



High Performance Magnetic Solutions for E-Mobility

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Materials & Components

Advanced Materials – The Key to Progress

Who we are

- Leading manufacturer of high-end magnetic alloys, components and applied products
- Developer of customized solutions based on 800+ patents
- Application Specialist for
 - Aerospace
 - Automotive Systems
 - Renewable Energy Applications
 - Industrial Automation
 - Scientific
 - and many more



VAC Global Footprint

Where we are



VAC Automotive



Closed-loop Current Sensors

with extraordinary accuracy for charging stations



benvac

AC and DC sensitive differential current sensor for IC-CPD



Common Mode Chokes

for EMI suppression in charging stations



Current Transformers

for power metering in charging stations



VITROBRAZE

amorphous brazing foils for use in waste gas applications



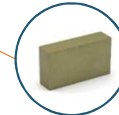
DSG Magnet Systems

for position sensors in dual-clutch transmission



Cores & Components

for new 48 V on-board power supplies



Permanent Magnets

made of VACOMAX and VACODYM for enhanced electrification of cars



Common Mode Chokes

for passenger occupant detection systems (PODS)



VACSTACK

full magnet assembly made of rotor and stator for electric drives



VACOFLUX Actuators

for improved dynamic behaviour of fuel injection systems



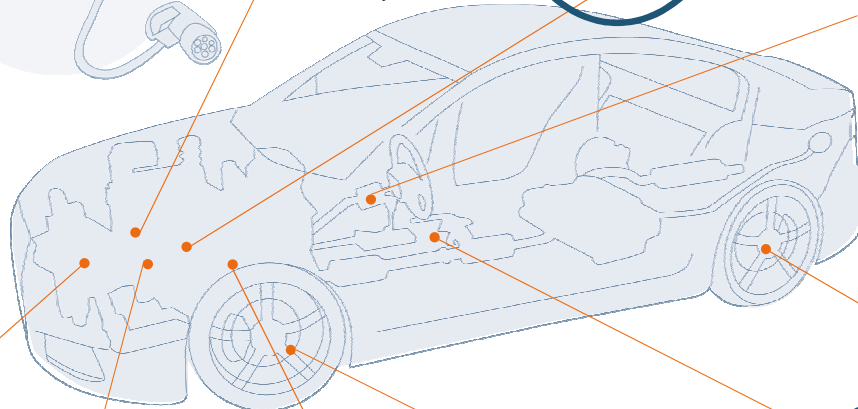
VITROPERM Cores

for EMI suppression



Soft Magnetic Parts and Components

for electric power assisted steering (EPAS)

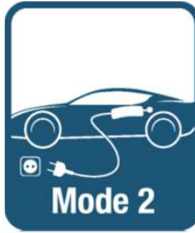


VAC Solutions for EV Charging





Mode 2: In-Cable Control & Protection Device



In brief:

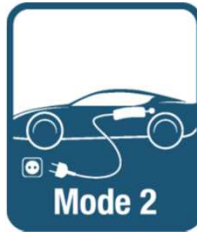
- AC-charging according to IEC 62752 or UL 2231
- Schuko connector as universally available plug
- slow charging method, considered as ,emergency charging' or ,spare can'
- however, this is presently the most prevalent form of charging

Technical requirements:

- safety features
- compact design of components due to limited IC-CPD outline
- mechanical robustness

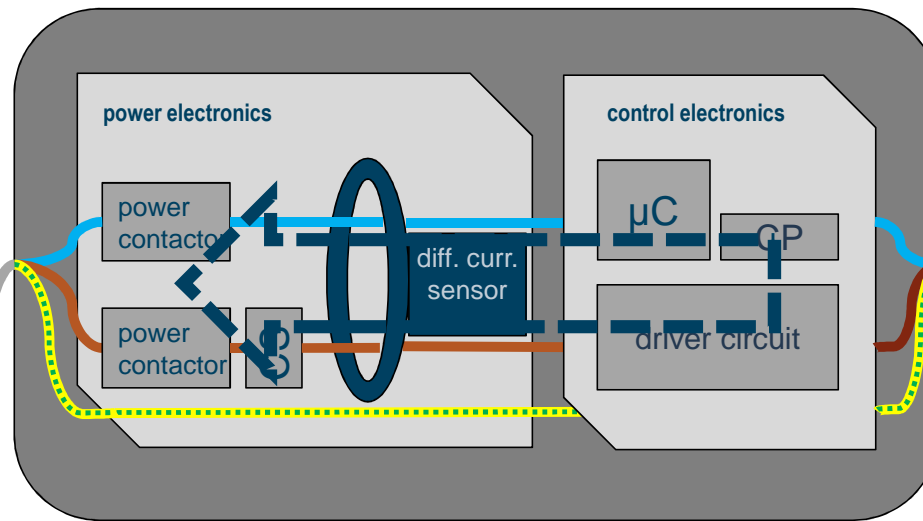
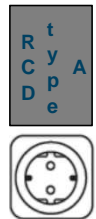
Mode 2: IC-CPD

General block diagram of IC-CPD



DC fault state

will drive standard
type A RCD in
household power grid
into saturation!

