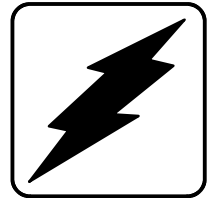


Operation and Installation

Automatic Transfer Switches



Models:

G/GN
GLN/GLS
GTN/GTS

Power Switching Device:
Contactor
40 to 400 Amperes



KOHLER®

POWER SYSTEMS

TP-5991 8/99b

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Safety Precautions and Instructions

Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

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.**

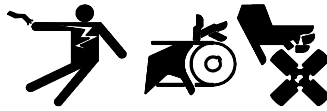
NOTICE

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

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



**Accidental starting.
Can cause severe injury or death.**

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery


WARNING



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


Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in the battery can cause blindness and burn skin. Always wear splashproof safety goggles when working near the battery. If battery acid splashes in the eyes or on the 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 the battery charger cause arcs or sparks.
Locate the battery in a well-ventilated area. Isolate the 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 flames or sparks to occur near a battery at any time, particularly when it is charging. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove wristwatch, rings, and other jewelry before handling the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together. Sparks could ignite the battery gases or fuel vapors. Ventilate the compartments containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.



Hazardous Voltage/ Electrical Shock

⚠ WARNING

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

(600 volts and under)

⚠ WARNING

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

(600 volts and under)

⚠ WARNING
 
Hazardous voltage. Moving rotor. Can cause severe injury or death.
Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, 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 because these conditions increase the risk of electrocution.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage. *(Models with E33+, S340, S340+, 340, R340, and R33 controls only)*

Installing accessories to the transformer assembly. Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to the 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 electrical shock deenergize the normal power source before making any line or auxiliary connections.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.



Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline 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 accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.

Heavy Equipment

⚠ WARNING

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

Moving Parts

⚠ WARNING	
	
Hazardous voltage. Moving rotor. Can cause severe injury or death.	
Operate the generator set only when all guards and electrical enclosures are in place.	

Notice

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

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

NOTICE

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

NOTICE

Foreign material contamination.

Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the 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.

This manual provides operation and installation instructions for Kohler® Model GTN/GTS and GLN/GLS transfer switches that use a 40- to 400-ampere contactor as the power switching device.

t:in:002:001

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this literature and the products represented without notice and without any obligation or liability whatsoever.

Read 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 the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

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List of Related Materials

This manual covers operation and installation information for the transfer switch's power switching device. Decode the transfer switch model number from the transfer switch nameplate and verify that the transfer switch's power switching device matches the model shown on the front cover of this manual before proceeding with operation or installation.

A separate operation and installation manual that covers information specific to the transfer switch's

electrical controls completes the operation and installation instructions for the transfer switch. The transfer switch model number shows which controls are installed on the switch. The following table lists the available electrical controls and the related operation and installation manual part numbers.

Electrical Controls (Type)	Operation/ Installation Manual
S340 (Solid State)	TP-5993
M340 (Microprocessor)	TP-5994

Separate manuals cover service and parts information for transfer switch power switching devices and electrical controls. The following table(s) list the available manual part number(s).

Electrical Controls (Type)	Service/ Parts Manual
S340 (Solid State)	TP-5612
M340 (Microprocessor)	TP-5604

A personal computer and software can monitor and control transfer switches with microprocessor electrical controls and communication accessories. The following table lists the available manuals and part numbers for remote monitoring and control communication software and controller communication kits.

Communication Item	Operation/ Installation Manual
Remote Monitoring and Control Communication (Monitor) Software DOS Win 95/98/NT	TP-5823 TP-5972
Controller Communication Kits	TT-847

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Service Assistance

Service Information

Please contact a local authorized distributor/dealer for sales, service, or other information about Kohler Generator Division products.

To locate a local authorized distributor/dealer inside the U.S.A. and Canada

- Look on the product or in the information included with the product
- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Generator Division web site at www.kohlergenerators.com
- Call 1-800-544-2444

To locate a local authorized distributor/dealer outside the U.S.A. and Canada

- Look on the product or in the information included with the product
- Consult the telephone directory under the heading Generators—Electric
- Visit the Kohler Generator Division web site at www.kohlergenerators.com
- Contact the nearest regional office

Africa, Europe, Middle East

London Regional Office
Langley, Slough, England
Phone: (44) 1753-580-771
Fax: (44) 1753-580-036

Australia

Australia Regional Office
Queensland, Australia
Phone: (617) 3893-0061
Fax: (617) 3893-0072

China

China Regional Office
Shanghai, People's Republic of China
Phone: (86) 21-6482 1252
Fax: (86) 21-6482 1255

India, Bangladesh, Sri Lanka

India Regional Office
Bangalore, India
Phone: (91) 80-2284270
(91) 80-2284279
Fax: (91) 80-2284286

Japan

Japan Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America

Latin America Regional Office
Lakeland, Florida, U.S.A.
Phone: (941) 619-7568
Fax: (941) 701-7131

South East Asia

Singapore Regional Office
Singapore, Republic of Singapore
Phone: (65) 264-6422
Fax: (65) 264-6455

Product Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Model Number _____

Serial Number _____

Accessory Number	Accessory Description
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Section 1. Specifications

1.1 Purpose

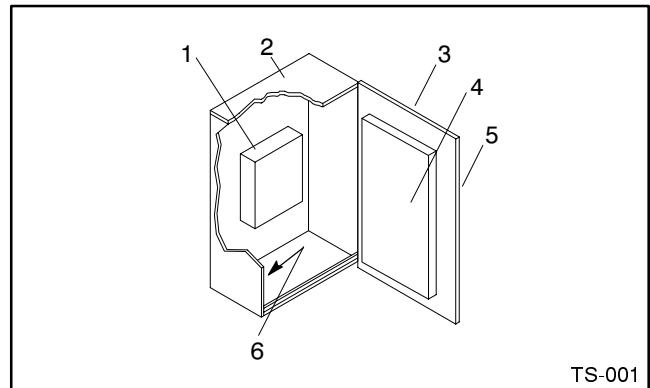
An automatic transfer switch (ATS) transfers electrical loads from a normal (preferred or utility) source of electrical power to an emergency (standby or replacement) source when the normal source fails to maintain a minimum power quality level.

When the normal source fails, the ATS signals the emergency source generator set to start. When the emergency source reaches a minimum quality level, the ATS transfers the load from the normal source to the emergency source. The ATS continuously monitors the normal source and transfers the load back to the normal source when the normal source returns. After transferring the load back to the normal source, the ATS removes the generator start signal, allowing the generator set to shut down.

1.2 Components

The ATS documented in this manual contains several components. See Figure 1-1. The power switching device connects the load to the normal or emergency source of power. The electrical controls monitor power sources, control the power switching device, and signal the generator to start when needed. Controls and indicators mounted on the door allow the operator to control the ATS operation and obtain system status information. The wire harness connects the controller to the power switching device using inline connectors to allow easy removal of the door for service.

Controls and indicators mounted on the door are determined by the electrical controls and installed accessories. The nameplate on the inside of the enclosure door shows the model number and lists factory-installed accessories. Use the chart in Section 1.4 to determine the type of electrical controls installed on the transfer switch. For control and accessory details see the operation and installation manual for the electrical controls. See the List of Related Materials in the Introduction section of this manual for the manual part number.



1. Power switching device
2. Enclosure
3. Enclosure door
4. Inner panel electrical controls
5. Controls and indicators (mounted on the enclosure door)
6. Neutral lug (location may vary)

Figure 1-1. Typical Transfer Switch Components

The contactor power switching device transfers power from the normal or emergency power sources to the load. The electrical controls electrically actuate the contactor to select a power source, and the contactor mechanically latches in the selected position. The contactor also includes a provision for manual operation in emergency nonpowered conditions.

The contactor power switching device uses two sets of multipole contacts. See Figure 1-2. One set of contacts connects the load to the normal source and the other set connects the load to the emergency source. The double-throw, inherently interlocked design of the contactor prevents simultaneous closing of both sets of contacts and cross-coupling of power sources.

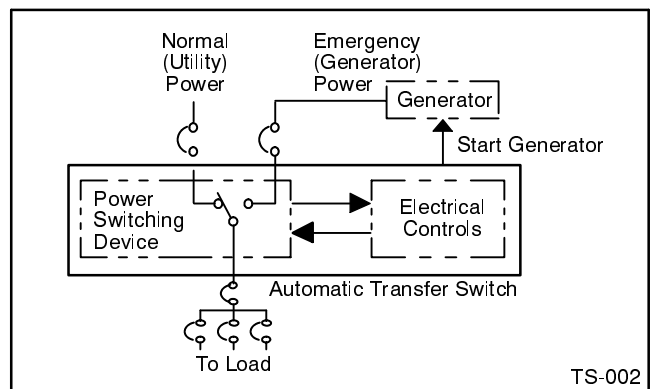


Figure 1-2. Typical ATS Block Diagram

1.3 Nameplate

A nameplate attached to the inside of the enclosure door or cover includes a model number, a serial number, ratings, and other information that may be needed to install, operate, service, or order parts for the ATS. See Figure 1-3.

Copy the model number, serial number, and accessory information from the nameplate into the spaces provided in the Service Assistance section in this manual for use when requesting service or parts. Copy the model number into the blank spaces in Figure 1-5 and use the figure to interpret the model number code.

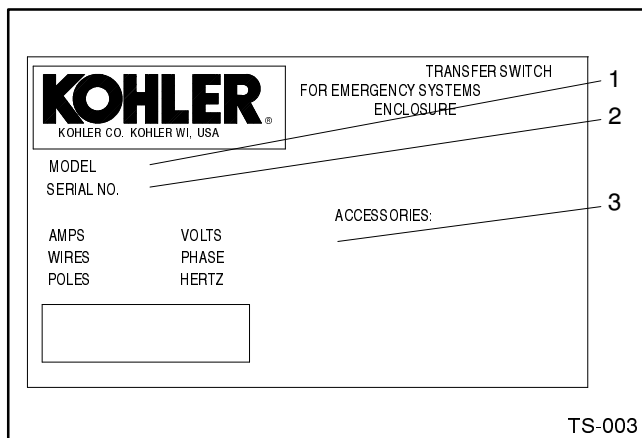


Figure 1-3. Typical Transfer Switch Nameplate

1.4 Model Number Code

Use Figure 1-5 to record and interpret the transfer switch model number code.

Model GTN/GTS and GLN/GLS transfer switches were once designated as Model G (automatic) or GN (nonautomatic) transfer switches.

Model G or GN transfer switches that used voltage and frequency codes beginning with 5, 6 or 7 to indicate a contactor voltage rating of 600 volt maximum are now designated as Model GLS (automatic) or GLN (nonautomatic).

Model G or GN transfer switches that used voltage and frequency codes beginning with 2 to indicate a contactor voltage rating of 250 volt maximum are now designated as Model GTS (automatic) or GTN (nonautomatic) and use voltage and frequency codes beginning with 6. Figure 1-4 summarizes 250 volt maximum voltage codes that are no longer used and the new codes.

Old Code	New Code	Voltage and Frequency
21	61	110 Volt, 50 Hz
22	62	120 Volt, 60 Hz
23	63	220 Volt, 50 Hz
24	64	240 Volt, 60 Hz
27	67	190 Volt, 50 Hz
28	68	208 Volt, 60 Hz

Figure 1-4. Voltage and Frequency Code Conversion

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

Model	Controls	Voltage and Frequency	Poles	Wires	Enclosure	Current Rating
<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div>

Kohler® Model Number Key

This chart explains the Kohler® transfer switch model numbering system. The sample model number shown is for a Model GTS automatic transfer switch that uses a 250-volt maximum contactor power switching device with S340 solid-state electrical controls rated at 240 volts, 60 hertz, 1 phase, 2 poles, and 3 wires in a NEMA type 1 enclosure with a current rating of 200 amperes. Not all possible combinations are available.

SAMPLE MODEL NUMBER

GTS-164231-0200

Switch Classification or Family

G: Model GLN/GLS/GTN/GTS contactor-type transfer switch

Power Switching Device Characteristics

T: 250-volt maximum contactor, 40–200 amperes
L: 600-volt maximum contactor, 40–400 amperes

Operation Classification

S: Automatic N: Nonautomatic

Electrical Controls (Logic Controller)

1: S340 solid state 5: M340 microprocessor

Voltage and Frequency (other codes possible)

53: 220 Volts, 60 Hz	60: 600 Volts, 60 Hz	61: 110 Volts, 50 Hz
62: 120 Volts, 60 Hz	63: 220 Volts, 50 Hz	64: 240 Volts, 60 Hz
65: 550 Volts, 60 Hz	66: 480 Volts, 60 Hz	67: 190 Volts, 50 Hz
68: 208 Volts, 60 Hz	69: 440 Volts, 60 Hz	70: 400 Volts, 50 Hz
71: 380 Volts, 50 Hz	72: 380 Volts, 60 Hz	73: 416 Volts, 50 Hz

Number of Poles and Phase

2: 2 pole, 1 phase 3: 3 pole, 3 phase 4: 3 pole, 1 phase
6: 4 pole, 3 phase

Number of Wires

3: 3 Wire 4: 4 Wire

Enclosure

0: Open unit 1: NEMA type 1 2: NEMA type 12
3: NEMA type 3R

Current Rating

Numbers indicate the current rating of switch in amperes

Figure 1-5. Transfer Switch Model Designations

1.5 Standard Features

The standard features listed here are for the Model GLN/GLS/GTN/GTS contactor power switching device. Refer to the electrical controls operation and installation manual for electrical controls specifications. See List of Related Materials in the Introduction section in this manual.

- UL 1008 listed and CSA certified
- Complies with transient tests in accordance with NEMA and IEEE standards
- Current ratings from 40 to 400 amperes
- 100% equipment rated and can be applied at the rated current without derating in open or enclosed configurations
- Rated for all classes of load, both inductive and noninductive
- Available in 2-, 3-, or 4-pole configurations
- Available in NEMA Types 1, 12, or 3R enclosures or as open units
- Model GLN, GLS, GTN, and GTS switches are available with S340 solid-state controls. Model GLS switches are available with M340 microprocessor electrical controls. See the electrical controls operation and installation manual for electrical control features and available options.
- Model GTN and GTS switches have 250-volt maximum contactor power switching devices which are UL listed and CSA certified at 240 VAC.
- Model GLN and GLS switches have 600-volt maximum contactor power switching devices which are UL listed at 480 VAC and CSA certified at 600 VAC.
- Transfer time less than 50 milliseconds
- Auxiliary position contacts: one closed on normal switch position and one closed on emergency switch position (model GLN and GLS switches only; model GTN and GTS switches do not have auxiliary contacts as a standard feature).
- Ambient operating temperature range
-4° to 167°F (-20° to 75°C)
- Ambient storage temperature range
-22° to 185°F (-30° to 85°C)
- Humidity range 5% to 95% noncondensing

1.6 Ratings

See Figure 1-7 for general contactor withstand and closing current ratings (WCR) as applicable to UL and CSA standards. See Figure 1-6 to find the table for WCR when coordinated with specific manufacturer's circuit breakers as applicable to UL and CSA standards.

