

Table of Contents

Section	Page	Section	Page
Introduction	1	Table 2. Inspection and Maintenance Procedure for the Enclosure and for Components in High-Voltage Bays	4
Table 1. Inspection Procedure for S&C Switchgear Equipped with Type AT-2 Source-Transfer Controls	3		

Introduction

⚠ CAUTION
The equipment covered by this publication must be inspected by qualified persons who are thoroughly trained and who understand any hazards that may be involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

This publication contains inspection and maintenance recommendations for S&C Power-Operated Metal-Enclosed Switchgear. Included in these recommendations are instructions to effect a complete functional inspection of Type AT-2 Source-Transfer Controls for switchgear having automatic source-transfer capabilities. Type AT-2 controls are used in switchgear configured in a common-bus primary-selective arrangement. For switchgear equipped with Type AT-3 Source-Transfer Controls, refer to Instruction Sheet 620-591 “S&C Power-Operated Metal-Enclosed Switchgear: Inspection Recommendations for Switchgear Equipped with Type AT-3 Source-Transfer Controls” for inspection recommendations.

To successfully complete the inspection procedures involving the Type AT-2 control, the gear must be energized with adequate voltage available on both power sources. It is recommended that this inspection be performed at least every year. Refer to Table 1 on page 3.

It is generally recommended that the metal-enclosed switchgear enclosure and components located in high-voltage bays be inspected six months to a year after installation and then every five years thereafter to ensure continued proper performance of the gear. Each user’s own experience as well

as environmental conditions at the installation will determine whether more or less frequent inspections are required. Refer to Table 2 on pages 4 through 6.

A partial visual inspection of the gear for general cleanliness and to confirm proper alignment and condition of barriers and terminators may be performed with the gear energized, if permitted by the user’s own operating practices and provided that standard precautionary practices are followed. Such visual inspections may also be performed when the gear is visited for other reasons. However, the more detailed inspection and maintenance procedures outlined in this publication may only be completed when the unit is completely de-energized and grounded.

⚠ CAUTION
When following the inspection procedures involving the AT-2 control, decouple all switch operators from their associated Mini-Rupter® or Alduti-Rupter® Switches. Switching operations will result in temporary service interruptions if the operators are coupled.

For instructions regarding switch operators, refer to:

Instruction Sheet 629-510 (Formerly 855-512):	
S&C Switch Operators Type MS-2	Catalog Numbers 38744 and 38754

Instruction Sheet 629-500 (Formerly 854-501):	
S&C Switch Operators Type AS-30	Catalog Numbers 38960

Instruction Sheet 629-520 (Formerly 855-501):	
S&C Switch Operators—Type MS-10	



Introduction

For instructions regarding operation of the AT-2 control, refer to:

Instruction Sheet 514-501	
S&C Source-Transfer Controls Type AT-2	For Two-Way Transfer, Catalog Numbers 38881 and 38883

For instructions regarding the operation of the optional S&C Test Accessory (catalog number TA-1316), refer to:

Instruction Sheet 514-605	
S&C Source-Transfer Controls Type AT-2, AT-3, and AT-12	S&C Test Accessory, Catalog Number TA-1316

For AT-2 troubleshooting, refer to:

Instruction Sheet 514-520	
S&C Type AT Source-Transfer Controls	Troubleshooting Guide

For instructions regarding the inspection and maintenance of SPD open-phase detectors and ZSD overcurrent relays, refer to:

Instruction Sheet 542-500	
S&C Open-Phase Detector Type SPD	For use in S&C Metal-Enclosed Switchgear

Instruction Sheet 542-500	
S&C Open-Phase Relay Type ZSD	For use in S&C Metal-Enclosed Switchgear

For instructions regarding manually operated S&C Alduti-Rupter Switches or S&C Mini-Rupter Switches, refer to:

Instruction Sheet 783-501	
S&C Alduti-Rupter Switches Indoor Distribution (4.8 kV through 34.5 kV)	Three-Pole

Instruction Sheet 785-501	
S&C Mini-Rupter Switches Indoor Distribution (4.16 kV through 25 kV)	Manually Operated Styles

Applicable instruction sheets, drawings, and wiring diagrams for each switchgear assembly, plus similar documents for meters, relays, and other low-voltage components not of S&C manufacture, are in an envelope entitled "Installation and Operation Information Kit." This envelope should be in a holder inside the appropriately labeled switchgear-bay door.

