



Owner Manual

Automatic Transfer Switch

RA Series
RA112L1 (Spec A)

Table of Contents

1. IMPORTANT SAFETY INSTRUCTIONS	1
1.1 Warning, Caution, and Note Styles Used in This Manual	1
1.2 General Information	1
1.2.1 General Precautions	1
1.3 Electrical Shock and Arc Flash Can Cause Severe Personal Injury or Death	2
1.3.1 Utility Supply and Isolation.....	2
1.3.2 Utility-to-Generator Set Applications.....	2
2. INTRODUCTION.....	5
2.1 Owner Manual.....	5
2.2 Transfer Switch Application	6
2.3 Transfer Switch Function	7
2.4 Model Identification	8
2.5 How to Obtain Service	8
2.6 Application and Installation	9
3. INSTALLATION.....	11
3.1 Installation Overview.....	11
3.1.1 Safety Considerations.....	11
3.2 Installation - Mounting.....	11
3.2.1 Introduction	11
3.2.2 Equipment Inspection and Storage.....	12
3.2.3 Location.....	12
3.2.4 Installing an Automatic Transfer Switch.....	12
3.2.5 Mounting Method	14
3.3 Installation - Wiring	14
3.3.1 AC Connections	15
3.3.2 Low Voltage Signal Connections	17
3.3.3 Final Inspection and Cleanup	19
4. TROUBLESHOOTING	21
4.1 Introduction	21
4.2 Troubleshooting Procedures for Experienced Service Personnel	21
4.2.1 Utility-to-Generator Set Sequence of Events.....	21
4.2.2 Generator-to-Utility Sequence of Events	21
4.2.3 Troubleshooting with Symptoms.....	22
4.2.4 Important Troubleshooting Reminders.....	22
4.2.5 Troubleshooting for Transfer Switches.....	22
5. TRANSFER SWITCH SERVICE.....	25
5.1 Introduction	25
5.2 Switch Removal and Replacement Procedure	25
5.2.1 Disconnect AC Power.....	25

5.2.2 Transfer Switch Mechanism Removal	26
5.2.3 Transfer Switch Replacement.....	26
5.2.4 Reconnect AC Power (When Finished).....	26
5.3 Control Relay (K1) Replacement Procedure	27
5.4 Utility Sense Relay (K2) Replacement Procedure	28
APPENDIX A. PARTS INFORMATION	31
APPENDIX B. WIRING DIAGRAMS	35
B.0 RA112L1 Automatic Transfer Switch Wiring Diagram.....	37
B.1 RA112L1 Automatic Transfer Switch Interconnection Diagram	39

1 Important Safety Instructions

Save these instructions. This manual contains important instructions that should be followed during installation and maintenance of the transfer switch.


Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

1.1 Warning, Caution, and Note Styles Used in This Manual

The following safety styles and symbols found throughout this manual indicate potentially hazardous conditions to the operator, service personnel, or equipment.

 DANGER
<i>Indicates a hazardous situation that, if not avoided, will result in death or serious injury.</i>

 WARNING
<i>Indicates a hazardous situation that, if not avoided, could result in death or serious injury.</i>

 CAUTION
<i>Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.</i>

NOTICE
Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

1.2 General Information

This manual should form part of the documentation package supplied by Cummins Inc. with specific transfer switches. In the event that this manual has been supplied in isolation please contact your authorized distributor.

NOTICE
It is in the operator's interest to read and understand all warnings and cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.

1.2.1 General Precautions

Refer to NFPA 70E Standard for Electrical Safety in the Workplace to be sure the proper personal protective equipment (PPE) is worn around this product.

Follow these guidelines while working on or around electrical equipment.

- Place rubber insulated mats on dry wood platforms over metal or concrete floors when working on any electrical equipment.
- Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling any electrical equipment.
- Remove all jewelry when working on electrical equipment.
- Wear safety glasses whenever servicing the transfer switch.
- Do not smoke near the batteries.
- Do not work on this equipment when mentally or physically fatigued, or after consuming alcohol or any drug that makes the operation of equipment unsafe.

⚠ WARNING

Incorrect service or replacement of parts can result in death, severe personal injury, and/or equipment damage. Service personnel must be qualified to perform electrical and/or mechanical service.

1.3 Electrical Shock and Arc Flash Can Cause Severe Personal Injury or Death

High voltage in transfer switch components presents serious shock hazards that can result in severe personal injury or death. Read and follow these suggestions:

- The Operator **must** always keep the transfer switch covers installed.
- Make sure only authorized personnel remove the covers.
- All installation, service, and adjustments to the transfer switch **must** be performed only by an electrician or authorized service representative.

1.3.1 Utility Supply and Isolation

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply with local electrical codes and regulations. Refer to the wiring diagram supplied with the generator set.

NOTICE

Local electrical codes and regulations (for example, the *National Electrical Code* or the *Canadian Electrical Code*) may require the installation of a disconnect means for the generator set, either on the generator set or where the generator set conductors enter a facility.

The utility disconnecting device is not provided as part of the generator set or automatic transfer switch, and Cummins Inc. accepts no responsibility for providing the means of isolation.

1.3.2 Utility-to-Generator Set Applications

If the cabinet must be opened for any reason:

1. Press the stop button on the local control at the generator set.
2. Turn off AC power supplying the battery charger and all accessories.
3. Disconnect the starting batteries of the generator set or sets, removing the ground (-) lead first.

4. Remove utility power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

 **WARNING**

AC power within the cabinet presents a shock hazard that can cause severe personal injury or death.

This page is intentionally blank.

2 Introduction

2.1 Owner Manual

This manual covers models produced under the Cummins® Power Generation (CPG) brand names.

This manual provides information necessary for operation, installation, and service of RA series RA112L1 transfer switches. This manual also includes parts information.

This is an open transition transfer switch which does not include an integral automatic transfer switch control. With an open transition switch, there is never a time when both sources are supplying power to the load. The design prevents accidental connection of the generator set to the utility.

This manual includes information on the RA Series RA112L1 transfer switch installation.

RA Series transfer switches are designed to only be installed with the Cummins generator set models shown below. Installing these switches with any other generator set models will void the warranty.

TABLE 1. CUMMINS GENERATOR SET MODELS USING RA SERIES TRANSFER SWITCHES

C10 D6	C25 D6	C40 D6
C13N6H*	C25 N6	C40 N6
C15 D6	C30 D6	C40 N6H
C17N6H*	C30 N6	C45 N6H
C20 D6	C30 N6H	C50 N6H
C20 N6	C35 D6	C60 N6H
C20N6H*	C36 N6	
C22 N6	C36 N6H	
* Requires TB4 Jumper.		

Refer to the wiring diagrams at the end of this manual for specific information about switch configuration.

Use normal and necessary safety precautions before starting any service procedure. Identify all hazards by referring to the Important Safety Instructions section of this manual and by observing all warnings and cautions within the manual. Whenever you are troubleshooting, remember that the generator set, the transfer switch, and the utility power source are all interdependent.

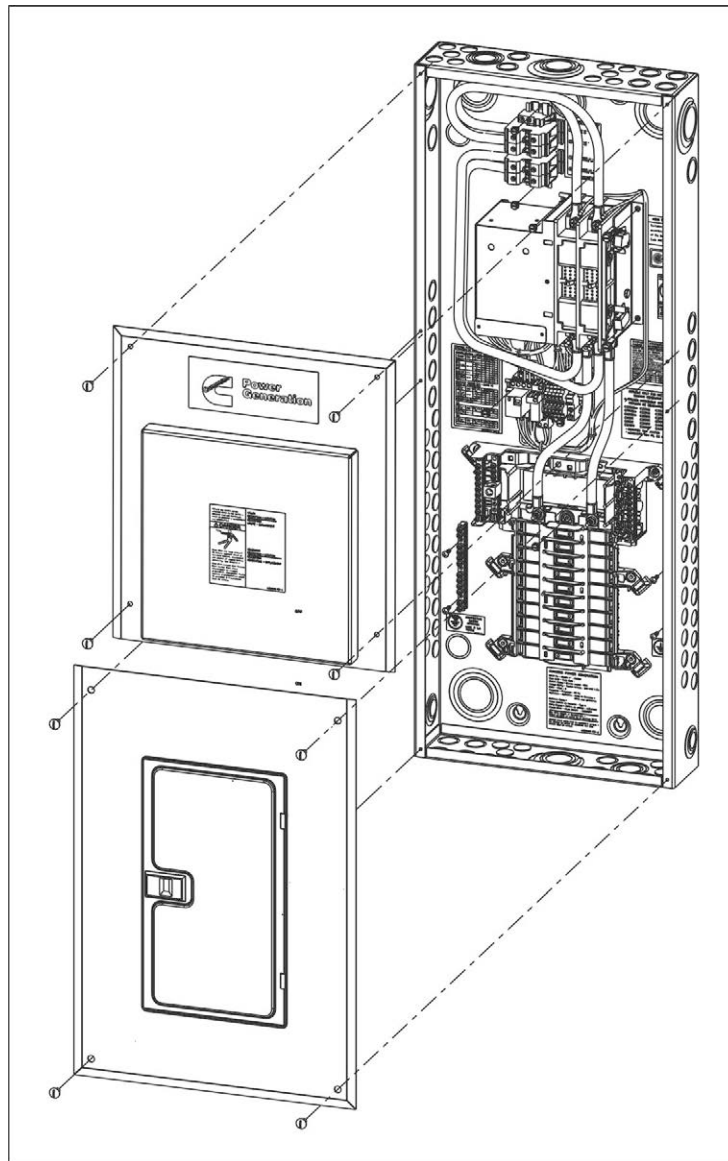


FIGURE 1. RA112L1 AUTOMATIC TRANSFER SWITCH

2.2 Transfer Switch Application

Transfer switches are an essential part of a building's standby or emergency power system. The utility line (normal power), is backed up by a generator set (emergency power). The transfer switch connects the electrical load to the utility or generator set.

