ELECTRIFICATION SERVICES

NFPA 70B standard for electrical equipment maintenance

Comply with the new standard to help protect personnel, equipment and your business.

With NFPA 70B now a standard, ABB Electrification Services can work with you to establish a compliant electrical preventive maintenance program to help increase workplace safety, maintain or extend equipment life and decrease equipment downtime — and resulting production revenue loss.

Why does NFPA 70B matter?
Previously a recommended practice, NFPA 70B has now become the standard for electrical equipment maintenance. This means authorities having jurisdiction, including OSHA, can mandate and enforce NFPA 70B, and third-party institutions that validate asset protection and safety for insurance may also require compliance. Now is the time to assess how the new standard will impact your facility and what changes you may need to implement to comply.

Count on ABB to help.
ABB Electrification Services has industry-leading knowledge and experience to help solve problems before they occur, both on- and off-site. With regionally based field service engineers and multiple service centers across North America, we are always nearby and ready to deal with any potential equipment failure.

Why work with ABB?
Our team has extensive knowledge of NFPA 70B standard practices. Whether you have an established electrical preventive maintenance program that requires a refresh to comply with NFPA 70B or you have no program in place and need to develop one, ABB can help design an electrical preventive maintenance program that complies with NFPA 70B and, most importantly, addresses the unique safety and reliability requirements of your site.

Contact us today.
For more information, call toll free +1 888 434 7378 or visit electrification.us.abb.com/services.

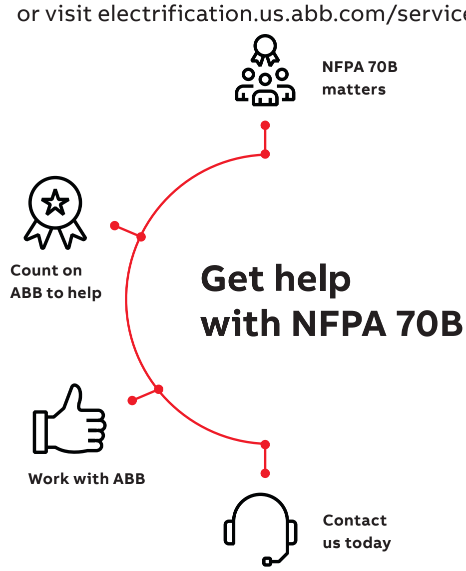


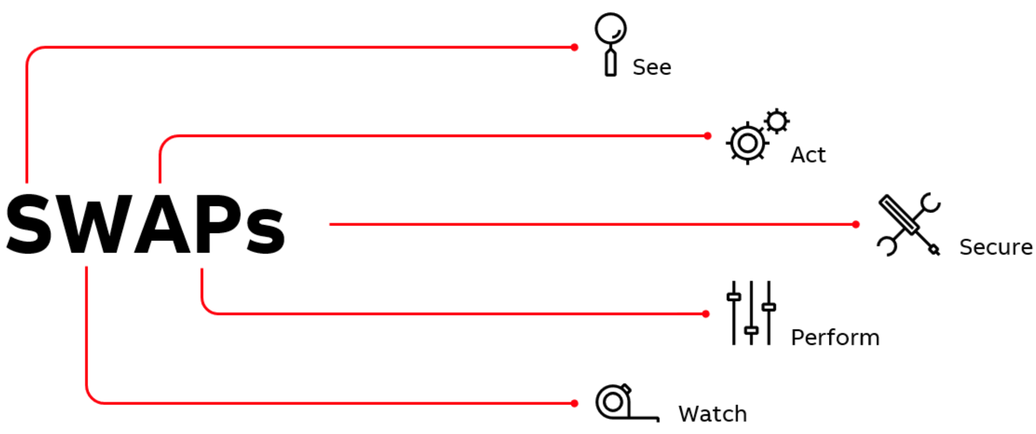
ABB SWAPs preventative maintenance

ABB's preventative maintenance program is branded as SWAPs which stands for See, Watch, Act, Perform and Secure. These refer to increasingly intensive sets of tasks which align to the **NFPA-70B** required scopes of work. Intervals are defined according to the assessment of the equipment **NFPA-70B** Condition.

The scopes of work that follow on the next pages refer to one or more of these SWAPs categories and those categories translate into the qualified NFPA-70B scopes of work as shown in the table below.

NFPA-70B Work Scopes	See	Watch	Act + Perform
Visual Inspection	X		
Cleaning		X	
Lubrication			X
Mechanical Servicing			X
Electrical Testing			X
Special			X
Mechanical Checks			X

Table 1: NFPA-70B to SWAPs work scopes translation



NFPA-70B 2023 - Standard for Electrical Equipment Maintenance

An expansion to the crucial **NFPA-70E** electrical safety standard, **NFPA-70B** outlines a comprehensive approach to electrical equipment maintenance that focuses on identifying potential hazards and addressing them before they become safety risks. Regular maintenance of electrical equipment can prevent costly downtime, minimize the risk of electrical fires, and ensure that equipment is functioning optimally, increasing its lifespan.

NFPA-70B maintenance practices include inspecting and testing equipment, performing preventative maintenance, and keeping detailed records of maintenance activities. Following these practices can help facility managers and maintenance personnel identify potential problems early on, which allows for more efficient and cost-effective maintenance, ultimately improving the safety and reliability of electrical systems.

Overall, implementing **NFPA-70B** maintenance practices is an effective way to minimize safety risks, reduce down-time, and extend the life of electrical equipment, providing long-term benefits to both personnel and equipment.

Applying **NFPA-70B Maintenance Practices** to customer specific electrical equipment maintenance needs can bring numerous benefits to the safety and reliability of a customer's electrical systems.

The **NFPA-70B Standard** details preventive maintenance for electrical, electronic and communication systems and equipment, and is the standard that can now be utilized and enforced to ensure proper conditions for maintenance have been established.

ABB's SWAPs preventative maintenance scopes of work meet the strict requirements of **NFPA-70B.**

Standard Scheduling & Conditions

NFPA-70B establishes a condition-based interval structure for electrical equipment maintenance rather than prescribing fixed schedules. The standard requires an assessment that evaluates three factors—physical condition, criticality, and operating environment—and assigns the highest risk category to determine maintenance frequency.

