

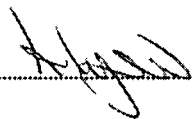
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| Issue | 2               |
| Date  | April 2006      |

# Business Process Document

## 25 kV a.c. power transformers and voltage regulators for auxiliary supplies

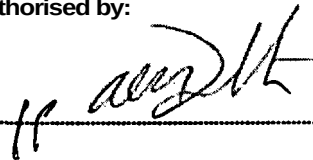
### Endorsement & Authorisation

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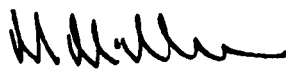
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## Issue record

| Issue | Date       | Comments                                                                       |
|-------|------------|--------------------------------------------------------------------------------|
| 2     | April 2006 | Re-issued as a SAF3 Business Process Document ( <i>formerly RT/E/S/27185</i> ) |

## Implementation

1 April 2006

## Compliance

This Network Rail product specification is mandatory and must be complied with by Network Rail and its contractors from 1 April 2006

When this product specification is implemented, it is permissible for all projects, which have formally completed GRIP Level 4 to continue to comply with the Issue of any relevant Network Rail standards current when GRIP Level 4 was reached and not to comply with requirements contained herein unless the head of electrification and plant has stipulated otherwise in the accompanying briefing note.

Where the head of electrification and plant has specified that all projects will comply with the requirements, specific authority not to comply can be sought in the usual manner using the appropriate non-compliance authority processes described in Network Rail standard, [NR/SP/STP/045](#) *Managing the process for non-compliance authority* (formerly RT/LS/P/045).

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|        |                        |
|--------|------------------------|
| Ref:   | <b>NR/PS/ELP/27185</b> |
| Issue: | 2                      |
| Date:  | April 2006             |

## Contents

|      |                                                                               |    |
|------|-------------------------------------------------------------------------------|----|
| 1    | Purpose                                                                       | 6  |
| 2    | Scope                                                                         | 6  |
| 3    | Reference documentation                                                       | 6  |
| 4    | Definitions                                                                   | 6  |
| 5    | General clauses                                                               | 7  |
| 5.1  | Safety                                                                        | 7  |
| 5.2  | Design, manufacture and workmanship                                           | 7  |
| 5.3  | Spare parts and consumables                                                   | 8  |
| 5.4  | Drawings                                                                      | 8  |
| 5.5  | Instruction manual                                                            | 9  |
| 6    | Compliance with standards                                                     | 10 |
| 6.1  | Network Rail Company Standards, European, International and British Standards | 10 |
| 6.2  | Specific equipment standards                                                  | 10 |
| 7    | General performance requirements                                              | 10 |
| 7.1  | General                                                                       | 10 |
| 7.2  | Environmental conditions                                                      | 11 |
| 7.3  | Noise emission                                                                | 11 |
| 7.4  | Maintainability                                                               | 11 |
| 7.5  | Special tools and test equipment                                              | 11 |
| 7.6  | Reliability and availability                                                  | 12 |
| 7.7  | Service life                                                                  | 12 |
| 7.8  | Interchangeability                                                            | 12 |
| 7.9  | Finish and resistance to corrosion                                            | 12 |
| 7.10 | Nuts, bolts and washers                                                       | 13 |
| 7.11 | Oil filled chambers                                                           | 13 |
| 7.12 | Materials                                                                     | 13 |
| 7.13 | Labels                                                                        | 13 |

|        |                        |
|--------|------------------------|
| Ref:   | <b>NR/PS/ELP/27185</b> |
| Issue: | 2                      |
| Date:  | April 2006             |

|        |                                                        |    |
|--------|--------------------------------------------------------|----|
| 8      | Technical and constructional requirements              | 14 |
| 8.1    | General                                                | 14 |
| 8.2    | Core flux density                                      | 14 |
| 8.3    | Insulating oil                                         | 14 |
| 8.4    | Self contained regulating transformers                 | 14 |
| 8.5    | Preferred components                                   | 14 |
| 9      | Power transformers                                     | 14 |
| 9.1    | Type and rating                                        | 14 |
| 9.1.1  | Type                                                   | 14 |
| 9.1.2  | Rating                                                 | 15 |
| 9.2    | Terminals and bushings                                 | 15 |
| 9.2.1  | Primary winding                                        | 15 |
| 9.2.2  | Secondary winding                                      | 15 |
| 9.2.3  | Air clearances                                         | 16 |
| 9.2.4  | Vandal resistant bushings and shed protectors          | 16 |
| 9.3    | Earth screen                                           | 16 |
| 9.4    | Mounting of power transformers                         | 16 |
| 9.4.1  | Terminals and bushings for ground mounted transformers | 17 |
| 9.5    | Dimensions of equipment                                | 17 |
| 9.6    | Weight                                                 | 17 |
| 9.7    | Fittings                                               | 17 |
| 9.8    | Transformer tank                                       | 18 |
| 9.8.1  | Construction                                           | 18 |
| 10     | Voltage regulators                                     | 18 |
| 10.1   | Voltage regulators for signalling supplies             | 18 |
| 10.1.1 | Type                                                   | 18 |
| 10.1.2 | Signalling supply units                                | 19 |
| 10.1.3 | Output voltage                                         | 19 |
| 10.1.4 | Distortion limits                                      | 19 |
| 10.1.5 | Control circuits                                       | 20 |
| 10.1.6 | Terminals                                              | 20 |
| 10.1.7 | Reliability                                            | 20 |

