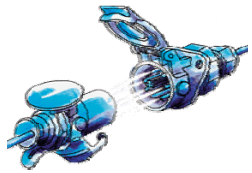
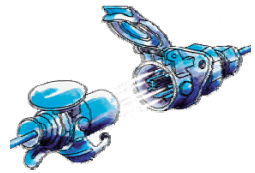
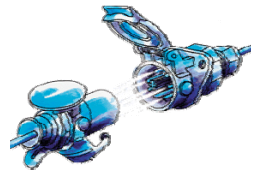


Our test laboratory - Apparatebau Kirchheim-Teck GmbH



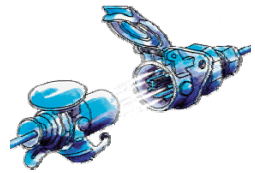
Test laboratory equipment 1

- Microsection lab for crimp contacts
- Tensile, pressure and bending test machine: Static + dynamic
- Vibration test: Vibration + shock
- Climate tests: Temperature + humidity
- High current tests up to 2000 A
- High current analysis with electrical loads
- Thermal imaging camera
- Leakage test station
- Measure- and test equipment for electrical analysis: Oscilloscope, different power supplies, multimeter, megohmmeter (megger), LCR-measuring instrument



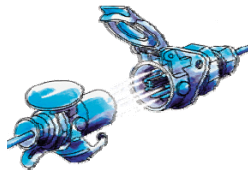
Test laboratory equipment 2

- Internal developed test stations:
  - Articulation test station + torsion strain test station for coils according ISO 4141
  - Cyclic extension test station for coils according ISO 4141
  - Dynamic test station for door contact
- Documentation of each analysis in a full test report
- Calibration of Measure- and test equipment with accredited laboratories
- Cooperation with external test laboratories



Microsection lab for crimp contacts

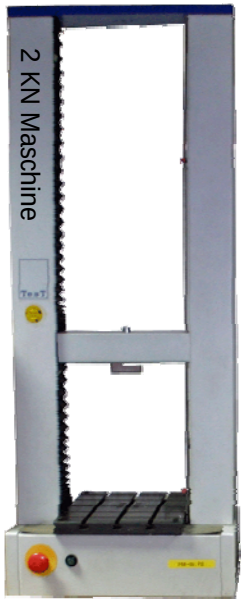
- Water-cooled 2-fold grinding table
- Swivel-mounted sample holder
- Copper etching bath
- Zeiss microscope up to 80-fold extension
- Monitor for inspection
- Thermal transfer printer (photo-quality)

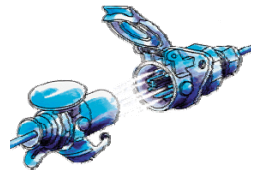


Tensile, pressure, and bending test machine: Static + dynamic

- Static and dynamic tests up to 10 kN
- Programmable test sequences
- Testing speed: 0,01 – 500 mm/min
- Working stroke resolution: < 1 µm
- Force resolution: +/- 60.000 Digits

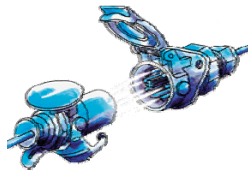
Cable extraction force - junction box





Vibration tests: Vibration + shock

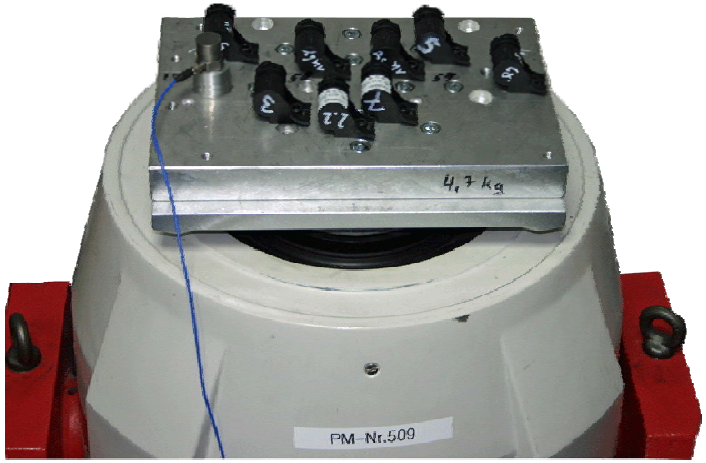
- Electromagnetic shakers are designed for simulation and reproduction of environmental influences, the exploration of the dynamic behavior of structures and the fatigue of materials in the test lab.
- Internal load support capacity: 100 kg
- Max. velocity: 700 mm/s (PEAK)
- Max. displacement s-s: 25,4 mm
- Max. acceleration: 688 m/s² (PEAK)
- Useful frequency range: 5 – 4.000 Hz
- Swivel-mounted rack – vertical + horizontal position possible.
- Power amplifier sine power 1.400 W