The load is connected to the common of the automatic transfer switch, as shown below. Under normal conditions, the load is supplied with power from the utility (as illustrated). If utility power is interrupted, the load is transferred to the generator set. When utility power returns, the load is retransferred to the utility. The transfer and retransfer of the load are the two most basic functions of a transfer switch.

NOTICE

Maximum continuous loads not to exceed 80% of the overcurrent protective device (circuit breaker and fuses) ratings employed in other than motor circuits, except for those circuits employing circuit breakers marked as suitable for continuous operation at 100% of their ratings.

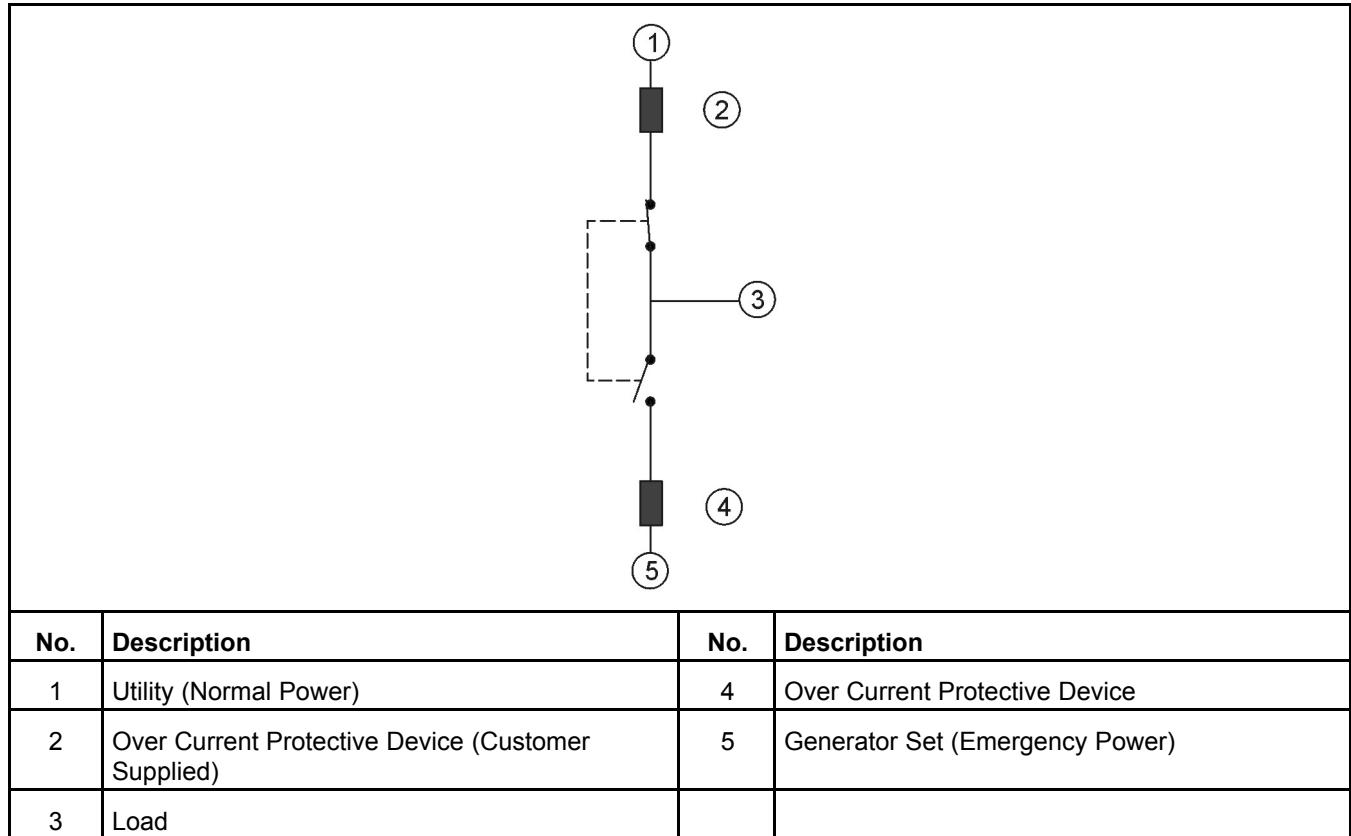


FIGURE 2. LOAD TRANSFER SWITCH (TYPICAL FUNCTION)

2.3 Transfer Switch Function

Automatic transfer switches, capable of automatic operation without operator intervention, perform the basic function of transferring the load to the available power source.

This automatic transfer switch, capable of automatic operation without operator intervention, is designed for utility-to-generator applications. In utility-to-generator applications, the transfer switch performs the following functions:

1. Senses the interruption of utility power
2. Sends a utility unavailable signal to the generator set
3. Receives transfer command from generator set control
4. Transfers the load to the generator set
5. Senses the return of utility power
6. Sends utility available signal to generator set
7. Receives retransfer command from generator set control
8. Retransfers the load to the utility

The transfer switch design is intended to signal when the utility voltage is not present and when it returns. The utility sense relay coil will energize or stay energized at voltages other than nominal. Therefore, the unit should not be expected to signal a failed utility to the generator set during undervoltage or overvoltage conditions.

2.4 Model Identification

The model number, serial number, and electrical characteristics are shown on the nameplate. The nameplates for the RA Series transfer switches are located on the inner back of the enclosure near the bottom. Refer to the table below for the meaning of the model number characters.

TABLE 2. RA SERIES TRANSFER SWITCH MODEL CHARACTER KEY

Character Type	Character(s) Used	Specification
Series Name	2	RA
Amperage	1	1
Phase	1	1
Poles	1	2
Configuration	1	L
Enclosure Type	1	1

The example below is the designation for the RA112L1 model:

- RA switch series
- 1 - Amps (1-100, 2-200, etc.)
- 1 - Phase (1-single, 3-3phase)
- 2 - Number of poles
- L - Configuration (S - service entrance, N - non service entrance, L - load center)
- 1 - NEMA rating on box (1-1, 3-3R)

When contacting a distributor regarding the transfer switch, always give the complete model and date code. This information is necessary to properly identify the unit among the many types manufactured. See the How to Obtain Service section for more information.

2.5 How to Obtain Service

When a product requires servicing, contact the nearest Cummins service provider. To locate the distributor, go to www.cummins.com/support and select Sales and Service Locator. When contacting the service provider, always supply the complete model (RA112L1), specification, and serial number as shown on the nameplate.

In the U.S. and Canada

To easily locate the nearest certified distributor/dealer for Cummins generator sets in your area, or for more information, contact us at 1-800-CUMMINS™ (1-800-286-6467) or visit www.cummins.com/support.

If unable to contact a distributor using the automated service, consult the Internet.

If unable to arrange a service or resolve an issue, contact the Service Manager at the nearest Cummins distributor for assistance.

When contacting the distributor, always supply the complete Model, Specification, and Serial Number as shown on the product nameplate.

Outside the U.S. and Canada

Refer to www.cummins.com/support and select Sales and Service Locator, or send an email to ask.powergen@cummins.com.

A model and date code label (shown below) is located on the on the inner back of the enclosure near the bottom.

CUMMINS POWER GENERATION	
Model No. / Modèle n° :	RA112L1
Date Code / Code Date :	
Current Rating / Courant nominal :	100A
Voltage Rating / Tension nominale :	240 VAC 1 PH
Poles / Pôles :	2
Frequency / Fréquence :	60 Hz
Application / Application :	Utility to Generator / Utilité vers génératrice
Enclosure Rating /	
Valeur nominale de l'enceinte :	Type 1
Wiring Diagram / Schéma de câblage :	A054P408
Manual Owner / Mode d'emploi :	A052S254
<hr/>	
Use 75°C, Copper or Aluminum wire. /	
Utiliser un câble en cuivre ou en aluminium 75°C.	
<hr/>	
Control circuit wiring must be installed in conduit. /	
Le câblage du circuit de commande doit être installé dans un conduit.	
A053G493 REV B	

FIGURE 3. MODEL AND DATE CODE LABEL

2.6 Application and Installation

Installations must be carefully planned and correctly installed for proper operation. This involves two essential elements: application and installation.

Application refers to the design of the complete standby power system that usually includes power distribution equipment, generator sets, transfer switches, mounting pads, and fuel systems. Each component must be correctly designed so the complete system functions as intended. Application and design is a technical function generally done by trained specialists. These specialists are responsible for the design of the complete standby system and for selecting the materials and products required.

Installation refers to the actual set-up and assembly of the standby power system. The installers set up and connect the various components of the system as specified in the system design plan. The installation of the standby system normally requires the special skills of qualified electricians, plumbers, sheet metal workers, etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices. Permits are also generally required. Be sure to have your installation inspected by the local authority that has jurisdiction.

3 Installation

3.1 Installation Overview

These installation recommendations apply to typical installations. Whenever possible, these recommendations also cover factory designed options or modifications. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest Cummins/Onan distributor or authorized dealer for assistance.

