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# Technical Rule for Design of Urban Power Cables

## 城市电力电缆线路设计技术规定 (英文版)

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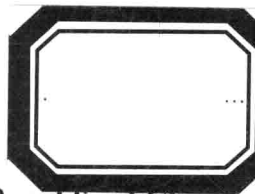
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## Technical Rule for Design of Urban Power Cables

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Translated by: SUNTHER Consulting Co., Ltd.

Reviewed by: Shanghai Electric Power Design Institute Co., Ltd.

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## Foreword

This rule is prepared in accordance with the *Notice on Issuing the Plan of Preparation and Amendment of Electric Power Industry Standards in 2002* issued by the State Economic and Trade Commission (GJMDL [2002] 973).

This rule is prepared for the purpose of meeting the demands for design and construction of urban power cables and is intended to specify the main technical design requirement of urban power cables rated AC 220 kV and below in China.

Appendix A, Appendix B, Appendix F and Appendix H to this rule are normative.

Appendix C, Appendix D, Appendix E and Appendix G to this rule are informative.

This rule is proposed by China Electricity Council.

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

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This rule is translated by SUNTHER Consulting Co., Ltd. under the authority of China Electric Power Planning & Engineering Association.

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## 1 Scope

This rule specifies the design principles and technical requirements for building and expanding urban power cables of 10 kV-220 kV.

This rule is mainly applicable to the design of 10 kV-220 kV urban power cable works that are newly built or expanded and may be taken as a reference for designing other cable works.

## 2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this rule. 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 rule 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 documents apply.

GB 50017 *Code for Design of Steel Structures*

JB/T 10181.1–10181.5 *Calculation of the Current Rating of Electric Cables*

### 3 Terms and Definitions

The following terms and definitions apply to this rule.

#### 3.0.1

##### **Direct Burying**

A cable laying method by which cables are placed in excavated trenches and covered with precast reinforced concrete slab after a certain thickness of sandy soil or fine soil has been spread above and below the cables along the cable route and then soil is backfilled and compacted flush with the ground surface.

#### 3.0.2

##### **Cable Duct**

An underground structure where multiple pipes are erected at one attempt after the trench is excavated in accordance with the planned number of cables.

#### 3.0.3

##### **Cable Trough**

A cable structure that is not accessible and covered with removable cover plates which are flush with or slightly deviate from the grade level.

#### 3.0.4

##### **Cable Tunnel**

A fully enclosed cable structure where a number of cables are contained and accesses are made available for installation and patrol inspection of cables.

#### 3.0.5

##### **Manhole**

A structure intended for operators to install joints or pull cables.

3.0.6

**Shield Voltage Limiter**

A device that is connected to the metallic sheath or shield or cross-bonding metallic shield and intended to limit the voltage of the metallic sheath or shield occurring during the transients of the system.

3.0.7

**Pressure Tank**

An oil tank that is used to accommodate the change in volume of oil in oil-filling cables.

3.0.8

**Oil Demand**

Oil quantity required to ensure continuous operation of cables within the specified oil pressure range when the temperature of cables changes.

3.0.9

**Normal Oil Pressure**

An oil pressure at which cables can operate safely and continuously.

3.0.10

**Transient Oil Pressure**

A temporary oil pressure that arise as a result of sudden change in the temperature of cables.

3.0.11

**Snake Laying**

Cables that are laid in a snake fashion so as to accommodate thermal expansion and contraction of cables.

3.0.12

**Offset**

Cables laid in arc-shaped at some local sections. Where offsets

are arranged at the manholes at both ends of cable ducts, they are used to accommodate the thermal expansion and contraction of the cables in the cable duct; where they are arranged on large-span bridges, they are used to accommodate the expansion and contraction of cables resulting from the thermal expansion and contraction of the bridge body.

3.0.13

**Cross-bonding**

A special connection mode in which the metallic sheaths or shield layers of the adjacent sectionalized cables are connected in a cross manner such that the continuous circuit of each metallic sheath or shield layer can surround the three-phase conductors successively.

