

# Operation & Maintenance Manual

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## **Caterpillar Automatic Transfer Switch (Contactor Type)**

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9Y-7900

Operation, Maintenance, Parts And  
Troubleshooting Information Included

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## Foreword

This manual contains safety precautions, operation instructions, maintenance instructions, parts and troubleshooting information.

Some illustrations in this publication show details or attachments that may be different from your transfer switch. Also guards and covers may have been removed for illustrative purposes.

Continuing improvement and advancement of product design may have caused changes to your switch which are not included in this publication.

Whenever a question arises regarding your transfer switch, or this publication, please consult your Caterpillar dealer for the latest available information.

### Operation

The operation section is a reference for the new operator and a refresher for the experienced one. Read-study-and keep it handy.

Illustrations guide the operator through correct procedures of checking, starting, operating and stopping the switch.

Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the switch and its capabilities.

### Maintenance

The maintenance section is a guide to equipment care. The illustrated, step-by-step instructions guide the operator through the necessary maintenance and care of the transfer switch.

### Parts

The parts information section provides the operator with various locations and availability of replacement parts.

### Troubleshooting

The troubleshooting section is provided as an aid for the serviceman in locating the cause of existing problems. Several possible problems are covered in the manual.

## Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

**Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.**

**Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.**

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "WARNING" as shown below.



The meaning of this safety alert symbol is as follows:

**Attention! Become Alert! Your Safety is Involved.**

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this publication are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. Caterpillar dealers have the most current information available. For a list of the most current publication form numbers available, see the Service Manual Contents Microfiche, REG1139F.



# Safety

## Warning Signs And Labels

There are several specific safety signs on your transfer switch. Their exact location and description of the hazard are reviewed in this section. Please take the time to familiarize yourself with these safety signs.

Make sure that you can read all safety signs. Clean and replace these if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc.

You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part. See your Caterpillar dealer for new labels.



### WARNING

**Do not operate the equipment unless you have read and understand the instructions in this manual. Improper operation is dangerous and could result in injury or death. Contact any Caterpillar dealer for a replacement guide. Proper operation is your responsibility.**

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## Installation

All electrical equipment supplied by Caterpillar should be installed in accordance with the Application and Installation Manual, form LEBX5048 and conform to national and local electrical codes of the area and county where the equipment is operating.

Any generator that is used for backup power in the event of a normal power source failure must be installed in conjunction with a transfer switch. Failure to isolate the normal and standby power sources from each other may result in damage to the standby generator and may also result in injury or death to electric utility workers, due to backfeed of electrical energy.

Improper or unauthorized installation, operation or repair of this equipment is extremely dangerous and may result in death, serious personal injury, or damage to equipment and/or property.

## General Hazard Information

Do not allow unauthorized or untrained personnel on or near equipment.

Do not wear loose clothing or jewelry while working around equipment.

Stop the engine before making adjustments or repairs to the engine or generator transfer switch unless otherwise specified.

Be sure the remote starting system is inoperative on the equipment being serviced.

Disconnect and tape the battery ground lead or move the automatic start-up switch to the STOP position before working on the equipment. Doing this will prevent accidental starting.

To prevent injury, install guards over all exposed drive shafts, pulleys and any application with exposed rotating parts.

Always use tools that are in good condition and be sure you understand how to use them before performing any service work. Remove all tools, electrical cords and any other loose items from the engine before starting.

Engine speeds, temperatures and load are the best indications of performance. Rely on your instruments, record and compare readings to detect developing abnormalities.

Wear a hard hat, face shield, clothing, shoes, respirator or other protective items when necessary.

When using pressure air, always use approved safety equipment.

To prevent hearing damage, wear ear protective devices if working inside an enclosed engine room with engine running.

Never work on this equipment while physically or mentally fatigued.

Keep the transfer switch door closed and locked at all times. Only authorized personnel should be permitted access to any transfer switch interior.

When this automatic transfer switch is installed in conjunction with a standby generator set, the engine generator may crank and start at any time without warning. To prevent possible injury that might be caused by such sudden startup, the system's automatic start circuit must be turned off before working on equipment. For that purpose, a MAINTENANCE DISCONNECT SWITCH is provided inside the transfer switch enclosure. Always set that switch to its MANUAL position before working on equipment. Then, place a "DO NOT OPERATE" tag on the transfer switch and on the generator.

### **Climbing**

Some engines in permanent installations may require the use of climbing equipment to provide access for normal routine maintenance. It is the responsibility of the owner and/or user to provide access which conforms to SAE J185 and/or local building codes.

Keep all climbing equipment, ladders, stairs, platforms clean and free of slippery surfaces and tripping hazards.

Secure the climbing equipment so it will not move or fall while in use.

Never jump from an elevated platform, ladder, or stairs.

Maintain all climbing equipment so it is in safe operating condition.

### **Fire Or Explosion Prevention**

Be sure the engine room is properly ventilated.

Keep the engine room and floor area clean.

Observe NO SMOKING signs. Do not smoke around batteries. Hydrogen gas generated by charging batteries is explosive. Keep batteries in a well ventilated area.

Never store flammable liquids near the engine.

Store oily rags in metal covered containers.

Always have a fire extinguisher on hand and know how to use it. Inspect and have it serviced as recommended on its instruction plate or label.

Do not use carbon tetrachloride fire extinguishers. Fumes are toxic and the liquid has a deteriorating effect on insulation.

### **Electrical Shock Prevention**

All electrical equipment must be grounded according to local building codes.

Always disconnect the engine starter circuit when working on the generator.

Be sure all electrical power is disconnected from electrical equipment being serviced.

Do not work on electrically "hot" equipment.

Do not touch the heat sink on the generator regulator when the generator is running. It is electrically "hot."

Check all connections periodically for tightness and insulation.

Insulate all connections and disconnected wires.

Keep all electrical equipment clean and dry.

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 hazardous and possibly lethal electrical shock. Do not work on the transfer switch until all sources of power supply to the switch have been positively turned off.

Jewelry conducts electricity and 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 insulated mats over a dry wood platform. Work on this equipment only while standing on such insulated mats.

### **Burn Prevention**

Do not touch any part of an operating generator. Allow the generator to cool before any repairs are performed.

### **Preparing to Start**

Be sure all protective guards and covers are installed if an engine must be started to make adjustments or checks. To help prevent an accident caused by parts in rotation, work carefully around them.

## **Starting**

Do not start the engine or move any of the controls if there is a warning tag attached to the controls.

Make sure no one is working on, or close to the engine or engine driven components, before starting it.

Start and operate the engine in a well ventilated area. If it is necessary to operate in a closed area, vent the exhaust to the outside.

Never handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet. Dangerous electrical shock will result.

## Purpose And Scope Of Manual

This manual has been prepared especially for the purpose of familiarizing personnel with the design, application, installation and operation of the applicable equipment.

Read the manual carefully and comply with all instructions. This will help prevent accident or damage to equipment that might be caused by carelessness, improper application, incorrect installation, or improper or unsafe operating procedures.

Every effort has been expended to ensure that the information in this manual is both accurate and current. However, the manufacturer reserves the right to change, alter, or otherwise improve his product at any time without prior notice.

### Why A Transfer Switch Is Needed

Whenever a STANDBY power source is to be used to power electrical loads that are normally powered by a NORMAL power source, installation of a transfer switch is required by electrical code. The transfer switch prevents electrical feedback between the two different power sources.

An automatic transfer switch is a device used for the purpose of transferring critical electrical loads from a NORMAL power source to a STANDBY power source. Such transfer occurs automatically when the NORMAL power source has failed or is substantially reduced and the STANDBY source voltage and frequency have reached an acceptable (pre-set) level.

### Transfer Switch Data Plate

CATERPILLAR TRANSFER SWITCH			
CATERPILLAR MODEL NO.	<input type="text"/>		
	<small>(AS SELECTED FROM CHART 9Y7400)</small>		
CATERPILLAR NUMERICAL CODE	<input type="text"/>	S.O. NUMBER	<input type="text"/>
SERIAL NO.	<input type="text"/>		
SWITCH RATING	<input type="text"/> AMPS	<input type="text"/> VOLT	<input type="text"/> HZ
<small>(DATA AS REQUIRED TO MEET UL1008)</small>			

A Data Plate is prominently affixed to the transfer switch enclosure.

The Data Plate lists System Frequency, Switch Rated Amps, Switch Rated Volts, Serial Number and Model Number.

Use the transfer switch only within the amperage and voltage limits shown on the Data Plate. When ordering parts always include all information from the Data Plate.

## Transfer Switch Selection

The transfer switch must be properly coordinated with the rest of the electrical distribution system. That is, the switch must be carefully selected on the basis of the voltage, continuous current, frequency, short circuit capabilities, etc., of the distribution system in which it is used.

The continuous current rating of the switch should be determined on the basis of both the NORMAL and STANDBY electrical loads being supplied. When coordinating a transfer switch with the rest of the electrical distribution system, the following factors are especially important.

1. The transfer switch must be capable of carrying full load currents and must also be able to withstand the thermal and electromagnetic effects of the available short circuit currents.
2. Transfer equipment and associated wiring must be provided with suitable protective devices (circuit breakers or fuses). Such over-current protective devices must be properly coordinated to permit them to clear a fault without extensive damage to other circuit components.

Under abnormal operating conditions where a fault exists between the transfer switch and load, the switch may be subjected to withstand, closing and interrupting conditions as follows.

1. Withstand – With the switch closed to the NORMAL power source, it must be able to withstand the energy let-through of the NORMAL source circuit breaker or fuse while that device interrupts the fault.
2. Closing – The transfer switch might “close in” on a fault and would then require a closing rating.
3. Interrupting – If NORMAL source voltage has dropped below an acceptable level and STANDBY source power is available, the switch could transfer before the NORMAL source protective device clears the fault. This would require that the switch be capable of interrupting the fuse or circuit breaker’s let-through current.

The installation engineer must ensure the correct transfer switch is installed for any given application. If assistance is needed in selecting a transfer switch, contact your nearest Caterpillar dealer.

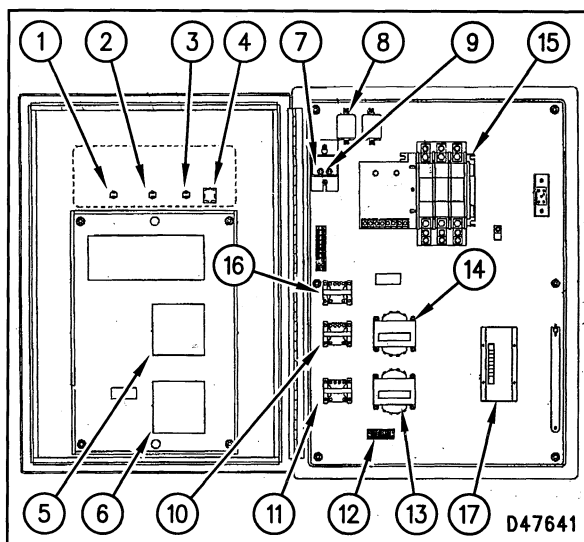
The transfer switch utility voltage sensing circuit constantly monitors NORMAL power source voltage. Should that source voltage drop below an acceptable, pre-set value and remain at such a low state for a pre-set time, closure of a start circuit will signal an automatic startup of the STANDBY engine-generator.

When the standby engine-generator AC output voltage and frequency have reached an acceptable (pre-set) level and following an optional pre-set engine warmup period, a microprocessor type circuit board will signal a transfer of the LOAD circuits to the STANDBY power source.

The utility voltage sensing circuit will continue to monitor NORMAL source voltage and, when that source voltage has been restored to an acceptable, pre-set level, will signal a re-transfer back to the NORMAL source.

Following re-transfer, and when the engine cooldown timer has timed out, circuit board action will open the start circuit and signal the standby engine-generator to shut down.

## General Components



A typical transfer switch (200 to 400 amp) is shown above. Components are housed inside a standard NEMA 1 enclosure for switches rated 400 amps and below. A NEMA 1 enclosure is a general purpose enclosure for use in clean, dry environments (the enclosure does not have door gaskets).

For switches rated more than 400 amps, a NEMA 12 enclosure is provided as standard. NEMA 12 enclosures are non-ventilated, dust-tight and drip-tight. Type 12 enclosures are intended for use indoors to protect the enclosed equipment against fibers, filings, lint, dust, dirt, light splashing, seepage, and external condensation of non-corrosive liquids.

In order to maintain the NEMA 12 enclosure, no holes through the enclosure, no conduit knockouts or conduit openings are permitted. Oil-tight or dust-tight mechanisms may be mounted through holes in the enclosure when provided with oil resistant gaskets. Enclosure doors have been factory equipped with oil resistant gaskets.

NOTE: Some transfer switches may have an optional NEMA 3R enclosure. See "Transfer Switch Options" in this manual.

### Transfer Switch Major Components (Typical 200 To 400 amp)

**Switch Position-Normal Indicator Light (1)** – Clear light comes on to indicate that load circuits are connected to the normal power source side. Also see transformer T2 (10) and auxiliary contacts on transfer mechanism (15).

**Switch Position-Standby Indicator Light (2)** – Red light comes on to indicate that load circuits are connected to the standby power source side. Also see transformer T2 (10) and auxiliary contacts on transfer mechanism (15).

**Standby Operating Indicator Light (3)** – Amber light comes on to indicate the standby generator has started and is running. Also see transformer T1 (11).

**Operating Mode Switch SW2 (4)** – Use this 3-position switch to select normal automatic operation or any of two different test modes, as follows:

- 1. Automatic Mode** – Set switch to this position for normal automatic operation. With AUTOMATIC MODE selected, the system will monitor normal source voltage. Any drop in that source voltage below a pre-set value and for a pre-set time interval will result in an automatic standby generator startup signal and transfer of load circuits to the standby power source, when conditions are correct.

- 2. Normal Test Mode** – Setting the switch to NORMAL TEST position will simulate a loss of normal source voltage, and will result in an automatic standby generator startup signal and transfer to the standby power source, just as though an actual normal source failure has occurred.

NOTE: When the switch is reset back to the AUTOMATIC MODE, re-transfer to the normal source and standby generator signal shutdown will occur as pre-set by system circuit board sensors and timers.

- 3. Fast Test Mode** – Switch is spring-loaded back to the AUTOMATIC MODE position, must be held at FAST TEST. When this switch position is selected, standby generator startup signal and transfer to the standby source will occur with all system timers bypassed (within less than 5 seconds). When the switch is released, re-transfer back to the normal source and standby generator shutdown will occur as pre-set by circuit board sensors and timers.

## Transfer Switch Major Components Section

### General Components

**Microprocessor Based Control Circuit Board (5)** – Often called a “CPU” or “Logic” circuit board, this solid state circuit board incorporates sensors and timers (not adjustable) which control system automatic operation.

In addition, the circuit board includes a 7-Day Exercise Timer circuit, which provides an automatic standby generator startup signal and exercise function. Such exercise will occur once every 7 days, on a day and at a time of day selected by the customer.

NOTE: Some transfer switches may be equipped with an optional In-Phase Monitor or Programmable Logic circuit board. These units have sensors and timers that are programmable (adjustable) by means of adjustable potentiometers. Units with the In-Phase Monitor or Programmable Logic circuit board will have a separate 7-Day Exerciser circuit board. See “Sensor and Timer Adjustments” and “Transfer Switch Options” sections of this manual.

**Utility Voltage Sensor Circuit Board (6)** – This solid state circuit board constantly monitors normal power source voltage.

The board mounts a voltage dropout sensor, voltage pickup sensor and a line interrupt delay timer. Should normal source voltage drop below the setting of the voltage dropout sensor and remain at such a low state for longer than the setting of the line interrupt delay timer, automatic standby generator startup signal will occur. This will be followed by transfer of load circuits to the standby source (as controlled by sensors and timers on the Microprocessor Based, the In-Phase Monitor or the Programmable Logic Control circuit board).

The board mounts a UTILITY ON light (LED), which is on when acceptable normal source voltage is available. See “Sensor and Timer Adjustments”.

**Time Delay Neutral On/Off Switch SW3 (7)** – The transfer switch provides a “time delay neutral” feature, which extends the normal main contacts disconnect (tripped) time during any transfer action. This time delay at neutral is a period of time during which the load is disconnected from both power sources. Such disconnect time permits residual voltages that might be generated by heavy inductive loads to decay to a safe level prior to reconnecting the main contacts.

Extending the normal disconnect (tripped) time provides some protection against nuisance tripping of circuit breakers or blowing of fuses that might otherwise occur during rapid transfer of motor and other heavy inductive loads. On units with the standard Microprocessor Based Control circuit board, time delay at neutral is fixed at 5 seconds. On units with optional In-Phase Monitor board or Programmable Logic board, the time delay is adjustable between 0.1 and 10 seconds. See “Sensor and Timer Adjustments”.

The Time Delay Neutral On/Off switch permits the operator to turn the time delay feature on or off.

**Transfer Relay TR (8)** – Transfer Relay operation is controlled by the Microprocessor Based Control circuit board (or by the optional In-Phase Monitor board or Programmable Logic board, as applicable).

Following standby generator startup and when standby source voltage and frequency have reached an acceptable level, the Microprocessor Based Control (or In-Phase Monitor or Programmable Logic) circuit board action will complete the circuit to the Transfer Relay actuating coil. The Transfer Relay will then energize, its normally-open (N.O.) contacts will close and its normally-closed (N.C.) contacts will open.

On closure of the Relay’s normally-open contacts, standby source voltage will be delivered to Transfer Mechanism terminals B1 and B2 (making command to the standby power source side). At the same time, the normally-closed contacts will open, to break the circuit to Transfer Mechanism terminals A1 and A2 (taking command away from the normal source side). Transfer to the STANDBY source side will then occur.

On restoration of NORMAL source voltage, System Central Control (or System Control) circuit board action will open the Transfer Relay actuating circuit. The Relay will then de-energize; standby voltage to Transfer Mechanism terminals B1 and B2 will be interrupted; and normal source power will be connected to Transfer Mechanism terminals A1 and A2. Re-transfer back to the normal source side will then occur.

**Maintenance Disconnect Switch SW1 (9)** – This safety switch permits the Transfer Mechanism main contacts actuating coil and the standby generator automatic start circuit to be effectively isolated from all automatic start and transfer signals. To prevent automatic standby generator startup, set the switch to MANUAL. For fully automatic system operation, set the switch to AUTOMATIC. With the switch set to MANUAL, the following circuit conditions will be established.

1. The NORMAL source circuit to Transfer Mechanism terminals A1 and A2 will be opened, making transfer to that source impossible.
2. The STANDBY source circuit to Transfer Mechanism terminals B1 and B2 will be opened, making transfer to that source impossible.
3. The automatic start/stop circuit (Wires 178 and 183) will be opened, making generator startup impossible.

NOTE: The maintenance disconnect switch must be in the automatic position for normal (automatic) transfer switch operation.

**Load Power Supply Transformer T2 (10) –** Transformer T2 reduces load terminal voltage to a value that is compatible with 7-Day Exercise Timer and Switch Position indicator lights requirements. The Transformer is a "step-down" type.

Load terminal voltage (from Transfer Mechanism T1, T2, T3 terminals) is delivered to the Transformer primary coil. 24 volts A-C are delivered from the Transformer secondary coil to the Exercise Timer and the Switch Position indicator lights by the Auxiliary Contacts.

**Standby Sensing Transformer T1 (11) –** Transformer T1 reduces standby voltage to a value that is compatible with Microprocessor Based Control (or In-Phase Monitor or Programmable Logic) circuit board requirements.

Transfer Mechanism standby terminals (E1 and E2) output is delivered to the Transformer primary winding. The Secondary winding output of 20 to 24 volts A-C is then delivered to the Microprocessor Based Control (or In-Phase Monitor or Programmable Logic) circuit board and to the Standby Operating indicator light.

This transformer provides a voltage reduction to the Microprocessor Based (or In-Phase Monitor or Programmable Logic) circuit board. That circuit board requires a 20 to 24 volts A-C input for operation. The reduced STANDBY source voltage powers the circuit board (board is operational only with engine-generator running), and the Standby Operating indicating light.

NOTE: Reduced standby source voltage is available to the Microprocessor Based Central Control (or In-Phase Monitor or Programmable Logic, as applicable) circuit board only when the standby generator is operating. Thus, the Microprocessor Based Control (or In-Phase Monitor or Programmable Logic) board is operational only when the generator is running.

**The 2-Wire Start Terminal Strip TS (12) –** The Customer supplied wiring must be interconnected between terminals 178 and 183 of this terminal strip and the start/stop control terminals in the standby engine-generator set. The 178 and 183 circuit is normally held open by circuit board action. During an automatic start, circuit board action will close the circuit to create an automatic engine startup signal. When NORMAL source voltage is restored, circuit board action will open the circuit to create an engine shutdown signal.

**Stepdown Transformer T4 (13) (For system operating voltages 460 to 600 Volts) –** The main contacts actuating coil (in the transfer mechanism) will respond only to approximately 240 volts A-C. This transformer reduces NORMAL source voltage (from terminals N1, N2, N3) to the 240 volts that is compatible with actuating coil needs. The reduced transformer secondary winding output is delivered to the actuating coil through the transfer mechanism terminals A1 and A2 (actuating command to the NORMAL power source side).

**Stepdown Transformer T3 (14) (For system operating voltages 460 to 600 Volts) –** Transformer T3 reduces STANDBY power source voltage to approximately 240 volts A-C. that is compatible with the main contacts actuating coil requirements. The reduced 240 volts A-C STANDBY source voltage is delivered to the actuating coil through the transfer mechanism terminals B1 and B2 (actuating command to the STANDBY source side).

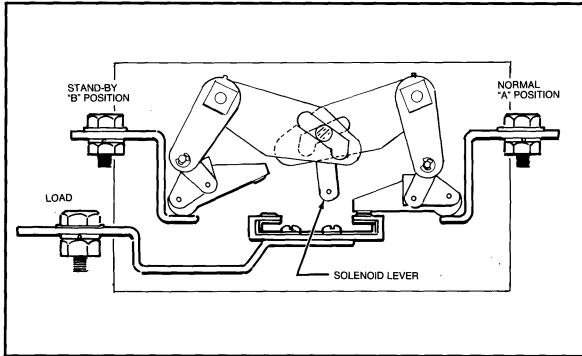
**Transfer Mechanism ATS (15) –** The Transfer Mechanism houses the main load carrying contacts, which are electrically actuated by means of a closing coil. Other switches and electrical devices necessary for operation are housed in the Mechanism. Also the Auxiliary Contacts for indicating lights and signals are housed in the Mechanism.

**Normal Power Sensing Transformer T8 (16) (Required only for transfer switches equipped with optional In-Phase Monitor Control) –** Transformer T8 reduces normal terminal voltage to a value that is compatible with the In-Phase Monitor circuit board. This transformer is necessary to provide NORMAL source voltage, phase and magnitude information to the In-Phase Monitor to allow the monitor to determine the difference between normal voltage values and standby voltage values.

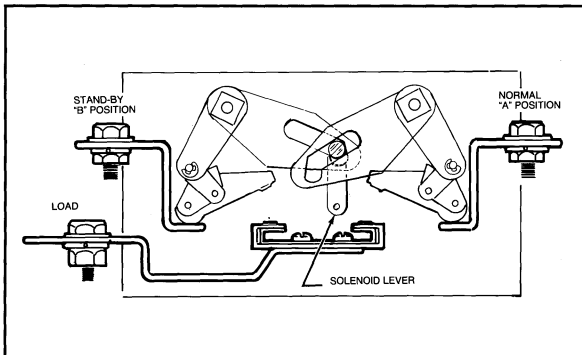


## Transfer Switch Major Components Section General Components

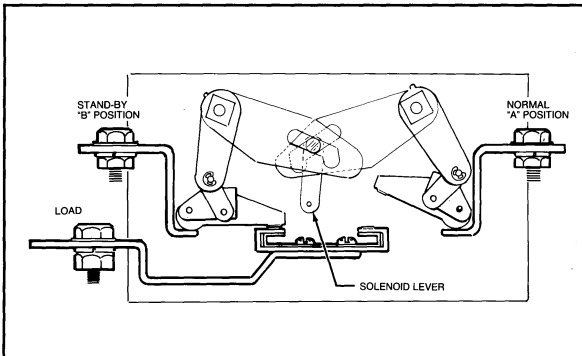
**Utility Sensing Interface (17)** – The Interface houses a set of normal power source three phase transformers, which act to reduce that source voltage to a value that is compatible with Utility Voltage Sensor circuit board requirements (6).



**Main Contacts** – Load terminals are connected to the normal power source.

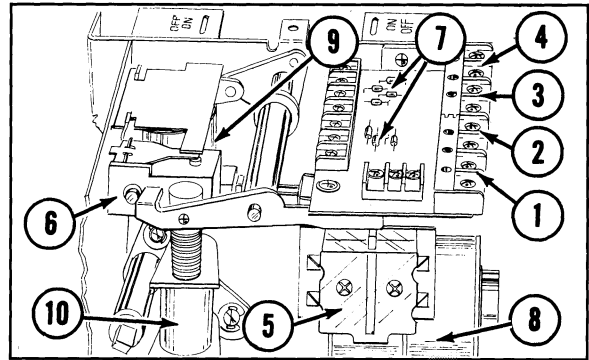


**Main Contacts** – Tripped or neutral condition shows both power sources disconnected from the load terminals.



**Main Contacts** – Load terminals are connected to the standby power source.

## Transfer Mechanism Terminals And Electrical Components



**Terminals A1, A2 (1)** – These terminals provide the actuating command to the NORMAL power source side (LOAD connected to NORMAL power supply). Transfer to the NORMAL source is powered by NORMAL source power. For that reason, transfer cannot occur unless that power supply is available.

**Terminals B1, B2 (2)** – These terminals provide the actuating command to the STANDBY power source side (LOAD connected to STANDBY source). Transfer to the STANDBY source is powered by the STANDBY source power. Transfer to that side cannot occur unless that power source is available.

**Terminals AT1, AT2 (3)** – These terminals provide the trip to neutral from NORMAL position command. Reduced (240 volt) STANDBY source voltage is applied to trip the main contacts to neutral from NORMAL.

**Terminals BT1, BT2 (4)** – These terminals provide the trip to neutral from STANDBY position command. Reduced (240 volt) NORMAL source voltage is applied to trip the main contacts to neutral from STANDBY.

**Transfer Mechanism Electrical Components** – The following electrical components are housed in the transfer mechanism:

**1. Control Switch Ax, Bx (5):** These two switches are actuated by the Closing Coil. They will close when tripping from NORMAL or STANDBY to the NEUTRAL (tripped) position. Switch contacts Ax and Bx will be closed during transfer to NORMAL, when the main contacts are neutral, and during transfer to STANDBY. Switch contacts Ax and Bx will be open when the main contacts are in NORMAL or STANDBY position.

**2. Selective Switch (LS) (6):** This switch is actuated by Selective Coil (SC). When the main contacts are actuated to their NORMAL side, LS will close the circuit between terminals B1/B2 and the closing coil, in preparation for transfer to STANDBY side. When the main contacts are actuated to their STANDBY side, LS will close the A1/A2 circuit to the closing coil, in preparation for re-transfer back to the NORMAL source.

**3. Rectifiers (7):** The closing coil, selective coil and trip coil all require direct current (DC) for their operation. The bridge rectifiers provide full-wave rectification of the NORMAL and STANDBY power supplies which energize those coils.

**4. Closing Coil (C) (8):** When the closing coil is energized by reduced (240 volt) and rectified NORMAL, or STANDBY source voltage, the coil actuates the main contacts and auxiliary contacts through mechanical links.

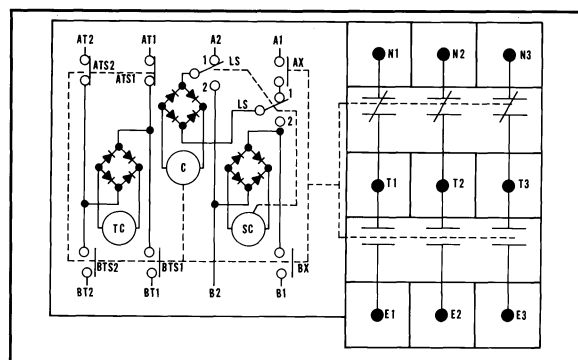
**5. Selective Coil (SC) (9):** When the selective coil is energized by reduced (240 volt) and rectified NORMAL, or STANDBY source power, the coil resets selective switch (LS) to either the NORMAL (A1, A2) or STANDBY (B1, B2) position.

**6. Trip Coil (TC) (10):** When the trip coil is energized by either power source, the coil holds the main contacts at their neutral (tripped) position.

**7. Trip Control Switch ATS1, ATS2, BTS1 and BTS2:** The trip control switches control the operation of trip coil (TC).

NOTE: Contacts ATS1 and ATS2 will be closed when the main contacts are in their NORMAL position (LOAD connected to NORMAL source). They will be open at all other times. Contacts BTS1 and BTS2 will be closed when the main contacts are in the STANDBY position (LOAD connected to STANDBY source). They will be open at all other times.

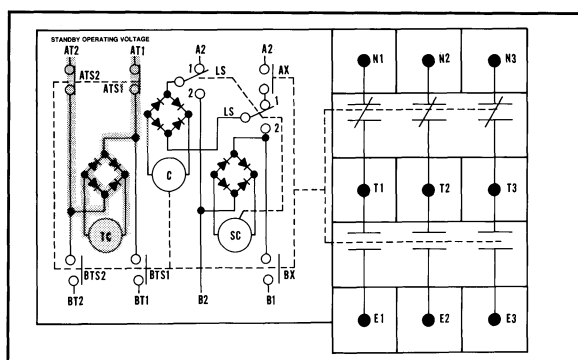
## Transfer Mechanism Operation



The transfer mechanism operation sequence is as follows:

Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in NORMAL position)

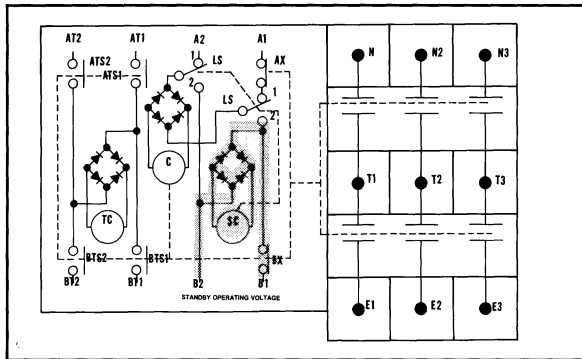
**1. Trip Open from Normal:** STANDBY operating voltage is applied across terminals AT1 and AT2. With control switches ATS1 and ATS2 closed, the trip coil TC is energized to trip open the mechanical latch on the main contacts. The main contacts then open to their neutral (tripped) position. With the main contacts at neutral, control switches Ax and Bx close.



Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in NORMAL position and signal to trip from NORMAL to neutral)

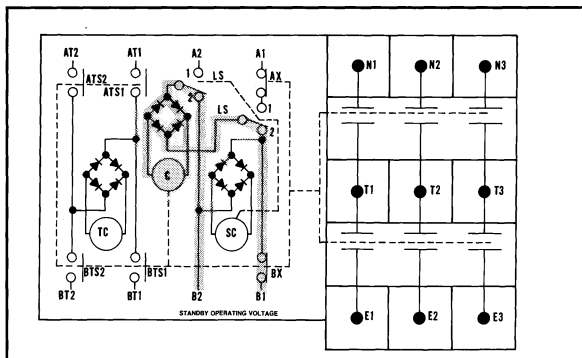
# Transfer Switch Major Components Section

## General Components

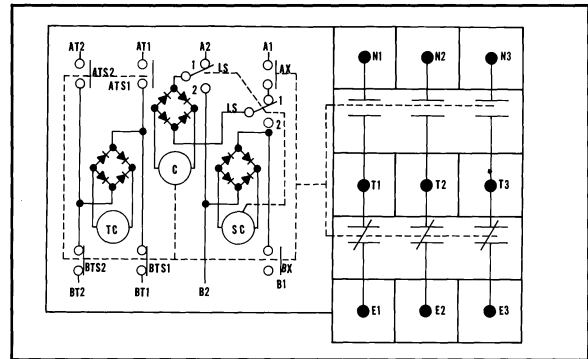


Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch tripped from NORMAL to neutral position, and signal to select STANDBY position)

**2. Close from Neutral to Standby:** STANDBY operating voltage is applied across terminals B1 and B2. With control switch Bx closed, selective coil SC energizes, causing both sets of selective switch LS contacts to close to Position 2. This, in turn, causes closing coil C to energize, and the main contacts close to their STANDBY position (LOAD connected to STANDBY power source). With the main contacts in the STANDBY position, control switches Ax and Bx open, control switches BTS1 and BTS2 close (in preparation for the "trip to open" sequence), and selective switch LS contacts return to position 1.

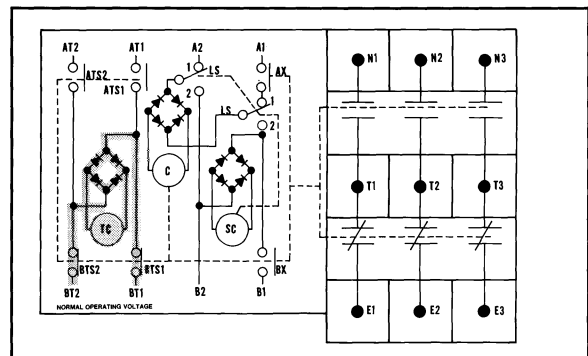


Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in neutral position, and signal to close from neutral to STANDBY position)

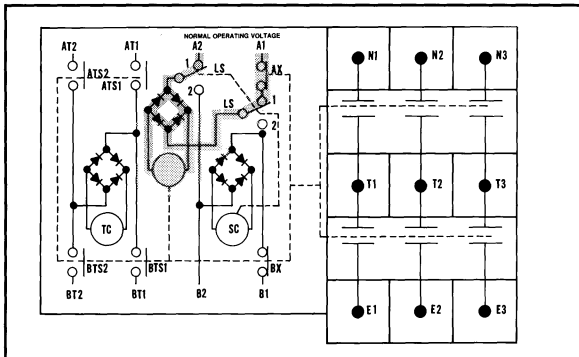


Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in STANDBY position)

**3. Trip Open from Standby:** NORMAL operating voltage is applied across terminals BT1 and BT2. With control switches BTS1 and BTS2 closed, trip coil TC energizes. This opens the mechanical latch on the main contacts, and the main contacts open to their neutral (tripped) position. With the main contacts at neutral, control switches Ax and Bx close.



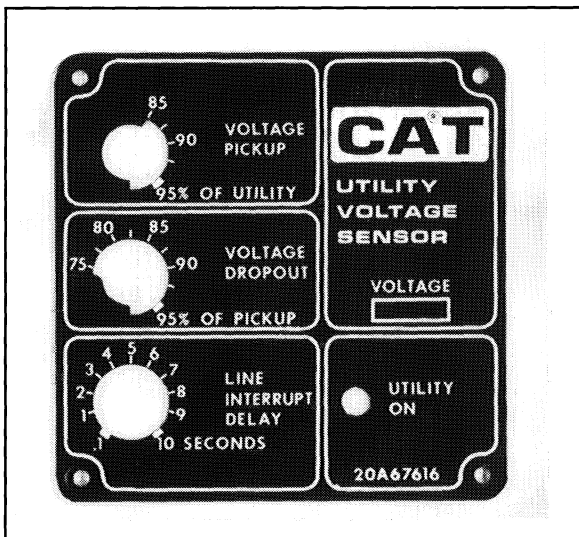
Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in STANDBY position, and signal to trip to neutral)



Transfer Mechanism Schematic Diagram (All relay contacts are shown with transfer switch in neutral position, and signal to close to NORMAL)

**4.** Close from Neutral to Normal Position: NORMAL Operating voltage is applied across terminals A1 and A2. With control switch Ax and Bx closed, and, with selective switch LS in Position 1, closing coil C energizes. This causes the main contacts to close to the NORMAL position. With the main contacts closed to the NORMAL source, control switches Ax and Bx open, and control switches ATS1 and ATS2 close (in preparation for the next "trip to open" sequence).

#### Utility Voltage Sensor Circuit Board



The Utility Voltage Sensor circuit board controls the following functions:

**1.** It continuously monitors for an acceptable NORMAL source voltage and, should that voltage drop below a pre-set level and remain at such a low state for a pre-set time, it will initiate the standby engine-generator startup and transfer of the LOAD to the STANDBY power source.

**2.** After the standby engine-generator startup signal, the utility voltage sensor circuit board will provide an "engine run" signal to the Microprocessor based (or In-Phase Monitor or Programmable Logic) circuit board to turn that circuit board's Engine Minimum Run and Engine Warmup Timers ON.

**3.** On restoration of NORMAL source voltage above a pre-set level, the utility voltage sensor circuit board will signal the Microprocessor based (or In-Phase Monitor or Programmable Logic) circuit board to turn on that board's Return to Utility Timer.

**4.** The utility voltage sensor circuit board has a light emitting diode (LED) which will illuminate to inform the operator that NORMAL source voltage is available to the board.

#### Microprocessor Based Circuit Board

This circuit board is powered by reduced voltage from the Standby Sensing Transformer T1, and is operational only when the standby engine-generator is running. The board mounts timers, sensors and switches for the control of automatic system operation (see SENSOR AND TIMER ADJUSTMENTS). The standard Microprocessor based circuit board permits selection of (a) engine warmup timer bypass, (b) transfer during exercise, and (c) exercise day and time of day. All sensors and timers on the standard board are fixed and non-adjustable.

**1.** Engine Minimum Run Timer: Fixed at 10 minutes. Establishes the minimum length of time the engine must run before it will shut down. This prevents shutdown of a cold engine.

**2.** Engine Warmup Timer: Fixed at 30 seconds. Allows the engine to warm up before the LOAD is transferred to STANDBY. A bypass switch is mounted on the board to eliminate this warmup time, if desired.

**3.** Return to Utility Timer: Fixed at 30 seconds. Establishes a time interval between restoration of NORMAL source voltage and re-transfer back to that source. This time interval is necessary, to prevent a false re-transfer that might be caused by transient NORMAL source voltage returns.

## Transfer Switch Major Components Section General Components

**4. Engine Cooldown Timer:** Fixed at 10 minutes. After the automatic re-transfer back to the NORMAL source, the engine is allowed to run for 10 minutes at no-load before shutdown.

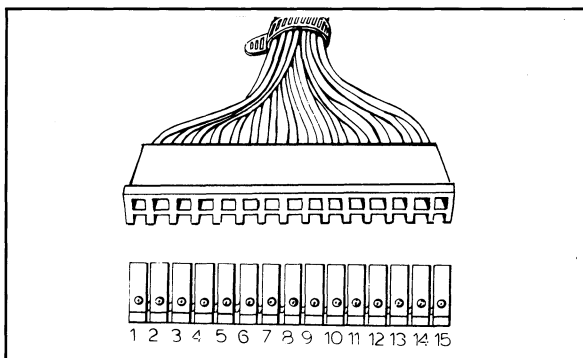
**5. Standby Voltage and Standby Frequency Sensors:** These sensors prevent transfer of the LOAD to the STANDBY source until engine-generator AC voltage and frequency have reached at least 80% of their nominal rated voltage and frequency.

**6. Time Delay Neutral:** Holds the LOAD disconnected from both power sources for a fixed interval of 5 seconds during any transfer action. This delay permits any highly inductive loads to decay to a safe level before reconnecting the LOAD, and to prevent nuisance blowing of fuses or tripping of circuit breakers. (The transfer switch contains a bypass switch to eliminate the time delay neutral, if desired.)

NOTE: Some units may be equipped with an optional In-Phase Monitor or Programmable Logic circuit board and a separate 7-Day Exerciser circuit board. See "Sensor And Timer Adjustments".

**7. Exerciser:** The standard Microprocessor Based circuit board includes a 7-day exerciser circuit. The exerciser can be sped up by placing a jumper in the test position; see the subject "The 7 Day Exercise Cycle" in the section "Operating Instructions". The standard Microprocessor Based circuit board does not require a separate Exerciser board.

### Wire And Pin Identification (Standard Microprocessor Based Circuit Board)



The standard Microprocessor Based circuit board interconnects electrically with other transfer switch components by means of a 15 pin connector. Connector pin numbers, associated wire numbers and their functions are as follows:

Pin 1, Wire #194: Delivers +12 volts DC to the actuating coils of the Transfer Relay TR and the Time Delay neutral relay TD when the standby engine-generator has started (when the STANDBY OPERATING light comes on).

Pin 2, Wire #202: This is the grounded side of the NORMAL and the FAST TEST circuit to the Operating Mode switch, and to the utility voltage sensor board.

Pin 3, Wire #201: This is the "High" side of the FAST TEST circuit. Setting the Operating Mode switch to the FAST TEST position closes the circuit between Pin 3 and Pin 2, initiating a FAST TEST operation.

Pin 4, Wire #203: This is the "High" side of the Operating Mode switch NORMAL TEST circuit. Setting the Operating Mode switch to the NORMAL TEST position closes the circuit between Pin 4 and Pin 2, initiating a NORMAL TEST operation.

Pin 5, Wire #199: Provides a "NORMAL Source Voltage Failed" signal to the Microprocessor Based circuit board (from the Utility Voltage Sensor board).

Pin 6, Wire #177: Part of the standby engine-generator automatic start/stop circuit.

Pin 7, Wire #178: Part of the standby engine-generator automatic start/stop circuit. When circuit board action closes the circuit between Wires #177/178, an automatic engine-generator start signal occurs.

Pin 8: Not Used

Pin 9: Not Used

Pin 10, Wire #193: (See Pin 1, Wire #194) Pin 10 is the negative side of the time delay neutral relay TD actuating coil. Circuit board action closes this circuit to ground to initiate the time delay neutral timing action. Circuit board action opens this circuit to ground to de-energize the time delay neutral relay TD, and allows the transfer switch to complete the transfer to either the NORMAL or the STANDBY source.

Pin 11, Wire #23: (See Pin 1, Wire #194) Pin 11 is the negative side of Transfer Relay TR actuating coil. Circuit board action closes this circuit to ground, to initiate transfer to the STANDBY power source side. Circuit board action opens this circuit to ground, to de-energize the Transfer Relay and initiate re-transfer back to the NORMAL source.

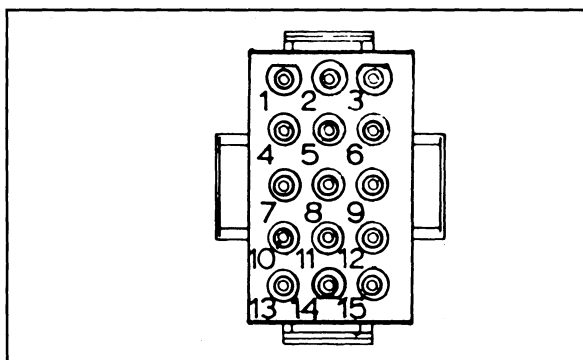
Pin 12, Wire #191: This is the power supply to the circuit board from the transformer reduced STANDBY source voltage when the engine-generator is running.

