



TECHNICAL SPECIFICATION

Doc Number:
CO.14900.TCSP.00222
Version: 3

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| SPMS ARTICLE CODE: 081301-0040 | DESCRIPTION OF MATERIAL: CABLE MV PVC SWA FRPVC 4 CORE COPPER 35 MMSQ 600/1000V | Page 1 of 8 |
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1.0 SCOPE

The specification covers the design, manufacture, testing, supply and delivery in proper packed condition of 35mmsq, 600/1000V, four core, Copper conductor, Polyvinyl Chloride (PVC) insulated, armoured cables. These cables shall be suitable for the 3 phase AC – 50Hz system and shall primarily be designed for effectively earthed neutral system.

The cables shall conform in all respects to the highest standards of engineering, design, workmanship of this specification and the latest revisions of relevant standards at the time of offer and ZESCO shall have the power to reject any work or material, which in ZESCO’s judgment is not in full compliance therewith.

2.0 SYSTEM PARAMETERS

Unless otherwise specified in the schedule of Requirements, the ZESCO distribution system parameters shall be taken to be as follows:

| Item | Description | Unit | Nominal Voltage Level | | |
|------|--|---------|-----------------------|------------------|-----------|
| | | | 33kV | 11kV | 0.4kV |
| 1. | Nominal system voltage phase to phase | kV | 33 | 11 | 0.4 |
| 2. | Highest system voltage phase - phase | kV | 36 | 12 | 0.44 |
| 3. | System Frequency | Hz | 50 ± 2.5% | 50 ± 2.5% | 50 ± 2.5% |
| 4. | Method of System Earthing | | Resist. | Resist. or Solid | Solid |
| 5. | Impulse withstand voltage (1.2/50 μsec wave) | kV peak | 170 | 95 | - |
| 6. | Power frequency withstand voltage 1 minute | kV peak | 70 | 28 | 3 |

3.0 ENVIRONMENTAL PARAMETERS

The cables shall be capable of operating under the following environmental conditions:

- a) At an altitude of 1,400m above sea level;
- b) Ambient air temperature not exceeding a maximum of +45°C or below - 1°C with a daily maximum average of 35°C;
- c) Relative humidity of 85%;
- d) Exposure to direct tropical sun; and
- e) Frequent and severe lightning storms occurring during summer months (isokeraunic level taken to be 86 days/year).

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4.0 DETAILED REQUIREMENTS

4.1 General

All cables, accessories and materials shall be in accordance with the latest editions (including all amendments) of the referenced standards as specified in schedule A of this specification.

All cables shall be suitable for operation: -

- a) On an effectively earthed system with earth faults cleared within 30 seconds;
- b) Under the loads specified and such sudden variations of load and voltage as may be met with under working conditions on the system; and
- c) In the climatic conditions prevailing on site.

4.2 Conductors

All conductors shall be compact sector shaped stranded Copper as specified in the technical schedules. The conductor shall be clean, uniform in size, shape and quality, smooth and free from scale, spills, splits, sharp edges and other harmful defects.

The conductors shall comply with the requirements of the referenced standards.

Where joints are permitted in individual wires formed into a conductor, they shall be made in the manner prescribed in the appropriate standard and the frequency shall conform to the limiting dimensions stated therein. No joints shall be made in the conductor after it has been formed.

4.3 Insulation

The insulation shall be of extruded Polyvinyl Chloride (PVC).

4.4 Identification of Cores

The cores of the four core cables shall be identified by color as red, yellow, blue for phases and black for the neutral.

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4.5 Cable Marking

The external surface of the cable shall be legibly embossed with the following information on two lines running parallel to the length of the cable, approximately equally spaced around the circumference of the cable:

- a) ZESCO Ltd, Copper Electric Cable 600/1000V, Manufacturer's Name, Description of Cable.