Equipment is classified into Condition 1 (like-new), Condition 2 (minor issues), or Condition 3 (urgent attention).

NFPA-70B Condition 1

- Equipment appears in **excellent physical condition**: clean, sealed, dry enclosure.
    - No active alerts from monitoring systems or predictive maintenance.
    - Previous maintenance was performed per OEM maintenance plan.
    - No deviations from historical test results.
- *Represents **low risk**, requiring only standard maintenance intervals.*

NFPA-70B Condition 2

- Equipment is functional but shows **early signs of degradation**:
    - Minor deviations in test results (e.g., insulation resistance trending down).
    - Repairs or component replacements occurred in prior cycles.
    - Predictive maintenance identifies **non-urgent issues**.
    - Notifications from monitoring systems since last assessment.
- *Requires **proactive monitoring** and shorter intervals to prevent escalation.*

NFPA-70B Condition 3

- High risk of failure or neglect:
    - Missed **two successive maintenance cycles**.
    - Repeated major issues in recent inspections.
    - Active or unresolved alerts from monitoring systems.
    - Urgent actions flagged by predictive techniques (e.g., infrared thermography).
- May also result from **criticality** (risk to personnel safety) or harsh operating environments, even if physical condition seems acceptable.
- *Requires **urgent intervention** and the shortest maintenance intervals.*

Table 9.2.2 of NFPA-70B specifies maximum intervals for each scope category. For example, visual inspections and cleaning may occur every 60 months for Condition 1, 36 months for Condition 2, and 12 months for Condition 3, while infrared thermography is required every 12 months for Conditions 1 and 2, and 6 months for Condition 3. This tiered approach ensures that assets in good condition receive extended intervals, while degraded or critical equipment is serviced more frequently. By linking intervals to risk and condition, NFPA-70B optimizes reliability, safety, and cost-effectiveness, and aligns with predictive and preventive maintenance best practices.

Example 5-year SWAPs schedule for Low Voltage Switchgear by Condition:

NFPA-70B Condition	Year 1	Year 2	Year 3	Year 4	Year 5
Condition 1	See	See	See	See	**SWAPs**
Condition 2	See	See	**SWAPs**	See	**SWAPs**
Condition 3	**SWAPs**	**SWAPs**	**SWAPs**	**SWAPs**	**SWAPs**

SWAPs Preventative Maintenance Scopes of Work – See

Each equipment type requires a different scope of work for preventative maintenance. The following work scopes are applicable to the equipment type in the title only. These work scopes may be combined with other work scopes to form maintenance service packages. This document is to be used in conjunction with an ABB empower Quote.

The 6 digit scope index helps align an ABB empower™ Bill of Material (BOM) with the appropriate scope of work. It ensures that everyone is speaking about the same set of instructions.

(PM0060) Transformers (Dry-Type) - Preventative Maintenance - See
- Inspect and maintain bolted connections for integrity and tightness.
- Check cooling devices for proper operation and cleanliness.
- Inspect neutral grounding impedance devices for correct configuration.
- Assess transformer enclosure for physical damage, corrosion, and security. Ensure ventilation and equipment enclosure integrity has not been compromised.

(PM0080) Transformers (Liquid Filled) - Preventative Maintenance - See
- Inspect and maintain bolted connections for integrity and tightness.
- Check cooling devices for proper operation and cleanliness.
- Verify liquid level gauges and alarms for accuracy and functionality.
- Inspect neutral grounding impedance devices for correct configuration.
- Confirm nitrogen bottle pressure systems are functioning and properly pressurized.
- Examine pressure relief devices for mechanical integrity and alarm response.
- Test sudden pressure relays for responsiveness and reliability.
- Inspect tank over/under pressure gauges and alarms for proper readings.
- Assess transformer enclosure for physical damage, corrosion, and security. Ensure ventilation and equipment enclosure integrity has not been compromised.

(PM0120) Switchgear - Preventative Maintenance - See
- Verify accessibility conditions: Check room accessibility and escape routes, cleanliness, and the presence of any unauthorized equipment.
- Verify ambient conditions: Check temperature, relative humidity, air quality, dust levels, and water ingress.
- Check room ventilation system: Ensure ventilation and air conditioning are available, unobstructed, and functioning properly.
- Check switchgear ventilation: Ensure the cleanliness of ventilation louvers.
- Check condition of enclosure/outside part of assembly:
- Verify ingress protection (IP class, IEC60529).
- Check for any damage or corrosion.
- Ensure no parts are missing, such as module doors or covers.
- Confirm compartment doors are closed, and locks are operable.
- Ensure the roof plate is not contaminated, covered, or obstructed.
- Check the fastening of cable compartment doors, side, and back walls.
- Verify the position of withdrawable modules (ensure they are present and in the operating or isolated position).
- Ensure labels and safety signs are correct and legible.
- Check documentation: Ensure all drawings and parameter settings are available and updated.
- Verify installed equipment: Check that the diversity/density factor of the switchgear meets design criteria.

(PM0400) Outdoor Substations - Preventative Maintenance - See

- Verify accessibility conditions: Check accessibility and escape routes, cleanliness, and the presence of any unauthorized equipment.
- Verify ambient conditions: Check temperature, relative humidity, air quality, dust levels, and water ingress.
- Check ventilation system: Ensure ventilation and air conditioning are available, unobstructed, and function properly.
- Check ventilation: Ensure the cleanliness of ventilation louvers.
- Check condition of enclosure/outside part of assembly:
- Verify ingress protection (IP class, IEC60529).
- Check for any damage or corrosion.
- Ensure no parts are missing, such as module doors or covers.
- Confirm compartment doors are closed, and locks are operable.
- Ensure the roof plate is not contaminated, covered, or obstructed.
- Check the fastening of cable compartment doors, side, and back walls.
- Verify the position of withdrawable modules (ensure they are present and in the operating or isolated position).
- Ensure labels and safety signs are correct and legible.
- Check documentation: Ensure all drawings and parameter settings are available and updated.
- Verify installed equipment: Check that the diversity/density factor of the switchgear meets design criteria.