Maximum Voltage		See WCR Table
Switch Rating	Application	
250	240	Figure 1-8
600	480	Figure 1-9
600	600	Figure 1-10

Figure 1-6. Index to Table for Withstand and Closing Current Ratings (WCR) When Coordinated with Specific Manufacturer's Circuit Breakers

Specifications		Max. Application Voltage	Withstand and Closing Current Ratings (WCR), Maximum Current in RMS Symmetrical Amperes When Coordinated With						
			Current-Limiting Fuses			Molded-Case Circuit Breakers (CB)			
Switch Rating (Amps)	Max. Voltage		WCR	Max. Fuse Size (Amps)	Class	Any Manufacturer's		Specific Manufacturer's (See the Following Tables)	Cycles @60 Hz
						WCR	Max. CB Size (Amps)	WCR	
40, 80, 100, 200	250	240	200,000	400	J, RK1, or RK5	10,000	400	22,000	1.5
40, 80, 100, 150	600	480						30,000	
		600						22,000	
225, 260, 400	600	480	200,000	600	J	35,000	800	50,000	3.0
			100,000		RK1 or RK5				
		600	200,000		J			42,000	

* Current ratings listed are based on UL 1008 standards. 250-volt maximum switches are UL 1008 listed at 240 VAC maximum. 600-volt maximum switches are UL 1008 listed at 480 VAC maximum and CSA certified at 600 VAC maximum.

Figure 1-7. Contactor Withstand and Closing Current Ratings as Applicable to UL and CSA Standards

Specifications		Max. Application Voltage	WCR (RMS Symmetrical Amps)	Specific Manufacturer's Molded-Case Circuit Breakers		
Switch Rating (Amps)	Max. Voltage			Manufacturer	Type or Class	Maximum Size (Amps)
40-200	250	240	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
				General Electric	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

Figure 1-8. Withstand and Closing Current Ratings (WCR) for 250 V Maximum Switches Rated 40-200 Amperes at 240 V Maximum Application Voltage With Coordinated Circuit Breakers as Applicable to UL and CSA Standards

Specifications		Max. Application Voltage	WCR (RMS Symmetrical Amps)	Specific Manufacturer's Molded-Case Circuit Breakers				
Switch Rating (Amps)	Max. Voltage			Manufacturer	Type or Class	Maximum Size (Amps)		
40-150	600	480	30,000	Cutler-Hammer/ Westinghouse	FDC, HFD	150		
					HJD, JDC	250		
					HKD, KD, KDB, KDC, LA Tripac, LCL	400		
				Square D	FC, FI	100		
					KC, KH, KI	250		
					LA, LC, LE, LH, LI, LX, LXI	400		
				ITE/Siemens	CED6, HED4, HED6	125		
					CFD6, FD6, FXD6, HFD6	250		
					CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6	400		
				General Electric	TB1	100		
					SEL, SEP, TEL, THLC1	150		
					TFL, THLC2	225		
					SFL, SFP	250		
					SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4	400		
225-400			600	480	50,000	Cutler-Hammer/ Westinghouse	JDC, HJD	250
							CHKD, HKD, KDC, LCL, LA Tripac	400
							CHLD, CLDC, HLD, LDC	300-600
							NB Tripac	300-800
						Square D	KC, KI	250
							LC, LE, LI, LX, LXI	600
							ME, MH, MX	800
						ITE/Siemens	CFD6, HFD6	250
	CJD6, HHJD6, HHJXD6, HJD6, SCJD6, SHJD6	400						
	CLD6, HHL6, HHLXD6, HLD6, SCLD6, SHLD6	600						
	CMD6, HMD6, HMXD6, MD6, MXD6, SCMD6, SHMD6, SMD6	800						
	General Electric	SFL, SFP, TFL, THLC2				250		
		SGL4, SGP4, TB4, THLC4, TLB4				400		
		SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S				600		
SKL8, SKP8, SKH8, TB8		800						
Merlin Gerin	CF250L, CF250H	250						
	CJ400L, CK400H, CJ400H, CK400N	400						
	CJ600H	600						
	CK800H, CK800N	800						

Figure 1-9. Withstand and Closing Current Ratings (WCR) for 600 V Maximum Switches Rated 40-400 Amperes at 480 V Maximum Application Voltage With Coordinated Circuit Breakers as Applicable to UL and CSA Standards

Specifications		Max. Application Voltage	WCR (RMS Symmetrical Amps)	Specific Manufacturer's Molded-Case Circuit Breakers		
Switch Rating (Amps)	Max. Voltage			Manufacturer	Type or Class	Maximum Size (Amps)
40-150	600	600	22,000	Cutler-Hammer/ Westinghouse	FDC, HFD	150
					HJD, JDC	250
					HKD, KD, KDB, KDC, LA Tripac, LCL	400
				Square D	FI	100
					KA, KH, KI	250
					LA, LC, LE, LH, LI, LX, LXI	400
				ITE/Siemens	CED6	125
					CFD6, HFD6	250
					CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6	400
				General Electric	TB1	100
					SEL, SEP, TEL, THLC1	150
					TFL, THLC2	225
					SFL, SFP	250
					SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4	400
225-400	600	600	42,000	Cutler-Hammer/ Westinghouse	KDC, LA Tripac, LCL	400
					CLDC, LDC	300-600
					NB Tripac	300-800
				Square D	KI	250
					LI, LXI	600
				ITE/Siemens	CFD6	250
					CJD6, HHJD6, HHJXD6, SCJD6	400
					CLD6, HHL6, HHLXD6, SCLD6	600
					CMD6, HMD6, HMXD6, SCMD6, SHMD6	800
				General Electric	THLC2	250
					SGL4, SGP4, TB4, THLC4	400
					SGL6, SGP6, TB6	600
					SKL8, SKP8, TB8	800
				Merlin Gerin	CF250L	250
					CJ400L, CK400H	400
					CK800H	800

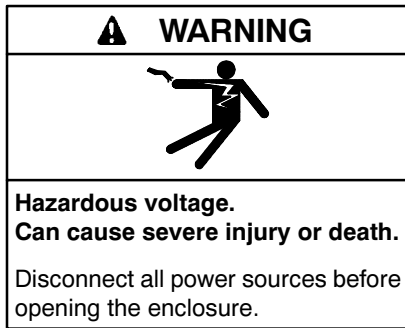
Figure 1-10. Withstand and Closing Current Ratings (WCR) for 600 V Maximum Switches Rated 40-400 Amperes at 600 V Maximum Application Voltage With Coordinated Circuit Breakers as Applicable to CSA Standards

1.7 Application Data

See Figure 1-11 for application data including the range of wire sizes for the transfer switch's power terminals.

UL-Listed Solderless Screw-Type Terminals for External Power Connections		
Switch Rating (Amps)	Normal, Emergency, and Load Terminals	
	Cables per Pole	Range of Wire Sizes (Copper or Aluminum)
40	1	#14 to #6 AWG
80	1	#14 to #1/0 AWG
100	1	#14 to #2/0 AWG
150	1	#8 to #3/0 AWG
200	1	#8 to #3/0 AWG (copper only)
225–400	1	#4 AWG to 600 MCM
	2	#1/0 AWG to 250 MCM

Figure 1-11. Application Data



(600 volts and under)

Have preventive maintenance performed on the transfer switch at regular intervals after installation. See Section 4 for preventive maintenance.

Refer to the electrical controls operation and installation manual for other startup and setup procedures.

Contact an authorized distributor/dealer to inspect and service the transfer switch when any wear, damage, deterioration, or malfunction of the transfer switch or its components is evident or suspected; *do not energize the switch*.

2.1 Startup

Perform the following powerup procedure after maintenance or service of the standby system that requires disconnection of power sources from the transfer switch, *not for initial startup*.

For initial startup, follow the instructions in the installation section of the operation and installation manual for the electrical controls and Section 6—Installation in this manual.

Read and understand documentation provided with the switch and labels affixed to the switch. Review the operation of installed accessories.

Follow the steps below to power up the transfer switch and prepare it for automatic operation.

Powerup Procedure

1. Place the generator set master switch in the OFF position to prevent starting the generator set.
2. Disconnect *both* the normal and emergency power sources by opening circuit breakers or switches leading to the transfer switch.
3. Open the enclosure and check that the wire harnesses for the power switching device and the

electrical controls are plugged together at the inline disconnect plug. See Figure 6-3.

4. Follow the manual operation procedure to prepare the transfer switch for automatic operation. See Section 2.3 for instructions.
5. Close and lock the transfer switch enclosure door. Replace and tighten any fastening screws on the enclosure door.
6. Prepare the standby generator set for operation. Check the oil level, coolant level, fuel supply, batteries, and items specified by the generator set Prestart Checklist or similar instructions in the operation manual.
7. Place the generator set master switch in the AUTO position. The generator set should start.
8. When loads are ready to be energized, close circuit breakers or switches leading to the transfer switch.

NOTE

When applying power to the transfer switch whose electrical controls have lost power, the engine start contacts remain closed, signaling the generator to run until the ATS's time delay engine cooldown (TDEC), if equipped, ends.

9. Perform an automatic operation test. See the electrical controls operation and installation manual for instructions.

Refer to the electrical controls operation and installation manual for other startup and setup instructions.

2.2 Automatic Operation

The electrical controls installed in the unit provide automatic operation. Refer to the electrical controls operation and installation manual for automatic operation details and procedures. See List of Related Materials in the Introduction section in this manual.

The transfer switch electrical controls circuitry, programming, or accessories determine when a power source is acceptable, has failed, or has been restored and operates accordingly. Failure of a power source occurs when the voltage and/or frequency on one or more phases fall below preset limits. A power source is acceptable when the voltage and frequency on all monitored phases rise above preset levels. A power source is restored when the voltage and frequency

return to acceptable levels after failure. Typical automatic operation is divided into two sequences:

- **Failure of the normal power source** and the resulting transfer to the emergency source or Emergency.
- **Restoration of the normal power source** and the resulting transfer back to the normal source or Normal.

The following sections briefly explain these sequences of operation. Installed controller accessories can change the sequence of operation. See the electrical controls operation and installation manual for specifications on time delays, voltage and frequency limits, control adjustments, and accessory information.

2.2.1 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 startup 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 signaling the generator to start, the controller monitors the emergency power source. When the controller determines that the emergency (generator) power source is acceptable it starts a time delay called time delay normal to emergency (TDNE). TDNE allows emergency power source stabilization before load connection and prevents nuisance transfers during short power interruptions. When TDNE ends the controller signals the power switching device 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.

2.2.2 Restoration of Normal Power

After normal power source restoration, the controller starts a time delay called time delay emergency to normal (TDEN). If the normal power 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 power switching device to reconnect the load to the normal source.

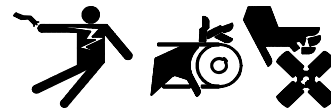
After load transfer the switch mechanically latches in the normal position and the controller starts a time delay called time delay engine cooldown (TDEC), if equipped. TDEC allows the engine and generator to run unloaded and cool down before shutdown. When TDEC expires the controller signals the generator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

The generator set controller may allow the generator to run for an additional cooldown period after the transfer switch signals a shutdown. Consult the generator set operation manual for more information.

2.3 Manual Operation

To test or troubleshoot the transfer switch manually operate the power switching device as described in the following procedure.

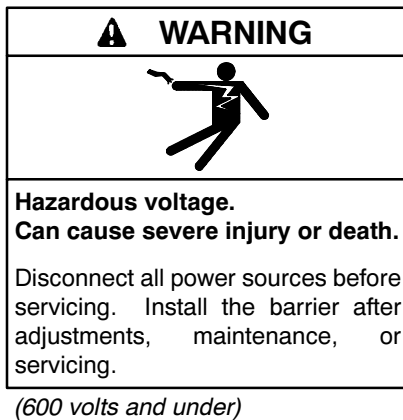
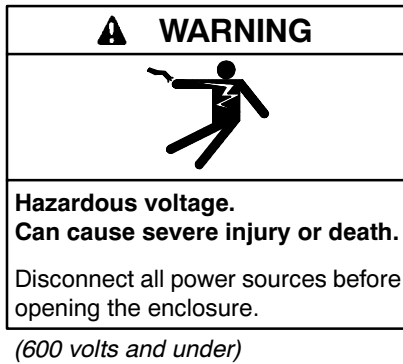
WARNING



**Accidental starting.
Can cause severe injury or death.**

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.



Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

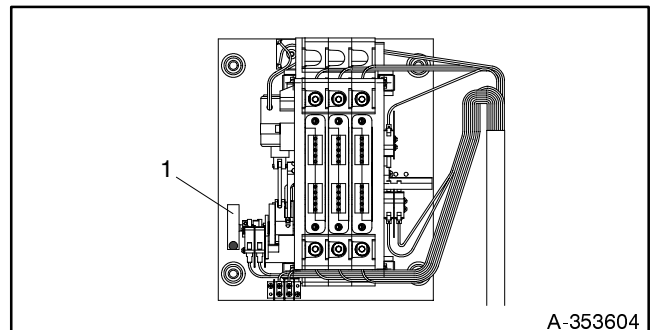
NOTICE

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

Manual Operation Procedure

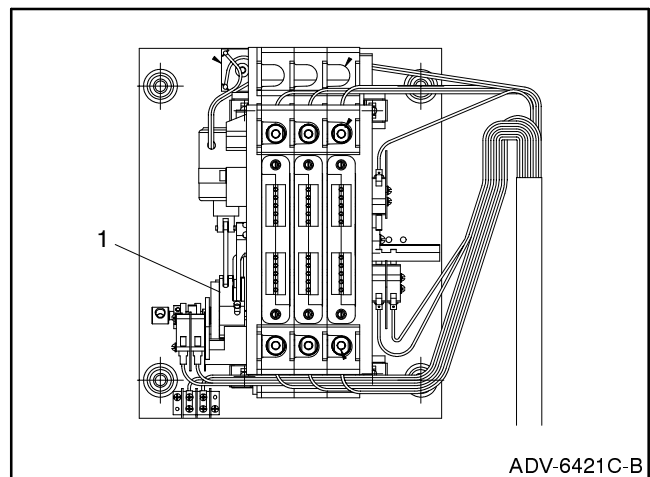
1. Prevent the generator set from starting by placing the generator set master switch in the OFF position, disconnecting power to the generator engine start battery charger, if installed, and disconnecting all generator engine start batteries, negative (-) leads first.