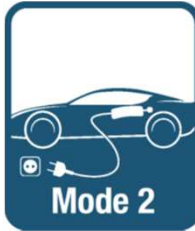


DC leakage current
from EV battery

Mode 2: benvac

Overview:

- AC and DC fault current measurement based on magnetic fluxgate principle
- excellent resolution and accuracy even under harsh electrical and environmental conditions
- integrated output to directly drive the power contactor within given tripping times according to the standards
- compact sensor design available with pass through opening or with integrated primary conductors



Mode 2: benvac

In detail:

- full load current up to $80 A_{rms}$
($1 \times 16 A_{rms}$ up to $3 \times 32 A_{rms}$)
- differential current range from 0...300 mA
(DC...2 kHz)
- measurement resolution: 0.2 mA
- fully compatible to relevant European and American standards:
 - **IEC 62752:** $6 mA_{DC}$ / $30 mA_{AC}$
 - **UL 2231:** $5 mA_{AC}$ / $20 mA_{AC}$
- open collector output for both fault current levels & internal error output

VAC PRODUCTS

N4641-X900

with primary conductor opening, 32 A, IEC

N4641-X901

with primary conductor opening, 32 A, UL

N4641-X910

3 primaries, 16 A, IEC

N4641-X911

3 primaries, 16 A, UL

N4641-X920

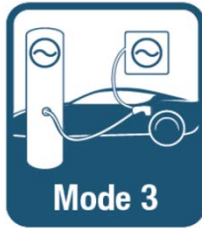
4 primaries, 32 A, IEC

N4641-X921

4 primaries, 32 A, UL



Mode 3: Residential Wallbox



In brief:

- AC-charging according to IEC 62955
- improved charging times compared to Mode 2 possible

Technical requirements:

- higher charging currents
- integration into household power grid

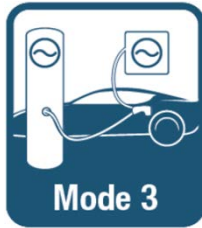
VAC products:

T60404-N4641-X904

Mode 3: benvac

In detail:

- same hardware and same characteristics as standard version
- modified firmware
- fully compatible to relevant European standard:
- **IEC 62955:** $6 \text{ mA}_{\text{DC}} / 30 \text{ mA}_{\text{AC}}$
- slower tripping time for AC fault current – type A RCD in private households



VAC products:

