GENERAC®

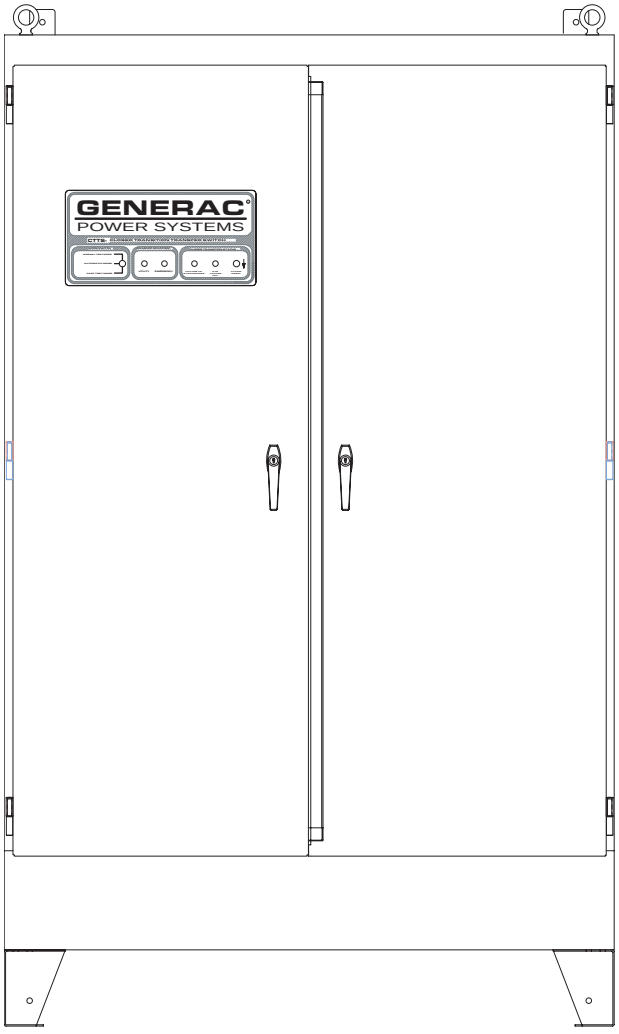
POWER SYSTEMS, INC.

Owner's Manual

CTTS Type

Closed Transition Transfer Switch

600 thru 2,600 amp, 600 volts



This manual should remain with the unit.

Read the following information carefully before attempting to install, operate or service this equipment. Also read the instructions and information on tags, decals, and labels that may be affixed to the transfer switch. Replace any decal or label that is no longer legible.

DANGER! Connection of a generator to an electrical system normally supplied by an electric utility shall be by means of suitable transfer equipment so as to isolate the electric system from utility distribution system when the generator is operating (Article 701 Legally Required Standby Systems or Article 702 Optional Standby Systems, as applicable). Failure to isolate electric system by these means may result in damage to generator and may result in injury or death to utility workers due to backfeed of electrical energy.

Generac cannot possibly anticipate every possible circumstance that might involve a hazard. The warnings in this manual, and on tags and decals affixed to the unit are, therefore, not all-inclusive. If you use a procedure, work method or operating technique that Generac does not specifically recommend, you must satisfy yourself that it is safe for you and others. You also must make sure the procedure, work method or operating technique that you choose does not render the transfer switch unsafe.

Throughout this publication, and on tags and decals affixed to the generator, DANGER, WARNING, CAUTION and NOTE blocks are used for special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Their definitions are as follows:

DANGER

After this heading, you can read instructions that, if not strictly complied with, will result in personal injury or property damage.

WARNING

After this heading, you can read instructions that, if not strictly complied with, may result in personal injury or property damage.

CAUTION

After this heading, you can read instructions that, if not strictly complied with, could result in damage to equipment and/or property.

NOTE:

After this heading, you can read explanatory statements that require special emphasis.

These safety warnings cannot eliminate the hazards that they indicate. Common sense and strict compliance with the special instructions while performing the service are essential to preventing accidents.

Four commonly used safety symbols accompany the DANGER, WARNING and CAUTION blocks. The type of information each indicates follows:

This symbol points out important safety information that, if not followed, could endanger personal safety and/or property of you and others.

This symbol points out potential explosion hazard.

This symbol points out potential fire hazard.

This symbol points out potential electrical shock hazard.

GENERAL HAZARDS

- Any AC generator that is used for backup power if a NORMAL (utility) power source failure occurs, must be isolated from the NORMAL (utility) power source by means of an approved transfer switch. Failure to properly isolate the NORMAL and STANDBY power sources from each other may result in injury or death to electric utility workers, due to backfeed of electrical energy.
- Improper or unauthorized installation, operation, service or repair of the equipment is extremely dangerous and may result in death, serious personal injury, or damage to equipment and/or personal property.
- Extremely high and dangerous power voltages are present inside an installed transfer switch. Any contact with high voltage terminals, contacts or wires will result in extremely hazardous, and possibly LETHAL, electric shock. DO NOT WORK ON THE TRANSFER SWITCH UNTIL ALL POWER VOLTAGE SUPPLIES TO THE SWITCH HAVE BEEN POSITIVELY TURNED OFF.
- Competent, qualified personnel should install, operate and service this equipment. Adhere strictly to local, state and national electrical and building codes. When using this equipment, comply with regulations the National Electrical Code (NEC), CSA Standard; C22.1 Canadian Electric Code and Occupational Safety and Health Administration (OSHA) have established.
- Never handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet. DANGEROUS ELECTRICAL SHOCK MAY RESULT.

- Because jewelry conducts electricity, wearing it may cause dangerous electrical shock. Remove all jewelry (such as rings, watches, bracelets, etc.) before working on this equipment.
- If work must be done on this equipment while standing on metal or concrete, place insulative mats over a dry wood platform. Work on this equipment only while standing on such insulative mats.
- Never work on this equipment while physically or mentally fatigued.
- Keep the transfer switch enclosure door closed and bolted at all times. Only qualified personnel should be permitted access to the switch interior.
- In case of an accident caused by electric shock, immediately shut down the source of electrical power. If this is not possible, attempt to free the victim from the live conductor but AVOID DIRECT CONTACT WITH THE VICTIM. Use a nonconducting implement, such as a rope or board, to free the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.
- When an automatic transfer switch is installed for a standby generator set, the generator engine may crank and start at any time without warning. To avoid possible injury that might be caused by such sudden start-ups, the system's automatic start circuit must be disabled before working on or around the generator or transfer switch. For that purpose, a SAFETY DISCONNECT is provided inside the transfer switch. Always set that switch to its MANUAL position before working on the equipment. Then place a "DO NOT OPERATE" tag on the transfer switch and on the generator.
- To disable the generator while working on or around the generator, do one of the following procedures: place generator in OFF Mode, remove fuse from control panel, and/or disconnect battery cables.

1.1 INTRODUCTION

This manual has been prepared especially for the purpose of familiarizing personnel with the design, application, installation, operation and servicing of the applicable equipment. Read the manual carefully and comply with all instructions. This will help to prevent accidents or damage to equipment that might otherwise be caused by carelessness, incorrect application, or improper procedures.

Every effort has been expended to make sure that the contents of this manual are both accurate and current. Generac, however, reserves the right to change, alter or otherwise improve the product at any time without prior notice.

1.2 EQUIPMENT DESCRIPTION

The automatic transfer switch is used for transferring critical electrical load from a UTILITY (normal) power source to a EMERGENCY (standby generator) power source. Such a transfer of electrical loads occurs automatically when the NORMAL power source has failed or is substantially reduced and the STANDBY source voltage and frequency have reached an acceptable level. The transfer switch limits electrical feedback between two different power sources (such as the NORMAL and STANDBY sources) and, for that reason, codes require it in all standby electric system installations.

The Generac Closed Transition Transfer Switch (CTTS) offers an effective solution for the problem of momentary loss of power during transfer. The Generac CTTS will eliminate momentary power interruption, when both sources are present and synchronized, by transferring the loads with an overlapping contact arrangement.

The transfer switch consists of a solid state intelligence circuit, a transfer mechanism and a control panel.

1.3 TRANSFER SWITCH DATA PLATE

A DATA PLATE is permanently affixed to the subplate inside the transfer switch enclosure. Use this transfer switch only with the specific limits shown on the DATA PLATE and on other decals and labels that may be affixed to the switch. This will prevent damage to equipment and property.

When requesting information or ordering parts for this equipment, make sure to include all information from the DATA PLATE.

Record the Model and Serial numbers in the space provided below for future reference.

MODEL #
SERIAL #

1.4 RATINGS DECAL

Each Closed Transition Transfer Switch (CTTS) contains a ratings decal that is attached to the inside left side of the enclosure wall. This decal describes the loads and fault circuit withstand/closing ratings for the CTTS mechanism.

⚠ WARNING ⚠

⚠ Do not exceed the values on the ratings label. Exceeding the values specified can cause personal injury or serious equipment damage.

1.5 TRANSFER SWITCH ENCLOSURE

The standard switch enclosure is a National Electrical Manufacturer's Association (NEMA) 12 type. NEMA 12 type enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

1.6 SAFE USE OF TRANSFER SWITCH

Before installing, operating or servicing this equipment, read the SAFETY RULES (inside front cover) carefully. Comply strictly with all SAFETY RULES to prevent accidents and/or damage to the equipment. Generac recommends a copy of the SAFETY RULES be posted near the transfer switch. Also, be sure to read all instructions and information found on tags, labels and decals affixed to the equipment.

Two publications that outline the safe use of transfer switches are the following:

- NFPA 70; National Electrical Code
- UL 1008; STANDARD FOR SAFETY-AUTOMATIC TRANSFER SWITCHES

2.1 INTRODUCTION TO INSTALLATION

This equipment has been wired and tested at the factory. Installing the switch includes the following procedures:

- Mounting the enclosure.
- Connecting power source and load leads.
- Connecting the generator start circuit.
- Connecting any auxiliary contact (if needed)
- Installing/connecting any options and accessories.
- Testing functions.

2.2 UNPACKING

Carefully unpack the transfer switch. Inspect closely for any damage that might have occurred during shipment. The purchaser must file with the carrier any claims for loss or damage incurred while in transit.

Check that all packing material is completely removed from the switch prior to installation.

Attach any lifting device to the transfer switch mounting holes or brackets only. DO NOT LIFT THE SWITCH AT ANY OTHER POINT.

2.3 MOUNTING

Mounting dimensions for the transfer switch enclosure are in this manual. Enclosures are typically wall-mounted. Components are generally mounted in a standard NEMA 12-type enclosure. A NEMA 3R, 4 & 4X are also available. See TRANSFER SWITCH OPTIONS, Section 3.15.

⚠ CAUTION ⚠

⚠ Handle transfer switches carefully when installing. Do not drop the switch. Protect the switch against impact at all times, and against construction grit and metal chips. Never install a transfer switch that has been damaged.

Install the transfer switch as close as possible to the electrical loads that are to be connected to it. Mount the switch vertically to a rigid supporting structure. To prevent switch distortion, level all mounting points. If necessary, use washers behind mounting holes to level the unit.

2.4 CONNECTING POWER SOURCE AND LOAD LINES

⚠ DANGER ⚠

⚠ Make sure to turn OFF both the Utility (normal) and Emergency (generator) power supplies before connection to power source and load lines to the transfer switch. Supply voltages are extremely high and dangerous. Contact with such high voltage power supply lines causes extremely hazardous, possibly lethal, electrical shock.

Wiring diagrams and electrical schematics are provided in this manual. Power source and load connections are made at a transfer mechanism, inside the switch enclosure.

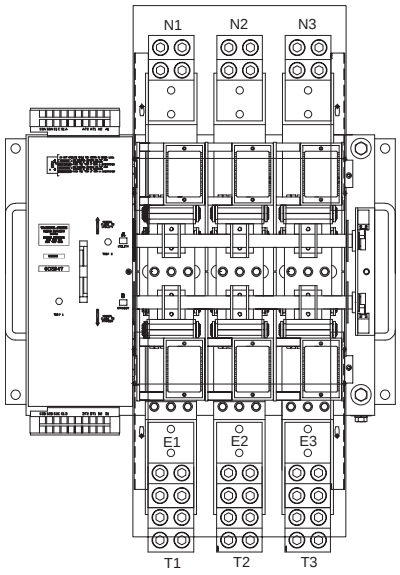
It will be necessary to remove the covers over the main terminals to gain access to the conductor screws. It is important to reinstall the covers before energizing the CTTS mechanism.

Do not run the high current cables in front of the CTTS mechanism. Cables can be routed on the right side of the CTTS mechanism.

◆ 2.4.1 3-POLE MECHANISM

This switch (Figure 2.1) is used with a single phase system, when the single phase NEUTRAL line is to be switched during transfer; or with a 3-phase system, when NEUTRAL is not to be switched.

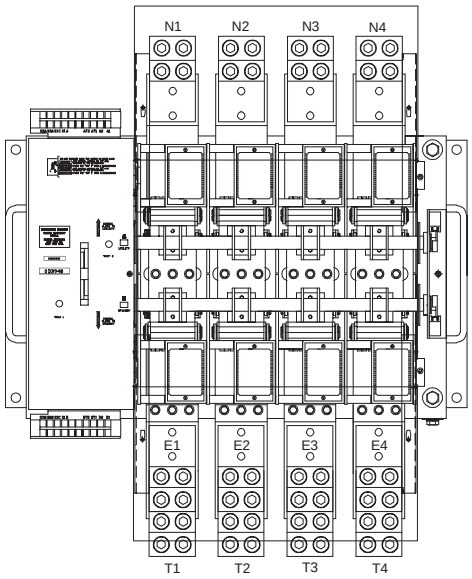
Figure 2.1 — Typical 3-Pole Transfer Mechanism (1600 Amp Shown)



◆ 2.4.2 4-POLE MECHANISM

This switch (Figure 2.2) is used with a 3-phase system, when the NEUTRAL line is to be switched during transfer action.

Figure 2.2 — Typical 4-Pole Transfer Mechanism (1600 Amp Shown)



DANGER

All power voltage supplies must be turned off before attempting to connect power source and load lines. Failure to turn off power voltage supplies will result in extremely dangerous and possibly lethal electrical shock.

All power cables should enter the switch next to the transfer mechanism terminals. Standard terminal lugs on the transfer mechanism are solderless screwtype.

Connect power source and load conductors to clearly marked terminal lugs on transfer mechanism as follows:

- LOAD leads: Connect to terminals T1, T2, T3, & T4*.
- UTILITY (normal) Source Leads: To terminals N1, N2, N3, & N4*.
- EMERGENCY (standby) Source Leads: Connect to transfer mechanism terminal lugs E1, E2, E3, & E4*.

* The connection diagram (Figure 2.3) shows a typical 3-phase installation without switched neutral. T4, N4, and E4 are not used.

NOTE:

Unless otherwise specified, a NEUTRAL block is not supplied with transfer switch on single phase, 3-pole units where the NEUTRAL line is to be switched during transfer action. Similarly, a NEUTRAL block is not supplied on 3-phase, 4-pole units where the NEUTRAL line is to be switched during transfer.

Solderless screw-type terminal lugs are standard. Conductor sizes must be adequate to handle the maximum current to which they will be subjected to, based on the 75°C column of tables, charts, etc. used to size conductors (600-2600A, rated minimum 90°C, sized for 75°C). The installation must comply fully with all applicable codes, standards and regulations.

Switch Rating	Wire Range
600A	(2) 500 MCM-1AWG
1000A	(4) 4/0-500 MCM
1600A	(4) #1-750 MCM

Before connecting wiring cables to terminals, remove any surface oxides from the cable ends with a wire brush. If ALUMINUM conductors are used, apply corrosion inhibitor to conductors. After tightening terminal lugs, carefully wipe away any excess corrosion inhibitor.

Tighten terminal lugs to the torque values as noted inside the transfer switch cabinet.

CAUTION

Use a torque wrench to tighten the conductors, making sure not to overtighten, or damage to the switch base could occur. If undertightened, a loose connection would result, causing excess heat which could damage the switch base.

Be sure to maintain proper electrical clearance between live metal parts and grounded metal. Allow at least 1/2 inch for 100-400 amp circuits; at least 1 inch for circuits over 400 amps.

2.5 CONNECTING START CIRCUIT WIRES

Connect suitable, approved wiring to transfer switch terminals 178 and 183 (see chart below). Route these wires through suitable, approved, separate conduit from the main AC power leads, and connect to identically numbered terminals in the AC connection (lower) panel of Generac power systems (engine-generator set). See Figure 2.3.

Closure of Wire 178/183 circuit by switch circuit action must result in generator engine cranking and startup.

Recommended wire gauge sizes for this wiring depends on the length of the wire, as recommended below:

MAXIMUM WIRE LENGTH	RECOMMENDED WIRE SIZE
460 feet (140m)	No. 18 AWG.
461 to 730 feet (223m)	No. 16 AWG.
731 to 1,160 feet (354m)	No. 14 AWG.
1,161 to 1,850 feet (565m)	No. 12 AWG.

2.6 AUXILIARY CONTACTS

If desired, there is access to Auxiliary Contacts on the transfer switch to operate customer accessories, remote advisory lights, or remote annunciator devices. A suitable power source must be connected to the COMMON (C) terminal. See Figure 2.4 on page 6.

Contact operation is shown in the following chart:

	Switch Position	
	Utility	Standby
Common to Normally Open	Closed	Open
Common to Normally Closed	Open	Closed

NOTE:

Auxiliary Contacts are rated 10 amps at 125 or 250 volts AC. DO NOT EXCEED THE RATED VOLTAGE AND CURRENT OF THE CONTACTS.

2.7 OPTIONAL ACCESSORIES

Note any optional accessories that may be installed on the transfer switch or are to be installed in the standby electric system in conjunction with the switch. Complete the necessary connections for these accessories.

3.1 FUNCTIONAL TESTS AND ADJUSTMENTS

Following transfer switch installation and interconnection, inspect the entire installation carefully. A certified, electrician should inspect it. The installation must comply strictly with all applicable codes, standards, and regulations. When absolutely certain the installation is proper and correct, complete a functional test of the system. Perform functional tests in the exact order presented in this manual, or damage to the switch will occur.

IMPORTANT: Before proceeding with functional tests, read and make sure you understand all instructions and information in this section. Also read the information and instructions of labels and decals affixed to the switch. Note any options or accessories that might be installed and review their operation.

