SECTION 7.5

TECHNICAL SPECIFICATION OF POWER CABLES & CONDUCTOR

7.5.1 Power Cables, Conductor and Control Cables

7.5.1.1 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 1CX800 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 800 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0221Ω/KM at 20°C.

Conductor Screen
The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation
The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen
The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.
The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen
The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.
The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath
The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour
The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.8 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

a) Manufacturer's name and/or trade name.
b) Voltage grade viz. 33 kV
c) Cable size (no. of core x conductor cross section).
d) Year of manufacture.
e) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33KV XLPE, 1-Core, 800 mm^2 Copper cable

Item No.	Description of Items	Particulars
I	Application	For 33KV, 1-core, XLPE 800 mm^2 Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	800 mm^2 1-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33KV, XLPE, 1-Core, 800 mm² Copper cable

I	Application	For 33KV, 1-core, XLPE 800 mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	800 mm² 1-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 800 mm² Copper Conductors - Installation instructions

Outdoor Termination Kits for 33KV, XLPE, 1-Core, 800 mm² Copper cable

I	Application	For 33KV, 1-core, XLPE 800 mm² Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	800 mm² 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 800 mm² Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.2 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 1CX500MM2 XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 500 sq. mm.

The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0366 Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen

shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)

A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied copper tape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.6 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

f) Manufacturer's name and/or trade name.
g) Voltage grade viz. 33 kV or 11 kV.

h) Cable size (no. of core x conductor cross section).
i) Year of manufacture.
j) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33kV XLPE, 1-Core, 500 mm^2 Copper cable

Item No.	Description of Items	Particulars
i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For underground horizontal mounting
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core, Copper Conductors
v	Construction	The joint shall be proof against ingress of moisture and water
vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33kV, XLPE, 1-Core, 500 mm^2 Copper cable

i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For Indoor switchgear terminations
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core, Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing

		- Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Installation instructions

Outdoor Termination Kits for 33kV, XLPE, 1-Core, 500 mm^2 Copper cable

i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.3 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 3CX95 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in

moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 3X95 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.193Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 3.10 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

k) Manufacturer's name and/or trade name.
l) Voltage grade viz. 33 kV
m) Cable size (no. of core x conductor cross section).
n) Year of manufacture.
o) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33KV XLPE, 3-Core, 95 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 33KV, 3-core, XLPE 95 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	95 mm² 3-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33KV, XLPE, 3-Core, 95 mm² Copper cable

I	Application	For 33KV, 3-core, XLPE 95mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	95 mm² 3-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for3X95 mm² Copper Conductors

		- Installation instructions

Outdoor Termination Kits for 33KV, XLPE, 3-Core, 95mm^2 Copper cable

I	Application	For 33KV, 3-core, XLPE 95 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	95 mm^2 3-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X95 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.4 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 11 KV, 1CX630 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 11kV XLPE Cu cable. The 11kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed

material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 11kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 630 sq. mm.

The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0366Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)

A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 3.8 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 25KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.5mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

p) Manufacturer's name and/or trade name.
q) Voltage grade viz. 11 kV
r) Cable size (no. of core x conductor cross section).
s) Year of manufacture.
t) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 11KV XLPE, 1-Core, 630 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 11KV, 1-core, XLPE 630 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	630 mm² 1-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 11KV, XLPE, 1-Core, 630 mm² Copper cable

I	Application	For 11KV, 1-core, XLPE 630mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	630 mm² 1-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit

		- Compression lugs for 630 mm^2 Copper Conductors - Installation instructions

Outdoor Termination Kits for 11KV, XLPE, 1-Core, 630mm^2 Copper cable

I	Application	For 11KV, 1-core, XLPE 630 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	11KV, effectively earthed system
iv	Cable conductor	630 mm^2 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 630 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.5 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 11 KV, 3CX185 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 11kV XLPE Cu cable. The 11kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 11kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 3X185 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0991Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.5 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 3.4 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 25KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 3.1mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

u) Manufacturer's name and/or trade name.
v) Voltage grade viz. 11 kV
w) Cable size (no. of core x conductor cross section).
x) Year of manufacture.
y) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 11KV XLPE, 3-Core, 185 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 11KV, 3-core, XLPE 185 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	185 mm² 3-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 11KV, XLPE, 3-Core, 185mm² Copper cable

