Power Generation

Owner Manual

Transfer Switch (20-2000 Amps)

GTEC (Spec A-B)

English
Original Instructions

11-2015

0914-0100 (Issue 19)

Table of Contents

1 Safety Precautions

This manual includes the following symbols to indicate potentially dangerous conditions. Read the manual carefully and know when these conditions exist. Then, take the necessary steps to protect personnel and the equipment.

⚠ DANGER

This symbol warns of immediate hazards that will result in severe personal injury or death.

⚠ WARNING

This symbol refers to a hazard or unsafe practice that can result in severe personal injury or death.

⚠ CAUTION

This symbol refers to a hazard or unsafe practice that can result in personal injury or product or property damage.

1.1 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 cabinet closed and locked.
- Make sure only authorized personnel have the cabinet keys.
- All service and adjustments to the transfer switch **must** be performed only by an electrician or authorized service representative.

NOTICE

Whenever closed transition is used, approval to parallel with the local electric utility must be obtained.

1.2 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 Utility-To-Generator Set Applications

If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set to STOP.
2. Disconnect the battery charger.
3. Disconnect the starting batteries of the generator set or sets (remove the ground [-] lead first).
4. Remove AC 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 and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. With the breaker in the OFF position, the line side lugs are still energized.

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 an GTEC transfer switch. This manual also includes parts information.

This is an open transition transfer switch that includes an automatic transfer switch (ATS) control. With an open transition switch, there is never a time when both sources are supplying power to the load.

Programmed transition switches briefly pause in the neutral position of the transfer switch, between switched positions, so that transient voltages from the load can diminish before the load is switched to the other source.

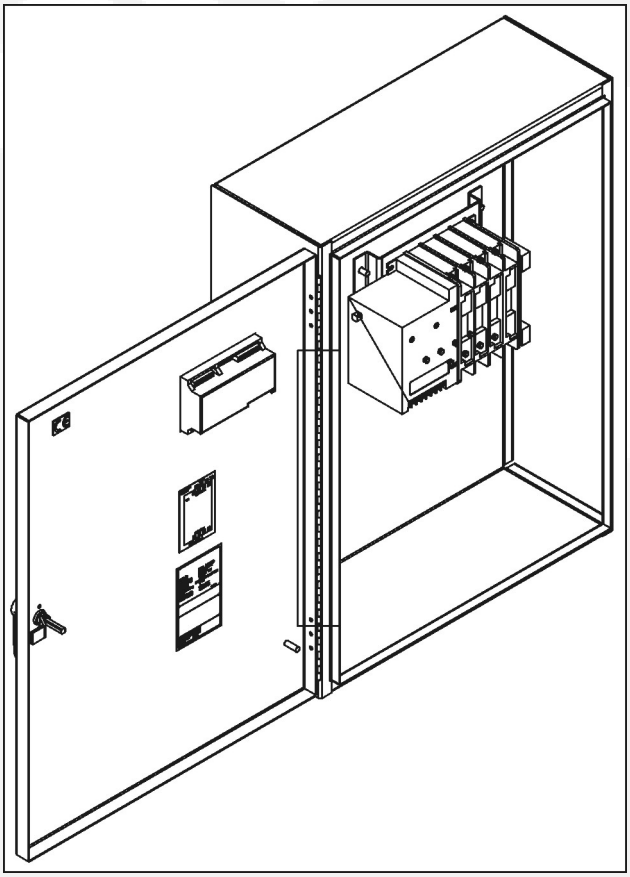


FIGURE 1. GTEC TRANSFER SWITCH WITH DOOR OPEN (125 AMP, 4 POLE SWITCH SHOWN WITH OPTIONAL 2 AMP BATTERY CHARGER) (SPEC A)

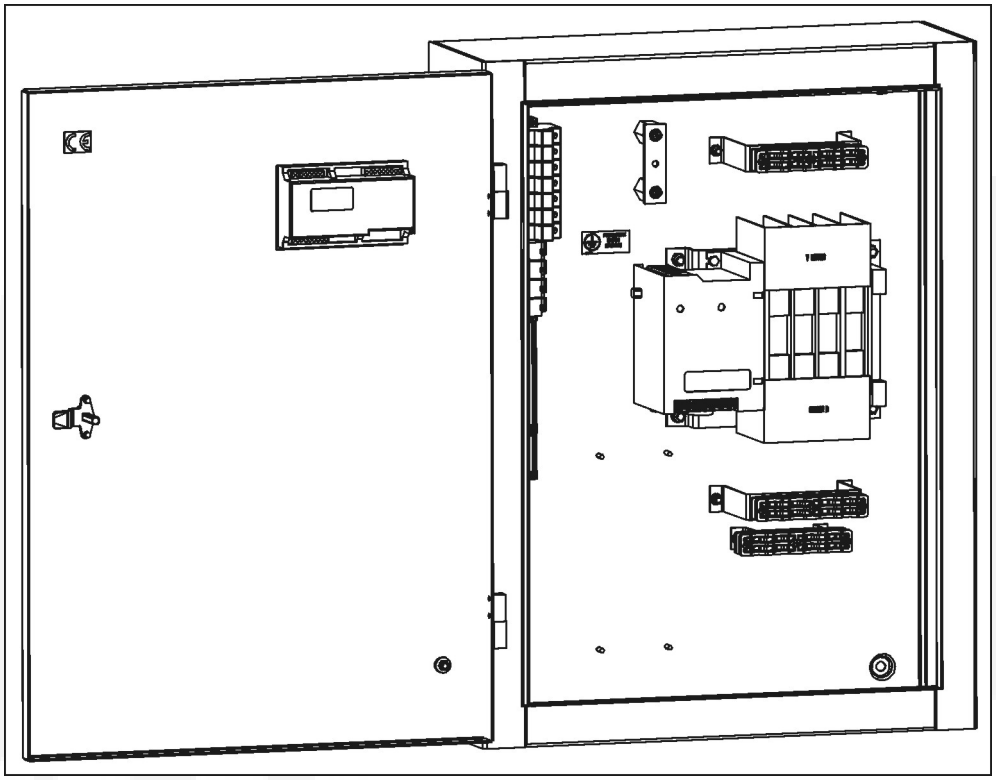


FIGURE 2. GTEC TRANSFER SWITCH WITH DOOR OPEN (125 AMP, 4 POLE SWITCH) (SPEC B)

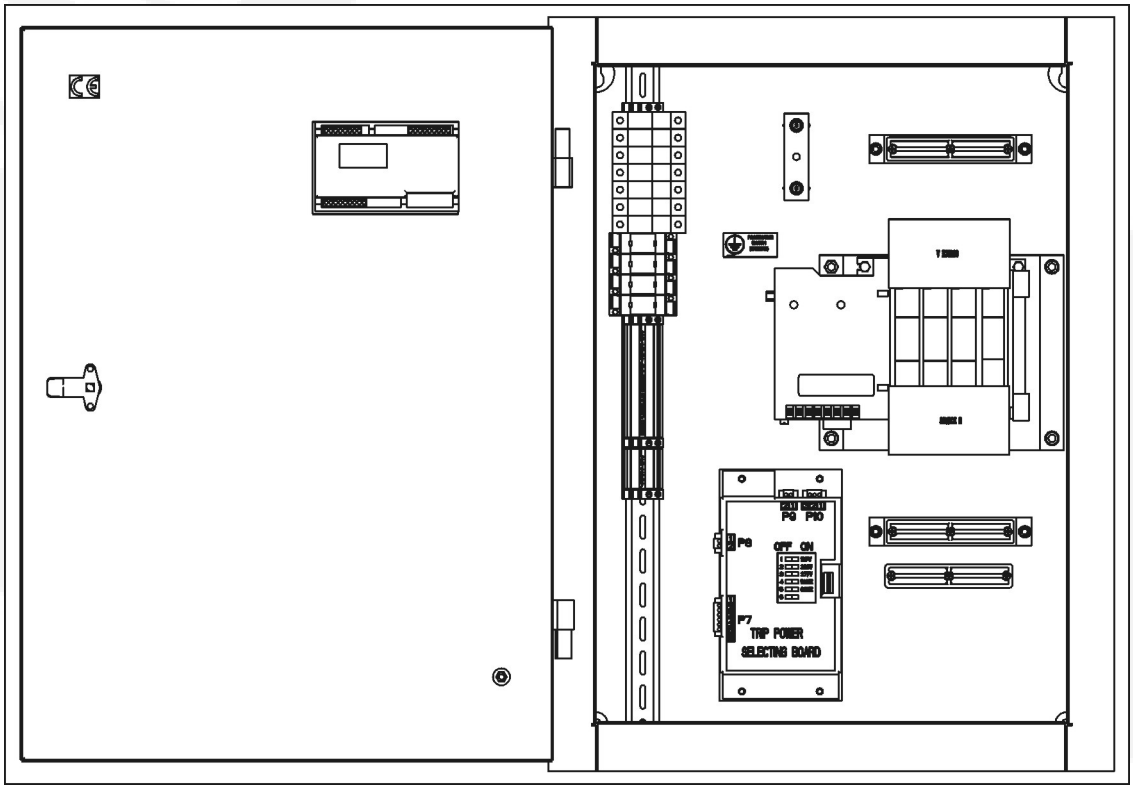
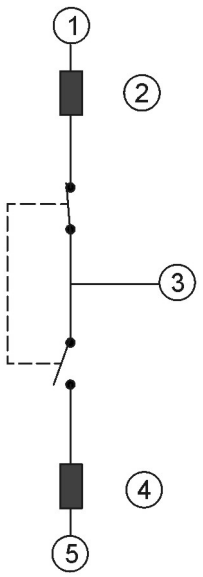


FIGURE 3. GTEC TRANSFER SWITCH WITH DOOR OPEN (TRIP-TO-NEUTRAL) (SPEC B)

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 automatically switches the electrical load from one source to the other.

The load is connected to the common of the ATS (Figure 4). 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 (genset). 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.



Number	Description	Number	Description
1	Utility (Normal Power)	4	Over Current Protective Device (Customer Supplied)
2	Over Current Protective Device (Customer Supplied)	5	Generator Set (Emergency Power)
3	Load		

FIGURE 4. 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. The controller monitors each source for allowable voltage and frequency range.

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

1. Senses the interruption of utility power.
2. Sends a start signal to the generator set.

3. Transfers the load to the generator set.
4. Senses the return of utility power.
5. Retransfers the load to the utility.
6. Sends a stop signal to the generator set.

2.4 Model Identification

Identify the model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate (see **Figure 5**), which is located on the cabinet door.

If it is necessary to contact a distributor regarding the transfer switch, always give the complete Model and Serial number. This information is necessary to properly identify the unit among the many types manufactured.

Cummins Power Generation

Model No.	**GT30160EQ5KA000**
Serial No.	**F05W000072**
Current Rating:	**160A**
Voltage Rating:	**110/190V**
Frequency:	**50 Hertz**
Class:	**PC**
Utilization Category:	**AC-31B**

Feature:
S903;R971;A028;A045;A035;B004;A042;
L989;M034

Enclosure Rating:	**None**
Application:	**Utility to Genset**
Wiring Diagram:	**0630–2993**
Outline Drawing:	**0300–6012**
Conditional Short Circuit Current:	**38,000A @480 VAC**
Fuse type:	**RT16NT-2**
Max. Fuse Rating:	**250A**

THIS PRODUCT CONFORMS TO
EN 60947-6-1 AND EN 60439-1

FIGURE 5. STANDARD NAMEPLATE

2.4.1 Model Number

The model number is made up of code segments that designate various features or options:

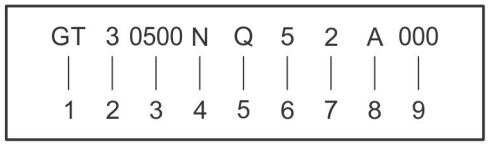


FIGURE 6. MODEL NUMBER SEGMENTS

1. GT = GTEC - Global transfer switch with open transition and delay transition
2. Number of poles: 2, 3, or 4
3. Current Rating: 20, 40, 63, 100, 125, 160, 200, 225, 250, 350, 400, 500, 630, 800, 1000, 1250, 1600, or 2000 amps
4. Voltage Code:

   A = 110 VAC*

   B = 115 VAC*

   C = 120 VAC*

   D = 127VAC*

   E = 110/190 VAC**

   F = 115/200 VAC**

   G = 120/208 VAC**

   H = 127/220 VAC**

   I = 220 VAC*

   J = 230 VAC*

   K = 240 VAC*

   L = 139/240 VAC**

   N = 220/380 VAC**

   O = 230/400 VAC**

   P = 240/416 VAC**

   Q = 255/440 VAC**

   U = Multi-Voltage 110/19 - 277/480 V

   W = Custom Define***

   X = 110/190 V, 115/200 V, 120/208 V, 127/220 V, 139/240 V

   Y = 220/380 V, 230/400 V, 240/416 V

   Z = 255/440 V, 277/480 V

   * = Single Phase, 2 Wire

   ** = Three Phase, 3 or 4 Wire OR

   *** = The rating voltage is set by custom Single Phase, 3 Wire
5. Control Type:

   L = 12 VDC, Powered Line-to-Line Sensing Control

   N = 12 VDC, Powered Line-to-Neutral Sensing Control

P = 24 VDC, Powered Line-to-Line Sensing Control

Q = 24 VDC, Powered Line-to-Neutral Sensing Control

6. Frequency:

   5 = 50 Hz

   6 = 60 Hz

   7 = 50/60 Hz

7. Construction Type:

   2 = IP32 Enclosure

   3 = IP54 Enclosure

   K = Kit (open construction)

8. Revision Letter:

   Factory Assigned (A through Z)

9. Spec Number:

   Factory Assigned (000 to 999)

2.4.2 Serial Number

The serial number is made up of nine characters.

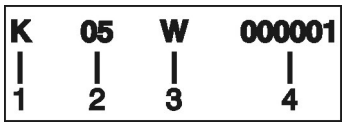


FIGURE 7. SERIAL NUMBER SEGMENTS

1. Character 1 = Month manufactured

   A = 1

   B = 2

   C = 3

   D = 4

   E = 5

   F = 6

   G = 7

   H = 8

   I = 9

   J = 10

   K = 11

   L = 12

2. Characters 2 and 3 = Year built

   05 = 2005

3. Character 4 = Plant location

   0 = Fridley, Minnesota

   1 = SML (Portables)

   2 = Cummins (USA)

   3 = Huntsville, Alabama

   4 = Onan Power Electronics

   5 = Singapore

   6 = Westinghouse (Transfer Switches and Breakers)

   7 = Canada (Linamar)

   8 = Lister-Petter

   9 = Kubota (K-series Portables)

   A = Australia (Dunlite and Adelaide)

   B = South America (Columbia)

   C = Italy (DIEM)

   H = Wuhan, Chine

   L = Libby

   M = Libby (Military)

   R = Robin (Fugi Engines) USA

   U = PGI

   K = UK (Kent)

   S = Mexico (Cumsa)

   T = Brazil

   X = Canada (Linamar - early production)

   W = Nexage Wuxl, China

4. Characters 5 through 10 = Manufacturing Order Number (Sequentially assigned number)

2.5 Manufacturing Facilities

NORTH AMERICA	EMEA, CIS	ASIA PACIFIC
Cummins Power Generation Limited 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Power Generation Limited Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Power Generation Limited 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838
Phone +1 763 574 5000 Toll Free +1 800 888 6626 Fax +1 763 574 5298	Phone +44 1843 255000 Fax +44 1843 255902	Phone +65 6417 2388 Fax +65 6417 2399

BRAZIL	CHINA	INDIA
Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	Cummins Power Generation 2 Rongchang East Street, Beijing Economic – Technological Development Area Beijing 100176, P.R.China	Cummins India Ltd, Power Generation Business Unit, Plot No B-2, SEZ Industrial Area, Village-Nandal & Surwadi, Taluka-Phaltan Dist- Satara, Maharashtra 415523 India
Phone +55 11 2186 4195 Fax +55 11 2186 4729	Phone +86 10 5902 3000 Fax +86 10 5902 3199	Phone +91 021 66305514
LATIN AMERICA	**MEXICO**	
3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	
Phone +1 954 431 551 Fax +1 954 433 5797	Phone +52 444 870 6700 Fax +52 444 824 0082	

2.5.1 How to Obtain Service

When a product requires servicing, contact the nearest Cummins Power Generation distributor. To locate the distributor, refer to **power.cummins.com** and select Distributor Locator. When contacting the distributor, always supply the complete model, specification, and serial number as shown on the nameplate.

2.5.1.1 Locating a Distributor

In North America

Telephone +1 800 888 6626 (this is an automated service for touch-tone phones only) to contact the nearest Cummins Power Generation distributor in the United States or Canada. Select Option 1 (press 1), to automatically connect to the nearest distributor.

If unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, distributors are listed under:

GENERATORS – ELECTRIC or

ENGINES – GASOLINE OR DIESEL

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

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

Outside North America

Refer to **power.cummins.com** and select Distributor Locator, or send an email to ask.powergen@cummins.com.

2.6 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 for assistance.

2.6.1 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, transfer switches, ventilation equipment, mounting pads, cooling systems, exhaust systems, and fuel systems. Each component must be correctly designed so the complete system functions as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers 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 complexity of the standby system normally requires the special skills of qualified electricians, plumbers, sheet metal workers, and etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices.

2.6.2 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.

2.7 GTEC Features

TABLE 1. GTEC FEATURES

Feature Description	Feature Option	Feature Description	Feature Option
Poles:		**Current Ratings:**	
2 Poles	A027	20 Amp	S820
3 Poles	A028	40 Amp	S840
4 Poles	A029	63 Amp	S901

Feature Description	Feature Option	Feature Description	Feature Option
Application:		100 Amp	S902
Utility to Genset	A035	125 Amp	S048
Frequency:		160 Amp	S903
60 Hertz	A044	200 Amp	S904
50 Hertz	A045	225 Amp	S905
50/60 Hertz	A086	250 Amp	S906
Phase:		350 Amp	S907
Single Phase, 2 or 3 Wire	A041	400 Amp	S053
Three Phase, 3 or 4 Wire	A042	500 Amp	S908
Cabinet:		630 Amp	S909
IP32	B026	800 Amp	S055
IP54	B027	1000 Amp	S056
Open Construction	B004	1250 Amp	S910
Battery Chargers:		1600 Amp	S916
2 Amp, 12/24VDC	K001-7	2000 Amp	S920
Voltage Ratings:		**Control Options:**	
110/190 VAC	R971	External Exercise Clock	J030-7
115/200 VAC	R972	Elevator Signal Relay	M032-7
120/208 VAC	R973	Manual Restore Switch	S071
127/220 VAC	R974	**Auxiliary Relays:**	
139/240 VAC	R975	24 VDC Coil	L101-7
220/380 VAC	R976	Emergency Position	L102-7
230/400 VAC	R977	Normal Position	L103-7
240/416 VAC	R978	12 VDC Coil	L201-7
255/440 VAC	R979	Emergency Position	L202-7
277/480 VAC	R980	Normal Position	L203-7
110 VAC	R981	**Miscellaneous:**	
115 VAC	R982	Terminal Block - 10 Position	M002-7
120 VAC	R983	**Controller Type:**	
127 VAC	R984	Line-to-Neutral	C108
220 VAC	R985	Line-to-Line	C107
230 VAC	R986	**Starting Battery:**	
240 VAC	R987	12V, Genset Starting Voltage	M033
110/190V-139/240V	R060	24V, Genset Starting Voltage	M034
220/380V-240/416V	R061	**Neutral Connection:**	
255/440V-277/480V	R062	Neutral Bar Assembly	B028
110/190V-277/480V	R063	**GTEC:**	

Feature Description	Feature Option	Feature Description	Feature Option
		Trip Power Selecting board	J031-7

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3 Transfer Switch Start-up

3.1 Transfer Switch Start-up

The GTEC transfer switch is preset at the factory to operate using default settings. The control will operate the transfer switch when power is applied. However, you may wish to adjust some of the settings for better performance.

The transfer switch must be installed correctly, with DC power present, before any adjustments to the configuration can be made. If the transfer switch is connected to utility power, the Utility Power Connected LED will be lit if battery power is available. Utility or genset voltage need not be present to adjust the configuration.

The following tables show which control functions should not be changed (**Table 2**) and which functions can be changed for local specific application **Table 3**. Refer to **Section 5.11** for more details.

TABLE 2. FUNCTIONS THAT SHOULD NOT BE CHANGED

Function	Factory Settings
System Nominal Voltage Table	Set for specific system voltage
System Nominal Voltage	Set for specific system voltage
System Nominal Frequency	Set for specific system frequency
System Phase	Set for specific system
External Exercise	Set to ON if the external exerciser option was ordered; otherwise, set to OFF

TABLE 3. FUNCTIONS THAT CAN BE CHANGED

Function	Factory Settings
TDES (Time Delay Engine Start)	3 Seconds
TDNE (Time Delay Normal to Emergency)	5 Seconds
TDEN (Time Delay Emergency to Normal)	10 Minutes
TDEC (Time Delay Engine Cooldown)	10 Minutes
TDPT (Time Delay Programmed Transition)	0 Seconds
TDEL (Time Delay Elevator Signal)	0 Seconds
Test With or Without Load	Without Load
Exercise With or Without Load	Without Load
Utility Undervoltage Pickup	90%
Utility Undervoltage Dropout	85%
Utility Overvoltage Pickup	120%
Utility Overvoltage Dropout	125%
Utility Underfrequency Pickup	80%

Function	Factory Settings
Utility Underfrequency Dropout	70%
Utility Overfrequency Pickup	130%
Utility Overfrequency Dropout	140%
Phase Check	Off
Return to Programmed Transition	Off
Elevator Post Transfer Delay	Off
Exercise Repeat Interval	Every 7 Days

NOTICE

Utility overvoltage and under/over frequency can be enabled or disabled but the set points can not be changed.

4 Description

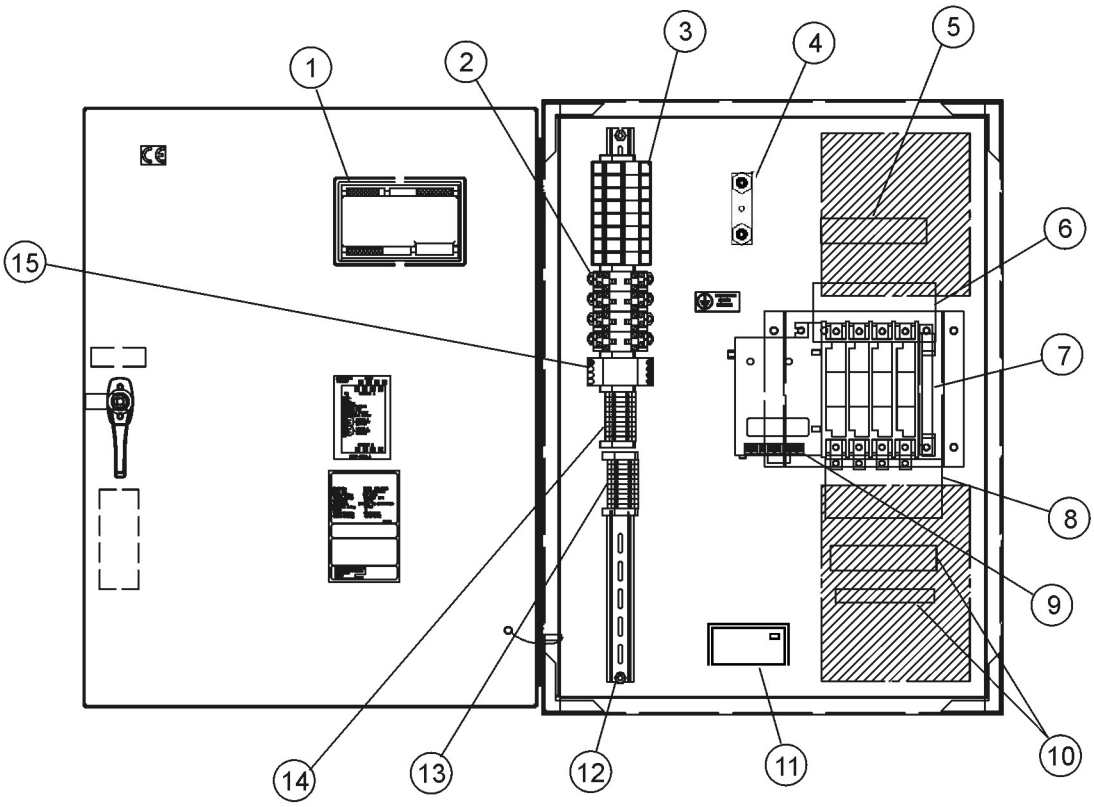
This section describes the control cabinet, the switch mechanism, and the standard and optional control features available with the GTEC transfer switch.

4.1 Cabinet

This transfer switch uses an IP32 type cabinet. These Ingress Protection (IP) cabinets are designed to prevent entrance of foreign objects that are 2.5 mm and larger and can keep out falling drops of water up to a 15-degree incidence angle.

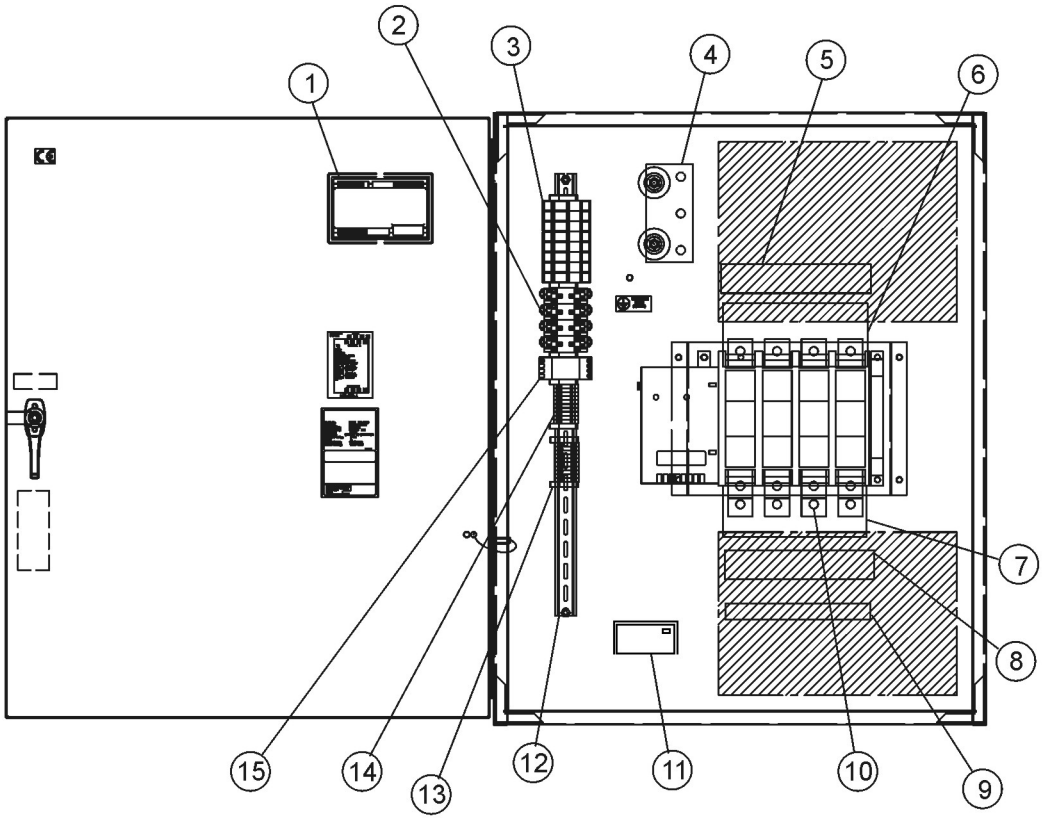
Examples of cabinets are shown in **Figure 8**, **Figure 9**, **Figure 10**, and **Figure 11**.

The GTEC is also available for open construction installations.



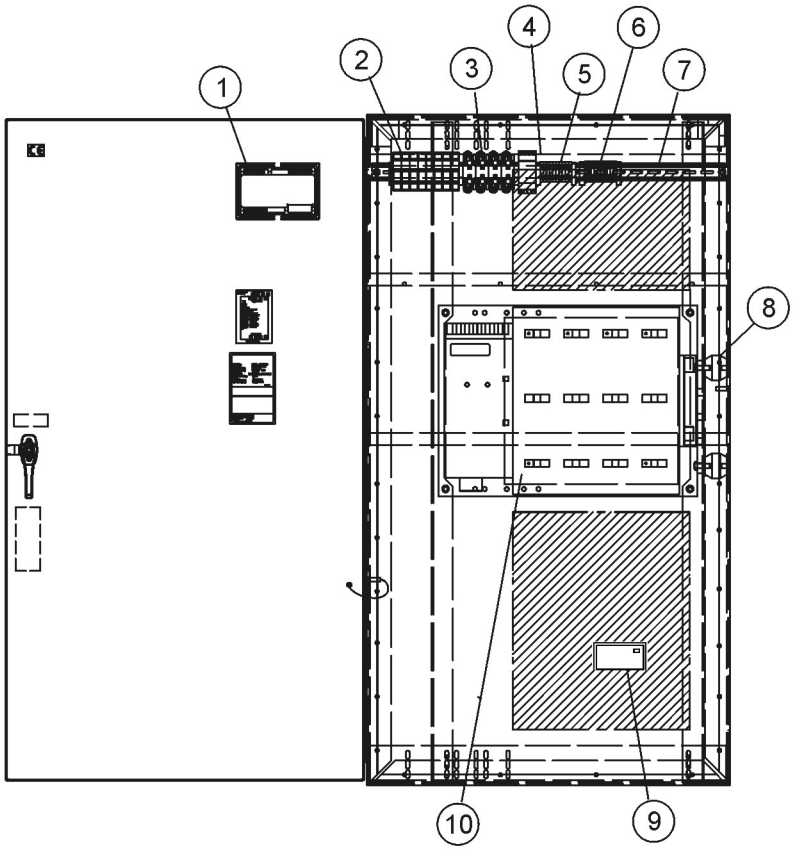
Number	Description	Number	Description
1	Control Panel	9	Control Wiring Terminals
2	Relay Coils K1 through K4	10	Cable Tie (Spec B) (20 - 500 amps)
3	Fuse Block	11	Battery Charger Option
4	Neutral Bar	12	Rail Assembly
5	Cable Tie (Spec B) (20 - 500 amps)	13	TB2 (Spec B)
6	Terminal Shield (Spec B) (20 - 500 amps)	14	TB1
7	Transfer Switch	15	Optional Exerciser Clock
8	Terminal Shield (Spec B) (20 - 500 amps)		

FIGURE 8. INTERIOR COMPONENTS: 20-125 AMP, 4 POLE SWITCH



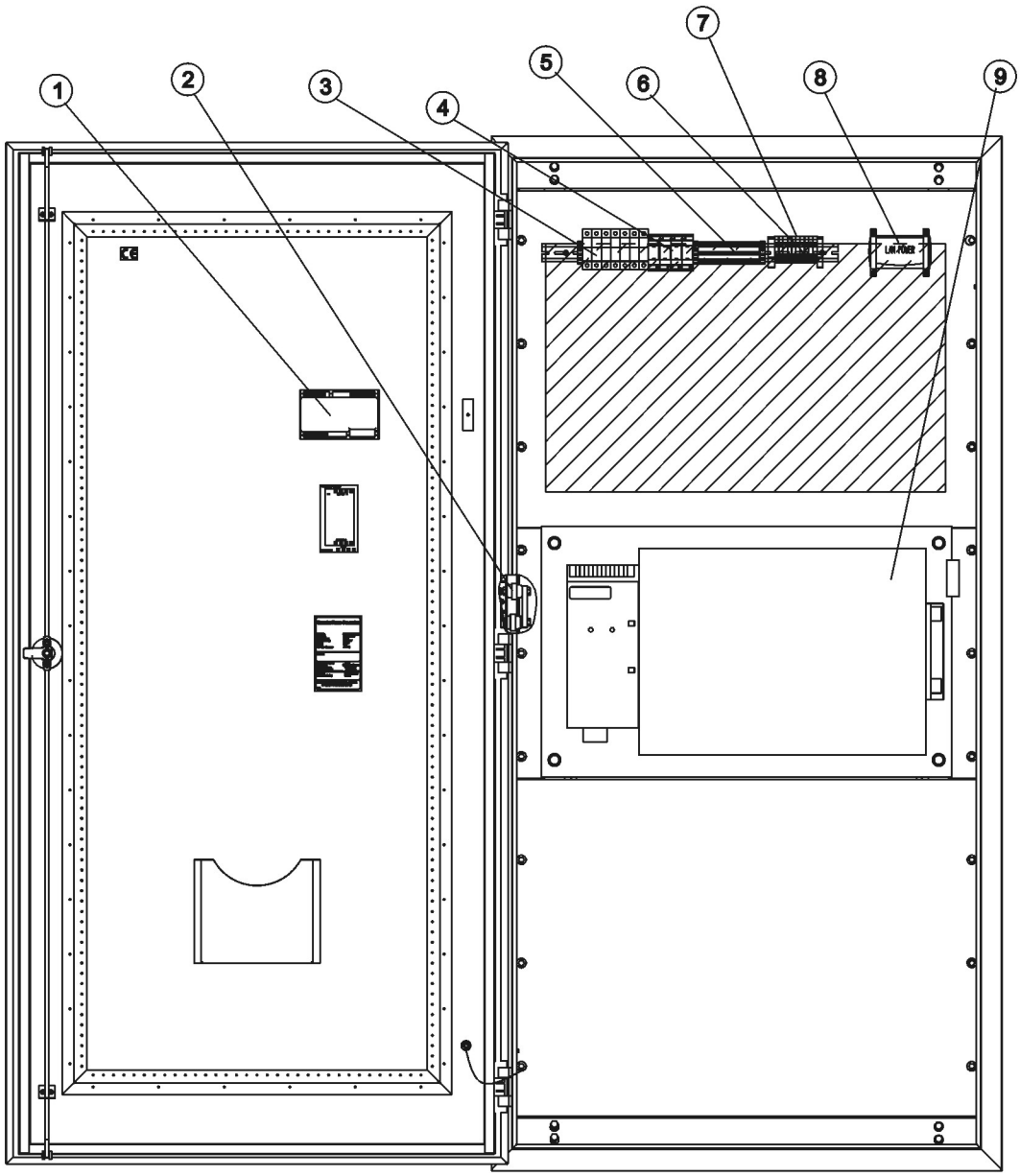
Number	Description	Number	Description
1	Control Panel	9	Cable Tie (Spec B) (20 - 500 amps)
2	Relay Coils K1 through K4	10	Transfer Switch
3	Fuse Block	11	Battery Charger Option
4	Neutral Bar	12	Rail Assembly
5	Cable Tie (Spec B) (20 - 500 amps)	13	TB2 (Spec B)
6	Thermal Shield (Spec B) (20 - 500 amps)	14	TB1
7	Thermal Shield (Spec B) (20 - 500 amps)	15	Optional Exerciser Clock
8	Cable Tie (Spec B) (20 - 500 amps)		

FIGURE 9. INTERIOR COMPONENTS: 160-500 AMP, 4 POLE SWITCH



Number	Description	Number	Description
1	Control Panel	6	TB2 (Spec B)
2	Fuse Block	7	Rail Assembly
3	Relay Coils K1 through K4	8	Neutral Bar
4	Optional Exerciser Clock	9	Battery Charger Option
5	TB1	10	Transfer Switch

FIGURE 10. INTERIOR COMPONENTS: 630-1250 AMP, 4 POLE SWITCH



Number	Description	Number	Description
1	Control Panel	6	Rail Assembly
2	Neutral Bar	7	TB2 (Spec B)
3	Fuse Block	8	Battery Charger Option
4	Relay Coils K1 through K4	9	Transfer Switch
5	TB1		

FIGURE 11. INTERIOR COMPONENTS: 1600-2000 AMP, 4 POLE SWITCH

4.2 Control Panel

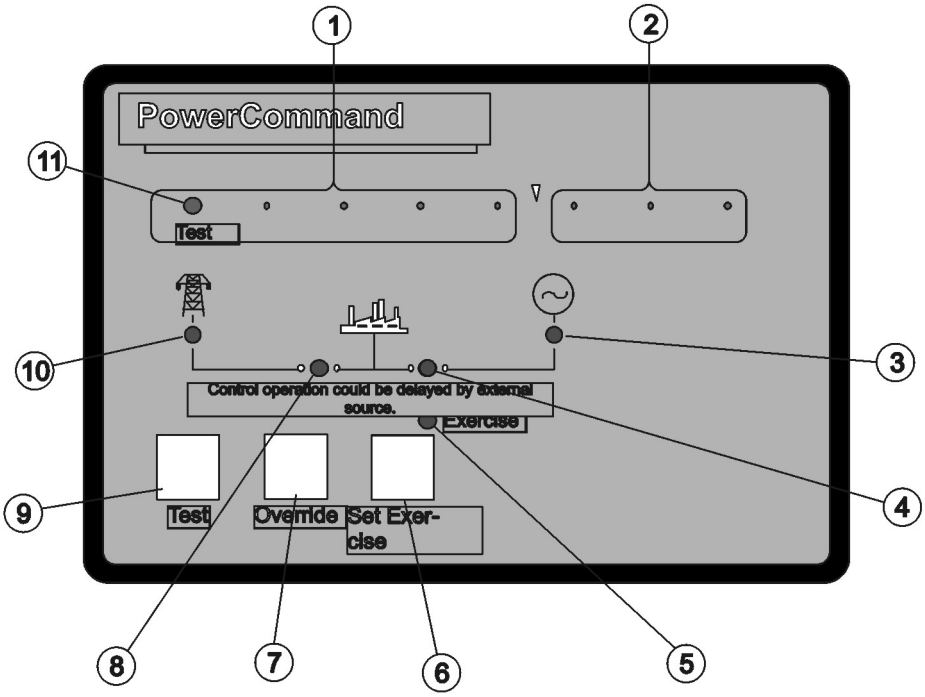
Figure 12 shows the control panel on the cabinet door. Two types of controls are available with GTEC transfer switches.

- TS1311 controls are used on transfer switches with line-to-neutral voltage sensing.
- TS1310 controls are used on transfer switches with line-to-line voltage sensing.

The front of the control panel is the same for both type of controls.

The control features are divided into three groups:

- Control Function LEDs
- Automatic Transfer Switch (ATS) Status LEDs
- Membrane Pushbuttons



Number	Description	Number	Description
1	Function Code LEDs	7	Override Push Button
2	Value Code LEDs	8	Utility Power Connected LED
3	Genset Power Available LED	9	Test Push Button
4	Genset Power Connected LED	10	Utility Power Available LED
5	Active Exercise LED	11	Test Activity LED
6	Set Exercise Push Button		

FIGURE 12. CABINET DOOR

4.2.1 Control Function LEDs

The control panel (see **Figure 12**) includes eight LEDs that display codes that indicate various control functions that can be configured. The first five LEDs display the function code and the last three LEDs display the value code for the displayed function. For information on configuring these functions, see **Section 5.11**.

With the exception of the first LED (Test), normally these LEDs are off and are only lit when in Configuration Mode. The Test LED is also used to notify the user of test periods.

4.2.2 Automatic Transfer Switch Status LEDs

The control panel includes six LEDs that provide Automatic Transfer Switch (ATS) status information.

Utility Power Available: This green LED is lit when the utility power source has acceptable output voltage.

Genset Power Available: This amber LED is lit when the generator set power source has acceptable output voltage and frequency.

Both power source LEDs can be lit simultaneously.

Utility Power Connected: This green LED is lit when utility power is supplying power to the load.

This LED flashes once per second if there is a failure to connect to or disconnect from utility power, when commanded. The control makes five attempts (there is 10 seconds between each attempt) to connect to or disconnect from utility power before it flashes the failure.

Genset Power Connected: This amber LED is lit when the generator set is supplying power to the load.

This LED flashes once per second if there is a failure to connect to or disconnect from the generator set, when commanded. The control makes five attempts (there is 10 seconds between each attempt) to connect to or disconnect from the generator set before it flashes the failure.

Test: This amber LED is lit when there is an active test period. This LED flashes twice per second when the Test push button is pressed to set or cancel a test period.

Exercise: This amber LED lights when repeat exercise periods have been set. This LED flashes twice per second when the Set Exercise push button is pressed to set or cancel an exercise. This LED flashes once per second during an active exercise period.

4.2.3 Membrane Pushbuttons

The control panel includes three membrane push buttons.

Test: The Test pushbutton is used to set or cancel a test period. The control can be configured to test the generator set with or without load. For more information, see **Chapter 5**.

The Test push button is also used in the Configuration Mode to step through the function codes, see **Section 5.11**.

Override: The Override push button is used to terminate or bypass some time delays, to stop the Power Connected LEDs from flashing as a result of a failure to connect to or disconnect from a power source, and to cancel an active exercise period. For more information, see **Chapter 5**.

The Override push button is also used in the Configuration Mode to step through the value codes, see Section 5.11.

Set Exercise: The Set Exercise push button is used to set or cancel repeat exercise periods using the integrated exerciser. For more information, see Section 5.6.3.

4.3 Electronic Control System

This section describes the stand and optional components for the electronic control system.

⚠ WARNING

Improper calibration or adjustment of electronic control modules can cause death, severe personal injury, and equipment or property damage. Calibration and adjustments of these components must be performed by technically qualified personnel only.

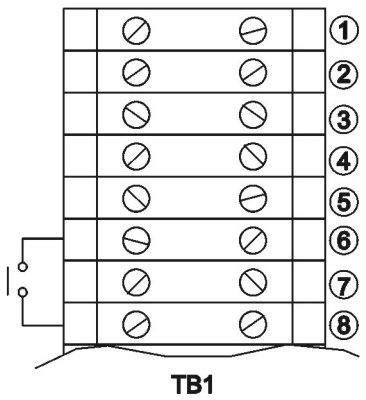
Installation of these components and calibration and adjustment procedures are described in Chapter 7.

⚠ WARNING

AC power within the cabinet and rear side of cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, and etc.

4.3.1 Transfer Inhibit Input

A transfer inhibit input is set up by connecting a dry (voltage free) contact between TB1-6 and TB1-8. Closing the contact enables the feature and opening the contact disables it.



Number	Description	Number	Description
1	GND	5	Remote Test
2	Genset Start	6	Transfer Inhibit
3	B+	7	Retransfer Inhibit
4	Genset Start	8	Common

FIGURE 13. TB1 CONNECTIONS FOR TRANSFER INHIBIT

This feature is used to control load transfer to generator sets. When enabled, load transfer will not take place unless the Override push button on the control panel is pressed or the transfer inhibit input is disabled.

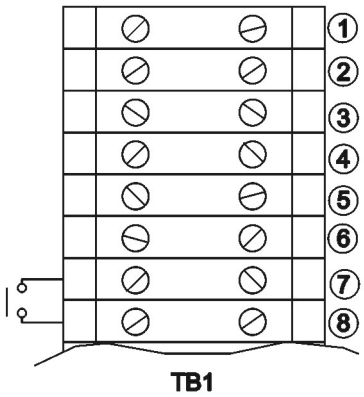
Pressing the Override push button on the control panel bypasses the transfer inhibit input and bypasses Time Delay Normal to Emergency (TDNE). The TDNE runs if the transfer inhibit input is disabled.

4.3.2 Retransfer Inhibit Input

A retransfer inhibit input is set up by connecting a dry (voltage free) contact between TB1-7 and TB1-8. Closing the contact enables the feature and opening the contact disables it.

This feature is used to prevent the Automatic Transfer Switch (ATS) from automatically transferring the load back to the utility. When enabled, load transfer will not take place unless the Override push button on the control panel is pressed, the retransfer inhibit input is disabled, or the generator set fails. If the generator set fails, retransfer inhibit is ignored.

Pressing the Override push button on the control panel bypasses the retransfer inhibit input and bypasses the Time Delay Normal to Emergency (TDNE). The TDNE runs if the retransfer inhibit input is disabled.



Number	Description	Number	Description
1	GND	5	Remote Test
2	Genset Start	6	Transfer Inhibit
3	B+	7	Retransfer Inhibit
4	Genset Start	8	Common

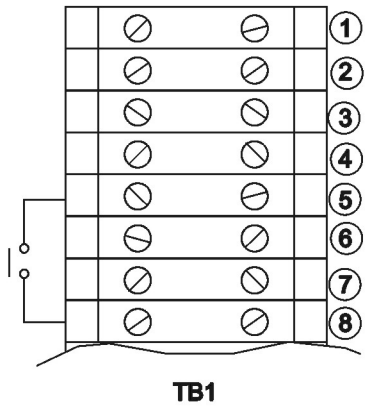
FIGURE 14. TB1 CONNECTIONS FOR RETRANSFER INHIBIT

4.3.3 Remote Test Input

The transfer switch may be wired for a remote test input. The switch is used to start and stop manually initiated system tests. As with the control panel Test push button, the remote test input can be configured to test with or without load. More information on testing is included in Chapter 5.

A remote test input is set up by connecting a dry (voltage free) contact between TB1-5 and TB1-8. Closing the contact starts a test and opening the contact cancels the test. The Test LED flashes to signify the start of a test and stays on during the test.

Closing the contact causes the transfer switch to sense a, simulated, utility power failure and sends a start and run signal to the generator set. If the control is set up to test with load, the load is transferred to the generator set when the generator set becomes available. The Utility Power Available LED remains on to show that the utility did not fail.



Number	Description	Number	Description
1	GND	5	Remote Test
2	Genset Start	6	Transfer Inhibit
3	B+	7	Retransfer Inhibit
4	Genset Start	8	Common

FIGURE 15. TB1 CONNECTIONS FOR REMOTE TEST TRANSFER

4.3.4 Two-wire Starting

The starting circuit is a basic supervisory function of the electronic control. Water-cooled generator sets use a two-wire start control.

