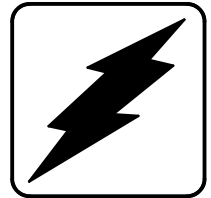


Operation and Installation

Automatic Transfer Switches



Models:

KB-Series

Contactors:
150-4000 Amperes

KOHLER[®]
POWER SYSTEMS

ISO 9001
KOHLER
GENERATORS
INTERNATIONALLY REGISTERED
U.S.A. Plant ISO Registered

TP-5813 3/96a

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Safety Precautions and Instructions

A transfer switch, like any other electromechanical device, can pose potential dangers to life and limb if improperly maintained or operated. The best way to prevent accidents is to be aware of potential dangers and act safely. Please read and follow the safety precautions and instructions below to prevent harm to yourself and others. This manual contains several types of safety precautions and instructions which are explained below. **SAVE THESE INSTRUCTIONS.**

DANGER

Danger indicates the presence of a hazard that *will* cause *severe* personal injury, death, or substantial property damage.

WARNING

Warning indicates the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage.

CAUTION

Caution indicates the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage.

NOTE

Notice communicates installation, operation, or maintenance information that is important but not hazard related.

Safety decals affixed to the generator set in prominent places advise the operator or service technician of potential hazards and how to act safely. The decals are reproduced in this publication to improve operator recognition. Replace missing or damaged decals.

Safety decals affixed to the transfer switch in prominent places advise the operator or service technician of potential hazards and how to act safely. The decals are reproduced here to improve operator recognition. Replace missing or damaged decals.

Accidental Starting



Accidental starting. Can cause severe injury or death.

Disconnect battery cables before working on generator set (disconnect negative lead first and reconnect it last).

Disabling generator set. Accidental starting can cause severe injury or death. Turn generator set master switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on the generator set or connected equipment. The generator set can be started by an automatic transfer switch or remote start/stop switch unless these precautions are followed.



Battery

WARNING



**Sulfuric acid in batteries.
Can cause severe injury or death.**

Use protective goggles and clothes. Battery acid can cause permanent damage to eyes, burn skin, and eat holes in clothing.



 WARNING

Explosion. Can cause severe injury or death. Relays in battery charger cause arcs or sparks. Locate battery in a well-ventilated area. Isolate battery charger from explosive fumes.

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working near the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.



Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area with large quantities of clean water. Continue flushing with water until emergency help arrives. Seek immediate medical aid. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is charging. Avoid touching terminals with tools, etc., to prevent burns and sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Never connect negative (-) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.


Hazardous Voltage/ Electrical Shock

 DANGER

Hazardous voltage. Will cause severe injury or death. Disconnect all power sources before opening enclosure.


(600 Volt and above)

 DANGER

Hazardous voltage. Will cause severe injury or death. Disconnect power sources before servicing. Install barrier after adjustments, maintenance, or servicing.

(600 Volt and above)

⚠ WARNING

<p>Hazardous voltage. Can cause severe injury or death.</p> <p>Disconnect power sources before servicing. Install barrier after adjustments, maintenance, or service.</p>

(under 600 Volt)

⚠ WARNING

<p>Hazardous voltage. Can cause severe injury or death.</p> <p>Disconnect all power sources before opening enclosure.</p>

(under 600 Volt)

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution is increased under such conditions.

Short circuits. Hazardous voltage can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry before servicing equipment.

Installing accessories to transformer assembly. Hazardous voltage can cause severe injury or death. To prevent the possibility of electrical shock, disconnect harness plug before installing any accessories which will be connected to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage!


Installing accessories to transformer assembly. Hazardous voltage can cause severe injury or death. To prevent the possibility of electrical shock, disconnect harness plug before installing any accessories which will be connected to transformer assembly primary terminals on microprocessor logic models. Terminals are at line voltage!

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent the possibility of electrical shock, de-energize the normal power source before making any line or auxiliary connections.

Servicing transfer switch. Hazardous voltage can cause severe injury or death. De-energize both normal and emergency power sources before proceeding. Move generator set master switch on controller to OFF position and disconnect battery negative (-) before working on transfer switch! Turn the transfer switch selector switch to the OFF position.

Servicing transfer inner panel. Hazardous voltage can cause severe injury or death. Disconnect inner panel harness at inline connector. This will de-energize circuit board and logic circuitry but allow transfer switch to continue to supply utility power to necessary lighting and equipment. Hazardous voltage exists for any accessories mounted to inner panel which are NOT wired through the inner panel harness and de-energized by inline connector separation. Such accessories are at line voltage.

Heavy Equipment

⚠ WARNING

<p>Unbalanced weight. Improper lift can cause severe injury or death and/or equipment damage.</p> <p>Use adequate lifting capacity. Never leave transfer switch standing upright unless it is securely bolted in place or stabilized.</p>

Notes

NOTE

Hardware damage! Transfer switch may use both American standard and metric hardware. Use the correct size tools to prevent rounding of bolt heads and nuts.

NOTE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. American Standard hardware uses a series of markings and metric hardware uses a numeric system to indicate hardness. Check markings on bolt head and nuts for identification.

NOTE

Improper operator handle usage! Use the manual operator handle provided on the transfer switch for maintenance purposes only. Return the transfer switch to the normal position. Remove manual operator handle (if used) and store it on the transfer switch in the place provided when service is completed.

NOTE

Perform voltage checks in the order given to avoid damaging the switch.

NOTE

These battery chargers are designed strictly for use in this transfer switch and conform with UL and CSA listing requirements where specified. Do not use battery charger before reading instructions.

NOTE

Connect source and load phases as indicated by the markings and drawings. Improper connections may cause short circuits or cause phase-sensitive load devices to malfunction or operate in reverse.

NOTE

Charger Damage! Connect battery charger only to a battery with the same DC voltage as the battery charger output rating.

NOTE

Foreign material contamination! Cover transfer switch during installation to keep dirt, grit, metal drill chips, etc., out of components. Cover solenoid mechanism during installation. After installation, use manual operating handle to position contactor to ensure that it operates freely. Do not use a screwdriver to force contactor mechanism.

Introduction

This manual provides operation and initial installation instructions for Kohler automatic transfer and bypass/isolation switches that use a 150- to 4000-ampere contactor as the power switching device.

Read through this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with equipment for future reference.

Equipment service requirements are minimal but are very important to safe and efficient operation; therefore, inspect parts often and perform required service at the prescribed intervals. An authorized service distributor/dealer should perform required service to keep equipment in top condition.

All information in this publication represents data available at time of printing. The equipment manufacturer reserves the right to change this literature and the products represented without incurring obligation.

Service Assistance

For sales and service in the U.S.A. and Canada check the yellow pages of the telephone directory under the heading GENERATORS– ELECTRIC for an authorized service distributor/dealer or call 1-800-544-2444.

For sales and service outside the U.S.A. and Canada, contact your local distributor.

For further information or questions, contact the company directly at:

KOHLER CO., Kohler, Wisconsin 53044 U.S.A.

Phone: 920-565-3381

Fax: 920-459-1646 (U.S.A. Sales)

920-459-1614 (International)

To ensure supply of correct parts or information, make note of the following identification numbers in the spaces provided:

PART NUMBER AND SERIAL NUMBER

Part and serial numbers are provided on the nameplate attached to the transfer switch.

Part No. _____

Serial No. _____

Notes

Section 1. Specifications

Purpose of Automatic Transfer Switch

An Automatic Transfer Switch (ATS) is a device that transfers critical electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source. This transfer occurs automatically when the normal source voltage fails, or is substantially reduced, and the emergency source's voltage reaches an acceptable level.

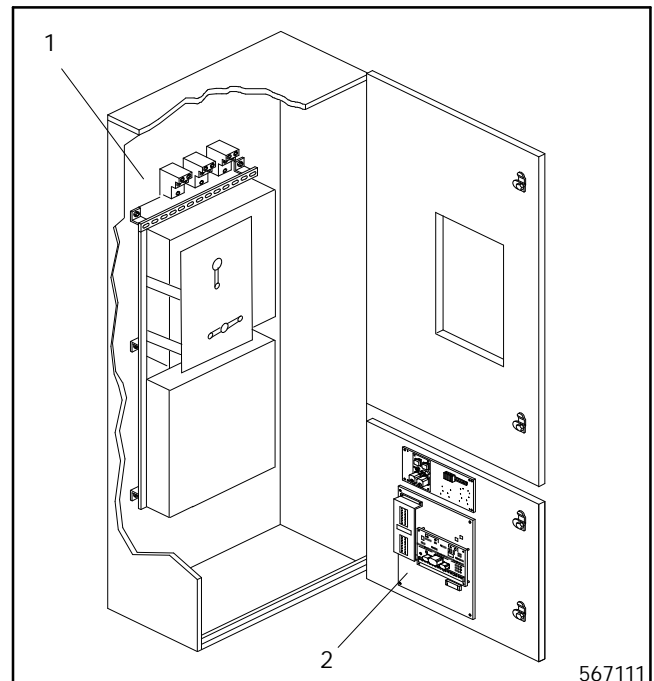
Upon normal source failure, the automatic transfer switch controller signals the generator set(s) to start and transfer to the emergency source. The automatic transfer switch controller continuously senses for an acceptable normal source and retransfers the load to the normal source after it is restored to an acceptable level. After retransfer of the load, the ATS removes the generator set start signal and allows the generator set(s) to shut down.

Transfer Switch Components

A typical automatic transfer switch includes the actual power switching device and the logic controller to perform power monitoring and transfer sequencing tasks. See Figure 1-1.

The power switching device used in the models covered by this manual is a true power transfer switch. The switch electrically actuates and then mechanically latches in the selected position. However, the switch also includes provisions for manual mechanical operation in an emergency. Within the switch, there are two sets of multipole contactors. One set selects power from the normal source while the other set selects power from the emergency source. The two sets of contacts are mechanically interlocked within the switch so that only one set of contactors can be closed at a given time. With this feature it is possible to select one power source to feed the load without crosscoupling that power source to the other power source. See Figure 1-2.

The two functional units that make up the automatic transfer switch mount in an enclosure with a hinged front door. The controller mounts on the back of the front door with controls and indicators available to the operator. A signal cable with in-line connectors to facilitate component replacement and door removal connects the controller to the switching devices.



