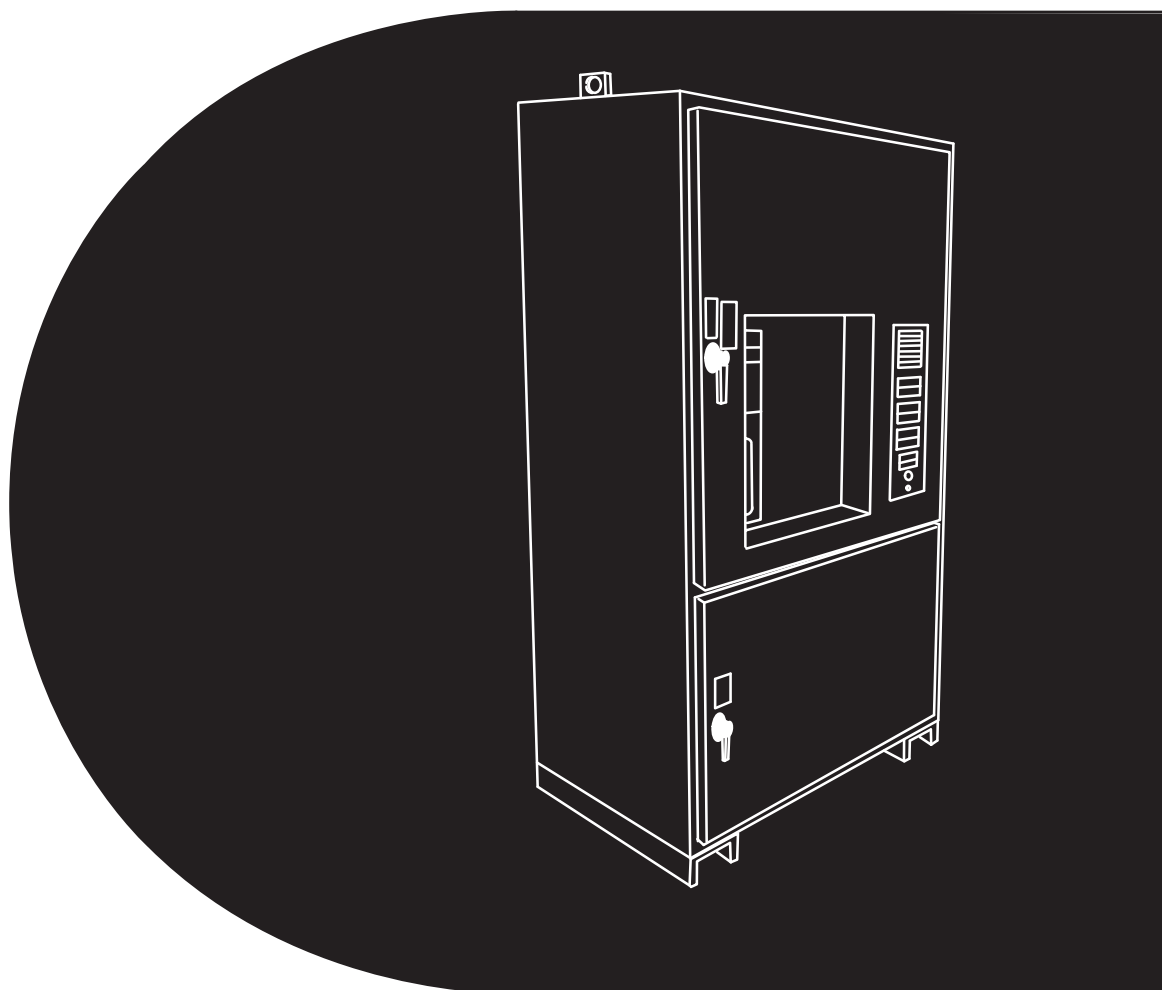


# Operator's Manual

**BT Bypass-Isolation Transfer Switches  
1200 - 3000 Ampere  
Utility-to-Generator Set**



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## **⚠ WARNING**

**INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

# Safety Precautions

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

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

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

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

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

Keep the transfer switch cabinet closed and locked. Make sure only authorized personnel have the cabinet and operational keys.

Due to the serious shock hazard from high voltages within the cabinet, all service and adjustments to the transfer switch must be performed only by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set to Stop.
2. Disconnect any external battery chargers and then disconnect the starting batteries of the generator set (remove the ground [–] lead first).
3. Remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

Place rubber insulative mats on dry wood platforms over metal or concrete floors when working on any electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling any electrical equipment.

Jewelry is a good conductor of electricity and should be removed when working on the electrical equipment.

Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

# 1. Introduction

## OPERATOR'S MANUAL

This operator's manual provides information necessary for operation of the transfer switch, and includes models produced under the Cummins®/Onan® and Cummins Power Generation brand names. This manual specifically provides information necessary for operation of a 1200- to 3000-ampere, utility-to-generator set BT bypass-isolation transfer switch.

### BT BYPASS-ISOLATION TRANSFER SWITCH

The BT bypass-isolation transfer switch combines an automatic transfer switch, a manual bypass switch, and a drawout isolation mechanism in a single unit.

#### Automatic Transfer Switch Function

Transfer switches are an essential part of a standby or emergency power system. The Normal power source, commonly the utility line, is backed up by an Emergency power source, often an electric generating set. The transfer switch supplies the electrical load with power from one of these two power sources.

The load is connected to the common of the transfer switch (Figure 1-1). Under normal conditions, the load is supplied with power from the Normal source (as illustrated). If the Normal power source is interrupted, the load is transferred to the Emergency power source. When Normal power returns, the load is retransferred to the Normal power source. The transfer and retransfer of the load are the two most basic functions of a transfer switch.

**Automatic Operation:** Automatic transfer switches, capable of automatic operation without operator involvement, perform the following basic functions:

1. Sense the interruption of the Normal power source.
2. Send a start signal to the generator set (Emergency power source).
3. Transfer the load to the Emergency power source.
4. Sense the return of the Normal power source.
5. Retransfer the load to the Normal power source.

6. Send a stop signal to the generator set.

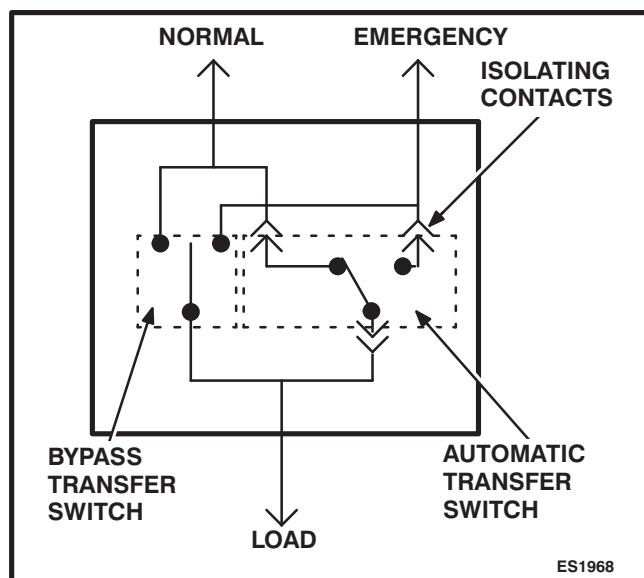


FIGURE 1-1. BT TRANSFER SWITCH (TYPICAL FUNCTION)

## **Bypass Switch Function**

The bypass switch allows the operator to manually connect the load to the available power source, bypassing the automatic transfer switch (Figure 1-1). When bypassed, the automatic transfer switch can be isolated for service or removal without causing a power interruption.

## **Drawout Isolation Mechanism**

The drawout isolation mechanism allows the automatic transfer switch to be withdrawn for testing or service. The transfer switch is connected to the load, power sources, and controls through isolation contacts. Turning a drawout cranking handle moves the automatic transfer switch and engages and disengages the isolation contacts to permit testing or service. If necessary, the switch can be removed for service.

## **MODEL IDENTIFICATION**

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate, which is located on the cabinet door.

If it is necessary to contact a dealer or distributor regarding the transfer switch, always give the complete Model, Specification, and Serial number. This

information is necessary to properly identify your unit among the many types manufactured.

## **HOW TO OBTAIN SERVICE**

When the transfer switch requires servicing, contact your nearest dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

If unable to locate a dealer or distributor, consult the Yellow Pages. Typically, our distributors are listed under:

**GENERATORS-ELECTRIC,  
ENGINES-GASOLINE OR DIESEL, OR  
RECREATIONAL VEHICLES-EQUIPMENT,  
PARTS AND SERVICE.**

For the name of your local Cummins Power Generation distributor or if you need more assistance, please call the phone number listed on the back cover of this manual during the hours of 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

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

Cummins is a registered trademark of Cummins Inc.

## 2. Description

This section describes the standard and optional components of the cabinet, the bypass operator panel, the automatic transfer switch, the bypass

switch, the isolation mechanism, and the electronic control system.