Although the logic is more involved, the two-wire starting circuit can be thought of as a single pole, single throw switch. A closed switch starts the generator set. An open switch stops the generator set.

NOTICE
Three-wire starting is not available on GTEC transfer switches.

4.4 Transfer Switch

The transfer switch (see Figure 8 through Figure 11) opens and closes the contacts that transfer the load between the power sources. The switch is mechanically interlocked to prevent simultaneous closing to both power sources. The main parts of the switch discussed here are the contact assemblies, linear actuator, and auxiliary contacts.

4.4.1 Contact Assemblies

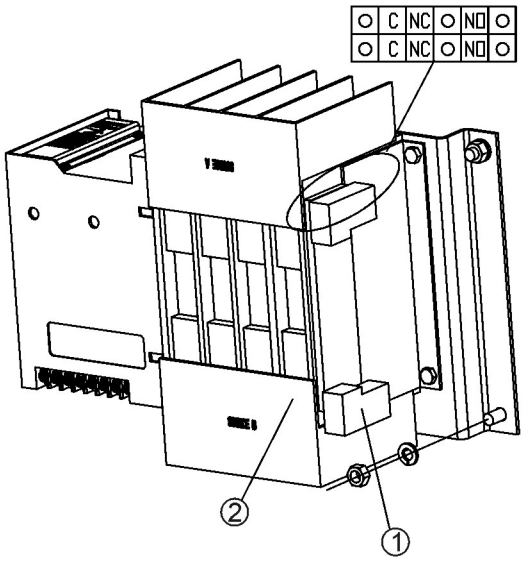
The automatic transfer switch has either two, three, or four poles. Three pole transfer switches are provided with a neutral bar. The contact assemblies make and break the current flow. When closed to either power source the contacts are mechanically held. A mechanical interlock prevents them from closing to both power sources at the same time.

4.4.2 Electromechanical Actuator

Actuator operation is initiated automatically by the transfer switch control. Manual operation of the switch is also possible. Refer to **Section 5.2**.

4.4.3 Auxiliary Contacts

Auxiliary contacts are provided on the utility and generator set sides of the transfer switch (see **Figure 16**). They are actuated by operation of the transfer switch during transfer and retransfer. The utility auxiliary contact switch is actuated when the transfer switch connected to the utility. The generator set auxiliary contact switch is actuated when the transfer switch is connected to the generator set. The auxiliary contacts have current ratings of five amperes at 250 VAC. The contacts are wired to terminal block TB1.



Number	Description	Number	Description
1	Utility Auxiliary Contacts	2	Generator Set Auxiliary Contacts

FIGURE 16. AUXILIARY CONTACTS (SPEC B SHOWN)

4.5 Voltage Sensing

The transfer switches in this manual are available with either line-to-neutral or line-to-line sensing.

4.5.1 Line-to-Neutral Voltage Sensing

The following is true if the transfer switch is configured for line-to-neutral voltage sensing.

- There is a letter 'N' or 'Q' in the model number just after the voltage code
- The controller is identified as TS1311 on the white label on its case
- The P3 connector on the back of the controller has 11 pins

4.5.2 Line-to-Line Voltage Sensing

The following is true if the transfer switch is configured for line-to-line voltage sensing.

- There is a letter 'L' or 'P' in the model number just after the voltage code
- The controller is identified as TS131o on the white label on its case
- The P3 connector on the back of the controller has 9 pins

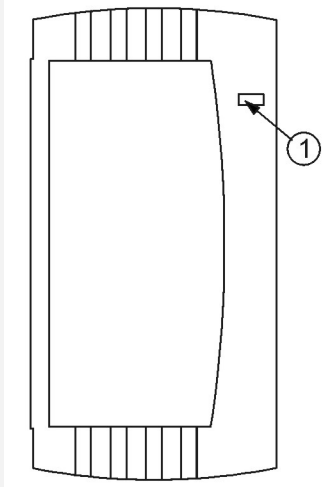
4.6 Options

4.6.1 Float-charge Battery Charger Option

A float-charge battery charger (**Figure 17**) regulates its charge voltage to continuously charge without damage to the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

Two 2-amp battery chargers are available. One battery charger is compact and does not have a digital display. The other battery charger is a premium charger which includes a digital display. The premium battery charger is only available for field installation.

2-Amp Battery Charger



Number	Description	Number	Description
1	LED		

FIGURE 17. 2-AMP BATTERY CHARGER

The input voltage range for the 2-amp battery charger is between 100 and 240 VAC. The maximum in-rush current at cold start is 15 amps for 115 VAC and 30 amps for 230 VAC.

The 2-amp battery charger includes one LED that displays the following conditions:

- **Red**: On solid indicates the unit is charging
- **Green**: On solid indicates the unit is fully charged

4.6.2 External Exercise Clock Option

The optional external exercise clock includes a 7-day, real-time clock that keeps track of the time and date. The clock can be set for automatic changeover for summer/winter (Daylight Savings/Standard) time. The exercise clock can be used with 12 or 24 VDC operation.

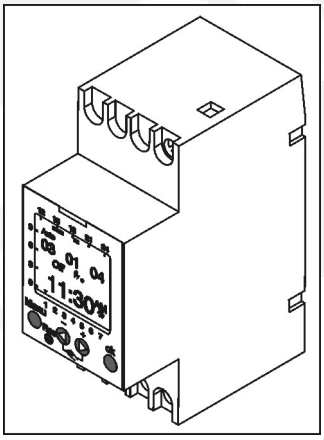


FIGURE 18. EXTERNAL EXERCISE CLOCK

Programs are available to set exercise start and stop times. One program is required to start an exercise period and a second one is required to stop an exercise period.

The exercise clock has a built-in test feature that can be used to initiate an exercise that has not been programmed or cancel a programmed exercise in process.

Information on setting the clock is included in **Chapter 4**.

NOTICE
The clock includes a non-replaceable lithium battery with a life expectancy of at least 10 years. If the clock battery is weak during a power failure, the clock will need to be replaced.

4.6.3 Elevator Relay Option

Connections to the elevator relay are made directly to the relay terminals. The elevator relay is mounted on the DIN rail. The terminals accept wire sizes from one number 18 AWG (1.0 mm^2) wire to two number 12 AWG (4.0 mm^2) wires. For connection to the screw terminal, strip the insulation back 3/8-inch (10 mm).

There are two types of relay coils (12 and 24 VDC).

The relay has two sets of Form-C contacts that are rated for five amperes at 250 VAC (see **Figure 19**).

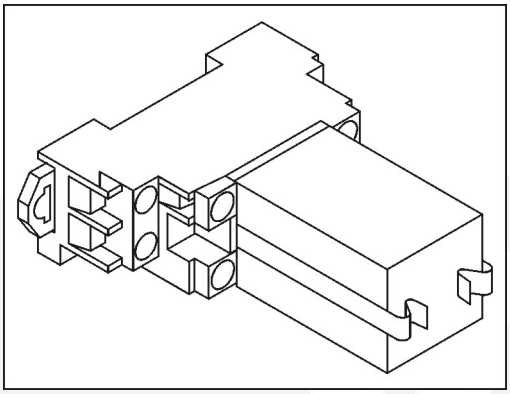
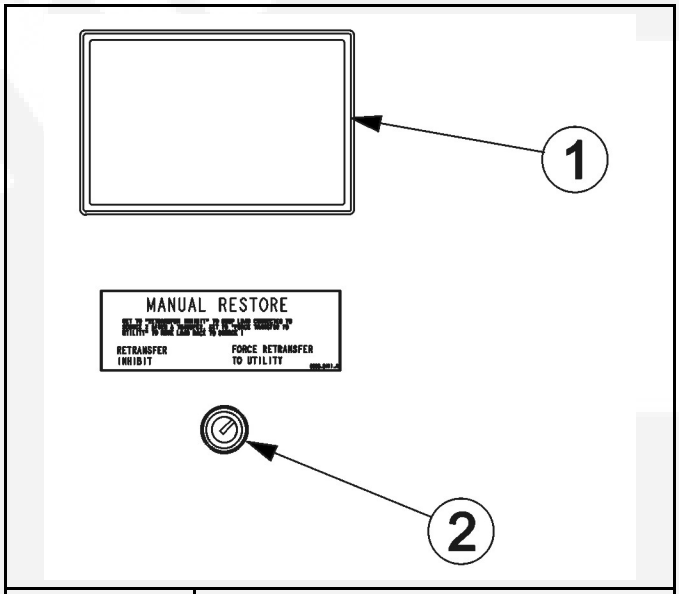


FIGURE 19. ELEVATOR RELAY

4.6.4 Manual Restore Option

The optional Manual Restore key switch (see **Figure 20**) is located on the front panel below the Control Panel.

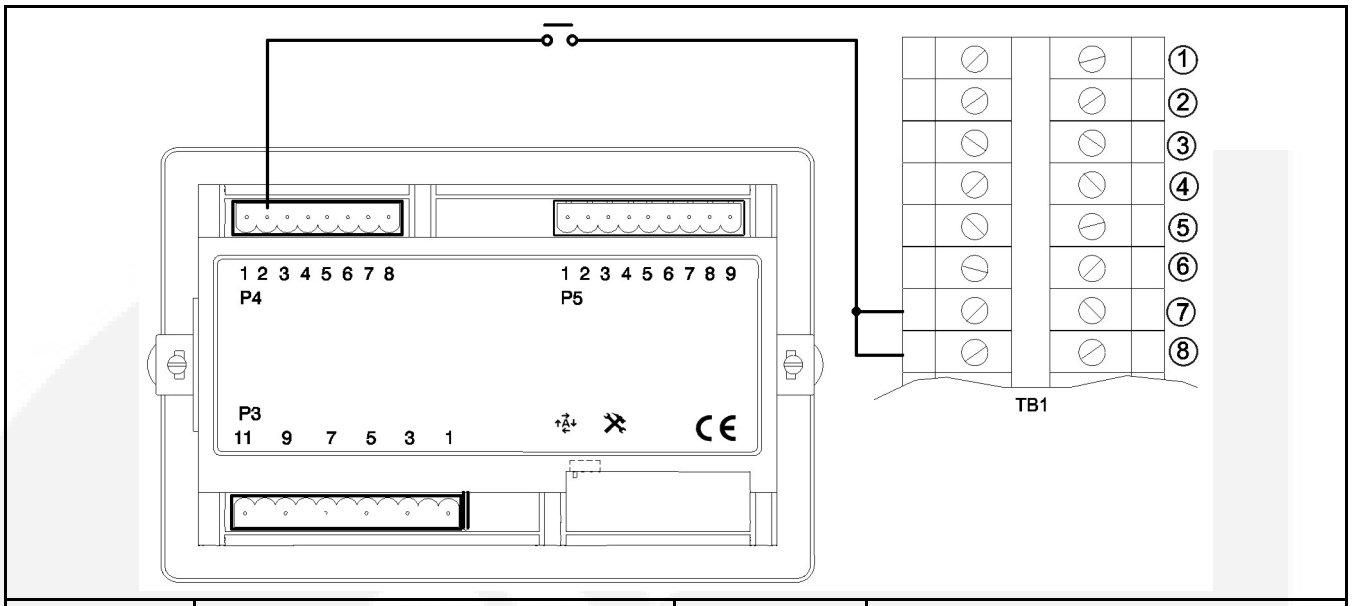


Number	Description
1	Control Panel
2	Manual Restore Key Switch

FIGURE 20. MANUAL RESTORE KEY SWITCH

When the switch is set to 'Retransfer Inhibit', the load remains connected to Source 2 after a transfer. When the switch is set to 'Force Retransfer to Utility', the load is transferred back to Utility power.

A manual restore input is set up by connecting a dry (voltage free) contact between P4-2 on the back of the control panel and TB1-7 and TB1-8 (see **Figure 21**). Closing the contact enables the feature and opening the contact disables it.

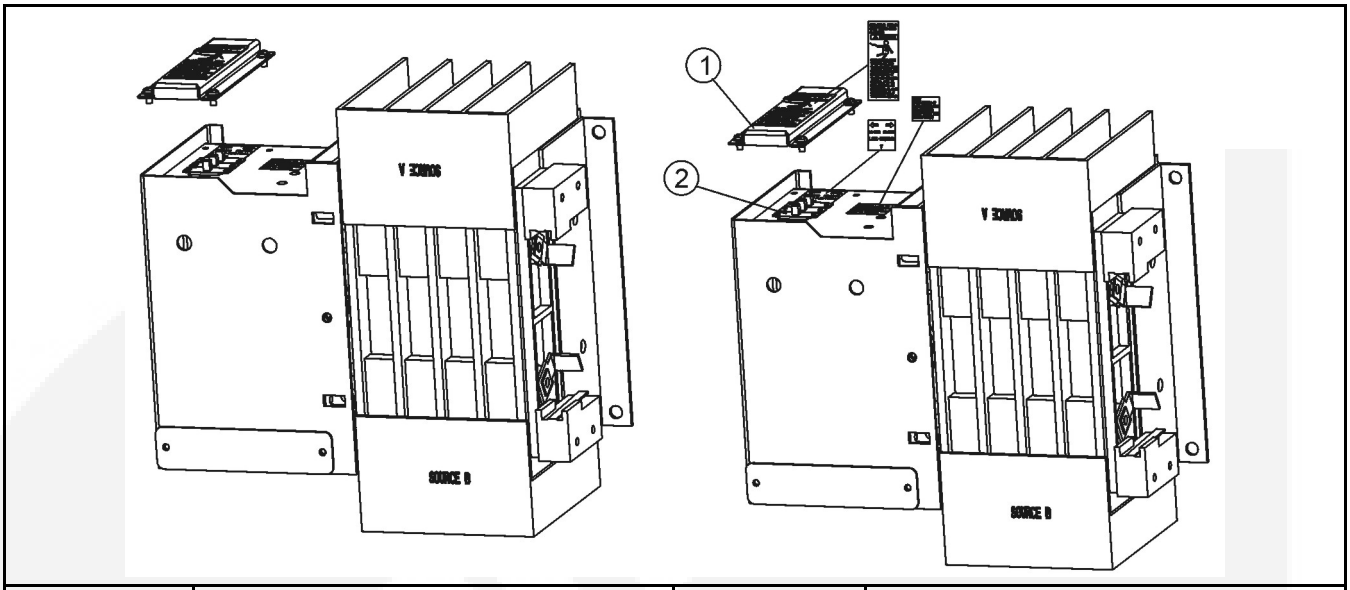


Number	Description	Number	Description
1	GND	5	Remote Test
2	Genset Start	6	Transfer Inhibit
3	B+	7	Retransfer Inhibit
4	Genset Start	8	Common

FIGURE 21. CONNECTIONS FOR MANUAL RESTORE INPUT

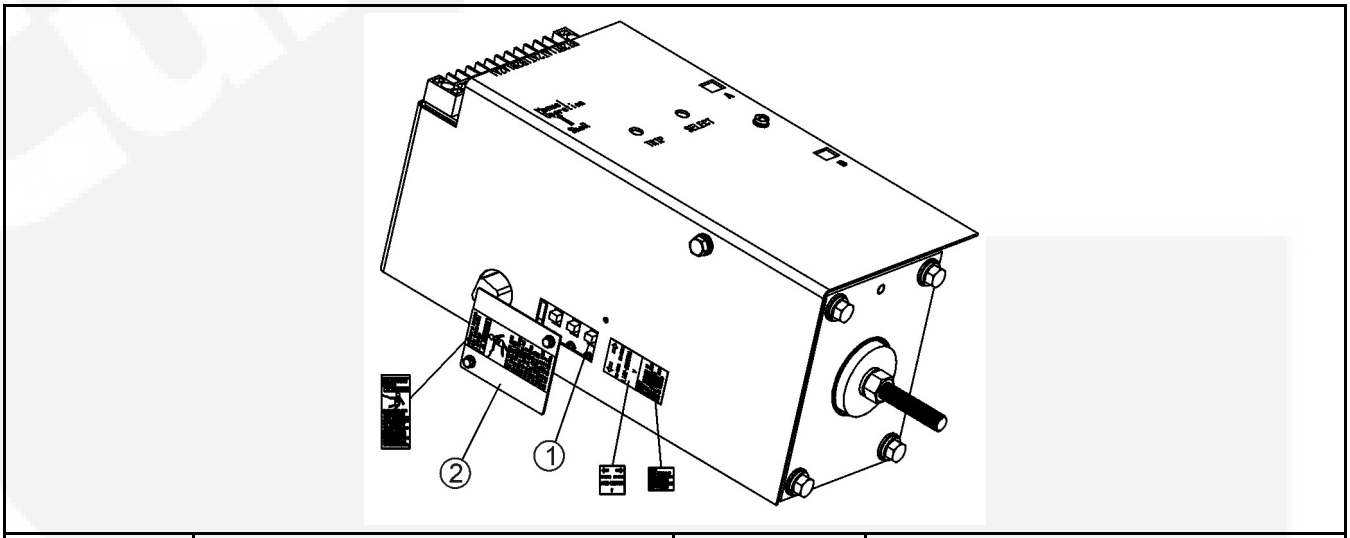
4.6.5 Transfer Switch Rating Voltage Change

Figure 22 and Figure 23 shows that transfer switch rating voltage can be changed with three voltage option switches installed on the top of transfer switch with current frame from 20 to 500 amp or left side of transfer switch with current frame from 630 to 1250 amp. And the protection cover is installed to prevent the incorrect manipulation.



Number	Description	Number	Description
1	Protection Cover	2	Transfer Switch Rating Voltage Option Switches

FIGURE 22. 20-500 AMP TRANSFER SWITCH (SPEC B SHOWN)



Number	Description	Number	Description
1	Transfer Switch Rating Voltage Option Switches	2	Protection Cover

FIGURE 23. 630-1250 AMP TRANSFER SWITCH (SPEC B SHOWN)

⚠ WARNING

Disconnect al AC and DC power with GTEC before changing the rating voltage of transfer switch.

NOTICE

Carefully read below sequence and the labels on the switch before changing the rating of the transfer switch.

Transfer switch voltage option sequence:

1. Disconnect all AC and DC power with GTEC.
2. Remove the protection cover shown in **Figure 22** and **Figure 23**
3. The voltage option switch has two positions, one is rating voltage for 110 to 139 VAC, the other is rating voltage from 220 to 277 VAC.

   Slide the handles of switches to required voltage position according to the label as show on **Figure 22** and **Figure 23**. Make sure to move the handles to end position.

   ⚠ WARNING

   Make sure that set three voltage option switches to the same position and move handle to end position before installing the protection cover, otherwise transfer switch will be damaged when it is energized.

4. Install the system rating voltage in the controller parameters
5. Reconnect all AC and DC power with GTEC

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5 Operation

5.1 Time Delays

The transfer switch control uses various time delays to break from one power source and reconnect to the other source. The control panel can be used to adjust these time delays (see Section 5.11).

In the following descriptions of time delays, it is important to remember that:

- When the transfer switch is connected to Normal, it is connected to the utility power source.
- When the transfer switch is connected to Emergency, it is connected to the generator set power source.
- When the transfer switch is in the Neutral position, it is not connected to either power source.

5.1.1 Time Delay Engine Start (TDES)

This time delay prevents the generator from starting during brief utility power interruptions. This timer starts the instant the utility fails, as detected by the Undervoltage Sensor.

When the control senses a utility failure, the control starts the Time Delay Engine Start (TDES) timer. This time delay is configurable for 0 (disabled), 0.5, 1, 2, 3, 4, 6, or 10 seconds (default = 3 seconds).

If utility power returns while the TDES timer is active, the timer is reset. When the timer expires, the control de-energizes the start relay, closing the start contact signaling the generator set to start. The timer is not reset until utility power returns. If the Override push button is pressed or the Override input is grounded while the TDES timer is active, the TDES timer immediately expires.

5.1.2 Time Delay Engine Cooldown (TDEC)

This time delay allows the generator to cool down (under no load conditions) before the control turns it off.

The Time Delay Engine Cooldown (TDEC) starts timing when the load is retransferred to utility power. This time delay is configurable for 0 (disabled), 0.1, 5, 10, 15, 20, 25 or 30 minutes (default = 10 minutes).

When the TDES expires, the stop signal is sent to the generator and the timer is reset. Pressing the Override pushbutton or grounding the Override input has no effect on this time delay.

5.1.3 Time Delay Normal-to-Emergency (TDNE)

This time delay allows the generator to stabilize before the load is applied.

While connected to Normal, this time delay starts after utility power fails and the generator becomes available (the amber Genset Power Available LED is lit). This time delay also starts after the generator becomes available when a load Test or Exercise period is activated.

The time delay is configurable for 0 (disabled), 1, 2, 3, 5, 30, 120, or 300 seconds (default = 5 seconds). If the generator fails any time during a TDNE, the control resets the timer and restarts it once the generator is again available.

If the Override pushbutton is pressed or the Override input is grounded while the TDNE timer is active, the TDNE timer immediately expires. The TDNE timer will not begin if a Transfer Inhibit input is active.

5.1.4 Time Delay Emergency-to-Normal (TDEN)

While connected to Emergency, this time delay allows utility power to stabilize before the retransfer command is issued. This delay also allows the generator to operate under load for a minimum amount of time before transferring back to utility power.

This time delay starts with the transfer switch connected to the generator and after the utility becomes available following an outage (The green Utility Power Available LED is lit). This time delay also starts when an active Test or Exercise period is ended. After the delay, the transfer switch can retransfer the load to the utility power source.

The time delay is configurable for 0 (disabled), 0.1, 5, 10, 15, 20, 25 or 30 minutes (default = 10 minutes). If the utility fails any time during this time delay, the control resets the timer and restarts it once utility power becomes available. If the generator fails at any time during this time delay, the timer expires and the normal retransfer sequence takes place.

If the Override pushbutton is pressed or the Override input is grounded while the TDEN timer is active, the TDEN timer immediately expires. The TDEN timer will not begin if a Retransfer Inhibit input is active.

5.1.5 Time Delay Programmed Transition (TDPT)

This feature causes the transfer switch to pause in the Neutral position for an adjustable period of time whenever there is a transfer from one source to another. The intentional delay allows the residual voltage of an inductive load to sufficiently decay before connecting it to another power source. This delay prevents potentially damaging voltage and current transients in the customer's power system. If TDPT is set to zero, then the transfer switch transfers from one source to the other with no neutral position delay.

The control activates a Program Transition Time Delay (TDPT) whenever the transfer switch has disconnected from one source and is in the Neutral position. The time delay is configurable for 0 (disabled), 0.5, 1, 2, 3, 4, 6 or 10 seconds (default = 0 seconds). The control also detects if the transfer switch has disconnected from the first source before connecting it to the second source.

If there is a power source failure while the TDPT is active, the control only transfers to the remaining active power source. The control does not terminate the TDPT timer if either source fails while the transfer switch is in the Neutral position.

5.1.6 Time Delay Elevator (TDEL) Pre-Transfer

Primarily used in elevator applications, this delay sets a time to wait for an elevator pre-transfer signal. This signal allows the elevator to come to a complete stop before the switch transfers.

The elevator pre-transfer signal and associated time delay, is used to signal an elevator control system that there is an impending transfer or retransfer (i.e., the elevator is going to see a brief power failure).

This delay is disabled during an actual source failure. If the timer is set for more than 0 seconds, then the control activates the elevator pre-transfer output and time delay prior to transferring the transfer switch between two live sources. If the control is in a Test or Exercise sequence, the control adds an additional delay prior to activating the transfer and retransfer commands. After the TDNE (and/or TDEN) time delay expires, the control activates the Elevator output and starts the TDEL timer.

The output relay has two normally open and two normally closed contacts, rated 5 amps at 380 volts.

When the timer expires, the control issues the transfer (or retransfer) command. When the timer is inactive or expires, the control deactivates the relay output.

The Elevator Pre-transfer Time Delay is configurable for 0 (disabled), 1, 2, 3, 5, 30, 120, or 300 seconds (default = 0 seconds).

Transfer Inhibit and Retransfer Inhibit do NOT affect or delay the elevator pre-transfer delay while it is active.

The Override pushbutton or Override input has no effect on this time delay.

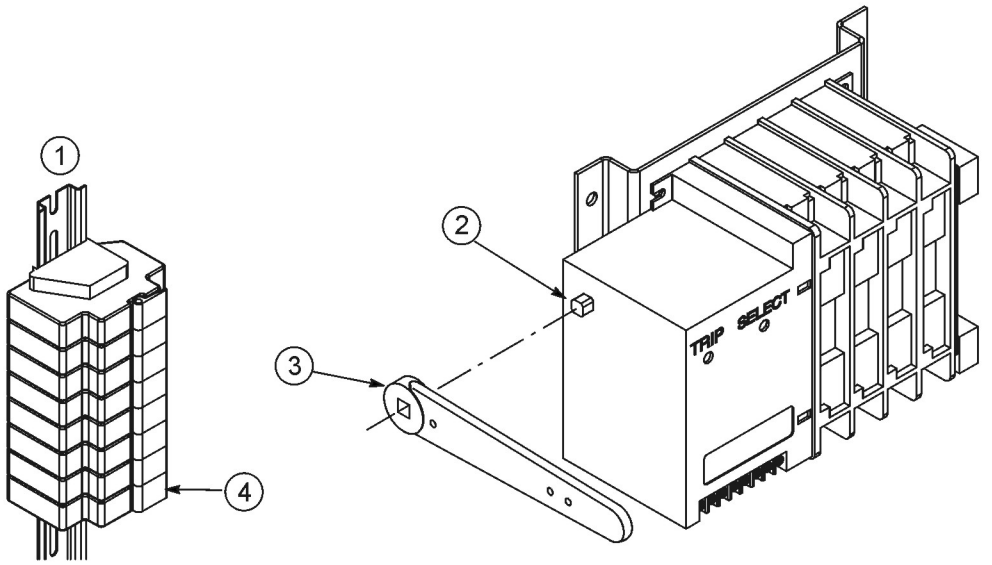
The GTEC control also includes a feature called Elevator Post Transfer Delay that keeps the elevator output active for the same TDEL time period after the transfer switch transfers. For more information (see **Section 5.1.7**).

5.1.7 Elevator Post Transfer Delay

The Elevator Post Transfer Delay feature keeps the elevator output active for the same TDEL time period after the transfer switch transfers. Instead of deactivating the elevator output when the pre-transfer time delay expires, the control keeps the output active and starts the TDEL timer again after it senses that the transfer switch has transferred. When the TDEL timer expires the second time, the control deactivates the elevator output. The Elevator Post Transfer Delay is configurable to be enabled (On) or disabled (Off) (default = Off).

5.2 Manual Operation

The transfer switch has an operator handle for manually transferring the load (see **Figure 24**). Manual operation must be performed by qualified personnel under **NO-LOAD CONDITIONS ONLY**. Use the following procedure:



Number	Description	Number	Description
1	Fuse Holders on DIN Rail	3	Transmission Switch Manual Operation Handle
2	Transmission Shaft	4	FB Fuse

FIGURE 24. MANUAL OPERATION HANDLE (SPEC A)

⚠ WARNING

Manual operation of the transfer switch under load presents a shock hazard that can cause severe personal injury or death. Do not attempt to operate the switch manually when it is under load. Disconnect both sources of power before operating manually.

1. Verify that the transfer switch is not under load.
2. Open the cabinet door of the automatic transfer switch.
3. Remove power to the control by removing the FB fuse (see Figure 24).
4. **To close Side A**:
   a. Place the handle on the transmission shaft.
   b. Rotate handle upwards until the switch locks.

   To open either (Side A or Side B):
   a. Remove the manual operation handle.
   b. Press the trip with a screwdriver.

   To close Side B:
   a. Place the handle on the transmission shaft.
   b. Press and hold "Select" with a screwdriver while rotating the handle upwards until the switch locks.

NOTICE

Remember that the transfer switch transfers the load to the active power source. If both power sources are available, it transfer the load to the utility.

⚠ WARNING

If not removed, automatic transfer switch operation results in rapid movement of the manual operator handle and presents a hazard of severe personal injury. Remove the handle before switching back to automatic operation. Store the manual operation handle in a safe location (for example, the bottom of the cabinet).

5. Make sure the manual operation handle is removed from the transmission shaft and stored in a safe location.
6. To return to automatic operation, restore power to the control by reinserting the FB fuse.
7. Close the cabinet door.

5.3 Pushbutton Operation

The following describes operation of the three pushbuttons located on the control panel.

5.3.1 Test Pushbutton

The Test pushbutton is used to:

- Start a generator set test. The Test LED flashes and stays on if the Test pushbutton is pressed and held for two seconds.
- Terminate a generator set test. The Test LED flashes for two seconds and goes out if the Test pushbutton is momentarily pressed

More information on testing is included on the following pages.

5.3.2 Override Pushbutton

The Override pushbutton is used to:

- Terminate the following system time delays:
  - Time Delay Engine Start (TDES)
  - Time Delay Normal-to-Emergency (TDNE)
  - Time Delay Emergency-to-Normal (TDEN)
- Bypass the TDNE timer and transfer the load immediately during an active Transfer Inhibit input.
- Bypass the TDEN timer and retransfer the load immediately during an active Retransfer Inhibit input.
- Stop the Utility Power Connected LED from flashing as a result of a failure to connect to or disconnect from the utility when commanded.
- Stop the Genset Power Connected LED from flashing as a result of a failure to connect to or disconnect from the generator set when commanded.

- Cancel an active exercise period.

The Program Transition (TDPT), Elevator signal (TDEL), and Engine Cool Down (TDEC) time delays are not affected by pressing the Override pushbutton.

5.3.3 Set Exercise Pushbutton

This pushbutton is only used with the integrated exerciser and only functions if the External Exercise function is disabled (set to Off). Information on configuring the control panel is included in **Section 5.11**.

The Set Exercise pushbutton is used to:

- Set a delayed repeat exercise period when the pushbutton is pressed and held for five seconds.
- Start an immediate exercise period (that also repeats) if the pushbutton is pressed momentarily within ten seconds of starting the delayed exercise period.
- Cancel a repeatable exercise period if the pushbutton is pressed and held for five seconds.

More information on using the integrated exerciser is included on **Section 5.6.3**.

5.4 Test with or without Load

This feature allows a transfer switch operator to test the transfer switch and generator power system. The test is configurable to be with load or without load. A test with load initiates a load transfer. A test without load just starts the generator and runs it without load.

1. Verify that the transfer switch is set to test with or without load, as desired (see **Section 5.11**).
2. To start a test, press and hold the Test Pushbutton for two seconds or ground the Remote Test input.
3. To end the test, momentarily press the Test pushbutton or remove the ground from the Remote Test input.

NOTICE
When ending a test with load, you can bypass the retransfer time delay (TDEN) and cause the immediate load retransfer by pressing the Override button. The generator stops after the engine cooldown time delay (TDEC).

5.4.1 Test with Load Sequence of Events

The following describes the sequence of events of an GTEC transfer switch during a test with load. In this example, TDPT is set to zero, the phase check sensor is disabled, the Transfer Inhibit and Retransfer Inhibit inputs are inactive, and TDEL is set to zero.

The utility must be acceptable during the entire test event. Acceptability is determined by the active source sensor (undervoltage sensor). If, at any time, the undervoltage sensor determines that the utility is not acceptable, the Test is terminated.

Before a test can begin, the transfer switch must be connected to the utility power source and utility power must be available.

1. Verify that the transfer switch is set to test with load.
2. Verify that the green Utility Power Connected LED on the control panel is lit.
3. Verify that the green Utility Power Available LED on the control panel is lit.
4. Press and hold the control panel Test pushbutton for two seconds or ground the Remote Test input to initiate the Test. The Test LED flashes two times per second for two seconds, acknowledging that the test was activated. Once the test period starts, the Test LED stays on continuously.
5. The control simulates a utility power failure but the Utility Power Available LED remains lit as long as the utility is still available.
6. The control starts the TDES timer. After the timer expires, the control de-energizes the start relay, closing the start contact to signal the generator to start.
7. When the generator set output is acceptable (the Genset Power Available LED is lit) the control starts the TDNE timer.
8. After the TDNE timer expires, the transfer switch transfers to the generator set (the Genset Power Connected LED is lit).
9. The control continues to run the generator set with the transfer switch connected to the generator set until the control panel Test pushbutton is momentarily pressed or the ground is removed from the Remote Test input.
10. After this action, the control starts the TDEN timer. The Test LED flashes twice per second for two seconds to acknowledge the operation and then the Test LED goes out.
11. After the TDEN timer expires, the transfer switch retransfers back to the utility (the Utility Power Connected LED is lit).
12. Once the transfer switch is connected to utility power, the control starts the TDEC timer.
13. After the timer expires, the control energizes the start relay, opening the start contact to signal the generator to stop.

5.4.2 Test without Load Sequence of Events

The following describes the sequence of events of a GTEC transfer switch during a test without load. In this sequence of events, the generator is started and runs without load for the duration of the test.

The utility must be acceptable during the entire test event. Acceptability is determined by the active source sensor (undervoltage sensor). If, at any time, the undervoltage sensor determines that the utility is not acceptable, the Test is terminated.

Before a test can begin, the transfer switch must be connected to the utility and utility power must be available.

1. Verify that the transfer switch is set to test without load.
2. Verify that the green Utility Power Connected LED on the control panel is lit.
3. Verify that the green Utility Power Available LED on the control panel is lit.

4. Press and hold the control panel Test pushbutton for two seconds or ground the Remote Test input. The Test LED flashes twice per second for two seconds acknowledging that the test was activated. Once the test period starts, the Test LED stays on continuously.
5. The control de-energizes the start relay, closing the start contact to signal the generator to start. When the genset starts and produces power, the amber Genset Power Available LED lights.
6. The control continues to run the generator without load until the control panel Test pushbutton is momentarily pressed or the ground is removed from the Remote Test input.
7. After the control panel Test pushbutton is momentarily pressed or the ground is removed from the Remote Test input, the control flashes the Test LED twice per second for two seconds to acknowledge the operation and then goes out.
8. The control energizes the start relay, opening the start contact to signal the generator to stop.

5.5 Sensors

5.5.1 Utility Sensor

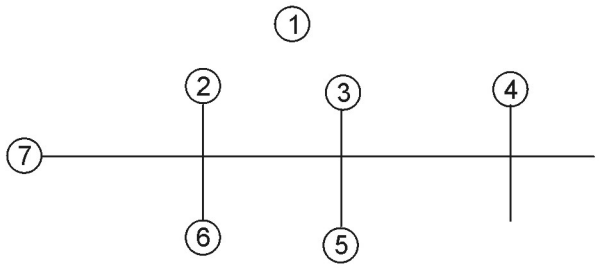
The utility sensor monitors all phases of the utility for under voltage conditions. Both the pickup and dropout set points are adjustable. The set points are listed in Table 4. Refer to Utility Undervoltage Pickup and Dropout Tables in Table 9 for information on how to make adjustments.

TABLE 4. UTILITY UNDER VOLTAGE SET POINTS

Description	Available Set Points
Undervoltage Pickup (% of Nominal)	95%
	90%
Undervoltage Dropout (% of Nominal)	90%
	85%
	80%
	70%
Overvoltage Pickup	120%
Overvoltage Dropout	125%
Underfrequency Pickup	80%
Underfrequency Dropout	70%
Overfrequency Pickup	130%
Overfrequency Dropout	140%

NOTICE
If the utility under voltage pickup is set at 90%, then the dropout has to be set lower than 90%.

Figure 25 illustrates how the pickup and dropout settings work.



Number	Description	Number	Description
1	Example of Default settings for Nominal Voltage of 240 VAC	5	90% of Nominal
2	Dropout Setting (194 V)	6	85% of Nominal
3	Pickup Setting (216 V)	7	Volts
4	Nominal Set Point (240 V)		

FIGURE 25. UNDERVOLTAGE SENSING

5.5.2 Generator Sensor

The generator sensor is a single phase sensor that monitors undervoltage and underfrequency conditions. All the pickup and dropout settings are fixed and are not adjustable. The generator set undervoltage and underfrequency set points are listed in **Table 5**.

TABLE 5. GENERATOR SET UNDERVOLTAGE AND UNDERFREQUENCY SET POINTS

Description	Set Point
Undervoltage Pickup (% of Nominal)	90%
Undervoltage Dropout (% of Nominal)	75%
Underfrequency Pickup (% of Nominal)	90%
Underfrequency Dropout (% of Nominal)	85%

5.5.3 Phase Check Sensor

The phase check sensor can be enabled, set to ON, for applications that require a fast transfer of a load between two live sources, both power source available LEDs are lit. The phase check sensor determines when the relative phase difference, less than 25 degrees and approaching 0, and the frequency difference, less than 1 Hz, of the two sources are within specified limits. When all conditions are met, a transfer is initiated. If enabled, the phase check sensor is activated after all time delays have expired, just before the transfer switch transfers the load, and only when both sources are available. Information on configuring the Phase Check On/Off function is included in **Table 9**.

5.5.4 Return to Programmed Transition

This feature can be used in conjunction with the phase check sensor. If, for some reason the two sources do not fall within the specified limits of the phase check sensor for a period of two minutes, then the control bypasses the phase check sensor, returns to the Programmed Transition sequence of operation, and transfers the load. If this feature is enabled, the programmed transition time delay (TDPT) should be set greater than zero. The actual setting depends on your load.

5.6 Generator Set Exerciser

There are two exercise clock options, A049B864 and 0307-3053. Please refer to the appropriate section for further details on your model: **Section 5.7** for A049B864 and **Section 5.8** for 0307-3053.

5.6.1 General Information

Run the generator for at least 30 minutes once each week with at least 50% load (if possible). If you do not want to use the exerciser, use the Test switch, to test the generator set each week.

The control includes an integrated exerciser that is set by pressing the Set Exercise pushbutton. In addition, there may also be an optional fully programmable external exerciser clock installed and wired to a control input.

If both types of exercisers are available, only one exerciser can operate at a time. The control panel must be configured for the type of exerciser being used. This is done by setting the External Exerciser function ON or OFF.

- If the **integrated exerciser is used**, the External Exercise ON/OFF function must be set to OFF.
- If the **external exerciser is used**, the External Exercise ON/OFF function must be set to ON.
- If the **external exerciser is factory-supplied**, the External Exercise ON/OFF function is set to ON at the factory.
- If the **external exerciser is not factory installed**, the External Exercise ON/OFF function is set to OFF.

5.6.2 Exercise with or without Load

The exercise with/without load configuration works with both types of exercisers (default = without load) - see **Section 5.11**. When "With Load" is selected, the load is transferred to the generator set. When "Without Load" is selected, the generator set runs with no load for the duration of the exercise period.

5.6.3 Integrated Exerciser

This function is standard and is built into the control. With this exerciser, the exercise period is 20 minutes and it repeats every 7, 14, 21, or 28 days (default = 7 days) - see **Section 5.11**.

The integrated exercise function cannot be used unless the External Exercise function is disabled (set to Off).

Before an exercise can begin, the transfer switch must be connected to utility power and utility power must be available (the green Utility Power Available LED must be lit).

5.6.4 Power Loss Backup

If DC power is removed from the control panel, the exercise clock uses a replaceable lithium battery (part number 416-1250) to back up the time setting. The battery is good for ten years and doesn't need to be serviced. The battery is attached to the time chip on the control board.

If no exercise period is set, the Exercise LED is off (see **Figure 12**).

5.6.4.1 Setting the Integrated Exercise Period

1. Verify that the Exercise LED is off and the External Exercise function is disabled (set to Off - see **Section 5.11**). If the External Exercise function is enabled, the integral exerciser is disabled.
2. To set the exercise start time for a **repeat exercise period**, press and hold the Set Exercise pushbutton for 5 seconds. The Exercise LED flashes at a rate of twice per second for 5 seconds and then stays on when the exercise period is set. A delayed 20 minute exercise period will start in 12 hours. At that time, the Exercise LED flashes at a rate of once per second during the entire exercise period. When the exercise period is over, the Exercise LED quits flashing and remains on to signify that repeat exercise periods are enabled.
3. To start an **immediate exercise period** and have it repeat, momentarily press the Set Exercise pushbutton a second time within ten seconds of starting the delayed exercise period. Momentarily pressing and releasing the Set Exercise pushbutton a second time starts an immediate 20 minute exercise period instead of waiting for 12 hours. The Exercise LED flashes at a rate of once per second during the entire exercise period. When the exercise period is over, the Exercise LED stops flashing and remains on to signify that repeat exercise periods are enabled.

5.6.4.2 Cancelling Repeat Exercise Periods

With the control panel Exercise LED on steady, press and hold the Set Exercise pushbutton for 5 seconds. The Exercise LED flashes at a rate of twice per second for 5 seconds and then goes out to signify that repeat exercise periods are cancelled.

5.6.4.3 Cancelling an Active Exercise Period

Active exercise periods can be canceled by pressing the Override pushbutton on the control panel or by grounding the remote override input (P4-2) on the back of the control panel.

5.6.4.4 Power Source Failure During an Active Exercise Period

If either power source fails during an active exercise period, the control immediately terminates the exercise and proceeds with the automatic mode of operation.

5.6.4.5 Exercise without Load Sequence of Events

1. When an exercise period becomes active, the Exerciser LED flashes at a rate of once per second.
2. The control signals the generator set to start and run for 20 minutes.
3. After the exercise period has ended, the control signals the generator set to stop.

4. The Exercise LED stops flashing and remains on to signify that repeat exercise periods are set (unless there are no repeat exercise periods). If there are no repeat exercise periods, the Exercise LED goes out.

5.6.4.6 Exercise with Load Sequence of Events

1. When an exercise period becomes active, the Exerciser LED flashes at a rate of once per second.
2. The control signals the generator set to start.
3. When the generator set output is acceptable, the control transfers the load to the generator set, following the configuration set points.
4. After the exercise period has ended, the control retransfers the load back to the utility, following the configured set points.
5. Once the load is connected to utility power, the control runs the generator set unload for the duration of the cooldown timer (TDEC).
6. After the TDEC timer expires, the control signals the generator set to stop.
7. Unless the repeat exercise periods have been canceled, the Exercise LED quits flashing and remains on to signify that repeat exercise periods are set. If the exerciser is not set up to repeat exercises, the Exercise LED goes out.

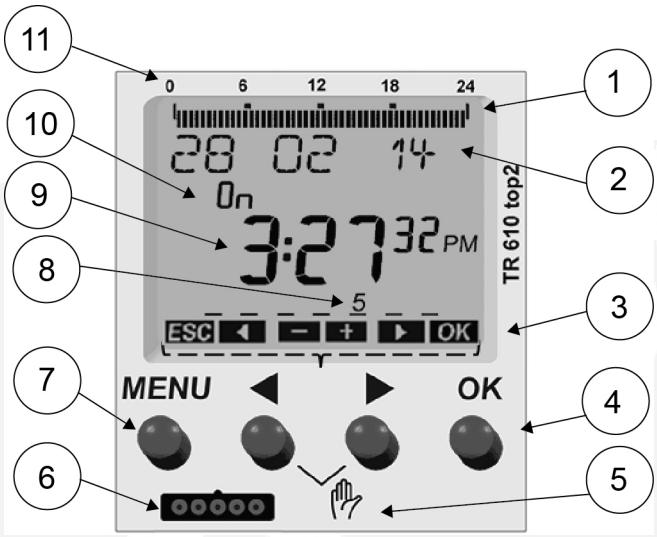
5.7 External Exercise Clock Option [TR 610 top2]

The optional external exercise clock includes a real-time clock that keeps track of the time and date. The 7-DAY exercise clock can be set for automatic changeover for summer/winter (daylight savings/standard) time. The exercise clock can be used with 120V AC, 230-240V AC or 12-24 V AC or DC +10%/-15% operation.

Up to 56 programs are available to set exercise start and stop times. One program is required to start an exercise period and a second one is required to stop an exercise period.

The exercise clock has a built-in test feature that can be used to initiate an exercise that has not been programmed or cancel a programmed exercise in process.

NOTICE
The clock includes a non-replaceable lithium battery with a life expectancy of at least ten years power reserved is reduced with memory card inserted (in battery mode). If the clock battery is weak during a power failure, the clock will need to be replaced.



No.	Description
1	Indicators of when exercises are scheduled for the current DAY.
2	DATE (DAY, MONTH and YEAR)
3	Dynamic display of the push button
4	OK button Used to confirm selection
5	-/+ push buttons Used to increase/decrease values, to scroll through menus and to select special functions.
6	Obelisk Top2 Memory card slot
7	Menu selection push button Used to select one of four display modes or to abort adjusting parameters
8	DAY of week indicator (1 = Monday, 7 = Sunday)
9	Time of DAY
10	Exercise state indicator (On/Off)
11	Time of DAY indicators

FIGURE 26. EXTERNAL EXERCISE CLOCK

5.7.1 Initial Start-Up

When the time switch is removed from the packaging all important settings have already been made. Individual settings can be performed by selecting and confirming.

1. The national language is being displayed, use the - or + push buttons to scroll through the available languages (English, Espanol, Francais, Portuguese, Italiano, or Deutsch).

2. When the desired language is displayed, press the OK push button. The FORM DATE is displayed.

3. Press OK push button to display the DATE formats.

4. Press - or + push buttons to select the desired date format, then press the OK push button. The YEAR is displayed.

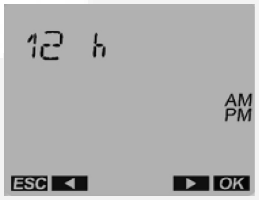
NOTICE
By pressing the ESC push button, i.e. the menu button, it is possible to return to the previous setting menu. For example, if the user had made a mistake and pressed the OK button too quickly, the menu button enables returning to the previous selection item.

