GENERAC®

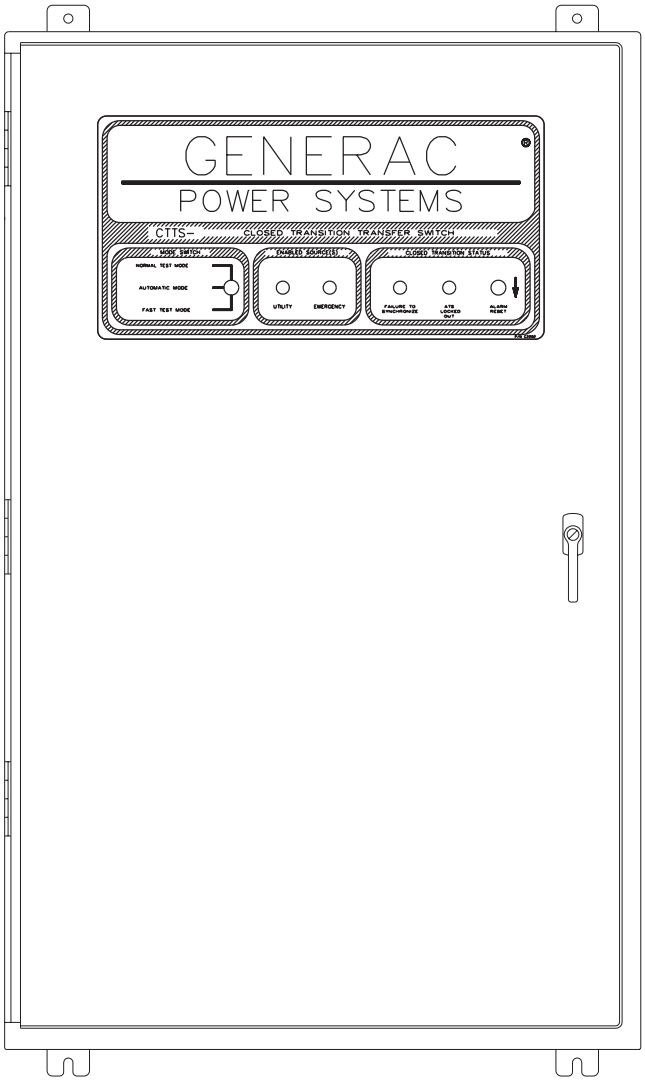
POWER SYSTEMS, INC.

Owner's Manual

CTTS Type

Closed Transition Transfer Switch

100 thru 400 amp, 600 volts



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 cir cumstance 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 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 to alert you to special instruction 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 you must work 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.

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 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 CTTS transfer switch 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) 1 type. NEMA 1 type enclosures primarily provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.

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 you may find 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 1-type enclosure. A NEMA 12, 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 trying to connect 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 bundled on the right side of the CTTS mechanism.

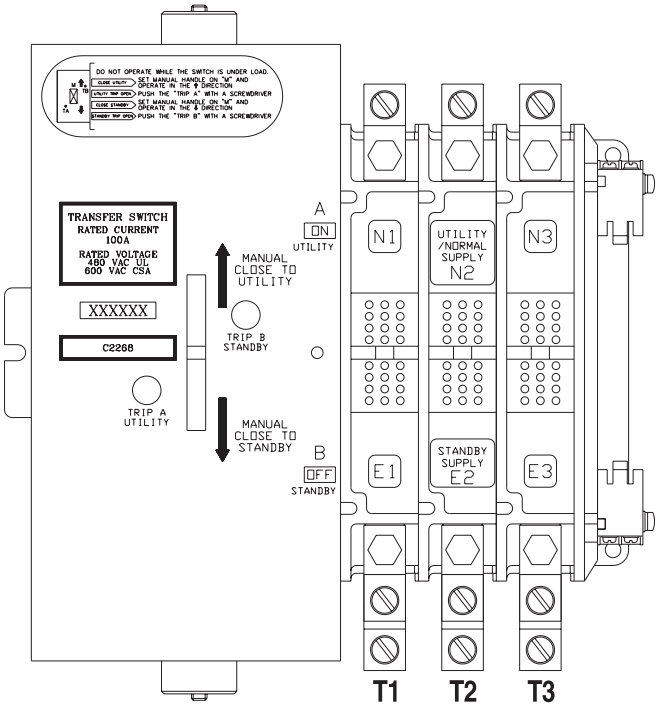
◆ 2.4.1 2-POLE MECHANISM

This switch (Figure 2.1) is used with a single phase system, when the single phase NEUTRAL line is to be connected to a Neutral Lug and is not to be switched.

NOTE:

Generac may use a 3-pole contactor for single phase systems with solid neutral.

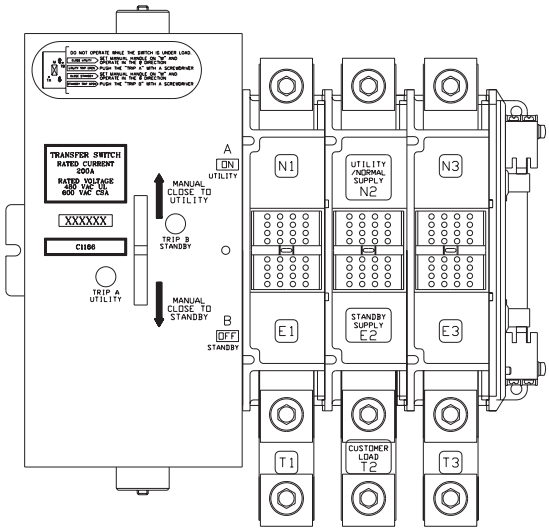
Figure 2.1 — Typical 3-Pole Transfer Mechanism (100 Amp Shown)



◆ 2.4.2 3-POLE MECHANISM

This switch (Figure 2.2) 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.

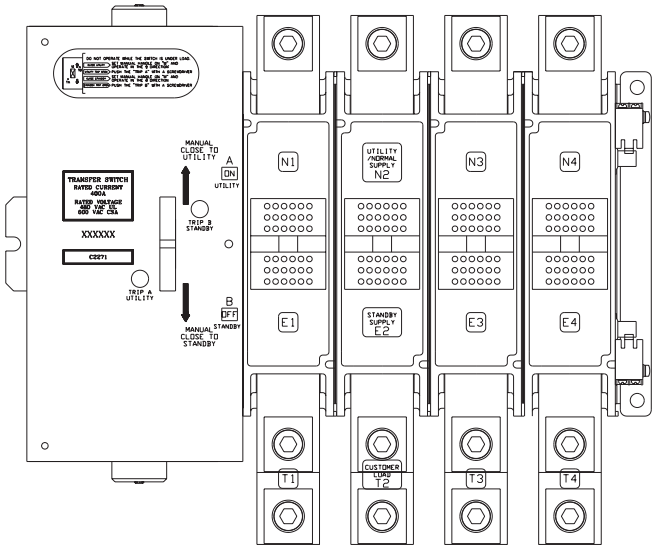
Figure 2.2 — Typical 3-Pole Transfer Mechanism (200 Amp Shown)



◆ 2.4.3 4-POLE MECHANISM

This switch (Figure 2.3) is used with a 3-phase system, when the NEUTRAL line is to be switched during transfer action.

Figure 2.3 — Typical 4-Pole Transfer Mechanism (400 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 2.4) 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; based on the 75°C column of tables, charts, etc. used to size conductors. The installation must comply fully with all applicable codes, standards and regulations.

Switch Rating	Wire Range
100A	#6-2/0 AWG
150-200A	#4-400 MCM
300-400A	(1) #4-600 MCM or (2) 1/0-250 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, being 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 2.4.

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 2.5 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.

Figure 2.4 — Connection Diagram - 3-Phase With Neutral Shown (Typical)

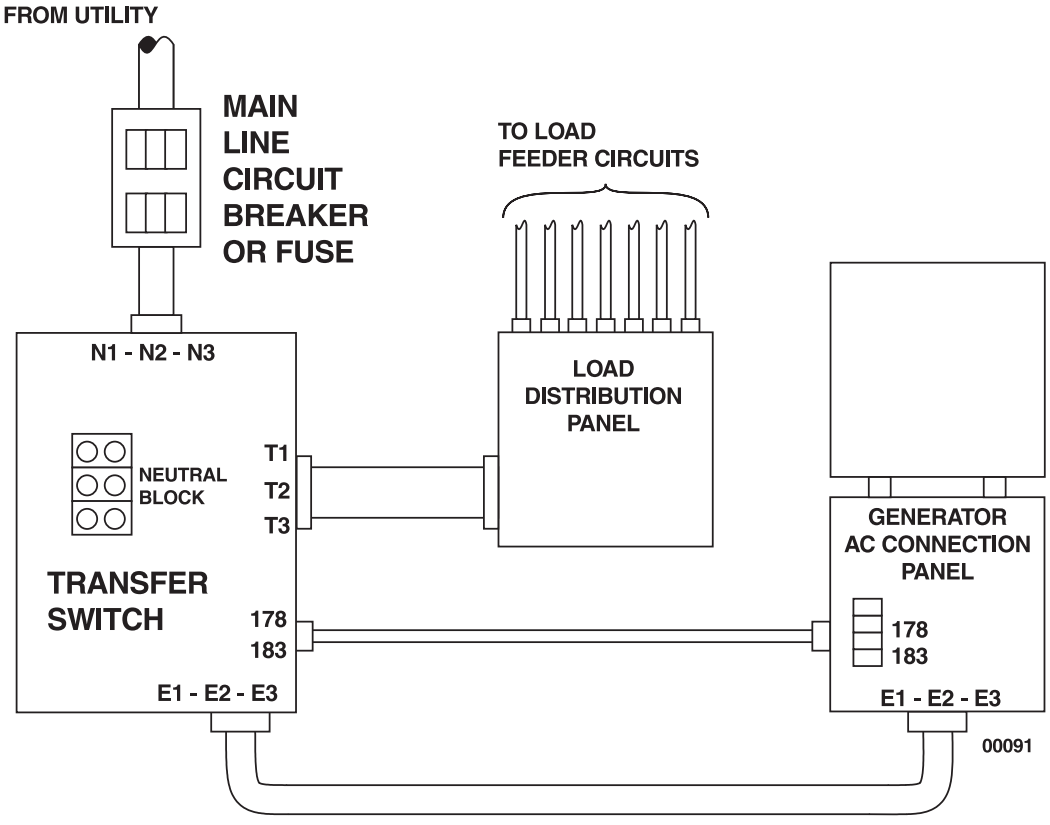
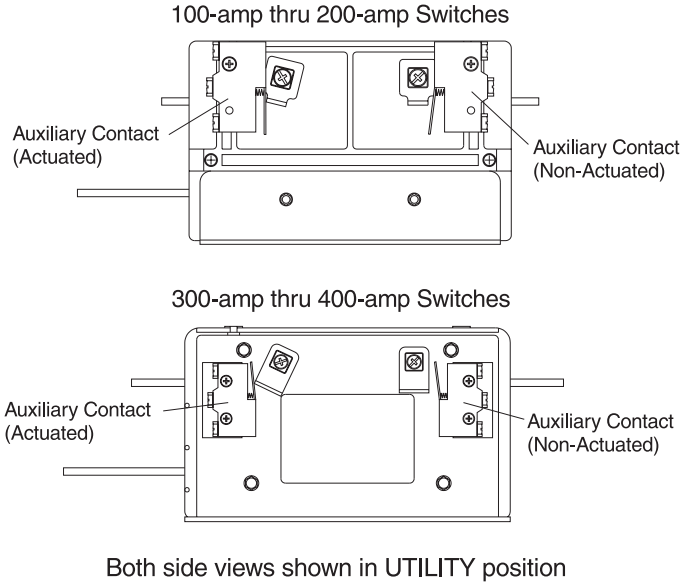
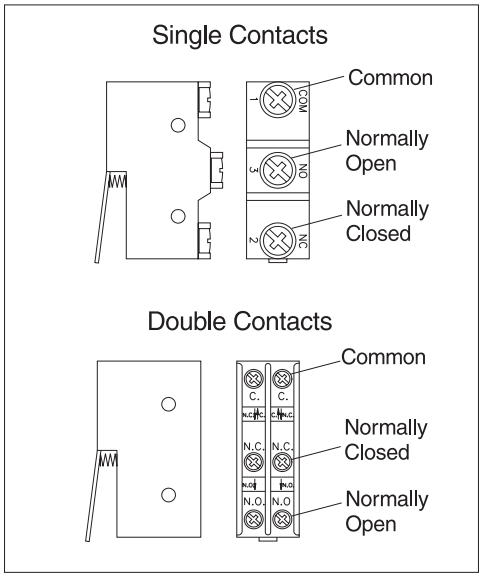


Figure 2.5 — Auxiliary Contact Diagram





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 competent, qualified electrician should inspect it. The installation should 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 you could damage the switch.

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.

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 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

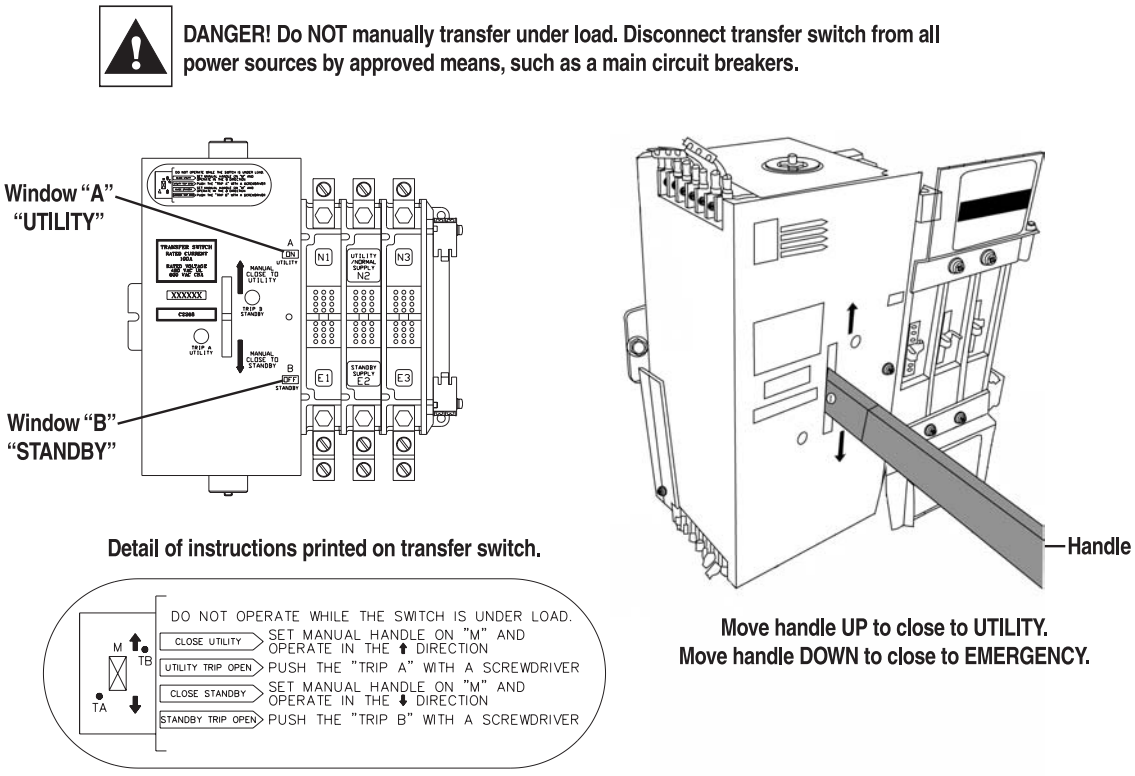
⚠ DANGER ⚠

⚠ 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.

