

ATS Installation Guide: Complete Automatic Transfer Switch Selection, Wiring, and Commissioning Manual

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Introduction

The Automatic Transfer Switch (ATS) is the brain of the generator system, responsible for sensing utility power failure, starting the generator, transferring load to generator power, and retransferring back to utility power when it returns. A properly installed ATS ensures seamless power transition during outages, preventing interruptions to critical operations. An improperly installed ATS can cause nuisance outages, generator damage, load interruption, and code violations.

This comprehensive guide covers ATS installation for generator systems ranging from small residential units (7-24 kW, 120/240V single-phase) to large industrial power plants (1000-2500+ kW, 480/600V three-phase). We address ATS selection (open transition, closed transition, soft load), sizing (ampere rating, withstand rating), installation (mounting, power wiring, control wiring), programming (time delays, voltage setpoints, exercise schedule), and commissioning (functional testing, simulated outage test). Whether you are installing a simple 200-amp residential ATS or a complex 3000-amp paralleling switchgear, this guide provides the methodology, procedures, and practical examples you need.

ATS installation is not merely connecting wires. It requires understanding of power system operation (sensing, transfer logic), protective devices (overcurrent, short circuit), control theory (sensors, actuators, logic), and codes and standards (NEC Article 700/701/702, NFPA 110, UL 1008). A proper ATS installation ensures that when the utility fails, the ATS senses the failure, starts the generator, verifies generator is ready, transfers load—and when utility returns, verifies utility is stable, retransfers load, and shuts down the generator after cooldown. All of this must happen automatically, reliably, and safely.

This guide is written for electrical contractors, electrical engineers, facility managers, and generator technicians who need to install or oversee ATS installations. We cover NEC (National Electrical Code), NFPA 110 (Emergency and Standby Power Systems), UL 1008 (Standard for Transfer Switch Equipment), and manufacturer requirements (Caterpillar, Cummins, Kohler, Generac, ASCO, Russelectric). By following this guide, you will ensure your ATS installation is safe, reliable, code-compliant, and ready to perform when called upon.

Compatible ATS Brands and Generator Compatibility

ATS Brand	Compatible Generator Brands	Transition Type	Control Type	Communication	Typical Application
ASCO (Schneider)	All major brands	Open, Closed, Soft Load	Microprocessor	Modbus, Ethernet	Commercial, Industrial
Russelectric	All major brands	Open, Closed, Paralleling	Microprocessor	Modbus, Ethernet, DNP3	Mission Critical, Data Centers
Kohler	Kohler, Cummins, Caterpillar	Open, Closed	Microprocessor	Proprietary, Modbus	Commercial, Healthcare
Generac	Generac, Other (with interface)	Open	Microprocessor	Proprietary	Residential, Small Commercial
Cummins (Onan)	Cummins, Other (with interface)	Open, Closed	Microprocessor	Proprietary, Modbus	Commercial, Industrial

| Eaton (Cutler-Hammer) | All major brands | Open, Closed | Microprocessor | Modbus, Ethernet | Commercial, Industrial |

| Siemens | All major brands | Open, Closed | Microprocessor | Modbus, Profibus | Industrial, Power Plants |

Technical Specifications and Design Criteria

| Design Parameter | Residential (≤ 50 kW) | Commercial (50-500 kW) | Industrial (500-2500+ kW) |

|-----|-----|-----|-----|

| ATS Type | Open Transition (Break-Before-Make) | Open or Closed Transition | Closed Transition or Soft Load (Paralleling) |

| Voltage Rating | 120/240V Single Phase | 208/480V Three Phase | 480/600/4160V Three Phase |

| Ampere Rating | 100-400A | 400-3000A | 3000A+ |

| Withstand Rating (AIC) | 10,000-65,000 AIC | 65,000-100,000 AIC | 100,000 AIC+ (with current limiting fuses) |

| Control Voltage | 120 VAC (from generator) | 120 VAC or 24 VDC | 120 VAC, 24 VDC, or 125 VDC |

| Sensing | Utility and Generator Voltage | Utility and Generator Voltage, Frequency | Voltage, Frequency, Phase Sequence, Synchroscope |

| Time Delays (adjustable) | Utility fail to start: 0-5 sec, Generator ready to transfer: 5-30 sec, Utility return to retransfer: 5-30 min | Same as residential, plus programmable logic | Same as commercial, plus synchronization time (0-10 sec) |

| Communication | None (standalone) or Simple Contacts (running, alarm) | Modbus RTU (RS-485) | Modbus RTU/TCP, Ethernet/IP, DNP3 |

| Enclosure Rating | NEMA 3R (outdoor) or NEMA 1 (indoor) | NEMA 3R or NEMA 12 (dust-tight) | NEMA 3R, NEMA 12, or NEMA 4X (corrosion-resistant) |

| Seismic Rating | Not required | Required (ICC-ES certified) | Required (ICC-ES certified, Zone 4) |

| Testing | Manual test switch | Manual test switch + remote test (BAS) | Comprehensive testing (simulated outage, load bank, paralleling) |

Step-by-Step ATS Installation Procedure

Phase 1: ATS Selection and Sizing (Week 1)

Step 1: Determine ATS Type (Open vs. Closed Transition)

The type of ATS determines whether power interruption occurs during transfer.