2. Disconnect **BOTH** the normal and emergency power sources by opening upstream circuit breakers or switches to the transfer switch.
3. Open the transfer switch enclosure door.
4. Insert the manual operator handle, a Phillips screwdriver, or a similar tool with an electrically-insulating handle into the hole located on the flywheel at the left of the contactor. Figure 2-1 and Figure 2-2 show the location of the flywheel. A letter stamped on the outer part of the flywheel shows the switch position when viewed from the front of the enclosure. Figure 2-3 shows the flywheel positions. 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].



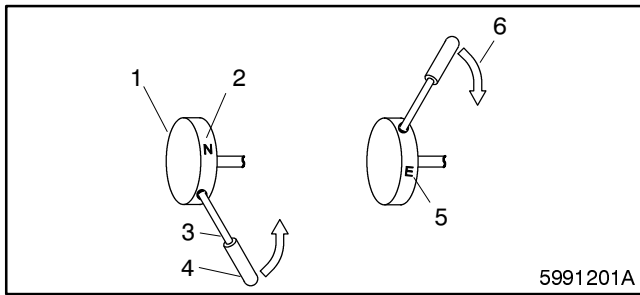
1. Flywheel

Figure 2-1. Typical Contactor, 40-200 Amps



1. Flywheel

Figure 2-2. Typical Contactor, 225-400 Amps



1. Flywheel
2. Letter N shows switch in the normal position
3. Manual operator handle inserted into the hole in the flywheel
4. Move handle up to select the emergency position
5. Letter E shows switch in the emergency position
6. Move handle down to select the normal position

Figure 2-3. Manual Operation of Contactor

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 distributor/dealer to service the contactor.

5. Move the manual operator handle up to rotate the flywheel to manually operate the switch into the emergency position. See Figure 2-3. Move the manual operator handle down to rotate the

flywheel to manually operate the switch into the normal position. See Figure 2-3.

6. Manually cycle the contactor between positions to verify that it operates smoothly without binding.
7. Manually operate the switch to select the normal position for automatic operation.
8. Remove the manual operator handle or other tool used to manually operate the switch. Return the manual operator handle to its storage location on the transfer switch.
9. Close and lock the transfer switch enclosure door.
10. Reconnect power supplies to the transfer switch.

NOTE

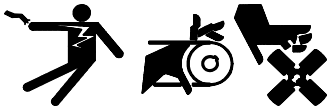
When applying power to a transfer switch whose electrical controls have lost power, the engine start contacts remain closed, signaling the generator to run until the ATS's time delay engine cooldown (TDEC), if equipped, ends.

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

Section 3. Accessories

Most accessories for the transfer switch covered by this manual are controller accessories. For controller accessory information and procedures, refer to the operation and installation manual for the electrical controls specified by the part number model code shown on the transfer switch nameplate. See Sections 1.3 and 1.4 for nameplate and part number model code information. See the List of Related Materials in the Introduction section in this manual.



WARNING



Accidental starting. Can cause severe injury or death.

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

 WARNING

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

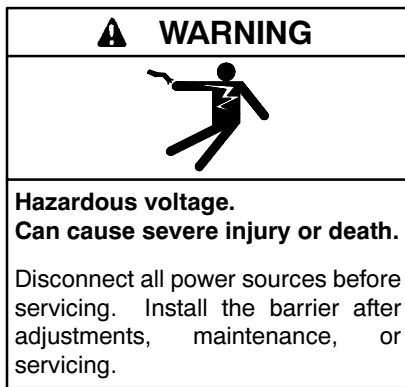
(600 volts and under)

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocuting is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, 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 because these conditions increase the risk of electrocution.

Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage. *(Models with E33+, S340, S340+, 340, R340, and R33 controls only)*

Installing accessories to the transformer assembly. Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to the 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 electrical shock deenergize the normal power source before making any line or auxiliary connections.



(600 volts and under)

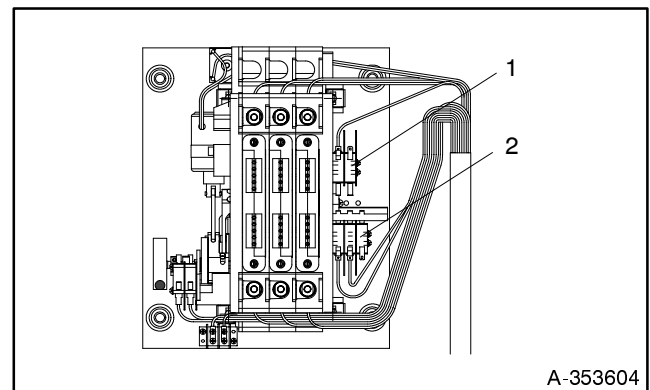
Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline 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 accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.

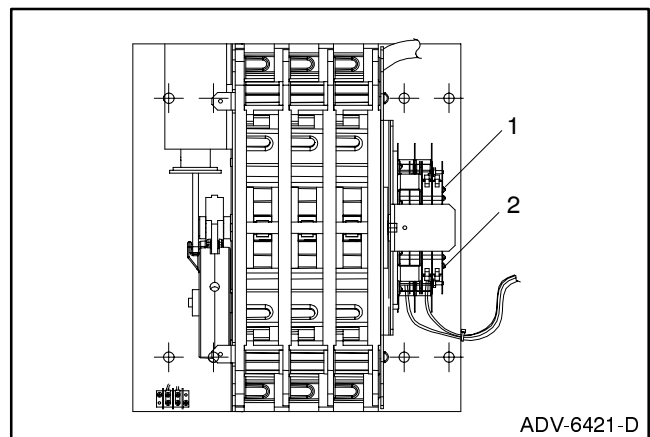
Main shaft auxiliary contacts (standard or accessory KA-15 or KD-15) are isolated contacts that operate with the main power switch to provide a positive indication of contactor position. Each set of auxiliary contacts provides one contact closed in the emergency position and one contact closed in the normal position for connection to customer circuitry. The contactor can have a maximum of two sets of auxiliary contacts.

Figure 3-1 and Figure 3-2 show the locations of the first set of auxiliary contacts on the contactor assemblies. The 250 volt maximum switches do not include auxiliary contacts as standard equipment. The 600 volt maximum switches include one set of auxiliary contacts, labeled A3 and A4, as standard equipment. The table in Figure 3-3 lists the accessory numbers for additional sets of auxiliary contacts.



1. Main shaft auxiliary contact closed on normal position.
2. Main shaft auxiliary contact closed on emergency position.

Figure 3-1. Location of First Set of Auxiliary Contacts on 40-200 Amp Contactors



1. Main shaft auxiliary contact closed on normal position.
2. Main shaft auxiliary contact closed on emergency position.

Figure 3-2. Location of First Set of Auxiliary Contacts on 225-400 Amp Contactors

Accessory Number	Description
KA-15-P	First set of auxiliary contacts for 250 volt maximum switches
KA-15-R	Two sets of auxiliary contacts for 250 volt maximum switches
KA-15-N	One additional set of auxiliary contacts for 600 volt maximum switches with solid-state controls
KD-15-N	One additional set of auxiliary contacts for 600 volt maximum switches with microprocessor controls

Figure 3-3. Auxiliary Contact Accessory Numbers

Figure 3-4 shows the auxiliary contact terminals. Terminals 10–13 connect to the first set of contacts. Terminals 29–32 connect to the second set of contacts. Each contact is rated 20 amperes, 250 VAC maximum.

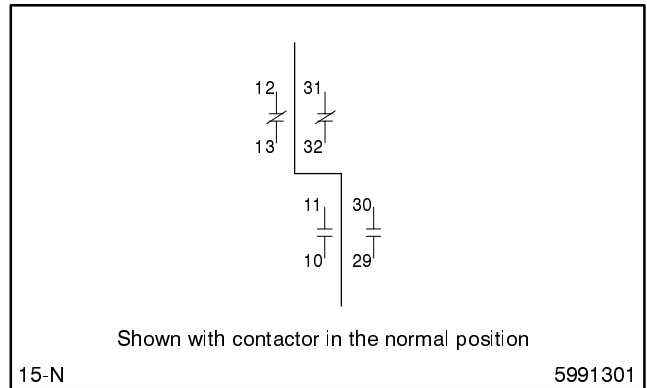


Figure 3-4. Auxiliary Contact Connections

Notes

Section 4. Scheduled Maintenance

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

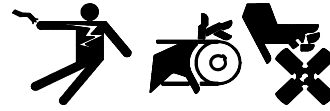
A local authorized distributor/dealer can provide complete preventive maintenance and services to keep the transfer switch in top condition. Contact a local distributor/dealer for additional information. See the Service Assistance section in the Introduction for information on locating a local distributor/dealer.

Read this entire section carefully before attempting any maintenance or service. Unless otherwise specified, have maintenance or service performed by an authorized distributor/dealer that has trained and qualified personnel who follow all applicable codes and standards.

Keep records of all maintenance or service.

Replace all barriers and close and lock the enclosure door before reapplying power.

WARNING



Accidental starting.
Can cause severe injury or death.

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

WARNING

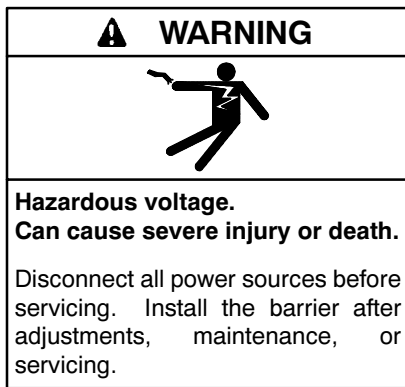


Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening the enclosure.

(600 volts and under)

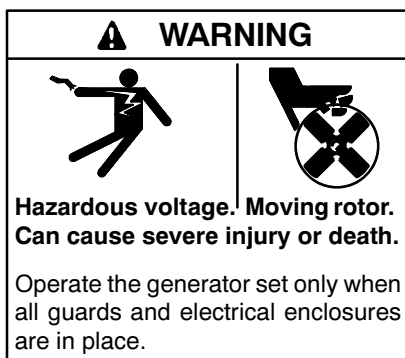
Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer 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 because these conditions increase the risk of electrocution.



(600 volts and under)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline 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 accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.



NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

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

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.

4.1 Inspection and Service

Contact an authorized distributor/dealer to inspect and service the transfer switch when any wear, damage, deterioration, or malfunction of the transfer switch or its components is evident or suspected.

4.1.1 General Inspection

External Inspection. Keep the transfer switch clean and in good condition by performing a weekly general external inspection of the transfer switch. Look for any signs of vibration, leakage, excessive noise, temperature, contamination, or deterioration. Remove accumulations of dirt, dust, and other contaminants from the transfer switch's external components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.* Replace any worn, missing, or broken external components with manufacturer-recommended replacement parts. Contact a local authorized distributor/dealer for specific part information and part ordering. Tighten loose external hardware.

Internal Inspection. Disconnect all power sources, open the transfer switch enclosure door, and inspect internal components every six months or when any condition noticed during an external inspection may have affected internal components.

Contact an authorized distributor/dealer to inspect and service the transfer switch if any of the following conditions are found inside the transfer switch.

- Accumulations of dirt, dust, moisture, or other contaminants
- Signs of corrosion
- Worn, missing, or broken components
- Loose hardware
- Wire or cable insulation deterioration, cuts, or abrasion
- Signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor
- Other evidence of wear, damage, deterioration, or malfunction of the transfer switch or its components.

If the power interruption required to perform an internal inspection is unacceptable in the application, have an internal inspection performed by an authorized distributor/dealer.

4.1.2 Other Inspections and Service

Have an authorized distributor/dealer perform scheduled maintenance, service, and other maintenance that ensures the safe and reliable operation of the transfer switch including annual

inspection and testing. See Section 4.3—Service Schedule for the recommended maintenance items and service intervals.

Have an authorized distributor/dealer repair or replace components inside the transfer switch enclosure with manufacturer-recommended replacement parts.

4.2 Testing

4.2.1 Weekly Generator Set Exercise

Use a plant exerciser or manual test to start and run the generator set under a load once a week to maximize the reliability of the emergency power system. See the electrical controls operation and installation manual for the procedure to exercise the generator set. See List of Related Materials in the Introduction section in this manual.

4.2.2 Monthly Automatic Operation Test

Test the transfer switch's automatic control system monthly. See the electrical controls operation and installation manual for the test procedure. Verify that the expected sequence of operations occurs as the switch transfers the load to the emergency source when a normal source failure occurs or is simulated. Observe the indicators (incandescent lamps and LEDs) included on the transfer switch to check their operation. When the switch transfers the load to the emergency source, end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the available normal source and signals the generator set to shut down after a cooldown period.