1. Power conversion unit
2. Logic controller

Figure 1-1. Transfer Switch Components

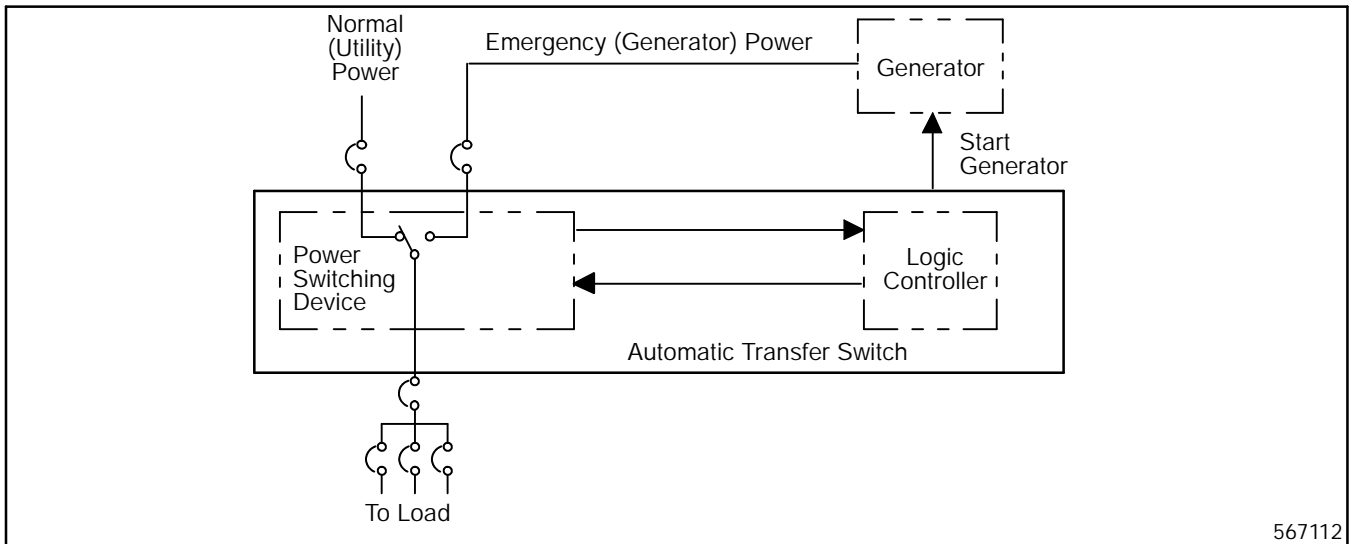


Figure 1-2. Basic Transfer Switch Block Diagram

Purpose of Bypass/Isolation Switch

A bypass/isolation switch is a manually operated device. Use a bypass/isolation switch in conjunction with an ATS to directly connect load conductors to either a normal (preferred) power source or to an emergency (standby) power source. See Figure 1-3. Use it also to disconnect the automatic transfer switch from the power sources and load for inspection and maintenance.

The bypass switch also functions as a manual transfer switch. It allows transfer of the load from one source to the other with the automatic transfer switch removed from the system.

Components of SB-Series Switch

A typical bypass/isolation transfer switch includes the actual power switching device, the bypass/isolation switching device, and the logic controller which performs power monitoring and transfer sequencing tasks. See Figure 1-4.

The three functional units that make up the bypass/isolation automatic transfer switch mount in an enclosure with a hinged front door. The controller mounts on the back of the door so its controls and indicators are available to an operator. A signal cable with in-line connectors to facilitate component replacement and door removal connects the controller to the switching devices.

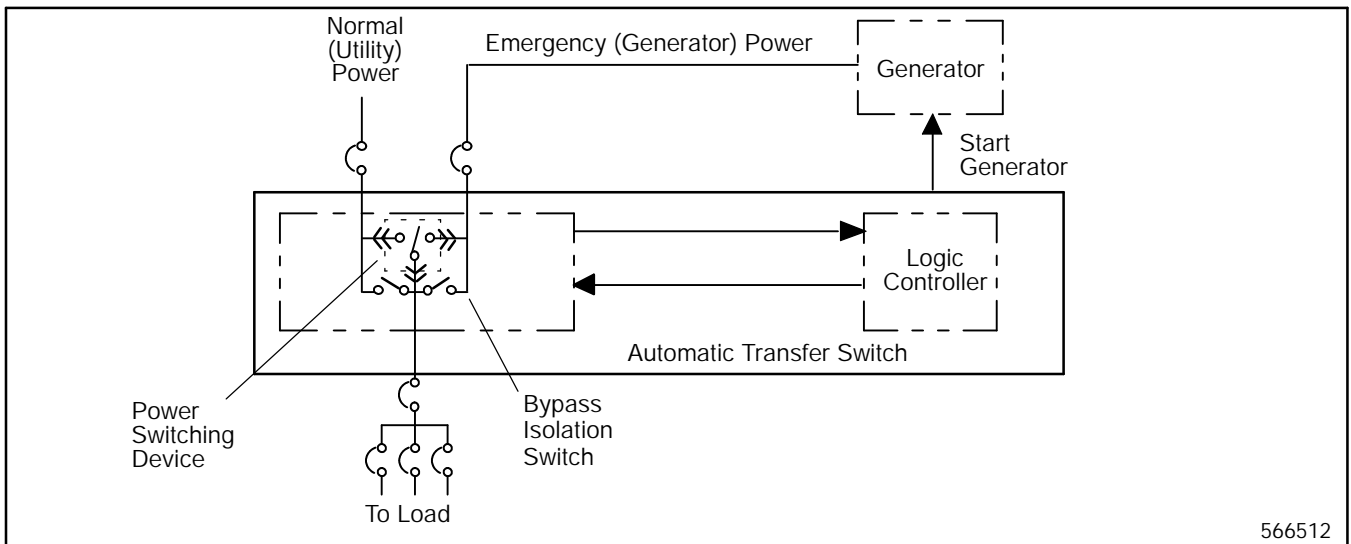
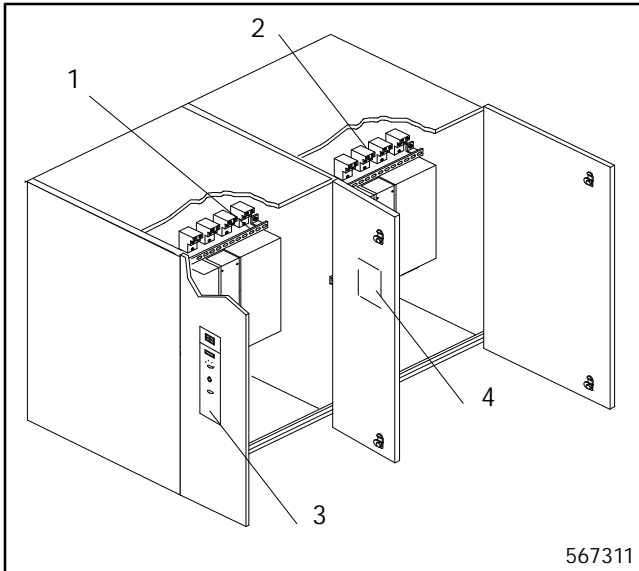


Figure 1-3. Basic Bypass/Isolation Transfer Switch Block Diagram



- 1. ATS
- 2. Bypass/isolation switch
- 3. Logic controller
- 4. Status panel

Figure 1-4. Transfer Switch Components

Ratings

A nameplate affixed to the ATS enclosure identifies the switch. See Figure 1-5. The nameplate label includes a factory part number coded to provide characteristic and rating information that affects installation and operation. Copy the part number into the blank spaces provided in Figure 1-6 and then use the charts in Figure 1-6 to interpret the part number.

NOTE

Also copy the part number and serial number from the nameplate into the spaces provided in the **Service Assistance** Section of the Introduction for use when requesting service or parts.

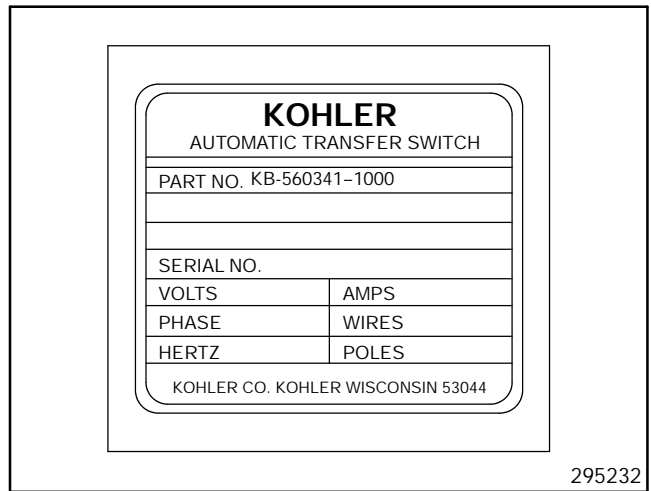


Figure 1-5. Transfer Switch Nameplate

Contactor Ratings*

Standard specifications		When used with current-limiting fuses]		Long-time withstand/closing ratings for use with any overcurrent protective device			
Switch rating		Number of poles	WCR 480-volt max.	Max. fuse size (amps.)	WCR 480-volt max.	WCR 600-volt max.	Time (cycles)
Amperes	Max. volts						
150	600	2, 3, 3 [	200,000	200	10,000	10,000	1.5
260	600	2, 3, 3 [	200,000	600	35,000	22,000	3.0
400	600	2, 3, 3 [	200,000	600	35,000	22,000	3.0
600	600	2, 3, 3 [	200,000	1,200	50,000	42,000	3.0
800	600	2, 3, 3 [	200,000	1,200	50,000	42,000	3.0
1000	600	3, 3 [	200,000	2,000	65,000	65,000	3.0
1200	600	3, 3 [	200,000	2,000	65,000	65,000	3.0
1600	600	3, 3 [	200,000	3,000	100,000	100,000	3.0
2000	600	3, 3 [	200,000	3,000	100,000	100,000	3.0
2500	600	3, 3 [	200,000	6,000	100,000	100,000	3.0
3000	600	3, 3 [	200,000	6,000	100,000	100,000	3.0
4000	600	3, 3 [	200,000	6,000	100,000	100,000	3.0

* Consult the Sales Engineering department of Kohler Co. Generator Division for more information on withstand current ratings for Kohler Automatic Transfer Switches. Current ratings listed reflect RMS symmetrical amperes at 480 VAC.

[3-pole with switched overlapping neutral contacts (4 pole).

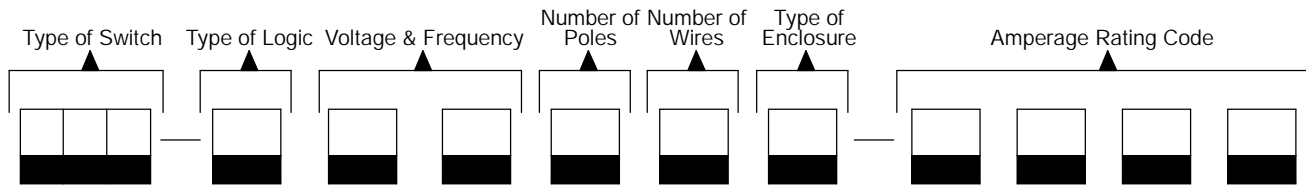
] Current-limiting fuses may be of Class J and L types, depending on amperage. For specific requirements and certified ratings consult the Sales Engineering department of Kohler Co. Generator Division.

Application Data

Sizes of AL/CU UL-listed solderless screw-type terminals for external power connections					
Switch Size (Amps)	Normal, Emergency, and Load Terminals		Switch Size (Amps)	Normal, Emergency, and Load Terminals	
	Cables per Pole	Range of Wire Sizes		Cables per Pole	Range of Wire Sizes
150	1	#8 to 3/0	600-800	3	#2 AWG to 600 MCM
260-400	2	#1/0 to 250 MCM	1000-1200	4	#2 AWG to 600 MCM
	1	#4 to 600 MCM	1600-4000	Bus Bar	

Interpreting a Transfer Switch Part Number

Record the transfer switch part number in the boxes below. The transfer switch part number defines characteristics and ratings explained in the accompanying chart.



