E2. Railway system products - additional routine / special test recommendations

Standard Approach

The main electrical standard of the product should again be selected according to the product type: IEC/EN 60076 or IEC/EN 61558 for transformers, IEC/EN 60076-6 for reactors, IEC/EN 62477-1 for rectifiers/static power electronic devices, and IEC/EN 61439 for panel/enclosed systems. For railway system conditions, IEC 61373 / EN 61373, EN 50155, EN 50121, EN 50124-1, EN 50125, and the EN 45545 family for fire/smoke should especially be considered.

1. Additional Routine / Special Test Recommendations

1 Vibration test

Main standard	IEC 61373 / EN 61373; IEC 60068-2-6 for general environmental testing
Construction / method standard	IEC 61373 vibration profile according to category; alternatively IEC 60068-2-6 sinusoidal vibration
For railway system product	For rolling-stock equipment, IEC 61373 should be the main reference. This standard defines the test requirements for equipment exposed to vibration and shock due to the operating environment in railway vehicles. For fixed installation/trackside products, the customer specification or IEC 60068-2-6 may be used.

2 Impact / shock test

Main standard	IEC 61373 / EN 61373; IEC 60068-2-27 for general environmental testing
Construction / method standard	IEC 61373 shock test; IEC 60068-2-27 half-sine shock profile if required
For railway system product	For transformers, reactors, rectifiers, regulators, electronic control panels and enclosed equipment on railway vehicles, mounting feet, coil fixing, core tightness, board connections and terminals are verified.

3 Temperature cycling test

Main standard	EN 50155 for electronic equipment; IEC 60068-2-14 for general environmental testing
Construction / method standard	Low-high temperature cycling, operating and storage conditions
For railway system product	EN 50155 is especially important for devices such as electronic control, rectifiers, static regulators, active filters and SVG; this standard covers operating conditions, design, documentation and test requirements for electronic equipment used on railway vehicles. In passive transformers/reactors, insulation and mechanical tightness should be checked after cycling.

4 Humidity test

Main standard	EN 50155; IEC 60068-2-30 or IEC 60068-2-78
Construction / method standard	Humidity/temperature cycling or constant humidity test; insulation repeat after test
For railway system product	Condensation risk may be high in metro tunnels, trackside panels, under-vehicle equipment and enclosed technical spaces. After humidity exposure, insulation resistance, dielectric withstand and function tests should be repeated.

5 Noise test

Main standard	IEC/EN 60076-10 for transformers/reactors; customer/vehicle standard if railway vehicle comfort requirements exist
Construction / method standard	Sound pressure or sound intensity method
For railway system product	Recommended for products operating inside vehicles, stations, signaling rooms or indoor technical spaces. In reactors and transformers, sound level caused by magnetostriction, core tightness and mechanical vibration can be reported.

6 Cable/terminal pull check

Main standard	EN 50155 as auxiliary reference for electronic equipment; IEC/EN 61439-1 for panels; IEC 60204-1 for machine/panel approach
Construction / method standard	Terminal torque check, cable pull/loosening check, ferrule/lug check
For railway system product	Loose terminals are a very critical failure cause in vibration environments. Power terminals, CT/sensor cables, communication cables, PE connections and fan/thermal ends should be checked separately.

7 Terminal loosening check - after vibration

Main standard	IEC 61373 / EN 61373; IEC/EN 61439-1
Construction / method standard	Torque, continuity and visual inspection after vibration/shock
For railway system product	The vibration test should not be closed only as mechanically “not broken”; after the test, connection loosening, insulation damage, terminal cracking, cable lug loosening and PE continuity should be checked again.

8 Insulation distance verification

Main standard	EN 50124-1; IEC 60076 / IEC 61558 / IEC 62477-1 as product standards
Construction / method standard	Clearance/creepage measurement, check according to pollution degree and overvoltage category
For railway system product	EN 50124-1 is the main standard for insulation coordination, clearances and creepage distances in railway equipment; it handles insulation dimensioning by considering electrical stresses and environmental conditions.

9 Creepage-clearance verification

Main standard	EN 50124-1
Construction / method standard	Production drawing, template/measurement, distance check between terminals/cards/busbars
For railway system product	It should be added to the report especially in rectifier, static regulator, SVG, active filter, electronic control board, DC busbar, AC busbar and high-voltage terminal areas.

10 EMC test - near signaling/communication

Main standard	EN 50121 series; EN 50155 as auxiliary reference for electronic devices
Construction / method standard	EN 50121-3-2 for rolling-stock apparatus; EN 50121-4 for signaling/telecom; EN 50121-5 for fixed power supply installations
For railway system product	EMC is a critical topic in railway systems. The EN 50121 series addresses emission and immunity requirements in railway environments in separate parts; BSI lists EN 50121-4 for signaling/telecom apparatus and EN 50121-5 for fixed power supply installations.