5. Press the - or + push buttons until the correct year is displayed and then press the OK push button. The MONTH is displayed.

6. Press the - or + push buttons until the correct month is displayed and then press the OK button. The screen then shows the DAY value flashing.

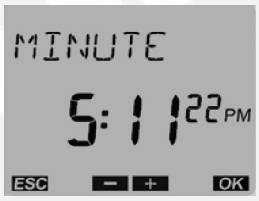
7. Press the - or + push buttons until the correct DAY is displayed and then press the OK push button. The screen then shows the FORM TIME menu.

8. Press the OK push button. Press - or + to select the desired Time Format.

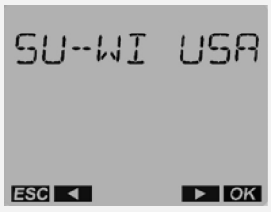


9. Press the OK push button when the desired Time format is displayed. The screen then shows the HOUR value flashing.

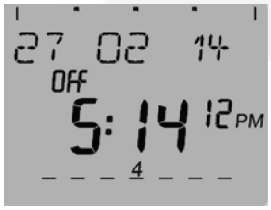
10. Press the - or + push buttons until the correct HOUR is displayed. Press the OK push button. The screen then shows the MINUTE value flashing.



11. Press the - or + push buttons until the correct minute is displayed. Press the OK push button. The screen then shows the automatic summer/winter (SU--WI USA) time changeover flashing.



12. Press the - or + push buttons until the correct summer/winter time changeover is displayed. Press the OK push button. The time switch is now in auto mode and screen displays the correct date and time.



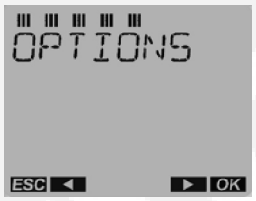
5.7.2 LCD Lighting (Display Back Light)

The LCD light (Display Back Light) can be set to "Always On" or "Off After 1 Minute."

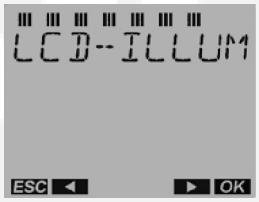
- ALWAYS ON = background lighting is never switched off
- OFF AFTER 1 MINUTE = background lighting is switched off again 1 minute after the last time the button was pressed

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed.

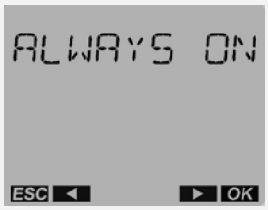
2. Press the + push button three times. The OPTIONS menu is displayed.



3. Press the OK push button, then press the + push button until the LCD ILLUMINATION menu appears.



4. Press the OK push button to display the ALWAYS ON menu.



NOTICE
With OK push button a return is made to LCD ILLUMINATION.

5. Press the - push button to display the "AFTER 1 MINUTE OFF" menu.

6. Press the OK push button to return to LCD Illumination menu. And then press the Menu button twice to return to the Home menu.

NOTICE
In the battery mode (no mains) there is no LCD lighting.

5.7.3 Using the Menu Buttons

The Menu selection button is used to select four display modes that have adjustable menus.

- **Time/DATE mode** is used to set the correct DATE and time. This mode can also be used to automatically switch to the correct summer/winter time.
- **Program mode** is used to set, review and clear exercise start/stop times.
- **Options mode** is used to enter a 4-digit code to prevent changing settings by unauthorized personnel. This mode can also be used to switch On/Off LCD-Illumination (Display Back Light).

When adjustments are completed, the Home menu (Auto mode) is redisplayed. The Menu button can also be used to abort adjusting parameters and return to the Home menu.

5.7.4 Using the -/+ Push Buttons

Pressing the - or + push buttons are used to:

- Increase or decrease a parameter in an adjustable menu
- Select the next or previous menu

Simultaneously pressing the - and + push buttons is used to select special functions.

- Activate manual switching
- Activate permanent switching
- cancelling manual/permanent switching

5.7.5 Using the OK Push Button

The OK push button is used to confirm the menu selection or program adjustments you have made. Upon pressing the OK push button, the next available menu is displayed and if any program adjustments were made, the changes are saved.

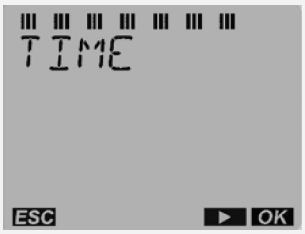
5.7.6 Setting the Time, Date with Summer/Winter Time (Daylight Savings Time)

The clock is programmed with the correct date and central USA standard time and with the correct daylight savings time settings. If it is necessary to change these settings, the following describes how to adjust the time and date and how to set the clock to automatically switch to summer/winter time (Daylight savings time).

1. Press the Menu push button on the exercise clock. The PROGRAM menu is displayed.

2. Press the **+** push button. The TIME/DATE menu is displayed.

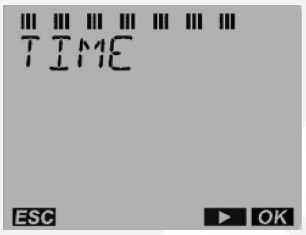
3. Press the OK button to display the TIME menu.



4. Press the OK push button to display the HOUR menu. Hour value will flash.

5. Press the **–** or + push button to set the correct hour. Press the OK push button to display the MINUTE menu. Minute value will flash.

6. Press the **–** or **+** push buttons to set the correct Minute. Press the OK button to display the TIME menu.



7. Press the **+** push button. The SET DATE menu is displayed.

8. Press the OK push button to display the YEAR menu. Year value will flash.

9. Press the **-** or **+** push buttons to set the correct year. Press the OK push button to display the MONTH menu. Month value will flash.

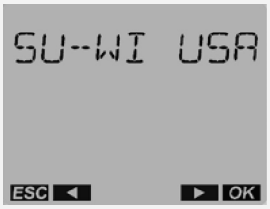
10. Press the **-** or **+** push buttons to set the correct Month. Press the OK push button to display the DAY menu. Day value will flash.

11. Press the **-** or **+** push buttons to set the correct day. Press the OK push button to display the SET DATE menu.

12. Press the + push button. The Summer/Winter (SU--WI) menu is displayed.

13. Press the OK push button to display the World Area menu.

    It is possible to choose between 6 pre-set changeover settings, use own changeover settings with 2 different methods, or switch off the automatic summer/winter time changeover using **-** or **+** push buttons. Country value will flash.

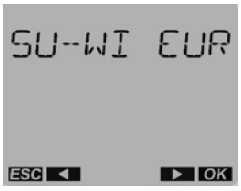


14. Press - or + push buttons to select one of the world areas that has been programmed for automatic time correction or else set up your own changeover times. Then press the OK push button to activate and return to SU-WI menu.

NOTICE

With the Daylight Savings Time Program set for North America:

- **The first Sunday in April moves the time forward 1 hour**
- **The last Sunday in October moves the time back 1 hour**
- **If you wish to select one of the world areas (GB/IRL/P, FIN/GR/TR, CDN, USA, IRAN, EUROPE) that has been programmed for automatic time correction, press the + or - push buttons until the correct world area is selected. Then press the OK button to activate and return to SU-WI menu.**

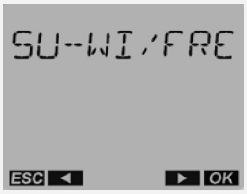


If you do not wish to set the clock for automatic Summer/Winter changeover, press the - or + push buttons. "No SU/WI" is displayed on the screen. Press the OK button to return to the SU-WI menu. SU value will flash.

TABLE 6. COUNTRY CODES AND NAMES

Code	Country Name
GB	Great Britain
IRL	Ireland
FIN	Finland
GR	Greece
TR	Turkey
CDN	Canada
USA	United States of America
IRAN	Iran
EUROPE	Europe

15. Press the - or + push buttons to display SU-WI FREE RULE, and press the OK push button to set up your own changeover times.



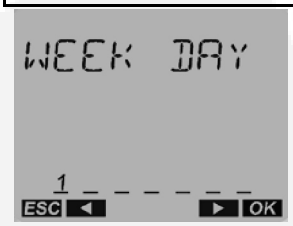
16. Press the OK push button to display the menu for setting the month when the summer changeover will take place. Press the **-** or **+** push buttons until the desired MONTH is displayed. The month value will flash.

17. Press the OK push button to display the menu for setting the week when the summer changeover will take place. Press the **-** or **+** push buttons until the desired week (1 to 5 [1 = first week, 4 = fourth week, 5 = last week]) is displayed. The week value will flash.

18. Press the OK push button to display the menu for setting the day of the week when the summer changeover will take place. Press the - or + push buttons until the desired week day (1 to 7 [1 = Monday, 7 = Sunday]) is displayed. The word "DAY" and number in lower left corner will flash.

TABLE 7. DAYS OF THE WEEK

Number	Day of the Week
1	**Monday**
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday
7	Sunday



19. Press the OK push button to display the menu for setting the hour of the day when the summer changeover will take place. Press the **-** or **+** push buttons until the desired hour is displayed. The hour value will flash.

NOTICE
The starting time can be set for 1.00 to 22.00 for 24h format and 1.00 to 12.00 for 12h format.

20. Press the Ok push button to display the menu for setting the month when the winter changeover will take place. Press the - or + push buttons until the desired month is displayed. Month value will flash.

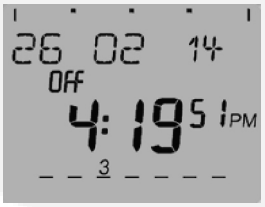
21. Press the OK push button to display the menu for setting the week when the winter changeover will take place. Press the - or + push buttons until the desired week (1 to 5 [1 = first week, 4 = fourth week, 5 = last week]) is displayed.

TABLE 8. WEEK TABLE

Number	Week
1	**First Week**
2	Second Week
3	Third Week
4	Fourth Week
5	Last Week

NOTICE
The starting time of the winter changeover is the same time that was set previously.

22. Press the OK push button followed by the Menu button twice. The Home menu is displayed.



5.7.7 Setting Exercise Start and Stop Times

Up to 56 programs can be used to set exercise start and stop times. One program is required to start an exercise period and a second one is required to stop an exercise period.

NOTICE

If the Menu button is pressed before a start/stop program is saved, “ABORT" is displayed on the screen. The program settings are lost and the new menu is displayed after two seconds or by pressing the OK button.

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed.

2. Press the OK button. The NEW Program menu is displayed.

3. Press the OK push button. A brief fade-in now occurs which is only for the programming of the free memory locations. The number of available programmable time periods (maximum of 56) is temporarily displayed.

   This fade-in can be prematurely ended by pressing the OK push button.

4. With the arrow push buttons **-** and **+** select the channel status "ON" followed by confirmation using the OK push button. The ON in the upper left corner will flash.

5. With the arrow push buttons - and +, set the HOUR for the switch-on (12:00 AM) and confirm with the OK push button. The hour value will flash.

6. With the arrow push buttons **-** and **+**, set the MINUTES for the switch-on (00 minutes) and confirm with the OK push button. The minute value will flash.

7. With the arrow push buttons **-** and **+**, select the first weekday for the switching time (Monday = DAY1) followed by confirmation with the OK push button. MONDAY and the number value in the lower left will flash.

8. In order to copy the switching time to other weekdays confirm the COPY with the OK push button

NOTICE
With the push buttons - and +, it is possible to change to SAVE if the switching time is only to be performed on this weekday. After pressing OK, the switching time would be saved "individually" and a return to NEW would be made.

9. To repeat an exercise more than once a week, press the OK push button when the Copy menu is displayed. The ADD ___ DAY menu is displayed. The day after the day selected in Step 7 is displayed.

10. Press the - or + push buttons to select the desired day of the week the exercise is to begin. Press the OK button.

11. After the weekday Sunday, SAVE is offered again. SAVE will flash. The switch-on timing of Monday at 12:00 AM has now been copied from Sunday. Confirm the programming by pressing the OK Push button.

12. The NEW Program menu is redisplayed. The switch-off time still has to be entered. Press OK push button.

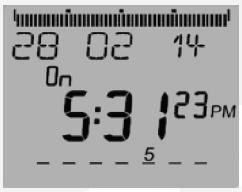
13. Press the OK push button. A brief fade-in now occurs which is only for the programming of the free memory locations. The number of available programmable time periods (maximum of 55) is temporarily displayed. This fade-in can be prematurely ended by pressing the OK push button.

14. Instead of a switch-on (ON) the push buttons **-** and **+** must be selected for a switch-off (OFF) and confirm using the OK push button.

15. Repeat steps 5 through 11 to set up the stop time for the exercise.
16. Press the menu button twice to return to the HOME menu

NOTICE

If there are any exercises scheduled for the current day, those time periods are indicated on the screen in the upper right.



5.7.8 Checking the Programs

The Check Program menus are used to review all set exercise start/stop times and, if necessary, delete them.

NOTICE

If the Menu button is pressed while viewing start/stop programs, the program check function is aborted and the Home menu is redisplayed.

5.7.8.1 Reviewing Exercise Start/Stop Times

All exercise start and stop exercise parameters can be viewed from the Program Check menu. Normally, the starting time is followed by the ending time for a programmed exercise. However, if a second exercise period overlaps the time frame of the first exercise period in the current day, two start times are displayed, followed by two stop times.

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed.

2. Press the OK push button. The NEW Program menu is displayed.

3. Press the **+** push button once. The CHECK menu is displayed.

4. Press the OK push button. Now all programmed switching times are displayed classified on the time bar according to the time sequence starting with the first weekday (e.g. MONDAY). The number in the lower left corner will flash.

NOTICE
If no exercise periods are set up, the message “EMPTY" is displayed. To return to the NEW Program menu, press the OK push button.

5. Review additional set exercise periods and return to the Main menu. To exit the Check Programs function without reviewing all set exercise periods, press the - or + push buttons until "END" is displayed. Press the OK button followed by the menu button twice to return to the Main menu.

5.7.8.2 Modifying Exercise Start/Stop Times

It is possible to change exercise start/stop times using the PROGRAM menu MODIFY.

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed

2. Press the OK push button. Press + push button twice to display the MODIFY menu.

3. Press the OK push button. Now all programmed switching times are displayed classified on the time bar according to the time sequence starting with the first weekday (e.g. MONDAY). The number in the lower left will flash.

4. Press the OK push button to modify the Monday switch-on time. The MODIFY HOUR menu is displayed. The hour value will flash.

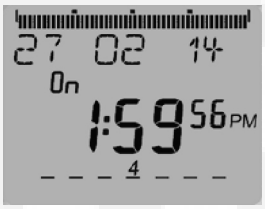
5. Press - and + push buttons to modify the hour. Press the OK push button to display the MODIFY MINUTE menu. The minute value will flash.

6. Press - and + push buttons to modify the minutes. Press the OK push button to display the MODIFY BLOCK menu. The numbers at the bottom of the screen will flash.

7. Press the + push button to modify the switch-on time day (MONDAY). The number in the lower left will flash.

8. Press the OK push button to return to the MODIFY menu.

9. Press the + push button until the "END" is displayed. Press the OK button or the Menu (ESC) push button to exit the menu.



5.7.8.3 Deleting Exercise Start/Stop Times

We can delete individual start and stop times.

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed.

2. Press the OK push button. Press **+** push button 3 times. The DELETE menu is displayed.

3. Press the OK push button. The SINGLE menu is displayed.

NOTICE

In the DELETE submenu it is also possible to select what is to be deleted. In addition to deleting the switching times, it is also possible to select the menu item DELETE ALL using the + push button. Here it is possible to jointly delete all saved switching commands for the selected channel.

4. Press the OK push button. The first switching time saved for the first weekday is displayed.

5. Press the OK push button to display the DELETE BLOCK menu. The entire switching time block (switch on at 9:00 AM from Monday to Sunday) can be deleted. The numbers at the bottom will flash.

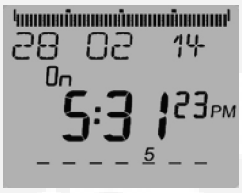
6. Press the + push button to remove MONDAY specifically from the block and delete it. The number in the lower part of the screen will flash.

7. Press the OK push button. The confirmation of the delete procedure is displayed briefly followed by an automatic return to the DELETE menu.

8. Press the OK push button to delete the other switching times.

9. Press the + push button until "END" is displayed.

10. Press the OK push button or the MENU (ESC) push button to exit the menu.



5.7.9 Initiating or Overriding an Exercise Program

The exercise clock has a built-in test feature that can be used to initiate an exercise that hasn't been programmed or cancel a programmed exercise in progress.

The control panel Load/No Load function can be set to test the generator set with or without the load as desired.

5.7.9.1 Initiating an Exercise

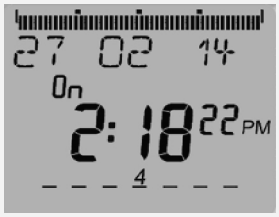
In the example shown below, “Off" indicates that no exercise is currently active.

1. With the Home menu displayed, simultaneously press the **-** and **+** buttons for approximately one second. “OVERRIDE" and a hand symbol are displayed on the screen. In addition, “Off" is switched to “On" to indicate the exercise is initiated.

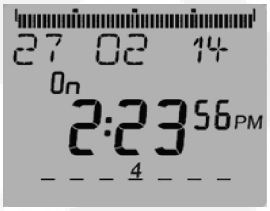
2. To end the exercise, simultaneously press the **-** and **+** buttons for approximately one second. The original Home menu is redisplayed and “On" is switched back to “Off."

5.7.9.2 Overriding an Exercise

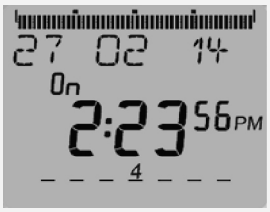
In the example shown below, “On" indicates that an exercise is currently active.



1. With the Home menu displayed, simultaneously press the **-** and **+** buttons for approximately one second. “OVERRIDE" and a hand symbol are displayed on the screen. In addition, “On" is switched to “Off" to indicate the exercise is stopped.



2. To restart the exercise, simultaneously press the **-** and **+** buttons for approximately one second. The original Home menu is redisplayed and “Off" is switched back to “On."



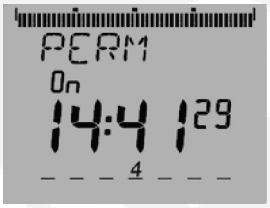
5.7.10 Selecting Permanent On/Off Mode

The exercise clock has a permanent on/off mode feature.

5.7.10.1 Selecting Permanent On/Off Mode Without an Active Exercise

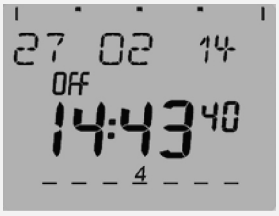
In the example shown below, “Off" indicates that no exercise is currently active.

1. With the Home menu displayed, simultaneously press the - and **+** buttons for approximately three seconds. The OVERRIDE menu is first displayed on the screen followed by “PERM ON" symbol. In addition, a continuous band of segments is displayed on top of the screen and "Off" is switched to "On."



2. To switch to Permanent Off mode, press the **–** and **+** push buttons for approximately three seconds. “PERM OFF" is displayed and “On" is switched back to “Off."

3. To return the clock to its original state, simultaneously press the **–** and **+** buttons for approximately one second. The original Home menu is redisplayed.



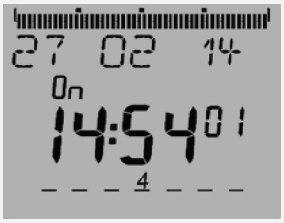
5.7.10.2 Selecting Permanent On/Off Mode With an Active Exercise

In the example shown below, “On" indicates that an exercise is currently active.

1. With the Home menu displayed, simultaneously press the **–** and **+** buttons for approximately three seconds. The Override menu is first displayed on the screen followed by “PERM OFF" symbol is displayed on the screen. In addition, the "On" is switched to "Off."

2. To switch to Permanent On mode, press the **–** and **+**push buttons for approximately three seconds. “PERM ON" is displayed and “Off" is switched back to “On." In addition, a continuous band of segments is displayed on the top of the screen.

3. To return the clock to its original state, simultaneously press the **+ –**and **+** buttons for approximately one second. The original Home menu is redisplayed.



5.7.11 Adding A Security Code

A 4-digit security code number can be entered to prevent unauthorized personnel from using the clock.

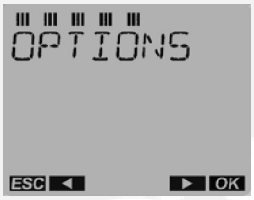
Once a security code has been set up, the exercise clock is locked 75 seconds after the last keystroke. It can only be operated again after the correct PIN code is entered.

⚠ CAUTION

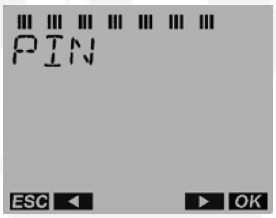
Once a PIN code has been activated and the Reset button is pressed (see Resetting the Timer), the exercise timer can no longer be activated without a valid PIN code.

1. From the Home menu, press the Menu button. The PROGRAM menu is displayed.

2. Press the **+** button 3 times. The OPTIONS menu is displayed.



3. Press the OK push button, then press the **+** push button until the PIN menu appears.



NOTICE

If the – or + button is pressed now, the message “END" is displayed. Press the OK push button to return to the Home menu.

4. Press the OK button to display the NO PIN menu. NO PIN will flash.

NOTICE

If NO PIN is selected and confirmed with the OK push button, a return is made to PIN

5. Press the **–** or **+** button to display the With PIN menu. WITH PIN will flash.

6. Press the OK push button to display the CURRENT PIN (here 0000). Continue with the OK push button.

7. The NEW PIN appears on the display. The first number will flash.

8. Press the **-** or **+** buttons to enter the first digit of the PIN code and confirm with the OK push button.
9. After this, the second, third and fourth number of the PIN code is stipulated. As soon as the fourth number has been confirmed with the OK push button a return is made to the auto mode.

Important Note: The PIN number is immediately valid and the time switch is locked by it.

Additional Information: "Super PIN"

- In time switch a super PIN code is stored individually for each device with which the time switch can be unlocked in spite of a set PIN. This super PIN specific to each device ensures that the time switch can be unlocked again if the PIN code has been forgotten.
- The super PIN code is calculated from a special algorithm from the time switch device serial number. This serial number, specific to each device, can be seen on the right-hand side of the housing.
- The super PIN software with the special algorithm is available from Theben AG.

  If required please contact the Theben hotline.

5.7.12 After Programming the Exercise Clock

1. Make sure the external exercise function on the transfer switch operator panel is set to On.
2. Place the generator set operation selector switch in the Remote position.
3. Check the system for proper operation as described in the Operator's Manual.

5.7.13 Resetting the Timer

The Reset button should only be used in cases of an emergency. Reset is achieved by pressing all 4 push buttons at the same time. By resetting, all configuration settings (time format, 24 Hour or AM/PM, etc.) are maintained. Date and time are however deleted. The selection "Keep program" or "Delete program" is available. "Delete program" must be confirmed separately. With "Delete program" all switching commands and the holiday program are deleted.

5.8 Optional External Exerciser

The optional external exercise clock is a 7-day, 24-hour clock that, when installed, can store and execute several start/stop programs per day and repeat exercise periods every week. It can be programmed to run exercise periods at different times on different days. Unlike the integrated exerciser, the external exercise can schedule an exercise period for something other than 20 minutes.

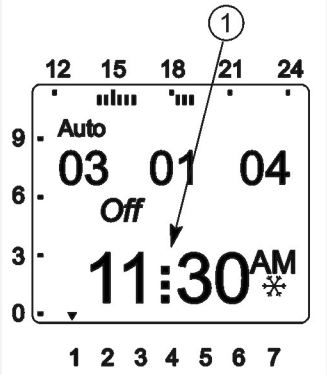
If the External Exercise function is enabled (set to On), then the integrated exerciser is disabled.

NOTICE
After a period of inactivity, the clock enters sleep mode and turns off the display. To re-activate the display, briefly press the Menu button.

Up to 28 programs are available to set exercise start and stop times. One program is required to start an exercise period and a second one is required to stop an exercise period.

The exerciser clock also has a built-in test feature that can be used to initiate a genset start and run cycle.

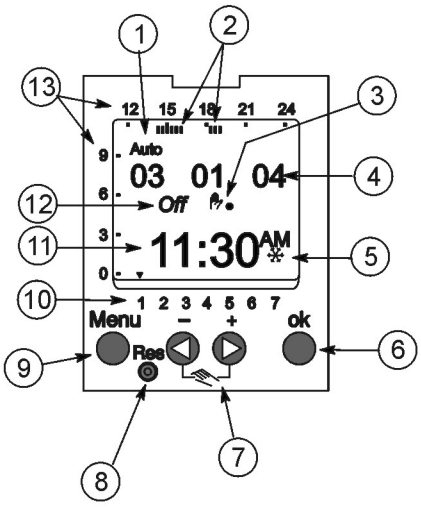
The exerciser clock contains a lithium battery that is used as a backup power source. The battery is not replaceable. When the clock is running off the internal battery, three flashing dots are displayed between the hour and minute values (see Figure 27). Unless the clock battery fails, exercise programs are stored and are not lost during a power outage.



Number	Description
1	Flashes

FIGURE 27. INDICATOR OF CLOCK RUNNING OFF THE INTERNAL BATTERY

Figure 28 illustrates the face of the exercise clock and provides information on the display and the function of the buttons.



Number	Description	Number	Description
1	Display Mode (Auto, Prog, Clock, or Man)	8	Reset Button - Used only in case of emergencies to delete individual settings, see Section 5.9.7
2	Indicators of when Exercises are Scheduled for the Current Day	9	Menu Selection Button - Used to select one of four display modes or to abort adjusting parameters
3	Special Function Indicators Override ON/OFF (Hand) Permanent ON/OFF (Hand and Dot) (shown)	10	Day of Week Indicator (1 - Monday, 7 - Sunday)
4	Date (Month, Day, and Year)	11	Time of Day
5	Summer/Winter Changeover Indicator Summer (sun indicator) Winter (snow flake) (shown)	12	Exercise State Indicator (On/Off)
6	ok Button - Used to confirm selection	13	Time of Day Indicators
7	+/- Buttons - Used to increase/decrease values, to scroll through menus, and to select special functions		

FIGURE 28. EXERCISE CLOCK FEATURES

5.8.1 Exercise with or without Load

The external exercise clock does not include an exercise with or without load function. This function must be configured using the transfer switch control panel. For more information, see Section 5.11.

5.8.2 Using the Menu Button

The Menu selection button is used to select three display modes that have adjustable menus.

- The Clock mode (clock) is used to set the correct date and time. This mode can also be used to automatically switch to the correct summer/winter time. See .

- The Program mode (Prog) is used to set (see **Section 5.8.6**), review (see **Section 5.9.1**), and clear exercise start/stop times (see **Section 5.9.2.1** and **Section 5.9.2.2**).
- The Manual mode (Man) is used to enter a 4-digit code to prevent changing settings by unauthorized personnel (See **Section 5.9.5**).

When adjustments are completed, the Home menu (Auto mode) is redisplayed (see **Figure 28**). The Menu button can also be used to abort adjusting parameters and return to the Home menu.

5.8.3 Using the +/- Buttons

Pressing the + or - button is used to:

- Increase or decrease a parameter in an adjustable menu
- Select the next or previous menu.

Simultaneously pressing the + and - buttons is used to select special functions.

- Initiate an exercise (see **Section 5.9.3.1**)
- Override an active exercise (see **Section 5.9.3.2**)
- Select permanent On/Off mode (see **Section 5.9.4**)

5.8.4 Using the ok Button

The **ok** button is used to confirm the menu selection or program adjustments that have been made. Upon pressing the **ok** button, the next available menu is displayed and, if any program adjustments were made, the changes are saved.

5.8.5 Setting the Clock with Summer/Winter Time (Daylight Savings Time)

The clock is programmed with the correct date and central USA standard time and with the correct daylight savings time settings. If it is necessary to change these settings, the following describes how to adjust the time and date and how to set the clock to automatically switch to summer/winter time (daylight savings time).

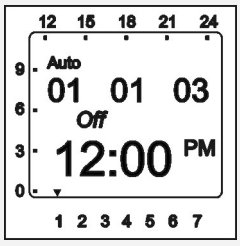
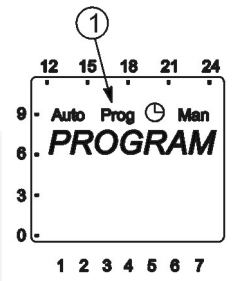


FIGURE 29.

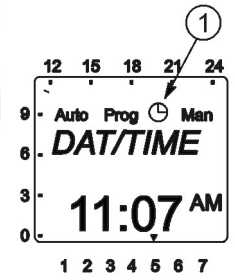
1. Press the Menu button on the exercise clock. The Program menu is displayed.



Number	Description
1	Flashes

FIGURE 30.

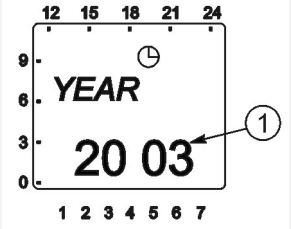
2. Press the **+** button. The Date/Time menu is displayed.



Number	Description
1	Flashes

FIGURE 31.

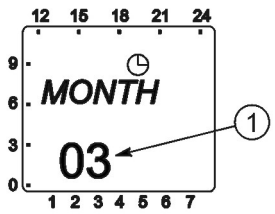
3. Press the **ok** button to display the Year menu.



Number	Description
1	Flashes

FIGURE 32.

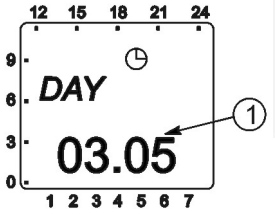
4. Press the **+** or **−** button to set the correct year. Press the **ok** button to display the Month menu.



Number	Description
1	Flashes

FIGURE 33.

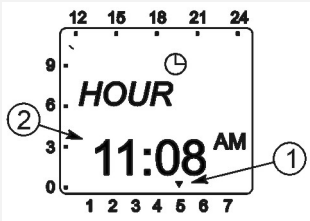
5. Press the **+** or **−** button to set the correct month. Press the **ok** button to display the Day menu.



Number	Description
1	Flashes

FIGURE 34.

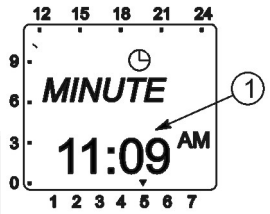
6. Press the + or - button to set the correct day. Press the **ok** button to display the Hour menu. A small triangle is displayed above the assigned number in the display for the day of the week (1 = Monday, 7 = Sunday).



Number	Description
1	Triangle
2	Flashes

FIGURE 35.

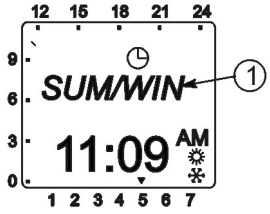
7. Press the + or - button to set the correct hour. A line is displayed on the screen indicating the hour of the day selected (the left side of the screen is for the first half of the day [AM] and the top of the screen is for the second half of the day [PM]). Press the **ok** button to display the Minute menu.



Number	Description
1	Flashes

FIGURE 36.

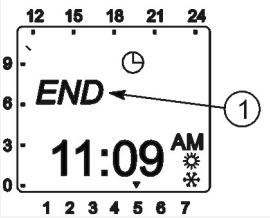
8. Press the **+** or **−** button to set the correct minute. Press the **ok** button to display the Summer/Winter menu.



Number	Description
1	Flashes

FIGURE 37.

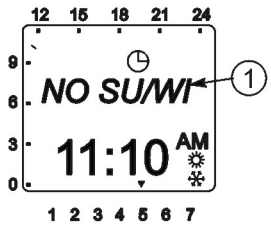
NOTICE
If you do not wish to set the clock for automatic summer/winter changeover at this time, press the + or - button. "End" is displayed on the screen. Press the ok button to return to the Home menu.



Number	Description
1	Flashes

FIGURE 38.

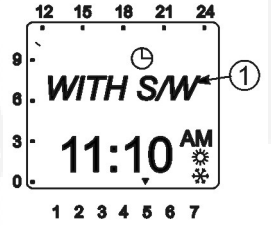
9. Press the **ok** button to display the No Summer/Winter menu.



Number	Description
1	Flashes

FIGURE 39.

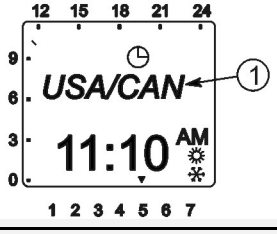
10. Press the + or - button to display the With Summer/Winter menu.



Number	Description
1	Flashes

FIGURE 40.

11. Press the **ok** button to display the World Area menu.



Number	Description
1	Flashes

FIGURE 41.

12. Either select one of the world areas that has been programmed for automatic time correction or else set up your own changeover times.

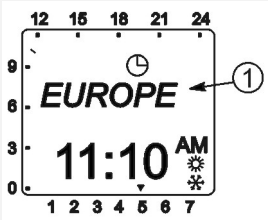
NOTICE

With the Daylight Savings Time program set for North America,

- **The second Sunday in March moves the time forward one hour**
- **The first Sunday in November moves the time back one hour**

NOTICE

- To select one of the world areas (Europe, GP/P, SF/GR/TR, USA/CAN) that has been programmed for automatic time correction, press the + or - buttons until the correct world area is selected. Go to step 19.

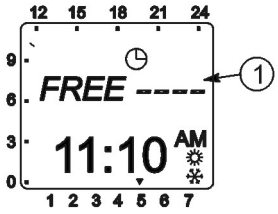


Number	Description
1	Flashes

FIGURE 42.

- To set up changeover times, continue with step 13.

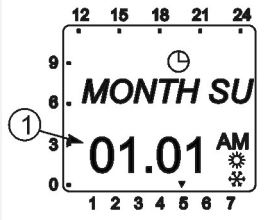
13. To set up individual local changeover times, press the **+** or **−** buttons from the World Area menu until the word “Free” is displayed.



Number	Description
1	Flashes

FIGURE 43.

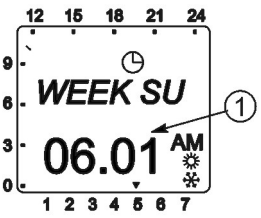
14. Press the **ok** button to display the menu for setting the month when the Summer changeover will take place. Press the **+** or **−** buttons until the desired month is displayed.



Number	Description
1	Flashes

FIGURE 44.

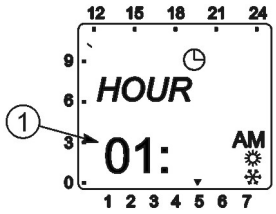
15. Press the **ok** button to display the menu for setting the week when the Summer changeover will take place. Press the **+** or **−** buttons until the desired week (1 thru 5 [1 = first week, 4 = fourth week, 5 = last week]) is displayed.



Number	Description
1	Flashes

FIGURE 45.

16. Press the **ok** button to display the menu for setting the hour of the day when the Summer changeover will take place. Press the **+** or **−** buttons until the desired hour (1 through 3) is displayed.

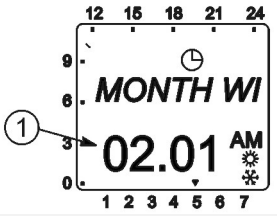


Number	Description
1	Flashes

FIGURE 46.

NOTICE
The starting time can only be set for 1:00 (1.00), 2:00 (2.00), or 3:00 (3.00) AM.

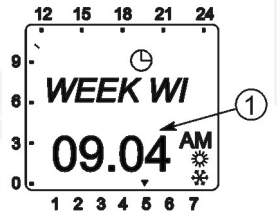
17. Press the **ok** button to display the menu for setting the month when the Winter changeover will take place. Press the **+** or **−** buttons until the desired month is displayed.



Number	Description
1	Flashes

FIGURE 47.

18. Press the **ok** button to display the menu for setting the week when the Winter changeover will take place. Press the **+** or **−** buttons until the desired week (1 through 5 [1 = first week, 4 = fourth week, 5 = last week]) is displayed.

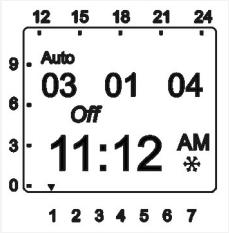


Number	Description
1	Flashes

FIGURE 48.

NOTICE
The starting time for the winter changeover is the same as set in step 16.

19. Press the **ok** button. The Home menu is redisplayed and the appropriate summer/winter symbol is displayed.



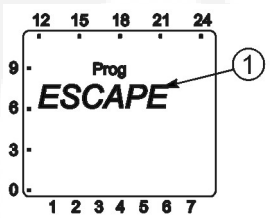
Number	Description
1	Flashes

FIGURE 49.

5.8.6 Exercise Start and Stop Times

Up to 28 programs can be used to set exercise start and stop times. One program is required to start an exercise period and a second one is required to stop an exercise period.

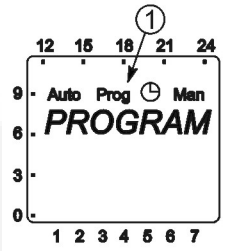
NOTICE
If the Menu button is pressed before a Start/Stop program is saved, the word "ESCAPE" is displayed on the screen. The program settings are lost and the Home menu is displayed after two seconds or by pressing the ok button.



Number	Description
1	Flashes

FIGURE 50.

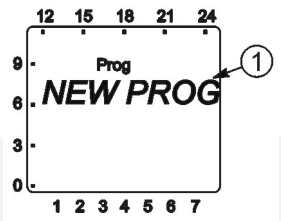
1. From the Home menu, press the **Menu** button. The PROGRAM menu is displayed.



Number	Description
1	Flashes

FIGURE 51.

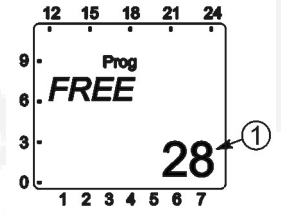
2. Press the **ok** button. The New Program (NEW PROG) menu is displayed.



Number	Description
1	Flashes

FIGURE 52.

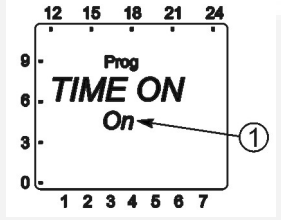
3. Press the **ok** button. The number of available programmable time periods (maximum of 28) is temporarily displayed.



Number	Description
1	Flashes

FIGURE 53.

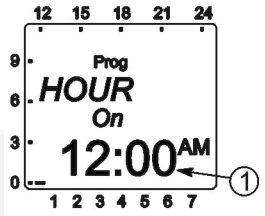
4. The Starting Time (TIME ON) menu is displayed. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 54.

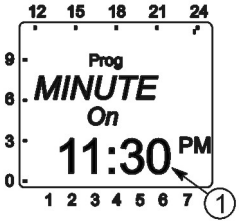
5. The Hour menu is displayed. Press the + or - buttons to set the desired exercise starting hour (default = 12:00 AM). A line is displayed on the screen indicating the hour of the day selected (the left side of the screen is for the first half of the day [AM] and the top of the screen is for the second half of the day [PM]). Press the **ok** button.



Number	Description
1	Flashes

FIGURE 55.

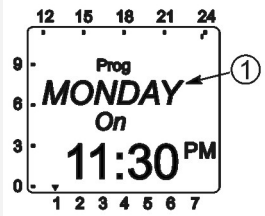
6. The Minute menu is displayed. Press the + or - buttons to set the desired exercise starting minute. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 56.

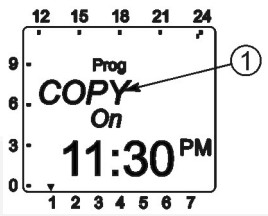
7. A menu is displayed for selecting the day of the week the exercise is to begin (default = MONDAY). Press the + or - buttons to select the desired day of the week. A small triangle is displayed above the assigned number in the display for the day of the week (1 = MONDAY, 7 = SUNDAY). Press the **ok** button.



Number	Description
1	Flashes

FIGURE 57.

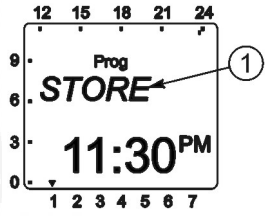
8. The Copy menu is displayed. If you do not wish to have the exercise repeat more than once a week, go to step 9. If you do wish to have the exercise repeat more than once a week, go to step 10.



Number	Description
1	Flashes

FIGURE 58.

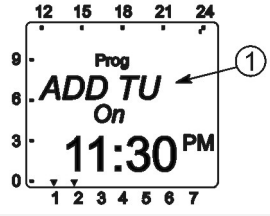
9. Press the + or - buttons. The Store menu is displayed. Press the **ok** button. Go to step 13.



Number	Description
1	Flashes

FIGURE 59.

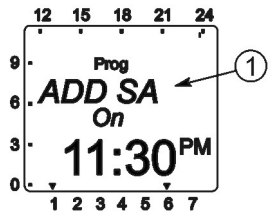
10. To repeat an exercise more than once a week, press the **ok** button when the Copy menu is displayed. The Add ___day menu is displayed. The day after the day selected in step 7 is displayed.



Number	Description
1	Flashes

FIGURE 60.

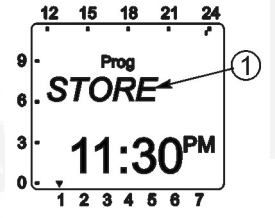
11. Press the + or - buttons to select the desired day of the week that an exercise is to begin. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 61.

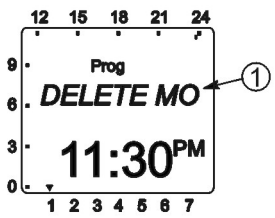
12. Press the + or - buttons. The Store menu is displayed. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 62.

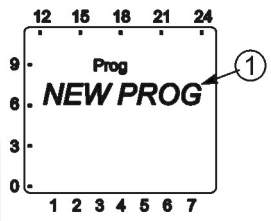
NOTICE
After setting all days of the week that an exercise is to be repeated, you can use the + or - buttons to cycle through the days and recheck the programs. When a day that has a set program is redisplayed, it can be deleted. In the menu shown below, press the ok button to delete the displayed program.



Number	Description
1	Flashes

FIGURE 63.

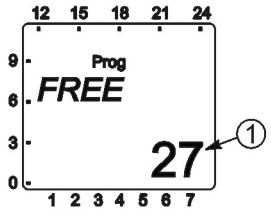
13. The New Program (NEW PROG) menu is redisplayed.



Number	Description
1	Flashes

FIGURE 64.

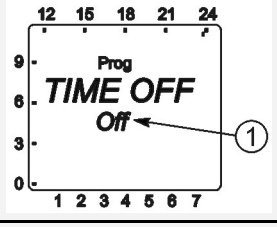
14. Press the **ok** button to enter a time the exercise is to end. The number of available programmable time periods is temporarily displayed. Please note that the number of available programmable time periods has now decreased by one.



Number	Description
1	Number of Available Programmable Time Periods

FIGURE 65.

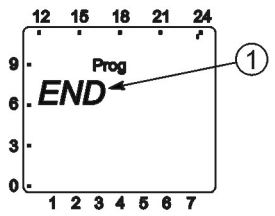
15. The Ending Time (TIME OFF) menu is displayed. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 66.

16. Repeat steps 5 through 13 to set the stop time for your exercise.
17. When the New Program (NEW PROG) menu is redisplayed, press the + or - buttons until "End" is displayed.

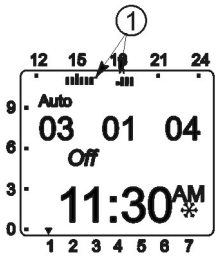


Number	Description
1	Flashes

FIGURE 67.

18. Press the **ok** button to return to the Home menu.

NOTICE
If there are any exercises scheduled for the current day, those time periods are indicated on the screen.



Number	Description
1	SCHEDULED EXERCISES

FIGURE 68.

5.9 Checking the Programs

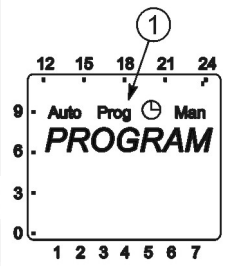
The Check Program menus can be use to review all set exercise start/stop times and, if necessary, delete them.

NOTICE
If the Menu button is pressed while viewing start/stop programs, the Program Check function is aborted and the Home menu is redisplayed.

5.9.1 Reviewing Exercise Start/Stop Times

All exercise start and stop exercise parameters can be viewed from the Program Check menu. Normally, the starting time is followed by the ending time for a programmed exercise. However, if a second exercise period overlaps the time frame of the first exercise period in the current day, two start times are displayed, followed by two stop times.

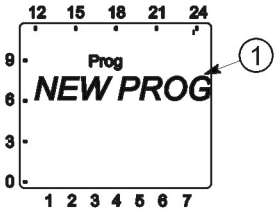
1. From the Home menu, press the **Menu** button. The PROGRAM menu is displayed.



Number	Description
1	Flashes

FIGURE 69.

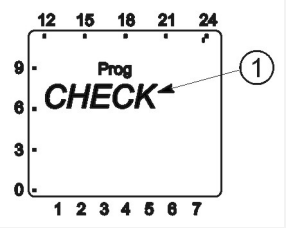
2. Press the **ok** button. The New Program (NEW PROG) menu is displayed.



Number	Description
1	Flashes

FIGURE 70.

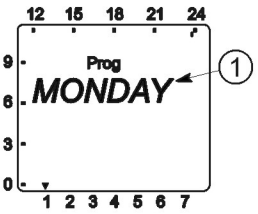
3. Press the **+** button once. The CHECK menu is displayed.



Number	Description
1	Flashes

FIGURE 71.

