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Code for Content Depth on Preliminary Design of Urban Power Cables

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Foreword

This code is prepared as required by the *Notice on Issuance of Development & Revision Plan for Industry Standards in 2007* issued by the General Office of National Development and Reform Commission (FGBGY〔2007〕1415).

This code is proposed by China Electricity Council.

This code is solely managed and interpreted by the Technical Committee on Electric Power Planning and Engineering of Standardization Administration of Power Industry.

This code is drafted by Beijing Electric Power Design Institute.

The participants in the development of this code also include Shanghai Electric Power Design Institute Co. Ltd.

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The opinions and suggestions proposed during the implementation of this code are to be referred to the Standardization Center of China Electricity Council at the following address: No. 1 Ertiao Lane, Baiguanglu Rd., Xuanwu District, Beijing 100761 China.

This code is translated by SUNTHER Translation & Solutions under the authority of China Electric Power Planning & Engineering Association.

1 Scope

This code specifies the content depth requirements of preliminary design of urban power cables.

This code is applicable to the preliminary design of newly built 35 kV–220 kV urban power cables. For newly built power cables rated below 35 kV or retrofitted cables rated 35 kV–220 kV, the code may be used for reference.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this code. For dated references, subsequent amendments (excluding the contents of errata) to, or revision of, any of these publications do not apply. However, parties to agreements based on this code are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

GB 50217 *Code for Design of Cables of Electric Engineering*

DL/T 5221 *Technical Rule for Design of Urban Power Cables*

3 Terms and Definitions

The following terms and definitions apply to this code.

3.0.1

Cable corridor

The collective term for direct burying, ducts, cable troughs, and cable tunnels.

4 General

4.0.1 Design documents shall comply with the regulations on their preparation and approval issued by the state and competent authorities.

4.0.2 National capital construction procedures shall be followed. Approved or submitted feasibility study reports and design basis documents (including approvals from the access system) are prerequisite for preliminary design.

4.0.3 Design documents shall comply with technical principles and policies promulgated by the state, instructions from superior authorities, and the provisions of GB 50217 and DL/T 5221.

4.0.4 The content depth of preliminary design shall meet the following requirements:

1 Design proposals shall be compared and demonstrated to determine the optimum proposal;

2 Implementation of design route and related agreements;

3 Estimation of main equipment and materials;

4 Control of project investments;

5 Basis for design of construction drawings.

4.0.5 A preliminary design shall cover the following contents:

1 Specifications;

2 Drawings;

3 Lists of main equipment and materials;

4 Budget estimates;

5 Survey reports on hydro-meteorology and engineering geology (if necessary);

6 Related technical subject reports on project (if necessary).

4.0.6 The specifications of a preliminary design shall usually cover the following contents:

1 Overview;
2 Power system access scheme;
3 Power cable route;
4 Meteorological conditions and soil characteristics;
5 Selection of power cables and their accessories;
6 Overvoltage protection, grounding and section;
7 Communication interference;
8 Laying mode, support and fixing of cables;
9 Cable terminal stations and poles (towers);
10 Design of oil supply for oil-filled cables;
11 Civil engineering work;
12 Cable corridor subsidiary facilities;
13 Cable corridor fire protection design;
14 Treatment of special areas in cable laying;
15 Environmental protection and labor safety;
16 Other descriptions;
17 Appendix.

5 Specifications

5.1 Overview

5.1.1 Design Basis

1 Related national policies, laws and regulations;

2 Commission contract or notice of award for design service;

3 Approved feasibility study reports and approvals (with identified document numbers and titles);

4 Other important documents related to engineering construction;

5 Planning proposals.

5.1.2 Scale of Construction

1 Start point and end point, rated voltage, transmission power, line length, and number of circuits of cable lines, as well as construction stage.

2 Structure and length of cable corridor, type and quantity of manhole.

3 Size and quantity of cable terminal stations and poles (towers).

5.1.3 Scope of Design

This section shall define the scope and contents of design, outsourced items, division of design, and preparation of project estimates.

5.1.4 Main Technical and Economic Features

1 Type, length and number of circuits of cable lines;

2 Type and quantity of cable accessories;

3 Hydrologic, geological, and traffic conditions, as well as

major intersections and crossovers along the route;

4 Length, way of construction, and structure of cable corridors;

5 Quantity of manholes and their distribution;

6 Size and quantity of cable terminal stations and poles (towers);

7 Cable line composite cost, proper cost, and cost per kilometer;

8 Amount of main materials of cable corridor per kilometer.

5.1.5 **Cost Analysis**

5.2 Power System Access Scheme

5.2.1 An overview of local conditions and current status of local power network shall be given.

5.2.2 The necessity of project shall be stated.

5.2.3 A brief description of the approved power system access scheme shall be given.

5.2.4 Planning of other cable lines within the region shall be stated.

5.2.5 Planning of power plant/substation incoming and outgoing lines at either end shall be stated.

5.3 Power Cable Route

5.3.1 The route of a power cable shall be determined in accordance with the following principles:

1 In line with the overall urban planning, arranged in coordination with other utility pipelines and facilities, and subject to approval by urban planning authorities;

2 The cables shall be protected against external mechanical force, excessive heat, corrosion, and other hazards;

3 The cables' length shall be made as short as possible so long

as safety requirements are met;

4 The cables shall allow for easy laying and maintenance;

5 The cables should be diverted to avoid locations where excavation is to be performed.

5.3.2 The location and direction of incoming and outgoing lines in substations and cable terminal stations, the relation of newly built cable corridors to the existing and proposed ones, and short-term and long-term transition plans shall be stated.