Figure 3.1 — Actuating Transfer Switch



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.

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".
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. Then 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 3.13.

NOTE:

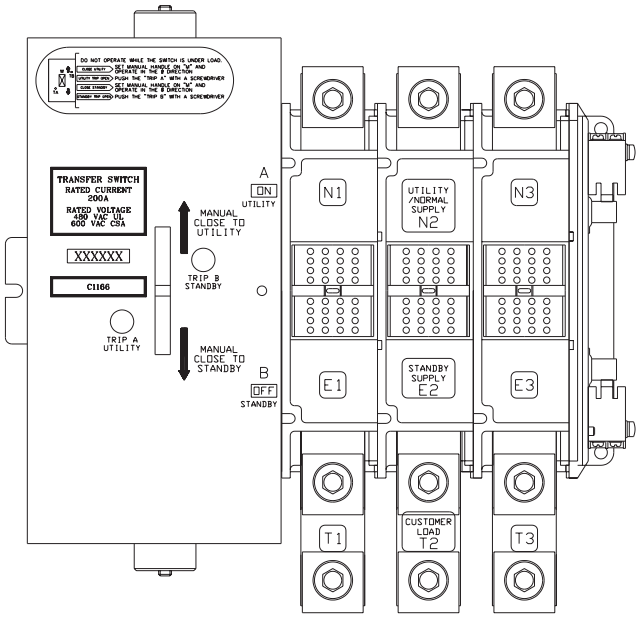
Advisory lights on the circuit board will light up to indicate operation of the various solid state timers that control automatic operation. By observing these lights (LED's), the operator can check the automatic operating sequences and timers. See SENSOR AND TIMER ADJUSTMENTS, Section 3.16. For a detailed description of the automatic operating sequences, see SEQUENCE OF OPERATION, Section 3.13.

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 TRANSFER MECHANISM

- The transfer mechanism houses the main, current carrying contacts, along with other mechanical and electrical components required for operating the switch (Figure 3.2). Main contacts are electrically operated and mechanically held. Power for that coil's operation is taken from the side to which the LOAD is being transferred. Thus, transfer to any power source cannot occur unless that power source is available to the switch.
- LOAD or "T" contacts, bolted to an insulated plastic pole piece are stationary. The UTILITY (normal) and EMERGENCY (standby) contacts are moveable. The contacts are actuated by means of a closing coil and mechanical linkage. The pole assemblies which retain the stationary moveable main contacts are assembled together and retained by through-bolts. Either 2, 3 or 4-pole assemblies may be used to form a 2, 3 or 4-pole mechanism.

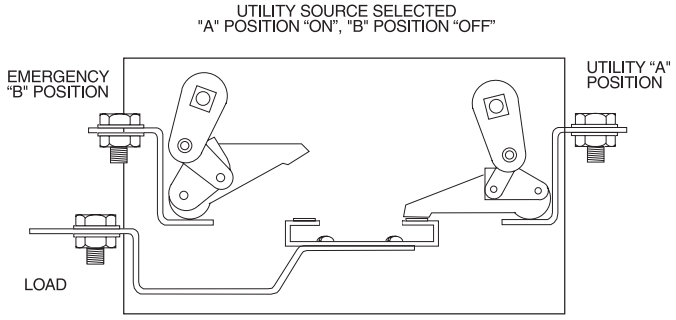
Figure 3.2 — The Transfer Mechanism



3.6 MAIN CONTACTS AT UTILITY (NORMAL)

The illustration shows the LOAD terminals connected to the NORMAL (utility) terminals. window "A" will display the word "ON"; Window "B" the word "OFF" (Figure 3.3).

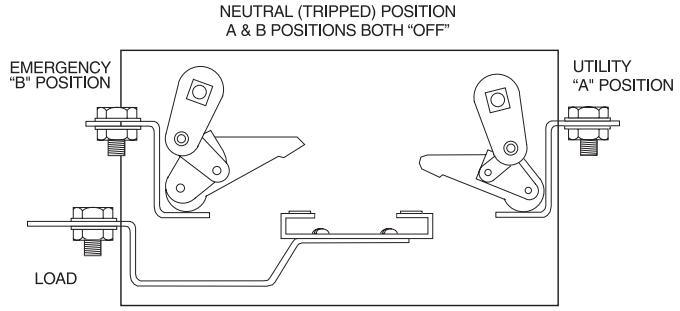
Figure 3.3 — Main Contact at Utility (Normal)



3.7 MAIN CONTACTS AT NEUTRAL

LOAD terminals are disconnected from both power supply terminals. The word "OFF" will be displayed in both Windows "A" and "B" (Figure 3.4).

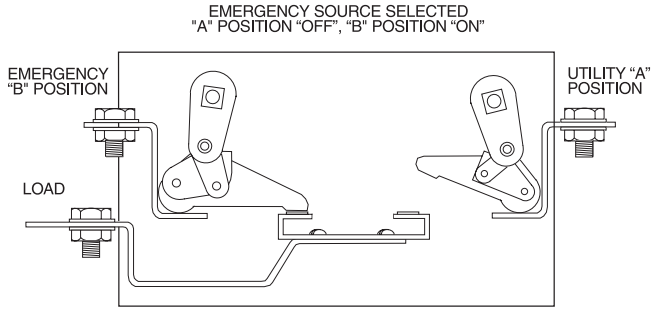
Figure 3.4 — Main Contacts at Neutral



3.8 MAIN CONTACTS AT EMERGENCY (STANDBY)

LOAD terminals are connected to the EMERGENCY (standby) power supply. Window "A" the word "OFF"; Window "B" will display the word "ON" (Figure 3.5).

Figure 3.5 — Main Contacts at Emergency (Standby)



3.9 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.

3.10 MODE SWITCH

This switch permits operator selection of AUTOMATIC, NORMAL TEST or FAST TEST mode as follows (Figure 3.6):

◆ 3.10.1 AUTOMATIC MODE

Use this switch position 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 3.14.

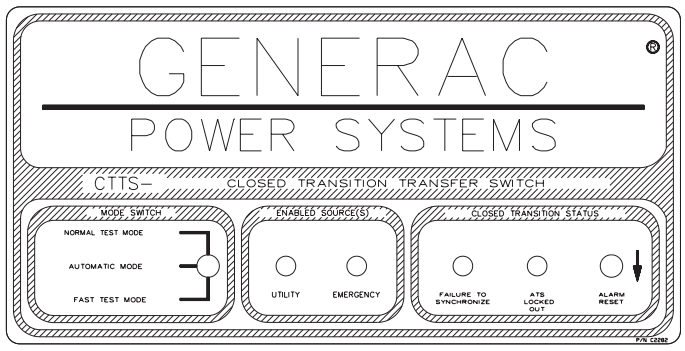
◆ 3.10.2 NORMAL TEST MODE

Permits the operator to test automatic operations, just as though an actual drop in NORMAL source voltage had occurred. See the chart in Section 3.14. During the test, observe the lights (LED's) on the transfer switch circuit board to monitor automatic operating sequences.

◆ 3.10.3 FAST TEST MODE

Permits the operator to test system operation with all circuit board timers accelerated to less than five seconds. Switch is spring-loaded back to AUTOMATIC MODE, so continuously press 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 3.6 — Mode Switch, Enabled Sources LEDs, and Closed Transition Status



3.11 CLOSED TRANSITION STATUS

◆ 3.11.1 FAILURE TO SYNCHRONIZE

Yellow flashing LED. 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.

◆ 3.11.2 ATS LOCKED OUT

Yellow flashing LED. 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.

◆ 3.11.3 ALARM RESET

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

3.12 ENABLED SOURCE LED

◆ 3.12.1 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.

◆ 3.12.2 UTILITY

The LED will go ON when 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).

3.13 SEQUENCE OF OPERATION

When acceptable NORMAL source voltage is available, you can 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 7-day exerciser board to operate the 7-day exercise timer.

If you want, you can monitor automatic timers and sensors on the CTTS controller circuit board, by observing light emitting diodes (LED's) next to the sensor/timer adjustments.

◆ 3.13.1 SEQUENCE 1 - 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.

◆ 3.13.2 SEQUENCE 2 - LINE INTERRUPT DELAY

- UTILITY voltage dropout below setting of Voltage Dropout sensor starts the Line Interrupt Delay Timer.
- Line Interrupt Delay may be set for 0.1 to 10 seconds; has been factory set to about 5 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, 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).

◆ 3.13.3 SEQUENCE 3 - ENGINE MINIMUM RUN AND WARMUP TIMERS

- This 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 5 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 5 seconds to 3 minutes; factory setting is about 1 minute.

NOTE:

Bypass the engine warmup timers 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.

◆ 3.13.4 SEQUENCE 4 - STANDBY VOLTAGE AND FREQUENCY SENSORS

- If generator AC output voltage and frequency is above the setting of these sensors, loads transfer 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%.

◆ 3.13.5 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.

◆ 3.13.6 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%.

◆ 3.13.7 SEQUENCE 7 - RETURN TO UTILITY TIMER

- This timer prevents re-transfer that a Utility Source voltage surge or transient might cause.
- Adjust timer between 1 to 30 minutes; factory setting is about 5 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.

◆ 3.13.8 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.

◆ 3.13.9 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 1-30 minutes; factory setting is about 10 minutes.

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.

3.14 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%	80%
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%	90%
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.

3.15 TRANSFER SWITCH OPTIONS

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

- Instrument Package, 3.15.1
- Signal Before Transfer, 3.15.2
- Remote Auto Control, 3.15.3
- Manual bypass for return to Normal, 3.15.4
- Preferred Source Selector, 3.15.5
- NEMA 3R, 4, 4X or 12 enclosure, 3.15.6 through 3.15.9

◆ 3.15.1 INSTRUMENT PACKAGE

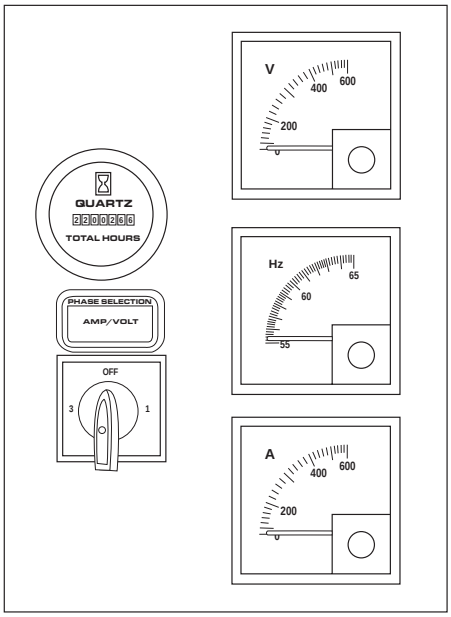
The optional instrument package includes (a) an AC voltmeter, (b) an AC frequency meter, (c) an AC ammeter, (d) an hourmeter, and (e) a phase selector switch (Figure 3.7). Current transformers are required to operate the instrument package, (two for single phase systems, three for 3-phase systems). Use the phase selector switch to select the 1-phase voltage and current being read 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

For 3-phase systems use the switch 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

Figure 3.7 — Instrument Package



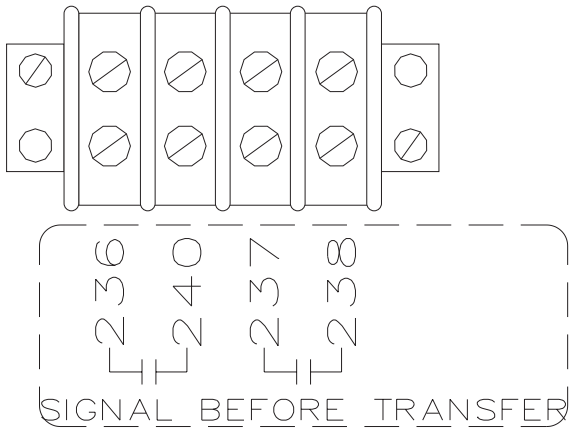
◆ 3.15.2 SIGNAL BEFORE TRANSFER

The signal before transfer option includes a signal relay, customer connection terminal strip and the associated wiring. See Figure 3.8.

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 1 to 30 seconds.

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, 2 sets of the dry contacts (wire nos. 236-240 and 237-238) are closed. These dry contacts can be connected to, via a terminal strip located on the bottom of the subplate. Reference wiring diagram No. 0C2909 (page 33) for further details. The customer connections are made on terminal strip TS4.

Figure 3.8 — Signal Before Transfer



NOTE:

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

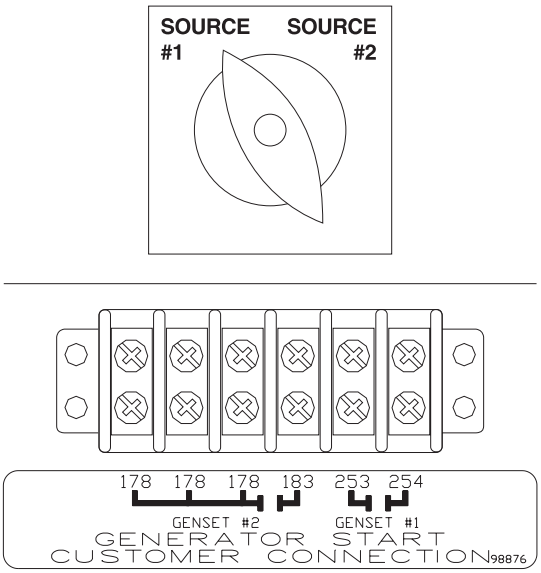
◆ 3.15.3 REMOTE AUTO CONTROL

The Remote Auto Control option includes a customer connection terminal strip and the associated wiring (Figure 3.9 on page 14).

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 3.10.3 on page 10.

Reference wiring diagram No. 0C2909 (page 33) for further details. The customer connections are made on TS3. The associated wire numbers are 0, 177, 178 and 201.

Figure 3.9 — Remote Auto Control



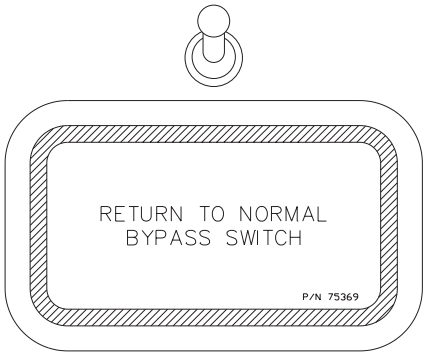
◆ 3.15.4 MANUAL BYPASS FOR RETURN TO NORMAL

The Manual Bypass for Return to Normal option includes a door mounted toggle switch and associated wiring (Figure 3.10).

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 3.10 — Manual Bypass for Return to Normal



◆ 3.15.5 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 3.9).

This option is normally used when there is not a UTILITY supply present and both sources are a generator. It may 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 No. 0C2909 (page 33) for further details. The customer connections are made on TS2. The associated wire numbers are 178, 183, 253 and 254.