Figure 2.3 — Connection Diagram - 3-Phase With Neutral Shown (Typical)

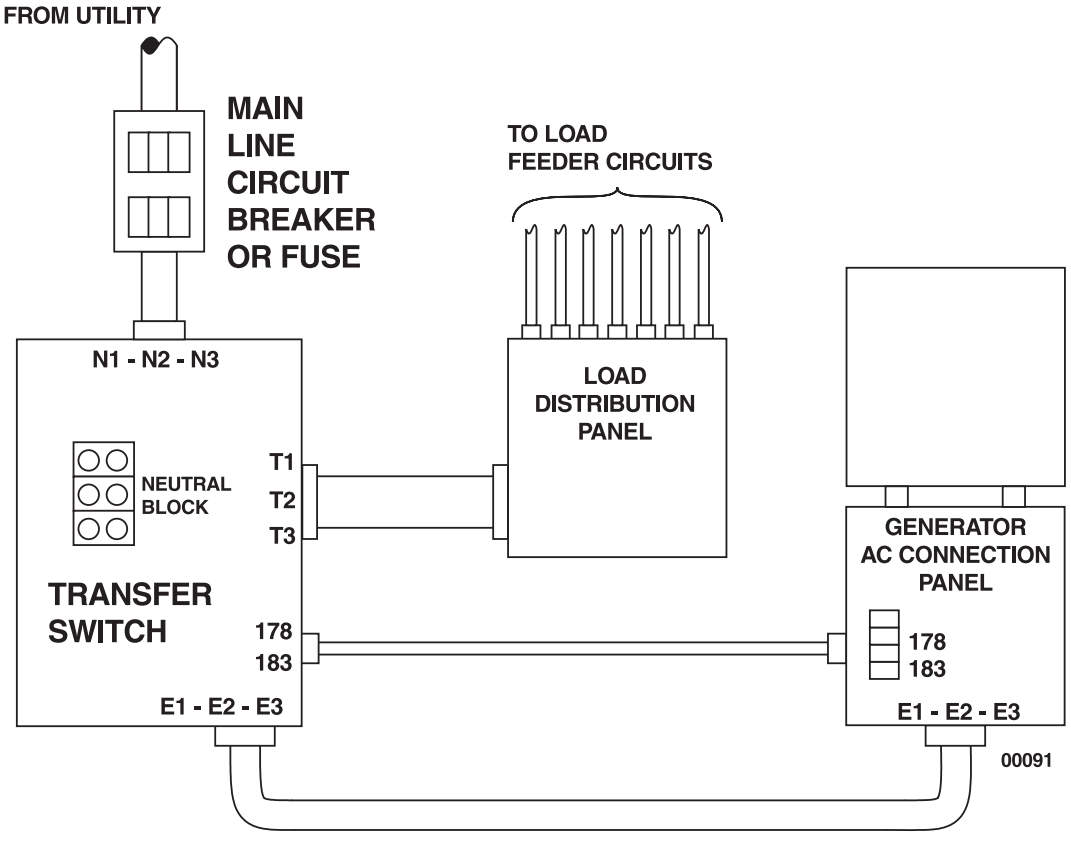
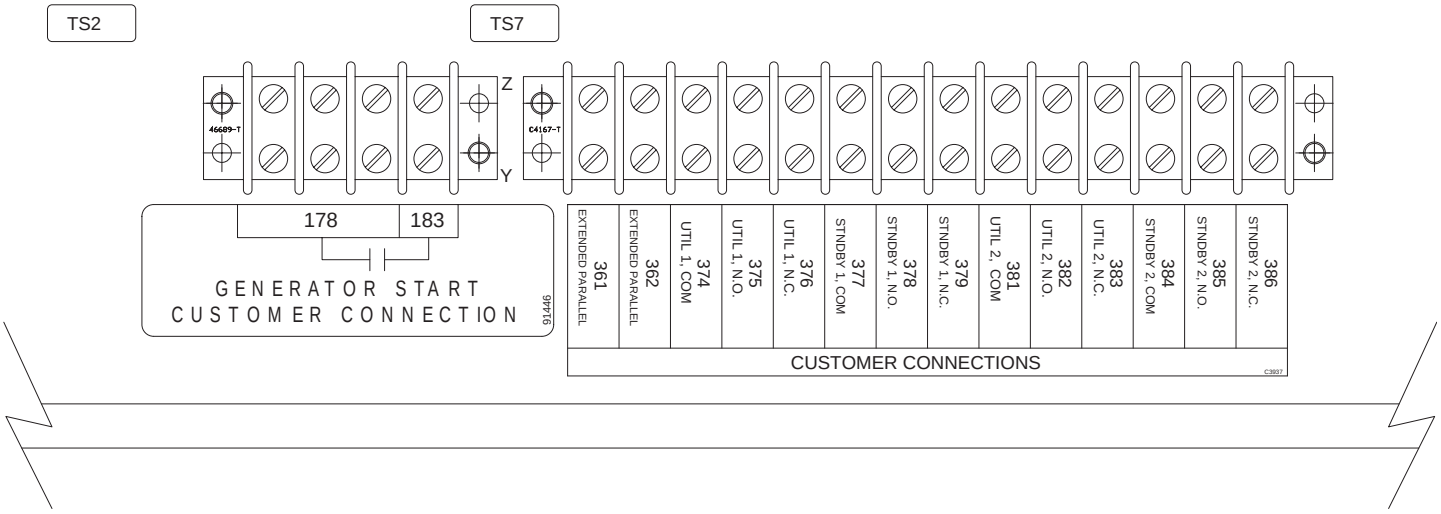


Figure 2.4 — Auxiliary Contact Diagram



3.2 MANUAL OPERATION

DANGER

Do NOT manually transfer under load. Disconnect transfer switch from all power sources by approved means, such as a main circuit breaker(s).

A manual actuation HANDLE is shipped with the transfer switch. Manual operation must be checked BEFORE the transfer switch is operated electrically. To check manual operation, proceed as follows:

1. In the transfer switch enclosure, set the Maintenance Disconnect switch to MANUAL. This prevents the generator from starting automatically, or the transfer mechanism from operating.
2. If so equipped, turn the generator's Manual-Off-Auto switch to OFF.
3. Turn OFF both NORMAL and STANDBY power supplies to the transfer switch, with whatever means provided (such as the main line circuit breakers).
4. Note position of transfer mechanism main contacts by observing display windows in "A" and "B" in Figure 3.1 as follows:
   - Window "A" "ON", Window "B" "OFF" - LOAD terminals (T1, T2, T3) are connected to NORMAL terminals (N1, N2, N3).
   - Window "A" "OFF", Window "B" "ON" - LOAD terminals (T1, T2, T3) are connected to STANDBY terminals (E1, E2, E3).

NOTE:

It is only possible to move the transfer switch mechanism in a "Break before Make" sequence. A closed transition transfer is only possible when electrically operated in the automatic mode of operation.

CAUTION

Do not use excessive force when operating the transfer switch manually or you could damage the manual handle and/or the internal mechanism.

◆ 3.2.1 CLOSE TO NORMAL SOURCE SIDE

Before proceeding, verify the position of the switch by observing window "A" in Figure 3.1. If window "A" reads "ON", it is already closed in the NORMAL source side. It is not necessary to move it to the NORMAL source side. If window "A" reads "OFF", proceed with step 1.

Step 1: With the handle attached to the actuating shaft, move handle UP.

NOTE:

Move the handle in the direction of the arrow labeled "Manual Close to Utility". DO NOT FORCE. Release handle slowly to make sure mechanism does not go over center. "ON" now appears in Window "A" and "OFF" appears in Window "B".

◆ 3.2.2 CLOSE TO EMERGENCY SOURCE SIDE

Before proceeding, verify the position of the switch by observing window "B" in Figure 3.1. If window "B" reads "ON", it is already closed in the EMERGENCY source side. It is not necessary to move it to the EMERGENCY source side. If window "B" reads "OFF" proceed with step 1.

Step 1: With the handle attached to the actuating shaft, move handle DOWN.

NOTE:

Move the handle in the direction of the arrow labeled "Manual Close to Standby". DO NOT FORCE. Release handle slowly to make sure mechanism does not go over center. ("OFF" appears in Window "A", and "ON" now appears in Window "B".)

3.3 VOLTAGE CHECKS

⚠ DANGER ⚠

Disconnect all loads from the transfer switch until all voltage checks and phase rotation checks have been completed to prevent possible injury to personnel and, or damage to equipment.

For safety, set the maintenance disconnect switch (inside transfer switch enclosure) to its manual position before proceeding with voltage checks.

Before proceeding, check the transfer switch data PLATE for switch rated voltage. Make sure the data plate voltage is compatible with UTILITY and EMERGENCY power source voltages.

Proceed with caution. Do not touch electrically hot terminals, wires, etc. During the voltage checks, the transfer switch is electrically energized.

Perform voltage checks as follows:

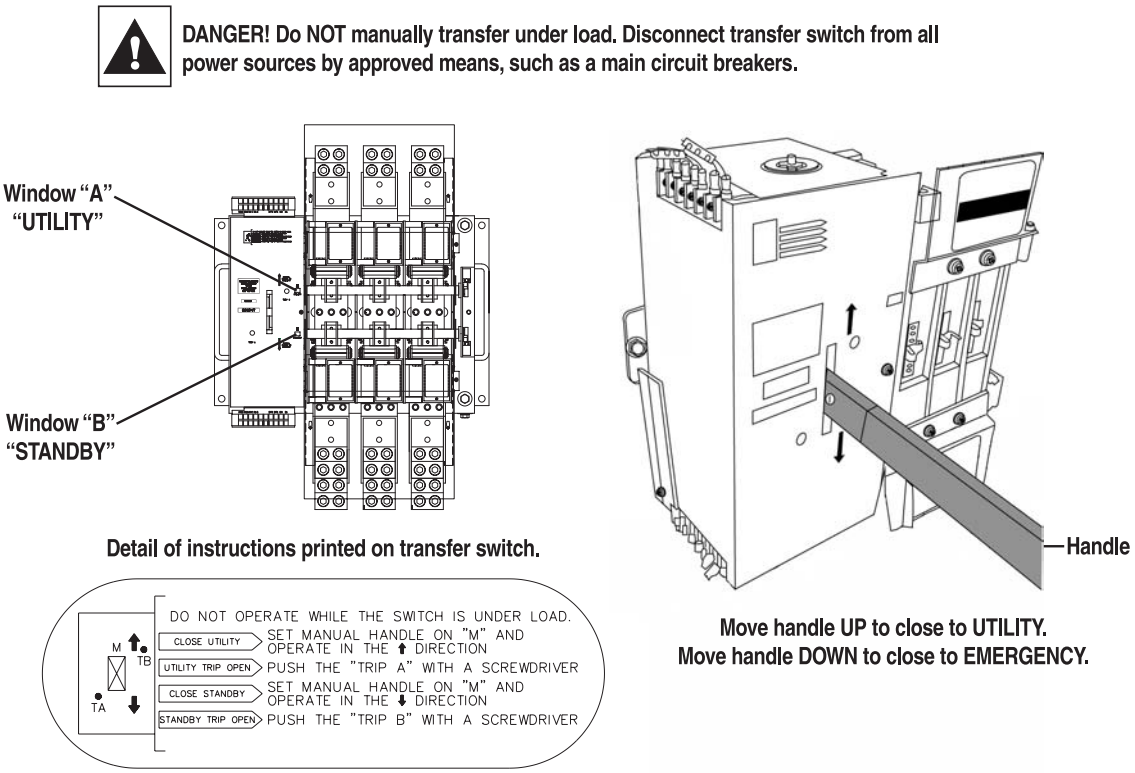
1. Inside the transfer switch enclosure, set the Maintenance Disconnect switch to MANUAL.
2. If generator is so equipped, set the Manual-Off-Auto switch to OFF.
3. On the switch enclosure door, set SYSTEM TEST switch to AUTOMATIC MODE position.
4. Check that the word "ON" is visible in Window "A", the word "OFF" in Window "B". See MANUAL OPERATION for location of "A" and "B" windows.

IMPORTANT: DO NOT PROCEED UNTIL STEPS 1, 2, 3, AND 4 HAVE BEEN COMPLETED.

⚠ CAUTION ⚠

Before proceeding to voltage checks, manually connect the load to NORMAL power supply. window "A" must indicate "ON", Window "B" must indicate "OFF" before proceeding.

Figure 3.1 — Actuating Transfer Switch



5. Turn ON the NORMAL (Utility) power supply to the transfer switch, with whatever means provided (such as the main line circuit breaker).

DANGER

The transfer switch is now electrically hot. Proceed with caution.

6. With UTILITY voltage available to the transfer switch, check that the ENABLED SOURCE-UTILITY lamp on the enclosure door is "ON". If the ENABLED SOURCE-UTILITY lamp is "OFF", turn off the utility power supply to the transfer switch by whatever means provided (such as the main line circuit breaker), then proceed back to Step 1 of "VOLTAGE CHECKS".
7. Inside the transfer switch enclosure door, locate the Utility Voltage Sensor Circuit Board. The "UTILITY ON" light (LED) should be "ON". See page 20 for calibration of Utility Voltage Sensor.
8. With an accurate AC voltmeter, check the phase-to-phase (line-to-line) and phase-to-neutral (line-to-neutral) voltages present at transfer mechanism terminals N1, N2, N3 and neutral. SUPPLIED VOLTAGES MUST BE FULLY COMPATIBLE WITH TRANSFER SWITCH RATED VOLTAGE.

DANGER

Ensure that the phase rotation of UTILITY (normal) power lines and transfer switch load power lines are compatible.

9. Refer to the standby generator instruction manual. Make sure the generator engine has been properly serviced and prepared for use, as outlined in that manual. Start the generator engine manually. Let the engine stabilize and warm up for a few minutes.
10. Turn ON the EMERGENCY (STANDBY) power supply to the transfer switch by whatever means provided (such as the main line circuit breaker).
11. With an accurate AC voltmeter, check phase-to phase (line-to-line) and phase-to neutral (line-to neutral) voltages present at transfer mechanism terminals E1, E2 and E3. Also check AC frequency at those terminals. If frequency is incorrect, the engine governor may require adjustment. Generator AC output voltage and frequency must be compatible with transfer switch rated voltage and frequency.

DANGER

Ensure that the phase rotation of EMERGENCY (STANDBY) power lines and transfer switch UTILITY (NORMAL) and load power lines are compatible.

12. If supplied voltage or frequency is incorrect, refer to standby generator Owner's Manual. If AC frequency is incorrect, adjust engine governed speed. If voltage is incorrect, adjust generator's voltage regulator or correct the problem.
13. When supplied voltage and frequency is correct, shut down the engine manually.

DANGER

Supplied voltages from both UTILITY (Normal) and EMERGENCY (Standby) power sources must be compatible with transfer switch rated voltage before proceeding.

14. Connect the transfer switch load to the transfer switch when "voltage checks" section has been completed. Connect the load to the transfer switch by whatever means provided (such as circuit breaker(s)), then proceed with the "ELECTRICAL OPERATION" section.

3.4 ELECTRICAL OPERATION

Test transfer system electrical operation as follows:

1. On the Utility Voltage Sensor circuit board, check that the "UTILITY ON" lamp (LED) is "ON".
2. On the enclosure door, check that the Enabled Source-Utility lamp is ON.

CAUTION

The UTILITY ON lamp (on circuit board) and the ENABLED SOURCE-UTILITY lamp (on enclosure door) must both be ON before proceeding to Step 3.

3. Refer to the appropriate owner's manual. Be sure the standby generator is prepared for automatic operation.
4. In the switch enclosure, set the Maintenance Disconnect switch to AUTOMATIC.

NOTE:

The generator may start at this time. The reason for this is that the Utility Voltage Sensor has a built-in timer. This timer is a delay on release type and will keep the 2-wire start contact closed for a period of 2 to 3 minutes every time the Utility supply falls below the preset levels.

5. Set the Mode switch to its NORMAL TEST MODE position. Generator startup and transfer to the STANDBY power source should occur. Refer to the SEQUENCE OF OPERATION, Section 3.9.

NOTE:

Advisory lights on the circuit board will light up to indicate operation of the various solid state timers that control automatic operation. By observing these lights (LED's), the operator can check the automatic operating sequences and timers. See SENSOR AND TIMER ADJUSTMENTS, Section 3.12. For a detailed description of the automatic operating sequences, see SEQUENCE OF OPERATION, Section 3.9.

6. When the test is complete, return the Mode Switch to its AUTOMATIC MODE position. Retransfer back to the UTILITY (normal) power source should occur. The generator should shut down according to circuit board timers.

3.5 SWITCHES AND ADVISORY LAMPS

This section will familiarize the reader with switches and advisory lights on the transfer switch enclosure door, as well as with the Maintenance Disconnect Switch inside the switch enclosure.

3.6 MODE SWITCH

This switch permits operator selection of AUTOMATIC, NORMAL TEST or FAST TEST mode as follows (Figure 3.2):

◆ 3.6.1 AUTOMATIC MODE

This switch position is for all normal automatic operations. With AUTOMATIC MODE selected, any NORMAL source voltage that dropped below a pre-set value will result in the automatic sequence of events listed in the chart in Section 3.11.

◆ 3.6.2 NORMAL TEST MODE

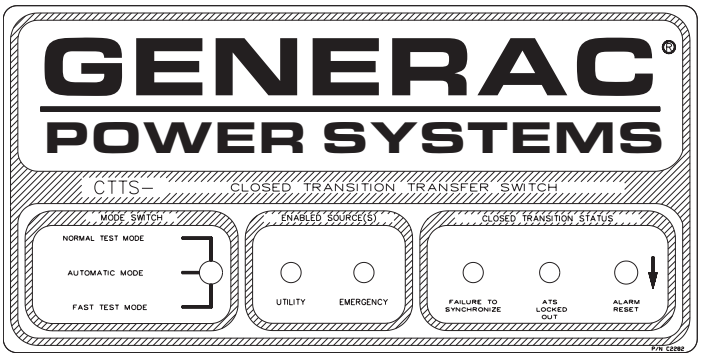
Permits the operator to test automatic operations, just as though an actual drop in NORMAL source voltage had occurred. See the chart in Section 3.11. During the test, observe the lights (LED's) on the transfer switch circuit board to monitor automatic operating sequences.

◆ 3.6.3 FAST TEST MODE

Permits the operator to test system operation with all circuit board timers accelerated to less than five seconds. The switch is spring-loaded back to AUTOMATIC MODE, so continuously hold the FAST TEST CONTROL.

Following the generator startup, loads are transferred to the EMERGENCY (standby) power source as soon as EMERGENCY source voltage and frequency have reached the settings of STANDBY VOLTAGE and STANDBY FREQUENCY sensors on the SYSTEM CONTROL board.

Figure 3.2 — Mode Switch, Enabled Sources LEDs, and Closed Transition Status



3.7 CLOSED TRANSITION STATUS

◆ 3.7.1 FAILURE TO SYNCHRONIZE

This LED is used to signal that the CTTS controller was not able to determine that the 2 sources were synchronized and the 30 second timer has timed out, indicated by a yellow flashing LED.

◆ 3.7.2 ATS LOCKED OUT

This LED is used to signal that the ATS contactor is locked out. This is a result of the 2 contacts staying closed for more than 0.5 seconds. This is indicated by a yellow flashing LED.

◆ 3.7.3 ALARM RESET

This is used to reset an ATS locked out condition. Toggle switch that is a momentary ON to reset.

3.8 ENABLED SOURCE LED

◆ 3.8.1 EMERGENCY

The LED will go ON when main current-carrying contacts have actuated to their EMERGENCY (Standby) position and that power source is available to the transfer switch.

◆ 3.8.2 UTILITY

The LED will go ON when the main contacts have actuated to UTILITY (Normal) position and that power supply is available to the transfer switch.

The switch is equipped with the CTTS controller circuit board. The sensors and timers are adjustable (see SENSOR AND TIMER ADJUSTMENTS).

3.9 SEQUENCE OF OPERATION

When acceptable NORMAL source voltage is available, observe the following:

- Utility Voltage Sensor circuit board monitor's NORMAL source voltage UTILITY ON LED is "ON".
- Enabled Source - UTILITY LED is "ON".
- Transformer reduced LOAD (T) terminal voltage is delivered to the seven-day exerciser board to operate the seven-day exercise timer.

Monitoring the automatic timers and sensors on the CTTS controller circuit board can be done by observing light emitting diodes (LED's) next to the sensor/timer adjustments.

◆ 3.9.1 SEQUENCE 1 - MONITORING THE VOLTAGE DROPOUT

- UTILITY source voltage drops below 75-95% of the Voltage Pickup Setting (factory set to about 80%). The UTILITY ON LED goes "OFF".
- Voltage Dropout Sensor is factory set to about 80% of "pickup" voltage.
- Voltage dropout below this sensor's setting triggers Sequence 2.

◆ 3.9.2 SEQUENCE 2 - LINE INTERRUPT DELAY

- UTILITY voltage dropout below setting of Voltage Dropout sensor starts the Line Interrupt Delay Timer.
- Line Interrupt Delay can be set for 0.1 to 10 seconds; has been factory set to about five seconds.
- If voltage dropout lasts longer than Line Interrupt Delay setting, circuit board action closes the automatic start circuit (Wires 178 and 183). When that circuit closes, the engine cranks and starts as controlled by a circuit board in the generator's control panel.
- Once the standby generator starts, circuit board is turned ON (go to Sequence 3).

NOTE:

Timers must be adjusted while generator engine is off.

◆ 3.9.3 SEQUENCE 3 - ENGINE MINIMUM RUN AND WARMUP TIMERS

- Timer establishes the minimum length of time for the generator to run before it will shut down automatically. Timer prevents shutdown of a cold engine.
- Timer is adjustable from five to 30 minutes; factory setting is about 20 minutes.
- The engine warmup timer is also turned ON. This timer permits engine to stabilize and warm up before loads are transferred to STANDBY. Timer is adjustable from five seconds to three minutes; factory setting is about one minute.

NOTE:

Timers must be adjusted while generator engine is off.

NOTE:

Bypass of the engine warmup timers is done by setting the Engine Warmup Timer Bypass switch to ON. Loads are transferred to STANDBY as soon as generator AC voltage and frequency have reached the settings of the Voltage and Frequency sensors without having to wait for the engine to warm up.

◆ 3.9.4 SEQUENCE 4 - STANDBY VOLTAGE AND FREQUENCY SENSORS

- If generator AC output voltage and frequency is above the setting of these sensors, loads are transferred to the STANDBY power source.
- Adjust Standby Voltage Sensor between 85% and 95% of nominal supply voltage; factory setting is about 90%.
- Adjust Standby Frequency Sensor between 80% and 90% or nominal supply frequency; factory setting is about 90%.

NOTE:

Timers must be adjusted while generator engine is off.

◆ 3.9.5 SEQUENCE 5 - OPEN TRANSITION TRANSFER

With the Utility voltage below its dropout setting the CTTS contactor mechanism will perform a break-before-make transfer. The Utility contacts will open before the Emergency contacts close. This is called an open transition transfer.

◆ 3.9.6 SEQUENCE 6 - VOLTAGE PICKUP

- If the UTILITY source voltage is restored above the setting of the Voltage Pickup sensor, Sequence 7 begins.
- Adjust Voltage Pickup between 85% to 95% of the normal supply voltage from the UTILITY source; factory setting is about 90%.