3.1.1 Safety Considerations

The transfer switch has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system depends on many factors outside the control of the manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the transfer switch exactly as specified in this manual. All systems external to the transfer switch must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service.

Verify that both power source voltages match the nameplate rating prior to installation.

NOTICE

Maximum continuous loads not to exceed 80% of the overcurrent protective device (circuit breaker and fuses) ratings employed in other than motor circuits, except for those circuits employing circuit breakers marked as suitable for continuous operation at 100% of their ratings.

3.2 Installation - Mounting

3.2.1 Introduction

Proper storage, installation, operation, and maintenance helps to increase the life of the transfer switch. **Installation must be done only by licensed, certified electricians.**

WARNING

AC power within the cabinet presents a shock hazard that can cause severe personal injury or death. Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. All corrective service procedures must be done only by technically trained and experienced personnel.

Each RA series transfer switch is factory wired and tested. Installation of the RA transfer switch includes the following:

- Mounting the transfer switch cabinet
- Connection of all utility, generator set, and load cables (covered in [Section 3.3](#))
- Connection of low voltage signal circuits (covered in [Section 3.3.2](#))
- Connection of branch circuits

RA Series transfer switches are only designed to be installed with the generator set models identified in [Section 2.1 on page 5](#). Installing this switch with any other generator set model will void the warranty and may result in the transfer switch not working properly.

3.2.2 Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. Check for damage to the enclosure, the transfer switch, the control panel (if applicable), and the wiring harness.

Prior to installation, make sure the transfer switch is stored in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation from gathering on the equipment. Be sure to adhere to the transfer switch storage and operating requirements listed below.

TABLE 3. TRANSFER SWITCH STORAGE AND OPERATING REQUIREMENTS

Storage Temperature	Operating Temperature (Ambient)	Humidity
-22 °F to +158 °F (-30 °C to +70 °C)	-4 to +140 °F (-20 to +60 °C)	5 to 95% (Non-Condensing)

3.2.3 Location

The location of the transfer switch in the existing electrical circuit varies with the application and the type of entrance switch. ***The location and wiring must comply with all local codes.***

There must be a service disconnect in the commercial power line ahead of the transfer switch.

A typical transfer switch installation plus cabinet dimensions and weights are shown in [Section 3.2.4](#).

Choose a vibration-free mounting surface that supports the weight of the switch. Avoid locations that are near flammable liquids or gases, or are hot, moist, or dusty.

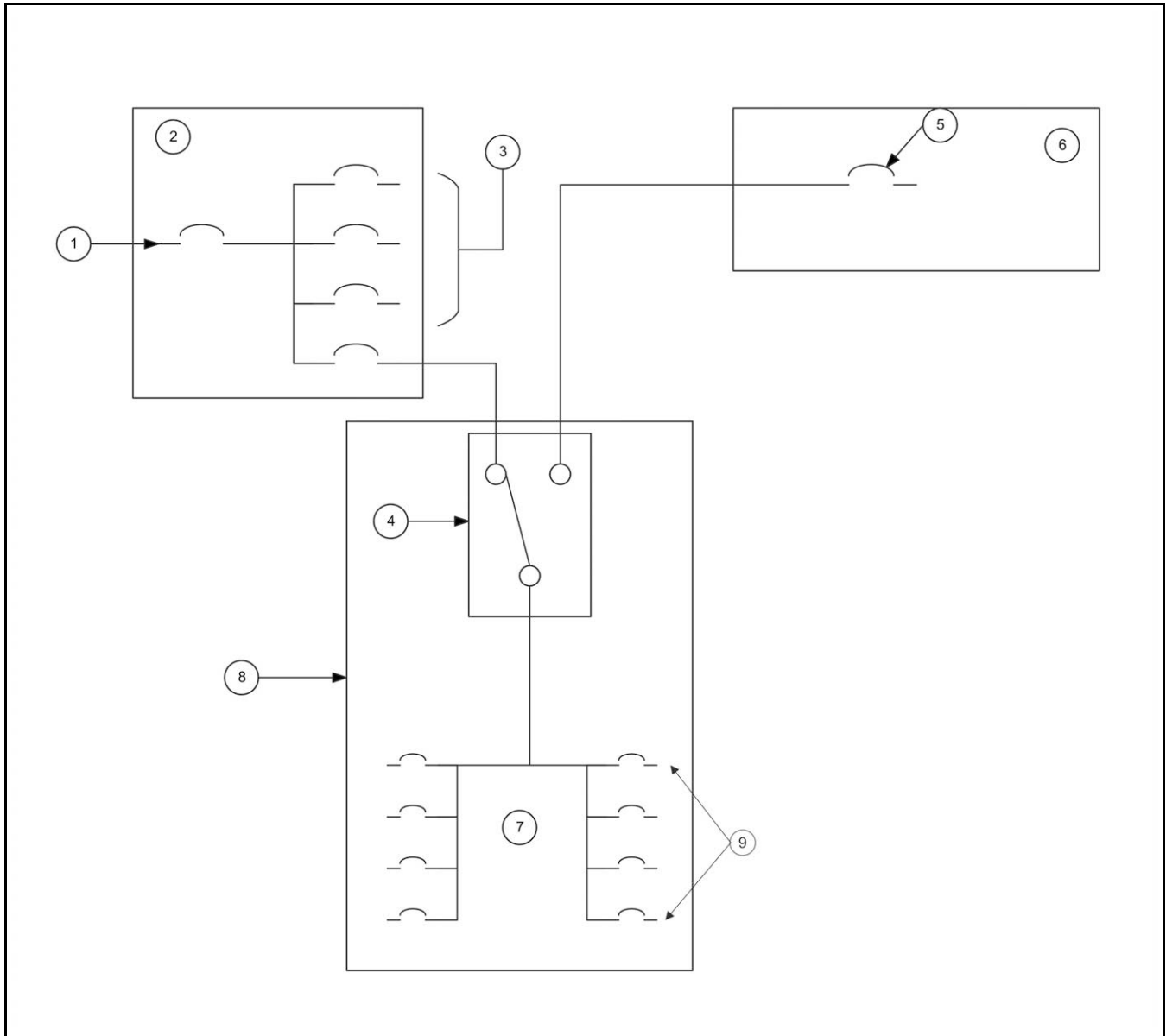
WARNING

An electrical arc occurs during transfer that can ignite a flammable atmosphere, resulting in severe personal injury or death. The switch must not be located near batteries, fuel tanks, solvents, or other sources of flammable liquids or gases, or in areas sharing ventilation with such sources.

3.2.4 Installing an Automatic Transfer Switch

NOTICE

Maximum continuous loads not to exceed 80% of the overcurrent protective device (circuit breaker and fuses) ratings employed in other than motor circuits, except for those circuits employing circuit breakers marked as suitable for continuous operation at 100% of their ratings.



No.	Description	No.	Description
1	Utility Source	5	Circuit Breaker
2	Utility Panel	6	Generator Set Source
3	Loads not backed up by generator set	7	Loads backed up by generator Set
4	Transfer Switch	8	Automatic transfer switch
		9	Circuit Breaker*

* Use only Square D Type QO for the branch circuit breakers.

FIGURE 4. PARTIAL COVERAGE SYSTEM

TABLE 4. APPROXIMATE CABINET DIMENSIONS

Switch Current Rating	Height	Width	Depth	Weight
100 Amp	38.0 in (965 mm)	14.25 in (362 mm)	4.0 in (102 mm)	40 lb (18.1 kg)

3.2.5 Mounting Method

RA Series transfer switches are mounted to a wall. Enough room must be allowed to remove the door panel for inspection and servicing of the switch, as per NEC and local codes.

3.2.5.1 Wall Mounting

1. Make sure that the wall where the transfer switch is to be mounted is suitable to hold firmly the weight and size of the transfer switch, within a reasonable safety factor.
2. Check the location to be sure that no wires or plumbing, gas, or exhaust lines run behind the wall.
3. Make sure that the anchorage fasteners used to bolt the switch to the wall are strong enough to withstand the switch weight and its vibration during operation, within a reasonable safety factor.
4. Use four 1/4 inch bolts for wall mounting. Measure and mark the wall for drilling.
5. Install two mounting bolts in the wall for the top cabinet mounting keyholes.

WARNING

Improper lifting can cause severe personal injury. Have sufficient manpower for lifting and mounting the cabinet.

6. Remove the transfer switch from the box.
7. Raise the cabinet and mount it on the two mounting bolts in the wall.
8. Install the two bottom mounting bolts, but do not tighten them.
9. Push the cabinet against the wall. If the cabinet does not align flush against the wall, shim the mounting bosses as required, using metal shims.
10. Tighten all mounting bolts.

3.3 Installation - Wiring

Refer to [Reconnect AC Power \(When Finished\) on page 26](#) for component locations.

WARNING

AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained and experienced personnel are to perform the following procedures.

CAUTION

Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the relays, contacts, and other parts of the automatic transfer switch when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.

When installing conduit, observe the following precautions:

- The RA Series transfer switch includes multiple knockouts in the cabinet for ease of wiring. **If you decide to drill your own holes instead of using the knockouts provided, cover the transfer switch and both terminal blocks to prevent accidental entry of metal chips before beginning conduit installation.**
- If using rigid conduit between the generator set and the transfer switch, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
- Control circuit wiring may be run through separate conduit (for the C13N6H-C20N6H products, Cummins recommends single conduit). Cutouts are available through the bottom of the cabinet. Refer to the transfer switch product image shown in [Appendix A on page 31](#).