Pin 13, Wire #192: Same as Pin 12.

Pin 14, Wire #185: This is transformer reduced LOAD terminal voltage, for operation of the 7-day exerciser timer.

Pin 15, Wire #0: Same as Pin 14.

### Wire And Pin Identification (Optional Programmable Logic Circuit Board)



Connector Pins - Optional Programmable Logic Circuit Board

A 15 pin connector interconnects the optional, programmable logic circuit board to other transfer switch components. Connector pin numbers, associated wire numbers, and their functions are as follows:

Pin 1: Not Used

Pin 2, Wire #191: This is the power supply to the circuit board from the transformer reduced STANDBY source voltage when the engine-generator is running.

Pin 3, Wire #192: Same as Pin 2.

Pin 4, Wire #199: "High" side of Wires 199/200 circuit. Provides a "normal source voltage failed" signal to the programmable logic circuit board (from the utility voltage sensor board).

Pin 5, Wire #200: "Low" (grounded) side of the Wires 199/200 circuit.

Pin 6, Wire #202: Grounded side of NORMAL and FAST TEST circuit to the Operating Mode switch.

Pin 7, Wire #177: Part of the standby engine-generator automatic start/stop circuit (see Pin 14, Wire #178).

Pin 8, Wire #197: Provides "low" (grounded) side of signal from exercise timer (See Pin 13, Wire #198).

Pin 9, Wire #194: Delivers +12 volts d-c to the actuating coils of the Transfer Relay TR and time delay neutral relay TD when the standby engine-generator has started.

Pin 10, Wire #201: This is the high side of the Operating Mode switch FAST TEST circuit. Setting the operating mode switch to FAST TEST closes the circuit to Pin 10. This initiates a FAST TEST operation.

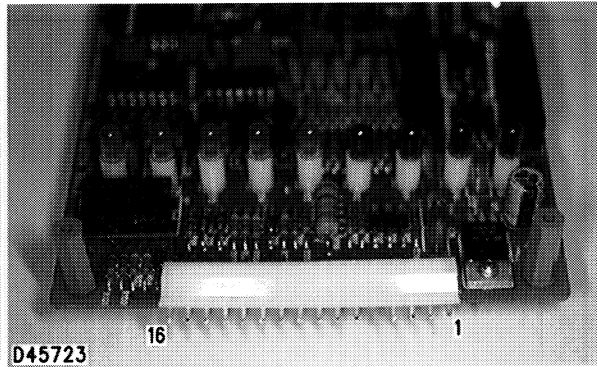
Pin 11, Wire #193: (See Pin 9, Wire #194) Pin 11 is the negative side of the time delay neutral relay TD actuating coil. Circuit board action closes this circuit to ground to initiate the time delay neutral timing action. Circuit board action opens this circuit to ground to de-energize the time delay neutral relay TD, and allows the transfer switch to complete the transfer to either the NORMAL or the STANDBY source.

Pin 12, Wire #203: This is the high side of the operating mode switch NORMAL TEST circuit. When the Operating Mode switch is set to the NORMAL TEST position, this circuit is closed to Pin 6, initiating a NORMAL TEST operation.

Pin 13, Wire #198: Provides high side of signal from exercise timer. (See Pin 8, Wire # 197)

Pin 14, Wire #178: Part of the standby engine-generator Automatic start/stop circuit. (See pin 7, Wire # 177)

Pin 15, Wire #23: (See Pin 9, Wire #194) Pin 15 is the negative side of Transfer Relay TR actuating coil. Circuit board action closes this circuit to ground, to initiate transfer to the STANDBY power source side. Circuit board action opens this circuit to ground, to de-energize the Transfer Relay and initiate re-transfer back to the NORMAL source.

**Wire And Pin Identification (Optional In-Phase Monitor Circuit Board)****Connector Pins - Optional In-Phase Monitor Circuit Board**

A 16 pin connector interconnects the optional, In-Phase Monitor circuit board to the other transfer switch components. Connector pin numbers, associated wire numbers, and their functions are as follows:

Pin 1, Wire #266: This is the power supply to the circuit board from the transformer reduced STANDBY source voltage when the engine-generator is running.

Pin 2, Wire #191: Same as Pin 1.

Pin 3, Wire #202: Grounded side of NORMAL and FAST TEST circuit to the operating mode switch.

Pin 4, Wire #264: Normal side voltage and phase input required for in-phase transfer function.

Pin 5: No Connection.

Pin 6, Wire #194: Delivers +12 volts dc to the actuating coils of the Transfer Relay TR and time delay neutral relay TD when the standby engine generator has started.

Pin 7, Wire #178: Part of the standby engine-generator automatic start/stop circuit.

Pin 8, Wire #177: Same as Pin 7.

Pin 9, Wire #23: Negative side of transfer relay TR actuating coil. Circuit board action closes this circuit to ground, to initiate transfer to the STANDBY power source side. To initiate re-transfer back to the NORMAL source, circuit board action opens this circuit which deenergizes the transfer relay.

Pin 10, Wire #193: Negative side of the time delay neutral relay TD actuating coil. Circuit board action closes this circuit to ground to initiate the time delay neutral timing action. Circuit board opens this circuit to deenergize the time delay neutral relay TD, and allows the transfer switch to complete the transfer to either the NORMAL or STANDBY source.

Pin 11, Wire #267: (Used when Transfer Contact-Elevator option is installed) Connects to negative side of SR relay. Circuit board action closes this circuit to ground to initiate the pre-transfer signal which closes SR contacts. Signal is active for the amount of time dictated by the Signal Before Transfer adjustable timer.

Pin 12, Wire #199: Provides a "normal source voltage failed" signal to the in-phase monitor circuit board from the utility voltage sensor board.

Pin 13, Wire #198: Connected to exercise timer "high" lead.

Pin 14, Wire #201: This is the high side of the operating mode switch FAST TEST circuit. Setting the operating mode switch to the FAST TEST position closes the circuit which initiates a FAST TEST operation.

Pin 15, Wire #203: This is the high side of the operating mode switch NORMAL TEST circuit. Setting the operating mode switch to the NORMAL TEST position closes the circuit which initiates a NORMAL TEST operation.

Pin 16, Wire #265: (Used when Return to Normal Bypass option is installed) Connects to the Return to Normal Bypass switch. Closing the normally open switch will cause the transfer mechanism to switch back to the normal power source, bypassing the return to utility timer.

# Transfer Switch Installation

## General Installation Information

Caterpillar automatic transfer switches have been factory wired and tested. Installation requires mounting of the switch, connection of power source and load lines, connection of the automatic start/stop circuit, and connection of any options. Protect the transfer switch against excessive moisture, construction grit, metal chips or shavings at all times.

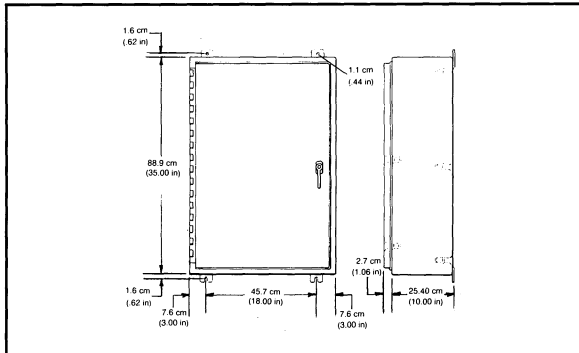
## Unpacking And Handling

1. Carefully unpack the transfer switch.
2. Inspect for any damage that might have occurred during shipment.

NOTE: Never install a transfer switch that has been damaged or is defective in any way.

3. Attach any lifting devices to enclosure mounting holes or channels only. Do not lift the switch at any other points. Protect the transfer switch against impact.

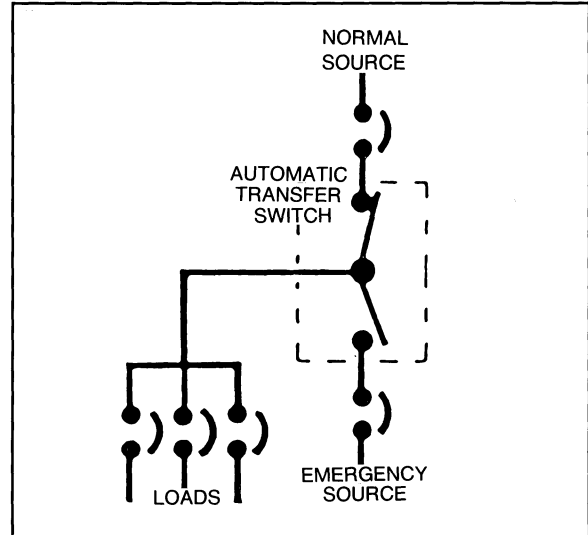
## Transfer Switch Mounting



Typical Example

1. Typical switch mounting dimensions are shown in illustration above. For the actual dimensions see the subject "Transfer Switch Mounting Dimensions" in the Specifications section of this manual.
2. Mount the switch enclosure vertically to a strong, rigid supporting structure.
3. If necessary, level all mounting points by installing washers behind mounting holes (to prevent distortion).

## Power Source And Load Line Connections



Schematic Representation Of A Typical Transfer Switch Installation

## WARNING

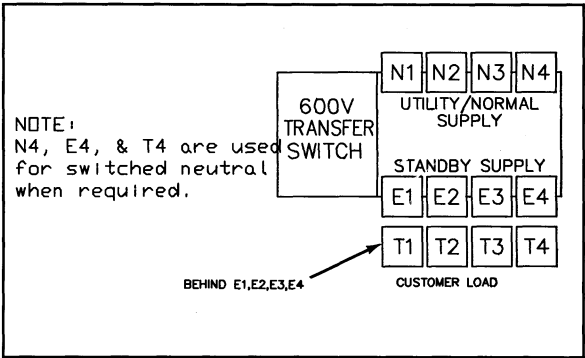
**Turn off both the normal and standby power supplies to the transfer switch before attempting to connect power source or load lines. Failure to turn off all power voltage supplies will result in extremely dangerous – possibly lethal – electrical shock.**

**Conductors** – Conductors must be properly supported, protected by approved conduit, have approved insulation qualities, and be of the correct wire gauge size in accordance with applicable codes. All conductors should enter the switch enclosure adjacent to their respective terminal lugs.



**Transfer Mechanism Terminal Lugs** – The transfer mechanism may be either a 3 or a 4-pole type. A neutral block may be provided for connection of 3-phase neutral lines. The neutral block is not required when the neutral line is to be switched on a 4-pole, 3-phase installation.

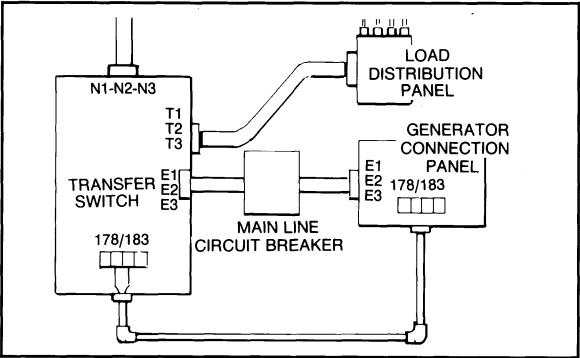
- 1. Connect normal power source 3-phase lines to terminal lugs N1, N2 and N3.
- 2. Connect standby power source 3-phase lines to terminals E1, E2 and E3.
- 3. Connect load lines to terminals T1, T2 and T3. See illustration below.



- 4. Before connecting lines to the proper terminal lugs, remove surface oxides from the conductors with a wire brush. If aluminum wires are used, apply joint compound to the stripped end of the conductor. After tightening the terminal lug, wipe away excess joint compound.

Tighten terminal lugs to 5.7 N•m (50 lb in) for units rated 100 amperes; to 28.3 N•m (250 lb in) for all other units.

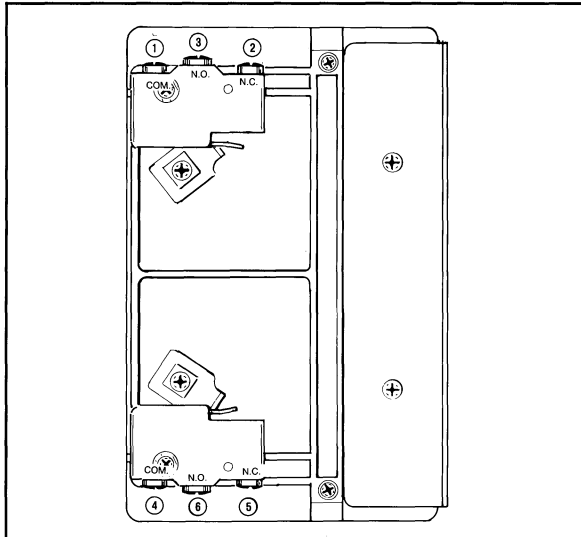
**2-Wire Start Terminal Strip**



Connect suitable, approved wiring to transfer switch terminals 178 and 183 and to the proper terminals in the standby generator set. Closure of this circuit by transfer switch circuit board action must result in automatic cranking and startup of the standby generator. Recommended wire gauge sizes for this wiring depends on the length of the wire and should be as recommended below:

Wire Gauges	
Wire Size	Maximum Wire Length
No. 18 AWG	140 m (460 ft)
No. 16 AWG	223 m (730 ft)
No. 14 AWG	354 m (1160 ft)
No. 12 AWG	565 m (1850 ft)

### Standard Auxiliary Contacts



Auxiliary Switches - Right Side Of Transfer Switch

A standard transfer switch has two single-pole dual-throw (SPDT) switches which provide the auxiliary contacts. In the above illustration, the upper auxiliary switch is on the normal end of the transfer switch and the lower auxiliary switch is on the standby end of the transfer switch

#### Auxiliary Switch Operation:

- a. In the NEUTRAL position of the transfer switch, the lower and upper auxiliary switches are activated.
- b. In the NORMAL position of the transfer switch, the lower auxiliary switch is activated and the upper auxiliary switch is not activated.
- c. In the STANDBY position of the transfer switch, the lower auxiliary switch is not activated and the upper auxiliary switch is activated.

The contacts of the upper (normal end) auxiliary switch are used to operate the panel indicator lamps and are not for customer use.

The contacts of the lower (standby end) auxiliary switch may be used to operate customer accessories, remote indicator lights, or remote annunciator devices. A suitable power source must be connected to the common (COM) terminal. The normally-closed (N.C.) contact is closed when the load is connected to the normal source. The normally-open (N.O.) contact is closed when the load is connected to the standby source side. The contacts are rated 5 Amp, 240 VAC, resistive.

NOTE: Extra auxiliary contacts (for customer use) are available as an option. See "Transfer Switch Options" section in this manual.

## Functional Tests

### General Functional Test Information

Following installation, the standby electric system installation should be inspected, and tested. All necessary adjustments should be completed. Functional testing of the transfer switch consists of (1) manual operation, (2) voltage checks, and (3) electrical operation.

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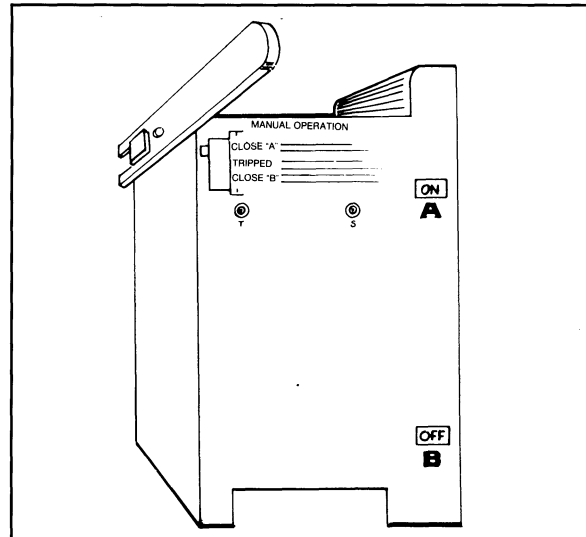
#### NOTICE

Perform functional tests in the exact order given, to avoid damaging the transfer switch.

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Read and make sure you understand all instructions in this section before proceeding with the functional tests. Also read all instructions and information on tags and decals that are affixed to the transfer switch. Note any options or accessories that might be installed or provided with the switch and review their operation.

### Manual Operation



#### WARNING

**Do not attempt manual operation of the transfer switch until both power supplies have been positively turned OFF, using whatever means provided (such as the normal and standby source main line circuit breakers). Failure to turn OFF all power voltage supplies to the transfer switch may result in extremely hazardous, and possibly lethal, electrical shock.**

---

A manual handle and an actuating pin are shipped with the transfer switch. Manual operation must be checked before the switch is operated electrically. To operate the switch manually, proceed as follows:

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#### NOTICE

Do not use excessive force when actuating the main contacts manually, or the manual handle may be damaged. Always set the contacts to their TRIPPED or NEUTRAL position before manually selecting either NORMAL or STANDBY. The switch is at TRIPPED or NEUTRAL when the word "OFF" appears in both windows "A" and "B".

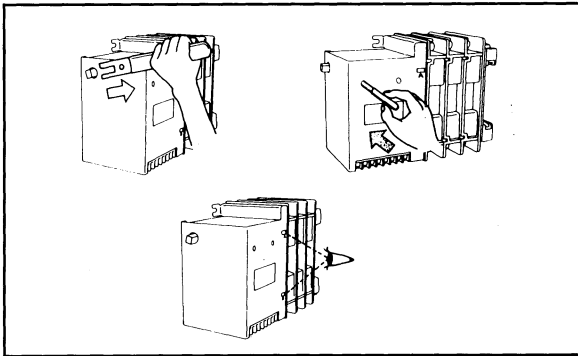
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**1.** Turn OFF both the NORMAL and STANDBY power supplies to the transfer switch.

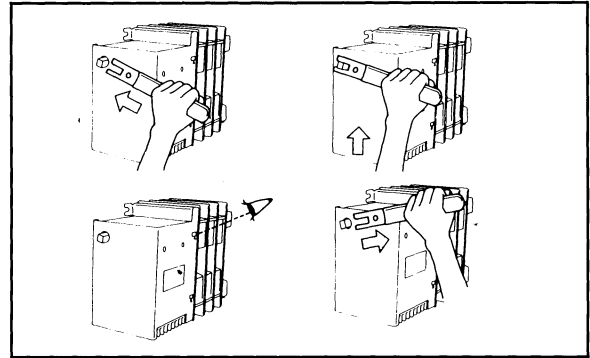
**2.** Note the position of the transfer mechanism main contacts by observing the display in Windows "A" and "B", as follows:

- Window "A" indicates "ON" – Load terminals (T1, T2, T3) are connected to the normal terminals (N1, N2, N3)
- Window "B" indicates "ON" – Load terminals (T1, T2, T3) are connected to the standby terminals (E1, E2, E3)
- Windows "A" and "B" both Indicate "OFF" – This is the tripped or neutral position, with both power sources disconnected from the load terminals.

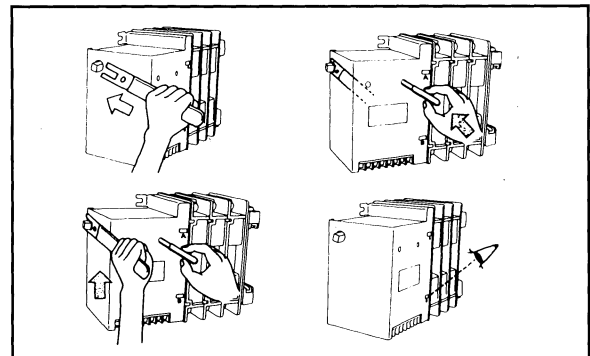
**3.** If the word "ON" is visible in either window "A" or "B", first trip the switch (set to NEUTRAL) as outlined in Step (4). Always trip the switch (set to NEUTRAL) before closing the switch to either Position "A" or "B". The switch is tripped if the word "OFF" appears in both windows "A" and "B". If the switch is already TRIPPED or at NEUTRAL, go to Step (5).



**4.** To trip the Switch – This is the NEUTRAL position, with both power sources disconnected from the load. Use the operating pin (shipped with unit) to push in on trip lever in Hole "T" (located on top of the transfer mechanism). The main contacts should trip and the word "OFF" should appear in both windows "A" and "B".



**5.** To close "A" – Attach the manual handle to square shaft at upper left corner of Transfer Mechanism. Move the handle upward. The word "ON" should appear in window "A" ("OFF" in window "B"). In this position, the load is connected to the normal power source.



**6.** To close "B" – Attach manual handle to square shaft. Operate manual handle upward while pushing in on lever in Hole "S" (located on top of the transfer mechanism). The main contacts should actuate and the word "ON" should appear in "B" ("OFF" in window "A"). In this position, the load is connected to the standby power source.

**7.** Before proceeding, trip the switch (Step 4) and then close "A" (Step 5). The switch must be at normal position before proceeding (load connected to normal source).

## Voltage Checks

Before proceeding, check the transfer switch data plate for rated voltage. The data plate voltage must be the same as the normal and standby line voltages.

### WARNING

**Personal injury or death could result by touching hot terminals or wires and by not setting maintenance disconnect switch to MANUAL.**

**During the voltage checks, the transfer switch will be electrically energized. PROCEED WITH CARE. DO NOT TOUCH ELECTRICALLY HOT TERMINALS OR WIRES.**

**During the voltage checks, set the MAINTENANCE DISCONNECT SWITCH to its MANUAL position.**

Perform voltage checks as follows:

1. Inside the transfer switch enclosure, set the Maintenance Disconnect Switch to MANUAL.
2. On the switch enclosure door, set the OPERATING MODE SWITCH to AUTOMATIC MODE.
3. Check that the switch main contacts are at their normal position, i.e., the word "OFF" appears in Window "B" and the word "ON" in window "A". See "Manual Operation" section of this manual.

### WARNING

**DO NOT PROCEED UNTIL STEPS 1, 2 AND 3 ARE ALL COMPLETED.**

4. Turn on the normal power source supply by whatever means provided (such as the normal source main line circuit breaker or fuse).

### WARNING

**THE TRANSFER SWITCH IS NOW ELECTRICALLY HOT. PROCEED WITH CAUTION.**

5. With normal source power available to the transfer switch, check that the SWITCH POSITION-NORMAL light (on enclosure door) is ON.

6. Inside the transfer switch door, locate the Utility Voltage Sensor circuit board. The UTILITY ON lamp (LED) should be ON, indicating that normal source sensing voltage is available to that circuit board.

7. Use an accurate AC voltmeter to check phase-to-phase (or line-to-line) and phase-to-neutral (or line-to-neutral) voltages present at Transfer Mechanism terminals N1, N2, N3 (N4). Supplied voltages must be compatible with the transfer switch rated voltage.

8. Use a phase rotation meter which has a suitable rating to determine the phase sequence at terminals N1, N2 and N3 of the Transfer Mechanism. For proper operation of the phase meter, refer to the manufacturers manual of the phase rotation meter.

9. Refer to the standby generator service manual. Make sure the generator has been properly serviced and prepared for use as outlined in that manual. Then, start the generator engine manually. Let the generator stabilize and warm up for a few minutes.

10. On the transfer switch enclosure door, check that the STANDBY OPERATING indicator light is ON.

**11.** Use an accurate AC voltmeter to check phase-to-phase (line-to-line) and phase-to-neutral (line-to-neutral) voltages at Transfer Mechanism terminals E1, E2, E3 (E4). If supplied voltage is incorrect, comply with engine-generator manufacturer's instructions to correct the voltage. Also check AC frequency and, if incorrect, adjust engine-generator operating speed as outlined in appropriate generator instructions.

**12.** Use the same phase rotation meter and the same connections as in Step 8 to verify the phase sequence at terminals E1, E2 and E3 of the Transfer Mechanism. The phase rotation of the NORMAL source (N1,N2,N3) should be the same as the STANDBY source (E1,E2,E3). Correct phase sequence or rotation should be established from both the NORMAL and STANDBY sources to satisfy the load.

**13.** Shut the engine-generator down manually.

### Normal Test

To test normal automatic operation, proceed as follows:

**1.** Open the transfer switch enclosure door and locate the UTILITY VOLTAGE SENSOR circuit board. The LED (Utility On) on that board should be ON, indicating that normal source voltage sensing is available to the board. If necessary, supply normal source power by whatever means provided (such as turning ON the normal source main line circuit breaker).

**2.** On the enclosure door, check the SWITCH POSITION lamps. The NORMAL lamp should be illuminated, indicating that (a) NORMAL source power is available to the switch and (b) the LOAD is connected to the normal source.

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#### NOTICE

The NORMAL lamp on the enclosure door must be ON before proceeding. If necessary, turn off all power supplies to transfer switch and manually actuate switch to its NORMAL position (ON appears in window "A").

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**3.** When the preceding Steps 1 and 2 are completed, open the switch enclosure door and set the Maintenance Disconnect switch to AUTOMATIC.

**4.** Refer to the appropriate service manual and make sure the standby generator is ready for automatic operation. Most standby generator sets will be equipped with a selector switch which must be set for automatic operation.

**5.** Set the Operating Mode Switch to its NORMAL TEST MODE position. The engine-generator should crank and start. Following generator startup, the transfer switch should actuate to its STANDBY position (Switch Position-STANDBY lamp on door illuminates). The automatic sequence of operation is described in SEQUENCE OF OPERATION section.

**6.** When the test is completed, set the Operating Mode Switch back to AUTOMATIC MODE. Re-transfer back to the normal source should occur (Switch Position-NORMAL lamp comes ON). After a pre-set engine cooldown time, the engine should shut down (Standby-operating lamp goes out).

## Preventive Maintenance

### Operate Transfer Switch

Operate the transfer switch at least once each month. This can be done by performing a normal test. Because the Operating Mode Switch only simulates failure of the normal power source, service will be interrupted only during actual transfer of the load.

### Clean And Inspect Transfer Switch

Protect the transfer switch components against construction grit and metal chips at all times. Also protect against excessive moisture.

Once each year, de-energize all power source supplies to the switch. Then, brush and vacuum away dust and dirt accumulations inside the enclosure.

After cleaning, inspect the unit carefully. Look for evidence of arcing, burning, hot spots, charring and other damage. If any of these are found, have the transfer switch checked by an authorized service technician.

### Transfer Switch Lubrication

Transfer Mechanism operating parts have been properly lubricated at the factory.

Under normal operating conditions, the Transfer Mechanism should require no additional lubrication. Lubricate all recommended points whenever major internal components are replaced.

### Main Current Carrying Contacts

At least once each year, have the main current carrying contacts inspected by an authorized service technician. The technician will replace or repair major assemblies that have become worn or defective.

### 9 Volt Battery

The standard Microprocessor Based Control circuit board utilizes a 9 volt battery to operate its exercise timer during the brief period of time when the load terminals are disconnected from both power sources. It is recommended that the battery be replaced at least once each year.

NOTE: On units with an optional In-Phase Monitor or Programmable Logic circuit board, a separate 7-Day Exerciser circuit board will connect to the 9 volt battery. See "Transfer Switch Options" section of this manual.

# Operating Instructions

## Normal Automatic Operation

When the system is set for normal automatic operation, NORMAL source voltage will be constantly monitored by circuit board action. Should that source voltage drop below a pre-set value and remain at such an unacceptable level for a pre-set time period, automatic generator startup will occur followed by automatic transfer of the load to the STANDBY source.

Refer to "Sequence of Operation" section of this manual. To set the system for normal automatic operation, proceed as follows:

1. On the switch enclosure door, check the Switch Position indicator lamps. The NORMAL lamp should be ON, indicating that (a) NORMAL source voltage is available to the switch, and (b) the load is connected to the NORMAL source. If necessary, turn OFF all power supplies to the transfer switch and manually operate the main contacts to their NORMAL position (the word "ON" appears in window "A"). See Manual Operation in ("Functional Test" section of this manual).
2. In the switch enclosure, set the Maintenance Disconnect Switch to AUTOMATIC.
3. On the enclosure door, set the Operating Mode Switch to AUTOMATIC MODE.
4. See appropriate standby generator instruction manual. Make sure the generator is set for fully automatic operation.

### WARNING

**The generator is now set for fully automatic operation. The engine may crank and start at any time without warning. To prevent possible injury that might be caused by such sudden startup, always disable the auto start circuit before working on or around the generator or transfer switch. To disable the auto start circuit, set the Maintenance Disconnect Switch to its MANUAL position.**

## Manual Operation – Transfer To STANDBY Source

To manually transfer load circuits to the STANDBY source and start the standby generator, proceed as follows:

1. In the transfer switch, set the Maintenance Disconnect Switch to MANUAL.
2. Turn off both the NORMAL and STANDBY power supplies to the transfer switch, using whatever means provided (such as the main line circuit breakers).
3. See Manual Operation (in "Functional Tests" section of this manual). Manually actuate the Transfer Mechanism to its STANDBY position, i.e., load connected to STANDBY source. The word ON must appear in window "B", "OFF" in window "A".
4. Remove the manual handle from the square actuating shaft.
5. See appropriate generator manual. Manually start the generator, let it stabilize and warm up.
6. Close the STANDBY power source main line circuit breaker, to power load circuits from that source.

## Manual Operation- Retransfer Back To The NORMAL Source

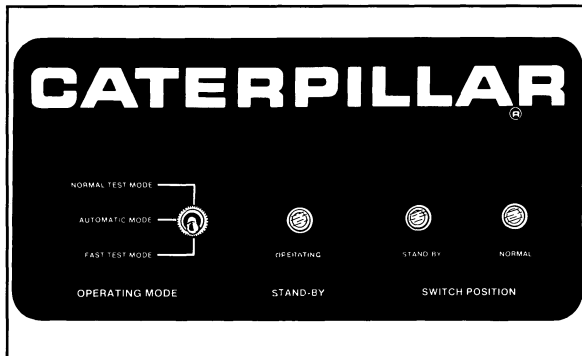
1. Turn OFF both power supplies to the transfer switch, using whatever means provided (such as the main line circuit breakers).
2. Shut the standby generator down manually.
3. Manually operate the transfer switch main contacts to their normal position, i.e., LOAD terminals connected to the NORMAL terminals (window "A" indicates ON). See Manual Operation in ("Functional Test" section of this manual).
4. Apply normal source power to the transfer switch, by whatever means provided (such as closing the normal source main line circuit breaker).
5. Set the system for normal automatic operation (see "Normal Automatic Operation" section of this manual).



### Conducting A Normal Test Of The System

To perform a normal test of automatic operation, refer to Normal Test in the "Functional Test" section of this manual.

### Conducting A Fast Test Of The System



A Fast Test will start the standby generator and transfer the load to STANDBY. During the Fast Test, all timers are sped up except the time delay neutral timer. The Time Delay Neutral Timer is not changed and will time out normally (approximately 5 seconds).

To conduct a fast test, hold the Operating Mode Switch in the FAST TEST position (switch is spring-loaded back to AUTOMATIC MODE). Standby generator should start and transfer to STANDBY should occur as soon as STANDBY source frequency and voltage have reached pre-set levels.

### Seven Day Exerciser Operation For Microprocessor Based Controls

NOTE: Also see the subject Microprocessor Based Control Circuit Board Adjustments in the Sensor And Timer Adjustments section.

During the exercise cycle, transfer to the STANDBY power source (transfer on exercise) occurs when the Transfer On Exercise Switch (located on the circuit board) is in the "XFR ON EX" position. Transfer does NOT occur when the switch is in the "OFF" position.

The generator will run for a length of time established by an Engine Minimum Run Timer (10 minutes) plus an Engine Cooldown Timer (10 minutes). See "Sequence of Operation" section of this manual.

NOTE: On units with optional In-Phase Monitor or Programmable Logic Control circuit board, the Engine Minimum Run and Engine Cooldown Timers are adjustable within certain limits. See "Sensor and Timer Adjustments" section of this manual.

NOTE: Battery – Normally the 7-day exerciser circuit is powered by the load terminal voltage from transformer T2; see the description of Load Power Supply Transformer T2 in the General Components section. However, during a transfer action there is a brief time when the supply voltage to the exerciser timer is not present. During this time period the 9 volt exerciser battery provides the timer power until the load terminal is reapplied.

### Normal 7-Day Exercise Test

#### A. General Conditions:

1. The standby engine start signal is initiated by the circuit board once every seven days. The day and time of exercise are selected by the customer by depressing and holding the "SET EX. TIME" switch for approximately 15 seconds. After the "SET EX. TIME" switch has been operated, the engine start signal will be initiated 7 days later.

If the "SET EX. TIME" switch is never operated, the 7-day exercise function will not occur.

2. After the voltage and frequency of the STANDBY power source reach the preset level (80% for both), the circuit board timers are activated.

#### B. Exercise Without Transfer (Transfer On Exercise Switch in the "OFF" position):

1. The run time of the standby generator set is 15 minutes. Timing begins after the voltage and frequency of the STANDBY power source is above the 80% level.

C. Transfer On Exercise (Transfer On Exercise Switch in the "XFR ON EX" position):

1. If the warm-up timer is selected, transfer to the STANDBY power source will occur after the 30 second warm-up time. The warm-up time begins after the voltage and frequency of the STANDBY power source is above the 80% level.
2. If the warm-up timer is not selected, transfer to the STANDBY power source will occur when the voltage and frequency of the STANDBY power source is above the 80% level.
3. If Time-Delay Neutral is selected, a five second delay occurs on the transfer from NORMAL to STANDBY and on the transfer from STANDBY to NORMAL.
4. The transfer to the STANDBY power source is maintained for five minutes.
5. After power is transferred back to the NORMAL source, the engine is allowed to run for ten minutes at no load for the engine to cool down. After running for ten minutes, the engine is signaled to shut down.

### Accelerated 7-Day Exercise Test

The 7-Day exercise test (as explained above) can be sped up by moving a jumper on the circuit board. The jumper connects to pins that are located just above the "SET EX. TIME" switch. When the jumper is in the TEST position, the time between exercise periods is shortened from seven days to approximately 39 minutes. Also, the exercise cycle is shortened from 16 minutes to approximately one minute. The reduced times should be helpful during startup testing. If the jumper is left in the TEST position, the STANDBY power source will exercise every 39 minutes and all time delays will be reduced. The jumper must be returned to the NORMAL position for the normal 7-day exercise cycle (as explained above).

## Sequence Of Operation

### Normal Source Voltage Available

When an acceptable normal source voltage signal is sensed by the Utility Voltage Sensor circuit board, that circuit board's UTILITY ON light (LED) will be illuminated. The circuit board will take no action. A transformer reduced voltage from the Transfer Mechanism LOAD terminals is delivered to the Microprocessor Based Control circuit board, to operate the 7-day exercise timer circuit in that circuit board.

NOTE: Units with optional In-Phase Monitor or Programmable Logic Control circuit board will have a separate 7-Day Exerciser circuit board. See Transfer Switch Options.

### Normal Source Voltage Dropout

The Utility Voltage Sensor circuit board mounts a Voltage Dropout Sensor and a Line Interrupt Delay Timer (see "Sensor and Timer Adjustments" section of this manual).

Should normal source voltage drop below the setting of the Voltage Dropout Sensor and remain at such a low state longer than the setting of the Line Interrupt Delay Timer, the following will occur:

1. The board's UTILITY ON light (LED) will go out.
2. Circuit board action will close the automatic start circuit (terminals 178/183), and will signal the standby generator engine to crank and start.
3. When standby generator AC output voltage is available to Transfer Mechanism STANDBY terminals (E1, E2 and E3), and to primary windings of Standby Sensing Transformer T1. A reduced voltage from the T1 secondary winding will be delivered to (a) the STANDBY OPERATING light, and (b) the System Microprocessor Based circuit board. That lamp will illuminate and that circuit board will operate.
4. An Engine Warmup Timer and a Minimum Run Timer on the Microprocessor Based Control circuit board start to time. The Engine Minimum Run Timer setting is fixed at 10 minutes and the Engine Warmup Timer setting is 30 seconds.

NOTE: On units with optional In-Phase Monitor or Programmable Logic Control circuit board, the Engine Warmup and Minimum Run Timers are adjustable. See "Sensor and Timer Adjustments" section of this manual.

5. When STANDBY generator AC output voltage and frequency have reached 80% of the rated voltage/frequency, and when the Engine Warmup Timer has timed out, the Microprocessor Based Control board action will energize the Transfer Relay circuit.

If the Time Delay Neutral switch is ON, the action of the Time Delay Relay (also controlled by the Microprocessor Based Control board) will hold the main transfer switch contacts at neutral (tripped) for about five seconds. The main contacts are then permitted to complete the transfer action to standby.

Power for all transfer actions to the standby source is provided by the standby power source. Thus, standby power must be available before any transfer to that source can occur.

NOTE: On units with optional In-Phase Monitor or Programmable Logic Control board, the time delay at neutral is adjustable from 0.1 to 10 seconds.

6. With load connected to the standby power source, the Switch Position-Standby light comes ON.

7. The Utility Voltage Sensor circuit board continues to seek an acceptable normal source voltage.

### Normal Source Voltage Restored

The Utility Voltage Sensor houses a Voltage Pickup Sensor. The Microprocessor Based Control board incorporates a Return to Utility Delay Timer. On restoration of normal source voltage above the setting of the Pickup Sensor, the Return To Utility Delay Timer starts to time. The Return To Utility Delay Timer is fixed at 30 seconds. On units with the optional In-Phase Monitor or the Programmable Logic Control circuit board, this timer is adjustable from 1 to 30 minutes.

If normal source voltage remains above the Sensor setting for a longer time than the Timer setting, Microprocessor Based Control board action will initiate re-transfer back to the normal source. Following re-transfer, an Engine Cooldown Timer starts timing. When the latter has timed out, circuit board action will open the start/stop circuit (terminals 178 and 183) and the generator will be signaled to shut down.

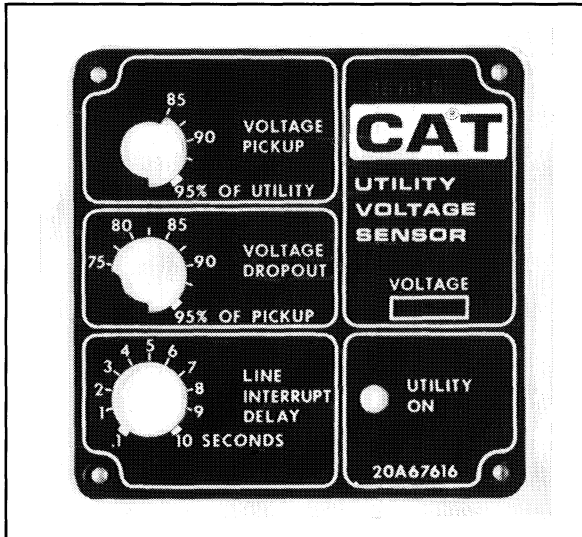
Following re-transfer and shutdown, the Utility Voltage Sensor circuit board will continue to monitor normal power source voltage.

### **Optional In-Phase Monitor Circuit Board**

The sequence of operation for units with the optional In-Phase Monitor circuit board is similar to the standard Microprocessor Based Control except during transfer between normal and standby power sources. Starting at the point in the sequence when the engine warmup timer has timed out, the In-Phase Monitor will evaluate both standby and utility power sources to determine if an in-phase transfer can be made. (See the Optional In-Phase Monitor Circuit Board Adjustments section for a list of conditions required for transfer.) If the required transfer conditions are not met within 10 seconds and the Time Delay Neutral Switch is ON, then the system reverts to a Time Delay Neutral transfer. If the required transfer conditions are not met and the Time Delay Neutral Switch is OFF, then the transfer between power sources will occur in the time that it takes for the transfer mechanism to operate. When the utility voltage is restored and the Return To Utility Timer times out, the In-Phase Monitor will evaluate both sources to determine if an in-phase transfer can be made. If an in-phase transfer is not possible, then the transfer will occur with or without the Time Delay Neutral delay depending on the state of the Time Delay Neutral Switch.

## Sensor And Timer Adjustments

### Adjustments On Utility Voltage Sensor Circuit Board



Utility Voltage Sensor Circuit Board

The Utility Voltage Sensor circuit board mounts easily adjustable potentiometers for Voltage Dropout Sensor setting, Voltage Pickup Sensor setting, and Line Interrupt Delay Timer.

**Voltage Dropout Sensor** – Establishes the normal power source voltage at which generator startup signal will occur. The adjustable potentiometer is factory set to about 80% of the Voltage Pickup Sensor setting; it may be reset to any voltage between 75-95% of the Pickup Sensor setting by simply turning the adjustment knob to the desired percentage.

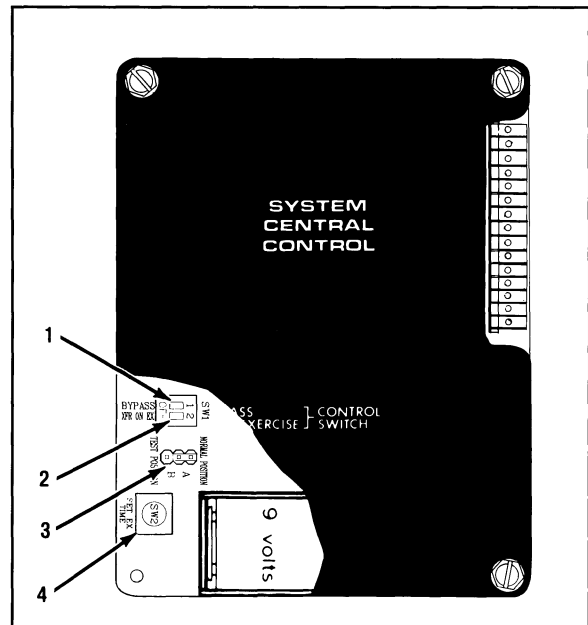
**Voltage Pickup Sensor** – Establishes the normal source voltage at which re-transfer back to that power source and generator shutdown will be initiated. The Sensor is factory set to approximately 90% of the rated normal source voltage; it may be reset to any voltage between 85-95% of the nominal rated normal source voltage.

**Line Interrupt Delay Timer** – Establishes the time interval between dropout of normal source voltage below the Voltage Dropout setting and generator startup signal. The timer is factory set to about five seconds; it may be reset to any time interval between 0.1 and 10 seconds.

NOTE: On earlier units, the Dropout and Pickup potentiometers allow settings that are outside the limits that are given above. Adjust the earlier units to the settings given above. On later units, the Dropout and Pickup potentiometers have stops which do not allow settings that are outside the limits that are given above.

NOTE: Establishment of a time delay between normal source dropout and generator startup is necessary, to prevent false starts that might be caused by transient voltage dips.

