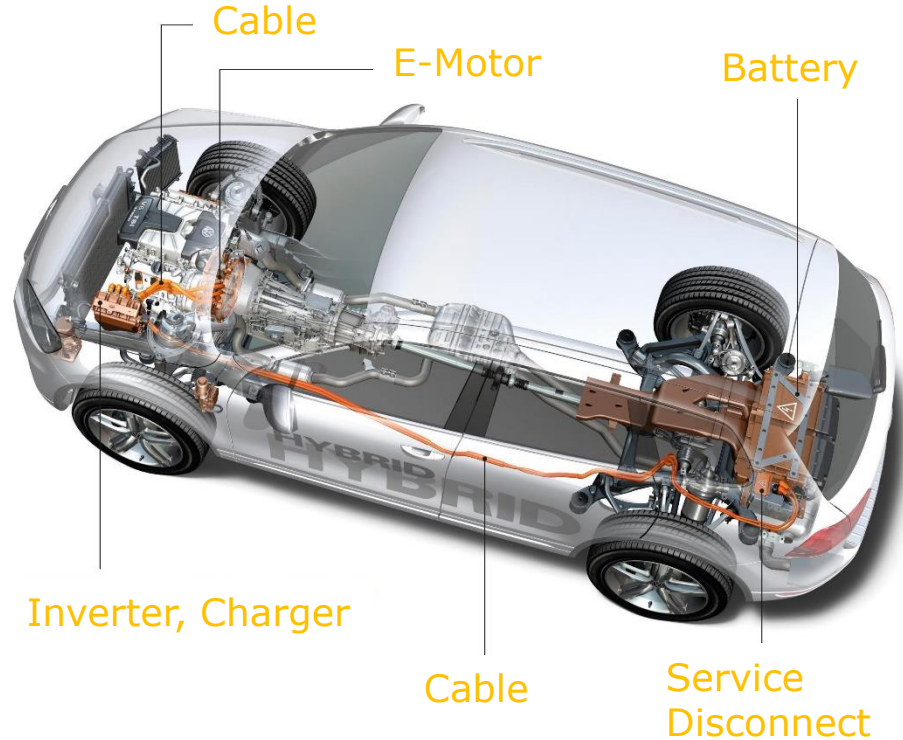
FAILURES IN HIGH VOLTAGE POWERTRAIN

Components

- E-Motor
- Inverter
- Charger
- Cable
- Battery

Replace

Repair
Replace
Reuse



Quelle: Volkswagen AG

WHY THINK ABOUT REPAIRING

Traction battery

Most expensive standard component in vehicle ever

Batteries gets

Defective

Aged

Replace whole Battery?

Expensive

Long delivery time

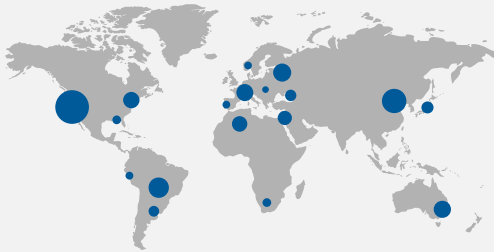
High warehouse costs



LOCATION OF BATTERY REPAIR WORKSHOPS

Centralized

- Few repair centers
- Highly sophisticated process
- Delay



Decentralized

- Each authorized repair shop
- Simple process
- Fast



Free market

- Independent workshops
- Uncontrolled by OEM
- Training required

WHAT CAN BE DEFECTIVE IN A BATTERY

Which parts are likely to get a defect in real life (empirical)

- Cells / Modules
- Cooling system
- Isolation
- Cables
- Connectors
- Electronics
- Sensors
- Contactors
- Fuse
- Housing
- Sealing
- Membranes