NOTICE

Running control circuit wiring and AC wiring in the same conduit is allowed with certain conditions per the NEC code (unless prohibited by the authority having jurisdiction). Cummins recommends shielded wire be used where AC and DC wiring is run through a single conduit.

3.3.1 AC Connections

RA Series transfer switches are supplied with screw type terminals for utility, generator set, and neutral power connections. Either copper or aluminum conductors can be used for AC connections. Load connections are directly to the individual branch breakers (not supplied with the automatic transfer switch). Use only directly connected Square D Type QO for the branch circuit breakers.

Connect the utility, generator set, and neutral conductors to the clearly marked terminals in the cabinet. Verify that all connections are correct before tightening the lugs. Connect utility and generator set neutral wires to the lugs on the circuit breaker backplane Neutral bus. All lug connections must be tightened to the proper torque values listed in the tables below.

Perform wiring in the following sequence:

Stop the generator set and remove the negative lead from the cranking battery to prevent starting.

1. Stop the generator set.

⚠ WARNING

Failure to prevent the generator set from starting before wiring procedures are performed presents a shock hazard that can cause severe personal injury or death. Disconnect generator set battery, negative (-) terminal first, before proceeding.

2. Remove the negative lead from the cranking battery to prevent starting.

⚠ WARNING

AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Make sure that both AC power sources are disconnected.

3. Make sure that both AC power sources are disconnected.
4. Connect power cables of sufficient size to carry rated current from the utility, and generator set directly to TB5 terminal blocks, which are marked Utility and Generator Set. A neutral bar is located on the **RA112L1 Automatic Transfer Switch interior**. For wire sizes and torque specifications, see the table below.

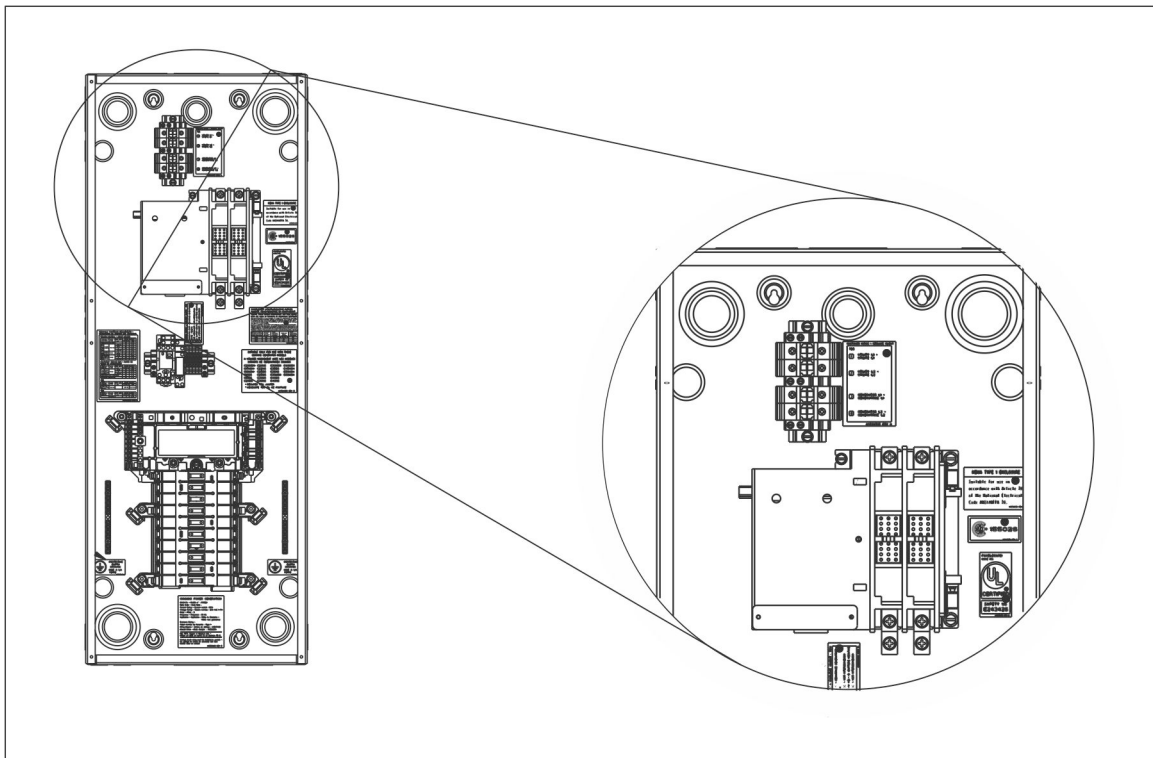


FIGURE 5. TRANSFER SWITCH AC CONNECTIONS LOCATION (TB5)

TABLE 5. SCREW TYPE TERMINALS AND TORQUE VALUES

Number of Terminals	Range	Wire Size	Tightening Torque	
			in-lb	Nm
Branch Neutral				
Main Lug 1	6 - 2/0		50	5.6
Bar with 2 screw sizes (Large screw) 3	14 - 1/0	1/0 - 3	50	5.6
		4-6	45	5.1
		8	40	4.5
		14 - 10	35	4.0
Bar with 2 screw sizes (Small screw) 6	14 - 6	6	25	2.8
		14 - 8	10	1.1
Bar with same size screws 12	14 - 4	6 - 4	35	4.0
		8	25	2.8
		14-10	2020	2.3
Equipment Ground Bar				

Number of Terminals	Range	Wire Size	Tightening Torque	
			in-lb	Nm
24 (1 wire per terminal)	14 - 4	6 - 4	35	4.0
		8	25	2.8
		14 - 10	20	2.3
Two 14 or 12 CU, two 12 AL			25	2.8
Two 14 AL			25	2.8
TB5				
1 cable per pole	14 - 1/0		28 - 32	3.2 - 3.6
TB4				
	26 - 12		7	0.8

3.3.2 Low Voltage Signal Connections

3.3.2.1 Control Wiring Connections

Control wiring connections are made at terminal block TB4, located in the center of the transfer switch enclosure.

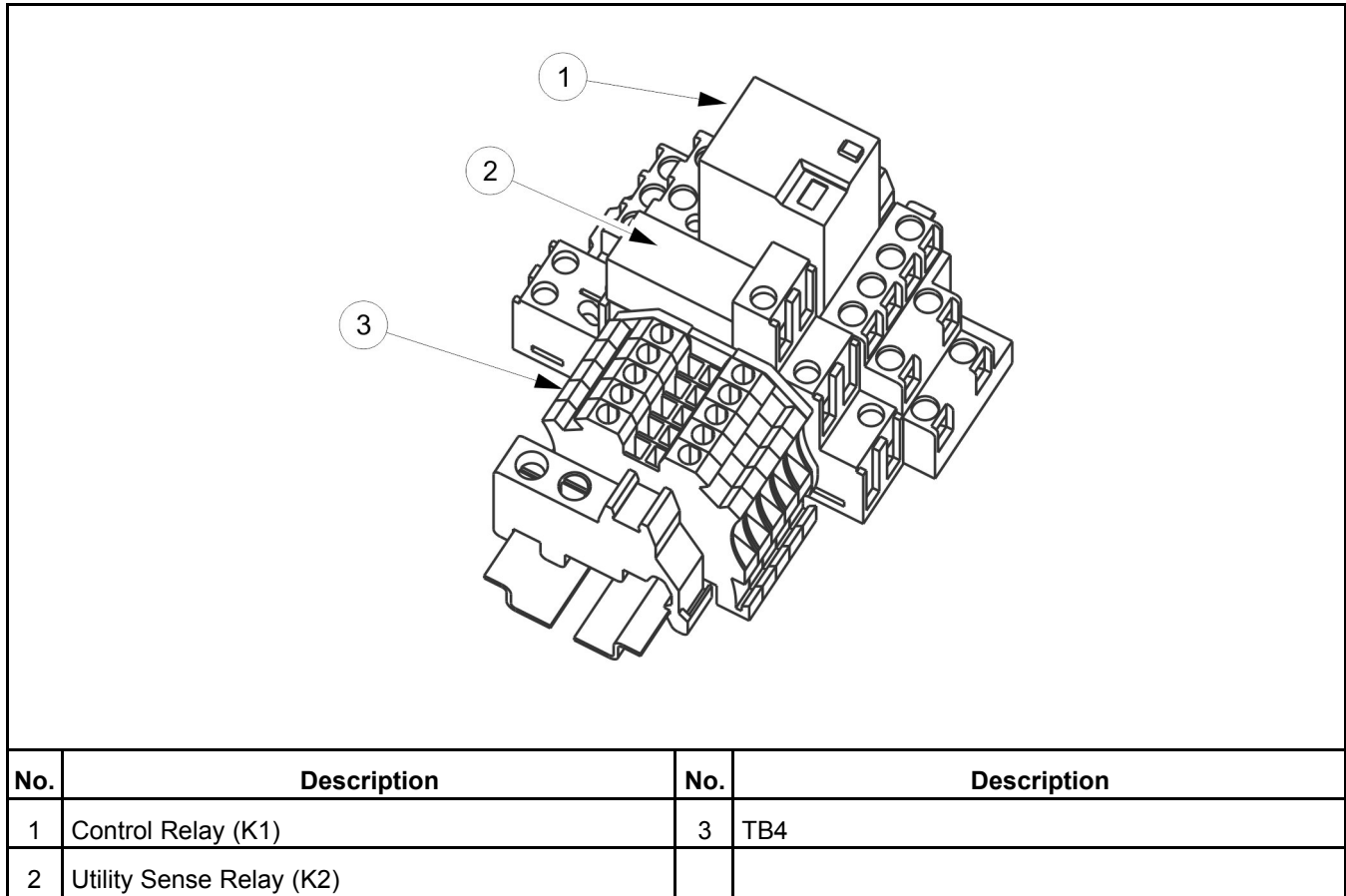


FIGURE 6. CONTROL WIRING CONNECTIONS

3.3.2.2 Connecting the Transfer Switch to the Generator Set

⚠ WARNING

AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Disconnect the AC power source.

