

CEB STANDARD 030 - 1 : 1996

Specification

for

**RESIN FILLING TYPE JOINTING KITS FOR
LOW VOLTAGE UNDERGROUND CABLES**

CEYLON ELECTRICITY BOARD

SRI LANKA

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CEYLON ELECTRICITY BOARD

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CONTENTS

	Page
1. Scope	2
2. System Parameters	2
3. Service Conditions	2
4. Applicable Standards	3
5. Basic Features	3
6. Joint/Pot-End Components	4
7. Quality Assurance	6
8. Additional Requirements	6
9. Information to be Supplied with the Offer	8
10. Sample Study	9
11. Inspection & Testing	9
12. Technical Literature & Drawings	10
11. Annexures	10

SPECIFICATION FOR RESIN FILLING TYPE JOINTING KITS FOR LOW VOLTAGE UNDERGROUND CABLES

1.0 SCOPE

This Specification covers the design, manufacture and Testing of outdoor Resin filling (cold pouring) type Jointing Kits for making following types of joints for PILC and XLPE armoured UG Cables of 600/1000 V range.

- a) Straight - through joints
- b) Service or tee joints (only one service per joint)
- c) Transition joints (for jointing of XLPE/SWA cables and PILC/DSTA or PILC/SWA cables).
- d) Pot end (for two or four core XLPE/SWA or PILC/DSTA cables which will be energised).

The types and sizes of LV cast resin joints/pot ends which are required have been indicated in the schedule of prices.

2.0 SYSTEM PARAMETERS

- | | | | |
|----|------------------------|---|---|
| a) | Nominal Voltage | - | 400/230 V |
| b) | System highest voltage | - | 440/240 V |
| c) | Frequency | - | 50 Hz |
| d) | Number of Phases | - | Three phase, four wire |
| e) | Maximum fault level | - | 25kA |
| f) | Installation earthing | - | "TT" system as per IEC 364 - 3 |
| g) | Earthing | - | Effective Earthing, Neutral Solidly earthed at the Distribution transformer |

3.0 SERVICE CONDITIONS

- | | | | |
|----|------------------------------------|---|--|
| a) | Annual average ambient temperature | - | 30°C. |
| b) | Maximum ambient temperature | - | 40°C. |
| c) | Maximum relative humidity | - | 90%. |
| d) | Environmental condition | - | Humid tropical climate with polluted atmosphere. |

- e) Ground conditions;
 - i) Ground ambient temperature can reach up to 35°C.
 - ii) Ground water table very high in some areas.
 - iii) Polluted by sea water in some areas.
 - iv) Dry sand conditions.

4.0 APPLICABLE STANDARDS

- 4.1 The Items supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.
 - a) The performance of the joints shall comply with VDE 0278 and British Engineering Recommendation C81.
 - b) Mechanical connectors shall comply with BS 4579, Engineering Council Recommendation C79.
- 4.2 The Cast Resin type cable jointing kits shall be suitable for in-line and branch joints in low voltage 600/1000 V armoured UG cables manufactured to the following standards.
 - a) BS 6480 (1969) - Impregnated Paper insulated lead or lead alloy sheathed electric cables
 - b) BS 5467 (1991) - Cables with thermosetting insulation for electricity supply.
 - c) BS 6622 (1991) - Cables with extruded cross linked polyethylene insulation.
 - d) BS 6346 (1989) - PVC insulated cables for electricity supply.

5.0 BASIC FEATURES

5.1 Design

Adequate consideration shall be given on the followings where design of LV cast resin joints and accessories.

- a) Service conditions in Sri Lanka stated in Clause 3.0
- b) Capable of withstanding mechanical, electrical and thermal stresses developed during normal working/emergency overloading/short-circuits/under service conditions mentioned in Clause 3.0.
- c) Better mechanical protection.
- d) Jointing under live conditions.
- e) Storage/shelf life; attention should be given for tropical environmental conditions.

5.2 General Requirements

5.2.1 General design of the LV Cast Resin type joints / pot-ends shall be such that:-

- a) The performance of materials and testing of cast resin joints/pot-ends and accessories shall meet the requirements of the relevant clauses and standards specified.
- b) The type, material, quantity, size and compatibility of the component supplied in all joints/pot-ends shall be suitable for the purpose and duties of the complete joint/pot-ends. The kits supplied shall require a minimum "on site" skill. Full details of all the items offered shall be submitted with the tender.

5.2.2 Joint/Pot-end Kits shall be supplied complete with all the necessary components, and materials such as insulating material, sleeves, shrouds etc. It shall not be necessary for the user to provide any additional items or materials whatsoever, in order to carry out the full jointing operation. Any special tools and equipment required to perform the joint shall be indicated separately.