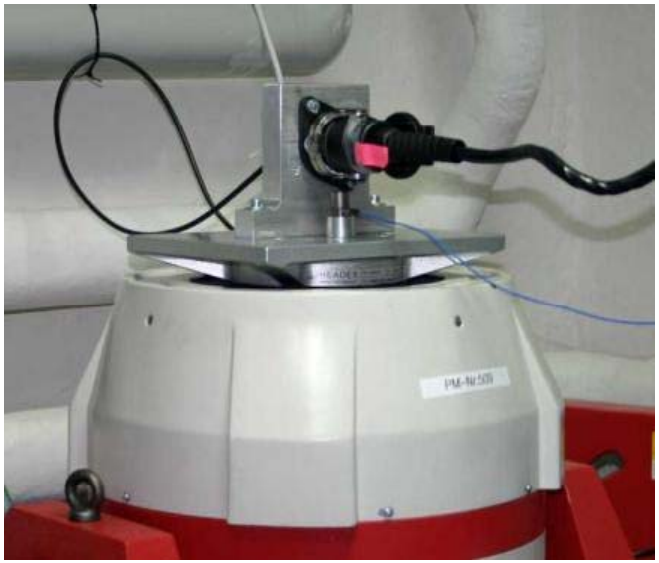
Vibration tests: Vibration + shock

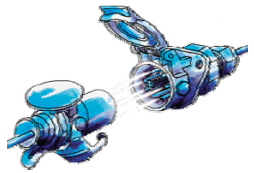
Test examples:

ADR-Fuses



ISO 7638 Connectors & coiled cables

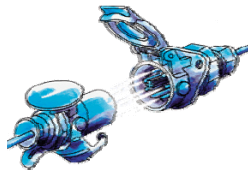




Climate tests: Temperature + humidity

- Temperature range: -40 C up to 180 C
- Humidity range: 10 % up to 98 % *RH*
- Test space capacity in liters: 350 L
- Temperature change rate cooling and heating are according to IEC 680068-3-5
- Software-controlled with RS232 interface
- Complies with current CE and EMV regulations