1. Open Transition (Break-Before-Make):

- Briefly opens utility breaker, then closes generator breaker (50-100 ms interruption)
- Most common, least expensive, adequate for most loads (lights blink, motors coast)
- Use for: Residential, commercial (office buildings, retail), industrial (non-critical processes)

2. Closed Transition (Make-Before-Break):

- Briefly closes both utility and generator breakers (paralleling for 50-100 ms), then opens utility breaker
- Seamless transfer (no interruption), required for sensitive loads
- Use for: Hospitals (Life Safety), Data Centers (UPS systems), Semiconductor manufacturing (critical processes)
- More expensive (requires synchronization equipment), subject to additional code requirements (NFPA 110, Type 10)

3. Soft Load (Ramp-Up/Down):

- Gradual transfer (generators ramp up/down over 10-30 seconds), minimizes voltage/frequency transients
- Use for: Paralleling multiple generators, or generator with utility (peak shaving, load management)
- Most complex (requires sophisticated control system), most expensive

Step 2: Size the ATS (Ampere Rating)

Size ATS based on load current, with appropriate margins for future expansion and code requirements.

1. Calculate Load Current:

- For 3-phase: $I = (kW \times 1000) / (\sqrt{3} \times V \times PF)$
- Example: 500 kW, 480V, PF = 0.8: $I = (500 \times 1000) / (1.732 \times 480 \times 0.8) = 752$ amps

2. Apply NEC 700.5 (Emergency Systems) or 701.5 (Legally Required Standby):

- ATS must be sized for 125% of continuous load (NEC 700.5(B))
- Required ampacity = $752 \times 1.25 = 940$ amps

3. Select Standard ATS Size:

- Next standard size above 940 amps = 1000 amps (or 800 amps if load is non-continuous, verify with AHJ)
- For 500 kW generator, select 1000-amp ATS (typical, provides margin for future expansion)

4. Verify Withstand Rating (AIC):

- Calculate available short circuit current at ATS (from utility and generator)
- Example: Utility contributes 50,000 amps, generator contributes 4,000 amps, total = 54,000 amps
- Select ATS with AIC rating $\geq 54,000$ amps (standard: 65,000 AIC for 480V systems)

Step 3: Select ATS Features and Options

Based on application requirements, select appropriate features.

1. Basic Features (Residential/Small Commercial):

- Open transition
- Utility and generator voltage sensing
- Adjustable time delays (utility fail, generator ready, utility return)
- Exercise schedule (weekly, same time each week)
- Manual test switch
- Status contacts (running, alarm, ATS position)

2. Advanced Features (Large Commercial/Industrial):

- Closed transition or soft load (if required)
- Communication (Modbus, Ethernet) for remote monitoring and control
- Load shed contacts (automatically shed non-essential loads if generator overloaded)

- Peak shaving control (automatically start generator when utility demand exceeds setpoint)
- Paralleling control (multiple generators, or generator with utility)
- Seismic certification (ICC-ES report, for seismic zones)

3. Enclosure:

- NEMA 3R (outdoor, rain-tight, sleet-tight)
- NEMA 12 (indoor, dust-tight, drip-tight)
- NEMA 4X (outdoor, corrosion-resistant, wash-down)

Phase 2: ATS Installation (Week 2-3)

Step 4: ATS Location Selection and Preparation

Proper ATS location ensures accessibility for maintenance, adequate ventilation, and code compliance.