5.3.3 The routing scheme of a power cable shall cover the following contents:

1 Topographic, geological and hydrologic conditions, forest, main rivers, railways, subways, Class-II above highways, urban planning, environmental characteristics, special obstacles along the route;

2 Type and distribution of manholes;

3 Sources of geological and hydrologic information;

4 Agreements related to cable route;

5 Special locations along the route and measures taken;

6 Technical and economic comparison of optional schemes and results;

7 A brief description of the recommended route scheme.

5.4 Meteorological Conditions and Soil Characteristics

5.4.1 Source of meteorological information, including names of meteorological observatories (stations).

5.4.2 The maximum temperature, minimum temperature, annual average temperature, thunderstorm days, wind speed, illumination, soil freezing depth and ice coating thickness through which the line runs.

5.4.3 Seismic intensity in areas through which the line runs.

5.4.4 Ambient temperature and soil characteristics of the project.

5.5 Selection of Power Cables and Their Accessories

5.5.1 Selection of Power Cables:

1 The cross section and type of power cables shall be determined based on the transmission capacity required by the system, the requirements for thermal stability under maximum short-circuit current, project-specific characteristics, laying environment, and past experiences.

2 The maximum and minimum working oil pressure of cables under steady state shall be considered to determine the cross section and type of oil-filled cables.

5.5.2 The cross section and type of cross bonding cables and ground wires and type of sheath protections shall be determined based on the short-circuit thermal stability conditions and grounding modes.

5.5.3 Selection of Cable Accessories:

1 Types and specifications of cable accessories shall be specified according to voltage level, type of cable insulation, installation environment, pollution level, operation condition, reliability and economic efficiency required by the project.

2 Cable accessories include terminals, cable joints, cross bonding boxes, grounding boxes, cross bonding cables, grounding cables, and sheath protections.

5.6 Overvoltage Protection, Grounding and Section

5.6.1 The overvoltage protection measures of power cables shall be stated.

5.6.2 The grounding mode and section length shall be specified according to the system short-circuit capacity, number of cores, cable length, and the core current under normal operation conditions.

5.6.3 The layout scheme of independent earthing devices along the cable corridor shall be proposed.

5.7 Communication Interference

5.7.1 Design Principles and Basis:

1 The calculation results of single-phase zero-sequence short-circuit current in the system whose neutral point is earthed, and the reference power system development plan's term;

2 Locations of communication lines within the affected scope of power cables and source of information, as well as plans of locations close to communication cables within the affected scope.

5.7.2 Calculation, Analysis, and Recommendations:

1 The hazard and interference effects on neighboring communication cables or microelectronic test equipment shall be calculated, and relevant parameters such as shielding factor and coefficients of mutual inductance shall be analyzed;

2 Recommended proposals for protection of neighboring communication cables or microelectronic test equipment shall be made after technical and economic comparison and based on project-specific information.

5.8 Laying Mode, Support and Fixing of Cables

5.8.1 The laying mode of cables shall be determined based on project conditions, environmental characteristics, load requirements, and cable types, which meets the requirements on reliable operation and convenient maintenance, and is technically and economically feasible.

The laying mode of cables along cable routes and the reasons for selecting this mode shall be given.

5.8.2 The arrangement mode and laying location of cables in newly built and existing cable corridors, manholes, cable mezzanines, and cable shafts shall be specified considering the transmission capacity and corridor capacity.

The arrangement and layout scheme of cable joints shall be specified based on corridor space, distribution of manholes, and cable sections.

5.8.3 Cable supports and fixtures shall be determined based on cable corridors and mezzanines environment, slope of cable corridors, and laying mode of cables:

5.8.4 Design of Cable Supports:

1 The material, number of layers, vertical distance between layers, layer length, and spacing between cable supports shall be described.

2 The grounding mode and anti-corrosion treatment of cable supports shall be specified.

5.9 Cable Terminal Stations and Poles (Towers)

5.9.1 The size of cable terminal stations shall be determined based on network planning and incoming and outgoing lines.

5.9.2 The layout scheme of cable terminal stations and type of electrical equipment shall be proposed.

5.9.3 The size, layout scheme, and type of cable poles (towers) shall be determined based on network planning.

5.10 Design of Oil Supply for Oil-filled Cables

5.10.1 Design of Oil Supply for Oil-filed Cables: