Electricity Specification 400C21

Issue 1 July 2008

Mechanical Connectors and Lugs for Cables (operating in the range LV to 33kV)

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   A2: 11kV Connectors and Lugs
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Approved for issue by the Technical Policy Panel

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## Issue and Amendment Summary

<table>
<thead>
<tr>
<th>Amendment No.</th>
<th>Date</th>
<th>Brief Description and Amending Action</th>
</tr>
</thead>
</table>
| 0            | 11/07/08 | Issue 1  
First Issue  
Prepared by: JS  
Approved by the Technical Policy Panel and signed on its behalf by: |
Uncontrolled copy.
MECHANICAL CONNECTORS AND LUGS FOR CABLES
(OPERATING IN THE RANGE LV TO 33KV)

1. INTRODUCTION

This specification comprises general requirements for approvals and testing of mechanical connectors and lugs for cables operating in the range from LV to 33kV employed within the cable network operated and owned by Electricity North West Limited (hereinafter referred to as Electricity North West). Also included are technical particulars relating to the constructional requirements, and schedules of all mechanical connectors and lugs for cables, grouped by voltage, and in alphanumeric order within each voltage group (Appendices A1 to A3).

2. SCOPE

This specification covers all types of mechanical connectors and lugs used on cables operating in the range LV to 33kV. The range of operation also includes service cables.

3. DEFINITIONS

Approval: Sanction by the Engineer that specified criteria have been satisfied.

Contract: The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.

Contractor: The person or person's firm or company, including personal representatives, successors and permitted assigns, whose tender has been accepted by Electricity North West.


Engineer: Asset Policy and Standards Manager (Electricity North West) or his successor or such person specifically nominated on his behalf.

N/A: Not applicable.

Specification: The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.

Supplier: Any person or person's firm or company who supply goods to Electricity North West or Electricity North West's contractor.

Tender: An offer in writing to execute work or supply goods at a fixed price.

Tenderer: The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a tender.

Words: Words importing persons shall include firms and corporations; words importing the singular only, also include the plural, and vice versa where the context requires.

Work: All materials, labour and actions required to be provided or performed by the Contractor under the Contract.

Writing: Any manuscript, typewritten or printed statement under seal or hand as the case may be.
4. GENERAL REQUIREMENTS FOR APPROVALS AND TESTING

4.1 Product not to be changed

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Engineer, and receipt of agreement from the Engineer, in writing, to the proposed change.

4.2 Electricity North West technical approval

4.2.1 The Tenderer shall submit, with his tender, proposals for testing which will demonstrate, to the satisfaction of the Engineer, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

4.2.2 Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Engineer, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Engineer but will not be unreasonably withheld.

4.2.3 The supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

4.2.4 Approval shall be site specific and is not transferable to another site without the written approval of the engineer.

4.3 Quality assurance

4.3.1 The Tenderer shall confirm whether or not approval is held in accordance with a Quality Assurance Scheme accredited under ISO 9000. If not, he shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

4.3.2 The right is reserved for the Engineer to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

4.3.3 The Tenderer shall submit, with his tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Engineer, fitness for installation and service.

4.3.4 The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Engineer, be reasonably required for inspection and/or retention as quality control samples. The Engineer will confirm the requirements for samples at the time of tendering.

4.3.5 The right is reserved for the Engineer to make, from time to time, such inspections of the Tenderer's facilities as he may deem to be reasonably necessary to ensure compliance with this Specification and any Contract of which it forms a part.

4.3.6 The Tenderer shall submit, with his tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001: 1996 – Environmental Management Systems.
4.4 Formulation

The Tenderer shall submit, with his tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Etc Act 1974 and the Control of Substances Hazardous to Health Regulations 1988, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that he requires it to remain confidential and the Engineer will, if requested, confirm his agreement to this prior to receipt of the information.

4.5 Identification markings

4.5.1 The Tenderer shall submit, with his Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Engineer, and shall in all cases include the Electricity North West Approved Description and Commodity Code Number.

4.5.2 The Tenderer shall submit, with his Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Engineer.

4.6 Minimum life expectancy

The minimum life expectancy of all products covered by this specification is 60 years.

4.7 Manufacturers already approved

Clauses 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.3 and 4.3.4 will be waived in the case of products already approved.

4.8 Product conformity

Preference will be given to those suppliers who can provide suitable Product Conformity Certification to a recognised or specified standard, or an equivalent certification.

5. REQUIREMENTS FOR TYPE AND ROUTINE TESTING

The Engineer shall set out the requirement of the following tests to be carried out by the suppliers at the suppliers’ cost.

5.1 Requirement for type tests at the suppliers’ premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the specifier.

These may or may not be destructive tests.
5.2 Requirement for routine tests at the suppliers’ premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the specifier.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined.