1. Location Criteria:

- Proximity to service entrance (minimize feeder length, reduce voltage drop)
- Accessibility (clearance: 36" front, 30" sides, per NEC 110.26)
- Dry location (NEMA 3R for outdoor, NEMA 1 for indoor)
- Adequate ventilation (ATS generates heat, provide ventilation or air conditioning if in enclosed space)
- Separation from combustibles (minimum 3 feet from combustible walls, or provide fire-rated barrier)

2. Wall-Mount vs. Pad-Mount:

- Wall-Mount: For ATS \leq 1200 amps, wall-mount on non-combustible wall (concrete, masonry) or on Unistrut backing (\geq 12 AWG steel)
- Pad-Mount: For ATS > 1200 amps, or if wall cannot support weight, install on concrete pad (4-6 inches thick, level, anchored)

3. Prepare Mounting Surface:

- Verify wall can support ATS weight (■: 200-2000 lbs, depending on size)
- Install Unistrut or angle iron backing (if wall-mount, ensure backing is secured to wall studs or concrete anchors)
- For pad-mount, pour concrete pad (4-6 inches thick, 110% of ATS footprint, level \pm ■" per foot)

Step 5: ATS Mounting

1. Wall-Mount Installation:

- Lift ATS onto wall (use appropriate rigging, ATS is heavy and awkward)
- Align ATS with backing (verify plumb, using level)
- Bolt ATS to backing (use minimum $\frac{1}{2}$ " bolts, torque to specification)
- Verify ATS is secure (tug test, should not move)

2. Pad-Mount Installation:

- Lift ATS onto pad (use forklift or crane)
- Align ATS on pad (verify plumb, using level)
- Anchor ATS to pad (use anchor bolts, minimum $\frac{1}{2}$ ", embedded in concrete, torque to specification)
- Verify ATS is level (check with machinist's level, shim if necessary)

3. Grounding:

- Connect ATS enclosure to building grounding electrode (GEC, 6 AWG copper minimum, per NEC 250.66)
- Verify continuity (resistance < 0.1 ohm, per NEC 250.53(A)(2))

Step 6: Power Wiring (Utility Source to ATS to Load)

Power wiring connects the utility source, generator source, and load to the ATS.

1. Conductor Selection:

- Use THHN/THWN-2 (90°C rating, 75°C termination rating per NEC 110.14(C)(1)(b))
- Size per NEC Table 310.15(B)(16) (75°C column, based on ATS ampere rating)
- Example: 1000-amp ATS, 480V:
- Required conductor ampacity = 1000 amps
- Select (3) 500 kcmil parallel per phase (each 500 kcmil rated 380 amps at 75°C, $380 \times 2 = 760$ amps, adequate for 1000 amps? No, need 4 parallel: $380 \times 4 = 1520$ amps, adequate)
- Alternatively, select 1000 kcmil (rated 560 amps at 75°C), 2 parallel per phase = 1120 amps (adequate)

2. Conduit Installation:

- Use rigid metal conduit (RMC) or intermediate metal conduit (IMC) (provide equipment grounding conductor, protect conductors)
- Size per NEC Chapter 9, Table 5 (conduit fill $\leq 40\%$ for 3+ conductors)
- Support conduit every 10 feet (NEC 358.30)
- Seal conduit at ATS (prevent water/moisture ingress, use duct seal or expanding foam)

3. Terminate Conductors at ATS:

- Utility Source: Connect to ATS utility terminals (L1, L2, L3, N for 4-pole ATS; L1, L2, L3 for 3-pole ATS)
- Generator Source: Connect to ATS generator terminals (L1, L2, L3, N for 4-pole ATS; L1, L2, L3 for 3-pole ATS)
- Load: Connect to ATS load terminals (L1, L2, L3, N for 4-pole ATS; L1, L2, L3 for 3-pole ATS)
- Neutral: For 4-pole ATS, neutral is switched (isolated when on generator). For 3-pole ATS, neutral is common (bonded to both utility and generator neutral, verify no circulating currents)
- Ground: Connect equipment grounding conductor (EGC) to ATS grounding bus (separate from neutral bus, unless ATS is service entrance rated and neutral is bonded to ground at ATS)

4. Torque Terminations:

- Use calibrated torque wrench (critical for high-current connections)
- Torque to manufacturer specification (typically 150-500 ft-lbs for 500 kcmil)
- Mark torque marks (paint or marker, verify no movement after energization)
- Perform thermographic scan after energization (verify no hot spots)

Step 7: Control Wiring (ATS to Generator)

Control wiring connects ATS to generator for start/stop control, status monitoring, and synchronization (if closed transition or paralleling).

1. Control Wiring Type:

- Use shielded twisted pair (18-22 AWG) for sensors and actuators (prevent EMI from power wiring)
- Use separate conduit for control wiring (do not mix with power wiring, NEC 300.3(B), prevent EMI)
- For communication wiring (Modbus, Ethernet), use manufacturer-specified cable (typically RS-485 for Modbus, Cat 5e or Cat 6 for Ethernet)

2. Control Signals (Open Transition ATS):

- Utility Voltage Sensor: Monitors utility voltage (signals ATS logic when utility fails or returns)
- Generator Voltage Sensor: Monitors generator voltage (signals ATS logic when generator is ready to accept load)
- Start/Stop Signal: ATS sends start signal to generator (when utility fails), sends stop signal to generator (after cooldown, when retransferred to utility)
- Status Contacts: ATS sends "Running" contact (to BAS), "Alarm" contact (to BAS), "ATS Position" contact (utility or generator, to BAS)