NOTE:

Timers must be adjusted while generator engine is off.

◆ 3.9.7 SEQUENCE 7 - RETURN TO UTILITY TIMER

- This timer prevents re-transfer that a Utility Source voltage surge or transient might cause.
- Adjust timer between one to 30 minutes; factory setting is about five minutes.
- If UTILITY voltage remains above the setting of the Voltage Pickup Sensor for the time interval of the Return to Utility Timer setting, loads are re-transferred back to the UTILITY source.

NOTE:

Timers must be adjusted while generator engine is off.

◆ 3.9.8 SEQUENCE 8 - CLOSED TRANSITION TRANSFER

When both sources of supply are present the CTTS contactor mechanism will perform a make-before-break transfer. The UTILITY side contacts will close before the EMERGENCY contacts open. The two sources will be connected together for a brief period of time (approximately 100 ms). This is called a closed transition transfer.

◆ 3.9.9 SEQUENCE 9 - ENGINE COOL DOWN TIMER

- After the switch re-transfers loads back to UTILITY, this timer starts. When the interval has "timed out", the automatic start circuit (Wires 178/183) are opened, and the engine shuts down.
- Timer permits engine to run at no-load for a fixed time, so the engine internal temperature can stabilize before shutting down.
- Set the timer for one to 30 minutes; factory setting is about 10 minutes.

NOTE:

Timers must be adjusted while generator engine is off.

NOTE:

Engine shutdown will occur when the Engine Cool Down timer or the Engine Minimum run timer times out, whichever is longer.

After the switch automatically re-transferred loads back to the UTILITY power source and generator has shut down, the system is "armed" for Sequence 1 again.

3.10 TRANSFER SWITCH OPTIONS

The transfer switch may be equipped with one or more of the following options:

- Instrument Package, 3.10.1
- Signal Before Transfer, 3.10.2
- Remote Auto Control, 3.10.3
- Manual bypass for return to Normal, 3.10.4
- Preferred Source Selector, 3.10.5
- NEMA 3R, 4, 4X or 12 enclosure, 3.10.6 through 3.10.9

◆ 3.10.1 INSTRUMENT PACKAGE

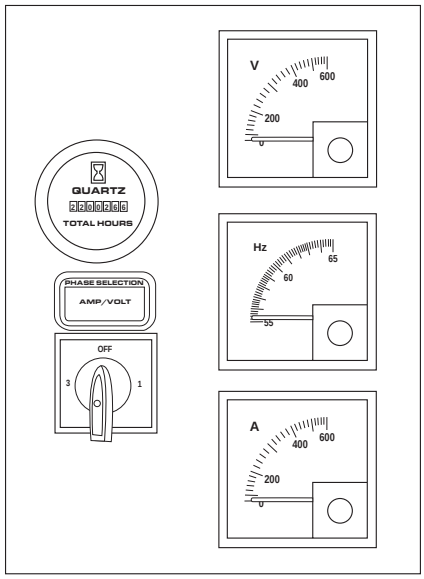
The optional instrument package includes (a) an AC voltmeter, (b) an AC frequency meter, (c) an AC ammeter, (d) an hourmeter, and (e) a phase selector switch (Figure 3.3). Current transformers are required to operate the instrument package, (two for single phase systems, three for three-phase systems). Use the phase selector switch to select the single-phase voltage and current being read as follows:

SWITCH OPERATION	CURRENT READING	VOLTAGE READING
1	Phase A	Phase A to Phase B
2	Phase B	Phase B to Phase C
3	Phase C	Phase C to Phase A
OFF	No reading	No reading

For three-phase systems use the switch as follows:

SWITCH OPERATION	CURRENT READING	VOLTAGE READING
1	Line 1	Line 1 to Neutral
2	Line 2	Line 2 to Neutral
3	No reading	Line 1 to Line 2
OFF	No reading	No reading

Figure 3.3 — Instrument Package



◆ 3.10.2 SIGNAL BEFORE TRANSFER

The signal before transfer option includes a signal relay, customer connection terminal strip and the associated wiring. See Figure 3.4.

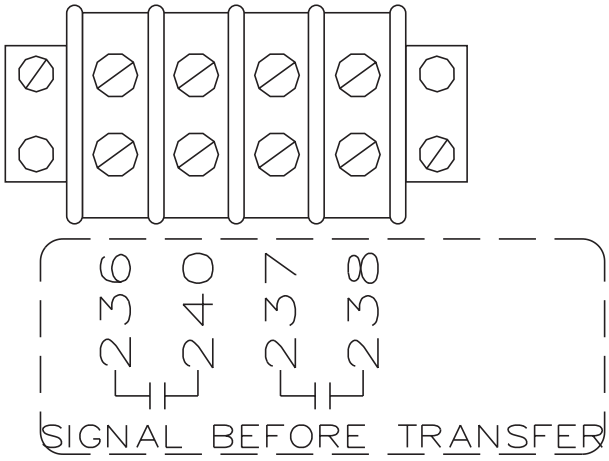
The logic for this option is a part of the CTTS Controller PCB. The option is active when the Signal Before Transfer switch is ON. The delay time is adjustable from one to 30 seconds.

NOTE:

Timers must be adjusted while generator engine is off.

The basic operation of the option is to delay (for the period of time set on timer) the transfer of the CTTS mechanism while a signal relay (SR) is energized. When the relay is energized, two sets of the dry contacts (wire nos. 236-240 and 237-238) are closed. These dry contacts can be connected to a terminal strip located on the bottom of the subplate. Reference wiring diagram No. 0D7838 (page 33) for further details. The customer connections are made on terminal strip TS4.

Figure 3.4 — Signal Before Transfer



NOTE:

This delay is not active on a Normal source failure. Transfer during Normal source failure is immediate.

◆ 3.10.3 REMOTE AUTO CONTROL

The Remote Auto Control option includes a customer connection terminal strip and the associated wiring (Figure 3.5 on page 13).

This option allows for remote starting of the generator and transfer of the CTTS to connect the LOAD to the EMERGENCY source. This is done by paralleling the Fast Test switch. A description of the Fast Test Mode function can be found in Section 3.6.3 on page 9.

Reference wiring diagram 0D7838 (page 33) for further details. The customer connections are made on TS3. The associated wire numbers are 0, 177, 178 and 201.

3.11 SEQUENCE OF OPERATION AND SETTINGS

ADJUSTMENT SEQUENCE I.D. LETTERS	ACTION	TIMER/SENSOR	ADJUST RANGE	FACTORY SETTING
—*	UTILITY volts available - no action	Voltage Dropout Sensor	75 - 95%	90%
A*	UTILITY voltage drops out	Voltage Dropout Sensor	75 - 95%	80%
B	Line Interrupt Delay Timer Starts	Line Interrupt Delay Timer	0.1 - 10 seconds	5 seconds
C	Line Interrupt Delay Timer Stops	Line Interrupt Delay Timer	.01 - 10 seconds	5 seconds
—	Engine cranks and starts			
D	Engine Minimum Run Timer starts	Engine Minimum Run Timer	5 to 30 minutes	20 minutes
E**	Engine Warmup Timer Starts	Engine Warmup Timer	5 sec. - 3 min.	1 minute
F	STANDBY Run Signal LED ON			
G**	Engine Warmup Timer stops	Engine Warmup Timer	5 sec. - 3 min.	1 minute
H	Is STANDBY voltage good?	Standby Voltage Sensor	85 - 95%	95%
J	Is STANDBY frequency good?	Standby Frequency Sensor	80 - 90%	90%
K	Open Transition to Emergency			
L	TRANSFERRED TO STANDBY LED ON			
—	STANDBY source powers LOAD			
M	UTILITY voltage restored	Voltage Pickup Sensor	85 - 95%	90%
N	Return to UTILITY Timer ON	Return to Utility Timer	1 - 30 minutes	5 minutes
O***	Closed Transition Transfer to Utility			
P	Signal Before Transfer LED lights	Signal Before Transfer Timer	1 - 30 seconds	10 seconds
—	Re-transfer to UTILITY source			
R****	Engine Cooldown Timer starts	Engine Cooldown Timer	1 - 30 minutes	10 minutes
S****	Engine Cooldown Timer stops	Engine Cooldown Timer	1 - 30 minutes	10 minutes
—	Engine shuts down			
—	UTILITY volts available - no action			

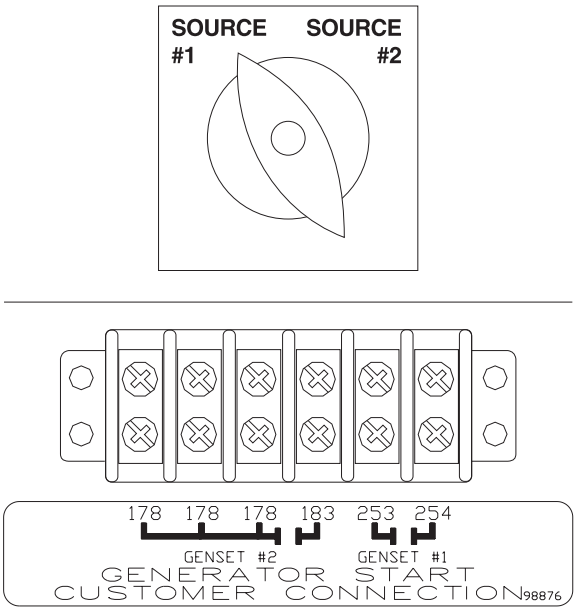
* 75 - 95% of the Voltage Pickup Sensor setting

** Engine Warmup Timer can be bypassed. See SENSOR AND TIMER ADJUSTMENTS

*** If the conditions for a closed transition transfer can not be met, a time delay neutral transfer will occur. (Switch selectable).

**** Following re-transfer to UTILITY source, engine shutdown will not occur until both Engine Minimum run and Engine Cooldown timers have timed out.

Figure 3.5 — Remote Auto Control



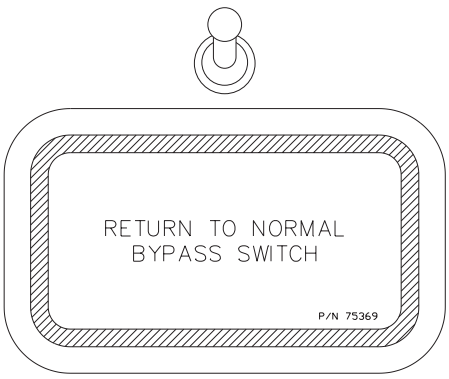
◆ 3.10.4 MANUAL BYPASS FOR RETURN TO NORMAL

The Manual Bypass for Return to Normal option includes a door mounted toggle switch and associated wiring (Figure 3.6).

This option will override the Return to Utility timer on the CTTS Controller PCB. When the toggle switch is activated (pushed down), and the Return to Utility timer is active, the remaining time on the timer will be cleared. Once the timer is cleared the CTTS mechanism will transfer and the LOAD will be connected to the UTILITY source.

If the toggle switch is not activated, the Return to Utility timer will function as normal. The retransfer of the CTTS will be delayed until it times out.

Figure 3.6 — Manual Bypass for Return to Normal



◆ 3.10.5 PREFERRED SOURCE SELECTOR SWITCH

The Preferred Source Selector Switch option includes a door mounted rotary 2-position selector switch, customer connection terminal strip and associated wiring (Figure 3.5).

This option is normally used when there is not a UTILITY supply present and both sources are a generator. It can be used when it is desirable for either source of power to serve as the preferred source. The other power source then becomes the backup source. The switch is manually operated

When the rotary switch is in position Source #1 the CTTS will perform as a normal system. Generator #1 will be the primary source and generator #2 will be the backup source.

When the rotary switch is in position #2, the CTTS will signal generator #2 to start and the CTTS will transfer the LOAD to generator #2. If Source #2 fails, Source #1 will be signaled to start. The CTTS mechanism will transfer the LOAD to Source #1. When Source #2 returns to service, the CTTS will transfer the LOAD to Source #2.

Reference wiring diagram 0D7838 (page 33) for further details. The customer connections are made on TS2. The associated wire numbers are 178, 183, 253 and 254.

◆ 3.10.6 NEMA 3R ENCLOSURE

National Electrical Manufacturer's Association (NEMA) 3R enclosure. This type of enclosure is intended for use outdoors to protect enclosed parts from windblown dust and water. The enclosure is sealed for dust, rain or sleet and is ice resistant. Consult a Dealer/Distributor or the factory for details.

◆ 3.10.7 NEMA 4 ENCLOSURE

National Electrical Manufacturer's Association (NEMA) 4 enclosure. This type of enclosure is intended for use indoors or outdoors to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water and is undamaged by the formation of ice on the enclosure. Consult a Dealer/Distributor or the factory for details.

◆ 3.10.8 NEMA 4X ENCLOSURE

National Electrical Manufacturer's Association (NEMA) 4X enclosure. This type of enclosure is intended for use indoors and outdoors to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water and is undamaged by the formation of ice on the enclosure. Consult a Dealer/Distributor or the factory for details.

◆ 3.10.9 ADDITIONAL OPTIONS

For information on additional options not covered in this manual, consult a Dealer/Distributor or the factory.

3.12 SENSOR AND TIMER ADJUSTMENTS — SENSING CIRCUIT BOARD

◆ 3.12.1 VOLTAGE DROPOUT SENSOR

This sensor (Figure 3.7) establishes the UTILITY power source voltage which generator startup and transfer to EMERGENCY (Standby) power source occurs. Adjust the sensor to any voltage between 75-95% of the nominal voltage Pickup Sensor setting, by turning the adjusting knob to the desired setting (in percent). Sensor is factory set to about 80% of the Voltage Pickup Sensor setting.

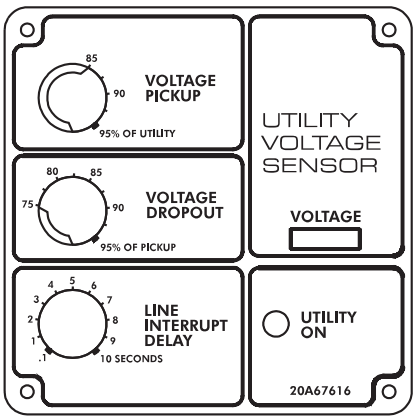
◆ 3.12.2 VOLTAGE PICKUP SENSOR

Establishes the UTILITY power source voltage at which re-transfer back to that power source occurs. Turn knob to adjust setting to 85-95% of the nominal UTILITY source supply voltage. Sensor has been factory set to about 90% of nominal rated NORMAL source voltage.

◆ 3.12.3 LINE INTERRUPT DELAY TIMER

Establishes a definite time interval between UTILITY source voltage dropout below the setting of the Voltage Dropout Sensor and generator startup. This time interval is necessary to prevent false generator starts that voltage transients might otherwise cause. Adjust timer from 0.1 to 10 seconds; factory set to about five seconds.

Figure 3.7 — Sensing Circuit Board Panel



3.13 ADJUSTMENTS ON CTTS CONTROLLER CIRCUIT BOARD

The CTTS controller is operational only when the generator set is running. Transfer will occur when UTILITY and EMERGENCY voltage and phase are comparatively equal with a maximum difference of 20° between the power sources. To assure precision matching control, minimum voltage and frequency ranges are specified by the operator. In addition, each CTTS controller is programmed with the use of an onboard DIP switch to match the actuation time of the corresponding switch. Controlled transition transfer is used only between two live power sources and NOT during a UTILITY source failure. The CTTS controller board (Figure 3.8 on page 16) is designed to transfer loads under the following conditions:

- When generator set frequency is between 59.5 - 60.5 Hz (49.5 - 50.5 Hz for 50 Hz systems).
- When generator set and utility power source frequencies are within 0.5 Hz.
- When the generator set and utility source voltage are within 85-100 percent of nominal voltage.
- When both power sources are able to come into phase within 30 seconds.
- When less than 30 seconds has elapsed since the engine warmup timer light has been illuminated.

NOTE:

For the two sources of supply to come into phase, it is necessary to have a slight difference in frequency (0.05 - 0.1 Hz). If the UTILITY and EMERGENCY sources are exactly the same frequency, they may never come in-phase to allow a closed transition transfer.

If any one of the preceding conditions are not met within 30 seconds, the system will signal a "Failure to Synchronize" condition and perform an open transition transfer.

When the open transition transfer occurs, it will depend on the following:

- If "TDN When Fail to Sync" switch is "ON", the system will do a TDN transfer. The off time will be the value set on the Time Delay Neutral timer.
- If "TDN When Fail to Sync" switch is "OFF", the system will wait for a period of 30 minutes and do a TDN transfer for the time set on the Time Delay Neutral timer.

◆ 3.13.1 ENGINE WARMUP TIMER

Permits the engine to warm up before transferring LOAD from UTILITY to EMERGENCY power. Reset timer to any time interval between five seconds and three minutes; factory set to about one minute.

◆ 3.13.2 ENGINE MINIMUM RUN TIMER

Establishes the minimum length of time the generator must run before it can be shut down automatically. Timer prevents a cold engine from being shut down. It is factory set to about 20 minutes, but you can reset the interval between five and 30 minutes.

◆ 3.13.3 RETURN TO UTILITY TIMER

Establishes time interval between restoration of UTILITY source voltage above the setting of the Voltage Pickup Sensor and re-transfer back to that source. This time interval is necessary, to prevent re-transfer that otherwise might occur as a result of transient voltages. Timer can be reset to any interval between one and 30 minutes, and is factory set to about five minutes.

◆ 3.13.4 ENGINE COOL DOWN TIMER

Provides a time delay between automatic re-transfer back to the UTILITY source and engine shutdown. This permits internal engine-generator temperatures to stabilize at "no-load" prior to shutdown. Set timer between one and 30 minutes and is factory set to about 10 minutes.

NOTE:

The actual time interval between re-transfer back to UTILITY and generator shutdown, is the time remaining on Engine Minimum Run timer or time setting of the Engine Cool Down Timer, whichever is longer.

◆ 3.13.5 STANDBY VOLTAGE SENSOR

After engine starts automatically, the system does not transfer LOAD to EMERGENCY power source until generator AC output voltage has reached the setting of this sensor. Factory set to about 90% of the nominal rated voltage, but you can reset between 85% and 95% of the unit's rated voltage.

◆ 3.13.6 STANDBY FREQUENCY SENSOR

This adjustment allows the installer or operator to select the minimum required frequency of the standby power source. It is adjustable between 80-90%. Factory set to 90%.

◆ 3.13.7 SIGNAL BEFORE TRANSFER TIMER

If this functionis selected, the timer will control the amount of time signal remains active. Timer is adjustable from one to 30 seconds and is factory set to about 10 seconds.

NOTE:

The "Signal Before Transfer" feature provides a time relay contact closure and associated delay that can be used to allow elevators to continue operating before transfer to another power supply occurs.

◆ 3.13.8 TIME DELAY NEUTRAL (TDN)

This timer holds the transfer mechanism's main contacts in the "Neutral" position for the time that is selected. "Neutral" is the main contacts position where the LOAD is disconnected from both UTILITY and EMERGENCY power supplies. Timer is adjustable from 0.1 and 10 seconds; factory set to about five seconds.

NOTE:

The TDN function will only operate when the "TDN when fail to sync" switch is ON and the CTTS controller was not able to determine the two (2) sources were synchronized.

◆ 3.13.9 CALIBRATION MODE SWITCH

This switch has three positions, identified as "STDBY", "OFF" and "UTIL". The switch allows the installer or operator to calibrate the circuit board to the existing generator set output voltage and to the existing UTILITY power source voltage. The board must be calibrated to both power source voltages in order to initiate transfer and re-transfer at the correct voltages. To calibrate the circuit board to the correct voltage, see "Calibrating the Circuit Board." (page 17)

◆ 3.13.10 TDN WHEN FAIL TO SYNC

This switch allows the operator or installer to select what happens when the CTTS can not determine the two sources are synchronized.

- Switch at ON: Transfer between sources will occur with the TDN equal to the setting of the TDN timer.
- Switch at OFF: Transfer between sources will not occur until a 30 minute timer has timed out.

◆ 3.13.11 SIGNAL BEFORE TRANSFER SWITCH

This switch allows the operator or installer to select the "Signal Before Transfer" feature or to turn OFF the feature. To activate the feature, set the switch to ON. To turn off the feature, set the switch to OFF.

◆ 3.13.12 ENGINE WARMUP TIMER BYPASS SWITCH

To bypass the Engine Warmup Timer and transfer as soon as generator voltage and frequency have reached the setting of the Standby Voltage and Frequency Sensors, set switch to ON. To place Engine Warmup Timer back into the automatic operating system, set the switch to OFF.

◆ 3.13.13 TRANSFER ON EXERCISE SWITCH

For transferring LOAD to the EMERGENCY source during the seven-day exercise cycle, set switch to ON. For no transfer during the exercise, set switch to OFF.

During the exercise period the exercise timer will start the generator by closing a contact across wire numbers 178 and 183. This contact closure will be maintained for the exercise period that is set, see Section 3.17 on page 19.