I	Application	For 11KV, 3-core, XLPE 185mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	185 mm² 3-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit

		- Solderless earth connection kit - Compression lugs for 3x185 mm^2 Copper Conductors - Installation instructions

Outdoor Termination Kits for 11KV, XLPE, 3-Core, 185mm^2 Copper cable

I	Application	For 11KV, 3-core, XLPE 185 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	11KV, effectively earthed system
iv	Cable conductor	185 mm^2 3-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X180 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.6 Tests for All 33kV & 11kV XLPE Power Cables .

All type, routine and acceptance (special) tests shall be carried out as per IEC 60 502-2. The manufacturer of cable must have at least ISO 9001 certified quality Assurance system in their manufacturing system.

Routine Tests

The following routine tests shall be carried out on each manufactured length

a) Partial discharge test
b) Voltage test
c) DC voltage test on outer sheath
d) Conductor resistance test

Special (Acceptance) Tests

The following tests shall be made on samples which, for the tests in items (b) and (g), may be on complete drum length of cable taken to represent batches

a) Conductor examination
b) Measurement of electrical resistance of conductor
c) Measurement of thickness of insulation and non-metallic sheath
d) Measurement of thickness of metallic sheath

e) Measurement of overall cable diameter
f) Hot set test for XLPE insulation
g) Measurement of capacitance

Frequency of Tests

The above special (acceptance) tests shall be made on one length from each manufacturing series of the same type size of cable, but shall be limited to not more than 10% of the number of lengths in any contract, rounded to upper unity.

Type Tests

The following tests shall be included in the type tests (Electrical) Tests.

a) Bending test followed by Partial discharge test
b) Tan δ measurement
c) Heating cycle test followed by partial discharge measurement
d) Impulse withstand test followed by a power frequency voltage test

Test on cable components

a) Check for cable construction
b) Resistivity of semi conducting layers
c) Test for determining the mechanical properties of insulation before and after ageing
d) Test for determining the mechanical properties of non-metallic sheath before and after ageing.
e) Ageing tests on pieces of complete cable to check compatibility of materials
f) Pressure test at high temperature on sheath
g) Hot set test on XLPE insulation
h) Carbon black content of PE sheath
i) Shrinkage test on XLPE insulation.

7.5.1.7 Technical Orientation and Quality Test Witness of XLPE Power cable:

The Purchaser shall have the right to inspect/test the goods/materials to confirm their conformity to the specification. The purchaser shall be entitled at all reasonable time during manufacture to inspect, examine and test of goods/materials at the manufacturers' premises, workmanship and performance.

At least the following test along with routine test shall be carried out as per latest version of IEC Standard or equivalent IEEE standard or BS standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

1. MeasurementofElectricalResistanceofconducts.
2. Highn voltagetest
3. Partialdischargetest
4. Capacitancetest
5. Voltagetestoncableserving
6. Measurement of dimension of insulation and conductor

The Supplier shall, after consulting the purchaser, give the Purchaser reasonable notice in writing of the date on and the place at which any material or equipment will be ready for testing as provided in the contract and unless the purchaser shall attend at the place so named on date, which the supplier has stated in his notice, the supplier may proceed with the tests, which shall be deemed to have been made in the purchaser's presence, and shall forth with forward to the purchaser duly certified copies of test readings.

When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test. The contractor shall submit the factory test report to the engineer for check and verification at least 15 days prior to inspection.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC Standard or equivalent IEEE standard or BS standard only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect. Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier have to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

7.5.1.8: TECHNICAL SPECIFICATIONS/REQUIREMENTS OF COPPER CABLE (1CX120 mm^2 , 4CX120 mm^2 & 1CX150 mm^2)

7.5.1.8.1 GENERAL:

This section of the document includes the design, manufacture, testing & inspection of PVC insulated and PVC sheathed Copper Cable (1CX120 mm^2, 4CX120 mm^2 & 1CX150 mm^2) as specified.