3. Control Signals (Closed Transition or Paralleling ATS):

- All above, plus:
- Synchronization Signals: ATS monitors generator voltage, frequency, phase angle (sends adjustments to generator governor and AVR to match utility)
- Paralleling Control: ATS controls generator breaker closing at 0° phase angle (synchroscope at 12 o'clock)
- Load Share Signals: ATS adjusts generator governor and AVR setpoints to proportion load based on generator capacity (if paralleling multiple generators)

4. Wiring and Termination:

- Follow ATS manufacturer wiring diagram (typically provided with ATS)
- Use wire numbers or labels (match diagram, ease troubleshooting)
- Terminate at ATS control terminal strip (tighten set screws, typical torque 5-10 in-lbs for 18-22 AWG)
- Terminate at generator control panel (follow generator manufacturer diagram)
- Test continuity (megohmmeter, verify no open circuits, no short circuits)

Phase 3: ATS Programming and Configuration (Week 4)

Step 8: Program ATS Time Delays and Setpoints

Microprocessor-based ATS have adjustable time delays and voltage/frequency setpoints. Program per application requirements.

1. Time Delays (adjustable via DIP switches or software interface):

- Utility Fail to Start Generator: Typically 0-5 seconds (adjustable, set to 2-3 seconds to prevent nuisance starts due to brief utility sags)
- Generator Ready to Transfer: Typically 5-30 seconds (adjustable, set to 10-15 seconds to allow generator to stabilize)
- Utility Return to Retransfer: Typically 5-30 minutes (adjustable, set to 15-20 minutes to ensure utility is stable)
- Generator Cooldown Before Shutdown: Typically 5-15 minutes (adjustable, set to 10 minutes to allow generator to cool down before shutting off)
- Exercise Schedule: Typically weekly, same day and time (adjustable, set to time when building load is low, e.g., Wednesday 2:00 PM)

2. Voltage and Frequency Setpoints:

- Utility Voltage Pickup/Dropout: Typically 90%/80% of nominal (adjustable, ATS transfers to generator when utility voltage drops below 80% nominal, retransfers when utility voltage returns above 90% nominal)
- Generator Voltage Pickup/Dropout: Typically 90%/80% of nominal (adjustable, ATS waits for generator voltage to reach 90% nominal before transferring load)

- Frequency Setpoints (if frequency sensing enabled): Typically 95%/98% of nominal (adjustable, ATS senses utility frequency drop, may transfer to generator if utility frequency unstable)

3. Programming Method:

- DIP Switches: For basic ATS (open transition, simple functionality)
- Keypad/LCD: For mid-range ATS (parameter adjustment via keypad on ATS front panel)
- Software Interface: For advanced ATS (connect laptop to ATS via RS-232/485 or Ethernet, use manufacturer software to program, monitor, troubleshoot)

Step 9: Program Load Shed and Peak Shaving (if applicable)

For ATS with load shed or peak shaving functionality:

1. Load Shed Programming:

- Connect load shed relay contacts to non-essential loads (HVAC, lighting)
- Program load shed setpoint (e.g., shed non-essential loads if generator load exceeds 80% capacity)
- Program load add setpoint (e.g., add non-essential loads back if generator load drops below 60% capacity)

2. Peak Shaving Programming:

- Connect ATS to utility meter (via pulse output or communication)
- Program peak shaving setpoint (e.g., start generator if utility demand exceeds 500 kW)
- Program generator shutdown setpoint (e.g., shutdown generator if utility demand drops below 400 kW)
- Verify utility interconnection agreement allows peak shaving (some utilities prohibit or require special agreement)

Phase 4: ATS Commissioning and Testing (Week 5-6)

Step 10: Pre-Start Checks

Before testing ATS, perform comprehensive verification.

1. Visual Inspection:

- Verify all power and control wiring correct (compare to drawings)
- Verify all terminations tight (torque to spec)
- Verify ATS enclosure grounded (continuity test)
- Verify no debris inside ATS (loose hardware, wire scraps, can cause short circuit)

2. Control Voltage Verification:

- Verify control voltage present (120 VAC or 24 VDC, from generator or separate source)
- Verify control voltage correct ($\pm 10\%$ of nominal)

3. Utility Voltage Verification:

- Verify utility voltage at ATS utility terminals (should be 480V $\pm 5\%$, or as specified)
- Verify phase sequence (A-B-C, use phase sequence meter)

4. Generator Voltage Verification (with generator off):

- Verify no voltage at ATS generator terminals (ATS isolates generator when on utility)

Step 11: Simulated Outage Test (Open Transition ATS)

Test ATS operation by simulating utility failure.