If the TRANSFER ON EXERCISE switch is OFF the generator set will start and run without load for the exercise period. At the end of the exercise period the generator set will turn off.

If the TRANSFER ON EXERCISE switch is ON the generator set will start and run. An exercise signal will be sent to the CTTS controller. This signal will initiate a load transfer from UTILITY to the EMERGENCY sources. The transfer will occur after the ENGINE WARM-UP timer times out and the conditions for a closed transition transfer are met. The load will stay connected to the Emergency source until the exercise period timer and the RETURN TO UTILITY timer times out. The load will be transferred back to the UTILITY source. This will not occur until the conditions for a closed transition transfer are met. The generator set will run without load until the ENGINE COOL-DOWN and ENGINE MINIMUM RUN timers time out. The generator set will shut down at this time.

NOTE:

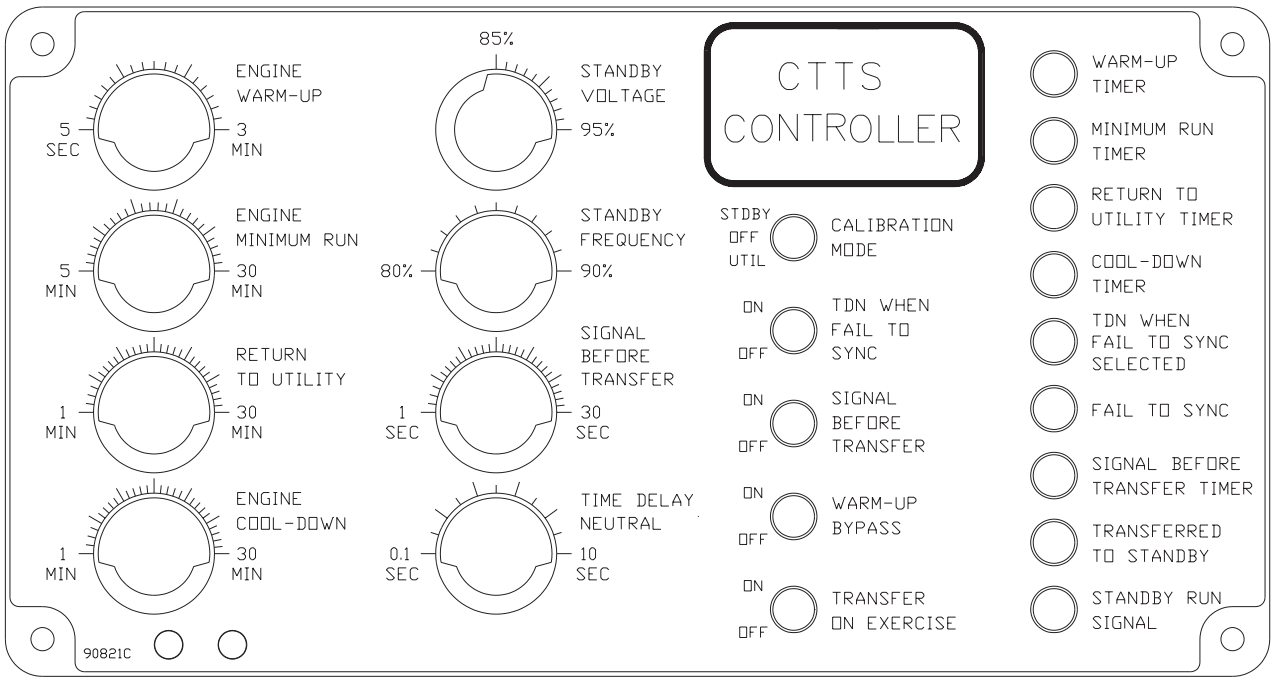
The total exercise time depends on the settings of the ENGINE MINIMUM RUN, RETURN TO UTILITY, and EINGINE COOL-DOWN timers.

◆ 3.13.14 ADVISORY LAMPS

The advisory lamps on the CTTS controller consists of nine LED's (light emitting diodes) and include the following:

- The four red timer lamps will turn ON when their respective timers are activated.
- The "TDN when fail to sync" selected LED goes ON when "TDN When Fail to Sync" switch is ON. This indicates the system will perform a "TDN Transfer" if the CTTS controller can not determine the two (2) sources are synchronized.
- The "Fail to Sync" LED goes ON when the CTTS controller has attempted to determine if the two (2) sources are synchronized and the time delay has expired.
- The "Signal Before Transfer Timer" lamp will turn ON for the duration of the Signal Before Transfer Timer, when it is turned ON.
- "Transfer to Standby Lamp" goes ON when LOAD has been transferred to STANDBY power source.
- "Standby Run Signal" will go ON when the generator is running and the CTTS controller is operational and controlling the generator.

Figure 3.8 — CTTS Controller Panel

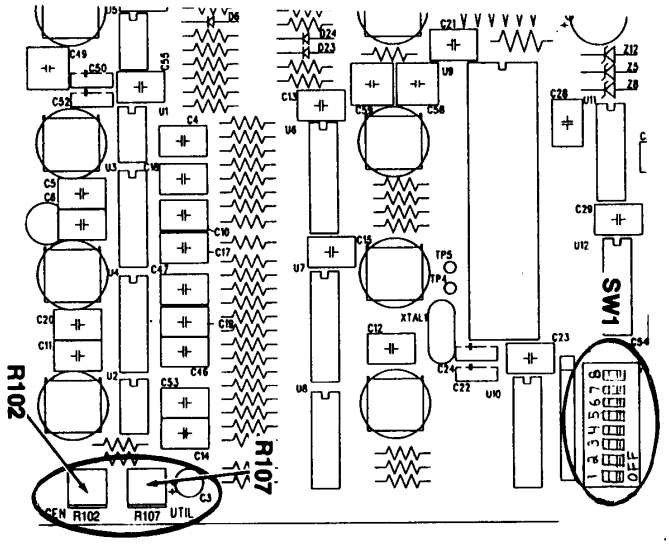


3.14 CALIBRATING THE CTTS CONTROLLER CIRCUIT BOARD

The CTTS controller circuit board must be calibrated to existing EMERGENCY and UTILITY source voltages if the system is to operate properly. To calibrate the circuit board, two adjustment potentiometers (R102 and R107) are provided in the lower left corner of the circuit board (Figure 3.9). The board must be calibrated as follows:

1. Check that UTILITY supply voltage is available to the system.
2. Manually start the generator, let it stabilize and warm up.
3. Set the Calibration Mode Switch to "STDBY" and observe the four top LED's on the circuit board (Warmup Timer, Minimum Run Timer, Return to Utility Timer and Cool down Timer). These are the RED lamps.
   - If one or both of the two upper LED's are illuminated, calibration is set too low.
   - If one or both of the two bottom LED's are illuminated, calibration is set too high.
4. On the circuit board, adjust potentiometer R102 until only the two center LED's are illuminated (Minimum Run and Return to Utility timers).
5. Now, set the Calibration Mode switch to "UTIL" and observe the four upper LED's on the circuit board.

Figure 3.9 — CTTS Controller Circuit Board



6. Adjust potentiometer R107 until only two center LED's are illuminated (Minimum Run and Return to Utility).
7. Set the Calibration Mode Switch to "OFF". The CTTS controller circuit board is calibrated.

NOTE:

With the Calibration Mode Switch set to "OFF", the four top LED's should turn ON in sequence. That is, the lights should sweep on and off, from one light to the next when the generator turns on. This indicates the internal program of the CTTS controller is functioning.

NOTE:

The CTTS controller circuit board should be calibrated when the transfer switch has been installed as part of an operating system. Also, replacement circuit boards must be calibrated.

3.15 CIRCUIT BOARD SWITCH SW1

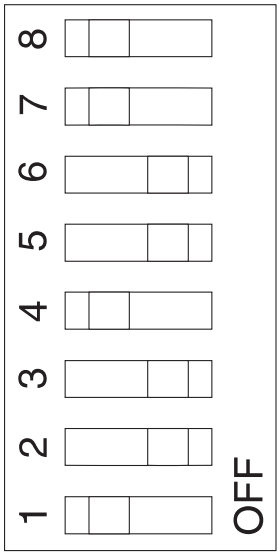
On the CTTS Controller Circuit Board, a switch assembly consisting of a bank of eight miniature switches is identified as "SW1" is usually set up at the factory and should require no additional configuring (Figure 3.10).

NOTE:

On boards not installed at the factory, SW1 must be set by the installer. SW1 must be set to match the type of transfer switch in which the board is installed.

The individual switches on SW1 are numbered from "1" (bottom) through "8" (top), as shown in Figures 3.9 and 3.10. To make the circuit board compatible to the specific transfer switch assembly, set the switches as indicated in the chart at the top of page 18. Improper settings may cause transfer outside the 20-degree specification.

Figure 3.10 — Circuit Board Switch SW1



3.16 EXERCISE TIMER DISPLAY

Figure 3.11 - DIP Switch Settings - CTTS Type Transfer Switches

TRANSFER SWITCH	SYSTEM VOLTAGE 208 VOLTS								SYSTEM VOLTAGE 240/416/480/600							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
600 amps, 3-pole (0D3943)	*	ON	OFF	OFF	ON	ON	ON	ON	*	ON	OFF	ON	OFF	ON	ON	OFF
600 amps, 4-pole (0D3944)	*	ON	OFF	OFF	ON	ON	OFF	ON	*	ON	OFF	ON	OFF	ON	OFF	OFF
1000 amps, 3-pole (0D3945)	*	ON	OFF	OFF	ON	ON	OFF	OFF	*	ON	OFF	ON	OFF	OFF	ON	OFF
1000 amps, 4-pole (0D3946)	*	ON	OFF	OFF	ON	ON	ON	OFF	*	ON	OFF	ON	OFF	OFF	ON	ON
1600 amps, 3-pole (0D3947)	*	ON	OFF	OFF	ON	OFF	ON	ON	*	ON	OFF	ON	OFF	OFF	OFF	ON
1600 amps, 4-pole (0D3948)	*	ON	OFF	ON	OFF	ON	OFF	OFF	*	ON	OFF	OFF	ON	ON	OFF	OFF
2000 amps, 3-pole (0D4425)	*	OFF	ON	ON	OFF	OFF	ON	ON	*	OFF	ON	ON	ON	ON	ON	ON
2000 amps, 4-pole (0D4427)	*	OFF	ON	ON	OFF	OFF	OFF	ON	*	OFF	ON	ON	ON	ON	ON	OFF
2600 amps, 3-pole (0D4428)	*	OFF	ON	ON	ON	OFF	OFF	ON	*	ON	OFF	OFF	OFF	OFF	ON	OFF
2600 amps, 4-pole (0D4429)	*	OFF	ON	OFF	OFF	ON	ON	OFF	*	OFF	ON	ON	OFF	ON	ON	ON

◆ 3.16.1 CURRENT TIME

The current time is selected with the time push-button and is displayed in 12:00 hour format on four 7 segment LED displays. The colon flashes at a rate of 0.5 seconds on/off to indicate normal operation and display of the current time.

◆ 3.16.2 EXERCISE TIME

The exercise time is selected with the time push-button, the exercise time for the selected day is displayed in a similar format to current time, except that the colon does not flash but is always ON to indicate that the exercise time is being displayed.

To change the exercise day that is being displayed use the "day" push-button when in this mode.

◆ 3.16.3 PM (TIME)

A single LED indicates PM (ON) time or AM (OFF).

◆ 3.16.4 DAY OF WEEK

The day of the week is indicated on the seven individual day LEDs which represent Sunday through Saturday.

◆ 3.16.5 EXERCISE ON (EX)

A single LED indicates that the relay output is switched ON (exercise period).

◆ 3.16.6 POWER SAVING

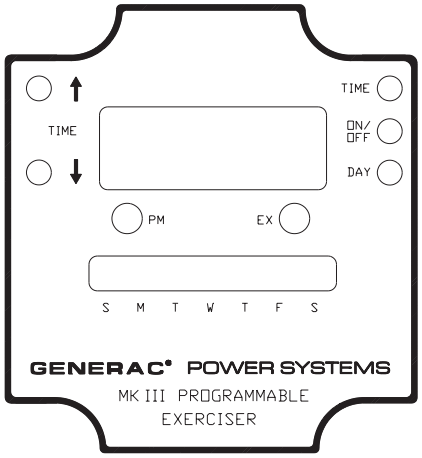
To minimize the power consumption of the unit, the unit will switch to a "dim" display mode of no keyboard activity is noted for five minutes. The display brightness is reduced to 50% of normal, but returns to 100% when any key is pressed.

◆ 3.16.7 DEFAULT TIMES

When the exerciser is first powered up, or if power is removed from the unit and the battery backup has expired, the default times will revert to:

Current time	9:00 am
Current day	Sunday
Sun-Sat exercise	9:00 am
Exercise period	20 minutes

Figure 3.12 — Display



3.17 EXERCISE TIMES

Exercise times may be set individually on a day by day basis. Exercise periods can overlap day's, i.e. if a time is set for 11:55 pm Sunday for 20 minutes, it will turn off at 12:15 am Monday.

The exercise period is globally programmable (common to all days), and is limited from 10-59 minutes.

3.18 PUSHBUTTONS (FIGURE 3.12)

◆ 3.18.1 UP ARROW ↑

The up arrow is used to step the time forward in increments of one minute. This feature has auto-acceleration such that if the button is held on, the step frequency will progressively increase to allow fast searching of a required time. As soon as the button is released, it will revert to normal speed.

◆ 3.18.2 DOWN ARROW ↓

The down arrow is used to step the time backwards in increments of one minute. It also has auto-acceleration.

◆ 3.18.3 TIME (TIME/ALARM TOGGLE)

This toggles the display between normal current time display and exercise time. When in exercise time mode the following happens:

1. The colon stops flashing to indicate exercise time mode.
2. The Sun LED flashes to indicate that it is initially selected. The rate of flashing is either:
   - 50/50% on/off to indicate exercise time "enabled".
   - 90/10% on/off to indicate exercise time "not enabled".
3. All other days that have exercise times enabled to ON are indicated by LED ON, days that are disabled are set to LED OFF.

If the display is inadvertently left in this mode with no keyboard activity for more than five minutes, it will revert back to normal (current time) display.

◆ 3.18.4 ON/OFF (ALARM SELECT TOGGLE)

When in exercise mode, this button will toggle the exercise enable/disable status of the displayed day. The rate of flashing will change as above.

◆ 3.18.5 DAY

The day button is used to step forward through the days in either the current time or exercise time:

- In current time mode, the days will step through seven states indicating Sunday to Saturday.
- In exercise time mode, the days will step through seven states indicating Sunday to Saturday and will then display state eight - all days LEDs flashing on/off together which represents the global exercise time period. In this mode, the exercise period may be changed using the up/down arrows as above but the on time is limited to between 10 and 59 minutes.

3.19 PROGRAMMING EXAMPLES

◆ 3.19.1 EXAMPLE 1 — CHANGE TIME FROM SUNDAY 9:00 AM TO WEDNESDAY 2:00 PM

1. Ensure that current time is displayed by flashing colon. If colon is not flashing, then press and release the "time" push-button once.
2. Press and hold the "Up arrow" push-button until the time steps to almost 2:00 pm - note that the pm LED will now be on.
3. Repeatedly press and release "Up arrow" push-button until exact time is obtained. If you go past 2:00 pm then use the "Down arrow" to step back to the required time.
4. Press the "Day" button to advance the day LED display until the LED next to "W" (Wednesday) is on.

◆ 3.19.2 EXAMPLE 2 — SET EXERCISER ON FOR 14 MINUTES MON-FRI AT 10:00 AM

1. Press and release the "time push-button once to display the exercise time for Sunday, indicated by a static (ON) colon and a flashing "Sun" LED. If the colon is still flashing, then repeat this step.
2. The "Sun" LED should be flashing on/off 50/50 approximately four times per second. This means that the exercise time is correctly set to OFF for Sunday. If it is ON but briefly flashes OFF once every 2 seconds, this indicates that the exercise time is set to ON so press and release the "on/off" push-button once to toggle this state to OFF.
3. Press and release the "day" button to advance from Sunday to Monday, indicated by the "Mon" LED flashing.
4. Press and release the "on/off" push-button once to toggle the exercise state from OFF to ON. This will be indicated by the "Mon" LED now flashing on/off 50/50 approximately four times per second as described previously.
5. Repeat steps 3 and 4 for Tues., Wed., Thurs. and Fri. ensuring the correct on/off exercise status for each day.
6. Press and release the "day" button once more and the display will now show "0:20" which is the exercise period in minutes. This is common for all days and this display mode is indicated by all seven "day" lights flashing simultaneously.
7. Use the Up/Down arrows to change the exercise period to 14 minutes.
8. Press and release the "time" push-button once to return the display mode to the current time.

3.20 CALIBRATE UTILITY VOLTAGE SENSING CIRCUIT BOARD

The utility sensing interface reduces utility source voltage at a fixed ratio. Thus, if utility voltage varies from the nominal, sensing voltage to the circuit board also varies. For that reason, calibration is needed so the circuit board can match the system (Figure 3.13 on page 21).

CAUTION

The installed transfer switch must be rated at a voltage and phase that is compatible with the utility and standby power supplies. DO NOT attempt to calibrate any utility voltage sensor board on any non-compatible unit trying to make the unit compatible.

Once the circuit board has been properly calibrated, the voltage that was present during calibration establishes 100 percent utility voltage for "pickup" and "dropout" settings. Utility source voltage must be available to the transfer switch during calibration.

NOTE:

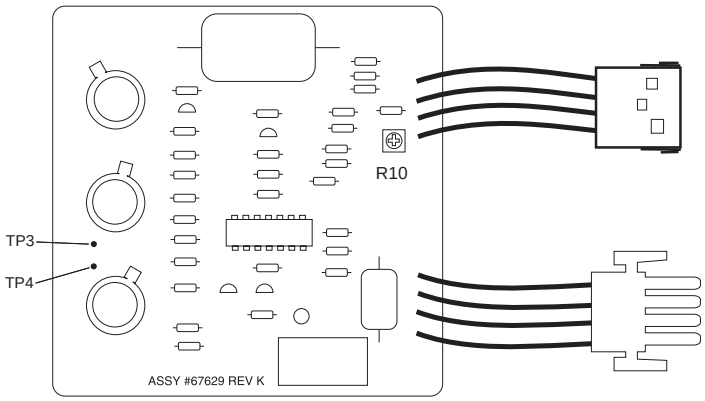
It is mandatory that this procedure be used to calibrate a replacement circuit board. Follow these instructions:

1. In the transfer switch enclosure, set the Maintenance Disconnect Switch to "Manual". Do NOT turn on generator.
2. On the Utility Voltage Sensor circuit board, locate test points "TP3" and "TP4" and install a jumper lead.
3. Locate the small potentiometer "R10". Turn the potentiometer fully counterclockwise.
4. Now, turn the "R10" potentiometer SLOWLY clockwise until the "Utility On" light emitting diode (LED) just turns ON.
5. Remove the jumper wire from "TP3" and "TP4".
6. Reset the Maintenance Disconnect switch to AUTOMATIC.

RESULTS:

- If the "Utility On" LED does NOT go on as described above, replace the utility voltage sensor board. Calibrate the new board and perform a "Normal Test" of the system.
- If the "Utility On" LED goes ON, discontinue the test.

Figure 3.13 — Utility Voltage Sensing Circuit Board



4.1 OPERATE TRANSFER SWITCH

Operate the transfer switch at least once each month. This can be done by performing a NORMAL TEST of the system.

4.2 CLEAN AND INSPECT TRANSFER SWITCH

Protect the transfer switch against construction grit, metal chips, excessive moisture and other harmful dirt at all times. At least once each year turn OFF all power supplies to the switch, then brush and vacuum away dust and dirt that has accumulated inside the enclosure. After cleaning, inspect the transfer switch carefully. Look for evidence of arcing, burning, hot spots, charring and other damage. If any of these are found, have the switch assembly checked by an authorized service technician.

4.3 LUBRICATION

Operating parts inside the transfer mechanism have been properly lubricated at the time of assembly. Under normal conditions no additional lubrication should be required. The service technician should lubricate all recommended points whenever major transfer mechanism components are replaced.

CAUTION

Use only specified greases to lubricate contactor parts. DO NOT USE ANY SUBSTITUTES.