If maintenance is required beyond the scope of this publication or if replacement parts are necessary, contact the nearest S&C Sales Office. Have the complete catalog number of the gear and date of shipment (as shown on the nameplate) available for reference.

Table 1. Inspection Procedures for S&C Switchgear Equipped with Type AT-2 Source-Transfer Controls^①

Item	Inspection Procedures
Voltage-sensor signal adjustments and measurements	<ol style="list-style-type: none"> 1. Place the MANUAL/AUTOMATIC selector switch in the Manual position and decouple each operator from its associated Mini-Rupter or Alduti-Rupter Switches (switching operations will result in temporary service interruptions if the operators are coupled). 2. If three voltage transformers are used for sensing on each source: The signal-voltage output of the voltage transformers need not be measured or adjusted. 3. If one voltage transformer and two voltage sensors are used for sensing on each source: <ol style="list-style-type: none"> a. At the programming panel on the AT-2 control, measure and record the magnitude of the voltage-transformer output voltage for the center phase of the preferred source using a voltmeter having an input impedance of at least 5,000 ohms per volt. b. Measure and record the magnitude of the voltage-sensor output signal for the other two phases of the preferred source. c. If the measured output of any voltage sensor differs from that of the voltage transformer, “scrub” the associated voltage-sensor potentiometer by rotating the adjustment screw back and forth 10 to 12 times. Then, adjust the setting to match the measured voltage-transformer output voltage. d. Repeat Steps a., b., and c., above for the alternate source.
Switch operators	<ol style="list-style-type: none"> 1. With the MANUAL/AUTOMATIC selector switch in the Manual position, open the preferred-source operator by pressing the appropriate OPEN pushbutton (or MANUAL TRIP lever, as applicable). After opening, Type MS-2 Switch Operators should recharge in 1½ seconds; Type AS-30 Switch Operators do not recharge. 2. Close the alternate-source operator by pressing the appropriate CLOSE pushbutton (or MANUAL TRIP lever, as applicable). This operator should also recharge in 1½ seconds if a MS-2 Switch Operator; Type AS-30 Switch Operators do not recharge. 3. Each switch operator should be given an exercising consisting of five or more operations, power-operated, unless normal operating duty provides equal or greater exercise. 4. Return both operators to their original positions (preferred closed, alternate open).
Time delay on loss of source (“62P” and “62A” Timers) and return of source (“2P” Timer)	<ol style="list-style-type: none"> 1. Place the MANUAL/AUTOMATIC selector switch in the Automatic position and note the position of the AUTOMATIC-HOLD RETURN selector switch. 