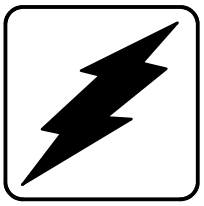
Operation and Installation

Automatic Transfer Switches



Models:

G120

Logic:
Solid-state

Contactors:
100 and 200 Amperes

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

KOHLER®
POWER SYSTEMS

TP-5990 6/98a

Table of Contents

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.

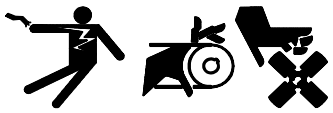
NOTICE

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

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

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set. (Remove negative (–) lead first when disconnecting battery. Reconnect negative (–) lead last when reconnecting battery.)

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (–) lead first). Reconnect negative (–) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

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.

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.

⚠ 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 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 charging. Always turn battery charger off before disconnecting battery connections. Remove negative (-) lead first when disconnecting battery. Reconnect negative (-) lead last when reconnecting battery.

Hazardous Voltage/ Electrical Shock

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect power sources before servicing. Install barrier after adjustments, maintenance, or service.

(under 600 Volt)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Only authorized personnel should open panel.

(under 600 Volt)

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

Grounding the transfer switch. 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 transfer switch and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

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. Deenergize all power sources before proceeding. Move all generator set master controller switches to the OFF position and disconnect all battery negative (-) leads before working on the transfer switch.

Servicing transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect transfer switch controls at the in-line connector to deenergize the circuit boards and logic circuitry but allow the transfer switch to continue to supply power to the load. Disconnect all power sources to any accessories mounted within the enclosure but which are not wired through the controls and deenergized by in-line connector separation. Test circuits with a voltmeter to verify that they are unpowered before servicing.

Lifting

⚠ WARNING

Unbalanced weight.
Improper lift can cause severe injury or death and/or equipment damage.

Use adequate lifting capacity.
Never leave transfer switch standing upright unless it is securely bolted in place or stabilized.

Moving Parts

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

Notice

NOTICE

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.

NOTICE

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.

NOTICE

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.

NOTICE

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.

NOTICE

Electrostatic discharge damage! Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Notes

Introduction

This manual provides operation and initial installation instructions for Kohler Model G120 automatic transfer switches (ATS) that use a 100- or 200-ampere contactor as the power switching device.

All information in this publication represents data available at time of print. Kohler Co. reserves the right to change this literature and the products represented without incurring obligation.

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.

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)

Kohler Power Systems, Asia Pacific Headquarters
7 Jurong Pier Road, Singapore 619159
Phone: (65)264-6422
Fax: (65)264-6455

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. _____

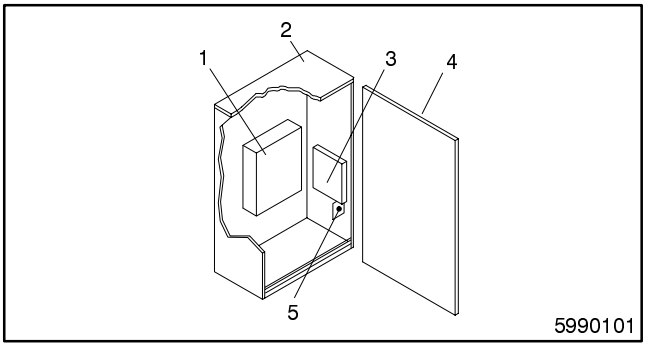
1.1 Purpose

An automatic transfer switch (ATS) transfers critical electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source when the normal source fails to maintain a minimum voltage level.

Upon normal source failure, the automatic transfer switch (ATS) signals the generator set(s) to start. When the emergency source reaches a minimum voltage level, the ATS transfers the load from the normal source to the emergency source. The ATS continuously senses the normal source and transfers the load back to the normal source when the normal source returns. After transfer of the load back to the normal source, the ATS removes the generator set start signal, allowing the generator set(s) to shut down.

1.2 Component Overview

The automatic transfer switch (ATS) covered in this manual has several components. See Figure 1-1. The power switching device (contactor) connects the load to the normal or emergency sources of power. The controller monitors power sources, controls the contactor, and signals the generator to start when needed. The exerciser switch controls the exerciser function.



1. Power switching device (contactor)
2. Enclosure
3. Controller
4. Enclosure cover
5. Exerciser switch

Figure 1-1. ATS Components

The power switching device used in the models covered in this manual transfers power from the normal or emergency power sources to the load. See Figure 1-2. The controller electrically actuates the switch to select a power source, and the switch mechanically latches the selected position. The switch also includes a provision for manual mechanical operation in emergency nonpowered conditions. Within the power switch are two sets of multipole contacts. One set of contacts selects power from the normal source and the other set selects power from the emergency source. The two sets of contacts are mechanically interlocked within the switch, ensuring that only one set of contacts is closed simultaneously. Mechanically interlocking ensures load servicing without cross-coupling of power sources.

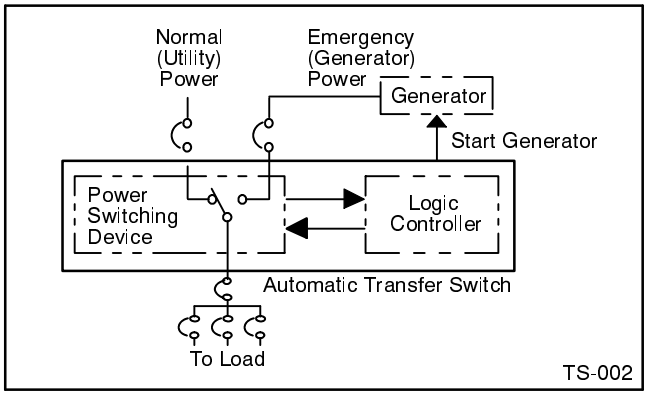
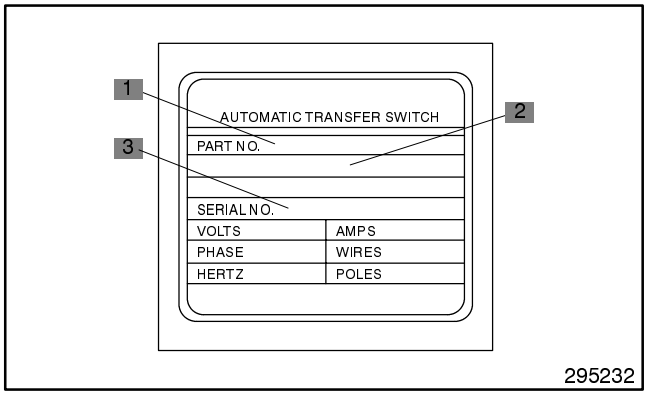