Use the following lubricants for the:

1. Main Contacts (Between movable contact and busbars).
   - Dow Corning (Molykote) BR2 Plus; (Mfg. by Dow Corning Co., USA)
   - Liqui-Moly (Mfg. by DAI TO Co., Ltd., Japan)
2. Operating Mechanism (Used on the actuator and other parts of the contactors. Excluding the movable contacts).
   - Mobilgrease 28 (Mfg. by Mobil Oil Co.)
   - Mobiltemp SHC 32 (Mfg. by Mobil Oil Co.)
   - Polo Moly Complex Grease #NLG12 (Mfg. by Polo Lubricants, USA)
   - Rheolube 363 (Mfg. by Nye Lubricants Inc., USA)

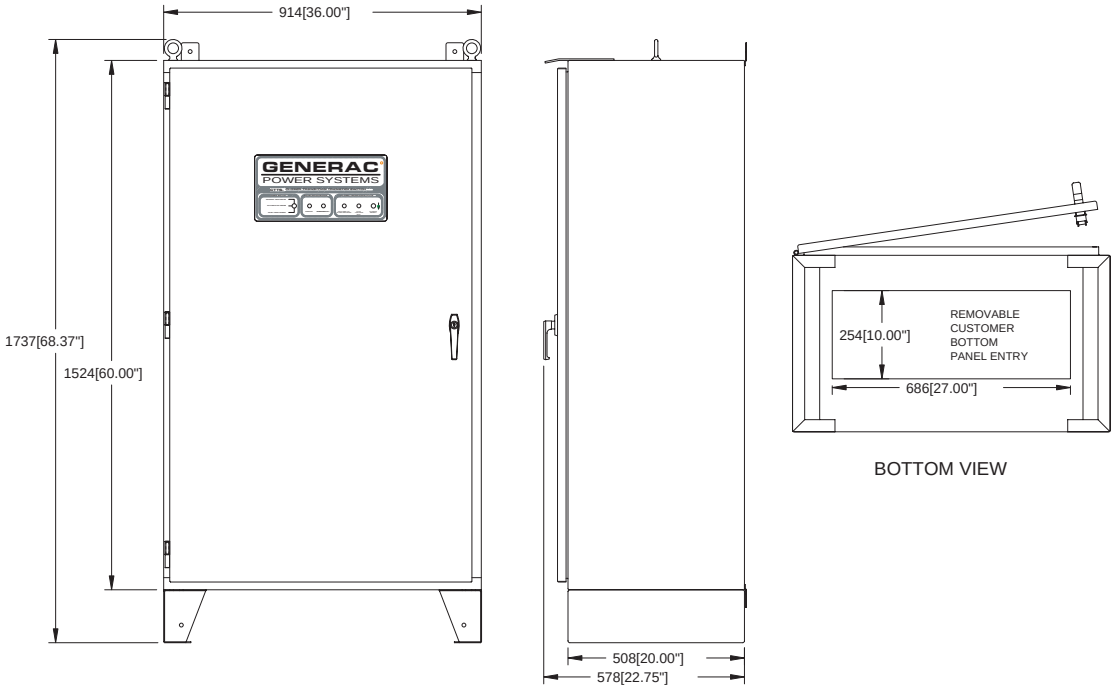
4.4 MAIN CURRENT CARRYING CONTACTS

At least once annually, have an Authorized Service Technician check the main current carrying contacts in the transfer mechanism. They will repair or replace major components that have been found defective.

4.5 NINE-VOLT BATTERY

The battery connects to the seven-day exerciser circuit board. Battery power for Exercise Timer operation is only needed during the short time interval during a utility failure until the generator starts to supply the load. It is recommended that the nine volt battery be replaced once each year.