4. Press the **ok** button. The MONDAY menu is displayed.



Number	Description
1	Flashes

FIGURE 72.

NOTICE
If no exercise periods are set up, the message "EMPTY" is displayed. To return to the New Program menu, press the ok button.

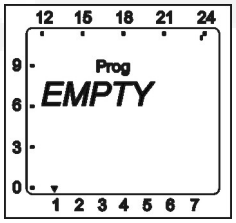
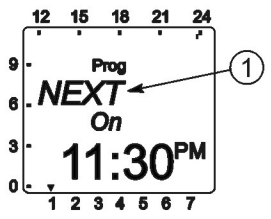


FIGURE 73.

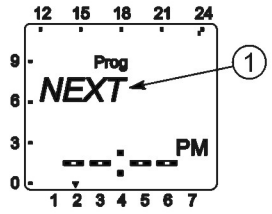
5. Use the + or - buttons to select the day of the week you wish to check. Press the **ok** button. The starting time for the first exercise for the selected day is displayed.



Number	Description
1	Flashes

FIGURE 74.

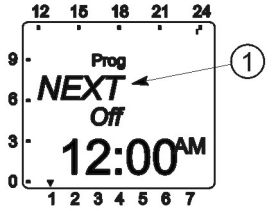
NOTICE
If a day does not have any set exercise periods, the screen below is displayed.



Number	Description
1	Flashes

FIGURE 75.

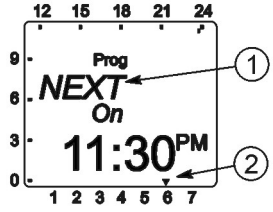
6. Press the **ok** button. The ending time for the first exercise for the selected day is displayed.



Number	Description
1	Flashes

FIGURE 76.

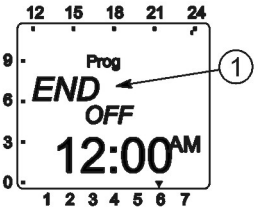
7. Press the **ok** button. The next exercise start time is displayed. If the next start time is not on the day selected in step 5, the day of the week is indicated on the bottom of the screen.



Number	Description
1	Flashes
2	Indicates that an Exercise is Set for Saturday

FIGURE 77.

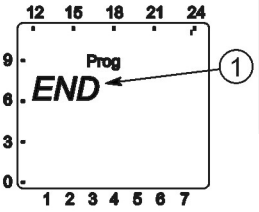
8. Review additional set exercise periods and return to the Main menu.
    - To exit the Check Programs function without reviewing all set exercise periods, press the + or - buttons until "END" is displayed. Press the **ok** button to return to the Main menu.



Number	Description
1	Flashes

FIGURE 78.

- To review all set exercise periods, repeat steps 6 and 7 until the word "END" is displayed. Press the **ok** button to return to the Main menu.

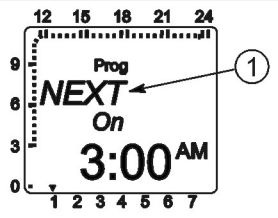


Number	Description
1	Flashes

FIGURE 79.

NOTICE

If an exercise period has been programmed with a start time only, a continuous band of segments is displayed on the left side and top of the screen showing the time of day the incomplete exercise period is set to begin. This band of segments is also displayed on any other exercise periods scheduled for that day.



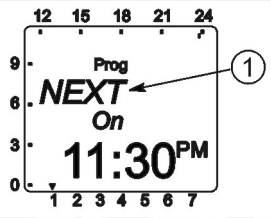
Number	Description
1	Flashes

FIGURE 80.

- If an exercise period has been programmed with a stop time only, no special indicator is displayed. The stop time is simply ignored.

5.9.2 Deleting Exercise Start/Stop Times

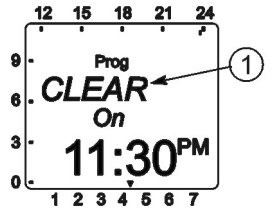
While checking the programs, you can also delete individual start and stop times.



Number	Description
1	Flashes

FIGURE 81.

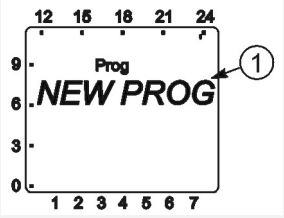
1. When a programmed exercise start time is displayed, press the + or - buttons until "CLEAR" is displayed.



Number	Description
1	Flashes

FIGURE 82.

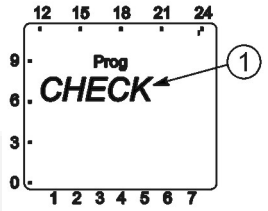
2. Press the ok button. The New Program (NEW PROG) menu is redisplayed.



Number	Description
1	Flashes

FIGURE 83.

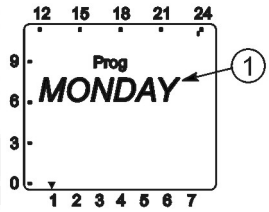
3. Press the **+** button once. The CHECK menu is displayed.



Number	Description
1	Flashes

FIGURE 84.

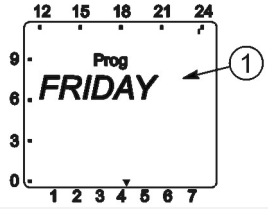
4. Press the **ok** button. The MONDAY menu is displayed.



Number	Description
1	Flashes

FIGURE 85.

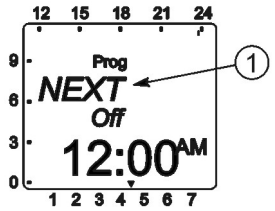
5. If necessary, use the **+** or **−** buttons to select the day of the week that includes the exercise ending time you wish to delete.



Number	Description
1	Flashes

FIGURE 86.

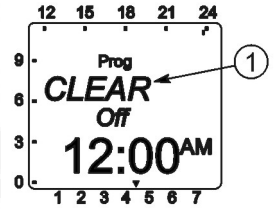
6. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 87.

7. Press the + or - buttons until "CLEAR" is displayed.



Number	Description
1	Flashes

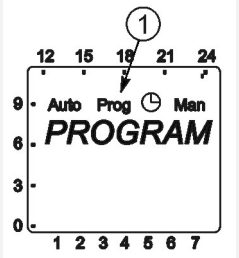
FIGURE 88.

8. Press the **ok** button. The NEW PROG menu is redisplayed.

Individual or all exercise periods can also be cleared. For more information, see "Section 5.9.2.1" and "Section 5.9.2.2".

5.9.2.1 Erase (Clear) A Programmed Exercise Period

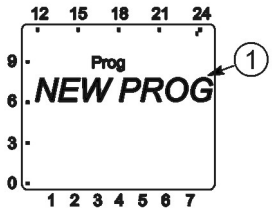
1. From the Home menu, press the **Menu** button. The PROGRAM menu is displayed.



Number	Description
1	Flashes

FIGURE 89.

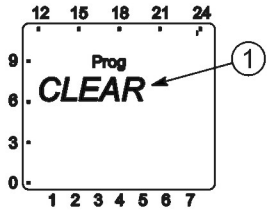
2. Press the **ok** button. The New Program (NEW PROG) menu is displayed.



Number	Description
1	Flashes

FIGURE 90.

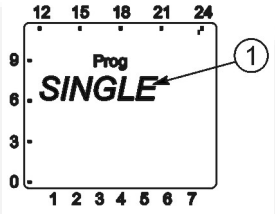
3. Press the **+** or **−** button until the CLEAR menu is displayed.



Number	Description
1	Flashes

FIGURE 91.

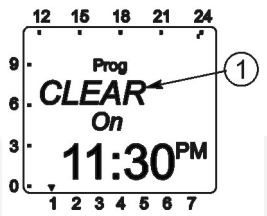
4. Press the **+** or **−** button until "SINGLE" is displayed.



Number	Description
1	Flashes

FIGURE 92.

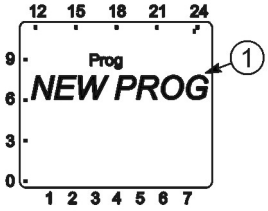
5. Press the **ok** button. The first exercise start time of the week is displayed. To select a different exercise start time, press the **+** or **−** buttons until the desired time is displayed.



Number	Description
1	Flashes

FIGURE 93.

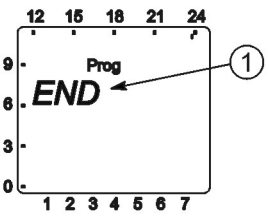
6. Press the **ok** button. The New Program (NEW PROG) menu is redisplayed.



Number	Description
1	Flashes

FIGURE 94.

7. Repeat steps 3 through 6 to erase the stop time for the exercise period erased above.
8. If necessary, repeat steps 3 through 7 for any additional exercise periods that need to be erased.
9. When the New Program (NEW PROG) menu is redisplayed, press the **+** or **−** buttons until the word "END" is displayed.



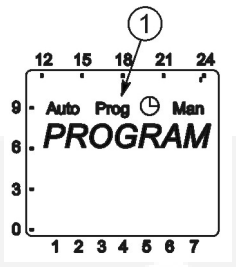
Number	Description
1	Flashes

FIGURE 95.

10. Press the **ok** button to return to the Home menu.

5.9.2.2 Erase (Clear) All Programmed Exercise Periods

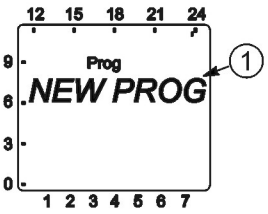
1. From the Home menu, press the **Menu** button. The PROGRAM menu is displayed.



Number	Description
1	Flashes

FIGURE 96.

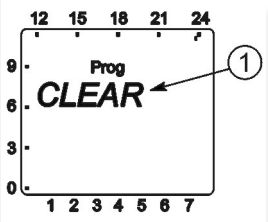
2. Press the **ok** button. The New Program (NEW PROG) menu is displayed.



Number	Description
1	Flashes

FIGURE 97.

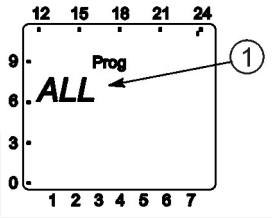
3. Press the **+** or **−** buttons until the CLEAR menu is displayed.



Number	Description
1	Flashes

FIGURE 98.

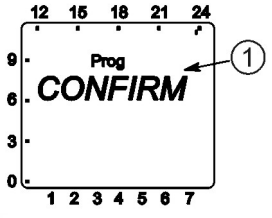
4. To clear all set exercise periods, press the **+** or - buttons until "ALL" is displayed. Press the **ok** button.



Number	Description
1	Flashes

FIGURE 99.

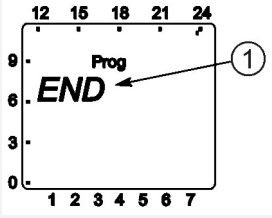
5. The word "CONFIRM" is displayed. To continue clearing all exercise programs, press the **ok** button. To abort clearing all exercise programs, press the **+** or **−** buttons.



Number	Description
1	Flashes

FIGURE 100.

6. The new program menu is redisplayed. Press the **+** or **−** buttons until the word "END" is displayed.



Number	Description
1	Flashes

FIGURE 101.

7. Press the **ok** button to return to the Home menu.

5.9.3 Initiating or Overriding an Exercise Program

The exercise clock has a built-in test feature that can be used to initiate an exercise that hasn't been programmed or cancel a programmed exercise in process.

The control panel Load/No Load function can be set to test the genset with or without load, as desired.

5.9.3.1 Initiating an Exercise

In the example shown below, "Off" indicates that no exercise is currently active.

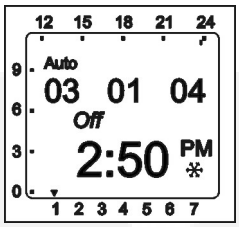


FIGURE 102.

1. With the Home menu displayed, simultaneously press the + and - buttons for approximately one second. "OVERRIDE" and a hand symbol are displayed on the screen. In addition, "Off" is switched to "On" and the exercise is initiated.

FIGURE 103.

2. To end the exercise, simultaneously press the + and - buttons for approximately one second. The original Home menu is redisplayed and "On" is switched back to "Off".

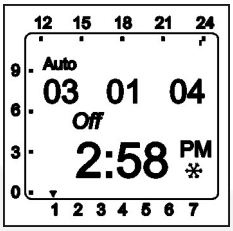


FIGURE 104.

5.9.3.2 Overriding an Exercise

In the example shown below, "On" indicates that an exercise is currently active.

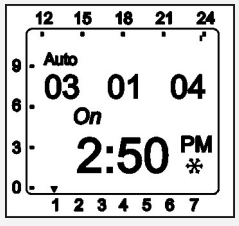


FIGURE 105.

1. With the Home menu displayed, simultaneously press the + and - buttons for approximately one second. "OVERRIDE" and a hand symbol are displayed on the screen. In addition, "On" is switched to "Off" and the exercise is stopped.

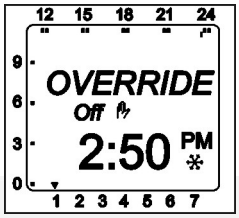


FIGURE 106.

2. To restart the exercise, simultaneously press the + and - buttons for approximately one second. The original Home menu is redisplayed and "Off" is switched back to "On".

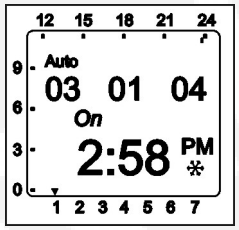


FIGURE 107.

5.9.4 Selecting Permanent On or Off Mode

The exercise clock has a permanent on/off mode feature.

5.9.4.1 Selecting Permanent On/Off Mode Without an Active Exercise

In the example shown below, "Off" indicates that no exercise is currently active.

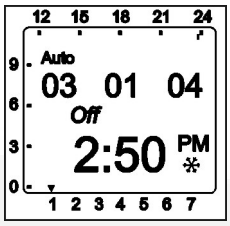


FIGURE 108.

1. With the Home menu displayed, simultaneously press the + and - buttons for approximately two seconds. The OVERRIDE menu is first displayed and then the "PERM ON" and the hand/dot symbols are displayed on the screen. In addition, a continuous band of segments is displayed on the left side and top of the screen and "Off" is switched to "On".

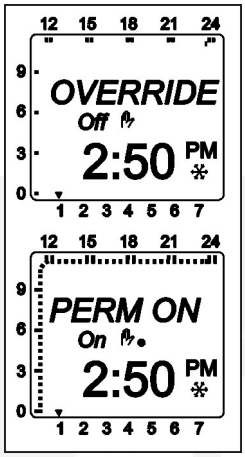


FIGURE 109.

2. To switch to Permanent Off mode, press the + and - buttons for approximately two seconds. "PERM OFF" is displayed and "On" is switched back to "Off".

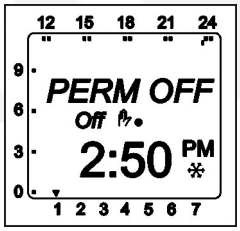


FIGURE 110.

3. To return the clock to its original state, simultaneously press the + and - buttons for approximately one second. The original Home menu is redisplayed.

5.9.4.2 Selecting Permanent On/Off Mode With an Active Exercise

In the example shown below, "On" indicates that an exercise is currently active.

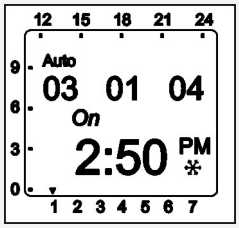


FIGURE 111.

1. With the Home menu displayed, simultaneously press the + and - buttons for approximately two seconds. The OVERRIDE menu is first displayed and then the "PERM OFF" and the hand/dot symbols are displayed on the screen. In addition, "On" is switched to "Off".

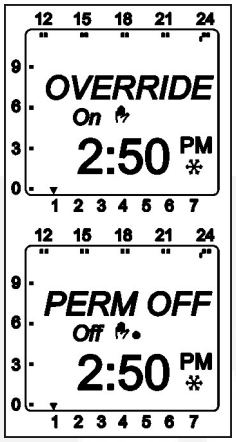


FIGURE 112.

2. To switch to Permanent On mode, press the + and - buttons for approximately two seconds. "PERM ON" is displayed and "Off" is switched back to "On". In addition, a continuous band of segments is displayed on the left side and top of the screen.

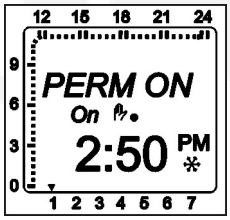


FIGURE 113.

3. To return the clock to its original state, simultaneously press the + and - buttons for approximately one second. The original Home menu is redisplayed.

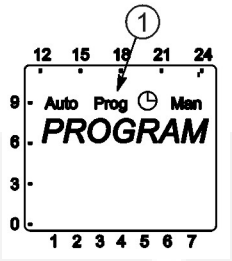
5.9.5 Adding A Security Code

A 4-digit security code number can be entered to prevent unauthorized personnel from using the clock.

Once a security code has been set up, the exercise clock is locked 90 seconds after the last keystroke. It can only be operated again after the correct PIN code is entered.

⚠ CAUTION
Once a PIN code has been activated and the Reset button is pressed (see Section 5.9.7), the exercise timer can no longer be activated without a valid PIN code. The device must be replaced

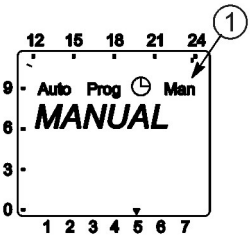
1. From the Home menu, press the **Menu** button. The PROGRAM menu is displayed.



Number	Description
1	Flashes

FIGURE 114.

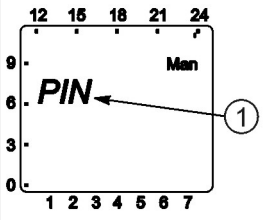
2. Press the **+** button twice. The Date/Time menu is displayed, followed by the MANUAL menu.



Number	Description
1	Flashes

FIGURE 115.

3. Press the **ok** button to display the PIN menu.



Number	Description
1	Flashes

FIGURE 116.

NOTICE
If the + or - button is pressed now, the message "END" is displayed. Press the ok button to return to the Home menu.

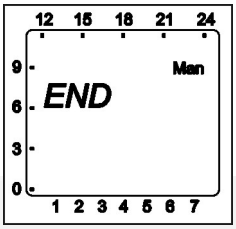
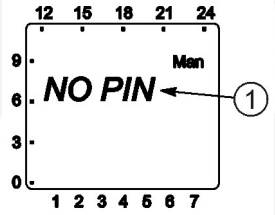


FIGURE 117.

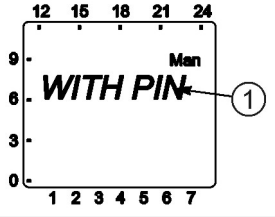
4. Press the **ok** button to display the NO PIN menu.



Number	Description
1	Flashes

FIGURE 118.

5. Press the **+** or **−** buttons to display the WITH PIN menu.

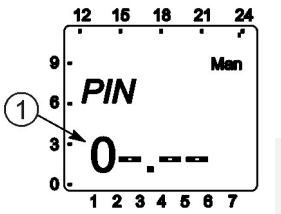


Number	Description
1	Flashes

FIGURE 119.

6. Press the **ok** button to display the PIN Number menu.

NOTICE
I a 4-digit access code is not entered at this time, the only way to exit MANUAL mode is to press the reset (RES) button.



Number	Description
1	Flashes

FIGURE 120.

7. Press the **+** or **−** buttons to enter the first digit of your 4-digit access code.
8. Press the **ok** button. Then press the **+** or **−** buttons to enter the second digit of the 4-digit access code.
9. Repeat step 8 for the third and fourth digit of the 4-digit access code.
10. Press the **ok** button. The Home menu is then redisplayed.

5.9.6 After Programming the Exerciser Clock

1. Make sure the External Exercise function on the transfer switch control panel is set to "On". For more information, see **Section 5.11**.
2. Place the generator set operation selector switch in the Remote position.
3. Check the system for proper operation as described elsewhere in the **Chapter 5** section of this manual.

5.9.7 Resetting the Timer

The Reset button should only be used in cases of an emergency. Resetting the timer erases all existing language, date, and time settings. Upon pressing the **Res** button, the clock is set to 12:00 midnight, Wednesday, January 1, 2003. However, **scheduled exercise periods remain intact**.

1. Use a pointed object to press the Res button for approximately one second. Two information screens are displayed and the default national language is flashed.

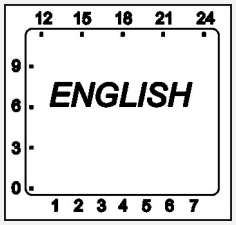


FIGURE 121.

2. If the incorrect language is being displayed, use the + or - button to scroll through the available languages (English, Espanol, Francais, Portugal, Italiano, or Deutsch).
3. When the desired language is displayed, press the **ok** button. The YEAR is displayed next.

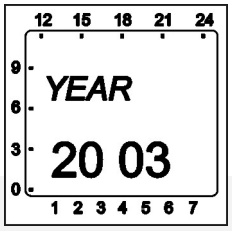


FIGURE 122.

4. Press the **+** button until the correct year is displayed and then press the **ok** button. The MONTH is displayed next.

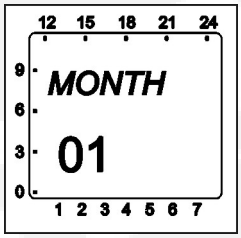


FIGURE 123.

5. Press the **+** or **−** button until the correct month is displayed and then press the **ok** button. The screen then shows the DAY value flashing.

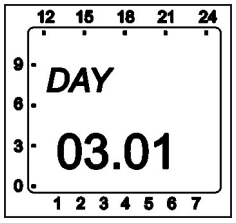


FIGURE 124.

6. Press the **+** or **−** button until the correct day is displayed. Press the **ok** button. The screen then shows the HOUR value flashing.

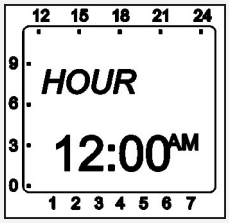


FIGURE 125.

7. Press the **+** or **−** button until the correct hour is displayed. Press the **ok** button. The screen then shows the MINUTE value flashing.

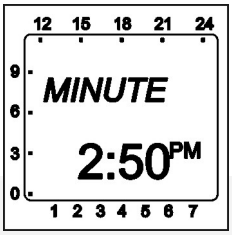


FIGURE 126.

8. Press the **+** or **−** button until the correct minute is displayed. Press the **ok** button. The screen then displays the correct date and time.

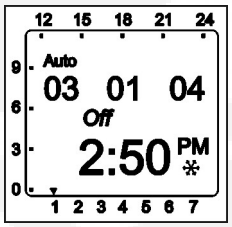


FIGURE 127.

5.10 Planned Maintenance

Performing the annual planned maintenance procedures increases reliability of the transfer switch.

The following procedures must be done only by trained and experienced personnel, according to procedures in **Chapter 8**. If repair or component replacement is necessary, call your dealer or distributor.

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door 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 qualified personnel, according to procedures in Chapter 9.

⚠ WARNING

The transfer switch presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Be sure to set the genset operation selector switch to Stop, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [-] lead first) 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.

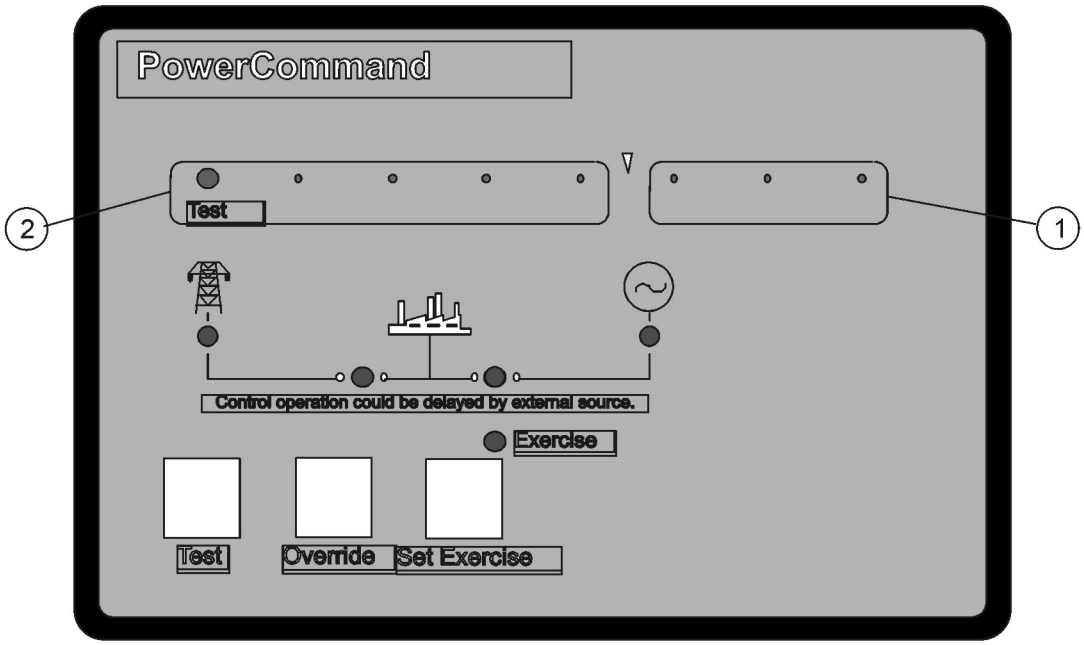
⚠ WARNING

1. **Disconnect All Sources of AC Power:**
   a. Disconnect both AC power sources from the transfer switch before continuing. Turn the generator set operation selector switch to Stop. (The selector switch is located on the generator set control panel.)
   b. ***If there is an external battery charger, disconnect it from its AC power source.***
   c. Disconnect the set starting battery (negative [-] lead first).
2. **Clean**
   a. Thoroughly dust and vacuum all controls, meters, switching mechanism components, interior buswork, and connecting lugs.
   b. Close the cabinet door and wash **exterior** surfaces with a damp sponge (mild detergent and water). ***Do not allow water to enter the cabinet, especially at meters, lamps, and switches.***
3. **Inspect**
   a. Check buswork and supporting hardware for carbon tracking, cracks, corrosion, or any other types of deterioration. If replacement is necessary, call your dealer or distributor.
   b. Check stationary and movable contacts. If contact replacement is necessary, the procedures are described in the **Chapter 7**.
   c. Check system hardware for loose connections. Tighten as indicated in step 4 (Perform Routine Maintenance).
   d. Check all control wiring and power cables (especially wiring between or near hinged door) for signs of wear or deterioration.
   e. Check all control wiring and power cables for loose connections. Tighten as indicated in step 4 (Perform Routine Maintenance).
   f. Check the cabinet interior for loose hardware. Tighten as indicated in step 4 (Perform Routine Maintenance).
4. **Perform Routine Maintenance**
   a. Tighten buswork, control wiring, power cables, and system hardware, as necessary. Hardware torque values are given in **Chapter 9**. Retorque all cable lug connections. Lug torque requirements are listed in **Chapter 7**.
5. **Connect AC Power and Check Operation**
   a. Connect the set starting battery (negative [-] lead last). Connect the utility AC power source, enable the genset power source. If applicable, connect power to the battery charger.
   b. Verify proper operation of the battery charger.
   c. Test system operation as described in this section. Close and lock the cabinet door.

5.11 Control Panel Configuration

The control panel can be used to configure ATS functions. When in **Configuration Mode**, the value code for the various control functions can be modified.

The control panel has a series of eight LEDs that display codes that indicate various control functions that can be configured. The first five LEDs display the function code and the last three LEDs display the value code for the displayed function (see **Table 9**). A listing of the control functions (including the function and value codes) is included in **Table 9**. Additional information on these functions is included in **Chapter 5**.



No.	Description
1	Value Indicator LEDs
2	Function Indicator LEDs

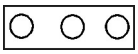
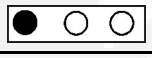
FIGURE 128. CONTROL PANEL

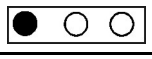
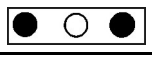
NOTICE

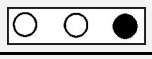
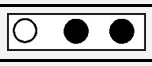
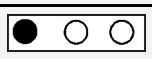
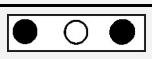
Two types of controls are available with GTEC transfer switches. Except for system nominal voltages, all control functions are the same for both types of controls. Units with line-to-neutral voltage sensing (TS1311 control) have fewer system nominal voltages available than units with line-to-line voltage sensing (TS1310 control). Nominal voltages for both types of controls are listed in Table 9.

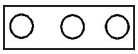
TABLE 9. ADJUSTABLE TRANSFER SWITCH FUNCTIONS

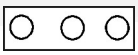
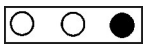
Function	Function Code	Value Code	Value (Default in bold italics)	Ref
Not Available	○ ○ ○ ○ ○	NA	NA	NA

Function	Function Code	Value Code	Value (Default in bold italics)	Ref
TDES (Time Delay Engine Start)			0 Seconds (Disabled)	Section 5.1.1
			0.5 Second	
			1 Second	
			2 Seconds	
			***3 Seconds***	
			4 Seconds	
			6 Seconds	
			10 Seconds	

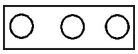
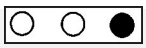
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
TDNE (Time Delay Normal to Emergency)			0 Seconds (Disabled)	Section 5.1.3
			1 Second	
			2 Seconds	
			3 Seconds	
			***5 Seconds***	
			30 Seconds	
			120 Seconds	
			300 Seconds	

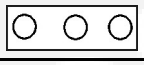
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
TDNE (Time Delay Normal to Emergency)			0 Seconds (Disabled)	Section 5.1.3
			1 Second	
			2 Seconds	
			3 Seconds	
			***5 Seconds***	
			30 Seconds	
			120 Seconds	
			300 Seconds	

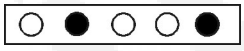
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
TDEN (Time Delay Emergency to Normal)			0 Minutes (Disabled)	Section 5.1.4
			0.1 Minutes (For Testing)	
			5 Minutes	
			***10 Minutes***	
			15 Minutes	
			20 Minutes	
			25 Minutes	
			30 Minutes	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
TDEC (Time Delay Engine Cooldown)			0 Minutes (Disabled)	Section 5.1.2
			0.1 Minutes (For Testing)	
			5 Minutes	
			***10 Minutes***	
			15 Minutes	
			20 Minutes	
			25 Minutes	
			30 Minutes	

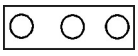
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
TDEL (Time Delay Elevator Signal)			***0 Seconds (Disabled)***	Section 5.1.6
			1 Second	
			2 Seconds	
			3 Seconds	
			5 Seconds	
			30 Seconds	
			120 Seconds	
			300 Seconds	

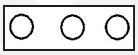
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Test With/Without Load			***Without Load***	Section 5.4
			With Load	

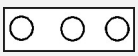
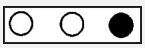
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
External Exercise On/Off (This control function is set at the factory and should not require adjusting.)			Off	Section 5.6
			On	

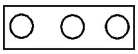
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Exercise With/Without Load			***Without Load***	Section 5.6.2
			With Load	

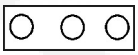
Function	Function Code	Value Code	Value (Default in bold italics)		Pg Ref
System Nominal Voltage Table Selection (This control function is set at the factory and should not require adjusting.)			Table 1 (tables below)		
				Table 2 (tables below)	

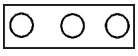
Function	Function Code	Value Code	Value (Default in bold italics)		Pg Ref
System Nominal Voltage (TS1311 Control - Transfer Switches with Line-to-Neutral Voltage Sensing) (This control function is set at the factory and should not require adjusting.)			110	230	
			115	240	
			120	255	
			127	277	
			139	347	
			220	347	

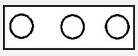
Function	Function Code	Value Code	Value (Default in bold italics)		Pg Ref
System Nominal Voltage (TS1310 Control - Transfer Switches with Line-to-Line Voltage Sensing) (This control function is set at the factory and should not require adjusting.)			115	400	
			120	415	
			190	440	
			208	460	
			220	480	
			230	550	
			240	575	
			380	600	

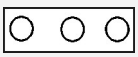
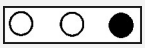
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
System Nominal Frequency 50/60 Hz (This control function is set at the factory and should not require adjusting.)			60 Hz	
			50 Hz	

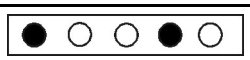
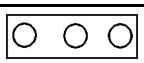
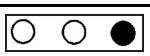
Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Single Phase/Three Phase (This control function is set at the factory and should not require adjusting.)			Three Phase	
			Single Phase	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Utility Undervoltage Pickup			***90%***	Section 5.5.1
			95%	
			80%	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Utility Undervoltage Dropout			90%	Section 5.5.1
			***85%***	
			80%	
			70%	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Phase Check On/Off			***Off***	Section 5.5.3
			On	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Return to Programmed Transition On/Off			***Off***	Section 5.5.4
			On	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Elevator Post Transfer Delay On/Off			***Off***	Section 5.1.7
			On	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Exercise Repeat Interval	● ○ ○ ● ●	○ ○ ○	***Every 7 Days***	Section 5.6.4.1
		○ ○ ●	Every 14 Days	
		○ ● ○	Every 21 Days	
		○ ● ●	Every 28 Days	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Utility Overvoltage Detection (See Note 1)	● ○ ● ○ ○	○ ○ ○	***Disabled***	
		○ ○ ●	Enabled	

Function	Function Code	Value Code	Value (Default in bold italics)	Pg Ref
Utility Frequency Detection (See Note 2)	● ○ ● ○ ●	○ ○ ○	***Disabled***	
		○ ○ ●	Enabled	

Note 1: If enabled, utility overvoltage detection drops out at 125% or rated voltage and picks up at 120%.

Note 2: Utility frequency detection covers both underfrequency and overfrequency. If enabled, underfrequency drops out at 70% of rated frequency and picks up at 80% while overfrequency drops out at 140% of rated frequency and picks up at 130%.

With the exception of the Test LED, the function and value LEDs are not lit during automatic operation (Automatic Mode).

5.11.1 Accessing the Front Panel Configuration Editor

⚠ WARNING

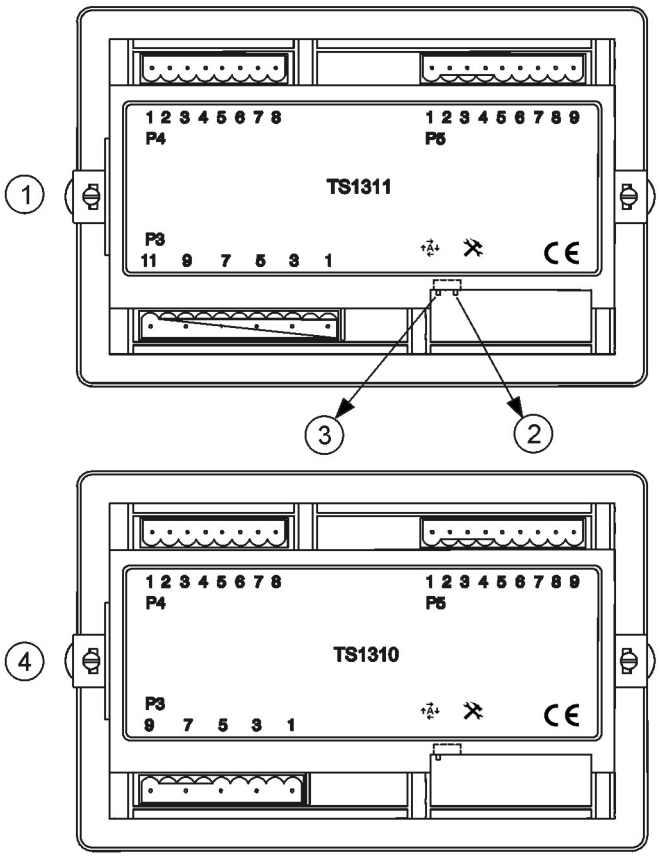
AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.

Battery power (DC power) must be available to configure the control panel functions. AC power may be present but doesn't have to be present to configure the control panel. To check for DC power, open the transfer switch door and place the ATS in the Normal or Emergency position. The Utility Power Connected or Genset Power Connected LED should light.

Configuration Mode is selected by operation of a small slide switch located on the back of the control panel. The switch is located near the bottom edge of the PCB (see Figure 129). The switch is partially hidden to prevent accidental operation.

NOTICE

The Configuration Mode can be entered at any time, but once it is selected, all automatic operation is suspended.



Number	Description	Number	Description
1	Back of TS1311 Control used on Units with Line-to_neutral Voltage Sensing	3	Switch in Automatic Mode
2	Switch in Configuration Mode	4	Back of TS1310 Control used on Units with Line-to-line Voltage Sensing

NOTE 1: If enabled, utility overvoltage detection drops out at 125% or rated voltage and picks up at 120%.

FIGURE 129. NORMAL/CONFIGURATION MODE SELECTOR SWITCH

NOTE 2: Utility frequency detection covers both underfrequency and overfrequency. If enabled, underfrequency drops out at 70% of rated frequency and picks up at 80% while overfrequency drops out at 140% of rated frequency and picks up at 130%.

5.11.2 Modify the Configuration

The control has been configured at the factory and does not require additional adjustments, default settings are shown in bold italics in each table section in **Table 9**. However, you may wish to adjust some of the settings for better performance.

⚠ CAUTION
Incorrect settings can result in the transfer switch failing to operate correctly. Only authorized trained personnel should make changes to the control function settings. External Exercise, System Nominal Voltage, System Nominal Frequency, and Single Phase/Three Phase settings are made at the factory and should not require any additional adjustments.

1. Slide the selector switch to the Configuration Mode position (see **Section 5.11**). TDES is always the first function shown when entering Configuration Mode.
2. Press the **Test** pushbutton to scroll through the various control function codes displayed with the first five LEDs . The black filled circles indicate which LEDs are lit for the function and value codes listed.
3. Once the desired function is selected, press the **Override** pushbutton to change the associated value code displayed with the last three LEDs.
4. When configuration is completed, return the selector switch back to the **Automatic Mode** position.

6 Installation - Mounting

6.1 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 the contract drawings.

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

A typical installation is shown in Figure 130. Cabinet type IP32 dimensions and weights are listed in Figure 130. Cabinet type IP54 dimensions and weights are listed in Table 11.

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.

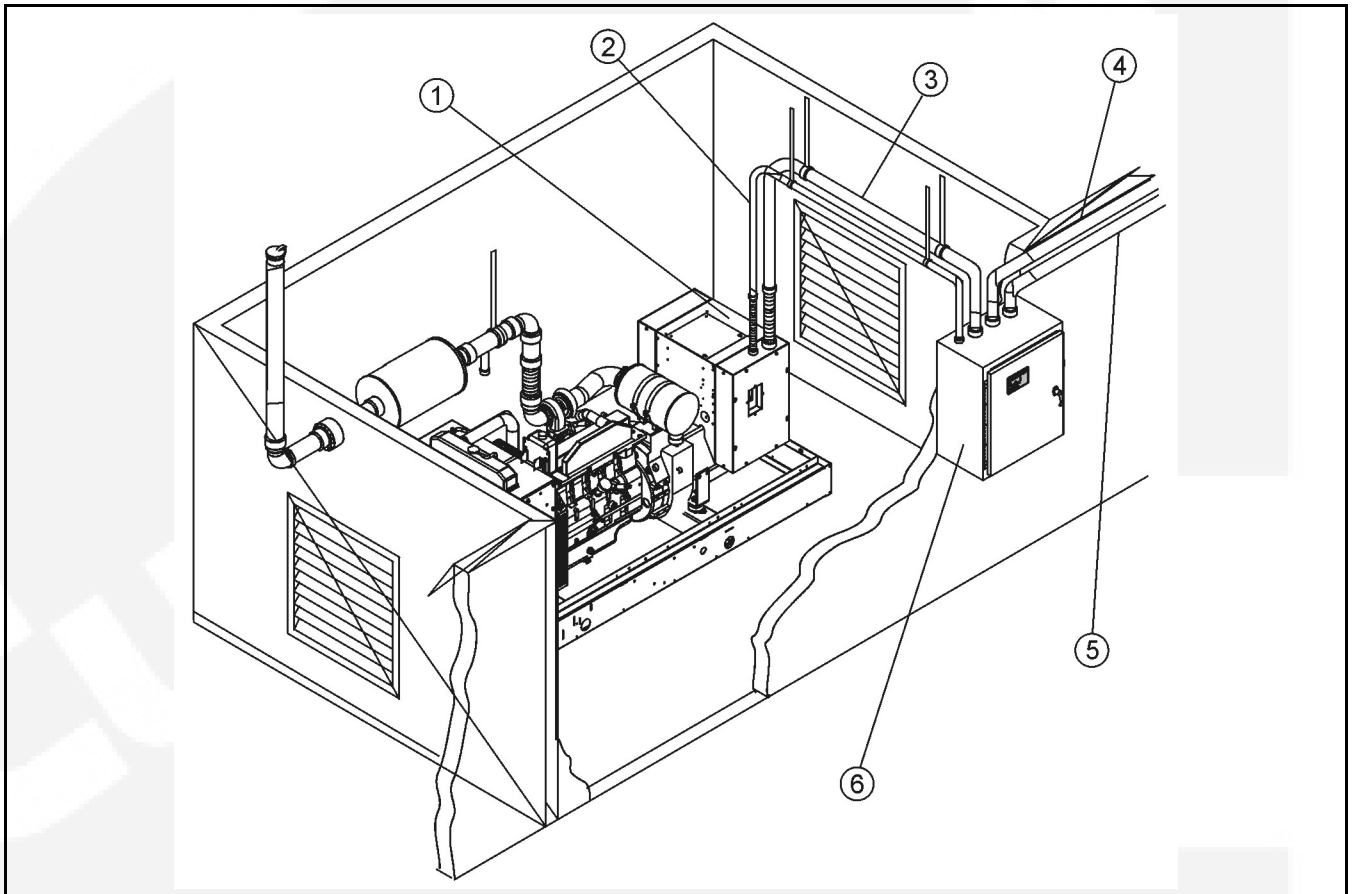
TABLE 10. APPROXIMATE IP32 CABINET DIMENSIONS

Switch Current Rating	Height	Width	Depth With Door		Weight
			Closed	Open	
20, 40, 63, 100, & 125	34.0 in. 864 mm	23.5 in. 598 mm	11.6 in. 296 mm	31.0 in. 788 mm	105.8 lb 48 kg
160, 200, 225, 250, 350, 400, & 500	41.9 in. 1064 mm	31.6 in. 804 mm	11.6 in. 296 mm	39.0 in 991.8 mm	143.3 lb 65 kg
630, 800, 1000, &1250	53.9 in. 1370 mm	29.5 in. 750 mm	26.6 in. 676 mm	51.9 in. 1319 mm	406 lb 184 kg
1600 & 2000	78.9 in. 2004 mm	39.4 in. 1000 mm	44.3 in. 1126 mm	83.7 in. 1126 mm	888.9 lb 400 kg

TABLE 11. APPROXIMATE IP54 CABINET DIMENSIONS

Switch Current Rating	Height	Width	Depth With Door		Weight
			Closed	Open	
20, 40, 63, 100, & 125	34.0 in. 864 mm	23.5 in. 598 mm	11.6 in. 296 mm	31.0 in. 788 mm	110 lb 50 kg
160, 200, 225, 250, 350, 400, & 500	41.9 in. 1064 mm	31.6 in. 804 mm	11.6 in. 296 mm	39.0 in 991.8 mm	143.3 lb 65 kg
630, 800, 1000, &1250	53.9 in. 1370 mm	29.5 in. 750 mm	26.6 in. 676 mm	51.9 in. 1319 mm	414.5 lb 188 kg

Switch Current Rating	Height	Width	Depth With Door		Weight
			Closed	Open	
1600 & 2000	78.9 in. 2004 mm	39.4 in. 1000 mm	44.3 in. 1126 mm	83.7 in. 1126 mm	892.9 lb 405 kg



Number	Description	Number	Description
1	Generator Set Control Housing	4	Load Cables
2	Remote Control Wires	5	Cables from Service Disconnect Switch Box and Meter
3	Cables to Source 2 Sides of Transfer Switch	6	Automatic Transfer Switch

FIGURE 130. TYPICAL WALL MOUNT INSTALLATION

6.2 Mounting Methods

Transfer switches can be free-standing or mounted to a wall. Follow the appropriate set of mounting instructions and refer to the outline drawing for installation dimensions, specifications, and mounting hole patterns.

6.2.1 Wall Mounting

Small and medium switches (40 through 500 amps) are wall mounted (see **Figure 130**).

1. Check the location to be sure that no wires or plumbing, gas, or exhaust lines run behind the wall.
2. Install two mounting bolts in the wall for the cabinet mounting keyholes.
3. With the shipping box standing so the cabinet is upright, carefully remove the top and sides of the box.
4. Raise the cabinet and mount it on the two mounting bolts in the wall.

⚠ WARNING

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

5. Install the two remaining mounting bolts, but do not tighten them.
6. Push the cabinet against the wall. If the cabinet does not align flush against the wall, shim the mounting bosses as required.
7. Tighten all mounting bolts.

6.2.2 Free-Standing

Large switches (630 through 1250 amps) are floor mounted.

1. Adhere to all local codes.
2. Make sure adequate access to the rear of the cabinet is available for wire connections.
3. Provide stability by bolting the cabinet to the floor at all four corners.

6.3 Open Construction

Use a cabinet that meets the requirements of all local codes and standards. The door should be secured and have safety warnings required to meet all applicable codes. The minimum cabinet size is determined by the current rating of the transfer switch. Refer to individual outline drawings for the minimum cabinet dimensions.

