

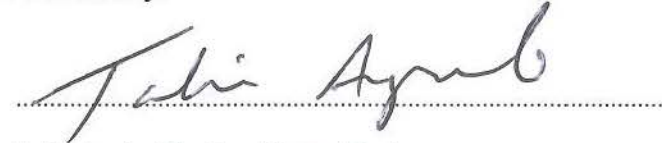
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Level 2

Product Specification for Power Transformers for Signalling Systems

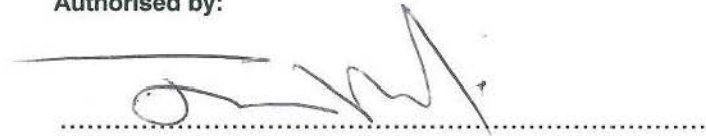
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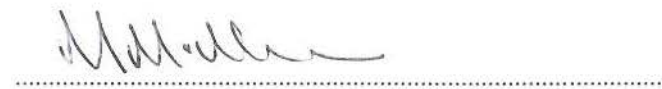


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User information

This Network Rail standard contains colour-coding according to the following Red–Amber–Green classification.

Red requirements – No deviations, could stop the railway

- **Red requirements shall** always be complied with and achieved.
- Red requirements shall be presented in a red box **with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of red requirements lies with the Professional Head/Standard Owner.
- Red requirements are monitored for compliance.
- Corrective actions shall be enforced if deviations are discovered through functional checks (e.g., engineering verification visits, audit or Operations Self-Assurance).

Amber requirements – Controlled deviations, approved risk analysis and mitigation

- **Amber requirements shall** be complied with unless deviation has been approved in advance.
- Amber requirements shall be presented with an amber sidebar **and with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of these requirements lies with the Professional Head/Standard Owner, or their nominated Delegated Authority.
- Amber requirements are monitored for compliance.
- Deviations **may** be permitted. Deviations are approved by the Standard Owner or through existing Delegated Authority arrangements.
- Corrective actions shall be enforced if **non-approved** deviations are discovered through functional checks (e.g., engineering verification visits, audit or Operations Self-Assurance).

Green – Guidance

- Guidance is based on good practice. Guidance represents supporting information to help achieve **Red** and **Amber** requirements.
- Guidance shall be presented with a dotted green sidebar **and with the word “should” (usually in notes) or as a direct instruction**.
- Guidance is **not mandatory** and is not monitored for compliance.
- Alternative solutions may be used. Alternative solutions do not need to be formally approved.
- Decisions made by a competent person to use alternative solutions should be backed up by appropriate evidence or documentation.

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Issue record

Issue	Date	Comments
1	Dec 2007	First issue, supersedes BR924A
2	03/12/2011	Class II hybrid requirements added
3	06/06/2015	The option of aluminium wound transformers and their respective requirements has been included

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 31 December 2015.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

BR924A	Specification for air cooled transformer for railway signalling equipment (superseded)
BS EN 50124-1	Railway applications – Insulation coordination –Part 1 Basic requirements – Clearances and creepage distances for all electrical and electronic equipment
BS EN 50125-3	Railway applications. Environmental conditions for equipment. Equipment for signalling and telecommunications
BS EN 60529	Degrees of protection provided by enclosures (IP code)
BS EN 60085	Electrical insulation. Thermal evaluation and designation
BS EN 60664-1	Insulation coordination for equipment within low-voltage systems. Principles, requirements and tests
BS EN 61238-1	Compression and mechanical connectors for power cables for rated voltages up to 36 kV (Um = 42 kV). Test methods and requirements
BS EN 61558-1	Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests
BS EN 61857-22	Electrical insulation systems. Procedures for thermal evaluation. Specific requirements for encapsulated-coil model. Wire-wound electrical insulation system (EIS)
BS EN 60137-0-3	Specification for particular types of winding wires. General requirements. Enamelled round aluminium wire
BS EN ISO 10007	Quality management systems. Guidelines for configuration management

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BRS SM 440 Sht 4	Standard Apparatus case G.A. of small case framework typical example
BRS SM 440 Sht 5	Standard apparatus case G.A. of large case framework typical example
Directive 2006/95/EC	Low voltage directive (LVD) 2006/95/EC
NR/L2/RSE/100/05	Product introduction and change

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1 Purpose

This specification defines the requirements for signalling functional supply point (FSP) isolating transformers and any intermediate transformers used to power signalling loads. The primary function of this specification is to clearly define to manufacturers the minimum performance requirements that need to be achieved for product acceptance to be considered. The secondary function of this specification is to provide background information to Electrical Power designers, Signalling designers, Signalling installers and Signalling maintainers.