### Microprocessor Based Control Circuit Board Adjustments



### Adjustments On Microprocessor Based Control Circuit Board

(1) Engine Warmup Timer Bypass Switch. (2) Transfer On Exercise Selector Switch. (3) Test Jumper For Accelerated Exercise Test. (4) Set Exercise Time Switch.

NOTE: Also see the subject The 7-Day Exercise Cycle For Microprocessor Based Controls in the Operating Instructions section.

**Engine Warmup Timer Bypass Switch (1)** – Following automatic generator startup, transfer to the standby power source will not occur until (a) the generator engine has warmed up for a fixed setting of about 30 seconds, and (b) generator AC output voltage and frequency have reached approximately 80% of the nominal rated values.

If desired, the circuit board's Engine Warmup Timer may be bypassed by means of this bypass switch. Transfer to standby will then occur as soon as standby voltage and frequency reach 80% of rated voltage. To bypass the Timer, move Switch 1 away from its OFF position (toward the number 1). To place the Warmup Timer back into operation, set the switch to OFF.

**Transfer on Exercise Selector Switch (2)** – On the circuit board, locate the switch identified by the words "XFR ON EX." If it is desired to transfer the load to the standby source during the exercise cycle, set Switch 2 away from the OFF position (toward the number 2). For no transfer during the exercise cycle, set the switch to OFF.

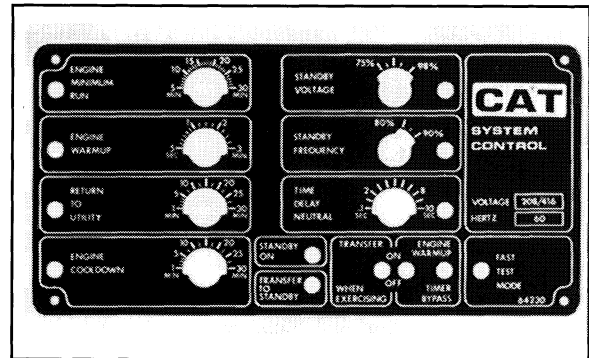
**Selecting the Day and Time of Exercise** – On the day and at the time of day at which you wish the standby generator to start and exercise automatically, push the "SET EX. TIME" switch (4) in and hold for about 15 seconds. The generator will start and exercise 7 days later at the selected time, and every 7 days thereafter.

If the "SET EX. TIME" switch (4) is never operated, the 7-day exercise function will not occur.

If it is necessary to reset the exercise time, all power must be disconnected and then reconnected to the microprocessor based circuit board. To disconnect power: remove all power to the transfer switch, unplug the microprocessor based control circuit board, and disconnect the 9 volt battery. To reconnect power, reverse the order.

**Test Jumper For Accelerated Exercise Test** – The 7-Day exercise test can be sped up by moving test jumper (3) from the normal position to the test position. The reduced times can be helpful during startup testing.

### Optional Programmable Logic Circuit Board Adjustments



Some transfer switches may be equipped with an optional, Programmable Logic Control circuit board (see "Transfer Switch Options" section of this manual). Adjustable (programmable) potentiometers are provided on this board for sensor and timer adjustments.

**Engine Minimum Run Timer** – Establishes a minimum operating duration for the standby generator, to prevent shutdown of a cold engine during brief normal source power outages. This potentiometer is factory set to approximately ten minutes; it may be reset to any time interval between five and thirty minutes.

**Engine Warmup Timer** – (Also see the Engine Warmup Timer Bypass Switch.) Establishes a time interval between generator startup and transfer of the load to standby power, to allow the engine to warm up before placing a load on it. This time interval is factory set to approximately one minute; it may be reset at any time interval between five seconds and three minutes.

**Return to Utility Timer** – Establishes a time interval between restoration of normal source voltage above the setting of the Voltage Pickup Sensor and re-transfer back to the normal source. This time delay is necessary to prevent "false" re-transfer that might be caused by transient normal source voltage signals during an outage. Timer is factory set to approximately five minutes; it may be reset to any time interval between one and thirty minutes.

NOTE: To find the actual time interval between re-transfer back to normal and generator shutdown, add any time remaining on the Engine Minimum Run Timer and the time setting on the Engine Cooldown Timer.

**Standby Frequency Sensor** – During automatic operation, transfer to the standby power source will not occur until generator AC frequency has reached the setting of this Sensor. Sensor is factory set to about 90% of the nominal rated normal source frequency. It may be reset to any frequency between 80-90% of the rated frequency.

Extending the normal disconnect (tripped) neutral time provides some protection against nuisance tripping of circuit breakers or blowing of fuses. The Timer is factory set to about 5 seconds; it may be reset to any disconnect time between 0.1 and 10 seconds.

**Transfer to Standby Light** – Not an adjustment. This LED will come on when the load has been transferred to the standby power source.

**Engine Warmup Timer Bypass Switch** – If you wish to transfer the load to standby as soon as generator AC voltage and frequency have reached an acceptable value, and without the time interval of the Engine Warmup Timer, set the switch to ON. This will eliminate the Engine Warmup Timer from any automatic operating sequence. To place the Engine Warmup Timer back into the system, set the switch to OFF.

The In-Phase Monitor circuit board is operational only when the generator set is running. Transfer will occur when both the voltage and the phase of both the utility and the generator are within assigned setpoints. Each in-phase control is programmed with the use of an onboard DIP switch to match the actuation time of the corresponding switch. In-phase transfer is used only between two live power sources and can not be implemented during a utility source failure. The In-Phase Monitor circuit board is designed to transfer loads under the following conditions:

- When there is no greater than 20 degrees difference in phase angle between the utility and the generator set power sources.
- When the generator set frequency is between 58-62 Hz (48-52 Hz for 50 Hz systems).
- When the generator set and utility power source frequencies are within 2 Hz.
- When the generator set and utility source voltages are within 85-110 percent of normal voltage.

If any one of these conditions are not met within 10 seconds from the time when the engine warmup timer permits transfer, the system automatically reverts to Time Delay Neutral operation.

Transfer time between sources is less than a second, or the time which it takes for the transfer mechanism to actuate.

## Adjustments

The following adjustable potentiometers, switches and lights are provided on the In-Phase Monitor circuit board for sensor and timer adjustments.

**Engine Warmup Timer** – (Also see the Warmup Bypass Switch.) Establishes a time interval between generator startup and transfer of the load to standby power, to allow the engine to warm up before placing a load on it. This time interval is factory set to approximately one minute; it may be reset to any time interval between 5 seconds and 3 minutes.

**Engine Minimum Run Timer** – Establishes a minimum operating duration for the standby generator, to prevent shutdown of a cold engine during brief normal source power outages. This potentiometer is factory set to approximately twenty minutes; it may be reset to any time interval between 5 and 30 minutes.

**Return To Utility Timer** – Establishes a time interval between restoration of normal source voltage above the setting of the Voltage Pickup Sensor and re-transfer back to the normal source. This time delay is necessary to prevent "false" re-transfer that might be caused by transient normal source voltage signals during an outage. Timer is factory set to approximately five minutes; it may be reset to any time interval between 1 and 30 minutes.

**Engine Cooldown Timer** – Provides a time delay after automatic re-transfer of the load back to the normal power source to permit the engine to run at no-load for a time before it is shut down. Timer is factory set to about 10 minutes; it may be reset to any time interval between 1 and 30 minutes.

NOTE: The actual time interval between re-transfer back to normal and generator shutdown is the time remaining on the Engine Minimum Run Timer or the time setting of the Engine Cooldown Timer, whichever is longer.

**Standby Voltage Sensor** – During automatic operation, transfer of the load to the standby power source will not occur until generator AC output voltage has reached the setting of this sensor. Sensor is factory set to about 80% of the nominal rated supply voltage. It may be reset to any voltage between 75-95% of the STANDBY rated voltage.

**Standby Frequency Sensor** – During automatic operation, transfer to the standby power source will not occur until generator AC frequency has reached the setting of this sensor. Sensor is factory set to about 90% of the nominal rated normal source frequency. It may be reset to any frequency between 80-90% of the rated frequency.

**Signal Before Transfer Timer** – (Also see the Signal Before Transfer Switch.) When the Transfer Contact-Elevator option is ordered, this timer will control the amount of time that the transfer to the standby power source is delayed in order to permit elevators to continue operating long enough to reach the next floor. Also the contacts will be closed for the time controlled by the Signal Before Transfer Timer. If this option is not ordered the adjustable potentiometer is still provided on the board, however it will have no effect on Automatic Transfer Switch operation. The Signal Before Transfer Timer is adjustable from 1 to 30 seconds.

**Time Delay Neutral Timer** – (Also see Time Delay Neutral On/Off Switch.) The time delay at neutral feature will hold the main current carrying contacts open to both power sources for a brief period of time during transfer. This permits residual voltages that might be generated by heavy inductive loads to decay to a safe level before reconnecting the main contacts.

Timer operation starts if the In-Phase Transfer Select Switch is ON and the conditions for an in-phase transfer to take place are NOT met within 10 seconds. Timer operation will also start automatically if the In-Phase Transfer Select Switch is OFF. The timer is factory set to about 5 seconds; it may be reset to any disconnect time between 0.1 and 10 seconds.

**Calibration Mode Switch** – Allows the operator to calibrate the in-phase monitor 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 at the time of installation in order to initiate transfer at the correct voltages. To calibrate the circuit board correctly see the "Calibrating The In-Phase Monitor Circuit Board" section.



**In-Phase Transfer Select Switch** – Allows the operator to select either In-Phase Transfer or Time Delay Neutral operation.

**Signal Before Transfer Switch** – When the Transfer Contact-Elevator option is ordered, this switch allows the operator to activate or turn off the option. When the Transfer Contact-Elevator option is ordered and switch is ON, the signal before transfer option will be functional. When the Transfer Contact-Elevator option is not ordered, the position of this switch will have no effect on the Automatic Transfer Switch operation.

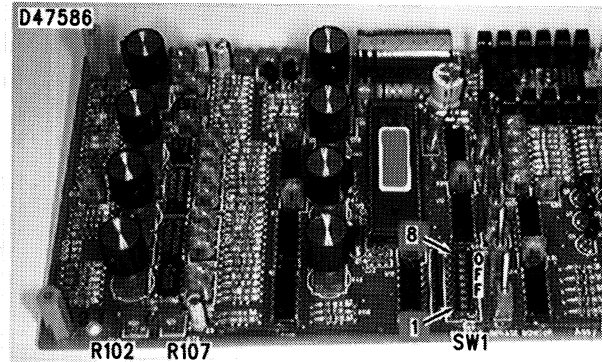
**Warmup Bypass Switch** – If it is desired to transfer the load to standby as soon as generator AC voltage and frequency have reached the setting of the Standby Voltage and Frequency Sensors, set the switch to ON. This will eliminate the Engine Warmup Timer from any automatic operating sequence. To place the Engine Warmup Timer back into the system, set the switch to OFF.

**Transfer On Exercise Switch** – If it is desired that the load be transferred to the standby source side during the 7-day exercise cycle, set this switch to ON. If no transfer on exercise is desired, set the switch to OFF.

#### Indicator LED's:

- The Warmup, Minimum Run, Return To Utility and Cooldown Timer LED's will turn ON when the respective timers are activated.
- The In-Phase Transfer Selected LED turns ON when the In-Phase Transfer Select Switch is set to ON. This indicates that the Automatic Transfer Switch will operate in the In-Phase mode and not the Time Delay Neutral mode.
- The TDN Timer LED turns ON when the Time Delay Neutral timer is activated.
- The Signal Before Transfer Timer LED turns ON when the Signal Before Transfer timer is activated.
- The Transfer To Standby LED will turn ON when the load has been successfully transferred to the standby power source.
- The Standby Run Signal LED will turn ON when the generator is running and the In-Phase Monitor circuit board is operational and controlling the generator.

### Calibrating The In-Phase Monitor Circuit Board



In-Phase Monitor Circuit Board

For proper operation, the In-Phase Monitor circuit board should be calibrated to the existing STANDBY and UTILITY source voltages.

NOTE: The In-Phase Monitor circuit board should be calibrated when the transfer switch has been installed as part of an operating system. Also, replacement circuit boards should be calibrated after installation.

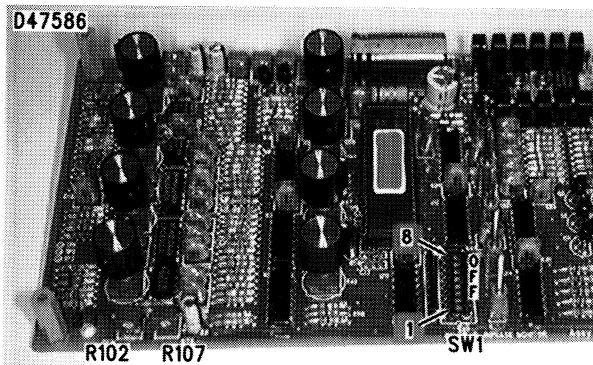
To calibrate the circuit board, two adjustment potentiometers (R102 and R107) are provided in the lower left corner of the circuit board. Always calibrate the circuit board in the following sequence:

- 1.** Check that the UTILITY supply voltage is available to the system.
- 2.** Start the generator set. Allow it to stabilize and warm up. The Standby Run Signal LED should be ON.
- 3.** Place the calibration mode switch in the STDBY position. Observe the four top red LED's on the circuit board (Warmup Timer, Minimum Run Timer, Return to Utility Timer and Cooldown Timer).
  - If the two upper LED's are flashing, calibration is set too low.
  - If the two bottom LED's are flashing, calibration is set too high.
- 4.** On the circuit board, adjust potentiometer R102 until only the Minimum Run LED and the Return To Utility LED (two center LED's of the top four red LED's) are flashing.

5. Place the calibration mode switch to the UTIL position. Observe the four upper LED's on the circuit board.
6. Adjust potentiometer R107 until only the Minimum Run LED and Return To Utility LED (two center LED's of the top four red LED's) are flashing.
7. Place the calibration mode switch to the OFF position. The In-Phase Monitor circuit board is now calibrated.

NOTE: With the calibration mode switch in the STDBY or UTIL positions, the top four LED's should turn ON in sequence. That is, the LED's should sweep ON and OFF, from one LED to the next. Calibration is obtained when the Minimum Run LED and Return To Utility LED (two center LED's of the top four red LED's) are flashing.

#### Setting The In-Phase Monitor Circuit Board



SW1 On In-Phase Monitor Circuit Board

The In-Phase Monitor circuit board must be set to match the type of the transfer switch on which it is installed. At the factory, the circuit board is set up to match the transfer switch and should require no additional configuring.

However, for units that are not installed at the factory, the circuit board must be set up to match the type of the transfer switch on which it is being installed. An improper setting may cause transfers that are out of the 20 degree specification.

The SW1 switch on the In-Phase Monitor circuit board is used to set the circuit board to match the transfer switch. SW1 is a DIP (dual inline package) switch assembly consisting of eight miniature switches. The individual switches on SW1 are labeled 1 through 8. SW1 is soldered to the circuit board near the Transfer On Exercise switch. The installer must set the switches 1 through 8 of SW1 as listed in the SW1 Settings chart.

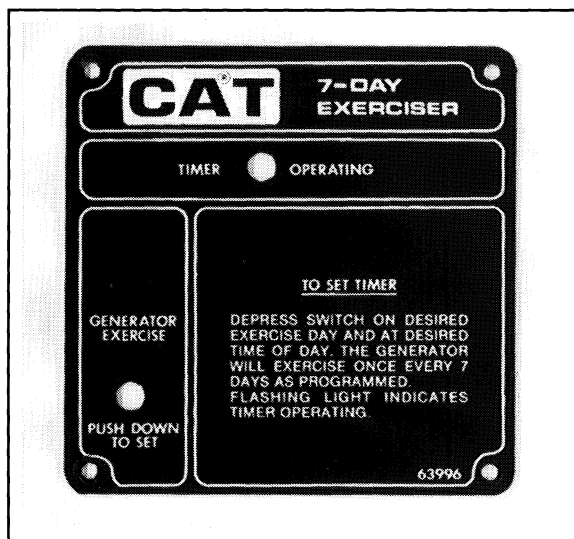
SW1 SETTINGS For 208 Volt Rated Transfer Switches								
Type Of Transfer Switch	SW1 -1	SW1 -2	SW1 -3	SW1 -4	SW1 -5	SW1 -6	SW1 -7	SW1 -8
100A, 3 Pole	*	on	on	off	on	off	on	off
100A, 4-Pole	*	on	on	off	on	on	off	off
150A, 3 Pole	*	on	on	off	on	on	off	on
150A, 4 Pole	*	on	on	off	on	on	off	off
200A, 3 Pole	*	on	on	off	on	on	off	on
200A, 4 Pole	*	on	on	off	on	on	off	off
300A, 3 Pole	*	on	on	off	off	on	off	on
300A, 4 Pole	*	on	on	off	off	on	on	on
400A, 3 Pole	*	on	on	off	off	on	off	on
400A, 4 Pole	*	on	on	off	off	on	on	on
600A, 3 Pole	*	on	off	off	on	on	on	on
600A, 4 Pole	*	on	off	off	on	on	off	on
800A, 3 Pole	*	on	off	off	on	on	off	off
800A, 4 Pole	*	on	off	off	on	on	on	off
1000A, 3 Pole	*	on	off	off	on	on	off	off
1000A, 4 Pole	*	on	off	off	on	on	on	off
1200A, 3 Pole	*	on	off	off	on	off	on	on
1200A, 4 Pole	*	on	off	on	off	on	off	off
1600A, 3 Pole	*	on	off	off	on	off	on	on
1600A, 4 Pole	*	on	off	on	off	on	off	off
2000A, 3 Pole	*	off	on	on	off	off	on	on
2000A, 4 Pole	*	off	on	on	off	off	off	on

\* Set SW1-1 to "off" for 60 Hz applications.  
Set SW1-1 to "on" for 50 Hz applications.

SW1 SETTINGS For 240, 415, 480, and 600 Volt Rated Transfer Switches								
Type Of Transfer Switch	SW1 -1	SW1 -2	SW1 -3	SW1 -4	SW1 -5	SW1 -6	SW1 -7	SW1 -8
100A, 3 Pole	*	on	on	off	on	on	on	on
100A, 4-Pole	*	on	on	on	off	off	off	off
150A, 3 Pole	*	on	on	on	off	off	off	on
150A, 4 Pole	*	on	on	on	off	off	on	off
200A, 3 Pole	*	on	on	on	off	off	off	on
200A, 4 Pole	*	on	on	on	off	off	on	off
300A, 3 Pole	*	on	on	off	on	off	off	on
300A, 4 Pole	*	on	on	off	on	on	off	off
400A, 3 Pole	*	on	on	off	on	off	off	on
400A, 4 Pole	*	on	on	off	on	on	off	off
600A, 3 Pole	*	on	off	on	off	on	on	off
600A, 4 Pole	*	on	off	on	off	on	off	off
800A, 3 Pole	*	on	off	on	off	off	on	off
800A, 4 Pole	*	on	off	on	off	off	on	on
1000A, 3 Pole	*	on	off	on	off	off	on	off
1000A, 4 Pole	*	on	off	on	off	off	on	on
1200A, 3 Pole	*	on	off	on	off	off	off	on
1200A, 4 Pole	*	on	off	off	on	on	off	off
1600A, 3 Pole	*	on	off	on	off	off	off	on
1600A, 4 Pole	*	on	off	off	on	on	off	off
2000A, 3 Pole	*	off	on	on	on	on	on	on
2000A, 4 Pole	*	off	on	on	on	on	on	off
2600A, 3 Pole	*	off	off	on	off	off	on	off

\* Set SW1-1 to "off" for 60 Hz applications.  
Set SW1-1 to "on" for 50 Hz applications.

## Seven Day Exerciser Circuit Board Adjustments



### 7-Day Exerciser Circuit Board

Units equipped with the optional In-Phase Monitor or Programmable Logic Control circuit board have a separate 7-Day Exerciser circuit board.

On the desired day of exercise and at the desired time of day, push the Generator Exercise switch down and hold for about 15 seconds.

The system will automatically start and exercise every 7 days thereafter, at the time of day selected.

NOTE: If it is required to operate the Automatic Transfer Switch without the 7 Day Exerciser, then the timer can be disconnected (unplugged) and no exercise will occur.

#### A. General Conditions:

1. The exercise signal output from the 7-day exerciser circuit board is maintained for 12.94 minutes (at a 60 Hz clock rate).
2. The STANDBY engine start signal is initiated by the 7-day exerciser circuit board at the selected exercise time.
3. After the voltage and frequency of the STANDBY power source have exceeded the user adjustable setpoints, the minimum run and cooldown timers (of the logic circuit board) are activated.

**B. Exercise Without Transfer (Transfer When Exercising Switch in the "OFF" position):**

After the general conditions have been met (as described above in "A"), the run time of the standby generator set is determined by the longest of the following timers:

1. Exercise time, 12.94 minutes.
2. The setting of the engine minimum run timer (30 minutes maximum).
3. The setting of the engine cooldown timer (30 minutes maximum); starts after the engine warmup timer has elapsed (3 minutes maximum).

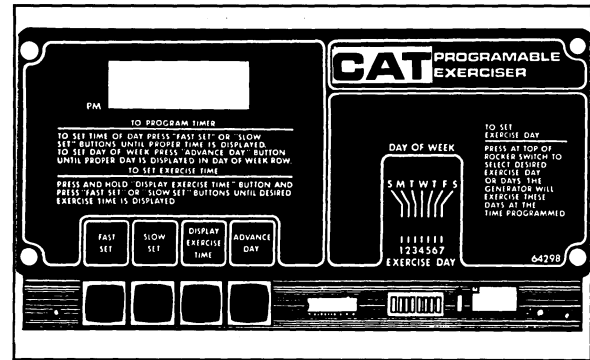
**C. Transfer On Exercise (Transfer When Exercising Switch in the "ON" position):**

After the general conditions have been met (as described above in "A"), the transfer to the STANDBY power source will occur with the following conditions:

1. The transfer to the STANDBY power source is determined by the condition of the warmup timer and the Engine Warmup Timer Bypass Switch.
2. The transfer to the STANDBY power source will occur as determined by the setting of the time delay neutral timer.
3. The transfer to the STANDBY power source is maintained for the remaining exercise period (12.94 minutes).
4. The run time of the standby generator set (after the retransfer from STANDBY to NORMAL) is controlled by the setting of either the minimum run timer or the cooldown timer (as described above in "B").

**NOTE:** Battery – Normally the 7-day exerciser circuit board is powered by the load terminal voltage from transformer T2; see the description of Load Power Supply Transformer T2 in the General Components section. However, during a transfer action there is a brief time when the supply voltage to the exerciser timer is not present. During this time period the 9 volt exerciser battery provides the timer power until the load terminal is reapplied.

**Optional Programmable Exerciser Circuit Board**



Optional Programmable Exerciser Circuit Board

When the transfer switch is equipped with an optional In-Phase Monitor or Programmable Logic Control circuit board, an optional Deluxe Exerciser circuit board may also be included. This type of circuit board permits the day (or days) of the week for system exercise to be selected, by means of a digital chronograph. Always adjust the circuit board in the following sequence:

- 1. Set Actual Time of Day** – Observe the lighted chronograph at left side of board while holding the FAST SET button down. When close to the actual time of day, release the FAST SET button. Then, use the SLOW SET button to complete the adjustment to the actual time of day (present time). A red dot adjacent to the time indicates "PM" times.
- 2. Set Actual Day of the Week** – Locate the switch above which appear the words "ADVANCE DAY". Depress the ADVANCE DAY switch while observing the lighted DAY OF WEEK indicator. The lighted indicator will advance one day each time the ADVANCE DAY switch is actuated. When the lighted indicator indicates the correct actual day of the week (the present day), adjustment is complete.
- 3. Select Exercise Day or Days** – A bank of eight miniature rocker switches is provided on the right side of the circuit board. Switches 1 through 7 correspond to days of the week (Sunday through Saturday, respectively). Switch 8 is not used.

To select a day of the week for system exercise, actuate the correct numbered switch to its ON position (opposite of OPEN). A lighted band will appear next to that day. In this manner, the system can be set to start and exercise one, two, or more days each week.

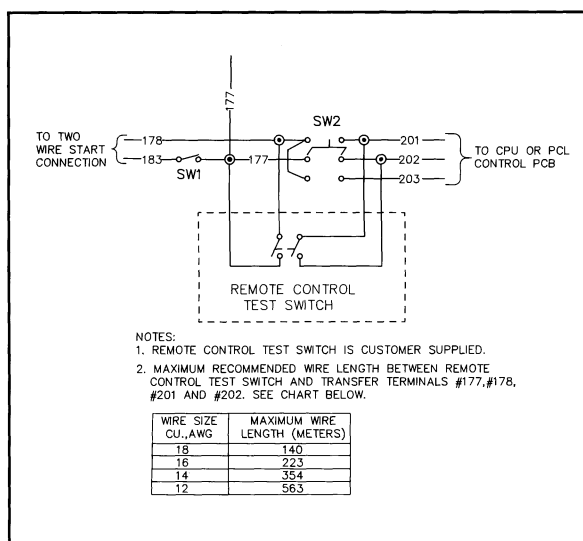
**4.** Select Time of Day for Exercise – Push down on switch below the words "DISPLAY EXERCISE TIME". While holding that switch down, press FAST SET and SLOW SET switches until the desired exercise time is displayed. A red dot adjacent to the time indicates "PM" times.

## Transfer Switch Options

### Optional NEMA 3R Enclosure

Some transfer switches may utilize a NEMA Type 3 enclosure. This type of enclosure is dust-tight, rain-tight, and sleet or ice resistant. They are intended for use outdoors to protect the enclosed equipment against windblown dust and water.

### Remote Control Circuit



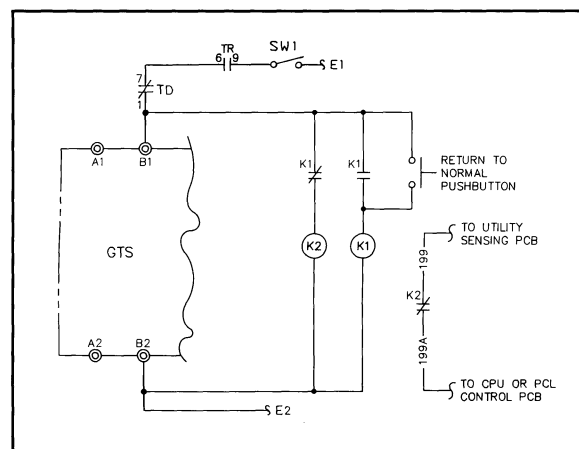
Remote Control Circuit Diagram

Also see Fast Test information in the "Operating Instructions" section of this manual. The optional Remote Control Circuit permits the operator to perform a normal test of the system from a selected, convenient, remote site.

When the remote control switch is activated, the transfer switch then sends the signal to start. When the standby power source is available, the transfer switch will operate to that source, and continue to operate from that source until the remote control switch is returned to normal.

The double pole, single throw (DPST) switch is customer supplied. Use stranded copper wire to connect the Remote Switch to the transfer switch. Recommended wire gauge size (AWG) depends on the length of the wire and is shown below.

### Return To NORMAL Bypass (For Use With Microprocessor Based Controls)



During automatic operation and following a normal power source failure, the generator will start and transfer to the standby source will occur. Under normal automatic operating conditions, restoration of normal source voltage and re-transfer back to that power source can occur at any time.

Under certain conditions, it may be undesirable for re-transfer back to normal to occur such as in a manufacturing plant. The optional Return To Normal Bypass overrides automatic re-transfer back to the normal source on restoration of that power source.

When normal source has been restored, the operator must initiate a return to normal transfer and generator shutdown by actuating the RETURN TO NORMAL pushbutton switch (mounted on the door).

### Return To NORMAL Bypass Operation Description:

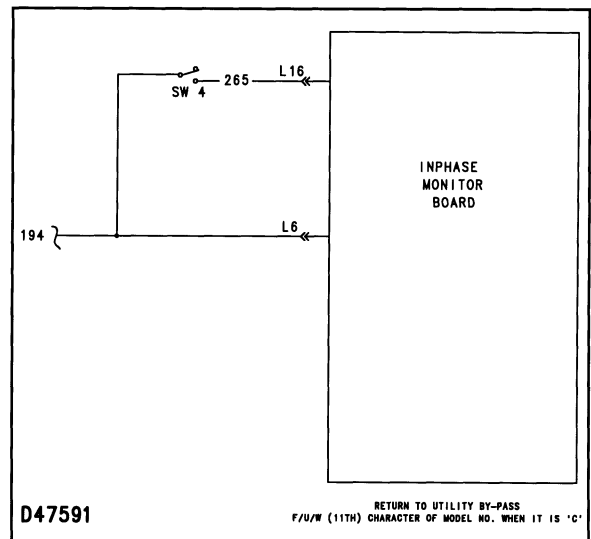
**1. NORMAL Power Available, Generator Stopped:** Transformer reduced STANDBY source power is not available to transfer mechanism terminals B1 and B2. Relay K2 is de-energized and its normally-closed contacts K2 are closed. Relay K1 is de-energized, its normally-closed contacts are closed, and its normally-open contacts are open. The Wire #199/199A circuit (between the Utility Voltage Sensor and the Microprocessor Based board) is closed and a "NORMAL Voltage Available" signal is available to the latter.

- 2. NORMAL Power Lost, Generator Running:** Transformer reduced STANDBY voltage is available to transfer mechanism terminals B1 and B2. Relay K2 energizes and its normally-closed contacts open. The Wires #199/199A circuit is held open by Relay K2 action.
- 3. NORMAL Power Restored, Generator Running:** With the engine-generator running, Relay K2 remains energized and its normally-closed contact remains open. The "NORMAL" voltage Available" signal that would normally be delivered to the Microprocessor Based (or In-Phase Monitor or Programmable Logic) board is not available. That circuit board "thinks" NORMAL source voltage is not available and provides no action to re-transfer the LOAD or stop the engine-generator.
- 4. Return to Normal Pushbutton Closed:** When the operator closes the pushbutton switch, Relay K1 is energized by reduced STANDBY source voltage. The normally-closed K1 contacts open, to de-energize Relay K2. The normally-open K1 contacts close, to hold the Relay K1 energized as long as STANDBY source power is available. When Relay K2 is de-energized, its normally-closed contacts close. The "NORMAL Voltage Good" signal is delivered to the Microprocessor Based (or In-Phase Monitor or Programmable Logic) board. When the Return To Utility Timer has timed out, the circuit board will then initiate re-transfer back to the NORMAL source and engine-generator shutdown sequences.

NOTE: When the bypass push-button is operated it starts the Time Delay Return To Utility timer of the microprocessor based circuit board. When this timer has timed out, the transfer to NORMAL will occur.

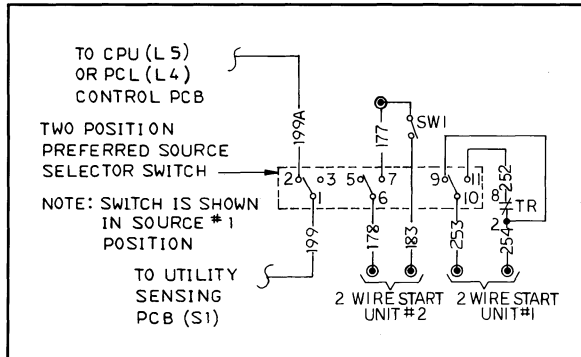
NOTE: For autotest and 7 day exercising (if transfer on exercise has been selected) the bypass push-button must be operated to return to NORMAL.

### Return To NORMAL Bypass (For Use With In-Phase Monitor Controls)



The Return To NORMAL Bypass option that can be used with the In-Phase Monitor Control does not work in the same manner as the Return To NORMAL Bypass option which is used with the standard Microprocessor Based Control. The In-Phase Monitor Control gives the operator the ability to transfer the load back to the normal power source after normal power is restored thus bypassing the Return To Utility timer. To bypass the Return To Utility timer, the operator should press switch SW4 (normally open). The circuit board will then cause the transfer mechanism to switch the load to the normal power source. SW4 is mounted on the front of the door panel of the Automatic Transfer Switch enclosure.

### Preferred Source Selector Switch

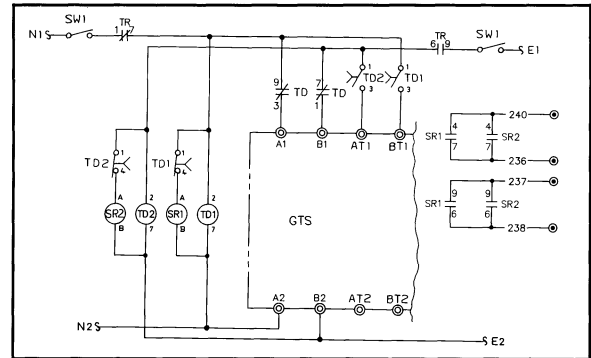


This option may be used when it is desirable for either source of power to serve as the normal (preferred) source. The other power source then becomes the standby source. The preferred source selector (PSS) switch: is mounted to the door, is manually operated, AND has two positions (SOURCE #1 and SOURCE #2). The PSS switch connects to the transfer switch, to provide a means of selecting the normal (preferred) source.

The PSS switch is shown above in the SOURCE #1 position. In this position, UNIT #1 is the preferred source and UNIT #2 is the standby source. The PSS switch shorts wires #253 and #254 together, which provides the signal to start and run UNIT #1. If SOURCE #1 fails with the PSS switch in the SOURCE #1 position, the transfer switch signals the standby power source (UNIT #2) to start.

When the PSS switch is in the SOURCE #2 position, UNIT #2 is the preferred source and UNIT #1 is the standby source. In this position, wire #199 is opened and therefore the control system (Microprocessor, In-Phase Monitor or Programmable Logic) thinks SOURCE #1 is not available. The transfer relay (TR) is energized and contacts 2 & 8 are open. The PSS switch shorts wires #178 and #183 together, which provides the signal to start and run UNIT #2. If SOURCE #2 fails with the PSS switch in the SOURCE #2 position; transfer relay (TR) de-energizes and contacts 2 & 8 close, and the transfer switch signals the standby power source (UNIT #1) to start.

### Transfer Contact- Elevator (For Use With Microprocessor Based Controls)

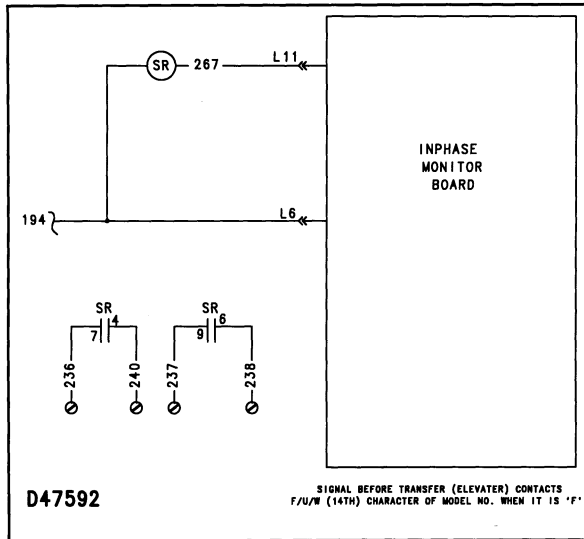


The optional Transfer Contact-Elevator provides a time delay, which permits elevators to continue operating (long enough to reach the next floor) before a transfer to another power source can occur. Without this optional time delay, the loss of power that occurs during any transfer action could result in elevator(s) stopping between floors. This option consists of Relays SR1 and TD1, which are energized by NORMAL source voltage; and Relays SR2 and TD2, which are energized by STANDBY source voltage.

The TD1, SR1 or TD2, SR2 relays delay the operation of the transfer switch for their preset time. Two sets of contacts are provided to signal the elevator prior to transfer switch operation.



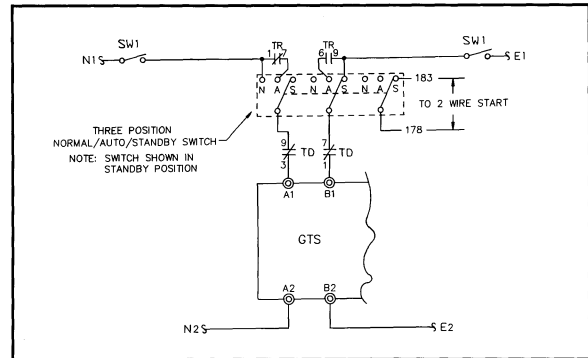
### Transfer Contact- Elevator (For Use With In-Phase Monitor Control)



The Transfer Contact- Elevator option for the In-Phase Monitor Control has the same purpose as the Transfer Contact- Elevator option for the standard Microprocessor Based Control. However the In-Phase Monitor Transfer Contract- Elevator option has an additional function. The additional function can control the amount of time that the transfer to the standby power source is delayed. This additional function is controlled by the Signal Before Transfer timer, located on the In-Phase Monitor circuit board. The Signal Before Transfer timer is adjustable from 1 to 30 seconds. The contacts provided by this option will be closed for the time period controlled by the Signal Before Transfer timer.

The Signal Before Transfer switch allows the operator to activate or turn off the option. It is located on the In-Phase Monitor circuit board. When the Transfer Contact-Elevator option is ordered and the switch is ON, the signal before transfer option will be functional. When the Transfer Contact-Elevator option is not ordered, the position of this switch has no affect on ATS operation.

### Optional Normal/Auto/Standby Switch

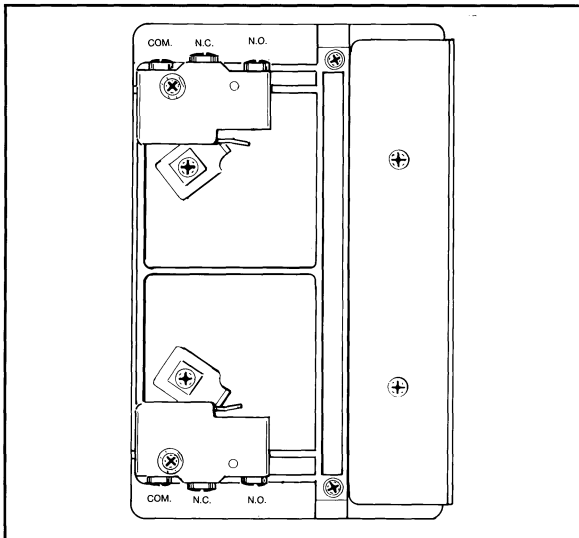


Under certain conditions it may be desirable to manually select the active power source, by means of a selector switch.

The 3-position Normal/Auto/Standby switch provides such a feature.

1. When the switch is set to NORMAL position, loads will be powered by that source. The generator can start on loss of normal source but transfer is inhibited.
2. When the switch is set to STANDBY, generator startup and transfer to the STANDBY source will occur. The loads will be powered by the standby source as long as it is available.
3. When the switch is set to AUTO, normal automatic operation will resume as outlined in Sequence Of Operation.

### Optional Auxiliary Contacts



Optional Auxiliary Switches (Upper and Lower) - Right Side Of Transfer Switch

Extra auxiliary contacts can be provided on the transfer mechanism, for customer use. Auxiliary contacts may be used to operate customer accessories, remote advisory lights, remote annunciator devices, etc.

The optional auxiliary switch (contacts) is a dual-pole dual-throw (DPDT) switch and replaces the standard auxiliary switch (SPST). When one additional set of auxiliary contacts are ordered, the standard lower auxiliary switch is replaced with the optional auxiliary switch (DPDT). When two additional sets of auxiliary contacts are ordered, the standard lower and standard upper auxiliary switches are replaced with optional auxiliary switches (DPDT).

In the above illustration, the upper optional auxiliary switch is on the normal end of the transfer switch and the lower optional auxiliary switch is on the standby end of the transfer switch. Each optional auxiliary switch (DPDT) has two sets of contacts which are marked COM, N C and N O. A suitable power source must be connected to the COM terminal.

#### Optional Auxiliary Switch Operation:

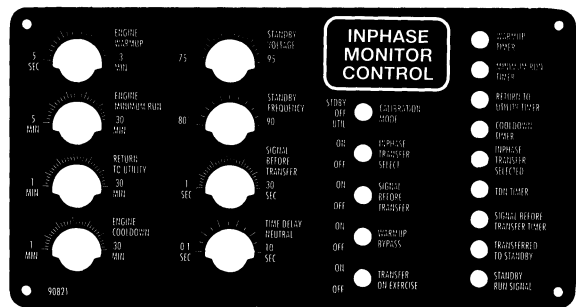
- In the NEUTRAL position of the transfer switch, the lower and upper optional auxiliary switches are activated.
- In the NORMAL position of the transfer switch, the lower optional auxiliary switch is activated and the upper optional auxiliary switch is not activated.
- In the STANDBY position of the transfer switch, the lower optional auxiliary switch is not activated and the upper optional auxiliary switch is activated.

One set of contacts of the upper optional auxiliary switch are used to operate the panel indicator lamps and are not for customer use.

The unused contacts of the upper optional auxiliary switch and the contacts of the lower optional auxiliary switch may be used to operate customer accessories, remote indicator lights, or remote annunciator devices.

**NOTE:** The optional auxiliary switches are configured differently than the standard auxiliary switches. The location of the COM, N O, and N C contacts is not the same. See the subject "Standard Auxiliary Contacts" in the "Transfer Switch Installation" section in this manual.

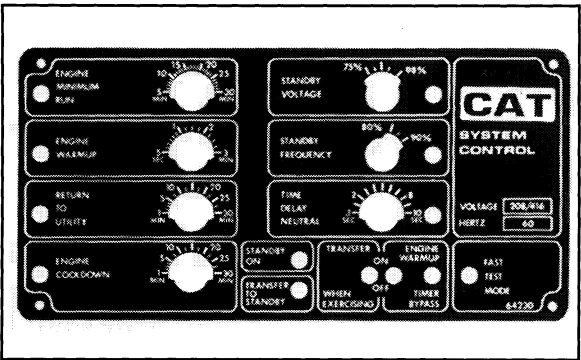
Optional In-Phase Monitor Control Circuit Board



Optional In-Phase Monitor Control Circuit Board

An In-Phase Monitor Control circuit board may be installed on some transfer switches, instead of the fixed setting type Microprocessor Based Control. When the In-Phase Monitor Control Circuit Board is used, a separate 7-Day Exerciser circuit board is used. In addition, an optional Programmable Exerciser circuit board is also available. For standard and optional circuit board adjustments, see the Sensor And Timer Adjustments section of this manual.