IDENTIFY BATTERY FAILURE

Symptom of battery failure

Reduced driving range

MIL, Malfunction Indicator Light

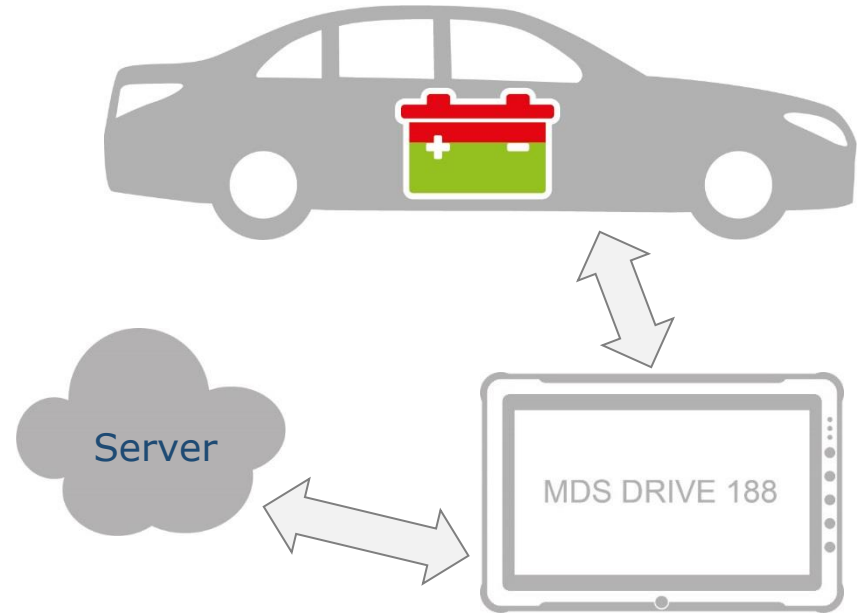
Not driving at all

Take vehicle to workshop

Diagnostic with battery in vehicle

Failure reported

Status of battery (charging level)



WHAT DO WE GET FROM DIAGNOSTIC

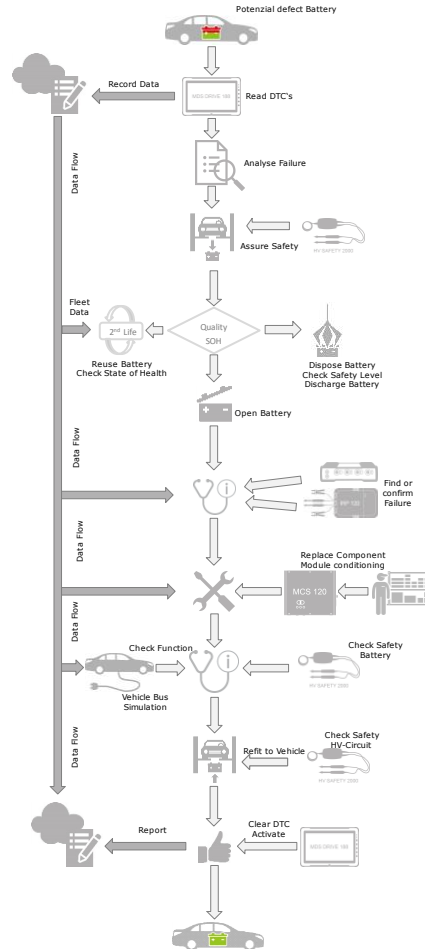
We get from diagnostic

- Suspect cell or module
 - Sensor
 - Electronic
 - Connector
- Isolation failure
- Battery End-of-Life

We do NOT get from diagnostic

- Exact failure mode
- Sensor or electronic
- Electronic or supply
- Connector or cable
- Exact position of isolation failure
- Battery fit for 2nd life

BATTERY REPAIR PROCESS







MODULE INTERNAL RESISTANCE MEASUREMENT

PATHFINDER

Module internal resistance measurement [Module 13]

Overview Detail Probe placement

Cancel

Next

Contact voltages

■	⚡	⚡	0.4 V
■	↑	↑	0.0 V
■	⚡	⚡	0.2 V
■	↑	⚡	0.1 V

Measurement results

Module internal resistance [mΩ]

↑ ↓ ---

Module voltage [V]