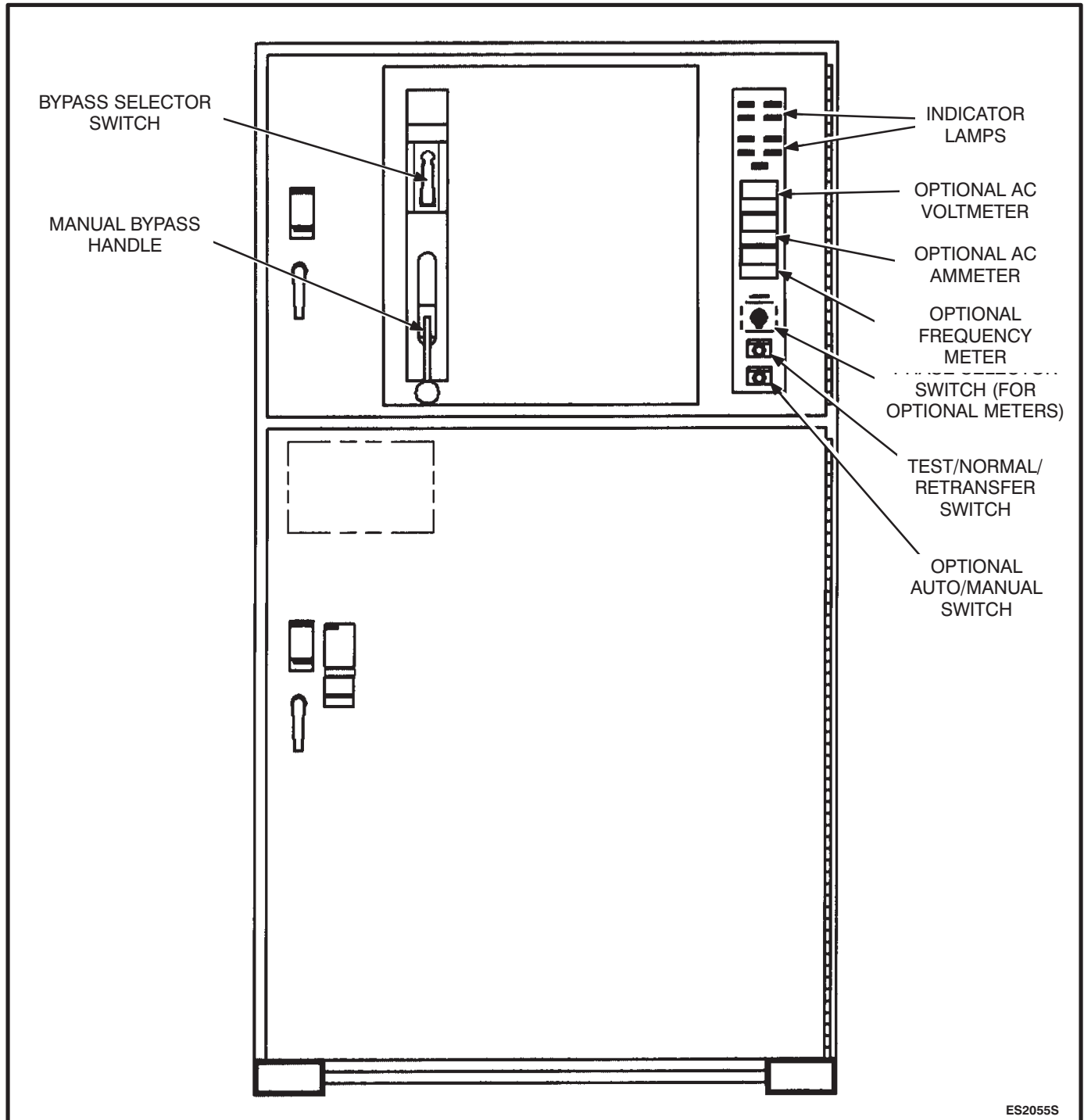


FIGURE 2-1. 1600- TO 3000-AMPERE CABINET WITH OPTIONS

## CABINET

The standard cabinet (Figure 2-1) meets the requirements for a UL Type 1 cabinet. This type is designated as a general-purpose, indoor cabinet.

### Indicator Lamps

There are nine indicator lamps on the cabinet door.

- Normal Available
- Emergency Available
- Normal Connected
- Emergency Connected
- Bypass Normal
- Bypass Emergency
- ATS in Test
- ATS Isolated
- ATS Inhibit

The **Normal Available** and **Emergency Available** lamps are lit whenever their corresponding power sources (utility or generator set) are producing power. These two lamps can be lit simultaneously.

The **Normal Connected** lamp is lit when the automatic transfer switch is in the normal position.

The **Emergency Connected** lamp is lit when the automatic transfer switch is in the emergency position.

The **Bypass Normal** lamp is lit whenever the bypass switch is connecting (bypassing) the Normal source to the load.

The **Bypass Emergency** lamp is lit whenever the bypass switch is connecting (bypassing) the Emergency source to the load.

The **ATS in Test** lamp is lit whenever the automatic transfer switch is in the Test position.

The **ATS Isolated** lamp is lit whenever the automatic transfer switch is in the Isolated position.

The **ATS Inhibit** lamp is lit whenever the automatic transfer switch is disabled by the limit switches and interlocks that respond to the operation of the bypass switch and the drawout/isolation mechanism.

The **ATS Inhibit** lamp is lit when the bypass switch is connected to the Normal or Emergency source and the ATS is in the Auto or Isolate position. When the bypass switch is connected to the Normal or Emergency source and the ATS is in the Test position, the **ATS Inhibit** lamp is **not** lit.

The **ATS Inhibit** lamp does not respond to the position of the Motor Disconnect switch.

## Test/Normal/Retransfer Switch

This switch has three positions. In the Normal position, the transfer switch is set for automatic operation. Moving the switch to Test sends a start signal to the generator set. After the transfer time delay, the generator set will assume the load—provided that the automatic transfer switch is in the Connected position and the Test With/Without Load switch (on the Power Sentry control) is in the With Load position.

Moving the switch to Normal causes the load to retransfer to the Normal power source after the retransfer time delay. To avoid the delay and cause a fast retransfer of load to the Normal power source, move the switch to the Retransfer position.

### Optional Meter Package

The optional meter package includes an AC ammeter, an AC voltmeter, a frequency meter, and a phase selector switch.

**AC Voltmeter:** The voltmeter measures line-to-line voltage of the selected power source.

**AC Ammeter:** The ammeter measures the line currents of the load.

**Frequency Meter:** This meter measures the output frequency of the selected power source in hertz.

**Phase Selector Switch:** This switch is used to select the source and phase to be measured.

### Optional Auto/Manual Switch

The Auto/Manual switch is used to enable or disable the automatic retransfer function. This switch has two positions. In the Auto position, normal automatic retransfer is enabled. In the Manual position, automatic retransfer (from a functioning generator set back to utility power) is disabled; only manual retransfer (using the Test/Normal/Retransfer switch) is possible. In the event of generator set failure, however, the Power Sentry control logic will ignore the Auto/Manual switch and initiate retransfer to utility power.



## AUTOMATIC TRANSFER SWITCH

The automatic transfer switch (Figure 2-2) opens and closes the contacts that transfer the load between Normal and Emergency power. The main parts of the transfer switch discussed here are the contact assemblies, the linear actuator, the Motor Disconnect switch, and the auxiliary contacts.

### Contact Assemblies

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

### Linear Actuators

The linear actuators are the devices that move the contact assemblies between the Normal power source and the Emergency power source. Linear actuator operation is initiated automatically with automatic transfer switches. Manual operation of the transfer switch (using the Test/Normal/Retransfer switch) is also possible. Refer to the Operation section.

### Motor Disconnect Switch

The Motor Disconnect toggle switch, on the accessory control panel, enables and disables the linear actuators. Place the switch in the Auto position to enable the linear actuators. Place the switch in the Off position to disable the linear actuators.

### Auxiliary Contacts

Auxiliary contacts are provided on the Normal and Emergency sides of the transfer switch. They are actuated by operation of the transfer switch during transfer and retransfer. The Normal side auxiliary contact switch is actuated when the transfer switch is in the Normal position. The Emergency side auxiliary contact switch is actuated when the transfer switch is in the Emergency position. The auxiliary contacts have current ratings of 10 amperes at 250 VAC. The contacts are wired to terminal block TB1.

## DRAWOUT-ISOLATION MECHANISM

The drawout-isolation mechanism allows the automatic transfer switch to be isolated for testing or service. Three sets of primary isolation contacts (Normal source, Emergency source, and Load) connect the switching contacts to the terminal lugs. A set of secondary isolation contacts connects the automatic transfer switch controls to the available power source.

### Drawout Cranking Handle

The drawout cranking handle is used to isolate and reconnect the automatic transfer switch. The cranking handle turns a gear drive that moves the transfer switch along a mechanically guided path. **The cranking handle will operate only when power is available, and when both the bypass and the automatic transfer switches are connected to the same source.**

### Drawout Position Indicator

The drawout mechanism can be latched in one of three positions: Auto, Test, and Isolate. The Drawout Position indicator shows which position the automatic transfer switch is in.

**In the Auto position**, both the primary and the secondary isolation contacts are closed. The automatic transfer switch is in its normal operating position.

**In the Test position**, the primary isolation contacts are open and the secondary isolation contacts are closed. The load-supplying contacts of the automatic transfer switch are out of service, but the Power Sentry control and the linear actuator are powered and fully operational. In this position, the control, the linear actuator, and the contact mechanisms can be tested.

**In the Isolate position**, both the primary and the secondary isolation contacts are open. Except for connector J12/P12, which must be manually disconnected, the automatic transfer switch mechanism is completely isolated from both the power and the control circuits and can be removed for service.