For example, for a 4-core, 35mmsq, PVC insulated cable, the legend would read as follows:

ZESCO Ltd, Copper Electric Cable 600/1000V, Manufacturer's Name 4x35mmsq PVC/SWA/FRPVC

NOTE: The bedding material is not included in the PVC/SWA/FRPVC naming convention.

In addition, the cable shall be sequentially marked, by indelible printing, indenting or other suitable means, at 1m intervals, to indicate the approximate length of cable remaining on the drum. The numbers shall start with 001, 1m from the inner end of the cable and continue every metre to the outer end.

4.6 Cable Drum Marking

The drum shall be marked in legible and indelible letters on both sides of the drum giving the following information:

- a) Manufacturer's name and/or trademark;
- b) Rated voltage, conductor material, number of cores and cable size;
- c) Serial number or other identification;
- d) Reference standard;
- e) Year of manufacture;
- f) Length and weight of cable on the drum;
- g) Gross weight;
- h) Dimensions of drum;
- i) ZESCO stock code in bold numerals. E.g. **081301 – 0040**;
- j) On each flange an arrow with the words "ROLL THIS WAY";
- k) "NOT TO BE LAID FLAT" instruction; and
- l) Indication by 'T' that wood is treated.

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4.7 Protective Coverings

Cables shall have an extruded black PVC oversheath with reduced flame propagation properties.

4.8 Laying-up and Fillers

The cores of the multicore cables shall be laid-up together with suitable fillers, wormed circular and binding tapes applied overall.

The direction of lay of the cores shall be right-hand for the multicore power cables. The term "right-hand" has the same meaning as for screw threads.

4.9 Armour

The type of armour shall be round galvanised steel wire armour.

4.10 Current Carrying Capacity & Design Parameters

The maximum continuous current carrying capacity and maximum permissible continuous conductor temperature and the factors for determining such rating and temperature shall be based on referenced standards, subsequent amendments and all conditions prevailing on site.

4.11 Routine Tests

The following routine tests shall be performed on the cables as per relevant standard:

- a) Spark test;
- b) Conductor resistance; and
- c) Voltage withstand.

4.12 Visual Inspections

The following visual inspections shall be conducted on the cables as per relevant standard:

- a) Assembly of cores;
- b) Cable markings; and
- c) Core identification.

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4.13 Sample Tests

The following sample tests shall be performed on the cables as per relevant standard:

- a) Construction;
- b) Dielectric resistance;
- c) Physical properties;
- d) Thickness;
- e) Wire diameter;
- f) Mass of zinc coating;
- g) Adhesion of zinc coating;
- h) Tensile strength;
- i) Elongation at break;
- j) Composition; and
- k) Belling.

4.14 Previous Type Tests

The following previous type test results shall be performed on the cables as per relevant standard:

- a) Fire propagation;
- b) Smoke emission; and
- c) Halogen.

Take note of the following: -

When type tests have been successfully performed on a type of cable covered by the applicable standard with a specific conductor cross-sectional area and rated voltage, type approval shall be accepted as valid for cables of the same type with other conductor cross-sectional areas and/or rated voltages, provided the following three conditions are all satisfied:

- a) The same insulation materials and manufacturing process are used;
- b) The conductor cross-sectional area is not larger than that of the tested cable;
- c) The rated voltage of the cable being procured is not higher than the rated voltage of the tested cable but tested to the same reference standard.

Approval shall be independent of the conductor material.



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5.0 TECHNICAL SCHEDULES (SCHEDULE A & B)