2. If the AT-2 control is in the Automatic Return mode: <ol style="list-style-type: none"> a. Simulate a prolonged loss of preferred-source voltage by pressing and holding in the SIMULATE-LOSS-OF-SOURCE test switch for the preferred source. Verify the time to initiate transfer is within ±20% of the setting on the “62P” timer. Also, confirm the associated source voltage lamp extinguishes. Verify, as well, the switch operator targets correctly indicate an Open or Closed position. b. Release the test switch to simulate a return of the preferred-source voltage. Verify the time to initiate back transfer is within ±20% of the setting on the “2P” timer. Confirm the associated source voltage lamp relights. Again, verify the switch operator targets’ positions. 3. If the AT-2 control is in the Hold Return mode: <ol style="list-style-type: none"> a. Simulate a prolonged loss of preferred-source voltage by pressing and holding in the SIMULATE-LOSS-OF-SOURCE test switch for the preferred source. Verify the time to initiate transfer is within ±20% of the setting on the “62P” timer. Also, confirm the associated source voltage lamp extinguishes. Verify, as well, the switch operator targets correctly indicate an open or closed position. b. After releasing the test switch, wait a sufficient length of time to make sure back transfer does not occur. Confirm the associated source voltage lamp relights. c. Now simulate a loss of alternate-source voltage by pressing the SIMULATE-LOSS-OF-SOURCE test switch for the alternate source. Verify the time to initiate retransfer is within ±20% of the setting on the “62A” timer.
Reset time for optional overcurrent-lockout feature (“62LR-1” and 62LR-2” timers)	<ol style="list-style-type: none"> 1. With the MANUAL/AUTOMATIC selector switch in the Automatic position, simulate an overcurrent condition on the preferred source by momentarily pressing the SIMULATE-OVERCURRENT test switch for the preferred source. Confirm the blue overcurrent-lockout indicator lamp lights for a period of time within ±20% of the setting on the “62LR” timer. 2. Simulate an overcurrent condition and a loss of source voltage on the preferred source. To accomplish this, momentarily press the SIMULATE-OVERCURRENT test switch and, at the same time, press and hold in the SIMULATE-LOSS-OF-SOURCE test switch for the preferred source. Confirm the preferred source operator opens while the alternate-source operator remains open and locked out. Release the SIMULATE-LOSS-OF-SOURCE test switch when the preferred-source operator opens. 3. Place the MANUAL/AUTOMATIC selector switch in the Manual position and reset the Overcurrent-Lockout feature. Confirm the blue Overcurrent-Lockout indicator lamp extinguishes. Then, close the preferred-source operator by pressing the appropriate CLOSE pushbutton or MANUAL TRIP lever as applicable.
Before leaving the gear...	<p>So the AT-2 Source-Transfer Control is ready for automatic operation, before leaving the site perform the following:</p> <ol style="list-style-type: none"> 1. If the operators were decoupled, place the MANUAL/AUTOMATIC selector switch in the Manual position, and recouple each operator to its associated Mini-Rupter or Alduti-Rupter Switches. 2. Return the MANUAL/AUTOMATIC selector switch to the Automatic position. 3. Confirm the READY indicator lamp is lit. (If the READY indicator lamp is not lit, refer to the conditions required to light the READY indicator lamp listed on the faceplate of the AT-2 Source-Transfer Control.) 4. Close and padlock all doors and covers.