(PM0000) Standard Service - Preventative Maintenance - See

The See scope corresponds to the NFPA 70B Visual Inspection requirement, focusing on evaluating the condition, safety, and operational integrity of electrical equipment. Certain equipment types may have dedicated See scopes tailored to their design and application. When no unique scope is defined and the inspection is performed independently, **PM0000** serves as the standard, generic scope of work to fulfill the Visual Inspection requirement.

- Inspect for signs of overheating, corrosion, moisture, or contamination.
- Verify equipment labeling, accessibility, and clearance.
- Check for loose or missing covers, guards, or hardware.
- Observe for abnormal noise, vibration, or odors.
- Confirm insulation integrity and wiring condition.
- Document findings with annotated photos and inspection notes.

SWAPs Preventative Maintenance Scopes of Work – Watch

Each equipment type requires a different scope of work for preventative maintenance. The following work scopes are applicable to the equipment type in the title only. These work scopes may be combined with other work scopes to form maintenance service packages. This document is to be used in conjunction with an ABB empower Quote.

The 6 digit scope index helps align an ABB empower™ Bill of Material (BOM) with the appropriate scope of work. It ensures that everyone is speaking about the same set of instructions.

(PM0121) Switchgear - Preventative Maintenance - Watch

- Check equipment compartment:
  - Verify the diversity/density factor.
  - Inspect internal conditions for dust, blackened surfaces on electrical contacts, and loosened screws.
  - Clean if necessary.
- Check cable compartment / cable terminal compartment:
  - Ensure there is sufficient room and strain relief.
  - Verify proper cable routing and fixing.
  - Check bending radii and ensure protective covers/bellows are in place and fixed accordingly.
- Check control equipment compartment (if present):
  - Verify the diversity/density factor.
  - Inspect internal conditions for dust and loosened screws.
  - Check cable routing and connections.
  - Clean if necessary.

(PM0401) Outdoor Substations - Preventative Maintenance - Watch

- Check equipment compartment:
- Verify the diversity/density factor.
- Inspect internal conditions for dust, blackened surfaces on electrical contacts, and loosened screws.
- Clean if necessary.
- Check cable compartment / cable terminal compartment:
- Ensure there is sufficient room and strain relief.
- Verify proper cable routing and fixing.
- Check bending radii and ensure protective covers/bellows are in place and fixed accordingly.
- Check control equipment compartment (if present):
- Verify the diversity/density factor.
- Inspect internal conditions for dust and loosened screws.
- Check cable routing and connections.
- Clean if necessary.

(PM0001) Standard Service - Preventative Maintenance – Watch

The Watch scope corresponds to the NFPA 70B Cleaning requirement, focusing on removing contaminants from electrical equipment using safe, non-conductive methods to protect components and maintain performance, while ensuring no damage, moisture ingress, or disturbance to settings, and disposing of waste per safety regulations. Certain equipment types may have dedicated See scopes tailored to their design and application. When no unique scope is defined and the inspection is performed independently, **PM0001** serves as the standard, generic scope of work to fulfill the Cleaning requirement.

- Remove dust, dirt, moisture, oil, and other contaminants from electrical equipment surfaces and components.
- Use appropriate cleaning methods such as vacuuming, brushing, wiping, or applying approved solvents—based on equipment type and contamination level.

- Avoid abrasive materials or methods that could damage insulation, coatings, or sensitive components.
- Ensure cleaning agents are non-conductive, non-corrosive, and compatible with the equipment materials.
- Prevent moisture ingress during cleaning and ensure complete drying before re-energization.
- Protect internal components and connections from dislodgement or misalignment during cleaning.
- Avoid disturbing calibration or settings of protective devices and sensors.
- Dispose of cleaning materials and contaminants in accordance with environmental and safety regulations.

SWAPs Preventative Maintenance Scopes of Work - See, Watch, Act, Perform

Each equipment type requires a different scope of work for preventative maintenance. The following work scopes are applicable to the equipment type in the title only. These work scopes may be combined with other work scopes to form maintenance service packages. This document is to be used in conjunction with an ABB empower Quote.

The 6 digit scope index helps align an ABB empower™ Bill of Material (BOM) with the appropriate scope of work. It ensures that everyone is speaking about the same set of instructions.

The following scopes of work include all tasks required to complete a full annual NFPA-70B qualified preventive maintenance visit for each equipment type.

(PM0024) Drives - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Measure and record the following:
- Perform on-line run tests.
- Verify accuracy drive front panel display parameters.
- Verify correct fan rotation in cabinet if applicable.
- Drive power supply voltages.
- Drive input signals.
- Drive output Voltage and Current.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0034) Low Voltage Starters - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Verify interconnect wiring corresponds to the ABB manual recommended wiring diagrams.
- Set starter parameters (voltage ramp or current limit, acceleration ramp time, kick- start feature, stopping, full voltage or energy save, etc.) to customer supplied settings.
- Operate the motor to the programmed settings. The motor must be coupled and unloaded.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0044) Low Voltage Heavy Duty Switches and Disconnects - Preventative Maintenance - SWAPs

- *Pending Release – contact ABB Electrification for quotation*

(PM0054) Low Voltage Motor Control Centers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage (optional)
- Inspect metal enclosures, verifying proper operation and securing of doors and covers.
- Clean and vacuum all buckets, raceways, and cableways.
- Visually inspect busbar, bus supports, wiring, and incoming/outgoing terminations.
- Verify operation of disconnects and circuit breakers.
- Inspect compartment space heaters for proper operation, if provided.
- Verify Emergency and remote circuits operate as designed.
- Test/verify designed transfer schemes, ground fault schemes, etc., operate as designed.
- Test/verify control wiring, control fuses/breakers ratings
- Place all breakers/disconnects in open position to perform insulation resistance test (Megger) phase to phase and phase to ground.
- Verify all buckets fully engaged to bus.