Kohler Part Number Key

This chart explains the Kohler transfer switch part numbering system. The sample part number shown is for a KB-Series contactor with M340 logic rated at 600 volts, 60 hertz, 3-phase, 3-pole, and 4 wires in a NEMA 1 enclosure with an amperage rating of 1000 amperes.

SAMPLE PART NUMBER

KB-560341-1000

Type Of Transfer Switch

KB: Bypass Transfer Switch and Bypass Isolation Switch
Includes domestic packing. Add prefix PE for export packing.

Type Of Logic

- 1: Solid State
- 2: Relay
- 3: Manual Relay
- 4: Elevator Control Switch
- 5: Microprocessor

Voltage & Frequency Phase-to-Phase

240V AC Max.

Available in 30-100 ampere sizes only.

600V AC Max.

21: 110 Volt, 50 Hz	60: 600 Volt, 60 Hz	67: 190 Volt, 50 Hz
22: 120 Volt, 60 Hz	61: 110 Volt, 50 Hz	68: 208 Volt, 60 Hz
23: 220 Volt, 50 Hz	62: 120 Volt, 60 Hz	69: 440 Volt, 60 Hz
24: 240 Volt, 60 Hz	63: 220 Volt, 50 Hz	70: 400 Volt, 50 Hz
27: 190 Volt, 50 Hz	64: 240 Volt, 60 Hz	71: 380 Volt, 50 Hz
28: 208 Volt, 60 Hz	65: 550 Volt, 60 Hz	72: 380 Volt, 60 Hz
	66: 480 Volt, 60 Hz	73: 416 Volt, 50 Hz

Number of Poles

- 2: 2 pole, 1 phase
- 3: 3 pole, 3 phase
- 4: 3 pole, 1 phase
- 5: 3 pole, 3 phase with overlapping neutral contacts (4 pole)

Number of Wires

- 2: 2 wire
- 3: 3 wire
- 4: 4 wire

Type of Enclosure

- 0: Open
- 1: NEMA Type 1
- 2: NEMA Type 12
- 3: NEMA Type 3R
- 4: NEMA Type 1 CSA*
- 7: Open CSA*

Amperes

0150: 150 amperes	1200: 1200 amperes
0225: 225 amperes	1600: 1600 amperes
0260: 260 amperes	2000: 2000 amperes
0400: 400 amperes	2500: 2500 amperes
0600: 600 amperes	3000: 3000 amperes
0800: 800 amperes	4000: 4000 amperes
1000: 1000 amperes	

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Figure 1-6. Transfer Switch Model Description

SB-Series Specifications

The specifications listed below apply to the SB-Series contactor. See the respective logic controller manual for its specifications.

Standard Features

- D All models are UL-1008 listed and meet NEMA standard ICS 2-447.
- D Transfer switch is CSA certified up to and including 2000 amperes.
- D All models are 100% equipment rated and can be applied at the rated current, either open or enclosed, without derating.
- D Switches are rated for all classes of inductive and noninductive load.
- D Contactors offer high-speed transfer, 1/6 second or less, including relay operating time for all ampacities exclusive of time delays.
- D All switches meet the transient overvoltage impulse withstand test in accordance with the proposed NEMA Standard ICS 1-109 and voltage surge withstand capability in accordance with ANSI/IEEE C37.90-1978.
- D Contactors use a reliable single-coil solenoid operating mechanism.
- D Contactors are mechanically held and electrically operated.
- D Switches are suitable for emergency and standby applications without modification. Transfer switches meet rating requirements of Articles 700, 701, and 702 of the National Electrical Code and UL-1008 Table 23.2 for emergency systems.
- D Contactors use true double-throw, inherently interlocked construction.
- D NEMA Type 3R enclosures have gasketed doors plus all features of the NEMA type 1 enclosures and meet the above NEMA and UL standards.
- D Solid neutral bars are used on two-pole and three-pole switches. They are of the insulated/groundable type and use separate connectors for normal, emergency, and load power connections.
- D Contacts are readily accessible from the front for easy inspection.
- D Contactors have no possible neutral position.
- D All components are front accessible and front removable.

Section 2. Transfer Switch Operation

Description of Bypass/Isolation Switch Components

The following section describes the components on a bypass/isolation transfer switch. See Figures 2-1 through 2-3.

Isolation Handle. The isolation handle controls the three ATS positions: connected, test, or disconnected.

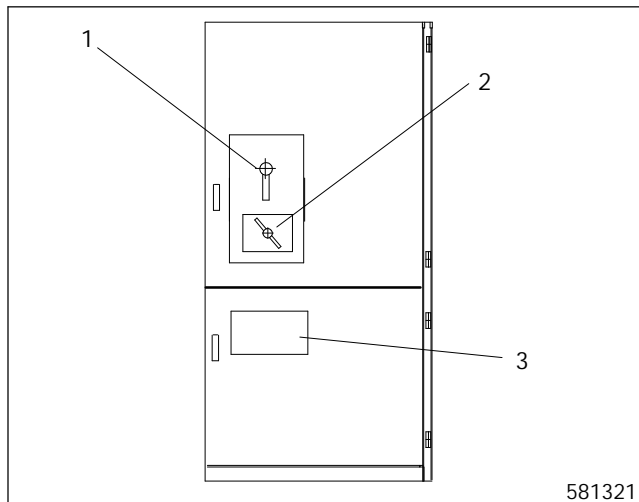
Bypass Handle. The bypass handle opens and closes the bypass contactors.

Bypass Handle, BYPASS Position. When the bypass handle is in the BYPASS position, the bypass contacts are closed on the same source as the ATS.

Bypass Handle, AUTOMATIC Position. When the bypass handle is in the AUTOMATIC position, the bypass contacts are isolated from the sources and load.

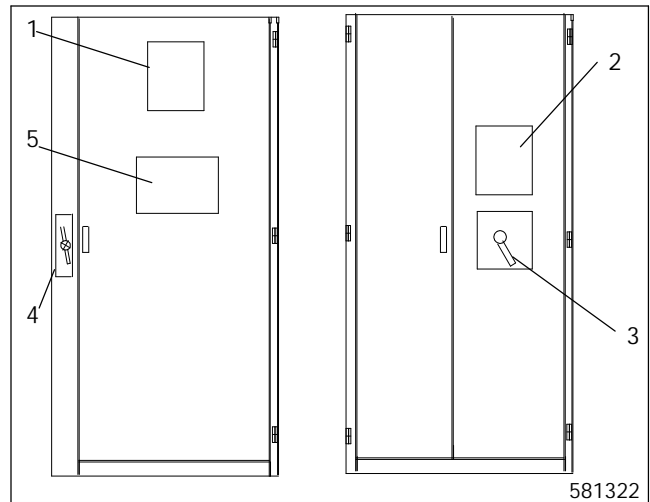
Status Panel. The status panel has lamps that display information on the availability of sources, position of the bypass and ATS contacts, and the physical position of the ATS. Refer to **Description of the Bypass/Isolation Status Panel Lamps** in this section for descriptions of each lamp.

Logic Controller. The logic controller controls the functions of the transfer switch. Refer to the logic controller operation manual for more information.



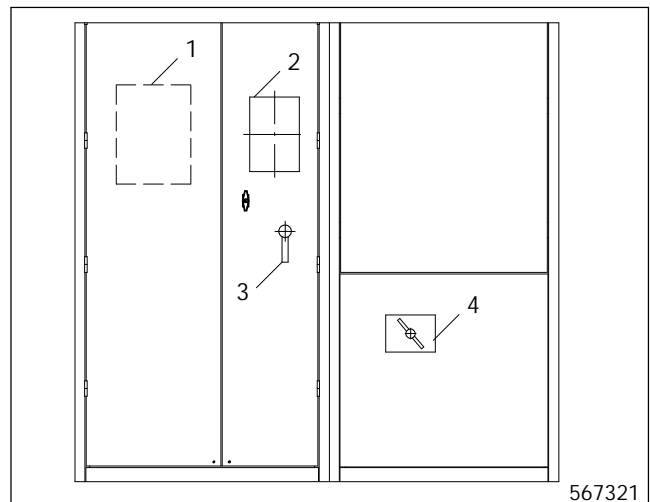
1. Isolation handle
2. Bypass handle
3. Logic panel

Figure 2-1. 150-800 Bypass/Isolation Components



1. Status panel front door
2. Status panel back door
3. Isolation handle
4. Bypass handle
5. Logic panel

Figure 2-2. 1000-1200 Bypass/Isolation Components



1. Logic panel
2. Status panel
3. Isolation handle
4. Bypass handle

Figure 2-3. 1600-4000 Bypass/Isolation Components

Description of the Bypass/Isolation Status Panel Lamps 1000-4000 Amp Only

The following section describes status panel lamps on 1000-4000 amp bypass/isolation transfer switches. See Figure 2-4.

Normal Available. Lamp illuminates to indicate the normal power source is available.

Emergency Available. Lamp illuminates to indicate the emergency power source is available.

Closed On Normal (Bypass Switch). Lamp illuminates to indicate the normal source bypass contacts are closed on the bus.

Closed On Emergency (Bypass Switch). Lamp illuminates to indicate the emergency source bypass contacts are closed on the bus.

Closed On Normal (ATS Switch). Lamp illuminates to indicate the normal source ATS contacts are closed on the bus.

Closed On Emergency (ATS Switch). Lamp illuminates to indicate the emergency source ATS contacts are closed on the bus.

ATS Position, TEST. Lamp illuminates to indicate the ATS is physically in the TEST position.

ATS Position, DISCONNECTED. Lamp illuminates to indicate the ATS is physically isolated from the switch.

ATS Position, CONNECTED. Lamp illuminates to indicate the ATS is physically attached to both the source and the load.

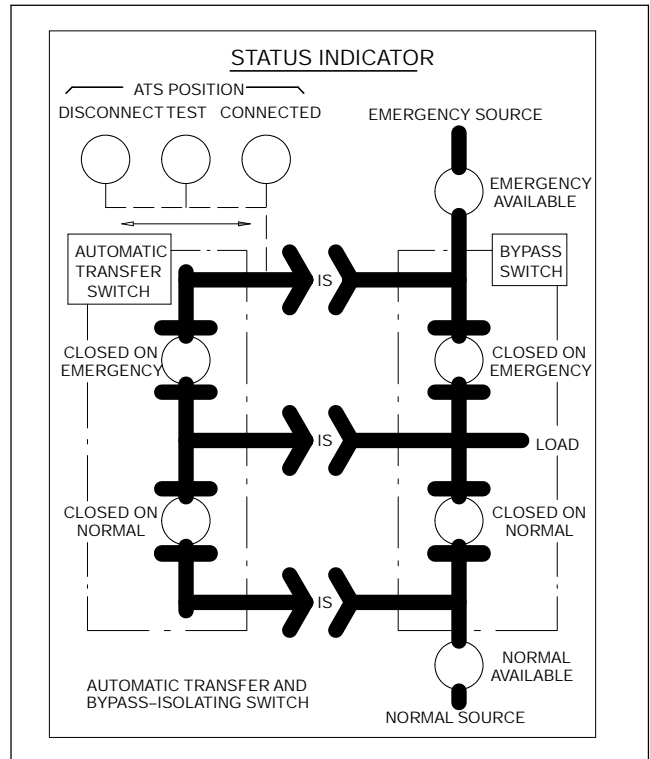


Figure 2-4. 1000-4000 Amp Bypass/Isolation Status Indicator

ATS Sequence of Operation

Operation of the typical automatic transfer switch is divided into two separate sequences: (1) failure of normal power and the resulting transfer to emergency power and (2) restoration of normal power and the resulting transfer back to normal power. See Figure 2-5. A brief description of both sequences follows. Note that accessories described in Section 4, Accessories may affect these sequences.