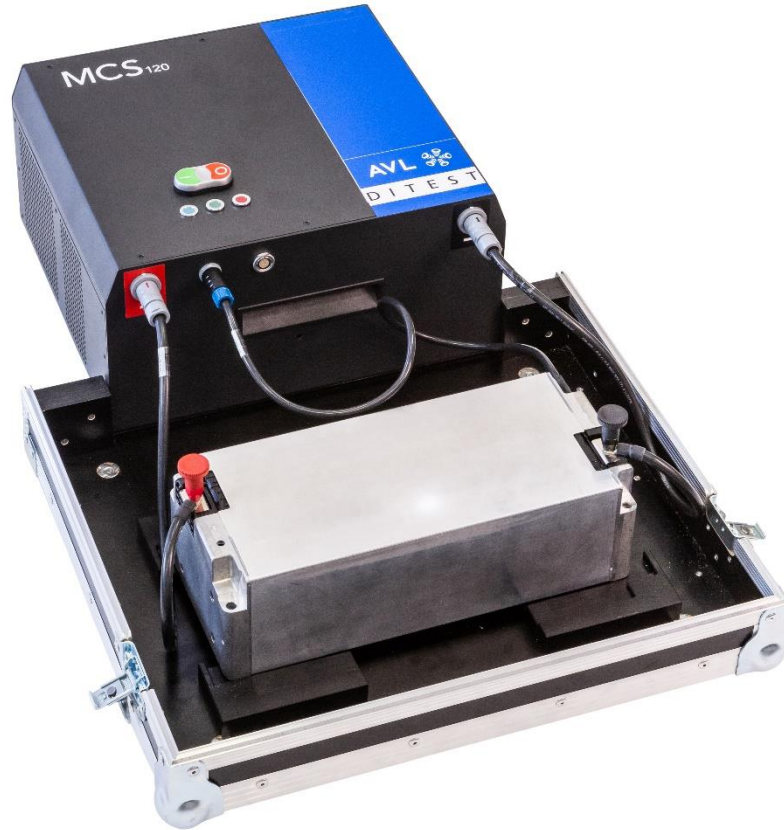
↑ ↓ ---

⚡ Place positive (red) and negative (black) clamp as shown under Probe placement

VIN: SAL GS2FK4H AX97883 Model year 2017 Odometer

12.0 V

- **Start:** module internal resistance measurement
- **Overview** tab shows where to connect clamps and probes
- Nothing connected yet



COMPLETE TOOLCHAIN

Withstand Voltage



Leakage



Charge/Discharge



Break-out Box



Diagnostic

Electric Measurement



Contact / Module Resistance



Safety, Isolation

UNIVERSAL HV TOOL HV SATELLITE



D I T E S T



Design Study

REPLACE AND REUSE BATTERY

After 300.000km

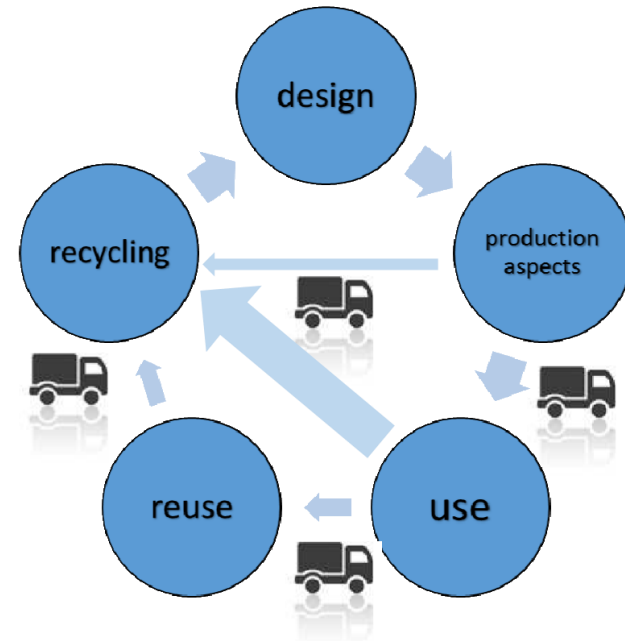
Electric Vehicle: **500kg** Battery >> Waste