- Verify proper operation of all MCC buckets contactors (open/close).
- Inspect all overload relays.
- Verify operation of all electrical and mechanical interlocks.
- Verify that equipment grounding conductor is present and tight.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0064) Transformers (Dry-Type) - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Remove transformer panels and inspect connections, core assembly and core clamps for discrepancies.
- Clean and vacuum interior and exterior.
- Inspect and replace filters, as necessary.
- Verify transformer connections for tightness.
- Verify bus mounting bolts and splice connection bolts for proper tightness, where possible.
- Perform a turn ratio test (TTR) in operating tap position.
- Perform a power factor test (optional)
- Perform a winding resistance test (optional)
- Inspect auxiliary devices such as fans, fan control/temperature indicating units.
- Perform an insulation resistance test (Megger) as follows: High to Low & Gnd., Low to High & Gnd.
- Verify all enclosure fasteners are tight.
- Verify frame ground connection is present and tight.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0074) Medium Voltage Switches - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage. (optional)
- Inspect and clean incoming and outgoing terminations (bus or cable).
- Clean and vacuum switch compartment(s).
- Visual inspection for deficiencies, damage, and proper installation
- Operate the switch a minimum of three (3) times, verifying main blade and arcing blade alignment with stationary contacts and arc chute.
- Measure the primary contact resistance of each phase using a Digital Low Resistance Ohmmeter (DLRO).
- Perform an insulation resistance test as follows:
- Switch closed: measure resistance phase to phase and phase to ground.
- Switch open: measure resistance across open poles.
- Adjust the switch as required to maintain the manufacture's minimum requirements.
- Inspect air puffers, if equipped.
- Remove the fuses and verify for the proper rating.
- Inspect the use clips and fuse ferrules for damaged or defective devices.
- Measure fuse resistance.
- Inspect, clean and lubricate operating mechanism.
- Inspect key interlocks for proper operating sequence and proper key distribution.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0084) Transformers (Liquid Filled) - Preventative Maintenance - SWAPs

- Visually inspect bushings, radiators, and gages for leaks
- Inspect and clean terminations and bushings. Wipe clean with lint free rags and manufacturer's recommended solvent.
- Draw oil samples for comprehensive and Dissolved Gas Analysis (DGA) analysis (optional).
- Draw oil samples for comprehensive and DGA analysis on Load Tap Changer (LTC) compartment, if equipped (optional).
- Inspect transformer auxiliary devices (gauges) for discrepancies.
- Verify tightness of all external bolted electrical joints.
- Verify equipment grounds for tightness.
- Perform a turns ratio test (TTR) in operating tap position. If equipped with an LTC, verify on all LTC taps positions.
- Perform an insulation resistance test (Megger) as follows: High to Low & Gnd., Low to High & Gnd.
- Perform a power factor (Doble) test on the transformer windings and bushings.

- Perform a winding resistance test.
- Perform an excitation test.
- Lift core ground and measure core insulation, if possible.
- Inspect and operate auxiliary devices such as fans and oil pumps, if equipped.
- Inspect auxiliary devices such as sudden pressure relays, Bucholz relays, etc., if equipped.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0094) Panelboards - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage. (optional)
- Verify proper open & close operation of breakers.
- Perform an insulation resistance test (Megger) of breakers phase to phase and phase to ground.
- Perform a resistance test of primary contacts (Ductor) of HPC switches and Powerbreak breakers.
- Program overcurrent devices with settings provided by Customer.
- Test overcurrent protective devices with appropriate digital test set (non-primary injection)

(PM0104) Surge Protective Device (SPD) - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify normal operating voltages of the power system match the voltage rating of the SPD nameplate
- Verify LED status indicators on the display panels and suppression modules to confirm normal status.
- Verify operation of the audible alarm and LED.
- Verify operation of the alarm silence switch.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0114) Switchboards - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage. (optional)
- Verify proper open & close operation of breakers.
- Perform an insulation resistance test (Megger) of breakers phase to phase and phase to ground.
- Perform a resistance test of primary contacts (Ductor) of HPC switches and Powerbreak breakers.
- Program overcurrent devices with settings provided by Customer.
- Test overcurrent protective devices with appropriate digital test set (non-primary injection)

(PM0124) Switchgear - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage. (optional)
- Clean and vacuum the circuit breaker cubicles, termination cubicles, auxiliary device cubicles, instrument transformer sections, etc.
- Inspect and verify compartment space heaters (if provided) for proper operation.
- Verify the racking mechanism (Disconnect, Test and Connect) operation and indication.
- Verify ground bus connections and supports for proper tightness.
- Inspect and verify CT ratio, polarity, and connections.
- Inspect and verify PT ratio, rating, and connections.
- Inspect and verify CPT ratio, rating, fuse rating, and connections.
- Verify bus connections have been properly torqued.
- Verify emergency and remote circuits operate correctly.
- Test/verify any designed transfer schemes, ground fault schemes, etc.
- Test/verify control wiring, control fuses/breakers ratings.

- Place all breakers in test or disconnect position and remove all PT fuses prior to performing an insulation integrity (Megger) test.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Verify proper interference plates on both the breaker and in the switchgear compartments.
- Verify proper operation and installation of medium voltage PT compartments, as applicable.
- Verify doors operate and latch correctly.
- Inspect panels to verify tightness of fasteners.
- Inspect and replace filters, as necessary.
- Verify that substation grounding conductor is present and tight.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0134) Busway - Preventative Maintenance - SWAPs

