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Code for aseismic design of electrical facilities in industrial plants

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1 General

1.0.1 In order to implement the principle of "prevention first" in the electrical engineering design of industrial enterprises, so as to reduce the earthquake damage and loss of electrical equipment and avoid casualties, this code is formulated.

1.0.2 This code is applicable to the seismic design of electrical equipment (hereinafter referred to as electrical equipment) of industrial enterprises with a voltage of 220kV and below in areas where the design basic seismic acceleration value is less than or equal to 0.40g (that is, the seismic fortification intensity is 9 degrees and below). The seismic design of electrical equipment in industrial enterprises with a design basic seismic acceleration value greater than 0.40g or in industries with special requirements shall be carried out in accordance with the relevant special regulations of the state.

1.0.3 The electrical equipment with anti-seismic design according to this code can not be damaged and can continue to be used when it is affected by an earthquake equal to or below the anti-seismic fortification intensity of the area.

1.0.4 The design of electrical equipment in areas where the basic seismic acceleration is 0.05g (that is, the seismic fortification intensity is 6 degrees) and above must be designed for earthquake resistance.

1.0.5 According to the importance and special needs in the power supply system, enterprise electrical equipment can be divided into important electrical equipment and general electrical equipment, and shall meet the following regulations.

1 The electrical equipment with a voltage of 110kV and 220kV or supplying power to the enterprise's primary power load, as well as other electrical equipment that needs to ensure continuous power supply during an earthquake, are important electrical equipment;

2 The electrical equipment other than those mentioned in the preceding paragraph are general electrical equipment.

1.0.6 The design basic seismic acceleration value shall adopt the provisions of China's seismic fortification zoning map; for areas where seismic fortification zoning has been compiled or for engineering sites that have undergone seismic safety evaluation, the approved design ground motion parameters or seismic fortification intensity may be used. Fortify against earthquakes.

1.0.7 This specification stipulates the basic technical requirements for the seismic design of electrical equipment in industrial enterprises. When this specification conflicts with the provisions of relevant national laws and administrative regulations, the provisions of national laws and administrative regulations shall be followed.

1.0.8 The anti-seismic design of electrical equipment shall not only comply with this code, but also comply with the current relevant national standards.

2.1.1 Aseismic design

A specialized design of engineering structures that require seismic fortification. Generally, it includes three aspects. seismic conceptual design, structural seismic calculation and seismic structural measures.

2.1.2 Basic seismic intensity bastcmic intensity

In the 50-year period, under general site conditions, the possible earthquake intensity value with a probability of exceeding 10% is equivalent to the intensity value that occurs once in 175 years.

2.1.3 earthquake action effect

The internal force (shear force, bending moment, axial force, torque, etc.) or deformation (linear displacement, angular displacement, etc.) of the structure generated by the earthquake.

2.1.4 Seismic influence coefficient

The statistical average of the ratio of the maximum acceleration response to the gravitational acceleration of a single-particle elastic system under earthquake action.

2.2.1 Earthquake action and action effect

F-seismic action of electrical equipment (structure);

m - the mass of electrical equipment;

mi-mass concentrated at the operating state of particle i;

M - bending moment;

T is the natural vibration period of the structure;

Tg - characteristic period;

sigma--tensile (compressive) stress;

tau--shear stress.

2.2.2 Material properties

E - elastic modulus of the material;

K--the lateral stiffness of the system;

sigma--tensile (compressive) stress;

tau--shear stress (Pa);

[sigma] - design value of allowable stress;

[tau] - design value of allowable shear stress.

2.2.3 Geometric parameters

A - cross-sectional area;

d - the inner diameter of the circular section;

D - the outer diameter of the circular section;

H - the height of the structure;

Hi--calculated height of particle i;

I--section moment of inertia;

W - section modulus;

Z--section moment.

2.2.4 Calculation coefficients

g - acceleration of gravity;

k - unbalance coefficient;

alpha-seismic influence coefficient;

alphamax--maximum value of seismic influence coefficient;

beta-floor power amplification factor;

lambda--stiffness reduction coefficient;

gamma-mode shape participation coefficient.

3 Basic requirements for seismic design

3.0.1 The earthquake impact on the area where the electrical equipment is located can be characterized by the following ground motion parameters.

1 Design basic seismic acceleration or seismic fortification intensity;

2 characteristic period.

3.0.2 The corresponding relationship between the design basic seismic acceleration value and the seismic fortification intensity shall comply with the provisions in Table 3.0.2.

Table 3.0.2 Correspondence between design basic seismic acceleration values and seismic fortification intensity

Note: g is the acceleration of gravity 9.81m/s2 3.0.3 When electrical equipment such as power transformers, vertically arranged three-phase reactors, lightning arresters, circuit breakers, and porcelain bushings have one of the following conditions, seismic check calculations shall be carried out.

1 The voltage is 110kV and 220kV;

2 Areas where the design basic seismic acceleration is 0.20g and above;

3 Design the area where the basic seismic acceleration is 0.10g and 0.15g and the height of the floor or support for placing electrical equipment is greater than 1.8m.

3.0.4 Power capacitors, batteries, high-voltage switchgear, rectifier cabinets, low-voltage power distribution panels, control protection panels, DC panels, uninterruptible power supply equipment, power distribution boxes, etc., and electrical equipment other than those specified in Article 3.0.3 of this code Seismic calculation may not be carried out, but anti-seismic measures shall be taken.

3.0.5 For important electrical equipment, anti-seismic measures shall be taken according to the increase of the seismic fortification intensity of the area by one degree, but when the seismic fortification intensity is 9 degrees, anti-seismic measures shall be taken according to the requirements higher than 9 degrees; the design basic seismic acceleration adopted in the calculation of earthquake action The value should be increased by 0.05g, but it will not be increased when the design basic seismic acceleration is 0.20g and above.