


کد سند: RO-S-F-28-04	معاونت پژوهشی	
تاریخ صدور: ۱۳۹۹/۴/۲۲		
تاریخ ویرایش: ۱۴۰۰/۰۳/۲۵	فرم خلاصه انگلیسی طرح/ پروژه	

**Project Title:** Instruction of selection and dimensioning of high-voltage insulators intended for use in polluted conditions (for a.c. systems)

<b>Department:</b>	Non metallic materials	<b>Employer:</b>	Niroo Research Institute
<b>Project/Program Manager:</b>	Hesam Fallah-Arani	<b>Executor:</b>	Majid Rezaei
<b>Project Financial Code:</b>	600039	<b>Project Quality Code:</b>	PTPN12
<b>Type of Project/Program:</b>	Instruction	<b>Assistant:</b>	Transmission

**Project Staff:** Safar Farzalizadeh, Majid Rezaei, Davood Mohammadi, Behnam Elmdoust, Somaye Nobari

**Keywords:** Instruction, Selection insulators, Creepage distance, Pollution environments, insulator profiles, Corona, Service experience, Electrical characteristic, Mechanical characteristic

#### **Project Necessity:**

One of the most important factors in the design of transmission lines is the design and selection of insulators. Transmission lines are always exposed to various environmental, electrical and mechanical stresses due to their extent in different parts of the country. Outdoor environmental conditions in a wide range of different environmental parameters such as temperature, humidity, ultraviolet radiation and pollution affect the performance of insulation surfaces. High voltage insulators, in addition to being subjected to constant stress by the operating voltage of the line, are always exposed to other unwanted voltage stresses, such as external over-voltages caused by lightning and lightning strikes on the transmission line, and internal over-voltages caused by switching. In addition to electrical stresses, transmission line insulators are also subject to mechanical stresses applied to conductors by the weight of the conductor, the possible ice weight on the conductors, the pressure, and the wind forces. Therefore, insulators should be designed and selected in such a way that, while having the desired electrical endurance, they also meet the necessary criteria mechanically. The reliability of power networks depends on the quality and reliability of insulators, and therefore the proper selection of insulators is very important. In general, the selection of insulators includes the following steps:

- 1- Choosing the appropriate approach to selecting an insulator according to the limitations, available resources and available information
- 2- Selection of insulators based on electrical criteria such as internal over-voltages, corona and pollution
- 3- Selection of insulators from the point of view of mechanical specifications

4- Selecting insulators that meet both electrical and mechanical criteria.

In all the above steps, the mentioned technical criteria must be accompanied by economic criteria. In other words, the final selection of insulators must be done in a way that leads to a technically and economically optimal design.

### **Project Goals:**

The objective of project of Instruction of selection and dimensioning of high-voltage insulators intended for use in polluted conditions (for a.c. systems) which are defined and developed in four chapters, is as follows:

- Review of investigation on the world and Iran to make power grids resistant to pollution conditions, especially the dust phenomenon
- Determination the necessary criteria for the type, dimensions and profile of insulators (ceramic, glass and polymer) in different pollution conditions of the Iran, especially in contaminated areas based on the site pollution severity (SPS)
- Determination the necessary criteria for the mechanical characteristics of types of insulators (ceramic, glass and polymer) for different regions of the country according to the SPS class
- Providing insulator selection criteria based on insulation coordination considerations (power frequency, lightning and switching)
- Determination of Input parameters for the selection and dimensioning of insulators
- Determination of creepage distance, profile, shed angle, clearance, Arc distance
- Insulator selection considerations in different conditions (with and without pollution)
- Considerations for selecting insulators in industrial pollution conditions

### **Abstract:**

In the mentioned project according to IEC 60815 standard, in order to select suitable insulators based on System Requirements and Environmental Conditions, 3 approaches have been proposed. The feasibility of each of these approaches depends on the available information, time and economic cost of the project, and in strategic lines all resources will be used with priority given to increasing line

reliability. Since the performance of insulators in contamination conditions is determined by a complex and dynamic reciprocal process between the environment and the insulator, ensuring the correct choice of the appropriate insulator type and dimensions varies depending on the decision-making process during these processes. It should be noted that the estimation in these approaches leads to the final solution being associated with the over-design relative to the actual operating conditions.

### **Steps and Methodologies:**

The project of Instruction of selection and dimensioning of high-voltage insulators intended for use in polluted conditions (for a.c. systems) in four chapters according to the considerations of insulation coordination, SPS class, climatic conditions, especially pollution and operation. In summary, in the first chapter, the necessary criteria for selecting the type of insulators in transmission lines up to 400 kV, along with international standards and technical documents related to insulators are studied. In the second chapter, insulator selection considerations in contaminated areas, including selection of material, profile, creep distance and insulator selection considerations in conditions of both snow and ice contamination and bird contamination are prepared. In the continuation of the project, the experiences of developed and developing countries in the field of insulator selection were collected and at the end, a draft of insulator selection instructions was compiled.

### **Main Results (technical outputs, patents, papers, books, reports, etc.):**

1. Instruction of "Selection and dimensioning of high-voltage insulators intended for use in polluted conditions (for a.c. systems)"
2. Study and review of ceramic, composite and polymer insulators standards
3. Study and review the necessary criteria for selecting insulators
4. Study and review of mechanical and electrical specifications of insulators
5. Study and review of types of pollution and insulator installation environment
6. Project documentation:
  - Project report; Phase 1, Report code: PTPN12 / T01
  - Project report; Phase 2, Report code PTPN12 / T02
  - Project report; Phase 3, Report code PTPN12 / T03
  - Project report; Phase 3, Report code PTPN12 / T04