6. CONSTRUCTIONAL REQUIREMENTS

6.1 All connectors and lugs covered by this specification are listed in Appendices A1 to A3.

6.2 The connectors, lugs and associated items included in this specification shall be made of aluminium unless stated otherwise in the Approved Description (refer to Appendices A1 to A3) or identified on the associated drawing. In every case, the material quality shall be such that the requirements of this specification are met.

6.3 Only critical dimensions are included on the drawings. Tolerances for outside dimensions are + 2mm, - 0mm.

Note: The drawings for each connector/lug type are given for reference purposes only and other types of connectors/lugs may be considered offering the same connection parameters. However, it should be noted that the dimensions given on the drawing may be critical, in both a physical and electrical sense, for the long term performance of the cable jointing system used.

6.4 Connectors shall meet the full requirements of BS EN 61238-1: 2003, after applying the tests given below in 6.5 or 6.6 where relevant.

6.5 Load pick up tests shall be performed on all sizes of Insulated Insulation Piercing Connectors (IPCs) on the smallest and largest cable the connector is suitable for at the maximum current rating of the cable. Six connectors shall be tested. Five at unity power factor and one at 0.8 power factor. The connectors shall pick up a load of 240 Amps on each occasion. The connectors that have been subjected to the load pick up test shall then be subjected to the full tests detailed in BS EN 61238-1.

6.6 Earth Bonds, both service and mains, shall be capable of carrying a maximum prospective short circuit current (PSCC) of 16kA for 1 second. Both earth bonds shall be subjected to the following tests:

(a) The service earth bond shall be tested on a 16mm² PILC (or equivalent) cable and the mains earth bond kit shall be tested on a 300mm² PILC (or equivalent) cable. The armoring shall be removed completely from each cable prior to the test.

(b) For both cables the maximum earth fault current shall be calculated for 1 second base on an ambient temperature of 20°C.

(c) Six earth bonds for both service and mains shall be subjected to earth fault current calculated in (b) above. The test shall be completed in still air. The lead sheath shall be allowed to cool to ambient before the next test is applied.

(d) The maximum continuous current rating of the lead sheaths shall be calculated for both cables based on an ambient temperature of 20°C. This current shall be applied to the bonds for all the service and mains earth bonds subjected to the tests in (c) above.

(e) The earth bonds that have been subjected to the above tests shall then be subjected to the full tests detailed in BS EN 61238-1.
7. DOCUMENTS REFERENCED

7.6 BS EN 61238-1: 2003: Compression and mechanical connectors for power cables for rated voltages up to 36 kV (Um = 42 kV). Test methods.
7.7 EPD311: Approval of Equipment.
7.8 CP311: Equipment Approval Process.

8. KEYWORDS

Connector
APPENDIX A

SCHEDULES OF CONNECTORS AND LUGS FOR CABLES

A1  LV CONNECTORS AND LUGS

The items listed below and shown on the drawings shall be made of aluminium unless identified otherwise.