Gasoline: **50.000kg** CO2

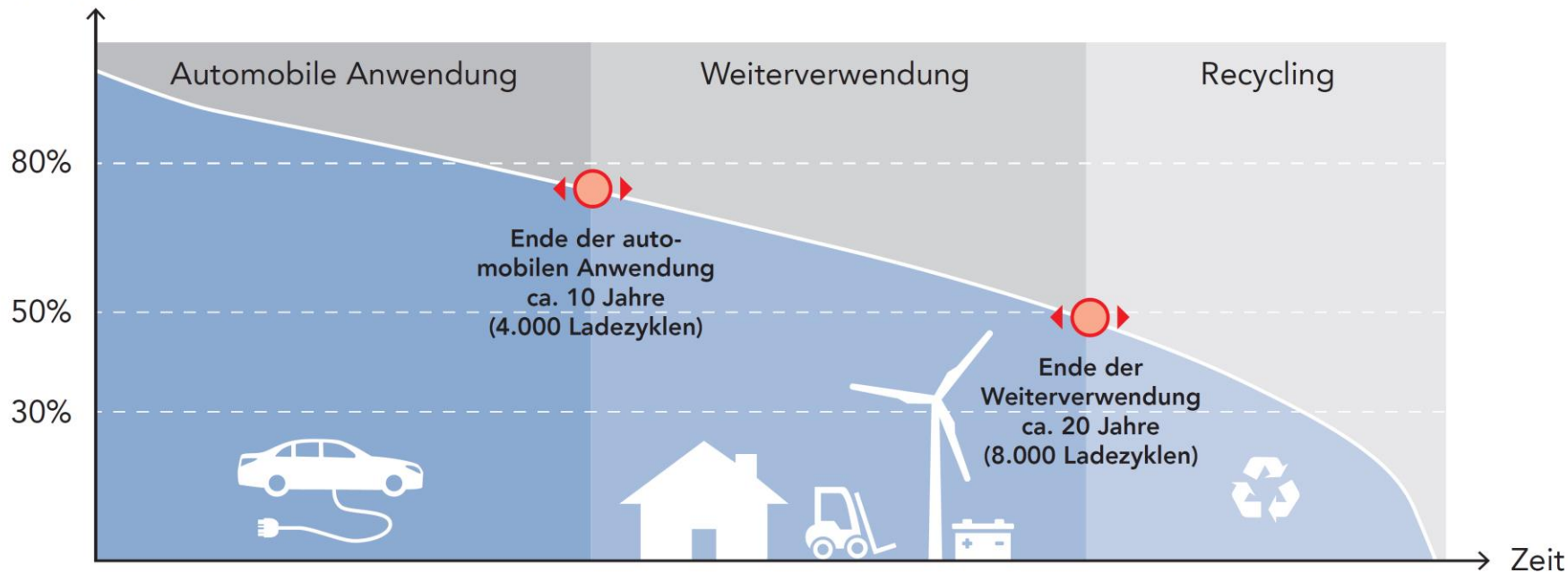
Recycling more expensive than value of raw material

Can it be used for stationary applications?

2nd Life of aged battery

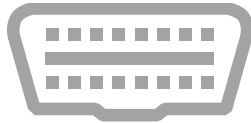


Leistungsfähigkeit
der Batterie

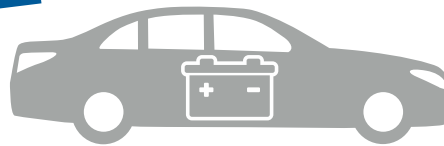


ANALYZE BATTERY QUALITY

Diagnostic Data
OBD

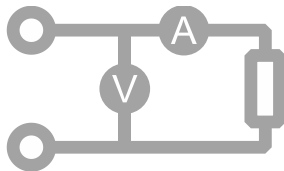


Driving
GPS, OBD



Battery Quality

Measuring
Testing



Statistic
Big Data

.. AND IF NONE OF THIS WORKS, ... LAST EXIT: RECYCLING

- Recycling is now in the focus of a lot of companies
- Now few batteries to recycle
- In few years this is a big business

- Deep discharge
- Manually separate the large parts
- Shreddering or pyrolytic treatment

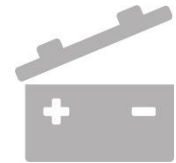
- Nickel, Manganese, Cobalt, Lithium
- Saves 40% of CO₂ compared to a new battery

OUTLOOK

E-MOBILITY IN THE WORKSHOP

Trends in e-Mobility Diagnostic and Repair

- Diagnostic to go deeper inside battery
- Gap open to get all relevant information by diagnostic
- Beside diagnostic -- measurement tools required
- Quality of used battery
- Battery life after in vehicle use





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