- Compare equipment nameplate data with drawings and specifications.
- Inspect physical and mechanical condition of busway system.
- Inspect anchorage, alignment, and grounding.
- Verify correct connection in accordance with single-line diagram.
- Inspect bolted electrical connections for high resistance using one or more of the following methods:
  - Low resistance ohmmeter
  - Calibrated Torque Wrench
  - IR Scan
- Verify physical orientation in accordance with manufacturer's labels to ensure adequate cooling.
- verify busway is plumb and level.
- Verify end cable tap boxes and switchboard/transformer stubs have been installed as per manufacturer's specifications.
- Verify any wall penetrations have been properly sealed (firestop as applicable)
- Verify support hangers have been properly and adequately placed to support busway.
- For plug-in bus, verify plugs are properly seated and level.
- For riser bus, verify spring hangers are properly installed and adjusted according to factory drawings, and have been readjusted to accommodate field installation of additional plugs.
- Examine outdoor busway for removal of weep-hole plugs, if applicable, and the correct installation of joint shields, caps and covers.
- Measure insulation resistance of each busway, phase-to-phase and phase-to-ground, for one (1) minute
- Perform phasing test on each busway.
- Verify operation of busway heaters, as applicable
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0154) Low Voltage Drawout Circuit Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify proper racking (in/out) of circuit breaker.
- Inspect and clean breaker, clean breaker surfaces with lint free rags and appropriate solvent.
- Record starting operations counter, if equipped.
- Slow close the circuit breakers to verify proper operation.
- Verify proper circuit breaker gaps and wipe measurements.
- Verify proper operation of circuit breaker interlocks.
- Lubricate mechanism according to manufacturer's recommendations.
- Inspect arc-chutes.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Inspect, clean, and lubricate mechanism according to manufacturer's recommendations.
- Inspect air puffers, if equipped.
- Verify wipe and gap.
- Inspect, clean, and lubricate primary disconnect fingers.
- Inspect, clean, and lubricate secondary disconnect pins.
- Verify operation of mechanical interlocks.
- Verify proper operation of the circuit breakers manual controls.
- Verify proper operation of electrically operated controls, if equipped.
- Verify circuit breaker operation via protective relay operation, if equipped.

- Verify correct trip settings are as per Customer provided coordination study.
- Perform secondary injection on breakers equipped with static trip units.
- Perform primary injection test on breakers with series overcurrent trip devices,
- If possible, place breaker into test position and operate breaker from local and/or remote controls, protective devices, and other designed operations.
- Record final operations counter if equipped.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0174) Low Voltage Fix Mounted, Insulated Case, Circuit Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify proper racking (in/out) of circuit breaker.
- Inspect and clean breaker, clean breaker surfaces with lint free rags and appropriate solvent.
- Record starting operations counter, if equipped.
- Slow close the circuit breakers to verify proper operation.
- Verify proper circuit breaker gap and wipe measurements.
- Verify proper operation of circuit breaker interlocks.
- Lubricate mechanism according to manufacturer's recommendations.
- Inspect arc-chutes.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Inspect, clean, and lubricate mechanism according to manufacturer's recommendations.
- Inspect air puffers, if equipped.
- Verify wipe and gap.
- Inspect, clean, and lubricate primary disconnect fingers.
- Inspect, clean, and lubricate secondary disconnect pins.
- Verify operation of mechanical interlocks.
- Verify proper operation of the circuit breakers manual controls.
- Verify proper operation of electrically operated controls, if equipped.
- Verify circuit breaker operation via protective relay operation, if equipped.
- Verify correct trip settings are as per Customer provided coordination study.
- Perform secondary injection on breakers equipped with static trip units.
- Perform primary injection test on breakers with series overcurrent trip devices,
- If possible, place breaker into test position and operate breaker from local and/or remote controls, protective devices, and other designed operations.
- Record final operations counter if equipped.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0184) Medium Voltage Vacuum Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify proper racking (in/out) of circuit breaker.
- Inspect and clean breakers. Clean breaker surfaces with lint free rags and appropriate solvent.
- Record starting operations counter, if equipped.
- Slow close the circuit breakers to verify proper operation.
- Verify proper circuit breaker gap and wipe measurements.
- Verify proper operation of circuit breaker interlocks.
- Lubricate mechanism according to manufacturer's recommendations.
- Perform a High-Pot test on each vacuum bottle, as per manufacturer's recommendations, so to validate bottle integrity.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Inspect, clean, and lubricate mechanism according to manufacturer's recommendations.
- Inspect, clean, and lubricate primary disconnect fingers.
- Inspect, clean, and lubricate secondary disconnect pins.
- Verify proper operation of mechanical interlocks.
- Verify proper operation of the circuit breaker manual controls.

- Verify circuit breaker operation via protective relay operation.
- If possible, place breaker into test position and operate breaker from local and/or remote controls, protective devices and other designed operations.
- Record final operations counter if equipped.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0194) Medium Voltage Vacuum Starters - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify ground bus connections for proper tightness.
- Verify proper insulation resistance of starter module using a megohmmeter.
- Verify tightness of lugs and bus splices.
- Verify tightness of control wiring.
- Verify operation of isolation switch and adjust interlock assembly, if required.
- Visually inspect cubicles and compartments for evidence of damaged or defective devices.
- Remove and inspect draw-out contactors for damaged components, operated, and lubricated, as required.
- Measure contact resistance with a DLRO
- Inspect space heaters, if applicable.
- Inspect and clean potential transformers and control power transformer compartments.
- Inspect fuses for proper rating.
- Inspect fuse clips and fuse ferrules for damaged or defective devices.
- Perform high potential test (Hipot) on any/all vacuum contactors.
- Measure contactor phase-to-phase and phase-to-ground insulation
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0204) Medium Voltage Gas Insulated Switchgear - Preventative Maintenance - SWAPs

- *Pending Release – contact ABB Electrification for quotation*

(PM0214) Busway – Medium Voltage - Preventative Maintenance - SWAPs

- Compare equipment nameplate data with drawings and specifications.
- Inspect physical and mechanical condition of busway system.
- Inspect anchorage, alignment, and grounding.
- Verify correct connection in accordance with single-line diagram.
- Inspect bolted electrical connections for high resistance using one or more of the following methods:
- Low resistance ohmmeter
- Calibrated Torque Wrench
- IR Scan
- Verify physical orientation in accordance with manufacturer’s labels to ensure adequate cooling.
- verify busway is plumb and level.
- Verify end cable tap boxes and switchboard/transformer stubs have been installed as per manufacturer’s specifications.
- Verify any wall penetrations have been properly sealed (firestop as applicable)
- Verify support hangers and/or struts have been properly and adequately placed to support busway.
- Examine outdoor busway for proper gasketing.
- Measure insulation resistance of each busway, phase-to-phase and phase-to-ground, for one (1) minute
- Perform phasing test on each busway.
- Verify operation of busway heaters, as applicable
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0224) Capacitors - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify correct ratings for given installation.
- Inspect and clean Capacitors. Wipe clean with lint free rags using manufacturer’s recommended solvent.
- Measure capacitance.
- Measure discharge resistance.
- Perform insulation resistance test to ground. Compare readings to manufacturer’s recommendations.
- Measure resistance of ground connection.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0234) Capacitive Trip Devices - Preventative Maintenance - SWAPs