1. Test Procedure:

- With ATS on utility, verify load has power (utility supplying load)
- Open utility disconnect (safe, controlled test, simulates utility failure)
- Verify ATS senses loss of voltage (typically 0-5 seconds, depending on programming)
- Verify ATS sends start signal to generator
- Verify generator starts, runs up to speed (verify voltage and frequency stabilize)
- Verify ATS transfers to generator (after "generator ready" time delay, typically 10-15 seconds)
- Verify load now powered by generator
- Hold for 15-30 minutes (verify stable operation)

2. Retransfer Test:

- Close utility disconnect (restore utility power)
- Verify ATS senses return of utility voltage (after "utility return" time delay, typically 15-20 minutes)
- Verify ATS transfers back to utility (after utility stable time delay)
- Verify generator runs unloaded for cooldown period (5-15 minutes, depending on programming)
- Verify generator shuts down after cooldown

3. Repeat Test 3 Times: Verify reliability (some ATS may fail intermittently due to control voltage fluctuation, sensor malfunction)

Step 12: Closed Transition Test (if applicable)

For closed transition ATS, test synchronization and paralleling.

1. Synchronization Test:

- With ATS on utility, initiate closed transition test (via manual test switch or BAS)
- Verify ATS adjusts generator voltage and frequency to match utility (governor and AVR adjustments)
- Verify synchroscope (if equipped) or synchronization lights (indicate phase match)
- Verify ATS closes generator breaker when phase angle = 0° (synchroscope at 12 o'clock)
- Verify ATS opens utility breaker (after paralleling period, typically 50-100 ms)
- Verify load now powered by generator

2. Retransfer Test (Closed Transition):

- Initiate retransfer (via test switch or utility return)
- Verify ATS adjusts generator voltage and frequency to match utility
- Verify ATS closes utility breaker when phase angle = 0° (paralleling)
- Verify ATS opens generator breaker (after paralleling period)
- Verify load now powered by utility
- Verify generator shuts down after cooldown

3. Verify No Interruption: Use oscilloscope or power quality analyzer to verify voltage waveform during transfer (should be seamless, no interruption).

Step 13: Documentation and Training

1. As-Built Drawings:

- Update drawings to reflect field changes (conduit routing, wire sizes, ATS settings)

- Provide ATS programming printout (time delays, setpoints, load shed settings)
 - Provide test report (simulated outage test, closed transition test if applicable)
2. Operation and Maintenance Manual:
- Provide ATS O&M; manual (from manufacturer)
 - Provide maintenance schedule:
 - Monthly: Exercise generator (via ATS, verify ATS transfers and retransfers)
 - Quarterly: Test ATS operation (simulated outage, verify reliability)
 - Annually: Calibrate sensors (voltage, frequency), verify time delays (using stopwatch)
 - Every 3-5 years: Overhaul ATS (clean contacts, adjust timing, replace wear parts)
3. Training:
- Train facility staff on:
 - ATS operation (normal, manual test, emergency)
 - ATS programming (adjust time delays, change exercise schedule)
 - Troubleshooting (alarm codes, what to do if ATS fails to transfer)

Download PDF Section

The complete ATS Installation Guide PDF is available for free download. This comprehensive manual includes all ATS selection criteria, wiring diagrams, programming guides, and commissioning checklists.

File Details:

- Format: PDF (Portable Document Format)
- Size: 26.7 MB
- Pages: 184 pages
- Language: English
- Compatibility: Windows, macOS, Linux, iOS, Android

Download Link: [\[ATS-Installation-Guide-Complete-Manual.pdf\]\(\)](#)

What's Included in the PDF:

1. ATS selection flowchart
2. ATS sizing spreadsheet (Excel)
3. Open transition vs. closed transition comparison guide
4. ATS control wiring diagrams (multiple manufacturers)
5. ATS programming guide (time delays, setpoints)
6. Simulated outage test procedure
7. Closed transition test procedure (if applicable)
8. ATS commissioning checklist
9. Maintenance log templates
10. Troubleshooting guide (ATS fails to transfer, nuisance tripping)

Frequently Asked Questions (FAQs)

1. What size ATS do I need for a 500 kW generator?

For a 500 kW, 480V, 3-phase generator:

- Full load current = $(500,000) / (1.732 \times 480 \times 0.8) = 752$ amps
- Required ATS ampacity = $752 \times 1.25 = 940$ amps (NEC 700.5, 125% of continuous load)
- Select standard ATS size: 1000 amps (next size above 940 amps, provides margin for future expansion)

Verify with ATS manufacturer (some ATS are rated for 100% continuous load, may select 800-amp ATS if load is non-continuous, verify with AHJ).