◆ 3.15.6 NEMA 12 ENCLOSURE

National Electrical Manufacturer's Association (NEMA) 12 enclosure. This type of enclosure is intended for use indoors to provide a degree of protection against dust, falling dirt, and dripping, non-corrosive liquids. Consult a Dealer/Distributor or the factory for details.

◆ 3.15.7 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.

◆ 3.15.8 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: undamaged by the formation of ice on the enclosure. Consult a Dealer/Distributor or the factory for details.

◆ 3.15.9 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: undamaged by the formation of ice on the enclosure. Consult a Dealer/Distributor or the factory for details.

◆ 3.15.10 ADDITIONAL OPTIONS

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

3.16 SENSOR AND TIMER ADJUSTMENTS — SENSING CIRCUIT BOARD

◆ 3.16.1 VOLTAGE DROPOUT SENSOR

This sensor (Figure 3.11) 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.

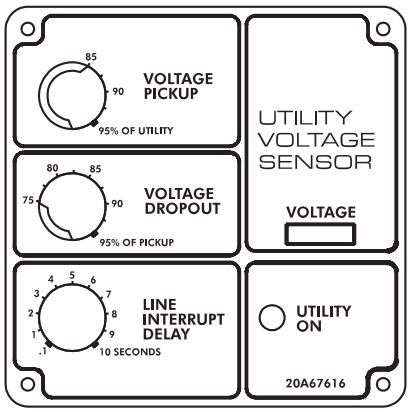
◆ 3.16.2 VOLTAGE PICKUP SENSOR

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.

◆ 3.16.3 LINE INTERRUPT DELAY TIMER

Established 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; is factory set to about five seconds.

Figure 3.11 — Sensing Circuit Board Panel



3.17 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 3.12 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 luminated.

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 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.

◆ 3.17.1 ENGINE WARMUP TIMER

Permits the engine to warm up before transferring LOAD from UTILITY to EMERGENCY power. Reset timer to any time interval between 5 seconds and 3 minutes; factory set to about 1 minute.

◆ 3.17.2 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 5 and 30 minutes.

◆ 3.17.3 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 may be reset to any interval between 1 and 30 minutes; factory set to about 5 minutes.

◆ 3.17.4 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 1 and 30 minutes; 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.

◆ 3.17.5 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.

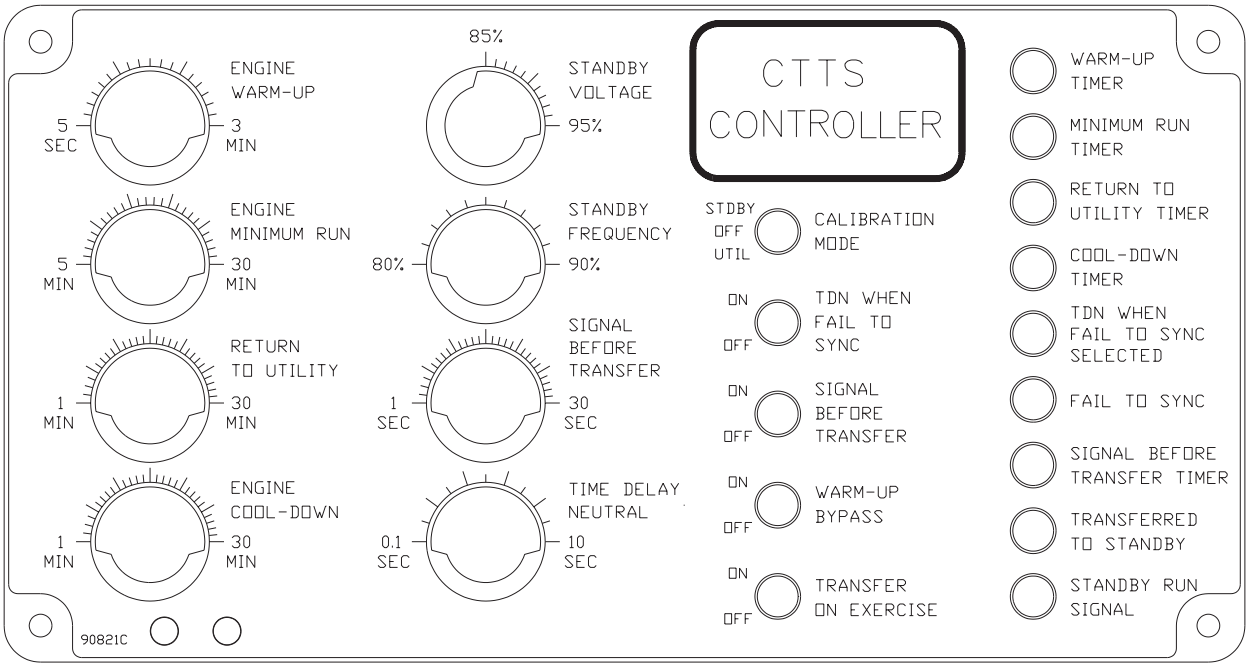
◆ 3.17.6 STANDBY FREQUENCY SENSOR

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%.

◆ 3.17.7 SIGNAL BEFORE TRANSFER TIMER

If you select this function, this timer will control the amount of time signal remains active. Timer is adjustable from 1 to 30 seconds; factory set to about 10 seconds.

Figure 3.12 — CTTS Controller Panel



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.

◆ 3.17.8 TIME DELAY NEUTRAL (TDN)

This timer holds the transfer mechanism's main contacts in the "Neutral" position for the time you have 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 5 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.

◆ 3.17.9 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."

◆ 3.17.10 TDN WHEN FAIL TO SYNC

This switch allows the operator or installer to select what happens when the CTTS can not determine the 2 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.

◆ 3.17.11 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.

◆ 3.17.12 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.

◆ 3.17.13 TRANSFER ON EXERCISE SWITCH

For transferring LOAD to the EMERGENCY source during the 7-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 3.21 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.

◆ 3.17.14 ADVISORY LAMPS

The advisory lamps on the CTTS controller consists of 9 LED's (light emitting diodes) and include the following:

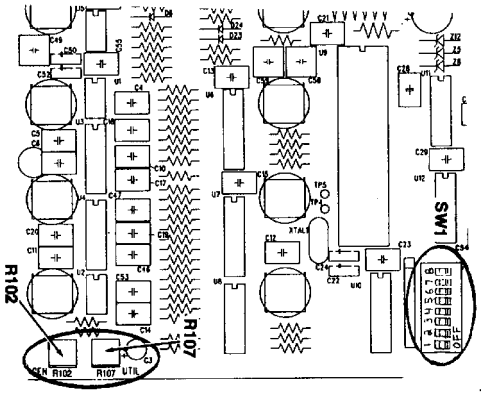
- The four red timer lamps will turn ON when their respective timers are activated.
- The "TDN when fail to sync" selected LED goes ON when "TDN When Fail to Sync" switch is ON. This indicates the system will perform a "TDN Transfer" if the CTTS controller can not determine the two (2) sources are synchronized.
- 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.

3.18 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 3.13). 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 3.13 — 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.

3.19 CIRCUIT BOARD SWITCH SW1

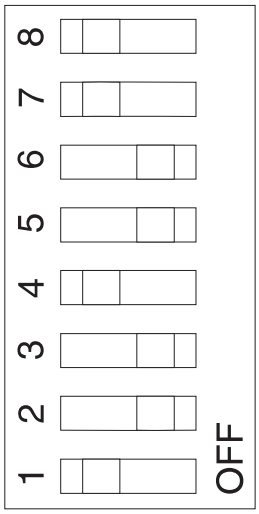
On the CTTS Controller Circuit Board, a switch assembly consisting of a bank of eight miniature switches is identified as "SW1" is usually set up at the factory and should require no additional configuring (Figure 3.14).

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 3.13 and 3.14. 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 19. Improper settings may cause transfer outside the 20-degree specification.

Figure 3.14 — Circuit Board Switch SW1



3.20 EXERCISE TIMER DISPLAY (FIGURE 3.15 ON PAGE 19)

◆ 3.20.1 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.

DIP Switch Settings - CTTS-Type Transfer Switches

TRANSFER SWITCH	SWITCH RATED 100/200; 110/220; 115/200; 120/208; 220/380 VOLTS								SWITCH RATED 120/240; 231/400; 240/416 VOLTS								SWITCH RATED 277.480; 346/600 VOLTS							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
100 amps, 3-pole (0C2268)	*	on	off	off	on	off	off	off	*	on	off	off	on	off	off	on	*	on	off	off	on	off	on	off
100 amps, 4-pole (0C2269)	*	on	off	off	on	on	off	off	*	on	off	off	on	on	on	off	*	on	off	off	on	on	on	off
150 amps, 3-pole (0C2874)	*	on	off	off	on	on	on	off	*	on	off	on	off	off	off	off	*	on	off	on	off	off	off	off
150 amps, 4-pole (0C2875)	*	on	off	on	off	on	on	off	*	on	off	on	on	off	off	off	*	on	off	on	off	on	on	off
200 amps, 3-pole (0C1166)	*	on	off	off	on	on	on	off	*	on	off	on	off	off	off	off	*	on	off	on	off	off	off	off
200 amps, 4-pole (0C2270)	*	on	off	on	off	on	on	off	*	on	off	on	on	off	off	off	*	on	off	on	off	on	on	off
300 amps, 3-pole (0C2876)	*	off	on	on	off	off	off	off	*	off	on	on	off	off	off	on	*	off	on	on	off	off	off	on
300 amps, 4-pole (0C2877)	*	off	on	on	off	off	off	on	*	off	on	on	off	on	on	on	*	off	on	on	off	on	off	off
400 amps, 3-pole (0C1165)	*	off	on	on	off	off	off	off	*	off	on	on	off	off	off	on	*	off	on	on	off	off	off	on
400 amps, 4-pole (0C2271)	*	off	on	on	off	off	off	on	*	off	on	on	off	on	on	on	*	off	on	on	off	on	off	off

* Set Switch 1 to OFF for 60 Hz systems; set Switch to ON for 50 Hz systems

◆ 3.20.2 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.

◆ 3.20.3 PM (TIME)

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

◆ 3.20.4 DAY OF WEEK

The day of the week is indicated on the 7 individual day LEDs which represent Sunday through Saturday.

◆ 3.20.5 EXERCISE ON (EX)

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

◆ 3.20.6 POWER SAVING

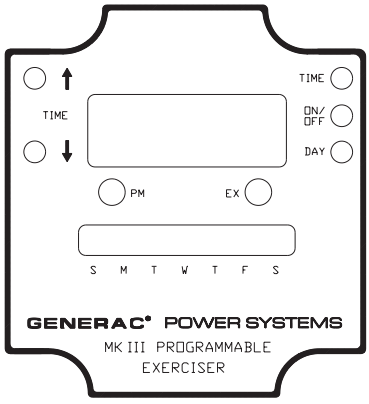
To minimize the power consumption of the unit, the unit will switch to a "dim" display mode of no keyboard activity is noted for 5 minutes. The display brightness is reduced to 50% of normal, but returns to 100% when any key is pressed.

◆ 3.20.7 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 3.15 — Display



3.21 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 10-119 minutes.

3.22 PUSHBUTTONS (FIGURE 3.15)

◆ 3.22.1 UP ARROW ↑

The up arrow is used to step the time forward in increments of 1 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.

◆ 3.22.2 DOWN ARROW ↓

The down arrow is used to step the time backwards in increments of 1 minute. It also has auto-acceleration.

◆ 3.22.3 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 is enabled.
   - 90:10% on/off to indicate exercise time is 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 5 minutes, it will revert back to normal (current time) display.

◆ 3.22.4 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.

◆ 3.22.5 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 7 states indicating Sunday to Saturday.
- In exercise time mode, the days will step through 7 states indicating Sunday to Saturday and will then display state 8 - 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 119 minutes.

3.23 PROGRAMMING EXAMPLES

◆ 3.23.1 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.

◆ 3.23.2 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 90:10, ON but briefly flashes OFF once every 2 seconds. This means that the exercise time is correctly set to OFF for Sunday. If it is 50:50, 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 approx. 4 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 7 "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.

3.24 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, you may need to calibrate the circuit board to match the system (Figure 3.16 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:

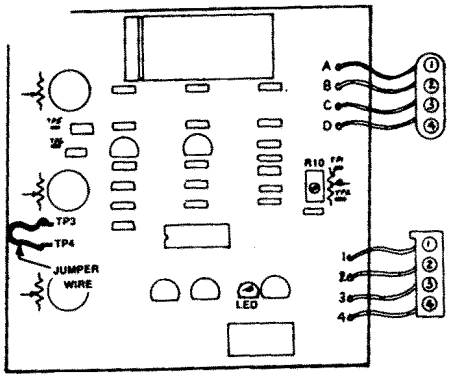
You must also use this procedure to calibrate a replacement circuit board. Follow these instructions:

1. In the transfer switch enclosure, set the Maintenance Disconnect Switch to "Manual".
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 3.16 — 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)

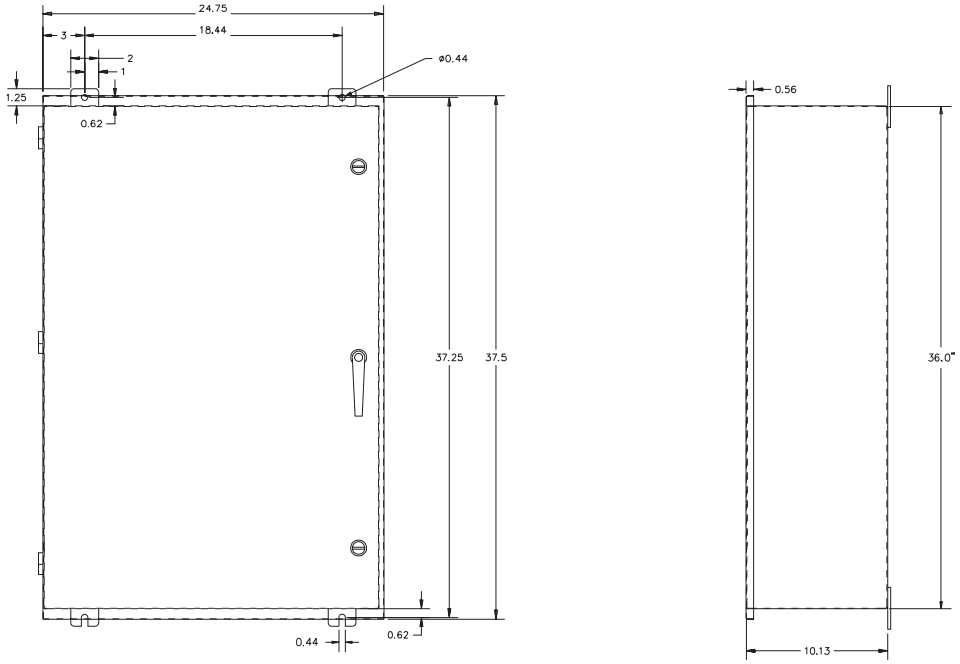
4.4 MAIN CURRENT CARRYING CONTACTS

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

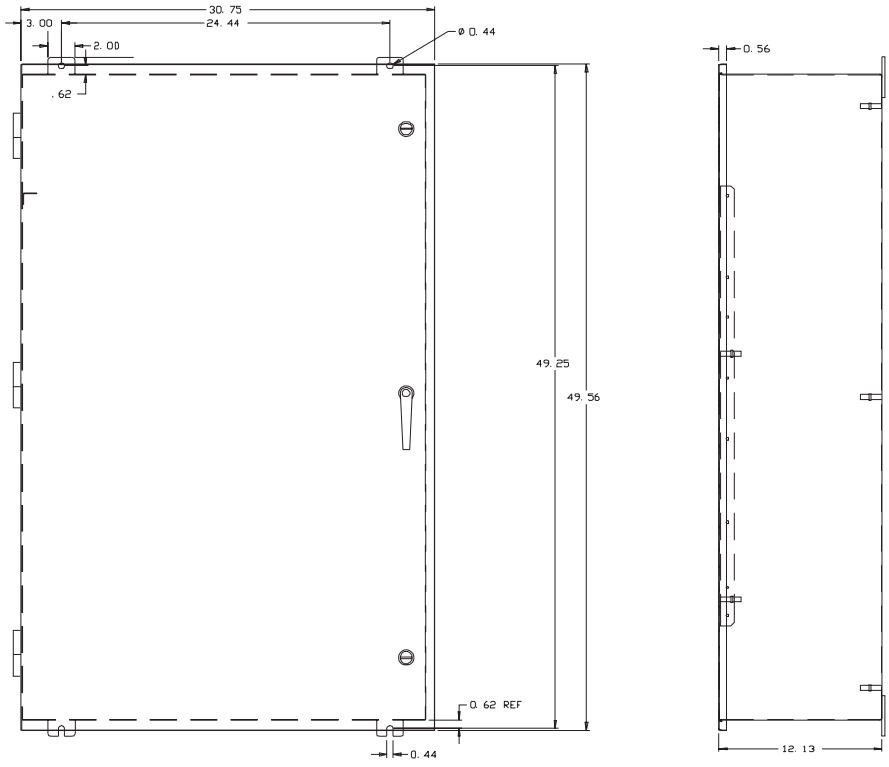
4.5 NINE-VOLT BATTERY

The battery connects to the 7-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 9 volt battery be replaced once each year.

