



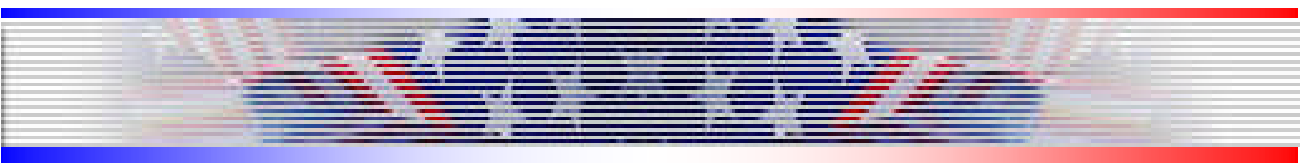
NETWORK RELIABILITY AND INTEROPERABILITY COUNCIL (NRIC) V

POWER Network Reliability Best Practices

- Working Draft -

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Service Providers

The Best Practice Team reviewed the complete list of Best Practices, for application to the service provider segment of the Telecommunications Industry and recommends full implementation of the following Best Practices:

POWER (PW) Best Practices

Lead Editor – Michael Marchando, Covad Communications

- PW01** Place strong emphasis on human activities related to the operation of power systems (e.g. maintenance procedures, alarm system operation and response procedures, and training for operations personnel (craft)). Provide hands-on training for operation and maintenance of power equipment, including regularly scheduled refresher training. Train local workforces on AC switchgear to understand procedures and stage occasional rehearsals.
- PW02** Ensure diversity within power supply and distribution system so that single point failures are not catastrophic. For large battery plants in critical offices, provide dual AC feeds (odd/even power service cabinets for rectifiers). Transfer switches (UL standard 1008) should be used in lieu of paired breakers. The two transfer breakers (in power transfer systems) must be mechanically and electrically interlocked. Dual commercial AC power feeds with diverse routing from separate substations should be provided for the most critical network facilities and data centers.
- PW03** Adhere to applicable power engineering design standards.
- PW04** Service Providers should retain complete authority about when to transfer from the electric utility and operate standby generators.
- PW05** Service Providers should not normally enter into power curtailment or load sharing contracts with electric utilities.
- PW06** Service Providers and electric utilities should plan jointly to coordinate hurricane and other disaster restoration work.
- PW07** Service Providers should establish a general requirement for some level of power conditioning, monitoring and protection for sensitive equipment.
- PW08** Design standby generator systems for fully automatic operation and for ease of manual operation, when required.
- PW09** Maintain adequate fuel on-site and have a well-defined re-supply plan. Improve fuel systems reliability. Provide redundant pumps for day tanks and a manual-priming pump. Wherever possible, use dual-source generators with direct line natural gas as the primary and liquid fuel (normally diesel) as a backup to provide a long-term fuel source in times of long power outages.
- PW10** Provide maintenance systems for extended operation of emergency backup systems.
- PW11** Have a well-defined plan that is periodically verified for providing portable generators to offices with and without stationary engines in the event of an engine failure.
- PW12** Service Providers should routinely exercise engines with load, within permissible state and federal laws.
- PW13** Service Providers should run engines for a period of at least 1 hour on a monthly basis and, at least 5 hours, with all available loads annually. Perform annual