Optional Programmable Logic Control Circuit Board

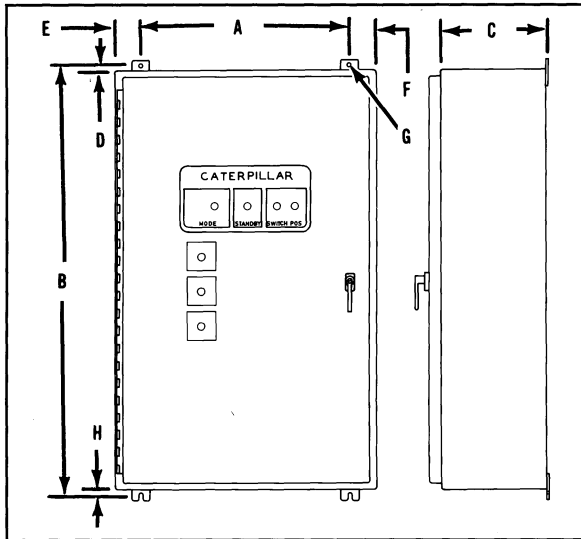


Optional Programmable Logic Control Circuit Board

A Programmable Logic Control circuit board may be installed on some transfer switches, instead of the fixed setting type Microprocessor Based Control. When the Programmable Logic Control Circuit Board is used, a separate 7-Day Exerciser circuit board is used. In addition, an optional Programmable Exerciser circuit board is also available. For standard and optional circuit board adjustments, see the Sensor And Timer Adjustments section of this manual.

## Enclosure Mounting Dimensions

### NEMA Enclosures For 100, 150, 200, 300 And 400 Amp Transfer Switches



Enclosure Mounting Dimensions;  
100 - 400 Amp Transfer Switches

#### NEMA 1 Enclosure For 100 Amp Transfer Switch

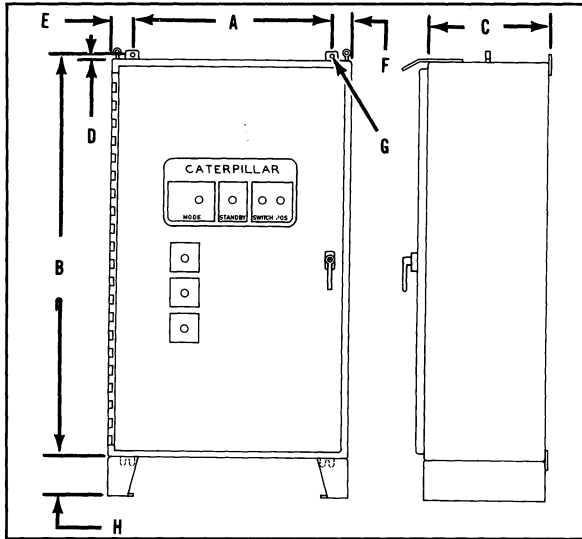
Dimension A	46.8 cm (18.44 in)
Dimension B	95.7 cm (37.69 in)
Dimension C	24.8 cm (9.76 in)
Dimension D	1.6 cm (.62 in)
Dimension E	7.6 cm (3.00 in)
Dimension F	7.6 cm (3.00 in)
Dimension G	1.1 cm (.43 in)
Dimension H	1.6 cm (.62 in)

#### NEMA 1 Enclosure For 150, 200, 300 And 400 Amp Transfer Switches

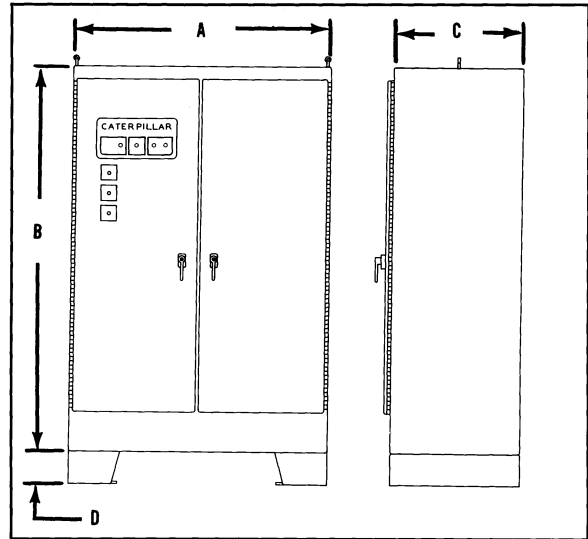
Dimension A	62.1 cm (24.44 in)
Dimension B	126.2 cm (49.69 in)
Dimension C	29.9 cm (11.76 in)
Dimension D	1.6 cm (.62 in)
Dimension E	7.6 cm (3.00 in)
Dimension F	7.6 cm (3.00 in)
Dimension G	1.1 cm (.43 in)
Dimension H	1.6 cm (.62 in)

#### NEMA 12 Enclosure For 150, 200, 300 And 400 Amp Transfer Switches

Dimension A	61.0 cm (24.00 in)
Dimension B	125.1 cm (49.24 in)
Dimension C	31.0 cm (12.19 in)
Dimension D	1.6 cm (.62 in)
Dimension E	7.6 cm (3.00 in)
Dimension F	7.6 cm (3.00 in)
Dimension G	1.1 cm (.43 in)
Dimension H	1.6 cm (.62 in)

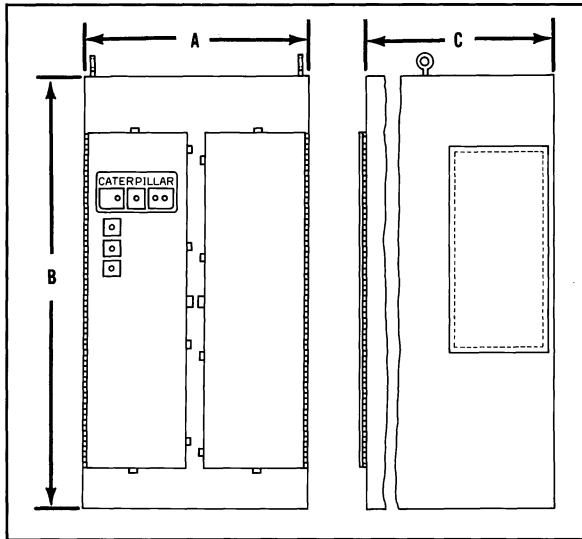
**NEMA 12 Enclosure For 600, 800 And 1000  
Amp Transfer Switches****NEMA 12 Enclosure Mounting Dimensions;  
600 - 1000 Amp Transfer Switches**

Dimension A .....	76.2 cm (30.00 in)
Dimension B .....	154.0 cm (60.62 in)
Dimension C .....	51.3 cm (20.19 in)
Dimension D .....	1.6 cm (.62 in)
Dimension E .....	7.6 cm (3.00 in)
Dimension F .....	7.6 cm (3.00 in)
Dimension G .....	1.1 cm (.43 in)
Dimension H .....	15.2 cm (6.00 in)

**NEMA 12 Enclosure For 1200 And 1600 Amp  
Transfer Switches****NEMA 12 Enclosure Mounting Dimensions;  
1200 And 1600 Amp Transfer Switches**

Dimension A .....	121.9 cm (48.00 in)
Dimension B .....	182.9 cm (72.00 in)
Dimension C .....	61.0 cm (24.00 in)
Dimension D .....	15.2 cm (6.00 in)

**NEMA 12 Enclosure For 2000 And 2600 Amp  
Transfer Switches**



NEMA 12 Enclosure Mounting Dimensions;  
2000 - 2600 Amp Transfer Switches

Dimension A .....	116.8 cm (46.00 in)
Dimension B .....	203.2 cm (80.00 in)
Dimension C .....	121.9 cm (48.00 in)

# Abbreviations And Symbols

## Abbreviations

A1, A2	A POWER SOURCE SIDE (ON)
AT1, AT2	A POWER SOURCE SIDE (TRIP)
ATS	AUTOMATIC TRANSFER SWITCH
ATS1	TRIP CONTROL SWITCH (NORMAL SOURCE)
ATS2	TRIP CONTROL SWITCH (NORMAL SOURCE)
AX	CONTROL SWITCH (NORMAL SOURCE)
AUX	AUXILIARY SWITCH
B1, B2	B POWER SOURCE SIDE (ON)
BT1, BT2	B POWER SOURCE SIDE (TRIP)
BTS1	TRIP CONTROL SWITCH (STANDBY SOURCE)
BTS2	TRIP CONTROL SWITCH (STANDBY SOURCE)
BX	CONTROL SWITCH (STANDBY SOURCE)
C	CLOSING COIL
CL	SWITCH POSITION NORMAL (CLEAR) LIGHT
CPU	CENTRAL PROCESSING UNIT
E	CONNECTOR, 7 DAY EXERCISER PCB
GTS	GENERATOR TRANSFER SWITCH
L	CONNECTOR, SYSTEM CONTROL PCB
LS	LIMIT SWITCH (OF SELECTIVE COIL
NAS	NORMAL/AUTO STANDBY 3 POSITION SWITCH
NB	NEUTRAL CONNECTION BLOCK
P	CONNECTOR, UTILITY VOLTAGE SENSING PCB
PCB	PRINTED CIRCUIT BOARD
PCL	PROGRAMMABLE CONTROL LOGIC
PSS	PREFERRED SOURCE 2 POSITION SWITCH
RL	SWITCH POSITION STANDBY (RED) LIGHT
RTN	RETURN TO NORMAL PUSHBUTTON
S	CONNECTOR, UTILITY VOLTAGE SENSING PCB
SC	SELECTIVE COIL
SR	SIGNAL RELAY
SW1	MAINTENANCE DISCONNECT SWITCH
SW2	SYSTEM TEST SWITCH
SW3	TIME DELAY NEUTRAL BYPASS
TC	TRIP COIL
TD	TIME DELAY RELAY
TDR	TIME DELAY RELAY
TR	TRANSFER RELAY
T1	STANDBY SENSING TRANSFORMER
T2	LOAD POWER SENSING TRANSFORMER
T3	STEPDOWN TRANSFORMER
T4	STEPDOWN TRANSFORMER
T5	UTILITY SENSING TRANSFORMER
T6	UTILITY SENSING TRANSFORMER
T7	UTILITY SENSING TRANSFORMER
T8	NORMAL POWER SENSING TRANSFORMER
TS	TERMINAL STRIP
YL	STANDBY OPERATING (YELLOW) LIGHT

## Symbols

	TERMINAL BOARD POINT
	STANDARD WIRING
	RELAY CONTACT (NORMALLY OPEN)
	RELAY CONTACT (NORMALLY CLOSED)
	TIMED CLOSED CONTACT
	TIMED OPEN CONTACT
	FRAME OR CHASSIS GROUND
	EARTH GROUND
	RELAY (CONTACTOR) COIL
	INDICATING LIGHT
	TRANSFORMER
	SINGLE POLE DOUBLE THROW CONTACT
	PLUG & SOCKET CONNECTOR

## Symbols

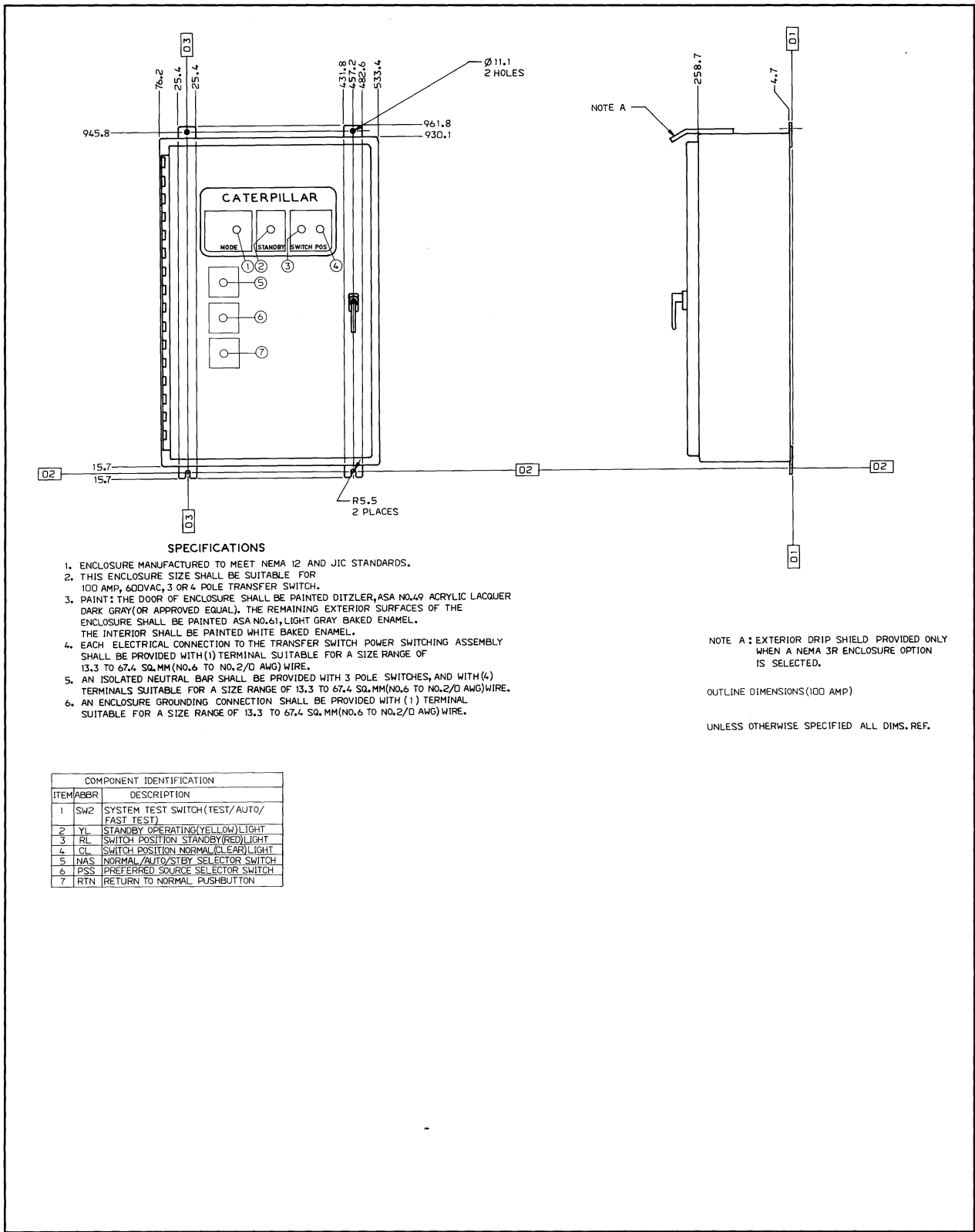


## SPECIFICATIONS

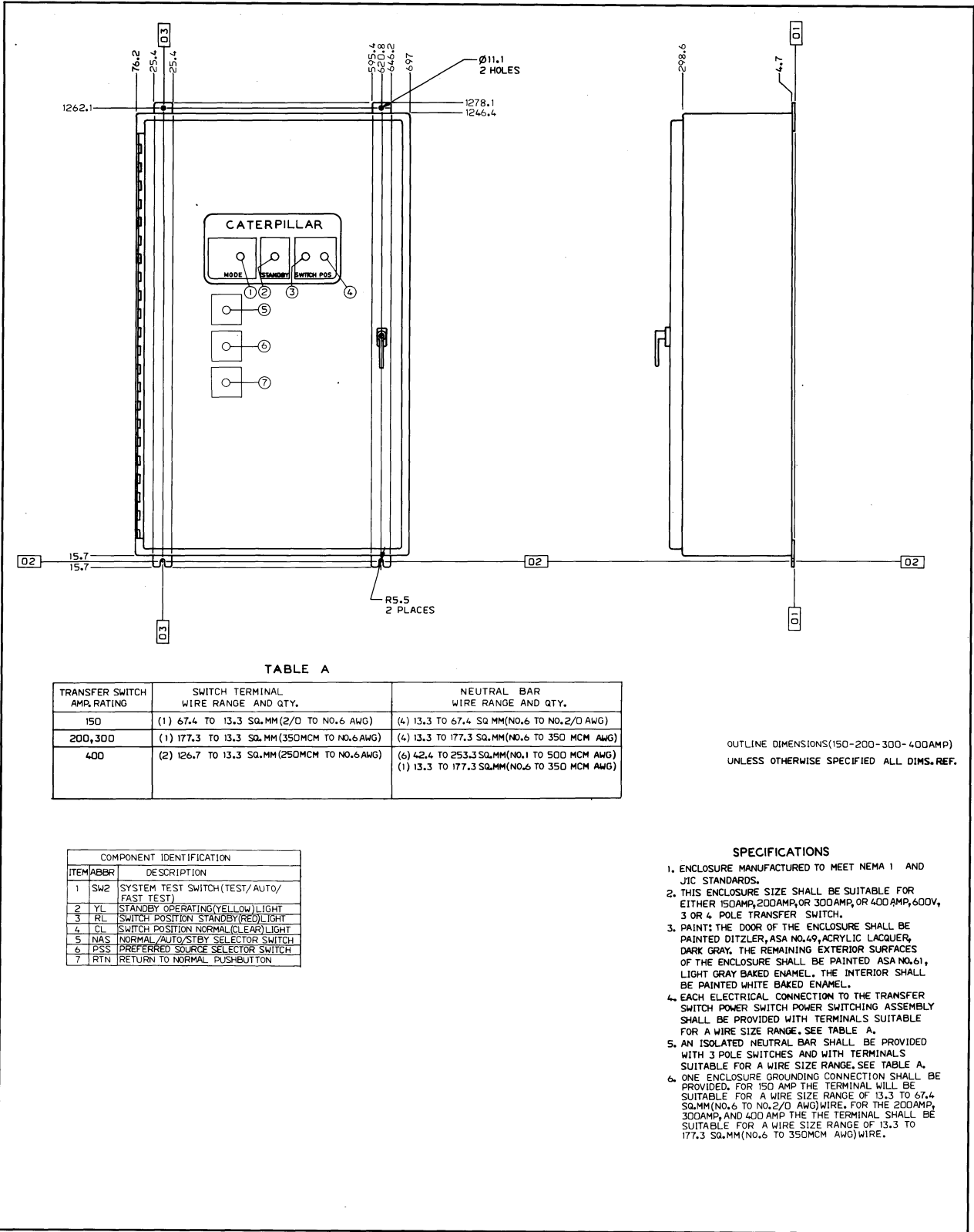
1. ENCLOSURE MANUFACTURED TO MEET NEMA 1 AND JIC STANDARDS.
2. THIS ENCLOSURE SIZE SHALL BE SUITABLE FOR 100 AMP, 600VAC, 3Ø/4 POLE TRANSFER SWITCH.
3. PAINT: THE DOOR OF ENCLOSURE SHALL BE PAINTED DITZLER, ASA NO.49 ACRYLIC LACQUER DARK GRAY (OR APPROVED EQUAL). THE REMAINING EXTERIOR SURFACES OF THE ENCLOSURE SHALL BE PAINTED ASA NO.61, LIGHT GRAY BAKED ENAMEL. THE INTERIOR SHALL BE PAINTED WHITE BAKED ENAMEL.
4. EACH ELECTRICAL CONNECTION TO THE TRANSFER SWITCH POWER SWITCHING ASSEMBLY SHALL BE PROVIDED WITH (1) TERMINAL SUITABLE FOR A SIZE RANGE OF 13.3 TO 67.4 SQ.MM (NO.6 TO NO.2/0 AWG) WIRE.
5. AN ISOLATED NEUTRAL BAR SHALL BE PROVIDED WITH 3 POLE SWITCHES, AND WITH (4) TERMINALS SUITABLE FOR A SIZE RANGE OF 13.3 TO 67.4 SQ.MM (NO.6 TO NO.2/0 AWG) WIRE.
6. AN ENCLOSURE GROUNDING CONNECTION SHALL BE PROVIDED WITH (1) TERMINAL SUITABLE FOR A SIZE RANGE OF 13.3 TO 67.4 SQ.MM (NO.6 TO NO.2/0 AWG) WIRE.

COMPONENT IDENTIFICATION		
ITEM	ABBR	DESCRIPTION
1	SW2	SYSTEM TEST SWITCH (TEST/AUTO/ FAST TEST)
2	YL	STANDBY OPERATING (YELLOW) LIGHT
3	RL	SWITCH POSITION STANDBY (RED) LIGHT
4	CL	SWITCH POSITION NORMAL (CLEAR) LIGHT
5	NAS	NORMAL/AUTO/STBY SELECTOR SWITCH
6	PSS	PREFERRED SOURCE SELECTOR SWITCH
7	RTN	RETURN TO NORMAL DISPOSITION





100 Amp - NEMA 12 (Outline Dimensions)



150, 200, 300 And 400 Amp - NEMA 1 (Outline Dimensions)

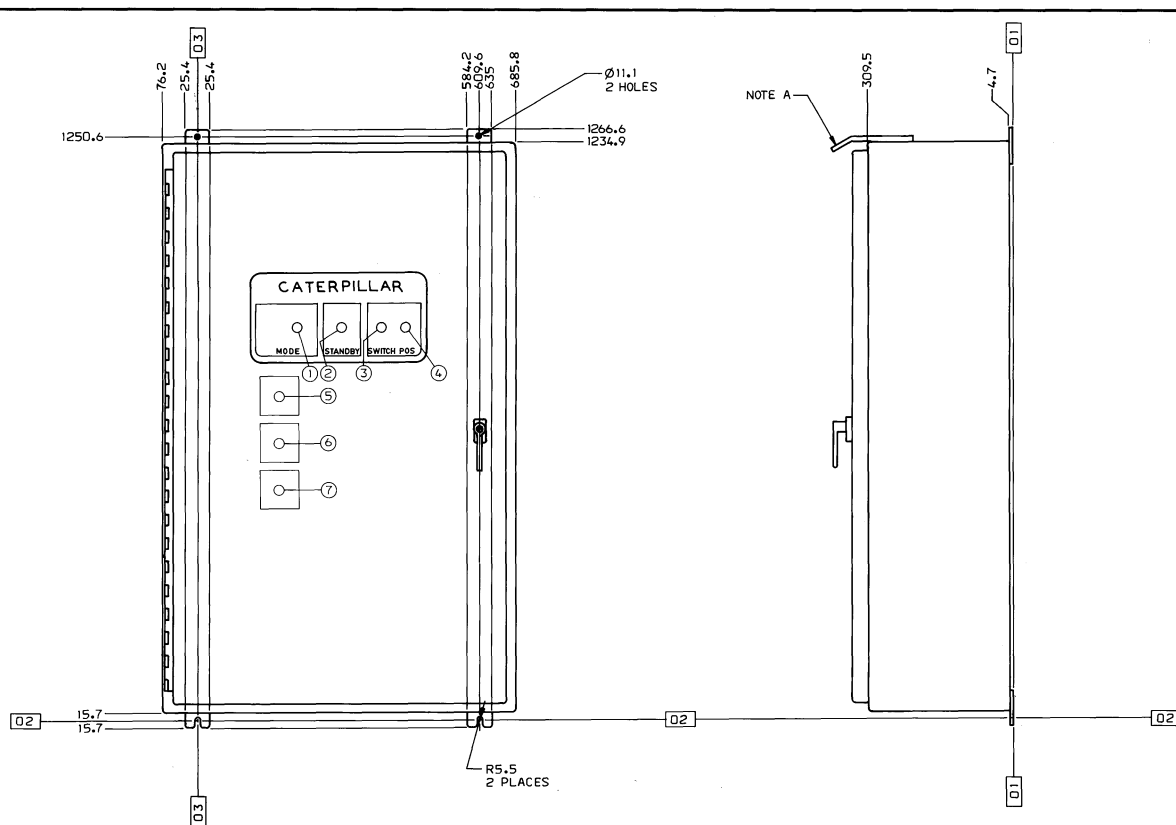


TABLE A

TRANSFER SWITCH AMP. RATING	SWITCH TERMINAL WIRE RANGE AND QTY.	NEUTRAL BAR WIRE RANGE AND QTY.
150	(1) 67.4 TO 13.3 SQ.MM (2/0 TO NO.6 AWG)	(4) 13.3 TO 67.4 SQ.MM (NO.6 TO NO.2/0 AWG)
200,300	(1) 177.3 TO 13.3 SQ.MM (350MCM TO NO.6 AWG)	(4) 13.3 TO 177.3 SQ.MM (NO.6 TO 350 MCM AWG)
400	(2) 126.7 TO 13.3 SQ.MM (250MCM TO NO.6 AWG)	(6) 42.4 TO 253.3 SQ.MM (NO.1 TO 500 MCM AWG) (1) 13.3 TO 177.3 SQ.MM (NO.6 TO 350 MCM AWG)

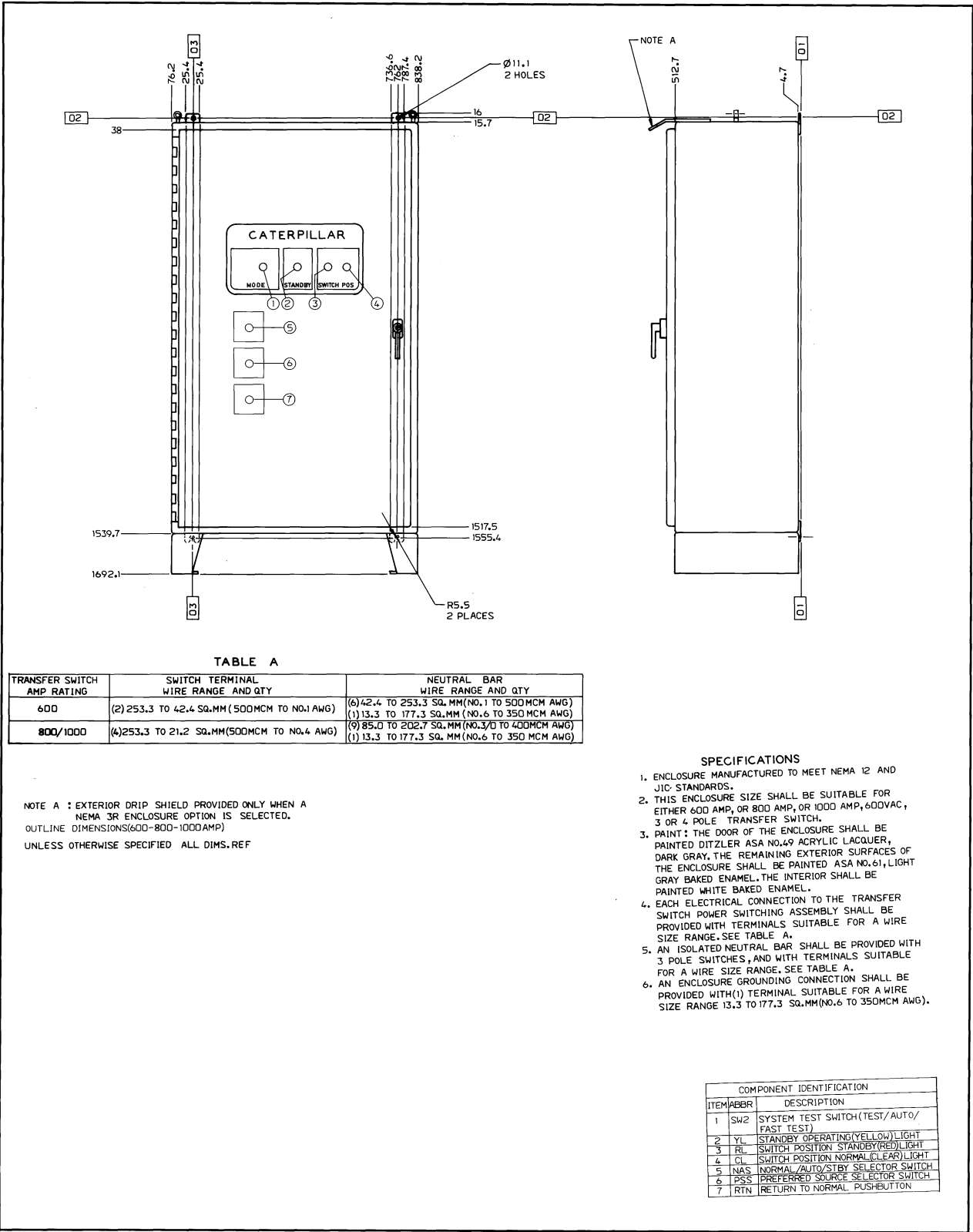
NOTE A : EXTERIOR DRIP SHIELD PROVIDED ONLY WHEN  
A NEMA 3R ENCLOSURE OPTION IS SELECTED.

OUTLINE DIMENSIONS(150-200-300-400AMP)  
UNLESS OTHERWISE SPECIFIED ALL DIMS. REF.

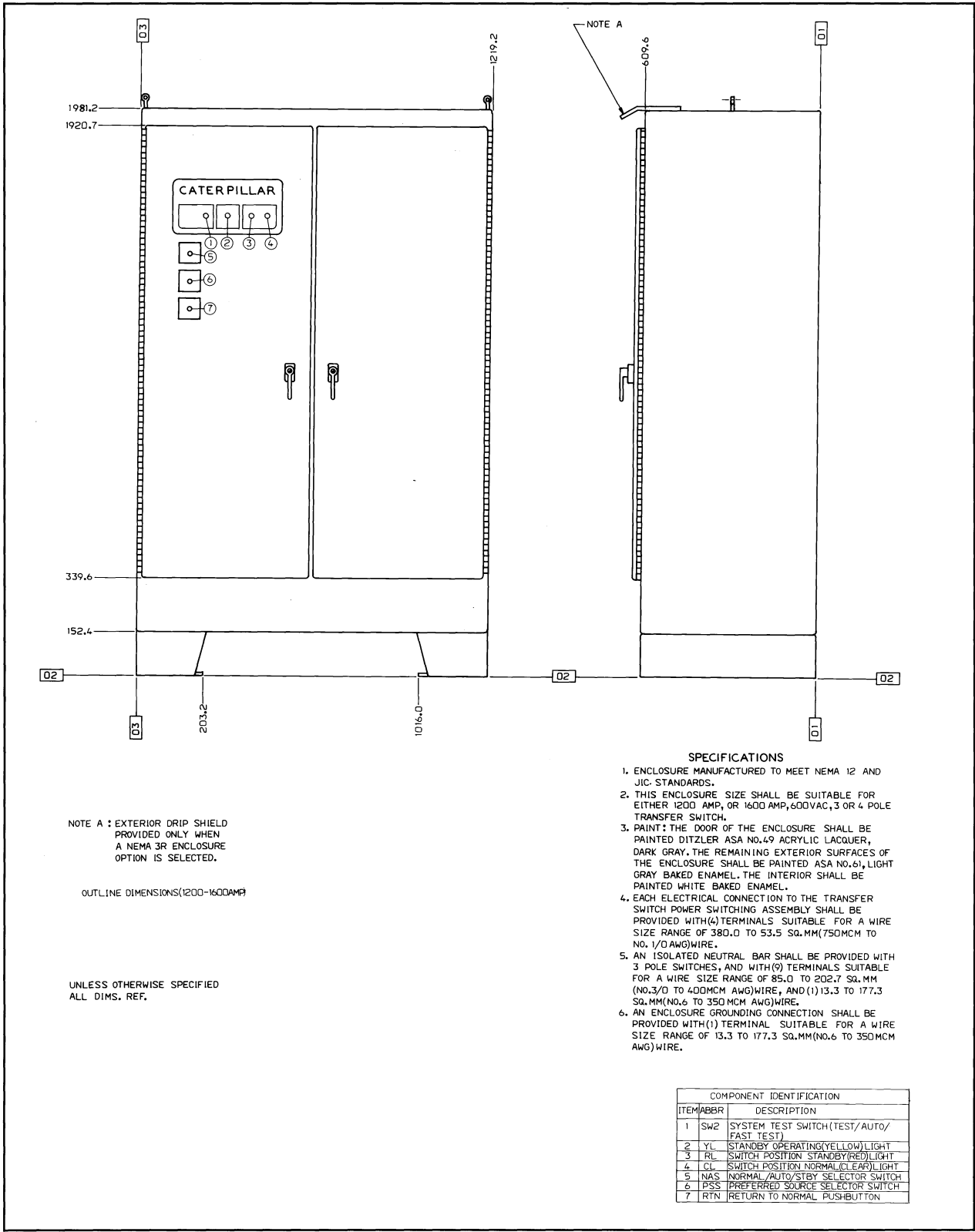
COMPONENT IDENTIFICATION		
ITEM#	ABBR	DESCRIPTION
1	SW2	SYSTEM TEST SWITCH (TEST/AUTO/ FAST TEST)
2	YL	STANDBY OPERATING (YELLOW) LIGHT
3	RL	SWITCH POSITION (STANDBY/RED) LIGHT
4	CL	SWITCH POSITION (NORMAL/CLAR) LIGHT
5	NAS	NORMAL/AUTO/STBY SELECTOR SWITCH
6	PSS	PREFERRED SOURCE SELECTOR SWITCH
7	RTN	RETURN TO NORMAL PUSHBUTTON

## SPECIFICATIONS

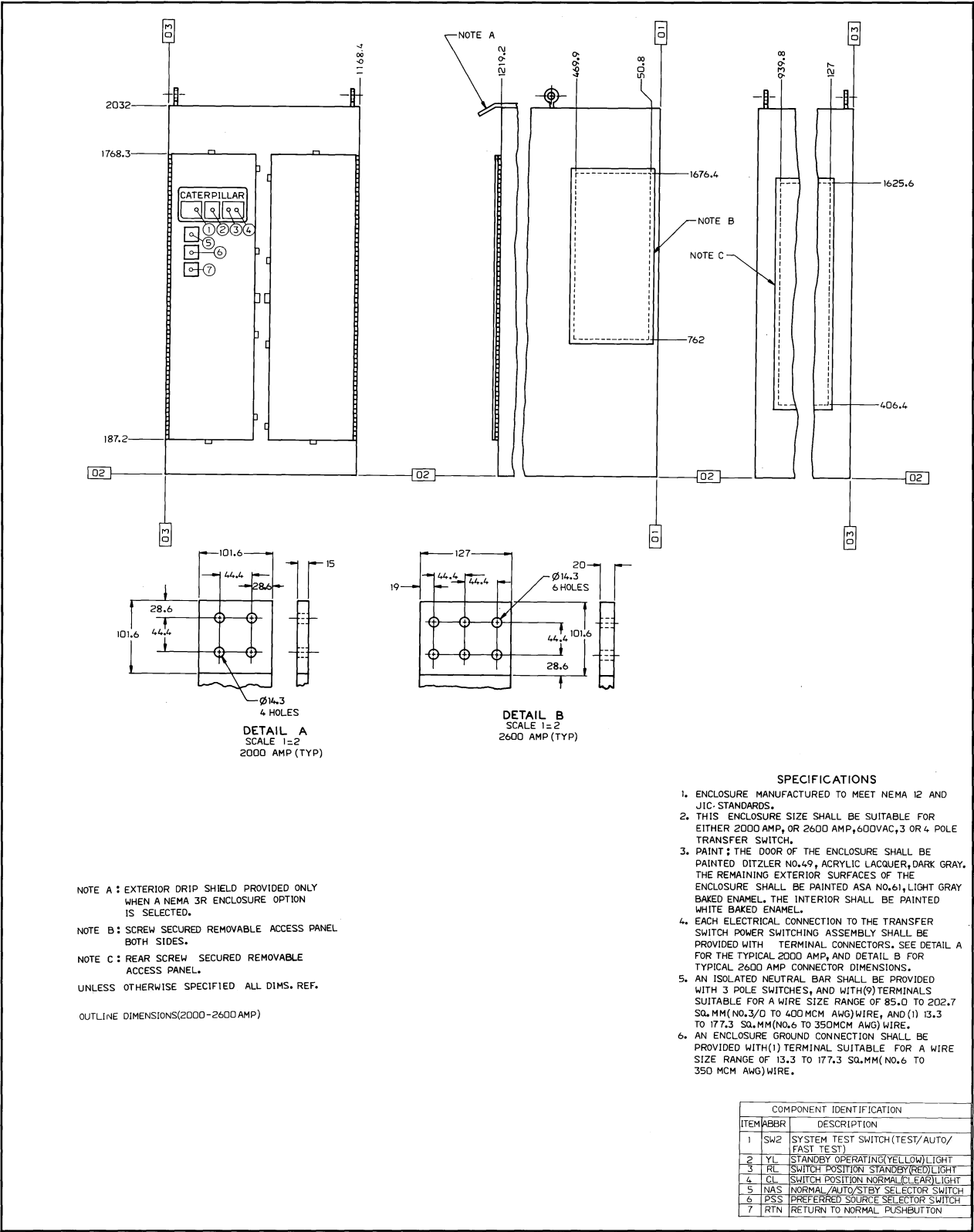
1. ENCLOSURE MANUFACTURED TO MEET NEMA 12 AND JIC STANDARDS.
2. THIS ENCLOSURE SIZE SHALL BE SUITABLE FOR EITHER 150AMP, 200AMP, OR 300AMP, OR 400 AMP, 600V, 3 OR 4 POLE TRANSFER SWITCH.
3. PAINT: THE DOOR OF THE ENCLOSURE SHALL BE PAINTED DITZLER, ASA NO.49, ACRYLIC LAQUER, DARK GRAY. THE REMAINING EXTERIOR SURFACES OF THE ENCLOSURE SHALL BE PAINTED ASA NO.61, LIGHT GRAY BAKED ENAMEL. THE INTERIOR SHALL BE PAINTED WITH LIGHT BAKED ENAMEL.
4. EACH ELECTRICAL CONNECTION TO THE TRANSFER SWITCH, POWER SWITCH POWER SWITCHING ASSEMBLY SHALL BE PROVIDED WITH TERMINALS SUITABLE FOR A WIRE SIZE RANGE, SEE TABLE A.
5. AN ISOLATED NEUTRAL BAR SHALL BE PROVIDED WITH 3 POLE SWITCHES AND WITH TERMINALS SUITABLE FOR A WIRE SIZE RANGE, SEE TABLE A.
6. ONE ENCLOSURE WITH 3 POLE CONNECTION SHALL BE PROVIDED FOR 150 AMP AND THE TERMINAL WILL BE SUITABLE FOR A WIRE SIZE RANGE OF 13.3 TO 67.4 SO.4MM (NO.6 TO NO.2/D AWG) WIRE. THE 300AMP, 300V AND 400 AMP WIRE THE TERMINAL SHALL BE SUITABLE FOR A WIRE SIZE RANGE OF 13.3 TO 107.3 SO.4MM (NO.6 TO 350MCM) WIRE.