The outline drawings supplied with the transfer switch provide outline dimensions for mounting the transfer switch components inside the cabinet. Page one of the outline drawing shows hole patterns that must be drilled in the cabinet door to align various control components. Figure **Figure 161** shows page one of a typical outline drawing. Additional outline drawings are included in **Appendix C**.

Refer to the **Chapter 7** for electrical connections.

Use a cabinet that meets the requirements of all local codes and standards. The door should be secured and have safety warnings required to meet all applicable codes. The minimum cabinet size is determined by the current rating of the transfer switch. Refer to individual outline drawings for the minimum cabinet dimensions.

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7 Installation - Wiring

Refer to Figure 131, Figure 132, Figure 133, and Figure 134 for component locations.

⚠ WARNING

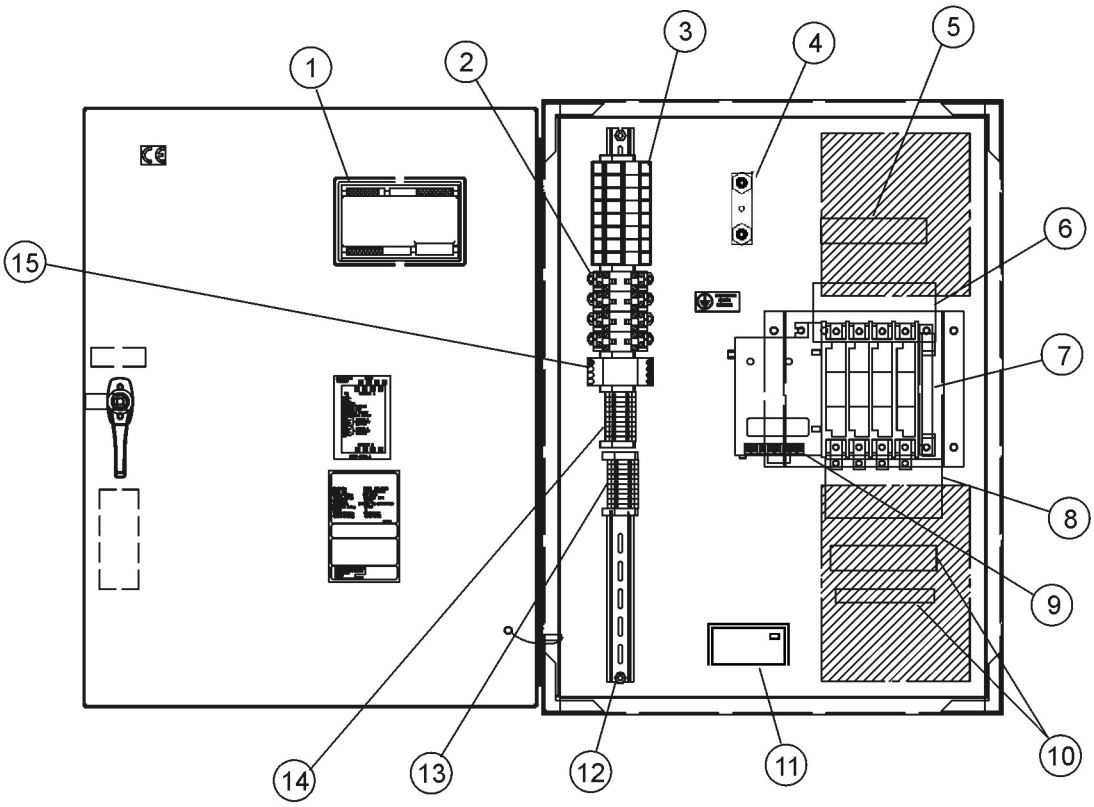
AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained and experienced personnel are to perform the following procedures.

⚠ 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.

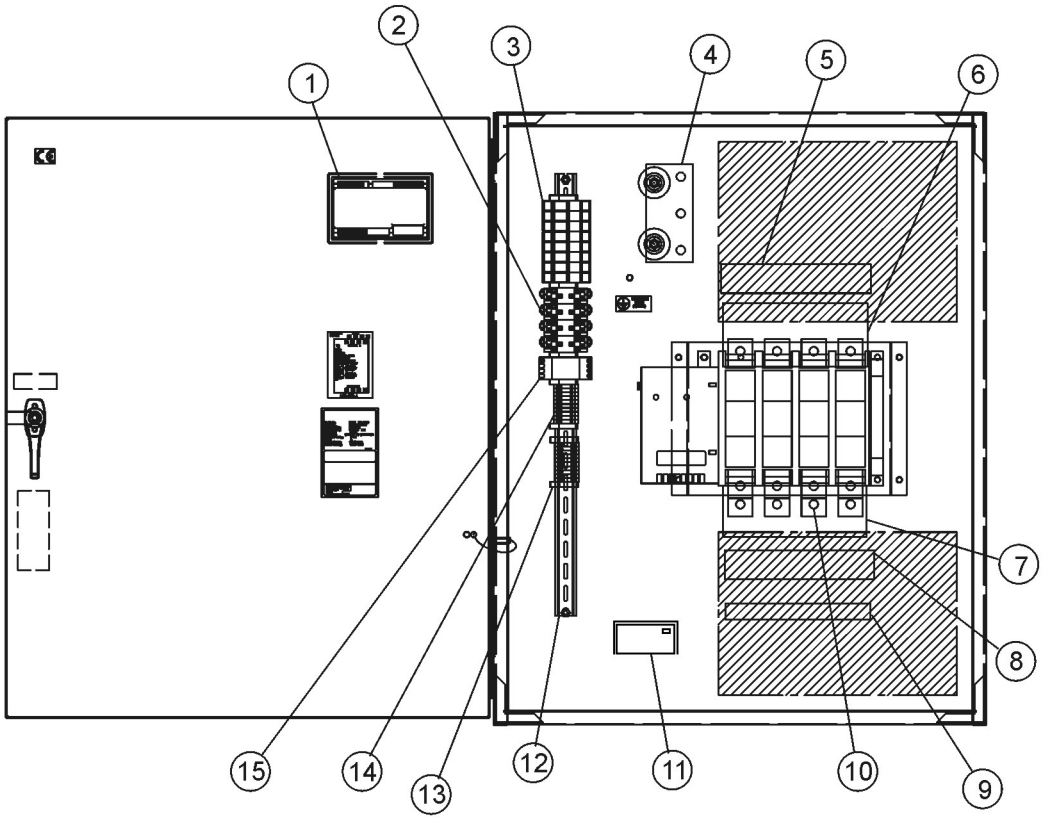
When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover the transfer switch to prevent accidental entry of metal chips.
2. 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.
3. Run control circuit wiring in separate conduit from the AC wiring; otherwise, induced currents could cause operational problems within the switch. Cutouts can be made through the top, bottom, or sides of the cabinet. Refer to the switch outline drawings included in Appendix B, Wiring Diagrams.



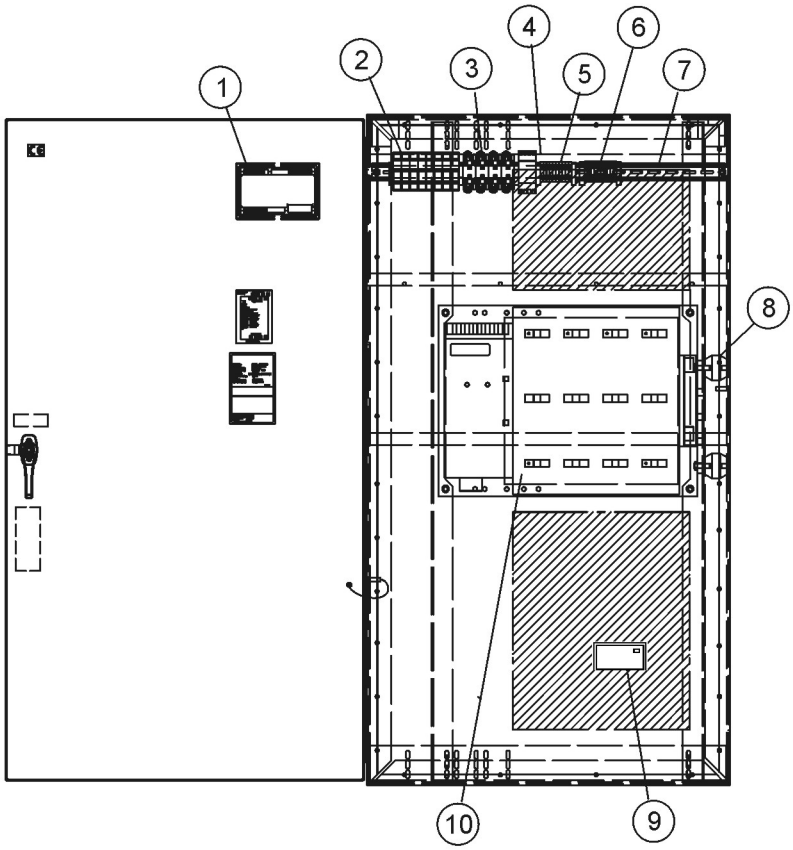
Number	Description	Number	Description
1	Control Panel	9	Control Wiring Terminals
2	Relay Coils K1 through K4	10	Cable Tie (Spec B) (20 - 500 amps)
3	Fuse Block	11	Battery Charger Option
4	Neutral Bar	12	Rail Assembly
5	Cable Tie (Spec B) (20 - 500 amps)	13	TB2 (Spec B)
6	Terminal Shield (Spec B) (20 - 500 amps)	14	TB1
7	Transfer Switch	15	Optional Exerciser Clock
8	Terminal Shield (Spec B) (20 - 500 amps)		

FIGURE 131. INTERIOR/COMPONENTS: 20 - 125 AMP, 4-POLE SWITCH



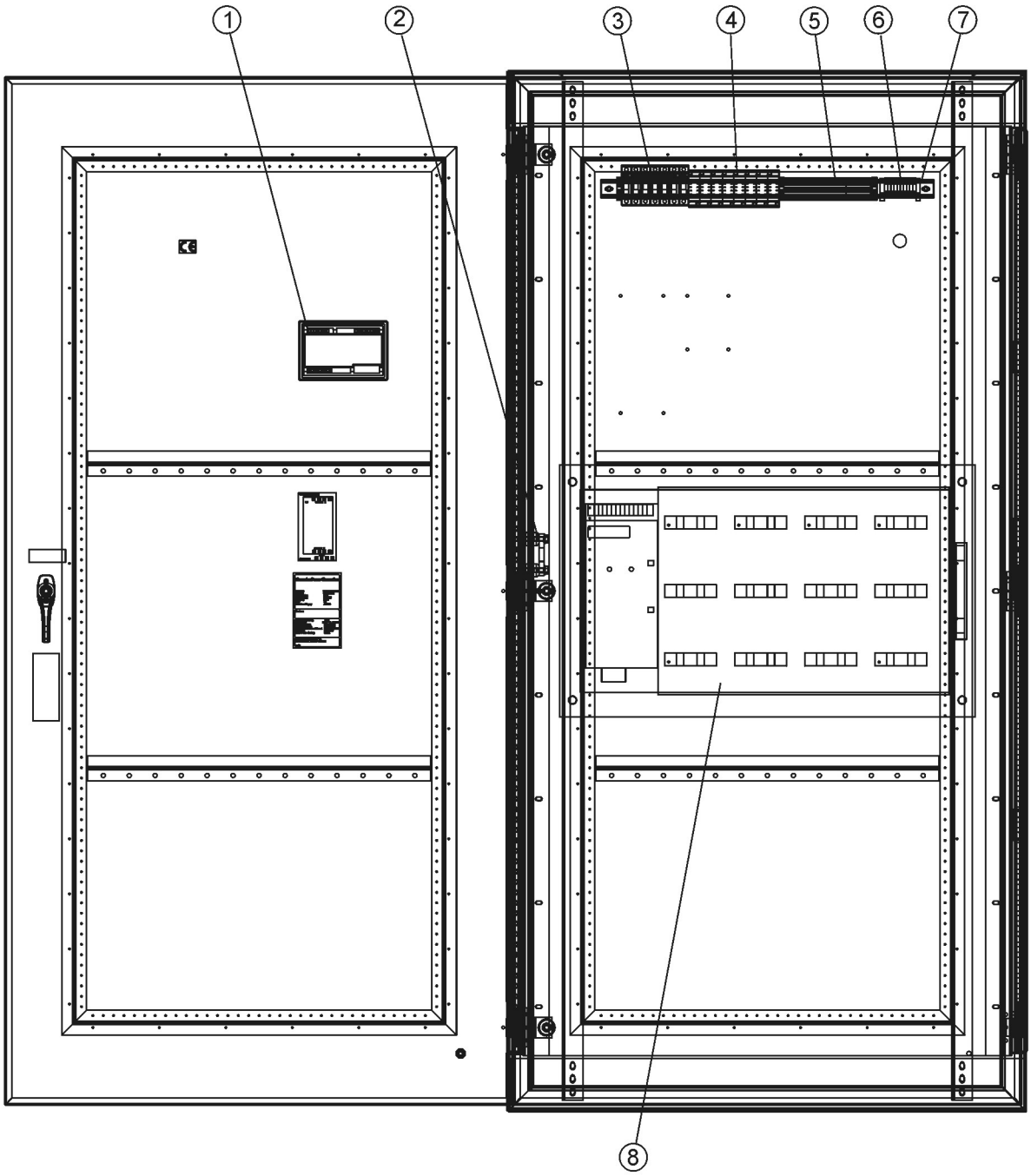
Number	Description	Number	Description
1	Control Panel	9	Cable Tie (Spec B) (20 - 500 amps)
2	Relay Coils K1 through K4	10	Transfer Switch
3	Fuse Block	11	Battery Charger Option
4	Neutral Bar	12	Rail Assembly
5	Cable Tie (Spec B) (20 - 500 amps)	13	TB2 (Spec B)
6	Thermal Shield (Spec B) (20 - 500 amps)	14	TB1
7	Thermal Shield (Spec B) (20 - 500 amps)	15	Optional Exerciser Clock
8	Cable Tie (Spec B) (20 - 500 amps)		

FIGURE 132. INTERIOR/COMPONENTS: 160 - 500 AMP, 4-POLE SWITCH



Number	Description	Number	Description
1	Control Panel	6	TB2 (Spec B)
2	Fuse Block	7	Rail Assembly
3	Relay Coils K1 through K4	8	Neutral Bar
4	Optional Exerciser Clock	9	Battery Charger Option
5	TB1	10	Transfer Switch

FIGURE 133. INTERIOR/COMPONENTS: 630 - 1250 AMPS, 4-POLE SWITCH



Number	Description	Number	Description
1	Control Panel	5	TB1
2	Neutral Bar	6	TB2 (Spec B)
3	Fuse Block	7	Rail Assembly
4	Relay Coils K1 through K4	8	Transfer Switch

FIGURE 134. INTERIOR/COMPONENTS: 1600 - 2000 AMPS, 4-POLE SWITCH

7.1 AC Connections

Perform wiring in the following sequence:

1. Test the operation of the generator set from its own controls.
2. Stop the generator set and remove the negative lead from the cranking battery to prevent starting.

> **⚠ 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.***

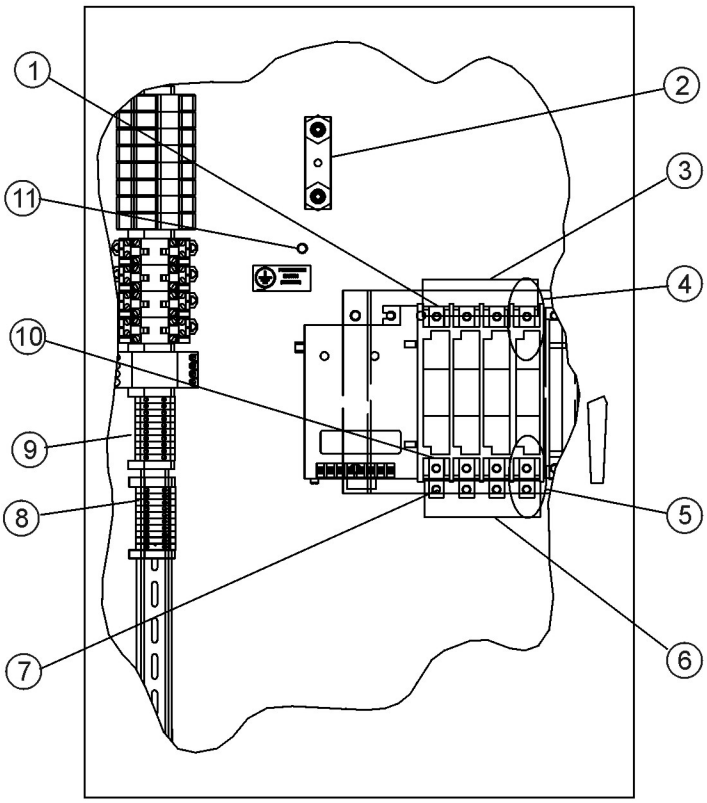
3. Connect conductors of sufficient size (see contract drawings) to carry rated current from the line, load, and generator set directly to the transfer switch terminals, which are marked A, B, and C (A, B, C, and N on 4-pole switches). A neutral bar is standard on 3-pole switches. Phase rotation must be the same on the utility and generator set power sources.
4. Connect power cables to the load terminals. Tighten the terminal lugs as indicated in **Table 12**.

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

5. Make sure that both AC power sources are disconnected.

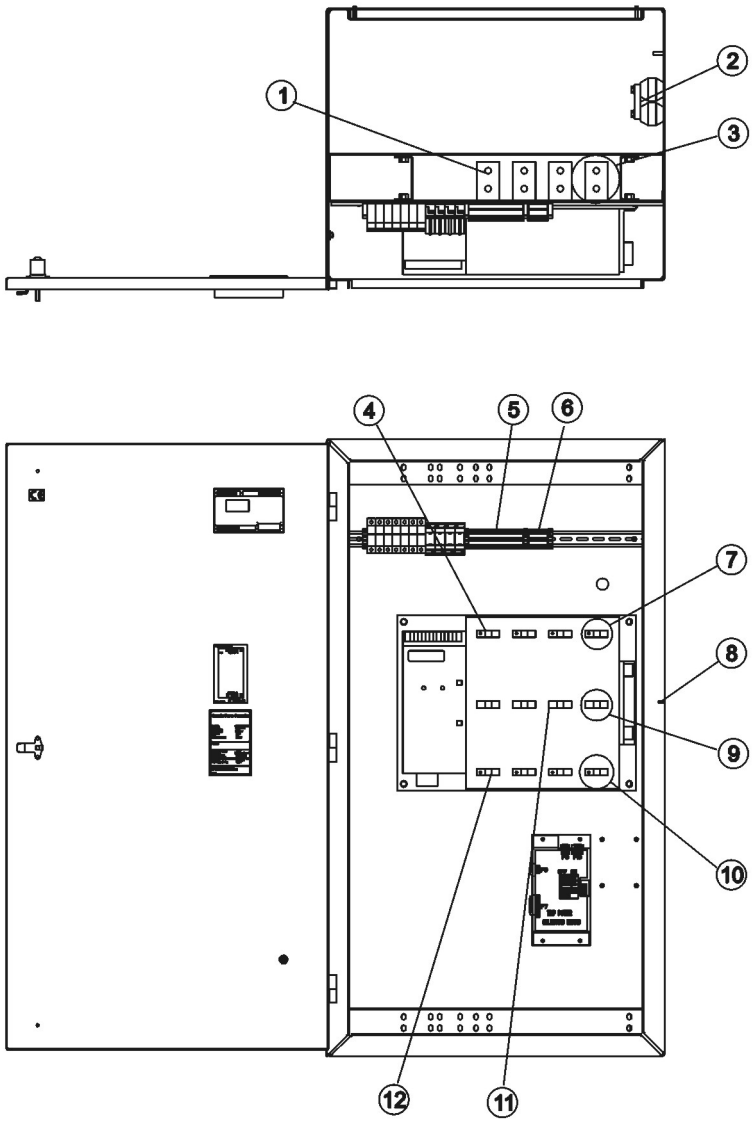
TABLE 12. TERMINAL LUG TORQUES

Control Set Screw	Minimum Torque For Proper Operation
M6	6 Nm
M8	16 Nm
M12	50 Nm



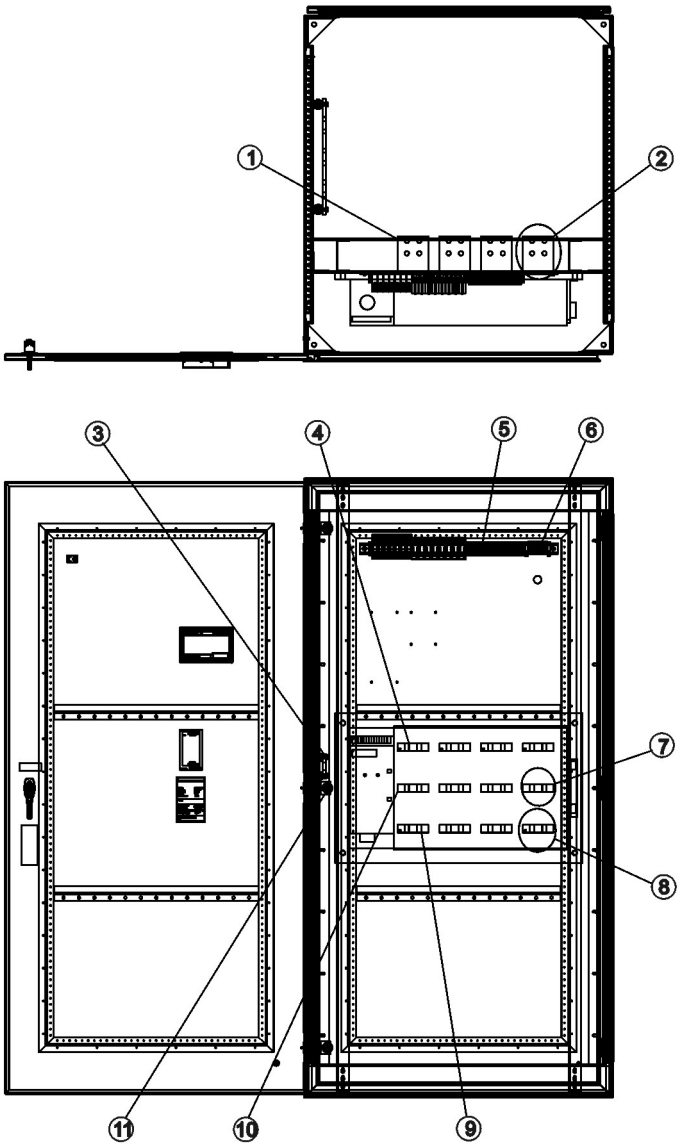
Number	Description	Number	Description
1	Source 1 (Normal) Terminals	7	Load Terminals
2	Neutral Bar (3-pole Only)	8	TB2 (Spec B)
3	Terminal Shield (Spec B)	9	TB1
4	Source 1 (Normal) Neutral Terminal (4-pole Only)	10	Source 2 (Emergency) Terminals
5	Source 2 (Emergency) and Load Neutral Terminals (4-pole Only)	11	Ground Stud
6	Terminal Shield (Spec B)		

FIGURE 135. 20 - 500 AMP, 4-POLE TRANSFER SWITCH TERMINAL ACCESS (125 AMP SWITCH SHOWN) (2 - 3-POLE SWITCHES ARE SIMILAR)



Number	Description	Number	Description
1	Source 1 (Normal) Terminals	7	Source 1 Neutral Terminal (4-pole Only)
2	Neutral Bar (3-pole Only)	8	Ground Stud
3	Source 1 Neutral Terminal (4-pole Only)	9	Load Neutral Terminal (4-pole Only)
4	Source 1 (Normal) Terminals	10	Source 2 Neutral Terminal (4-pole Only)
5	TB1	11	Load Terminals
6	TB2	12	Source 2 (Emergency) Terminals

FIGURE 136. 600 - 1250 AMP, 4-POLE TRANSFER SWITCH TERMINAL ACCESS (1250 AMP SWITCH SHOWN - OTHERS ARE SIMILAR)

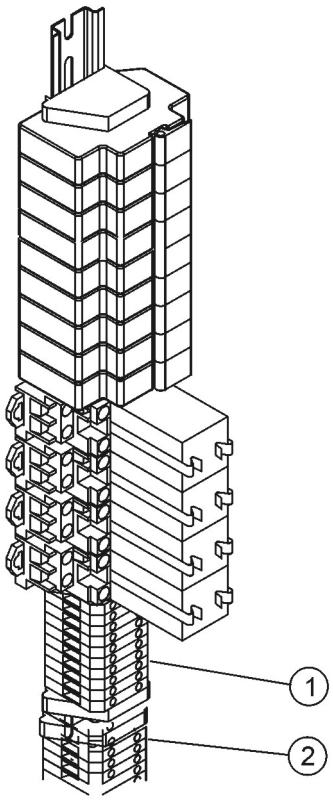


Number	Description	Number	Description
1	Source 1 (Normal) Terminals	7	Load Neutral Terminal (4-pole Only)
2	Source 1 Neutral Terminal (4-pole Only)	8	Source 2 Neutral Terminal (4-pole Only)
3	Neutral Bar (3-pole Only)	9	Source 2 (Emergency) Terminals
4	Source 1 (Normal) Terminals	10	Load Terminals
5	TB1	11	Ground Stud
6	TB2 (Spec B)		

FIGURE 137. 1600 - 2000 AMP, 4-POLE TRANSFER SWITCH TERMINAL ACCESS (2000 AMP SWITCH SHOWN - OTHERS ARE SIMILAR)

7.1.1 Control Connections

Connections of standard and optional control wiring are made at terminal block TB1. TB1 is located near the bottom of the DIN rail (see **Figure 138**).



Number	Description	Number	Description
1	TB1	2	TB2 (Spec B)

FIGURE 138. CONTROL WIRING CONNECTIONS

7.1.1.1 Connect Transfer Switch to 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.

Wire size depends on the distance and the type of battery charger installed in the transfer switch. Refer to **Table 13** to determine the wire size required.

- Use Column A for connections to TB1-2, 4, 5, 6, 7, 8, and, if equipped, the annunciator.
- Use Column B for connections to TB1-1 (GND) and TB1-3 (B+) if no battery charger is installed in the transfer switch.
- Use Column C for connections to TB1-1 (GND) and TB1-3 (B+) if a 2 Amp battery charger is installed in the transfer switch.

- Use Column D for connections to TB1-1 (GND) and TB1-3 (B+) if a 10 Amp battery charger is installed in the transfer switch.

TABLE 13. WIRE SPECIFICATIONS

Wire Size (AWG) [mm²]	Distance in Meters, One Way (Multiply by 3.3 for Feet)			
	Column A	Column B	Column C	Column D
16 [1.5]	305	130	38	8
14 [2.5]	488	206	61	12
12 [4.0]	732	329	91	18
10 [6.0]	1219	523	152	31

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

Remote starting (for Cummins Power Generation water-cooled generator sets only) uses terminals B+, GND (ground), and RMT of terminal block TB1, **Figure 138**. Connect these terminals to like terminals on the generator set. Refer to Interconnect Wiring diagram shipped with the switch.

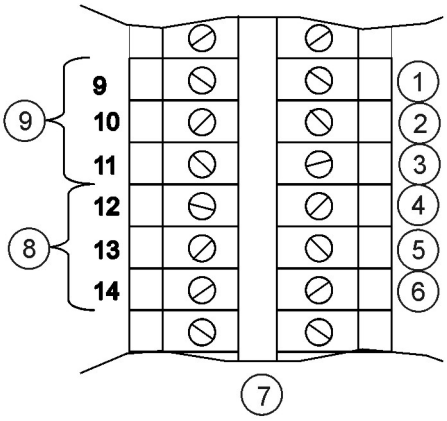
- For PCC 3100 and PCC 2100 generator set controls, install a jumper between TB1-1 and TB1-2 for ground-to-start connection.
- For PCC 1301, 1302, 2300, and 3300 generator set controls, install a jumper between TB1-10 and TB1-11 for ground-to-start connection.
- For Detector 12 generator set controls, install a jumper between TB1-2 and TB1-3 for B+ start.
- For PCC 3200 generator set controls requiring a dry contact start, do not install a jumper.

Be sure to check the Interconnect Wiring diagram shipped with the transfer switch.

7.1.1.2 Auxiliary Contacts

Auxiliary contacts, for external alarm or control circuitry, are available for the Normal (utility power) and Emergency (generator set power) sides of the transfer switch. Connections for the auxiliary contacts can be made on terminal block TB1, **Figure 139**. The contacts have ratings of 5 amperes at 250 VAC. **Figure 139** shows the normally open and normally closed positions of the auxiliary contacts with the transfer switch in the neutral position. Moving the transfer switch to Normal or Emergency actuates the corresponding auxiliary contacts.

Use number 22 (0.4 mm²) to number 12 AWG (4 mm²) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).



Number	Description	Number	Description
1	COM	6	NO
2	NC	7	TB1
3	NO	8	Emergency Auxiliary Switch
4	COM	9	Normal Auxiliary Switch
5	NC		

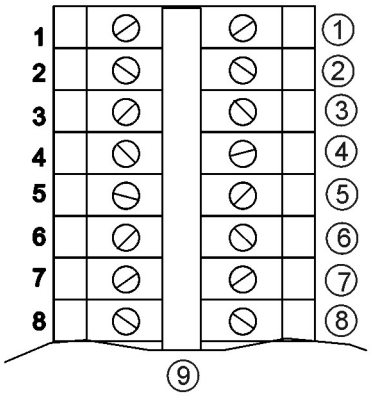
FIGURE 139. TERMINAL BLOCK TB1

7.1.1.3 Remote Start Stop Connections

Use number 18 (1 mm^2) to number 12 AWG (4 mm^2) wire. Resistance must not exceed 0.5 ohm per line. Stranded wire is recommended. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

Remote starting (for Cummins Power Generation water-cooled generator sets only) uses terminals B+, GND (ground), and RMT of terminal block TB1, **Figure 140**. Connect these terminals to like terminals on the generator set. Refer to your generator set wiring diagrams.

Connect a jumper between terminals 1 and 2 for PowerCommand control systems. Connect a jumper between terminals 2 and 3 for Detector Control systems. A jumper is not needed in any of the other systems.



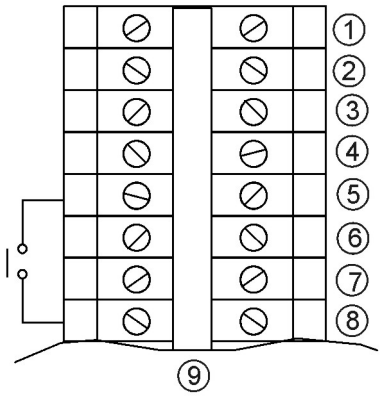
Number	Description	Number	Description
1	GND	6	Transfer Inhibit
2	Genset Start	7	Retransfer Inhibit
3	B+	8	Common
4	Genset Start	9	TB1
5	Remote Test		

FIGURE 140. TB1 START CONNECTIONS, REMOTE TEST, AND TRANSFER/RETRANSFER INHIBIT

7.1.1.4 Remote Test Input

To add remote test, connect a normally open, dry contact between terminals 5 and 8 of TB1 (see **Figure 141**). Closing the contact activates the feature and opening the contact deactivates it.

Use number 22 (0.4 mm^2) to number 12 AWG (4 mm^2) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).



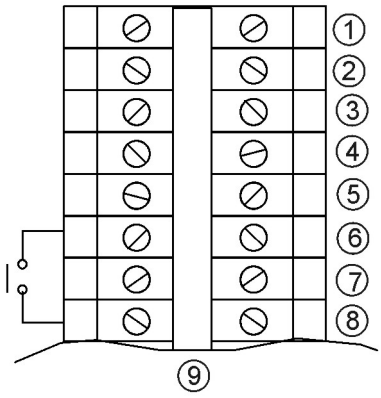
Number	Description	Number	Description
1	1 GND	6	6 Transfer Inhibit
2	2 Genset Start	7	7 Retransfer Inhibit
3	3 B+	8	Common
4	4 Genset Start	9	TB1
5	5 Remote Test		

FIGURE 141. TB1 CONNECTIONS FOR REMOTE TEST TRANSFER

7.1.1.5 Transfer Inhibit Input

To add transfer inhibit, connect a normally open, dry contact between terminals 6 and 8 of TB1, see **Figure 142**. Closing the contact enables the feature and opening the contact disables it.

Use number 22 (0.4 mm^2) to number 12 AWG (4 mm^2) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).



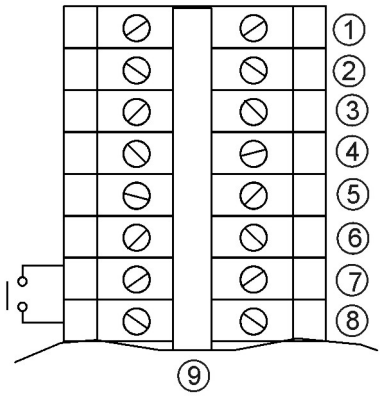
Number	Description	Number	Description
1	1 GND	6	6 Transfer Inhibit
2	2 Genset Start	7	7 Retransfer Inhibit
3	3 B+	8	Common
4	4 Genset Start	9	TB1
5	5 Remote Test		

FIGURE 142. TB1 CONNECTIONS FOR TRANSFER INHIBIT

7.1.1.6 Retransfer Inhibit Input

To add retransfer inhibit, connect a normally open, dry contact between terminals 7 and 8 of TB1, see **Figure 143**. Closing the contact enables the feature and opening the contact disables it.

Use number 22 (0.4 mm^2) to number 12 AWG (4 mm^2) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).



Number	Description	Number	Description
1	1 GND	6	6 Transfer Inhibit
2	2 Genset Start	7	7 Retransfer Inhibit
3	3 B+	8	Common
4	4 Genset Start	9	TB1
5	5 Remote Test		

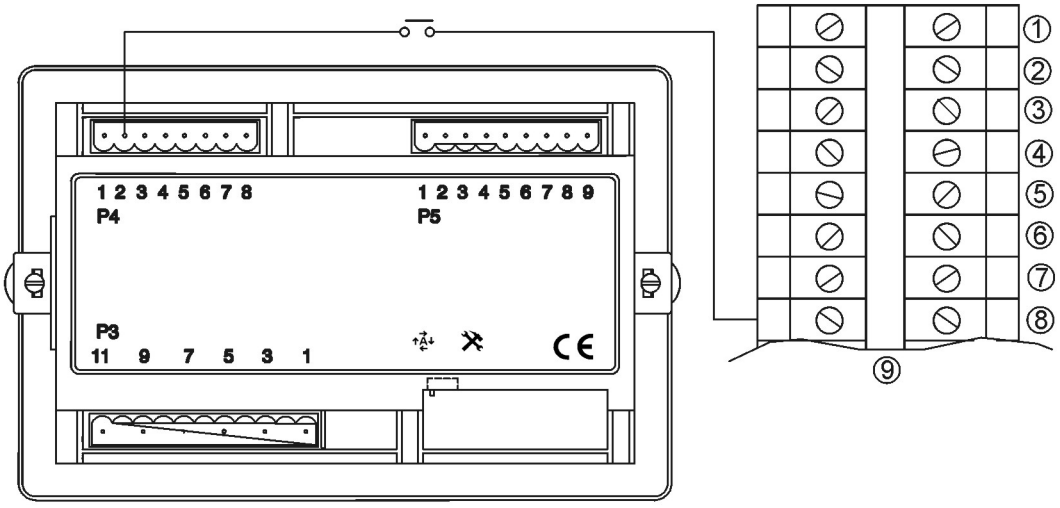
FIGURE 143. TB1 CONNECTIONS FOR RETRANSFER INHIBIT

7.1.1.7 Remote Override Input

The transfer switch may be wired with a remote Override switch that functions the same as the control panel Override pushbutton.

To add remote override, connect a normally open, dry (voltage free) contact between P4-2 on the back of the control panel and TB1-8 (see **Figure 144**). Closing the contact enables the feature and opening the contact disables it.

Use number 22 (0.4 mm^2) to number 12 AWG (4 mm^2) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).



Number	Description	Number	Description
1	1 GND	6	6 Transfer Inhibit
2	2 Genset Start	7	7 Retransfer Inhibit
3	3 B+	8	Common
4	4 Genset Start	9	TB1
5	5 Remote Test		

FIGURE 144. CONNECTIONS FOR REMOTE OVERRIDE INPUT

TABLE 14. TB CONNECTIONS

Signal	Terminal Number
PCC 1301 Start Signal	TB1: Terminals 10 and 11 (11 is GND)
PCC 2100 Start Signal	TB1: Terminals 1 and 22 (22 is GND)
PCC 3100 Start Signal	TB1: Terminals 5 and 4 (4 is GND)
PCC 3201 Start Signal	TB8: Terminals 4 and 5 (5 is GND)
PCC 3300 Start Signal	TB8: Terminals 4 and 5 (5 is GND)

7.1.1.8 Inspection and Cleanup

Inspect all wiring to be certain that:

- 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

After mounting and wiring the cabinet, clean the interior with a vacuum cleaner to remove any chips, filings, or dirt from the cabinet interior and components.

Double check the power supply voltages to make sure they match the voltages listed on the nameplate. Some installations with a nonstandard nameplate require that the voltage rating and frequency be recorded.

- An example of a standard nameplate is shown in **Figure 5**.
- Examples of non-standard nameplates are shown in **Figure 145**, **Figure 146**, and **Figure 147**.

1. Remove the Factory Default Setting label located on the control, see **Figure 149**, the tag attached inside the transfer switch, see **Figure 150**, and the tag on the trip power selecting board. Examples of these labels/tags are shown in **Figure 151**.
2. If the power supply voltage and frequency for the installation matches the default setting listed on the label, record the settings on the Site Set-up label located next to the nameplate on the inside of the transfer switch door (see **Figure 148**).

⚠ CAUTION
Incorrect settings can result in the transfer switch failing to operate correctly. To avoid equipment malfunction and damage, make sure the control is configured to match the power supply voltage and frequency.

⚠ CAUTION
Do not reset factory default time delay settings. Resetting factory default time delay setting will affect oil recirculation system with integrated ATS.

3. If the power supply voltage and frequency for the installation does not match the default setting listed on the label, access the configuration editor on the transfer switch control and change the voltage/frequency settings to match the installation. Refer to **Section 5.11**of this manual for information on how to adjust these settings. Record the settings on the Site Set-up label located next to the nameplate on the inside of the transfer switch door (see **Figure 148**).

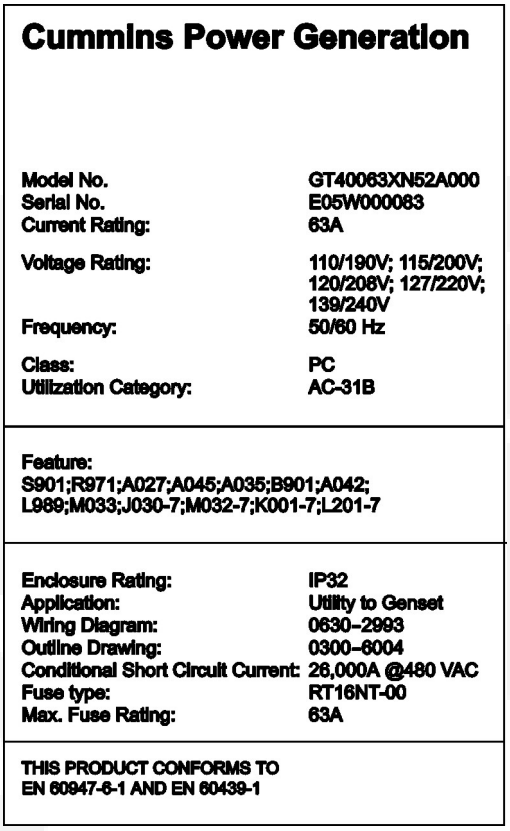


FIGURE 145. NAMEPLATE FOR TRANSFER SWITCH WITH "X" VOLTAGE CODE

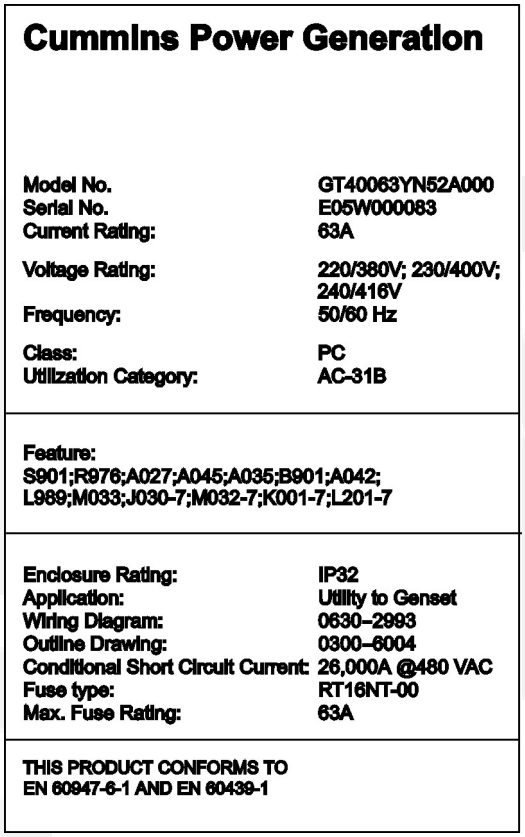


FIGURE 146. NAMEPLATE FOR TRANSFER SWITCH WITH "Y" VOLTAGE CODE

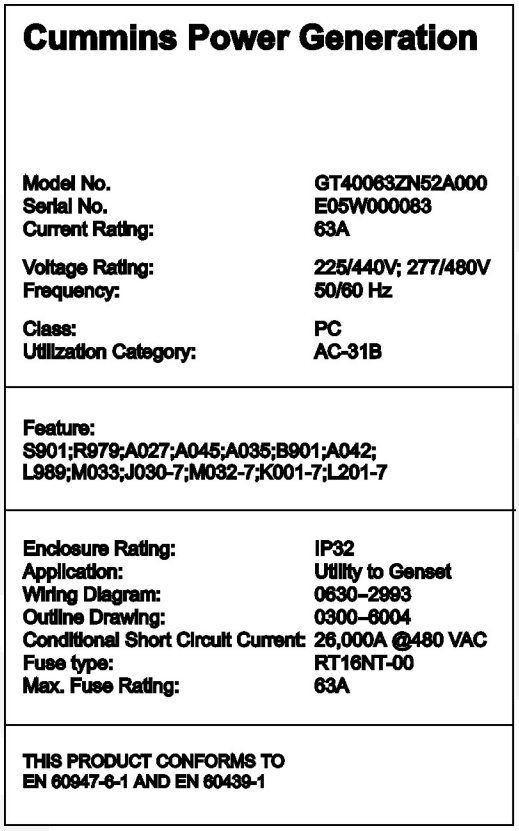


FIGURE 147. NAMEPLATE FOR TRANSFER SWITCH WITH "Z" VOLTAGE CODE

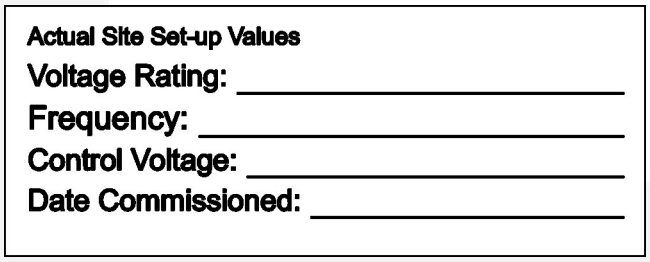


FIGURE 148. SITE SET-UP LABEL

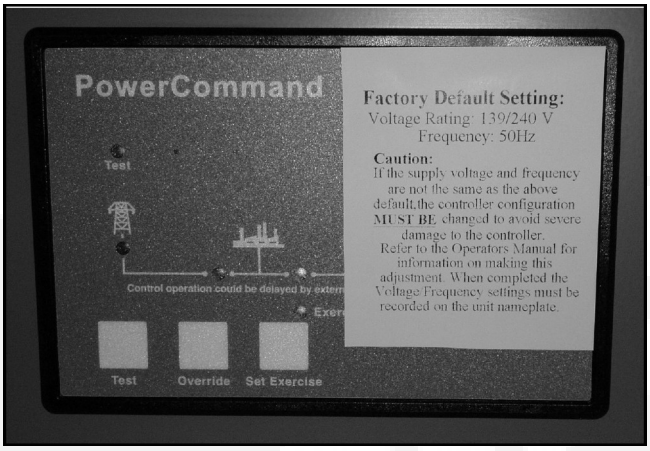


FIGURE 149. FACTORY DEFAULT SETTING LABEL ON CONTROL

- Double check the phase rotation. The Normal side phase rotation must match the Emergency side phase rotation.
- Verify that the remote start connections are correct for your application. For more information on jumper replacement, determine the control type and refer to information provided earlier in this section.
- Manually operate the Automatic Transfer Switch (ATS) with power off to make sure it operates smoothly, with no binding. If it does not operate smoothly, check for damage that may have occurred during shipping or installation. Also check for installation debris.