600-1000 Amp NEMA 12 Units

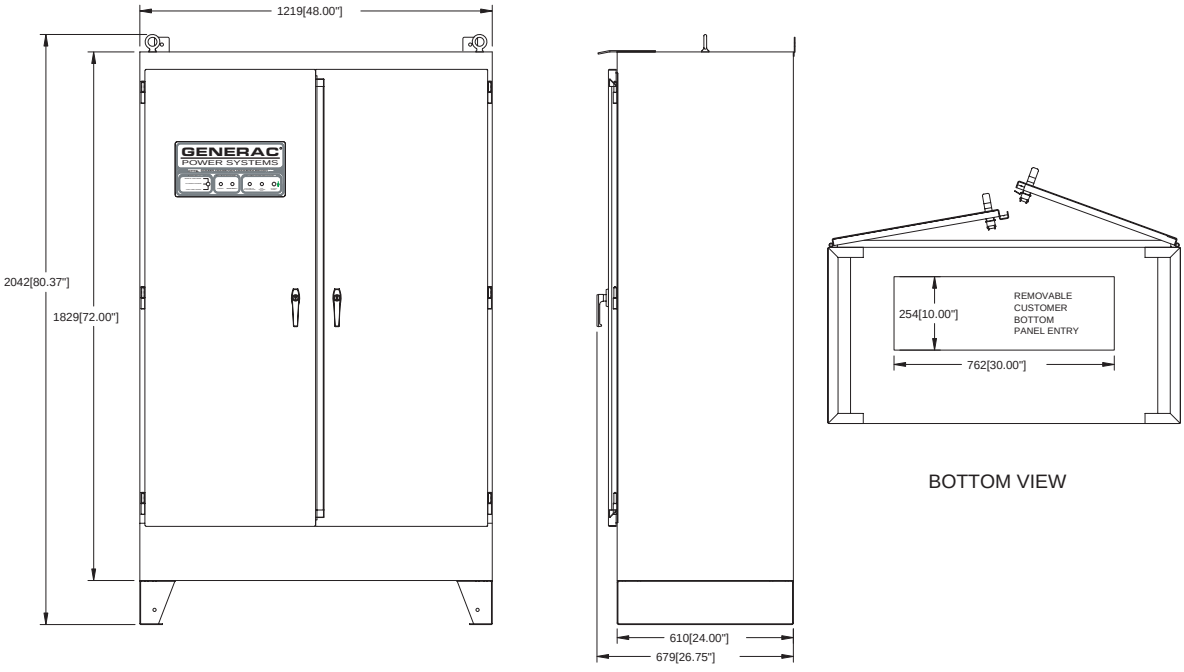


FRONT VIEW

RIGHT SIDE VIEW

BOTTOM VIEW

1600 Amp NEMA 12 Units

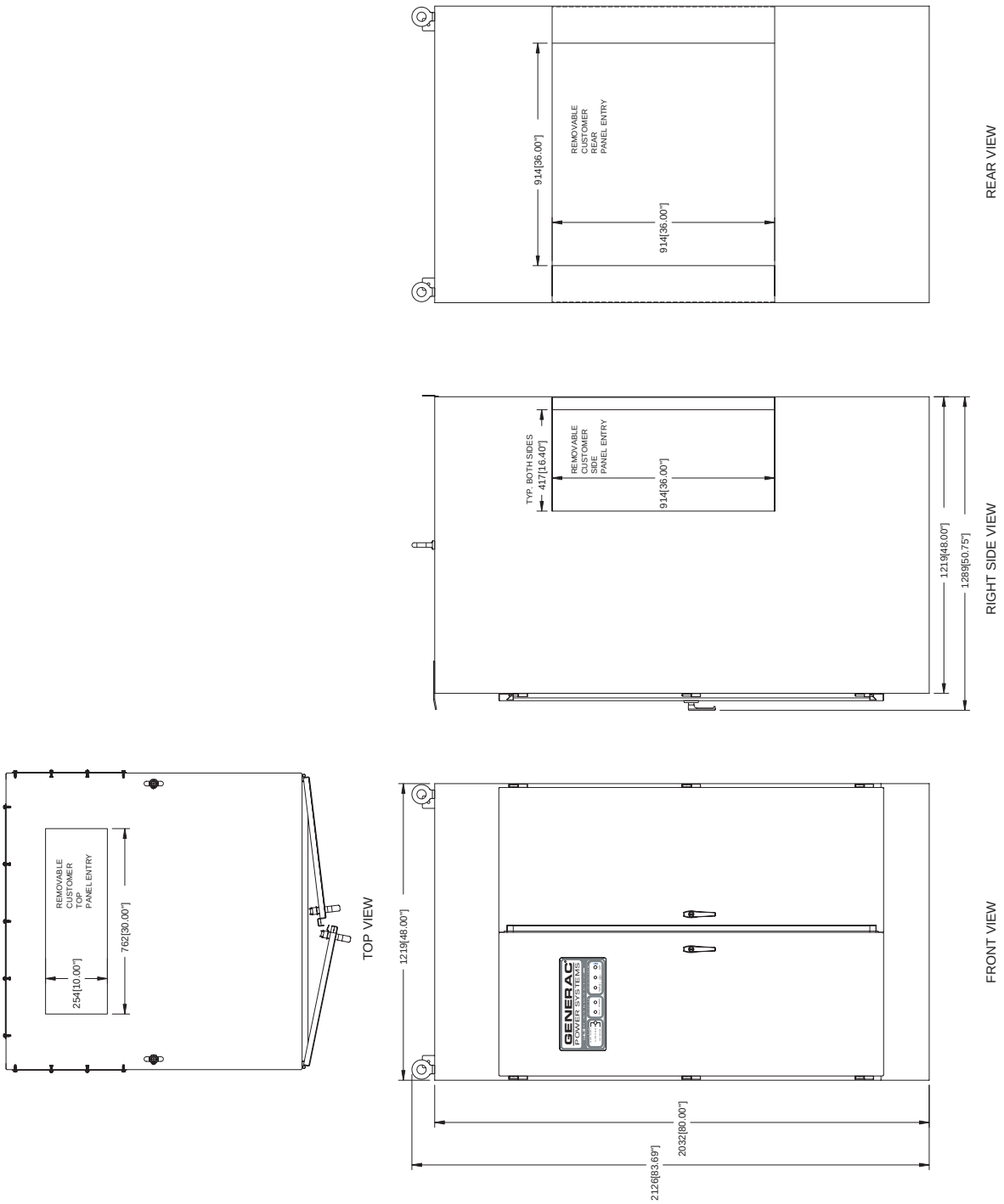


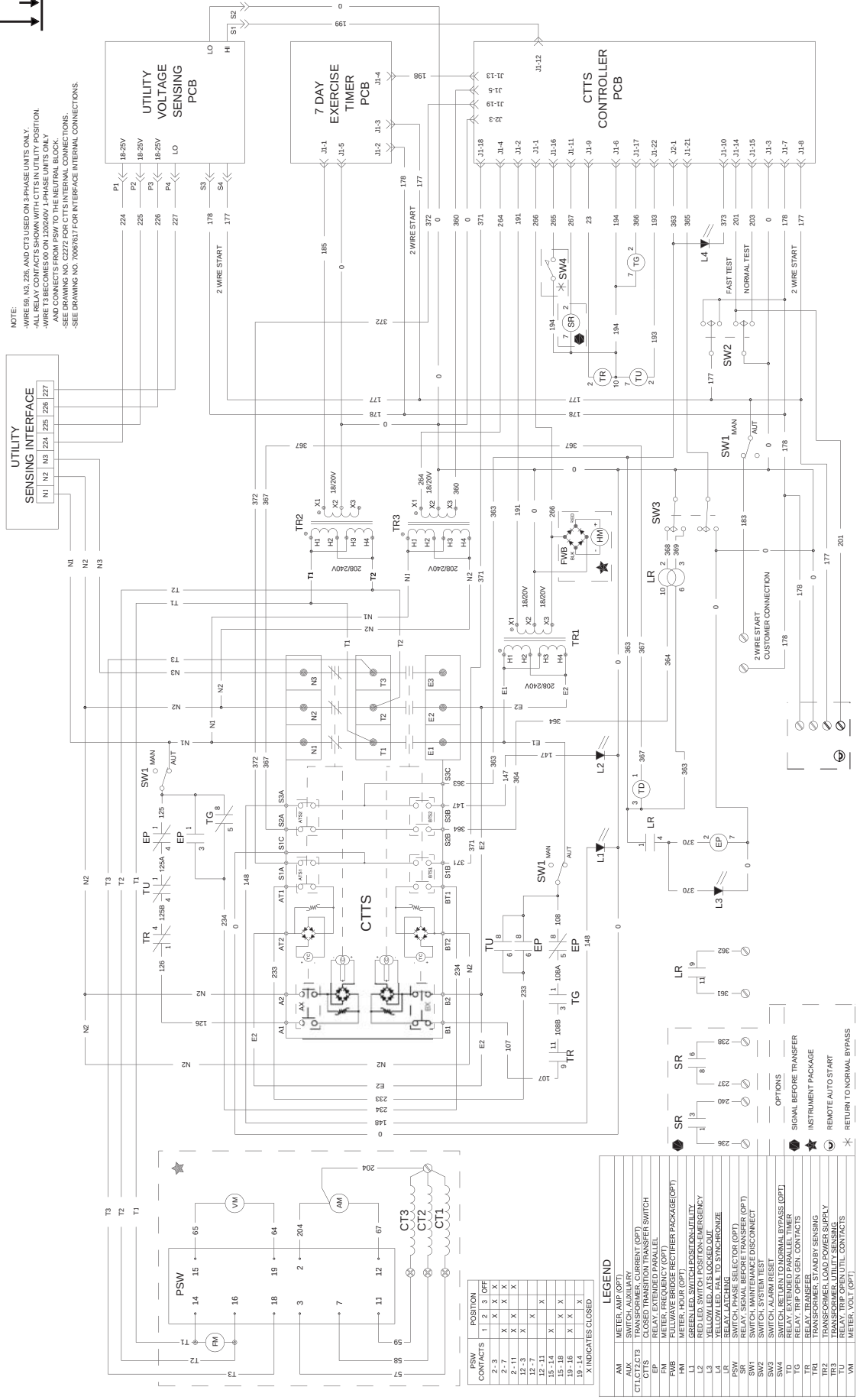
FRONT VIEW

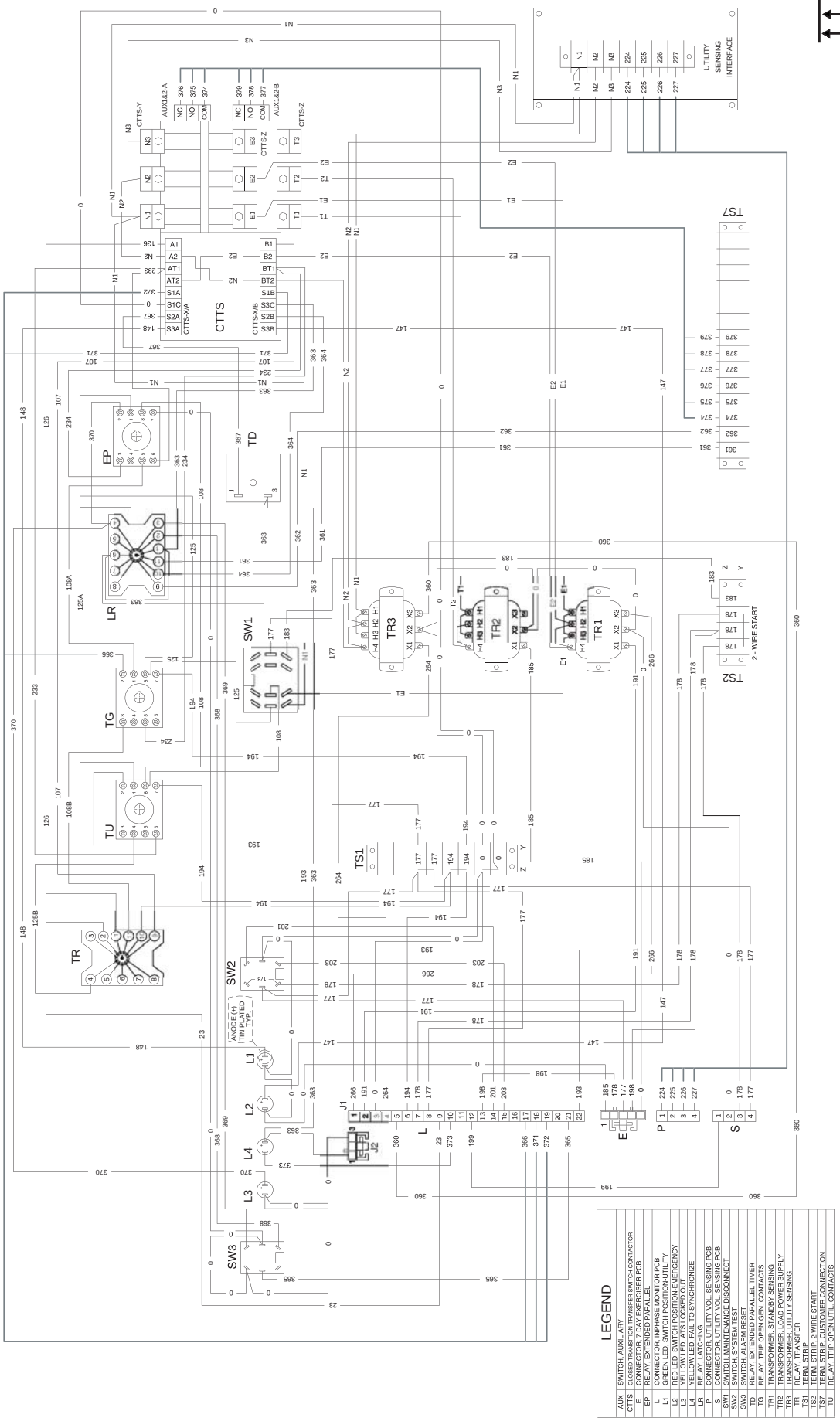
RIGHT SIDE VIEW

BOTTOM VIEW

2000-2600 Amp NEMA 12 Units

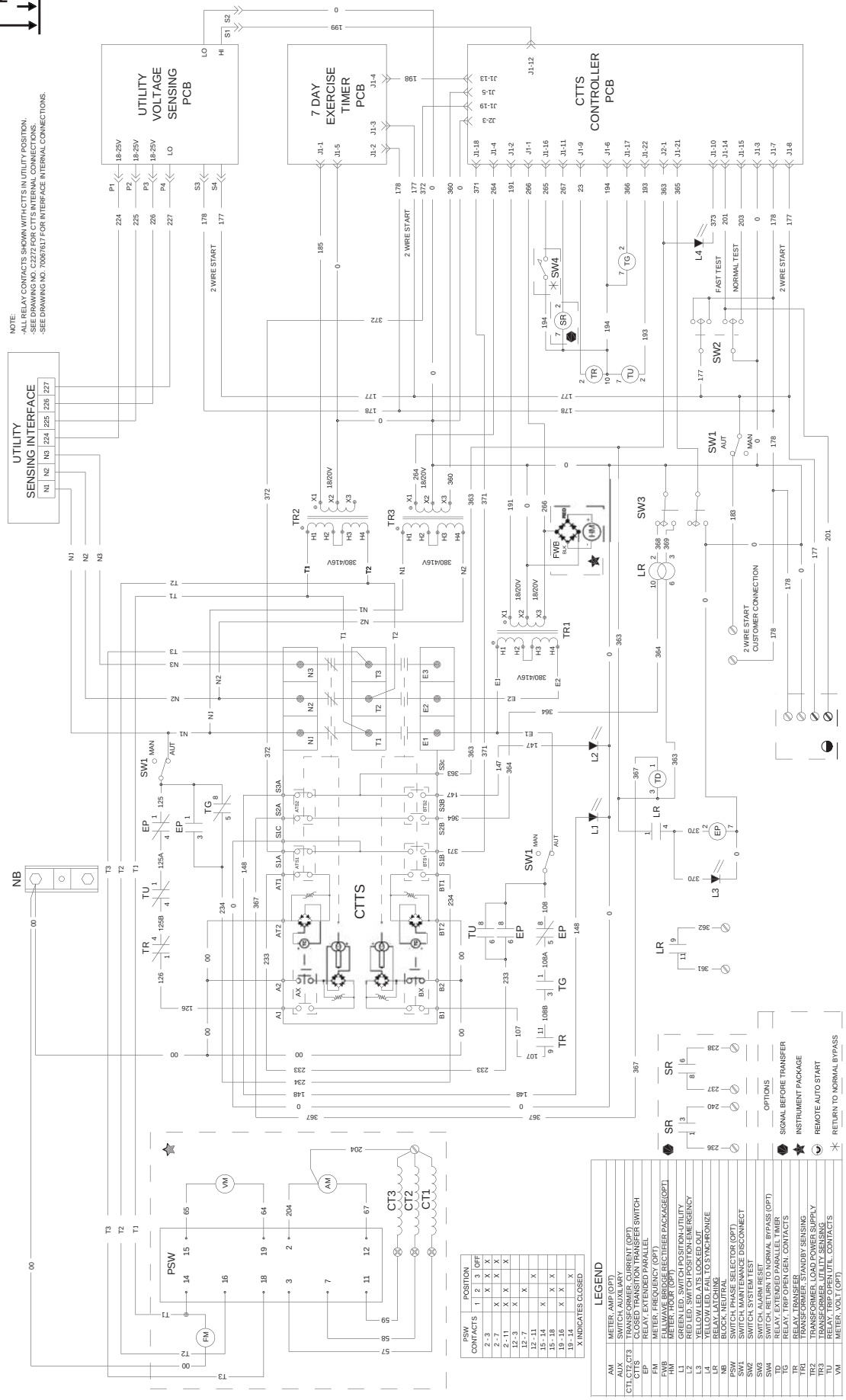


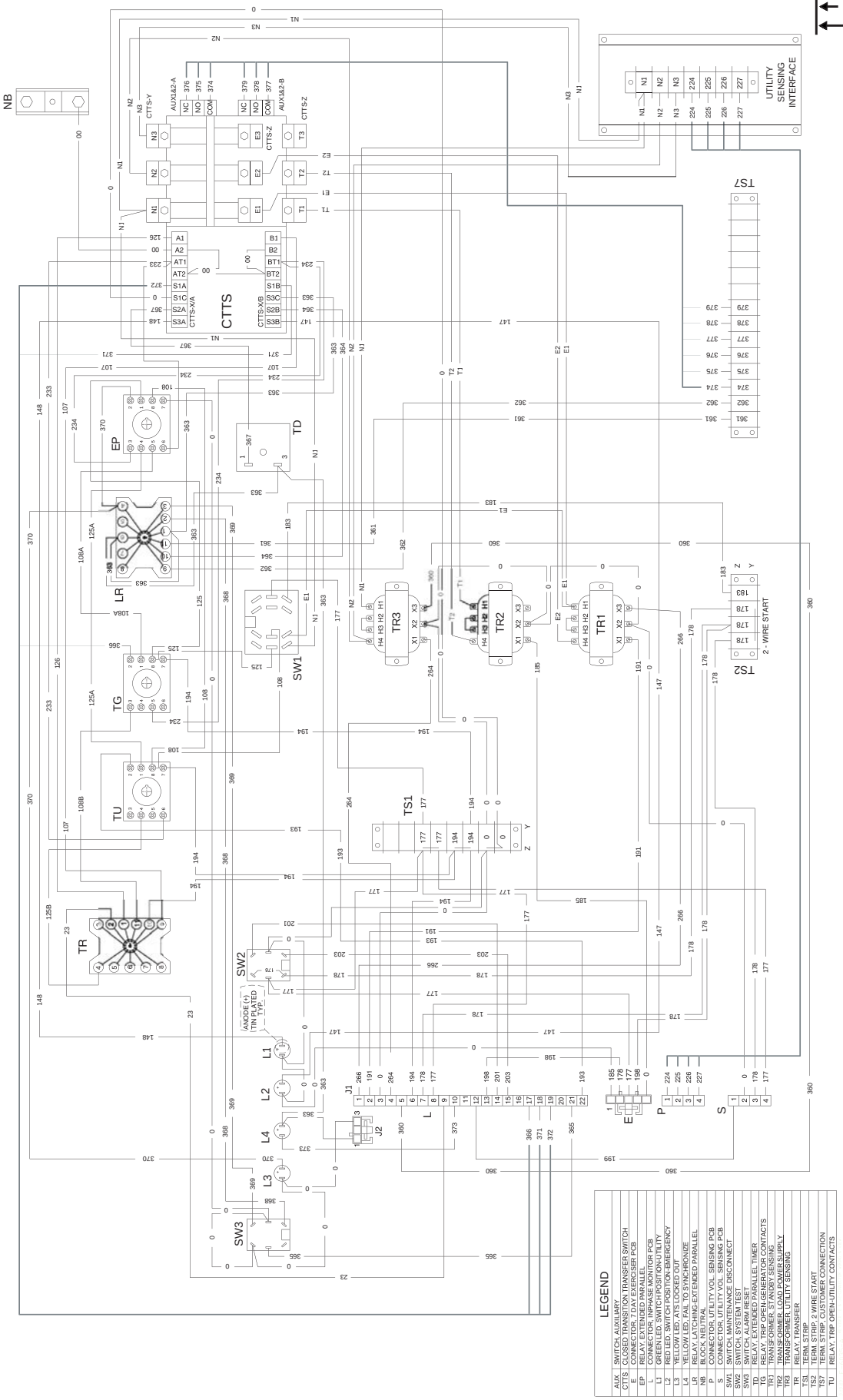

NOTE:
-WIRE 59, N3, 226, AND CT3 USED ON 3-PHASE UNITS ONLY.
-ALL RELAY CONTACTS SHOWN WITH CTTS IN UTILITY POSITION.
-WIRE T3 BECOMES 00 ON 120/240V 1-PHASE UNITS ONLY AND CONNECTS FROM PSW TO THE NEUTRAL BLOCK.
-SEE DRAWING NO. C2272 FOR CTTS INTERNAL CONNECTIONS.
-SEE DRAWING NO. 7069761 FOR INTERFACE INTERNAL CONNECTIONS.
UTILITY VOLTAGE SENSING PCB
7 DAY EXERCISE TIMER PCB
CTTS CONTROLLER PCB
UTILITY SENSING INTERFACE
CTTS
PSW
SW1 MAN AUT
SW2 FAST TEST NORMAL TEST
SW3
SW4
TR1
TR2
TR3
FWB
LR
SR
TU
TR
TG
EP
TD
L1
L2
L3
L4
CT1
CT2
CT3
VM
AM
2 WIRE START
2 WIRE START CUSTOMER CONNECTION
208/240V
180/20V
POSITION
PSW CONTACTS
1 2 3 OFF
2 - 3 X X X
2 - 7 X X X
2 - 11 X X
12 - 3 X
12 - 7 X
12 - 11 X
15 - 14 X X X
15 - 18 X X X
19 - 16 X X X
19 - 14 X
X INDICATES CLOSED
LEGEND
AM METER, AMP (OPT)
AUX SWITCH, AUXILIARY
CT1,CT2,CT3 TRANSFORMER, CURRENT (OPT)
CTTS CLOSED TRANSITION TRANSFER SWITCH
EP RELAY, EXTENDED PARALLEL
HM METER, HOUR (OPT)
FWB FULLWAVE BRIDGE RECTIFIER PACKAGE(OPT)
HM METER, HOUR (OPT)
L1 GREEN LED, SWITCH POSITION-UTILITY
L2 RED LED, SWITCH POSITION-EMERGENCY
L3 YELLOW LED, ATS LOCKED OUT
L4 YELLOW LED, TIME DELAY
PSW SWITCH, PHASE SELECTOR (OPT)
SR RELAY, SIGNAL BEFORE TRANSFER (OPT)
SW1 SWITCH, MAINTENANCE DISCONNECT
SW2 SWITCH, SYSTEM TEST
SW3 SWITCH, ALARM RESET
SW4 SWITCH, REMOTE NORMAL BYPASS (OPT)
TD RELAY, EXTENDED PARALLEL TIMER
TG RELAY, TRIP OPEN GEN. CONTACTS
TR RELAY, TRANSFER
TR1 TRANSFORMER, STANDBY SENSING
TR2 TRANSFORMER, LOAD POWER SUPPLY
TR3 TRANSFORMER, UTILITY SENSING
TU RELAY, TRIP OPEN UTIL CONTACTS
VM METER, VOLT (OPT)
OPTIONS
SIGNAL BEFORE TRANSFER
INSTRUMENT PACKAGE
REMOTE AUTO START
RETURN TO NORMAL BYPASS



LEGEND

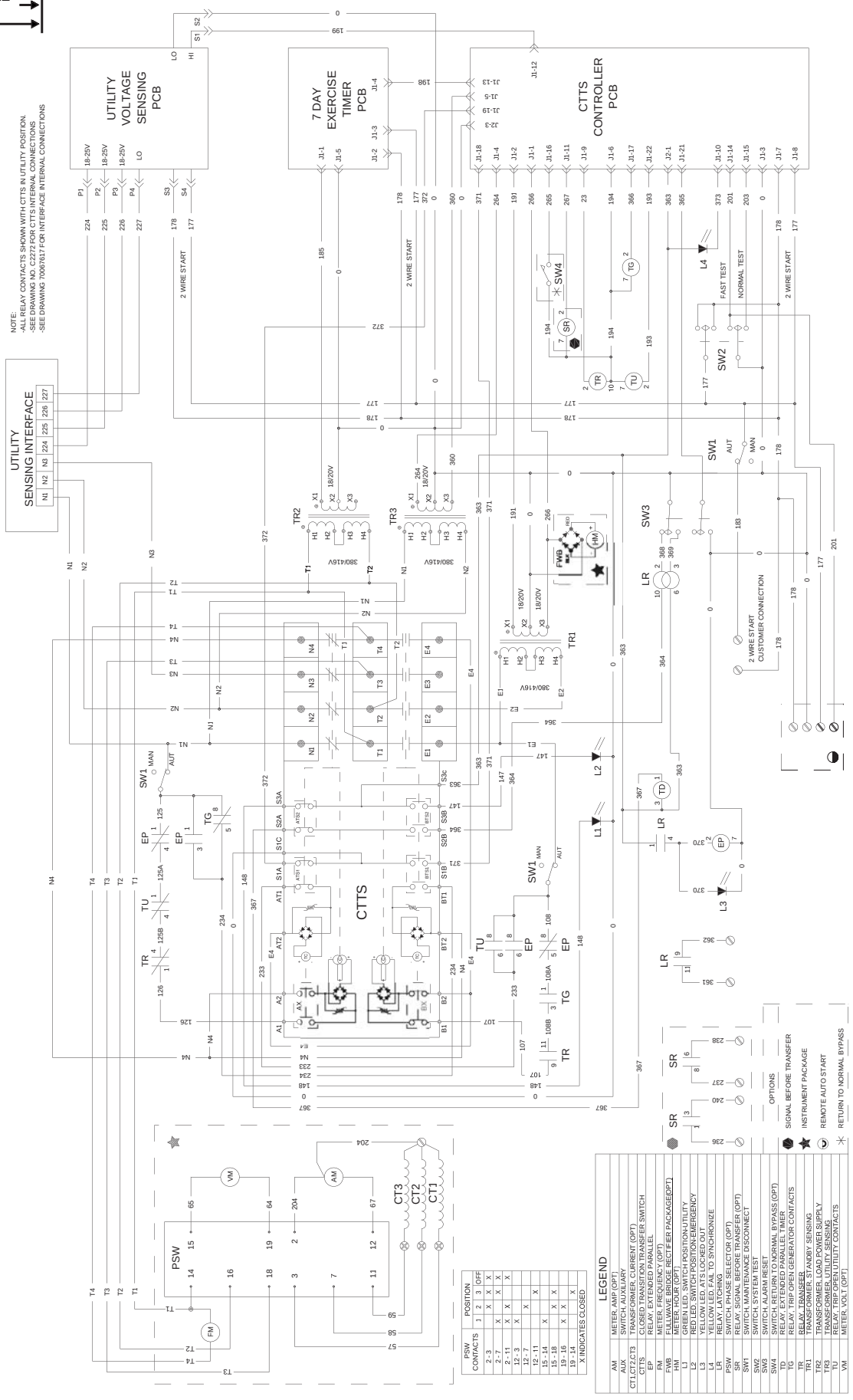
AUX	SWITCH, AUXILIARY
CTTS	CLOSED TRANSITION TRANSFER SWITCH CONTACTOR
E	CONNECTOR, CTTS TRANSFER SWITCH PCB
EP	RELAY, EXTENDED PARALLEL
L	CONNECTOR, INPHASE MONITOR PCB
L1	GREEN LED, SWITCH POSITION-UTILITY
L2	RED LED, SWITCH POSITION-EMERGENCY
L3	YELLOW LED, ATS LOCKED OUT
L4	YELLOW LED, FAILED TO SYNCHRONIZE
LR	RELAY, LATCHING
P	CONNECTOR, UTILITY VOL. SENSING PCB
S	CONNECTOR, UTILITY VOL. SENSING PCB
SW1	SWITCH, MAINTENANCE DISCONNECT
SW2	SWITCH, SYSTEM TEST
SW3	SWITCH, ALARM RESET
TD	RELAY, EXTENDED PARALLEL TIMER
TG	RELAY, TRIP OPEN GEN. CONTACTS
TR1	RELAY, STANDBY SENSING
TR2	TRANSFORMER, LOAD POWER SUPPLY
TR3	TRANSFORMER, UTILITY SENSING
TR	RELAY, TRANSFER
TS1	TERM. STRIP
TS2	TERM. STRIP, 2 WIRE START
TS7	TERM. STRIP, CUSTOMER CONNECTION
TU	RELAY, TRIP OPEN UTIL. CONTACTS

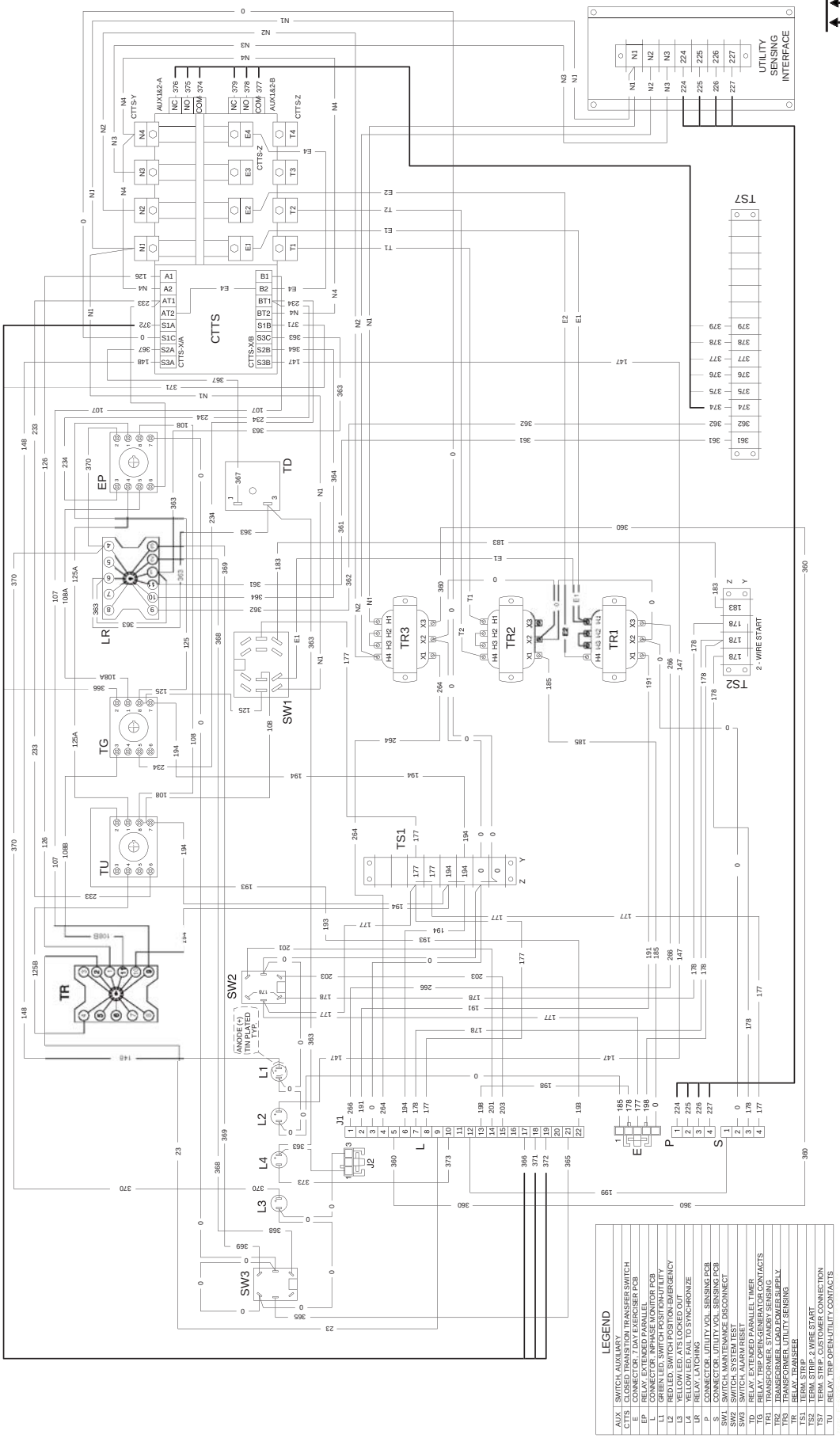

NOTE:
-ALL RELAY CONTACTS SHOWN WITH CTTS IN UTILITY POSITION.
-SEE DRAWING NO. C2272 FOR CTTS INTERNAL CONNECTIONS.
-SEE DRAWING NO. 7006761T FOR INTERFACE INTERNAL CONNECTIONS.
UTILITY VOLTAGE SENSING PCB
7 DAY EXERCISE TIMER PCB
CTTS CONTROLLER PCB
UTILITY SENSING INTERFACE
CTTS
NB
PSW
TR1
TR2
TR3
SW1
SW2
SW3
SW4
LR
FWB
FM
VM
AM
CT1
CT2
CT3
2 WIRE START
FAST TEST
NORMAL TEST
2 WIRE START CUSTOMER CONNECTION
LEGEND
AM METER, AMP (OPT)
AUX SWITCH, AUXILIARY
CT1,CT2,CT3 TRANSFORMER, CURRENT (OPT)
CTTS CLOSED TRANSITION TRANSFER SWITCH
EP RELAY, EXTENDED PARALLEL
FM METER, FREQUENCY (OPT)
FWB FULLWAVE BRIDGE RECTIFIER PACKAGE(OPT)
HM METER, HOUR (OPT)
L1 GREEN LED, SWITCH POSITION-UTILITY
L2 RED LED, SWITCH POSITION-EMERGENCY
L3 YELLOW LED, ATS LOCKED OUT
L4 YELLOW LED, FAIL TO SYNCHRONIZE
LR RELAY, LATCHING
NB BLOCK, NEUTRAL
PSW SWITCH, PHASE SELECTOR (OPT)
SW1 SWITCH, MAINTENANCE DISCONNECT
SW2 SWITCH, SYSTEM TEST
SW3 SWITCH, ALARM RESET
SW4 SWITCH, RETURN TO NORMAL BYPASS (OPT)
TD RELAY, TIME DELAY (ENGINE) (OPT)
TG RELAY, TRIP OPEN GEN. CONTACTS
TR RELAY, TRANSFER
TR1 TRANSFORMER, STANDBY SENSING
TR2 TRANSFORMER, LOAD POWER SUPPLY
TU RELAY, TIME DELAY (UTILITY) CONTACTS
VM METER, VOLT (OPT)
OPTIONS
SIGNAL BEFORE TRANSFER
INSTRUMENT PACKAGE
REMOTE AUTO START
RETURN TO NORMAL BYPASS
PSW CONTACTS POSITION 1 2 3 OFF
2 - 3 X X X
2 - 7 X X X
2 - 11 X X X
12 - 3 X X
12 - 7 X
12 - 11 X
15 - 14 X X X
15 - 18 X X X
19 - 16 X X X
19 - 14 X
X INDICATES CLOSED