**⚠ WARNING Improper removal of the automatic transfer switch can cause severe personal injury or death. Removal of the automatic transfer switch must only be performed by technically qualified personnel, following the procedures provided in this manual.**



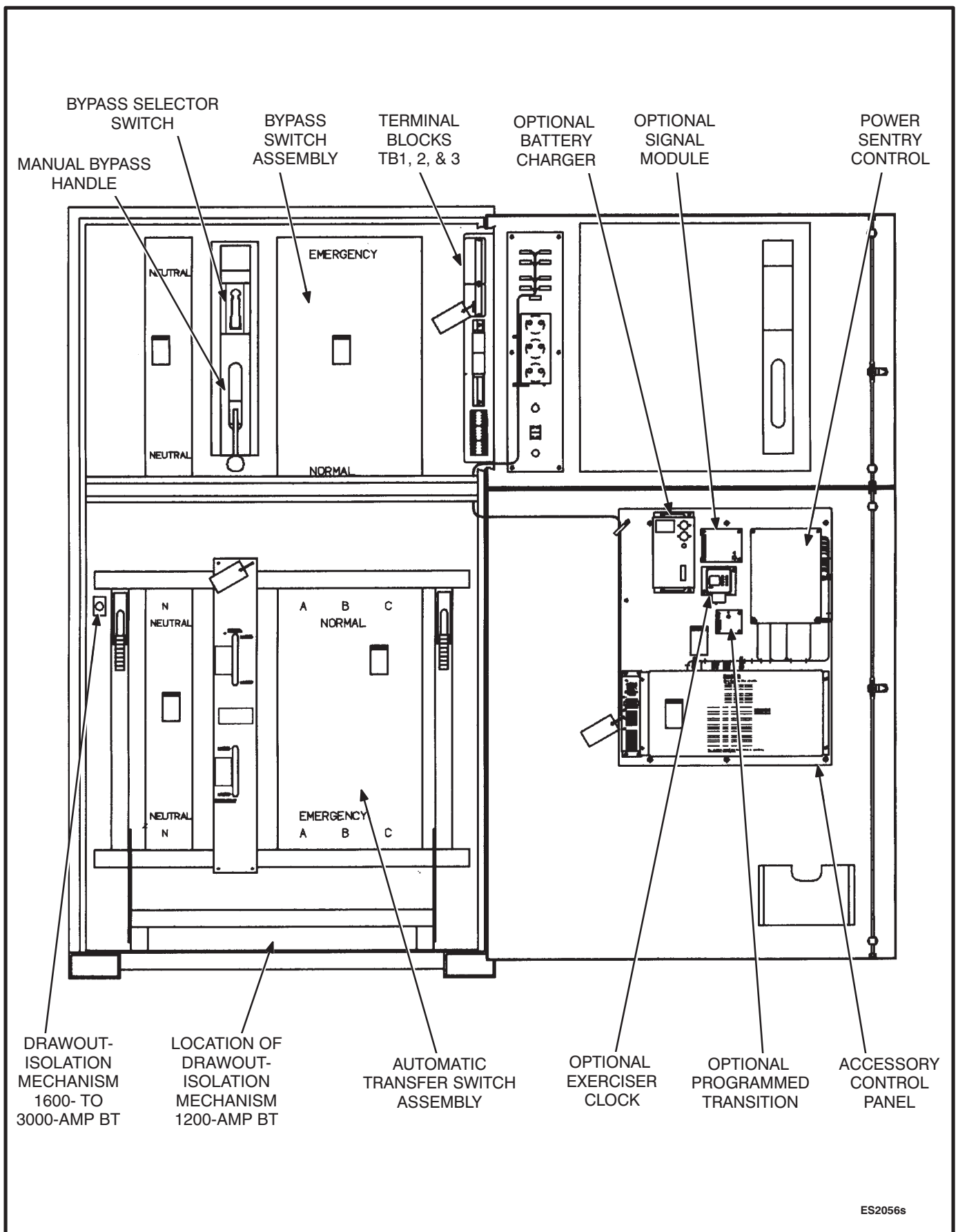


FIGURE 2-2. 1600- TO 3000-AMPERE INTERIOR/COMPONENTS

## BYPASS SWITCH

The bypass switch, located above the automatic transfer switch, is used to open and close the contacts that connect the load to the Normal or Emergency power source. **The manually operated bypass switch is mechanically and electrically interlocked to prevent the operator from manually closing the load to a dead source or to both sources at the same time.** Operation of the bypass switch is accomplished with the bypass switch operator handle and the Bypass Selector switch.

### Manual Bypass Handle and Bypass Selector Switch

The Manual Bypass handle is used in conjunction with the Bypass Selector switch. Before operating the Manual Bypass handle, the Bypass Selector switch must be turned to select the source that the bypass contacts are to be connected to. The operator can move the Manual Bypass handle, closing the bypass contacts to that source, without interrupting the load.

### Contact Assemblies

Like the automatic transfer switch, the bypass switch has either three or four poles. Three pole transfer switches are provided with a neutral bar. The contact assemblies are manually actuated to connect the load to one of the two power sources, bypassing the automatic transfer switch. When closed to either the Normal or the Emergency power source, the contacts are mechanically held.

### Auxiliary Contacts

Auxiliary contacts are provided on the Normal and Emergency sides of the bypass switch. The Normal side auxiliary contact switch is actuated when the bypass switch is in the Normal position. The Emergency side auxiliary contact switch is actuated when the bypass switch is in the Emergency position. The auxiliary contacts have current ratings of 10 amperes at 250 VAC. The contacts are wired to terminal block TB1.

## ELECTRONIC CONTROL SYSTEM

This section describes the standard and optional components of the electronic control system.

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

All calibration and adjustment procedures are described in the Installation manual (which was shipped with the transfer switch) and in the Service manual (which is available through your distributor).

The most important component of the electronic control system is the Power Sentry control (Figure 2-2). The Power Sentry includes voltage sensing circuits, time delay circuits and control relays. There are also several adjustment potentiometers and indicator lamps on the Power Sentry. The adjustments must be performed only by qualified service personnel.

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

**⚠WARNING** *Accidental actuation of the linear actuators can cause severe personal injury. Isolate the transfer switch, as described in the Operation section, before making any adjustments.*

## Power Sentry Time Delays

**Start Time Delay:** This delay is adjustable from 0 to 15 or (optionally) from 0 to 90 seconds. This brief time delay prevents generator set starting during power interruptions of short duration. Timing starts the moment of Normal (utility) power interruption. If the duration of interruption exceeds the delay time, the control system signals the generator set to start. To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

**Stop Time Delay:** This delay is adjustable from 0 to 10 minutes. It begins timing when the load is retransferred to the Normal power source. At the end of the delay, the stop signal is sent to the generator set. This time delay allows the generator set to cool down at no load before stopping.

To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

**Transfer Time Delay:** This delay begins when generator voltage and frequency reach the settings of the control. After the delay, the transfer switch transfers the load to the Emergency power source. This brief time delay allows the generator set to stabilize before the load is applied. It has an adjustable range of 0 to 120 seconds.

To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

**Retransfer Time Delay:** This delay begins the moment Normal line voltage and frequency return. After the delay, the transfer switch can retransfer the load to the Normal source. The delay allows the Normal source to stabilize before retransfer. It has an adjustable range of 0 to 30 minutes.

To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

## Undervoltage Sensing

Two voltage sensors, one for the Normal side and one for the Emergency side, monitor source voltages for an undervoltage condition and generate signals, which are sent to the time delay module. If,

for example, an undervoltage condition is sensed on the Normal source, the voltage sensor module sends a signal to the time delay module that initiates and controls the timing for generator set start and the transfer of load.

The standard transfer switch has undervoltage sensing for all phases of the Normal and Emergency power sources.

## Overvoltage and Frequency Sensing Option

Overvoltage and frequency sensing are available as a single option.

**Overvoltage Sensing:** With optional overvoltage sensing, the Normal and Emergency sources are monitored for an overvoltage condition.

As with the standard undervoltage sensing, the voltage sensors signal the time delay module, which controls the transfer or retransfer sequence.

An adjustable time delay (0 to 120 seconds) overrides momentary overshoots in voltage.

To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

**Frequency Sensing:** With optional frequency sensing, the Normal and Emergency sources are monitored for variations in frequency. The sensors determine whether the source is within an adjustable bandwidth.

As with the standard undervoltage sensing, the frequency sensors signal the time delay module, which controls the transfer or retransfer sequence.

An adjustable time delay (0 to 15 seconds) allows the control to ignore momentary dips or rises in frequency.

To set this time delay, align the slot on the potentiometer with the desired marking on the Power Sentry cover.

## Starting Circuit

The starting circuit is a basic supervisory function of the electronic control. Although the logic is more involved, the starting circuit can be thought of as a single-pole, single-throw switch. A closed switch signals the generator set to start. An open switch signals the electric generator set to stop.

## Programmed Transition Option

The optional Program Transition module (Figure 2-3) is used to introduce a pause during transition. Programmed transition allows the transfer switch to assume a midtransition position for an adjustable interval of time. In this position, the load is **not** connected to either (Normal or Emergency) power source.

This feature allows residual voltage from inductive loads to decay to an acceptable level before transfer is completed. The length of time that the transfer switch is in the midposition can be adjusted from 0 to 7.5 seconds or 0 to 60 seconds, depending on the timer option. The proper adjustment is a function of the load.