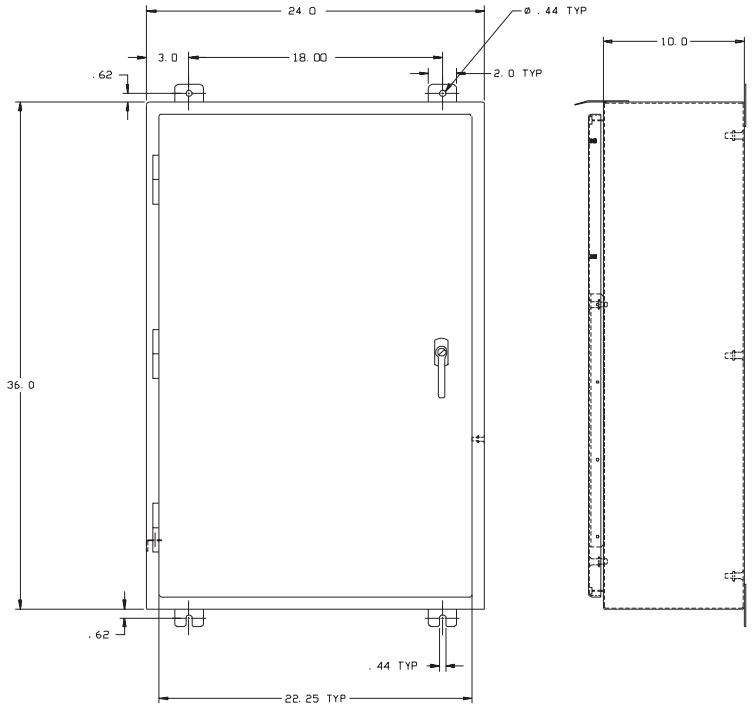
100 Amp NEMA 1 Units



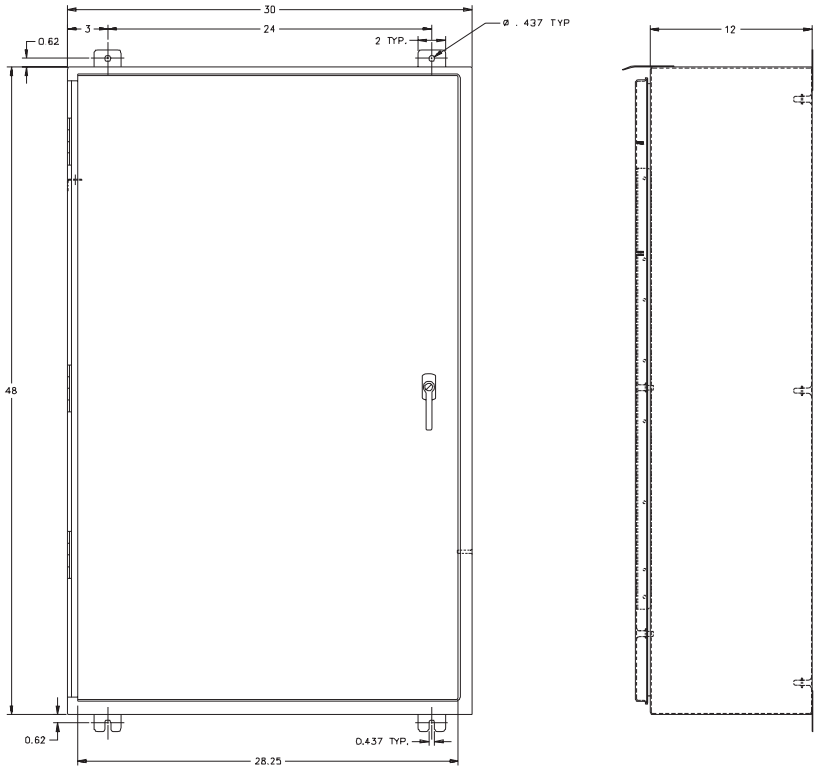
150-400 Amp NEMA 1 Units



100 Amp NEMA 12, 3R, 4, and 4X Units (Typical)

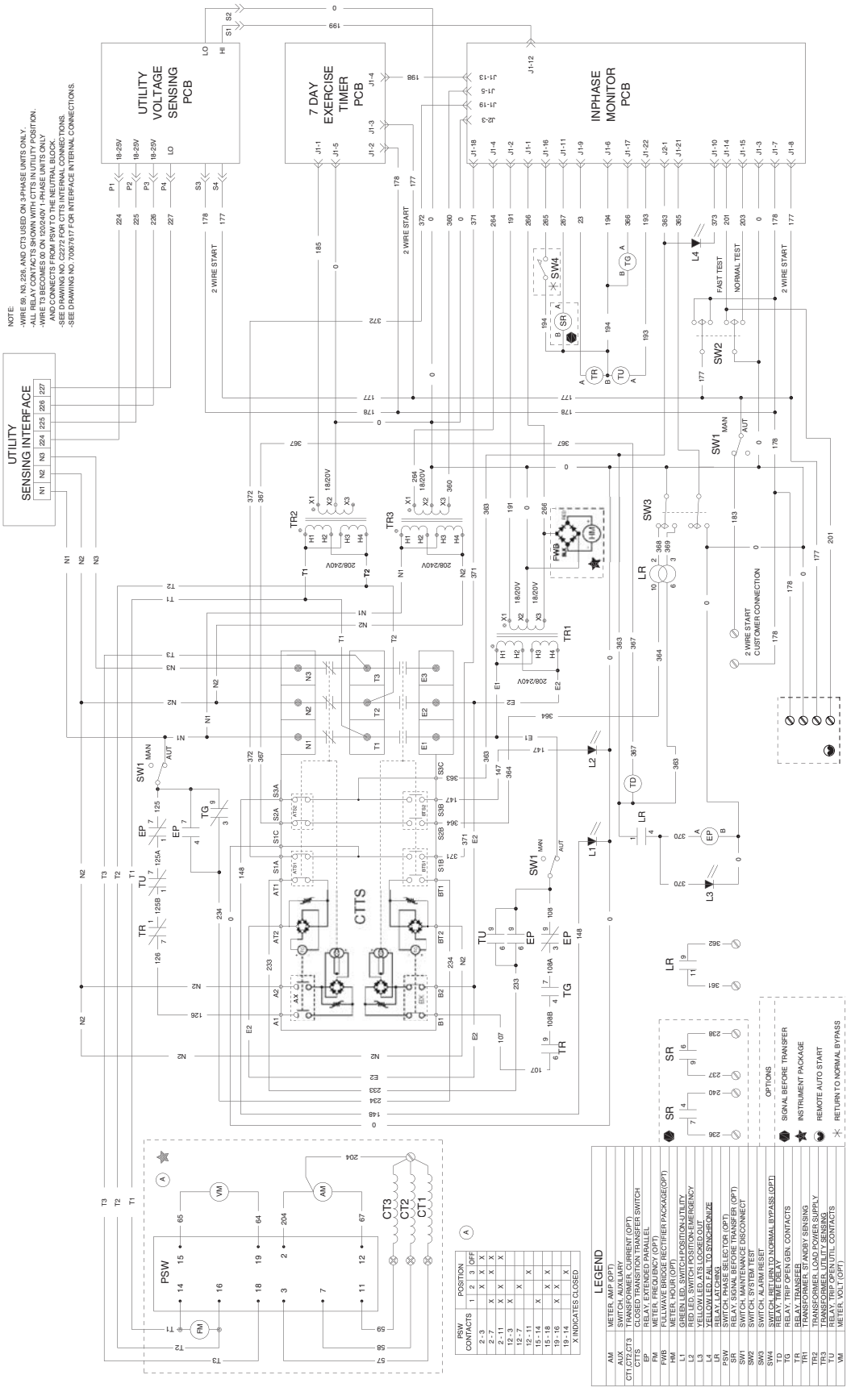


150-400 Amp NEMA 12, 3R, 4 and 4X Units (Typical)