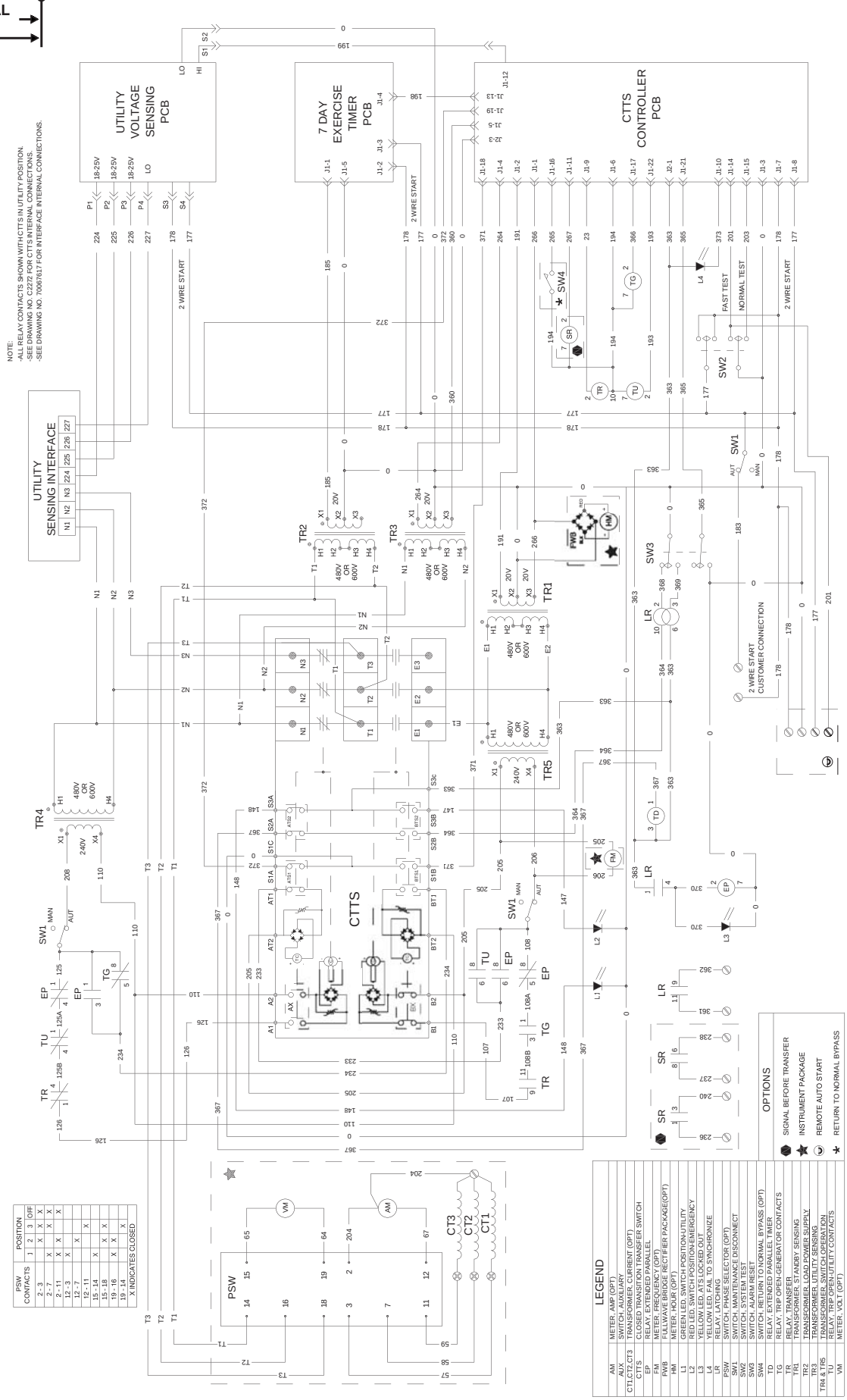


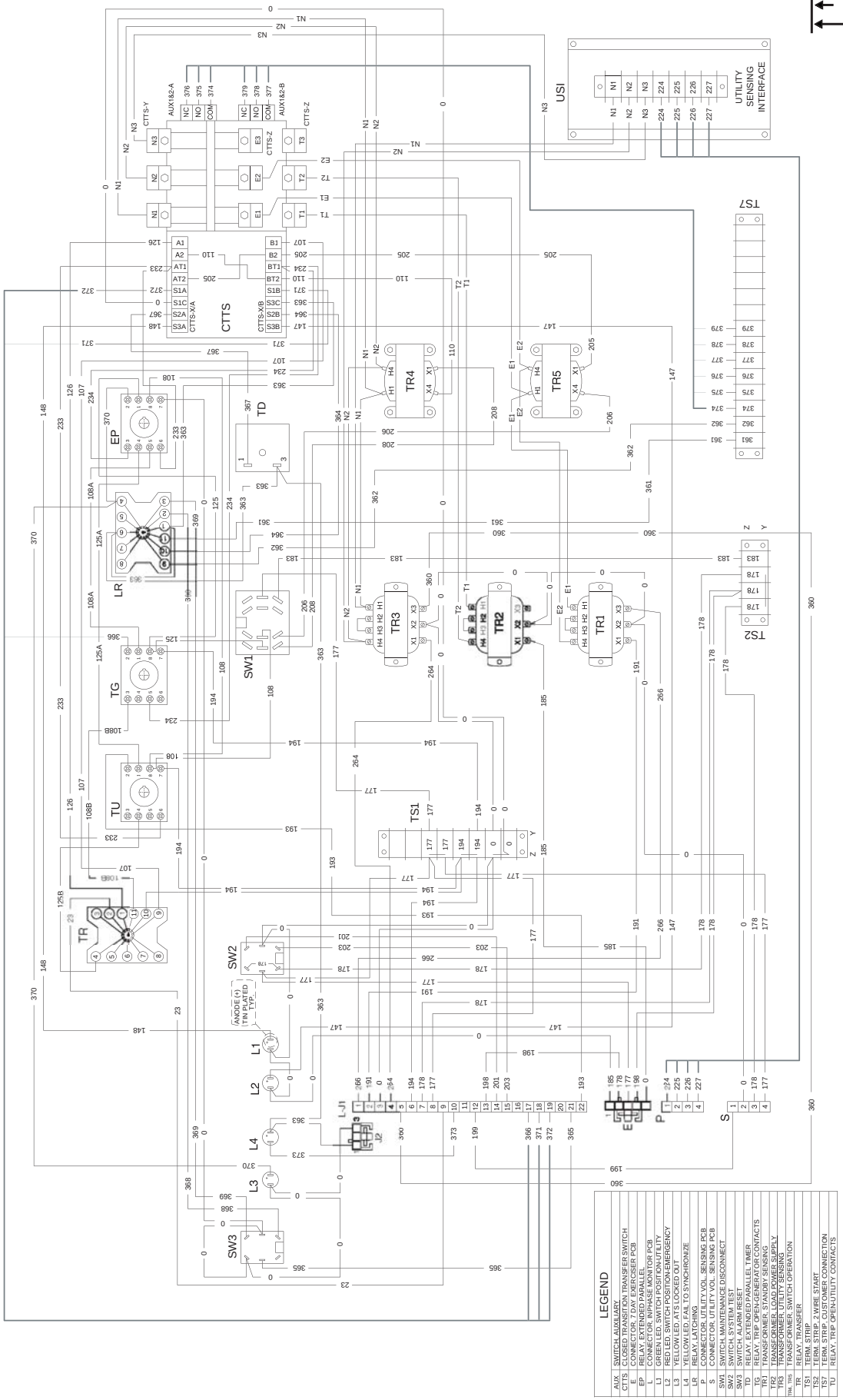
LEGEND

AUX	SWITCH, AUXILIARY
CTTS	CONTROL, TIMED TRANSFER SWITCH
E	CONNECTOR, 7 DAY EXERCISER PCB
EP	RELAY, EXTENDED PARALLEL
L	CONNECTOR, INPHASE MONITOR PCB
L1	GREEN LED, SWITCH POSITION UTILITY
L2	RED LED, SWITCH POSITION EMERGENCY
L3	YELLOW LED, ATS LOCKED OUT
L4	YELLOW LED, FAIL TO SYNCHRONIZE
LR	RELAY, LATCHING-EXTENDED PARALLEL
NB	BLOCK, NEUTRAL
P	CONNECTOR, UTILITY VOL. SENSING PCB
S	CONNECTOR, UTILITY VOL. SENSING PCB
SW1	SWITCH, MAINTENANCE DISCONNECT
SW2	SWITCH, SYSTEM TEST
SW3	SWITCH, ALARM RESET
TD	RELAY, TIMED-EXTENDED PARALLEL TIMER
TG	RELAY, TRIP OPEN-GENERATOR CONTACTS
TR1	TRANSFORMER, STANDBY SENSING
TR2	TRANSFORMER, LOAD POWER SUPPLY
TR3	TRANSFORMER, UTILITY SENSING
TR	RELAY, TRANSFER
TS1	TERM. STRIP
TS2	TERM. STRIP, 2 WIRE START
TS7	TERM. STRIP, CUSTOMER CONNECTION
TU	RELAY, TRIP OPEN-UTILITY CONTACTS

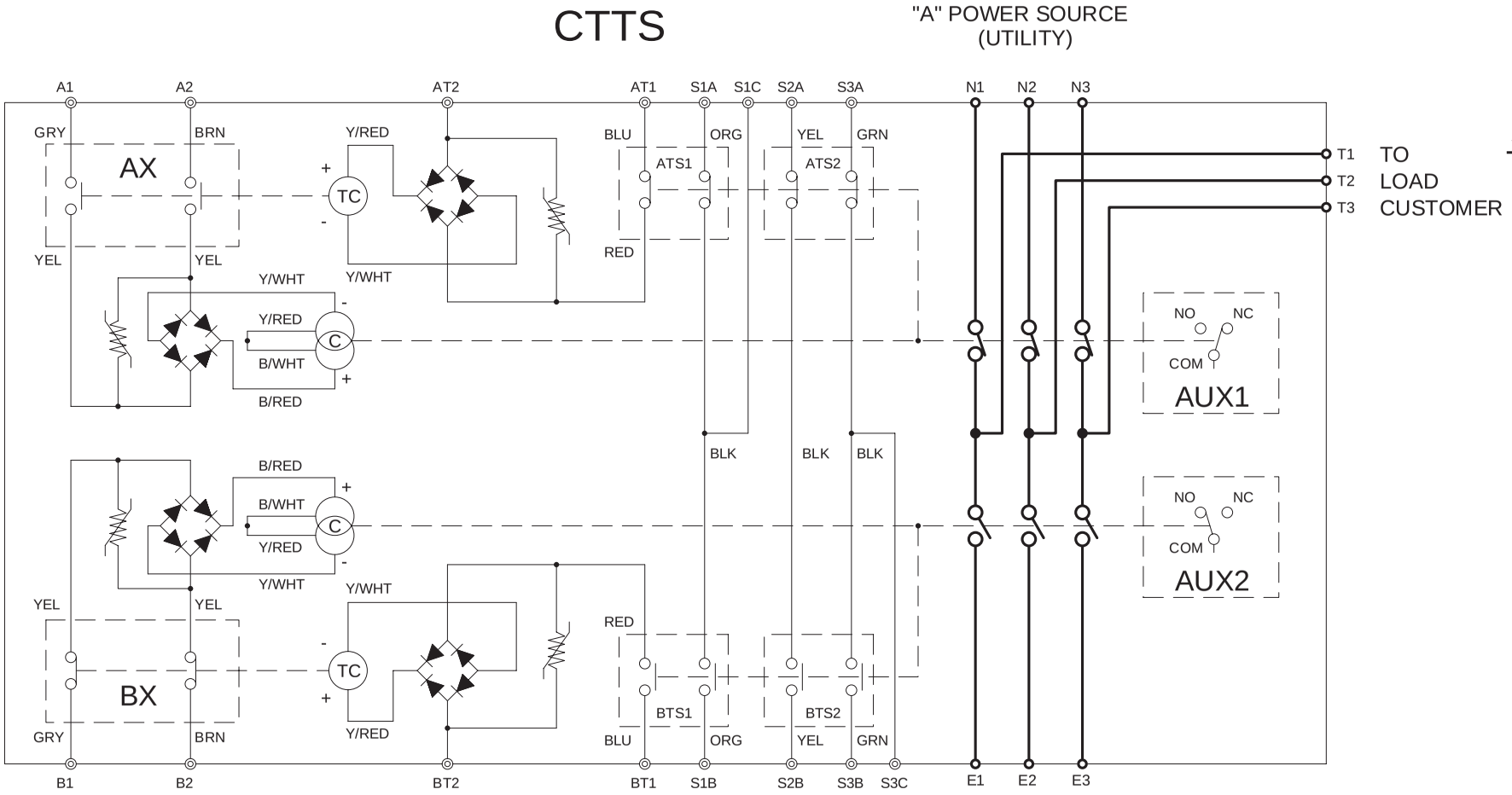

NOTE:
-ALL RELAY CONTACTS SHOWN WITH CTTS IN UTILITY POSITION.
-SEE DRAWING NO. 0J2272 FOR CTTS INTERNAL CONNECTIONS.
-SEE DRAWING 70067617 FOR INTERFACE INTERNAL CONNECTIONS
UTILITY SENSING INTERFACE
UTILITY VOLTAGE SENSING PCB
7 DAY EXERCISE TIMER PCB
CTTS CONTROLLER PCB
CTTS
PSW
2 WIRE START
FAST TEST
NORMAL TEST
2 WIRE START CUSTOMER CONNECTION
LEGEND
OPTIONS
SIGNAL BEFORE TRANSFER
INSTRUMENT PACKAGE
REMOTE AUTO START
RETURN TO NORMAL BYPASS


UTILITY SENSING INTERFACE
CTTS
CTTS-XA
CTTS-XB
CTTS-Y
CTTS-Z
AUX1&2-A
AUX1&2-B
TD
EP
LR
TG
TU
TR
SW1
SW2
SW3
TR1
TR2
TR3
TS1
TS2
TS7
2 - WIRE START
ANODE (+) TIN PLATED TYPE
L1
L2
L4
L3
J1
J2
L
E
P
S
LEGEND
AUX SWITCH, AUXILIARY
CTTS CLOSED TRANSITION TRANSFER SWITCH
E CONNECTOR, 7 DAY EXERCISER PCB
EP RELAY, EXTENDED PARALLEL
LR CONNECTOR, PARALLELING PCB
L1 GREEN LED, SWITCH POSITION-UTILITY
L2 RED LED, SWITCH POSITION-EMERGENCY
L3 YELLOW LED, ATS LOCKED OUT
L4 YELLOW LED, FAIL TO SYNCHRONIZE
LR RELAY, LOCKOUT, LOAD
P CONNECTOR, UTILITY VOL. SENSING PCB
S CONNECTOR, UTILITY VOL. SENSING PCB
SW1 SWITCH, MAINTENANCE, DISCONNECT
SW2 SWITCH, SYSTEM TEST
SW3 SWITCH, ALARM RESET
TD RELAY, EXTENDED PARALLEL, TIMER
TG RELAY, TRIP, OPEN-GENERATOR CONTACTS
TR1 TRANSFORMER, STANDBY SENSING
TR2 TRANSFORMER, LOAD POWER SUPPLY
TR3 TRANSFORMER, UTILITY SENSING
TR RELAY, TRANSFER
TS1 TERM. STRIP
TS2 TERM. STRIP, 2 WIRE START
TS7 TERM. STRIP, CUSTOMER CONNECTION
TU RELAY, TRIP, OPEN-UTILITY CONTACTS


NOTE:
-ALL RELAY CONTACTS SHOWN WITH CTTS IN UTILITY POSITION.
-SEE DRAWING NO. C2272 FOR CTTS INTERNAL CONNECTIONS.
-SEE DRAWING NO. 70067617 FOR INTERFACE INTERNAL CONNECTIONS.
UTILITY VOLTAGE SENSING PCB
7 DAY EXERCISE TIMER PCB
CTTS CONTROLLER PCB
UTILITY SENSING INTERFACE
CTTS
PSW
2 WIRE START
FAST TEST
NORMAL TEST
2 WIRE START CUSTOMER CONNECTION
480V OR 600V
240V
20V
LEGEND
AM METER, AMP (OPT)
AUX. SWITCH, AUXILIARY
CT1,CT2,CT3 TRANSFORMER, CURRENT (OPT)
CTTS CLOSED TRANSITION TRANSFER SWITCH
EP RELAY, EXTERNAL POWER FAIL
FM METER, FREQUENCY (OPT)
FWB FULLWAVE BRIDGE RECTIFIER PACKAGE(OPT)
HM METER, HOUR (OPT)
L1 GREEN LED, SWITCH POSITION-UTILITY
L2 RED LED, SWITCH POSITION-EMERGENCY
L3 YES / LOW LED, TS CONTROL
L4 YELLOW LED, FAIL TO SYNCHRONIZE
LR RELAY, LATCHING
PSW SWITCH, PHASE SELECTOR (OPT)
SW1 SWITCH, MAINTENANCE DISCONNECT
SW2 SWITCH, TEST / NORMAL
SW3 SWITCH, ALARM RESET
SW4 SWITCH, RETURN TO NORMAL BYPASS (OPT)
TD RELAY, EXTENDED PARALLEL TIMER
TG RELAY, TRIP OPEN-GENERATOR CONTACTS
TR RELAY, TRANSFER
TU RELAY, TRIP OPEN-UTILITY
TR1 TRANSFORMER, STANDBY SENSING
TR2 TRANSFORMER, LOAD POWER SUPPLY
TR3 TRANSFORMER, UTILITY SENSING
TR4 & TR5 TRANSFORMER, SWITCH OPERATION
TU RELAY, TRIP OPEN-UTILITY CONTACTS
VM METER, VOLT (OPT)
OPTIONS
SIGNAL BEFORE TRANSFER
INSTRUMENT PACKAGE
REMOTE AUTO START
RETURN TO NORMAL BYPASS
PSW CONTACTS
POSITION 1 2 3 OFF
2 - 3 X X X
2 - 7 X X X
2 - 11 X X X
12 - 3 X X
12 - 7 X X
12 - 11 X
15 - 14 X X X
15 - 18 X X X
19 - 16 X X X
19 - 14 X
X INDICATES CLOSED


LEGEND
AUX SWITCH, AUXILIARY
CTTS CLOSED TRANSITION TRANSFER SWITCH
E CONNECTOR, 7 DAY EXERCISER PCB
EP RELAY, CONTROL ENABLE
L CONNECTOR, INPHASE MONITOR PCB
L1 GREEN LED, SWITCH POSITION-UTILITY
L2 RED LED, SWITCH POSITION-EMERGENCY
L3 YELLOW LED, ATS LOCKED OUT
L4 RELAY, LOCKOUT TIMING
P CONNECTOR, UTILITY VOL. SENSING PCB
S CONNECTOR, UTILITY VOL. SENSING PCB
SW1 SWITCH, MAINTENANCE DISCONNECT
SW2 SWITCH, SYSTEM TEST
SW3 SWITCH, LAMP TEST
TD RELAY, EXTENDED PARALLEL TIMER
TG RELAY, TRIP OPEN-GENERATOR CONTACTS
TR1 TRANSFORMER, STANDBY SENSING
TR2 TRANSFORMER, LOAD POWER SUPPLY
TR3 TRANSFORMER, UTILITY SENSING
TR4, TR5 TRANSFORMER, SWITCH OPERATION
TR RELAY, TRANSFER
TS1 TERM. STRIP
TS2 TERM. STRIP, 2 WIRE START
TS7 TERM. STRIP, CUSTOMER CONNECTION
TU RELAY, TRIP OPEN-UTILITY CONTACTS
USI
UTILITY SENSING INTERFACE
CTTS-Y
CTTS-Z
AUX182-A
AUX182-B
CTTS
CTTS-X/A
CTTS-X/B
TR4
TR5
TD
EP
LR
SW1
TG
TU
TR
TR3
TR2
TR1
TS2
TS7
TS1
SW2
SW3
L1
L2
L4
L3
L-J1
J2
E
P
S

CTTS



LEGEND

A1, A2	"A" POWER SOURCE SIDE (ON)
AT1, AT2	"A" POWER SOURCE SIDE (TRIP)
ATS1, ATS2 BTS1, BTS2	SWITCH, POSITION CONTACTS
AUX1, 2	SWITCH, AUXILIARY
Ax, Bx	SWITCH, CONTROL
B1, B2	"B" POWER SOURCE SIDE (ON)
BT1, BT2	"B" POWER SOURCE SIDE (TRIP)
C	COIL, CLOSING
COM	COMMON
CTTS	CLOSED TRANSITION TRANSFER SWITCH
E1, E2, E3	STANDBY POWER SOURCE CONN.
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
N1, N2, N3	UTILITY POWER SOURCE CONN.
S1A, S1B, S1C	SWITCH, POSITION SENSING
S2A, S2B S3A, S3B, S3C	
TC	COIL, TRIP
T1, T2, T3	CUSTOMER LOAD CONN.