To set the time delay, align the slot on the potentiometer with the desired marking on the faceplate (Figure 2-3).

If a time delay is desired, make sure that the Delay/No Delay switch is in the Delay position.

## Signal Module Option

The main function of the optional Signal Module (Figure 2-4) is to delay transfer (or retransfer) for a preset time while operating a signal contact to give warning that a transfer (or retransfer) is about to occur. This option is typically used in elevator applications.

This module also provides four other sets of form C signal contacts.

The Signal Module has one adjustable timer. The Elevator Signal delay controls the timing of two events. It delays transfer/retransfer and energizes the Elevator Transfer Signal relay during the delay period.

This time delay is adjustable over a range of 0 to 50 seconds.

To set the time delay, align the slot on the potentiometer with the desired marking on the faceplate (Figure 2-4).

If a time delay is desired, make sure that the Delay/No Delay switch is in the Delay position.

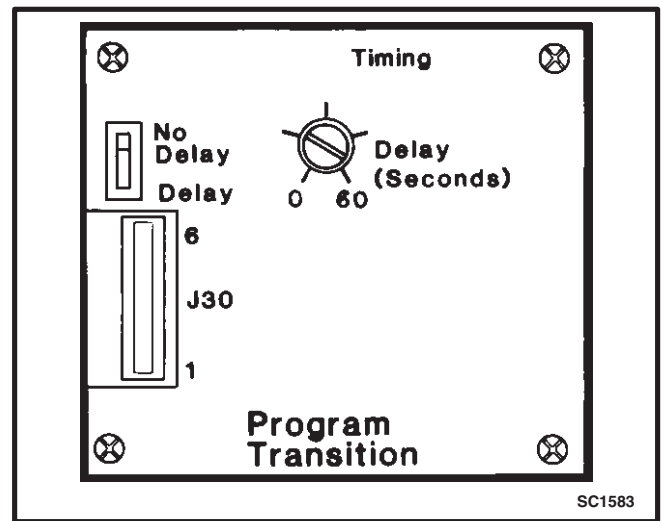


FIGURE 2-3. PROGRAM TRANSITION MODULE

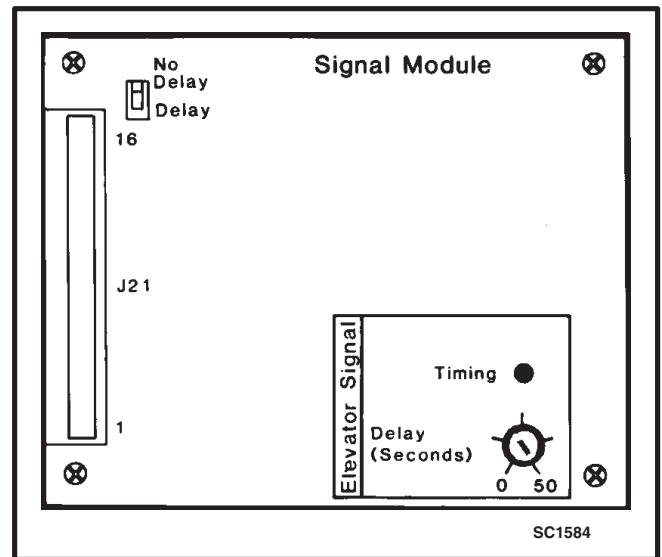


FIGURE 2-4. SIGNAL MODULE

## Load Shed Option

The optional Load Shed function is used to disconnect the load from an available Emergency source in order to reduce the power consumed from that source. When the load shed function is initiated, the switch is moved to the neutral position.

The load shed function is initiated by a customer-supplied signal.

When load shedding is in effect, a return of Normal utility power will cause immediate retransfer to the Normal power source.

If the load shed signal is removed before Normal power returns, the switch will transfer back to the Emergency side.

## Remote Test Transfer

The transfer switch may be wired with a remote test switch. Closure of a set of contacts across the remote test transfer inputs causes the transfer switch to sense a (simulated) utility power failure and send a start/run signal to the generator set. The load is transferred to the generator set when generator set power becomes available. (Refer to the Installation and Service manuals.)

## Float Battery Charger Option

A float-charge battery charger (Figure 2-5) regulates its charge voltage to continuously charge without damage to the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

There are two chargers available. One battery charger is rated for 10 amperes at 12 or 24 VDC. The other battery charger is rated for 2 amperes at 12 or 24 VDC.

The 2-ampere battery charger has an ammeter to indicate charging current and a fuse to protect the battery charger circuit.

The 10-ampere battery charger has three fuses (two on the AC input and one on the DC output), three fault display LEDs, and an ammeter for indication of charging current.

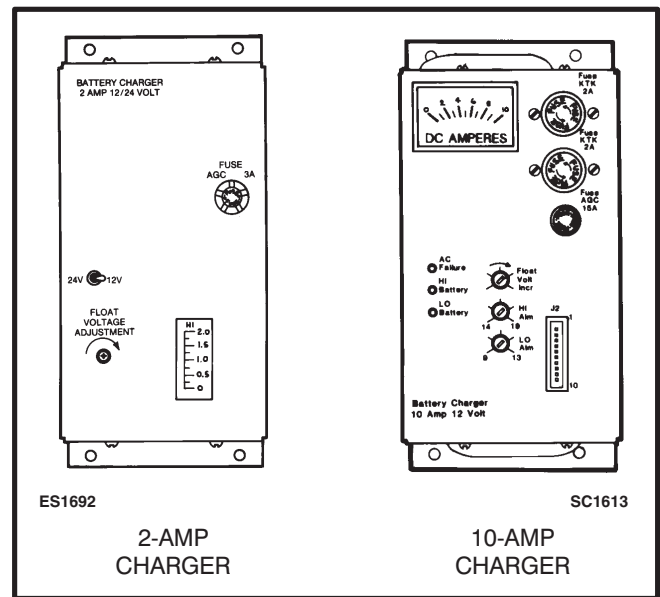


FIGURE 2-5. BATTERY CHARGER

On the 10-ampere charger, three sets of (form C) alarm contacts (corresponding to the three fault LEDs) are also available. Using an optional alarm contact harness, these contacts can be wired by the installer to activate other audible or visual alarms.

Under normal operating conditions, the Low Bat and AC Fail relays are energized and the High Bat relay is de-energized. In response to a Low Bat or AC Fail condition, the appropriate normally energized relay (Low Bat or AC Fail) drops out. In response to a High Bat condition, the normally de-energized High Bat relay is energized.

### Auxiliary Relays Option

Optional auxiliary relays provide contacts for energizing external alarms, remote indicators, and control equipment such as louver motors and water pumps.

### Exerciser Clock Option

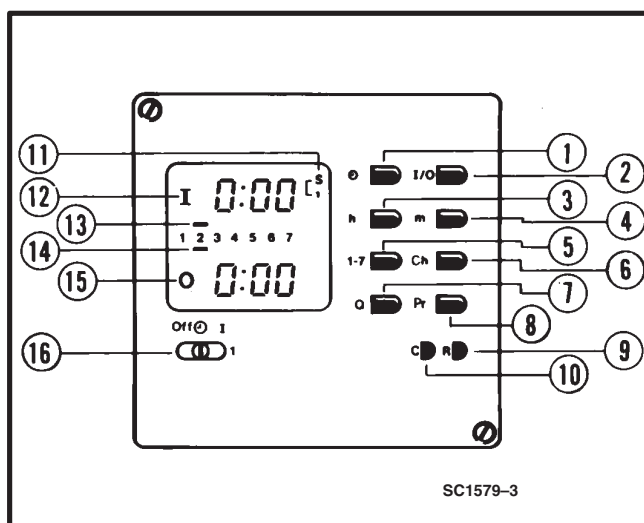
The exerciser clock initiates generator set start/run cycles at programmable intervals and for programmable durations. It is a 7-day, 24-hour clock that can store and execute up to ten start/stop programs (exercise cycles).

Programming the exerciser clock requires setting the time of day and entering the exercise start and stop times.

Refer to the circled numbers in Figure 2-6 when reading the following instructions.

#### **To set the time of day:**

1. If you are performing installation and setup, press the R button (9) with the tip of a ball point pen to reset all memory. Do not press the R button if you are only changing the time of day.
2. Press the clock button (1).
3. Press the h button (3) to set the hour of the day. The clock uses 24-hour (military) time.
4. Press the m button (4) to set the minutes of the hour.
5. Press the 1-7 button (5) to advance the indicator bar over the desired day number. (Use the 1 to represent Sunday.)
6. Press the Pr button (8) to enter the time.



**FIGURE 2-6. EXERCISER CLOCK**



### ***To set the exercise start time:***

1. Slide the output selector switch (16) to the center position. The output selector switch has three positions. The Off position overrides the program and causes an exercise stop. The I position overrides the program and causes an exercise start. The center position selects program control.
2. Press the I/O button (2). An "I" (12) appears in the upper display window. The "I" is a symbol for start time.
3. Press the h button (3) to set the start hour.
4. Press the m button (4) to set the start minute.
5. Press the 1-7 button (5) to advance the indicator bar (13) from 1 to 7 and back to 1. For each day to be selected for exercise, press the Q button (7) when the indicator is over the desired day number. (1 represents Sunday.)