2. Can I use a manual transfer switch instead of ATS?

Yes,

Manual transfer switch:

- Less expensive (no sensors, no logic, manual operation)
- Requires personnel to start generator, transfer switch, retransfer (not automatic)
- Use for: Standby generators where personnel are always present (small businesses, farms)

Automatic transfer switch (ATS):

- More expensive,
- Required for: Emergency systems (NEC 700, hospitals, fire pumps), or where personnel not always present (most commercial/industrial)

For most installations, ATS is preferred (automatic operation, reliable, code-compliant).

3. What is the difference between service-rated and non-service-rated ATS?

Service-rated ATS: Includes a main breaker or fused disconnect on the utility side, allowing it to serve as the service entrance equipment. Required when the generator is the only source of power (no separate service disconnect) or when local code requires service entrance rated equipment.

Non-service-rated ATS: Does not have main breaker, must be installed downstream of existing service disconnect. Less expensive, adequate if service entrance is separate.

For most commercial installations, service-rated ATS is preferred (simplifies installation, provides single point of disconnect). Verify with local AHJ (some jurisdictions require service entrance rated equipment for emergency systems).

4. How do I test an ATS without simulating a utility outage?

Use the ATS manual test switch (provided on most ATS):

1. Manual Test Switch: Initiates ATS test sequence (starts generator, transfers load, holds for preset time, retransfers, shuts down generator)

2. Procedure:

- With ATS on utility, press manual test switch
- Verify ATS starts generator (same as simulated outage)
- Verify ATS transfers to generator
- Hold for 15-30 minutes (verify stable operation)
- Verify ATS retransfers to utility (after test time delay)
- Verify generator shuts down after cooldown

3. Frequency: Test monthly (NFPA 110 requires monthly test, or weekly exercise with unloaded run)

Note: Manual test switch tests ATS logic and generator start/transfer,

5. What causes an ATS to nuisance transfer (transfer to generator when utility is OK)?

Common causes:

1. Utility voltage sag: Utility voltage drops below ATS dropout setpoint (typically 80% of nominal) due to large motor starting, utility switching, or fault

- Solution: Adjust ATS dropout setpoint (raise to 85% or 90% of nominal, if utility sags are frequent)

2. Loose connection at utility voltage sensor: Sensor does not read voltage correctly (ATS thinks utility failed)

- Solution: Tighten sensor connections, verify sensor calibration

3. Faulty ATS logic board: Sensor input circuit failed (ATS erroneously senses loss of voltage)

- Solution: Replace logic board (typical warranty item, if ATS is new)

4. Generator exercise schedule: ATS transfers to generator during exercise (normal, not nuisance)

- Solution: Adjust exercise schedule (to time when load can be interrupted,

6. Can I install ATS in parallel (N+1 redundancy)?

Yes,

N+1 ATS configuration:

- Install 2 ATS (each rated for full load, or each rated for 50% load if loads can be split)
- If one ATS fails, other ATS carries full load (redundancy)
- Use for: Mission critical facilities (data centers, hospitals, where even brief interruption for ATS repair is unacceptable)

More complex (requires load splitting, coordination between ATS), more expensive,

7. What is a bypass isolation switch, and do I need one?

A bypass isolation switch allows ATS to be isolated (for maintenance) while still providing power to load (bypass ATS, connect utility or generator directly to load).

- When needed: For critical loads where ATS maintenance cannot interrupt power (hospitals, data centers)
- Installation: Install bypass switch around ATS (typically integrated in ATS enclosure, or separate enclosure)

- Operation: During ATS maintenance, manually operate bypass switch (connects utility to load, or generator to load, bypasses ATS)
- Cost: Adds 20-30% to ATS cost (significant, but justified for critical applications)

For most installations, bypass isolation switch is not required (ATS maintenance can be scheduled during non-critical periods, or generator can be down for a few hours). For mission critical, justify the cost.

8. How do I adjust ATS time delays?

ATS time delays are adjustable via:

1. DIP Switches: For basic ATS (open transition, simple functionality), DIP switches on logic board (refer to ATS manual for DIP switch settings)
2. Keypad/LCD: For mid-range ATS, keypad on ATS front panel (enter password, navigate menu, adjust time delays)
3. Software Interface: For advanced ATS, connect laptop to ATS via RS-232/485 or Ethernet, use manufacturer software (easier to adjust, can save settings to file)

Typical time delays:

- Utility fail to start generator: 2-3 seconds
- Generator ready to transfer: 10-15 seconds
- Utility return to retransfer: 15-20 minutes
- Generator cooldown: 10 minutes

Adjust per application (e.g., if utility sags are frequent, increase utility fail delay to 5 seconds to prevent nuisance starts).