Make sure the generator set is not running and cannot be started. Disconnect the batteries and open the generator set mounted circuit breaker. Lock out the circuit breaker if it is equipped with a lockout feature.

Consult the generator set manual for interconnection requirements. Consult the generator set manual and the transfer switch interconnect diagram at the back of this manual for required electrical connections to the generator set control.

TABLE 6. MAXIMUM WIRE LENGTH BY WIRE SIZE

Wire Size (AWG)	Distance in Feet (One Way)
18	100
16	200
14	300

Wire resistance must not exceed 0.5 Ohm per line. Use stranded or solid wire. For connection to the screw terminal, strip the insulation back 3/8 in (10 mm).

3.3.3 Final Inspection and Cleanup

Prior to energizing the transfer switch:

1. Inspect all wiring to be certain that:
 - All connections are correct.
 - All generator set start low voltage signal connections are correct (refer to drawings at the end of this manual and in the generator set manual).
 - Wiring does not interfere with switch operation.
 - Wiring is not damaged as the door opens and closes.
 - Wiring does not contact sharp or abrasive surfaces.
 - No wiring is left loose and unconnected.

⚠ CAUTION

Debris lodged in the electrical and mechanical components may result in equipment damage. Do not use a blower to remove debris.

2. Use a vacuum cleaner to remove any dust, filings, chips, or debris from the cabinet interior and components.
3. Check the lug torque values of the power connections.

NOTICE

Lug torque values are specified on the label inside of the enclosure and in this manual.

4. Double check the power supply voltages to make sure they match the voltages listed on the nameplate.
5. Make sure that all covers and barriers are installed and properly fastened.

NOTICE

The automatic transfer switch mechanism is shipped from the factory with load connected to utility source.

This page is intentionally blank.

4 Troubleshooting

4.1 Introduction

This section describes troubleshooting issues, as well as the sequence of events for the automatic transfer switch.

4.2 Troubleshooting Procedures for Experienced Service Personnel

This section describes a typical transfer switch sequence of events, and provides detailed troubleshooting procedures for experienced service personnel. The troubleshooting procedures use schematics and symptoms to diagnose all possible problems.

⚠ WARNING

Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.

⚠ WARNING

AC power within the cabinet presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, etc. The following procedures are to be performed only by technically trained and experienced personnel.

4.2.1 Utility-to-Generator Set Sequence of Events

Refer to the transfer switch interconnect diagram at the back of this manual for transfer switch control wiring and signal information.

The following steps describe what normally happens when the transfer switch is connected to the utility, utility power fails, and the switch transfers to the generator set.

1. When utility power fails, K2 is de-energized which closes contacts K2-11/K2-12 which applies B- signal to TB4-1. This signals the generator set to start.
2. When the generator set reaches nominal voltage and frequency, it sends a signal to energize relay K1 (B+ for C13N6, C17N6H, C20N6H; B- for all other models), which opens contacts K1-1/K1-9 and K1-2/K1-10, and closes K1-7/K1-11 and K1-8/K1-12. This disconnects the load from the utility and connects to the generator set supply.
3. The S2 auxiliary switch within the transfer switch mechanism opens, removing power from the operator coil C.

4.2.2 Generator-to-Utility Sequence of Events

The following steps describe what normally happens when the transfer switch is connected to the generator set, utility power returns, and the switch moves from the Generator set position to the Utility position.

1. The utility returns.

2. Relay K2 energizes, opening K2-11 and K2-12, which removes the run command from the generator set control.
3. After the retransfer delay, the generator set control de-energizes the relay coil (K1), which closes K1-1/K1-9 and K1-2/K1-10 and opens K1-7/K1-11 and K1-8/K1-12 to move the transfer switch from the Generator set position to the Utility position.
4. The S1 auxiliary switch within the transfer switch mechanism breaks the power to the automatic transfer switch operator coil (C).
5. The load is retransferred to the utility.
6. After a delay to let the engine cool down, the generator set stops.

4.2.3 Troubleshooting with Symptoms

Use the troubleshooting guide to help diagnose transfer switch problems. It is divided into sections based on the symptom. Common problems are listed with their possible causes. Refer to the corrective action column for the appropriate test or adjustment procedure. The section in the right column lists the location of the test or adjustment procedure in the manual.

Always refer to the schematic and wiring diagram package that was shipped with the transfer switch for specific information about its configuration.

Make a thorough inspection of the transfer switch wiring to make sure that all wires are in good condition and all connections are made. Correct wiring problems before performing any test or replacing any components.

4.2.4 Important Troubleshooting Reminders

When troubleshooting the transfer switch, it is important to remember the following:

- This is a two-position transfer switch. It can only be connected to one source. There is no neutral position and no possibility of paralleling with the utility.
- The generator set control energizes relay coil K1 by supplying a B+ (C13N6H, C17N6H, C20N6H) or a B- (all other models).
- Terminal Block Jumper (A034N106) provided with model C13N6H, C17N6H, or C20N6H generator sets is installed between TB4-3 and TB4-4.
- The transfer switch mechanism cannot transfer to a dead source.
- The transfer switch design is intended to signal when utility voltage is not present and when it returns. The utility sense relay coil will energize or stay energized at voltages other than nominal. Therefore, the unit should not be expected to signal a failed utility to the generator set during utility undervoltage or overvoltage conditions.

4.2.5 Troubleshooting for Transfer Switches

For information on the generator set controller fault signals, refer to the generator set service manual. The tables below list troubleshooting issues for RA Series transfer switches.

WARNING

AC power within the cabinet presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, and etc. Prior to working with live circuits, remove all sources of AC power and remove power to the door by removing the fuse from the FB fuse block. The following procedures are to be performed only by technically trained and experienced personnel.

⚠ WARNING

Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.

TABLE 7. TROUBLESHOOTING THE TRANSFER SWITCH (PROBLEM #1)

Problem	Possible Causes	Corrective Actions
The transfer switch failed to transfer to the generator set.	1. The K1 relay coil may not have received a signal from the controller.	Refer to the interconnect diagram at the end of this manual and check for the transfer command signal at TB4. Generator set models C13N6H, C17N6H, C20N6H require a jumper between TB4-3 and TB1-4.
	2. K1 relay may malfunction.	Verify the K1 relay coil is energizing: <ol style="list-style-type: none"> 1. If the coil is energizing: <ul style="list-style-type: none"> • Check the wiring between the relay and the transfer switch (B1 and B2). It should be 240 VAC. • Check to see if the transfer switch is faulty. 2. The coil is not energizing: <ul style="list-style-type: none"> • Check to see if the K1 relay is faulty. • If faulty, replace the K1 relay.
	3. There may be a defective wire.	Check, inspect, or replace the defective wire.
	4. The switch mechanism solenoid may have failed.	Be sure that both voltage sources are turned off before operating the switch manually. Manually operate the switch by using the operator handle to manually transfer the switch. If the switch manually transfers, the solenoids are burnt out; replace the switch mechanism.
	5. There may be loose or broken parts within the switch mechanism.	Be sure that both voltage sources are turned off before operating the switch manually. Manually operate the switch by using the operator handle to manually transfer the switch. If the switch does not manually transfer, replace the switch mechanism.
	6. If the generator set started it may have been running an Exercise program.	The transfer switch does not transfer for a programmed exercise.
	7. The circuit breaker on the generator set may be set to off (open).	Close the generator set circuit breaker.

TABLE 8. TROUBLESHOOTING THE TRANSFER SWITCH (PROBLEM #2)

Problem	Possible Causes	Corrective Actions
The transfer switch failed to transfer to the utility.	1. The utility source may not be present.	<ol style="list-style-type: none"> 1. Check to see that the Utility service disconnect (circuit breaker) is in the ON position. 2. Make sure that the feeder breaker to the transfer switch is on. 3. Check for a ground (B-) signal on TB4-1.
	2. The K2 relay, which is used to detect if utility voltage is present, is faulty.	Replace the relay.
	3. The K1 relay coil may still be receiving a signal due to a shorted wire or TB4 jumper is incorrectly installed.	Refer to the interconnect diagram at the back of this manual and verify the generator set transfer command is inactive. Only generator set models C13N6H, C17N6H, C20N6H should have a jumper between TB4-3 and TB1-4.
	4. The K1 relay may have malfunctioned.	<p>Verify that the K1 relay coil is de-energizing:</p> <ol style="list-style-type: none"> 1. If the coil is de-energizing: <ul style="list-style-type: none"> • Check the voltage between the relays and the transfer switch (A1 and A2). It should be 240 VAC. • Check to see if the transfer switch is faulty. 2. If the coil is not de-energizing: <ul style="list-style-type: none"> • Check to see if the K1 relay is faulty. • If faulty, replace the K1 relay.
	5. There may be a defective wire.	Check, inspect, or replace the defective wire.
	6. The switch mechanism solenoid may have failed.	Be sure that both voltage sources are turned off before operating the switch manually. Manually operate the switch by using the operator handle to manually transfer the switch. If the switch manually transfers, the solenoids are burnt out; replace the switch mechanism.
	7. There may be loose or broken parts within the switch mechanism.	Be sure that both voltage sources are turned off before operating the switch manually. Manually operate the switch by using the operator handle to manually transfer the switch. If the switch does not manually transfer, replace the switch mechanism.