^① If the power-operated switchgear being inspected does not operate as indicated in these inspection recommendations, refer to S&C Instruction Sheet 514-520, “S&C Type AT Source-Transfer Controls: *Troubleshooting Guide*.” If further assistance is necessary, contact the nearest S&C Sales Office. Have the complete catalog number of the switchgear, date of shipment (as shown on the nameplate), operating mode settings, and timer settings available for reference.

Table 2. Inspection and Maintenance Procedures for the Enclosure and for Components in High-Voltage Bays

⚠ DANGER
<p>When access to high-voltage bays is required, it must be restricted only to qualified persons who must observe the following procedures:</p> <ol style="list-style-type: none"> 1. Adhere to prescribed safety rules at all times. 2. Be certain that fuses, interrupter switches, switch operators and their mechanisms, and any other devices are disconnected from all power sources and grounded before the device is inspected, serviced, or repaired. 3. Discharge all stored-energy switch operators by using the utility crank (for MS-2 operators), the manual trip handle (for MS-10 operators), or a manual-operating wrench (for AS-30 operators), as applicable. 4. Always assume both sets of terminals on any interrupter switch or fuse are energized unless proven otherwise by test, by visual evidence of open-circuit conditions on both terminal ends, or by grounding. 5. Test for voltage. Qualified persons should be certain they know how to operate the correct test equipment for determining voltage on both sets of terminals on any fuse or interrupter switch. 6. After the switchgear has been completely disconnected from all sources of power and tested, properly connect suitable grounding leads to both sides of the equipment, that is, incoming and outgoing phases of the equipment to be maintained. 7. Install dual-purpose front barriers, if furnished, in the “slide-in” position. If a contact on either side of a barrier is energized, do not leave the barrier in the “slide-in” position for longer than one week. These barriers are intended for temporary use only to isolate the blades of the switch from the main contacts while work is being performed. If the barriers are left in the “slide-in” position for extended periods of time, there is the possibility of corona discharge to the barriers. Prolonged exposure to corona discharge may damage the barriers and result in a flashover. 8. Padlock and tag equipment in accordance with the user’s standard operating procedures. 9. All voltage transformers and voltage sensors must be disconnected when external voltage is used to test any secondary-side wiring or devices to avoid energizing the high-voltage conductors through the voltage transformers or sensors. If drawout-type voltage transformers are provided, draw out the transformers and completely disconnect the secondary connections. Otherwise, remove the primary fuses of the voltage transformers and disconnect the secondaries by removing the secondary fuses or by disconnecting the secondary leads. Do not disconnect the burden or the voltage limiter from the voltage sensor until the switchgear is de-energized; otherwise, the voltage sensor will be damaged. For voltage sensors, the secondary leads must be shorted either by removing the plug from the input receptacle and transferring it to the shoring receptacle (for applications involving AT-2 Source-Transfer Control), or by inserting screws into shorting-type terminal blocks. 10. When the equipment to be inspected is not of S&C manufacture, follow instructions supplied by the manufacturer of the equipment. 11. Make certain ground connections from the ground bus (or ground pad on a single-bay assembly) to the permanent station or system ground facility are made. No equipment should be returned to service unless such grounds are properly made. <p>Note: Occasionally, low-voltage components may require maintenance. In the servicing or repair of space heaters, voltage-transformer secondary wiring, and any other components located in a high-voltage bay, all the preceding safety procedures apply. The maintenance of other low-voltage components (such as voltmeters, ammeters, relays, etc.) isolated from high voltage may be performed under the safety rules for equipment rated 600 volts or less. If maintenance is to be performed on ammeters, short-circuit the secondary connections of the associated current transformer at the shorting-type terminal block prior to removal of the ammeter. This may require access to a high-voltage bay, in which case the foregoing procedures apply.</p>

Table 2. Inspection and Maintenance Procedures for the Enclosure and for Components in High-Voltage Bays^①—Continued

WARNING	
<p>When returning the equipment to service, observe the following procedures:</p> <ol style="list-style-type: none"> 1. Reconnect any low-voltage terminals that may have been disconnected when servicing the switchgear. 2. Withdraw any dual-purpose front barriers, if furnished, from the “slide-in” position and return them to their normal, suspended position. 3. Make certain that fuses (or switch blades in lieu of fuses) are closed and securely latched. 4. Open any grounding switch, or remove other grounding means, before energizing the associated interrupter switch(es). 5. Close and securely latch each switchgear bay door before energizing the circuit or operating any switching device. 6. Lock interrupter switches in the Open or Closed position, as dictated by the electric power system design. 7. Padlock all doors, switch-operating handles, and covers before leaving the installation site, even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons. 	