### ***To set the exercise stop time:***

1. Press the I/O button (2). An "O" (15) appears in the lower left display window. The "O" is a symbol for stop time.
2. Press the h button (3) to set the stop hour.
3. Press the m button (4) to set the stop minute.
4. Press the 1-7 button (5) to advance the indicator bar (14) from 1 to 7 and back to 1. For each start time (selected in step 5 above), there must be a corresponding stop time. A program can start on day 2, pass through midnight, and stop on day 3 (for example); but there must be a stop time for every start time. Press the Q button (7) when the indicator is under the desired day number.
5. To enter the complete start/stop program, press the Pr button (8). If all program requirements have been satisfied, the display returns to the time of day. If the program requirements are not met, the display of the section that needs correction flashes on and off.

To enter more programs, repeat the two 5-step procedures. A maximum of ten programs can be en-

tered. (The same ten programs can be repeated each day.)

The word "Full" appears in the display when the memory is full.

If the I/O button (2) is pressed and no program is to be entered, press the Ch button (6) and then the Pr button (8) to get out of the program mode.

### ***To check the programs:***

1. Press the Ch button (6). An "I" (12) and an "O" (15) are displayed.
2. Press the Ch button (6) again. The start and stop information for the first program is displayed.
3. Continued pressing of the Ch button (6) causes the display to sequence through all of the programs in memory. If ten programs have been entered, the word "Full" appears after the tenth program display.
4. Press the Pr button (8) to return to the time-of-day display.

### ***To change (edit) a program:***

1. Press the Ch button (6) until the program you want to change appears in the display window.
2. Press the I/O button (2) to select start or stop time.
3. Press the h (3), m (4), or 1-7 (5) and Q (7) buttons to change the hour, minute, or day.
4. Press the Pr button (8) to enter the edited program and return to the time-of-day display.

### ***To erase (clear) a program:***

1. Press the Ch button (6) until the program to be erased is displayed.
2. Press the C button (10) with a ball point pen to clear the program.
3. Press the Pr button (8) to return to the time-of-day display.



# 3. Operation

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## AUTOMATIC OPERATION

Place control switches in the positions given below.

- **Test/Normal/Retransfer switch:**  
Normal position.
- **Manual Bypass mechanism:**  
Lower position. Both the Bypass Normal and the Bypass Emergency indicator lamps are NOT illuminated.
- **Motor Disconnect toggle switch:**  
Auto position
- **Operation selector switch (engine control):**  
Remote position.

## SYSTEM TESTING

Three types of tests can be performed.

- The **generator set start test** tests the start circuits of the Power Sentry control and starts the generator set. The linear actuators and contact mechanisms are not tested. There is no transfer of load to the Emergency source.
- The **with-load standby system test** simulates a power outage. This tests the start circuits of the Power Sentry control and starts the generator set. When the Power Sentry control senses that the generator set is producing acceptable power, the appropriate linear actuators are energized and the contact mechanism transfers load to the emergency source. Because there is transfer of load to the Emergency source, there is brief interruption of power to the load.
- The **non-load break transfer switch test** allows testing the Power Sentry control, the linear actuators, and the contact mechanisms without interrupting power to the load.

**To perform this test, the operator must (first) bypass the automatic transfer switch by moving the manual bypass switch to the Normal position, and (second) isolate the automatic transfer switch from the load.**

Like the other tests, this tests the start circuits of the Power Sentry control and starts the generator set. When the Power Sentry control senses that the generator set is producing acceptable power, the appropriate linear actuators are energized and the automatic transfer switch contact mechanism is driven to the emergency side. Because the automatic transfer switch is bypassed and isolated, there is NO transfer of load to the Emergency source and NO interruption of power to the load.

## GENERATOR SET START TEST

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

1. Place the Test With/Without Load selector switch, on the Power Sentry control, in the Without Load position.

**The Test With/Without Load selector switch must be in the Without Load position.**

2. Close the cabinet door.
3. Move the Test/Normal/Retransfer switch to Test. The generator set should start and run.
4. At the end of the test period, move the Test/Normal/Retransfer switch to the Normal position. The generator will stop.
5. In anticipation of scheduled or automatic generator set exercise, check that the With/Without Load selector switches are in the desired positions. Refer to *Generator Set Exercise*.
6. Close and lock the cabinet door.

## WITH-LOAD STANDBY SYSTEM TEST

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

1. Place the Test With/Without Load selector switch, on the Power Sentry control, in the With Load position.

**The Test With/Without Load selector switch must be in the With Load position in order to test with load.**

2. Close the cabinet door.

**⚠WARNING** *AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Close the cabinet door.*

3. Move the Test/Normal/Retransfer switch to Test. The generator set should start and assume the load after the transfer time delay.
4. At the end of the test period, move the Test/Normal/Retransfer switch to the Normal position if you want to retransfer load back to the Normal power source after the retransfer time delay. To bypass the retransfer time delay and cause immediate load retransfer, move the Test/Normal/Retransfer switch to Retransfer and release (the switch will return to Normal). The generator will stop after the stop time delay.
5. In anticipation of scheduled or automatic generator set exercise, check that the With/Without Load selector switches are in the desired positions. Refer to *Generator Set Exercise*.
6. Close and lock the cabinet door.

## NON-LOAD BREAK TRANSFER SWITCH TEST

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

In the Test position, the load-supplying contacts of the automatic transfer switch are out of service, but the Power Sentry control and the linear actuators are powered and fully operational. In this position, the control, the linear actuators, and the contact mechanisms can be tested.

1. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Off position to disable the automatic transfer switch linear actuators.
2. Insert the Manual Bypass handle into the bypass drive mechanism as shown in Figure 3-1. Turn the Bypass Selector switch to the Normal position and move the Manual Bypass handle up. Check that the **Bypass Normal** and **ATS Inhibit** lamps are lit.
3. Rotate the drawout cranking handle (Figure 3-2) counterclockwise to move the automatic transfer switch to the Test position. Check that the automatic transfer switch position pointer is aligned with the word "Test" (Figure 3-3). Check that the **ATS in Test** lamp is lit. Check that the **ATS Inhibit** lamp is not lit. Return the drawout cranking handle to its stored position.

**The cranking handle will operate only when power is available, and when the bypass and the automatic transfer switches are connected to the same source.**

4. Place the Test With/Without Load selector switch, on the Power Sentry control, in the With Load position.  
**The Test With/Without Load selector switch must be in the With Load position in order to test the linear actuators and the contact mechanisms. Because the automatic transfer switch is bypassed and isolated from the load, there will NOT be an actual With Load test.**
5. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Auto position to enable the automatic transfer switch linear actuators. Close the cabinet door.
6. Move the Test/Normal/Retransfer switch to Test. The generator set will start and run. After the transfer time delay, the linear actuators will drive the contact mechanism to the Emergency side. Because the automatic transfer switch is bypassed and isolated from the load, there is NO transfer of load to the Emergency source and NO interruption of power to the load.