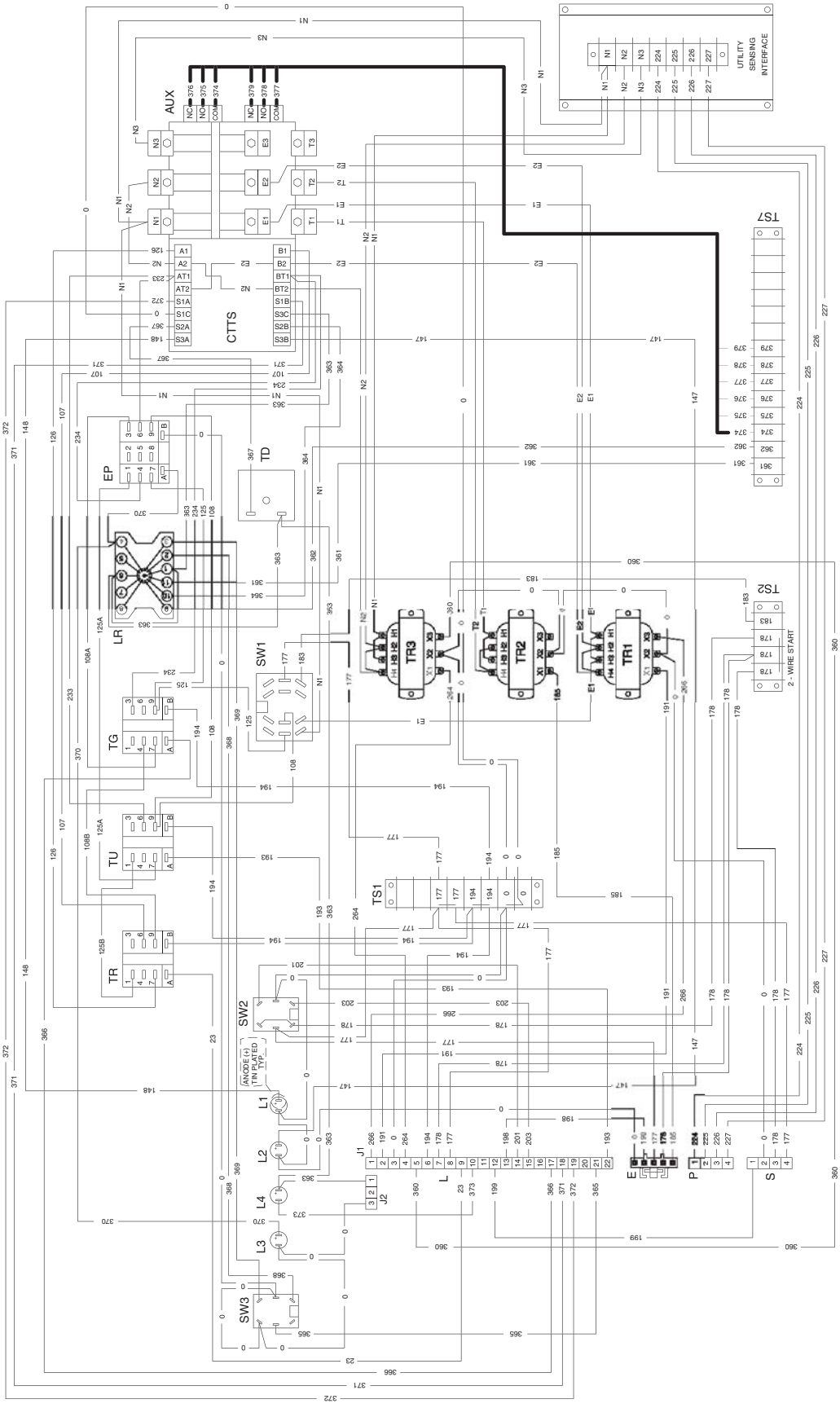


Section 6 — Electrical Data

Electrical Schematic (208/240V) - Drawing No. 0C2277-A



Wiring Diagram (208/240V) - Drawing No. C2273

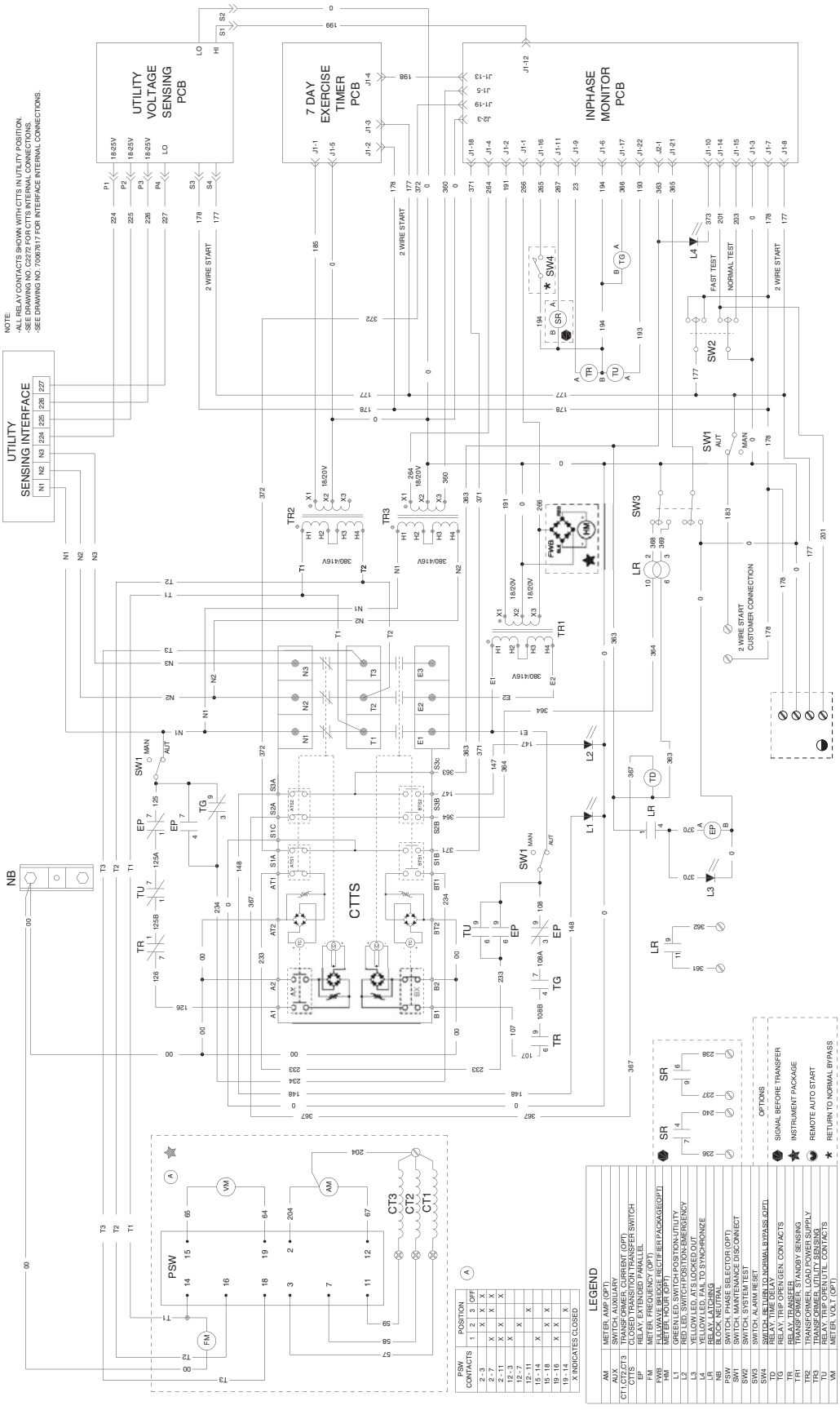


SW1	SWITCH, MAINTENANCE DISCONNECT
SW2	SWITCH, SYSTEM TEST
SW3	SWITCH, ALARM RESET
TD	RELAY, EXTENDED PARALLEL
TG	RELAY, TRIP OPEN GEN. CONTACTS
TR1	TRANSFORMER, STANDBY SENSING
TR2	TRANSFORMER, LOAD POWER SUPPLY
TR3	TRANSFORMER, UTILITY SENSING
TR	RELAY, TRANSFER
TS1	TERM. STRIP
TS2	TERM. STRIP, 2 WIRE START
TS7	TERM. STRIP, CUSTOMER CONNECTION
TU	RELAY, TRIP OPEN UTIL. CONTACTS

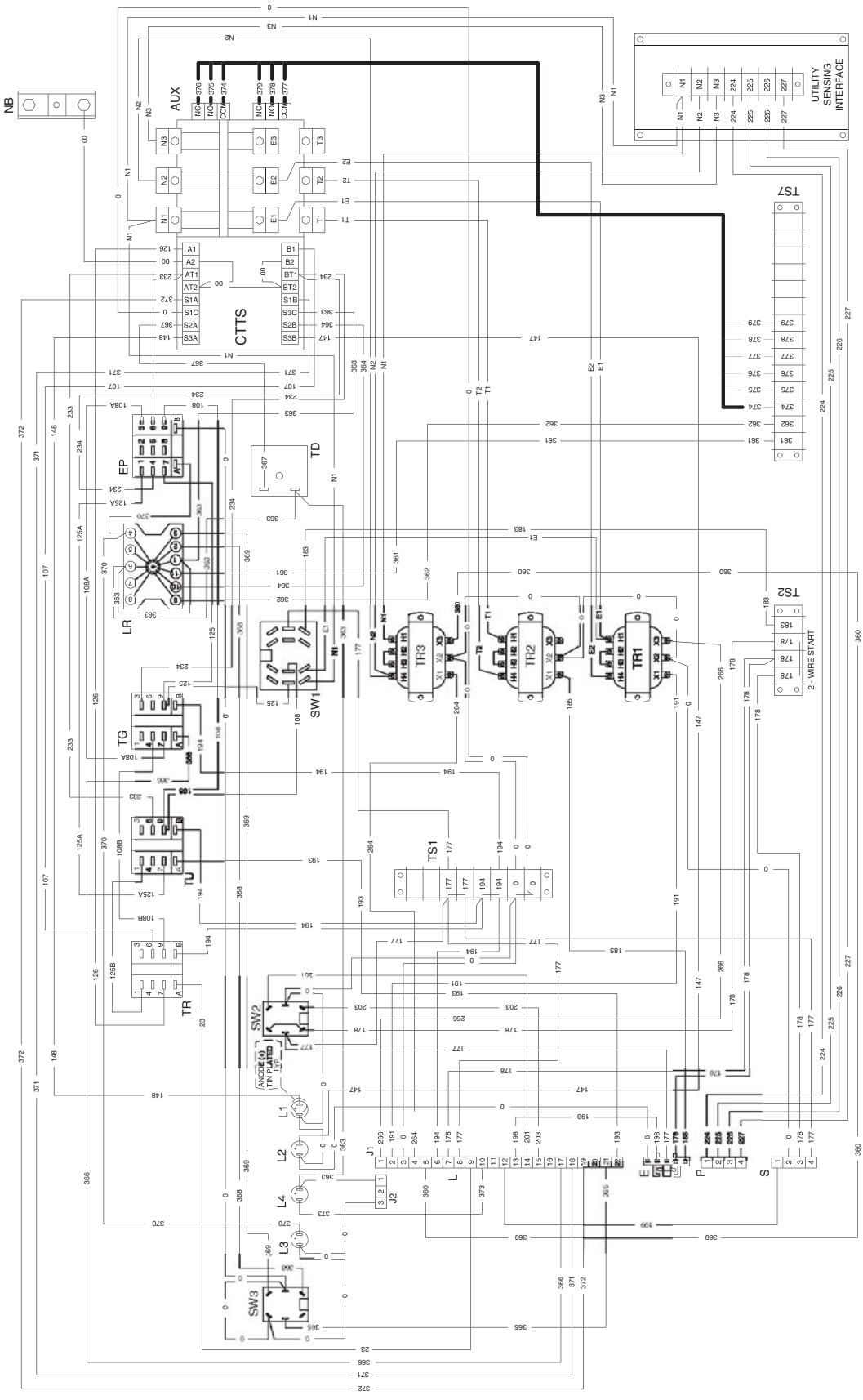
LEGEND

AUX	SWITCH, AUXILIARY
CTTS	CLOSED TRANSITION TRANSFER SWITCH CONTACTOR
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
P	CONNECTOR, UTILITY VOL. SENSING PCB
S	CONNECTOR, UTILITY VOL. SENSING PCB

Electrical Schematic (416 3-Phase, 3-Pole) - Drawing No. 0C2280-A



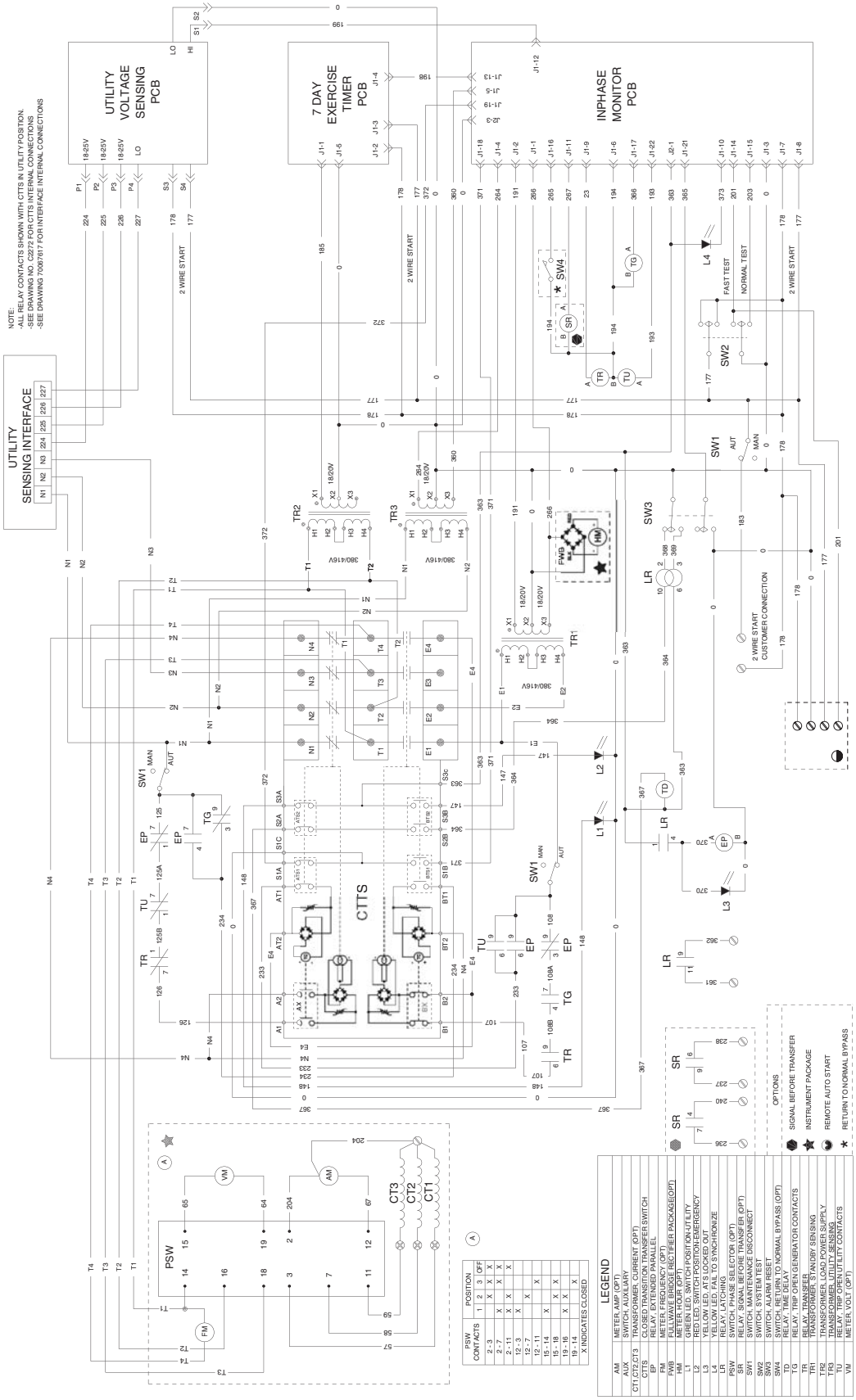
Wiring Diagram (416V 3-Phase, 3-Pole) - Drawing No. C2276



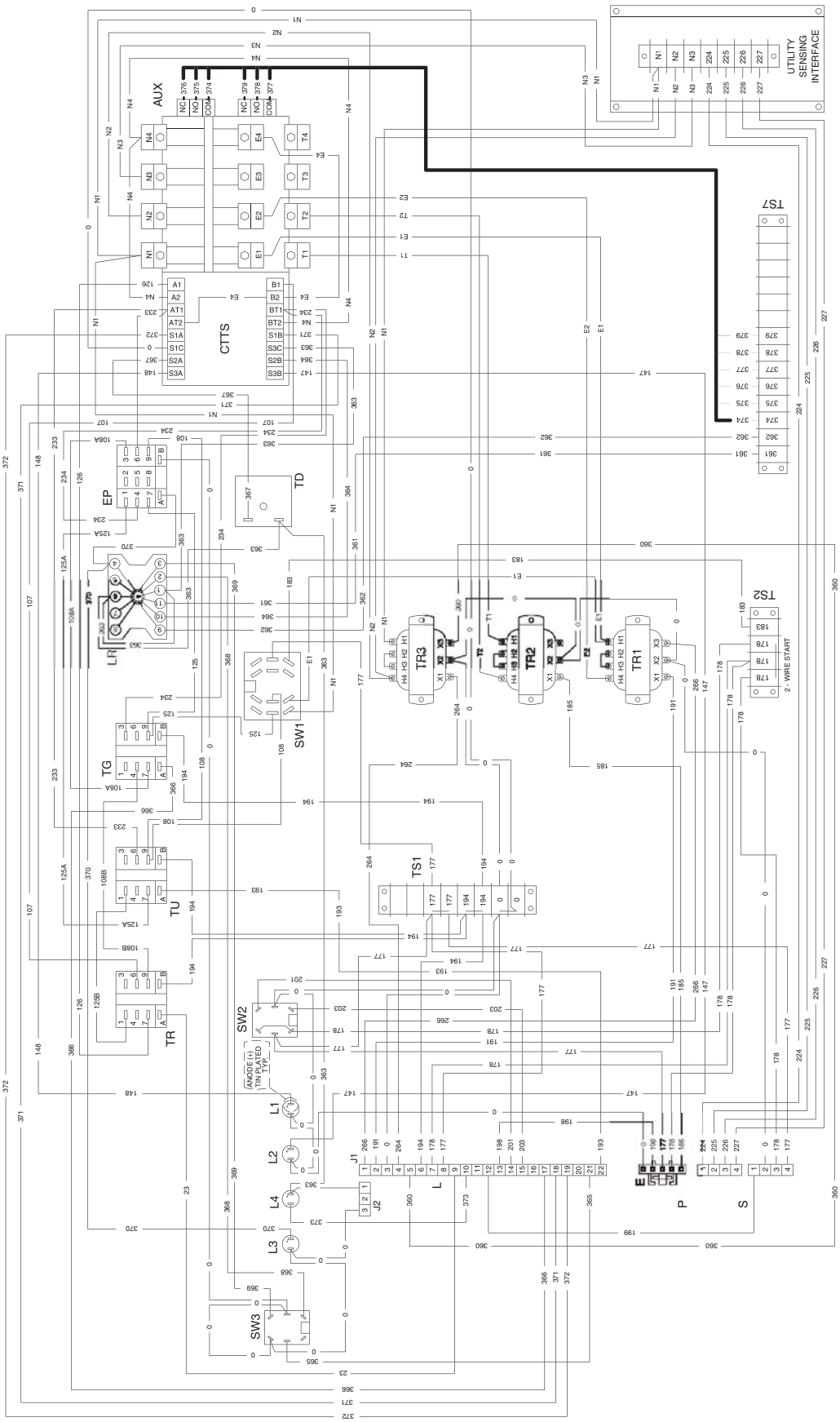
LEGEND	
AUX	SWITCH, AUXILIARY
CTTS	CLOSED TRANSITION TRANSFER SWITCH
E	CONNECTOR, 7 DAY EXERCISER PCB
EP	RELAY, EXTENDED PARALLEL
L	CONNECTOR, INPHASE MONITOR PCB
L1	GREEN LED, SWITCH POSITION-UTILITY
L2	RED LED, SWITCH POSITION-EMERGENCY
L3	YELLOW LED, ATS LOCKED OUT
L4	YELLOW LED, FAIL TO SYNCHRONIZE
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, EXTENDED PARALLEL
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