D Failure of Normal Power is either loss or deterioration of one or more phases. The monitor that detects the failure starts a time delay, called Time Delay Engine Start (TDES). If power restores before the time delay expires, the timer resets. But if the failure persists and the time delay expires, the controller issues a signal to start the standby (emergency) power generator. This time delay scheme prevents unnecessary starting of the generator during short power interruptions.

A second set of controller monitors checks the status of the emergency power. When the voltage and frequency of the emergency (generator) power are acceptable, these monitors start a timing cycle called Time Delay Normal to Emergency (TDNE) which allows the generator outputs to stabilize. At the end of this timing cycle the controller issues a signal to the transfer switch operators to remove normal power and then connect emergency power to the load.

Once the ATS switches, the transfer switch mechanically latches in the emergency position, supplying power to the load from the emergency source until normal power restores.

D Restoration of Normal Power automatically begins a sequence that transfers the load back to the normal power source. The controller monitors continue to check the status of the normal power, even when the load is operating from emergency power. When these monitors detect stable normal power, a time delay called Time Delay Emergency

to Normal (TDEN) starts. If the normal power fails again before the time delay expires, the time delay resets. This timing period ensures that the normal power stabilizes before it reconnects to the load.

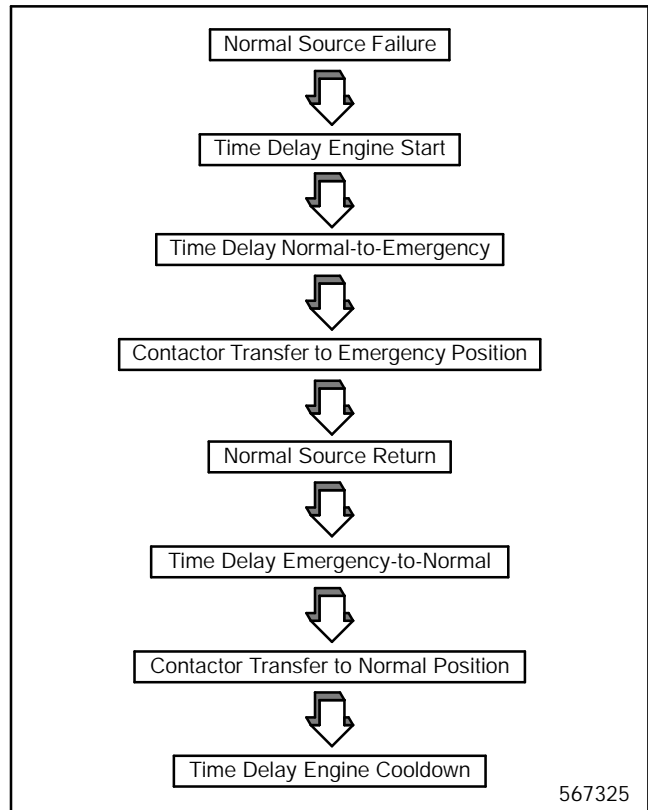


Figure 2-5. Logic Board Operation

If the normal power remains acceptable and the time delay expires, the controller will issue signals to the transfer switch to remove emergency power and reconnect normal normal power to the load. After switching, the transfer switch mechanically latches in the NORMAL position. The controller starts a timer called Time Delay Engine Cooldown (TDEC) simultaneously with the power transfer. After this time delay expires, the generator engine stops.

Operation of the Bypass/Isolation Switch

The following procedures explain how to bypass closed ATS contacts. ATS testing or isolation requires bypassing the ATS to the manual source. See Figure 2-6 for a line diagram of the bypass/isolation switch in the BYPASS position.

To Bypass the ATS to the Normal Source

1. Place the bypass switch in the AUTOMATIC position and the isolation handle in the CONNECTED position. The connected lamp illuminates.
2. Verify that the normal source is supplying power to the load by observing the illuminated closed-on-emergency (ATS) lamp on the status indicator panel.
3. For load transfer procedure refer to the following:
 - a. For 150-800 Amp ATS:

Turn the bypass handle clockwise to the NORMAL position.
 - b. For 1000-4000 Amp ATS:

Push in the bypass handle and turn it counterclockwise to the BYPASS position. The closed-on-normal (bypass) lamp illuminates.

To Bypass the ATS to the Emergency Source

1. Place the bypass switch in the AUTOMATIC position and the isolation handle in the CONNECTED position. The connected lamp illuminates.
2. Verify that the emergency source is supplying power to the load by observing the illuminated closed-on-normal (ATS) lamp on the status indicator panel.
3. For load transfer procedure refer to the following:

- a. For 150-800 Amp ATS:

Turn the bypass handle counterclockwise to the EMERGENCY position.
- b. For 1000-4000 Amp ATS:

Pull out the bypass handle and turn it counterclockwise to the BYPASS position. The closed-on-emergency (bypass) lamp illuminates.

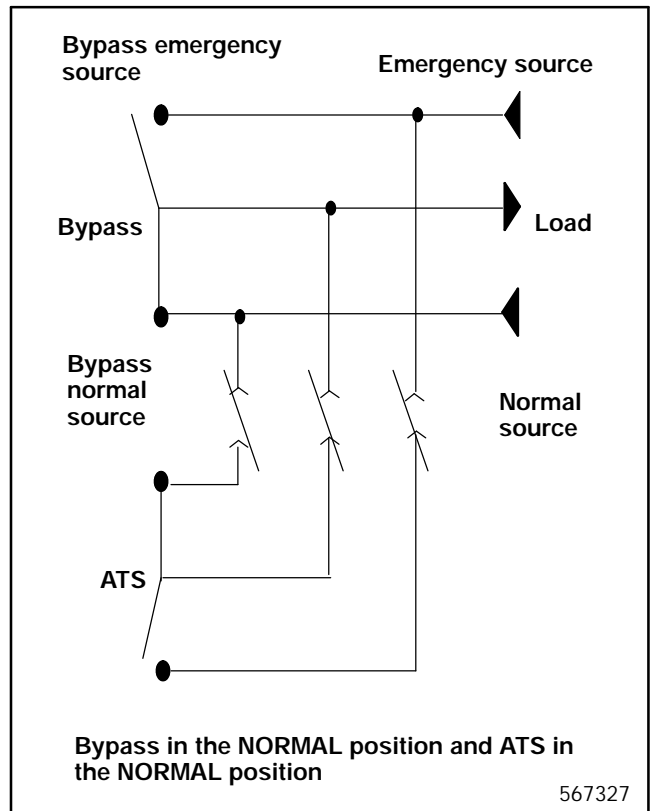


Figure 2-6. ATS/BIS in the BYPASS Position

To Test the ATS

This procedure explains how to place the ATS in the TEST position. See Figure 2-7 for a line diagram of the bypass/isolation switch in the TEST position.

To bypass the ATS, refer to **To Bypass the ATS to the Normal Source** or **To Bypass the ATS to the Emergency Source** previously in this section, depending on which source is supplying power to the load.

150-400 Amp ATS

Rotate the isolation handle counterclockwise to the TEST position.

600-800 Amp ATS

Push in the isolation handle and rotate it clockwise to the TEST position.

1000-1200 Amp ATS

Rotate the isolation handle counterclockwise to the TEST position.

1600-4000 Amp ATS

1. Open the right cabinet door and remove the isolation handle stored on the right side of the carriage frame. Close the cabinet door and insert the handle through the door into the isolation shaft.
2. Rotate the isolation handle counterclockwise until the test lamp illuminates (approximately 6 or 7 turns).

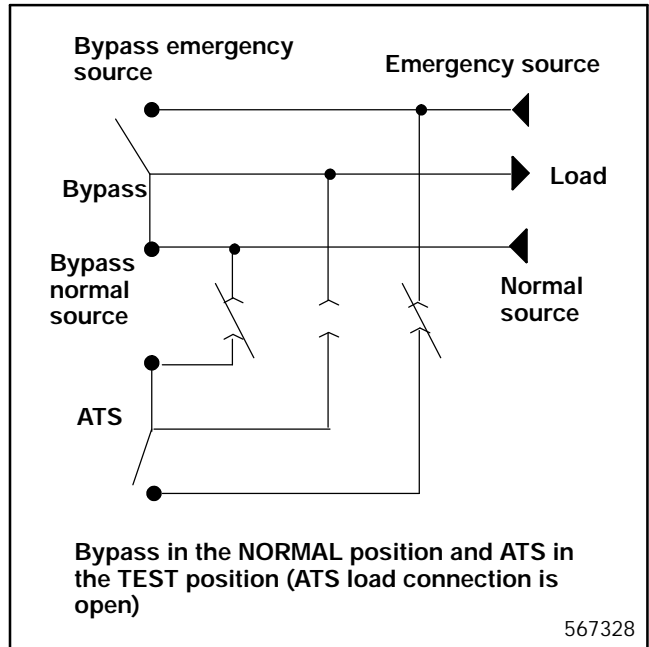


Figure 2-7. ATS/BIS in the TEST Position

To Isolate the ATS

This procedure explains how to isolate the ATS. Isolate the ATS before performing any service work. Refer to Figure 2-8 for line diagram of the bypass/isolation switch in the ISOLATE position.

To bypass the ATS, refer to **To Bypass the ATS to the Normal Source** or **To Bypass the ATS to the Emergency Source** previously in this section depending on which source is supplying power to the load.

150-400 Amp ATS

Pull out the isolation handle and rotate it counterclockwise to the OPEN position.

600-800 Amp ATS

Push in the isolation handle and rotate it clockwise to the OPEN position.

1000-1200 Amp ATS

Rotate the isolation handle counterclockwise to the ISOLATE position.

1600-4000 Amp ATS

1. Open the right cabinet door and remove the isolation handle stored on the right side of the carriage frame. Close the cabinet door and insert the handle through the door into the isolation shaft.
2. Rotate the isolation handle counterclockwise until the test lamp illuminates (approximately 6 or 7 turns).

3. Continue to rotate the isolation handle counterclockwise until the handle stops (approximately 10 or 11 turns). The disconnected lamp will illuminate and the test lamp will turn off.
4. Remove the isolation handle and store it inside the enclosure on the right side of the carriage frame.

The transfer switch can now be removed for inspection and maintenance.