2 Scope

This specification defines the performance requirements for Class I and Class II hybrid, signalling FSP and intermediate transformers with a power rating of up to and including 10kVA. Unless otherwise stated, the requirements are required to be considered common to both Class I and Class II hybrid transformers.

The requirement for Class II hybrid transformers, where it is specified, is with respect to the primary winding only. There is no requirement for the secondary winding to be Class II.

Signalling FSP isolating transformers may be housed either in signalling equipment apparatus cases, relocatable equipment buildings or control centres, or co-located in electrical and plant apparatus cases.

NOTE: The size of Class I and Class II hybrid signalling FSP isolating transformers has been limited to ensure that system leakage currents are not exceeded. This limits the number of circuits to ensure distributed cable capacitance does not exceed limits that will affect insulation monitors and/or give rise to electric shock under earth fault conditions.

3 Definitions

Class I transformer	Transformer in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means, such as a protective earth terminal, are provided for the connection of accessible conductive parts to the protective earth conductor in the fixed wiring of the installation, so that accessible conductive parts cannot become live in the event of a failure of the basic insulation (from EN 61558).
Class II transformer	Transformer in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions (from EN 61558).
Class II hybrid	Transformer in which the primary side, including its terminals, meet the requirements for Class II and the secondary side meets the requirements for Class I, allowing ready access to the secondary tapplings for adjustment in service.

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Functional supply point (FSP)	The point at which the power supply distribution system connects with an item of supplied equipment.
Principal supply point (PSP)	The a.c. supply point to the FSP.
Rated supply voltage	The rated supply voltage is the nominal output voltage derived from the PSP output that is connected to the primary, e.g., a supply sourced from a 650V PSP shall be considered to have a rated supply voltage of 650V.
Rated output voltage	The rated output voltage is the optimum load voltage desirable at the secondary, e.g., a transformer providing a BX110 supply shall be considered to have a rated supply voltage of 110V.

4 Symbols and abbreviations

A	amps
a.c.	alternating current
ART _{MEAN}	active repair time (mean)
ART _{MAX}	active repair time (maximum)
d.c.	direct current
EMC	electromagnetic compatibility
FSP	functional supply point
Hz	hertz
kVA	kilo-volt-amperes
mm	millimetre
PIDG	pre-insulated diamond grip
PSP	principal supply point
rms	root mean square
UV	ultraviolet
V	volts
Ω	ohms
°C	degrees Celsius

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5 Electrical

5.1 General

The following clauses define the electrical performance requirements for signalling FSPs and power transformers. Some prescriptive requirements are also identified and have been defined to achieve functional interchangeability of different manufacturers' designs, and achieve backwards compatibility with existing transformers.

5.2 Class II hybrid transformer construction

The primary side, including its terminals, shall meet the requirements of BS EN 61558-1 for a Class II isolating transformer. Where the requirements of this standard exceed those given in BS EN 61558-1, the requirements of this standard shall be met.

NOTE 1: For guidance, attention is drawn to the following clauses of BS EN 61558-1:2009:

1. Clause 8.11: Graphical symbols
2. Clause 9.1.2: Accessibility to hazardous live parts
3. Clause 18.2: Insulation resistance
4. Clause 18.3: Dielectric strength test
5. Clause 18.5.1: Touch current
6. Clause 18.5.2: Protective earth conductor current
7. Clause 19: Construction (specifically subclauses 19.4/5/6/9/22)
8. Clause 20: Components
9. Clause 22: Supply connection of other flexible cables and cords (specifically subclauses 22.9.2 and 22.9.5)
10. Clause 23: Terminals for external conductors (specifically subclauses 23.1/7/9)
11. Clause 24.1: Provisions for protective earthing.

NOTE 2: The requirements of BS EN 61558-1 are not expected to have a significant impact on the design of existing transformers.

NOTE 3: The insulation withstand requirements of this standard are higher than those given in BS EN 61558-1 (see Section 5.15).

5.3 Input

The input power to a signalling FSP isolating transformer should be assumed to have the following characteristics:

- the rated supply voltage is within a tolerance of $\pm 10\%$ of nominal;
- the established rated supply voltages include, but are not limited to: 110V, 230V, 400V, 415V, 440V and 650V;
- the rated supply voltage has a nominal frequency of 50Hz with a tolerance of +4% to -6%.