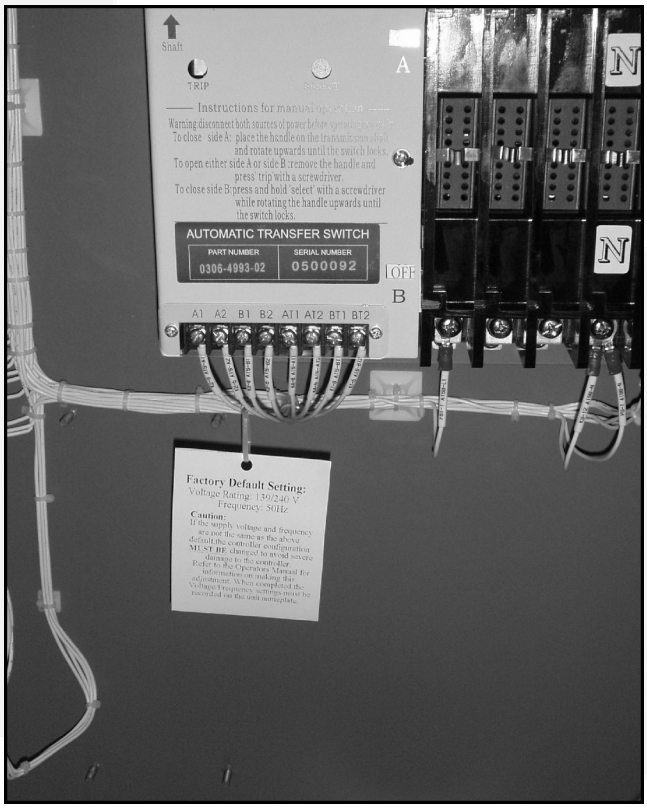


FIGURE 150. FACTORY DEFAULT SETTING TAG

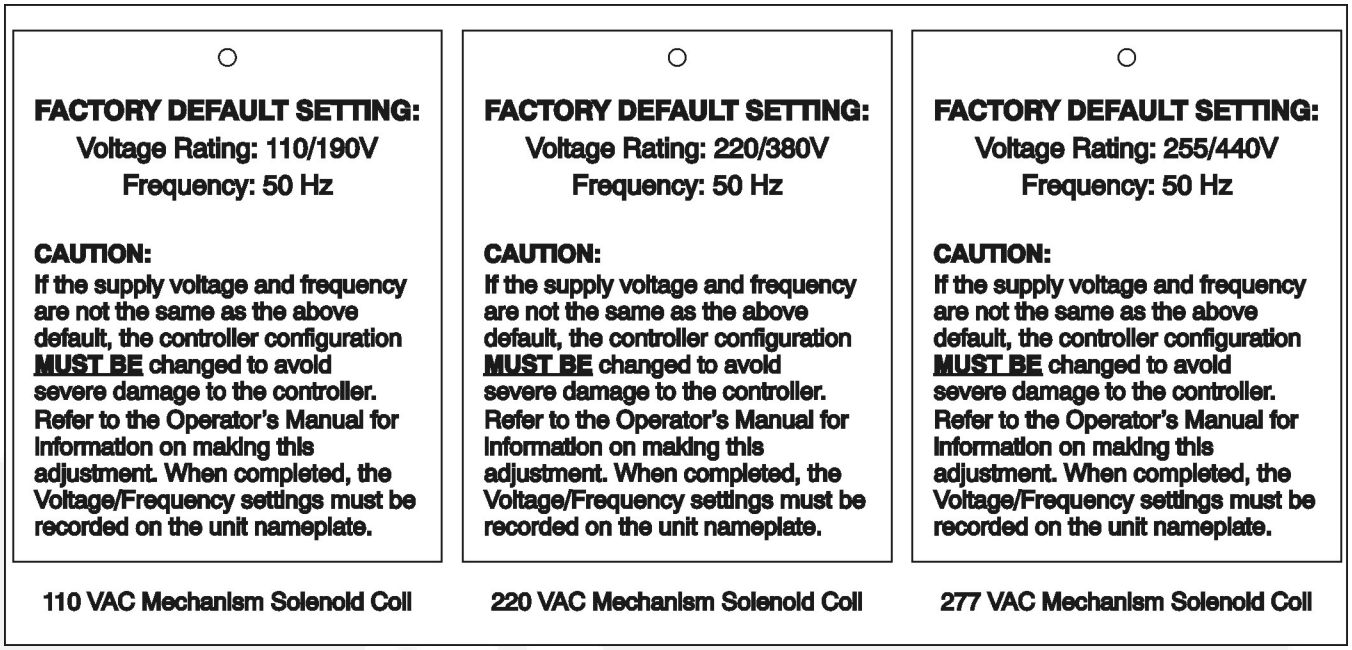


FIGURE 151. FACTORY DEFAULT SETTING TAGS

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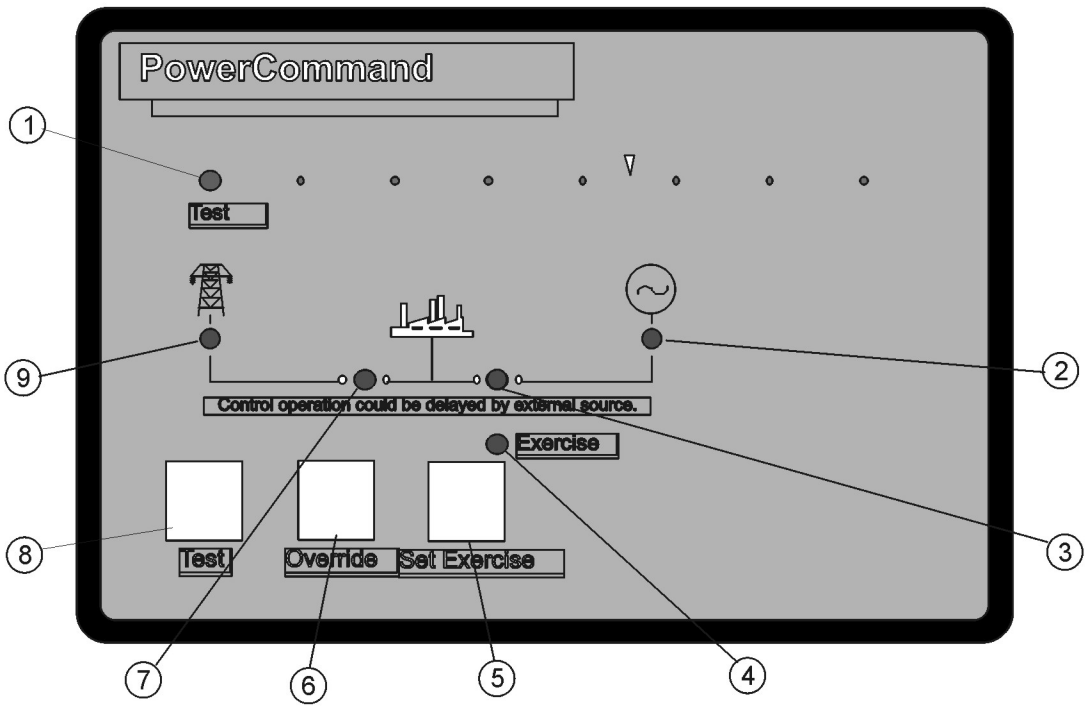
8 Troubleshooting

The first part of this section includes a description of the control LED indicators and provides preliminary troubleshooting checks for operators and service personnel.

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

8.1 Control Panel LED Indicators

The control panel contains six LED indicators that provide some information about the current control status and may be helpful in troubleshooting the transfer switch (see **Table 15**). Descriptions of these indicators are included in **Table 15**.



Number	Description	Number	Description
1	Test LED	6	Override Push Button
2	Genset Power Available LED	7	Utility Connected LED
3	Genset Connected LED	8	Test Push Button
4	Exercise LED	9	Utility Power Available LED
5	Set Exercise Push Button		

FIGURE 152. CONTROL PANEL

TABLE 15. CONTROL PANEL LED INDICATORS

Indicator	Definition
Utility (Normal) Power Available	This indicator lights when the utility source voltage sensor has determined that Utility power is available and is within acceptable voltage limits.
Utility (Normal) Connected	1. Lights constantly when the transfer switch is connected to the Utility. 2. Blinks once per second when the transfer switch has failed to connect to or disconnect from the Utility when commanded. 3. Is off when the transfer switch is not connected to the Utility.
Genset (Emergency) Power Available	This indicator lights when the generator set source voltage sensor has determined that generator set power is within acceptable voltage and frequency limits.
Genset (Emergency) Connected	1. Lights constantly when the transfer switch is connected to the generator set. 2. Blinks once per second when the transfer switch has failed to connect to or disconnect from the generator set when commanded. 3. Is off when the transfer switch is not connected to the generator set.
Exercise	The following describes the Exercise LED when an exercise is enabled. 1. Lights constantly when integrated repeat exercise periods have been set. 2. Blinks twice per second when the Set Exercise button is pressed and held to set or cancel an integrated exercise period. 3. Blinks once per second when an integrated or external exercise period is active. 4. Is off when no integrated repeat exercise periods are set.
Test	1. This indicator blinks at two times per second rate during the two seconds that the Test button is pressed to acknowledge that a test has been activated or when the remote test input is grounded. 2. The indicator lights constantly during the test and goes out once the test is terminated or normal power has failed. 3. The indicator blinks at two times per second rate during the two seconds to acknowledge that the Test button has been pressed to cancel a Test. The light then goes out.

8.2 Troubleshooting Procedures for Operators and Service Personnel

The following procedures describe preliminary troubleshooting checks. These checks can be used by both the operator and service personnel. If the trouble persists, call your dealer or distributor.

⚠ WARNING

Some ATS service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of electricity and machinery hazards should perform service.

Diagnosis of problems involves observing system operation. If you cannot determine the problem, contact Cummins/Onan Service.

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Whenever the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

Several of the steps listed on the following pages include checking on the control panel settings. To check the control settings, open the transfer switch door and slide the selector switch on the back on the control panel to the Configuration Mode position. Additional information on configuring the control panel is included in Section 5.11.

8.2.1 Power Outage Occurs, But Generator Set does not Start

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Whenever the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Verify that the operation selector switch on the generator set control panel is set to the Remote position. Check for fault indicators on the generator set control.
2. Start the generator set using its start-stop controls. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply. If the problem persists, call your dealer or distributor.

⚠ WARNING

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

⚠ WARNING

Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, arcing equipment, or other possible source of ignition near the fuel system.

8.2.2 Generator Set Starts During Normal Power Service

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Whenever the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Verify that the operation selector switch on the generator set control panel is set to the Remote position.
2. Check the Utility Power Available LED on the control panel to see if it is lit.

   If the Utility Power Available LED is lit,

   a. Check the Active Exercise LED to see if it is in an exercise period.

   NOTICE

   If the exercise period occurs at an unexpected time or for an excessive duration, refer to the exerciser clock programming procedure or call the dealer or distributor.

   b. Momentary voltage dips might cause voltage sensors to initiate generator set starting. Check the utility undervoltage parameter settings on the control panel. Increase the TDES setting.

   If the Utility Power Available LED is not lit,

   a. Check the control setting to verify that the system nominal voltage matches what is listed on the nameplate.

   b. Check the control setting to verify that the system frequency matches what is listed on the nameplate.

   c. Check the control setting to verify that the system phase setting matches what is listed on the nameplate.

   d. Check the control setting to verify that the utility undervoltage dropout point is set lower than the pickup set point.
3. If the problem persists, call the dealer or distributor.

8.2.3 Generator Set does not Exercise

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Whenever the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Verify that the operation selector switch on the generator set control panel is set to the Remote position.
2. If the optional external exerciser is installed, verify that the External Exercise function has been set to On.

3. Check the Exercise LED on the control panel to see if it is lit.
   a. If the Exercise LED is not lit, no exercise period has been set. Refer to the exerciser programming procedure for information on setting an exercise.
   b. If the Exercise LED is lit but not flashing, the exercise period has not yet started. Integrated exercisers do not display exercise start and stop times. If the optional external exerciser is enabled, check the exercise clock to see when an exercise is scheduled.
4. Start the generator set using its start-stop controls. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply.

⚠ WARNING

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

⚠ WARNING

Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, arcing equipment, or other possible sources of ignition near the fuel system.

5. If the problem persists, call your dealer or distributor.

8.2.4 After a Power Failure, the Generator Set Starts but does not Assume the Load

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

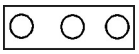
1. Check to see if the Genset Power Available LED on the control panel is lit.

   If the Genset Power Available LED is not lit,

   a. Check the output voltage of the power source by observing the voltmeter on the generator set.
   b. Check the control setting to verify that the system nominal voltage matches what is listed on the nameplate.
   c. Check the control setting to verify that the system frequency matches what is listed on the nameplate.
   d. Check the control setting to verify that the system phase setting matches what is listed on the nameplate.

   If the Genset Power Available LED is lit,

   a. The transfer time delay may not have expired. The TDNE can be set for up to 300 seconds. If you do not wish to wait until the time delay expires, press the Override pushbutton.

Function Code for TDNE	Value Code	Value (Default in bold italics)
		0 Seconds (Disabled)
		1 Second
		2 Seconds
		3 Seconds
		***5 Seconds***
		30 Seconds
		120 Seconds
		300 Seconds

b. There may be an active transfer inhibit. If a transfer inhibit is enabled, the load transfer will not take place until the Override pushbutton on the control panel is pressed or the transfer inhibit input is disabled.

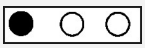
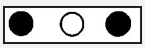
2. If the problem persists, call your dealer or distributor.

8.2.5 After Power Returns, the Transfer Switch does not Return to Normal Position

1. Check to see if the Utility Power Available LED is lit.

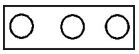
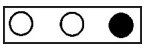
If the Utility Power Available LED is lit,

a. The retransfer time delay period may not have expired. The TDEN can be set for up to 30 minutes. If you do not wish to wait until the time delay expires, press the Override pushbutton.

Function Code for TDEN	Value Code	Value (Default in bold italics)
		0 Minutes (Disabled)
		0.1 Minutes
		5 Minutes
		***10 Minutes***
		15 Minutes
		20 Minutes
		25 Minutes
		30 Minutes

b. There may be an active retransfer inhibit. If a retransfer inhibit is enabled, the load transfer will not take place until the Override push button on the control panel is pressed, the retransfer inhibit input is disabled, or the generator set fails.

c. There may be an active TDEL. Wait until the time delay has expired. The TDEL can be set for up to 300 seconds.

Function Code for TDEL	Value Code	Value (Default in bold italics)
		***0 Seconds (Disabled)***
		1 Second
		2 Seconds
		3 Seconds
		5 Seconds
		30 Seconds
		120 Seconds
		300 Seconds

d. A phase check may be enabled. When the phase check function is enabled, the utility does not assume the load until both sources are within acceptable limits of the phase check sensor.

If the Utility Power Available LED is not lit,

a. Check the control setting to verify that the utility undervoltage dropout point is set lower than the pickup set point.

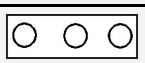
2. If the problem persists, call your dealer or distributor.

8.2.6 Generator Set Continues to Run After Retransfer of Load to Normal Power

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. The engine cooldown time delay may not have expired. The TDEC can be set for up to 30 minutes.

Function Code for TDEC	Value Code	Value (Default in bold italics)
		0 Minutes (Disabled)
		0.1 Minutes
		5 Minutes
		***10 Minutes***
		15 Minutes
		20 Minutes
		25 Minutes
		30 Minutes

2. Stop the generator set with its Start/Stop switch. Call your dealer or distributor.

8.2.7 System does not Test with Load

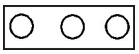
⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Check the control setting to verify that the Test With/Without Load function has been set to With Load.
2. If the control has been set to Test With Load
   a. The transfer time delay may not have expired. The TDNE can be set for up to 300 seconds. If you do not wish to wait until the time delay expires, press the Override pushbutton.

Function Code for TDNE	Value Code	Value (Default in bold italics)
○ ○ ○ ● ○	○ ○ ○	0 Seconds (Disabled)
	○ ○ ●	1 Second
	○ ● ○	2 Seconds
	○ ● ●	3 Seconds
	● ○ ○	***5 Seconds***
	● ○ ●	30 Seconds
	● ● ○	120 Seconds
	● ● ●	300 Seconds

   b. There may be an active transfer inhibit. If a transfer inhibit is enabled, the load transfer will not take place until the Override pushbutton on the control panel is pressed or the transfer inhibit input is disabled.
   c. There may be an active TDEL. Wait until the time delay has expired. The TDEL can be set for up to 300 seconds.

Function Code for TDEL	Value Code	Value (Default in bold italics)
		***0 Seconds (Disabled)***
		1 Second
		2 Seconds
		3 Seconds
		5 Seconds
		30 Seconds
		120 Seconds
		300 Seconds

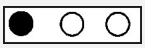
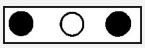
d. A phase check may be enabled. When the phase check function is enabled, the generator set does not assume the load until both sources are within acceptable limits of the phase check sensor.

8.2.8 System does not Exercise with Load

⚠ WARNING

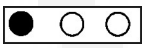
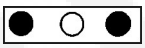
AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Check the control setting to verify that the Exercise With/Without Load function has been set to With Load.
2. If the control has been set to Exercise With Load
   a. The transfer time delay may not have expired. The TDNE can be set for up to 300 seconds. If you do not wish to wait until the time delay expires, press the Override pushbutton.

Function Code for TDNE	Value Code	Value (Default in bold italics)
		0 Seconds (Disabled)
		1 Second
		2 Seconds
		3 Seconds
		***5 Seconds***
		30 Seconds
		120 Seconds
		300 Seconds

b. There may be an active transfer inhibit. If a transfer inhibit is enabled, the load transfer will not take place until the Override pushbutton on the control panel is pressed or the transfer inhibit input is disabled.

c. There may be an active TDEL. Wait until the time delay has expired. The TDEL can be set for up to 300 seconds.

Function Code for TDEL	Value Code	Value (Default in bold italics)
		***0 Seconds (Disabled)***
		1 Second
		2 Seconds
		3 Seconds
		5 Seconds
		30 Seconds
		120 Seconds
		300 Seconds

d. A phase check may be enabled. When the phase check function is enabled, the generator set does not assume the load until both sources are within acceptable limits of the phase check sensor.

8.2.9 External Exercise Clock Does Not Start an Exercise

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.

1. Check the control setting to verify that the External Exercise function has been set to On.
2. Check the exercise program to see if exercise periods have been set up.
3. Check the exercise program to verify that both start and stop times for the exercise period have been set up. The exercise will not start if only the start time is set up.

8.2.10 External Exerciser Does Not Repeat an Exercise

Check the external exercise clock Permanent On/Off Mode setting. Exercises will not repeat if this feature is set to Off.

8.2.11 Battery Charger Fails to Charge (if Equipped)

Check the battery charger fuse(s). Replace, if necessary, with fuses of the correct rating. Fuse ampere ratings are shown on the charger faceplate.

⚠ WARNING

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

If the fuse is OK, call your dealer or distributor.

8.2.12 Battery Loses Water

Battery charger float voltage could be too high (if equipped with battery charger). If the problem continues, call your dealer or distributor

8.2.13 Battery Loses Charge

Battery charger float voltage could be too low (if equipped with battery charger). If the problem continues, call your dealer or distributor

8.3 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 conditional 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 and the rear side of the cabinet door 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.

8.3.1 About Customer Inputs

In applications with remote customer inputs, the generator set may start unexpectedly as a result of these inputs. These symptoms may appear to be caused by the transfer switch control. Verify that the remote input is not causing the symptom or isolate the control from these inputs before troubleshooting the control.

8.3.2 Control Panel LED Indicators

The control panel located on the transfer switch enclosure door contains six LED indicators. The indicators provide some information about the current control status and may be helpful in troubleshooting the transfer switch. See **Table 15**, **Table 16** and **Table 17**.

TABLE 16. TROUBLESHOOTING

Troubleshooting	Page
Sequence of Events	Section 8.3.3
Troubleshooting with Symptoms	Section 8.4
Utility Power Failure	Section 8.4.2
Utility Power is Restored	Section 8.4.3
Miscellaneous Troubleshooting Issues	Section 8.4.4

TABLE 17. CONTROL PANEL CONNECTIONS

Connector	Pin #	Function	Type	Comments
P3 TS1311 Control for Transfer Switches with Line-to-Neutral Voltage Sensing	1	N Generator	Voltage Sensor Inputs	75 - 480 Volts AC
	3	L1 Generator		
	5	N Utility		
	7	L3 Utility		
	9	L2 Utility		
	11	L1 Utility		
P3 TS1310 Control for Transfer Switches with Line-to-Line Voltage Sensing	1	L3 Generator	Voltage Sensor Inputs	75 - 480 Volts AC
	3	L1 Generator		
	5	L3 Utility		
	7	L2 Utility		
	9	L1 Utility		
P4	1	Functional Earth Ground	Inputs	Common for remote inputs
	2	Remote Override		Connect to P4-1 to activate
	3	Remote Test		Connect to P4-1 to activate
	4	External Exerciser Clock		Connect to P4-1 to activate
	5	Transfer Inhibit		Connect to P4-1 to activate
	6	Retransfer Inhibit		Connect to P4-1 to activate
	7	Connected to Utility (Normal)		Connect to P4-1 to activate when connected to utility power
	8	Connected to Genset (Emergency)		Connect to P4-1 to activate when connected to the genset

Connector	Pin #	Function	Type	Comments
P5	1	Open Normal (Utility)	Outputs	Grounded internally to energize open normal K4 relay
	2	Close Normal (Utility)		Grounded internally to energize close normal K2 relay
	3	Open Emergency (Genset)		Grounded internally to energize open emergency K1 relay
	4	Close Emergency (Genset)		Grounded internally to energize close emergency K3 relay
	5	Elevator Pretransfer		Grounded internally to energize elevator pretransfer relay
	6	Genset Start Relay		Internal dry contact closes (de-energizes) to start the genset and is held open (energized) to stop the genset
	7	Genset Start Relay		
	8	Ground Input (−)	Battery Connections	8 - 35 Volts DC
	9	B+ Input		

NOTICE
L3 Utility is not available on 2-pole transfer switches.

8.3.3 Sequence of Events

The control executes a prescribed sequence of events for all transfer switch operations.

8.3.3.1 Normal-to-Emergency Sequence of Events (Disable Trip Function)

The following describes the sequence of events for an GTEC transfer switch during a **normal (utility) power failure**. In this example, TDNE and TDPT are set higher than zero, TDEL is set to zero, and phase check is not enabled, trip function is not enabled.

Steps 1 through 8 describe what normally happens when the transfer switch is in the Normal position, utility power fails, and the switch transfers to the Neutral position (see **Figure 154**). Steps 9 through 12 describe what then normally happens when the switch then moves from the Neutral position to the Emergency position (see **Figure 155**).

1. While the transfer switch is connected to the utility (Normal position), utility power fails. The Utility Connected LED remains lit but the Utility Power Available LED goes out.
2. The Time Delay Engine Start (TDES) begins.
3. When the TDES expires, the internal start contact closes P5-6 and P5-7, sending a start signal to the generator set.
4. When the generator set starts and produces power, the Genset Power Available LED lights.
5. A Time Delay Normal-to-Emergency (TDNE) begins.

6. After the TDNE expires, the control enables the Open Normal output by grounding P5-1, energizing the K4 relay coil.
7. The transfer switch moves to the Neutral position.
8. Auxiliary switch ASW1 removes the ground signal from P4-7, signaling that the ATS has disconnected from Normal; then the Utility Connected LED goes out.
9. The control starts the Time Delay Programmed Transition (TDPT) timer.
10. When the TDPT timer expires, both the Open Normal (P5-1) and Close Emergency (P5-4) outputs are grounded, energizing K3 and K4 relay coils to move the transfer switch from the Neutral position to the Emergency position. An auxiliary switch within the ATS breaks the signal.
11. The load is transferred to the generator set.
12. Auxiliary switch BSW1 provides a ground signal to P4-8, signaling that the ATS has transferred; then the Genset Connected LED lights. The control then removes the ground signal from the Open Normal (P5-1) and Close Emergency (P5-4) outputs, de-energizing relays K3 and K4.

8.3.3.2 Emergency-to-Normal Sequence of Events (Disable Trip Function)

The following describes the sequence of events for a GTEC transfer switch during a normal (utility) power failure. In this example, TDEN and TDPT are set higher than zero, TDEL is set to zero, and phase check is not enabled, trip function is not enabled.

Steps 1 through 5 describe what normally happens when the transfer switch is in the Emergency position (connected to the generator set), utility power returns, and the switch transfers to the Neutral position (see **Figure 156**). Steps 6 through 10 describe what then normally happens when the switch moves from the Neutral position to the Normal position (see **Figure 157**).

1. The utility returns. The Utility Power Available LED lights.
2. A Time Delay Emergency-to-Normal (TDEN) begins.
3. After the TDEN expires, the control grounds the Open Emergency output (P5-3), energizing K1 relay coil.
4. The transfer switch moves to the Neutral position.
5. Auxiliary switch BSW1 removes the ground signal from P4-8, signaling that the ATS has disconnected from Emergency; then the Genset Connected LED goes out.
6. The control starts the TDPT timer.
7. When the TDPT timer expires, the control grounds both the Open Emergency (P5-3) and Close Normal (P5-2) outputs, energizing K1 and K2 relay coils to move the transfer switch from the Neutral position to the Normal position. The load is transferred to the utility.
8. Auxiliary switch ASW1 provides a ground signal to P4-7, signaling that the ATS has transferred; then the Utility Connected LED lights. The control then removes the ground signal from the Open Emergency (P5-3) and Close Normal (P5-2) outputs, de-energizing relays K1 and K2.
9. The control starts the Time Delay Engine Cooldown (TDEC) timer.
10. When the TDEC timer expires, the P5-6 to P5-7 contact opens and the generator set stops running and the Genset Power Available LED goes out.

8.4 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.

NOTICE
In the schematics shown in this section, "Source 1 Position" refers to the Normal position on the transfer switch which is connected to the utility power source. "Source 2 Position" refers to the Emergency position on the transfer switch which is connected to the generator set.

Conditional schematics are used to highlight the circuit that is energized during the sequence of the events. These conditional schematics are for a typical transfer switch with options. 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 good wire harness and ground connections are made. Correct wiring problems before performing any test or replacing any components.

8.4.1 Transfer Switch Operation

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

- The control uses an auxiliary contact (ASW1 and BSW1) on either side of the switch to determine if the switch has opened or closed. If the switch is bad, the control will continue to either open or close that side of the switch.
- The control supplies a grounding signal to pick up the control relays (K1, K2, K3, and K4).
- All inputs are activated by applying a ground to the signal input.
- The control operates over a DC voltage range of 8 to 35 volts but the control relays are voltage dependent (12 or 24 volts, depending on the generator set start battery).
- If the switch is left connected to a DC power source (for example, the generator set start battery) but there is no AC power available, the control panel Connected LED for that power source will still be lit.
- The transfer, retransfer, and program transition relays (K1, K2, K3, and K4) are pulsed and are powered for only one second, or until an auxiliary contact (ASW1 or BSW1) changes state, and then the power is removed (the relays are de-energized). When a relay is being energized, there is an audible click.
- The software includes a retry function. If the switch fails to transfer within one second, power is removed and the software waits 10 seconds before trying again. After five attempts, the software quits trying and either the Utility

  Connected LED or the Genset Connected LED flashes, depending on which part of the switch circuit has failed. All operations are then locked out until the software is reset by pressing the Override pushbutton on the control panel.

8.4.2 Utility Power Failure

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door 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 you generator set manuals.

TABLE 18. UTILITY POWER (SOURCE 1) FAILS BUT THE GENERATOR SET DOES NOT START

Problem	Possible Cause	Corrective Action	Section
Generator set cranks but does not start	There may be a generator set problem	Check the fuel system. Refer to the generator set's service manual	
Generator set does not crank	1. A Time Delay Engine Start (TDES) may be timing. 2. There may not be a generator set start signal. 3. The generator set may be waiting for a remote start command. 4. There may be defective wiring. 5. There may be a defective battery or cables. 6. The generator set control may not be functioning correctly.	1. Wait until the time delay (up to 10 seconds) has expired, or press the Override pushbutton on the control panel, or ground the Override input. 2. Check for a generator set start signal (closed contact between P5-6 and P5-7). 3. Verify that the generator set control is set for Remote Start. 4. a. Check the start circuit wiring (see Figure 154). b. Check the wiring between the ATS and the generator set control. 5. Check the batteries and cable connections. 6. Check the generator set control for proper operation.	Section 5.1 Section 5.3.2 Figure 154

TABLE 19. GENERATOR SET IS RUNNING BUT THE ATS DID NOT TRANSFER TO THE GENERATOR SET

Problem	Possible Cause	Corrective Action	Section/Page
Genset Available LED is off	1. There may be improper voltage at the voltage sensor inputs. 2. There may be improper voltage between the ATS power terminals. 3. There may be improper voltage at the generator set output terminals.	1. a. Check for proper generator set voltage between P3-1 and P3-3. The voltage must be higher than the generator set voltage sensor pickup point. b. Check voltage sensing wiring between the control and the ATS. 2. Check for proper generator set voltage between ATS power terminals EA and EC (line-to-line) or between EA and EN (line-to-neutral). Voltage must be higher than the generator set voltage sensor pickup point. 3. a. Check for proper voltage at generator set output terminals. Voltage must be higher than the generator set voltage sensor pickup point. b. Check the power circuit wiring between the ATS and the generator set.	Section 5.5.2 Section 5.5.2

Problem	Possible Cause	Corrective Action	Section/Page
Genset Available LED is on	1. A Time Delay Normal-to-Emergency (TDNE) may be timing. 2. There may be an active transfer inhibit. 3. A Time Delay ELevator pre-transfer (TDEL) may be timing.	1. Wait until the time delay (up to 300 seconds) has expired, or press the Override pushbutton on the control panel, or ground the Override input. 2. Check for ground on P4-5, If present, remove the ground or press the Override pushbutton. 3. Check for a ground on P5-5. If present either remove the ground or else wait until the time delay (up to 300 seconds) has expired.	Section 5.1.3 Section 5.3.2 Section 5.3.2 Section 5.1.5

Problem	Possible Cause	Corrective Action	Section/Page
Utility Connected LED is flashing	The control was unsuccessful in its attempts to open the Normal side of the ATS. After 5 attempts to move the ATS, the Utility Connected LED flashes, indicating that it failed to open. To open Normal, the control grounds P5-1 to energize K4 for 1 second and monitors the Source 1 position input (P4-7) to see if auxiliary switch ASW1 opens. If ASW1 doesn't open, the control de-energizes K4, waits 10 seconds, and tries again. If ASW1 doesn't open after the fifth try, the Utility Connected LED flashes and the control quits trying.	1. Check the Open Normal circuit for a bad connection, open wire, or a faulty part. 2. Check K4 or the continuity through AT1 and AT2 or B1 and B2 of the ATS. 3. Press the Override pushbutton to reset the control so it will try to open the Normal side of the ATS. Observe what happens and verify that the relay coils are energizing. a. If the coils are energizing, • Check the wiring between the relays and the transfer switch. • Check to see if the transfer switch is faulty. b. The coils are not energizing, • Check the wiring between the relay and the control. • Check to see if the relay is faulty. 4. Check the three option switch settings according to operation in Chapter 4	Section 5.3.2

NOTICE

The above description describes the operation if the programmed transition timer is set higher than zero. If TDPT is set to zero, the control grounds both the P5-1 and P5-4 outputs to energize the K3 and K4 relays to transfer the ATS to Emergency. If phase check is enabled, then both K3 and K4 are also energized but not until both sources are in phase.

Problem	Possible Cause	Corrective Action	Section/Page
Genset Connected LED is flashing	The control was unsuccessful in its attempts to close the Emergency side of the ATS. After 5 attempts to move the ATS, the Genset Connected LED flashes, indicating that it failed to close. To close Emergency, the control grounds P5-1 and P5-4 to energize K3 and K4 for 1 second and monitors the Source 2 position input (P4-8) to see if auxiliary switch BSW1 closes. If BSW1 doesn't close, the control de-energizes K3 and K4, waits 10 seconds, and tries again. If BSW1 doesn't close after the fifth try, the Emergency Connected LED flashes and the control quits trying.	1. Check the Close Emergency circuit for a bad connection, open wire, or faulty part. 2. Check K3, K4, or the continuity through B1 and B2 of the ATS. 3. Press the Override pushbutton to reset the control so it will try to close the Emergency side of the ATS. Observe what happens and verify that the relay coils are energizing. a. If the coils are energizing, • Check the wiring between the relays and the transfer switch. • Check to see if the transfer switch is faulty. b. If the coils are not energizing, • Check the wiring between the relay and the control. • Check to see if the relay is faulty. 4. Check the three option switch settings according to operation in Chapter 4.	Section 5.3.2

8.4.3 Utility Power is Restored

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door 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 you generator set manuals.

TABLE 20. UTILITY POWER IS RESTORED BUT THE SWITCH DOES NOT TRANSFER TO NORMAL

Problem	Possible Cause	Corrective Action	Section/Page
Utility Power Available LED is off	1. There may be improper voltage at the voltage sensor inputs. 2. There may be improper utility voltage between the ATS power terminals.	1. Check for proper utility voltage between P3-5, P3-7, and P3-9 (line-to-line) or between P3-5, P3-7, P3-9, and P3-11 (line-to-neutral). Voltage must be higher than the utility voltage sensor pickup point. a. Check voltage sensing wiring between the control and the ATS. b. Make sure the utility voltage sensing pickup setting and dropout setting are not both set at 90%. 2. Check a. for proper utility power between ATS power terminals NA, NB, and NC. Voltage must be higher than the utility voltage sensor pickup point. b. power circuit wiring between the ATS and the upstream circuit breaker.	Section 5.5.1, Section 5.11.2

Problem	Possible Cause	Corrective Action	Section/Page
Utility Power Available LED is on	1. A Time Delay Emergency-to-Normal (TDEN) may be timing. 2. There may be an active retransfer inhibit input. 3. A TDEL may be timing. 4. A Phase Check may be enabled and the sources are not in phase.	1. Wait until the time delay (up to 30 minutes) has expired, or press the Override pushbutton on the control panel, or ground the Override input. 2. Check for ground on P4-6. If present, remove the ground or press the Override pushbutton. 3. Check for a ground on P5-5. If present, either remove the ground or else wait until the time delay (up to 300 seconds) has expired. 4. a. Check phase rotation b. Check frequency differences between the two sources, frequency differences must be 1 Hz or less. c. Both sources may be at the exact same frequency but not in phase. The phase angle difference between the sources must be 25 degrees or less. Enable the 'Returned to Programmed Transition' function. If the sources don't meet the requirements of in-phase for 2 minutes, then the control will transfer the ATS in the programmed transition mode.	Section 5.1.4 Section 5.3.2 Section 5.1.6

Problem	Possible Cause	Corrective Action	Section/Page
Genset Connected LED is flashing	The control was unsuccessful in its attempts to open the Emergency side of the ATS. After 5 attempts to move the ATS, the Emergency Connected LED flashes, indicating that it failed to open. To open Emergency, the control grounds P5-3 to energize K1 for 1 second and monitors the Source 2 position input (P4-8) to see if auxiliary switch BSW1 opens. If BSW1 doesn't open, the control de-energizes K1, waits 10 seconds, and tries again. If BSW1 doesn't open after the fifth try, the Genset Connected LED flashes and the control quits trying.	1. Check the Open Emergency circuit for a bad connection, open wire, or a faulty part. 2. Check K1 or the continuity through BT1 and BT2 of the ATS. 3. Press the Override pushbutton to reset the control so it will try to open the Emergency side of the ATS. Observe what happens and verify that the relay coils are energizing. a. If the coils are energizing, • Check the wiring between the relays and the transfer switch. • Check to see if the transfer switch is faulty. b. If the coils are not energizing, • Check the wiring between the relay and the control. • Check to see if the relay is faulty. 4. Check the three option switch settings according to operation in Chapter 4.	Section B.1 Section 5.3.2

NOTICE

The above description describes the operation if the programmed transition timer is set higher than zero. If TDPT is set to zero, the control grounds both the P5-2 and P5-3 outputs to energize the K1 and K2 relays to transfer the ATS to Normal. If phase check is enabled, then both K1 and K2 are also energized but not until both sources are in phase.

Problem	Possible Cause	Corrective Action	Section/Page
Utility Connected LED is flashing	The control was unsuccessful in its attempts to close the Normal side of the ATS. After 5 attempts to move the ATS, the Utility Connected LED flashes, indicating that it failed to close. To close Normal, the control grounds P5-2 and P5-3 to energize K1 and K2 for 1 second and monitors the Source 1 position input (P4-7) to see if auxiliary switch ASW1 closes. If ASW1 doesn't close, the control de-energizes K1 and K2, waits 10 seconds, and tries again. If ASW1 doesn't close after the fifth try, the Utility Connected LED flashes and the control quits trying.	1. Check the Close Normal circuit for a bad connection, open wire, or faulty part. 2. Check K1, K2, or the continuity through A1 and A2 of the ATS. 3. Press the Override pushbutton to reset the control so it will try to close the Normal side of the ATS. Observe what happens and verify that the relay coils are energizing. a. If the coils are energizing, • Check the wiring between the relays and the transfer switch. • Check to see if the transfer switch is faulty. b. If the coils are not energizing, • Check the wiring between the relay and the control. • Check to see if the relay is faulty. 4. Check the three option switch settings according to operation in Chapter 4.	Section 5.3.2

TABLE 21. SWITCH TRANSFERRED TO NORMAL BUT THE GENERATOR SET CONTINUES TO RUN

Problem	Possible Cause	Corrective Action	Section/Page
Generator set did not shut down after the ATS has transferred to Normal position	1. A Time Delay Engine Cooldown (TDEC) may be timing. 2. The generator set may not have received a stop signal. 3. The selector switch on generator set control panel may not be in the correct position. 4. There may be defective wiring. 5. The generator set control may not be operating correctly.	1. Wait for the time delay (up to 30 minutes) to expire. 2. Check for a generator set stop signal (open contact between P5-6 and P5-7). 3. Check to see if the generator set control is set for Remote Start. 4. Check the start circuit wiring. 5. Check the generator set control for proper operation.	Section 5.1.2 Section B.1

8.4.4 Miscellaneous Troubleshooting Issues

⚠ WARNING

AC power within the cabinet and the rear side of the cabinet door 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 you generator set manuals.

TABLE 22. MISCELLANEOUS

Problem	Possible Cause	Corrective Action	Section/Page
Generator set running for no apparent reason	1. The generator set may not have received a stop signal. 2. The selector switch on generator set control panel may not be in the correct position. 3. There may be defective wiring. 4. The generator set control may not be operating correctly.	1. Check for a generator set stop signal (open contact between P5-6 and P5-7). 2. Check to see if the generator set control is set for Remote Start. 3. Check the start circuit wiring. 4. Check the generator set control for proper operation.	Section B.1

Problem	Possible Cause	Corrective Action	Section/Page
Front panel test does not transfer the load	1. The control is not set to Test With Load. 2. The control is set to Test With Load but one of the following has occurred. a. The transfer time delay may not have expired. b. There may be an active transfer inhibit. c. There may be an active TDEL. d. A phase check may be enabled.	1. Check the control setting to verify that the Test With/Without Load function has been set to With Load. 2. If the control has been set to Test With Load, a. The TDNE can be set for up to 300 seconds. If no desire to wait until the time delay expires, press the Override pushbutton. b. Check for ground on P4-5. If a transfer inhibit is enabled, the load transfer will not take place until the Override pushbutton on the control panel is pressed or the transfer inhibit input is disabled. c. Check for a ground on P5-5. If present, either remove the ground or else wait until the time delay has expired. The TDEL can be set for up to 300 seconds. d. When the phase check function is enabled, the generator set does not assume the load until both sources are within acceptable limits of the phase check sensor.	Section 5.4 Section 5.1.3 Section 5.3.2 Section 5.3.2 Section 5.1.6 Section 5.5.3
Remote test does not function	There is no contact between TB1-5 and TB1-8.	Close the contact to start a test.	

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9 Transfer Switch Service

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

9.1 Switch Assembly Removal and Replacement Procedures

There are separate switch assemblies. Each assembly corresponds to a particular current range, and coil operating voltage, and number of poles. There are six current ranges; 20 to 63 amperes, 100 to 125 amperes, 160 to 250 amperes, 300 to 500 amperes, 630 to 800 amperes, 1000 to 1250 amperes, and 1600 to 2000 amperes) and three coil voltages (110, 220, and 277 VAC). Transfer switches can be in 2-, 3-, or 4-pole configurations.

For servicing purposes, each transfer switch assembly is removed and replaced as a unit. There are no serviceable components.

9.1.1 Switch Removal and Replacement Procedure

9.1.1.1 Disconnect AC Power

⚠ WARNING

The transfer switch presents 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. If a generator provides emergency power, move the generator operation selector switch to Stop, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery negative (-) cable.

1. Move the operation selector switch on the generator to Stop (Off). The selector switch is located on the generator set control panel.

⚠ 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.

2. 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 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.

3. Disconnect the battery charger, if present, from its AC power source and disconnect the set starting battery negative (−) cable (disconnect 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.

4. Remove all AC power to the automatic transfer switch.

9.1.1.2 Transfer Switch Assembly Removal

1. For transfer switches with a controller, remove the transfer switch cabinet door panel. For transfer switches without a controller, remove the outer and inner door panels.
2. Remove all control and power wiring from the switch terminals.
3. Loosen and remove switch assembly,
   - Loosen and remove the four screws, nuts, and washers that secure the switch panel and switch to the rear wall of the cabinet
   - Loosen the six 1/4-20 bolts securing the mechanical lugs.
   - For transfer switches with a controller or with one circuit breaker, loosen and remove the two screws, nuts, and washers securing the bracket at the load and emergency side (bottom) of the switch.
   - Loosen and remove all M6 nuts and lock washers securing the switch to the rear wall of the cabinet.
   - Remove the switch and bottom bracket from the cabinet.
4. Mark the bus bar of each phase of the Utility/Generator and Load. Then remove all of the bus bars from the old switch.

⚠ CAUTION

Mounting the bus bar in the wrong direction may increase the risk of a short to ground. Mount the bus bar with the long end toward the breaker.

5. Lift out the switch and panel assembly and set it aside
6. Remove the switch from the mounting panel

9.1.1.3 Transfer Switch Replacement

1. Install the bus bars on the new switch in accordance to the markings. Making sure the long end of the bus bar is connected to the breaker.

2. Lift the switch and panel assembly and place the assembly into the cabinet and hang it on the studs on the rear wall. Use the hardware removed previously to install the new switch assembly in the cabinet. Torque the nuts per Table 23.
3. For transfer switches with a controller or with one circuit breaker, use the hardware removed previously to install the bracket at the Load and Emergency side of the switch. Torque the M6 nuts per Table 23.
4. Tighten the 1/4-20 bolts securing the mechanical lugs. Torque the bolts per Table 23.
5. Reinstall the cabinet door panel(s).

TABLE 23. METRIC HARDWARE TORQUES

Source Connection Lug	Recommended Torque (Nm)
M6	6
M8	16
M12	50

9.1.1.4 Reconnect AC Power (When Finished)

1. Replace all AC power to the automatic transfer switch.
2. Connect the generator set starting battery (negative (−) battery cable last).

⚠ 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.

3. If there is an external 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.

4. Reconnect utility power (Normal) and generator set power (Emergency)
5. Set the operation selector switch on the generator set to in the Remote (or Auto) position

⚠ WARNING

AC power in the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.