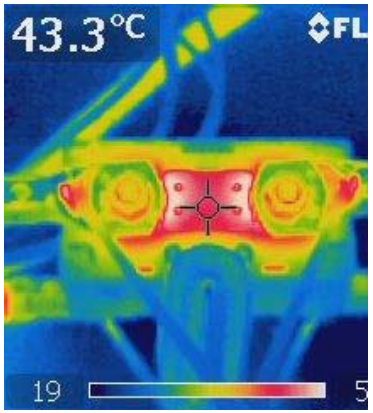
Sample applications



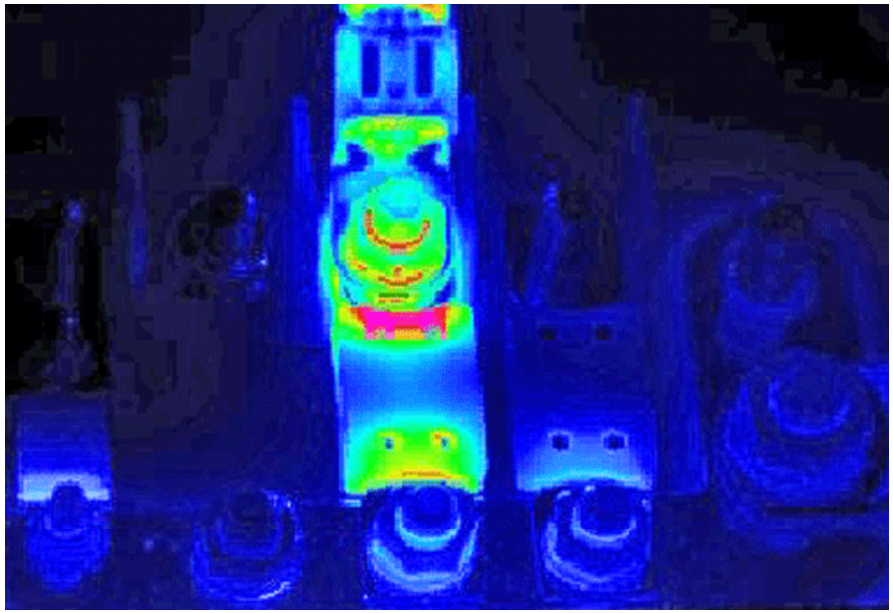
High current test station up to 2.000 A

- Current simulation up to 2.000 Ampere
- Big appliance simulated with electrical loads: 2x 125 A, 1x 200 A, 1x 400 A
- Thermal imaging camera for heating analysis
- Temperature sensors for record the temperature

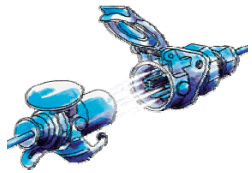
Thermal imaging picture: Mega-Fuse



Fuse box @ 500 Ampere



Electrical loads



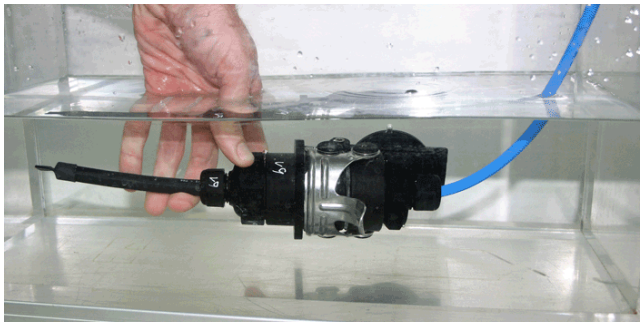
Internal developed test stations:

Leakage test station with internal pressure

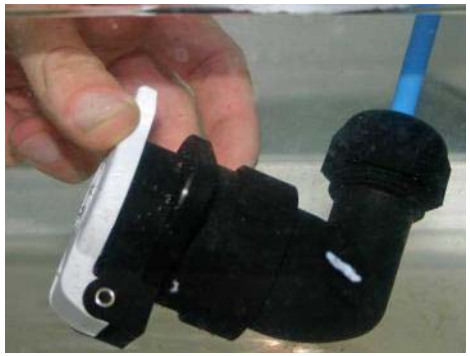
- Simple and fast test to analyze the water proof class
- If there is a leak, bubbles come out of the housing

→ You can see, where the leak is and at which pressure the leak occurs

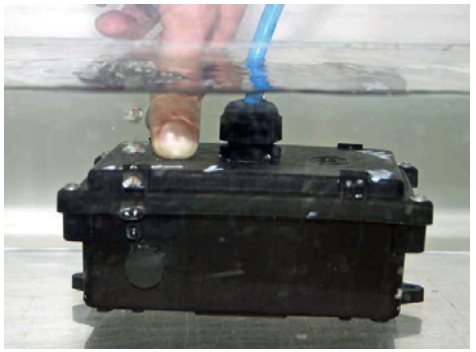
ISO 7638 Connector

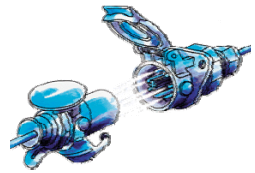


ISO 3731 Connector



Junction box



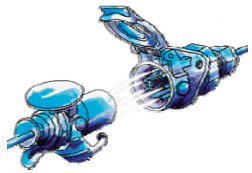


Internal developed test stations:

Articulation test station for coils

(According to ISO 4141-4)