5 Transfer Switch Service

5.1 Introduction

This section covers the removal and replacement procedures for transfer switch components.

NOTICE

For servicing purposes, each transfer switch mechanism is removed and replaced as a single component; there are no serviceable sub-components.

5.2 Switch Removal and Replacement Procedure

5.2.1 Disconnect AC Power

⚠ WARNING

The transfer switch is a shock hazard that can cause severe personal injury or death unless all AC power is removed. Disconnect all sources of AC power to the transfer switch before servicing.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

⚠ WARNING

Accidental starting of the generator set can cause severe personal injury or death due to electrocution or contact with moving parts. Disconnect the starting battery cables before performing service. Remove the negative (-) cable(s) first to reduce the risk of arcing.

⚠ WARNING

Batteries emit hydrogen, a highly explosive gas. Thoroughly ventilate the battery compartment before removing battery cables. Disconnect the starting battery cables before performing service. Remove the negative (-) cable(s) first to reduce the risk of arcing.

1. Remove all sources of power from the transfer switch in the following order:
 - a. Press the stop button on the local display located on the generator set.

⚠ CAUTION

Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits.

- b. Open and lock out the generator set AC circuit breaker. The generator set main breaker has a lockout mechanism built in between the handles on the breaker.

- c. If there is a battery charger, disconnect the battery charger from its AC power source.
- d. Disconnect the generator set starting battery negative (-) cable.
- e. Remove all AC power to the automatic transfer switch by turning off the feeder breaker in the main house panel.
- f. Remove AC power from any accessory such as battery heater, oil heater, etc.

5.2.2 Transfer Switch Mechanism Removal

1. Remove the upper and lower covers.
2. Use a multimeter in good operating condition to verify that all power has been removed from the switch.

WARNING

Electric Shock Hazard

Voltages and currents present an electrical shock hazard that can cause severe burns or death.

Make sure all power is has been removed before proceeding.

3. Remove all control and power wiring from the switch terminals.
4. Loosen and remove the switch assembly:
 - Loosen and remove the six bolts securing the cable lugs.
 - Loosen and remove all three screws securing the switch to the rear wall of the cabinet.
 - Remove the switch from the cabinet.

5.2.3 Transfer Switch Replacement

CAUTION

Carefully follow all hardware torque requirements to avoid damage to parts.

1. Use the hardware that was previously removed to install the new switch in the cabinet.

NOTICE

Do not over-tighten.

- Torque the mounting screws to 7.34 Nm (65 in-lb).
 - Torque the cable lug screws to 7 to 8 Nm (62 to 70.8 in-lb).
2. Install control wires.
 3. Reinstall the cabinet door panel(s).

5.2.4 Reconnect AC Power (When Finished)

1. Connect the generator set starting battery (negative (-) battery cable last).
2. If there is a battery charger, connect the battery charger to its AC power source.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

⚠ WARNING

Batteries emit hydrogen, a highly explosive gas. Thoroughly ventilate the battery compartment before connecting battery cables. Connect the negative (-) cable (s) first to reduce the risk of arcing.

3. Reconnect utility power (Normal).
4. Reconnect generator set power (Emergency).
5. Enable Remote and Standby using the local display mounted on the generator set.
6. Test system operation by turning off the utility feeder breaker.
7. Make sure the generator set starts and the switch transfers.
8. Turn the utility feeder breaker back on.
9. Make sure the switch transfers back to utility and the generator set shuts off.

5.3 Control Relay (K1) Replacement Procedure

⚠ WARNING

The transfer switch presents a shock hazard that can cause severe personal injury or death. Before beginning installation, remove all sources of AC power. If a generator set provides emergency power, press the generator set stop button, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [-] lead first).

1. Remove all sources of power from the transfer switch in the following order.
 - a. Press the stop button on the generator set.

⚠ CAUTION

Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits.

- b. If there is an external battery charger, disconnect the battery charger from its AC power source.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

⚠ WARNING

Accidental starting of the generator set can cause severe personal injury or death due to electrocution or contact with moving parts. Disconnect the starting battery cables, before performing service. Batteries emit hydrogen, a highly explosive gas. Thoroughly ventilate the battery compartment before removing battery cables. Remove the negative (-) cable (s) first to reduce the risk of arcing.

- c. Disconnect the generator set starting battery (negative [-] lead first).

⚠ WARNING

If the cabinet must be opened for any reason, remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

- d. Remove AC power to the automatic transfer switch.
- e. Remove AC power from any accessories, such as a battery heater, oil heater, etc.
2. Remove the transfer switch cabinet door panel.
3. Remove the relay from the relay base.
4. Install the new relay into the relay base.
5. Restore power.

5.4 Utility Sense Relay (K2) Replacement Procedure

⚠ WARNING

The transfer switch presents a shock hazard that can cause severe personal injury or death. Before beginning installation, remove all sources of AC power. If a generator set provides emergency power, press the generator set stop button, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [-] lead first).

1. Press the stop button on the generator set.
 - a. Press the stop button on the local generator set control.

⚠ CAUTION

Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits.

- b. If there is an external battery charger, disconnect the battery charger from its AC power source.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

⚠ WARNING

Accidental starting of the generator set can cause severe personal injury or death due to electrocution or contact with moving parts. Disconnect the starting battery cables, before performing service. Batteries emit hydrogen, a highly explosive gas. Thoroughly ventilate the battery compartment before removing battery cables. Remove the negative (-) cable (s) first to reduce the risk of arcing.

- c. Disconnect the generator set starting battery (negative [-] lead first).

⚠ WARNING

If the cabinet must be opened for any reason, remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

- d. Remove the AC power that goes to the automatic transfer switch.
 - e. Remove AC power from any accessories, such as a battery heater, oil heater, etc.
2. Remove the transfer switch cabinet door panels.
 3. Grasp the relay and pull it straight out of the socket (see [Section 3.3.2.1](#)).
 4. Place the new relay on the socket while aligning pins to socket holes.
 5. Firmly push the relay straight down onto the socket until you feel the relay is seated securely.
 6. Restore power.

This page is intentionally blank.

Appendix A. Parts Information

Table of Contents

Figure 7. RA112L1 Automatic Transfer Switch Model	32
Table 10. RA112L1 Automatic Transfer Switch Model	33

This section includes information on replaceable parts used with RA transfer switches.

