White Paper

Maintaining Automatic Transfer Switches for Reliability and Longevity

ASCO®

Properly maintained automatic transfer switches (ATSs) can provide decades of reliable, trouble-free, and cost-effective load switching between primary and standby power sources. However, to reduce costs, some owners may contemplate implementing a reduced scope of service and/or using low-cost service providers that are not trained or supported by the ATS manufacturer. This document describes avoidable costs that could result from unintended outcomes of low-cost service, and explains the scope of maintenance that will provide reliable ATS service for decades to come.

Ramifications of Improper Service

Reviewing potential problems resulting from improper service shows why it is important to implement a maintenance program based on thorough procedures performed by qualified service providers. In one instance, a hospital awarded a contract to maintain 18 ATSs to a low-cost, third-party service provider. Following the initial service, one of the ATSs failed while transferring power during a routine test. The event damaged both the ATS and the facility's generator control system, leaving the hospital without reliable backup power. Subsequent inspection found the remnants of a rag in the affected ATS, which had caused one of its transfer switching mechanism linkages to bind. A flammable lubricant was also found to be dripping from components in all of the transfer switches.

The damaged ATS was subsequently repaired. However, because the generator controls were no longer supported by their manufacturer, wiring and components were installed to temporarily regain back-up power and the entire generator control system was eventually replaced. A factory-authorized vendor also cleaned the lubricant and re-performed maintenance on all 18 ATSs to assure that they would continue to provide reliable service. These remedial actions incurred significant costs.

Components of an Adequate Maintenance Program

A well-founded maintenance program ensures that ATSs will deliver reliable power transfer switching over the entire service life of the equipment. An effective program provides for inspection, testing, and maintenance in compliance with manufacturer recommendations and applicable codes and regulations. Effective programs also mitigate conditions that could impact reliability and equipment wear.

Frequency of Inspection and Service

For regulated facilities such as hospitals, Sections 8.3.4, 8.3.5, and A.8.3.4 of NFPA 110: Standard for Emergency & Standby Power Systems require annual ATS inspection and maintenance including the measurement of specific electrical values.[1, 2] Inspections records are necessary to demonstrate compliance with the requirements of the National Fire Protection Agency and the Joint Commission on Accreditation of Healthcare Organizations.

Managers should consider more frequent inspections and maintenance if the environmental conditions are severe. For instance, the presence of moisture and airborne chemicals could accelerate corrosion in an ATS located at a water or wastewater treatment plant. Consult the ATS manufacturer or its authorized service provider to establish an inspection and service frequency that will adequately mitigate the impacts of exceptional environmental exposures.

[1] National Fire Protection Association, NFPA 110: Standard for Emergency & Standby Power Systems, 2016 ed. Quincy, MA: 2015, p. 110-20.
[2] Ibid, pp. 110-26 to 110-33.

Scope of Maintenance

To properly maintain an ATS, thorough periodic inspections are required to ensure that all components will perform as designed. Adequate assessment cannot be completed without performing specific electrical tests. The resulting data could indicate that service adjustments or repairs must be undertaken to ensure the highest level of reliability.

Prior to inspection and service, technicians should review whether the manufacturer has issued Engineering Change Notices, technical service bulletins, or software updates for its ATS equipment. Bringing the necessary tools, parts, software, and procedures to the site is the only way to assure that the ATS will deliver maximum reliability, longevity, and customer value.

The inspection, testing, and service tasks needed to properly maintain an ATS are described as follows.

Inspections

When arriving at a site, service personnel should verify that ATS instruction manuals and circuit drawings are readily available. These documents assist technicians in completing inspections, maintenance, and repairs. Verifying their presence assures that these important documents will be available for facility personnel, contractors, and consultants who may become involved in assessment, upgrade, repair, or disaster prevention and recovery activities.

Comprehensive inspection of an ATS is the cornerstone of an effective maintenance program. Observations offer important clues about condition, wear, and function. When completing periodic service, technicians should perform the following tasks:

- Inspect the visually accessible portions of the ATS for evidence of heat, water, and mechanical damage. Such evidence guides the technician's further investigation and assessment of the internal portions of the ATS and its gear.
- After de-energizing upstream switchgear or placing the ATS in bypass mode, inspect the interior to verify that transfer switch mechanisms are intact together with their control circuit wiring, relays, and contacts.
- Inspect insulating parts, mechanism covers, and arc chutes for evidence of heat, discoloration and/or mechanical damage, and replace any that are excessively worn or damaged.
- Check the alignment, deflection, gap, and wiping action of the main and arcing contacts.
- Inspect main and arcing contacts for wear, pitting, erosion, and discoloration, which indicate arcing or heat-related deterioration.
- Inspect the transfer mechanisms, coils, and contacts for evidence of damage or malfunction.
- Check the tightness of all de-energized cable, wire, and bus connections, and re-secure any loose connections that are found.
- Record and verify all settings for voltage and frequency sensing, pickup, and dropout parameters for both normal and emergency power, as well as settings for all timing functions. If the settings are inadvertently changed, then the recorded information will facilitate the recovery of normal operation.