|             |                                                                                                                                     |    |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------|----|
| 10.2        | Voltage regulators for non-signalling supplies                                                                                      | 21 |
| 10.2.1      | Type                                                                                                                                | 21 |
| 10.2.2      | Output voltage                                                                                                                      | 21 |
| 10.2.3      | Response time                                                                                                                       | 22 |
| 10.2.4      | Terminals                                                                                                                           | 22 |
| 10.2.5      | Manual control                                                                                                                      | 22 |
| 10.3        | Fuses                                                                                                                               | 22 |
| 10.4        | Enclosures                                                                                                                          | 23 |
| 10.5        | Control equipment                                                                                                                   | 23 |
| 10.6        | Printed circuit boards                                                                                                              | 23 |
| 11          | Inspection and testing                                                                                                              | 23 |
| 11.1        | Type tests at place of manufacture or accredited testing facility                                                                   | 24 |
| 11.1.1      | Power transformer                                                                                                                   | 24 |
| 11.1.2      | Voltage regulator                                                                                                                   | 24 |
| 11.1.3      | Voltage regulator                                                                                                                   | 25 |
| 11.1.4      | Performance tests                                                                                                                   | 25 |
| 11.2        | Routine and site tests                                                                                                              | 26 |
| 11.2.1      | Power transformer                                                                                                                   | 26 |
| 11.2.2      | Voltage regulator                                                                                                                   | 26 |
| 11.3        | Mechanical tests                                                                                                                    | 26 |
| 11.4        | Test certificates                                                                                                                   | 26 |
| Appendix A1 | Typical test results of traction current harmonics                                                                                  | 27 |
| Appendix A2 | Typical harmonic voltages due to traction loads                                                                                     | 28 |
| Appendix B  | Drawing no. I/121/806/A3 "Auxiliary supplies transformer"                                                                           | 31 |
| Appendix C  | Drawing no. HP/D/18027 "Terminal clamp for use on M20 or 3/4" B.S.W. bushing"                                                       | 32 |
| Appendix D  | Drawing no. HP/D/17820 "Mounting details and clearance requirements for live end and earth end bushings for auxiliary transformers" | 33 |

## 1 Purpose

25 kV single phase 50 Hz Power Transformers and associated Voltage Regulators are used to provide standby supplies from the overhead line to signalling and other auxiliary equipment.

## 2 Scope

This specification covers the design, manufacture, testing and delivery of 25 kV single phase 50 hz power transformers and associated voltage regulators together with the preparation of drawings and instruction manuals.

The equipment will be erected under a separate contract.

## 3 Reference documentation

|                          |                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| BS 88 Part 2             | Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c.                                                   |
| <a href="#">BS 148</a>   | Specification for unused and reclaimed insulating oils for transformers and switchgear                                         |
| BS 223                   | Specification for bushings for alternating voltages above 1000 V                                                               |
| BS 729                   | Hot dip galvanized coating on iron and steel articles                                                                          |
| BS 2011                  | Environmental testing                                                                                                          |
| <a href="#">BS 5499</a>  | Graphical symbols and signs. Safety signs, including fire safety signs. Specification for geometric shapes, colours and layout |
| <a href="#">BS 7671</a>  | IEE Wiring regulations                                                                                                         |
| <a href="#">EN 60076</a> | Power transformers                                                                                                             |
| <a href="#">EN 60137</a> | Insulating bushings for alternating voltages above 1000 V                                                                      |
| <a href="#">EN 60617</a> | Graphic symbols for diagrams                                                                                                   |
| BS EN ISO 9000 series    | Quality management and quality assurance standards.                                                                            |