- evaluation/maintenance of all power equipment. Maintain the power alarms by testing the alarms on a scheduled basis.
- PW14** Coordinate engine runs with all building occupants to avoid interruptions.
- PW15** Provide indicating type control fuses on the front of the power panels, including smaller distribution panels.
- PW16** Provide color-coded mimic buses showing power sources, transfer arrangements, essential/nonessential buses, etc.
- PW17** Post at the equipment (or have readily available) single line and control schematics.
- PW18** Keep circuit breaker racking/ratchet tools, spare fuses, fuse pullers, etc. on hand.
- PW19** Clearly label the equipment served by each circuit breaker.
- PW20** Develop and/or provide appropriate emergency procedures for AC transfer.
- PW21** Provide surge arrestors (bring text from reference) at the AC service entrance of all Service Provider equipment buildings.
- PW22** Design and implement a professionally administered preventive maintenance and inspection program for each company's electrical systems.
- PW23** Provide a minimum of 3 hours battery reserve for central offices equipped with fully automatic standby systems.
- PW24** When valve regulated batteries are used, provide temperature compensation on the rectifiers. (see FR06)
- PW25** A modernization program should be initiated or continued to ensure that outdated power equipment is phased out of plant. Service Providers should consider and include the capabilities of smart controllers, local and remote monitoring, and alarm systems when updating their power equipment. Power monitors and smart controllers should be integrated into engineering and operational strategies.
- PW26** For new installations, multiple smaller battery plants should be used in place of single very large plants serving multiple switches, etc.
- PW27** Low voltage disconnects should not be used at the battery plant.
- PW28** The rectifier sequence controller should be used only where necessary to limit load on the backup power generator.
- PW29** Manufacturers are encouraged to continue to improve the human-machine interfaces of power equipment.
- PW30** Provide diverse power feeds for all redundant links, (BITS clocks) and any components identified as "critical" single points of failure in transport and operations of the network (e.g., routers, cross-connects, switches).
- PW31** Provide protective covers and warning signs on all vulnerable circuit breakers.
- PW32** Ensure that the fuses and breakers meet quality level III reliability. ([ref. TR-332](#))
- PW33** Power wire, cable, and signaling cables that meet NEBS should be provided in all telecommunications locations.
- PW34** Wherever possible, DC power cables, AC power cables and telecommunications cables should not be mixed.
- PW35** Verify DC fusing levels throughout the power supply and distribution system, especially at the main primary distribution board, to avoid over fusing or under fusing. All new power equipment, including batteries should conform to NEBS.
- PW36** Detailed methods and procedures are needed to identify all protection required around the energized DC bus.
- PW37** Verify front and rear stenciling.
- PW38** Procedures and restoral processes are required for any cable-mining job. Develop and/or adopt a defined procedure for removal of unused cable (e.g., cable mining) (ref 6.3.1)

- PW39** Each company must have an alarm strategy.
- PW40** Provide a separate "battery discharge" alarm for all battery plants. Program the alarm to repeat (e.g., at least every 15 minutes).
- PW41** Redundancy must be provided, so that no single point alarm system failure will lead to a battery plant outage.
- PW42** Highlight the battery discharge (and other critical alarms) at the remote center.
- PW43** For critical alarms produced by single contacts (one on one), use fail-safe, normally closed contacts that open for an alarm.
- PW44** Emphasize use of methods of procedures (MOPs); vendor monitoring; and performing work on in-service equipment or high-risk operations during low traffic periods.
- PW45** On removal projects, check for current flow in power cables with AC/DC clamp-on ammeters before removing the associated fuses or opening the circuits.
- PW46** Provide and test detailed action plans to address emergency situations, such as when both the commercial AC power and the standby engine fails to start. Continue to emphasize the need for local procedures and contingency plans for power emergencies.
- PW47** Use infrared thermographic scanners to check power connections when trouble shooting, prior to installation acceptance, and every 5 years.
- PW48** Employ an "Ask Yourself" program to supplement conventional training. (e.g., Exhibit 2 from the purple book, Check Procedures BP)
- PW49** In preparation for a hurricane, place standby generators on line and verify proper operation of all subsystems.
- PW50** Where appropriate, design standby systems to withstand high winds, wind-driven rain and debris.
- PW51** Consider the need for power expertise/power teams.
- PW52** Provide security from theft of portable generators. Trailer mounted generators equipped with wheel locks are recommended.
- PW53** Minimize dependence on equipment requiring AC power feeds in favor of DC-powered components. (Parking Lot – To be Studied Further).
- PW54** Remote power maintenance systems should be secured to prevent, detect and contain any unauthorized access, modification or use.