Figure 1-2. Typical ATS Block Diagram

1.3 Nameplate

A nameplate is attached to the inside of the ATS enclosure cover. See Figure 1-3. The nameplate label includes a factory part number and serial number and provides characteristic and rating information that affects installation and operation.

Copy the part number and serial number from the nameplate into the spaces provided in the **Service Assistance** section of this manual for use when requesting service or parts.



1. Location for part number used to identify type of ATS
2. Location for installed option numbers
3. Location for ATS serial number

Figure 1-3. Typical Transfer Switch Nameplate

1.4 Model Number

Most Model G120 ATS's have a model number beginning with G120 that directly encodes the transfer switch properties. See Figure 1-4 to interpret this type of transfer switch model number.

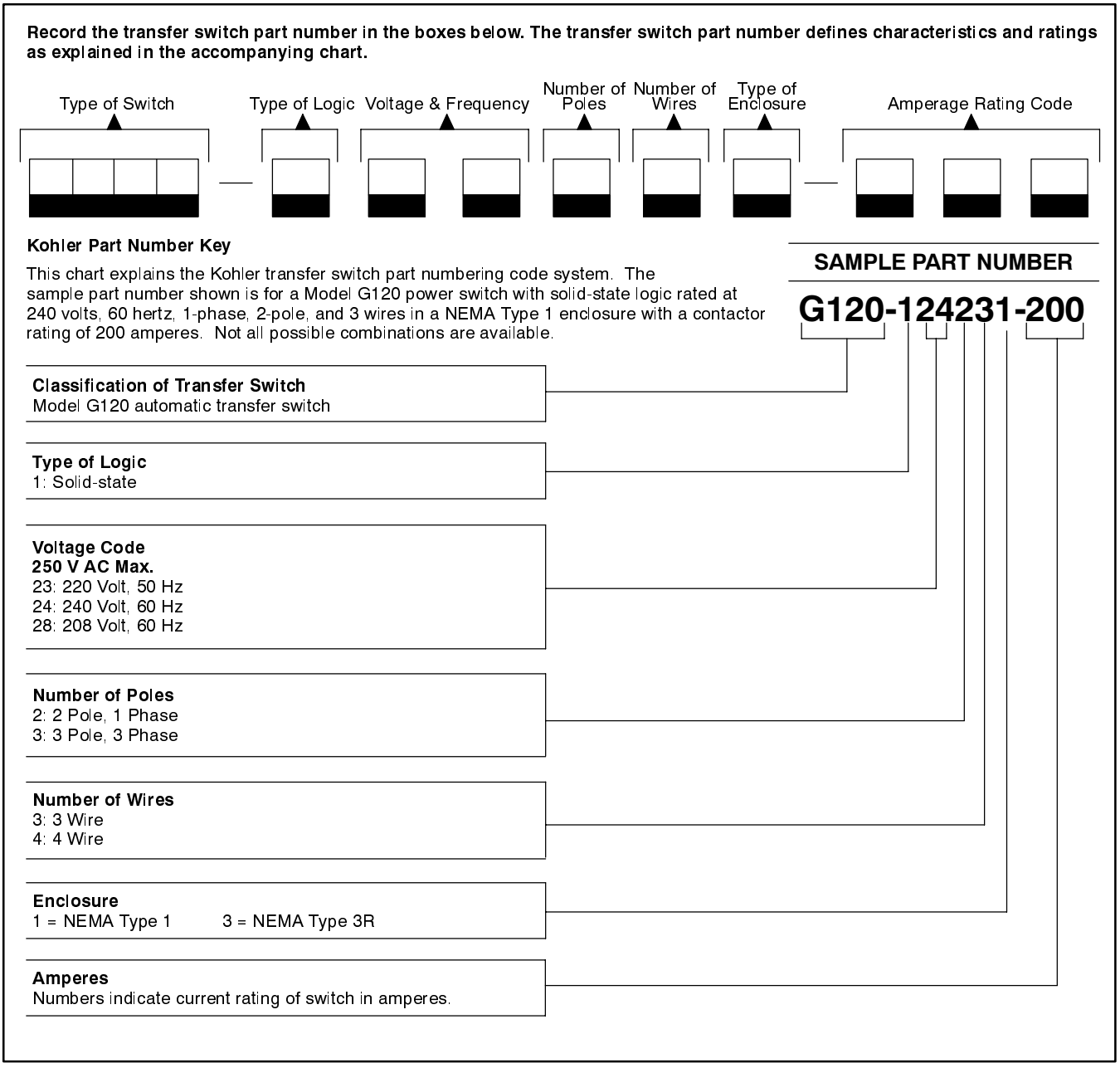


Figure 1-4. Transfer Switch Model Designations

Some Model G120 ATS's have a model number beginning with A-. See the table in Figure 1-5 to interpret this type of transfer switch model number.

Model Number	Type of Logic	Nominal Voltage	Number of Poles	Number of Wires	Enclosure Type	Current Rating (Amps)
A-362117	Solid-state	240	2	3	NEMA Type 3R	100
A-362120	Solid-state	240	2	3	NEMA Type 3R	200

Figure 1-5. Transfer Switch Model Designations

1.5 Specifications

The following specifications apply to the Model G120 ATS.