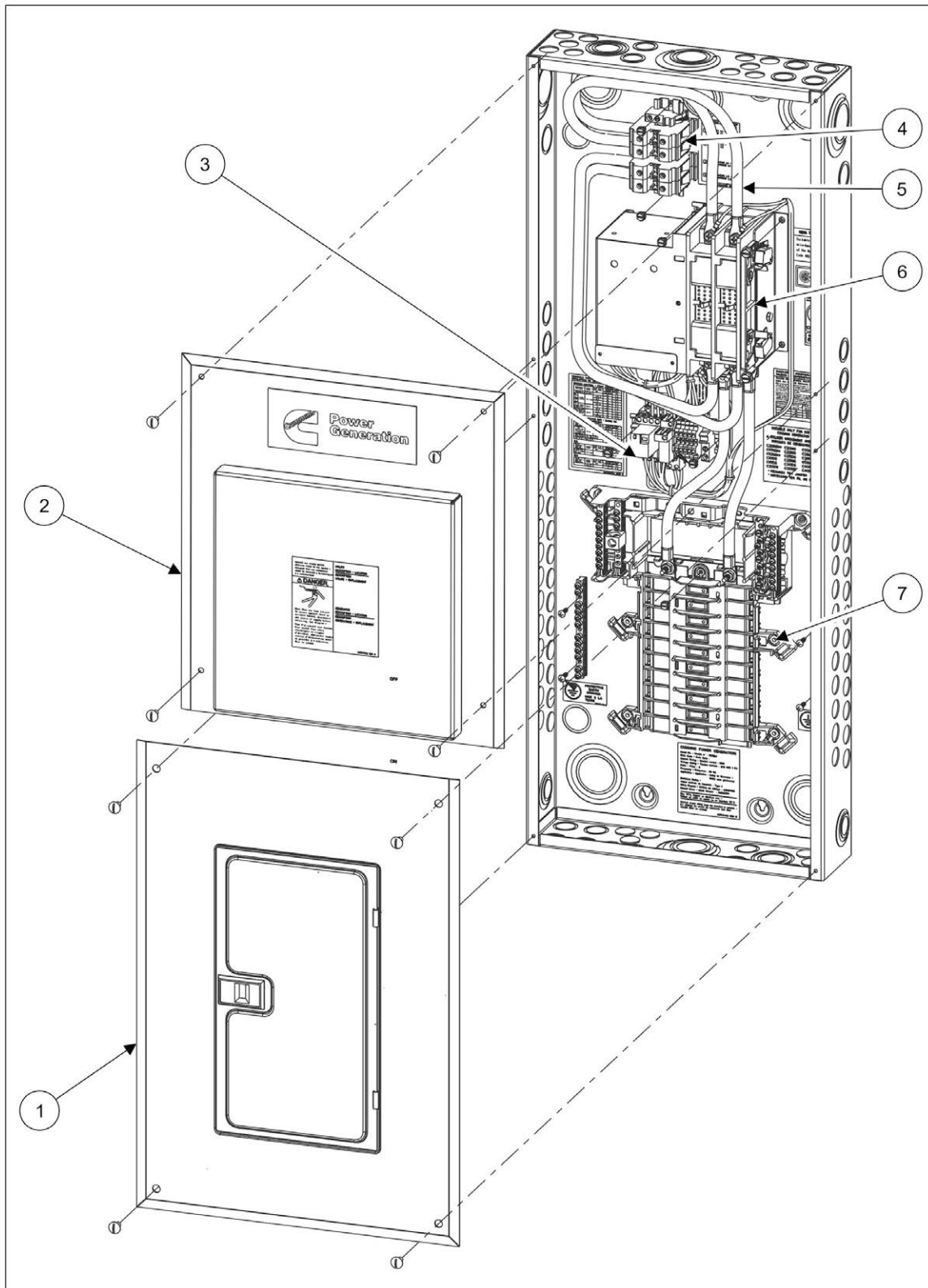


FIGURE 7. RA112L1 AUTOMATIC TRANSFER SWITCH MODEL

TABLE 10. RA112L1 AUTOMATIC TRANSFER SWITCH MODEL

Ref No.	Part No.	Qty.	Part Description
1	A051C973	1	Bottom cover
2	A051B094	1	Top cover
3	A051X853	1	Relay module
	A051X671	1	K1 relay (part of relay module)
	A044K057	1	K2 relay (part of relay module)
4	A051X682	1	Power terminal block assembly
5	A051X678	1-	Lead package
6	A051X676	1	RA112L1 Automatic Transfer Switch interior
7	0306-5191	1	Switch mechanism
	0306-5297	1	Manual operating handle (not shown)

This page is intentionally blank.

Appendix B. Wiring Diagrams

Table of Contents

Figure 8. RA112L1 Automatic Transfer Switch Wiring Diagram (Sheet 1)	37
Figure 9. RA112L1 Automatic Transfer Switch Wiring Diagram (Sheet 2)	38
Figure 10. RA112L1 Automatic Transfer Switch Interconnection Diagram (Sheet 1)	39
Figure 11. RA112L1 Automatic Transfer Switch Interconnection Diagram (Sheet 2)	40

This page is intentionally blank.

B.0 RA112L1 Automatic Transfer Switch Wiring Diagram

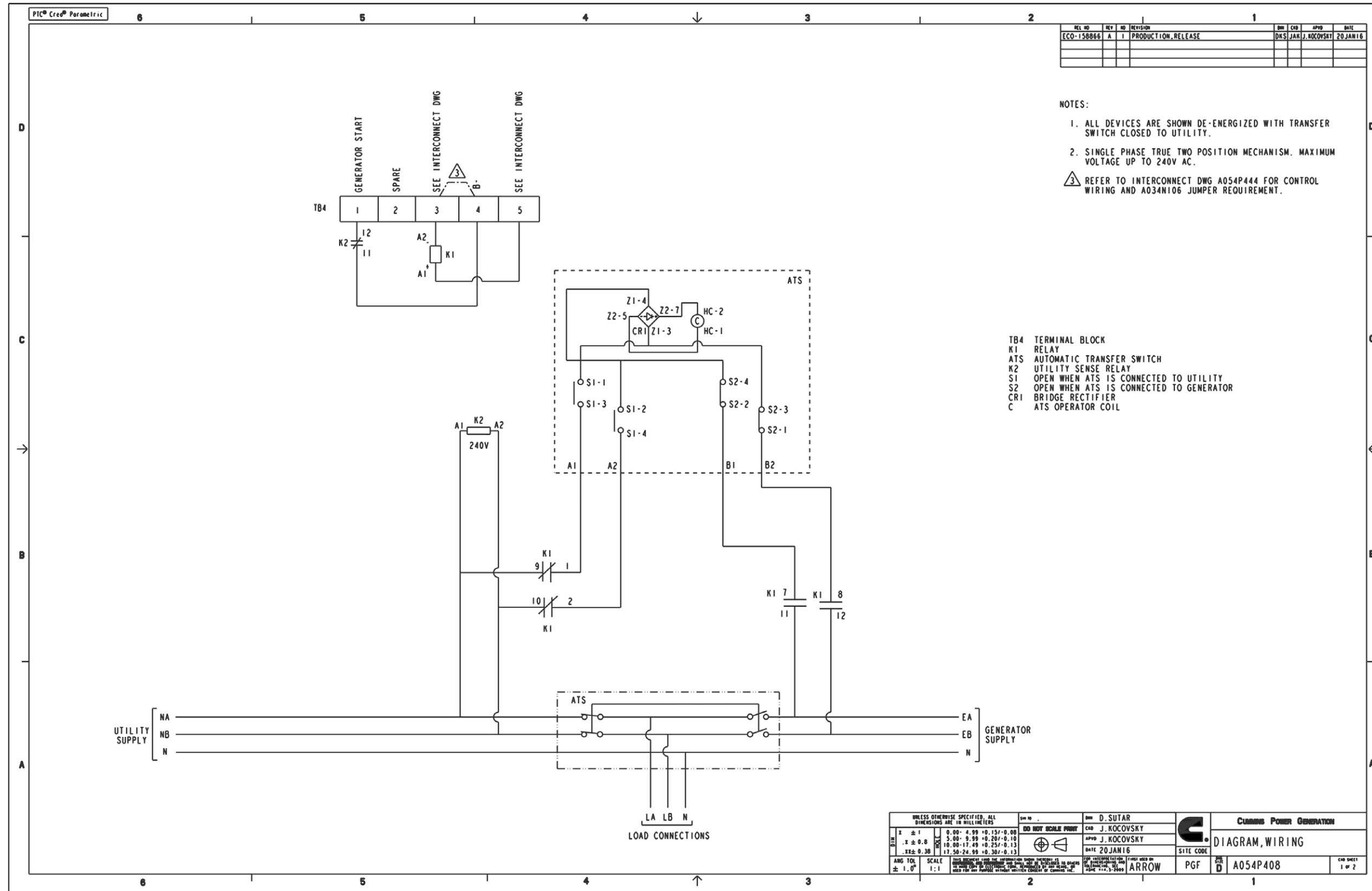


FIGURE 8. RA112L1 AUTOMATIC TRANSFER SWITCH WIRING DIAGRAM (SHEET 1)

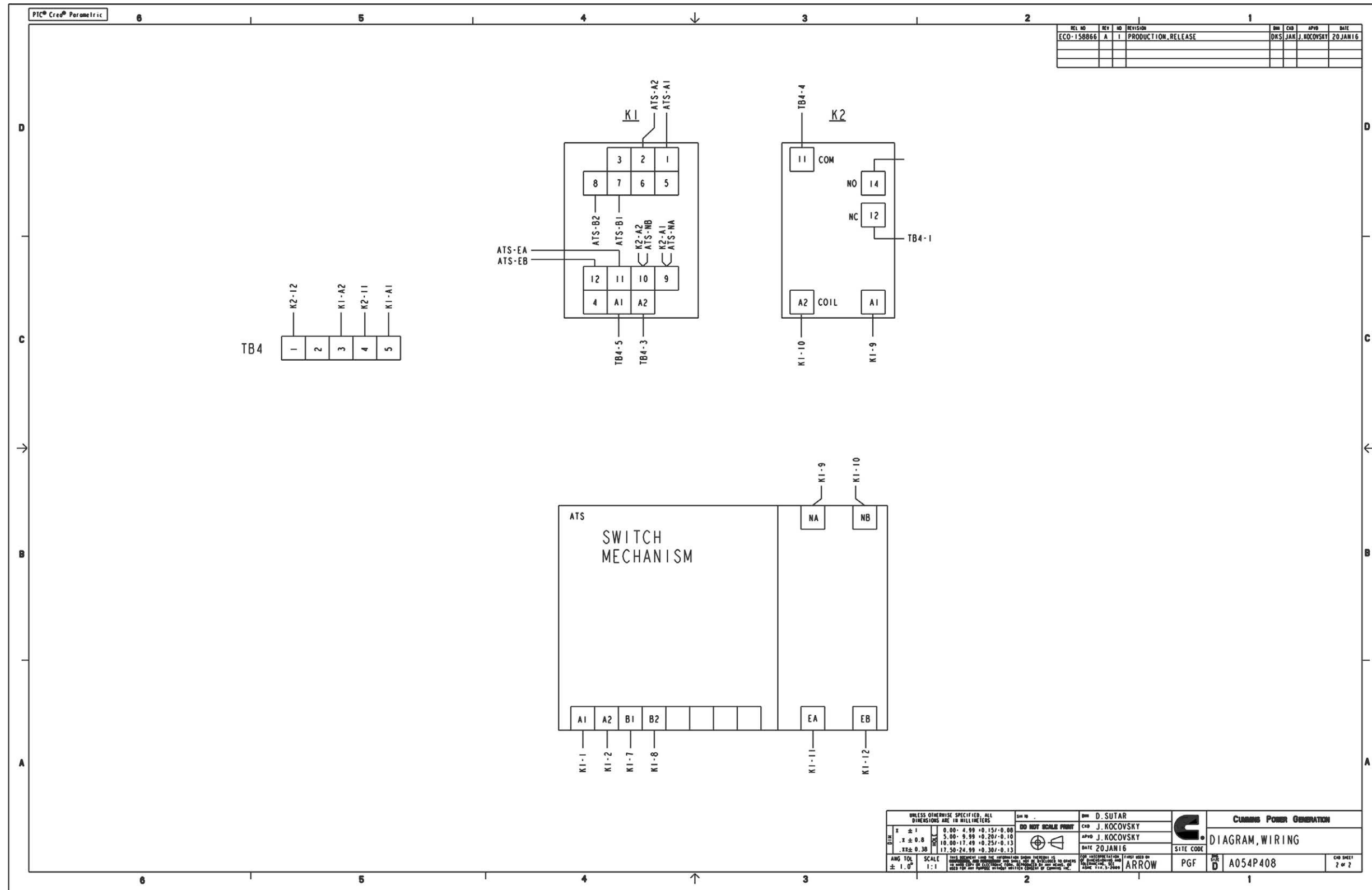


FIGURE 9. RA112L1 AUTOMATIC TRANSFER SWITCH WIRING DIAGRAM (SHEET 2)