Electrical Schematic (416V 3-Phase, 4-Pole) - Drawing No. 0C2281-A

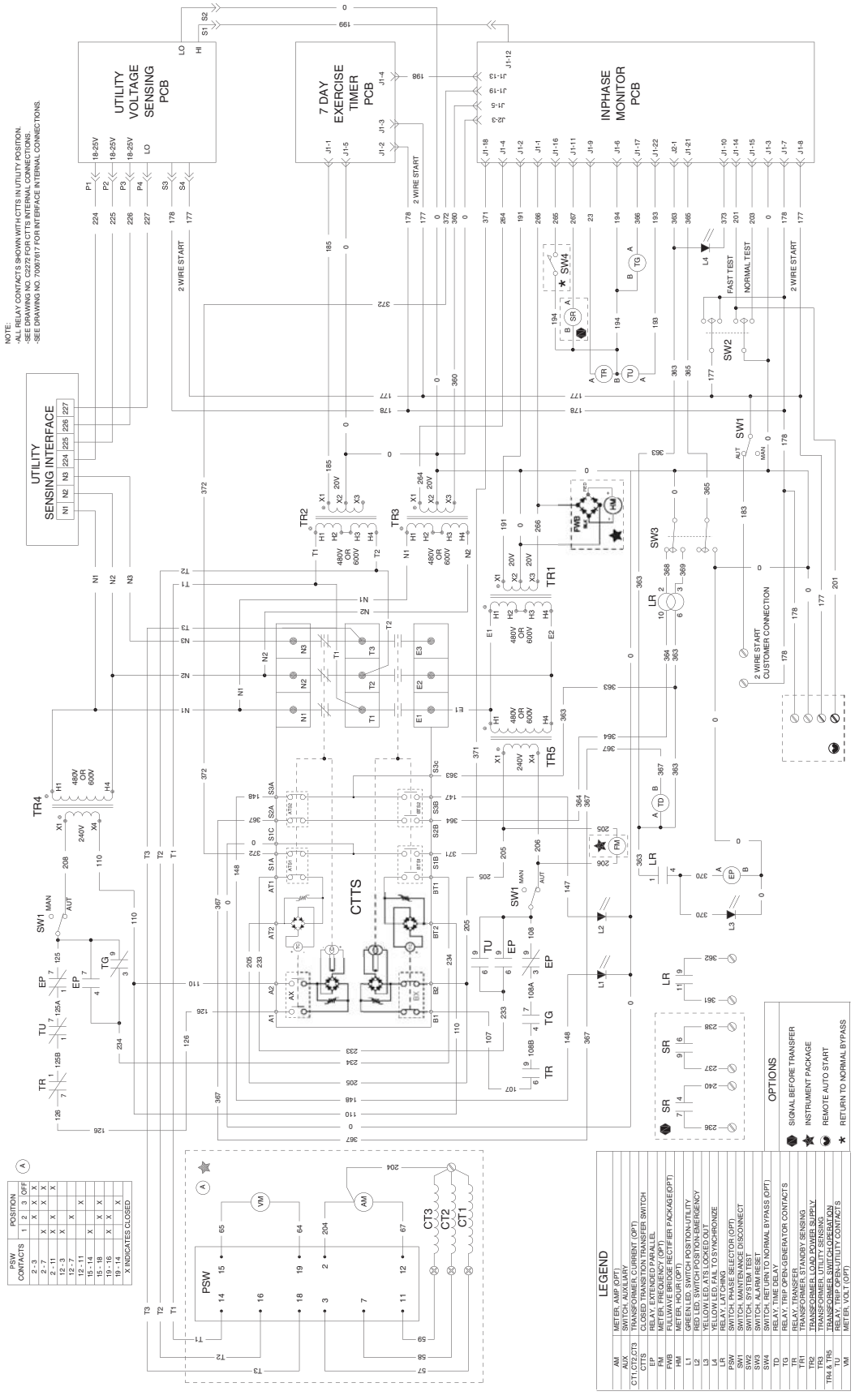


Wiring Diagram (416V 3-Phase, 4-Pole - Drawing No. C2278)

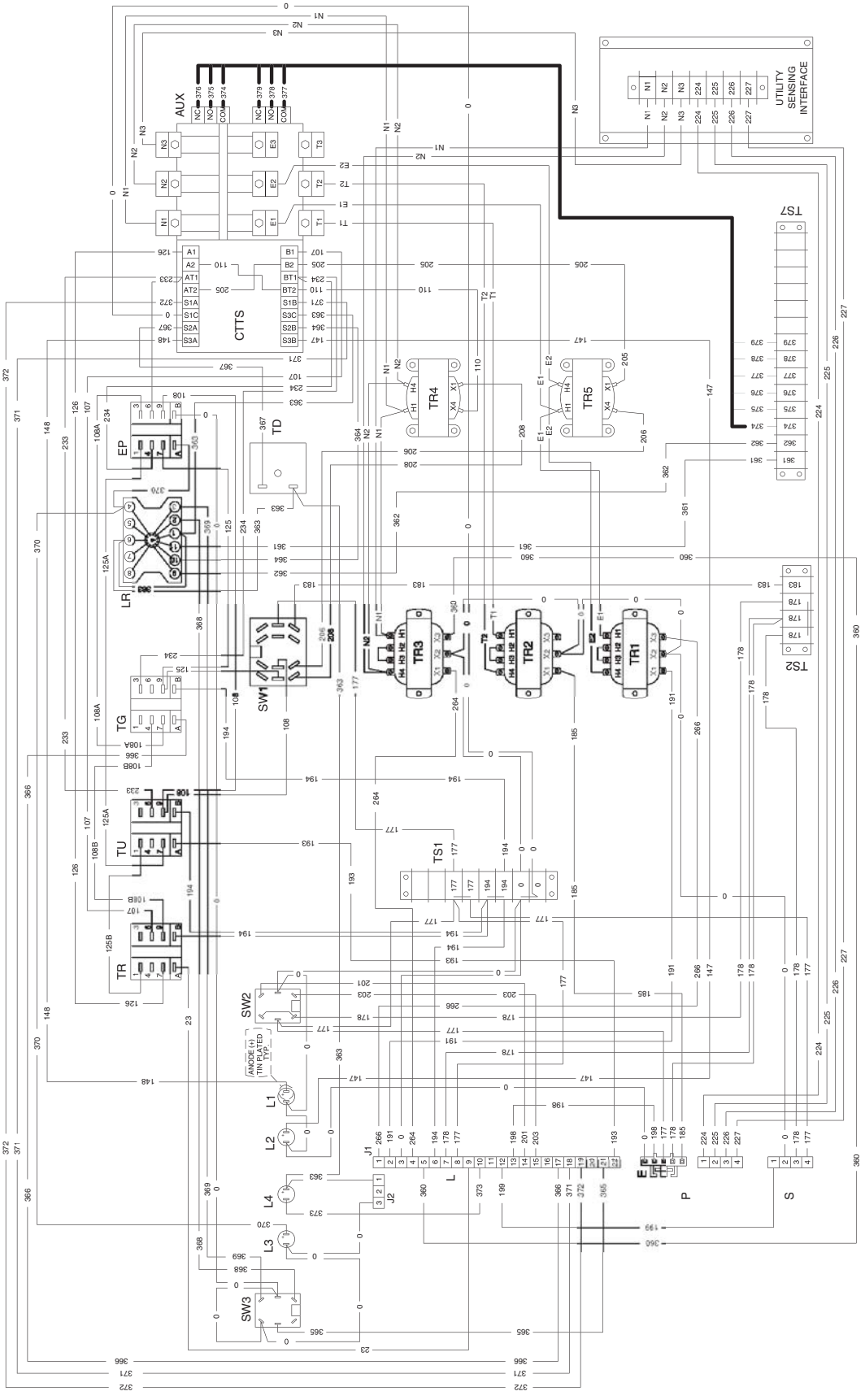


LEGEND	
AUX	SWITCH, AUXILIARY
CTTS	CLOSED TRANSITION TRANSFER SWITCH
E	CONNECTOR, 7 DAY EXERCISER PCB
EP	RELAY, EXTENDED PARALLEL
L	CONNECTOR, INPHASE MONITOR PCB
L1	GREEN LED, SWITCH POSITION-UTILITY
L2	RED LED, SWITCH POSITION-EMERGENCY
L3	YELLOW LED, ATS LOCKED OUT
L4	YELLOW LED, FAIL TO SYNCHRONIZE
LR	RELAY, LATCHING
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
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

Electrical Schematic (480/600V) - Drawing No. 0C2279-A



Wiring Diagram (480/600V) - Drawing No. C2275

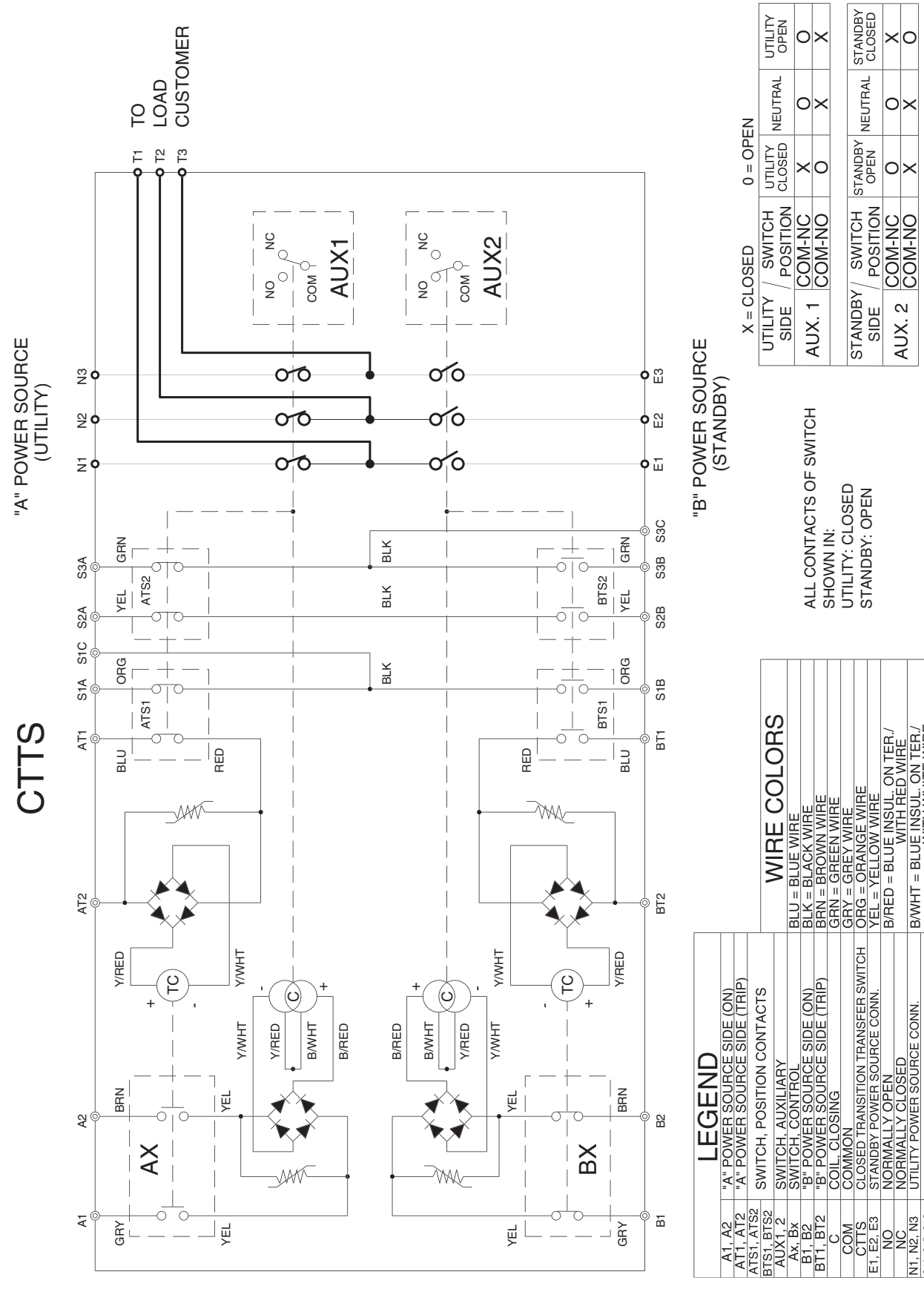


SW2	SWITCH, SYSTEM TEST
SW3	SWITCH, ALARM RESET
TD	RELAY, EXTENDED PARALLEL
TG	RELAY, TRIP OPEN-GENERATOR CONTACTS
TR1	TRANSFORMER, STANDBY SENSING
TR2	TRANSFORMER, LOAD POWER SUPPLY
TR3	TRANSFORMER, UTILITY SENSING
TR4, TR5	TRANSFORMER, SWITCH OPERATION
TR	RELAY, TRANSFER
TS1	TERM. STRIP
TS2	TERM. STRIP, 2 WIRE START
TS7	TERM. STRIP, CUSTOMER CONNECTION
TU	RELAY, TRIP OPEN-UTILITY CONTACTS

LEGEND

AUX	SWITCH, AUXILIARY
CTTS	CLOSED TRANSITION 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
P	CONNECTOR, UTILITY VOL. SENSING PCB
S	CONNECTOR, UTILITY VOL. SENSING PCB
SW1	SWITCH, MAINTENANCE DISCONNECT

Electrical Schematic (CTTS Contactor) - Drawing No. C2272-A



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
AUX. 1 COM-NO	O	X	X

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

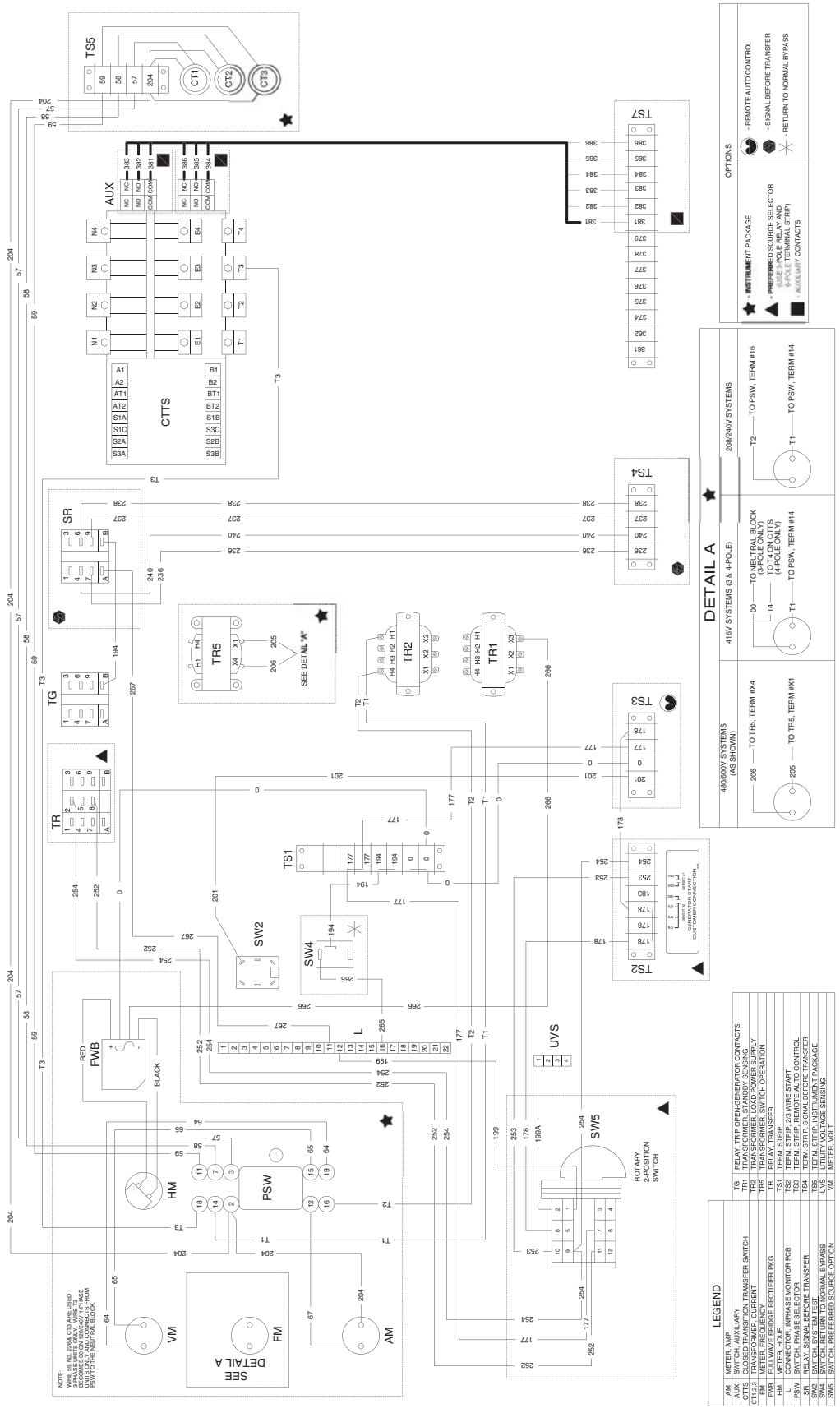
LEGEND

A1, A2	"A" POWER SOURCE SIDE (ON)
AT1, AT2	"A" POWER SOURCE SIDE (TRIP)
ATS1, ATS2	SWITCH, POSITION CONTACTS
BTS1, BTS2	
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.