4.3 Service Schedule

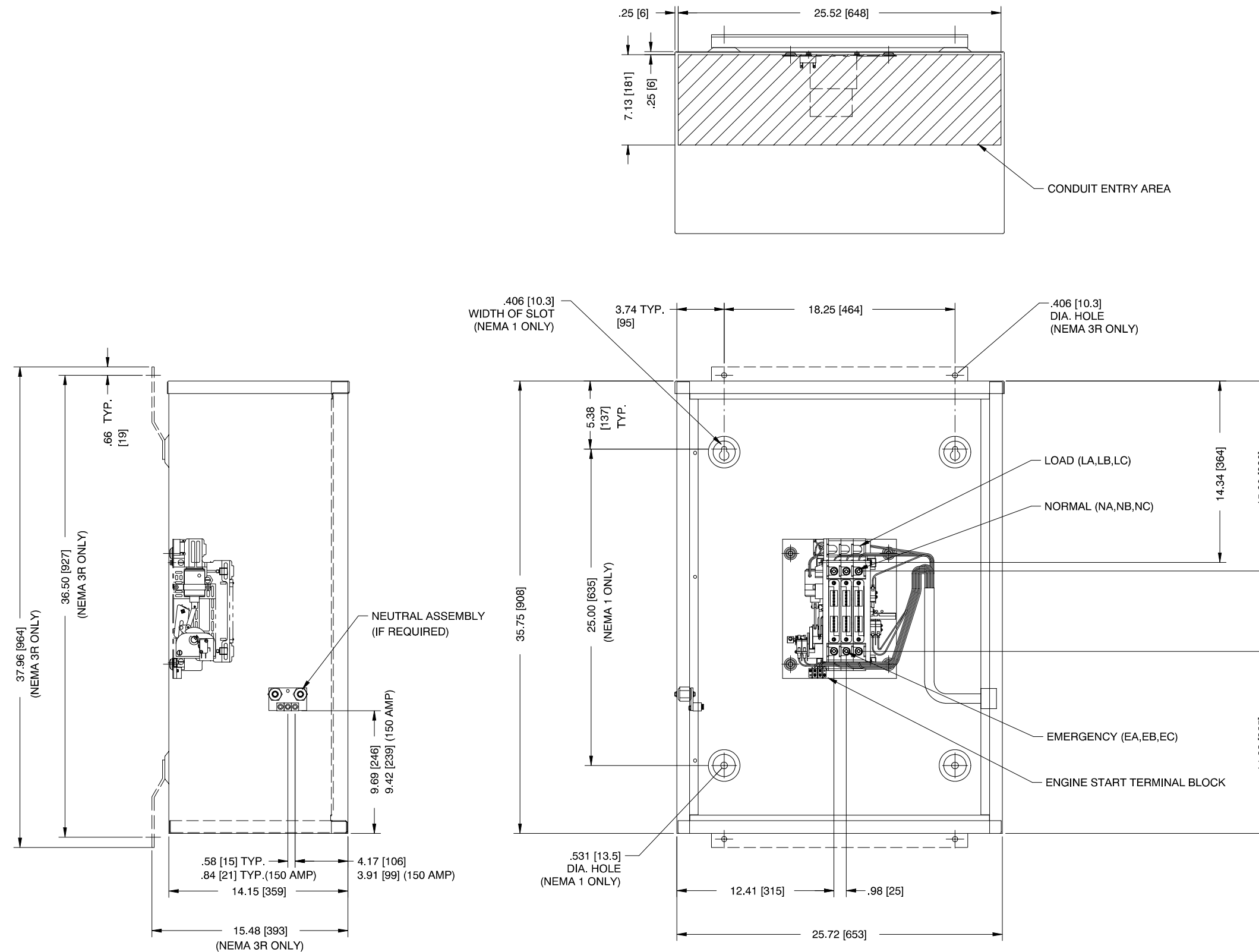
Follow the service schedule below for the recommended service intervals. Have all service performed by an authorized distributor/dealer except for activities designated by an X.

System Component or Procedure	See Section	Visually Inspect	Check	Change	Clean	Test	Interval
ELECTRICAL SYSTEM							
Check for signs of overheating or loose connections: discolored metal, melted plastic, or a burning odor.	4.1.1	X	X				S
Check the contactor's external operating mechanism for cleanliness and clean and relubricate if dirty. *	4.1.1	X		D (lubricant)	D		Y
Check wiring insulation for deterioration, cuts, or abrasion and repair or replace wiring to regain the properties of the original wiring.	4.1.1	X		D, R (wiring)			S
	4.1.2	D	D				Y
Check the transfer switch's main power switching mechanisms' mechanical operation and integrity.	4.1.2	D	D			D	Y
Tighten control and power wiring connections to specifications.	4.1.2, 6.4, C		D			D	Y
Check the transfer switch's main power switching contacts' condition and clean or replace the main contacts or replace the contactor assembly as necessary.	4.1.2	D		D, R	D		Y
Perform a millivolt drop test to check for high contact resistances on power circuits. Tighten connections, clean main contacts, adjust or replace main contacts or contactor assembly to eliminate high contact resistances.	4.1.2		D	D, R	D	D	Y
Test wire and cable insulation for electrical breakdown.	4.1.2					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary.	4.1.2		D			D	Every 5 Years
CONTROL SYSTEM							
Exercise the generator set under load.	4.2.1, C					X	W
Test the transfer switch's automatic control system.	4.2.2, C	X				X	M
Test all indicators (incandescent lamps and LEDs) and all remote control systems for operation.	C	D	D	D, R		D	Y
GENERAL EQUIPMENT CONDITION							
Inspect the outside of the transfer switch for any condition of vibration, leakage, noise, temperature, contamination, or deterioration to keep the transfer switch clean and in good condition. *	4.1.1	X			X		W
Check that all external hardware is in place, tightened, and not badly worn.	4.1.1	X	X	R			W
Inspect the inside of transfer switch for any condition of vibration, leakage, noise, temperature, contamination, or deterioration to keep the inside of the transfer switch clean, dry, and in good condition. *	4.1.1	X	X		D		S
	4.1.2	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn.	4.1.2	X	D				Y
<p>* Service more frequently if operated in dusty or dirty areas.</p> <p>See Section Read these sections carefully for additional information before attempting maintenance or service.</p> <p>Visually Inspect Examine these items visually.</p> <p>Check Requires physical contact with or movement of system components, or the use of nonvisual indications.</p> <p>Change May require replacement of components depending upon the severity of the problem.</p> <p>Clean Remove accumulations of dirt and contaminants from external transfer switch's components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush. <i>Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.</i></p> <p>Test May require tools, equipment, or training available only through an authorized distributor/dealer/dealer.</p> <p>C See the transfer switch electrical controls operation and installation manual for more information.</p> <p>P See the transfer switch power switching device operation and installation manual installation section for specifications.</p> <p>D Have service performed by an authorized distributor/dealer.</p> <p>X Operator action.</p> <p>R May require replacement of components.</p>							<p>W=Week</p> <p>M=Month</p> <p>Q=Quarter</p> <p>S=Six Months</p> <p>Y=Year</p>

Section 5. Diagrams and Drawings

Diagram or Drawing	Drawing Number	Page
Enclosure Dimensions Drawings		
40–200 Amp, NEMA Type 1 and 3R, S340 Controls	ADV-6424-A	23
40–200 Amp, NEMA Type 12, 4, and 4X, S340 Controls	ADV-6423-A	24
40–150 Amp, NEMA Type 1, M340 Controls	ADV-6424-A	23
40–150 Amp, NEMA Type 3R, 12, 4, and 4X, M340 Controls	ADV-6422-A	25
225–400 Amp, NEMA Type 1 and 3R, S340 Controls	ADV-6472-A	26
225–400 Amp, NEMA Type 12, 4, and 4X, S340 Controls	ADV-6473-A	27
225–400 Amp, NEMA Type 1, M340 Controls	ADV-6472-A	26
225–400 Amp, NEMA Type 3R, 12, 4, and 4X, M340 Controls	ADV-6473-A	27
Open Units Dimensions Drawings		
40–400 Amp, S340 Controls and Inner Panel Mounting	ADV-6421B-B	28
40–400 Amp, M340 Controls and Inner Panel Mounting	ADV-6421A-B	29
40–200 Amp, Contactor Assembly	ADV-6421C-B	30
225–400 Amp, Contactor Assembly	ADV-6421D-B	31
Schematic Diagrams		
40–200 Amp, 250 vac Maximum, S340 Controls	362114-C	32
40–400 Amp, 600 vac Maximum, S340 Controls	362172-B	33
40–400 Amp, 600 vac Maximum, M340 Controls	362173-B	34
Generator Interconnection Drawings		
40–400 Amp, 3 Pole	ADV-6495A	35
40–400 Amp, 4 Pole	ADV-6495B	36

Notes



SIZES OF UL LISTED SOLDERLESS
SCREW TYPE TERMINALS FOR
EXTERNAL POWER CONNECTIONS

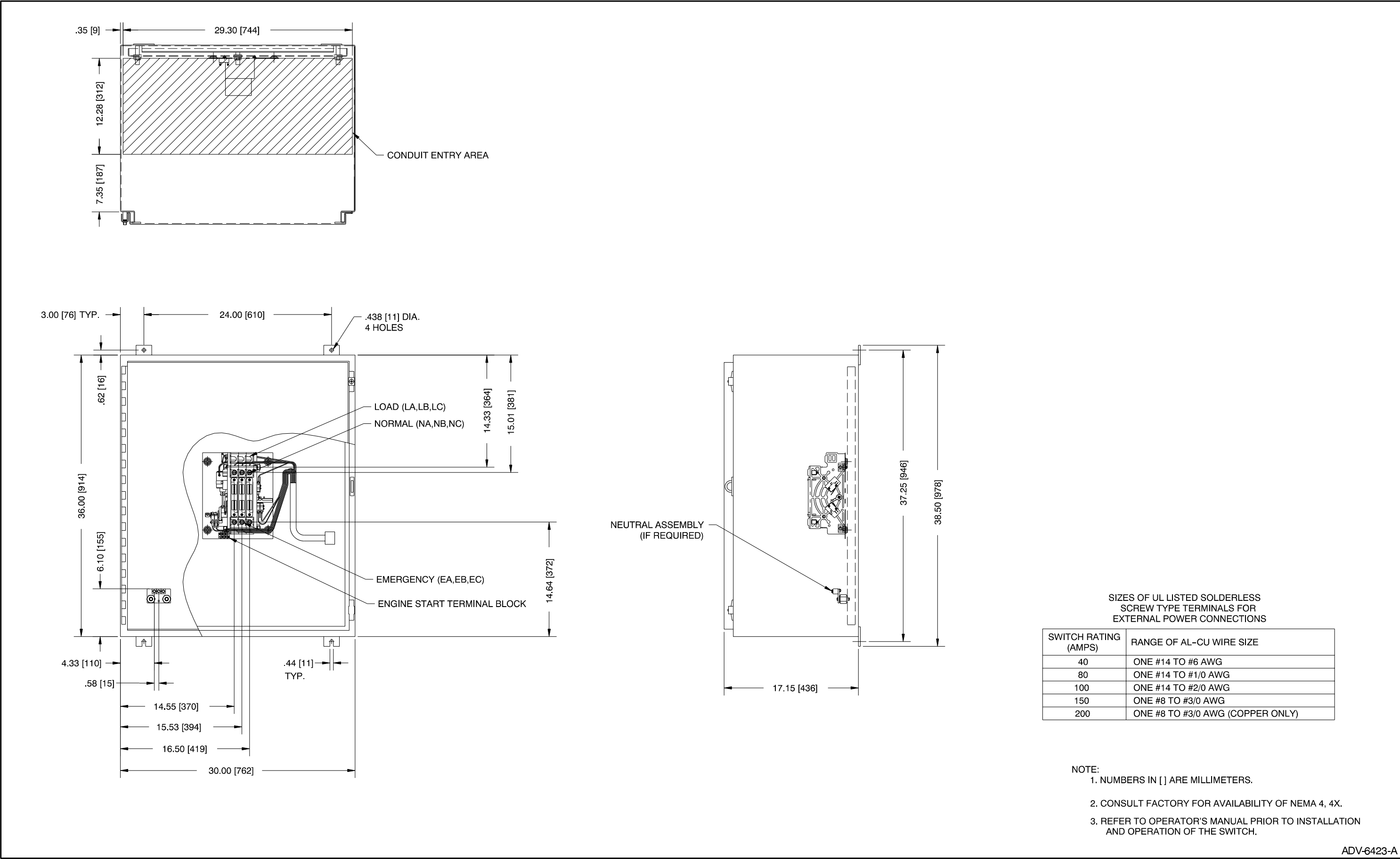
SWITCH RATING (AMPS)	RANGE OF AL-CU WIRE SIZE
40	ONE #14 TO #6 AWG
80	ONE #14 TO #1/0 AWG
100	ONE #14 TO #2/0 AWG
150	ONE #8 TO #3/0 AWG
200	ONE #8 TO #3/0 AWG (COPPER ONLY)

NOTE:

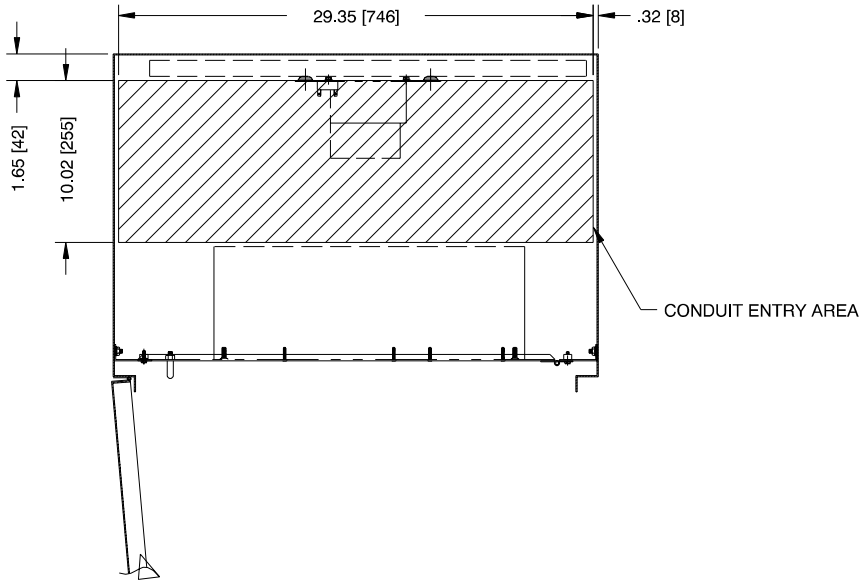
1. NUMBERS IN [] ARE MILLIMETERS
2. DIMENSIONS ARE FOR REFERENCE ONLY.
3. REFER TO OPERATOR'S MANUAL PRIOR TO INSTALLATION AND OPERATION OF THE SWITCH.