9. What maintenance does an ATS require?

Maintenance tasks:

1. Monthly: Exercise generator (via ATS, verify ATS transfers and retransfers)
2. Quarterly: Test ATS operation (simulated outage, verify reliability), verify time delays (using stopwatch), verify control voltage (120 VAC or 24 VDC)
3. Annually: Calibrate sensors (voltage, frequency), clean ATS enclosure (dust, debris), verify torque on power terminations (thermal cycling loosens connections), perform thermographic scan (detect hot spots)
4. Every 3-5 years: Overhaul ATS (clean contacts, adjust timing, replace wear parts like contactors, logic board batteries)

Keep maintenance log (required for warranty, code compliance, NFPA 110).

10. Can I monitor ATS remotely?

Yes,

1. Status Contacts: Simple contacts (running, alarm, ATS position) wired to BAS (Building Automation System) or remote alarm panel
2. Communication (Modbus, Ethernet): For advanced ATS, connect to BAS or remote monitoring system (allows reading ATS parameters, adjusting settings, receiving alarms)

3. Cellular Modem: For remote sites (no Ethernet), install cellular modem in ATS (allows remote monitoring via web interface or mobile app)

4. Generator Manufacturer Monitoring: Some generator manufacturers (Caterpillar, Cummins, Kohler) provide remote monitoring service (subscription, they monitor generator and ATS, alert you to problems)

Remote monitoring is highly recommended (allows early detection of problems, prevents generator failure during outage).

11. What is selective coordination, and does my ATS need it?

Selective coordination: Protective devices (breakers, fuses) are coordinated such that only the faulted circuit breaker trips (not upstream breakers). Required by NEC 700.28 for emergency systems (Level 1).

For ATS:

- ATS has main breaker (on utility and generator side)
- If fault downstream of ATS, only downstream breaker should trip (not ATS main breaker)
- Achieve selective coordination by setting breaker trip curves (using manufacturer software, or time-current coordination study)

Verify with electrical engineer (selective coordination is complex, requires coordination study). Not required for non-emergency standby systems (NEC 701 does not require selective coordination,

12. Can I use ATS for peak shaving (generator assists utility during peak demand)?

Yes,

Peak Shaving Operation:

- ATS monitors utility demand (via utility meter pulse output or communication)
- If demand exceeds setpoint (e.g., 500 kW), ATS starts generator, transfers part of load to generator (reduces utility demand)
- If demand drops below setpoint, ATS retransfers load to utility, shuts down generator

Requirements:

- Utility interconnection agreement (some utilities prohibit peak shaving, or require special agreement)
- ATS with peak shaving control (programmable logic, communication with utility meter)
- Generator sized for peak shaving load (not just standby load)

Peak shaving can reduce utility demand charges (significant cost savings for large facilities),

13. What causes ATS contacts to weld (fail closed)?

Common causes:

1. Excessive short circuit current: Breaker AIC rating inadequate (does not interrupt fault, current continues to flow, welds contacts)

- Solution: Verify available short circuit current, select ATS with adequate AIC rating

2. Excessive motor starting current: Large motors (> 50% of generator capacity) cause high inrush current (contacts weld due to high heat)

- Solution: Use ATS with motor-rated contacts, or add soft starter for large motors

3. Low control voltage: ATS control voltage drops below minimum (contacts do not open quickly enough, weld)

- Solution: Verify control voltage stable (120 VAC \pm 10%, 24 VDC \pm 10%), add control voltage regulator if necessary

4. Worn contacts: Contacts reach end of life (mechanical wear, arcing damage)

- Solution: Replace contacts (typical life 10,000-100,000 operations, depending on load)

Preventive maintenance (inspect contacts annually, replace if worn) prevents contact welding.

14. How do I select ATS enclosure rating (NEMA 1, 3R, 4X, 12)?

Select enclosure rating based on installation environment:

1. NEMA 1: Indoor, dry location (office, electrical room)

2. NEMA 3R: Outdoor, rain-tight, sleet-tight (most common for outdoor ATS)

3. NEMA 4X: Outdoor, corrosion-resistant (coastal, chemical plants, wash-down areas)

4. NEMA 12: Indoor, dust-tight, drip-tight (industrial, where oil or coolant mist present)

For most installations, NEMA 3R (outdoor) or NEMA 1 (indoor) is adequate. For harsh environments, NEMA 4X or NEMA 12.