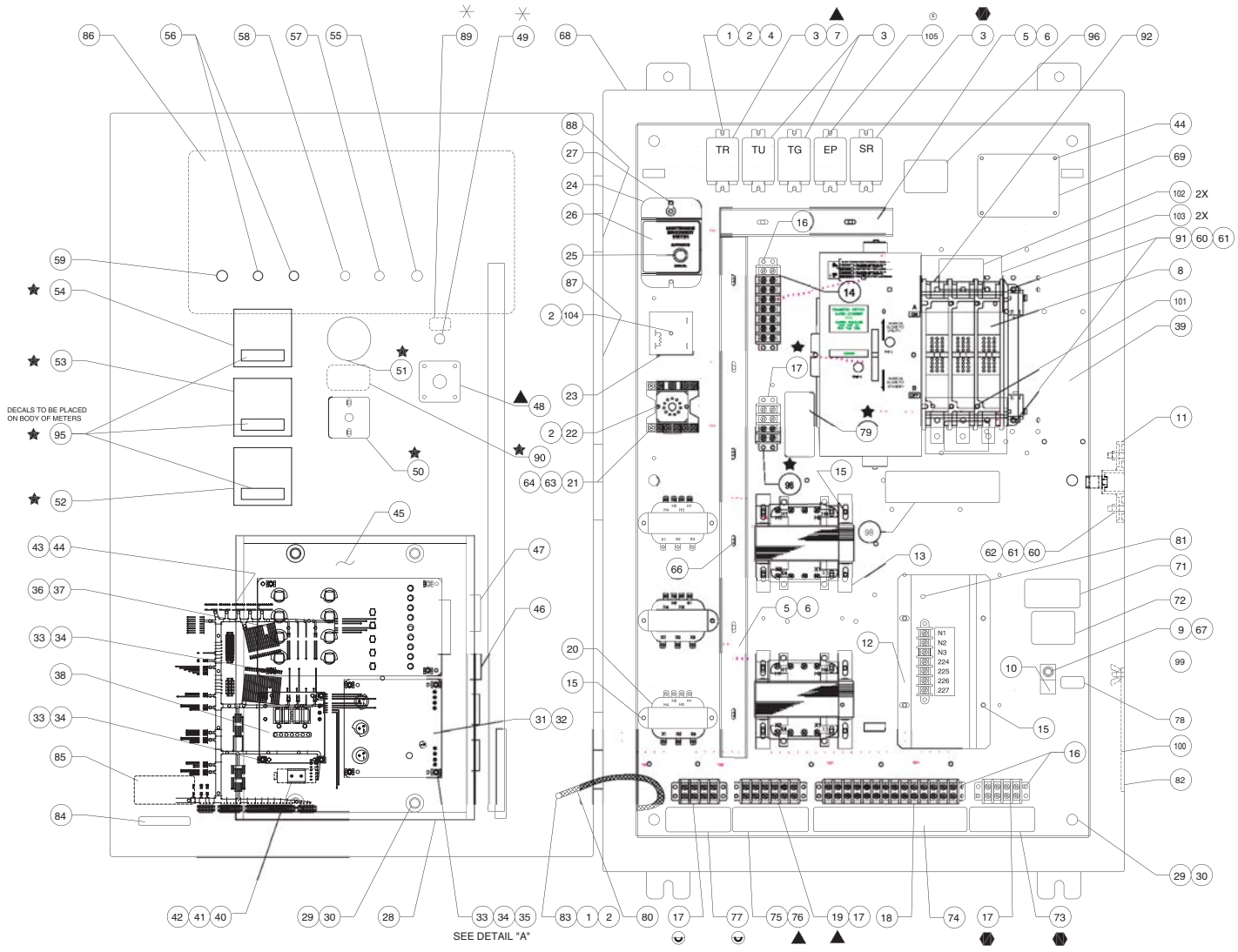
WIRE COLORS

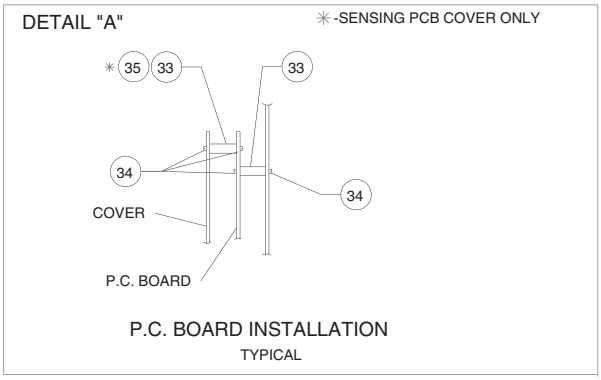
BLU = BLUE WIRE	
BLK = BLACK WIRE	
BRN = BROWN WIRE	
GRN = GREEN WIRE	
GRY = GREY WIRE	
ORG = ORANGE WIRE	
YEL = YELLOW WIRE	
B/RED = BLUE INSUL. ON TER./ WITH RED WIRE	
B/WHT = BLUE INSUL. ON TER./ WITH WHITE WIRE	
Y/RED = YELLOW INSUL. ON TER./ WITH RED WIRE	
Y/WHT = YELLOW INSUL. ON TER./ WITH WHITE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

Wiring Diagram (CTTS Contactor) - Drawing No. 0C2909-A



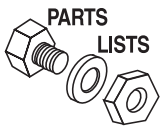
100A CTTS Assembly – Drawing No. 0C2286$-F





LEGEND

- ★ - INSTRUMENT PACKAGE
- ✳ - RETURN TO NORMAL BYPASS
- ▲ - PREFERRED SOURCE SELECTOR (USE 3-POLE RELAY AND 6-POLE TERMINAL STRIP)
- ◡ - REMOTE AUTO CONTROL
- ⬣ - SIGNAL BEFORE TRANSFER

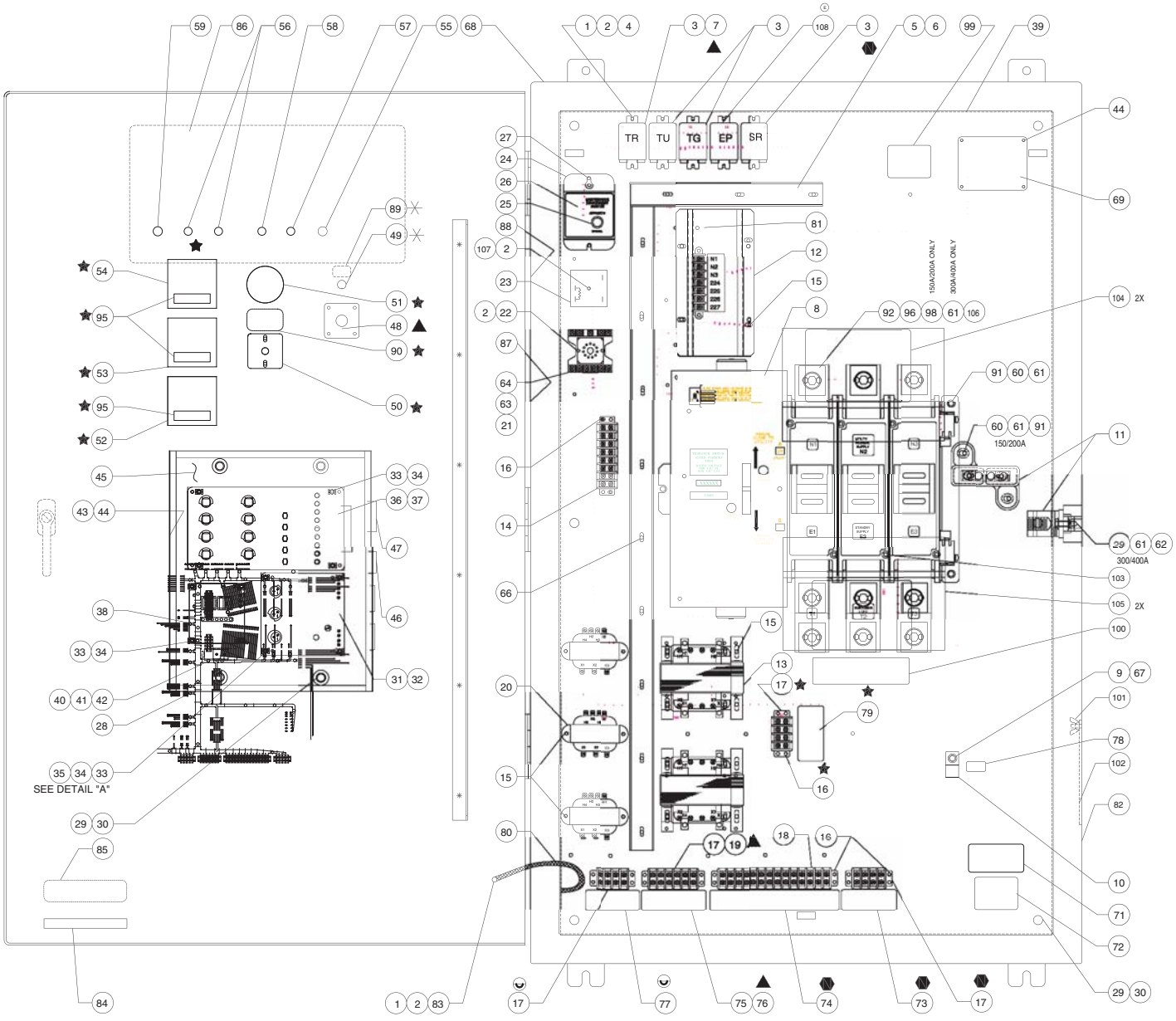


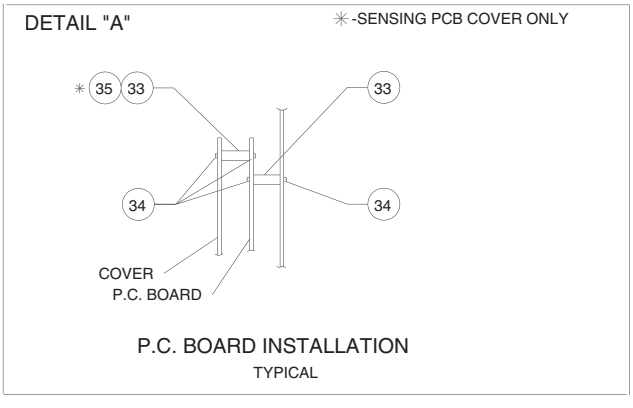
ITEM	PART NO.	QTY.	DESCRIPTION
1	038150	REF	WASHER FLAT #8 ZINC
2	022264	REF	WASHER LOCK M4
⬣3	063617	REF	RELAY PNL 12VDC DPDT 10A@240VA
4	0A2284	REF	SCREW SWAGE 8-32 X 1/2 Z/YC
5	091472A	REF	COVER WIRE DUCT 1 IN
6	091472	REF	DUCT WIRING 1X1.5 6 FT
▲7	057334	REF	RELAY PNL 12VDC 3PDT 10A FL MT
8	0C2268	1	CTTS-100A 3-POLE
	0C2269	1	CTTS-100A 4-POLE
9	024526	1	SCREW HHTT 5/16-18 X 3/4 BP
10	062684	1	LUG SLDLSS 2/0-#12 X 11/32 CU
11	0C4449	1	ASSY NEUTRAL BLOCK 100A
12	072158	1	INTRFC,3PHS 600V
	072160	1	INTRFC,3P 400V 50/60
	067617030A	1	INTRFC,3PHS 416/480V
	067617030B	1	INTRFC,3PHS 208/240V
	086961	1	INTRFC,1PH 240V
13	072162	2	TRANSFRM 600V TO 240V 200VA
	064126	2	TRANSFRM 240/480V-120/240V
14	057701	1	BLOCK TERM 20A 8 X 6 X 1100V
15	056893	-	CRMPTIT 10-24 X 1/2
16	0A1661	12	RIVET POP .156 X .160-.164/#20
⬣17	046689	REF	BLOCK TERM 20A 4 X 6 X 1100V
18	0C4167	1	BLOCK TERM 20A 14 X 6 X 1100V
▲19	046357	REF	BLOCK TERM 20A 6 X 6 X 1100V
20	090975	3	XFRMR 240/40V 25VA
	095394	3	XFRMR 600/40V 25VA
21	0C3211A	1	RELAY 10A DPDT W/SOCKET
22	0C4981	1	SCREW TAPTITE PH 8-32 X 1 Z/YC
23	0C3211D	1	RELAY SOLID STATE SPST
24	074509	1	BRACKET SWITCH
25	055868	1	SWITCH TOGGLE 4PDT 15A SPADE
26	0C3486	1	DECL-MAINT DISC CTTS
27	0A2111	2	SCREW SWAGE 10-32 X 5/16 Z/YC
28	0C1652	1	ENCLOSURE-PCB, NEW
29	022131	10	WASHER FLAT 3/8-M10 ZINC
30	064101	10	NUT LOCK FL 3/8-16
31	067616020A	1	ASS'Y-STNDSNS CVRPLT
32	067629	1	ASSY STANDARD SENSNG
33	064525	16	STANDOFF HEX 3/4
34	064526	40	SCREW TAP HWH #6-25 X 3/8 ZINC
35	068337	4	STANDOFF-HEX 1.00 LG
36	0C1977	1	ASSY CLSD TRANS XFER
37	0C3314A	1	ASSY COVER CTTS CNTL
38	0A8637	1	ASSY MK3 EXERCISER
39	0C3593	1	SBPL100A W/Y/C-XFRSW
40	063982	1	CLIP BATT-9V TRANSIS
41	029357	2	RIVET AVDEL3/32X1/8L
42	063998	1	BATTERY-9V TRANSISTR
43	0C1720	2	SD GUIDE-NEW PCB ENC
44	036261	8	RIVET POP .125 X .129-.133/#30
45	0C1721	1	DOOR, NEW PCB ENC
46	038057	1	GROMMET 7/8 X 1/16 X 3/4
47	072252	1	GROMMET 1.37 X .06 X 1.00
▲48	074613	1	SW 2POS SOURCE SELCT
✳49	072827	1	SWITCH TOG SPST 6A@125V SP MOM
★50	074386	1	SWITCH SELECT VOLT/AMP 3PH
★51	070081	1	HOURMETER
★52	070045	1	AMMETER AC 0-200
★53	070042	1	FREQUENCY METER 240V 55-65HZ
★54	070043	1	VOLTMETER AC 0-300
★	070044	1	VOLTMETER AC 0-600