- Test current continuous 5 A over all contacts
- If an interruption in the cable occurs (more than 1,0 A for 10 ms), the test station stops automatically
- Test speed: 15 cycles per minute
- Movement in each direction: 90 degree
- Software-controlled test procedures

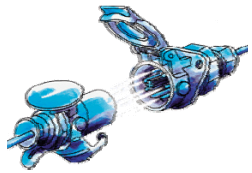


Internal developed test stations:

Torsion strain test station for coils

(According to ISO 4141-4)

- Test current continuous 5 A over all contacts
- If an interruption in the cable occurs (more than 1,0 A for 10 ms), the test station stops automatically
- Test speed: 15 degree per seconds
- Movement in each direction: 360 degree
- Software-controlled test procedures



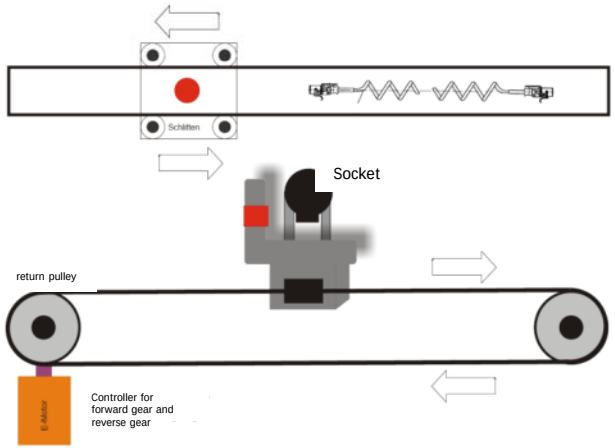
Internal developed test stations:

Cyclic extension test station for coils

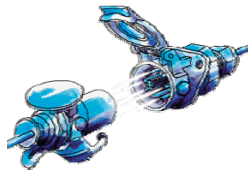
(According to ISO 4141-2)

- Test current continuous 5 A over all contacts
- If an interruption in the cable occurs (more than 1,0 A for 10 ms), the test station stops automatically
- Test speed: 10 cycles per minute
- Software-controlled test procedures

Control system



Schematic design

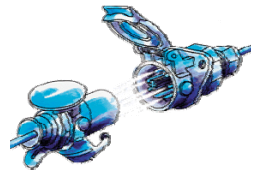


Internal developed test stations:

Dynamic test station for door contact

- Life time test: Min. 200.000 cycles
- Simulated kinetic radius of the door
- Impact speed: 1,2 m/s (adjustable)
- Absorbed test chamber

Test station door contact



Documentation of each analysis in a full test report

- Comprehensive description of the test procedures
- Accurate analysis of the test results
- Detailed visual presentation