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Appendix A. Parts Information

Table of Contents

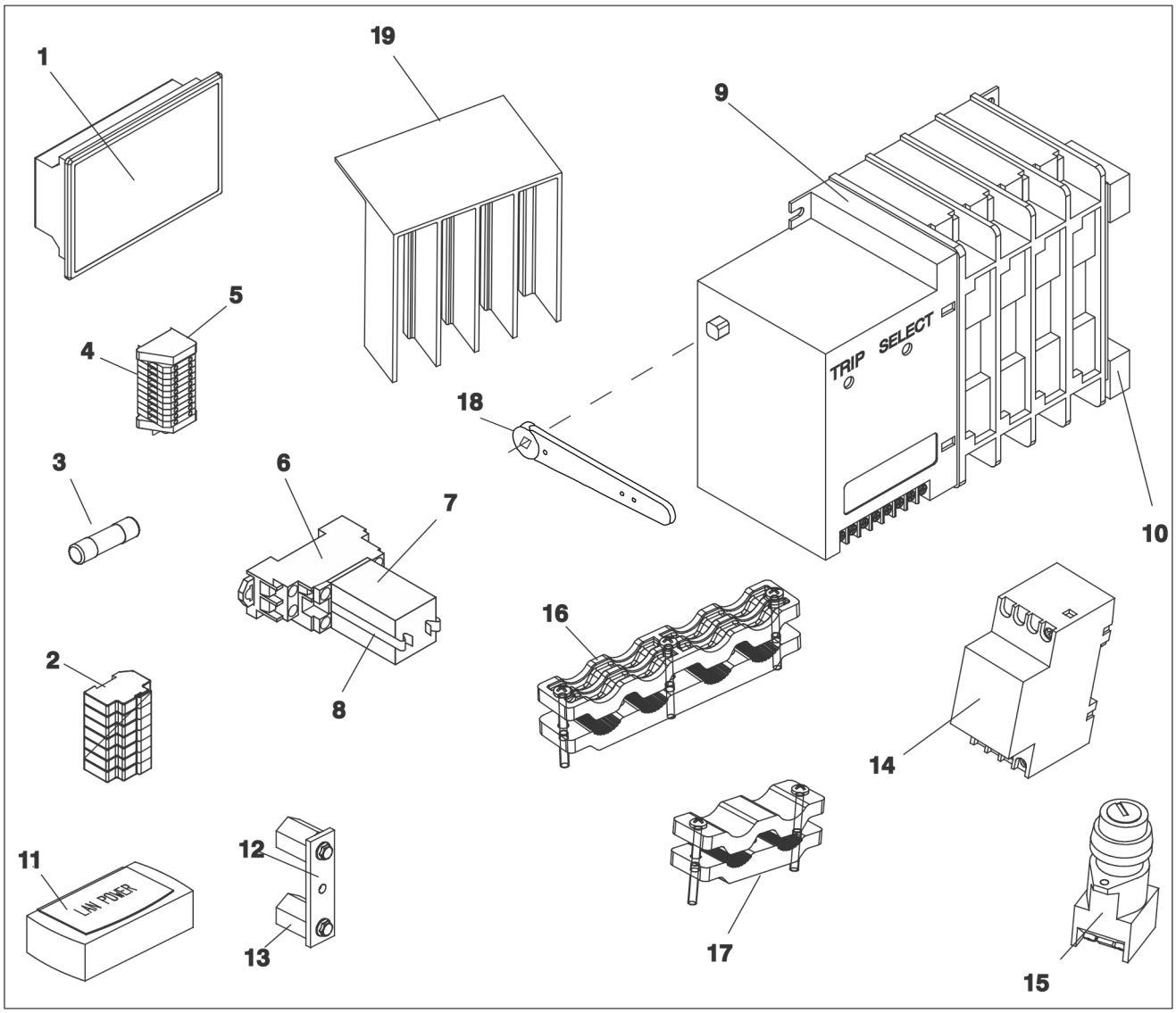

FIGURE 153. GTEC TRANSFER SWITCH PARTS

TABLE 25. GTEC TRANSFER SWITCH PARTS

Ref No.	Part No.	Qty Used	Part Description	Ref No.	Part No.	Qty Used	Part Description
1			Control Display Line-to-Line Voltage Sensing (TS1310)	9			Transfer Switch Assembly
	300-5965	1	Cabinet Construction with PowerCommand		306-4984-01	1	110 VAC 4Pole 800 Amp
	300-5975	1	Open Construction without PowerCommand		306-4984-02	1	220 VAC 4Pole 800 Amp
			Line-to-Neutral Voltage Sensing (TS1311)		306-4984-03	1	277 VAC 4Pole 800 Amp
	300-5985	1	Cabinet Construction with PowerCommand		306-5015-01	1	110 VAC 2Pole 1250 Amp

Ref No.	Part No.	Qty Used	Part Description	Ref No.	Part No.	Qty Used	Part Description
1	300-5986	1	Open Construction without PowerCommand	9	306-5015-02	1	220 VAC 2Pole 1250 Amp
2	321-0418	1	Fuse Block (includes fuse)		306-5015-03	1	277 VAC 2Pole 1250 Amp
3			Fuse		306-4985-01	1	110 VAC 3Pole 1250 Amp
	321-0417-01	4	2 Amp		306-4985-02	1	220 VAC 3Pole 1250 Amp
	321-0417-02	1	4 Amp		306-4985-03		277 VAC 3Pole 1250 Amp
	321-0417-03	2	10 Amp		306-4986-01	1	110 VAC 4Pole 1250 Amp
4	332-3125-02	1	Terminal Block - (TB1,10 Poles)		306-4986-02	1	220 VAC 4Pole 1250 Amp
5	332-2878	2	Terminal End Bracket		306-4986-03	1	277 VAC 4Pole 1250 Amp
6	307-3076	4	Base, Relay (Socket)		A029C492	1	110 VAC 3Pole 1600 & 2000 Amp
7			Relay		A029G083	1	220 VAC 3Pole 1600 & 2000 Amp
	307-3070	4	12 VDC		A029G085	1	277 VAC 3Pole 1600 & 2000 Amp
	307-3071	4	24 VDC		A026K751	1	110 VAC 4Pole 1600 & 2000 Amp
8	307-3077	8	Bracket, Relay (Clip)		A029G079	1	220 VAC 4Pole 1600 & 2000 Amp
9			Transfer Switch Assembly		A029G081	1	277 VAC 4Pole 1600 & 2000 Amp
	306-5010-01	1	110 VAC 2Pole 20-63 Amp	10	308-1217	2	Auxiliary Switch Level
	306-5010-02	1	220 VAC 2Pole 20-63 Amp	11			Battery Charger - 2 Amp.
	306-5010-03	1	277 VAC 2Pole 20-63 Amp		300-6207-01	1	12VDC (100-240 VAC)
	306-4992-01	1	110 VAC 3Pole 20-63 Amp		300-6207-02	1	24VDC (100-240 VAC)
	306-4992-02	1	220 VAC 3Pole 20-63 Amp	12			Neutral Bus Bar
	306-4993-03	1	277 VAC 3Pole 20-63 Amp		337-2366	1	20, 63, and 125 Amp
	306-4993-01	1	110 VAC 4Pole 20-63 Amp		337-3760	1	250 and 500 Amp
	306-4993-02	1	220 VAC 4Pole 20-63 Amp		337-3761	1	800 and 1250 Amp
	306-4993-03	1	277 VAC 4Pole 20-63 Amp		A028U410	1	1600 and 2000 Amp
	306-5011-01	1	110 VAC 2Pole 100-125 Amp	13			Isolator Standoff
	306-5011-02	1	220 VAC 2Pole 100-125 Amp		872-0033	2	20, 63 and 125 Amp
	306-5011-03	1	277 VAC 2Pole 100-125 Amp		872-0034	2	250 and 500 Amp
	306-4990-01	1	110 VAC 3Pole 100-125 Amp		872-0034	4	800 and 1250 Amp
	306-4990-02	1	220 VAC 3Pole 100-125 Amp		872-0034	4	1600 and 2000 Amp
	306-4990-03	1	277 VAC 3Pole 100-125 Amp	14	307-3053	1	External Exercise Clock

Ref No.	Part No.	Qty Used	Part Description	Ref No.	Part No.	Qty Used	Part Description
9	306-4991-01	1	110 VAC 4Pole 100-125 Amp	15	308-1209	1	Manual Key Restore Switch
	306-4991-02	1	220 VAC 4Pole 100-125 Amp	16	A035J311	1	Bracket, Cable (Spec B)
	306-4991-03	1	277 VAC 4Pole 100-125 Amp	17	A035J303	1	Bracket, Cable (Spec B)
	306-5012-01	1	110 VAC 2Pole 250 Amp	18	306-5297	1	Handle, Switch
	306-5012-02	1	220 VAC 2Pole 250 Amp	19		1	Terminal, Shield (Spec B)
	306-5012-03	1	277 VAC 2Pole 250 Amp		A040K274	1	63A, 3Pole, Source B
	306-4968-01	1	110 VAC 3Pole 250 Amp		A040K276	1	63A, 3Pole, Source A
	306-4968-02	1	220 VAC 3Pole 250 Amp		A040K278	1	63A, 4Pole, Source A
	306-4968-03	1	277 VAC 3Pole 250 Amp		A040K280	1	63A, 4Pole, Source B
	306-4969-01	1	110 VAC 4Pole 250 Amp		A040K282	1	63A, 2Pole, Source A
	306-4969-02	1	220 VAC 4Pole 250 Amp		A040K284	1	63A, 2Pole, Source B
	306-4969-03	1	277 VAC 4Pole 250 Amp		A040K290	1	125A, 4Pole, Source A
	306-5013-01	1	110 VAC 2Pole 500 Amp		A040K292	1	125A, 4Pole, Source B
	306-5013-02	1	220 VAC 2Pole 500 Amp		A040K294	1	125A, 3Pole, Source B
	306-5013-03	1	277 VAC 2Pole 500 Amp		A040K296	1	125A, 3Pole, Source A
	306-4970-01	1	110 VAC 3Pole 500 Amp		A040K298	1	125A, 2Pole, Source B
	306-4970-02	1	220 VAC 3Pole 500 Amp		A040K300	1	125A, 2Pole, Source A
	306-4970-03	1	277 VAC 3Pole 500 Amp		A040J812	1	250A, 2Pole, Source A
	306-4971-01	1	110 VAC 4Pole 500 Amp		A040J814	1	250A, 2Pole, Source B
	306-4971-02	1	220 VAC 4Pole 500 Amp		A040J816	1	250A, 3Pole, Source A
	306-4971-03	1	277 VAC 4Pole 500 Amp		A040J818	1	250A, 3Pole, Source B
	306-5014-01	1	110 VAC 2Pole 800 Amp		A040J820	1	250A, 4Pole, Source A
	306-5014-02	1	220 VAC 2Pole 800 Amp		A040J822	1	250A, 4Pole, Source B
	306-5014-03	1	277 VAC 2Pole 800 Amp		A040J824	1	500A, 2Pole, Source A&B
	306-4983-01	1	110 VAC 3Pole 800 Amp		A040J826	1	500A, 3Pole, Source A&B
	306-4983-02	1	220 VAC 3Pole 800 Amp		A040J828	1	500A, 4Pole, Source A&B
	306-4983-03	1	277 VAC 3Pole 800 Amp				

Appendix B. Troubleshooting Reference Drawings for Sequence of Events

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B.0 Troubleshooting Reference Drawings for Normal-to-Emergency Sequence of Events

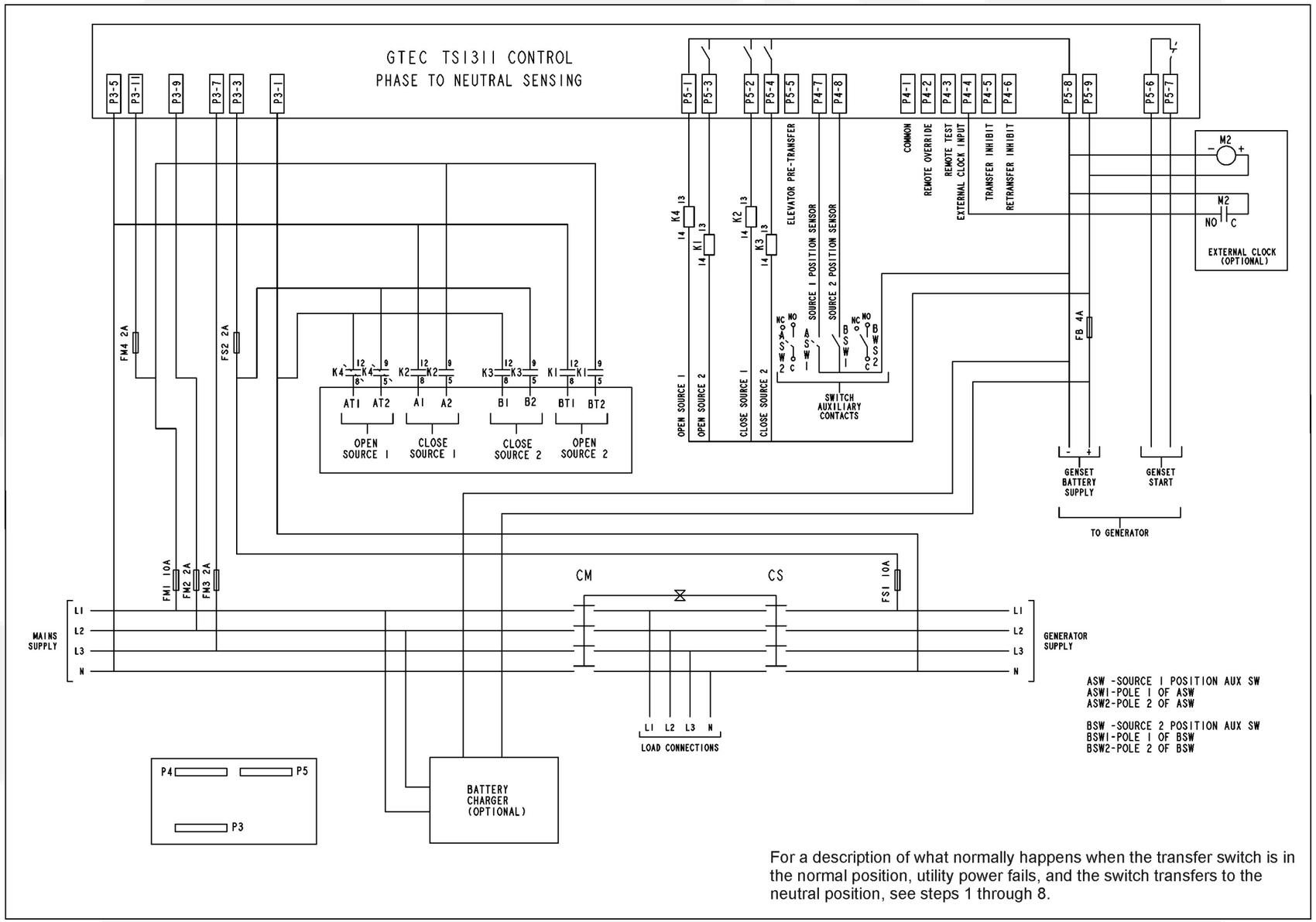

FIGURE 154. TYPICAL CONDITIONAL SCHEMATIC - LOSS OF UTILITY POWER OCCURS, TRANSFER FROM UTILITY (SOURCE 1) TO NEUTRAL

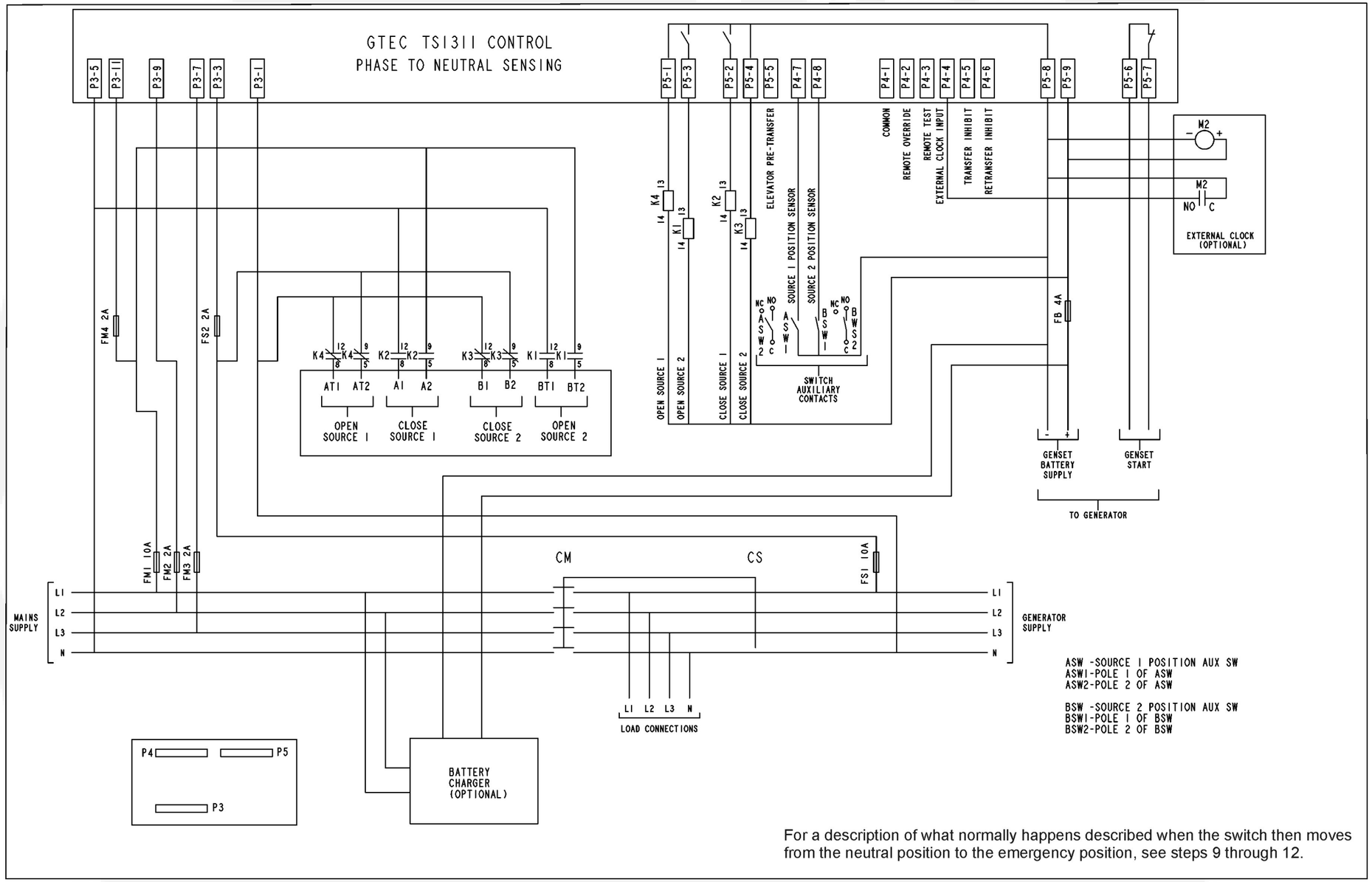

FIGURE 155. TYPICAL CONDITIONAL SCHEMATIC - GENERATOR SET (SOURCE 2) AVAILABLE, TRANSFER FROM NEUTRAL TO THE GENERATOR SET

B.1 Troubleshooting Reference Drawings for Emergency-to-Normal Sequence of Events

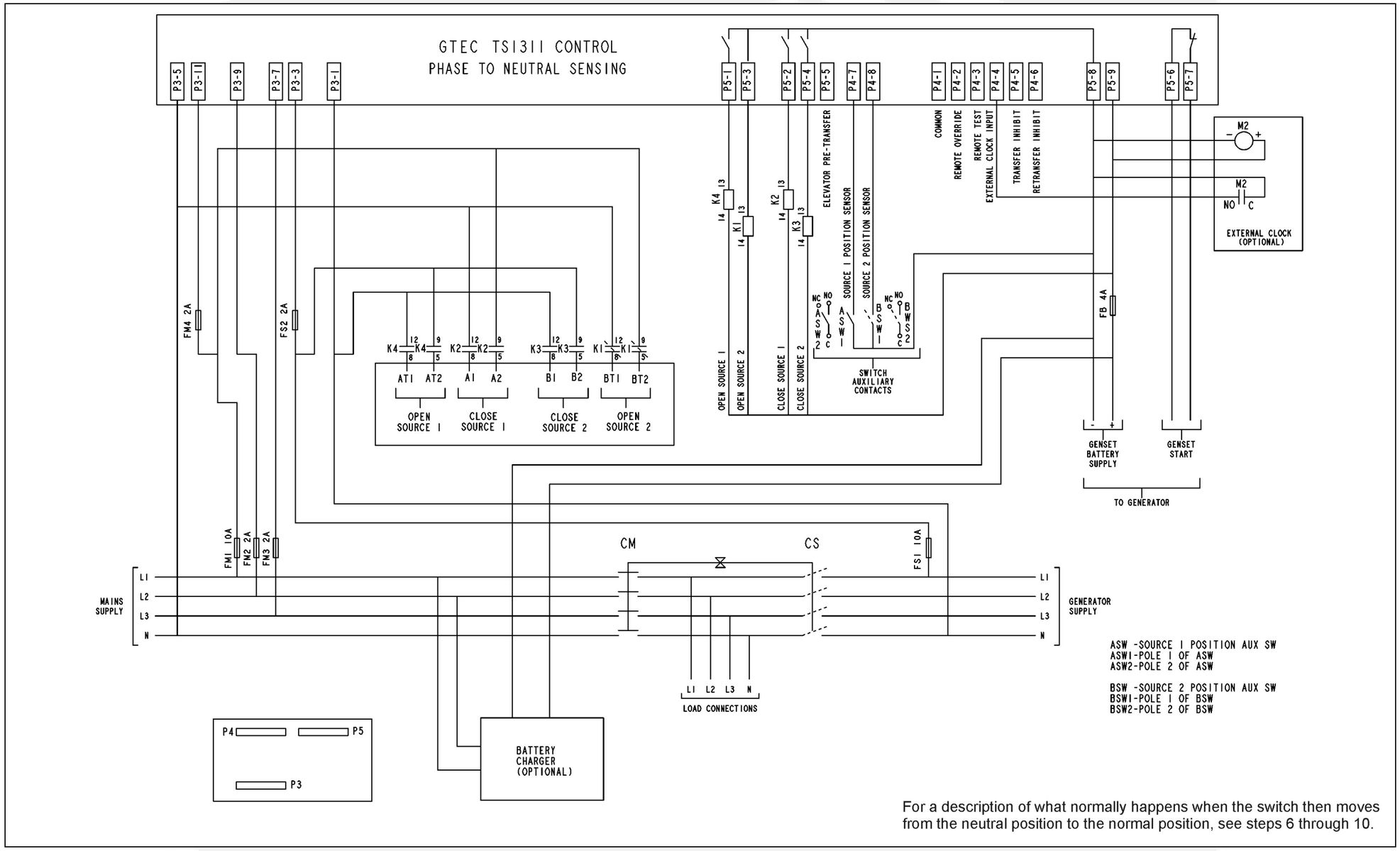

FIGURE 156. TYPICAL CONDITIONAL SCHEMATIC - UTILITY POWER RETURNS, TRANSFER FROM GENERATOR SET (SOURCE 2) TO NEUTRAL

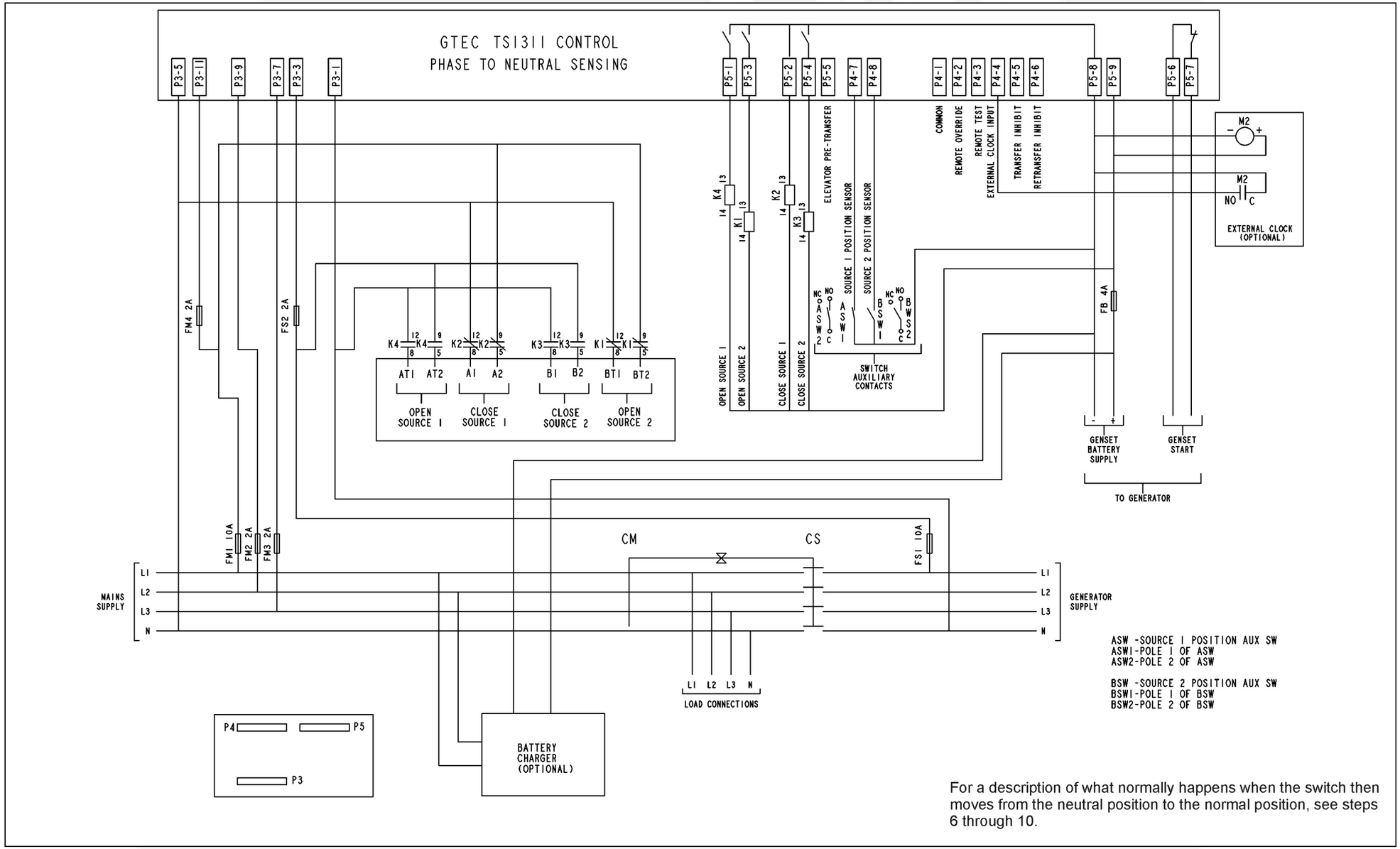

FIGURE 157. TYPICAL CONDITIONAL SCHEMATIC - UTILITY POWER AVAILABLE, TRANSFER FROM NEUTRAL TO UTILITY (SOURCE 1)

Appendix C. Wiring Diagrams

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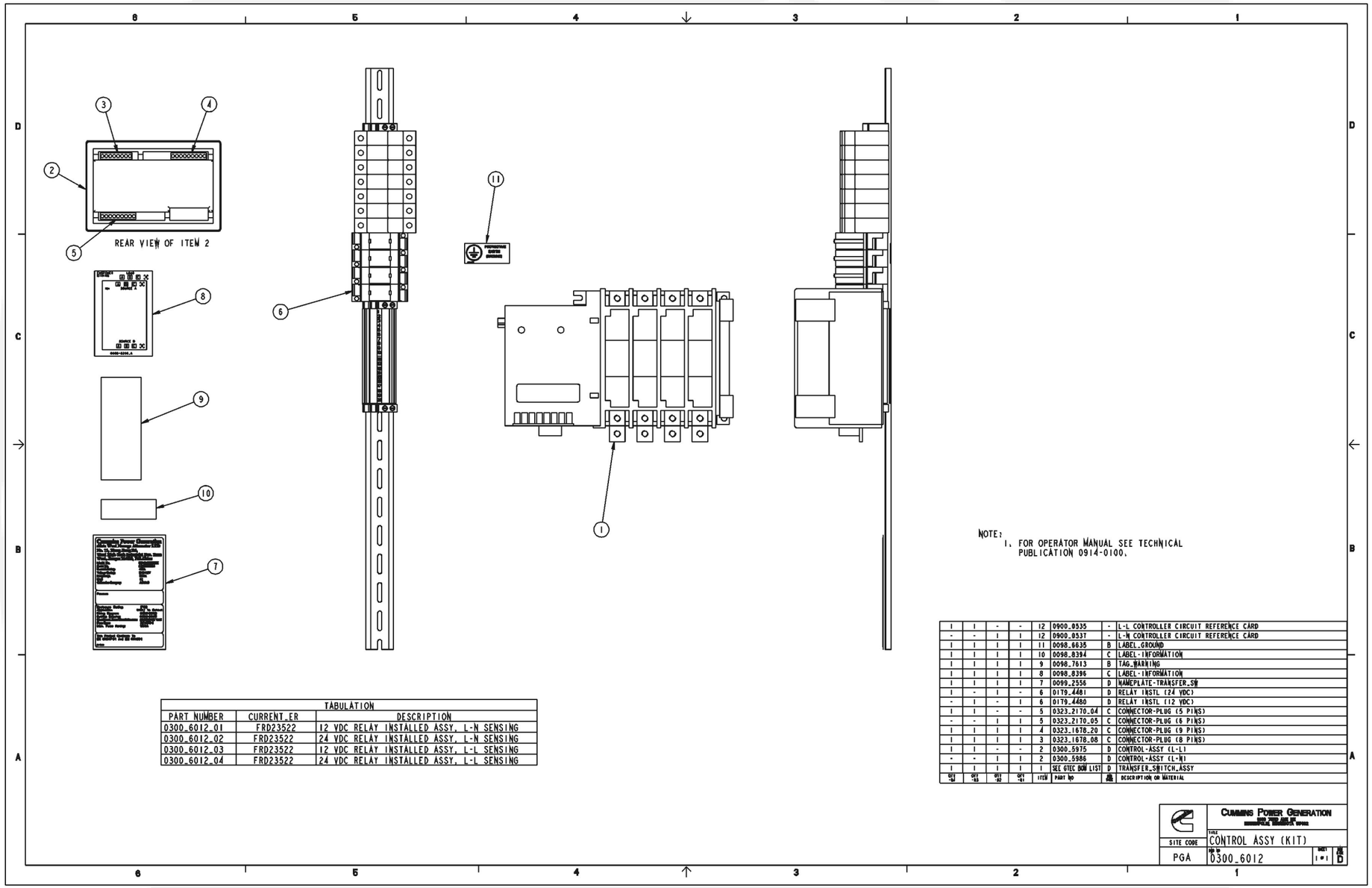
C.0 Control Assembly (Kit), 0300-6012 Revision D



TABULATION		
PART NUMBER	CURRENT_ER	DESCRIPTION
0300_6012_01	FRD23522	12 VDC RELAY INSTALLED ASSY, L-N SENSING
0300_6012_02	FRD23522	24 VDC RELAY INSTALLED ASSY, L-N SENSING
0300_6012_03	FRD23522	12 VDC RELAY INSTALLED ASSY, L-L SENSING
0300_6012_04	FRD23522	24 VDC RELAY INSTALLED ASSY, L-L SENSING

1	1	-	-	12	0900_0535	-	L-L CONTROLLER CIRCUIT REFERENCE CARD
-	-	1	1	12	0900_0537	-	L-N CONTROLLER CIRCUIT REFERENCE CARD
1	1	1	1	11	0098_6035	B	LABEL_GROUND
1	1	1	1	10	0098_0394	C	LABEL-INFORMATION
1	1	1	1	9	0098_7613	B	TAG_WARNING
1	1	1	1	8	0098_0396	C	LABEL-INFORMATION
1	1	1	1	7	0099_2556	D	NAMEPLATE-TRANSFER_SW
1	-	1	-	6	0179_4481	D	RELAY INSTL (24 VDC)
-	1	-	1	6	0179_4480	D	RELAY INSTL (12 VDC)
1	1	-	-	5	0323_2170_04	C	CONNECTOR-PLUG (5 PINS)
-	-	1	1	5	0323_2170_05	C	CONNECTOR-PLUG (6 PINS)
1	1	1	1	4	0323_1678_20	C	CONNECTOR-PLUG (9 PINS)
1	1	1	1	3	0323_1678_08	C	CONNECTOR-PLUG (8 PINS)
1	1	-	-	2	0300_5975	D	CONTROL-ASSY (L-L)
-	-	1	1	2	0300_5986	D	CONTROL-ASSY (L-N)
1	1	1	1	1	SEE GTEC BOM LIST	D	TRANSFER_SWITCH_ASSY
QTY -50	QTY -60	QTY -50	QTY -60	ITEM	PART NO	REV	DESCRIPTION OR MATERIAL

FIGURE 158. TYPICAL OPEN CONSTRUCTION TRANSFER SWITCH, SPEC B (SHEET 1)

C.1 Transfer Switch Wiring Diagram, 0630-2993 Revision H

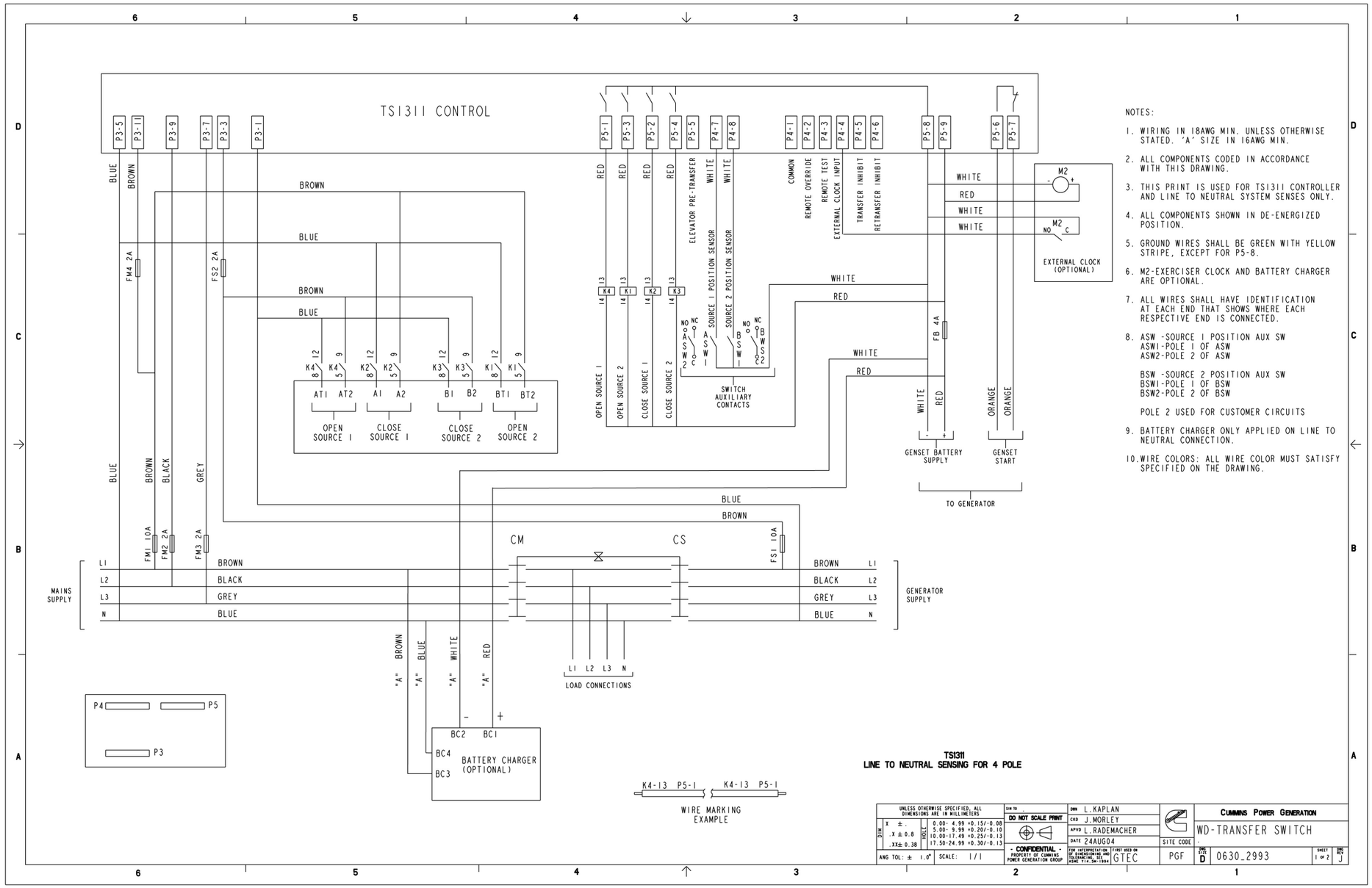


FIGURE 159. TRANSFER SWITCH, LINE-TO-NEUTRAL SENSING, SPEC A (SHEET 1 OF 2)

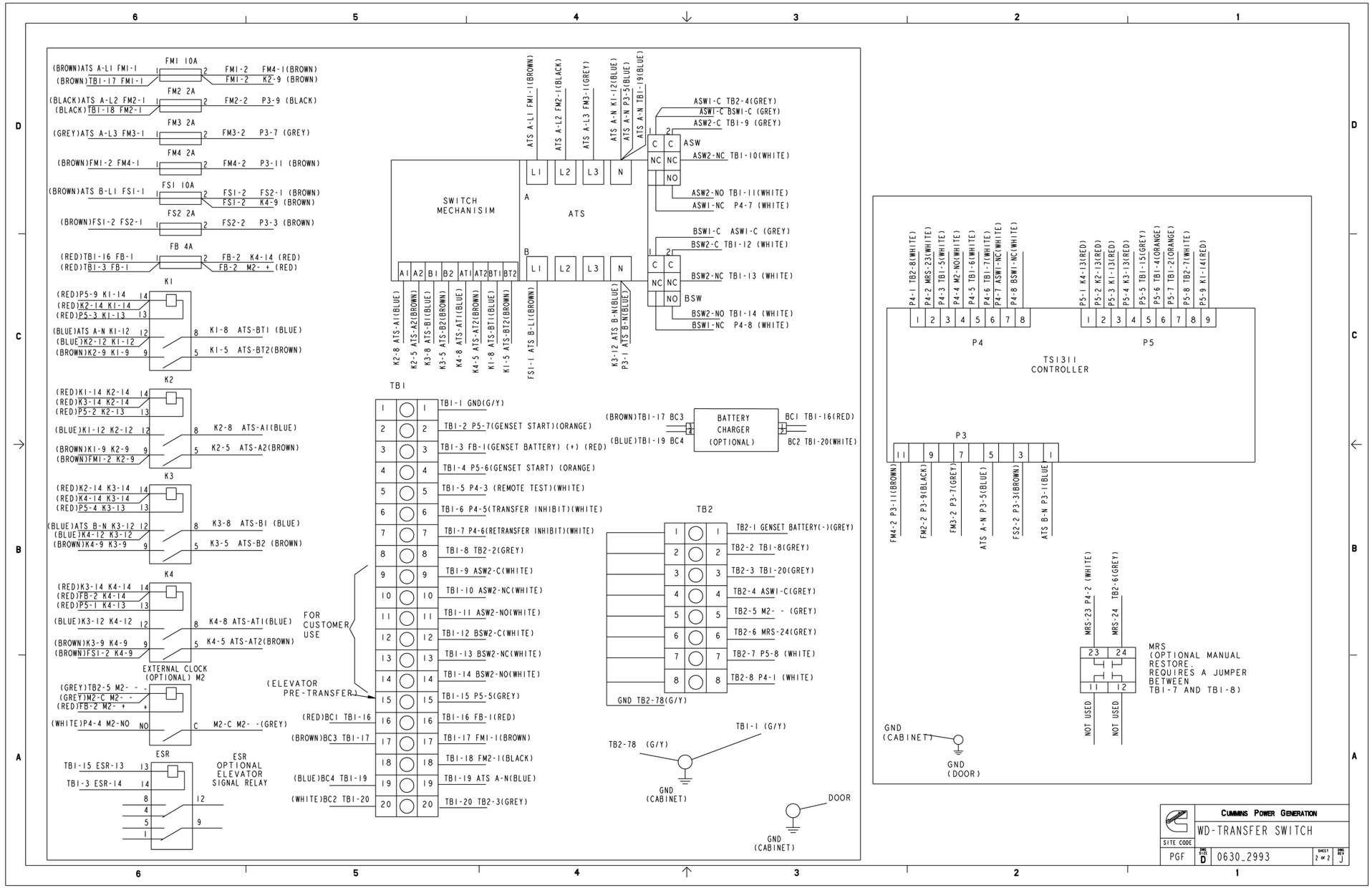


FIGURE 160. TRANSFER SWITCH, LINE-TO-NEUTRAL SENSING, SPEC A (SHEET 2 OF 2)