ADV-6424-A

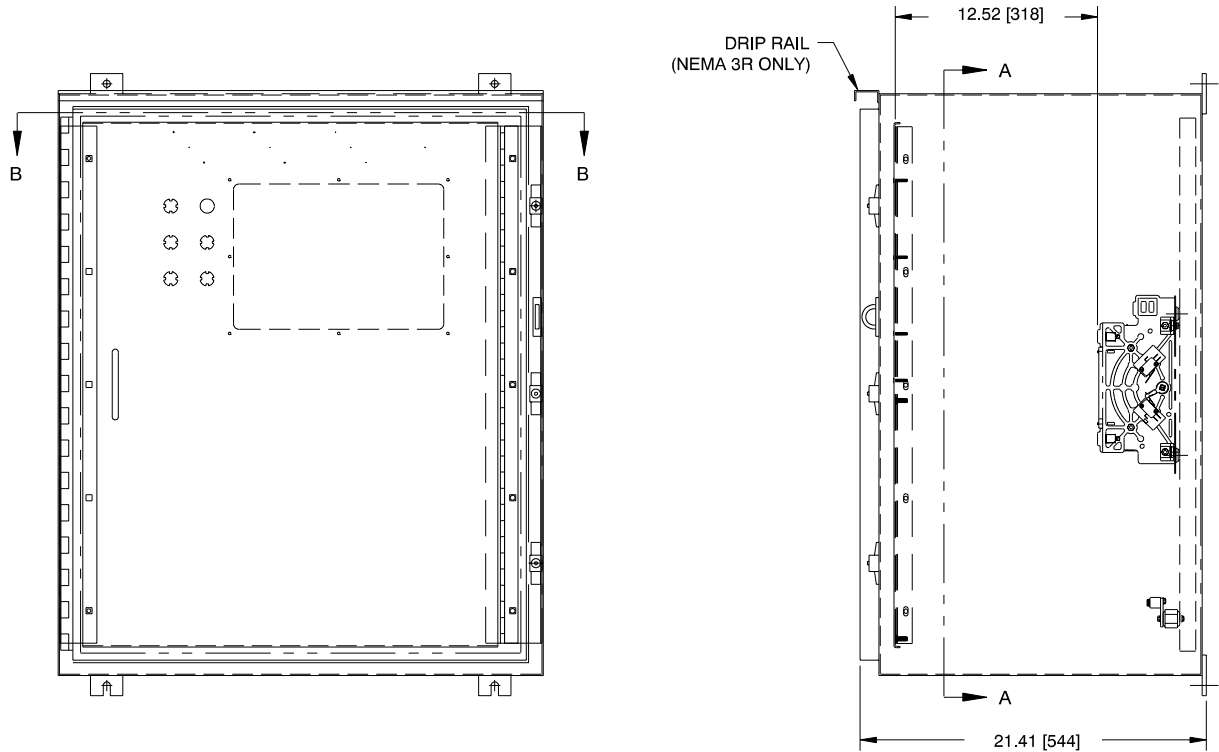
**Enclosure Dimensions, 40-200 Amp, NEMA Type 1 and 3R, S340 Controls;
40-150 Amp, NEMA Type 1, M340 Controls; ADV-6424-A-**



Enclosure Dimensions, 40-200 Amp, NEMA Type 12, 4, and 4X, S340 Controls; ADV-6423-A

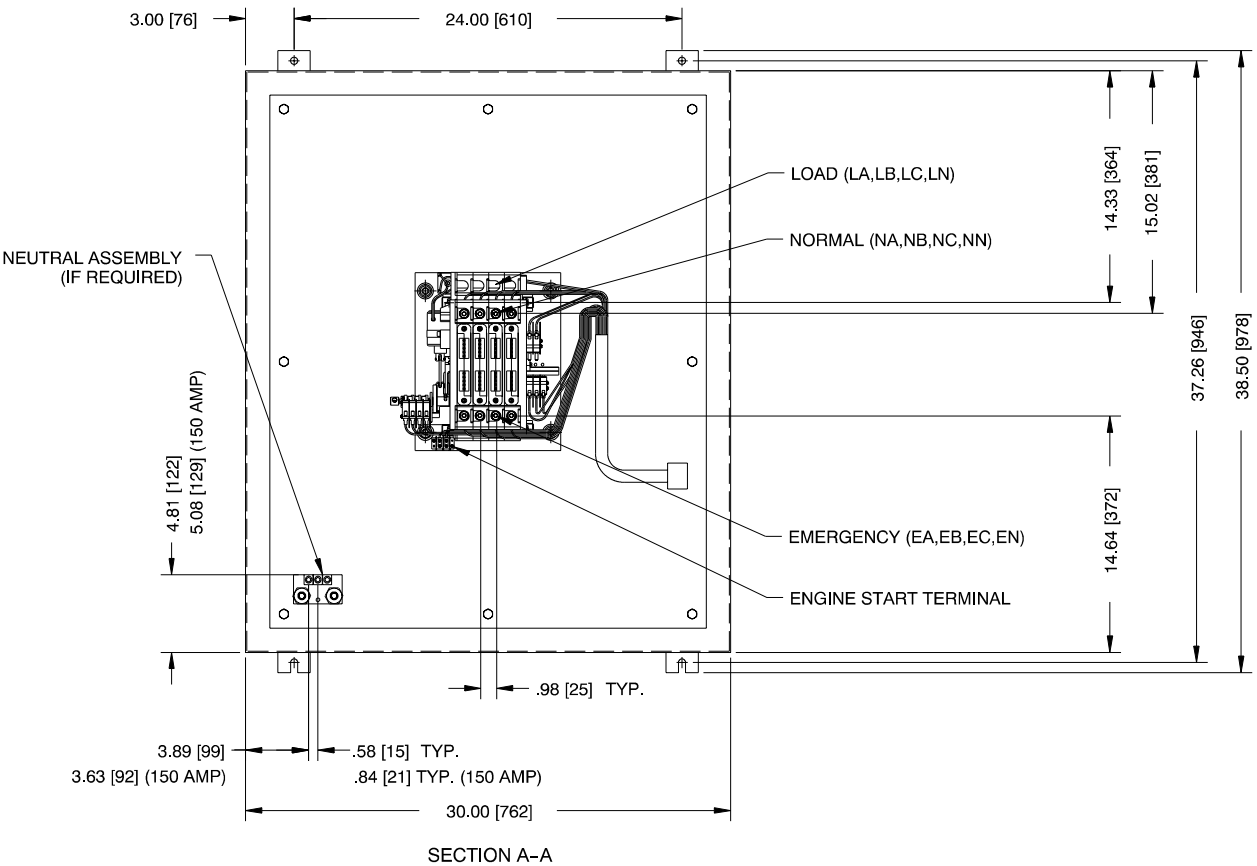


SECTION B-B
SHOWN WITH PARTIAL ENCLOSURE
DOOR REMOVED FOR CLARITY.



SIZES OF UL LISTED SOLDERLESS
SCREW TYPE TERMINALS FOR
EXTERNAL POWER CONNECTIONS

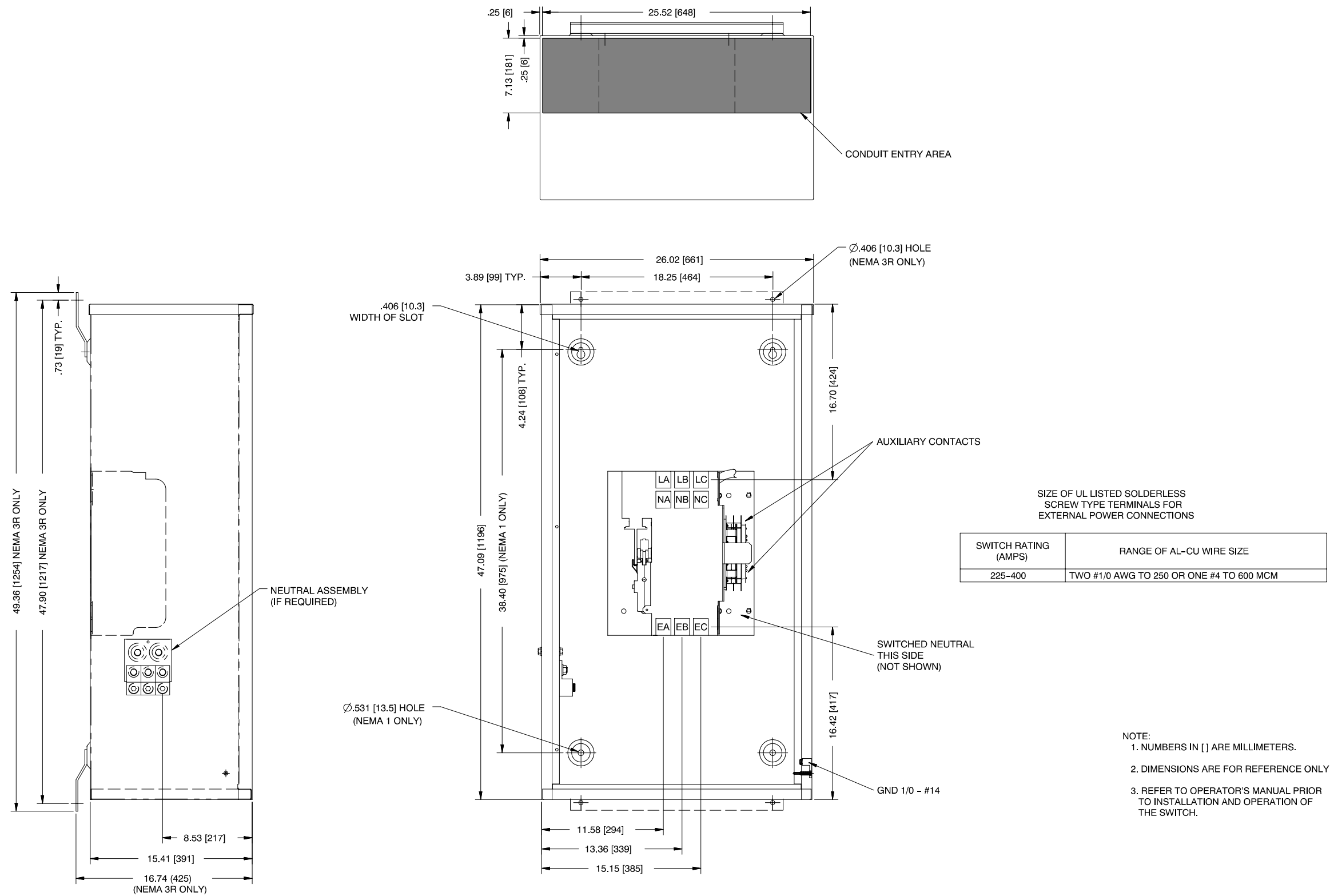
SWITCH RATING (AMPS)	RANGE OF AL-CU WIRE SIZE
40	ONE #14 TO #6 AWG
80	ONE #14 TO #1/0 AWG
100	ONE #14 TO #2/0 AWG
150	ONE #8 TO #3/0 AWG
200	ONE #8 TO #3/0 AWG (COPPER ONLY)



- NOTE:
1. NUMBERS IN [] ARE MILLIMETERS.
 2. CONSULT FACTORY FOR AVAILABILITY OF NEMA 4, 4X.
 3. REFER TO OPERATOR'S MANUAL PRIOR TO INSTALLATION AND OPERATION OF THE SWITCH.

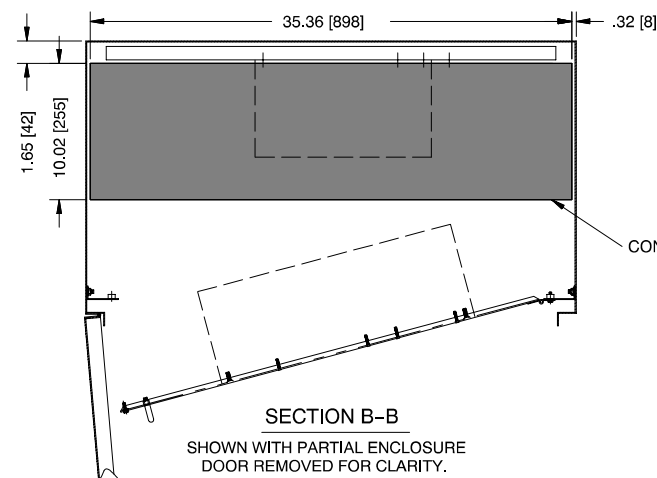
ADV-6422-A

Enclosure Dimensions, 40-150 Amp, NEMA Type 3R, 12, 4, and 4X, M340 Controls; ADV-6422-A

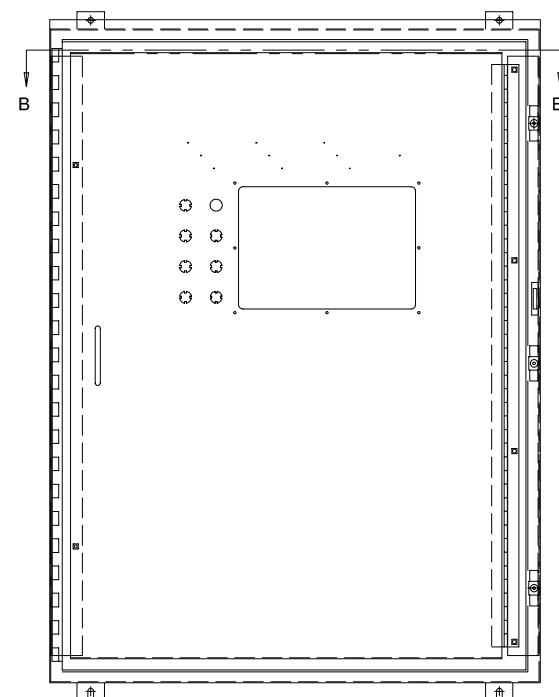


ADV-6472-A

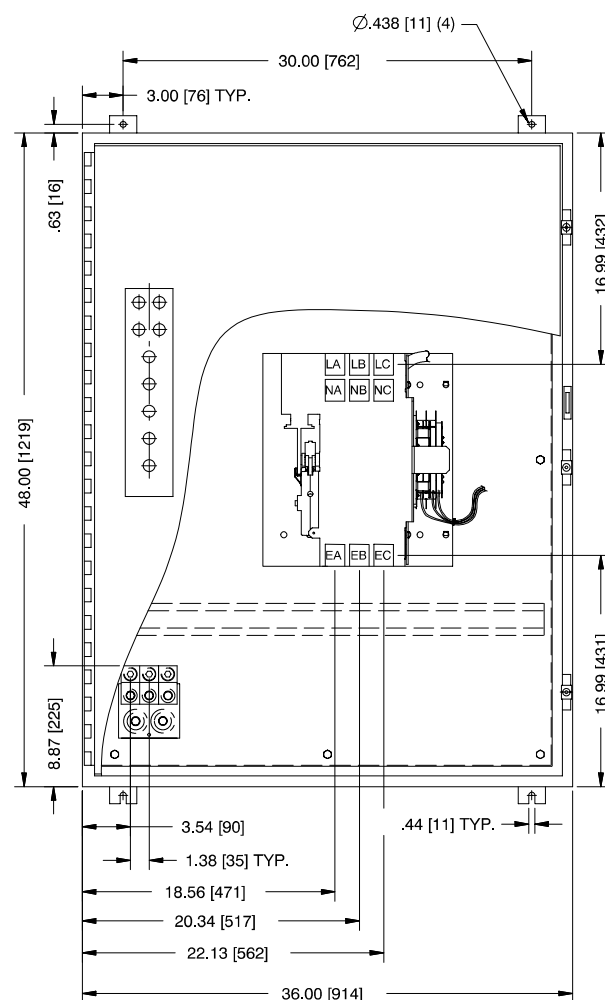
**Enclosure Dimensions, 225-400 Amp, NEMA Type 1 and 3R, S340 Controls;
NEMA Type 1, M340 Controls; ADV-6472-A**



SECTION B-B
SHOWN WITH PARTIAL ENCLOSURE
DOOR REMOVED FOR CLARITY.