ITEM	PART NO.	QTY.	DESCRIPTION
55	055142	1	SWITCH TOG DPDT 15A MOM W/SEAL
56	0C2163D	2	LED YEL FLASH WITH HOLDER
57	0C2163A	1	LED GRN WITH HOLDER
58	0C2163B	1	LED RED WITH HOLDER
59	0C4249	1	SWITCH TOGGLE DPST M/O-N-(O)
60	022473	REF	WASHER FLAT 1/4 ZINC
61	022097	REF	WASHER LOCK M6-1/4
62	022127	2	NUT HEX 1/4-20 STEEL
63	0C3211B	1	SOCKET RELAY 11P C3211A
64	0C3211C	1	SPRING RELAY RETAINING
65	0C2283	REF	WRG HARN-CTTS 100A (NOT SHOWN)
66	091477	8	RIVET, WIRE DUCT MNT
67	027482	1	WASHER SHAKEPROOF EXT 5/16 STL
68	0C3468	1	ENCL-NEM1 1-150A
	0C3468A	1	ENL W/IN-NEM1 1-150A
	OC3470	1	ENC W/IN-NEM12 1-150
	OC3470A	1	ENCL-NEM12 100A CTTS
	OC3471A	1	ENC W/IN-NEM3R 1-150
	OC3471	1	ENCL-NEM3R 1-150A
	OC3472A	1	ENC W/IN-NEM4 1-150A
	OC3472	1	ENCL-NEM4 1-150A
	OC3472C	1	ENL W/IN-NEM4X 1-150
	OC3472B	1	ENCL-NEM4X 1-150A
69	063578	1	PLATE DATA - GTS
70	064153A	REF	WIRE-XFMER JUMPER (NOT SHOWN)
71	083736	1	DECAL-CSA GTS (OPTIONAL)
72	062209	1	DECAL UL LABEL E84929-GTS
⬣73	075355	1	DECAL-SGNL BFR XFER
74	0C3937	1	DCL-CTTS AUX CONTACT
75	091466	1	DECAL 2 WR TERM STRP
▲76	098876	1	DECAL, DUAL START
◒77	074571	1	DECAL-REM. AUTO CNTR
78	067210A	1	DECAL GROUND LUG
★79	064114	1	DECAL-CUST CONN CTS
80	0536210193	1	GND WIRE-ENCLSR DOOR
81	063378	13	HOLDER CABLE TIE
82	0C3487	1	DECAL-MAN OPER CTTS
83	022471	2	NUT HEX #8-32 STEEL
84	077228	1	DECAL-ENCLOSURE NOTE
85	095282	1	DECAL-LIVE CIRCUIT
86	0C2282	1	DECAL-ENCLSR CTTS
	0C8133	1	DECAL-CTTS DR-IN-DR
87	063385B	1	DECAL-SWITCH INFO, CTTS
88	073619B	1	DECAL-TEST SEQ 100WN
	095089H	1	DECAL 600V100A W/WN
✳89	075369	1	DECAL-RET NML BYPASS
★90	0C2603	1	DECAL PH SELECT A/V
91	090388	3	SCREW HHTT M6-1.0 X 12 YC
92	099084	REF	LUG SLDLSS 2/0-#6X21/64 AL/CU
★95	0C4895	4	DECAL SHOCK HAZARD
96	054199	1	DECAL HIGH VOLTAGE
★97	064117	2	TRANSFRM 200A TO 5A 4VA (NOT SHOWN)
98	064510	1	DECAL-TERMINAL NOTE
99	025870	1	NUT WING 1/4-20
100	063321	1	HANDLE XFER SWITCH 1-400A
101	0C8275	4	SCREW PPHM DSEMS M4-7 X 10 ZNC
102	0C8308	2	DECAL TERMINAL SHOCK HAZARD
103	0C7907B	2	COVER LUG 3P 100AMP
	0C7907C	2	COVER LUG 4P 100AMP
104	0D5509	2	SCREW PHTT #8-32 X 1.25 ZYC
105	081767	1	RELAY PNL 24VDC DPDT 10A

Generac GTS "CTTS" Type Transfer Switch

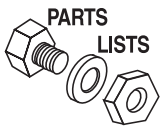
150-400A CTTS Assembly – Drawing No. 0C2286$-F





LEGEND

- ★ - INSTRUMENT PACKAGE
- ✳ - RETURN TO NORMAL BYPASS
- ▲ - PREFERRED SOURCE SELECTOR (USE 3-POLE RELAY AND 6-POLE TERMINAL STRIP)
- ◡ - REMOTE AUTO CONTROL
- ⬢ - SIGNAL BEFORE TRANSFER



150-400A CTTS Assembly – Drawing No. 0C2286$-F

ITEM	PART NO.	QTY.	DESCRIPTION
1	038150	REF	WASHER FLAT #8 ZINC
2	022264	REF	WASHER LOCK M4
⬣3	063617	REF	RELAY PNL 12VDC DPDT 10A@240VA
4	0A2284	REF	SCREW SWAGE 8-32 X 1/2 Z/YC
5	091472A	REF	COVER WIRE DUCT 1 IN
6	091472	REF	DUCT WIRING 1X1.5 6 FT
▲7	057334	REF	RELAY PNL 12VDC 3PDT 10A FL MT
8	0C2874	1	CTTS CNTCTR 150A 3P
	0C2875	1	CTTS CNTCTR 150A 4P
	0C1166	1	CTTS SW-C 200A 600V 3P
	0C2270	1	CTTS-200A 4-POLE
	0C2876	1	CTTS CNTCTR 300A 3P
	0C2877	1	CTTS CNTCTR 300A 4P
	0C1165	1	CTTS SW-C 400A600V3P
	0C2271	1	CTTS-400A 4-POLE
9	024526	1	SCREW HHTT 5/16-18 X 3/4 BP
10	057329	1	LUG SLDLSS 350-#6X13/32 AL/CU
11	0C4449A	1	ASS'Y-NTRL BL150-200A
	0C2162	1	ASSY-NEUT BLK 300-400A
12	072158	1	INTRFC,3PHS 600V
	072160	1	INTRFC,3P 400V 50/60
	067617030A	1	INTRFC,3PHS 416/480V
	067617030B	1	INTRFC,3PHS 208/240V
	086961	1	INTRFC,1PH 240V
13	072162	2	TRANSFRM 600V TO 240V 200VA
	064126	2	TRANSFRM 240/480V-120/240V
14	057701	1	BLOCK TERM 20A 8 X 6 X 1100V
15	056893	REF	CRMPTIT 10-24 X 1/2
16	0A1661	12	RIVET POP .156 X .160-.164/#20
⬣17	046689	REF	BLOCK TERM 20A 4 X 6 X 1100V
★18	0C4167	1	BLOCK TERM 20A 14 X 6 X 1100V
▲19	046357	REF	BLOCK TERM 20A 6 X 6 X 1100V
20	090975	3	XFRMR 240/40V 25VA
	095394	3	XFRMR 600/40V 25VA
21	0C3211A	1	RELAY 10A DPDT W/SOCKET
22	0C4981	1	SCREW TAPTITE PH 8-32 X 1 Z/YC
23	0C3211D	1	RELAY SOLID STATE SPST
24	074509	1	BRACKET SWITCH
25	055868	1	SWITCH TOGGLE 4PDT 15A SPADE
26	0C3486	1	DECL-MAINT DISC CTTS
27	0A2111	2	SCREW SWAGE 10-32 X 5/16 Z/YC
28	0C1652	1	ENCLOSURE-PCB, NEW
29	022131	REF	WASHER FLAT 3/8-M10 ZINC
30	064101	10	NUT LOCK FL 3/8-16
31	067616020A	1	ASS'Y-STNDSNS CVRPLT
32	067629	1	ASSY STANDARD SENSNG
33	064525	16	STANDOFF HEX 3/4
34	064526	40	SCREW TAP HWH #6-25 X 3/8 ZINC
35	068337	4	STANDOFF-HEX 1.00 LG
36	0C1977	1	ASSY CLSD TRANS XFER
37	0C3314A	1	ASSY COVER CTTS CNTL
38	0A8637	1	ASSY MK3 EXERCISER
39	0C3938	1	SBPL15-400A W/Y/C-SW
40	063982	1	CLIP BATT-9V TRANSIS
41	029357	2	RIVET AVDEL3/32X1/8L
42	063998	1	BATTERY-9V TRANSISTR
43	0C1720	2	SD GUIDE-NEW PCB ENC
44	036261	8	RIVET POP .125 X .129-.133/#30
45	0C1721	1	DOOR, NEW PCB ENC
46	038057	1	GROMMET 7/8 X 1/16 X 3/4
47	072252	1	GROMMET 1.37 X .06 X 1.00
▲48	074613	1	SW 2POS SOURCE SELCT
✳49	072827	1	SWITCH TOG SPST 6A@125V SP MOM
★50	074386	1	SWITCH SELECT VOLT/AMP 3PH
★51	070081	1	HOURMETER
★52	070057	1	AMMETER AC 0-300
	070058	1	AMMETER AC 0-400
	070059	1	AMMETER AC 0-600
★53	070042	1	METER FREQUENCY 55-65HZ
★54	070043	1	VOLTMETER AC 0-300
★	070044	1	VOLTMETER AC 0-600
55	055142	1	SWITCH TOG DPDT 15A MOM W/SEAL
56	0C2163D	2	LED YEL FLASH WITH HOLDER
57	0C2163A	1	LED GRN WITH HOLDER
58	0C2163B	1	LED RED WITH HOLDER
59	0C4249	1	SWITCH TOGGLE DPST M/O-N-(O)
60	022473	REF	WASHER FLAT 1/4 ZINC
61	022097	REF	WASHER LOCK M6-1/4
	022237	2	WASHER LOCK 3/8
62	022241	2	NUT HEX 3/8-16 STEEL
63	0C3211B	1	SOCKET RELAY 11P C3211A
64	0C3211C	1	SPRING RELAY RETAINING
65	0C2284	1	WRG HARN-CTTS 2-400A (NOT SHOWN)
66	091477	13	RIVET, WIRE DUCT MNT
67	027482	1	WASHER SHAKEPROOF EXT 5/16 STL
68	0C3474	1	ENCL-NEM1 15-400A
	0C3474A	1	ENLW/IN-NEM1 15-400A
	0C3475A	1	ENCL-NEM12 15-400A
	0C3475	1	ENLW/IN-NEM12 15-400
	OC3477	1	ENCL-NEMA,3R,GTS,150-400A
	0C3477A	1	ENLW/IN-NEM3R 15-400
	0C3478	1	ENCL-NEM4 15-400A
	OC3478A	1	ENLW/IN-NEM4 15-400A
	OC3478B	1	ENCL-NEM4X 15-400A
	OC3478C	1	ENLW/IN-NEM4X 15-400
69	063578	1	PLATE DATA - GTS
70	064153A	REF	WIRE-XFMER JUMPER (NOT SHOWN)
71	083736	1	DECAL-CSA GTS
72	062209	1	DECAL UL LABEL E84929-GTS
⬣73	075355	1	DECAL-SGNL BFR XFER
74	0C3937	1	DCL-CTTS AUX CONTACT
75	091466	1	DECAL 2 WR TERM STRP
▲76	098876	1	DECAL, DUAL START
◒77	074571	1	DECAL-REM. AUTO CNTR
78	067210A	1	DECAL GROUND LUG
★79	064114	1	DECAL-CUST CONN CTS
80	0536210193	1	GND WIRE-ENCLSR DOOR
81	063378	15	HOLDER CABLE TIE
82	0C3487	1	DECAL-MAN OPER CTTS
83	022471	2	NUT HEX #8-32 STEEL
84	077228	1	DECAL-ENCLOSURE NOTE
85	095282	1	DECAL-LIVE CIRCUIT
86	0C2282	1	DECAL-ENCLSR CTTS
	0C8133	1	DECAL-CTTS DR-IN-DR
87	063385B	1	DECAL-SWITCH INFO, CTTS
88	073619N	1	DECAL-TEST SEQ150AWN
	073619C	1	DEC-TEST SEQ200AW/WN
	073619P	1	DECAL-TEST SEQ 300 W
	073619S	1	DECAL-TEST SEQ 400 B
	095089J	1	DCL 600V150/200AW/WN
	095089K	1	DECAL 600V100A W/WN
	095089L	1	DECAL 600V400A W
✳89	075369	1	DECAL-RET NML BYPASS
★90	0C2603	1	DECAL PH SELECT A/V
91	074906	REF	SCREW HHTT M6-1.0 X 20 BP
92	0A9949	REF	LUG SLDLSS 400-#4X1/4-20 CU7AL
	0A7822	REF	LUG SLDLSS 600/250-1/0X1/4-28
★95	0C4895	4	DECAL SHOCK HAZARD
96	0C4896	REF	SCREW FHMS M8-1.25 X 20MM CR
	0A8261	REF	SCREW HHC 1/4-28 X 5/8 .625TH
★97	064118	REF	TRNSFRM 300A TO 5A 7.5VA (NOT SHOWN)
	064119	REF	TRNSFRM 400A TO 5A 10VA (NOT SHOWN)
	064120	REF	TRNSFRM 600A TO 5A 15VA (NOT SHOWN)
98	067989	REF	NUT LOCK FL M8-1.25 YEL CHR
	XXX	REF	N/A 300A/400A
99	054199	1	DECAL HIGH VOLTAGE
100	064510	1	DECAL-TERMINAL NOTE
101	025870	1	NUT WING 1/4-20
102	063321	1	HANDLE XFER SWITCH 1-400A
103	0C8275	4	SCREW PPHM DSEMS M4-7 X 10 ZNC
104	0C8308	1	DECAL TERMINAL SHOCK HAZARD
105	0C7907D	2	COVER LUG 3P 150/200AMP
	0C7907E	2	COVER LUG 4P 150/200AMP
	0C7907F	2	COVER LUG 3P 300/400AMP
	0C7907G	2	COVER LUG 4P 300/400AMP
106	026902	7	SCREW HHTT #8-32 X 1/4 BP
107	0D5509	2	SCREW PHTT #8-32 X 1.25 ZYC
108	081767	1	RELAY PNL 24VDC DPDT 10A

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, and 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.

GENERAC® POWER SYSTEMS, INC. · P.O. BOX 8 · WAUKESHA, WI 53187
PH: (262) 544-4811 · FAX: (262) 544-4851

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