



Electricity Specification 397

Issue 3 July 2006

Electrical Installations within Distribution Substations

Contents

- 1 Scope
- 2 Technical and Performance Requirements
- 3 Documents Referenced
- 4 Keywords

Approved for issue by the Technical Policy Panel

© 2010 Electricity North West Limited.

All Rights Reserved

The copyright of this document, which contains information of a proprietary nature, is vested in Electricity North West Limited. The contents of this document may not be used for purposes other than that for which it has been supplied and may not be reproduced, either wholly or in part, in any way whatsoever. It may not be used by, or its contents divulged to, any other person whatsoever without the prior written permission of Electricity North West Limited.

Amendment Summary

Amendment No. Date	Brief Description and Amending Action
0 9/06/03	<p>Issue 1</p> <p>First Issue</p> <p>Prepared by: G Bryson.</p> <p>Authorised by the Standards Steering Group and signed on its behalf by: Paul Whittaker Policy & Standards Manager</p>
0 01/03/05	<p>Issue 2</p> <ul style="list-style-type: none"> • Cable requirements changed from double insulated to PVC insulated and sheathed. • Circuit socket outlets changed from ring circuit with 32A MCB to radial socket outlet circuit with 20A MCB. • Installation height of consumer unit added. • Removed use of bulkhead luminaries; • Added requirement for polycarbonate cover and • Changed rating of light switch to 10A rated, non-grid type. • Changed socket labelling to read “Test Equipment Only”. <p>Prepared by: G Bryson.</p> <p>Authorised by the Standards Steering Group and signed on its behalf by:</p>
0 01/07/06	<p>Issue 3</p> <ul style="list-style-type: none"> • Conduit now specified as high impact rather than heavy duty and reference to colour removed • Cable size now specified as a minimum size • Wording added to state that UU will confirm if heating, battery charger and dehumidification supplies are required • 2.1 – Cable size changed from 16mm² to 4mm² • 2.2 – Section reworded to request 2 radial circuits for sockets and to clarify each way of the consumer unit and the required labelling. Consumer unit now to be totally enclosed • 2.3 – Luminaires now to be to IP65 and positioning to be considered for maintenance purposes. Other wording altered for clarification • 2.9 – Specifications for labels added • 2.10 – Details of where test certificates to be sent added <p>Prepared by: G Bryson.</p> <p>Authorised by the Standards Steering Group and signed on its behalf by:</p>

<p>1</p> <p>01/03/07</p>	<p>Issue 3</p> <ul style="list-style-type: none"> • Rating of MCB for lighting circuit changed from 10A to 6A <p>Prepared by: G Bryson.</p> <p>Authorised by the Standards Steering Group and signed on its behalf by:</p>
<p>2</p> <p>16/07/07</p>	<p>Issue 3</p> <ul style="list-style-type: none"> • Wording added to Scope to clarify that this specification applies to all substations housing UU equipment but not necessarily owned by UU <p>Prepared by: G Bryson.</p> <p>Authorised by the Standards Steering Group and signed on its behalf by:</p>

ELECTRICAL INSTALLATIONS WITHIN DISTRIBUTION SUBSTATIONS

1. SCOPE

This specification covers the requirements for the electrical installation works within indoor 6.6kV or 11kV Distribution Substations (non-kiosk type) housing equipment owned and operated by Electricity North West Limited, hereinafter referred to as Electricity North West. This specification supersedes and replaces ES397 – Issue 2.

16/07/07

A typical substation wiring installation shall comprise:

- Low Voltage Main Supply
- Mains and Distribution Equipment
- General Lighting Installation
- General Power Installation
- Electric Heating Installation
- Auxiliary Supplies for Battery Charger Unit (where required)
- Facility for Supply to Dehumidification Unit (where required)
- Earthing of the Installation
- Labelling of the Installation
- Inspection & Testing

2. TECHNICAL AND PERFORMANCE REQUIREMENTS

2.1 Low Voltage Main Supply

General

In each substation, the method to provide the low voltage supply shall be selected from the Options below and agreed between the Engineer and the contractor, who shall consider all Health & Safety implications and relevant Electricity North West policies.

Option 1 (preferred option)

The preferred option for arranging the low voltage supply for the substation electrical installation shall be to take the supply from the low voltage fuseboard within the substation.

Commonly, many low voltage fuseboards within distribution substations have provision for an auxiliary supply to be taken from a High Rupturing Capacity (HRC) fuse of 32A rating mounted on the front of the low voltage board framework. The supply to the new consumer unit shall be connected to this fuse via 4mm² copper, either insulated and sheathed PVC singles, contained in high impact conduit / trunking, or SWA cable.

If no auxiliary fused supply exists, then if practical, a 32amp rated HRC fuse carrier shall be installed to provide this supply.

Should the foregoing supply arrangement not exist then other options as detailed below shall be considered for the provision of the low voltage supply.

Option 2

This option shall be used, wherever practicable, when the preferred option is not available.