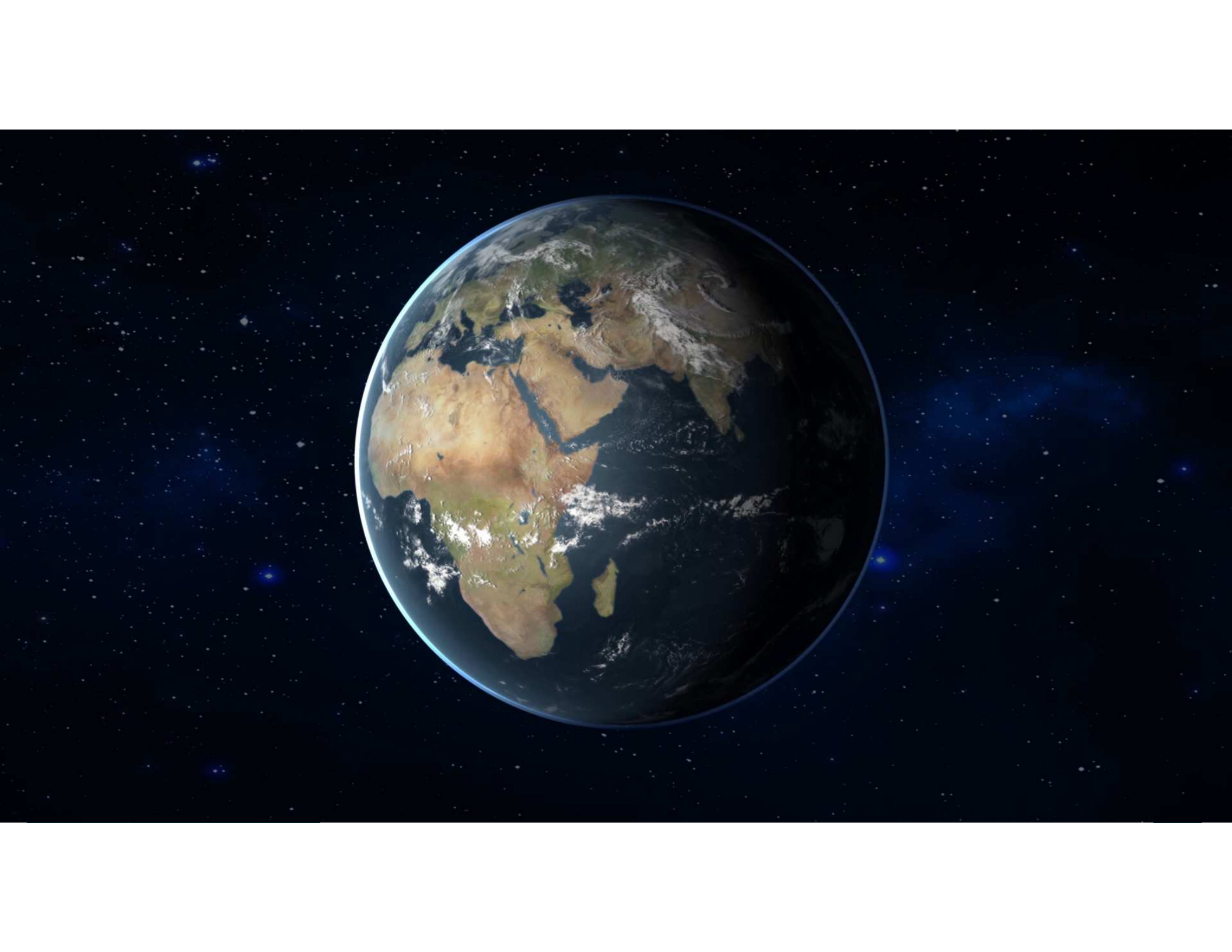
T60404-N4641-X904

not released yet –
samples available



Automotive Common Mode Noise Suppression





Automotive Common Mode Noise Suppression

- New **CMC series**:

- size I: 31 x 22 x 33 **mm** 8 A < I < 15 A
- size II: 35 x 23 x 35 **mm** 8 A < I < 21 A

- New **core series**:

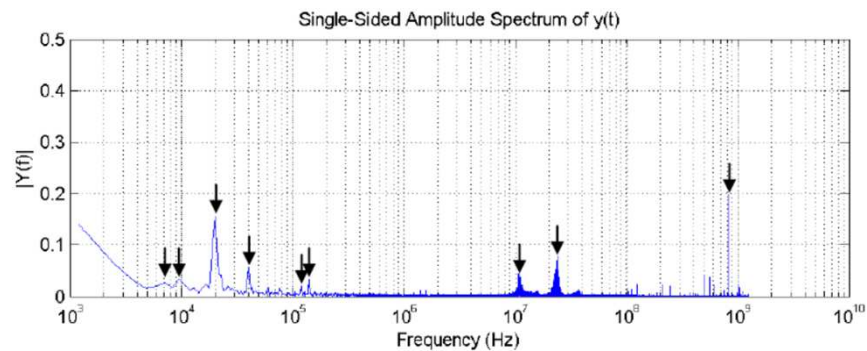
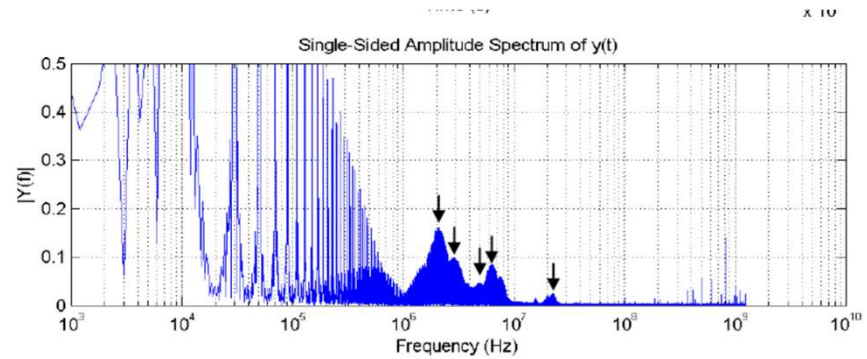
- oval: narrow and wide opening for busbars; two permeability levels each
- toroidal: 7 sizes, 23 mm < OD < 67 mm; two permeability levels each

- developed for DC/DC inverters in hybrid and electric cars
- high ambient temperatures of up to 115°C
- continuous operating temperature of 130°C or 150°C
- nanocrystalline core material delivering high performance in compact design
- automotive qualified acc. to AEC-Q200



Automotive Common Mode Noise Suppression

without filtering in place:



Technical Cleanliness

- design & manufacturing taking into account:
 - ‚Technical Cleanliness‘ acc. to VDA 19 Part II
 - ‚Technical Cleanliness in Electrical Engineering‘ acc. to ZVEI Guideline (VAC is co-author!)
- technical cleanliness starts with the design!



- specially designed overlap between core box and cover
- no ‘trapping’ of particles during interlocking procedure
- metallic particles inside the core box are safely enclosed
- clean surfaces for easier cleaning at the end of the production line (brushing & blowing)
- all cores are under regular control of cleanliness level, by internal lab on our production site