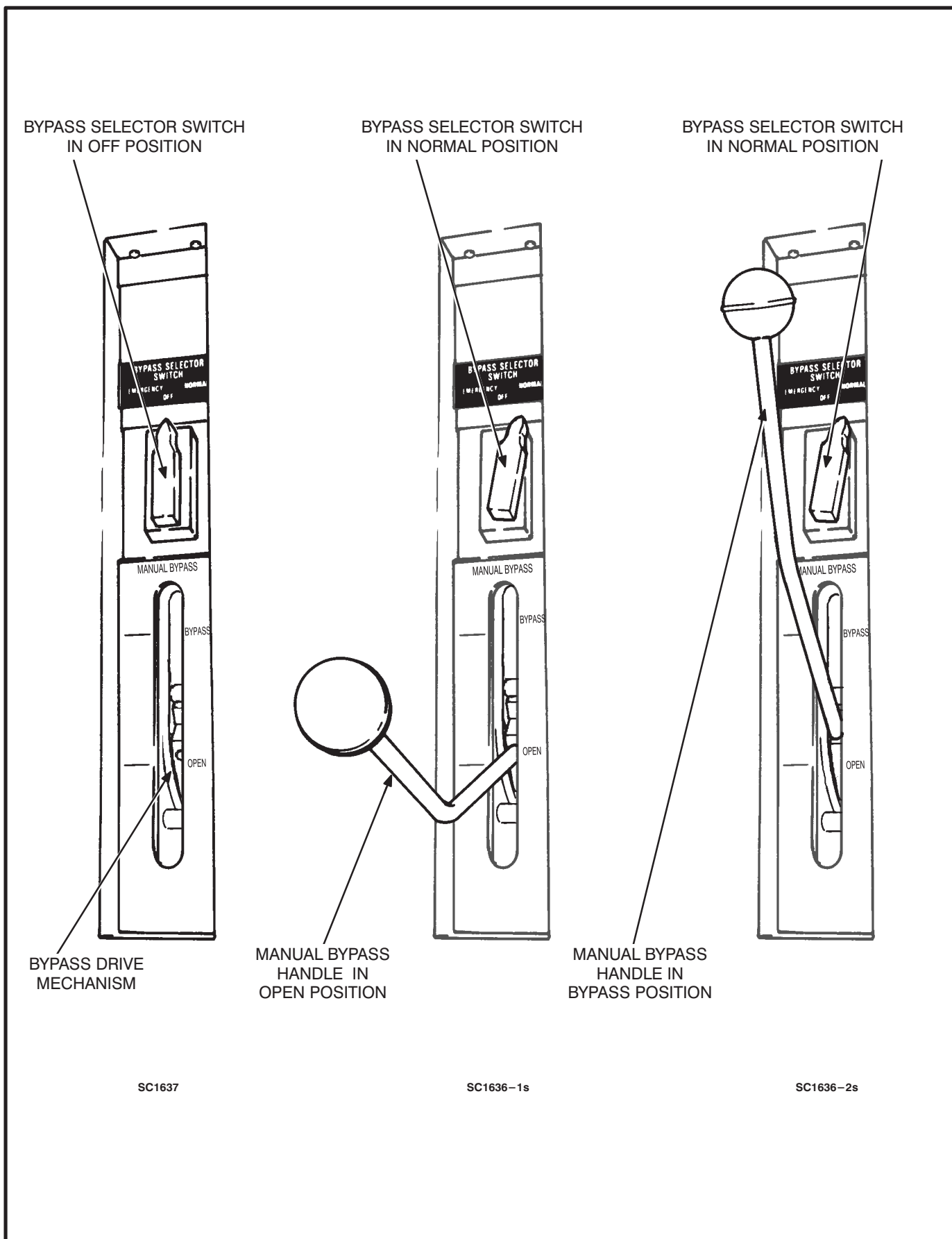
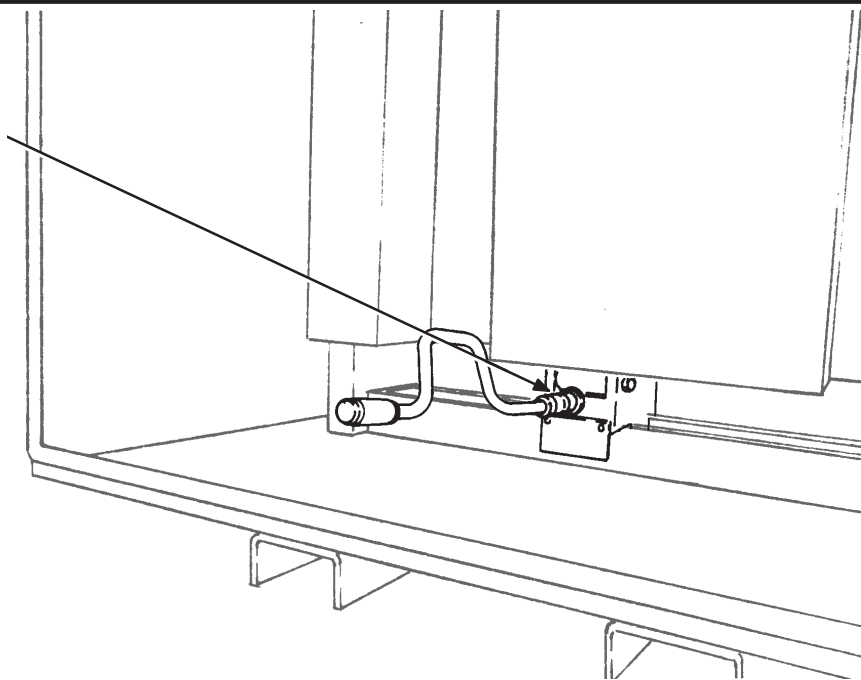
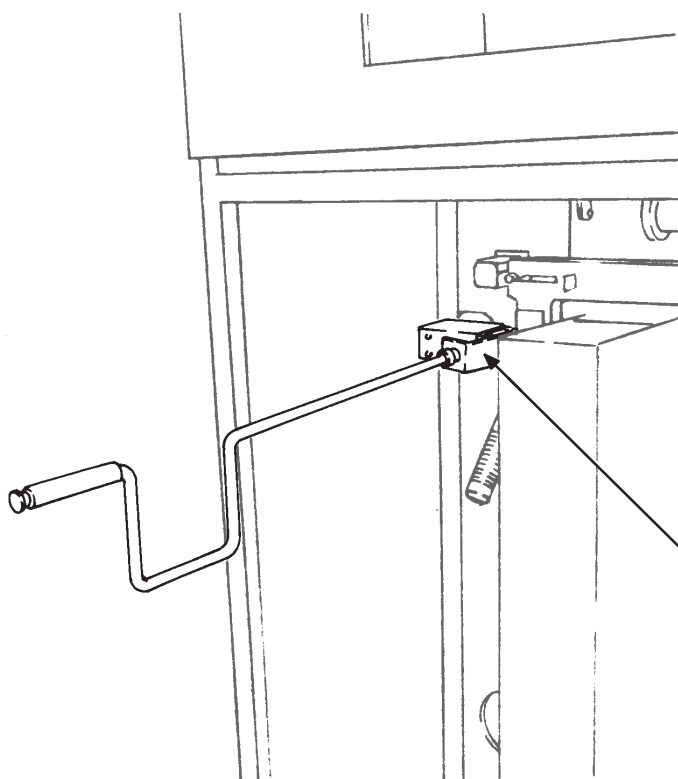


FIGURE 3-1. MANUAL BYPASS OPERATION

**DRAWOUT MECHANISM LOCATION  
1200-AMP BT**



SC1638s



**DRAWOUT MECHANISM LOCATION  
1600- TO 3000-AMP BT**

SC1639s

**FIGURE 3-2. DRAWOUT CRANKING OPERATION**

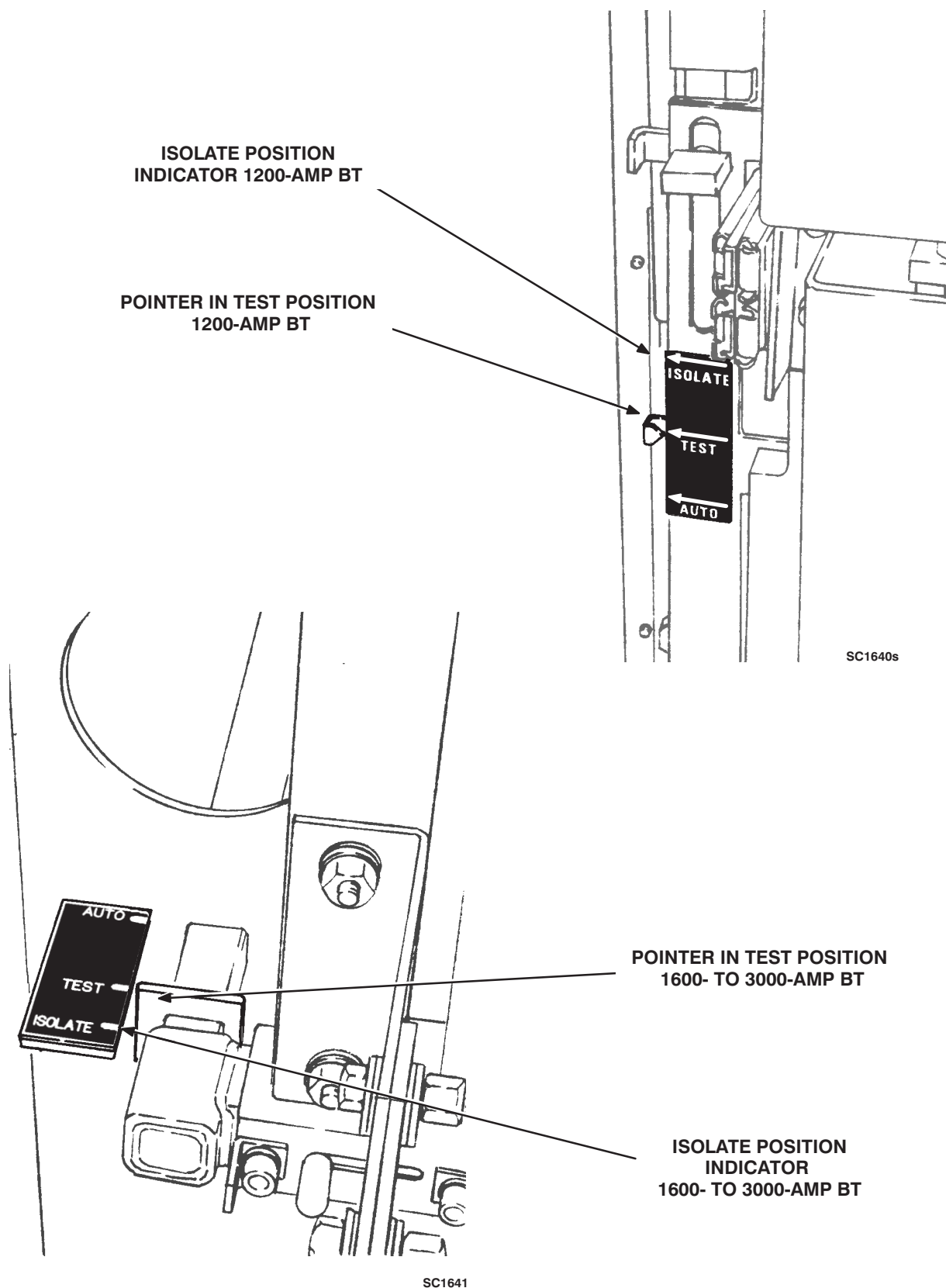


FIGURE 3-3. AUTO/TEST/ISOLATE POSITION POINTER

7. At the end of the test period, move the Test/Normal/Retransfer switch to the Normal position. After the retransfer time delay, the linear actuators will drive the contact mechanism back to the Normal side. To avoid the retransfer time delay, move the Test/Normal/Retransfer switch to Retransfer and release (the switch will return to Normal). The generator will stop after the stop time delay.
8. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Off position to disable the automatic transfer switch linear actuators.
9. Rotate the drawout cranking handle clockwise to move the automatic transfer switch back to the Auto position. Note that the **ATS Inhibit** lamp is lit. Check that the position pointer is aligned with the word "Auto." Return the drawout cranking handle to its stored position.
10. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Auto position. Close the cabinet door.
11. Move the Manual Bypass handle down. Check that the **ATS Inhibit**, **Bypass Normal** and the **Bypass Emergency** indicator lamps are **not** lit. Return the Manual Bypass handle to its stored position.  
**After the automatic transfer switch is returned to the Auto position, the Motor Disconnect toggle switch is moved to the Auto position, and the bypass switch is moved to the open (disconnected) position, the automatic transfer switch will respond to transfer/retransfer signals from the Power Sentry control.**
12. In anticipation of scheduled or automatic generator set exercise, check that the With/Without Load selector switches are in the desired positions. Refer to *Generator Set Exercise*.
13. Close and lock the cabinet door.