The low voltage supply shall be taken from a phase core of a suitable low voltage cable fed from the substations low voltage board. The method of connection shall be by a Electricity North West approved live piercing type connector. The neutral / earth conductor shall be either connected to the corresponding neutral on the main cable or to the LV board's neutral bar if 3 core waveform type cables are in use.

The sub mains cabling shall terminate in a standard 100A cut-out complete with a 60A HRC fuse.

The supply to the cut-out shall be connected via 16mm² copper insulated and sheathed PVC singles, contained in high impact conduit or trunking.

This method of installation shall be undertaken by competent staff that are trained to work on the Electricity North West low voltage network.

Option 3

This option shall be used when options 1 and 2 above are not practical.

The low voltage supply for the substation electrical installation shall be taken from a separate low voltage incoming single phase service cable. The incoming service cable shall be connected to an underground Low Voltage mains cable within the substation grounds and shall supply a standard 100A cut-out complete with a 60A HRC fuse. The distribution cabling to the new consumer unit shall be connected to this cut-out via 16mm² copper insulated and sheathed PVC single cables or 3 core 16 mm² steel wire armoured cable if more suitable.

This method of installation shall be undertaken by competent staff that are trained to work on the Electricity North West low voltage network.

2.2 Mains & Distribution equipment

The contractor shall supply and install the following equipment:

1 N^o 100A rated single phase totally enclosed metalclad consumer unit. Consumer unit outgoing circuits shall be configured into outgoing ways as indicated below:

Way 1: Radial Circuit Socket Outlet - 20A MCB, labelled "General Power"

Way 2: Radial Circuit Socket Outlet - 20A MCB, labelled "Test Equipment Power"

Way 3: Radial Circuit Lighting - 6A MCB, labelled "Lighting"

01/03/07

And in special circumstances, if requested by Electricity North West in writing any or all of the following: -

Way 4: Radial Circuit Electric Heating - 20A MCB, labelled "Heating"

Way 5: Radial Circuit Dehumidifier - 20A MCB, labelled "Dehumidifier"

Way 6: Radial Circuit Battery Charger - 20A MCB, labelled "Battery Charger"

All consumer units shall have a minimum of 1 spare way. Any ways that are not utilised will have blank inserts fitted and labelled up as a spare way.

All MCBs installed shall be to BS EN 60898 Type B.

All conduits shall be high impact pvc. On completion of the wiring all conduits shall have at least 35% spare capacity

All accessories shall be metalclad and sourced from a quality manufacturer.

The cut-out shall be mounted on a standard meter board fixed via plastic spacers to the substation wall. The meter board shall be fixed at least 1m from the nearest part of the low voltage board. The consumer unit top edge shall be positioned 1200mm above the finished floor level (AFFL).

2.3 General Lighting Installation

The contractor shall supply and install the general lighting installation as detailed below:

The general lighting installation shall comprise linear fluorescent luminaires to IP65. (See guidelines below). Circuit wiring to the luminaires shall be carried out using a minimum size of 1.5 mm² pvc copper single cables + a minimum size of 1.5 mm² pvc circuit protective conductor. The circuit wiring shall be contained within 20mm high impact pvc conduit.

The number of luminaires installed shall depend upon the substation dimensions and arrangement of apparatus within the substation. The service luminance level shall be a minimum of 130 lux on and in front of all Low Voltage and High Voltage apparatus.

The luminaires shall be fixed to a ceiling having a maximum height of 3 metres to FFL.

For buildings with a ceiling height greater than 3 metres the luminaires will be wall mounted.

To achieve this level of luminance the following guidelines apply:

Substation Dimensions	Lighting Requirement
4m x 3m	2N ^o -1.8m twin fluorescent luminaires to IP65.
7m x 4m	4N ^o -1.8m twin fluorescent luminaires to IP65.

The luminaires shall be spaced to provide an even level of illumination and shall be positioned, where possible, to provide maximum illumination on High Voltage and Low Voltage switchgear. The position of luminaires shall be such that they provide for safe working conditions for staff carrying out HV and LV operational work.

The contractor shall supply and install a one way switch immediately adjacent the entrance door, the switch shall be surface mounted at 1200mm to top AFFL. The exact position of the switch shall be considered before installation. Switches shall be mounted to be within easy reach of a person, immediately on entry to the substation via a single door or via the first leaf of a double door, without endangering the person through coming into contact with any exposed live LV apparatus such as LV boards, etc.

All switches shall be metalclad 6 / 10 A rated and incorporate a permanently illuminated neon locator to indicate the switch location for staff entering the substation during darkness. These switches shall be based on a grid switch system.

Two-way or intermediate switching shall be installed where the substation has two or more entrances. Each switch shall incorporate a neon locator.

The contractor shall avoid the installation of luminaires or wiring containment directly above open type Low Voltage boards due to the increased risk to Health & Safety.

2.4 General Power Installation

The contractor shall supply and install the general power installation as detailed below.

The general power installation shall comprise of 2 No two gang 13A switched socket outlets.

The socket outlets shall be standard metalclad type and shall comply with BS 1363. The socket outlets shall be wall mounted adjacent to each other at a height of 450mm to lower edge AFFL.