- Visually inspect the device for signs of leaking capacitors or batteries.
- Perform a trip test with control power removed to make confirm operation of the device.
- Replace the batteries according to the battery manufacturers' recommendations.
- NOTE: Before changing batteries, discharge the capacitor with a 500- ohm resistor.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0244) Electro-Mechanical Relays - Preventative Maintenance - SWAPs

- Verify relay is correct model # vs. coordination study.
- Inspect and clean relays.
- Tune each electro-mechanical relay to the manufacturer's operating time/current curves at twice the relay current setting.
- Verify the induction disk and retard magnet are free of dirt particles or obstructions that would hamper relay operation.
- Verify the induction disk bearings for proper alignment and adjustment.
- Verify the instantaneous and seal-in units for proper contact alignment and flag operation.
- Verify the stationary contacts of the induction disk for proper position in relation to the zero-time dial setting.
- Verify the relay internal wiring connections, and the relay case external connections, for proper tightness or other discrepancies.
- Inspect the relay contacts for proper circuit continuity.
- If required, the silver contacts will be cleaned with a burnishing tool.
- Verify calibration of protective relays with settings provided by the Customer.
- Verify and adjust the minimum pick-up or operating point of each relay and adjust as required.
- Test the seal-in and instantaneous units for proper electrical operation and calibration.
- Test relays with special functions (example: restraint, directional, etc.) as per manufacturer's instruction manual.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0254) Electronic Equipment - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Perform an IR scan, if requested.
- Visually inspect components.
- Adjust/calibrate equipment to manufacturer's recommendations.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0264) Emergency Systems, Engine Generators - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Compare equipment nameplate data with drawings and specifications.
- Inspect physical and mechanical condition.
- Inspect anchorage, alignment, and grounding.
- Verify the unit is clean.
- Perform insulation-resistance test.
- Perform polarization index test (optional)
- Test protective relay devices.
- Verify phase rotation, phasing, and synchronized operation as required by the operation.
- Functionally test engine shutdown for low oil pressure, overtemperature, overspeed and other protection features, as applicable.
- Perform vibration test for each main bearing cap.(optional)
- Conduct a performance test in accordance with ANSI/NFPA 110
- Verify correct functioning of the governor and regulator.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0294) Fuses – 1000V Or Greater - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Verify all fuses are same and of the correct rating.
- Perform an IR scan, if requested.
- Inspect and clean oxidation on fuses and fuse ferrules.
- Inspect fuse body for cracks.
- Clean surfaces of oxidation and corrosion.
- Verify fuse clips are tight.
- Measure and record fuse resistance.

- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0304) Fuses – 1000V Or Less - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify all fuses are same and of the correct rating.
- Perform an IR scan, if requested.
- Inspect and clean oxidation on fuses and fuse ferrules.
- Clean surfaces of oxidation and corrosion.
- Verify fuse clips are tight.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0314) Fuses – Expulsion Type - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify all fuses are same and of the correct rating.
- IR Scan (if requested).
- Inspect and clean oxidation on fuses and fuse ferrules.
- Inspect fuse body for cracks.
- Clean surfaces of oxidation and corrosion.
- Verify fuse clips are tight.
- Measure and record fuse resistance.
- Verify fuse is correctly assembled.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0324) HMI and PLC Controls - Preventative Maintenance - SWAPs

- Visually inspect HMI and PLC for damaged or defective devices.
- Confirm proper factory settings / set up
- Confirm HMI screen and PLC power up indicators
- Step through sequence of operations (as provided by factory) to ensure proper operation of throw-over scheme
- Verify Manual / Automatic Operation and Interlocks
- Verify Open / Closed Transfer Operations and Interlocks
- Verify Open / Close Operations of Breakers via HMI

- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0334) IR Scan - Preventative Maintenance - SWAPs

- Review the Customer provided electrical drawings and most recent Arc Flash Study.
- Perform, while equipment is energized and loaded an Infrared (IR) Scan to identify any potential hot spots and issues to be further investigated during future, scheduled outage.
- Open/close hinged doors and remove/replace covers only where it is safe to do so.
- Submit to the Customer pictures of the equipment in the Engineering Appraisal Report

(PM0344) Load Banks (Generator, Ups) - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify appropriate size load bank is available for testing emergency power circuits.
- Verify fluid levels to ensure the fuel tank is full and the oil level is correct. If water cooled, the radiator or coolant tank level should be verified. (Generators only)
- Start the generator or apply UPS power to the load bank, looking and listening for any abnormalities.
- Begin applying loads to the system. Loading should be balanced across each leg of the system.
- Increase load to 50% rated or desired test load.
- Record amperage of each leg of the system
- Verify voltage and current fall within expected tolerances for specified load
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0354) Low Voltage Drawout Circuit Breakers (Entellisys™) - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Perform contact resistance test.
- Perform insulation integrity test using 500-1000 VDC.
- Rack breakers in and out of cubicle and verify proper fit.
- Verify breakers operate (Close/Open/Trip) via Entellisys™ system utilizing Entellisys™ Test Set.