7.5.1.8.2 CLIMATE DATA:

PVC insulated and PVC sheathed Copper Cable (1CX120 mm^2 , 4CX120 mm^2 & 1CX150 mm^2) to be supplied against this tender shall be suitable for satisfactory use under the following climatic conditions:

Climate	:	Tropical, intense sunshine, heavy rain & humid. Maximum humidity and temperature sometimes occur simultaneously.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average Temperature	:	30^0 C
Relative humidity	:	50-100%
Annual mean relative humidity		75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Average isokeraunic level	:	80 days/ year
Maximum altitude above sea level	:	300 meters
Atmospheric, Mechanical and Chemical impurities	:	Moderately polluted

Cable as specified will be installed in tropical locations and in a hot humid environment with presence of the insects and vermin. The information is given as a guide for Tender and no responsibility for its accuracy will be accepted, nor will any claim based on the above be entertained.

7.5.1.8.3 SYSTEM PARTICULARS:

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, KV (Voltage Class)	230	132	33	11
3.	Maximum System Voltage, KV	245	145	36	12
4.	System Frequency, Hz	50	50	50	50
5.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
6.	Type of System Grounding	Solid	Solid	Solid	Solid

7.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	12550	6000	1500	381
8.	Basic Insulation Level, KV	750	650	170	75
LOW VOLTAGE 415/ 240V CHARACTERISTICS:					
9.	Normal System Voltage, V (Voltage Class)	415/ 240			
10.	Type of System Grounding	Solid			

7.5.1.8.4 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 502-1, IEC 60228, BS 6004:1994 or equivalent International standards.

7.5.1.8.5 SPECIFICATIONS:

These single core cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The acceptable length of cable on a drum shall be 500M and shall be supplied on standard non-returnable treated wooden drum, each drum having stencilled on each side : drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. Thickness of insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable. No negative tolerances for the diameter and thickness are acceptable

7.5.1.8.6 FEATURES AND ACCESSORIES:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size (1CX120 mm^2,4CX120 mm^2 & 1CX150 mm^2) diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC60502-1.
- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.
-

7.5.1.8.7 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.

b) Cross-sectional drawings of offered cable.

c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

d) Manufacturer's valid ISO 9001 Certificate.

7.5.1.8.8 Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

z) Manufacturer's name and/or trade name.
aa) Cable size (no. of core x conductor cross section).
bb) Year of manufacture.
cc) Purchaser's name i.e. BPDB.
dd) Meter Marking (PVC cable should carry a meter mark)

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300

mm. In case of printed over a tape, the same shall be provided inside the cable.

7.5.1.8.9 TYPE TEST:

Type Test Reports for PVC insulated and PVC sheathed Copper cable (1CX120 mm^2 , 4CX120 mm^2 & 1CX150 mm^2)from an independent testing Laboratory/ Institute as per relevant Standards (unless otherwise specified);

7.5.1.9 SPECIFICATION FOR COPPER CONTROL CABLE

7.5.1.9.1 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 502-1, BS 6004:1994 or equivalent International standards.

7.5.1.9.2 SPECIFICATIONS:

These cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 1000M and shall be supplied on standard non-returnable treated wooden drum, each drum having stencilled on each side, drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Thickness of PVC insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A mean of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name shall be provided throughout the length of the cable with year of manufacture.