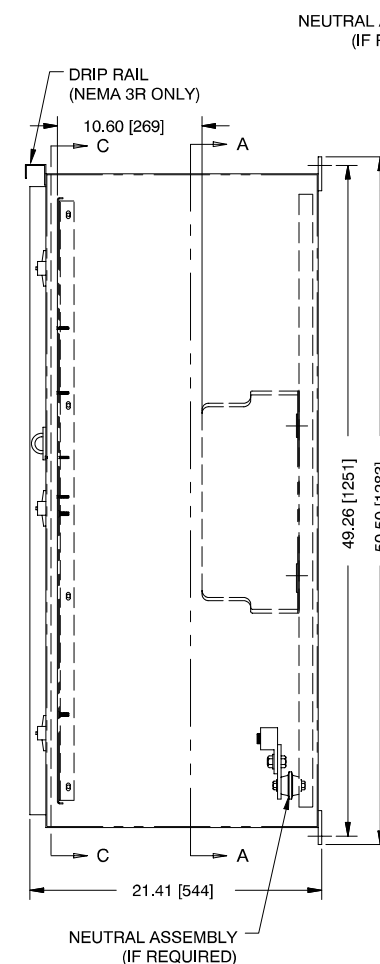


SECTION C-C
NEMA 3R, 12, 4 & 4X
M340 CONTROLS

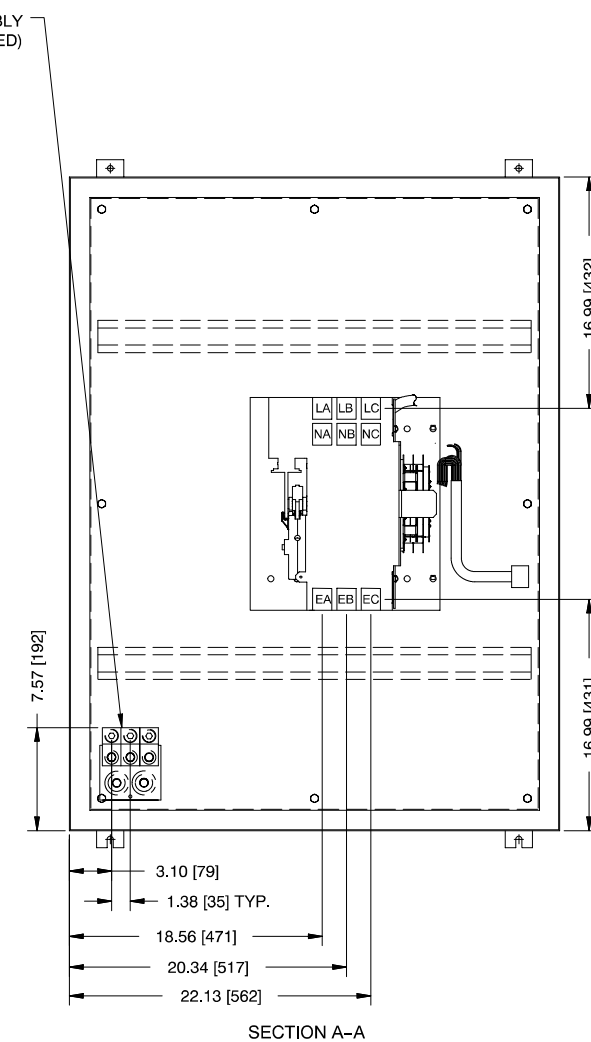


NEMA 12, 4 & 4X
S340 CONTROLS

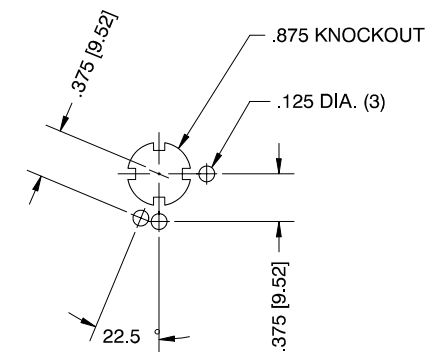
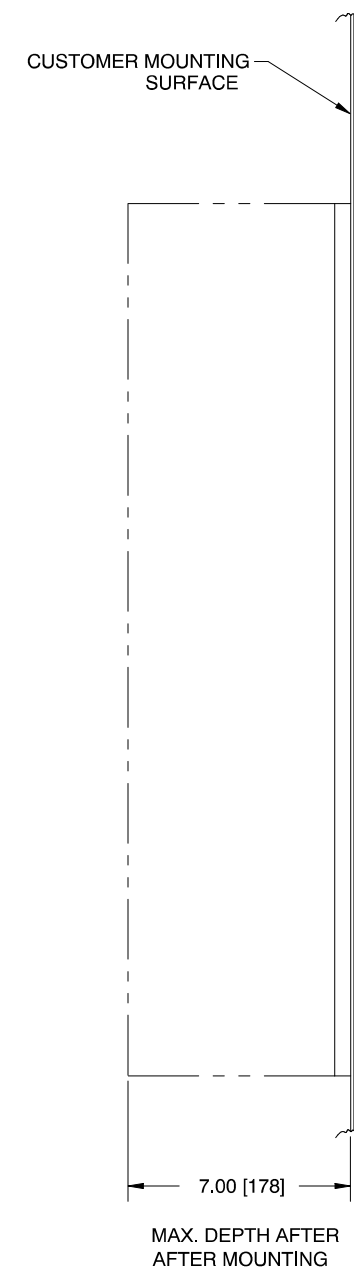
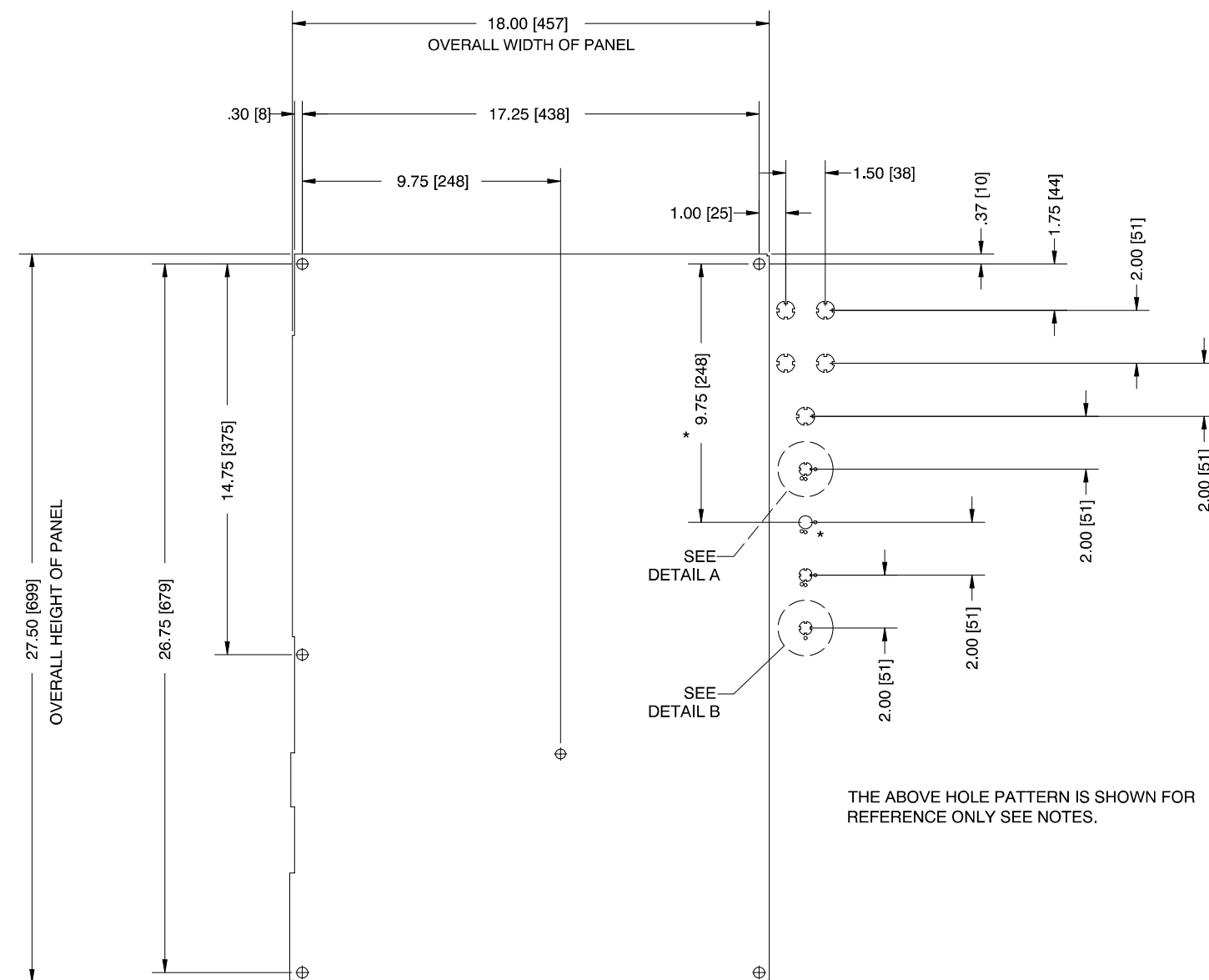
SIZE OF UL LISTED SOLDERLESS SCREW TYPE TERMINALS FOR EXTERNAL POWER CONNECTIONS	
SWITCH RATING (AMPS)	RANGE OF AL-CU WIRE SIZE
225-400	TWO #1/0 AWG TO 250 OR ONE #4 TO 600 MCM



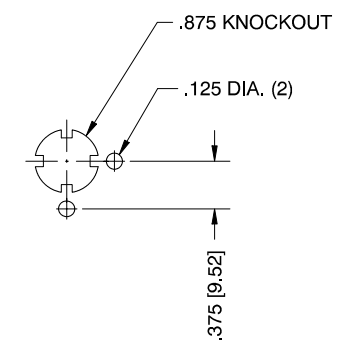
- NOTES:
1. NUMBERS IN [] ARE MILLIMETERS.
 2. DIMENSIONS ARE FOR REFERENCE ONLY.
 3. REFER TO OPERATOR'S MANUAL PRIOR TO INSTALLATION AND OPERATION OF THE SWITCH.



SECTION A-A



DETAIL A (TYP. 3 PLCS.)
(4X SCALE)

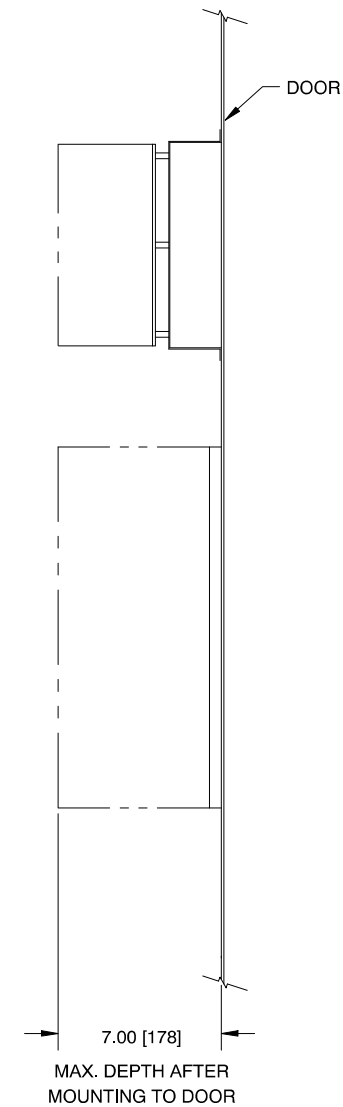


DETAIL B
(4X SCALE)

NOTE:
DIMENSIONS IN [] ARE MILLIMETER EQUIVALENTS.
THE HOLE PATTERN REPRESENTED BY A (*) IS REQ'D, FOR THE TEST SWITCH WHICH IS PART OF THE UNIT. ALL REMAINING HOLES AND RECTANGLES ARE RECOMMENDED ACCESSORY LOCATIONS.
— — — — — INDICATES ELECTRICAL COMPONENTS

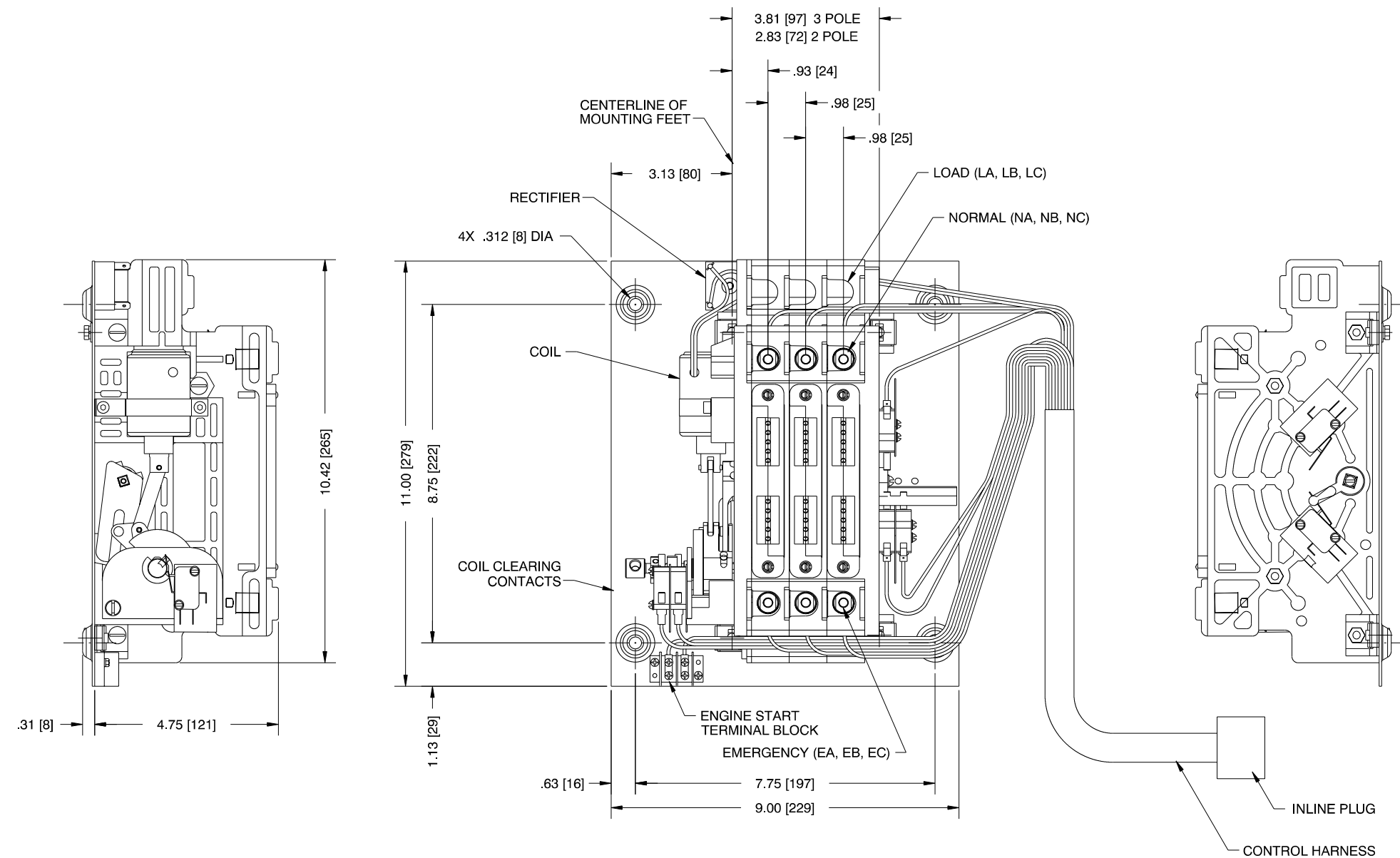
ADV-6421B-B

Open Units Dimensions, 40-400 Amp, S340 Controls and Inner Panel Mounting; ADV-6421B-B