5.2.3 Full details of any adverse physiological effects shall be submitted with the offer.

5.2.4 Detailed instructions with picture/sketches shall be submitted with any offer, and such instructions shall be included in each individual kit purchased. All written matter supplied with the joint kits shall be in English.

5.3 Types of Under ground Cables.

All cast resin joints/pot-end and accessories shall be suitable for use with the following types of Under Ground Cables in the systems:-

- a) 0.6/1 kV, 4 core, shaped stranded copper/aluminium conductor, impregnated paper insulated, belted, lead sheathed (alloy E) with compounded bedding, DSTA/SWA, PVC over-sheath manufactured to IEC 55 and BS 6480.

Sizes of cable 240, 95, 70, 35 and 16 sq. mm.

- b) 0.6/1kV, 4 core, shaped stranded aluminium conductor, XLPE/PVC insulated, polypropylene, non-hygroscopic filling and inner covering, PVC extruded bedding, galvanised steel wire armour with PVC over-sheath manufactured to IEC 502, IEC 228, BS 5467, BS 6469 and BS 6746.

Sizes of cable 240, 150, 95, 70, 35 and 16mm?.

6.0 JOINT/POT-END COMPONENTS

All components and materials used in the jointing kits/pot-ends shall conform to the relevant standard specified.

6.1 Insulation Resin and Hardener

6.1.1 Resins shall be of Acrylic type and consist of toxic free Resin and Hardener, which are mixed just prior to pouring in to the joint shell. The Resin then shall be cured in to the hard

medium in approximately 30 minutes at the specified ambient temperature.

- 6.1.2 Non-setting compounds and Epoxy resin are not acceptable.
- 6.1.3 Good bonding to all parts of the joints particularly Paper/XLPE insulation is absolutely essential.
- 6.1.4 Any exothermic reaction, or volume contraction during curing is to be kept to the absolute minimum. Quantities of insulating resin and other additives supplied for each joint shall be adequate enough for filling the shell when using the lower size of cables for the range of the joint.
- 6.1.5 All components shall mix together easily, using one of the containers in which the components are supplied.
- 6.1.6 Components shall be capable of being stored without any deterioration within the temperature range from 10°C to 45°C and the shelf life of the components shall not be less than 24 months, stored in high humid tropical climate.

6.2 Outer Shell Moulds

- 6.2.1 The Outer Shell Moulds shall be of two piece type and shall be of reasonable size to accommodate with easy, the cross of cores while jointing and shall be provided to hold the two pieces together during the filling and curing stage, without leakage and also proper sealing arrangements at all cable entries.
- 6.2.2 The material, design and construction of the moulded shell shall impart sufficient strength, robustness and impact resistance to ensure safe storage, easy handling, assembly and filling.
- 6.2.3 Filler holes and air vents shall be of sufficient size for easy 'spill free' pouring (over caps are to be included).

6.3 Connector/Ferrules

- 6.3.1 Shear Head Bolts type Connectors / Ferrules shall be supplied with all types of joints to accommodate a wide range of sizes of cable as per the schedule of prices.
- 6.3.2 The design of the branch or 'T' connectors shall be such that the joint could be performed without cutting the main conductor.
- 6.3.3 The Connectors / Ferrules shall be of High Conductivity Aluminium, Copper and Bi-metallic as applicable.

6.4 Armour Bonding Arrangements

- 6.4.1 The armour bonding arrangement provided shall withstand short circuit/earth fault current.
- 6.4.2 The current carrying capacity of the bonding conductors shall not be less than that of the complete armour of XLPE cable or the armour and lead sheath of PILC cable. The continuity bond can be copper strips, copper strap, copper wire or copper braid.

- 6.4.3 A suitable clamping device shall be provided for effectively clamping the armour (galvanised steel wire / steel tape), lead sheath and bonding conductor.

6.5 Special Tools and Equipment Required for Jointing Work

- 6.5.1 Full details of any special tool and equipment needed for the assembly, insulation and filling of the joint/pot-end, mixing of the resin or assembly of components shall be included in the offer as separate items and with individual prices.
- 6.5.2 Specially in branch joints special tools and accessories needed to perform the joint with main conductor shall also be provided in relation to number of joints.

Preference will be given to those offers with the fewest requirement of special tools and equipment.

7.0 QUALITY ASSURANCE

The Manufacturer shall have received ISO 9002 Certification for the type of Cast Resin filling type joints / pot end kits.