### GENERATOR SET EXERCISE

Cummins Power Generation recommends running the generator for at least 30 minutes once each week with at least 50 percent load (if possible). If you do not have an optional exerciser, use the Test/Normal/Retransfer switch to test the generator set each week.

The optional exerciser has preselected exercise periods and exercises the generator set automatically with or without load, depending on the position of the Exercise With/Without Load switch.

If the Normal power source has an interruption while the generator set is exercising without load,

the automatic transfer switch will transfer the load to the generator set.

### ISOLATING THE AUTOMATIC TRANSFER SWITCH FOR SERVICE

**⚠WARNING** *Improper removal of the automatic transfer switch can cause severe personal injury or death. Removal of the automatic transfer switch must only be performed by technically qualified personnel, following the procedures provided in the Service manual.*

To isolate the automatic transfer switch for servicing, the operator must manually bypass the load to either the Normal source or to the Emergency source, and then crank the transfer switch out to the Isolated position.

**The load can only be bypassed to the same source that the automatic transfer switch is connected to. Interlocks prevent the operator from bypassing the load to the opposite source or to a dead source.**

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

#### **To Bypass and Isolate the Automatic Transfer Switch:**

1. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Off position to disable the automatic transfer switch linear actuators.
2. Insert the Manual Bypass handle into the bypass drive mechanism as shown in Figure 3-1. Turn the Bypass Selector switch to the desired position (Normal or Emergency) and move the Manual Bypass handle up. Check that the appropriate **Bypass Emergency** or **Bypass Normal** lamp is lit. Check that the **ATS Inhibit** lamp is lit.
3. Rotate the drawout cranking handle (Figure 3-2) counterclockwise to move the automatic transfer switch to the Isolated position. Check that the automatic transfer switch position pointer is aligned with the word "Isolate" (Figure 3-3). Check that the **ATS Isolated** and **ATS Inhibit** lamps are lit. Return the drawout cranking handle to its stored position.

**The cranking handle will operate only when power is available, and when both the bypass**



and the automatic transfer switches are connected to the same source.

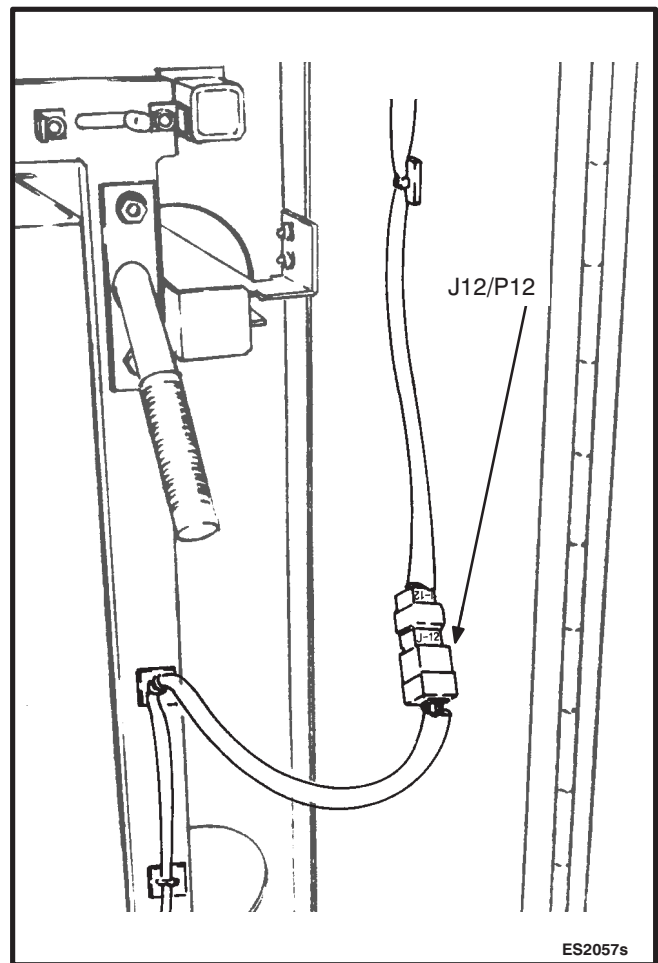
4. Disconnect J12/P12 (Figure 3-4).

**⚠WARNING** *Improper removal of the automatic transfer switch can cause severe personal injury or death. Removal of the automatic transfer switch must only be performed by technically qualified personnel, following the procedures provided in the Service manual.*

**To Reconnect the Automatic Transfer Switch:**

1. Move the automatic transfer switch to the same source as the bypass switch.
2. Connect J12/P12 (Figure 3-4).
3. Rotate the drawout cranking handle clockwise to move the automatic transfer switch back to the Test position. Check that the automatic transfer switch position pointer is aligned with the word "Test." Check that the **ATS in Test** lamp is lit. Check that the **ATS Inhibit** lamp is not lit.
4. Rotate the drawout cranking handle clockwise to move the automatic transfer switch back to the Auto position. Check that the automatic transfer switch position pointer is aligned with the word "Auto." Return the drawout cranking handle to its stored position.
5. Move the Motor Disconnect toggle switch (located on the accessory control panel) to the Auto position to enable the automatic transfer switch linear actuators. Close the cabinet door.
6. Move the Manual Bypass handle down. Check that the **ATS Inhibit**, **Bypass Normal** and the **Bypass Emergency** indicator lamps are **not** lit. Return the Manual Bypass handle to its stored position.

**After the automatic transfer switch is returned to the Auto position, the Motor Disconnect toggle switch is moved to the Auto position, and the bypass switch is moved to the open (disconnected) position, the automatic transfer switch will respond to transfer/retransfer signals from the Power Sentry control.**
7. In anticipation of scheduled or automatic generator set exercise, check that the With/Without Load selector switches are in the desired positions. Refer to *Generator Set Exercise*.
8. Close and lock the cabinet door.



**FIGURE 3-4. CONNECTOR J12/P12**



## MANUAL OPERATION OF ATS

The automatic transfer switch has operator handles that are intended for maintenance use only. Manual operation must be performed by qualified personnel under **NO-LOAD CONDITIONS ONLY**.

**⚠WARNING** *Manual operation of the transfer switch under load presents a shock hazard that can cause severe personal injury or death. For this reason, do not attempt to perform manual operation of the transfer switch when it is under load.*

### Manual Transfer to The Emergency Position

1. Bypass and isolate the automatic transfer switch as described in this section. Make sure the Motor Disconnect switch is in the Off position.

**⚠WARNING** *Manual operation of the transfer switch under load presents a shock hazard that can cause severe personal injury or death. For this reason, do not attempt to perform manual operation of the transfer switch when it is energized by either Normal or Emergency power sources.*

2. A manual operating handle is provided with the transfer switch. The handle is a steel rod or tube, with a knob or hand grip on one end. On standard transfer switches (Figure 3-5), there are two manual operator slots—one for the Normal contacts and one for the Emergency contacts.

First, insert the handle in the slot for the Normal contacts and open the Normal contacts. Then, insert the handle in the slot for the Emergency contacts and close the Emergency contacts.

Be certain to push the handle all the way to the LOCK position. A distinct over-center locking action can be felt. Return the handle to its storage position.

3. If the transfer switch is not functioning correctly. Call your dealer or distributor immediately.

### Manual Transfer to The Normal Position

1. Bypass and isolate the automatic transfer switch as described in this section. Make sure the Motor Disconnect switch is in the Off position.

**⚠WARNING** *Manual operation of the transfer switch under load presents a shock hazard that can cause severe personal injury or death. For this reason, do not attempt to perform manual operation of the transfer switch when it is energized by either Normal or Emergency power sources.*

2. A manual operating handle is provided with the transfer switch. The handle is a steel rod or tube, with a knob or hand grip on one end. On standard transfer switches (Figure 3-5), there are two manual operator slots—one for the Normal contacts and one for the Emergency contacts.

First, insert the handle in the slot for the Emergency contacts and open the Emergency contacts. Then, insert the handle in the slot for the Normal contacts and close the Normal contacts. Be certain to push the handle all the way to the LOCK position. A distinct over-center locking action can be felt. Return the handle to its storage position.