ADV-6421A-B

Diagrams and Drawings 29



SIZES OF UL LISTED SOLDERLESS
SCREW TYPE TERMINALS FOR
EXTERNAL POWER CONNECTIONS

SWITCH RATING (AMPS)	RANGE OF AL-CU WIRE SIZE
40	ONE #14 TO #6 AWG
80	ONE #14 TO #1/0 AWG
100	ONE #14 TO #2/0 AWG
150	ONE #8 TO #3/0 AWG
200	ONE #8 TO #3/0 AWG (COPPER ONLY)

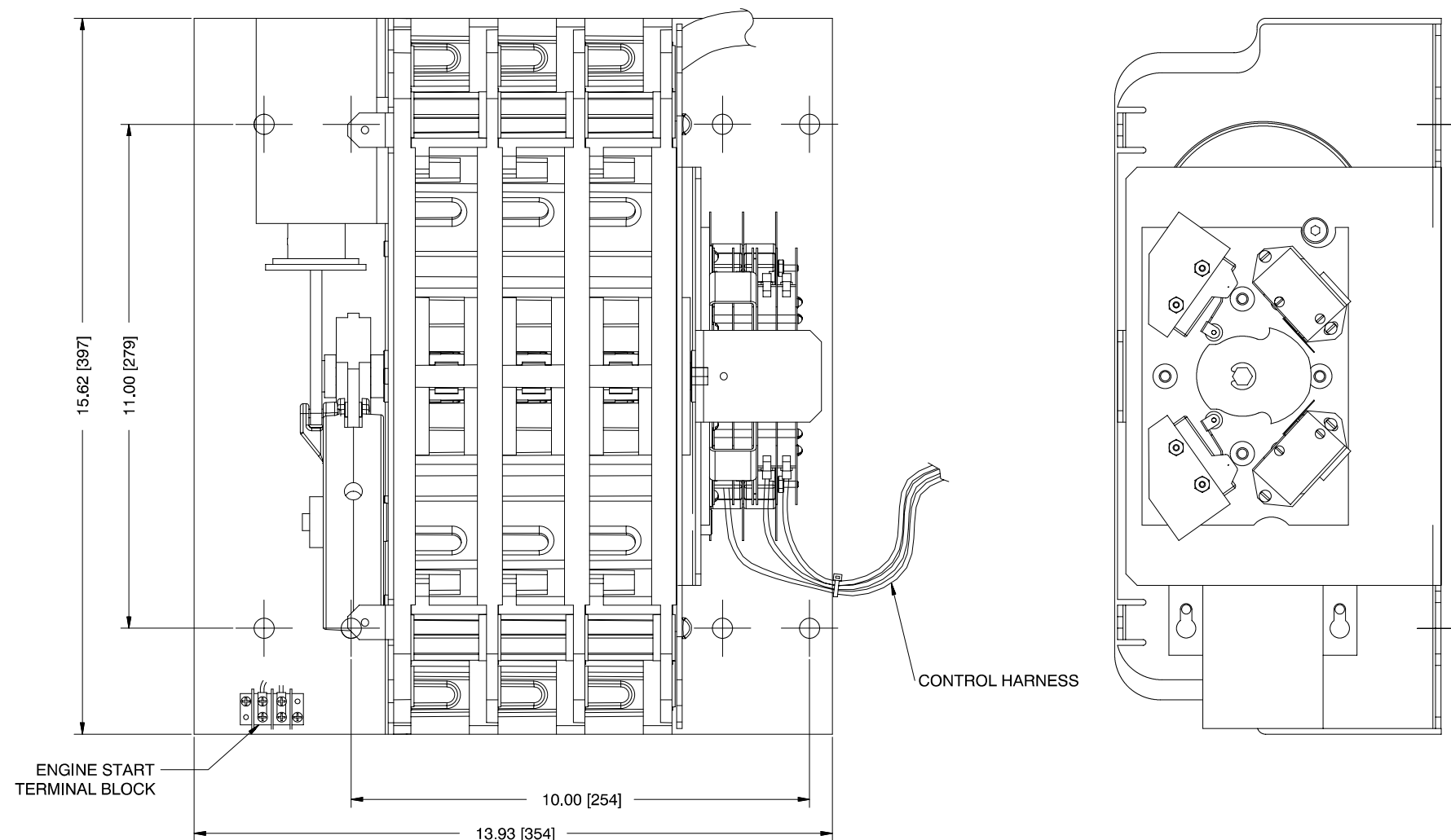
NOTE:
DIMENSIONS IN [] ARE MILLIMETER EQUIVALENTS.

GENERAL NOTES:

1. WHEN INSTALLING, CONNECT NORMAL, EMERGENCY, AND LOAD CONDUCTORS TO SIMILARLY MARKED TERMINALS.
2. ALL INTERNAL CONNECTIONS ARE MADE AT THE FACTORY.
3. MAINTAIN ELECTRICAL CLEARANCE OF .50 (12.7 MM) MINIMUM BETWEEN LIVE METAL PARTS AND GROUND METAL WHEN MOUNTING 40 THRU 200 AMP. SIZES
4. WHEN OPEN TYPE ATS'S ARE INTENDED FOR ENCLOSURE TYPE MOUNTING BY OTHERS, MOUNT THE TRANSFER SWITCH UNIT ON THE INSIDE BACK SURFACE AND THE CONTROL PANEL (S) ON THE INSIDE DOOR SURFACE.
5. THE CONTROL PANEL IS CONNECTED TO THE TRANSFER SWITCH PANEL BY A WIRE HARNESS WITH A QUICK DISCONNECT PLUG. HARNESS LENGTH IS - 30.00 (762 MM) FOR 40-200 AMP
6. SUGGESTED BOLT SIZE AND LENGTH FOR MOUNTING ATS.
40-200 AMP: 1/4-20 X 1" MIN. QTY. 4

ADV-6421C-B

Open Units Dimensions, 40-200 Amp, Contactor Assembly; ADV-6421C-B



SIZES OF UL LISTED SOLDERLESS
SCREW TYPE TERMINALS FOR
EXTERNAL POWER CONNECTIONS

SWITCH RATING (AMPS)	RANGE OF AL-CU WIRE SIZE
225, 260, 400	TWO 1/0 TO 250 MCM ONE #4 TO 600 MCM

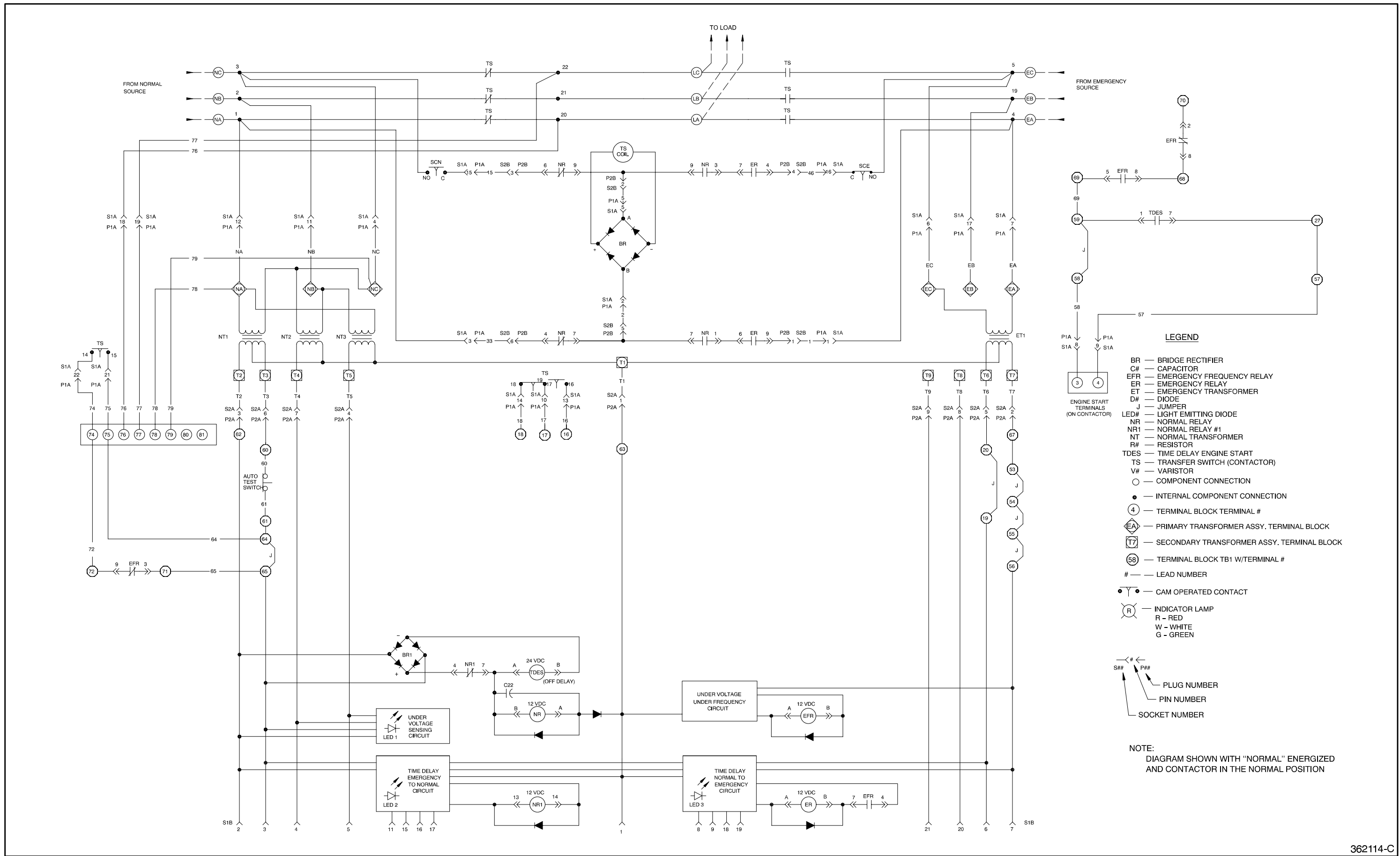
NOTE:
DIMENSIONS IN [] ARE MILLIMETER EQUIVALENTS.

GENERAL NOTES:

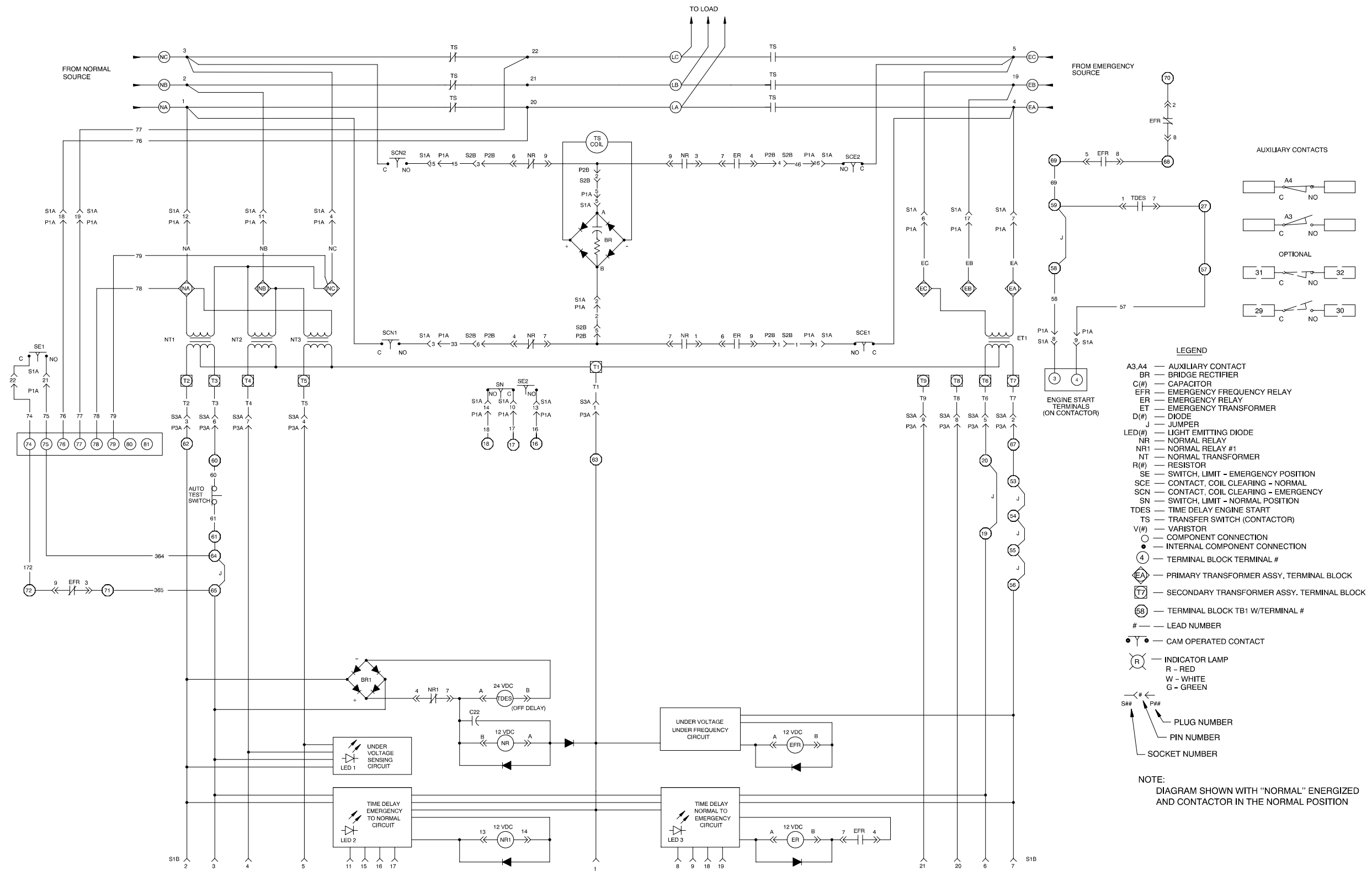
1. WHEN INSTALLING, CONNECT NORMAL, EMERGENCY, AND LOAD CONDUCTORS TO SIMILARLY MARKED TERMINALS.
2. ALL INTERNAL CONNECTIONS ARE MADE AT THE FACTORY.
3. MAINTAIN ELECTRICAL CLEARANCE OF .50 (12.7 MM) MINIMUM BETWEEN LIVE METAL PARTS AND GROUND METAL WHEN MOUNTING 40 THRU 200 AMP SIZES.
4. WHEN OPEN TYPE ATS'S ARE INTENDED FOR ENCLOSURE TYPE MOUNTING BY OTHERS, MOUNT THE TRANSFER SWITCH UNIT ON THE INSIDE BACK SURFACE AND THE CONTROL PANEL (S) ON THE INSIDE DOOR SURFACE.
5. THE CONTROL PANEL IS CONNECTED TO THE TRANSFER SWITCH PANEL BY A WIRE HARNESS WITH A QUICK DISCONNECT PLUG. HARNESS LENGTH IS - 30.00 (762 MM).
6. SUGGESTED BOLT SIZE AND LENGTH FOR MOUNTING ATS.
225-400 AMP: 1/4-20 X 1" MIN. QTY 4.

