

From TSS interim guidelines

V.L. LINE AND SUBSTATION OPERATION AND MAINTENANCE

1.0 GENERAL REQUIREMENTS

1.1 Each facility owner shall have an established and documented program for the maintenance of all equipment critical to the reliable operation of the bulk power system.

1.2 Preventive maintenance shall be performed at a level that assures that the unscheduled outage performance of Customer owned equipment, *if applicable*, is at least as good as that of the TO's system to which it is connected.

1.3 Maintenance programs can vary in range from strict adherence to manufacturers recommendations to RCM (reliability centered maintenance), as appropriate, but should reflect Good Utility Practice.

1.4 Maintenance of equipment shall be performed such that the facility owner is able to support any local interconnection agreements. Additionally, the maintenance of system spare equipment must not be overlooked.

1.5 Substation equipment shall be maintained by qualified personnel in accordance with applicable industry standards and Good Utility Practice to provide maximum operating performance and reliability.

1.6 Incorrect operation of equipment or equipment failure should be thoroughly investigated and documented to determine the root cause of the problem in collaboration with the affected Transmission Owners.

2.0 EQUIPMENT AND FACILITIES

2.1 Equipment diagnostic tools and tests can be utilized in the evaluation of the need for required maintenance. Examples include dielectric testing and analysis, breaker timing, thermography scans, and acoustic monitoring. The facility owner's plan should be clear as to the application, as appropriate, of these diagnostic tools. Pass/fail ranges and testing intervals should be well documented. *Manufacturers should be contacted concerning specific maintenance intervals.*

2.2 Thermography scanning should be incorporated in inspections. Thermography in electrical inspection is a non-contacting operation, which is applied to in-service equipment while energized and carrying load. Problems are detected either as a function of excessive temperature rise (such as a poor connection) or a subnormal temperature (such as a cool transformer radiator fin signifying a blocked passage). It is considered by many to be an easy and very productive method of finding potential problems before they become failures. Most utilities conduct such inspections at least annually.

2.3 Frequency of operation should also be factored into the determination of maintenance periodicity. Trending of equipment performance versus maintenance should be used to re-evaluate maintenance intervals.

2.4 For equipment under warranty all required maintenance to maintain warranty should be performed.

It is suggested that equipment performance be reviewed prior to warranty expiration.

2.5 Maintenance of equipment should include diagnostics and overhauls as required to maintain system integrity. Attention should be given to both the mechanical and the electrical aspects of the equipment being maintained. Use of incorrect lubricants can adversely affect equipment performance.

2.6 Adequate spare parts should be kept on hand to support maintenance and anticipated failures.

2.7 Manufacturer's service bulletins must be acted upon in a timely manner.

~~2.A OVERHEAD TRANSMISSION LINES~~

~~2.A.1 Preventive Maintenance~~

~~2.A.1.1 Intervals~~

~~Maintenance intervals shall be determined and appropriate maintenance action shall be performed at specified intervals.~~

~~2.A.1.2 Required Inspections~~

~~Inspection of transmission lines for defects can be accomplished via ground or aerial patrols. The purpose of these patrols is to identify transmission line defects which can include: loose / missing / worn hardware, broken/cracked insulators, broken conductor and static wire strands, guy wires, foundations, loose/missing structure bolts and other defects.~~

~~2.A.2 Corrective Repair & Maintenance~~

~~The defects identified during the transmission line inspection shall be repaired based upon the priority and significance of the defect. Routine maintenance activities such as structure painting, grounding system testing, right-of-way maintenance, etc. shall be performed on a routine basis.~~

2.B UNDERGROUND TRANSMISSION CABLES

2.B.1 Pipe type cable systems require regular maintenance, inspection, monitoring on pumping plants to confirm that the plants are operating reliably. Alarms are usually included in these plants to indicate that low pressure or frequent pump cycling has been detected. Ability to monitor the plant remotely is highly suggested.

2.B.2 Cathodic protection systems need to be routinely inspected and maintained to ensure long term pipe reliability.

2.B.3 Dissolved gas analysis of oil removed from the pipe system, usually taken from splice and termination locations should be performed routinely. Tracking levels of dissolved combustible gases in the dielectric fluid over time can be used as a sensitive method of identifying incipient failures in pipe type cable systems.