WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION E-30-01

ELECTRICAL CABLES

1. GENERAL

1.1 Climate Conditions

The cables supplied shall be suitable for operation in tropical climate with maximum relative humidity of 100% and for continuous operation at an ambient temperature of 40°C.

1.2 Standards

1.2.1 The cables supplied shall comply with this Specification, the latest edition of the General Specification for Electrical Installation in Government Buildings of the HKSAR and the latest version of the following standards:

IEC 60227-3	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V – Part 3: Non-sheathed cables for fixed wiring
IEC 60227-4	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V – Part 4: Sheathed cables for fixed wiring
IEC 60228	Conductors of insulated cables
IEC 60502-1	Power cables with extruded insulation and their accessories for rated voltages from 1kV (Um=1.2kV) up to 30kV (Um=36kV) – Part 1: Cables for rated voltages of 1kV (Um=1.2kV) and 3kV (Um=3.6kV)
IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1kV (Um=1.2kV) up to 30kV (Um=36kV) – Part 2: Cables for rated voltages from 6kV (Um=7.2kV) up to 30kV (Um=36kV)
IEC 60702-1	Mineral insulated cables and their terminations with a rated voltage not exceeding 750V – Part 1: Cables
IEC 60702-2	Mineral insulated cables and their terminations with a rated voltage not exceeding 750V – Part 2: Terminations
IEC 60708	Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath

1.2.2 Subject to the agreement of the Engineer, cables complying with the following British Standards (BS) may also be accepted:

BS 5467	Thermosetting insulated, armoured cables for voltages of 600/1000V and 1900/3300V
BS 6004	PVC insulated, non-armoured cables for voltages up to and including 450/750V, for electric power, lighting and internal wiring
BS 6234	Specification for polyethylene insulation and sheath of electric cables
BS 6346	PVC insulated, armoured cables for voltages of 600/1000V and 1900/3300V
BS 6387	Specification for performance requirements for cables required to maintain circuit integrity under fire conditions
BS 6622	Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6kV to 19/33kV
BS 6724	Thermosetting insulated, armoured cables for voltages of 600/1000V and 1900/3300V, having low emission of smoke and corrosive gases when affected by fire
BS 7846	600/1000V armoured fire-resistant cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire

1.2.3 Other equivalent standards issued by internationally recognized engineering institutions or organizations may also be accepted. Manufacturers offering cables to other standards shall provide duplicate copies of such standards in English together with full details of any deviations from the standards referred above for evaluation. The quality of the cables offered shall be equal to or better than that specified in the standards stated above.

1.3 Test Certification

Type test certificates and sample test reports shall be submitted after the award of contract and before the delivery of cables for approval. Certificates covering only part of the specified requirements or not certified by a competent testing authority will not be accepted.

The test samples shall be of the same design and manufacturing process as to the cable supplied under the contract and shall be manufactured within a period not earlier than 18 months from the date of submission of the test reports.

The following tests shall be covered in the type test certificates/sample test reports submitted:

1.3.1 Cross-linked Polyethylene (XLPE) Insulated Cable

(a) Physical properties of insulation and sheaths
(b) Fire tests
(c) Conductor properties
(d) Armour resistance and physical properties
(e) Routine tests

1.3.2 PVC-insulated Cables (Non-armoured)

(a) Physical properties of PVC insulation
(b) Physical properties of sheath
(c) Conductor properties
(d) Fire tests
(e) Long term insulation resistance
(f) Routine tests

1.3.3 PVC-insulated Power and Control Cables (Armoured or Non-armoured)

(a) Insulation tests
(b) Oversheath tests
(c) Conductor properties
(d) Armour resistance and physical properties
(e) Fire tests
(f) Routine tests

1.3.4 PVC-insulated Cables for Panel Wiring

(a) Conductor properties
(b) Insulation tests
(c) Fire tests

1.3.5 Telecommunication Cables

(a) Electrical tests
(b) Mechanical tests

1.4 Cable Identification

The oversheath of cables shall be embossed with the following identification at approximately 1 metre interval :-

(a) manufacturer's name and/or trademark,
(b) voltage designation,
(c) cable type, and
(d) conductor size.

1.5 High Voltage Cables

Cables with rated voltage of 3300V or above shall be directly delivered from the cable manufacturer's works. Surplus cables which have been supplied to other projects will not be accepted unless otherwise approved by the Engineer.

1.6 Packing and Shipping

Cables shall be wound onto robust drums and adequately protected and packed so as to minimize the possibility of damage during shipment and handling. Fabricated and painted steel drums shall be used if the gross weight exceeds 8 tonnes. All drums and packing supplied shall be suitable to withstand rough handling and storage for long periods outdoors and under adverse climatic conditions. All drums, packing cases and other such materials supplied shall be non-returnable. Both ends of each cable shall be sealed to prevent ingress of moisture and to facilitate testing. For the convenience of testing, the inner end of the cable shall be brought through the side of the drum and protected by a suitable cover.

Each cable drum shall be clearly stencilled with the purchase order number, drum number, voltage designation, cable type, conductor size and length, and gross and nett weight. Each packing case shall be clearly marked so that it can be easily identified against the relevant shipping advice note.