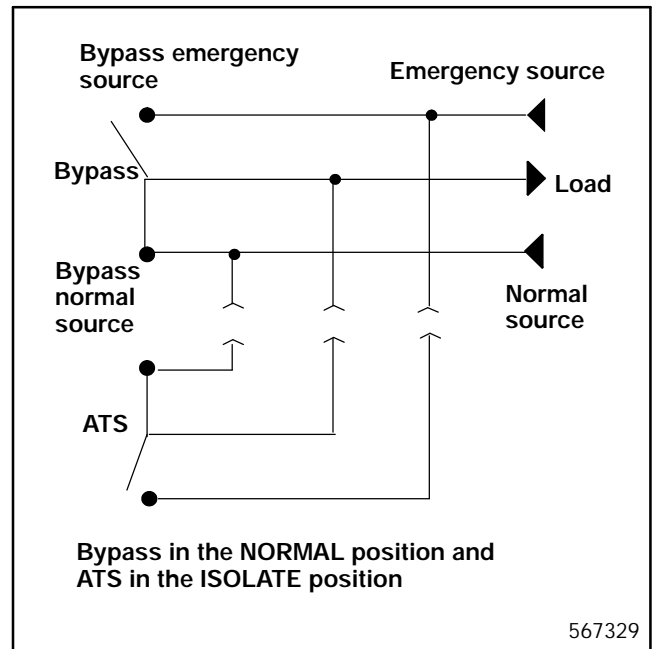


Figure 2-8. ATS/BIS in the ISOLATE Position

Electric Operation Test

Use the following procedure to check the electrical operation of the automatic transfer switch without interrupting the load.

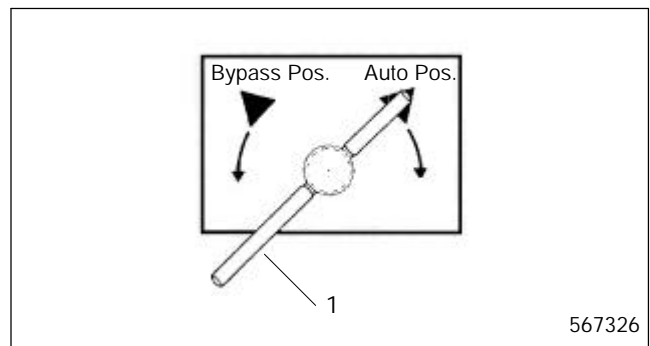
1. Confirm that the ATS is in the TEST position and bypassed.
2. Confirm that the engine start control is in the AUTOMATIC position.
3. Place the test switch in the TEST position until the engine starts and runs.
4. The ATS will transfer to the emergency position after the time delay normal-to-emergency timer completes. The ATS closed-on-emergency lamp illuminates. If using Time Delay Normal to Emergency (TDNE), the transfer occurs after the time delay.
5. The ATS retransfers to the normal source after the Time Delay Emergency to Normal (TDEN) completes timing.

Bypass/Isolation Switch Operation Notes

The following notes apply to all bypass/isolation switches.

1. When the ATS is in the TEST or ISOLATE position the bypass switch acts as a manual transfer switch.
2. The ATS will not operate if any of the following is true:
 - a. The harness plugs are disconnected.
 - b. The ATS is not in the AUTOMATIC or TEST positions.
 - c. The ATS is in the AUTOMATIC position and the bypass switch is not open.
3. If the bypass handle, see Figure 2-9, will not turn:
 - a. Verify that either the normal source available or the emergency source available lamp is illuminated.

- b. Verify that the ATS is closed on the same source as the one to be bypassed.





1. Bypass handle

Figure 2-9. Bypass Handle 1600-4000 Amp

Preventive Maintenance

Reasonable care and preventive maintenance will ensure high reliability and long life of the switch.

	DANGER
	
Hazardous voltage. Will cause severe injury or death.	
Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.	

Clean and inspect the switch once a year. Deenergize all sources, then brush and vacuum away any dust accumulation. Remove the ATS barriers and check the condition of the contacts. Replace the contacts when they are pitted or worn. Reinstall the barriers carefully.

The transfer switch is lubricated and no further lubricating is required under normal operating conditions. Renew factory lubrication if the switch is subjected to severe dust or abnormal operating conditions. Relubricate the operator during TS coil replacement.

Exercise the generator under load. To test the generator set with load perform the Electric Operation Test procedure located previously in the section. Service to the load is not interrupted during this test.

Manual Load Transfer

If the ATS is out of service, use the procedure following to manually transfer the load to the opposite source. Manual load transfer causes a brief (under 5 seconds) interruption to the load.

1. Bypass and isolate the ATS as described earlier in this section.
2. Check that both normal available and emergency available lamps are illuminated. Start the generator set if necessary.
3. To transfer the load perform the following steps.
 - a. For 150-800 Amp ATS:
 - (1) Turn the bypass handle to the AUTO position.
 - (2) Turn the bypass handle to the BYPASS position (select opposite source). To select the emergency source turn the bypass handle counterclockwise. To select the normal source turn the bypass handle clockwise.
 - b. For 1000-4000 Amp ATS:
 - (1) Turn the bypass handle clockwise to the AUTOMATIC position.
 - (2) Pull out or push in the bypass handle. If the switch is in the EMERGENCY position, pull the handle out. If the switch is in the NORMAL position push the handle in. Turn the bypass handle counterclockwise to the BYPASS position (select opposite source).

Disconnecting the Control Panel

The harness disconnect plug P1 is furnished for repair purposes only. Do not unplug it. If it is necessary to disconnect the control panel for removal or testing, perform the following steps:

1. Bypass and isolate the ATS by following the steps earlier in section 2.
2. Open the cabinet doors.
3. Separate the quick-disconnect plug by squeezing the latches. Do not pull on the harness wires.

Reconnecting the Plug

To reconnect the P1 plug and restore power to the control panel. Perform the following steps.

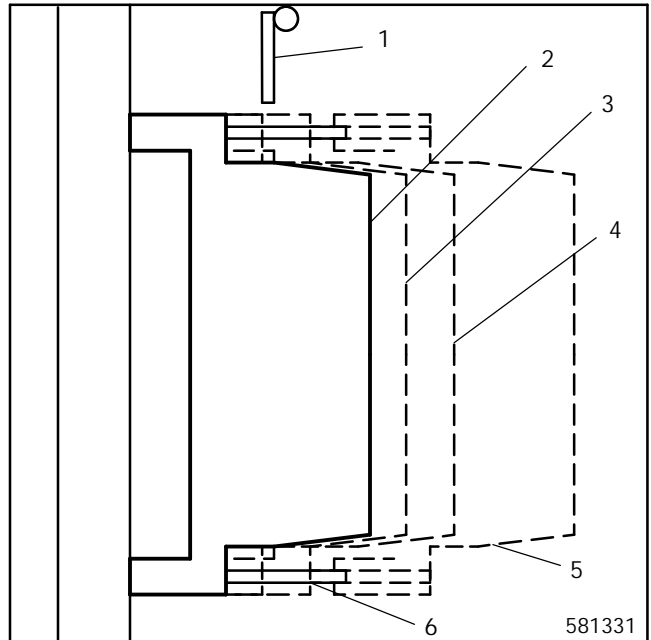
1. The harness plug and socket in the control panel are keyed. Carefully align the P1 plug with the J1 socket (in the control panel) and press it straight in until both latches click.
2. Close the cabinet doors.

Section 3. Removal and Reconnection of the ATS

To Remove the ATS

The following procedure explains removal of the transfer switch.

1. Bypass and isolate the ATS by following the **To Isolate the ATS** procedure in Section 2. Be sure that the ATS position disconnected lamp is illuminated.
2. Open the cabinet door (lower door on 600-800 amp switches).
3. Separate the in-line disconnect plugs by squeezing the plugs. Do not pull on the harness wires. Label, tape and disconnect wires from the controller to auxiliary contacts.
4. To remove the transfer switch perform the following:
 - a. For 150-400 amp switches:
 - (1) Lift the panel latch (upper left of ATS panel).
 - (2) Pull the transfer switch straight out on the guide rods. The transfer switch weighs about 30 pounds (15 kg). See Figure 3-1.



1. Lift latch
2. CLOSED position
3. TEST position
4. OPEN position
5. REMOVED position
6. Guide rod

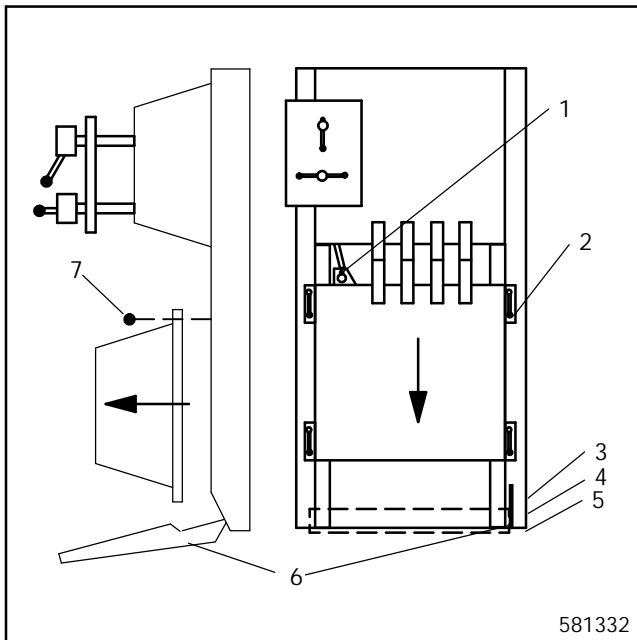
Figure 3-1. 150-400 Amp Transfer Switches

b. For 600-800 amp switches:

- (1) Pull out the disconnect pin to release linkage to isolation handle.
- (2) Remove safety retaining nut from upper right mounting bushing.
- (3) Push down spring-loaded balancing handle (right side of ATS) until bushings are at top of key slots.
- (4) Grasp back panel of transfer switch and pull it straight out. To protect barriers, do not lift at any other points.
- (5) Lift transfer switch out of cabinet. Transfer switch weighs about 100 pounds (50 kg). See Figure 3-2.

c. For 1000-4000 amp switches

- (1) Remove the isolation handle.
- (2) Open the ATS cabinet door all the way and remove the bottom enclosure pan.
- (3) Disconnect multipin plugs J2 and J5.
- (4) Roll the ATS out of the cabinet on its built-in cart.



1. Pin
2. Nut
3. CLOSED position
4. TEST position
5. OPEN position
6. Balancing handle
7. Safety nut

Figure 3-2. 600-800 Amp Transfer Switches

To Reconnect the ATS

Use the following procedure to install the ATS after inspection and maintenance.

1. Open the cabinet door (lower door on 600-800 amp switches).

Caution

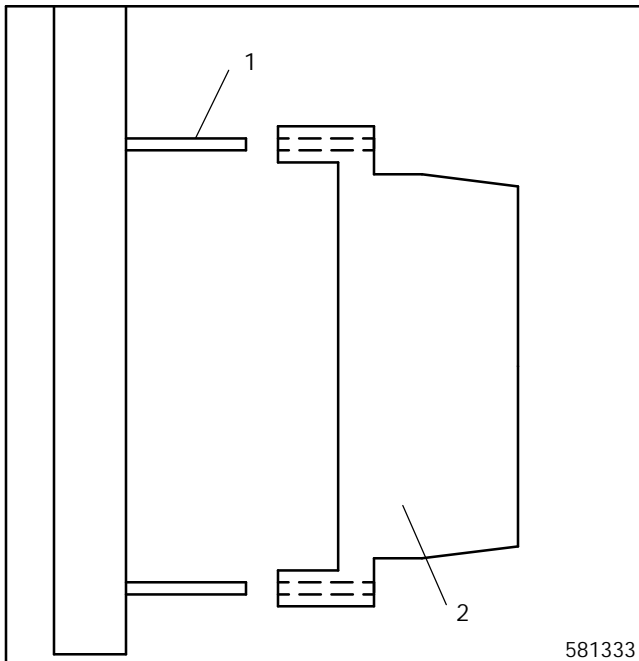
Ensure all arc chutes and pole covers are in place on the transfer switch. Check that the transfer switch normal contacts are closed (use the manual operator handle provided to manually transfer the switch).