600, 800 And 1000 Amp - NEMA 12 (Outline Dimensions)

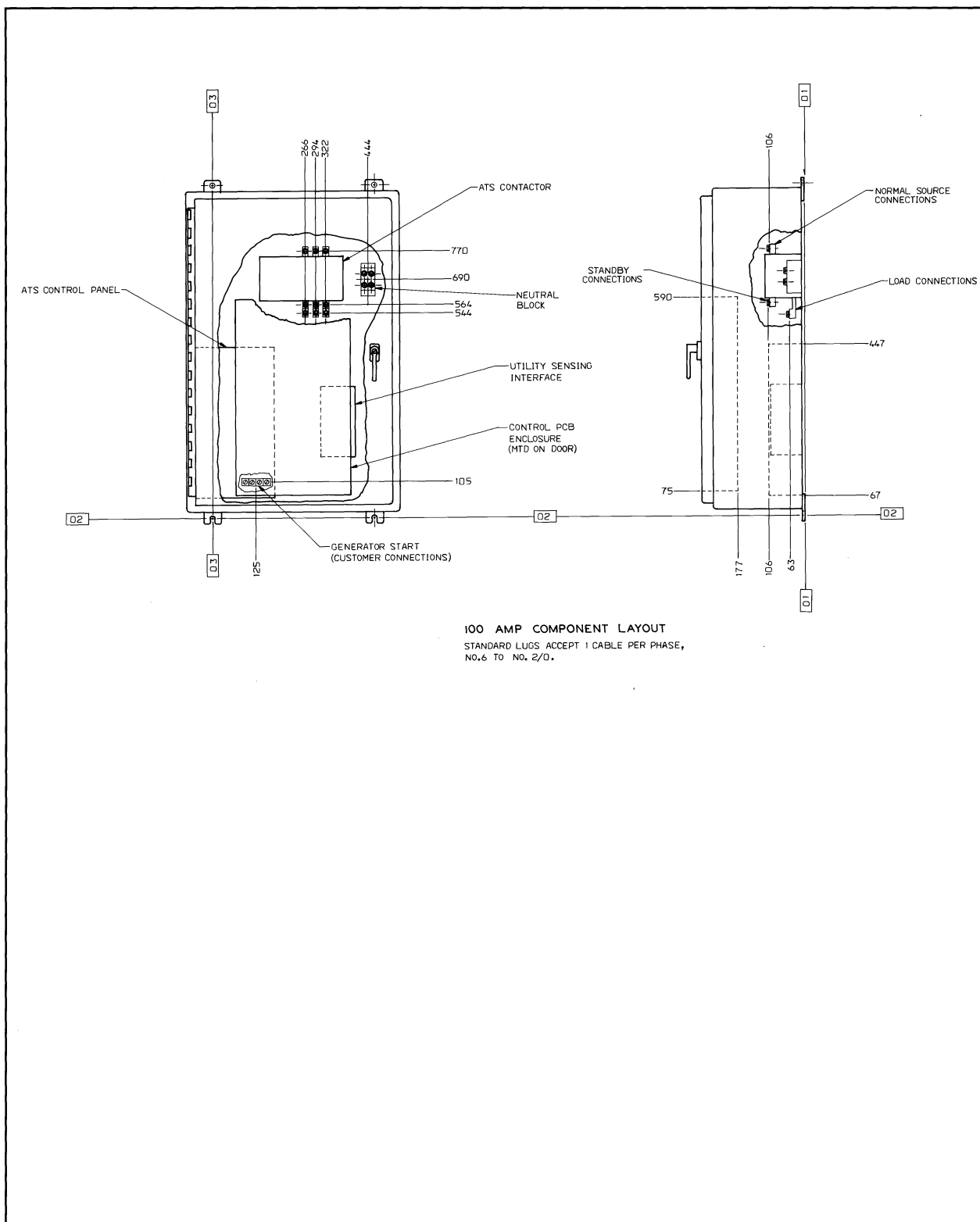


1200 And 1600 Amp - NEMA 12 (Outline Dimensions)

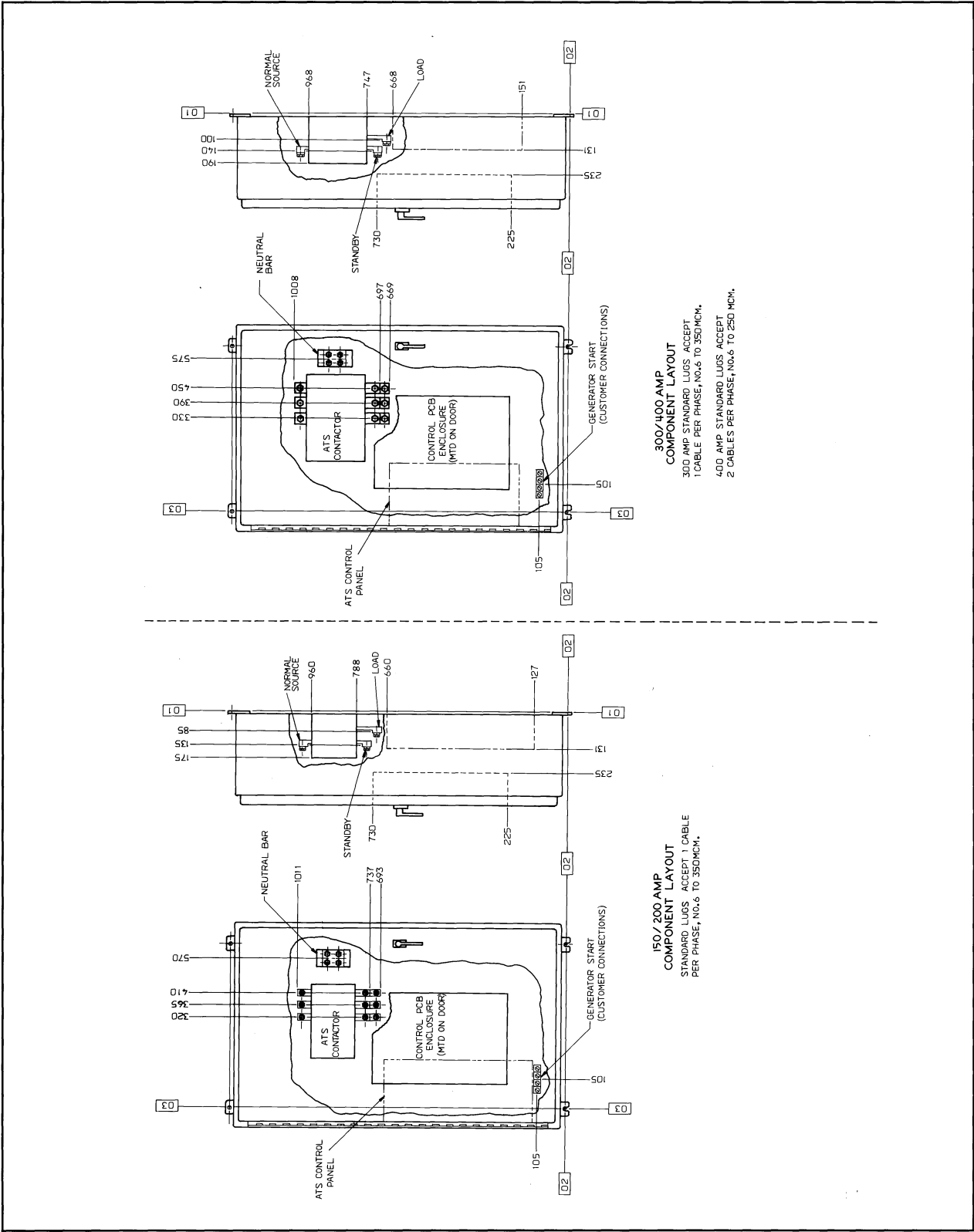


2000 And 2600 Amp - NEMA 12 (Outline Dimensions)

## Component Layout



100 Amp (Component Layout)

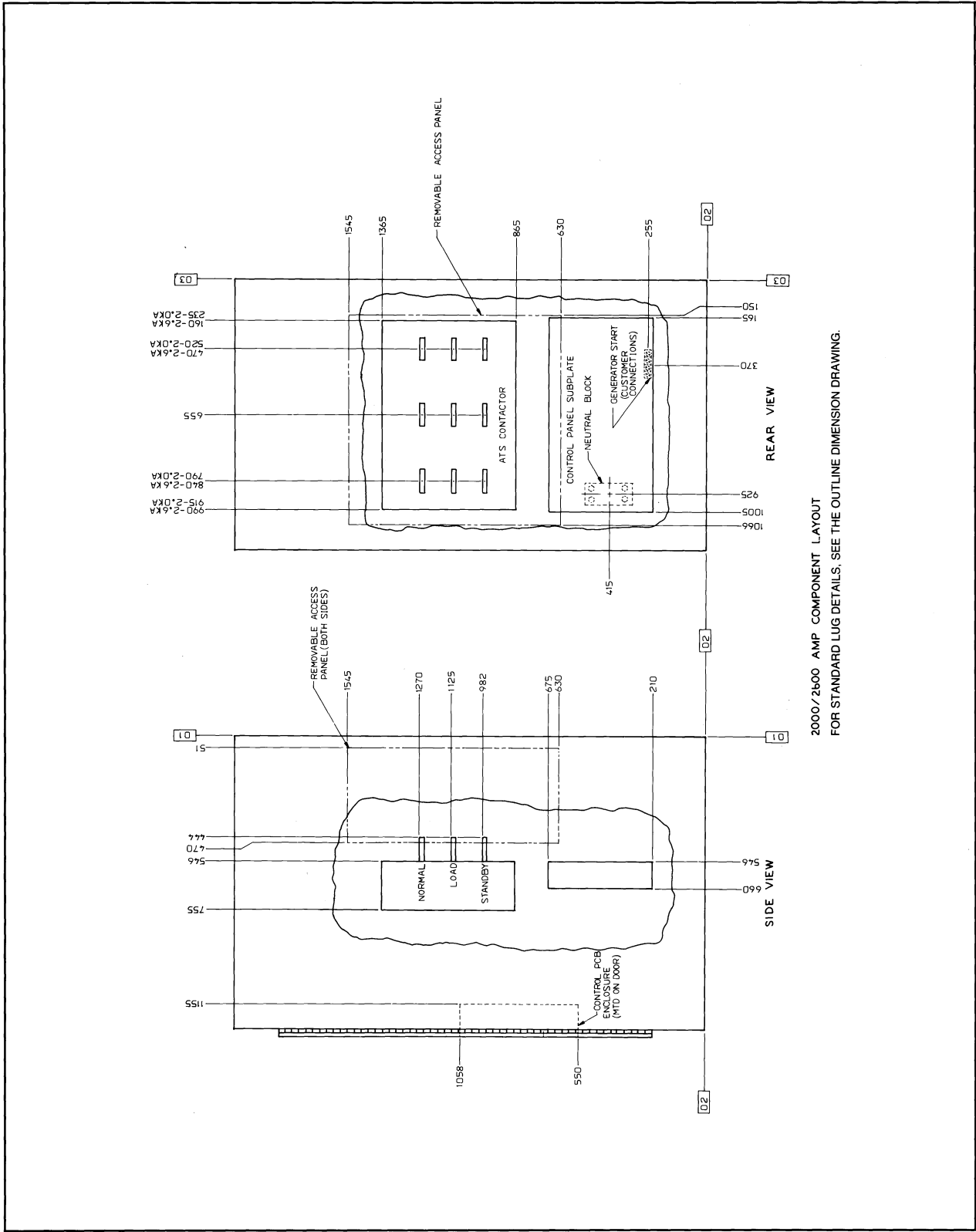


150, 200, 300 And 400 Amp (Component Layout)



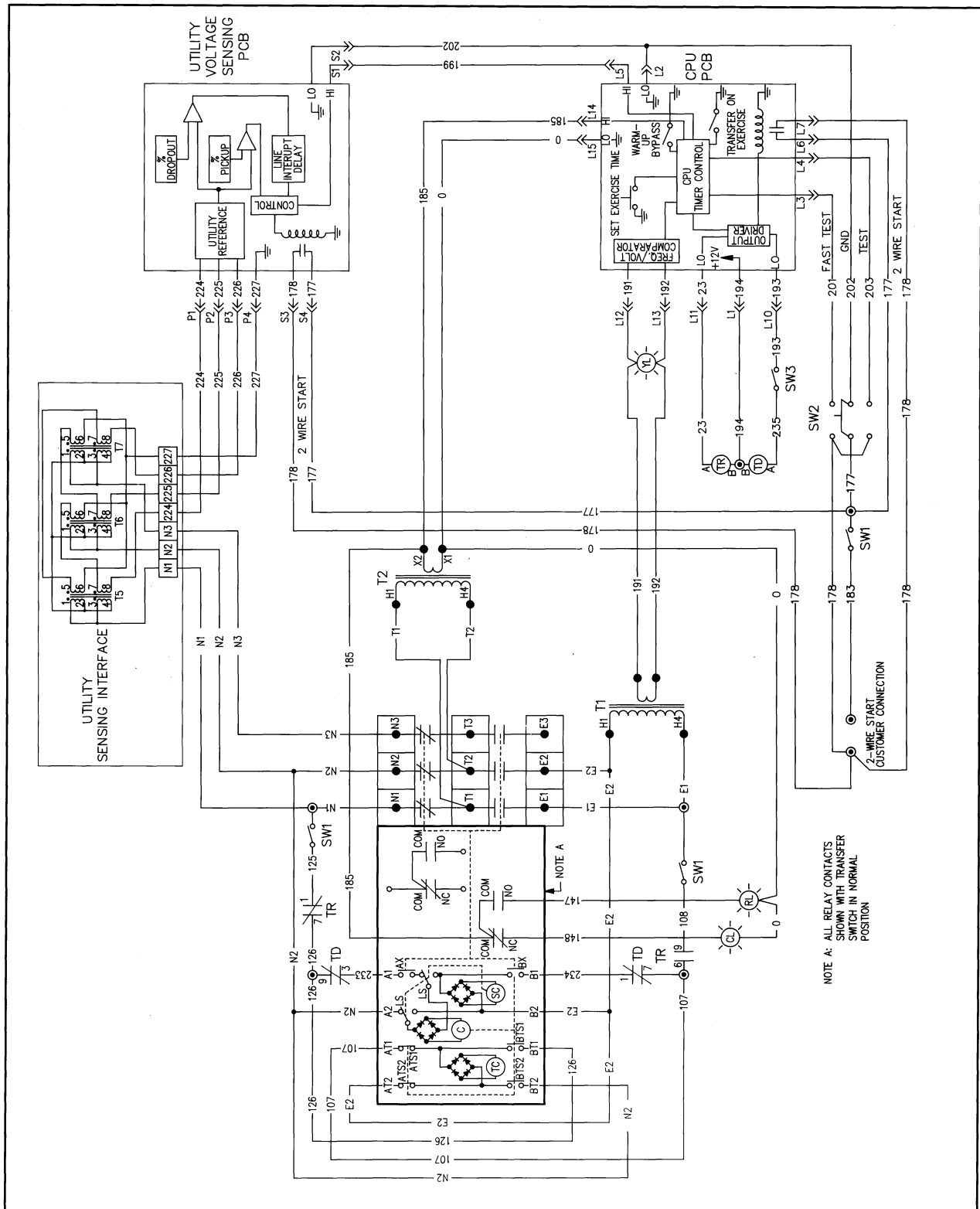




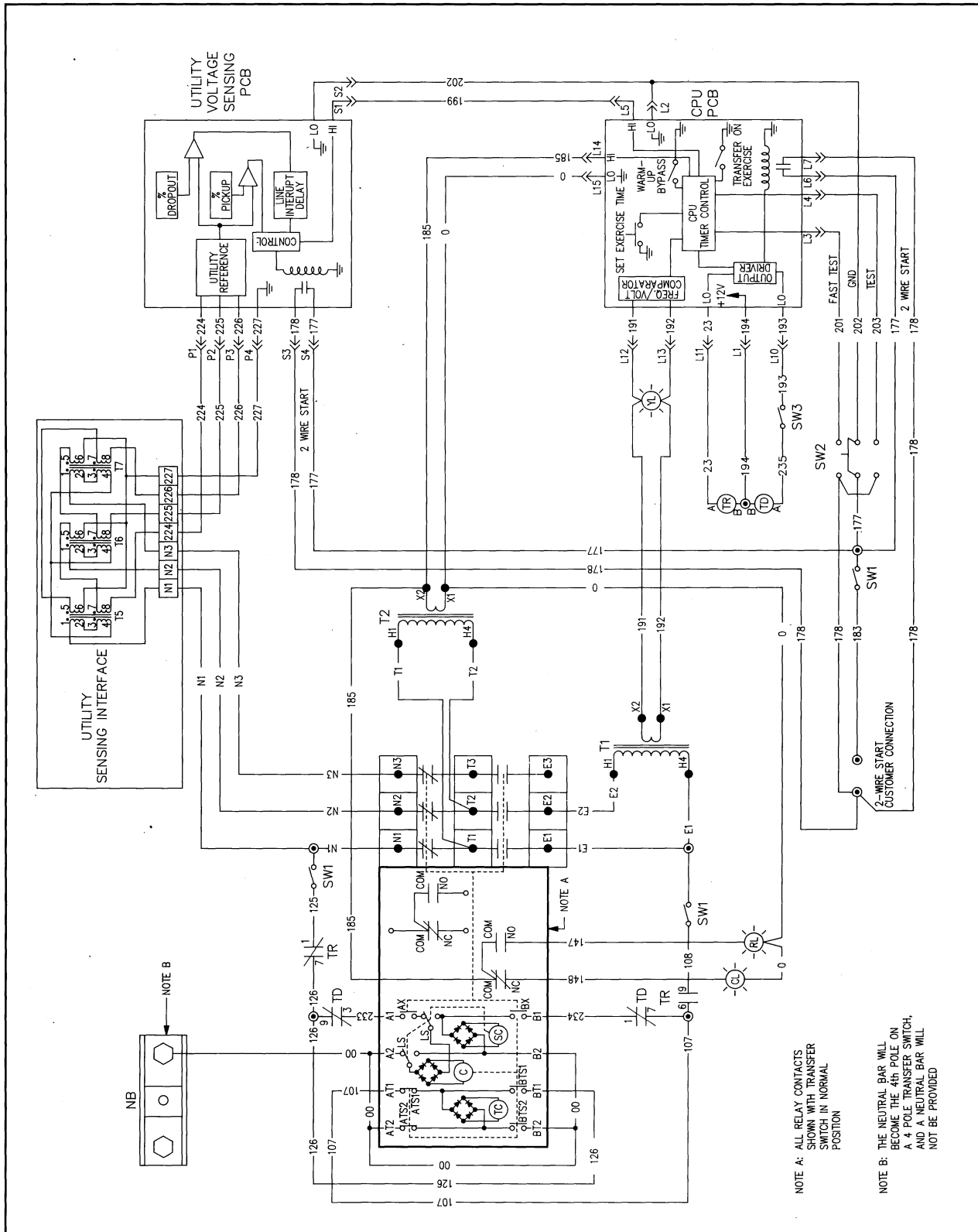


2000 And 2600 Amp (Component Layout)

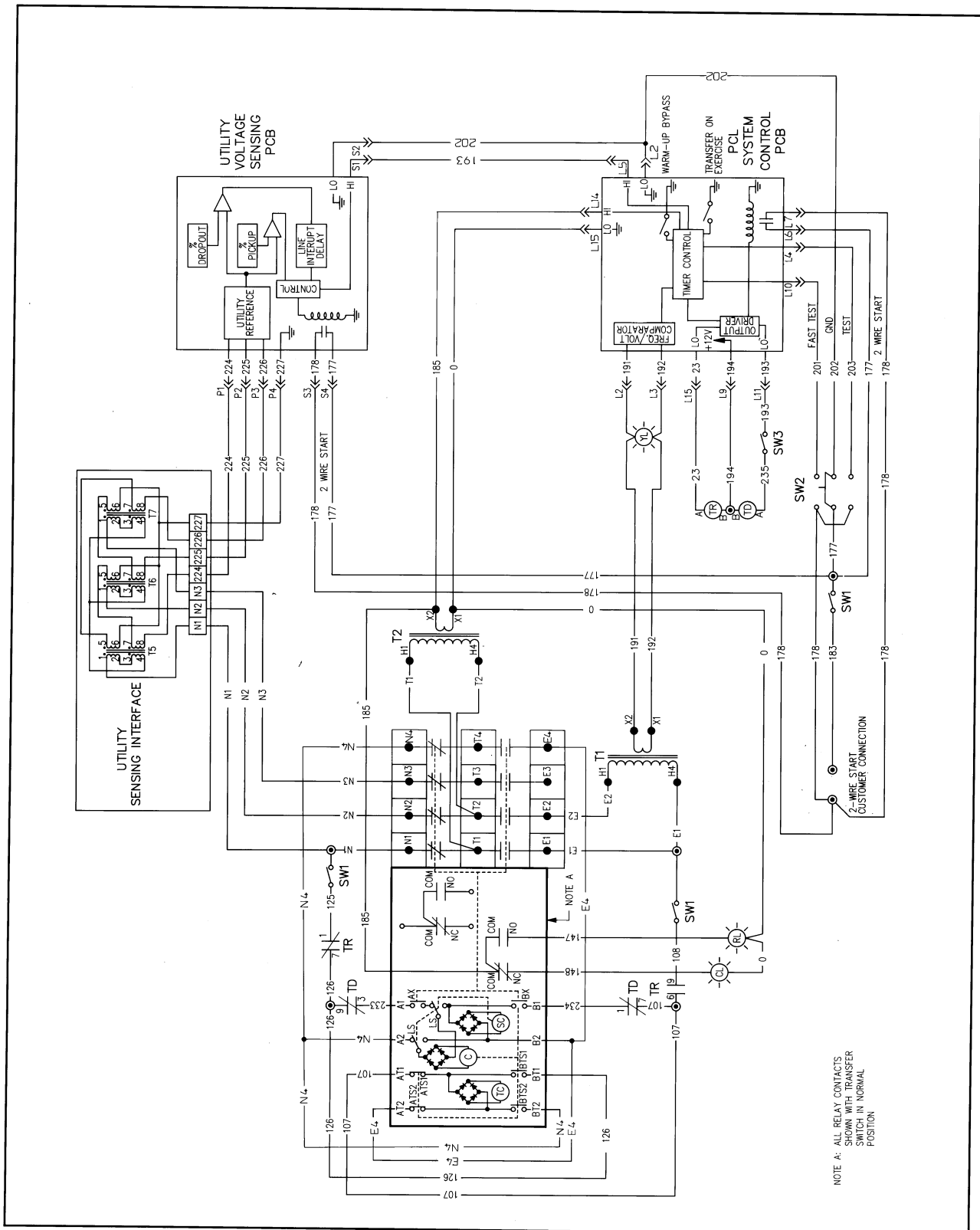
# Schematic Diagrams



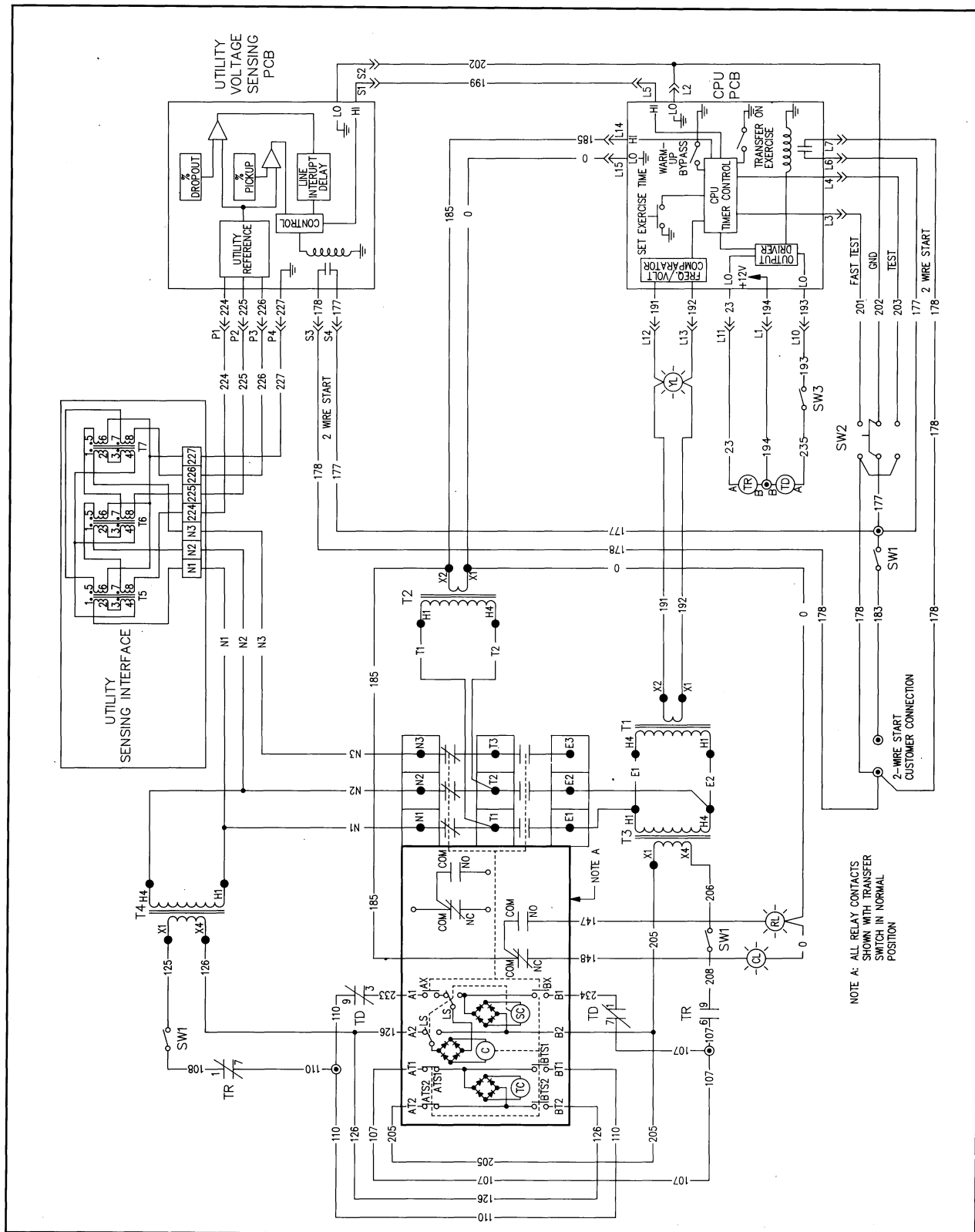
208-240 Volt, 60 Hz, With Microprocessor (Schematic Diagram)



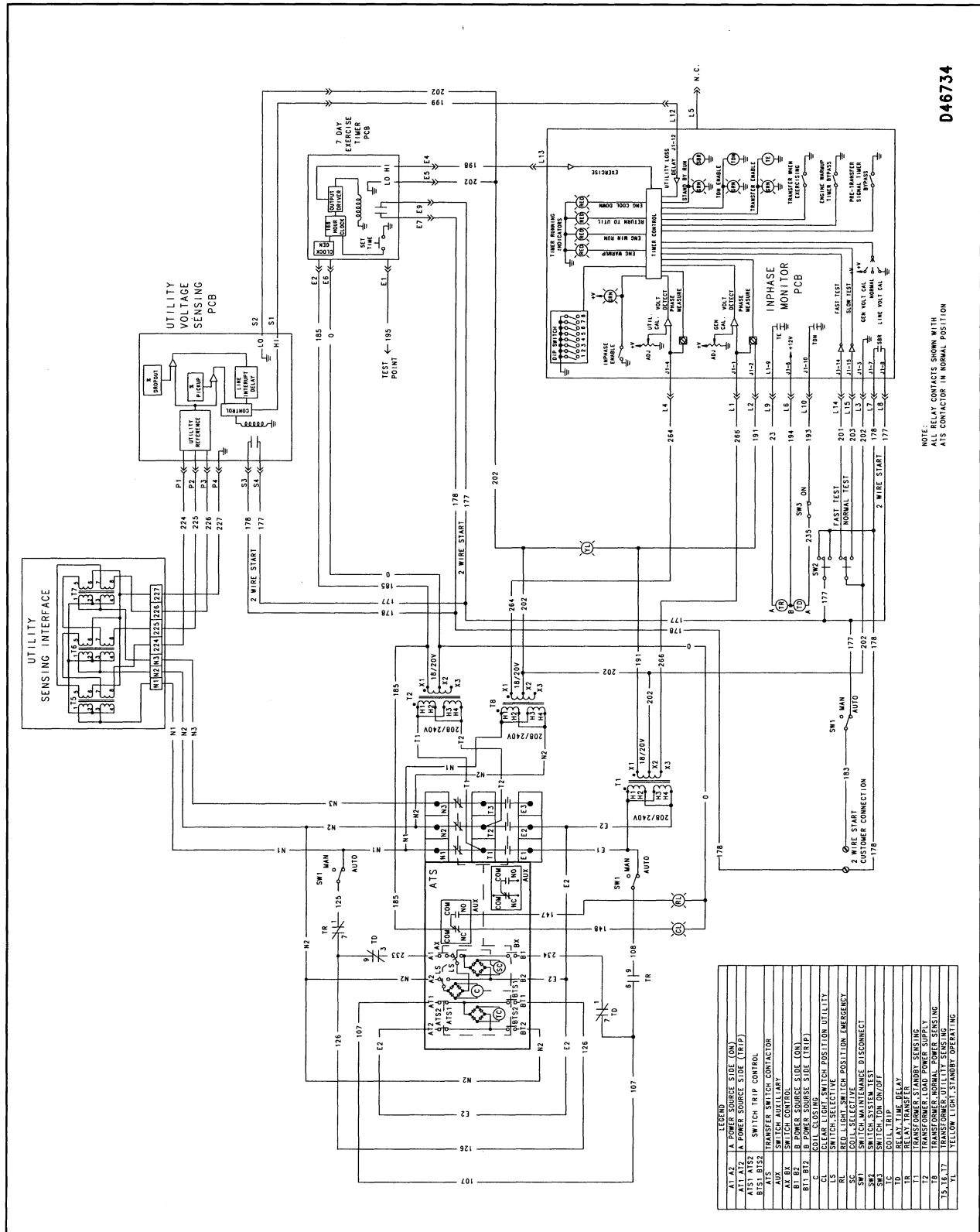
380-416 Volt, 60 Hz, 3 Pole, With Microprocessor (Schematic Diagram)



380-416 Volt, 60 Hz, 4 Pole, With Microprocessor (Schematic Diagram)



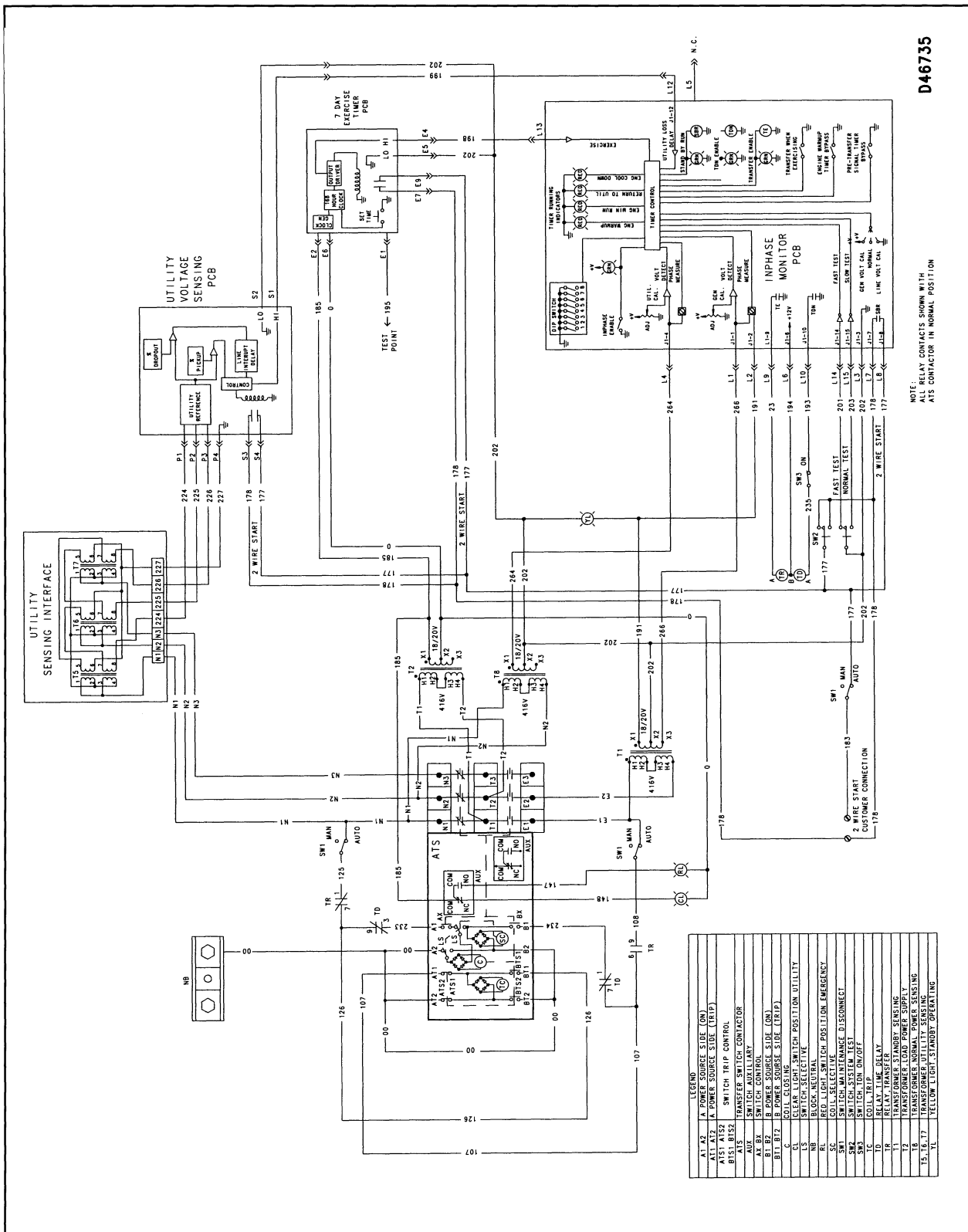
460-600 Volt, 60 Hz, With Microprocessor (Schematic Diagram)



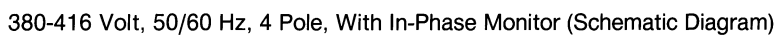
D46734

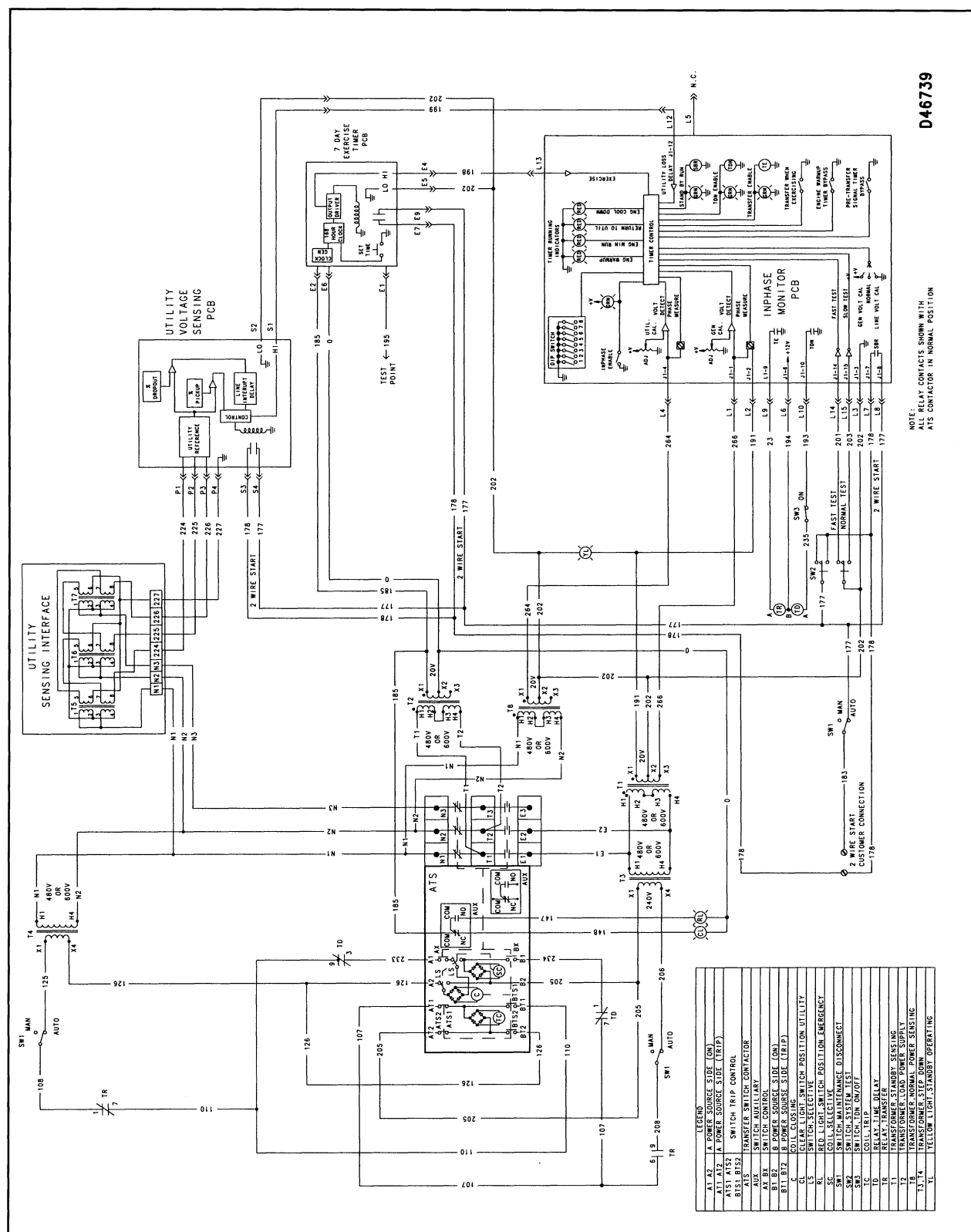
208-240 Volt, 50/60 Hz, 3 Pole, With In-Phase Monitor (Schematic Diagram)



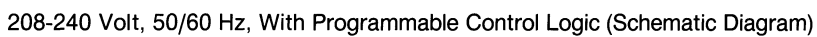


### 380-416 Volt, 50/60 Hz, 3 Pole, With In-Phase Monitor (Schematic Diagram)

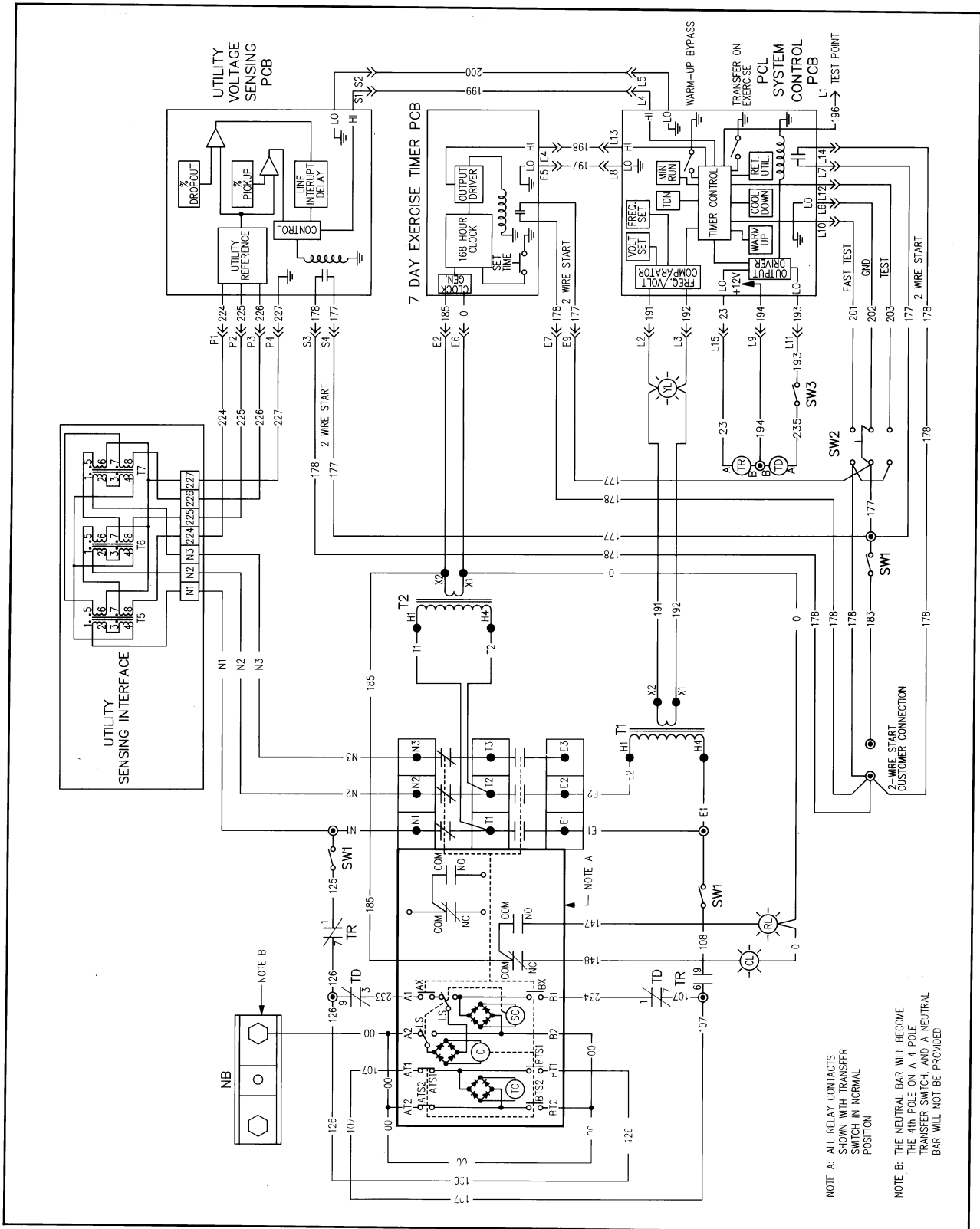




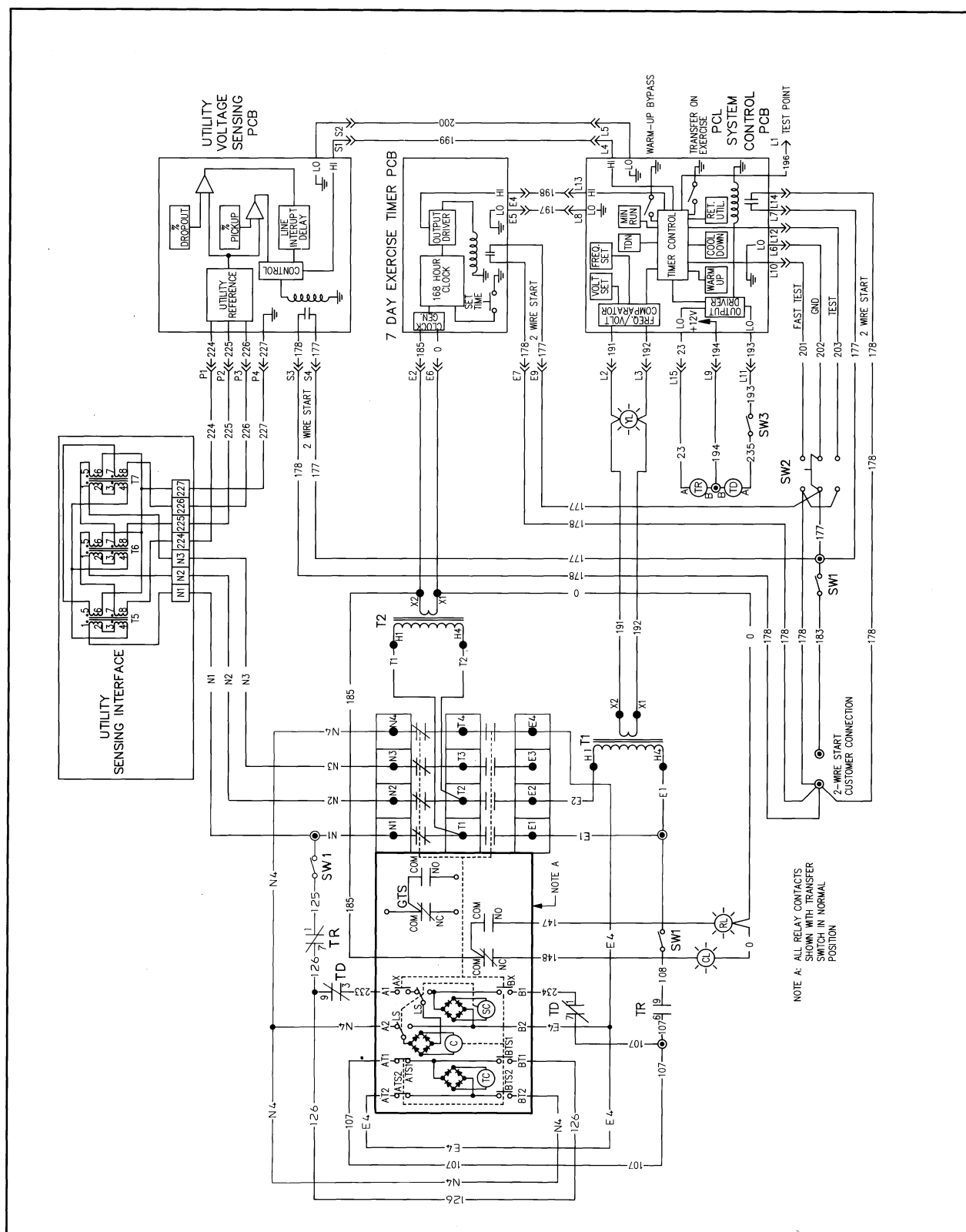
### 480-600 Volt, 50/60 Hz, 3 Pole, With In-Phase Monitor (Schematic Diagram)