15. Can I install ATS in a hazardous location (Class I, Division 2)?

Yes,

Hazardous Location ATS:

- ATS must be rated for hazardous location (Class I, Division 2, Group C, D or specific gas/vapor)

- Typically, ATS is installed in NEMA 7 enclosure (explosion-proof), or in separate non-hazardous location with conduit to hazardous location (intrinsically safe wiring)

- Expensive (hazardous location rating adds 50-100% to ATS cost)

For most generator installations, ATS is installed in non-hazardous location (separate electrical room, or outdoor away from hazardous process). If must install in hazardous location, consult manufacturer (few ATS are rated for hazardous locations, may need to use isolation relays, intrinsically safe sensors).

Related Downloads

Ensure complete ATS integration with these additional resources:

1. [Generator Installation Guide PDF]() - Comprehensive installation manual covering all aspects of generator setup, including ATS integration.

2. [Generator Foundation Design Guide PDF]() - Foundation design manual, including ATS pad foundation requirements (if pad-mount).

3. [Generator Room Ventilation Design PDF]() - Ventilation design guide, including ventilation for ATS room (ATS generates heat, may need cooling).

4. [Generator Fuel System Installation Guide PDF]() - Fuel system design, including ATS interlocks (ATS can signal fuel system to start transfer pump, if day tank).
5. [Generator Electrical Installation Guide PDF]() - Electrical integration guide (this document is the primary reference for ATS installation, covers power wiring, control wiring).
6. [Generator Exhaust System Installation PDF]() - Exhaust system design, including separation distance from ATS (high exhaust temperature, not a fire hazard for ATS if separated).
7. [Generator Cooling System Installation PDF]() - Cooling system design, including ATS cooling fan (if ATS has cooling fan, interlocked with generator).
8. [Containerized Generator Installation PDF]() - Containerized generator installation, including ATS in container (if ATS is in same container as generator, integrated system).
9. [Soundproof Enclosure Installation Guide PDF]() - Acoustic enclosure installation, including ATS enclosure (if ATS is in separate enclosure, sound attenuation).
10. [Generator Commissioning Checklist PDF]() - Commissioning checklist that includes ATS testing and verification procedures.
11. [NEC Article 700/701/702 ATS Compliance Guide PDF]() - Summary of NEC requirements for ATS in emergency, legally required standby, and optional standby power systems.
12. [UL 1008 ATS Testing Guide PDF]() - Guide to UL 1008 testing requirements for ATS (withstand rating, endurance testing, temperature rise).
13. [ATS Communication Protocol Guide PDF]() - Guide to ATS communication protocols (Modbus, Ethernet/IP, DNP3), including wiring diagrams, register maps.
14. [Selective Coordination Study Spreadsheet (Excel)]() - Excel spreadsheet for performing selective coordination study (time-current curve coordination).
15. [ATS Troubleshooting Guide PDF]() - Comprehensive troubleshooting guide for ATS problems (fails to transfer, nuisance tripping, communication loss).

Conclusion

ATS installation is a critical discipline that directly impacts generator system reliability, safety, and code compliance. A properly installed ATS ensures seamless power transition during outages, preventing interruptions to critical operations. This guide has provided you with the methodology, procedures, and practical examples needed to install ATS for generators of all sizes.

Remember that ATS installation is not a DIY project. It requires knowledge of the NEC, NFPA 110, UL 1008, and local electrical codes, as well as experience with power system operation and control wiring. Always engage a licensed electrical contractor and have the installation permitted and inspected by the local Authority Having Jurisdiction (AHJ). The cost of professional installation is insignificant compared to the risks of improper installation: generator damage, load interruption, fire, and code violations.

Key takeaways from this guide:

1. Select appropriate ATS type. Open transition for most applications, closed transition for sensitive loads, soft load for paralleling.

2. Size ATS adequately. Ampacity = 125% of continuous load (NEC 700.5), withstand rating \geq available short circuit current.
3. Install properly. Mount securely, provide adequate clearance, terminate power and control wiring correctly, torque all connections.
4. Program correctly. Set time delays and voltage/frequency setpoints per application requirements.
5. Test thoroughly. Perform simulated outage test, verify reliable operation, test under load if possible.
6. Maintain regularly. Monthly exercise, quarterly functional test, annual calibration and inspection.

By following the procedures outlined in this guide and adhering to applicable codes and standards, you can install an ATS that provides decades of reliable service. Invest the time and effort in proper selection, installation, and testing—your generator system will reward you with seamless power when you need it most.

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Disclaimer: This guide is for informational purposes only. ATS installation must be performed by licensed electricians and permitted through the local Authority Having Jurisdiction. Always consult the NEC, NFPA 110, UL 1008, and local electrical codes before proceeding with ATS installation. The authors assume no liability for damages resulting from the use of this information.

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