EARTHQUAKE RESISTANCE OF PORCELAIN INSULATOR ELECTRIC POWER EQUIPMENT

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SYNOPSIS

As many earthquake disaster in electric power industry were caused by failure of porcelain insulators, this research has been principally concentrated on these types of equipments, considering earthquake resistance of equipment which is actually installed on a ground. In this study, it is found that non linear characteristics of stays and soil springs are useful to keep equipments safe against strong motion earthquake.

CONCLUSION

1) Non Linear Characteristics Produced by Heavy Weighted Stays

Electric equipments employing porcelain insulators are, in dynamic sence, composed of gantry structures, frameworks and heavy weighted stays, and are a sort of complicated structures being mounted with a series of eccentric heavy weighted masses.

Therefore many field experiments have indicated that the vibration contains considerably complicated phenomena. The main vibration usually are caused by irregular vibrations of heavy stays, being induced from change of tension by acceleration and vibration of equipment proper.

Such a phenomenon is conceived, on the other hand, to attribute largely to the non linearity of response magnification and consequently to secure earthquake resistance.

2) Aseismatic Improvement

Various investigation on aseismatic improvement have been made. That is to say, reinforcement of supporting porcelain insulators and frameworks for cable head, emplyment of dampers and cushion rubbers for circuit brakers, rearrangement of stays for various line switches and supporting porcelain insulators being attached on pipe bus and etcs. These measures were confirmed to contribute greatly to improvement of ultimate strength of the electric equipments, not only by tests but also by various quantitative analyses.

3) Safety of Comprehensive Systems

After confirming strength of the equipment proper, the overall safety of the equipment in-situ as a comprehensive system including the effect of ground, must be ultimately confirmed. Then a calculation method for obtaining the optimum size and shape of foundation structures has been developed to secure the ultimate strength of the equipment.

4) Future Problems

In order to simplify such designing method reasonably and to confirm the adequacy of the above mentioned method, a large scale vibration experiment in-situ by means of large vibration machine (out put 450 tons at 13 Hz) will be conducted to secure proving data.

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