Challenges of New Technology for Technical Inspection

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Challenges of New Technology for Technical Inspection

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## Agenda

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1. Introduction to E-Mobility
Market and Offer - All different Ways of E-Mobility
1. Introduction to E-Mobility

Electric Mobility Past and Present

The development of electric vehicles (EV) is in its third phase at present.

**Phase I**
- Lohner-Porsche 4-wheel drive racing car
- Hansa-Lloyd electric truck CL5
- Elektromote by Werner Siemens, Berlin

**Phase II**
- Golf III - Citystromer
- General Motors EV1
- Bergmann parcel delivery vehicle

**Phase III**
- Tesla Roadster
- Toyota Formula 1 TF 109-02
- Apollo 17 mission
1. Introduction to E-Mobility
Global Market Offers - Definition of new vehicle concepts to increase energy efficiency

- Conventional
- Hybrid
  - Micro Hybrid
  - Mild Hybrid
  - Full Hybrid
  - Plug-in Hybrid
- Battery
- Fuel Cell

E-Mobility
1. Introduction to E-Mobility

Global Market Growth Expectation - Worldwide Sales of E-Vehicles per Type, 2012-2020

HEV = Hybrid Electric Vehicle
PHEV = Plug In Hybrid Electric Vehicle
BEV = Battery Electric Vehicle

Quelle: Pike Research
1. Introduction to E-Mobility
Global E-Mobility Focus Markets

The world today has about 30 megacities with a population of more than 10 million. The tendency for urbanisation is rising significantly.
1. Introduction to E-Mobility

The **Process Chain** of E-Mobility at TÜV Rheinland

- **Industrie Service**
- **Mobility**
- **Products**
- **Systems**
- **Training and Consulting**

**Energy Generation and Grids**

**Storage Systems/Batteries**

**Vehicle Utilization**
- Homologation
- Training
- Recycling

**Distribution/Charging Stations**
- Charging Station
- Exchange Station

**Billing System, Data Security**

**Generation**
- Transport

**Operation**
- Billing

**Storage**

2nd/3rd Life

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2013 CITA Conference, 15-17th May, Sevilla, Spain
2. Definition of High Voltage Systems

**Global Market Offers** - Definition of new vehicle concepts to increase energy efficiency

- Hybrid
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  - Mild Hybrid
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- Conventional
- Battery
- Fuel Cell

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10 16.05.2013 2013 CITA Conference, 15-17th May, Sevilla, Spain
2. Definition of High Voltage Systems

Power-split Hybrid

- Combustion Engine
- Generator MG1
- Inverter
- Differential
- Option Electric Motor with 4WD
- Electric Motor MG2 / Front Axle
- Heavy-Duty Battery System

- Serial
- Parallel
- Split
2. Definition of High Voltage Systems

Power diagrams

- **Combustion Engine**
  - Performance
  - Torque

- **Electric Motor**
  - Performance
  - Torque
2. Definition of High Voltage Systems

Power diagram for a hybrid system

Two Types of drive that are mutually supportive

E-Motor: high starting torque
Combustion Engine: high engine power
2. Definition of High Voltage Systems

Hybrid drive energy management

- Combustion Engine
- Energy Demand

Battery
Energy Storage
Power Supply
Wiring Systems 12V/42V

- Energy
- Charging Rate
- Braking Energy

Acceleration
Electric Drive
Combustion Engine works with a maximum efficiency
Deceleration
Combustion Engine stopped

Source: Toyota
2. Definition of High Voltage Systems

Comparison between the behaviour of hydraulic and electrical braking

1-2: Field Weakening
- Building of brake force
2: E-Motor in Anchor Adjusting Range
- maximum energy recovery
3: Battery is charged
- no further regenerative braking possible