- UL 1008 listed and CSA certified
- Contactors rated 250 vac maximum, 50 or 60 Hz
- ATS available with ratings of 100 and 200 amperes, 2 or 3 poles, single- or three-phase
- NEMA type 1 and 3R enclosures available
- Integrated solid-state logic controller with conformally coated printed circuit board for protection against harsh environments
- Emergency source voltage sensing one phase: dropout fixed at 160 vac and pickup fixed at 190 vac
- Single-phase switches: normal source dropout fixed at 160 vac and pickup fixed at 190 vac
- Three-phase switches: normal source dropout fixed at approximately 80% of nominal for single-phase failure and pickup fixed at approximately 90% of nominal
- Time Delay Engine Start (TDES) fixed at 3 seconds
- Time Delay Normal to Emergency (TDNE) fixed at 2 seconds
- Time Delay Emergency to Normal (TDEN) fixed at 12 seconds
- Time Delay Engine Cooldown (TDEC) fixed at 2 minutes
- User-enabled generator exerciser: starts and runs the generator unloaded for a 20-minute period once a week
- Transfer time 50 milliseconds maximum
- Contactor electrically and mechanically interlocked
- Contactor manually operable for maintenance purposes
- Ambient operating temperature range −4° to 140°F (−20° to 60°C)
- Ambient storage temperature range −22° to 158°F (−30° to 70°C)
- Humidity range 5 to 85% noncondensing
- Provision for test switch

1.6 Ratings*

The following tables provide contactor withstand and closing current ratings (WCR) per UL 1008 standards. Figure 1-6 provides WCR when used with given types of fuses and circuit breakers. Figure 1-7 provides WCR for 100 and 200 ampere switch sizes when coordinated with specific manufacturer's circuit breakers. Figure 1-7 has ratings for 240 V maximum and apply to both UL and CSA listings.

	Withstand and Closing Ratings per UL 1008 and CSA, Maximum Current (amps)		
	When Used With 400 Amps Maximum Class J, RK5, or RK1 Fuse	When Coordinated With Molded-case Circuit Breakers	
UL 1008 Switch Size (amps)		Any, 400 Amps Maximum	Specific Manufacturer's (see Figure 1-7)
100	200,000	10,000	22,000
200	200,000	10,000	22,000

* UL 1008 listed and CSA certified at 240 vac maximum.

Figure 1-6. Withstand and Closing Current Ratings

WCR, RMS Symmetrical Amperes	Specific Manufacturer's Molded-case Circuit Breakers		
	Manufacturer	Type or Class	Maximum Size (amps)
22,000	Cutler-Hammer/ Westinghouse	FCL, FB Tripac	100
		FD, FDC, HFD	150
		HJD, JD, JDB, JDC	250
		HKD, KD, KDB, KDC, LA Tripac, LCL, DK	400
	Square D	FC, FH, FI	100
		KA, KC, KH, KI	250
		LA, LC, LE, LH, LI, LX, LXI	400
	ITE/Siemens	CED6, ED6, HED4, HED6, ED4	125
		CFD6, FD6, FXD6, HFD6	250
		CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6	400
	GE	TB1	100
		SEL, SEP, TEL, THED, THLC1	150
		TFK, TFL, THFK, THLC2	225
		SFL, SFP, TFJ	250
		SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4	400

* UL 1008 listed and CSA certified at 240 vac maximum.

Figure 1-7. Withstand and Closing Current Ratings (WCR) With Coordinated Circuit Breakers, 240 V Maximum, UL and CSA Listings

1.7 Application Data

See Figure 1-8 for application data including the range of wire sizes for transfer switch power terminals.

AL/CU UL-listed Solderless Screw-type Terminals for External Power Connections		
Switch Size (amps)	Normal, Emergency, and Load Terminals	
	Cables per Pole	Range of Wire Sizes
100	1	#8 to 3/0 (copper or aluminum)
200	1	#8 to 3/0 (copper only)

Figure 1-8. Application Data

2.1 Automatic Operation

The ATS controller monitors the normal and emergency power sources and determines when a power source has failed or is acceptable and controls the system accordingly. Failure of a power source occurs when its voltage on one or more phases falls below the dropout voltage level. A power source is acceptable when its voltage on one or more phases rises above the pickup voltage level and stays above the dropout voltage level. A power source is restored when it becomes acceptable again after failure. See Section 1.5 for voltage sensing and pickup and dropout voltage specifications. Typical ATS operation occurs in two separate automatic sequences.

- **Failure of normal power** and the resulting transfer to emergency power.
- **Restoration of normal power** and the resulting transfer back to normal power.

2.1.1 Failure of Normal Power

When the normal power source fails, the controller starts a time delay called Time Delay Engine Start (TDES). TDES prevents unnecessary generator start-up during short normal power interruptions. If the normal power source is restored before TDES ends, the controller resets the time delay. If the normal power failure persists and TDES ends, the controller issues a signal to start the standby (emergency) generator to produce the emergency power source.

After signalling the generator to start, the controller monitors the emergency power source. When the controller determines that the emergency source is acceptable, the controller starts a time delay called Time Delay Normal to Emergency (TDNE). TDNE allows emergency power source stabilization before load connection. When TDNE ends, the controller signals the contactor to connect the load to the emergency source.

After load transfer the switch mechanically latches in the emergency position, supplying emergency source power to the load until normal power source restoration and stabilization.

2.1.2 Restoration of Normal Power

When the normal power source is restored, the controller starts a time delay called Time Delay Emergency to Normal (TDEN). If the normal source fails before TDEN ends, the time delay resets. TDEN ensures normal power source stabilization before load reconnection.

When the controller determines that the normal power source has maintained an acceptable level and TDEN ends, the controller signals the contactor to reconnect the load to the normal source.

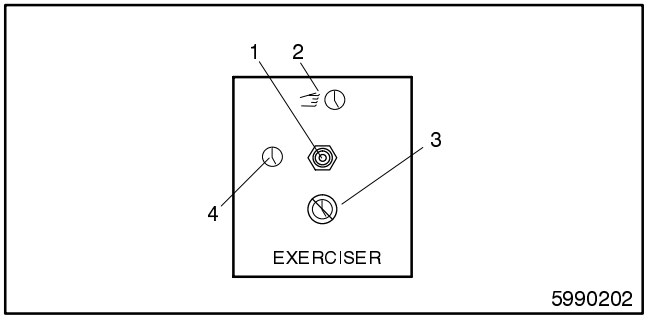
After load transfer the switch mechanically latches in the normal position and the controller starts a time delay called Time Delay Engine Cooldown (TDEC). TDEC allows the engine and generator to run unloaded and cool down before shutdown. When TDEC ends, the controller signals the generator set to shut down.

2.2 Exerciser Function

The exerciser function, when enabled, automatically starts and runs the generator set unloaded (the ATS does not transfer the load to the emergency source) for 20 minutes once a week. Exercising the generator set helps to ensure that the generator set starts when emergency power is needed. An exerciser switch selects exerciser functions. Automatic operation overrides the exerciser function. The loss of all power sources for an extended period can result in the loss of the exerciser set time. See Section 2.2.2.

2.2.1 Exerciser Switch

An exerciser switch is located inside the ATS enclosure. See Figure 1-1 and Figure 2-1.



1. Exerciser switch
2. Set position
3. Disable position
4. Run position

Figure 2-1. Exerciser Switch

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Only authorized personnel should open panel.

(under 600 Volt)

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

NOTE

The exerciser switch is set during installation and normally does not require adjustment. Line voltage is present on some components inside the ATS enclosure when power sources are applied. Only trained and qualified personnel should open the ATS enclosure when power is present. Read and follow all safety decals inside the enclosure and avoid contact with line voltage.

The exerciser switch selects the following exerciser functions when power is available. See Section 2.2.2.

- **Set (⏲). ** Placing the switch in the set position and releasing the switch sets the exerciser: the exerciser's internal one-week timer is reset and the exerciser starts and runs the generator set for a 20-minute period. Subsequent weekly 20-minute exercise periods start at the same day and time the exerciser was set.
- **Run (⏲).** Returning the switch to the run position enables the exerciser. The controller starts and runs the generator set unloaded for 20 minutes on the same day and time each week the exerciser was set.
- **Disable (⊘).** Placing the switch in the disable position prevents the exerciser from starting and running the generator. The exerciser's internal one-week timer continues to run and the exerciser's set day and time are not lost. The ATS, however, starts the generator automatically when the normal power source fails.

Replace the enclosure cover on the ATS enclosure and tighten the screws that hold it in place after viewing or making changes to the exerciser switch setting.

2.2.2 Exerciser Power Requirements

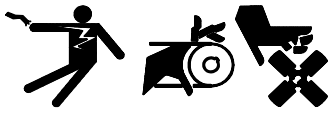
An internal one-week timer for the exerciser function maintains its setting for up to 90 seconds after power loss on both the normal and emergency sources. When the normal power source fails, the generator must start and run to provide emergency power within approximately 90 seconds or the system loses the previously set day and time for the exerciser.

When power loss on both the normal and emergency power sources lasts longer than approximately 90 seconds, the exerciser is set to the day and time that either power source returns. Then, if the exerciser switch is in the Run (⏲) position, the controller starts and runs the generator set unloaded for 20 minutes one week from the day and time of power source return and on subsequent weeks at the same day and time.

2.3 Manual Operation

To test or troubleshoot the transfer switch, or when the controller fails in an emergency situation, manually operate the contactor as described below.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set. (Remove negative (-) lead first when disconnecting battery. Reconnect negative (-) lead last when reconnecting battery.)

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

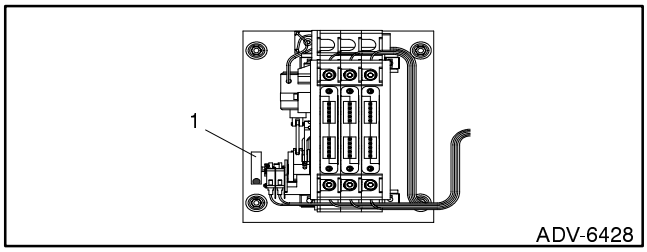
Servicing transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before proceeding. Move all generator set master controller switches to the OFF position and disconnect all battery negative (-) leads before working on the transfer switch.

Manual operation procedure:

1. Prevent the generator set, which provides the emergency power source to the transfer switch, from starting by moving the generator set master switch to the OFF position; disconnecting power to the generator engine start battery charger, if installed; and disconnecting all generator engine start batteries, negative (-) leads first.
2. Disconnect or turn off **both** the normal and emergency power sources by opening upstream circuit breakers or switches to the transfer switch.
3. Remove the cover on the front of the transfer switch enclosure.
4. Insert a #2 Phillips screwdriver or similar tool with an electrically-insulating handle into the hole located on the flywheel at the left of the contactor. See Figure 2-2 and Figure 2-3. A marking on the outer part of the flywheel shows the switch position when viewed from the front of the enclosure. The letter E is visible if the switch is in the emergency position [load is connected to the emergency (standby) power source]. The letter N is visible if the switch is in the normal position [load is connected to the normal (utility) power source].

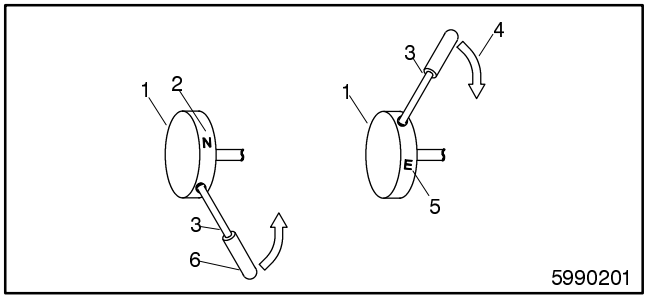
NOTE

A contactor in normal and serviceable condition transfers smoothly without binding when operated manually. Do not place the transfer switch into service if the contactor does not manually operate smoothly without binding; contact an authorized service distributor to service the contactor.



1. Flywheel

Figure 2-2. Typical Contactor



1. Flywheel
2. Marking shows switch in the normal position
3. Tool inserted into hole in flywheel
4. Move down to select the normal position
5. Marking shows switch in the emergency position
6. Move up to select the emergency position

Figure 2-3. Manual Operation of Contactor

5. Move the tool's handle up to rotate the flywheel to manually operate the switch into the emergency position. See Figure 2-3. Move the tool's handle down to rotate the flywheel to manually operate the switch into the normal position. See Figure 2-3.
6. Manually operate the switch to select the normal position for automatic operation.
7. Remove the tool used to manually operate the switch.
8. Replace the cover on the transfer switch enclosure and tighten the screws that hold it in place.
9. Reconnect power supplies to the transfer switch.

NOTE

When initially applying power to the transfer switch, the engine start contacts remain closed and the Engine Start LED stays off at least until Time Delay Engine Cooldown (TDEC) ends.

10. Reconnect generator engine start battery cables, negative (-) leads last; reconnect power to the generator engine start battery charger, if installed; and move the generator set master switch to the AUTO (automatic) position. The generator may start and run for a while (see NOTE above).

Notes

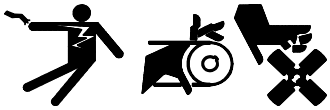
3.1 Maintenance

Preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspection, and replacement of worn or missing components.

Keep the outside of the transfer switch clean and dry. Have any other maintenance and service performed only by trained and qualified personnel following all applicable codes and standards. Keep a record of all maintenance and service.

Your local authorized distributor/dealer can provide complete preventive maintenance and service to keep the transfer switch in top condition. Contact your local authorized distributor/dealer for additional information.

⚠ WARNING



Accidental starting.
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⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect power sources before servicing. Install barrier after adjustments, maintenance, or service.

(under 600 Volt)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Only authorized personnel should open panel.

(under 600 Volt)

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

Servicing transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before proceeding. Move all generator set master controller switches to the OFF position and disconnect all battery negative (-) leads before working on the transfer switch.

NOTICE

Electrostatic discharge damage! Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Have an authorized service distributor/dealer perform periodic (at least annual) preventive maintenance of the transfer switch including the following.

Preventive Maintenance

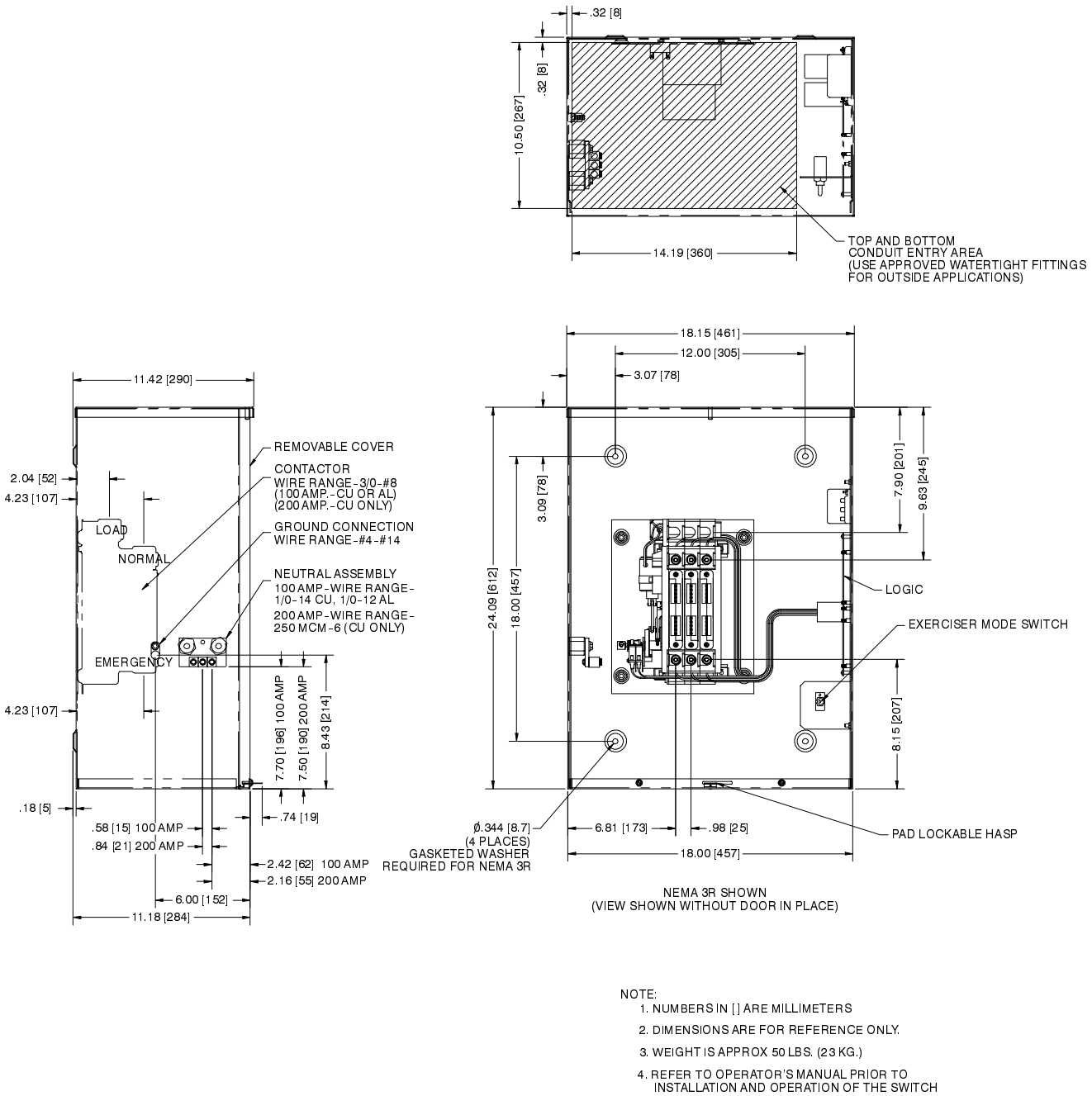
- Clean and inspect the transfer switch.
- Tighten control and power terminals to torque specifications.
- Clean the contactor external operating mechanism when contaminated by debris and relubricate the mechanism using the lubricant recommended by the manufacturer.
- Perform any other maintenance, tests, or service that maintains the safe and reliable operation of the switch.

3.2 Testing

Start and run the generator set weekly. See Section 2.2 to set and enable the exerciser function to start and run the generator set once a week for 20 minutes.

Test the transfer switch operation monthly. To test, disconnect the normal power source by opening circuit breakers or switches to cause the transfer switch to automatically start the generator set and transfer the load to the emergency power source. When the switch has transferred the load to the emergency power source, reconnect the normal power source and verify that the transfer switch retransfers to the normal power source and shuts down the generator set after TDEC ends. See Section 2.1.

Section 4. Diagrams and Drawings



NOTE:

1. NUMBERS IN [ ] ARE MILLIMETERS
2. DIMENSIONS ARE FOR REFERENCE ONLY.
3. WEIGHT IS APPROX 50 LBS. (23 KG.)
4. REFER TO OPERATOR'S MANUAL PRIOR TO INSTALLATION AND OPERATION OF THE SWITCH

Figure 4-1. Enclosure Dimensions Drawings, NEMA 1 and 3R, 100 and 200 Amp, ADV-6428-

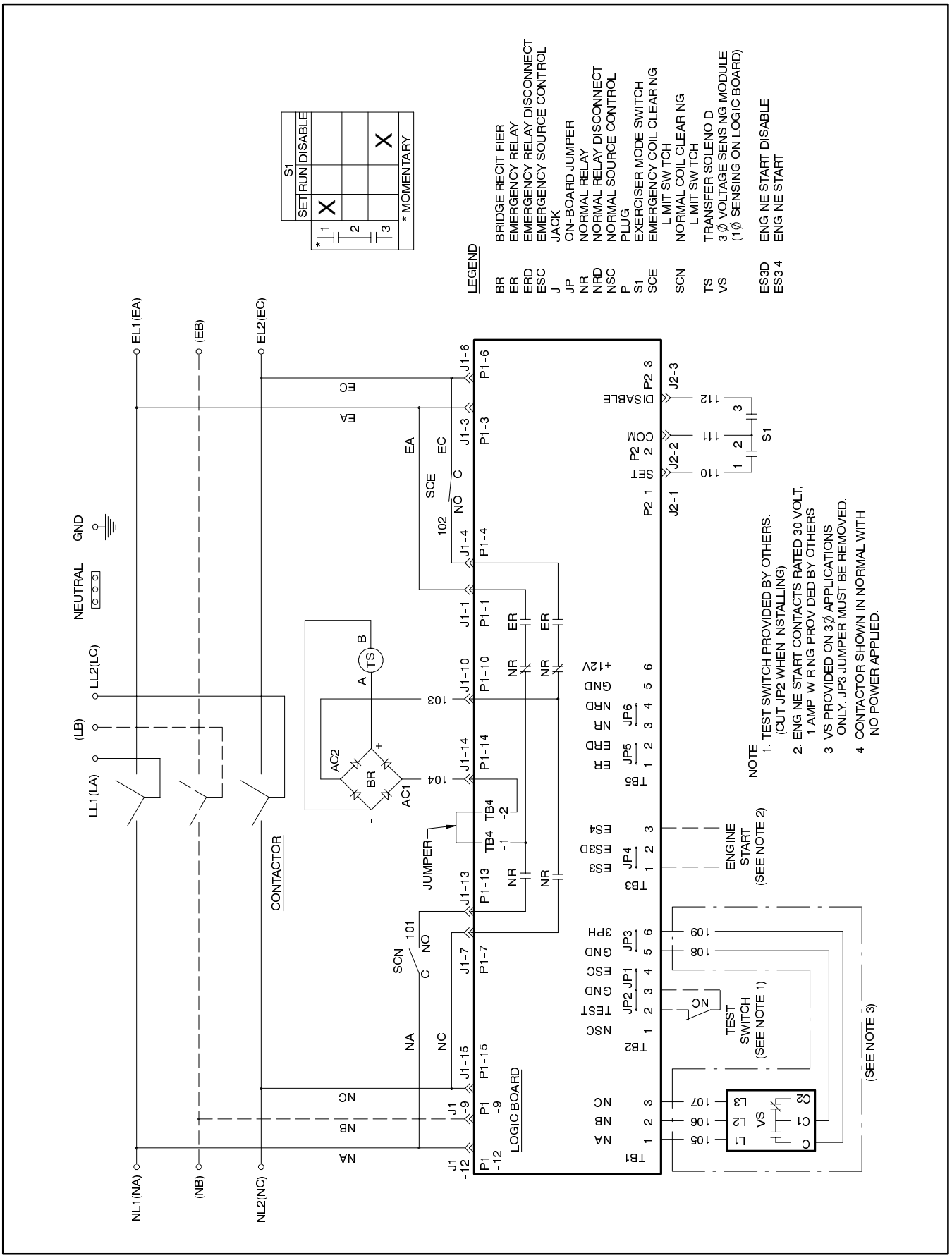


Figure 4-2. Schematic Diagram, 100 and 200 Amperes, 362140-

Notes

Kohler transfer switches are shipped factory wired and tested, ready for installation. The installation process includes mechanical mounting; electrically wiring the unit to the normal and emergency power sources, to the load circuits, and to the generator; and initial setup and testing. Have installation performed only by trained and qualified personnel following all applicable codes and standards.

5.1 Upon Receipt of Unit

5.1.1 Inspection

At time of delivery, inspect the transfer switch 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.

5.1.2 Lifting

⚠ WARNING

Unbalanced weight.
Improper lift can cause severe injury or death and/or equipment damage.

Use adequate lifting capacity.
Never leave transfer switch standing upright unless it is securely bolted in place or stabilized.

See Figure 5-1 for the approximate weight of each transfer switch covered in this manual. Carefully lift the enclosure to avoid damage to the transfer switch. Ensure that the front cover is in place and that the cover screws are tight when moving the unit.

Transfer Switch Rating (amps)	Number of Poles	Approximate Weight lb. (kg)
100	2	46 (21)
	3	48 (22)
200	2	47 (21)
	3	49 (22)

Figure 5-1. Approximate Transfer Switch Weight

5.1.3 Unpacking

Unpack the transfer switch immediately after receipt and inspect for shipping damage. Failure to perform an immediate inspection impedes recovery of losses caused by shipping damage. Use care when unpacking to avoid damaging any of the transfer switch components. Remove all dirt and packing material that may have accumulated in the transfer switch or any of its components.

If the equipment has been stored at cold temperatures, allow equipment to warm to room temperature for 24 hours (minimum) before unpacking to prevent condensation on the electrical apparatus.

5.1.4 Storage

Do not remove the protective packing until ready for final installation. Protect the transfer switch at all times from excessive moisture, construction grit, and metal chips. Avoid storage in low temperature and high humidity areas where condensation could occur on the unit.

5.2 Mechanical Installation

To plan the installation, use the dimensions given on the enclosure dimension drawings in Section 4. Select the mounting site to comply with electrical code restrictions for the enclosure type. Mount the transfer switch as close to the load and power sources as possible. Ensure adequate space for transfer switch servicing and opening of the enclosure.

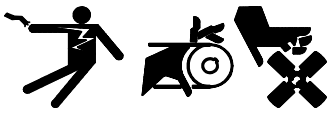
Vertically mount the 100- or 200-ampere automatic transfer switches covered in this manual to a rigid supporting structure, such as a wall, using 1/4-inch hardware. For mounting, use the four holes on the top and bottom of each unit. When mounting the unit, plumb the enclosure to avoid any distortion of the enclosure. Place washers behind the key holes to shim the enclosure to a plumb condition. Seal the mounting holes for installing the unit outdoors.

5.3 Contactor Manual Operation Test

Follow steps 1 through 7 in Section 2.3 to manually operate the contactor power switching device to verify that it operates smoothly without binding. If the contactor does not operate smoothly without binding, **stop.** Call an authorized service distributor to service the contactor before proceeding.

5.4 Electrical Wiring

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set. (Remove negative (-) lead first when disconnecting battery. Reconnect negative (-) lead last when reconnecting battery.)

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

Grounding the transfer switch. 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 transfer switch and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

Servicing transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before proceeding. Move all generator set master controller switches to the OFF position and disconnect all battery negative (-) leads before working on the transfer switch.

All internal electrical connections are prewired. The only wiring necessary for installing the transfer switch is to connect the transfer switch to external devices and power sources.

Observe all applicable national, state, and local electrical codes during installation. See Section 4 for schematic diagrams and enclosure drawings.

Install DC, control, and communication system wiring in separate raceways, cables, or conduit from AC power wiring.

5.4.1 Line Connections

All conductors should enter the enclosure at the locations shown on the drawings. When drilling entry holes for any conductors, cover the transfer switch components for protection from metal chips and construction grit. Remove any debris from the enclosure with a vacuum cleaner—**using compressed air for this purpose can lodge contaminants in components and cause damage.**

Use watertight conduit hubs approved for outdoor use for installing the transfer switch outdoors.

Before connecting wiring cables to terminal lugs, remove surface oxides from cables by cleaning with a wire brush. If using aluminum conductors, apply a joint compound to cables. After tightening terminal lugs, carefully wipe off excess joint compound.

Connection points for the normal power, emergency power, and load are clearly marked on the contactor assembly and drawings. See Section 4. Be sure to heed the phase markings (A, B, C, and N).

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

When making power connections to the power switching device, leave sufficient slack in the power leads to reach all of the power connecting lugs.

Connect the normal, emergency, and load conductors to the clearly marked terminals on the contactor. Verify that all connections are consistent with drawings before tightening the contactor terminal lugs. Tighten all contactor terminal lugs to 200 in. lbs. (16.7 ft. lbs. or 22.6 Nm) of torque.

Connect the neutral wires to the neutral terminals and tighten the lugs to the torque values shown in Figure 5-2.

Wire Size (AWG or MCM)	Torque		
	In. Lbs.	Ft. Lbs.	Nm
8	75	6.2	8.5
6	110	9.2	12
4	110	9.2	12
2	150	13	17
1	150	13	17
1/0	180	15	20
2/0	180	15	20
3/0	250	21	28
4/0	250	21	28
250	325	27	37

Figure 5-2. Tightening Torque for Neutral Terminal Lugs

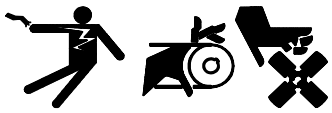
Connect the ground wires to the ground terminal and tighten to the torque values shown in Figure 5-3.

Wire Size (AWG or MCM)	Torque		
	In. Lbs.	Ft. Lbs.	Nm
14	35	2.9	4.0
12	35	2.9	4.0
10	35	2.9	4.0
8	40	3.3	4.5
6	45	3.8	5.1
4	45	3.8	5.1

Figure 5-3. Tightening Torque for Ground Screw Terminal

5.4.2 Generator Start Connection

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set. (Remove negative (-) lead first when disconnecting battery. Reconnect negative (-) lead last when reconnecting battery.)

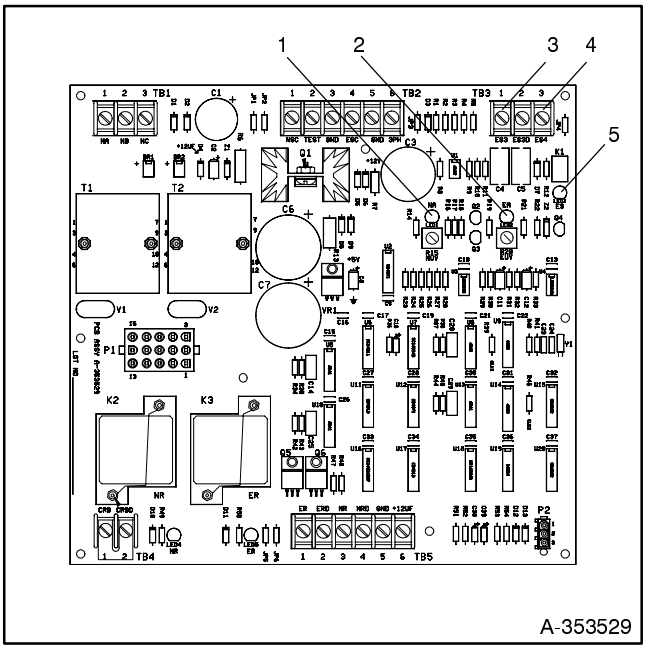
Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

NOTICE

Electrostatic discharge damage! Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Prevent the generator set, which will provide the emergency power source to the transfer switch, from starting by moving the generator set master switch to the OFF position; disconnecting power to the generator engine start battery charger, if installed; and disconnecting all generator engine start battery cables, negative (-) leads first.

Connect the generator set remote engine start signal inputs to the engine start terminals ES3 and ES4 on the transfer switch controller circuit board. See Figure 5-4. The controller provides a contact closure across ES3 and ES4 to signal the generator set to start. The location of the terminal block is marked by an orange decal within the enclosure. Tighten the terminal screws to 9 in. lbs. (1.0 Nm) of torque.



1. Normal Acceptable (NA) LED
2. Emergency Acceptable (EA) LED
3. Engine start terminal ES3
4. Engine start terminal ES4
5. Engine Start (ES) LED

Figure 5-4. Controller Terminals and LEDs

5.5 Initial Start-up and Setup

Perform the following procedures before placing the transfer switch into normal service.

5.5.1 Manually Select the Normal Position

Manually operate the contactor to the normal position by following steps 1 through 7 in Section 2.3.

5.5.2 Select the Exerciser Function and Close the Enclosure

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

Move the exerciser switch to the Run (🕐) position to enable the weekly generator exerciser. Move the exerciser switch to the Disable (⊘) position to disable the weekly exerciser. See Section 2.2. Replace the transfer switch enclosure cover and tighten the screws that hold it in place.

5.5.3 Prepare the Generator Set for Operation

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

Prepare the generator set that provides the emergency power source to the transfer switch for operation. Check the oil level, coolant level, fuel supply, batteries, and items specified by the generator set installation or operation checklist or manual.

Reconnect generator engine start battery cables, negative (–) leads last; reconnect power to the generator engine start battery chargers, if installed; and move the generator set master switch to the AUTO (automatic) position. The generator set should start.

5.5.4 Connect the Power Sources

Connect the normal and emergency power sources to the transfer switch by closing upstream circuit breakers or switches.

NOTE

When initially applying power to the transfer switch, the engine start contacts remain closed and the Engine Start LED stays off at least until Time Delay Engine Cooldown (TDEC) ends.

If the transfer switch determines that the normal power source is acceptable, the transfer switch runs the generator for TDEC and then signals the generator set to shut down by opening the engine start contacts. The Engine Start LED lights.

If the transfer switch determines that the normal power source is unacceptable at any time, the transfer switch begins an automatic sequence to transfer the load to the emergency source as if TDES had ended. The engine start contacts remain closed and the Engine Start LED remains off. See Section 2.1.1.

The transfer switch sets the exerciser function when power is first applied. If the exerciser switch is in the Run (🕐) position, the first exercise period occurs one week from when power is first applied and on

subsequent weeks at the same day and time. See Section 2.2.

5.5.5 Perform a System Test

With normal power present, test the system by disconnecting the normal power source and verifying that the system responds as described in Section 2.1.1, starting the generator set automatically and transferring the load to the emergency power source. When the transfer switch has transferred the load to the emergency source, reconnect the normal power source and verify that the system operates as described in Section 2.1.2, retransferring the load to the normal source and shutting down the generator set after TDEC.

5.5.6 Complete the Installation

Ensure that the normal and emergency power sources are connected to the transfer switch. To set the exerciser to a different day and time, see Section 2.2. Replace the cover on the transfer switch enclosure and tighten the screws that hold it in place.

5.5.7 Ensure Warranty Registration

The transfer switch seller must complete a Start-up Notification Form and submit it to the manufacturer within 60 days of the initial start-up date. A Start-up Notification Form is included with generator sets and covers all equipment in the standby system. Standby systems not registered within 60 days of the initial start-up date are automatically registered using the manufacturer's ship date as the start-up date.

Notes

Appendix A. Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally in the text they will appear in complete form with the abbreviation following in parenthesis the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below.

AC	alternating current
AISI	American Iron and Steel Institute
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
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
aux.	auxiliary
AWG	American Wire Gauge
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective pressure
Btu	British thermal unit
°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
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch, cubic inches
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	et cetera (and so forth)
ext.	external
°F	Fahrenheit degree
fl. oz.	fluid ounce, fluid ounces
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound, foot pounds
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 (or engine) temperature
Hg	mercury (element)
H_2O	water
HP	horsepower
hr, hrs	hour
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch(es)
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external
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
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minutes
LOP	low oil pressure
LP	liquefied petroleum
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
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m^3/min	cubic meters per minute
MPa	megaPascal
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available or not applicable
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, Newton meters
no., nos	number, numbers
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
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 mean square
RPM	revolutions per minute
RTV	room temperature vulcanization
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, square inches
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

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