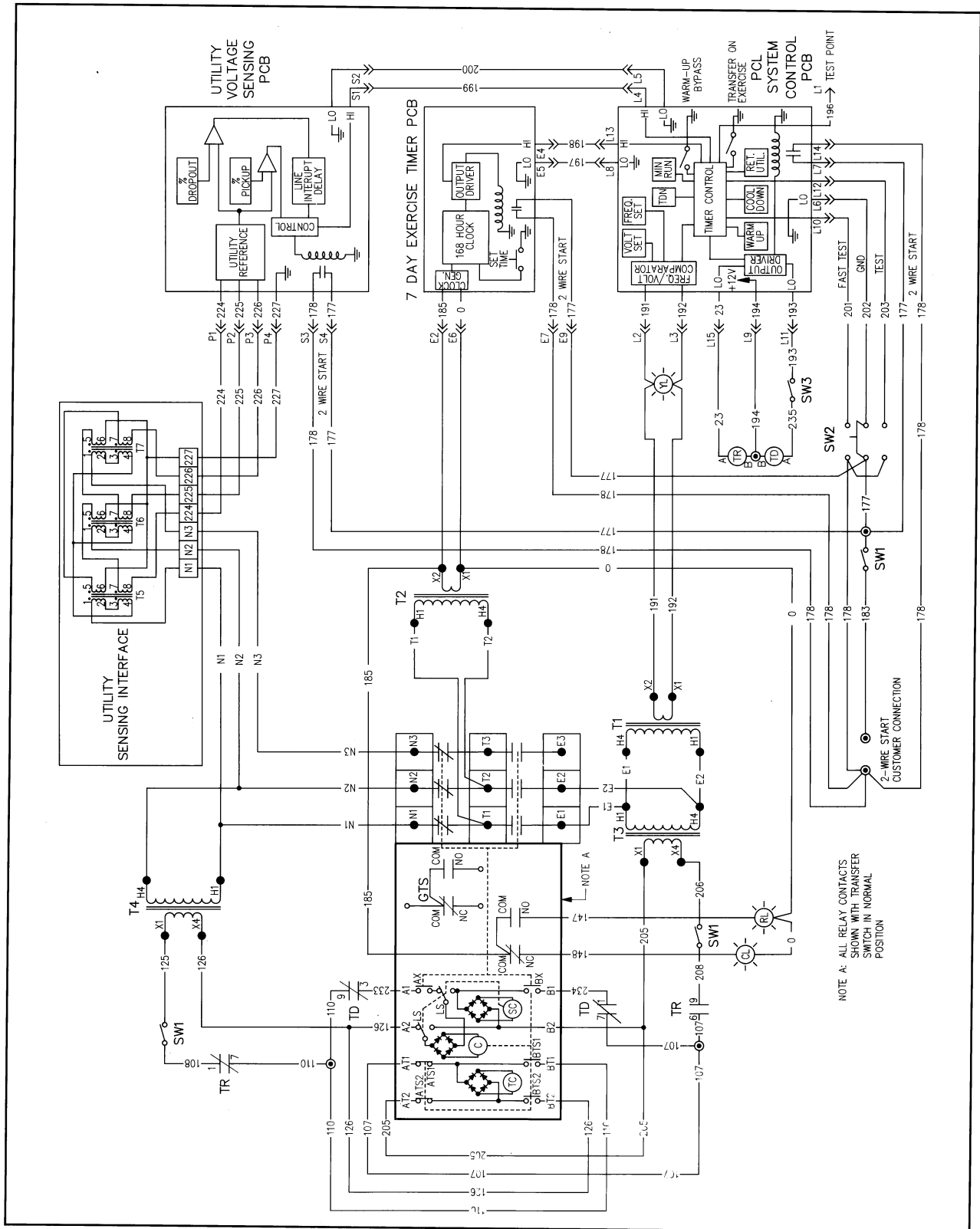
NOTE A: ALL RELAY CONTACTS SHOWN WITH TRANSFER SWITCH IN NORMAL POSITION



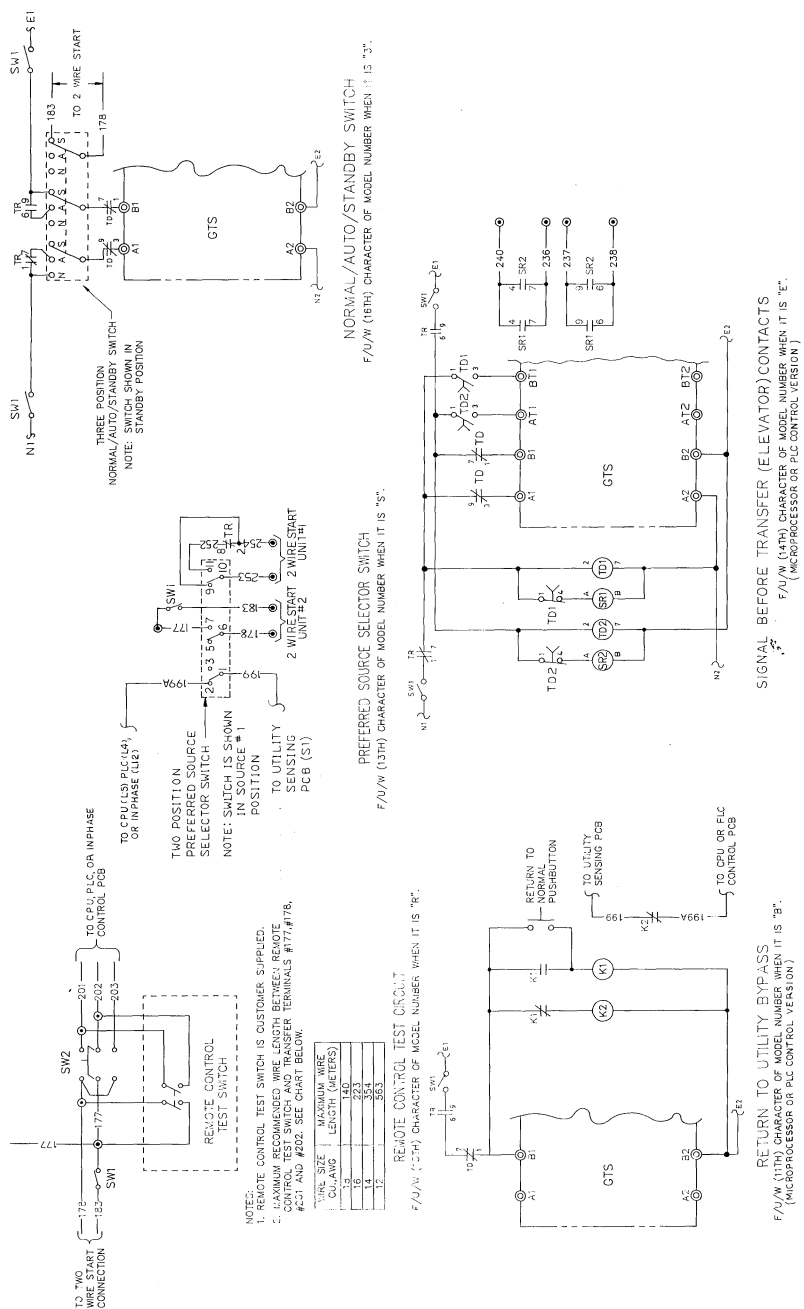
380-416 Volt, 50/60 Hz, 3 Pole, With Programmable Control Logic (Schematic Diagram)



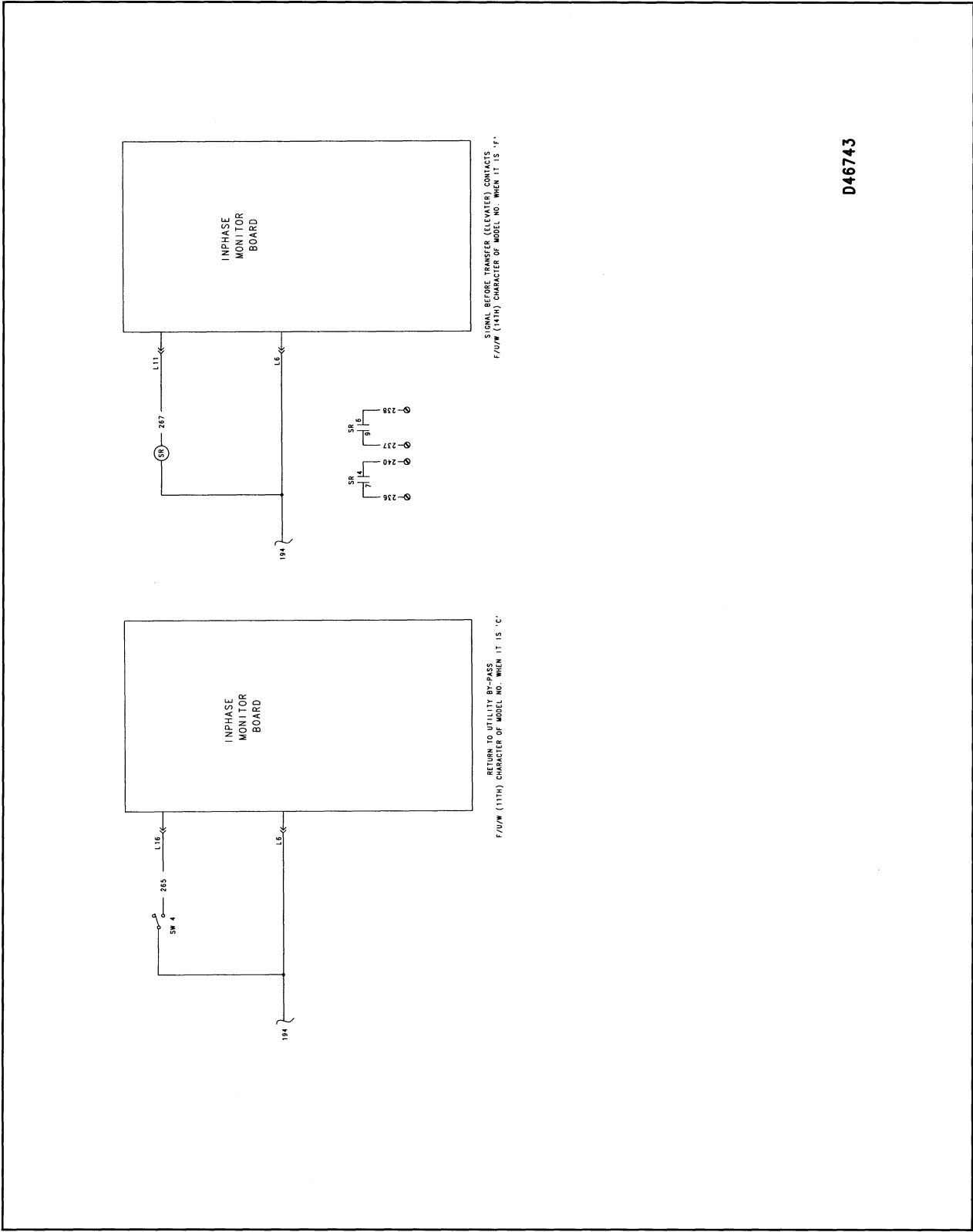
### 380-416 Volt, 50/60 Hz, 4 Pole, With Programmable Control Logic (Schematic Diagram)



460-600 Volt, 50/60 Hz, With Programmable Control Logic (Schematic Diagram)



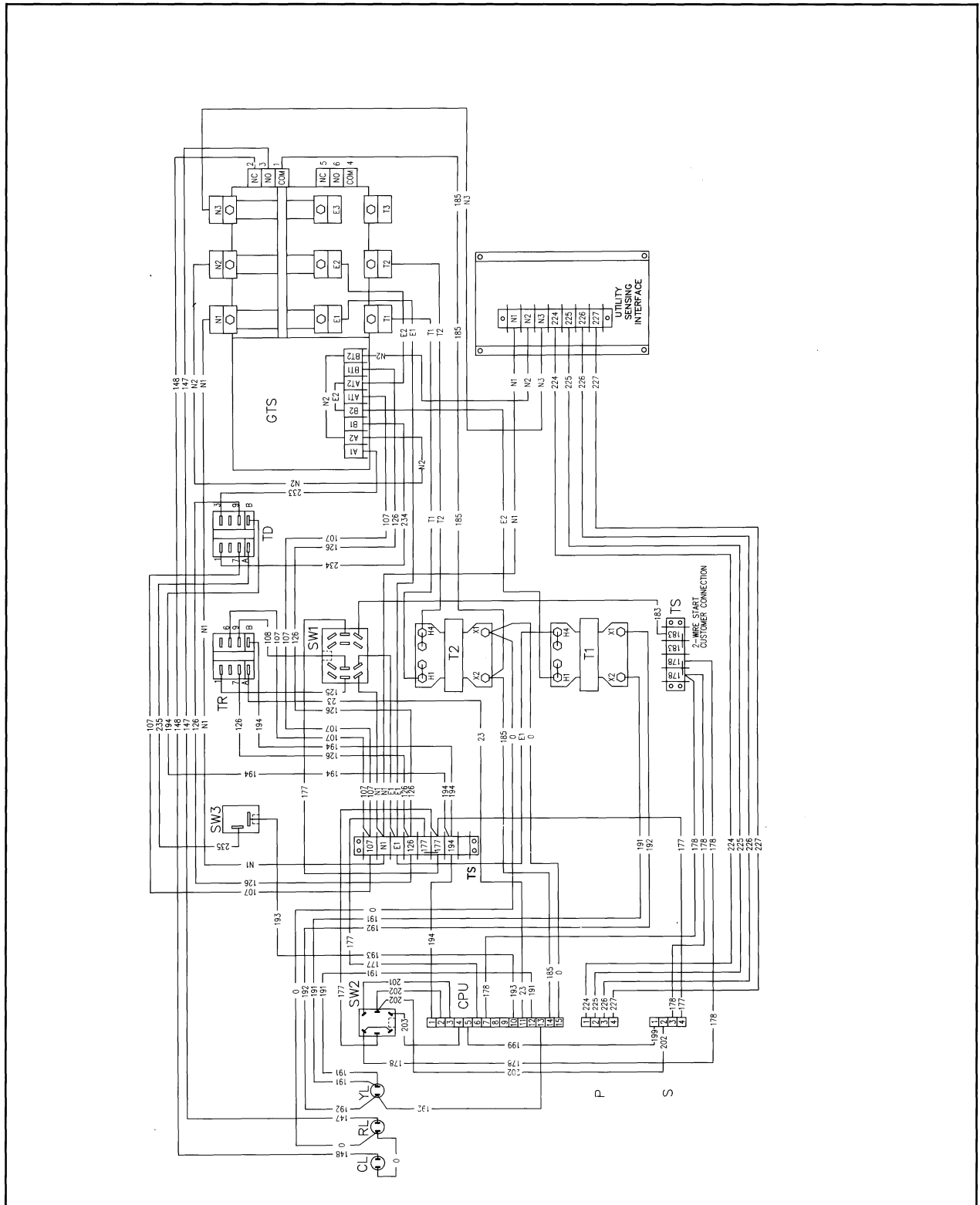




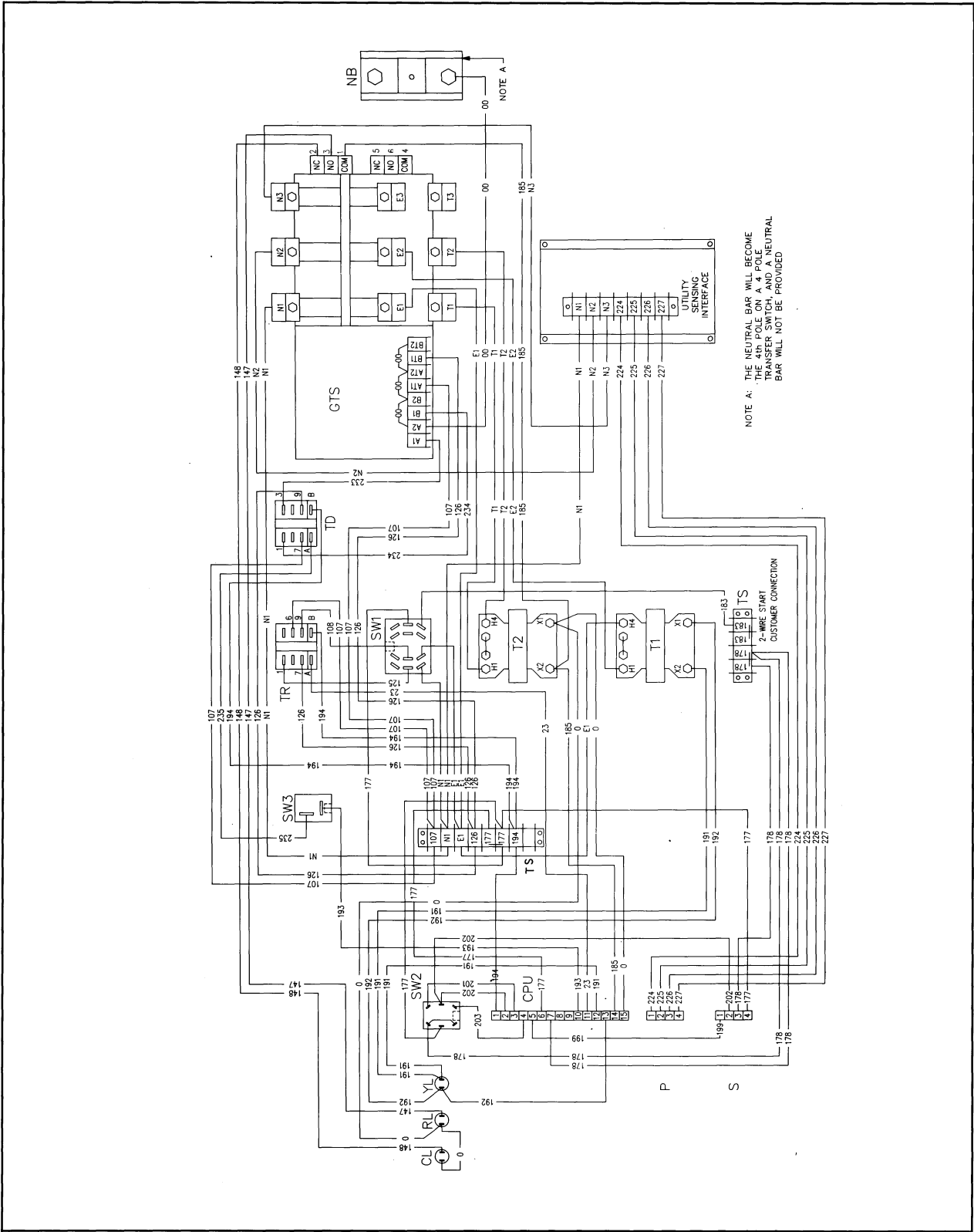
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Options, In-Phase Monitor (Schematic Diagram)

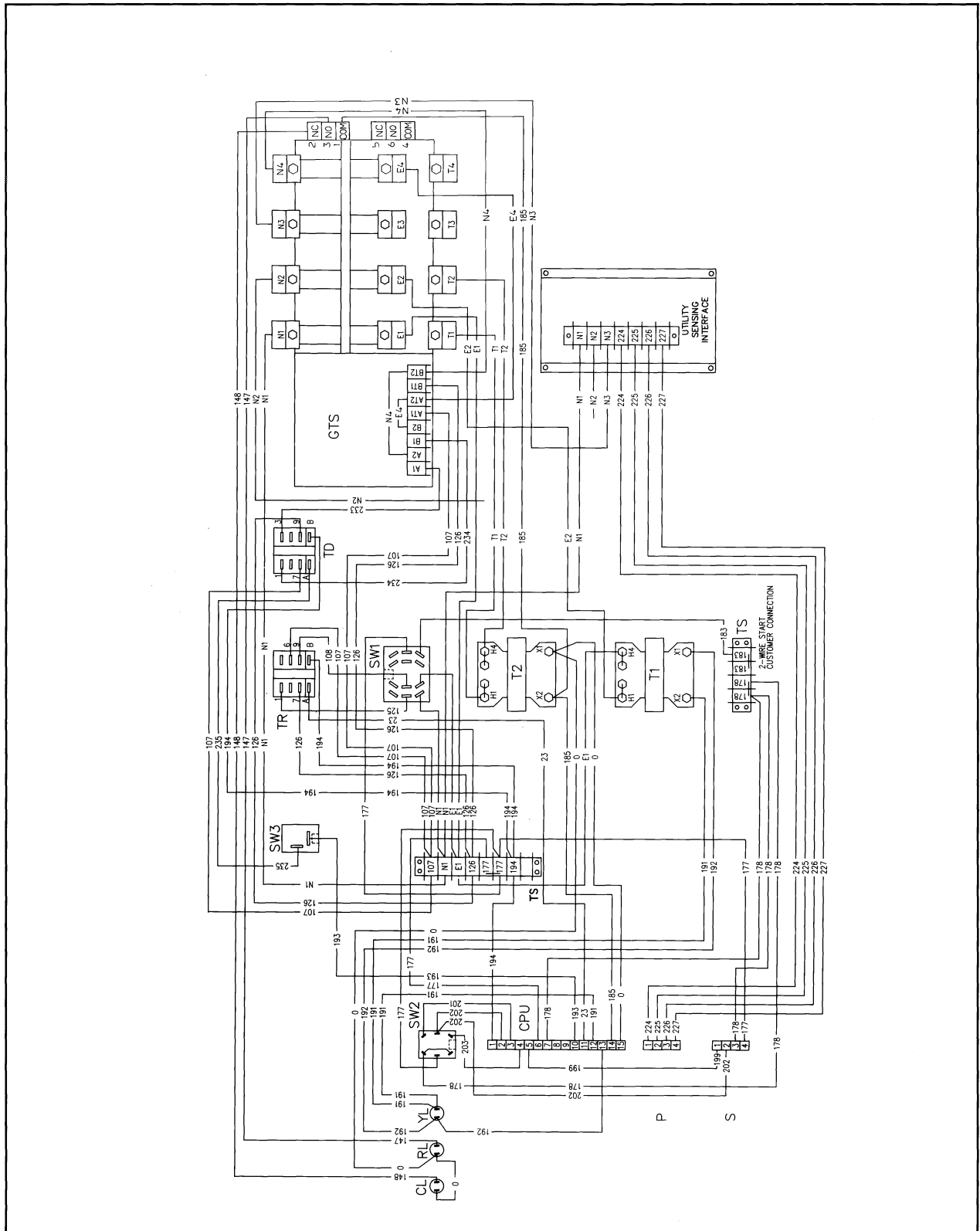
# Wiring Diagrams



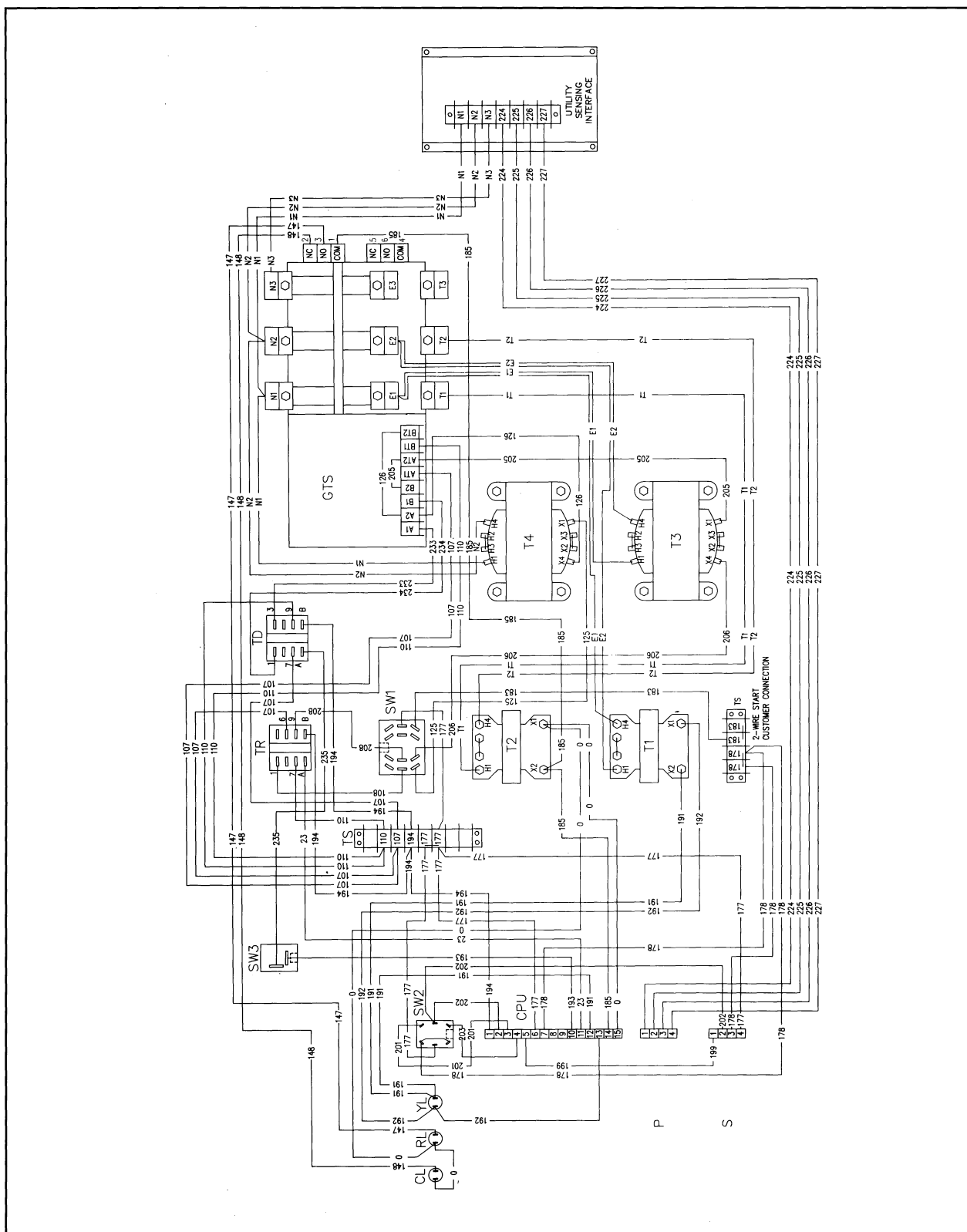
208-240 Volt, 60 Hz, With Microprocessor (Wiring Diagram)



380-416 Volt, 60 Hz, 3 Pole, With Microprocessor (Wiring Diagram)



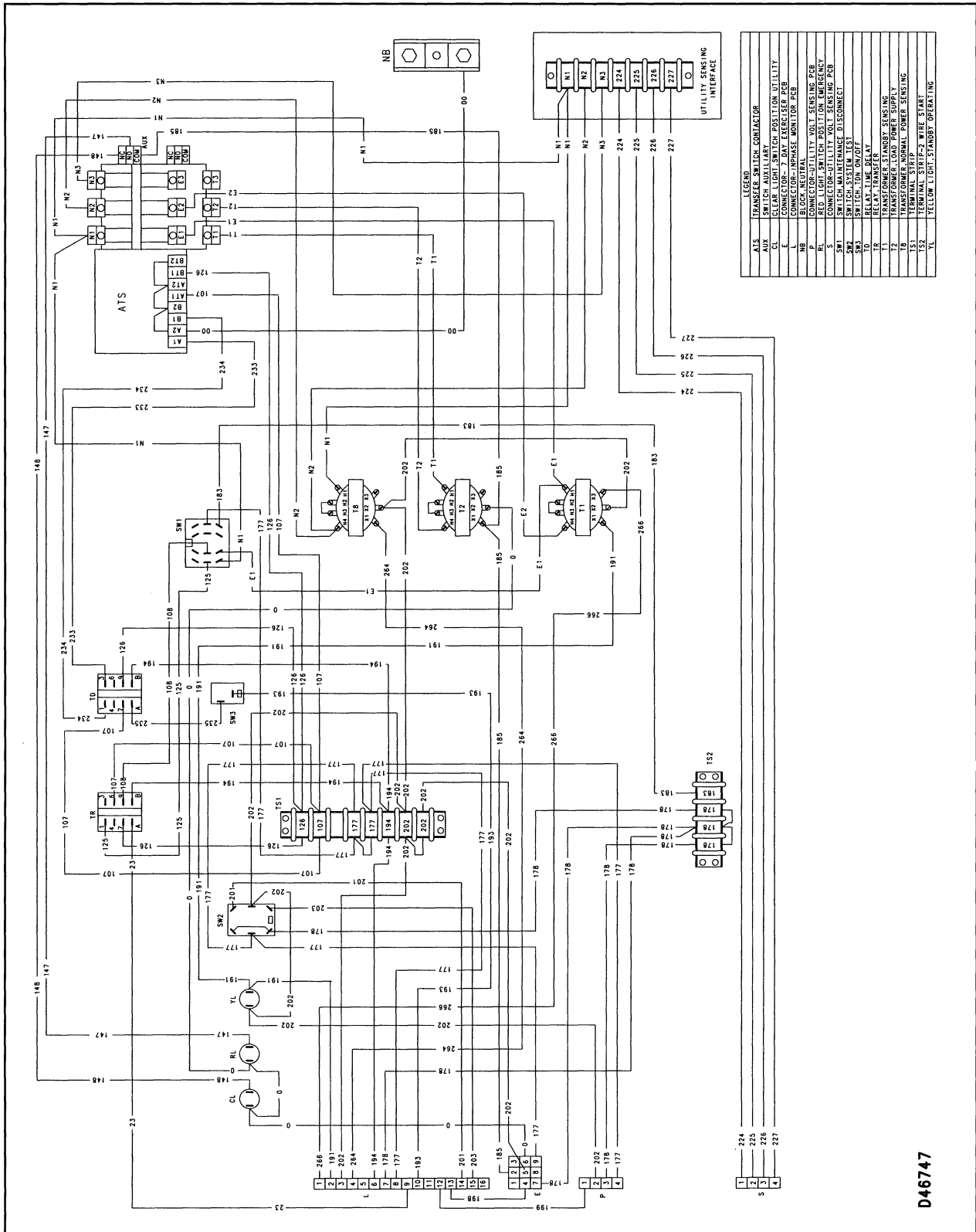
380-416 Volt, 60 Hz, 4 Pole, With Microprocessor (Wiring Diagram)



### 460-600 Volt, 60 Hz, With Microprocessor (Wiring Diagram)



1-82  
Specifications Section  
Wiring Diagrams



380-416 Volt, 50/60 Hz, 3 Pole, With In-Phase Monitor (Wiring Diagram)

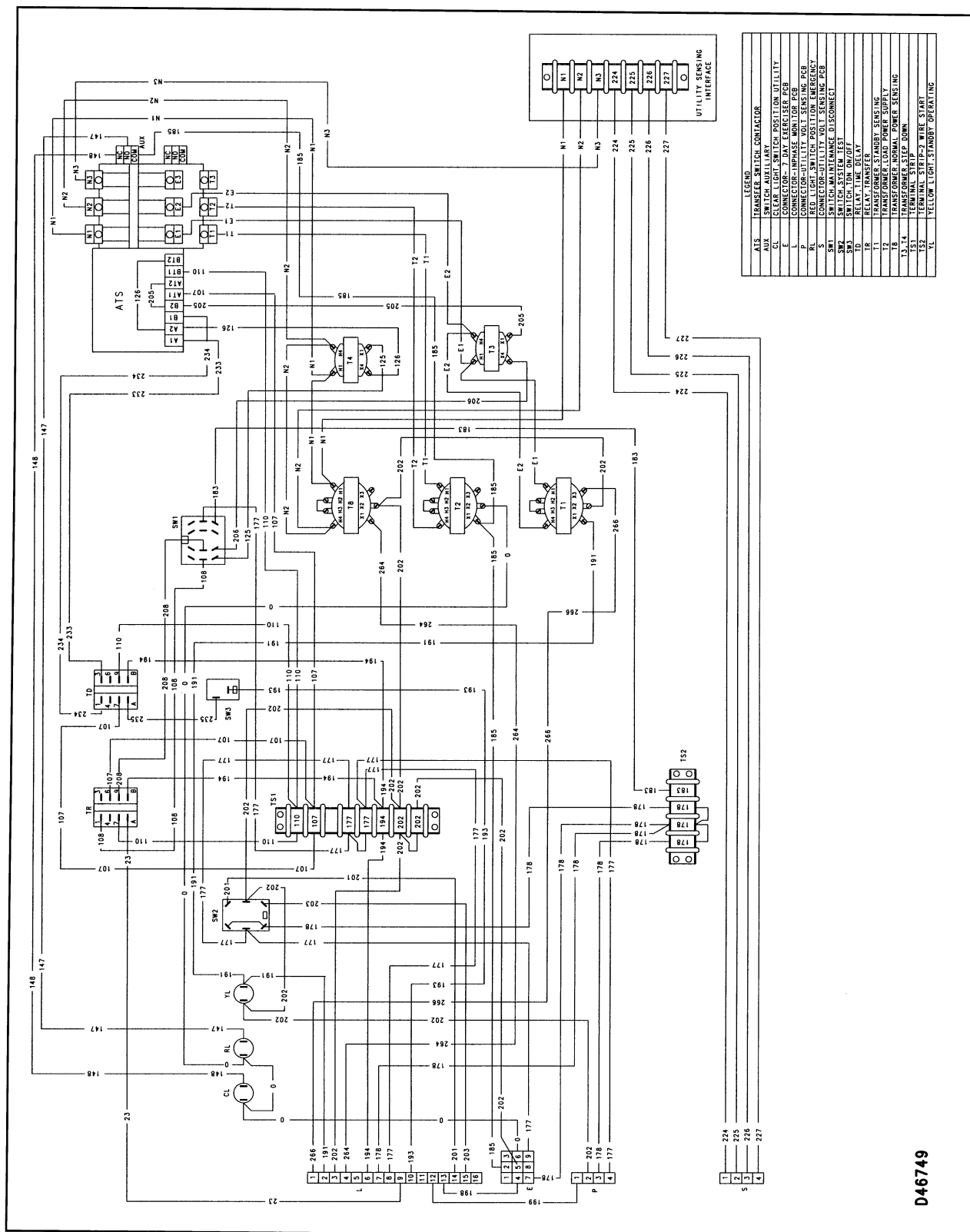
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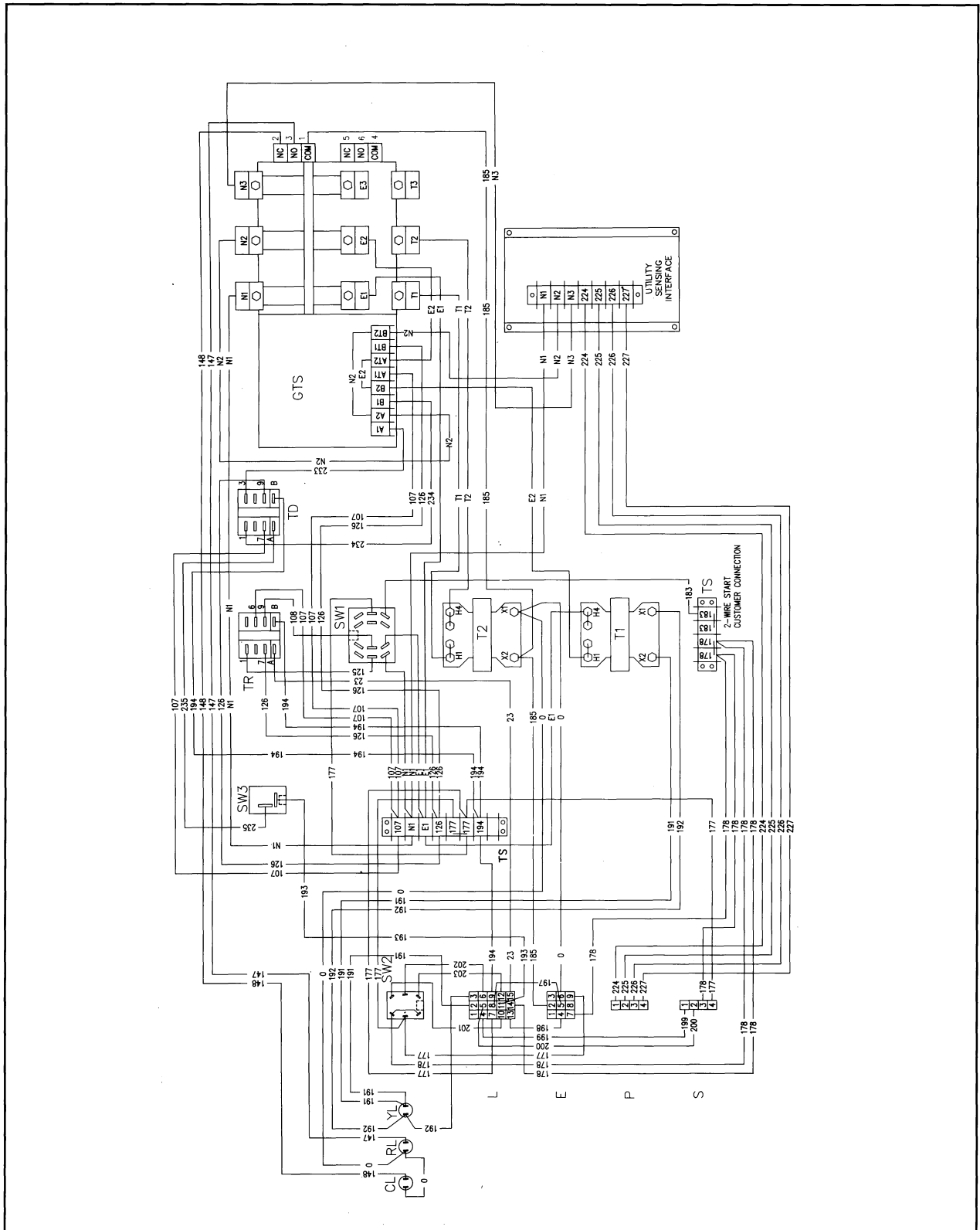
### 380-416 Volt, 50/60 Hz, 4 Pole, With In-Phase Monitor (Wiring Diagram)



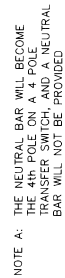
1-84  
Specifications Section  
Wiring Diagrams



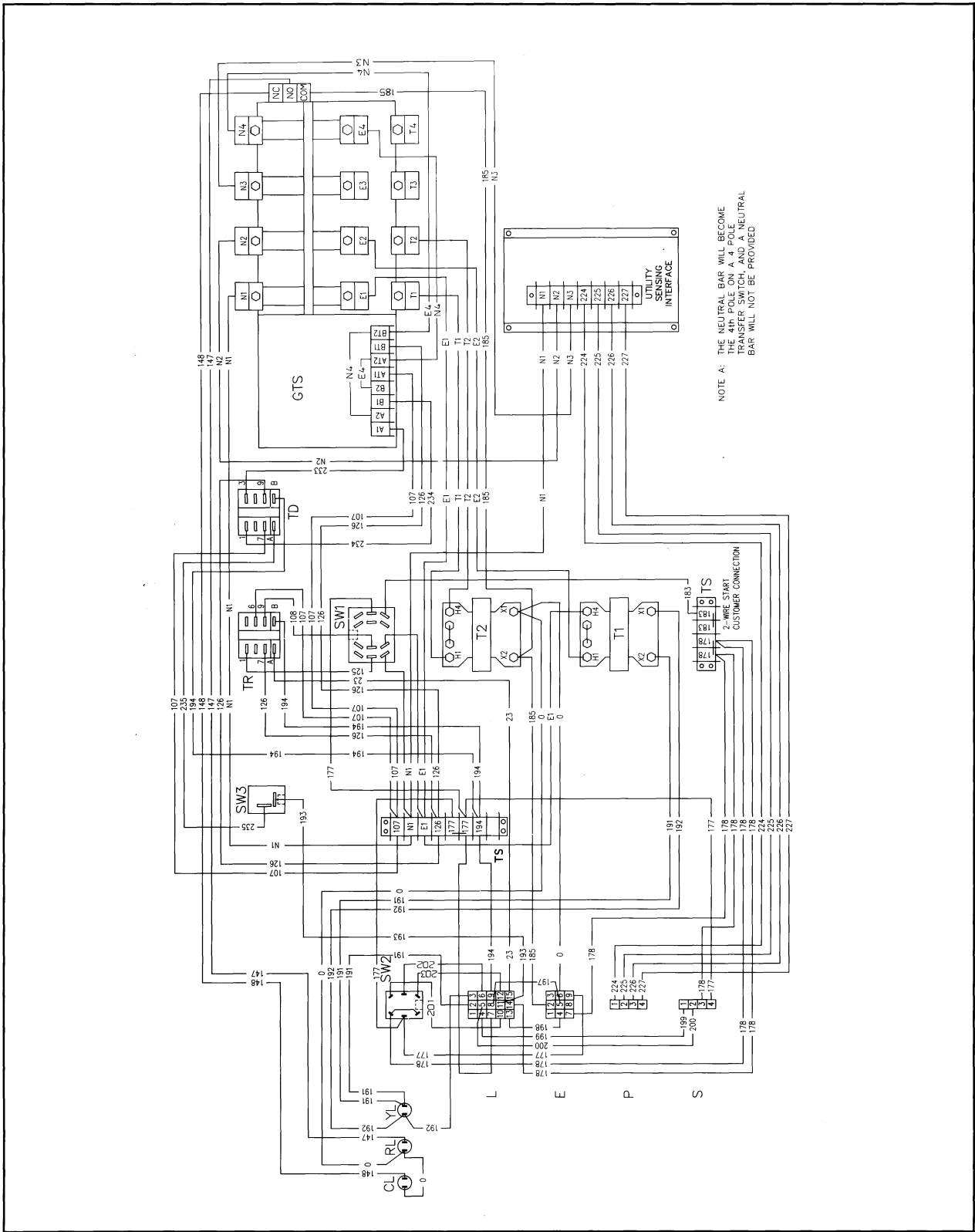
480-600 Volt, 50/60 Hz, 3 Pole, With In-Phase Monitor (Wiring Diagram)