- Verify proper operation all system schemes such as automatic transfer, ground fault, etc. via Entellisys™ system.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0364) Medium Voltage Air Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify proper racking (in/out) of circuit breaker.
- Inspect and clean breakers. Clean breaker surfaces with lint free rags and appropriate solvent.
- Record starting operations counter, if equipped.
- Slow close the circuit breakers to verify proper operation.
- Verify proper circuit breaker gap and wipe measurements.
- Verify proper operation of circuit breaker interlocks.
- Lubricate mechanism according to manufacturer's recommendations.
- Inspect arc-chutes.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Inspect, clean, and lubricate mechanism according to manufacturer's recommendations.
- Inspect air puffers, if equipped.
- Verify wipe and gap.
- Inspect, clean, and lubricate primary disconnect fingers.
- Inspect, clean, and lubricate secondary disconnect pins.
- Verify operations of mechanical interlocks.
- Verify proper operation of the circuit breakers manual controls.
- Verify circuit breaker operation via protective relay operation.
- If possible, place breaker into test position and operate breaker from local and/or remote controls, protective devices, and other designed operations.
- Record final operations counter if equipped.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0374) Medium Voltage Capacitors - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Verify proper sequence of interlocks, as applicable.
- Verify control cable and wire connections.
- Verify power cable connections.
- Inspect cabinet interior and components for evidence of damage.
- Verify cabinet is clean and clear of any obstructions.
- Verify HOA features, as applicable.
- Verify CT terminations are tight, and no open circuits are present.
- Perform insulation resistance test on all power and control components.
- Perform low resistance ohmmeter test across contactors and/or disconnects.
- Verify operation of main disconnect, as applicable.
- Apply control power and step through sequencing of contactors as per manufacturer's instructions.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0384) Molded Case Circuit Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Perform an IR scan, if requested.
- Visually inspect breakers.
- Mechanically operate (open/close) breakers.
- Perform and insulation resistance test phase to phase, phase to ground, and pole to pole (open)
- Perform secondary injection test of breakers with electronic trips.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0394) Oil Circuit Breakers - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Draw oil samples for comprehensive and DGA analysis.
- Inspect and clean breakers. Clean breaker surfaces with lint free rags and appropriate solvent.
- Record starting operations counter, if equipped.

- Slow close the circuit breakers to verify proper operation.
- Perform time travel test.
- Perform visual inspection of contacts and interrupters. (optional)
- Lubricate mechanism according to manufacturer's recommendations.
- Perform primary contact resistance test (Ductor) on each circuit breaker.
- Perform and insulation resistance test (Megger) of each breaker in the closed position, phase to phase and phase to ground.
- Inspect, clean, and lubricate mechanism according to manufacturer's recommendations.
- Perform a power factor test on breakers and bushings.
- Verify proper operation of the circuit breakers manual controls.
- Verify proper operation of space heaters.
- Verify operation of mechanism as per manufacturer's recommendations. (Special consideration given to pneumatically operated, and solenoid operated mechanisms.
- Verify circuit breaker operation via protective relay operation and remote controls.
- Record final operations counter, if equipped.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0404) Outdoor Substations - Preventative Maintenance - SWAPs

- Visually inspect all bus systems, insulators, air switches, structures, etc.
- Perform partial discharge and corona inspection while energized. Compare results to past inspection records.
- Perform infrared inspection of current carrying conductors and exposed devices.
- Inspect air and grounding switches for proper operation.
- Inspect operating handles, mechanisms, and gearboxes for proper operation.
- Inspect operating handles for proper grounding, ground straps, slips ring, etc.
- Perform contact resistance test on phase and ground switches.
- Inspect and clean switch contacts, burnish contacts to remove oxidation.
- Verify proper operation of auxiliary devises.
- Inspect key interlocks for proper operating sequence and proper key distribution, if equipped.
- Verify tightness of ground connections.
- Inspect for broken or frayed ground connections to structures and fence enclosures.
- Verify proper operation of gates and access security.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0404) Outdoor Substations - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for potential issues to be addressed during the outage. (optional)
- Clean and vacuum the circuit breaker cubicles, termination cubicles, auxiliary device cubicles, instrument transformer sections, etc.
- Inspect and verify compartment space heaters (if provided) for proper operation.
- Verify the racking mechanism (Disconnect, Test and Connect) operation and indication.
- Verify ground bus connections and supports for proper tightness.
- Inspect and verify CT ratio, polarity, and connections.
- Inspect and verify PT ratio, rating, and connections.
- Inspect and verify CPT ratio, rating, fuse rating, and connections.
- Verify bus connections have been properly torqued.
- Verify emergency and remote circuits operate correctly.
- Test/verify any designed transfer schemes, ground fault schemes, etc.
- Test/verify control wiring, control fuses/breakers ratings.
- Place all breakers in test or disconnect position and remove all PT fuses prior to performing an insulation integrity (Megger) test.
- Perform a primary contact resistance test (Ductor) across each set of contacts,
- Perform an insulation resistance test (Megger) on each breaker in the closed position, phase to phase and phase to ground.
- Verify proper interference plates on both the breaker and in the switchgear compartments.
- Verify proper operation and installation of medium voltage PT compartments, as applicable.

- Verify doors operate and latch correctly.
- Inspect panels to verify tightness of fasteners.
- Inspect and replace filters, as necessary.
- Verify that substation grounding conductor is present and tight.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0414) Power Cables - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Perform an Infrared scan, if requested.
- Visually inspect and clean terminations.
- Inspect terminations taping or insulating boots.
- Perform insulation resistance tests according to manufacturer's recommendations.
- Perform shield continuity test, if equipped.
- Perform VLF Test, if required.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0434) Rotating Machinery, Ac Induction Motors and Generators - Preventative Maintenance - SWAPs

- Visually inspect for deficiencies, damage, and proper installation
- Compare equipment nameplate data with drawings and specifications.
- Inspect physical and mechanical condition.
- Inspect anchoring, alignment, and grounding.
- Inspect air baffles, filter media, cooling fans, slip rings brushes and brush riggings
- Inspect bolted electrical connections for high resistance using one or more of the following methods:
- Use of low-resistance ohmmeter
- Use of calibrated torque wrench
- Perform IR scan.
- Perform optional tests such as air-gap spacing and machine alignment
- Perform optional manual rotation of rotor and inspect for issues with the bearing or shaft.
- Perform optional rotation of shaft and measure / record the shaft extension runout.
- Verify the application of appropriate lubrication and lubricating systems.
- Verify any resistance temperature detector (RTD) circuits conform to drawings.
- Perform an insulation resistance test on windings (Optional polarization index test)
- Perform phase-to-phase stator resistance test.
- Perform insulation power-factor or dissipation-factor test (Optional tip up test)
- Perform insulation-resistance test on insulated bearings in accordance with manufacturer's specifications.
- Test surge protection devices
- Perform resistance tests on RTDs.
- Verify operation of machine space heater, if applicable
- Perform vibration test.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0444) Rotating Machinery, Synchronous Motors and Generators - Preventative Maintenance - SWAPs