3.0.14

**Circumscribed Circle Diameter**

The diameter of the circumscribed circle around three cables arranged in delta fashion.

## 4 General Provisions

4.0.1 This rule is established to satisfy the demand for development of urban power cables and design of HV power cables such that the urban power cables are technically advanced and economically reasonable, can supply power safely and reliably and can be easily built, repaired and maintained.

4.0.2 The power cable works must be designed in line with the national technical and economic policies and the requirements for urban planning and development through aggressive and prudent use of new technologies and techniques in an effort to render them technically advanced, economically reasonable, safe and applicable and to be easily built and maintained.

4.0.3 In addition to this rule, other relevant national standards in force shall also be complied with in the design of urban power network.

## 5 Cable Route

5.0.1 The design of the cable route shall be adaptable to the overall planning of urban areas, and shall be arranged together with various pipelines and other municipal facilities in a unified way and subject to the approval from the urban planning authorities.

5.0.2 The design of the cable route shall be made in a cost effective, safe and applicable manner by considering various factors including the route length and the ease of construction, operation and maintenance.

5.0.3 The civil works facilities for laying cables should be built at one attempt in accordance with the prospective planning of grids and have appropriate margin reserved.

5.0.4 The underground facilities intended for cable laying or cables directly buried shall not be arranged right above or below other pipelines in parallel with them.

5.0.5 The minimum permissible spacing between the power cables and that between power cables and other pipelines or building foundations shall comply with the values specified in Table 5.0.5. If it cannot comply with these values at local sections, then necessary protective measures shall be taken.

**Table 5.0.5 Minimum permissible spacing between power cables and that between power cables and pipelines or building foundations**

| Surrounding conditions of directly buried cables | Minimum permissible spacing<br>m |                   |
|--|----------------------------------|-------------------|
|  | Parallel                         | Cross             |
| Centers between power cables                     | 0.20                             | 0.50 <sup>a</sup> |

Table 5.0.5 (continued)

| Surrounding conditions of directly buried cables  | Minimum permissible spacing<br>m |                   |
|---|----------------------------------|-------------------|
|   | Parallel                         | Cross             |
| Net distance apart from cables used by other departments  | 0.50 <sup>a</sup>                | 0.50 <sup>a</sup> |
| Net distance apart from thermal pipes and thermal equipment   | 2.00                             | 0.50 <sup>a</sup> |
| Net distance apart from gas pipes, oil pipes, underground oil tanks or gas tanks  | 1.00                             | 0.50 <sup>a</sup> |
| Net distance apart from potable water pipes and other pipes   | 0.50                             | 0.50 <sup>a</sup> |
| Net distance apart from the railway road bed  | 3.00                             | 1.00              |
| Net distance apart from building foundations  | 0.06                             | —                 |
| Centers between power cables and distribution line poles, lamp posts, streetcar pulling line poles and overhead communication line poles  | 1.00                             | —                 |
| Centers between power cables and tree trunks  | 0.70                             | —                 |
| Net distance apart from the bank of drainage ditches  | 1.00                             | 0.50              |
| Net distance apart from the side of roads   | 1.50                             | 1.00 <sup>a</sup> |
| Net distance apart from weak current communication or signal cables   | According to the calculation     | 0.25              |
| <p>a The net distance may be reduced by half in cases where the cables are separated using partition plates or are laid by penetrating them through conduits.</p> <p>b The permissible minimum net distance between power cables and weak current communication or signal cables are determined by the calculation results of the single-phase grounding short-circuit current of the power system and the length by which they run parallel to each other.</p> |                                  |                   |

5.0.6 Where cables cross rivers, laying cables on urban traffic bridges and in traffic tunnels should be given priority.



5.0.7 Laying cables on urban traffic bridges or in traffic tunnels shall not affect the structure of the bridges or tunnels and shall be subject to the approval from the design and management department of bridges and tunnels.

5.0.8 Where no traffic bridge or tunnel is available for utilization in the vicinity of the cable route, the processes other than excavation should be adopted for cable laying, or bridges or tunnels exclusively used for cable laying should be built.