SCHEDULE A: MINIMUM ZESCO REQUIREMENTS

| S/N | Detail | Unit | Data |
|-----------------------------------|--|-----------------|---|
| 1. | Description | | 35mmsq 4 core PVC/SWA/FRPVC 600/1000V Copper cable |
| 2. | Maximum sustained conductor temperature | °C | 70 |
| 3. | Maximum DC resistance at 20°C | Ω/km | 0.524 |
| 4. | Maximum AC resistance at 70°C | Ω/km | 0.627 |
| 5. | Minimum current rating (direct burial/in air) | A | 140/135 |
| 6. | Ground temperature | °C | 25 |
| 7. | Ground Thermal Resistivity | K.m/W | 1.2 |
| 8. | Depth of laying | m | 0.5 |
| 9. | Method of Installation | | Both in air and direct burial under ground |
| 10. | Exposure to sunlight | | Yes |
| 11. | Material of conductor | | Circular shaped stranded Copper |
| 12. | Insulating material | | PVC |
| 13. | Number of cores | | 4 |
| 14. | Core identification | Phases | Red, Yellow, Blue |
| | | Neutral | Black |
| 15. | Nominal system voltage (U ₀ /U) | V | 600/1000 |
| 16. | Maximum permissible operating voltage | V | 1100 |
| 17. | Conductor size | mm ² | 35 |
| 18. | Armour | | Galvanised steel wire |
| 19. | Armour diameter | mm | As per SANS 1507 |
| 20. | Type of outer sheath | | Ultra violet stabilized FRPVC |
| 21. | Cable length per drum | m | 500 |
| 22. | Type of drum | | Treated wooden |
| 23. | Bedding material | | Flame-retardant PVC |
| 24. | Filler material | | Polypropylene (Non-hygroscopic material) |
| 25. | Detailed requirements as per clause 4.0 above | | Required |
| Environmental Parameters | | | |
| 26. | Ambient temperature | °C | -1 to 45 |
| 27. | Altitude | m | 1400 |
| 28. | Relative humidity | % | 85 |
| Drawings/Test Certificates | | | |
| 29. | Complete manufacturers' cable technical data sheets/brochure in English to be submitted with the bid | | Required |
| 30. | Previous type tests certificates/results to be submitted with the bid | | Required |
| 31. | Routine test results/certificate to be provided on delivery | | Required |
| 32. | Quality assurance certification to be provided with bid | | Required |
| 33. | Applicable standard(s) | | SANS 1507; SANS 1411; IEC 60502; IEC 60228; IEC 60287 |



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SCHEDULE B: TO BE FULLY COMPLETED BY SUPPLIER

| S/N | Detail | Unit | Data |
|-----|---|-------------------|------|
| 1. | Description | | |
| 2. | Maximum sustained conductor temperature | °C | |
| 3. | Maximum DC resistance at 20°C | Ω/km | |
| 4. | Maximum AC resistance at 70°C | Ω/km | |
| 5. | Minimum current rating (direct burial/in air) | A | |
| 6. | Ground temperature | °C | |
| 7. | Ground thermal resistivity | K.m/W | |
| 8. | Depth of laying | m | |
| 9. | Method of Installation | | |
| 10. | Exposure to sunlight | Yes/No | |
| 11. | Material of conductor | | |
| 12. | Insulating material | | |
| 13. | Number of cores | | |
| 14. | Core identification | Phases Neutral | |
| 15. | Nominal system voltage (U ₀ /U) | V | |
| 16. | Maximum permissible operating voltage | V | |
| 17. | Conductor size | mm ² | |
| 18. | Armour | | |
| 19. | Armour diameter | mm | |
| 20. | Type of outer sheath | | |
| 21. | Cable length per drum | m | |
| 22. | Type of drum | | |
| 23. | Bedding material | | |
| 24. | Filler material | | |
| 25. | Are detailed requirements as per clause 4.0 above? | Yes/No | |
| | Environmental Parameters | | |
| 26. | Ambient temperature | °C | |
| 27. | Altitude | m | |
| 28. | Relative humidity | % | |
| | Drawings/Test Certificates | | |
| 29. | Have complete manufacturers' cable technical data sheets/brochure in English been submitted with the bid? | Yes/No | |
| 30. | Have previous Type Tests Certificates/results been submitted with the bid? | Yes/No | |
| 31. | Will routine Test Results/Certificate be provided on delivery? | Yes/No | |
| 32. | Have quality assurance certifications been provided with bid? | Yes/No | |
| 33. | Applicable standard(s) | | |