Drum wound length of each drum may vary up to ± 5% of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

Description	Unit	Requirements					
Cable Size	mm^2	4CX2.5 mm^2	4CX4mm^2	4CX6mm^2	8CX2.5 mm^2	16CX2.5 mm^2	24CX2.5 mm^2
Material		plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper
Numbers &	No/m	7/0.67	7/0.85	7/1.04	7/0.67	7/0.67	7/0.67

Diameter of wires	m						
Diameter of Steel wires/ Strips	mm	1.4	4×0.8	4×0.8	4x0.8	4x0.8	4x0.8
Thickness of Steel Tape	mm	-	0.25	0.25	0.25	0.25	0.25
Maximum resistance at 30 °C	Ω/KM	7.28	3.20	3.20	7.69	7.69	7.69
Nominal thickness of PVC insulation	mm	0.8 (min.)	1.0 (min.)	1.0 (min.)	0.8 (min.)	0.8 (min.)	0.8 (min.)
Nominal thickness of PVC sheath	mm	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)
Co lour of sheath		Black	Black	Black	Black	Black	Black
Approximate outer diameter	mm	17	20	21	20	25	28
Approximate weight	Kg/KM	670	810	920	1040	1630	1730
Continuous permissible service voltage	V	600/1000	600/1000	600/1000	600/1000	600/1000	600/1000

7.5.1.9.3 FEATURES AND ACCESSORIES:

- Cables shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameters. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminum water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate without undue deterioration.
- There shall be only one length of cable on a drum.
- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.

7.5.1.9.4 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
b) Cross-sectional drawings of offered cable.
c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.
d) Manufacturer's valid ISO 9001 Certificate.

7.5.1.10 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF All Control Cable XLPE Insulated Armoured Copper Cable

7.5.1.10.1 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 502-1, IEC 60228, BS 6004:1994 or equivalent International standards.

7.5.1.10.2 SPECIFICATIONS:

These All Control cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The acceptable length of cable on a drum shall be 1000M and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side : drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. The armoured shall be round Aluminium Wire.Thickness of insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable.
The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirements as per IEC-60502-2. The insulation shall be applied by extrusion and vulcanization to form a compact homogeneous body free from micro voids and contaminates.

7.5.1.10.3 FEATURES AND ACCESSORIES:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC60502-1.
- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.

7.5.1.10.4 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.

b) Cross-sectional drawings of offered cable.

c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

d) Manufacturer's valid ISO 9001 Certificate.

7.5.1.10.5 Type Test

Type Test Reports for XLPE Insulated and PVC sheathed Copper cable (4CX4mm^2) from an independent testing Laboratory/ Institute as per relevant Standards (unless otherwise specified).

7.5.1.10.6 Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

ee) Manufacturer's name and/or trade name.
ff) Cable size (no. of core x conductor cross section).
gg) Year of manufacture.
hh) Purchaser's name i.e. BPDB.
ii) Meter Marking (PVC cable should carry a meter mark)

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm.

In case of printed over a tape, the same shall be provided inside the cable.

Note: No negative tolerances for the diameter and thickness are acceptable

4CX2.5mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**4CX2.5mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	3.20
Nominal thickness of insulation	mm	0.80
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	18
Approximate weight	Kg/KM	670
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	34
Current rating at 35 °C ambient in air	Amps	31

4CX4mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**4CX4mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.85
Maximum resistance at 20 °C	Ω/KM	4.61
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	18.4
Approximate weight	Kg/KM	720
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	34
Current rating at 35 °C ambient in air	Amps	31

4CX6mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**4CX6mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/1.04
Maximum resistance at 20 °C	Ω/KM	3.08
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	19.80
Approximate weight	Kg/KM	860
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	64
Current rating at 35 °C ambient in air	Amps	56

8CX2.5mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**8CX2.5mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.69
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	20
Approximate weight	Kg/KM	1040
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	64
Current rating at 35 °C ambient in air	Amps	56

16CX2.5mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**16CX2.5mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.41
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	25.00
Approximate weight	Kg/KM	1260
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	15
Current rating at 35 °C ambient in air	Amps	12

24CX2.5mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**16CX2.5mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.69
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	28.00
Approximate weight	Kg/KM	1730
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	15
Current rating at 35 °C ambient in air	Amps	12