The packing list and the works test reports shall be submitted with the delivered cables for verification and acceptance.

2. XLPE INSULATED CABLE

2.1 Applicable Standards

XLPE insulated cable of voltage rating up to 1900/3300V shall comply with IEC 60502-1 or BS 5467.

XLPE insulated cable of voltage rating 6600/11000V shall comply with IEC 60502-2 or BS 6622.

2.2 Conductor

The conductor shall be high conductivity, stranded, plain, and annealed copper complying with IEC 60228. Four-core cables shall have full size neutral conductors.

2.3 Insulation

The insulation shall consist of extruded XLPE.

2.4 Bedding

The bedding shall consist of an extruded PVC or polyethylene.

2.5 Identification of Core

Cores of cables shall be identified continuously throughout its entire length.

Identification of cores shall take the form of appropriate color or number codes in accordance with the following requirements:

Function of core	Color code	Number code
Phase conductor of a single phase circuit	Brown	L
Phase conductor of a three-phase circuit	Brown or black or grey according to phase concerned	L1 or L2 or L3 according to phase concerned
Neutral conductor	Blue	N
Core used as protective conductors shall have an exclusive color identification of green-and-yellow.		

2.6 Armour

Armour for multi-core cable shall consist of single layer of galvanised steel wires. Armour for single core cable shall consist of single layer of aluminum wires or strips.

2.7 Oversheath

The oversheath shall consist of an extruded layer of black PVC. The oversheath shall be termite proof and shall have flame retardant characteristics.

3. PVC INSULATED CABLE

3.1 Applicable Standards

PVC insulated non-armoured cables for power and lighting shall comply with IEC 60227-3 or BS 6004.

PVC insulated power and control cables shall comply with IEC 60502-1 or BS 6346.

PVC insulated cables for panel wiring shall comply with IEC 60227-3 or BS 6004.

3.2 Conductor

The conductor shall be of stranded, plain, annealed copper complying with IEC 60228. Four core cables shall have full size neutral conductors.

3.3 Insulation

The insulation shall be extruded PVC compound.

3.4 Bedding

The bedding shall consist of an extruded PVC.

3.5 Identification of Core

Requirements are same as those specified in Clause 2.5.

3.6 Armour

The wire armour shall consist of a single-layer galvanised steel wires for multi-core cables and aluminum wires or strips for single-core cable.

3.7 Oversheath

The oversheath shall consist of an extruded PVC. The oversheath shall be of black colour, termite proof and shall have flame retardant characteristics.

4. TELECOMMUNICATION CABLE

4.1 Applicable Standards

Telecommunication cables shall comply with IEC 60708.

4.2 Conductor

The conductor shall be of high conductivity, plain, annealed copper complying with IEC 60228.

4.3 Insulation

The insulation shall be of solid polyethylene compound. The insulation colours shall be easily identifiable.

A minimum of 2 pairs of cables shall be individually screened by laminated aluminum/PETP tape. Pairs shall be disposed with different lays to keep cross talk between pairs to a minimum. The interlayer lapping tape shall be of polyethylene terephthalate.

4.4 Armour

Where specified, armouring shall be of a single-layer galvanized steel wires laid helically over the sheathed cable. The armour shall be protected against corrosion by an extruded oversheath of black PVC.

4.5 Oversheath

The oversheath shall be extruded as a continuous, seamless, close fitting tube of PVC. The sheath shall be black colour, termite proof and shall have flame retardant characteristic.

5. INSPECTION & TESTING IN MANUFACTURER'S WORKS

5.1 General

Where specified in the Particular Specification, the cables supplied shall be subject to witnessed tests and inspections at the manufacturer's works by an Independent Inspection Body (IIB) approved by the Purchaser.

A report shall be produced by the cable manufacturer at the time of testing giving the readings obtained, performance calculations and any other details required to verify that the equipment under test meets the requirements of this Specification. If the IIB is employed to witness the tests, he shall endorse the test report with the original sent to the Purchaser immediately after the tests and a copy sent to the contractor.

5.2 Inspection and Test Requirements

The following inspection/tests shall be carried out on the supplied cables to verify compliance with the Specification:

Visual Inspection/Examination

(a) Identification of cable and cores
(b) Laying-up of cable cores
(c) Conductor material and construction
(d) Cable construction and overall dimensions
(e) Sealing and markings of cable ends
(f) Markings on drum

Works Test

(a) Dielectric test (except for telecommunication cables)
(b) Insulation resistance test
(c) Conductor resistance test

6. INFORMATION TO BE SUBMITTED UPON REQUEST

6.1 Technical Particulars

(a) Catalogues of the cables showing technical specifications, constructional details, materials used, current carrying capacities, etc. shall be submitted upon request by the Purchaser.

(b) Recommended bending radius, depth of direct laying, method of installation when direct laid in ground, in cable duct and in air.
(c) Cable group rating at different spacing. Effect of thermal resistivity of soil.
(d) Dimensions and weights, constructional details, cross-section drawing.
(e) Cable jointing and termination instructions, stripping dimensions, bonding of semi-conducting layers etc.

- End of this Specification -