Item	Inspection Procedures																																																						
Inspect and clean interior	<ol style="list-style-type: none"> 1. Visually inspect the interior of each bay for dirt, weeds, rodent, reptile, and insect intrusion. 2. If cleaning is necessary, S&C recommends using water to wash dirty or contaminated surfaces. Mild soap may be used to remove particularly stubborn deposits on painted surfaces, barriers, and Cypoxy® Insulator parts.▲ 3. Inspect insulators, surge arrestors, terminators, etc., for physical and electrical damage. 4. Check that the gasketing around doors and windows is securely affixed and that grouting around the exterior of the bays is in good condition. Verify there has been no major water ingress. 																																																						
Inspect barriers and minimum air clearances	<ol style="list-style-type: none"> 1. Inspect barriers for signs of tracking and corona discharge. Surface deposits can be wiped off. If surface erosion is present, the barriers may need to be replaced. 2. Verify the interphase and end barriers hang vertically and that the retaining hardware securely holds them in place. 3. Verify, as well, that the clearance from the terminators and other energized parts to the barriers and electrical ground is maintained to prevent flashover (e.g., fuse silencer to terminator drain wire). Minimum air clearances are listed below: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr style="background-color: #d3d3d3;"> <th colspan="2" style="text-align: center;">Rating, kV</th> <th colspan="4" style="text-align: center;">Minimum Air Clearance, Inches (mm) ●</th> </tr> <tr style="background-color: #d3d3d3;"> <th style="text-align: center;">Nominal</th> <th style="text-align: center;">BIL</th> <th style="text-align: center;">Energized Parts to Barriers</th> <th style="text-align: center;">Terminator Skirts to Barriers</th> <th style="text-align: center;">Energized Parts to Elec. Ground</th> <th style="text-align: center;">Phase-to-phase</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">4.8</td> <td style="text-align: center;">60</td> <td style="text-align: center;">½ (13)</td> <td style="text-align: center;">½ (13)</td> <td style="text-align: center;">3½ (89)</td> <td style="text-align: center;">4½ (114)</td> </tr> <tr> <td style="text-align: center;">7.2</td> <td style="text-align: center;">75</td> <td style="text-align: center;">1 (25)</td> <td style="text-align: center;">½ (13)</td> <td style="text-align: center;">4½ (114)</td> <td style="text-align: center;">6 (152)</td> </tr> <tr> <td style="text-align: center;">13.8</td> <td style="text-align: center;">95</td> <td style="text-align: center;">1 (25)</td> <td style="text-align: center;">½ (13)</td> <td style="text-align: center;">6 (152)</td> <td style="text-align: center;">6 (152)</td> </tr> <tr> <td style="text-align: center;">25</td> <td style="text-align: center;">125</td> <td style="text-align: center;">2¼ (57)</td> <td style="text-align: center;">1¼ (32)</td> <td style="text-align: center;">7½ (191)</td> <td style="text-align: center;">7½ (191)</td> </tr> <tr> <td style="text-align: center;">25</td> <td style="text-align: center;">150</td> <td style="text-align: center;">2¼ {¾} (57 {83})</td> <td style="text-align: center;">1¼ {2} (32 {51})</td> <td style="text-align: center;">10½ (267)</td> <td style="text-align: center;">12 (305)</td> </tr> <tr> <td style="text-align: center;">34.5</td> <td style="text-align: center;">150</td> <td style="text-align: center;">¾ (83)</td> <td style="text-align: center;">3 (76)</td> <td style="text-align: center;">10½ (267)</td> <td style="text-align: center;">12 (305)</td> </tr> <tr> <td style="text-align: center;">34.5</td> <td style="text-align: center;">200</td> <td style="text-align: center;">¾ {¾} (82 {121})</td> <td style="text-align: center;">3 {¾} (76 {89})</td> <td style="text-align: center;">15 (381)</td> <td style="text-align: center;">15 (381)</td> </tr> </tbody> </table>	Rating, kV		Minimum Air Clearance, Inches (mm) ●				Nominal	BIL	Energized Parts to Barriers	Terminator Skirts to Barriers	Energized Parts to Elec. Ground	Phase-to-phase	4.8	60	½ (13)	½ (13)	3½ (89)	4½ (114)	7.2	75	1 (25)	½ (13)	4½ (114)	6 (152)	13.8	95	1 (25)	½ (13)	6 (152)	6 (152)	25	125	2¼ (57)	1¼ (32)	7½ (191)	7½ (191)	25	150	2¼ {¾} (57 {83})	1¼ {2} (32 {51})	10½ (267)	12 (305)	34.5	150	¾ (83)	3 (76)	10½ (267)	12 (305)	34.5	200	¾ {¾} (82 {121})	3 {¾} (76 {89})	15 (381)	15 (381)
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TABLE CONTINUED ►

**Table 2. Inspection and Maintenance Procedures for the Enclosure and for components in High-Voltage Bays^①—
Continued**