B.1 RA112L1 Automatic Transfer Switch Interconnection Diagram

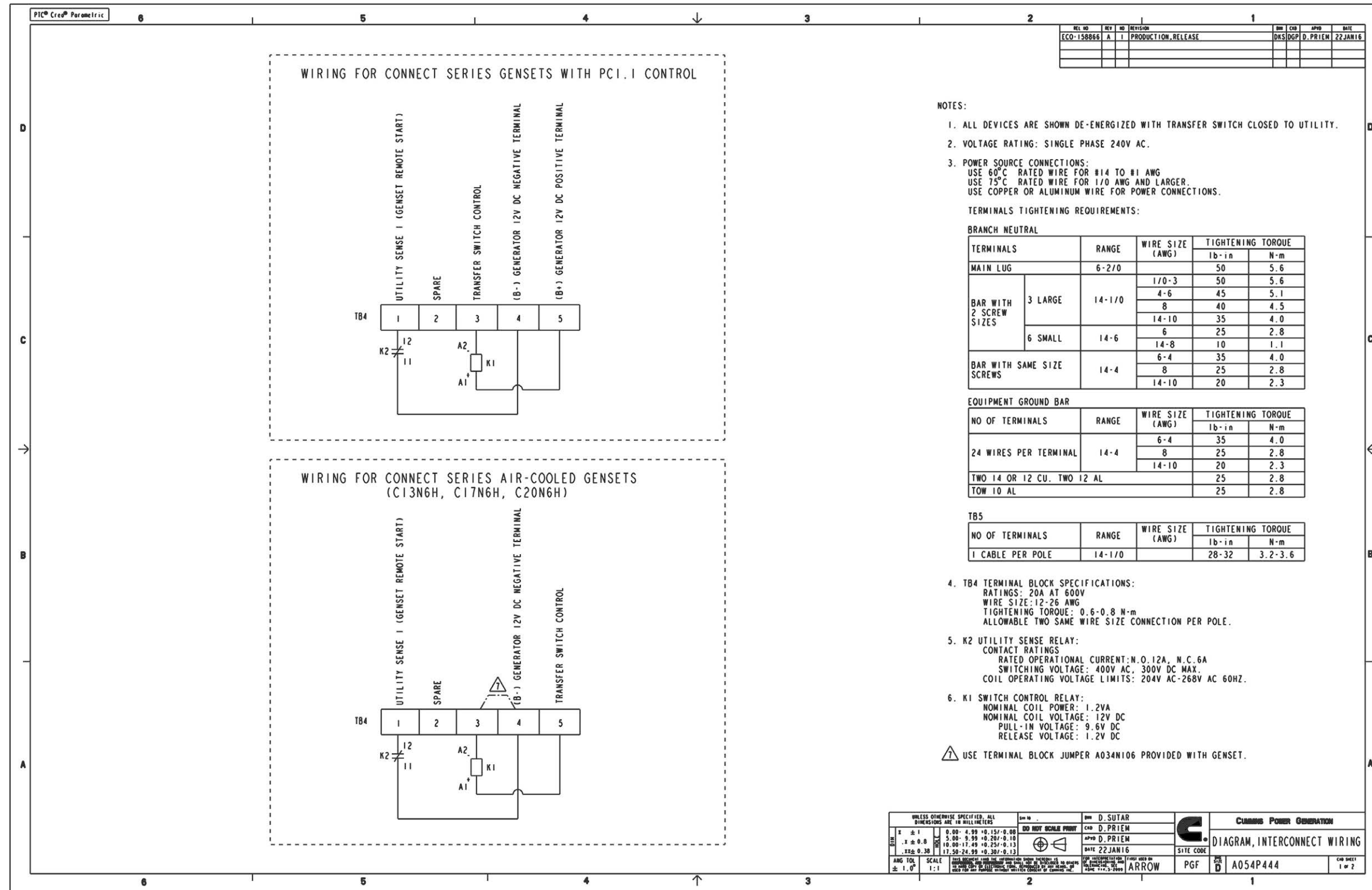


FIGURE 10. RA112L1 AUTOMATIC TRANSFER SWITCH INTERCONNECTION DIAGRAM (SHEET 1)

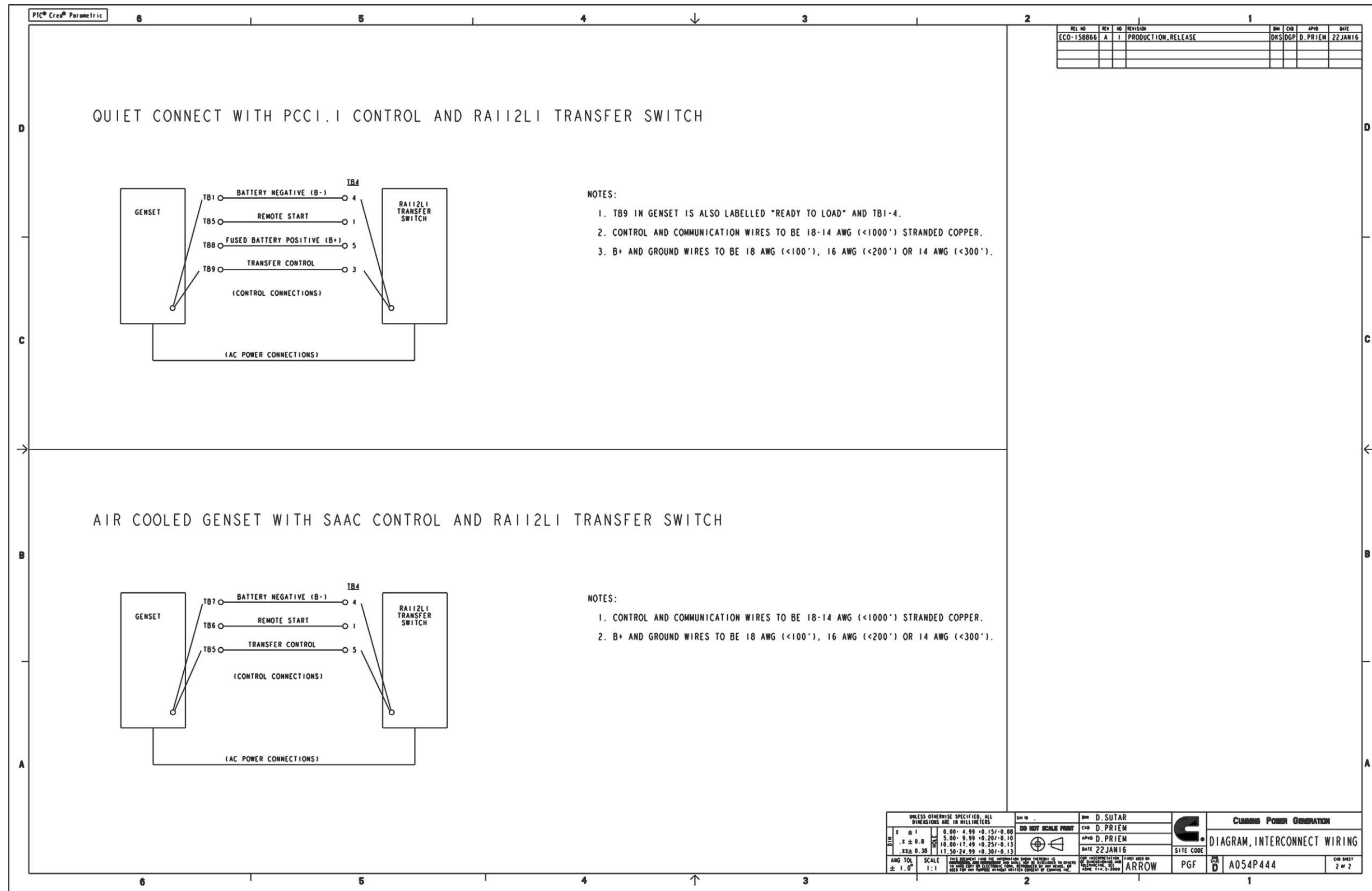


FIGURE 11. RA112L1 AUTOMATIC TRANSFER SWITCH INTERCONNECTION DIAGRAM (SHEET 2)

power.cummins.com

Copyright © 2019 Cummins Inc. All rights reserved.

Cummins, the "C" logo, PowerCommand, AmpSentry, and InPower are trademarks of Cummins Inc.

Other company, product, or service names may be trademarks or service marks of others.

Specifications are subject to change without notice.