Testing

A low-cost service provider might provide only limited inspection and cleaning of an ATS. However, the condition and proper function of the switch cannot be ascertained without conducting specific electrical measurements and evaluating the resulting values. Service personnel should undertake the following tasks during each periodic maintenance event:

- Measure the pre-inspection voltage and current at the Phase A, B, and C connections to verify that these values are within corresponding operating specifications.
- Measure and record the millivolt drop across each energized stationary and main contact while the switch is placed in each source position.
- Measure the contact resistance across the main and arcing contacts.

Proper evaluation of the measured values is an important step for ensuring reliable ATS operation and longevity. If any of the measured values vary from manufacturer specifications, the reason for variance should be investigated. By comparing the measured values with those recorded during prior inspections, technicians can monitor year-to-year changes to assess whether an ATS will continue to function as designed. While most well-maintained ATSs will rarely need repairs, significant changes in year-to-year values could indicate that further investigation and action is required to correct specific ATS or power system conditions.

Services

Following thorough inspection and cleaning, the ATS should be serviced according to the technician's observations and measurements. In the course of the work, service personnel should perform the following tasks to assure optimal function:

- Replace eroded arcing contacts, if necessary.
- Adjust main and arcing contacts for simultaneous breaking in accordance with the manufacturer's procedure.
- Remove old lubricant residues, then lubricate the transfer switch mechanisms and their associated devices and linkages as specified by the manufacturer.
- Operate the ATS manually to verify proper function.
- Check for the proper settings for voltage and frequency sensing, pickup, and dropout features for both normal and emergency power, as well as settings for all timing functions.
- Clean the top, bottom, and doors of the ATS enclosure.
- If authorized and coordinated by the facility manager, test the re-energized ATS by switching from the normal source to the emergency source and back to verify proper function under load.

Recordkeeping

When a failure does occur, insurers and inspectors will request records relating to the usage and maintenance of the affected ATS. If service and maintenance events are undocumented, manufacturers, government authorities, insurers, and potential purchasers of the facility will assume that the necessary actions were not undertaken. Properly documented inspection and maintenance records are the only tangible evidence of compliance with a comprehensive maintenance program, and could protect your organization from regulatory penalties, legal liability, and warranty or insurance claim denials.

Complete records also assist managers in planning future maintenance and upgrades and the associated budgets. Historical inspection reports and recorded electrical measurements can be used to project future needs, and for forensic investigations of electrical events. Recorded ATS settings can be used to verify that inadvertent changes have not occurred.

For ATSs that are equipped with digital controllers that log system events, the recorded event log should be downloaded and stored for future retrieval. Any electronic settings in the controller should also be downloaded at that time. Thereafter, the event log and settings information should be presented in the vendor's maintenance report for the service event.

Safety Practices

NFPA 110 - Standard for Emergency and Standby Power Supply Systems specifies the scope and frequency of inspection and testing for critical switchgear. In addition, most customers require that the testing activities will not interrupt power to their facility or disrupt its business operations. These requirement present safety challenges.

To implement a successful ATS maintenance program, service providers must follow the safety guidelines set forth in both *NFPA 70E - Standard for Electrical Safety in the Workplace* and *IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations*. To satisfy these requirements, managers should verify that providers will observe the applicable standards for processes, tools, and personal protective equipment specified by these sources. Managers can find additional information about these topics in ASCO's white paper entitled *Safety When Servicing Energized Switchgear*.

Selecting an Appropriate Service Provider

To be effective, an adequate ATS maintenance program should be implemented by a service organization that is able and willing to commit sufficient resources to meet the applicable inspection, testing, maintenance, recordkeeping, and safety requirements. Managers should consider whether service organizations can provide technicians to the site when needed; how its technicians have been qualified to service the equipment in the facility and whether the manufacturer has authorized the firm to do so; how technicians will learn of changing products and practices; and, how they will obtain the necessary spares. Criteria for evaluating these and other service provider issues are presented in ASCO's white paper entitled, *Identifying Qualified Service Providers to Optimize Power Reliability.*

ASCO Power Technologies - Global Headquarters
160 Park Avenue
Florham Park, NJ 07932
Tel: 800 800 ASCO
customercare@ascopower.com

www.ascopower.com

www.ascoapu.com

ASCO. Innovative Solutions.