Item	Inspection Procedures
Inspect and exercise Mini-Rupter and Alduti-Rupter Switches	<ol style="list-style-type: none"> 1. While switchgear-bay doors are closed and latched, exercise the Mini-Rupter and Alduti-Rupter Switches and verify proper opening and closing. If dual-purpose front barriers are furnished, make sure they are not in the “slide-in” position. 2. Inspect, clean, and re-lubricate the Mini-Rupter Switches.▲◆ <ol style="list-style-type: none"> a. SimCheck blades for signs of galling and excessive arc interruption. Minor surface imperfections can be burnished out. Clean the blades and apply a thin layer of lubricant, as necessary. b. SimClean rotating hinge contacts and apply a thin layer of lubricant, as necessary. c. SimCheck contacts and joints for signs of overheating, as evidenced by distorted or discolored metal. ■ 3. Inspect, clean, and re-lubricate the Alduti-Rupter Switches.▲○ <ol style="list-style-type: none"> a. SimCheck main current-carrying contacts for signs of galling. Minor surface imperfections can be burnished out. Clean the contacts and apply a thin layer of lubricant, as necessary. b. SimCheck contacts and joints for signs of overheating, as evidenced by distorted or discolored metal. ■ <p>Note: S&C recommends cleaning and re-lubricating Mini-Rupter and Alduti-Rupter Switches every 10 years, regardless of condition, to ensure proper operation. This should be done more frequently if the environment tends to be excessively hot, humid, dry, dirty, or contaminated.</p>
Inspect fuses	<ol style="list-style-type: none"> 1. Open and close fuses to ensure proper latching. Refer to the applicable S&C Instruction Sheet for fuse-handling instructions. 2. Inspect the fuse contact surfaces for signs of galling and overheating, as evidenced by distorted or discolored contacts. ■ Minor surface imperfections can be burnished out. Clean contacts and apply a thin layer of lubricant, as necessary. ▲
Inspect mechanical and key interlocks and door latching mechanisms	<ol style="list-style-type: none"> 1. Inspect all mechanical interlocks and key interlocks for proper functioning. Refer to S&C Instruction Sheets 621-500, “S&C Custom Metal-Enclosed Switchgear: <i>Instructions for Installation</i>,” and 622-500, S&C System II Metal-Enclosed Switchgear, <i>Instructions for Installation</i>,” respectively. 2. Verify proper operation of the door-latching mechanisms.
Inspect, clean, and touch up exterior	<ol style="list-style-type: none"> 1. To maintain the original integrity of the finish, clean the exterior of the switchgear and touch up scratches and abrasions using S&C touch-up finish and red-oxide primer, available in aerosol spray cans. Order catalog number 9999-058 for olive green finish, 9999-079 for light-gray indoor finish, 9999-080 for light-gray outdoor finish, and 9999-061 for red-oxide primer. 2. Inspect exterior vent filters (if supplied). Replacement fiberglass filters (two required per vent) are available from S&C, catalog number CD-1056-6. If the environment is very dusty, S&C recommends that the filters be inspected several times during the year to ensure sufficient ventilation in the switchgear.

① If maintenance is required beyond the scope of this publication or if replacement parts are necessary, contact the nearest S&C Sales Office. Have the complete catalog number of the switchgear and date of shipment (as shown on the nameplate) available for reference.

▲ Do not use industrial-strength cleaning solutions (e.g. Formula 409®, Simple Green®) or lubricants that contain solvents. Solvent vapors can attack arc compressor components and fuse pull-rings, resulting in reduced interrupting performance or weakened parts.

◆ NYE Rheolube 368, available in ¼-oz. tubes from S&C, part number 9999-044, is the only approved lubricant.

● The number in brackets “{}” applies to switchgear furnished with Benelex barriers. Switchgear manufactured prior to 1982 may use Benelex barriers.

■ There may be discoloration of copper and copper alloy surfaces due to oxidation. This does not indicate overheating.

○ Shell Gadus® S2 U1000 2 Lubricant, catalog number 9999-043, is available in 1-oz. tubes from S&C. Shell Darina SD1, Dow 33, or equivalent can be substituted.