Wiring to the socket outlets shall be in a minimum size of 2.5mm² pvc copper singles cables + a minimum size of 1.5mm² pvc circuit protective conductor. The socket outlets shall be connected as two single radial circuits from the consumer unit.

Each socket outlet shall be designated for use as follows:

Socket Outlet No1 (Way 1 of the consumer unit) shall be 13A rated with integral 30mA RCD protection and used for general power tools etc.

Socket Outlet No2 (Way 2 of the consumer unit) shall be a standard 13A switched socket outlet, labelled 'TEST EQUIPMENT ONLY'

2.5 Electric Heating Installation

The contractor shall supply and install an electric heating installation in the following Distribution Substations:

Those that contain High Voltage apparatus specifically designed for indoor use (this rule applies only where it is considered that the Distribution Transformer within the substation is unlikely to provide sufficient heat to maintain an adequate temperature). This situation will probably be experienced where transformers are very lightly loaded during winter.

Those that contain High Voltage apparatus specifically designed for indoor use where no Distribution Transformer is present. In this case the transformer will probably be installed in an adjacent room and will offer no heat gain to the room housing the High Voltage apparatus.

The purpose of the heating installation is to maintain a temperature of 10°C within the substation so that apparatus such as oil dashpots/switch mechanisms and battery charger unit's etc. remain in serviceable and satisfactory working order.

The heating installation shall comprise of a 2kW wall mounted panel heater.

The panel heater shall be installed on the wall at the rear of the high voltage switchgear, where possible, and shall be controlled by an external thermostat located away from the heater with a typical range of 0°C to 35°C. The thermostat should be set to 10°C and be mounted at 1800mm AFFL.

In substations larger than 7m x 4m the contractor shall install 2.No heaters to provide the required protection.

Wiring to each panel heater shall be carried out in radial circuits using a minimum size of 2.5mm² pvc copper singles cables + a minimum size of 1.5mm² pvc circuit protective conductor. Each panel heater shall be controlled via a 13A switched metalclad fused connection unit, with flex outlet and neon indicator, fixed at 450mm AFFL adjacent the panel heater.

The final connection to the panel heater shall be in 3-core 1.5mm² heat resistant flexible cable securely clipped to the substation wall if required.

2.6 Auxiliary Supplies to Battery Charger Unit (where required)

These supplies are required in substations that contain a battery for the purpose of high voltage protection tripping supplies. Electricity North West will confirm in writing, at the design approval stage, or at a point where the design is formally issued for construction, if this is required. If no such written confirmation is issued there will not be a requirement for this circuit.

The contractor shall supply and install a radial circuit wired in a minimum size of 2.5mm² pvc copper singles cables + a minimum size of 1.5mm² pvc circuit protective conductor contained within 20mm high impact pvc conduit.

The contractor shall supply and install a 13A unswitched metalclad fused connection unit, with flex outlet and neon indicator, adjacent to the battery charge unit and make final connection in suitably rated 3 core heat resistant flexible cable.

2.7 Facility for Dehumidification Unit Supply

The contractor shall supply and install a 20A MCB within the Consumer Unit for the provision of a circuit to a dehumidification unit (if required). Electricity North West will confirm in writing, at the design approval stage, or at a point where the design is formally issued for construction, if this is required. If no such written confirmation is issued there will not be a requirement for this circuit.

2.8 Earthing of the Installation

The whole of the electrical installation shall be earthed to comply with the current edition of the IEE Regulations for Electrical Installations-BS7671.

The contractor shall supply and install 16mm² pvc copper single cable as a main earthing conductor from the substation low voltage earth bar to the new cut-out for the substation electrical installation. The consumer unit shall be connected to the earth system using 16mm² pvc copper single cable.

2.9 Labelling of the Installation

The whole of the electrical installation shall be labelled to comply with the IEE Regulations for Electrical Installations-BS7671, and in accordance with sections 2.2 and 2.4 of this specification.

In general, labels shall be fixed to the following items:

Item	Text
Main Earth Connection to Substation LV Bar	Electrical Earth-Do Not Remove
Distribution Consumer Unit (all circuits labelled)	As section 2.2
Test Van Socket Outlet	Test Equipment Only

All labels shall be clearly printed and unambiguous.

2.10 Inspection & Testing of the Installation

During and at the completion of the works, the entire electrical installation shall be inspected, tested and commissioned in accordance with BS7671 and the results recorded on the Electrical Installation Works Certificate, an example of which can be found in BS7671-Section 7 - Inspection & Testing. One copy of the certificates shall be stored on site in the LV cabinet and one copy of the certificates shall be returned to Regional Work Planning in order for the data to be entered into the Master Asset Management System.

3. DOCUMENTS REFERENCED

- 3.1 BS EN 60898: Specification for Circuit Breakers for Overcurrent Protection for Household and Similar Installations.
- 3.2 BS 1363: 13A Plugs, Socket Outlets and Adaptors.
- 3.3 BS 7671: 2001 Requirements for Electrical Installations.

4. KEYWORDS

Distribution; Battery; LV Board; Inspection; Lighting; Substation; Wiring