## 4 Definitions

For the purpose of this product specification the following definitions shall apply:

|                         |                                                                                                         |
|-------------------------|---------------------------------------------------------------------------------------------------------|
| <b>British Standard</b> | A standard published by the British Standards Institution. Its alphanumeric identity is prefixed by BS. |
| <b>Equipment</b>        | The equipment covered by this specification, including all component parts and accessories.             |

|                                  |                                                                                                                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>European Standard</b>         | A standard published by the European Committee for Standardisation or by the European Committee for Electrotechnical Standardisation. Its alphanumeric identity is prefixed by EN. |
| <b>International Standard</b>    | A standard published by the International Electrotechnical Commission. Its alphanumeric identity is prefixed by IEC.                                                               |
| <b>Network Rail Standard</b>     | A collective term for a Network Rail documents published by a directorate of Network Rail PLC. Its alphanumeric identity is prefixed by NR/, followed by a unique reference.       |
| <b>Procurement specification</b> | Network Rail's contract specific documentation, such as, Invitation to Tender or Technical Workslope.                                                                              |

## 5 General clauses

### 5.1 Safety

At all times the equipment shall be safe. Measures shall be taken to ensure the safety of persons concerned in its installation, operation, maintenance, repair and its eventual disposal. All equipment and connections for the safe and satisfactory operation, control and protection of the equipment concerned, shall be provided whether or not specifically mentioned.

The equipment shall be adequately provided with padlocking facilities, earthed, insulated, screened, enclosed etc. Safe and appropriate access shall be provided for operation and maintenance purposes.

The supplier shall provide training in safe operation and maintenance of the equipment.

### 5.2 Design, manufacture and workmanship

The equipment shall be designed and manufactured in accordance with best practice, taking cognisance of the system in which it will operate. All material shall be of the quality and of the type most suitable for working under the conditions specified for the full service life of the equipment.

### 5.3 Spare parts and consumables

The supplier shall make recommendations to the purchaser for holdings of spare parts and consumables based on estimated replacement rates and delivery periods to ensure that the equipment complies with this product specification throughout its specified service life. The supplier shall indicate the extent of commonality with equipment previously supplied.

### 5.4 Drawings

Drawings of the equipment covering each of the following aspects shall be submitted to the purchaser for scrutiny with the tender return:

- a) General arrangement of the power transformer and voltage regulator.
- b) Section drawings of power transformer and voltage regulator showing construction details of construction.
- c) General arrangement of bushing insulators.
- d) Drawings of equipment showing foundation requirements with loadings.

Drawings of the equipment covering each of the following aspects shall be submitted to the purchaser for scrutiny before the installation of the equipment:

- e) General arrangement of the equipment
- f) Static and dynamic loadings and foundation and fixing requirements.
- g) Schematic/circuit diagrams.
- h) Detailed arrangement of voltage regulator control equipment including printed circuit board layout drawings.
- i) Diagram and rating plates.
- j) Details of cable terminations.
- k) Detailed wiring diagram or schedules.

All diagrams shall be legible and of good quality. Where symbols are used, they shall be in accordance with [EN 60617](#).

Unless otherwise stated in the procurement specification, four copies of each drawing shall be provided.

Where it is essential for clear understanding of the circuits, block or circuit diagrams shall include details of existing components or components not being provided by the supplier. Wiring diagrams shall include any unused wires, contacts, plugs, sockets, terminals and the like.

As an alternative to separate circuit and wiring diagrams, combined diagrams may be provided. In this case, the position of each wire termination shall be indicated either on the drawing or by means of a schedule of terminations.

|        |                        |
|--------|------------------------|
| Ref:   | <b>NR/PS/ELP/27185</b> |
| Issue: | 2                      |
| Date:  | April 2006             |

Circuit diagrams and wiring diagrams should be kept to a minimum. Generic diagrams are encouraged where appropriate to keep the quantity of diagrams to a minimum.

A short description of each revision shall be provided under consecutive revision letters or numbers together with the date.

Wherever feasible, some means shall be used to identify the location of the most recent revision, for instance by circling the locations.

All drawings shall be brought up to date as necessary, to provide a permanent as-fitted record and shall be supplied in the software format specified in the procurement specification.