Be sure to install the correct transfer switch into the enclosure. If more than one is supplied, each will be labelled.

2. To install the transfer switch perform the following:

- a. For 150-400 amp switches:

- (1) Align the transfer switch on the guide rods.
- (2) Push the transfer switch in until it stops. See Figure 3-3.

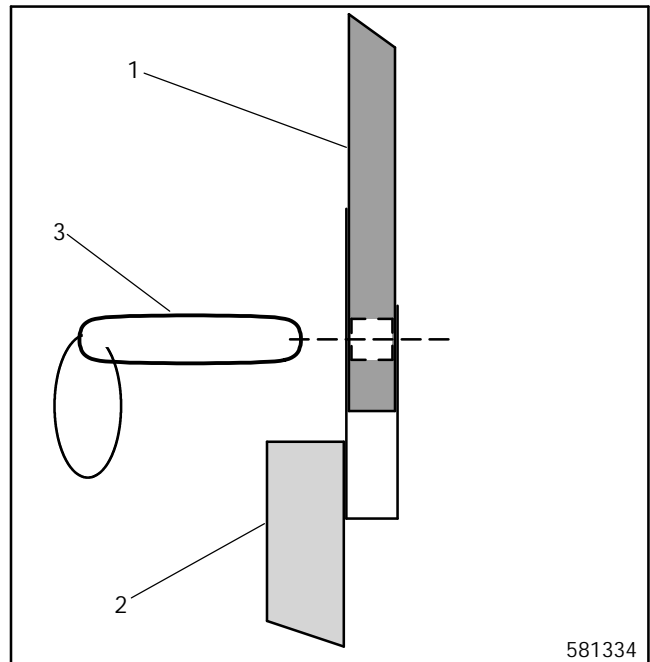


1. Guide rod
2. Transfer switch

Figure 3-3. Guide Rods, 150-400 Amp

- b. For 600-800 amp switches:

- (1) Grasp the back panel of the transfer switch and lift it onto two support brackets extending out from the mounting channels.
- (2) Press the balancing handle down (right side of ATS) until the slots accept the mounting bushings. Push the panel flat against rails and secure it by lifting up the balancing handle.
- (3) Install the safety retaining nut (upper right corner).
- (4) Position linkage from isolation handle to the U bracket on the transfer switch (use balancing handle to line up linkage).
- (5) Insert the quick-disconnect pin and press ring flush. See Figure 3-4.



1. Linkage
2. Transfer switch panel
3. Pin

Figure 3-4. Reconnecting Linkage 600-800 Amp

c. For 1000-4000 amp switches:

- (1) Open the ATS cabinet door all the way. Remove the bottom louvered enclosure pan (if not already removed).

NOTE

Clean debris from the enclosure tracks and floor. All arc chutes and inphase barriers must be in place on the ATS.

- (2) Verify that the ATS contacts are in the NORMAL position.

- (3) Roll the ATS cart into the cabinet (isolation contacts facing inward). Align the rollers between the floor guides and push the carriage in until the crank pins engage the latch plates on both sides.

- (4) Reconnect the multipin harness plugs (J2 and J5).

- (5) Close the cabinet door and install the bottom enclosure pan.

3. Refer to the **To place the ATS in the Automatic Mode** procedure in Section 2 to return the ATS to its normal state of operation.

Section 4. Accessories

NOTE

Refer to the logic controller operation manual for details on all accessories.

Notes

Section 5. Installation

Kohler ships automatic transfer switches factory wired and tested, ready for installation. The actual installation process consists of mechanically mounting and

electrically wiring the unit to the normal and emergency power sources and load circuits.

Upon Receipt of Unit

Unpacking

Unpack the ATS and loose parts immediately after receipt and inspect for shipping damage. Failure to perform an immediate inspection impedes recovery of losses caused by shipping damage not evident upon receipt. Use care when unpacking to avoid damaging any of the ATS components. Check that no loose parts are missing or left in the packing material. Remove all

dirt and packing material that may have accumulated in the ATS or any of its components.


Allow equipment to warm up to room temperature for 24 hours (minimum) prior to unpacking to prevent condensation on the electrical apparatus from surrounding moist air.

Inspection

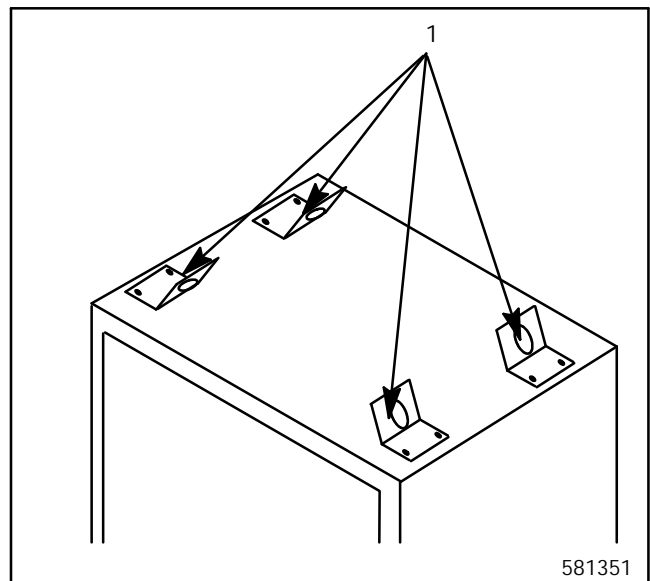
At time of delivery inspect the ATS and all loose parts for signs of shipping damage. If damage and/or rough handling is evident, file a damage claim immediately

with the transportation company and promptly notify the distributor/dealer.

Lifting

⚠ WARNING

<p>Unbalanced weight. Improper lift can cause severe injury, death, or equipment damage.</p> <p>Use adequate lifting capacity. Never leave automatic transfer switch standing upright unless it is securely bolted in place.</p>

Attach the bar only to the enclosure's mounting holes or lifting brackets: do not lift the unit at any other points. See Figure 5-1. Refer to Figure 5-2 for the approximate weight of each automatic transfer switch covered by this manual. Ensure the front door is in place and latched closed when moving or mounting the unit.



1. Lifting points

Figure 5-1. Lifting Points

Specifications		Nominal Weight Lbs. (kg) NEMA Type 1 Enclosed
Amperes	Poles	
150	2	656 (297)
150	3	669 (303)
150	3*	692 (313)
225-260	2	659 (298)
225-260	3	673 (305)
225-260	3*	697 (316)
400	2	673 (305)
400	3	693 (314)
400	3*	713 (323)
600	2	811 (368)
600	3	831 (377)
600	3*	856 (388)
800	2	826 (375)
800	3	841 (382)
800	3*	881 (400)
1000	3	1638 (743)
1000	3*	1728 (784)
1200	3	1728 (784)
1200	3*	1768 (802)
1600	3	4802 (2178)
1600	3*	5002 (2269)
2000	3	4802 (2179)
2000	3*	5002 (2269)
2500	3	6366 (2888)
2500	3*	6766 (3069)
3000	3	6366 (2888)
3000	3*	6766 (3069)
4000	3	7768 (3526)
4000	3*	8368 (3796)

* 3-pole with overlapping neutral contacts.

Figure 5-2. Transfer Switch Weight

Storage

Protect the automatic transfer switch at all times from excessive moisture, construction grit, and metal chips.

Avoid storage in low-temperature, high-humidity areas where moisture could condense on the unit.

Mechanical Installation

Select the mounting site to match local electrical code restrictions for the enclosure type. Mount the automatic transfer switch as near the load and power sources as

possible. Also be sure to allow adequate space for switch service and full opening of the enclosure door.

Remove the Transfer Switch, 1000-4000 Amp Switches

The transfer switch is shipped inside the ATS enclosure in the fully engaged position (connected).

Before installing the enclosure, remove the ATS by completing the following steps:

1. Open the enclosure door and install the two ramps stored on the right side of the enclosure.
2. Remove the isolation handle which is stored on the lower right front of the ATS carriage frame.

3. Position the isolation handle on the protruding isolation shaft and turn it counterclockwise (approximately 10 turns) until it stops.
4. Unplug J2 and J5 harness plugs.
5. Roll the ATS out of the cabinet.
6. Cover the ATS to keep it clean and free of moisture.

ATS Supporting Foundation

It is very important to verify that the supporting foundation and adjacent area are level and straight. Verify that the structure of the enclosure is straight and square. Allow at least 36 inches for the ATS to roll out (1000-4000 amp).



If using bottom cable entry, verify that the conduit stubs are located according to specifications. Provide cable bending space and clearance to live parts. When pouring concrete floor, use interlocking conduit spacer caps, wood template, or a metal template to maintain conduit alignment.

Electrical Connections

All internal electrical connections are prewired. The only wiring necessary to install the transfer switch is the wiring that connects the transfer switch to the external devices.

NOTE

For easy access during installation wiring, remove the front door and sides of the enclosure. Simply disconnect the cable plug that connects the front door components to the internal components and then lift the door off its hinge pins or unbolt the side covers.

 DANGER

Hazardous voltage. Will cause severe injury or death.
Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

Testing Power Cable

Test the power cables before connecting them to the transfer switch. Installing power cables in conduit, cable troughs, and ceiling-suspended hangers often requires considerable force. The pulling of cables can damage

insulation and stretch or break the conductor's strands. Test the cables after installation and before final connection to verify that no damage or defects exist in the cables.

Connecting Power Cables

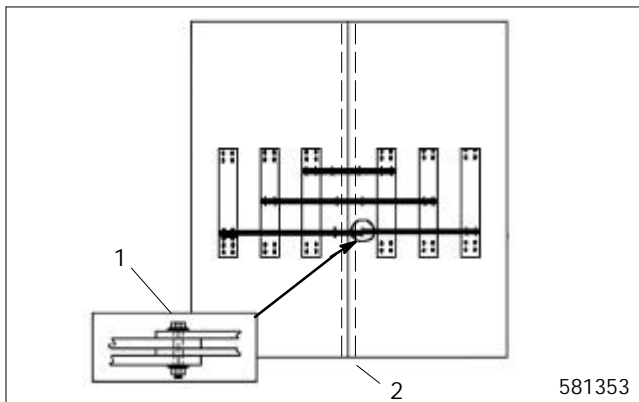
After testing the power cables, connect them to the appropriate terminal lugs on the bypass switch. Make sure the lugs provided are suitable for use with the cables being installed. Standard terminal lugs are solderless screw type. Be careful when stripping

insulation from the cables; avoid nicking or ringing the conductor. Clean cables with a wire brush to remove surface oxides. Apply joint compound to conductor of aluminum cable. Tighten the cable lugs to the torque specified on the rating label.

Bus Connections

Use grade 5 hardware to connect bus tie plates at shipping split and terminal plates on the bypass switch (If not using lugs). Refer to Figure 5-3. Wipe off the bus surfaces before joining. If the bus is dirty, gently clean the surface with a nonflammable solvent. Avoid touching the cleaned surfaces with hands.

Use grade 5 hardware with 1 in. flatwashers and 1 in. heavy duty belleville washers on each side. Tighten the bolted joints to the torque specified in Figure 5-4.



1. Grade 5 hardware
2. Shipping split

Figure 5-3. Bus Bar Connections

Bolt Diameter in Inches	Torque	
	Ft. lbs	Nm
5/16	12	16.3
3/8	20	27.1
1/2	50	68.8
5/8	95	128.9
3/4	155	210.3

Figure 5-4. Tightening Torque for Bolt Joints on Bus Bar

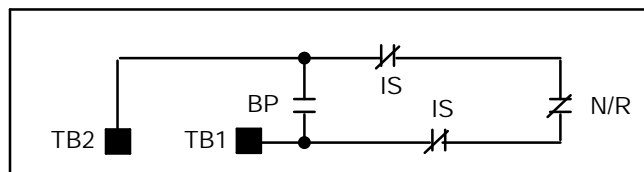
Harnesses

The factory makes all internal connections. An interconnecting wiring harness joins the bypass switch, transfer switch, and control panel. Align the appropriate plug halves of P1 and push them together until the latches click.

Note any optional accessories that are furnished on this switch. Refer to Section 4, Accessories for additional information and wiring diagrams.

Engine Starting Contacts

The engine control contacts are located on the bypass-isolation switch. Connect the generator set conductors for the start signal to terminals TB1 and TB-2. See Figure 5-5.



**Figure 5-5. Engine-starting contacts
(Shown deenergized)**

When making normal, emergency, and load connections to a rear connected bus bar, use a compression washer, flat washer, and a minimum grade 5 bolt, and torque to the values in Figure 5-4.

Installing the Transfer Switch, 1000-1600 Amp Switches

After installing the enclosure and connecting power cables or bus to the bypass switch, roll in the ATS carriage. Clean the floor of the cabinet. If necessary, use a vacuum cleaner. Do not leave any tools inside the ATS.

NOTE

Do not yet apply electrical power to the transfer switch.

1. Place the bypass handle in the BYPASS position and bypass to the normal source.
2. Verify that the isolation handle is fully counterclockwise against the stop.

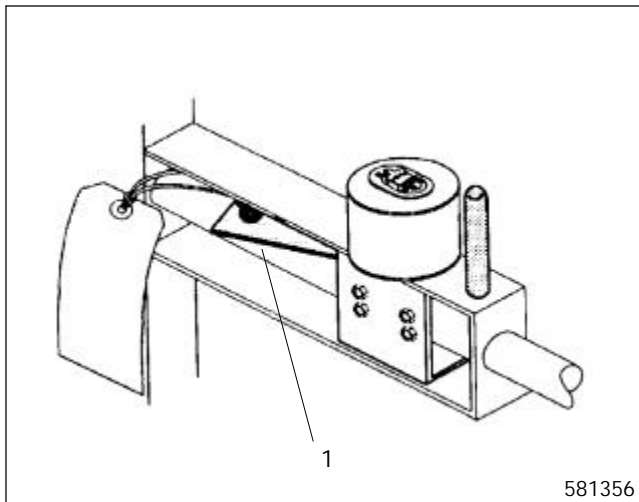
3. Close the ATS normal source contacts using the manual operator handle. (Maintenance handle is stored on the lower carriage.)
4. Check that all arc chutes and interphase barriers are in place on the ATS and bypass switches.
5. Grasp the ATS carriage frame and roll it into the cabinet, isolation contacts facing inward.
6. Align the ATS carriage rollers between the floor guides and push the carriage in until the crank pins engage the latch plates on both sides of the ATS carriage.

Nonpowered Inspections, 1000-4000 Amp Switches

Perform the following inspections before applying electrical power to the transfer switch to verify that the isolation contacts align. If necessary, add shims under the floor of the enclosure to adjust the alignment.

NOTE

The solenoid SL1 locks the isolation shaft to inhibit the operation of the drawout (isolation contacts) unless the ATS and the bypass/isolation switches are closed on the same source. The factory installs an interference tag to defeat the function of the solenoid during the following inspections. See Figure 5-6.



1. Interface tag

Figure 5-6. Interface Tag

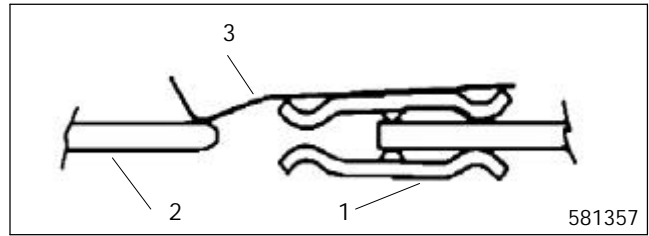
Inspection 1

Move the ATS from the DISCONNECTED position to the TEST position

NOTE

Do not force the isolation handle. Verify that the sensing leads on the isolation contacts do not hit the stabs heads but instead slide on them.

1. Turn the isolation handle clockwise approximately 7 or 8 turns.
2. Observe that the ATS is pulled inward and the sensing leads' contacts make contact with the stabs as shown in Figure 5-7.



1. Contact fingers
2. Stab
3. Sensing lead

Figure 5-7. Isolation Contact Alignment

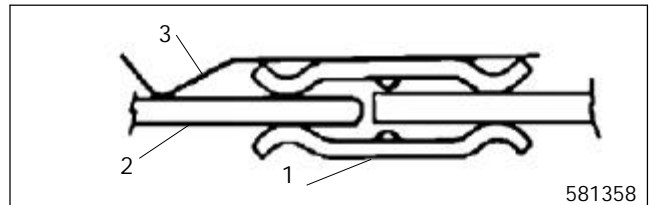
Inspection 2

Move the ATS from the TEST position to the CONNECTED position

NOTE

Do not force the isolation handle. Verify that the isolation contact fingers do not hit the stabs heads but slide on both sides when the ATS is in the CONNECTED position.

1. Turn the isolation handle clockwise until it stops (approximately 6 to 7 turns). Remove the interference tag from the solenoid latch.
2. Observe that the ATS is pulled inward and the isolation contact fingers make contact with the stabs as shown in Figure 5-8. Check that the bypass switch's switched neutral contacts have opened.



1. Contact fingers
2. Stab
3. Sensing lead

Figure 5-8. Isolation Contact Alignment

Inspection 3

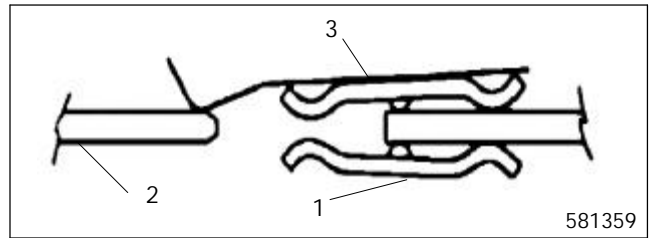
Move the ATS from the CONNECTED position to the TEST position

NOTE

Do not force the isolation handle. Verify that the isolation contact fingers disconnect from the stab when the ATS is in the TEST position. The sensing leads on the isolation contacts must touch the stab.

1. Turn the isolation handle counterclockwise until the isolation contact fingers separate (approximately 6 to 7 turns).
2. Observe that the ATS is pushed outward and the isolation contact fingers are disconnected from the

stabs. The sensing leads on the isolation contacts must touch the stabs as shown in Figure 5-9.



1. Contact fingers
2. Stab
3. Sensing lead

Figure 5-9. Isolation Contact Alignment

Functional Tests

The functional test consists of three checks: voltage, manual operation, and electrical operation.

NOTE

Perform these checks in the order given to avoid damaging the switch.

Read and understand all instructions on installation drawings and labels affixed to the switch. Note any optional accessories that have been furnished with the switch and review their operation.

If the handles are not in the correct position, follow the instructions for bypassing and isolating the ATS in Section 2. Do not force handles while performing tests. Electrical interlocks prevent a wrong sequence of operation.

Perform the following voltage check and manual operation test before attempting to electrically test the ATS. The purpose of these tests is to verify that all switches operate smoothly and that there is no damage from shipping or installation.

Voltage Checks

Perform the following voltage checks:

1. Check nameplate for rated voltage. The transfer switch rated line voltage should be the normal and emergency line voltage. Place the transfer switch in the NORMAL position before proceeding.
2. Close the normal source circuit breaker. Verify that the following lamps on the indicator panel are illuminated: normal source available, closed on normal (ATS), closed on normal (BIS), and test.
3. Use an accurate voltmeter to check phase-to-phase and phase-to-neutral voltages present at the bypass switch normal source terminals.
4. Close the emergency source circuit breaker.
5. Manually start the generator at the set using the engine control switch on the generator set

controller. Verify that the emergency available lamp illuminates on the status indicator panel.

6. Use an accurate voltmeter to check for phase-to-phase and phase-to-neutral voltages and phase rotation at the bypass switch emergency-source terminals.
7. If necessary, adjust the generator voltage regulator following the generator set manufacturer's instructions. The automatic transfer switch responds only to rated voltage and frequency specified on the nameplate. Verify that phase rotation is the same as the normal source.
8. Use the generator engine control switch to shut down the generator set.

Manual Operation Check

Use this procedure to check the manual operation of the bypass switch and ATS. Observe the lamps on the status indicator panel. The closed-on-normal (bypass) and test lamps should be illuminated.

For 150-800 Amp switches:

1. Turn the isolation handle to the OPEN position. The ATS is now in the disconnected position.
2. A detachable manual operator handle is provided on the transfer switch for maintenance purposes only. Install the manual handle shown in Figures 5-10 and 5-11.

NOTE

Do not manually operate the transfer switch unless the isolation handle is in the OPEN position and the disconnected lamp is on.

3. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the NORMAL position. Remove the manual operator handle and store it on the transfer switch in the place provided.
4. On 150-400 amp switches swing the shaft cover over the shaft.

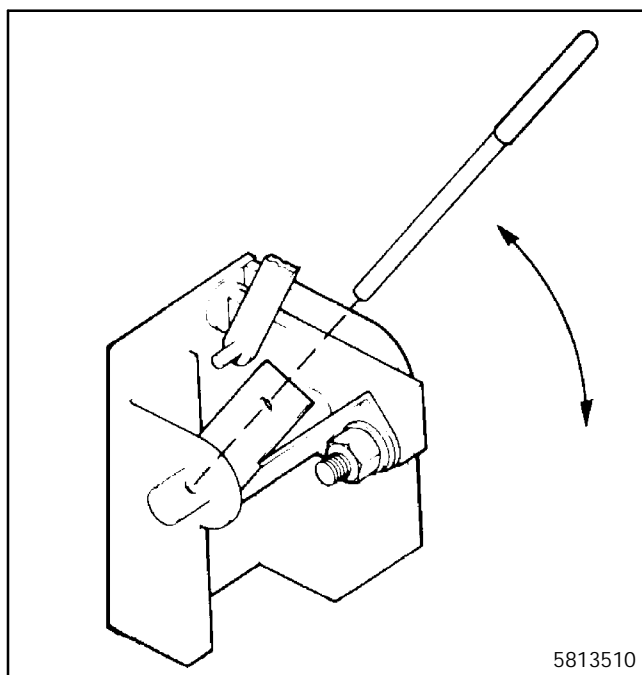


Figure 5-10. Operating Handle 150-400 Amp

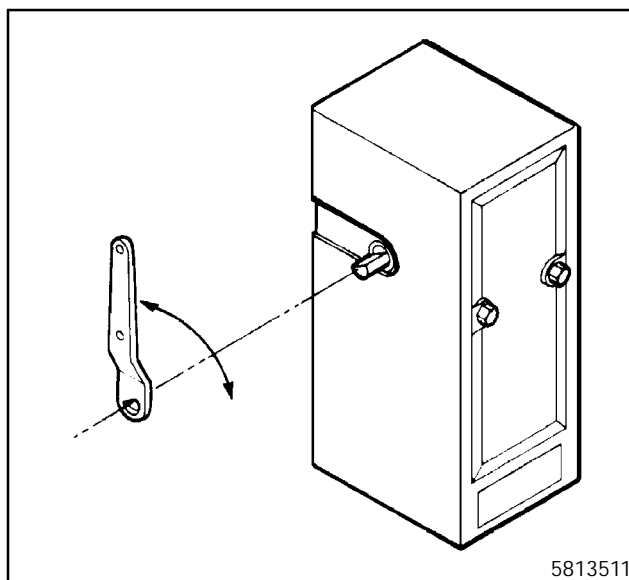


Figure 5-11. Operating Lever 600-800 Amp

For 1000-4000 Amp switches

1. Isolate the ATS: Install the isolation handle and turn it counterclockwise until it stops (approximately 7 or 8 turns). The ATS is now in the disconnected position. The disconnected lamp should be illuminated.

NOTE

A detachable manual operator handle is provided on the transfer switch for maintenance purposes only.

NOTE

Do not manually operate the transfer switch unless the isolation handle is in the OPEN position and the disconnected lamp is on.

2. Insert the manual handle into the hole in the rotating weight as shown in Figure 5-12. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the NORMAL position. Remove the manual operator handle and store it on the transfer switch in the place provided.

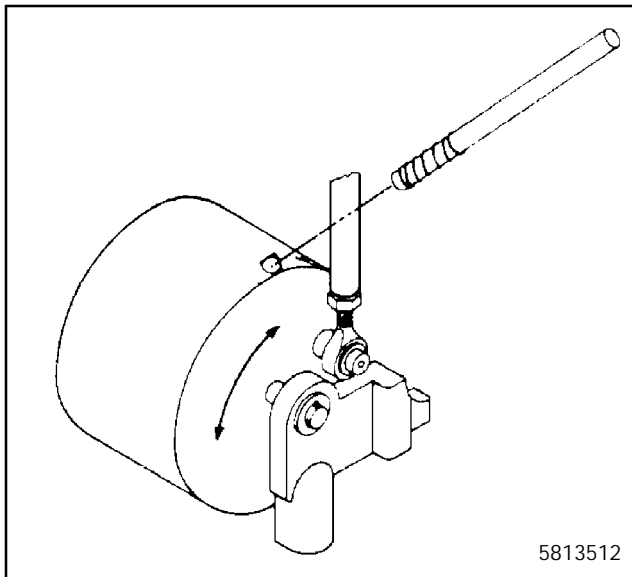


Figure 5-12. Operating Lever 1000-4000 Amp

Electrical Operation Test

Before performing the electrical operation test place the transfer switch in the BYPASSED and ISOLATION positions and perform the following procedure:

1. Turn the isolation handle to the OPEN position on 150-800 amp switches or turn the isolation handle clockwise until the test lamp illuminates and the disconnect lamp turns off (approximately 7 or 8 turns) on the 1000-4000 amp switches.
2. Place the test selector switch, if equipped, in the TEST position.
3. Move the door-mounted test switch to the TEST position and hold it for generator set start. The generator set should start and run after the time delay engine start (TDES) completes timing.
4. The transfer switch transfers to the EMERGENCY position and the closed emergency lamp illuminates. The transfer occurs after the normal-to-emergency time delay (TDNE) completes timing.
5. Release the door-mounted test switch. The transfer switch retransfers to normal after the emergency-to-normal time delay (TDEN) completes timing. The closed lamp illuminates.
6. Time delay engine cooldown (TDEC, if equipped) allows the engine to continue running for an additional unloaded running time. The transfer switch TDEC completes timing before any TDEC function in the generator set begins timing.

NOTE

Do not close the isolation contacts unless the transfer switch and bypass switch are in the same position.

7. To electrical test the transfer switch perform the following:
 - a. For 150-400 Amp switches:
 - (1) Turn the isolation handle clockwise to the CLOSE position.
 - (2) Turn the bypass handle clockwise to the AUTO position.
 - b. For 600-800 Amp switches:
 - (1) Turn the bypass handle clockwise to the AUTOMATIC position.
 - (2) Push in and turn the isolation handle to the CLOSE position.
 - (3) Turn the bypass handle clockwise to the AUTO position.
 - c. For 1000-4000 Amp switches:
 - (1) Turn the isolating handle clockwise until it stops (approximately 6 or 7 turns). The connected lamp illuminates and the test lamp turns off.
 - (2) Remove the isolation handle and store it inside the enclosure on the carriage frame on the right side.
 - (3) Turn the bypass handle clockwise to the AUTOMATIC position. The closed on emergency lamp turns off.

This completes the functional test of the transfer switch. Leave the generator set's starting control in the AUTOMATIC position.

Troubleshooting

Use the following steps to troubleshoot problems with the ATS or bypass/isolation switch.

NOTE

Note any optional accessories that may have been furnished on this switch.

Generator Set Does Not Start When Test Switch Is Operated

1. Place the test switch in the TEST position.
2. Place the engine control switch in the AUTOMATIC position. Make sure batteries are charged and connected.
3. Make sure start signal wires from the generator set controls are connected to terminals TB2-1 and TB2-2 on the contactor.
4. Disconnect and tape the engine start wires.
5. Connect an ohmmeter between terminals TB2-1 and TB2-2 on the contactor. Reading should indicate an open circuit.
6. Place the test switch in the TEST position. After time delay engine start (TDES) operates, ohmmeter should indicate a closed circuit.

Transfer Switch Does Not Retransfer After Normal Returns or After Test Switch is Placed in the AUTO Position

1. Make sure at least 30 minutes have passed to allow for time delay to operate.
2. Check the input voltage at the transformer assembly terminals. On a 3-phase system, voltmeter should read phase-to-phase voltage between terminals NA and NB, NA and NC, NB and NC. On a single-phase system, voltmeter should read system voltage between terminals NA and NC.
3. Check voltage on transformer secondaries. On 3-phase systems voltage at T2-T3 should be 24 volts, with 12 volts at T1-T4 and T1-T5. No voltage at these points indicates a defective transformer.

With Generator Set Running, Transfer Switch Does not Transfer to Emergency

1. Make sure sufficient time has passed to allow for the time delay on transfer to emergency to operate (up to 30 minutes).
2. Check generator output frequency and voltage. Output should be at least 90% of nominal voltage and 95% of nominal frequency. Make sure any generator output circuit breakers are closed.
3. Voltmeter should read phase-to-phase voltage between transfer switch terminals EA and EC, and also between terminals EA and EC on transformer assembly.

Transfer Switch Retransfers the Load, But Generator Set Continues to Run

1. Make sure sufficient time has passed to allow for the engine-cooldown time delay, up to 5 minutes, to time out.
2. Place the engine start control switch in the AUTOMATIC position.

Bypass Handle Cannot be Turned

1. Make sure that a source-available lamp is on.
2. Observe the load-connected-to signal lights. Make sure the transfer switch contacts are closed on the same source to which the ATS is bypassing.

Isolation Handle Cannot be Turned to the Closed Position

1. Make sure that a source-available lamp is on.
2. On 600-800 amp switches, make sure that the isolation handle is pushed in before turning it.
3. Observe load-connected-to lights. Make sure that the transfer switch contacts are closed on the same source to which the ATS is bypassing.

Normal Source Fails While in Bypassed-to-Normal Position

1. Make sure that the emergency-source-available lamp is illuminated.
2. Put the isolation switch in the TEST position.
3. Manually transfer the load to the emergency source.

Appendix A. Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally they will appear in the text in complete form with the abbreviation following in parentheses the first time they are used. After that they will appear in the

abbreviated form. The commonly used abbreviations are shown below. Some items may not apply to this application.

Abbreviation	Description
ABDC	after bottom dead center
AC	alternating current
AISI	American Iron and Steel Institute
AHWT	anticipatory high water temp.
ALOP	anticipatory low oil pressure
AM	amplitude modulation
amp	ampere
amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association (former name of ANSI)
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after dead top center
aux.	auxiliary
A/V	audio-visual
AWG	American Wire Gage
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective power
BTDC	before top dead center
Btu	British thermal unit
$^{\circ}\text{C}$	Celsius degree
cc	cubic centimeter
CCA	cold cranking amps
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
CPVC	chloropoly vinyl chloride
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch (es)

Abbreviation	Description
CWC	city-water cooled
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	etcetera, (and so forth)
ext.	external
$^{\circ}\text{F}$	Fahrenheit degree
fl. oz.	fluid ounce(s)
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound(s)
fs	full scale
ga.	gauge (meters wire size)
gal./gals.	gallon, gallons
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust temperature
Hg.	mercury (element)
H ₂ O	water
HP	horsepower
hr, hrs	hour, hours
HWT	high water temperature
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch, inches
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external

Abbreviation	Description
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm ²	kilograms per square centimeter
kgm	kilogram meter(s)
kJ	kilojoules (btu cal)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED(s)	light emitting diode(s)
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minute
LOP	low oil pressure
LP	liquified petroleum
LWT	low water temperature
m	meter, meters
m ³	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
meggar	megohmmeter
MHz	megahertz
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
misc.	miscellaneous
mJ	milli joule(s)
MJ	mega joule(s)
mm	millimeter
m ³ /min	cubic meters per minute
MPa	megaPascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
mW	milliwatt(s)
MW	megawatt(s)
N/A	not available
NBS	National Bureau of Standards
N.C.	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter(s)
N.O.	normally open
no., nos.	number, numbers

Abbreviation	Description
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed
O/S	oversize
OSHA	Occupational Safety and Health Act
OV	overvoltage
oz.	ounce, ounces
PF	power factor
PMG	permanent magnet generator
pot	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
PVC	polyvinyl chloride
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
r.h.m.	round-head machine (screw)
rms	root means square
RPM	revolutions per minute
RTV	room temperature vulcanization
RV	recreational vehicle
SAE	Society of Automotive Engineers
SCR	silicon controlled rectifier
sec.	second, seconds
spec, specs	specification
sq.	square
sq. cm.	square centimeters
sq. in.	square inch(es)
tach	tachometer
TDC	top dead center
tech. pub.	technical publications
temp.	temperature
TIF	telephone influence factor
TP, TPs	technical publications
turbo	turbocharger
UHF	ultrahigh frequency
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter's Laboratories, Inc.
U/S	undersize
U.S.A.	United States of America
V	volt, volts
vac	volts alternating current
vdc	volts direct current
VHF	very high frequency
W	watt, watts

TP-5813 3/96a

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