C.2 IP Control Boxes

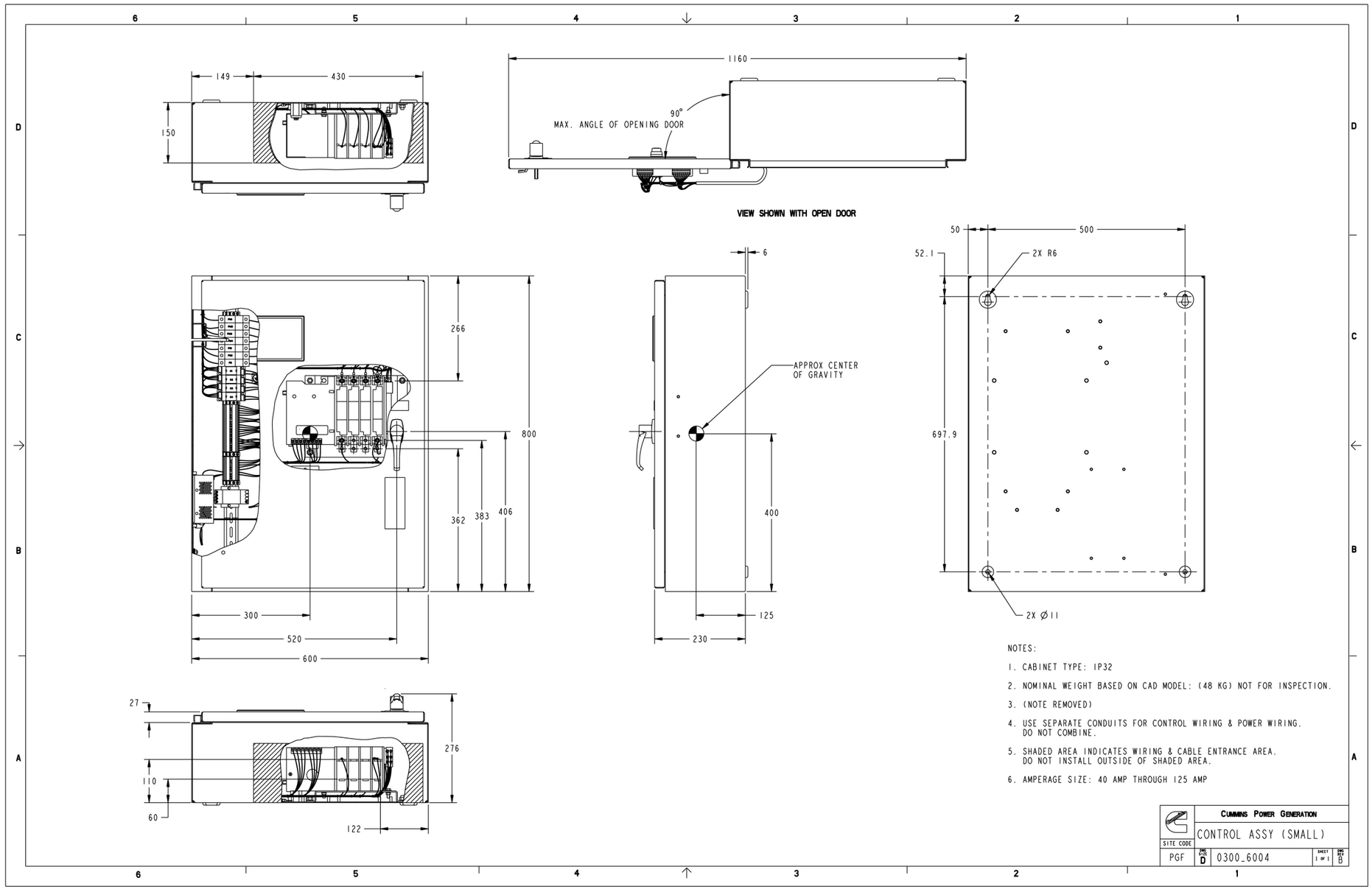


FIGURE 161. IP32 CONTROL BOX, 20 - 125 AMPS (SPEC A), SHEET 1 OF 1

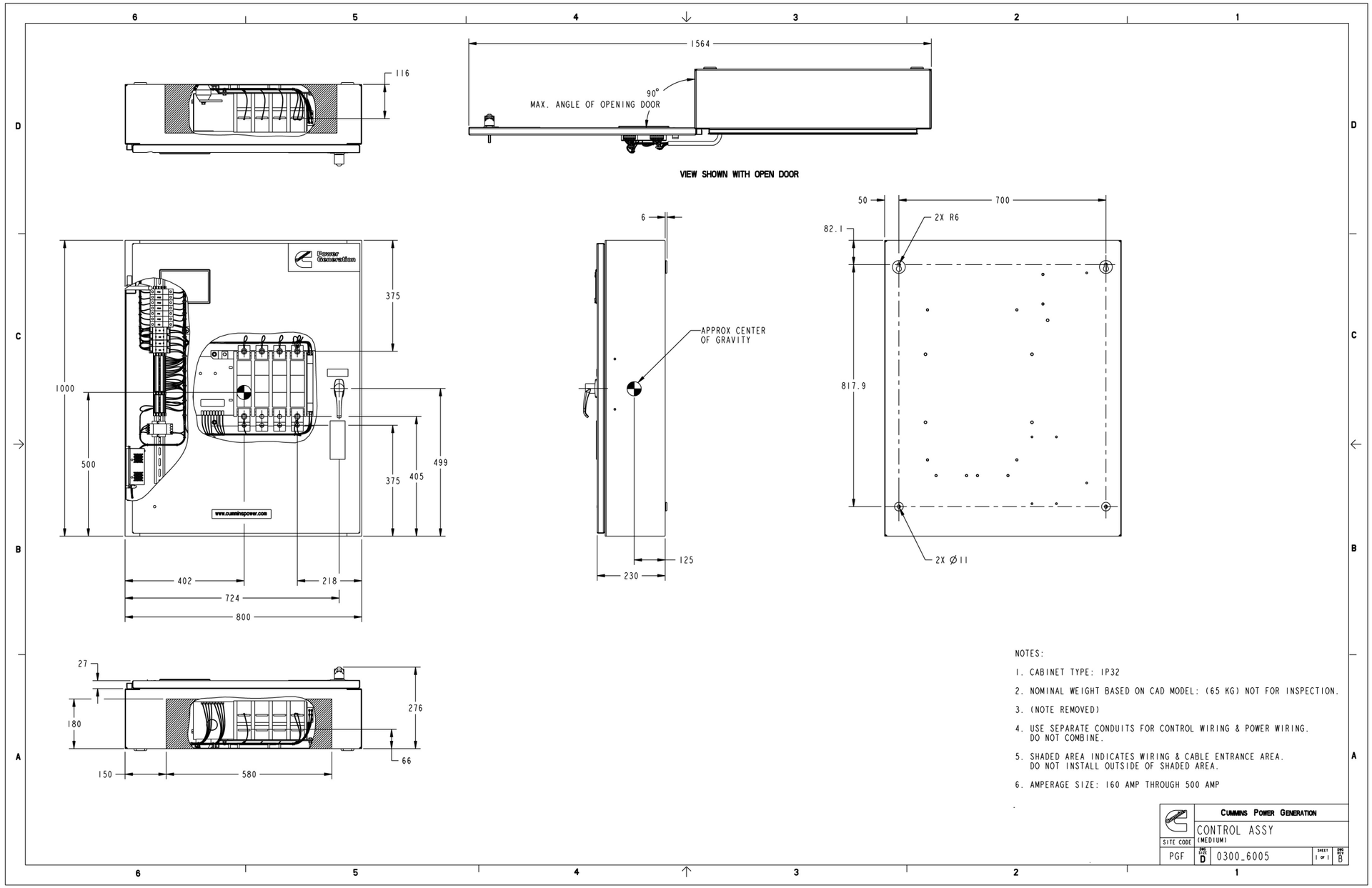


FIGURE 162. IP32 CONTROL BOX, 200 - 500 AMPS (SPEC A), SHEET 1 OF 1

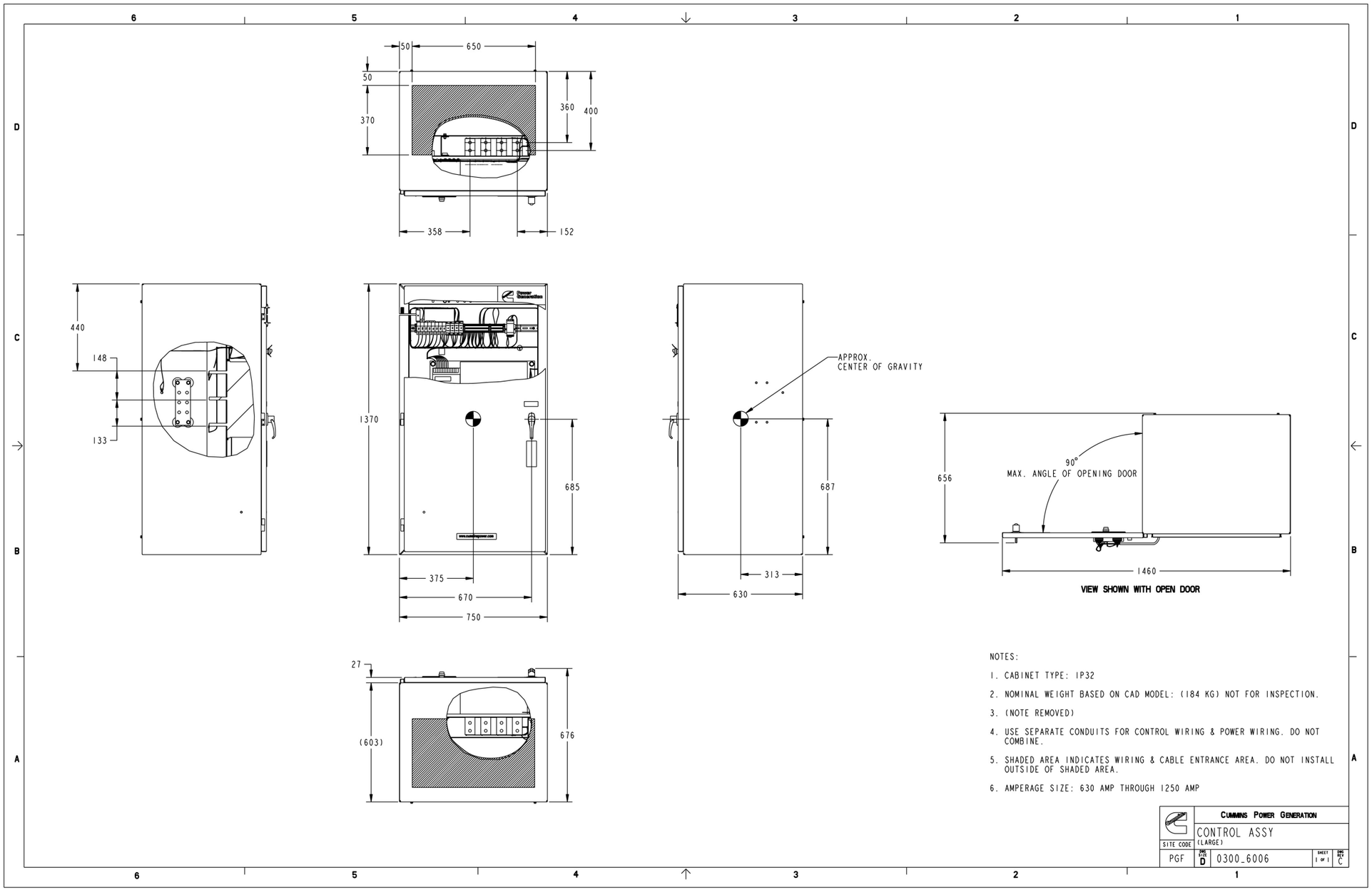


FIGURE 163. IP32 CONTROL BOX, 630 - 1250 AMPS (SPEC A), SHEET 1 OF 1

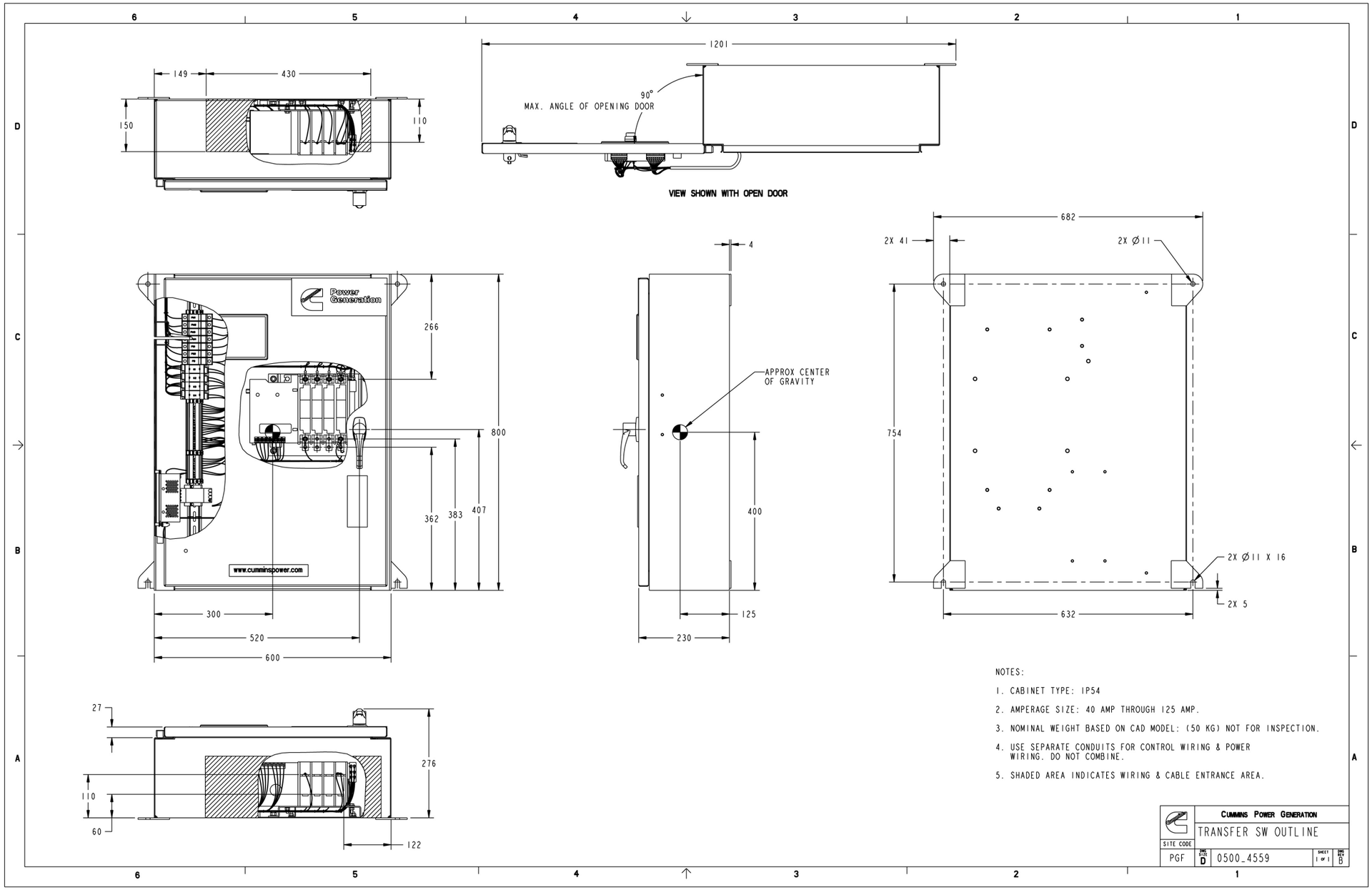


FIGURE 164. IP54 CONTROL BOX, 20 - 125 AMPS (SPEC A), SHEET 1 OF 1

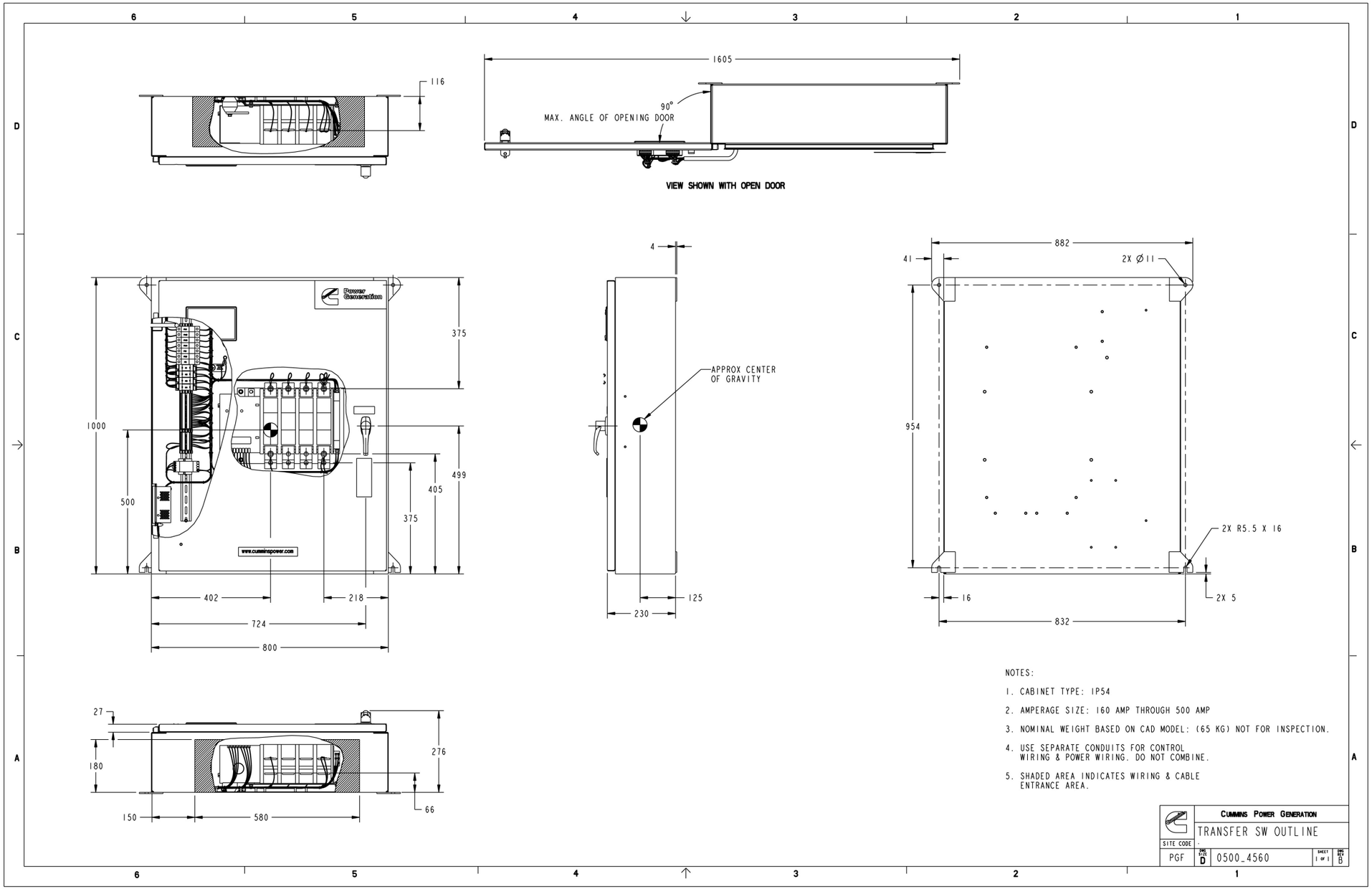


FIGURE 165. IP54 CONTROL BOX, 200 - 500 AMPS (SPEC A), SHEET 1 OF 1

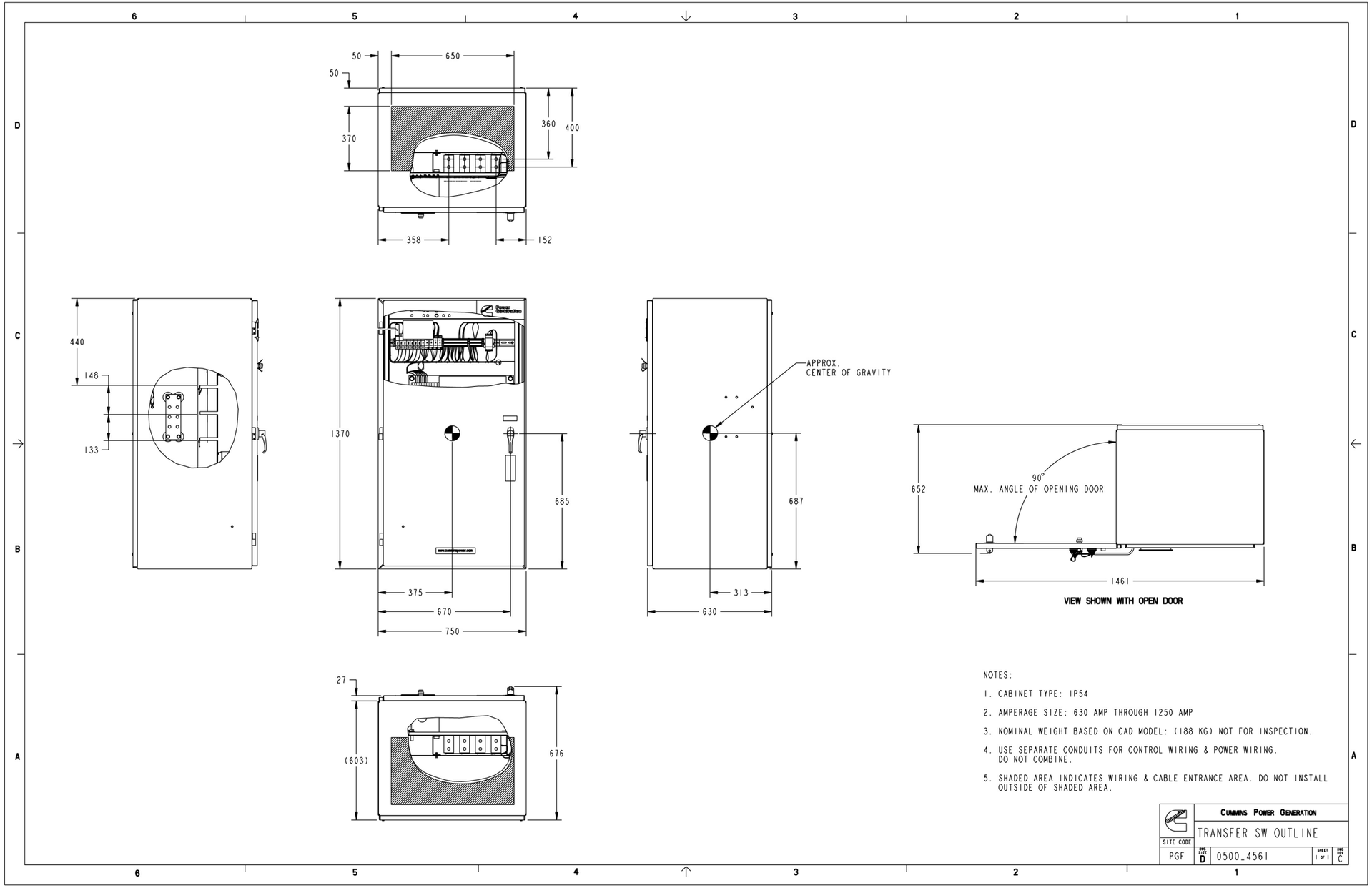


FIGURE 166. IP54 CONTROL BOX, 630 - 1250 AMPS (SPEC A), SHEET 1 OF 1

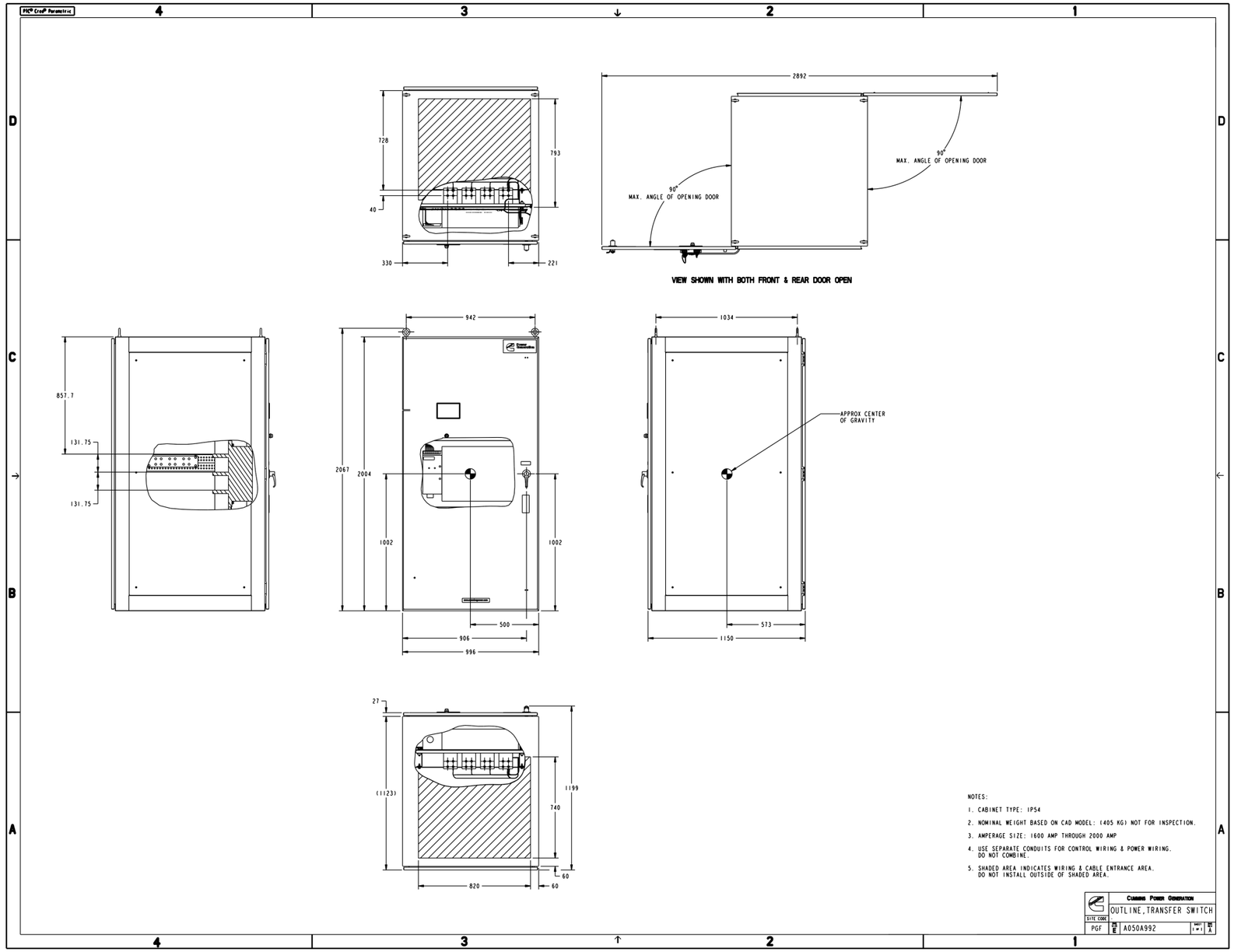


FIGURE 167. IP32 AND IP54 COUNTRY BOX, 1600 - 2000 AMPS (SPEC A), SHEET 1 OF 1

C.3 Transfer Switch

The transfer switch (see **Figure 8** through **Figure 11**) opens and closes the contacts that transfer the load between the power sources. The switch is mechanically interlocked to prevent simultaneous closing to both power sources. The main parts of the switch discussed here are the contact assemblies, linear actuator, and auxiliary contacts.

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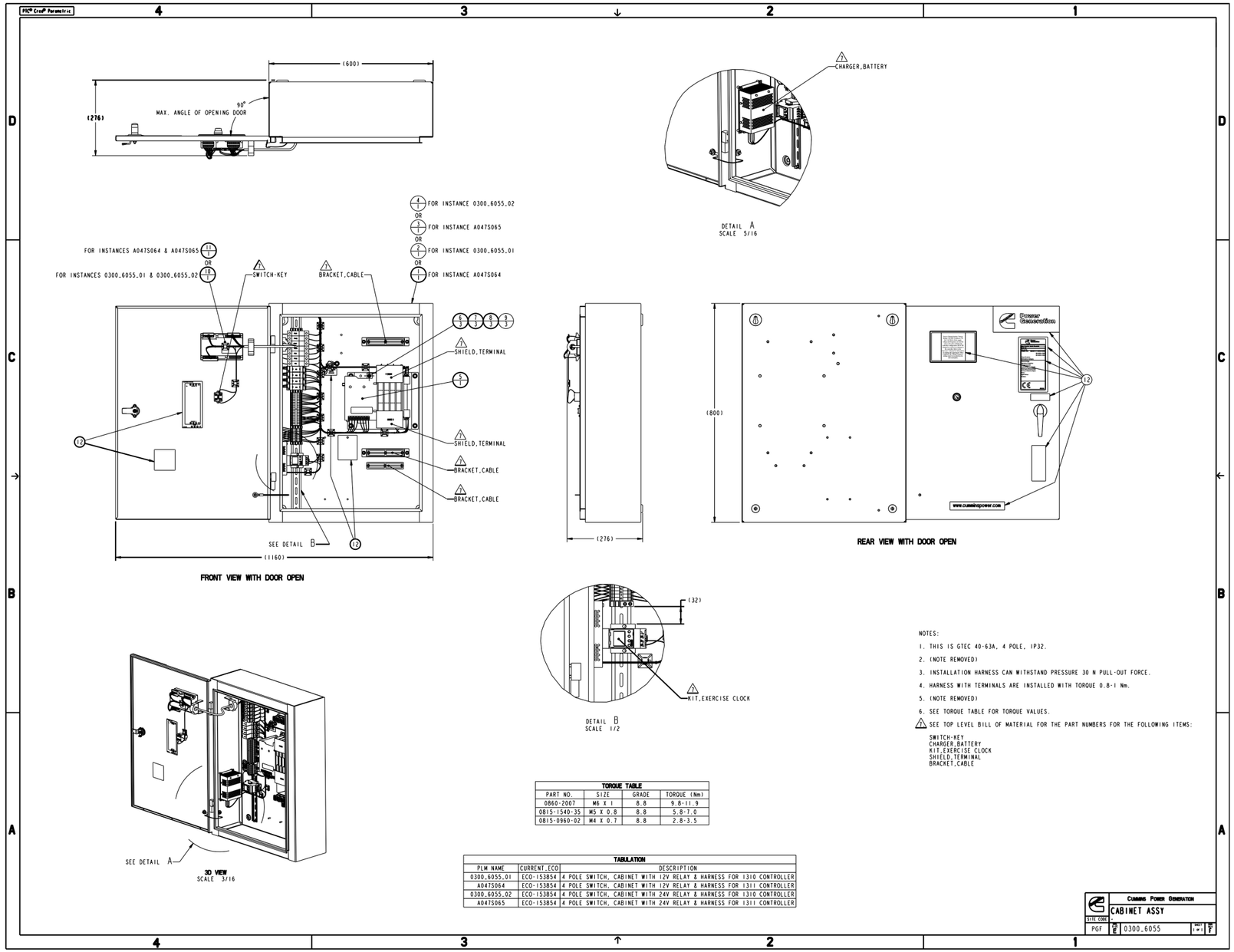
C.4 Transfer Switch Cabinet Assembly



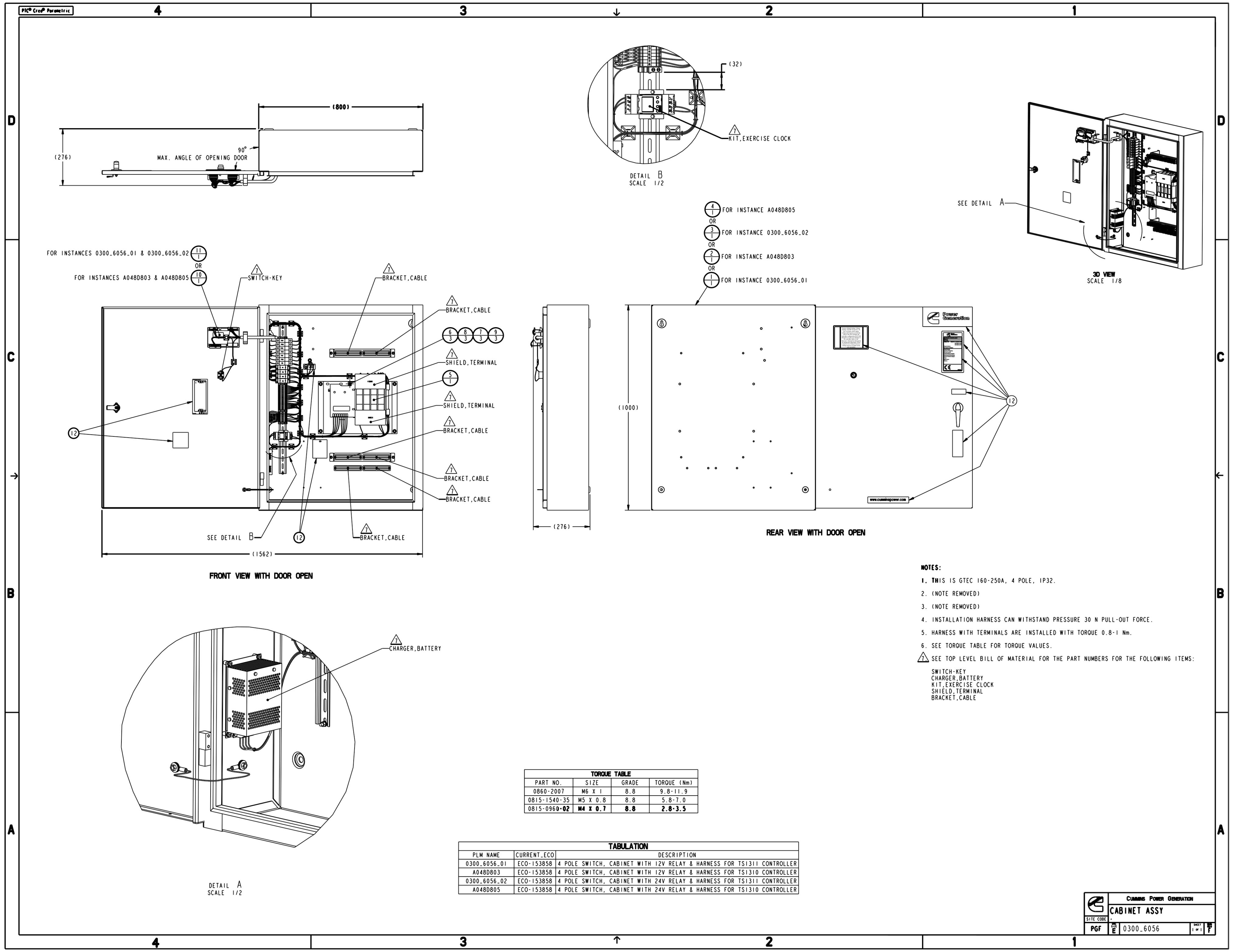
TORQUE TABLE

PART NO.	SIZE	GRADE	TORQUE (Nm)
0860-2007	M6 X 1	8.8	9.8-11.9
0815-1540-35	M5 X 0.8	8.8	5.8-7.0
0815-0960-02	M4 X 0.7	8.8	2.8-3.5

TABULATION

PLM NAME	CURRENT_ECO	DESCRIPTION
0300_6055_01	ECO-153854	4 POLE SWITCH, CABINET WITH 12V RELAY & HARNESS FOR I310 CONTROLLER
A047S064	ECO-153854	4 POLE SWITCH, CABINET WITH 12V RELAY & HARNESS FOR I311 CONTROLLER
0300_6055_02	ECO-153854	4 POLE SWITCH, CABINET WITH 24V RELAY & HARNESS FOR I310 CONTROLLER
A047S065	ECO-153854	4 POLE SWITCH, CABINET WITH 24V RELAY & HARNESS FOR I311 CONTROLLER

FIGURE 168. TRANSFER SWITCH SMALL CABINET ASSEMBLY (SPEC A), SHEET 1 OF 1



TORQUE TABLE

PART NO.	SIZE	GRADE	TORQUE (Nm)
0860-2007	M6 X 1	8.8	9.8-11.9
0815-1540-35	M5 X 0.8	8.8	5.8-7.0
0815-0960-02	M4 X 0.7	8.8	2.8-3.5

TABULATION

PLM NAME	CURRENT_ECO	DESCRIPTION
0300_6056_01	ECO-153858	4 POLE SWITCH, CABINET WITH 12V RELAY & HARNESS FOR TS1311 CONTROLLER
A048D803	ECO-153858	4 POLE SWITCH, CABINET WITH 12V RELAY & HARNESS FOR TS1310 CONTROLLER
0300_6056_02	ECO-153858	4 POLE SWITCH, CABINET WITH 24V RELAY & HARNESS FOR TS1311 CONTROLLER
A048D805	ECO-153858	4 POLE SWITCH, CABINET WITH 24V RELAY & HARNESS FOR TS1310 CONTROLLER

FIGURE 169. TRANSFER SWITCH MEDIUM CABINET ASSEMBLY (SPEC A), SHEET 1 OF 1

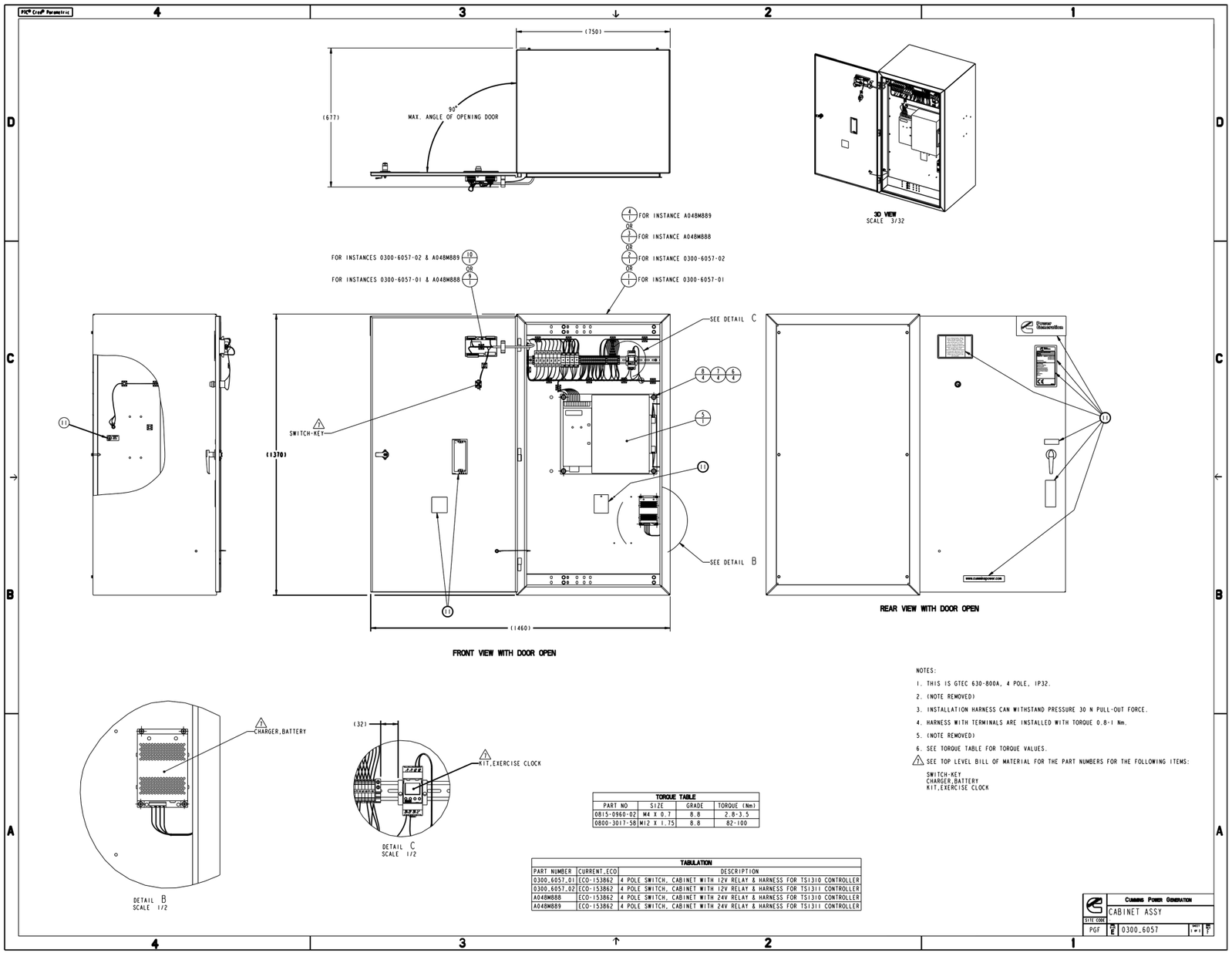


FIGURE 170. TRANSFER SWITCH LARGE CABINET ASSEMBLY (SPEC A), SHEET 1 OF 1

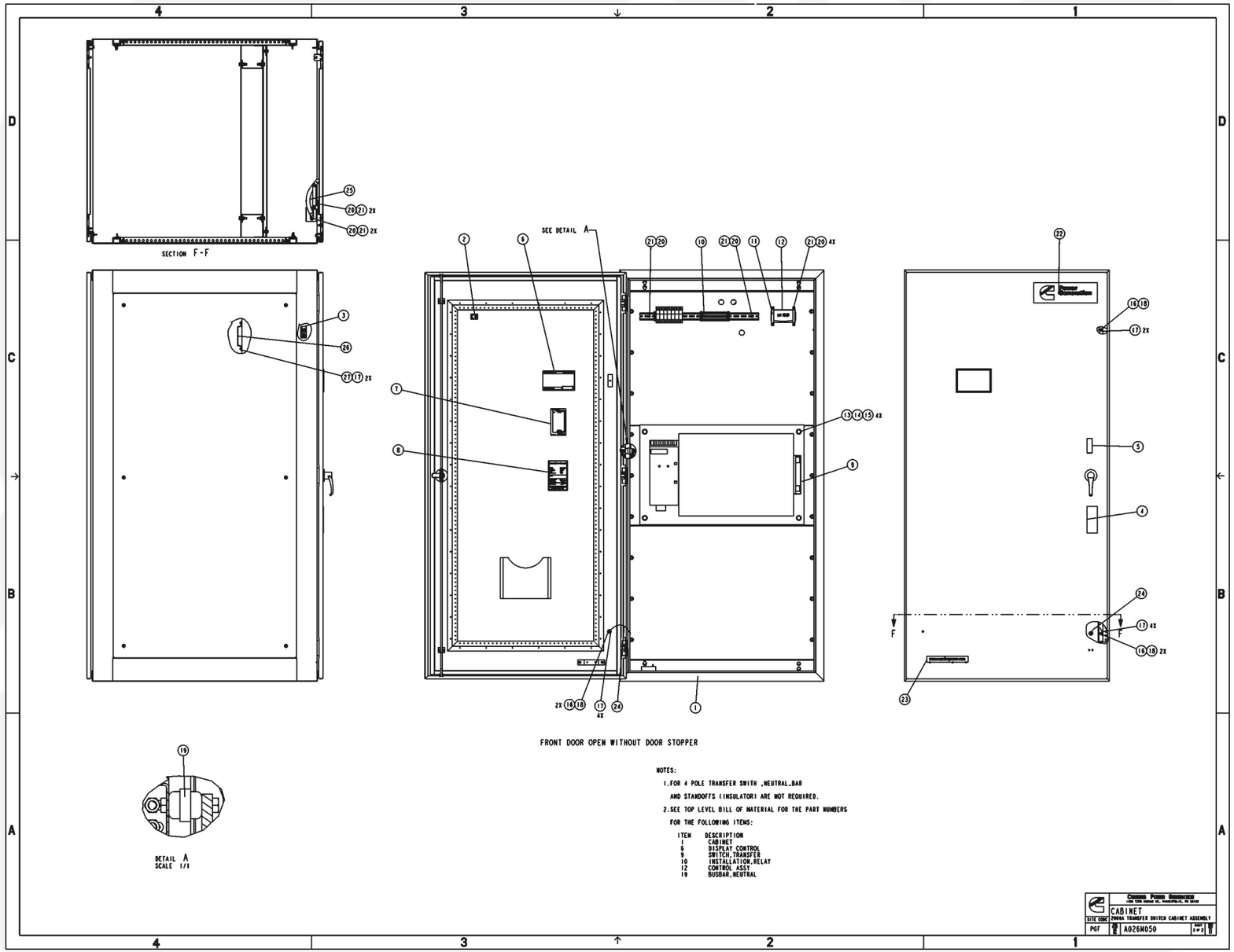


FIGURE 171. TRANSFER SWITCH 2000 AMP CABINET ASSEMBLY (SPEC A), SHEET 1 OF 2

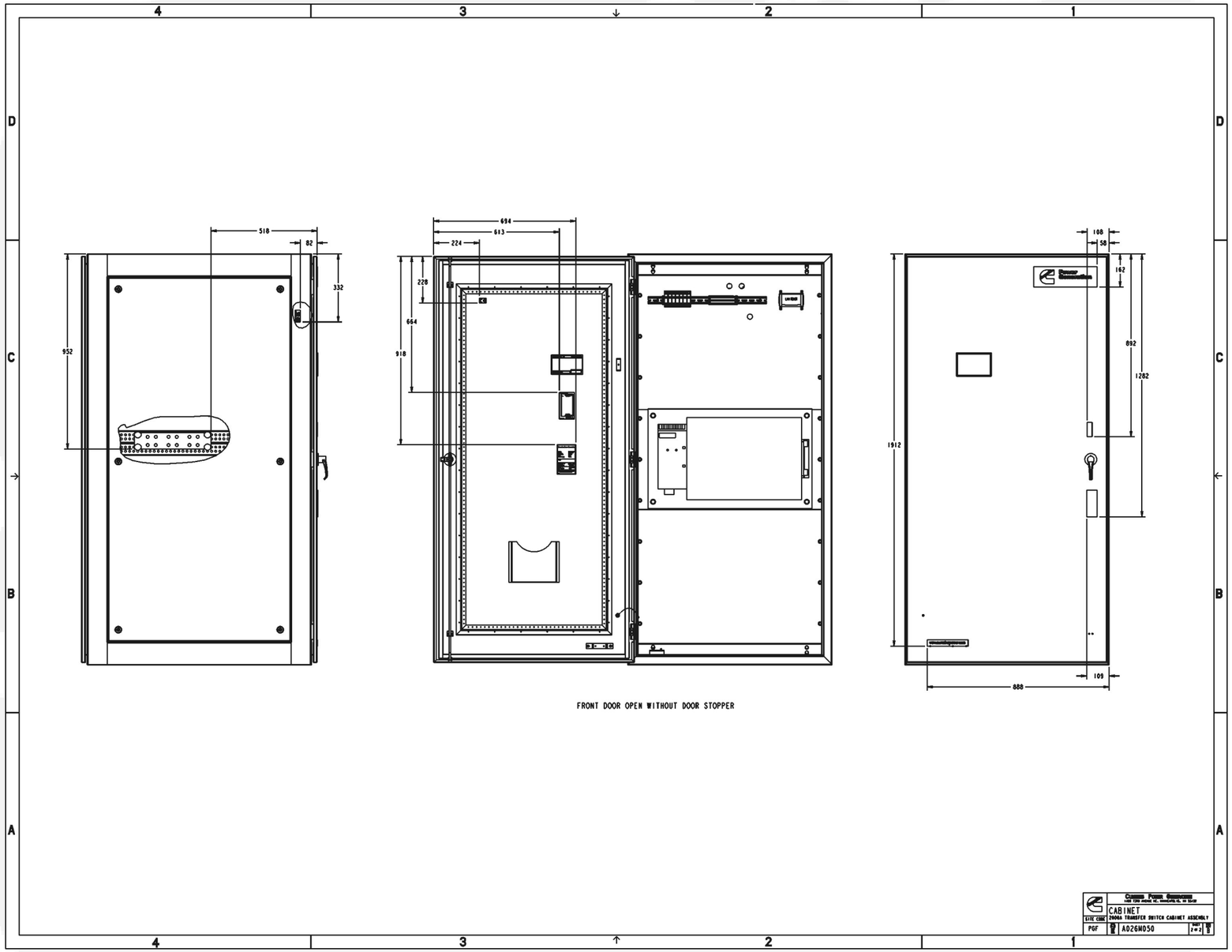


FIGURE 172. TRANSFER SWITCH 2000 AMP CABINET ASSEMBLY (SPEC A), SHEET 2 OF 2

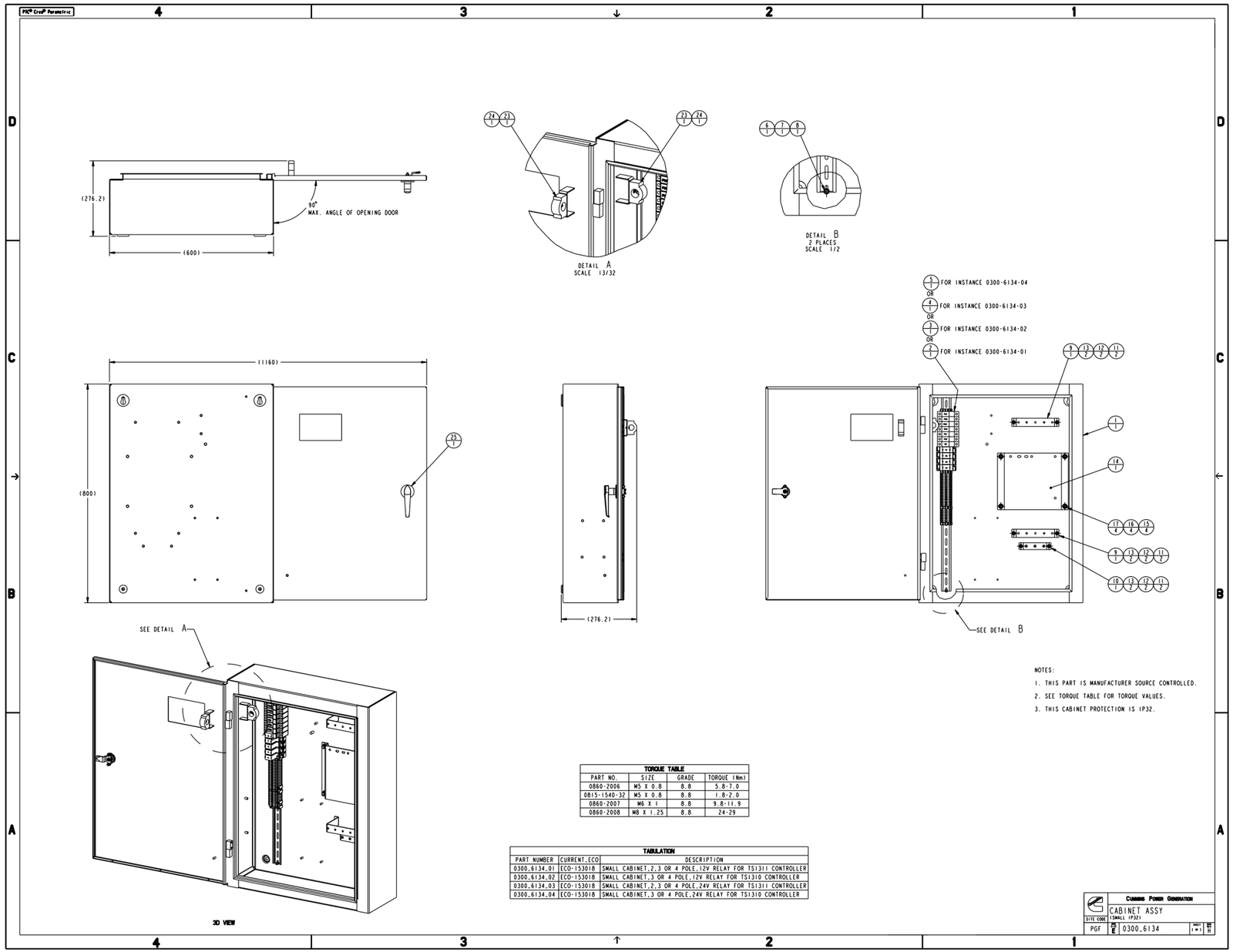


FIGURE 173. TRANSFER SWITCH SMALL CABINET ASSEMBLY (SPEC B), SHEET 1 OF 1

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