## 5.5 Instruction manual

The supplier shall produce a comprehensive and specific instruction manual covering all aspects of installation, operation and maintenance and eventual disposal, and shall supply the number of copies specified. The manual shall provide guidance to enable all work to be carried out safely and efficiently. The manual shall contain only relevant information and shall include:

- a) A description of the construction, installation, functioning and rating of the equipment.
- b) Operating instructions, including safety and isolation procedures.
- c) Procedures with periodicities for routine maintenance including any special precautions, fault finding and major overhauls.
- d) A list of all consumable items with part numbers or references.
- e) Full details of recommended adjustments and settings for the equipment and its protective devices where appropriate.
- f) Instructions for eventual disposal including safety and handling precautions and recommendations.
- g) Drawings, illustrations and data enabling all component parts to be readily identified and to allow procurement for replacement purposes.
- h) The drawings listed in clause 5.4 entitled 'Drawings'.
- i) A list of locations and associated serial numbers.

The manual shall be of loose leaf design with at least four retaining rings and with oil resistant hard covers. It shall be of A4 size and include drawings reduced to A3 or A4 size. Drawings reduced in size shall remain clearly legible. The purchaser may accept drawings larger than A3 subject to suitable, clearly labelled protective drawing storage folders being provided for inclusion in the manual.

|        |                        |
|--------|------------------------|
| Ref:   | <b>NR/PS/ELP/27185</b> |
| Issue: | 2                      |
| Date:  | April 2006             |

Unless otherwise stated in the procurement specification, two paper copies of the final version of the manual shall be submitted to the purchaser prior to delivery of the equipment. In addition, two electronic copies of the manual shall be supplied to the purchaser.

Before the purchaser takes over full responsibility for the equipment, for example, at the expiry of the warranty period, any necessary modifications shall be made and sufficient paper copies provided to the purchaser for incorporating into the full quantity of manuals supplied. In addition, two electronic copies of the modified manual shall be supplied to the purchaser.

## 6 Compliance with standards

### 6.1 Network Rail Company Standards, European, International and British Standards

The equipment shall comply with relevant Network Rail standards and European Standards EN's whether or not reference is made to them.

The English language versions of EN's are British Standards referred to as BS EN's.

In the absence of European Standards, International Standards or British Standards, best practice having currency within the European Community shall apply subject to the prior agreement of the purchaser.

The editions of standards current at the date of tender shall apply. Where superseded standards are referenced, the replacement standard will apply.

### 6.2 Specific equipment standards

The standards listed in clause 3 entitled 'Reference documentation', shall be adhered when specified in this specification and as appropriate. In particular, [EN 60076](#) and [BS 7671](#) shall be adhered to.

Where superseded standards are referenced and there is a direct replacement, the replacement standard shall apply.

Where there are conflicts between standards that may affect the design and equipment supplied which are not resolved within this standard or in the procurement specification, the purchaser shall be informed in writing with a proposed solution.

## 7 General performance requirements

### 7.1 General

The power transformer and voltage regulator equipment shall be fully functional, complete and in accordance to this specification.

|        |                        |
|--------|------------------------|
| Ref:   | <b>NR/PS/ELP/27185</b> |
| Issue: | 2                      |
| Date:  | April 2006             |

The equipment shall be fit for its intended purpose when connected to Network Rail's electrification system.

## 7.2 Environmental conditions

The equipment shall be suitable for its rated characteristics when installed at locations adjacent to railway tracks.

The normal service conditions include the following:

- a) The minimum ambient air temperature for indoor equipment shall be -5 °C.
- b) The maximum ambient air temperature for indoor equipment shall be +40 °C and not exceeding +35 °C average over any 24 hour period.
- c) The minimum ambient air temperature for outdoor equipment shall be -25 °C.
- d) The maximum ambient air temperature for outdoor equipment shall be +40 °C and not exceeding +30 °C average over any 24 hour period.
- e) The equipment is subject to strong magnetic fields emanating from adjacent electrical equipment and to vibration caused by passing trains.
- f) Hand-held portable radio transmitter/receiver apparatus will be used near the equipment.
- g) The ambient air is polluted by the presence of airborne iron dust from train brakes.

## 7.3 Noise emission

Noise emission from indoor and outdoor equipment shall be the minimum practicable and shall be less than 55 dB (A) measured at any point 2 m in a horizontal direction from the envelope of any item. In addition, the level in any of the octave bands of centre frequency 250 Hz, 500 Hz, 1 kHz, 4 kHz and 8 kHz shall be less than 53 dB. All levels shall apply to the equipment when operating over its full working range. Ambient noise level shall be assumed to be 10 dB below these values.

The installation building or housing shall be considered to have reverberant surfaces.

## 7.4 Maintainability

The equipment shall be designed for minimum maintenance. A power transformer and voltage regulator should not require a shutdown for routine preventive maintenance for more than a single hour in a two year period.

## 7.5 Special tools and test equipment

The supplier shall advise the purchaser of any special tools and test equipment required for the installation, operation and maintenance of the equipment.