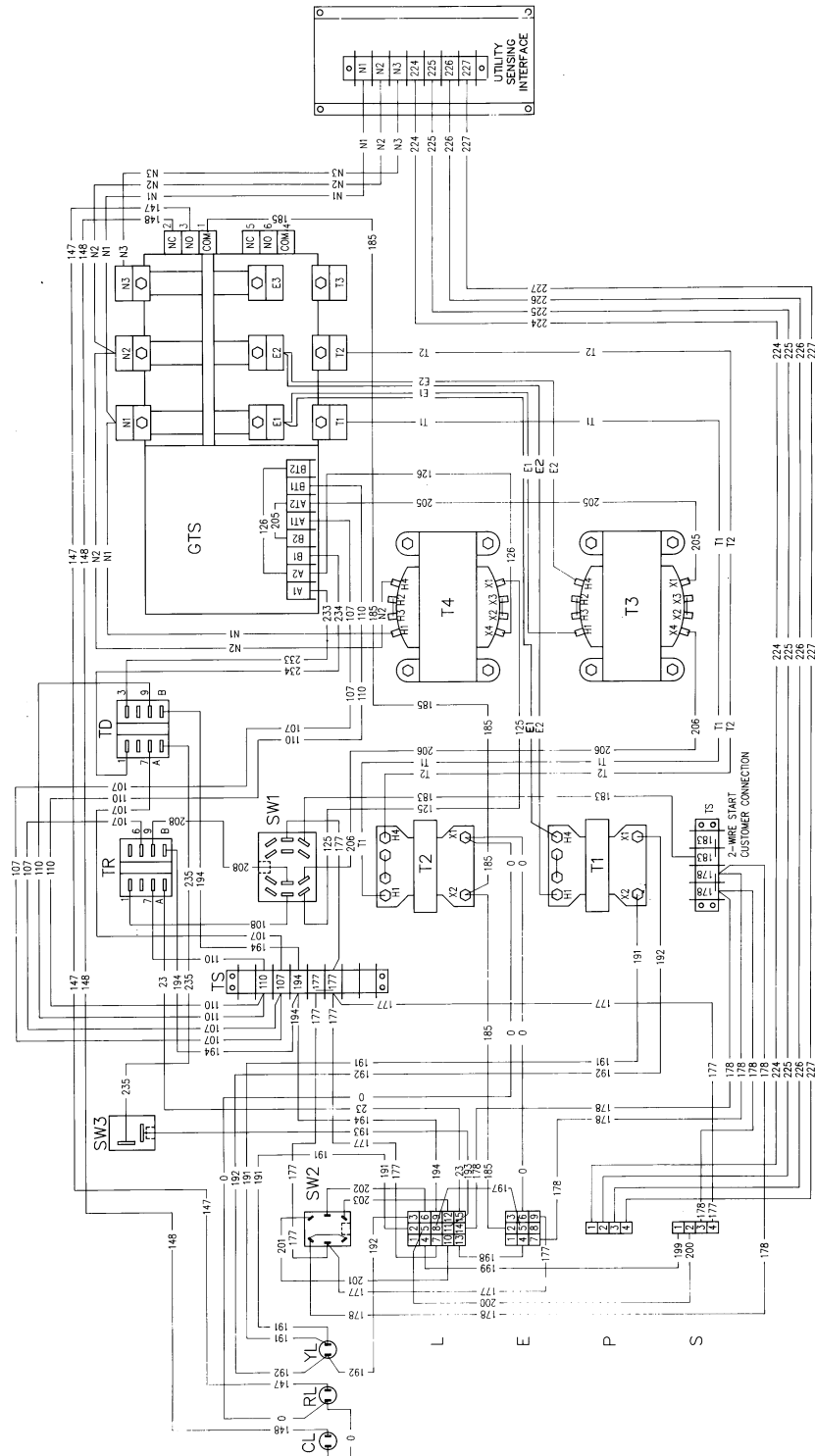
208-240 Volt, 50/60 Hz, With Programmable Control Logic (Wiring Diagram)



### 380-416 Volt, 50/60 Hz, 3 Pole, With Programmable Control Logic (Wiring Diagram)

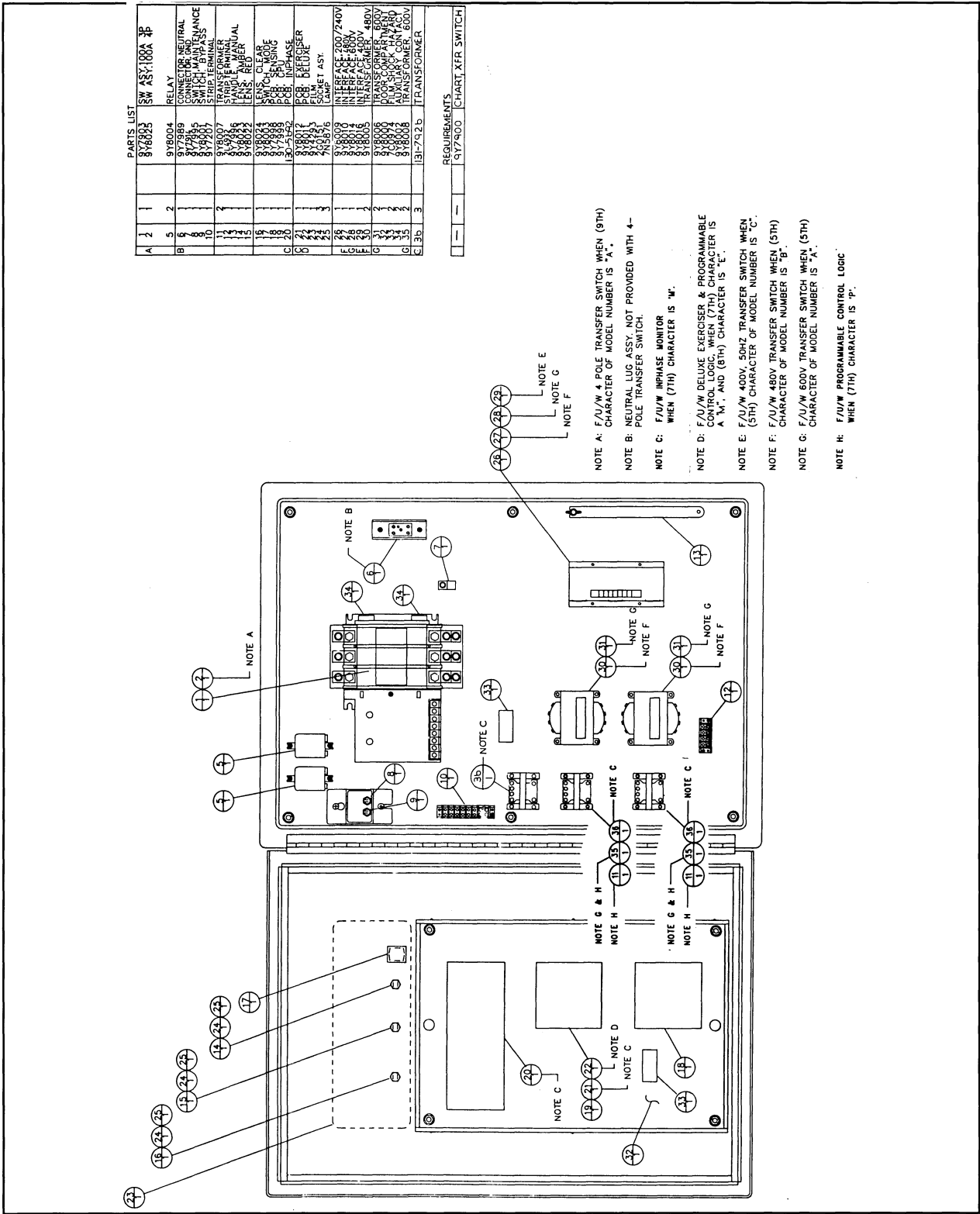


380-416 Volt, 50/60 Hz, 4 Pole, With Programmable Control Logic (Wiring Diagram)

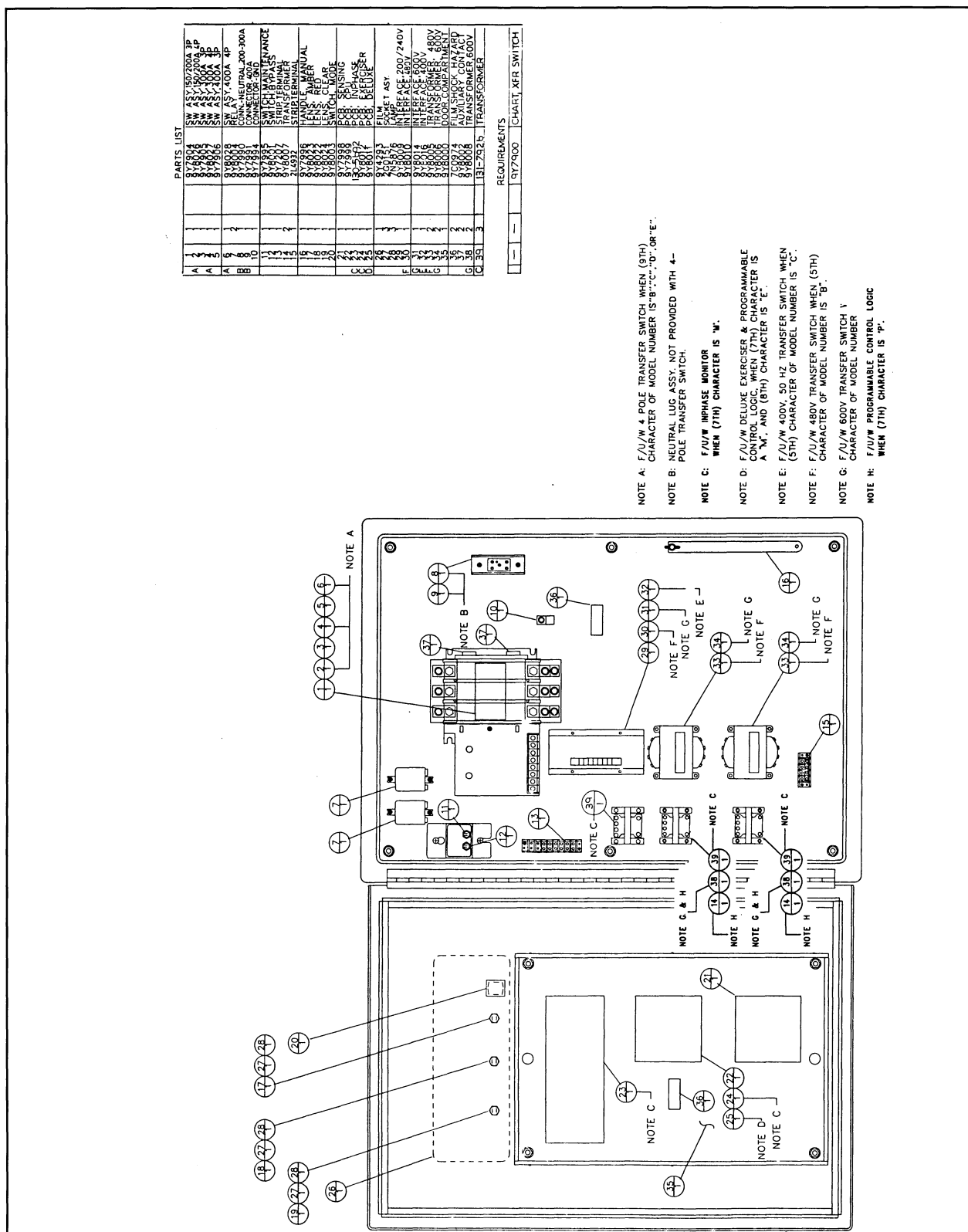


460-600 Volt, 50/60 Hz, With Programmable Control Logic (Wiring Diagram)

Assembly Diagrams



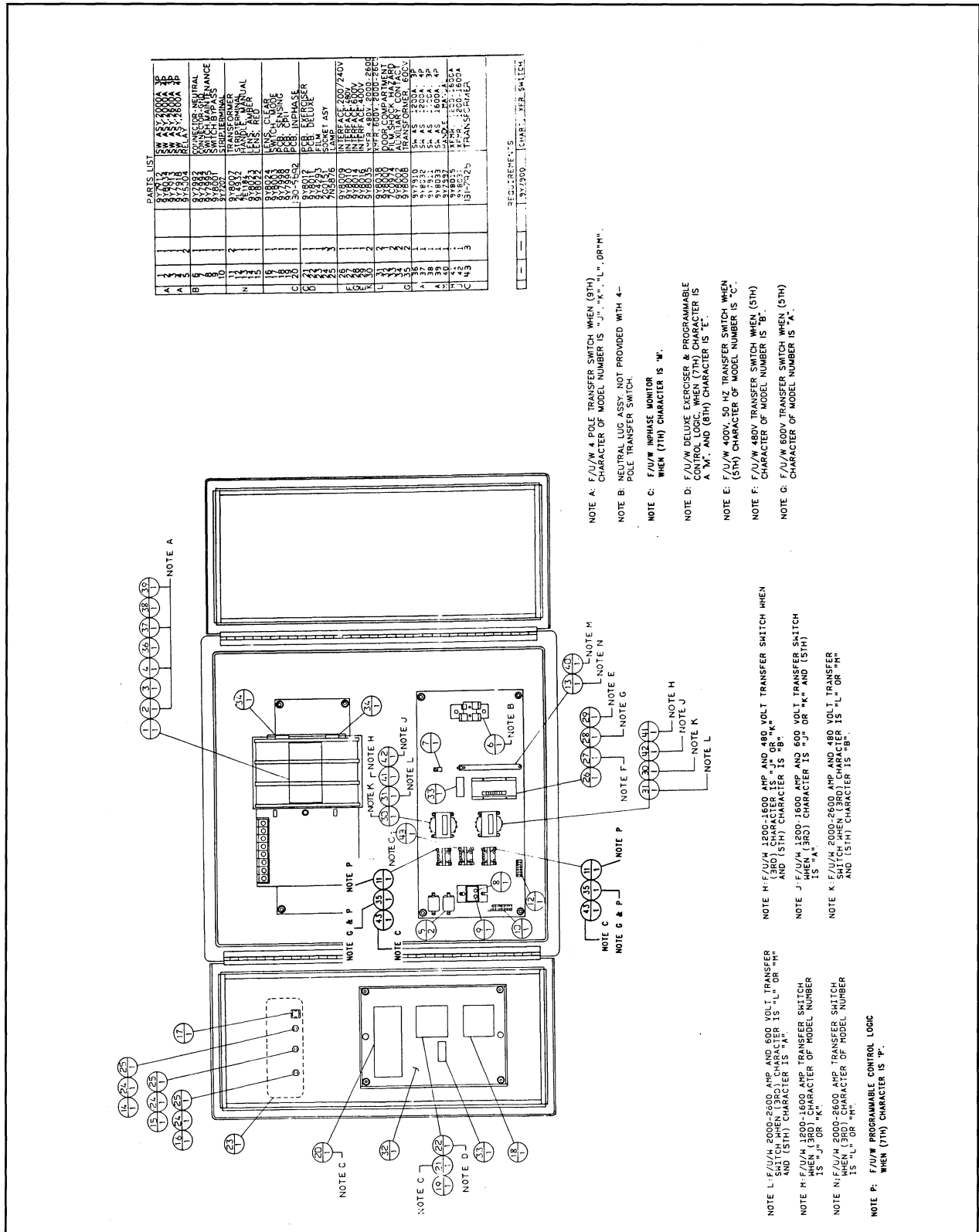
100 Amp (Assembly Diagram)

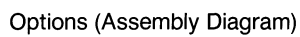


### 150, 200, 300 And 400 Amp (Assembly Diagram)









## Parts Information

### Required Data

Serviced parts requiring replacement can be located by Caterpillar Part Number in the following illustrations and charts under either of two conditions.

**1.** Knowing the eighteen (18) digit Caterpillar Model Number, which is found on the nameplate inside the control panel. This number designates the standard and optional component parts for the panel under the original operating characteristics, or

**2.** Knowing only the electrical characteristics of the generator, as stamped on the generator nameplate, Kilowatts (Kw)

Connected Voltage

Frequency (hertz)

Amperes

The needed digits of the 18 digit code number can be found, except for optional equipment, by referring to the charts.

Sheet metal, electrical wiring, cables, or common hardware items not serviced by Caterpillar may be obtained from local sources. If you cannot obtain replacement parts, call your Caterpillar Dealer. If you have any difficulty contacting your dealer, call, write, or telex one of the following Caterpillar offices. Ask to speak to the Customer Service Manager.

#### North America

Caterpillar Inc.  
Engine Division  
P.O. Box 610  
Mossville, IL 61552-0610  
Phone: (309), 578-8288  
Telex: 190423

#### Japan

Shin Caterpillar Mitsubishi Ltd.  
3700, Tana,  
Sagamihara-Shi  
Kanagawa-ken, 229 Japan  
Phone: Sagamihara  
(0427) 62-1121  
Telex: 2872-261CM HAJ

#### Australia

Caterpillar of Australia Ltd.  
1 Sharps Road  
Private Mail Bag 4  
Tullamarine  
Victoria 3043, Australia  
Phone: (03) 3399333  
Telex: AA 30240

#### Mexico, The Caribbean, South America

Caterpillar Americas Co.  
100 N.E. Adams  
Peoria, IL 61629  
Phone: (309), 675-5876  
Telex: 404435

#### Far East

Caterpillar Far East Ltd.  
28th Floor, Sun Hung Kai Centre  
30 Harbour Road  
G.P.O. Box 3069  
Wanchai, Hong Kong  
Phone: 5-8326333  
Telex: HX73305 CFEL

#### Brazil

Caterpillar Brasil S.A.  
04795-Av. Das Nacoes Unidas, 22.540 (S. Amaro)  
Caixa Postal, 8239  
01.000-SAO PAULO-SP-BRAZIL  
Phone: 247-1011/5919/1100  
Telex: 391-01122824 or 391-01121496

#### Europe, Middle East, Africa

Caterpillar Overseas S.A.  
P.O. Box 456  
1211 Geneva 6, Switzerland  
Phone: (022) 37 44 44  
Telex: 22706 or 22833

I. THIS CHART WILL ENABLE THE PROPER SELECTION AND ORDERING OF A CONTACTOR TYPE AUTOMATIC TRANSFER SWITCH PACKAGE RATED 100 THROUGH 2800 AMPERES, 50 OR 60 HERTZ, AND UP TO AND INCLUDING 800 VOLTS AC.

II. SELECTION OF A MODEL NUMBER FOR A TRANSFER SWITCH

TRANSFER SWITCHES SELECTED UNDER THIS CHART ARE TO BE ORDERED BY AN EIGHTEEN CHARACTER MODEL NUMBER. (EXAMPLE TCA1B 6PEX1 B1SER3X5). THE TRANSFER SWITCH AMP RATING IS DETERMINED FROM TABLE 1A FOR THE OPERATING VOLTAGE AND KILOWATT RATING OF THE INSTALLATION. THE FIRST FOUR CHARACTERS OF THE MODEL NUMBER THEN ARE OBTAINED FROM TABLE 1B, AND THE FIFTH AND SIXTH CHARACTERS MUST BE SELECTED TO COMPLETE THE BASIC TRANSFER SWITCH MODEL NUMBER. OPTIONS SELECTED FROM CHARACTERS SEVEN THRU EIGHTEEN WILL DETERMINE THE REMAINING CHARACTERS OF THE MODEL NUMBER.

1. A "T" AS THE FIRST CHARACTER OF THE MODEL NUMBER SPECIFIES A TRANSFER SWITCH.
2. A "C" AS THE SECOND CHARACTER OF THE MODEL NUMBER SPECIFIES A CONTACTOR TYPE TRANSFER SWITCH.
3. THE THIRD CHARACTER OF THE MODEL NUMBER SPECIFIES THE POWER SWITCHING PANEL RATING, NEUTRAL ASSEMBLY BAR, INTELLIGENCE PANEL, TRANSFER SWITCH ASSEMBLY DRAWING ASSOCIATED WITH THE APPLICABLE TRANSFER SWITCH RATING, GROUND CONNECTION, AND MANUAL OPERATING HANDLE.
4. THE FOURTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE TRANSFER SWITCH STANDARD ENCLOSURE SIZE.
5. THE FIFTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE SYSTEM VOLTAGE RATING. (A) 600 VOLTS (B) 480 VOLTS (C) 400 VOLTS (D) 240 VOLTS (E) 208 VOLTS.
6. THE SIXTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE SYSTEM FREQUENCY. (5) 50 HERTZ; (6) 60 HERTZ. THE 50 HERTZ FREQUENCY IS ONLY AVAILABLE WITH PROGRAMMABLE LOGIC CONTROL. CHARACTER "7" MUST BE "M" FOR 50 HERTZ OPERATION.
7. THE SEVENTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE INPHASE MONITOR CONTROL BOARD IF REQUIRED. (X) NOT REQUIRED; (M) INPHASE MONITOR CONTROL
8. THE EIGHTH CHARACTER OF THE MODEL NUMBER SPECIFIES A PROGRAMMABLE (DELUXE) EXERCISE TIMER, IF REQUIRED. (X) NOT REQUIRED; (E) PROGRAMMABLE EXERCISE TIMER. THIS OPTION ONLY AVAILABLE WHEN INPHASE MONITOR CONTROL CHARACTER "7" HAS BEEN SPECIFIED.
9. THE NINTH CHARACTER OF THE MODEL NUMBER SPECIFIES A FOUR POLE TRANSFER POWER SWITCHING PANEL, IF REQUIRED. (X) NOT REQUIRED, (A) 100 AMP, (B) 150 AMP, (C) 200 AMP, (D) 300 AMP, (E) 400 AMP, (F) 600 AMP, (G) 800 AMP, (H) 1000 AMP, (J) 1200 AMP, (K) 1600 AMP, (L) 2000 AMP, (M) 2600 AMP.
10. THE TENTH CHARACTER OF THE MODEL NUMBER SPECIFIES ADDITIONAL AUXILIARY CONTACTS, IF REQUIRED. (X) NOT REQUIRED (1) ONE AUXILIARY CONTACT (2) TWO AUXILIARY CONTACTS
11. THE ELEVENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A MANUAL BYPASS FOR RETURN TO NORMAL, IF REQUIRED. (X) NOT REQUIRED, (B) MANUAL BYPASS, F/U/W MICROPROCESSOR CONTROL, (C) MANUAL BYPASS, F/U/W INPHASE MONITOR
12. THE TWELFTH CHARACTER OF THE MODEL NUMBER SPECIFIES NEMA 3R RAIN TIGHT OR NEMA 12 DUST TIGHT ENCLOSURES, IF REQUIRED. (X) NOT REQUIRED (1) 100-1000 AMP NEMA 3R (2) 1200-2600 AMP NEMA 3R (3) 100 AMP NEMA 12 (4) 150-400 AMP NEMA 12.
13. THE THIRTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A TWO POSITION SOURCE SELECTOR SWITCH, IF REQUIRED. (X) NOT REQUIRED (S) TWO POSITION SWITCH
14. THE FOURTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A SIGNAL BEFORE TRANSFER (ELEVATOR) CONTACT, IF REQUIRED. (X) NOT REQUIRED (E) ELEVATOR CONTACT, F/U/W MICROPROCESSOR CONTROL, (F) ELEVATOR CONTACT, F/U/W INPHASE MONITOR.
15. THE FIFTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A REMOTE AUTOMATIC TRANSFER SWITCH CONTROL CIRCUIT, IF REQUIRED. (X) NOT REQUIRED (R) REMOTE CONTROL CIRCUIT
16. THE SIXTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A MANUAL THREE POSITION SWITCH WITH NORMAL/AUTO /STANDBY POSITIONS, IF REQUIRED. (X) NOT REQUIRED (3) 3 POSITION SWITCH
17. THE SEVENTEENTH CHARACTER OF THE MODEL NUMBER IS FOR FUTURE USE.
18. THE EIGHTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE CHANGE NUMBER OF THE CHART TO WHICH THE TRANSFER SWITCH WAS BUILT.

CHARACTER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
MODEL NUMBER	T	C	A	1	B	6	P	E	X	1	B	1	S	E	R	3	X	5
DESIGNATION																		

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TABLE 1A – TRANSFER SWITCH RATING

TRANSFER SWITCH AMP RATING	KW RANGE BY VOLTAGE				
	208 * (200)	240 * (230) (220)	400 * (415) (380)	480 * (460)	600 * (580)
100	-28	-33	-55	-66	-83
150	29-43	34-49	56-83	67-99	84-124
200	44-57	50-66	84-110	100-133	125-166
300	58-86	67-99	111-166	134-199	167-249
400	87-115	100-133	167-221	200-266	250-332
600	116-172	134-199	222-332	267-399	333-498
800	173-230	200-266	333-443	400-532	499-665
1000	231-288	267-332	444-554	533-665	666-831
1200	289-345	333-399	555-665	667-798	832-997
1600	346-461	400-532	666-886	799-1064	998-1330
2000	462-576	533-665	887-1108	1065-1330	1331-1662
2600	577-749	666-864	1109-1441	1331-1729	1663-2161

\* KW RANGE BY VOLTAGE CALCULATED AT THE \* VALUE. ALL OTHER LISTED VOLTAGES AND TRANSFER SWITCH AMP RATINGS SHOULD BE CALCULATED BY THE FORMULA

$$AMP = \frac{KW \times 1000}{VOLT \times 0.8 \times 1.732}$$

TABLE 1B  
AUTOMATIC TRANSFER SWITCH

CONSISTS OF 3 POLE 600 VAC RATED NORMAL AND STANDBY POWER SOURCE SWITCHING ELEMENTS, AND AUTOMATIC TRANSFER SWITCH MECHANISM THAT PROVIDES MICROPROCESSOR BASED INTELLIGENCE PANEL AND CIRCUITS TO SIGNAL ENGINE INITIATING (N.O.) START CONTACTS. THE FOLLOWING FEATURES ARE INCLUDED AS STANDARD:

- AN ADJUSTABLE NORMAL SOURCE 3 PHASE VOLTAGE SENSING PICK-UP AND DROP-OUT (70-95%)
- AN ADJUSTABLE TIME DELAY FOR ENGINE STARTING (0.1 TO 10 SEC.)
- SINGLE PHASE STANDBY VOLTAGE AND FREQUENCY SENSING (FIXED AT 80%)
- ENGINE MINIMUM RUN TIMER (FIXED AT 10 MINUTES)
- RETURN TO NORMAL TIMER (FIXED AT 30 SEC.)
- TIME DELAY NEUTRAL WITH OVERRIDE SWITCH (FIXED AT 0 OR 5 SEC.)
- ENGINE WARMUP TIMER WITH OVERRIDE SWITCH (FIXED AT 0 OR 30 SEC.)
- ENGINE COOLDOWN TIMER (FIXED AT 10 MINUTES)
- 7 DAY EXERCISE TIMER WITH TRANSFER WHEN EXERCISING ON/OFF SWITCH
- NEMA 1 ENCLOSURE
- NEMA 12 ENCLOSURE WITH KEY LOCK AND DOOR HANDLE ON SWITCHES RATED GREATER THAN 400 AMPERES
- AUTO/TEST/FAST TEST OPERATING MODE SELECTOR SWITCH
- NORMAL, STANDBY, AND STANDBY OPERATING INDICATING LIGHTS
- NORMAL, STANDBY, LOAD AND NEUTRAL CONNECTION LUGS
- NO LOAD MANUAL TRANSFER OPERATING HANDLE
- AUXILIARY CONTACT (1) C-FORM SINGLE POLE DOUBLE THROW

SELECTION OF TRANSFER SWITCH RATING TO BE DETERMINED BY LOAD REQUIREMENTS, SERVICE ENTRANCE EQUIPMENT AND/OR CAPACITY, AND LOCAL ELECTRICAL CODE REQUIREMENTS.

TRANSFER SWITCHES IDENTIFIED BY TABLE 1B ARE RATED FOR 100% CONTINUOUS CURRENT AT RATING SPECIFIED AND FOR VOLTAGES UP TO AND INCLUDING 600 VOLTS AC.

MODEL NUMBER	TRANSFER SWITCH RATING
TCA1	100 AMP
TCB1	150 AMP
TCC2	200 AMP
TCD2	300 AMP
TCE2	400 AMP
TCF3	600 AMP
TCG3	800 AMP
TCH3	1000 AMP
TCJ4	1200 AMP
TCK4	1600 AMP
TCL5	2000 AMP
TCM5	2600 AMP

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### III. DESCRIPTION OF EQUIPMENT SPECIFIED BY MODEL NUMBER

1. A "T" AS THE FIRST CHARACTER OF THE MODEL NUMBER SPECIFIES THE EQUIPMENT AS A TRANSFER SWITCH.
2. A "C" AS THE SECOND CHARACTER OF THE MODEL SPECIFIES A CONTACTOR TYPE TRANSFER SWITCH.
3. THE THIRD CHARACTER OF THE MODEL NUMBER SPECIFIES THE POWER SWITCHING ASSEMBLY RATING, NEUTRAL ASSEMBLY BAR, TRANSFER SWITCH ASSEMBLY DRAWING, GROUND CONNECTION, AND MANUAL OPERATING HANDLE.

TCA1B 6PEX1 B1SER3X5

	TRANSFER SWITCH AMPERE RATING	THREE POLE POWER SWITCHING * ASSEMBLY		NEUTRAL CONNECTOR ASSEMBLY PART NO.	9Y7901 TRANSFER SWITCH ASSEMBLY DRAWING	GROUND CONNECTION PART NO.	MANUAL OPERATING HANDLE PART NO.
		PART NO.	NORMAL & STANDBY				
X	NONE						
A	100	9Y7903	100 AMP	9Y7989	SHEET 27	9Y7914	9Y7996
B	150	9Y7904	150 AMP	9Y7989	SHEET 28	9Y7914	9Y7996
C	200	9Y7904	200 AMP	9Y7990	SHEET 28	9Y7994	9Y7996
D	300	9Y7905	300 AMP	9Y7990	SHEET 28	9Y7994	9Y7996
E	400	9Y7906	400 AMP	9Y7991	SHEET 28	9Y7994	9Y7996
F	600	9Y7907	600 AMP	9Y7991	SHEET 29	9Y7994	9Y7997
G	800	9Y7908	800 AMP	9Y7992	SHEET 29	9Y7994	9Y7997
H	1000	9Y7909	1000 AMP	9Y7992	SHEET 29	9Y7994	9Y7997
J	1200	9Y7910	1200 AMP	9Y7992	SHEET 29	9Y7994	9Y7997
K	1600	9Y7911	1600 AMP	9Y7992	SHEET 29	9Y7994	9Y7997
L	2000	9Y7912	2000 AMP	9Y7992	SHEET 30	9Y7994	7E1184
M	2600	9Y7913	2600 AMP	9Y7992	SHEET 30	9Y7994	7E1184

TO COMPLETE THE SELECTION OF THE TRANSFER SWITCH MODEL NUMBER THE PARTS CALLED FOR BY THE 4TH, 5TH, AND 6TH CHARACTERS ON THIS CHART MUST BE SPECIFIED.

\* THREE POLE POWER SWITCH IS SERVICED AS A COMPLETE UNIT.  
FOR SWITCH ASSEMBLY SERVICEABLE PARTS, SEE THE PARTS BOOK SECTION OF THIS MANUAL.

4. THE FOURTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE STANDARD ENCLOSURE SIZE. THE ENCLOSURE SELECTION MUST BE PROVIDED TO COMPLETE THE MODEL NUMBER.

TCA1B 6PEX1 B1SER3X5

TRANSFER SWITCH ENCLOSURE SIZE		SWITCH AMP RATING	STANDARD ENCLOSURE TYPE	OUTLINE DRAWING 9Y7901
1	620 (24.4)W X 926 (36.5)H X 243 (9.6)D	100 AMPERES	NEMA 1	SHEET 3
2	773 (30.4)W X 1231 (48.5)H X 294 (11.6)D	150-400 AMPERES		SHEET 6
3	914 (36)W X 1676 (66)H X 508 (20)D*	600-1000 AMPERES	NEMA 12	SHEET 8
4	1219 (48)W X 1981 (78)H X 610 (24)D*	1200-1600 AMPERES		SHEET 10
5	1168 (46)W X 2032 (80)H X 1219 (48)D	2000-2600 AMPERES		SHEET 12

\* HEIGHT INCLUDES 152.4 (6) LEGS PROVIDED WITH THE ENCLOSURE

NUMBERS IN PARENTHESIS ARE IN INCHES

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#### 9Y-7900 TRANSFER SWITCH PANEL - PART 3 OF 8

Reference: For The Part List Of Specific Transfer Switches, See the pages that follow.

Reference: See The Outline Dimension Drawings.

Reference: See The Assembly Diagrams.

5. THE FIFTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE SYSTEM CONNECTED VOLTAGE.  
THE VOLTAGE SELECTION MUST BE PROVIDED TO COMPLETE THE MODEL NUMBER.

TCA1B 6PEX1 B1SER3X5

	SYSTEM CONNECTED VOLTAGE	STANDBY & LOAD VOLT. SENSING TRANSFORMER		POWER SWITCHING TRANSFORMER	
		PART NO.	QTY.	PART NO.	QTY.
A	600 (580)VOLTS	9Y8008	2	TABLE 1C	2
B	480 (460)VOLTS	9Y8007	2	TABLE 1C	2
C	400 (380-415)VOLTS	9Y8007	2	NOT REQ'D.	—
D	240 (220-230)VOLTS	9Y8007	2	NOT REQ'D.	—
E	208 (200)VOLTS	9Y8007	2	NOT REQ'D.	—

6. THE SIXTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE SYSTEM FREQUENCY.  
THE FREQUENCY SELECTION MUST BE PROVIDED TO COMPLETE THE MODEL NUMBER.

TCA1B 6PEX1 B1SER3X5

	SYSTEM FREQUENCY	NORMAL SOURCE VOLTAGE INTERFACE MODULE PART NO.	SYSTEM VOLTAGE & 5TH CHARACTER	SYSTEM FREQUENCY & 6TH CHARACTER
5	50 HERTZ	9Y8014	A-600V	6-60HZ
6	60 HERTZ	9Y8010	B-480V	5&6-50/60HZ
		9Y8016	C-400V	5&6-50/60HZ
		9Y8009	D-240V	5&6-50/60HZ
		9Y8009	E-208V	5&6-50/60HZ

NOTE: IF THE SIXTH CHARACTER IS A "5" FOR 50 HERTZ FREQUENCY,  
THEN CHARACTER "7" MUST BE A "M" FOR INPHASE MONITOR CONTROL.

NOTE: TWO (2) POWER SWITCHING TRANSFORMERS ARE  
REQUIRED FOR 480 VOLT & 600 VOLT OPERATION. (5TH  
CHARACTER "A" OR "B") PER TABLE 1C

TABLE 1C

TRANSFORMER PART NO.	3RD CHARACTER		5TH CHARACTER	
	TRANS. SW. AMP RATING	CHARACTER LETTER	OPERATING VOLTAGE	CHARACTER LETTER
9Y8005	100A-400A	A,B,C,D,E	480V	B
9Y7993	600A-1000A	F,G,H	480V	B
9Y8015	1200A/1600A	J,K	480V	B
9Y8035	2000A/2600A	L,M	480V	B
9Y8006	100A-400A	A,B,C,D,E	600V	A
9Y8036	600A-1000A	F,G,H	600V	A
9Y8037	1200A/1600A	J,K	600V	A
9Y8038	2000A/2600A	L,M	600V	A

7. THE SEVENTH CHARACTER OF THE MODEL NUMBER SPECIFIES AN IN-PHASE MONITOR CONTROL PANEL AND EXERCISER TIMER. THE CONTROL PROVIDES FIELD ADJUSTMENT FOR TIME DELAY NEUTRAL, COOL DOWN TIMER, MINIMUM RUN TIMER, RETURN TO NORMAL TIMER, STANDBY VOLTAGE AND FREQUENCY, ENGINE WARM-UP TIMER WITH OVERRIDE SWITCH, AND 7 DAY EXERCISER TIMER. THE PROGRAMMABLE LOGIC CONTROL INTELLIGENCE PANEL, IF SELECTED, REPLACES THE MICROPROCESSOR BASED INTELLIGENCE PANEL.

TCA1B 6PEX1 B1SER3X5

		PART NO.	
		LOGIC CONTROL BOARD	EXERCISER TIMER
X	NOT REQUIRED	—	—
M	INPHASE MONITOR CONTROL	130-5692	9Y8012

8. THE EIGHTH CHARACTER OF THE MODEL SPECIFIES A PROGRAMMABLE (DELUXE) EXERCISE TIMER, IF REQUIRED. THIS OPTION ONLY AVAILABLE WHEN INPHASE MONITOR CONTROL CHARACTER "7" HAS BEEN SPECIFIED AS A "M". TO PROVIDE ADJUSTABLE TIME OF DAY/WEEK ENGINE EXERCISE TIMER AND DIGITAL CLOCK.

TCA1B 6PEX1 B1SER3X5

	PROGRAMMABLE EXERCISE TIMER	PART NUMBER
X	NOT REQUIRED	—
E	PROGRAMMABLE EXERCISE TIMER	9Y8011

9. THE NINTH CHARACTER OF THE MODEL NUMBER SPECIFIES A FOUR (4) POLE TRANSFER SWITCH POWER SWITCHING ASSEMBLY, TRANSFER SWITCH ASSEMBLY DRAWING, GROUND CONNECTION, AND MANUAL OPERATING HANDLE, IF REQUIRED. TO PROVIDE SWITCHING THE NEUTRALS OF THE NORMAL AND STANDBY SOURCES.

TCA1B 6PEX1 B1SER3X5

	TRANSFER SWITCH AMPERE RATING	FOUR POLE POWER SWITCHING * ASSEMBLY		9Y7901 TRANSFER SWITCH ASSEMBLY DRAWING	GROUND CONNECTION PART NO.	MANUAL OPERATING HANDLE PART NO.
		PART NO.	NORMAL & STANDBY			
X	NOT REQ'D	—	—	—	—	—
A	100	9Y8025	100 AMP	SHEET 27	9Y7914	9Y7996
B	150	9Y8026	150 AMP	SHEET 28	9Y7914	9Y7996
C	200	9Y8026	200 AMP	SHEET 28	9Y7994	9Y7996
D	300	9Y8027	300 AMP	SHEET 28	9Y7994	9Y7996
E	400	9Y8028	400 AMP	SHEET 28	9Y7994	9Y7996
F	600	9Y8029	600 AMP	SHEET 29	9Y7994	9Y7997
G	800	9Y8030	800 AMP	SHEET 29	9Y7994	9Y7997
H	1000	9Y8031	1000 AMP	SHEET 29	9Y7994	9Y7997
J	1200	9Y8032	1200 AMP	SHEET 29	9Y7994	9Y7997
K	1600	9Y8033	1600 AMP	SHEET 29	9Y7994	9Y7997
L	2000	9Y8034	2000 AMP	SHEET 30	9Y7994	7E1184
M	2600	9Y7918	2600 AMP	SHEET 30	9Y7994	7E1184

\* FOUR POLE POWER SWITCH IS SERVICED AS A COMPLETE ASSEMBLY. FOR SWITCH ASSEMBLY SERVICEABLE PARTS, SEE THE PARTS BOOK SECTION OF THIS MANUAL.

10. THE TENTH CHARACTER OF THE MODEL NUMBER SPECIFIES ADDITIONAL AUXILIARY CONTACTS FOR EXTERNAL USE (EACH ARE SINGLE POLE DOUBLE THROW 5A, 250VAC.), IF REQUIRED, TO INDICATE TRANSFER SWITCH POSITION.

TCA1B 6PEX1 B1SER3X5

	AUXILIARY CONTACTS	PART NUMBER	QTY
X	NOT REQUIRED	—	—
1	AUXILIARY CONTACT (ONE)	9Y8039	1
2	AUXILIARY CONTACT (TWO)	9Y8039	2

11. THE ELEVENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A MANUAL BYPASS FOR RETURN TO NORMAL, IF REQUIRED. TO PROVIDE A MANUAL RETURN TO NORMAL. (THIS OPTION IS NOT U.L. APPROVED).

TCA1B 6PEX1 B1SER3X5

	MANUAL BYPASS	PART NO. & QTY		
		AUXILIARY RELAY	PUSHBUTTON	CONTACT SWITCH
X	NOT REQUIRED	—	—	—
B	F/U/W STANDARD	(2)9Y8021	(1)9Y8017	(1)133-0126
C	F/U/W INPHASE	—	(1)9Y8017	(1)133-0126

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#### 9Y-7900 TRANSFER SWITCH PANEL – PART 5 OF 8

Reference: For The Part List Of Specific Transfer Switches, See the pages that follow.  
Reference: See The Assembly Diagrams.



12. THE TWELFTH CHARACTER OF THE MODEL NUMBER SPECIFIES OPTIONAL ENCLOSURES, A NEMA 3R RAINTIGHT ENCLOSURE OR A NEMA 12 ENCLOSURE.

TCA1B 6PEX1 B1SER3X5

				OUTLINE DRAWING 9Y7901
ENCLOSURE TYPE		AMPERE RATING	TRANSFER SWITCH ENCLOSURE SIZE	
X	NOT REQUIRED			
1	NEMA 3R	100 AMPERES	610 (24)W X 914 (36)H X 254 (10)D	SHEET 2
1		150-400 AMPERES	762 (30)W X 1219 (48)H X 305 (12)D	SHEET 5
1		600-1000 AMPERES	914 (36)W X 1676 (66)H X 508 (20)D	SHEET 8
2		1200-1600 AMPERES	1219 (48)W X 1981 (78)H X 610 (24)D	SHEET 10
2		2000-2600 AMPERES	1168 (46)W X 2032 (80)H X 1219 (48)D	SHEET 12
3		100 AMPERES	610 (24)W X 914 (36)H X 254 (10)D	SHEET 2
3	NEMA 12	150-400 AMPERES	762 (30)W X 1219 (48)H X 305 (12)D	SHEET 5

NOTED: NEMA 12 ENCLOSURE IS STANDARD ON TRANSFER SWITCHES  
RATED OVER 400 AMPERES.

\* HEIGHT INCLUDES 152.4 (6) LEGS PROVIDED WITH THE ENCLOSURE  
NUMBERS IN PARENTHESIS ARE IN INCHES

13. THE THIRTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A TWO POSITION SELECTOR SWITCH TO ALLOW SELECTION OF EITHER THE NORMAL OR STANDBY POWER SOURCE AS THE PREFERRED SOURCE, IF REQUIRED.

TCA1B 6PEX1 B1SER3X5

	SOURCE SELECTOR SWITCH	PART NO.
X	NOT REQUIRED	—
S	2 POSITION SWITCH	9Y8018

14. THE FOURTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A SIGNAL BEFORE TRANSFER (ELEVATOR) CONTACT, IF REQUIRED, TO PROVIDE A CONTACT SIGNAL PRIOR TO A TRANSFER SWITCH OPERATION.

TCA1B 6PEX1 B1SER3X5

		PART NO. & QTY.	
ELEVATOR CONTACT		RELAY	TIMER
X	NOT REQUIRED	—	—
E	F/U/W STANDARD	(2)9Y8021	—
F	F/U/W INPHASE	(1)9Y8004	—

15. THE FIFTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A REMOTE AUTOMATIC TRANSFER SWITCH CONTROL CIRCUIT, IF REQUIRED, TO PROVIDE FOR AUTOMATIC TRANSFER SWITCH OPERATION FROM A REMOTE SIGNAL.

TCA1B 6PEX1 B1SER3X5

	REMOTE CONTROL CIRCUIT	PART NO.
X	NOT REQUIRED	—
R	REMOTE CONTROL CIRCUIT	2L4932

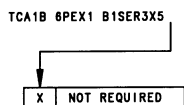
16. THE SIXTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES A MANUAL THREE POSITION SELECTOR SWITCH, IF REQUIRED, TO PROVIDE A SWITCH TO SELECT EITHER NORMAL, OR AUTOMATIC, OR STANDBY TRANSFER SWITCH POSITION. (THIS OPTION IS NOT U.L. APPROVED).

TCA1B 6PEX1 B1SER3X5

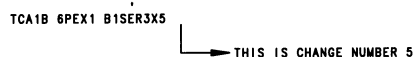
	3 POSITION SWITCH	PART NO.
X	NOT REQUIRED	—
3	3 POSITION SWITCH	9Y8019

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17. THE SEVENTEENTH CHARACTER OF THE MODEL NUMBER IS FOR FUTURE USE.  
USE (X) FOR THE PRESENT.