11 EMC immunity tests

Main standard	EN 50121 series; IEC 61000-4-2 / -4 / -5 / -6 / -11
Construction / method standard	ESD, EFT/burst, surge, RF conducted immunity, voltage dips/interruptions
For railway system product	Recommended for products containing electronics such as rectifiers, regulators, active filters, SVG, control boards, communication panels and signaling supplies.

12 EMC emission tests

Main standard	EN 50121 series; IEC/CISPR auxiliary standards
Construction / method standard	Conducted emission, radiated emission
For railway system product	Conducted/radiated emission must be evaluated for devices operating near signaling, telecom and SCADA lines.

13 Long-term burn-in test

Main standard	EN 50155 for electronic devices; IEC/EN 62477-1 for power electronics; product standard
Construction / method standard	Long-term operation at specified load; monitoring of temperature, alarm, fan, output values and fault log
For railway system product	Recommended for rectifiers, static regulators, active filters, SVG and electronically controlled panels. In passive transformers/reactors, long-term load testing can be used for temperature and mechanical sound/vibration observation.

14 Galvanic isolation verification

Main standard	IEC/EN 61558 or IEC/EN 60076; EN 50124-1 as additional railway system requirement
Construction / method standard	Insulation resistance, dielectric withstand, primary-secondary/enclosure tests
For railway system product	OMSAN quality documentation specifically mentions galvanic isolation tests for railway system transformers. Primary-secondary insulation should appear separately in the report for signaling and control supplies.

15 Voltage and current verification

Main standard	IEC/EN 60076, IEC/EN 61558, IEC/EN 60076-6, IEC/EN 62477-1
Construction / method standard	Nominal voltage/current measurement; output verification under load
For railway system product	OMSAN documentation lists voltage and current verification as a special test heading for railway system products. In critical supplies, input tolerance, output regulation and voltage drop under load should be reported separately.

16 Short-circuit / protection function check

Main standard	According to product type: IEC 60076-5, IEC 61558, IEC 62477-1, IEC 61439
Construction / method standard	Protection device verification, calculation, simulation or safe function test
For railway system product	OMSAN quality documentation also includes short-circuit protection checks for railway system transformers. Fuse, MCB/MCCB, electronic protection, alarm and trip contact should be checked.

17 Fire / smoke / material conformity

Main standard	EN 45545 series; customer specification for electronic/panel materials
Construction / method standard	Material certificate, HL class, cable and plastic material check
For railway system product	For in-vehicle/on-vehicle products, EN 45545 fire-smoke requirements may come into scope for cables, terminal blocks, insulation materials, plastic parts and coating materials.

18 Supply voltage variation test

Main standard	EN 50155 for electronic equipment; IEC 61000-4-11 as supporting reference
Construction / method standard	Nominal, minimum, maximum, dip and short interruption scenarios
For railway system product	Function should be verified against input voltage fluctuations in rectifiers, regulators, control transformers, active filters/SVG and electronic devices.

19 Grounding / bonding continuity

Main standard	IEC/EN 61439-1; IEC 60204-1; railway system specification
Construction / method standard	Low-resistance continuity measurement
For railway system product	Body, cover, mounting plate, screen connection, PE busbar and cable screens should also be checked after vibration.

20 Thermal camera check

Main standard	Product standard; thermal performance approach
Construction / method standard	IR thermography under load
For railway system product	Hot spots are searched for at terminals, busbars, reactor winding, transformer outputs, rectifier diode/IGBT, heat sink, fan area and PE connections.

2. Lines Recommended to Add to the Test Report

Report line	Recommended content
Application type	Railway system transformer / reactor / rectifier / regulator / panel
Installation location	On-vehicle, under-vehicle, station, trackside, signaling room, telecom/SCADA
Main product standard	IEC 60076, IEC 61558, IEC 60076-6, IEC 62477-1 or IEC 61439
Railway system standards	IEC/EN 61373, EN 50155, EN 50121, EN 50124-1, EN 45545, customer/operator specification
Vibration/shock	Category, axes, profile, duration, post-test terminal/PE/insulation result
Temperature/humidity	Temperature class, number of cycles, humidity condition, post-test insulation
EMC	EN 50121 part, ESD/EFT/surge/RF, conducted/radiated emission result
Insulation coordination	Clearance, creepage, pollution degree, overvoltage category
Cable/terminal	Pull, torque, loosening, repeat check after vibration
Burn-in	Duration, load ratio, ambient temperature, fault/alarm log
Protection functions	Short circuit, overcurrent, phase loss, thermal protection, alarm/trip
Fire material	Material certificate and HL level if EN 45545 is required