Purely electric braking is not allowed!
2. Definition of High Voltage Systems

Electrical drives – Overview

Main properties of electrical drive concepts

<table>
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<tr>
<th></th>
<th>HEV</th>
<th>PHEV</th>
<th>EV</th>
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<tr>
<td><strong>Power</strong></td>
<td>10 - 40 kW</td>
<td>30 - 80 kW</td>
<td>30 - 80 kW</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>42 - 300 V</td>
<td>150 - 400 V</td>
<td>400 V</td>
</tr>
<tr>
<td><strong>Energy per cycle</strong></td>
<td>&lt; 300 Wh</td>
<td>&gt; 4 kWh</td>
<td>&gt; 15 kWh</td>
</tr>
<tr>
<td><strong>Cycles during 12 yrs operation</strong></td>
<td>300,000</td>
<td>4,000</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Battery size</strong></td>
<td>0.6 - 2 kWh</td>
<td>5 - 15 kWh</td>
<td>&gt; 15 kWh</td>
</tr>
<tr>
<td><strong>Battery mass</strong></td>
<td>≈ 50 kg</td>
<td>≈ 120 kg</td>
<td>≈ 250 kg</td>
</tr>
<tr>
<td><strong>Battery Price</strong></td>
<td>≈ 1.000 €</td>
<td>≈ 7.500 €</td>
<td>≈ 12.000 €</td>
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3. Challenges during the Vehicle Inspection

View under the hood
3. Challenges during the Vehicle Inspection

Electrical drive train: how to identify an EV

Registration Documents:
E.g. T.1:
Field P.3: Fuel type or source or energy
E.g. "Electric", "Hybr. petrol/E", ...

Vehicle registration certificate (Part 1):
Field 5: Drive type
E.g. "Key no. 25", ....

25 = combination of combustion engine with an electric drive (hybrid)
3. Challenges during the Vehicle Inspection

Electrical drive train: how to identify an EV

Dashboard displays:

Renault

Toyota

Volkswagen

http://www.Mein-Elektroauto.com
3. Challenges during the Vehicle Inspection
Electrical drive train: how to identify an EV

**Markings on the vehicle:**

Labels / striking stickers

Warnings

Cable colour coding
(HV cables/conduits are generally orange*)

*: Colour only changed to orange with ECE R-100, rev. 01
4. Potential Hazards due to High Voltage
Injuries caused by electrical current and batteries

**Electrical effect - Low voltage**

**Thermal effect - High voltage**

**Batteries**

*Electrical current, toxic substances, explosion*

**Brain** *Loss of consciousness*

**Heart** *Ventricular fibrillations*

**Lungs** *Toxic, hot vapours*  
*Inhalation trauma, Ruptures*

**Muscles** *Cramping, twitching, tears*

**Eyes** *Flash burns*

**Ear** *Bang trauma*

**Skin** *Burns, acid burns*

**Internal organs**  
*Cooking effect, burns*

**Bones**  
*Breaks due to falls, Crushing*
4. Potential Hazards due to High Voltage
Physiological Effects of Energy on the Human Body

These effects are depending on currency level and exposure time.

- **Zone 1**: No effect
- **Zone 2**: No harmful physiological effect
- **Zone 3**: Muscle contraction, breathing difficulties; disruption to the conduction system in the heart
- **Zone 4**: Ventricular fibrillations likely, possible cardiac arrest, respiratory arrest, serious burns

These effects are depending on currency level and exposure time.
4. Potential Hazards due to High Voltage

**Examples:**

- Unprofessional changes on the vehicle (work/repair/tuning by "electrical lay person") possible.
- High-voltage components not identifiable as such at a glance.
- Negative effects due to not easily visible wear conditions.
- Use of non original spare parts.

- Prominent HV markings/cable colours in force since ECE R-100.
5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

**e.g. effect/function testing of the overall system**

**Test run**
- Overall function of the (electrical) drive train,
- Overall function of the braking system (with/without conditioning), Function of (HV) pilot lamps, displays, alarms, active vehicle operation state, …

**e.g. visual/effect/function testing of components**

**Electromotor(s), performance electronics**
- Function, state, installation position, manipulation, …

**Electric steering, power-assisted braking, recuperation function**
- Function, state, effect, …
5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

e.g. visual/effect/function testing of components

High-voltage cable harness
- State, installation position, connections, shielding, equipotential bonding, …

Traction battery, (BMS), housing for HV components
- State, attachment, design, ventilation, cooling, …
5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

- **e.g. visual/effect/function testing of components**

**Special Heater Systems, air-conditioning**
- Function, effect, state, attachment, design, sealing, ...

**Warning/safety notices**
- Presence, design, ...

**Charging connections/Charging cables**
- Function, state, (immobiliser), ...
6. Future topics

- Electric mobility includes more than just electric vehicles.
- Electric mobility is an indispensable component of economical and ecological individual mobility, now and in the future.
- Sustainable mobility is more than just a task for the automobile manufacturers: it is a task for all of society and all of the economy.
- Road Safety is manly driven by an optimized PTI system to ensure a very high technological level in operation.

Our claim: At the very least, electric mobility must match the safety and attractiveness of conventional mobility.
Thank you very much for your attention!

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