18. THE EIGHTEENTH CHARACTER OF THE MODEL NUMBER SPECIFIES THE CHANGE NUMBER OF THIS  
CHART TO WHICH THE TRANSFER SWITCH WAS BUILT.



- IV - THE FOLLOWING COMPONENTS, AS INDICATED, ARE REQUIRED TO COMPLETE THE TRANSFER SWITCH,  
IN ADDITION TO THE COMPONENTS SPECIFIED BY THE MODEL NUMBER.

QTY	PART NUMBER	NAME	DESCRIPTION
2	9Y8004	RELAY - AUXILIARY	12VDC, 3PDT PLUG-IN (TR-TRANSFER RELAY) (TD-TIME DELAY NEUTRAL RELAY)
1	9Y8003	SWITCH - MODE	3-POSITION ("TEST"/"AUTO"/"FAST TEST")
1	9Y4293	FILM	DECAL ON ENCLOSURE DOOR (CAT NAMEPLATE)
MISC		SOCKETS AND PLUGS	APPROVED BY CAT.
2	7C0974	FILM	WARNING ELECTRIC SHOCK
3	7N5876	BULB-LAMP	28VOLT, T3 1/4 SIZE, MINATURE
3	2G0151	LAMP - HOLDER	ACCEPTS T3 1/4 SIZE LAMPS
1	9Y8024	LENS	CLEAR - NORMAL POSITION LIGHT
1	9Y8022	LENS	RED - STANDBY OPERATING LIGHT
1	9Y8023	LENS	AMBER - STANDBY POSITION LIGHT
2	9Y8002	CONTACT - AUXILIARY	SINGLE POLE DOUBLE THROW, 5A, 250VAC
1	9Y8001	SWITCH - BYPASS	TIME DELAY NEUTRAL BYPASS
1	9Y8000	DOOR - COMPARTMENT	CIRCUIT BOARD ENCLOSURE COVER
1	9Y7999	BOARD - CPU MICROPROCESSOR	INTELLIGENCE SYSTEM CONTROL
1	9Y7998	BOARD -NORMAL VOLT. SENSING	ADJUSTABLE DROPOUT & PICKUP NORMAL VOLTAGE
1	9Y7995	SWITCH	MAINTENANCE DISCONNECT
1	9Y7207	TERMINAL STRIP	8 POINTS
1	2L4932	TERMINAL STRIP	4 POINTS
1	3LB203	TERMINAL STRIP	6 POINTS
1 LOT	—	INTERNAL WIRING	APPROVED BY CAT.
1 LOT	—	LABELS - COMPONENT	APPROVED BY CAT.

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## V. GENERAL REQUIREMENTS.

1. THE OPERATION OF THE TRANSFER SWITCH SHALL MEET THE REQUIREMENTS FOR EMERGENCY SYSTEMS (AS DEFINED IN ACCORDANCE WITH ARTICLES 517 AND 700 IN NFPA NO. 70- NATIONAL ELECTRICAL CODE); AND SHALL COMPLY WITH ATS - UL 1008 AS APPLICABLE WITH REGARD TO CONSTRUCTION, PERFORMANCE, RATINGS AND MARKINGS.
2. UP TO AND INCLUDING 400 AMPERE RATING THE SWITCH SHALL BE CONTAINED IN A NEMA 1 ENCLOSURE WHICH SHALL CLASSED AS A WALL MOUNTED UNIT. ABOVE 400 AMPERES THROUGH 2800 AMPERES THE SWITCH SHALL BE CONTAINED IN A NEMA 12 ENCLOSURE AND WILL BE CLASSED AS FLOORSTANDING AND BE PROVIDED WITH LIFTING EYES.
3. PAINT - THE DOOR(S) OF THE ENCLOSURE SHALL BE PAINTED DITZLER, ASA #49, ACRYLIC LACQUER (OR EQUAL) AND THE REMAINING EXTERNAL SURFACES OF THE ENCLOSURE SHALL BE PAINTED ASA NO. 61 GRAY BAKED ENAMEL.
4. TWO NAMEPLATES SHALL BE PROVIDED FOR EACH TRANSFER SWITCH. THE FIRST NAMEPLATE SHALL BE ATTACHED TO THE OUTSIDE DOOR, AND SHALL CONSIST OF THE CATERPILLAR LOGO - PART NO. 9Y4293. THE SECOND NAMEPLATE SHALL BE PROVIDED BY GENERAC AND LOCATED ON THE INSIDE OF THE ENCLOSURE. IT SHALL CONSIST OF THE FOLLOWING:

CATERPILLAR TRANSFER SWITCH			
MANUFACTURED EXCLUSIVELY FOR CATERPILLAR BY			
GENERAC CORP., WAUKESHA, WISCONSIN, U.S.A.			
CATERPILLAR MODEL NO.	<input type="text"/>		
	(AS SELECTED FROM CHART 9Y7900)		
CATERPILLAR NUMERICAL CODE.	<input type="text"/>	S.O. NUMBER	<input type="text"/>
GENERAC SERIAL NO.	<input type="text"/>		
SWITCH RATING	<input type="text"/>	AMPS	<input type="text"/>
		VOLT	<input type="text"/>
			HZ
(DATA AS REQUIRED TO MEET UL1008)			

5. EACH TRANSFER SWITCH SHALL CONTAIN ONE OPERATION AND MAINTENANCE INSTRUCTION MANUAL SHIPPED INSIDE THE ENCLOSURE.
6. CATERPILLAR REFERENCE DRAWINGS.

### 9Y7901 INSTRUCTIONS TRANSFER SWITCH

- A. SHEETS 2 THRU 13 - OUTLINE AND COMPONENT LAYOUT DRAWINGS
- B. SHEETS 14 THRU 20 - SCHEMATIC DIAGRAMS
- C. SHEETS 21 THRU 26 - WIRING DIAGRAMS
- D. SHEETS 27 THRU 31 - ASSEMBLY DIAGRAMS

### 131-2915 INSTRUCTIONS-TRANSFER SWITCH (INPHASE MONITOR SPECIFIC)

- A. SHEET 2 - ABBREVIATIONS & SYMBOLS
- B. SHEETS 3 THRU 7 - SCHEMATIC DIAGRAMS
- C. SHEETS 8 THRU 11 - WIRING DIAGRAMS

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## 9Y-7900 TRANSFER SWITCH PANEL - PART 8 OF 8

Reference: See The Outline Dimension Drawings.

Reference: See The Assembly Diagrams.

Reference: See The Wiring Diagrams.

Reference: See The Schematic Diagrams.

1	9Y-7981	ACTUATOR
1	9Y-7914	CONNECTOR
2	9Y-7921	COVER
3	9Y-7973	EXTINGUISHER
1	9Y-7937	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-7903 SWITCH AS - TRANSFER  
100 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 100 Amp Assembly Diagram.

1	9Y-7982	ACTUATOR
9	9Y-7915	CONNECTOR
2	9Y-7923	COVER
3	9Y-7974	EXTINGUISHER
1	9Y-7938	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-7904 SWITCH AS - TRANSFER  
150, 200 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly Diagram.

1	9Y-7983	ACTUATOR
9	9Y-7915	CONNECTOR
2	9Y-7925	COVER
3	9Y-7975	EXTINGUISHER
1	9Y-7939	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-7905 SWITCH AS - TRANSFER  
300 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly Diagram.

1	9Y-7983	ACTUATOR
9	9Y-7916	CONNECTOR
2	9Y-7925	COVER
3	9Y-7975	EXTINGUISHER
1	9Y-7940	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-7906 SWITCH AS - TRANSFER  
400 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly Diagram.

1	9Y-7984	ACTUATOR
9	9Y-7917	CONNECTOR
2	9Y-7927	COVER
6	9Y-7976	EXTINGUISHER
1	9Y-7948	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7941	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7907 SWITCH AS - TRANSFER  
600 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

1	9Y-7985	ACTUATOR
9	9Y-7919	CONNECTOR
2	9Y-7929	COVER
6	9Y-7977	EXTINGUISHER
1	9Y-7949	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7942	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7908 SWITCH AS - TRANSFER  
800 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

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1	9Y-7985	ACTUATOR
9	9Y-7919	CONNECTOR
2	9Y-7929	COVER
6	9Y-7977	EXTINGUISHER
1	9Y-7950	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7943	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7909 SWITCH AS – TRANSFER  
1000 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

1	9Y-7986	ACTUATOR
9	9Y-7920	CONNECTOR
2	9Y-7931	COVER
6	9Y-7978	EXTINGUISHER
1	9Y-7952	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7945	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7911 SWITCH AS – TRANSFER  
1600 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7986	ACTUATOR
9	9Y-7920	CONNECTOR
2	9Y-7931	COVER
6	9Y-7978	EXTINGUISHER
1	9Y-7951	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7944	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7910 SWITCH AS – TRANSFER  
1200 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7987	ACTUATOR
2	9Y-7933	COVER
6	9Y-7979	EXTINGUISHER
1	9Y-7953	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7946	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7912 SWITCH AS – TRANSFER  
2000 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7988	ACTUATOR
2	9Y-7935	COVER
6	9Y-7980	EXTINGUISHER
1	9Y-7954	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7947	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7913 SWITCH AS - TRANSFER  
2600 Amp, 3 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly  
Diagram.

1	9Y-7981	ACTUATOR
12	9Y-7914	CONNECTOR
2	9Y-7922	COVER
4	9Y-7973	EXTINGUISHER
1	9Y-7955	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-8025 SWITCH AS - TRANSFER  
100 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 100 Amp Assembly Diagram.

1	9Y-7982	ACTUATOR
12	9Y-7915	CONNECTOR
2	9Y-7924	COVER
4	9Y-7974	EXTINGUISHER
1	9Y-7956	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-8026 SWITCH AS - TRANSFER  
150, 200 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly  
Diagram.

1	9Y-7983	ACTUATOR
12	9Y-7915	CONNECTOR
2	9Y-7926	COVER
4	9Y-7975	EXTINGUISHER
1	9Y-7957	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-8027 SWITCH AS - TRANSFER  
300 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly  
Diagram.

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1	9Y-7983	ACTUATOR
12	9Y-7916	CONNECTOR
2	9Y-7926	COVER
4	9Y-7975	EXTINGUISHER
1	9Y-7958	KIT - MAIN CONTACT (INCLUDES POLES - EACH WITH NORMAL & STANDBY CONTACTS)

9Y-8028 SWITCH AS – TRANSFER  
400 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 150, 200, 300 and 400 Amp Assembly  
Diagram.

1	9Y-7984	ACTUATOR
12	9Y-7917	CONNECTOR
2	9Y-7928	COVER
8	9Y-7976	EXTINGUISHER
1	9Y-7966	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7959	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8029 SWITCH AS – TRANSFER  
600 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

1	9Y-7985	ACTUATOR
12	9Y-7919	CONNECTOR
2	9Y-7930	COVER
8	9Y-7977	EXTINGUISHER
1	9Y-7967	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7960	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8030 SWITCH AS – TRANSFER  
800 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

1	9Y-7985	ACTUATOR
12	9Y-7919	CONNECTOR
2	9Y-7930	COVER
8	9Y-7977	EXTINGUISHER
1	9Y-7968	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7961	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8031 SWITCH AS – TRANSFER  
1000 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 600, 800 and 1000 Amp Assembly Diagram.

1	9Y-7986	ACTUATOR
12	9Y-7920	CONNECTOR
2	9Y-7932	COVER
8	9Y-7978	EXTINGUISHER
1	9Y-7969	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7962	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8032 SWITCH AS - TRANSFER  
1200 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7986	ACTUATOR
12	9Y-7920	CONNECTOR
2	9Y-7932	COVER
8	9Y-7978	EXTINGUISHER
1	9Y-7970	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7963	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8033 SWITCH AS - TRANSFER  
1600 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7987	ACTUATOR
2	9Y-7934	COVER
8	9Y-7979	EXTINGUISHER
1	9Y-7971	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7964	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-8034 SWITCH AS - TRANSFER  
2000 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.

1	9Y-7988	ACTUATOR
2	9Y-7935	COVER
8	9Y-7980	EXTINGUISHER
1	9Y-7972	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE STANDBY SOURCE)
1	9Y-7965	KIT - MAIN CONTACT (INCLUDES CONTACTS FOR THE NORMAL SOURCE)

9Y-7918 SWITCH AS - TRANSFER  
2600 Amp, 4 Pole, 600 Volt  
Part Of 9Y-7900 Transfer Switch Panel  
Reference: See the 1200, 1600, 2000 and 2600 Amp Assembly Diagram.



## Testing The Transfer Mechanism

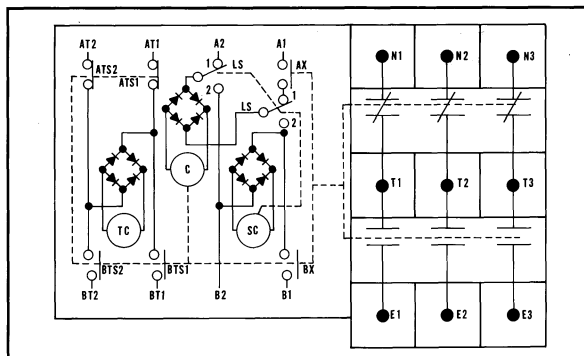
The transfer mechanism must be tested with all power supplies turned OFF. Use a volt-ohm-meter (VOM) for the tests. During the tests the main contacts will be manually actuated to (a) tripped or NEUTRAL position, (b) STANDBY position, and (c) NORMAL position.

### WARNING

**WARNING: ALL Power must be turned OFF to the transfer switch before attempting manual operation and/or tests. Extremely dangerous – possibly lethal – electrical shock could occur.**

NOTE: In the tests that follow, the actual resistance reading is not given. A specific resistance is not important. Either a small resistance or infinity should be indicated, as specified in the specific test.

### Tests With Main Contacts At NEUTRAL



Transfer Mechanism Terminal Strip

Turn OFF all power voltage supplies to the transfer switch. Manually actuate the main contacts to their NEUTRAL (Tripped) position. (See functional tests, manual operation for instructions to manually actuate the transfer mechanism) Verify that the word "OFF" is visible in both power source display windows. To completely check the transfer mechanism when in the NEUTRAL position, perform all the following tests with an ohmmeter.

With the main contacts tripped (in NEUTRAL position), connect ohmmeter test probes across transfer mechanism terminals as follows.

### Closing Coil (C) Continuity And Diode Test

1. Positive test probe at A1, Negative at A2: Meter should indicate a small resistance.
2. Positive test probe at A2, Negative at A1: Meter should indicate a small resistance.

### Selective Coil (SC) Continuity And Diode Test

1. Positive test probe at B1, Negative at B2: Meter should indicate a small resistance.
2. Positive test probe at B2, Negative at B1: Meter should indicate a small resistance.

### Trip Coil Switch (ATS1 and ATS2) Test

1. Positive test probe at AT1, Negative at AT2: Meter should indicate infinity.
2. Positive test probe at AT2, Negative at AT1: Meter should indicate infinity.

### Trip Coil Switch (BTS1 and BTS2) Test

1. Positive test probe at BT1, Negative at BT2: Meter should indicate infinity.
2. Positive test probe at BT2, Negative at BT1: Meter should indicate infinity.

### Tests With Main Contacts At NORMAL Position

Turn OFF all power voltage supplies to the transfer switch. Manually actuate the main contacts to their NORMAL position. (See functional tests, manual operation for instructions to manually actuate the transfer mechanism) Verify that the word "ON" is visible in the "A" power source display window. To completely check the transfer mechanism when in the NORMAL position, perform all the following tests with an ohmmeter.

#### Control Switch (AX) And Limit Switch (LS) Test

1. Positive test probe at A1, Negative at A2: Meter should indicate infinity.
2. Positive test probe at A2, Negative at A1: Meter should indicate infinity.

#### Control Switch (BX) And Limit Switch (LS) Test

1. Positive test probe at B1, Negative at B2: Meter should indicate infinity.
2. Positive test probe at B2, Negative at B1: Meter should indicate infinity.

#### Trip Coil (TC) Continuity And Diode Test

1. Positive test probe at AT1, Negative at AT2: Meter should indicate a small resistance.
2. Positive test probe at AT2, Negative at AT1: Meter should indicate a small resistance.

#### Trip Coil Switch (BTS1 and BTS2) Test

1. Positive test probe at BT1, Negative at BT2: Meter should indicate infinity.
2. Positive test probe at BT2, Negative at BT1: Meter should indicate infinity.

### Tests With Main Contacts At STANDBY Position

Turn OFF all power voltage supplies to the transfer switch. Manually actuate the main contacts to their STANDBY position. (See functional tests, manual operation for instructions to manually actuate the transfer mechanism) Verify that the word "ON" is visible in the "B" power source display window. To completely check the transfer mechanism when in the STANDBY position, perform all the following tests with an ohmmeter.

#### Control Switch (AX) And Limit Switch (LS) Test

1. Positive test probe at A1, Negative at A2: Meter should indicate infinity.
2. Positive test probe at A2, Negative at A1: Meter should indicate infinity.

#### Control Switch (BX) And Limit Switch (LS) Test

1. Positive test probe at B1, Negative at B2: Meter should indicate infinity.
2. Positive test probe at B2, Negative at B1: Meter should indicate infinity.

#### Trip Coil Switch (ATS1 And ATS2) Test

1. Positive test probe at AT1, Negative at AT2: Meter should indicate infinity.
2. Positive test probe at AT2, Negative at AT1: Meter should indicate infinity.

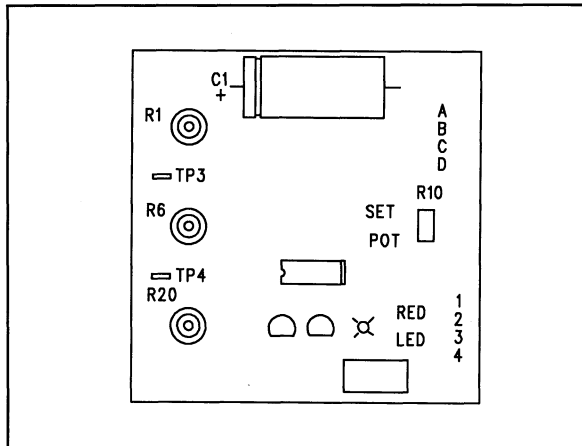
#### Trip Coil (TC) Continuity And Diode Test

1. Positive test probe at BT1, Negative at BT2: Meter should indicate a small resistance.
2. Positive test probe at BT2, Negative at BT1: Meter should indicate a small resistance.

### Test Results

If any meter reading is not as stated in the preceding test procedures, a fault exists in the transfer mechanism.

### Installation Of A New Utility Voltage Sensor Circuit Board



New Utility Voltage Sensor Circuit Board

When installing a new utility voltage sensor circuit board perform the following procedure.

#### Adjustment Procedure

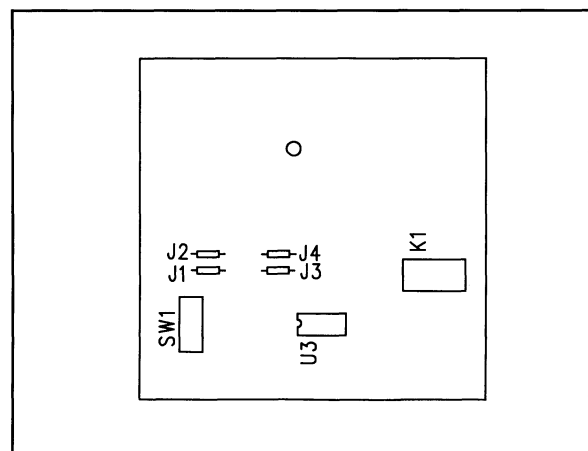
1. Set the Maintenance Disconnect Switch to the MANUAL position.
2. Plug both harness connectors into the new circuit board.
3. Locate TP3 and TP4 on the circuit board.
4. Use a jumper wire to short TP3 to TP4.
5. Locate the small SET POT (R10).
6. With a small screwdriver, adjust the SET POT until the LED just comes ON. When performing this setting, make sure the utility voltage is close to nominal. This setting establishes 100% utility voltage for the pickup and dropout settings.
7. Remove the jumper wire from TP3 and TP4.

NOTE: The utility voltage sensor circuit board has a 3 minute (minimum) run timer. When the Maintenance Disconnect Switch is set to AUTO as in Step 8, the engine may start and run for the time remaining on the 3 minute run timer.

8. Set the Maintenance Disconnect Switch to the AUTO position.

9. Adjust the voltage pickup, the dropout and the line interrupt delay time. See the Sensor And Timer Adjustments topic in this manual.

### Installation Of A New 7-Day Exerciser Circuit Board (used with the optional In-Phase Monitor or Programmable Logic Circuit Board)



New 7-Day Exerciser Circuit Board

When installing a new 7-day exerciser circuit board, the generator frequency (50 or 60 Hz) must be programmed on to the circuit board. This is done by service personnel by cutting the proper jumpers on the new circuit board.

For 60 Hz operation cut jumpers J2 and J4.

For 50 Hz operation cut jumpers J1 and J3.

NOTE: Failure to cut the appropriate jumpers, will result in disruption or failure of the normal exercise cycle time.

## Troubleshooting And Test Procedures

This troubleshooting guide is provided as an aid for the serviceman in locating the cause of existing problems. Several possible problems are covered in the guide.

Identify the problem from the Problem Index. Then, go directly to the problem in the guide. When you begin the procedure for that problem, start at Step 1 and follow through the step by step sequence. The Steps in solving each problem are arranged in a definite sequence, from the more probable or easiest to check to the less probable or more complex to check. When the cause of the problem is found and corrected, stop the test.

NOTE: Before attempting to analyze transfer switch problems, check any options that might be included with the unit. Refer to TRANSFER SWITCH OPTIONS. Such options will affect the way a transfer switch works and what you thought was a problem may be only one of the options at work.

### Problem Index

**Problem No. 1: "Utility On" Light Will Not Come ON**

**Problem No. 2: No Automatic Startup Or Shutdown Of The Standby Generator**

**Problem No. 3: No Automatic Transfer To STANDBY Power Source**

**Problem No. 4: No Automatic Re-Transfer Back To The NORMAL Source**

**Problem No. 5: On Manual Startup Of Generator With NORMAL Source Voltage Available, Transfer To STANDBY Occurs**

### Problems

**Problem No. 1: "Utility On" Light Does Not Come On When NORMAL Source Power To Transfer Switch Is Turned ON**

STEP 1: Check for burnt out normal position indicating light on the transfer switch door, and replace if necessary.

STEP 2: Check switch position-utility light and switch position indicator windows.

Test Procedure: Visually check the switch position and the utility on LED on the utility voltage sensor circuit board. The LED should be ON, indicating that (a) NORMAL source power is available to the switch and (b) the LOAD is connected to the NORMAL power supply. If the light is not ON, check Windows A and B on the transfer mechanism. The word "ON" should be visible in Window "A"; the word "OFF" in Window "B". The latter indicates the LOAD is connected to power source "A" (NORMAL source). If necessary, turn OFF all power voltage supplies to the transfer switch and manually actuate the main contacts to their NORMAL source position. With the LOAD connected to the NORMAL power supply and the NORMAL power supply to the switch is turned ON, recheck the switch position-normal position light. The light should be ON.

Test Results:

A. Switch position-normal position light and circuit board "Utility On" LED are both ON: STOP the test.

B. Both Lights are OFF but the standby engine-generator did not start: Go to Problem No. 2.

C. Switch position-normal position light is ON but "Utility On" LED is OFF: Go to Step 3.

STEP 3: Check power supply to utility sensing interface.

Test Procedure: With the NORMAL source power supply to the transfer switch turned ON and the switch position-normal position light is ON, use an a-c voltmeter to check voltage at the utility sensing interface terminals N1, N2, and N3. The voltmeter should indicate rated NORMAL source supply voltage.

Test Results:

A. Voltage reading is low or zero: Check Wires N1, N2, and N3 between the utility sensing interface and terminal lugs N1, N2, and N3 of the transfer mechanism for an open condition. Repair or replace any defective wire(s) as necessary. If the problem is corrected, STOP the tests.

B. Meter indicates rated NORMAL supply voltage: Go to Step 4.

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## Troubleshooting Section

## Troubleshooting And Test Procedures

STEP 4: Check utility sensing interface output voltage.

Test Procedure: Use an a-c voltmeter to check voltage across utility sensing interface terminals 224, 225, 226, and 227. Line to line voltage on terminals 224, 225, and 226 should be approximately 24 to 44 volts A-C. Line to neutral voltages on terminals 224-227, 225-227, and 226-227 should be approximately 13.8 to 25 volts A-C. (Actual voltage indicated will depend on the actual NORMAL source supply voltage, since the interface provides a fixed stepdown ratio.)

Test Results:

A. Indicated voltage checks good: Go to Step 5.

B. Indicated voltage checks bad: Check utility sensing interface transformer connections against applicable wiring diagram and/or schematic. Reconnect as necessary. Also test individual transformers for open or shorted condition (both primary and secondary coils). Replace utility voltage sensing interface module.

STEP 5: Check sensing voltage to utility voltage sensor circuit board.

Test Procedure: At the utility voltage sensor circuit board, unplug the Wires 224-225-226-227 connector plug. Use a voltmeter to check voltage across connector plug pins. Approximately 24 to 44 volts A-C line-to-line and 13.8 to 25 volts A-C line to neutral should be indicated.

Test Results:

A. Voltage checks bad: Test Wires 224, 225, 226 and 227 between utility voltage sensor board and utility sensing interface for open or shorted condition. Repair or replace wire(s) and/or connector plug as necessary.

B. Voltage checks good, but the "Utility On" LED is still out: Replace the utility voltage sensor circuit board.

### **Problem No. 2: No Automatic Startup Of The Standby Engine-Generator**

STEP 1: Check Position of maintenance disconnect switch (SW1).

Test Procedure: Inside the transfer switch enclosure, check that the maintenance disconnect switch is set to the AUTOMATIC position. Set the switch to the AUTOMATIC position, if required.

Test Results:

A. Switch is in the AUTOMATIC position, and the engine-generator starts: STOP the Tests.

B. Switch is in the AUTOMATIC position, but the engine-generator will still not automatically start: Go to Step 2.

STEP 2: Check the auto-manual switch on the standby engine-generator (If equipped).

Test Procedure: If the standby engine-generator is equipped with an auto-manual switch, set that switch to its AUTO position. See applicable engine-generator service manual.

Test Results:

A. The automatic engine-generator startup is good: STOP the tests.

B. There is still no automatic startup: Go to Step 3.

STEP 3: Check the engine-generator d-c control circuit protective devices (if so equipped).

Test Procedure: If the standby engine-generator is equipped with fuses and/or circuit breakers for protection of its d-c control circuits, check for tripped (open) circuit breaker(s) or blown fuse(s). Reset circuit breaker(s) or replace blown fuse(s) as required.

Test Results:

A. The automatic engine-generator startup checks good: STOP the Tests.

B. There is still no automatic startup: Go to Step 4.

STEP 4: Determine if problem is in the transfer switch.

Test Procedure: At the 2-wire start/stop terminal strip in the transfer switch, connect a temporary jumper wire across terminals 178 and 183. The standby engine-generator should crank and start. Remove the jumper wire, and a shutdown should occur.

Test Results:

A. The generator engine cranks and starts: The problem is in the transfer switch, go to Step 6.

B. The generator engine does not start: The problem is in customer wiring, or in the engine-generator's d-c control circuit, go to Step 5.

STEP 5: Determine if the Problem is in the customer wiring or in the engine-generator control circuits.

Test Procedure: Inside the engine-generator connection panel, connect a temporary jumper wire across terminals 178 and 183. The engine-generator should crank and start.

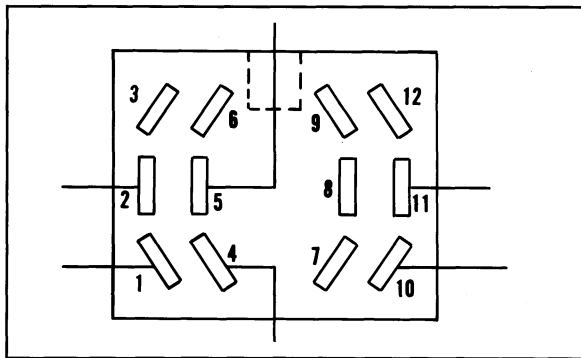
Test Results:

A. The engine-generator cranked and started, but it did not in Step 4: Check the customer wiring between the engine-generator and the transfer switch start/stop terminal strips. Repair or replace defective wire(s) as necessary.

B. The engine-generator does not crank and start: The problem is in the engine-generator electrical system, refer to engine-generator service manual.

STEP 6: Test maintenance disconnect switch.

Test Procedure: Turn OFF all power voltage supplies to the transfer switch. Use an ohmmeter to test the maintenance disconnect switch as follows:



Maintenance Disconnect Switch

With the switch Set to AUTOMATIC, connect ohmmeter test probes across the switch terminals as follows:

Across Terminals 1 and 2 : Meter should indicate Continuity.

Across Terminals 2 and 3 : Meter should indicate Infinity.

Across Terminals 4 and 5 : Meter should indicate Continuity.

Across Terminals 5 and 6 : Meter should indicate Infinity.

Across Terminals 7 and 8 : Meter should indicate Continuity.

Across Terminals 8 and 9 : Meter should indicate Infinity.

Across Terminals 10 and 11 : Meter should indicate Continuity.

Across Terminals 11 and 12 : Meter should indicate Infinity.

With switch set to MANUAL, connect ohmmeter test probes across the switch terminals as follows:

Across Terminals 1 and 2 : Meter should indicate Infinity.

Across Terminals 2 and 3 : Meter should indicate Continuity.

Across Terminals 4 and 5 : Meter should indicate Infinity.

Across Terminals 5 and 6 : Meter should indicate Continuity.

Across Terminals 7 and 8 : Meter should indicate Infinity.

Across Terminals 8 and 9 : Meter should indicate Continuity.

Across Terminals 10 and 11 : Meter should indicate Infinity.

Across Terminals 11 and 12 : Meter should indicate Continuity.

Test Results:

A. Switch tests good: Go to Step 7.

B. Switch tests bad: Replace switch.

## Troubleshooting Section

### Troubleshooting And Test Procedures

STEP 7: Check transfer switch wires 178/183.

Test Procedure: With all power voltage supplies to the transfer switch turned OFF, test wires 178 and 183 in the transfer switch for an open or shorted condition. Refer to applicable wiring diagram.

Test Results:

A. An open or shorted wire was found: Repair or replace as necessary.

B. All wires test good, but the engine-generator still does not automatically start: Replace the utility voltage sensor circuit board and perform a NORMAL TEST. If the test checks good, STOP the tests.

#### Problem No. 3: No Automatic Transfer To The STANDBY Power Source

STEP 1: Check standby operating light.

Test Procedure: Standby generator a-c output must be available to the transfer switch or the transfer to the STANDBY source will not be possible. The Standby operating light should be ON, indicating that STANDBY power is available.

Test Results:

A. Standby operating light is ON: Go to Step 2.

B. Standby operating light is OUT: Check for burnt out light bulb, replace if necessary.

C. Standby operating light is OUT: Go to Step 8.

STEP 2: Test voltage at the transfer mechanism terminals AT1, AT2.

Test Procedure: Connect an a-c voltmeter across the transfer mechanism terminals AT1 and AT2 (Trip to Neutral from NORMAL). Perform a NORMAL TEST. Following the engine-generator startup and after the engine warmup timer has timed out, the voltmeter should indicate approximately 240 volts and the word OFF should appear in both windows A and B of the transfer mechanism.

Test Results:

A. If the voltage reading is good, and OFF appears in both windows: Go to Step 3.

B. If the voltage reading is bad: Go to Step 4.

C. If the voltage reading is good, but OFF is not indicated in both windows: See TESTING THE TRANSFER MECHANISM.

STEP 3: Check Voltage at the transfer mechanism terminals B1, B2.

Test Procedure: Connect a voltmeter across the transfer mechanism terminals B1 and B2. Perform a NORMAL TEST. Following the engine-generator startup, the main contacts should trip to neutral. After the time delay neutral timer has timed out, the time delay neutral relay should de-energize and approximately 240 volts should be indicated at terminals B1 and B2. With voltage available at B1 and B2, the word ON should appear in window B and the word OFF in window A.

Test Results:

A. If the voltage is good but no transfer action occurs: Refer to TESTING THE TRANSFER MECHANISM.

B. If the voltage is BAD: Go to Step 4.

STEP 4: Check the transfer relay.

Test Procedure: Shut down the engine-generator and turn OFF all power voltage supplies to the transfer switch. Disconnect all wires from the transfer relay noting the wire numbers and relay terminal number connections. Connect the positive post of a 12 volt battery to transfer relay terminal B, and the negative battery post to relay terminal A. The transfer relay should energize. Now connect an ohmmeter across transfer relay terminals 6 and 9. The meter should indicate continuity. Connect a meter across relay terminals 1 and 7. The meter should read infinity. Disconnect the 12 volt battery leads from the relay and it should de-energize. With the relay de-energized, connect the ohmmeter across terminals 1 and 7. The meter should indicate continuity. Connect the ohmmeter across terminals 6 and 9. The meter should read infinity.

Test Results:

A. If the transfer relay checks good: (For 460 to 600 volts rated transfer switches) Go to Step 5; (For all other voltages): Go to Step 6.

B. If the transfer relay failed the test: Replace the transfer relay.

STEP 5: Test transformer T3 (For 460 to 600 volt rated transfer switches).

Test Procedure: With the standby engine-generator running, check the voltage across transformer T3 primary terminals H1 and H4. Rated standby generator voltage should be indicated. Now check voltage across transformer T3 secondary terminals X1 and X4. Approximately 240 volts should be indicated.

Test Results:

A. If the H1/H4 Voltage reading is BAD: Test wires E1 and E2 between the transformer and transfer mechanism. Repair or replace any wires as necessary.

B. If the H1/H4 voltage is good, but X1/X2 voltage is BAD: Replace transformer T3.

C. If the voltage readings at H1/H4 and X1/X4 are both GOOD: Go to Step 6.

STEP 6: Test time delay neutral relay.

Test Procedure: Turn OFF all power supplies to the transfer switch. Disconnect all wires from the time delay neutral relay terminals noting the wire numbers and relay terminal number connections. Connect the positive post of a 12 volt battery to relay terminal B, and the battery negative post to relay terminal A. The relay should energize. Connect an ohmmeter across relay terminals 1 and 7 (Wires 234 and 107 terminals). The meter should read infinity. Now connect the ohmmeter test leads across relay terminals 3 and 9 (Wires 233 and 126) (Wires 233 and 110 for 460 to 600 volt rated transfer switches). The meter should read infinity. With the relay de-energized, terminals 1 and 7, and 3 and 9 should read continuity with the ohmmeter.

Test Results:

A. Relay checks GOOD: Go to Step 7.

B. Relay checks BAD: Replace time delay neutral relay.

STEP 7: Test wires.

Test Procedure: Turn OFF all power voltage supplies to the transfer switch. Visually inspect the wiring connections at the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board. Also inspect the connections at transformer T1 (and T3 for 460 to 600 volt rated transfer switches); at the transfer relay; at the time delay neutral relay; and at the transfer mechanism. If no bad connections are found, check wires E1, E2, 205, 206, 208, 107, 234 and 110 for open or shorted condition.

Test Results:

A. Bad connection or defective wire: Replace or repair as needed.

B. All wires check good: Go to Step 8.

STEP 8: Test transformer T1.

Test Procedure: With the standby engine-generator running, test for the RATED voltage at transformer T1 primary terminals H1 and H4. Now, check for approximately 24 volts at transformer secondary terminals X1 and X4.

Test Results:

A. If the voltage reading at H1/H4 is BAD: Check wires E1 and E2 back to the transfer mechanism for an open or a shorted condition. Repair or replace any defective wires as required.

B. If the voltage at H1/H4 is GOOD, but it is BAD at the X1/X4 terminals: Replace transformer T1.

C. If the voltage is GOOD at both the H1/H4 and X1/X4 terminals: Go to Step 9.

STEP 9: Check wires 191 and 192.

Test Procedure: With the standby engine-generator running, check for approximately 24 volts across wires 191 and 192 where they connect to the standby operating light.



## Troubleshooting Section

### Troubleshooting And Test Procedures

#### Test Results:

- A. If the voltage checks GOOD: Go to Step 10.
- B. If the voltage checks GOOD, but the light is OUT: Replace the standby operating light.
- C. If the voltage checks BAD: Shut down the engine-generator and check wires 191 and 192 (between transformer T1 and the standby operating light) for an open or a shorted condition. Repair or replace any defective wire(s).

STEP 10: Check the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board.

Test Procedure: Disconnect the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board connector plug. With the engine-generator running, check for approximately 24 volts across pins 12 and 13 (wires 191 and 192) of the plug (Pins 2 and 3 on the In-Phase Monitor or Programmable Logic circuit board connector).

#### Test Results:

- A. If the voltage is BAD: Check wires 191 and 192 (between the standby operating light and circuit board connector) for open or shorted condition. Repair or replace defective wire(s) as necessary.
- B. If the voltage checks GOOD: Replace the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board and perform a NORMAL TEST.

#### **Problem No. 4: No Automatic Re-Transfer Back To The NORMAL Source**

STEP 1: Check utility ON LED on utility voltage sensor circuit board.

Test Procedure: Normal A-C voltage must be available to the transfer switch or the transfer to the normal source will not be possible. Visually check the utility ON LED (Light Emitting Diode) on the utility voltage sensor circuit board. The light should be ON, indicating that the normal power is available.

#### Test Results:

- A. LED is ON: Go to Step 2.
- B. LED is OUT: See Problem No.1.

STEP 2: Check for correct voltage at transfer mechanism terminals.

Test Procedure: With the NORMAL source power available to the transfer switch, and after the return to normal timer has timed out, connect an A-C voltmeter across transfer mechanism terminals BT1 and BT2 (trip to neutral from standby) and check for correct voltage. Approximately 240 volts should be indicated and the word OFF should appear in both windows A and B of the transfer mechanism.

#### Test Results:

- A. If the voltage is GOOD across terminals BT1/BT2, and OFF appears in both windows: Go to Step 3.
- B. If the voltage is BAD: Go to Step 4.
- C. If the voltage reading is good, but OFF is not indicated in both windows: see Testing the Transfer Mechanism.

STEP 3: Check the voltage at transfer mechanism terminals A1 and A2.

Test Procedure: Connect a voltmeter across transfer mechanism terminals A1 and A2. With NORMAL A-C voltage available to the transfer switch and after the return to normal timer has timed out and the time delay neutral relay has de-energized, approximately 240 volts should be indicated at terminals A1 and A2. With voltage available at terminals A1 and A2, the word ON should appear in window A and the word OFF in window B.

#### Test Results:

- A. If the voltage is good but no transfer occurs: Refer to Testing The Transfer Mechanism.
- B. If the voltage is bad: Go to Step 4.

STEP 4: Check the transfer relay.

Test Procedure: Shut down the engine-generator and turn OFF all power voltage supplies to the transfer switch. Disconnect all wires from the transfer relay noting the wire numbers and relay terminal number connections. Connect the positive post of a 12 volt battery to transfer relay terminal B, and the negative battery post to relay terminal A. The transfer relay should energize. Now connect an ohmmeter across transfer relay terminals 6 and 9. The meter should indicate continuity. Connect an ohmmeter across relay terminals 1 and 7. The meter should read infinity. Disconnect the 12 volt battery leads from the relay and it should de-energize. With the relay de-energized, connect the ohmmeter across terminals 1 and 7. The meter should indicate continuity. Connect the ohmmeter across terminals 6 and 9. The meter should read infinity.

Test Results:

A. If the transfer relay checks good: (For 460 to 600 volts rated transfer switches) Go to Step 5; (For all other voltages): Go to Step 6.

B. If the transfer relay failed the test: Replace the transfer relay.

STEP 5: Test transformer T4 (For 460 to 600 volt rated transfer switches).

Test Procedure: With NORMAL voltage available, check the voltage across transformer T4 primary terminals H1 and H4. RATED NORMAL voltage should be indicated. Now check voltage across transformer T4 secondary terminals X1 and X4. Approximately 240 volts should be indicated.

Test Results:

A. If the H1/H4 Voltage reading is BAD: Test wires N1 and N2 between the transformer and transfer mechanism. Repair or replace any wires as necessary.

B. If the H1/H4 voltage is good, but X1/X2 voltage is BAD: Replace transformer T4.

C. If the voltage readings at H1/H4 and X1/X4 are both GOOD: Go to Step 6.

STEP 6: Test time delay neutral relay.

Test Procedure: Turn OFF all power supplies to the transfer switch. Disconnect all wires from the time delay neutral relay terminals noting the wire numbers and the relay terminal number connections. Connect the positive post of a 12 volt battery to relay terminal B, and the battery negative post to relay terminal A. The relay should energize. Connect an ohmmeter across relay terminals 1 and 7 (Wires 234 and 107 terminals). The meter should read infinity. Now connect the ohmmeter test leads across relay terminals 3 and 9 (Wires 233 and 126) (Wires 233 and 110 for 460 to 600 volt rated transfer switches). The meter should read infinity. With the relay de-energized, terminals 1 and 7, and 3 and 9 should read continuity with the ohmmeter.

Test Results:

A. Relay checks GOOD: Go to Step 7.

B. Relay checks BAD: Replace time delay neutral relay.

STEP 7: Test wires.

Test Procedure: Turn OFF all power voltage supplies to the transfer switch. Visually inspect the wiring connections at the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board. Also inspect the connections at transformer T4 (for 460 to 600 volt rated transfer switches); at the transfer relay; the time delay neutral relay; and at the transfer mechanism. If no bad connections are noted, check wires N1, N2, 125, 126, 208, 107, 233, 234 and 110 for open or shorted condition.

Test Results:

A. Bad connection or defective wire: Replace or repair as needed.

B. All wires check good: Replace the Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board, and perform a normal test.

**Problem No. 5: On Manual Startup Of Standby Engine-Generator With NORMAL Source Voltage Available, Transfer To STANDBY Occurs**

STEP 1: Test wires 199/202.

Test Procedure: Turn OFF all power supplies to the transfer switch. Then:

For standard Microprocessor Based or In-Phase Monitor circuit board, check wires #199 and 202 for an open condition.

For Programmable Logic circuit board, check wires #199 and 200 for an open circuit.

Test Results:

A. Wires check GOOD: Replace Microprocessor Based (or optional In-Phase Monitor or Programmable Logic) circuit board.

B. Wires check BAD: Repair or replace wires as necessary.

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