<table>
<thead>
<tr>
<th>Item No</th>
<th>Approved Description (for purchasing and product labelling)</th>
<th>CC No</th>
<th>Drawing Ref</th>
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<tbody>
<tr>
<td>1.</td>
<td>Connector, LV, brass, bolt, insulation piercing, 4 – 50mm²</td>
<td>160785</td>
<td>I-400C21-CON-001</td>
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<tr>
<td>2.</td>
<td>Connector, LV, brass, CNE, bottom bolt, up to 120mm²</td>
<td>160600</td>
<td>I-400C21-CON-002</td>
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<td>3.</td>
<td>Connector, LV, brass, CNE, up to 120mm²</td>
<td>160598</td>
<td>I-400C21-CON-003</td>
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<td>4.</td>
<td>Connector, LV, brass, earth block, 3 way, double, 16mm²</td>
<td>160842</td>
<td>I-400C21-CON-005</td>
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<td>5.</td>
<td>Connector, LV, brass, neutral earths, service extension, 25mm²</td>
<td>160842</td>
<td>I-400C21-CON-005</td>
</tr>
<tr>
<td>6.</td>
<td>Connector, LV, brass, straight, hook, 35mm²</td>
<td>160218</td>
<td>I-400C21-CON-006</td>
</tr>
<tr>
<td>7.</td>
<td>Connector, LV, brass, straight/branch, anchor, 35mm²</td>
<td>160229</td>
<td>I-400C21-CON-007</td>
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<tr>
<td>8.</td>
<td>Connector, LV, earth bond kit, mains</td>
<td>160237</td>
<td>I-400C21-CON-008</td>
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<td>9.</td>
<td>Connector, LV, earth bond kit, service</td>
<td>160571</td>
<td>I-400C21-CON-009</td>
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<tr>
<td>10.</td>
<td>Connector, LV, earth kit, service</td>
<td>234450</td>
<td>I-400C21-CON-010</td>
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<tr>
<td>11.</td>
<td>Connector, LV, flexible, transformer, 400mm²</td>
<td>160834</td>
<td>I-400C21-CON-011</td>
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<td>12.</td>
<td>Connector, LV, generator kit</td>
<td>177330</td>
<td>I-400C21-CON-012</td>
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<td>13.</td>
<td>Connector, LV, insulation piercing, main to service, 70mm² to 185mm²</td>
<td>175274</td>
<td>I-400C21-CON-013</td>
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<td>14.</td>
<td>Connector, LV, insulation piercing, main to service, 185mm² to 300mm²</td>
<td>175276</td>
<td>I-400C21-CON-013</td>
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<td>15.</td>
<td>Connector, LV, lug, 1-hole (13mm), waveform indoor termination kit, 95mm²</td>
<td>175760</td>
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<td>16.</td>
<td>Connector, LV, lug, 1-hole (17mm), waveform indoor termination kit, 95mm²</td>
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<td>17.</td>
<td>Connector, LV, lug, 1-hole (13mm), waveform indoor termination kit, 185mm²</td>
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<td>I-400C21-CON-015</td>
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<td>18.</td>
<td>Connector, LV, lug, 1-hole (17mm), waveform indoor termination kit, 185mm²</td>
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<td>Connector, LV, lug, 1-hole (13mm) waveform indoor termination kit, 300mm²</td>
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<td>21.</td>
<td>Connector, LV, pole top termination kit, CNE, 95-185mm²</td>
<td>143219</td>
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<td>22.</td>
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<td>23.</td>
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<td>24.</td>
<td>Connector, LV, sectoral to circular, straight, 300mm²</td>
<td>160560</td>
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<td>Connector, LV, sectoral, branch, 95mm²</td>
<td>160091</td>
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<td>26.</td>
<td>Connector, LV, sectoral, branch, 185mm²</td>
<td>160105</td>
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</table>
## A1 LV CONNECTORS AND LUGS

The items listed below and shown on the drawings shall be made of aluminium unless identified otherwise.

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<td>28.</td>
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<td>29.</td>
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<td>160848</td>
<td>I-400C21-CON-022</td>
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<td>32.</td>
<td>Connector, LV, sectoral, straight, 95mm²</td>
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<td>I-400C21-CON-023</td>
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<td>160016</td>
<td>I-400C21-CON-023</td>
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<td>34.</td>
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<td>Connector, LV, sectoral, straight, 400mm²</td>
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<td>36.</td>
<td>Connector, LV, sectoral, straight with service, 95mm²</td>
<td>160199</td>
<td>I-400C21-CON-024</td>
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<td>Connector, LV, sectoral, straight with service, 185mm²</td>
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<td>I-400C21-CON-024</td>
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<td>160210</td>
<td>I-400C21-CON-024</td>
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<td>39.</td>
<td>Connector, LV, service, double branch, 400mm²</td>
<td>160847</td>
<td>I-400C21-CON-025</td>
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## A2 11kV CONNECTORS AND LUGS

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<td>050689</td>
<td>I-400C21-CON-026</td>
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<td>41.</td>
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<td>050690</td>
<td>I-400C21-CON-027</td>
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<td>42.</td>
<td>Connector, 11kV, lug, 1-hole (13mm with insert, 17mm without), indoor, termination, single core, 300mm²</td>
<td>175840</td>
<td>I-400C21-CON-028</td>
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<td>43.</td>
<td>Connector, 11kV, lug, 1-hole (13mm with insert, 17mm without), indoor, termination, 95mm² with insert, 185mm² without</td>
<td>175850</td>
<td>I-400C21-CON-029</td>
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<td>44.</td>
<td>Connector, 11kV, lug, 1-hole (17mm), offset palm, 300mm²</td>
<td>160327</td>
<td>I-400C21-CON-030</td>
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<td>45.</td>
<td>Connector, 11kV, lug, brass, 120mm²</td>
<td>160830</td>
<td>I-400C21-CON-031</td>
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<td>46.</td>
<td>Connector, 11kV, lug, outdoor, termination, single core, 95mm² to 185mm²</td>
<td>175880</td>
<td>I-400C21-CON-032</td>
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<td>47.</td>
<td>Connector, 11kV, lug, outdoor, termination, single core, 300mm²</td>
<td>175860</td>
<td>I-400C21-CON-032</td>
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<td>48.</td>
<td>Connector, 11kV, straight, solid, 95mm²</td>
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<td>Connector, 11kV, straight, solid, 300mm²</td>
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<td>160739</td>
<td>I-400C21-CON-033</td>
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The items listed below and shown on the drawings shall be made of aluminium unless identified otherwise.