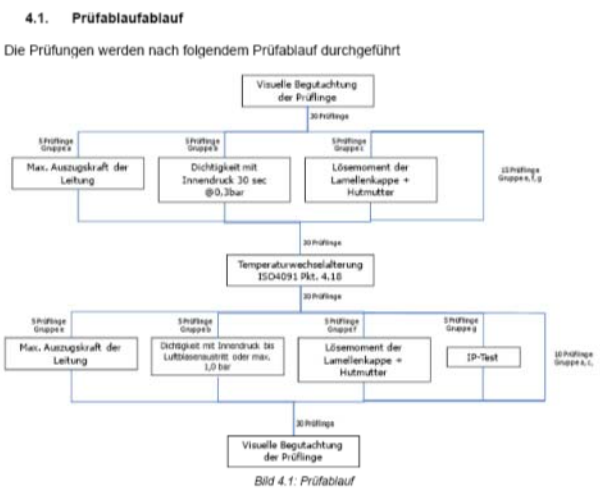
Test report

Test report no.: PB 2010 058

Page 1 of 10

Title of the test:	Testing Cable Box
Date of the test:	2010-05-27 – 2010-07-07
Client:	Volvo Powertrain
Test object:	Cable Box
Samples date of receipt:	2010-05-24
Object identification: (article number/description/customer)	Test samples No. 1 – 15 Volvo Part No 21484107 AK1930269054 (drawing change level: h; 2010-01-29)
Specification/test method:	Volvo TECHNICAL REGULATION (TR) 21356365: - 5.3.1 Conditioning of test sample - 5.3.2 Cold test - 5.3.3 Damp heat (cyclic) test - 5.3.4 Temperature change test - 5.2 Functional test - 5.3.5 Stone impact test - 5.3.6 Free fall or drop
Place of the test:	**Apparatebau Kirchheim-Teck GmbH** Alleenstraße 36 D-73230 Kirchheim-Teck **TELUS - Test laboratory for environment simulation GmbH** Bodenäckerstr. 12 D-73266 Bissingen-Teck
Participant:	Michael Berndt
Test result:	All test samples passed the tests. We have no cracks or damages on the test samples.
Notes:	

Tester	Originator	Release
Date: 2010-07-14	Date: 2010-07-14	Date: 2010-07-14
Name: Michael Berndt Signature:	Name: Michael Berndt Signature:	Name: Rainer Matterne Signature:



4.1. Prüfablaufablauf

Die Prüfungen werden nach folgendem Prüfablauf durchgeführt

Bild 4.1: Prüfablauf

4.2. Visuelle Begutachtung der Prüflinge

Die Prüflinge werden einer Sichtprüfung unterzogen
Es dürfen keine Brüche, Risse, Quellungen, Verfärbungen, Verklebungen oder sonstige sichtbaren Beschädigungen erkennbar sein.

Prüfbericht

Bericht Nr.: PB 2009 112

Seite 6 von 10

Bild 4.3: Prüfaufbau Dichtigkeitstest

4.5. Lösemomente Lamellenkappe + Hutmutter

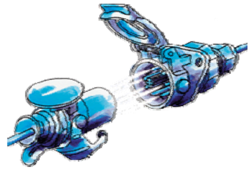
Mit Hilfe eines Zeigerdrehmomentschlüssels wird vor und nach der Temperaturwechselalterung das Lösemoment der Hutmutter und der Lamellenkappe an der ABS/EBS-Steckdose gemessen.

Bild 4.4: Prüfaufbau Lösemoment Hutmutter

Bild 4.5: Prüfaufbau Lösemoment Lamellenkappe

Den Versatz des Drehpunktes zwischen Mittelpunkt der Kappen und Drehpunkt des Drehmomentschlüssels wir berechnet und abgezogen.

Bild 4.6: Drehmomentschlüssel



Calibration of Measure- and test equipment with DKD-accredited laboratories

Cooperation with external test laboratories

Deutscher Kalibrierdienst (DKD)
Akkreditierungsstelle
vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die Akkreditierungsstelle des Deutschen Kalibrierdienstes akkreditiert hiermit
esz Elektronik-Service GmbH
Max-Planck-Straße 16
82223 Eichenau

nach DIN EN ISO/IEC 17025:2005 für Kalibrierungen im Bereich / in den Bereichen:

elektrische Gleichstrom- und NF-Größen, elektrische HF-Größen, Zeit und Frequenz, dimensionelle Größen, optische Größen, Temperatur, Feuchte, Druck

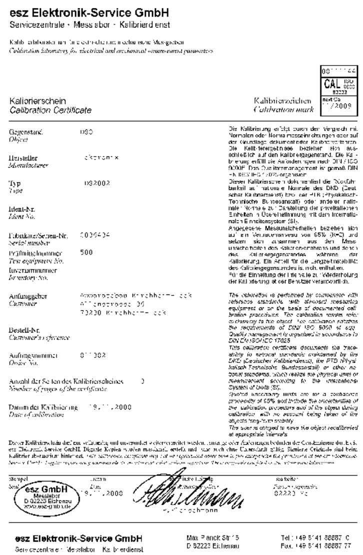
Bestandteil der Urkunde ist: Anlage 10 (15 Seiten), 2008-11-10

DAR-Registriernummer: DKD-K-18201
Akkreditiert im DKD seit: 1997-08-05

Braunschweig, 2008-11-10

Dipl.-Ing. Michael Schaller
Leiter der Akkreditierungsstelle

Siehe Hinweise auf der Rückseite



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Calibration Certificate

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