3. If the transfer switch is not functioning correctly. Call your dealer or distributor immediately.

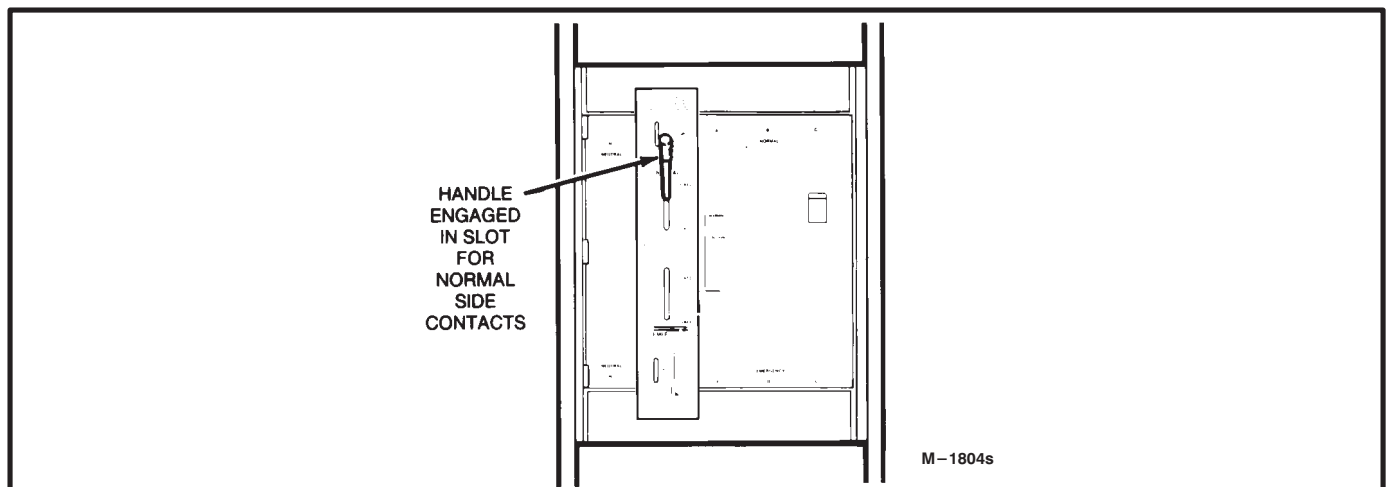


FIGURE 3-5. MANUAL OPERATION

## PREVENTIVE MAINTENANCE

Performing the yearly preventive maintenance procedures in Table 3-1 will result in operational reliability of the transfer switch.

The following procedures must only be performed by technically qualified personnel, following the procedures provided in the Service manual (962–0515). **If repair or replacement of components is necessary, call your dealer or distributor.**

**⚠WARNING** *AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. In addition, incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Therefore, all corrective service procedures must only be performed by technically qualified personnel, following the procedures provided in the Service manual (962–0515).*

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

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

TABLE 3-1. ANNUAL PREVENTIVE MAINTENANCE

### 1. DISCONNECT ALL SOURCES OF AC POWER:

Disconnect both the Normal and the Emergency AC power sources from the transfer switch before continuing. Turn the operation selector switch to Stop. (The selector switch is located on the generator set control panel.) ***If there is an external battery charger, disconnect it from its AC power source.*** Then disconnect the set starting battery (negative [–] lead first).

### 2. CLEAN

- Thoroughly dust and vacuum all controls, meters, switching mechanism components, interior buswork, and connecting lugs.
- Close the cabinet door and wash **exterior** surfaces with a damp sponge (mild detergent and water). ***Do not allow water to enter the cabinet, especially at meters, lamps, and switches.***

### 3. INSPECT

- Check buswork and supporting hardware for carbon tracking, cracks, corrosion, or any other types of deterioration. If repair or replacement is necessary, call your dealer or distributor.
- Check stationary and movable contacts. If contact replacement is necessary, the procedures are described in sections 5 and 6 of the Service manual (962–0515).
- Check system hardware for loose connections. Tighten as indicated in step 4.
- Check cams, gears, and primary disconnects. If the lubricant is contaminated, clean it off and apply additional lubricant as described in the Service manual (962–0515).
- Check all control wiring and power cables (especially wiring between or near hinged doors) for signs of wear or deterioration.
- Check all control wiring and power cables for loose connections. Tighten as indicated in step 4.
- Check the cabinet interior for loose hardware. Tighten as indicated in step 4.

### 4. PERFORM ROUTINE MAINTENANCE

- Tighten buswork, control wiring, power cables, and system hardware, as necessary. Hardware torque values are given in sections 5 and 6 of the Service manual (962–0515). Retorque all cable lug connections. Lug torque values are listed on a decal near the transfer switch lugs.
- Service or replace the batteries.

### 5. CONNECT AC POWER AND CHECK OPERATION

- Connect the normal AC power source, enable the backup power source, and connect the set starting battery (negative [–] lead last). If applicable, connect power to the battery charger.
- Verify proper operation of the battery charger.
- Test system operation as described in this section. Close and lock the cabinet door.



## 4. Troubleshooting

### POWER OUTAGE OCCURS, BUT GENERATOR SET DOES NOT START

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

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

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

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

### GENERATOR SET STARTS DURING NORMAL POWER SERVICE

1. The operation selector switch on the generator set control panel should be set at Remote.

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

2. Check the Test/Normal/Retransfer switch to make sure it is in the Normal position.
3. Check the exerciser clock to see if it is in an exercise period. When the exerciser clock is in an exercise period, a "1" appears in the upper right-hand corner of the display window (Figure 4-1). You can view the display by looking through the transparent clock cover. Check that the red slide switch is in the center position (Figure 4-1).

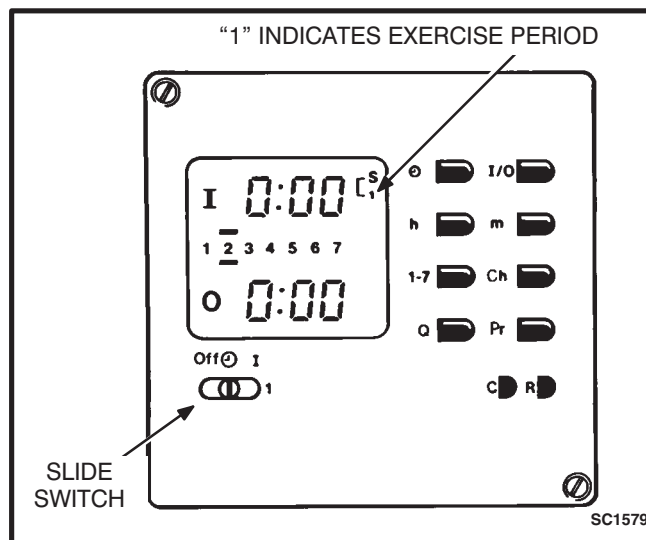


FIGURE 4-1. EXERCISER CLOCK

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

4. Momentary voltage dips might cause voltage sensors to initiate generator set starting. If the problem persists, call your dealer or distributor.

#### **GENERATOR SET DOES NOT EXERCISE (IF EQUIPPED WITH EXERCISER)**

1. The operation selector switch on the generator set control panel should be set at Remote.

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

2. Check the exerciser to see if it is in an exercise period. When the exerciser clock is in an exercise period, a "1" appears in the upper right-hand corner of the display window (Figure 4-1). You can view the display by looking through the transparent clock cover. Check that the red slide switch is in the center position (Figure 4-1).
3. Start the generator set using its start-stop controls. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply. If the problem persists, call your dealer or distributor.

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

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

#### **AFTER A POWER FAILURE, GENERATOR SET STARTS BUT DOES NOT ASSUME LOAD**

1. Check the output voltage of the emergency power source by observing the voltmeter on the generator set or the optional voltmeter on the automatic transfer switch.

2. Check that the Auto Transfer Switch Disabled lamp, on the bypass operator panel, is off.

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

3. Check the Source 2 Available lamp on the Power Sentry control.
4. Check that the manual bypass drive mechanism is in the down position.
5. If the automatic transfer switch is not operable, manually bypass the switch. (Refer to: *Isolating the Transfer Switch for Service* in the *Operation* section.) Call your dealer or distributor.

#### **AFTER POWER RETURNS, TRANSFER SWITCH DOES NOT RETURN TO NORMAL POSITION**

1. The retransfer time delay period may not have expired. Check the Retransfer Timing lamp on the Power Sentry control.
2. Check that the ATS Inhibit lamp is off.

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

3. Check that the manual bypass drive mechanism is in the down position.
4. Check to see if the automatic transfer switch is withdrawn for testing or service.
5. Manually initiate retransfer by turning the Test/Normal/Retransfer switch to Retransfer.
6. Stop the generator set with the Start/Stop switch (located on the generator set). When the generator set stops, the transfer switch will transfer load to the Normal power source if power is acceptable. Call your dealer or distributor.

### **GENERATOR SET CONTINUES TO RUN AFTER RETRANSFER OF LOAD TO NORMAL POWER**

The stop time delay function may not have expired. Check the Stop Timing lamp on the Power Sentry. Stop the generator set with the Start/Stop switch (located on the generator set). Call your dealer or distributor.

### **BATTERY CHARGER FAILS TO CHARGE (IF EQUIPPED)**

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

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

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

### **BATTERY LOSES WATER**

The battery charger float voltage could be too high (if equipped with battery charger). Call your dealer or distributor.

### **BATTERY LOSES CHARGE**

Battery charger float voltage could be too low (if equipped with battery charger). Call your dealer or distributor.





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