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<td>51.</td>
<td>Connector, 33kV, brass, straight, reducer, 400mm² – 185mm²</td>
<td>160030</td>
<td>I-400C21-CON-034</td>
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<td>52.</td>
<td>Connector, 33kV, brass, straight, up to 185mm²</td>
<td>160020</td>
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<td>53.</td>
<td>Connector, 33kV, brass, straight, 185mm² to 300mm²</td>
<td>160028</td>
<td>I-400C21-CON-036</td>
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<td>54.</td>
<td>Connector, 33kV, copper, straight, 300mm² to 400mm²</td>
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<td>Connector, 33kV, copper, straight, 500mm² to 630mm²</td>
<td>160045</td>
<td>I-400C21-CON-036</td>
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<td>56.</td>
<td>Connector, 33kV, lug, brass, outdoor, termination, single core, 185mm²</td>
<td>175285</td>
<td>I-400C21-CON-037</td>
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<td>57.</td>
<td>Connector, 33kV, lug, palm, brass, 1-hole (17mm), termination, up to 185mm²</td>
<td>179523</td>
<td>I-400C21-CON-038</td>
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<td>58.</td>
<td>Connector, 33kV, lug, palm, brass, 1-hole (17mm), termination, 400mm²</td>
<td>179566</td>
<td>I-400C21-CON-039</td>
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</table>
CONNECTOR
LV
BRASS, EARTH BLOCK
3 WAY, DOUBLE
16mm²
CONNECTOR
LV
BRASS, NEUTRAL EARTHS, SERVICE EXTENSION
25mm²
CONNECTOR
LV
BRASS, STRAIGHT / BRANCH, ANCHOR
35mm²
ROLL SPRING

SWAGED END

GREEN / YELLOW HEATHSHRINK SLEEVING

COPPER BRAID

x 1

KIT CC 234450

CONNECTOR LV EARTH KIT SERVICE

drawn JS drawing number

approved JS 26.1.08 I-400C21-CON-010-11-1

scale nts
CONNECTOR
LV
INSULATION PIERCING MAIN TO SERVICE

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<th>SIZE SERVICE</th>
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<td>70 TO 185mm²</td>
<td>4 TO 35mm²</td>
<td>60</td>
<td>44</td>
<td>50</td>
<td>175274</td>
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<tr>
<td>185 TO 300mm²</td>
<td>4 TO 35mm²</td>
<td>60</td>
<td>51</td>
<td>60</td>
<td>175276</td>
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x 4 BRASS

133

Ø 28

x 4

CONNECTOR
LV
POLE TOP TERMINATION KIT
CNE, 300mm²

KIT CC 177350

scale
nts

drawn JS
drawing number
approved JS 26.1.08
I-400C21-CON-018-11-1
CONNECTOR
LV
SECTORAL TO CIRCULAR, STRAIGHT, 300mm²

KIT CC 160560

Scale

NTS

Electricity North West

Drawn JS

Drawing number

Approved JS 26.1.08

I-400C21-CON-020-11-1
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<td>SIZE SERVICE</td>
<td>A</td>
<td>B</td>
<td>C</td>
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**Diagram:**

- Connector: LV
- Sectoral:
- Straight with Service

**Dimensions:**
- C
- B
- A

**Drawing Information:**
- Drawn by JS
- Approved by JS 26.1.08
- Drawing Number: I-400C21-CON-024-11-1
CONNECTOR
11kV
LUG, 1-HOLE (13mm WITH INSERT, 17mm WITHOUT), INDOOR, TERMINATION, SINGLE CORE, 300mm²
CONNECTOR
11kV
LUG, 1-HOLE (13mm WITH INSERT, 17mm WITHOUT), INDOOR, TERMINATION, 95mm² WITH INSERT, 185mm² WITHOUT
CONNECTOR
11kV
LUG, 1-HOLE (17mm)
OFFSET PALM
300mm²
CONNNECTOR
11kV
LUG, OUTDOOR, TERMINATION,
SINGLE CORE

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<th>B</th>
<th>Ø C</th>
<th>Ø D</th>
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CONNECTOR
33kV
BRASS
STRaight, REDucer
400mm² – 185mm²
CONNECTOR
33kV
BRASS / COPPER, STRAIGHT
UP TO 630mm²
CONNECTOR
33kV
LUG, BRASS, OUTDOOR TERMINATION,
SINGLE CORE, 185mm²

KIT CC 175285

20 x 13 SLOT
2 HOLES Ø 13

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CONNECTOR
33kV
LUG, PALM, BRASS,
1-HOLE (17mm)
TERMINATION, UP TO 185mm²
x 3
BRASS

74
62
44

Ø 28

x 1

44

Ø 17

CONNECTOR
33kV
LUG, PALM, BRASS
1-HOLE (17mm)
TERMINATION, 400mm²

KIT CC 170566

scale
nts

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