WIRE COLORS

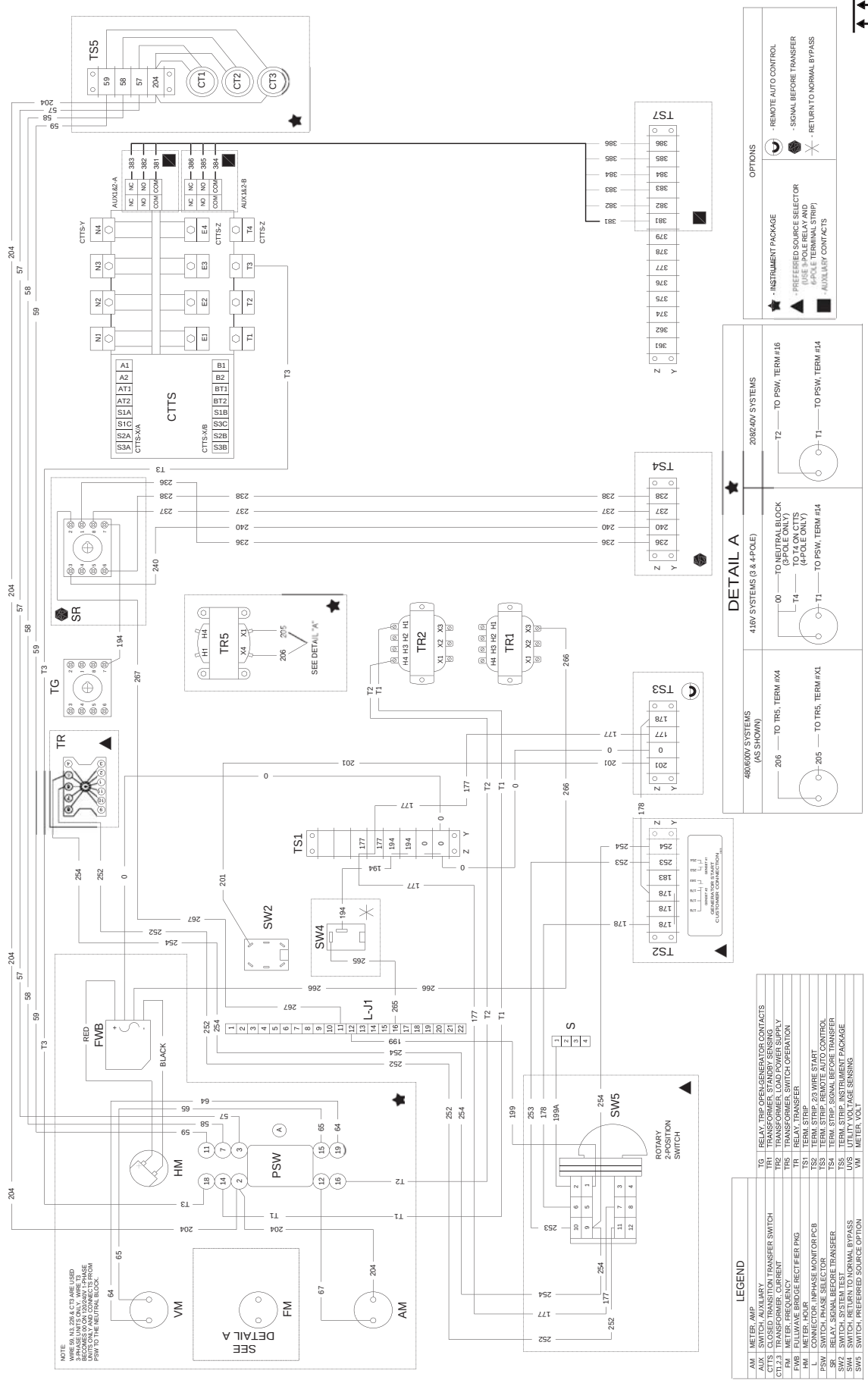
BLU = BLUE WIRE
BLK = BLACK WIRE
BRN = BROWN WIRE
GRN = GREEN WIRE
GRY = GREY WIRE
ORG = ORANGE WIRE
YEL = YELLOW WIRE
B/RED = BLUE INSUL. ON TER./ WITH RED WIRE
B/WHT = BLUE INSUL. ON TER./ WITH WHITE WIRE
Y/RED = YELLOW INSUL. ON TER./ WITH RED WIRE
Y/WHT = YELLOW INSUL. ON TER./ WITH WHITE WIRE

ALL CONTACTS OF SWITCH SHOWN IN:
UTILITY: CLOSED
STANDBY: OPEN

X = CLOSED 0 = OPEN

UTILITY SIDE / SWITCH POSITION		UTILITY CLOSED	NEUTRAL	UTILITY OPEN
AUX. 1	COM-NC	X	O	O
	COM-NO	O	X	X

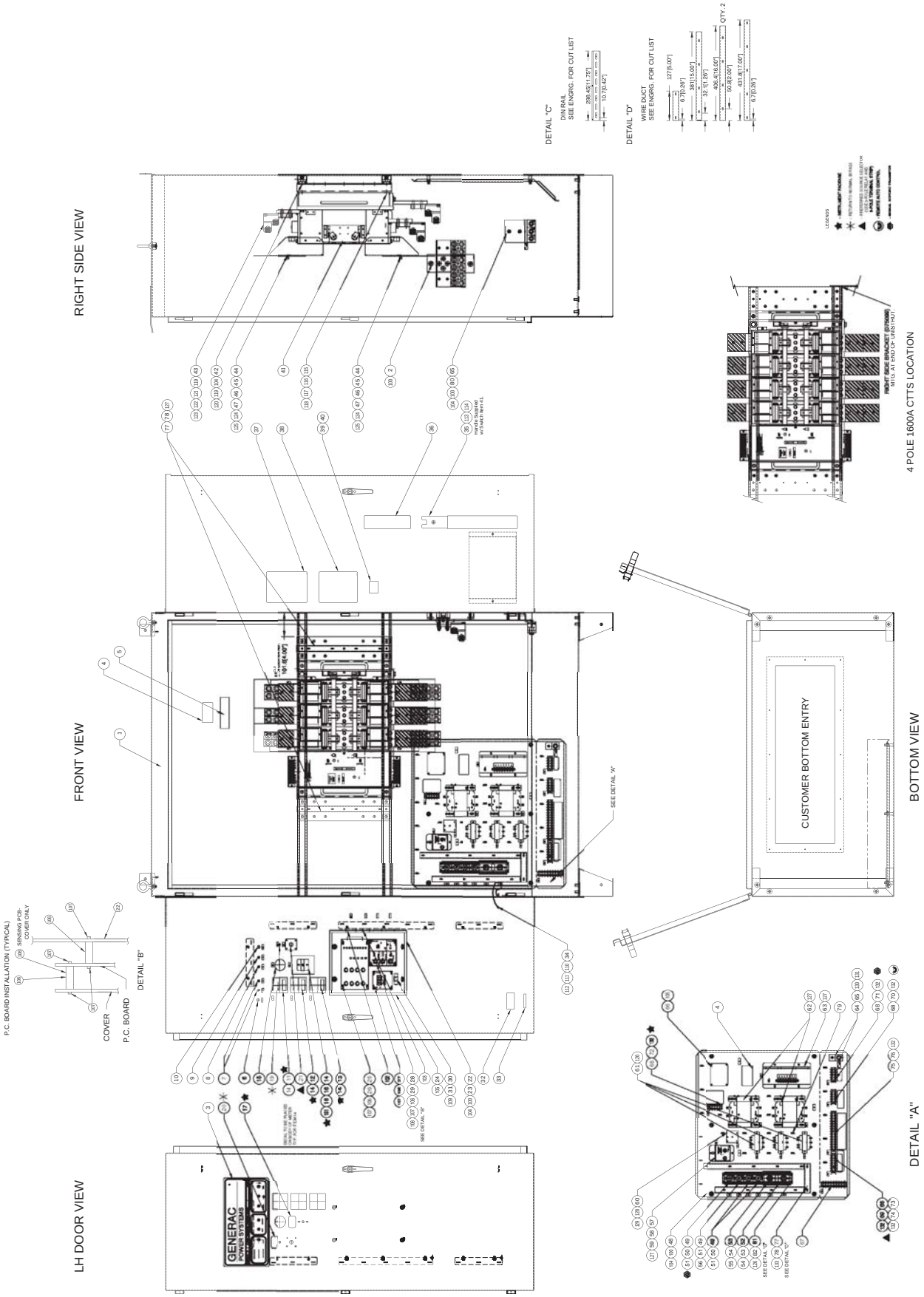
STANDBY SIDE / SWITCH POSITION		STANDBY OPEN	NEUTRAL	STANDBY CLOSED
AUX. 2	COM-NC	O	O	X
	COM-NO	X	X	O

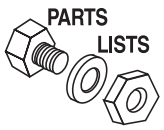


LEGEND			
AM	METER, AMP	TG	RELAY, TRIP OPEN GENERATOR CONTACTS
AUX	AUXILIARY CONTACT, AUXILIARY	TR	TRANSFORMER, STANDBY SENSING
CTTS	CLOSED TRANSITION TRANSFER SWITCH	TR1	TRANSFORMER, LOAD POWER SUPPLY
CT1,2,3	TRANSFORMER, CURRENT	TR2	TRANSFORMER, SWITCH OPERATION
FM	METER, FREQUENCY	TR5	RELAY, TRANSFER
FWB	FULLWAVE BRIDGE RECTIFIER PKG	TR	TERM. STRIP
HM	METER, HOUR	TS1	TERM. STRIP, 2/3 WIRE START
L	CONNECTOR, 3PHASE MONITOR PCB	TS2	TERM. STRIP, REMOTE AUTO CONTROL
PSW	SWITCH, PHASE SELECTOR	TS3	TERM. STRIP, SIGNAL BEFORE TRANSFER
SR	RELAY, SIGNAL BEFORE TRANSFER	TS4	TERM. STRIP, INSTRUMENT PACKAGE
SW2	SWITCH, SYSTEM TEST	TS5	UTILITY VOLTAGE SENSING
SW4	SWITCH, RETURN TO NORMAL BYPASS	UVS	METER, VOLT
SW5	SWITCH, PREFERRED SOURCE OPTION	VM	

Generac GTS "CTTS" Type Transfer Switch

1600A CTTS Assembly – Drawing No. 0D3143-A





ITEM	PART NO.	QTY.	DESCRIPTION
1	SEE TABLE**	1	ENCLOSURE-NEMA 12 CTTS 1600A
2	0D4203	1	NEUTRAL BLOCK ASS'Y 1600A ATS
3	0C2282	1	DECAL-ENCLSR CTTS
4	054199	2	DECAL HIGH VOLTAGE
5	064510	1	DECAL-TERMINAL NOTE
6	0C4249	1	SWITCH TOGGLE DPST M/O-N-(O)
7	0C2163D	2	LED YEL FLASH WITH HOLDER
8	0C2163B	1	LED RED WITH HOLDER
9	0C2163A	1	LED GRN WITH HOLDER
10	055142	1	SWITCH TOG DPDT 15A MOM W/SEAL
★11	070043	1	VOLTMETER AC 0-300
★	070044	1	VOLTMETER AC 0-600
★12	070042	1	FREQUENCY METER 240V 55-65HZ
★13	075324	1	AMMETER AC 0-1600
★14	0C4895	4	DECAL SHOCK HAZARD
★15	070081	1	HOURMETER
★16	061945	1	SWITCH SELECTOR 6A AMP/V
17	0C2603	1	DECAL PH SELECT A/V
★18	0C2060	1	COVER-PHASE SEL.SW.
✳19	072827	1	SWITCH TOG SPST 6A@125V SP MOM
✳20	075369	1	DECAL-RET NML BYPASS
▲21	074613	1	SW 2POS SOURCE SELCT
22	0C1652	1	ENCLOSURE-PCB, NEW
23	0C1721	1	DOOR, NEW PCB ENC
24	0C1720	1	SD GUIDE-NEW PCB ENC
25	0C1977	1	ASSY CLSD TRANS XFER
26	0C3314A	1	ASSY COVER CTTS CNTL
27	0A8637	1	ASSY MK3 EXERCISER
28	067616020A	1	ASS'Y-STNDSNS CVRPLT
29	0676290SRV	1	ASSY STANDARD SENSNG
30	063982	1	CLIP BATT-9V TRANSIS
31	063998	1	BATTERY 9V
32	095282	1	DECAL-LIVE CIRCUIT
33	077228	1	DECAL-ENCLOSURE NOTE
34	0536210193	1	GND WIRE-ENCLSR DOOR
35	072164	1	MNL HNDL 6-1600A WN
36	0C3487	1	DECAL-MAN OPER CTTS
37	063385B	1	DECAL-SWITCH INFO, CTTS
38	073619K	1	DECAL-TEST SEQ1600WN
39	062209	1	DECAL UL LABEL E84929-GTS(NOT FOR SALE)
40	083736	1	DECAL-CSA GTS OPTIONAL (NOT FOR SALE)
41	0D3947	1	CTTS-1600A,600V 3POLE
	0D3948	1	CTTS-1600A, 4-POLE
42	075099	2	MOUNTING BRACKET-WN
43	063963	9	LUG SLDLSS 750-1/2X13/32 AL/CU
44	074349E	2	SW CVR 1200/1600A 3P
	074349F	2	SW CVR 1200/1600A 4P
45	063986	4	KNOB,COVER HOLD-DOWN
46	074351	2	CVR BRCKT 600-1600A
47	074351A	2	CVR BRCKT600-1600 LH
48	0D3110	1	SUBPLT CTTS 600-2600A
49	0C3211G	4	SOCKET RELAY 8 PIN
●50	0C3211E	3	RELAY PNL 12VDC DPDT 8PIN
●51	0C3211H	4	SPRING RELAY RETAINING
52	0C3211A	1	RELAY,LATCHING 24VDC 1OA
53	0C3211B	2	SOCKET RELAY 11P C3211A
54	0C3211C	2	SPRING RELAY RETAINING
55	0C3211K	1	RELAY 12VDC 3PDT
56	0C3211F	1	RELAY 24VDC DPDT 8 PIN
57	074509	1	BRACKET SWITCH
58	0C3486	1	DECL-MAINT DISC CTTS
59	055868	1	SWITCH TOGGLE 4PDT 15A SPADE
60	0C3211D	1	RELAY SOLID STATE SPST
61	090975	3	TRANSFOMER 240/40V 25VA
62	074653	2	TRANSFRM 600V TO 240V 350VA
	064929	2	TRANSFRM 240/480V-120/480V
63	067617030A	1	INTRFC,3PHS 416/480V
	067617030B	1	INTRFC,3PHS 208/240V
	072158	1	INTRFC,3PHS 600V
	072160	1	INTRFC,3P 400V 50/60
64	057329	1	LUG SLDLSS 350-#6X13/32 AL/CU
65	067210	2	DECAL, GND
66	063578	1	PLATE DATA - GTS
67	057701	1	BLOCK TERM 20A 8 X 6 X 1100V
◒★68	046689	4	BLOCK TERM 20A 4 X 6 X 1100V
69	091466	1	DECAL 2 WR TERM STRP
◒ 70	074571	1	DECAL-REM. AUTO CNTR
⬢71	075355	1	DECAL-SGNL BFR XFER
★72	064114	1	DECAL-CUST CONN CTS
▲73	046357	1	BLOCK TERM 20A 6 X 6 X 1100V
▲74	098876	1	DECAL, DUAL START
75	0C4167	1	BLOCK TERM 20A 14 X 6 X 1100V
76	0C3937	1	DCL-CTTS AUX CONTACT
77	091472	FT	DUCT WIRING 1X1.5 6 FT
78	091472A	FT	COVER WIRE DUCT 1 IN
79	063378	21	HOLDER CABLE TIE
80	0D6584	1	ASSY DWG GRD.TERM.1600-2600A
81	0A9992B	2	BRKT, DIN TERM END
82	0C3996	FT	RAIL DIN ALUMINUM BULK
100	064101	14	NUT LOCK FL 3/8-16
101	0C4979	2	SCREW TAP HWH #8-25 X 3/8 ZINC
102	072252	1	GROMMET 1.37 X .06 X 1.00
103	038057	1	GROMMET 7/8 X 1/16 X ¾
104	022131	18	WASHER FLAT 3/8-M10 ZINC
105	036261	8	RIVET POP .125 X .129-.133/#30
106	064525	16	STANDOFF HEX ¾
107	064526	40	SCREW TAP HWH #6-25 X 3/8 ZINC
108	068337	4	STANDOFF-HEX 1.00 LG
109	029357	2	RIVET AVDEL3/32X1/8L
110	038150	2	WASHER FLAT #8 ZINC
111	022264	2	WASHER LOCK #8-M4
112	022471	2	NUT HEX #8-32 STEEL
113	022473	1	WASHER FLAT 1/4 ZINC
114	025870	1	NUT WING 1/4-20
115	022304	4	WASHER FLAT 1/2 ZINC
116	022195	4	WASHER LOCK ½
117	061342	4	SCREW HHC 1/2-13 X 1-1/4 G5
118	022196	4	NUT HEX 1/2-13 STEEL
119	022237	28	WASHER LOCK 3/8
120	031863	8	SCREW HHC 3/8-16 X 1-1/4 G5
121	022241	20	NUT HEX 3/8-16 STEEL
122	022258	18	SCREW HHC 3/8-16 X 2 G5
123	026902	8	SCREW HHC 3/8-16 X 2 G5
124	022152	8	WASHER LOCK #10
125	024469	8	SCREW HHTT #10-32 X 3/8 CZ
126	045764	10	SCREW HHTT M4-0.7 X 8 BP
127	0C2267	22	SCREW HHTT M4-0.7 X 8 BP
	074906	8	SCREW HHTT M6-1.0 X 20 BP
128	043180	1	WASHER FLAT M4
129	0C6617	1	SCREW PHTT M4-0.7 X 30
130	022129	1	WASHER LOCK M8-5/16
131	083512	1	SCREW HHTT M8-1.2 X 16 YC
132	0A1661	10	RIVET POP .156 X .160-.164/#20
133	091477	11	RIVET, WIRE DUCT MNT

NOTES

GENERAC POWER SYSTEMS STANDARD TWO-YEAR LIMITED WARRANTY FOR GENERAC TRANSFER SWITCH SYSTEMS

NOTE: ALL UNITS MUST HAVE A START-UP INSPECTION PERFORMED BY AN AUTHORIZED GENERAC DEALER.
For a period of 2 (two) years from the date of sale/start date, Generac Power Systems, Inc. will, at its option, repair or replace any part(s) which, upon examination, inspection, and testing by Generac Power Systems or a Generac Power Systems Authorized Warranty Service Facility, is found to be defective under normal use and service, in accordance with the warranty schedule set forth below. Any equipment that the purchaser/owner claims to be defective must be returned to, and examined by the nearest Generac Power Systems Authorized Warranty Service Facility. All transportation costs under the warranty, including return to the factory, are to be borne and prepaid by the purchaser/owner. This warranty applies only to Generac Power Systems Transfer Switch applications, as Generac Power Systems, Inc. have defined Transfer Switch application, provided said Transfer Switch has been initially installed and inspected on-site by a Generac Power Systems Authorized Service Dealer or branch thereof. A scheduled maintenance agreement with a local Authorized Generac Power Systems Dealer is highly recommended to verify adequate service has been performed on the unit throughout the warranty period.

WARRANTY SCHEDULE

- **YEAR ONE** — 100% (one hundred percent) coverage on mileage*, labor, and parts listed.
- **ALL COMPONENTS**
- **YEAR TWO** — 100% (one hundred percent) coverage on parts listed.
- **ALL COMPONENTS — *PARTS ONLY**
- *Travel allowance is limited to 300 miles maximum, or 7.5 hours maximum (per occurrence), **round trip**, to the nearest authorized Generac Service Facility.
- A Generac Power Systems, Inc. Transfer Switch is highly recommended to be used in conjunction with the genset. If a non Generac genset is substituted for use and directly causes damage to the Generac Transfer Switch, no warranty coverage shall apply.
- All warranty expense allowances **are** subject to the conditions defined in Generac Power Systems Warranty, Policies, and Procedures Flat Rate Manual.
- Units that have been resold **are not** covered under the Generac Power Systems Warranty, as this Warranty **is not** transferable.

THIS WARRANTY SHALL NOT APPLY TO THE FOLLOWING:

1. Any unit built/manufactured prior to January 1, 2002.
2. Unit enclosure is only covered against rust or corrosion the first year of the warranty provision.
3. Costs of normal maintenance i.e. tune-ups, associated part(s), adjustments, loose/leaking clamps, installation and start-up.
4. Use of Non-Generac replacement part(s) will void the warranty in its entirety.
5. Any failure caused by contaminated fuels, oils, coolants/antifreeze or lack of proper fuels, oils or coolants/antifreeze.
6. Failures due, but not limited to, normal wear and tear, accident, misuse, abuse, negligence, or improper installation or sizing.
7. Failures caused by any external cause or act of God such as collision, fire, theft, freezing, vandalism, riot or wars, lightning, earthquake, windstorm, hail, volcanic eruption, water or flood, tornado, hurricane, terrorist acts or nuclear holocaust.
8. Products that are modified or altered in a manner not authorized by Generac Power Systems in writing.
9. Any incidental, consequential or indirect damages caused by defects in materials or workmanship, or any delay in repair or replacement of the defective part(s).
10. Failure due to misapplication, misrepresentation, or bi-fuel conversion.
11. Telephone, telegraph, teletype or other communication expenses.
12. Living or travel expenses of person(s) performing service, except as specifically included within the terms of a specific unit warranty period.
13. Rental equipment used while warranty repairs are being performed i.e. rental generators, cranes, etc..
14. Overtime labor or more than one person performing repairs.
15. Any and all expenses incurred investigating performance complaints unless defective Generac materials and or workmanship were the direct cause of the problem.
16. *Engine coolant heaters (block-heaters), heater controls and circulating pumps after the first year.
17. *Starting batteries, fuses, light bulbs, engine fluids, tires, brakes, and overnight freight cost for replacement part(s).

THIS WARRANTY IS IN PLACE OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, SPECIFICALLY, GENERAC POWER SYSTEMS MAKES NO OTHER WARRANTIES AS TO THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

GENERAC POWER SYSTEMS ONLY LIABILITY SHALL BE THE REPAIR OR REPLACEMENT OF PART(S) AS STATED ABOVE. IN NO EVENT SHALL GENERAC POWER SYSTEMS BE LIABLE FOR ANY INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF SUCH DAMAGES ARE A DIRECT RESULT OF GENERAC POWER SYSTEMS, INC. NEGLIGENCE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you. Purchaser/owner agrees to make no claims against Generac Power Systems, Inc. based on negligence. This warranty gives you specific legal rights. You also may have other rights that vary from state to state.

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