- In addition to the tests listed above for AC motors and generators:
- Perform insulation resistance tests on the main rotating field winding, the exciter field winding, and exciter armature winding.
- Perform and AC voltage-drop test on all rotating field poles.
- Perform a high-potential test on all rotating field poles.
- Perform a high-potential test on the excitation system.
- Measure resistance on machine-field winding, exciter-stator winding, exciter-rotor windings, and field discharge resistors.
- Perform front-to-back resistance tests on diodes and gating tests of silico-controlled rectifiers for field application semiconductor.
- Prior to re-energizing, apply voltage to the exciter supply and adjust exciter-field current to nameplate value.
- Verify the field application timer and enable timer for the power-factor relay have been tested and set per the manufacturer's recommendations.
- Record stator current, stator voltage and field current for the complete acceleration period, including stabilization time for a normally loaded starting condition (optional).
- Plot V-Curve of stator current versus excitation current at approximately 50 percent load to verify correct exciter operation (optional).
- Reduce excitation if the range of the exciter adjustment and machine loading permit, to cause power factor to fall below the trip value of

the power-factor relay. Verify relay operation. (optional)
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0454) SG Series UPS - Preventative Maintenance - SWAPs
- Visually inspect for deficiencies, damage, and proper installation.
- Verify proper input and output power cabling.
- Verify correct grounding scheme, as required.
- Visually inspect all control wiring and power for proper connection and tightness.
- Visually inspect all systems cabinets for debris.
- Verify all UPS breakers are open, then close main feeder breaker to UPS.
- Verify proper phase at input terminals of UPS and bypass source if applicable.
- Energize UPS and perform normal tests and alignments.
- Place unit in normal service.

(PM0464) Solid State Relays/Metering - Preventative Maintenance - SWAPs
- Verify relay is correct model # vs. coordination study.
- Visually inspect and clean relay.
- Verify correct programming of CT & PT ratios.
- Test relay operating time /current curves using appropriate current injection test equipment.
- Verify inputs operate correctly as per configuration file.
- Verify contact output functions per protection and monitoring features in configuration file.
- Cycle control power and confirm setting files remain unchanged.
- Provide documentation of field tests performed and results of those tests in an Engineering Appraisal Report.

(PM0474) Static Drives and Motors. - Preventative Maintenance - SWAPs
- Visually inspect for deficiencies, damage, and proper installation.
- Perform an insulation resistance test (Megger) on the motor.
- Verify tightness of connections.
- Verify contactors.
- Verify all boards and cables are properly seated.
- Perform static ohm meter test on drive input and output section.
- Verify filters are clean.
- Verify drive cabinets are free of debris.
- Provide documentation of Field Tests performed and results of those tests in an

(PM0484) Station Batteries & Charger - Preventative Maintenance - SWAPs
- Visually inspect the battery cells for corrosion and/or physical damage.
- Measure and record single cell (pilot cell) voltage.
- Measure and record float voltage.
- Measure and record Internal cell resistance.
- Measure and record Intercell connection resistance.
- Measure and record specific gravity of each battery.
- Verify proper functionality of battery charger.
- Verify water level in batteries.
- Clean batteries if necessary.
- Verify all connections and tighten when necessary.
- Verify charger's ventilation and free it of obstruction.
- Perform load test to manufacturer's recommendations, if required.
- Perform during load test an IR scan, if performing load test
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0494) Surge Arrestors - Preventative Maintenance - SWAPs
- Visually inspect for deficiencies, damage, and proper installation
- Verify correct ratings for given installation.
- Inspect and clean arrestors. Wipe clean with lint free rags using manufacturer's recommended solvent.
- Perform an insulation resistance test to ground. Compare readings to manufacturer's recommendations.
- Measure resistance of ground connection.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0504) Switchgear (Entellisys™) - Preventative Maintenance - SWAPs
- Visually inspect for deficiencies, damage, and proper installation
- Prior to a maintenance outage, perform infrared (IR) inspection and evaluate the results for

potential issues to be addressed during the outage. (optional)

- Verify control power interconnects (include Entellisys™ interconnects)
- Verify terminal connections on devices and terminal blocks.
- Verify Ethernet connections.
- Verify HMI
- Verify communication w/each node (messenger)
- Verify breaker status indication.
- Verify HMI screens (i.e. one-line, control, elevation) are correct
- Verify information integrity between HMI and C/CPUs
- Verify HMI parameters (i.e. date and time)
- Verify system protection settings.
- Verify IP address.
- Verify discrete I/O label descriptions.
- Verify current sensors are correctly installed.
- Verify current sensor ratio and polarity.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0524) Automatic Transfer Switches (Models ZTX, ZTG & ZTS) - SWAPs

- Visually inspect for deficiencies, damage, and proper installation.
- Verify the lug torque values of power connections.
- Verify Engine Start connections.
- Verify correct connections of all control wires.
- Verify all covers and barriers are properly fastened.
- Verify settings of timers and adjust to customer-supplied settings.
- Verify phase rotation if it is permissible to apply normal and emergency power to the ATS as described below.
- Close primary source breaker feeding the ATS and verify phase-to-phase voltages at the ATS's normal (or primary) side, line terminals.
- Verify that the controller LEDs for source availability are illuminated.
- Close alternate source breaker feeding the ATS.
- Start the engine-generator.
- Verify the phase-to-phase voltages at the ATS' alternate (or emergency) side, line terminals. Verify that the controllers LEDs for source availability are illuminated.
- Verify that the phase rotation of the primary source is the same as the phase rotation of the alternate source.
- Shut down the engine-generator.
- Place the ATS starting controls in the Automatic position.
- Provide documentation of Field Tests performed and results of those tests in an Engineering Appraisal Report.

(PM0534) Medium Voltage Motor Control Center - SWAPs

- *Pending release. Contact ABB Electrification for quotation.*

Additional services

Power Care

Day of Service?

References

ABB SWAPs Global Preventative Maintenance

US Electrification Website

US Electrification Preventative Maintenance Website

Power Care Service Agreements

Notes

ABB Inc.
305 Gregson Drive
Cary, NC 27511

electrification.us.abb.com/service

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