- a) ISO 9002 Quality Assurance System shall be followed in the manufacture of the Cast Resin filling type joints / pot end kits.
- b) Bidder shall furnish documentary evidence that he has obtained ISO 9002 Certification.
- c) Offers of Bidders who fail to furnish the proof of ISO 9002 Certification will be rejected.

8.0 ADDITIONAL REQUIREMENTS

8.1 Identification marking

All the components of the joints/pot-ends and accessories shall be distinctly and durably marked with the following, for tracing the quality control/quality assurance records maintained by the manufacturer:

8.1.1 Connector/Ferrules

- a) Name of the manufacturer/Trade mark
- b) Country of Manufacture
- c) Catalogue No./Type NO.
- d) Conductor Size

8.1.2 Resin

- a) Name of Manufacturer/Trade Mark
- b) Country of manufacture
- c) Type of Designation

- d) Manufacturer's batch No./Year of manufacture or any code for tracing the above records
- e) Date of expiry for the resin, for storage under specified service conditions

8.1.3 Hardener

- a) Name of Manufacturer/Trade Mark
- b) Country of manufacture
- c) Type of Designation
- d) Manufacturer's batch No./Year of manufacture or any code for tracing the above records
- e) Date of expiry for the activator, for storage under service conditions as specified.

8.1.4 Outer Shell

- a) Name of the manufacturer/Trade mark
- b) Country of Manufacture
- c) Catalogue No./Type No.
- d) Cable size it will accommodate

8.2 Packing

Packing for each complete joint kit shall be as follows :-

- a) One carton to contain components, connectors tapes and outer shells without resin.
- b) One carton to contain the resin, hardener and mixing bucket if required.

The packing shall be robust and able to withstand very rough handling during transport and storage and also to protect against ingress of moisture.

Each complete unit Kit shall be clearly marked with the following;

- a) Manufacturer's Name.
- b) Reference Number (as indicated in the Catalogue).
- c) Application and cable size.
- d) Voltage.
- e) List of materials indicating quantities.

- f) Jointing instructions, step by step with drawings

8.3 Guarantee

The manufacturer shall guarantee the joint/pot-end kits against all defects arising out of faulty design or workmanship, or defective material for a period of four years from the date of delivery of the joint/pot-end kit. The certificate of the CEB for the date of commissioning each joint/pot-end shall be accepted.

9.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be furnished with the offer;

- a) Catalogues indicating the detailed instructions for carrying out all type of cable jointing as given below;
 - i) Step by step procedure,
 - ii) Illustrated drawings.
 - iii) List of materials indicating quantities in each kit.
 - iv) Time required for carrying out a complete joint of each type ;
 - 1) Straight through joint.
 - 2) Tee-off (branch) joint.
 - 3) Termination and Pot end
 - v) Recommended time period between completion of joints and energising of cable, to allow for curing and setting of compounds
 - vi) Documentary evidence in support of conformity of various materials and components to specified standards shall be furnished.
- b) Completed Schedule of Technical Particulars (ANNEXURE - A)
- c) Type Test Certificates

Test certificates, performance curves, tables etc. based on the Type Test conforming to the relevant standard shall be supplied along with the offer for evaluation purposes. The test certificates should clearly identify the equipment concerned, showing the Manufacturer's identify, type No. and basic technical parameters.

Copies of type certificates shall include -

- i) A C Voltage withstand test-in accordance with IEC publication 60.
- ii) Impulse voltage withstand test in accordance with IEC publication 60.
- iii) Load cycle tests - in accordance with VDE 0278.
- iv) Thermal short circuit test in accordance with VDE 0278
- v) Humidity withstand test in accordance with IEC publication 466 appendix - D.

Copies of type tests are required to prove the particular design. **The test certificates referred to shall be from a recognised independent testing authority acceptable to the purchaser.**

d. Performance Guarantee

- i) Bidders shall furnish a minimum of three (3) Performance Certificates obtained from Electricity Supply Authorities outside the country of the Manufacturer to whom the Bidders have supplied Cast Resin filling type joints / pot end kits of similar type in the past five years.
- ii) The certificate shall indicate the Type (model) of the Cast Resin filling type joints / pot end kits, Year of Supply, Quantity Supplied, Percentage of Defective and the Performance of the Cast Resin Joints based on field experience or field studies.
- iii) The purchaser reserves the right to communicate with such Electricity Supply Authorities with regard to the performance of the Cast Resin filling type joints / pot end kits and the authenticity of the Performance Certificates issued by them.

Failure to furnish the above particulars and adequate details with regard to the item offered will result in the offer being rejected.

10.0 SAMPLE STUDY

A sample Resin Filling Type Cable Jointing Kit of the make and type quoted shall accompany the Bid to facilitate analysis and evaluation.

11.0 INSPECTION AND TESTING

11.1 Inspection

The selected tenderer shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary simulation and conventional tests of the materials, equipment offered.

11.2 Acceptance /Sample Tests

- 11.2.1 These shall be carried out on random samples as required by the CEB. Random samples shall be selected from the offered lot in order to detect any defects in the material, manufacture, workmanship and markings.
- 11.2.2 When testing is required, the manufacturer shall provide to the representative of the CEB, all the testing facilities required at the works.
- 11.2.3 All tests shall be conducted in accordance with the specifications mentioned in the Table relevant for the type of joint/pot end kits on order.
- 11.2.4 Performance tests shall be conducted on completed product without any modification to the product during testing.

12.0 TECHNICAL LITERATURE AND DRAWINGS

The selected tenderer shall supply all relevant drawings, technical literature, hand books etc along with the equipment, in order to facilitate a faultless installation.

Extra copies of the Routine Test Certificates shall be supplied with the equipment.

13.0 ANNEXURE

- A - Schedule of Particulars (To be filled by the Bidder)

ANNEXURE - A

SCHEDULE OF TECHNICAL PARTICULARS
(Bidders shall fill this form for each type of joint/pot end kit)

- | | | |
|----|--|-----------|
| 1) | Name of Manufacturer | - |
| 2) | Country of origin | - |
| 3) | Whether the following are furnished; | |
| | i) Step by step procedure. | Yes/No. - |
| | ii) Illustrated drawings furnished. | Yes/No. - |
| | iii) List of materials indicating quantities in each kit. | Yes/No. - |
| 4) | Time required for carrying out a complete joint of each type. | |
| | i) Straight through joint. | - |
| | ii) Tee-off (branch) joint. | - |
| | iii) Termination and Pot end. | - |
| 5) | Recommended time period between completion of joints and energising of cable, to allow for curing and setting of resin. | |
| 6) | Whether the documentary evidence in support of conformity of various materials and components to specified standards is furnished. | |
| 7) | Whether the copies of the following Type Test Certificates are furnished; | |
| | i) A C Voltage withstand test-in accordance with IEC 60. | Yes/No. - |
| | ii) Impulse voltage withstand test in accordance with IEC 60. | Yes/No. - |
| | iii) Load cycle tests - in accordance with VDE 0278. | Yes/No. - |
| | iv) Thermal short circuit test in accordance with VDE 0278 | Yes/No. - |
| | v) Humidity withstand test in accordance with IEC publication 466 appendix - D. | Yes/No. - |
| 8) | Whether the following arrangements are provided in joints/pot-ends | |
| | i) Electrical Stress Control. | Yes/No. - |
| | ii) Moisture sealing. | Yes/No. - |
| | iii) Continuity of lead sheath and armour. | Yes/No. - |

- 9) Clearance
- i) Between phases mm. -
-
- ii) Between phase and earth parts mm. -
- 10) Whether the components used are compatible with XLPE and PILC cables Yes/No. -
- 11) Whether the components used are toxic Yes/No. -
- 12) Whether the joints/pot-ends could be done under life conditions Yes/No. -
- 13) Whether the backfilling could be commenced immediately after completing the jointing work / duration. Yes/No. ,mts. -
- 14) Whether the energising of cables could be possible immediately after completing the jointing work /duration. Yes/No.,mts. -
- 15) Whether the joints could withstand mechanical, electrical and thermal Stress during;
- i) Normal working conditions Yes/No -
- ii) Emergency overloading conditions Yes/No-
- iii) Short Circuit conditions Yes/No. -
- 16) Storage/shelf life of the components between the temperature of 10°C to 45°C Months -
- 17) Recommended temperature at which the components are to be stored to keep them for two years. °C -
- 18) Outer Shell Moulds
- i) Type of material
- ii) Number of pieces
- iii) Whether the filler holes and air vents provided for spill free pouring. Yes/No. -
- 19) Type of connectors provided. -
- 20) Details of special tool and equipment provided with the Kit;
- 21) Whether the quality assurance system conforming to ISO 9002 followed in the manufacture of joints/pot-ends Yes.No. -
- 22) Whether the quality assurance Certification conforming to ISO 9002 furnished. Yes/No. -

- 23) Whether the components are packed to withstand rough handling Yes/No. -
- 24) Whether the kits are marked as per Clause 8.2 Yes/No. -
- 25) Whether the Kits are Guaranteed against all defects arising out of faulty design or workmanship or defective materials Yes/No. -

SEAL AND SIGNATURE OF THE MANUFACTURER/BIDDER

DATE-----