ADV-6421D-B

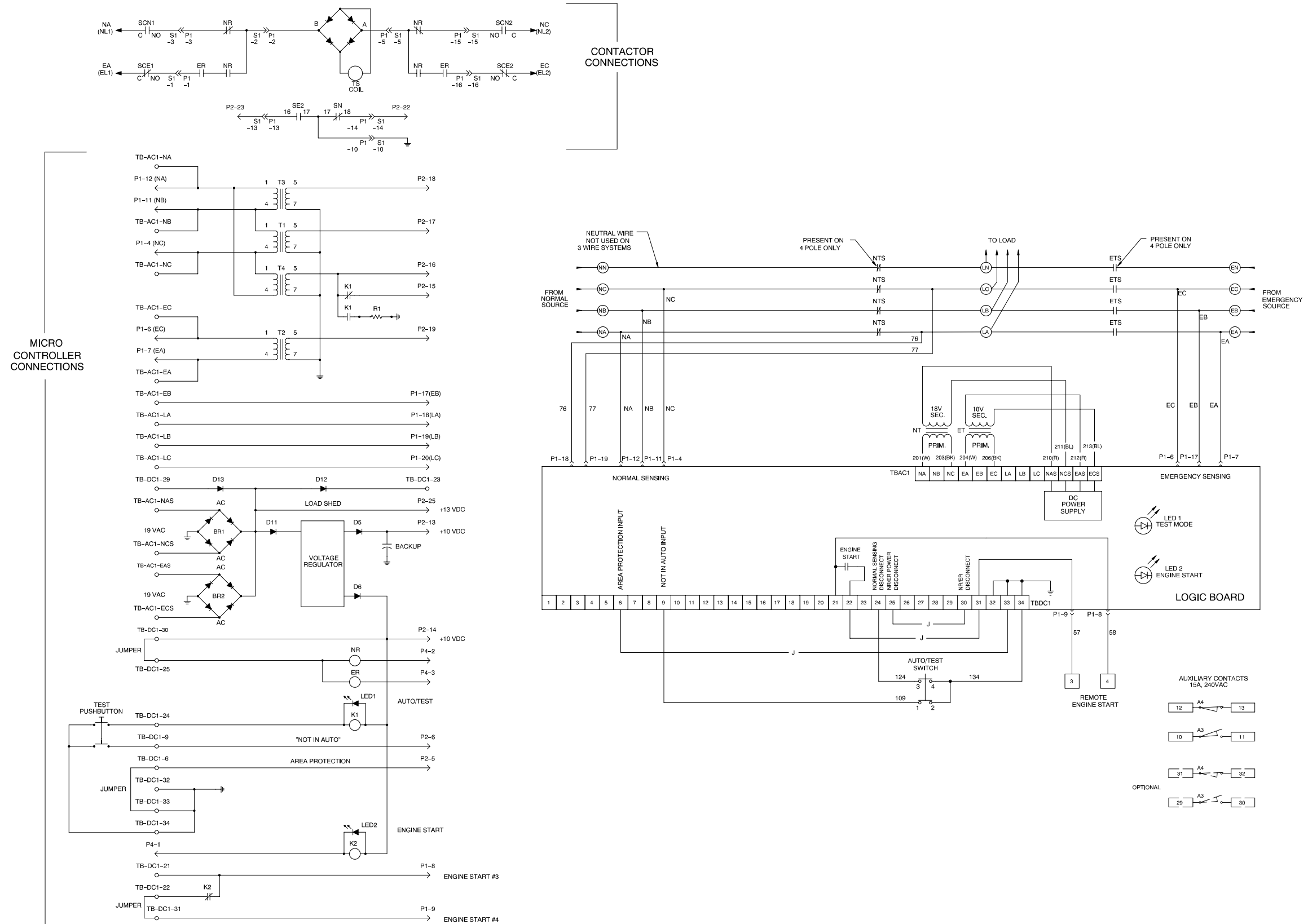
Open Units Dimensions, 225-400 Amp, Contactor Assembly; ADV-6421D-B



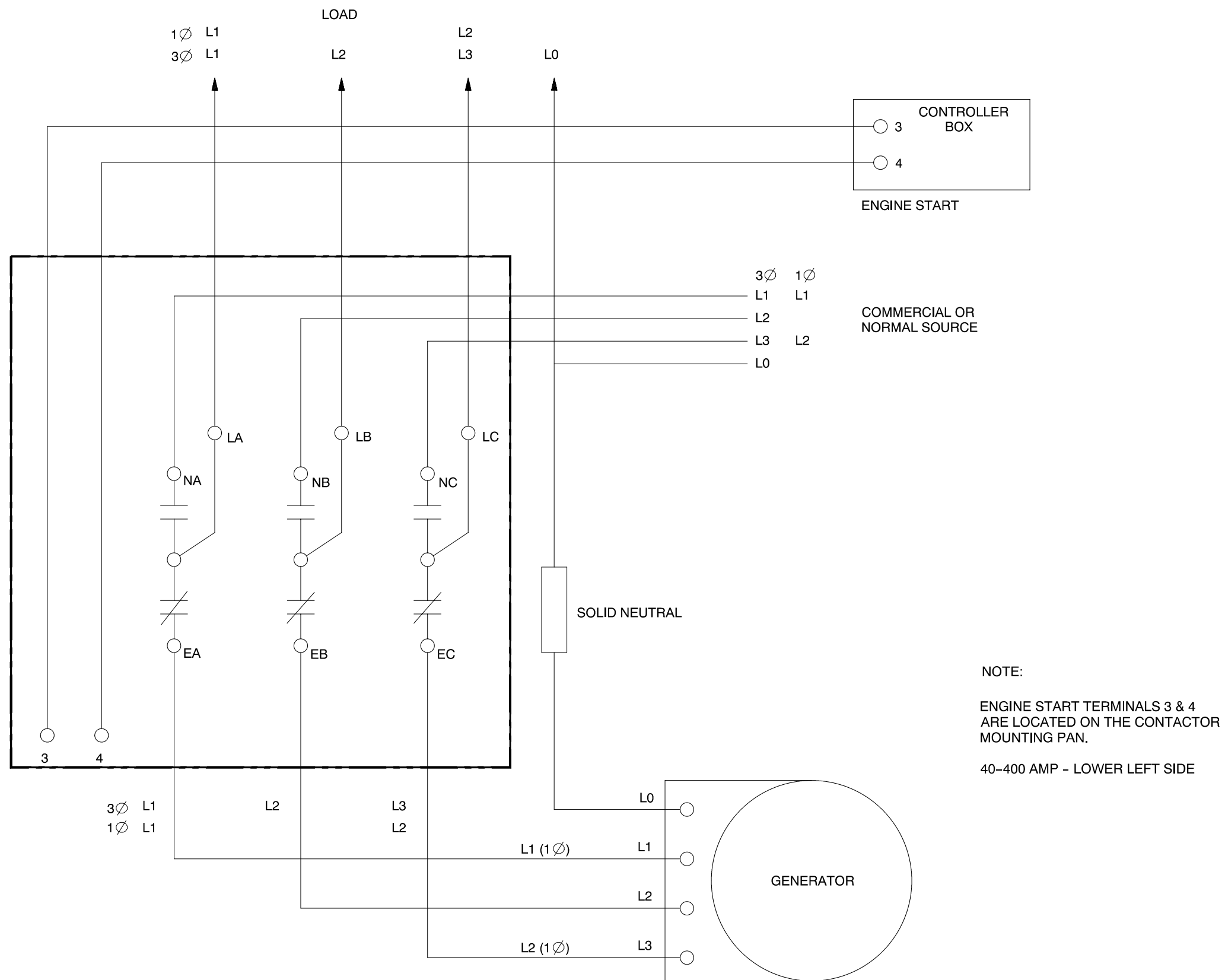
Schematic Diagram, 40-200 Amp, 250 VAC Maximum, S340 Controls; 362114-C



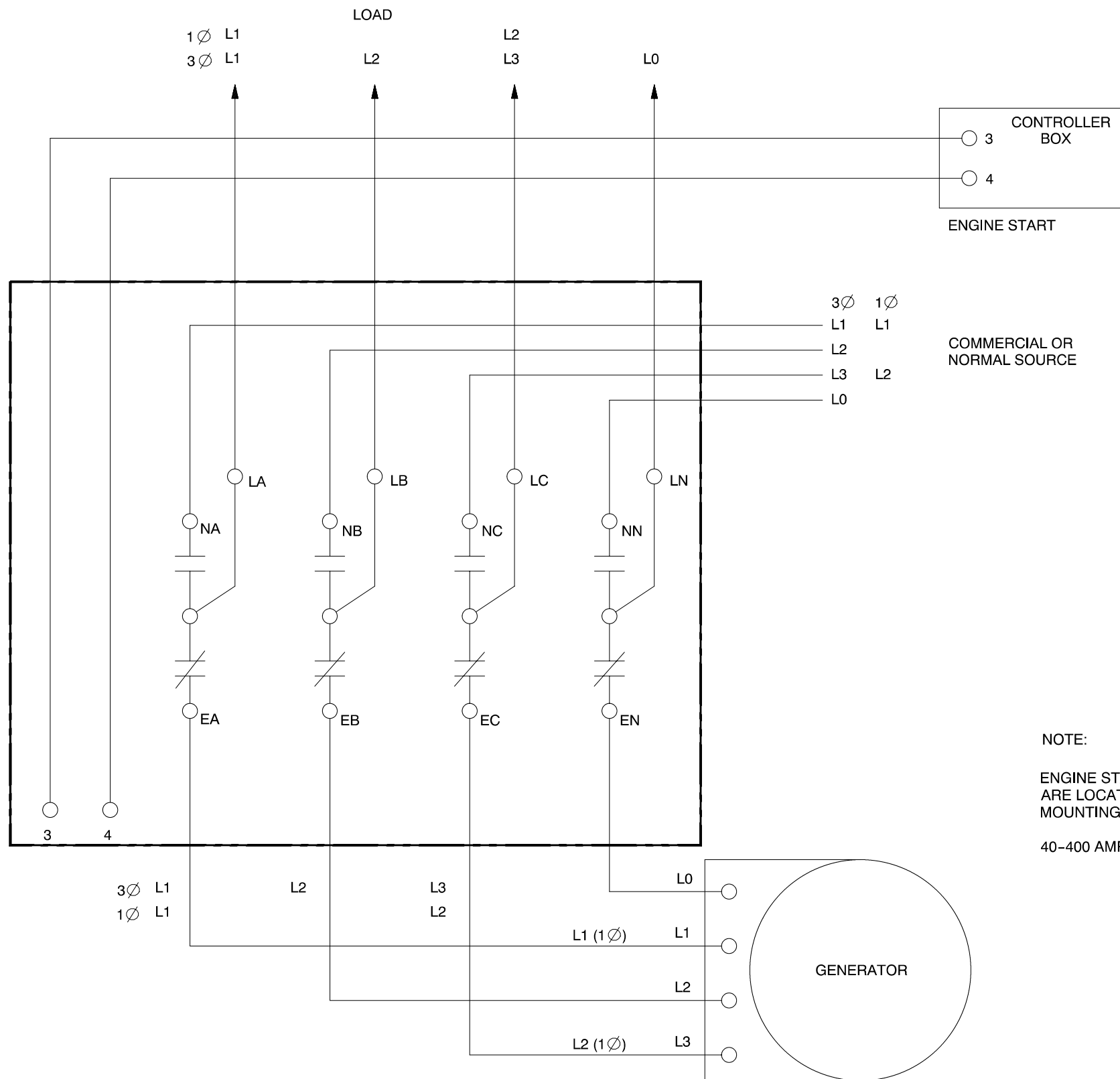
Schematic Diagram, 40-400 Amp, 600 VAC Maximum, S340 Controls; 362172-B



Schematic Diagram, 40-400 Amp, 600 VAC Maximum, M340 Controls; 362173-B



NOTE:
ENGINE START TERMINALS 3 & 4
ARE LOCATED ON THE CONTACTOR
MOUNTING PAN.
40-400 AMP - LOWER LEFT SIDE



NOTE:

ENGINE START TERMINALS 3 & 4
ARE LOCATED ON THE CONTACTOR
MOUNTING PAN.

40-400 AMP - LOWER LEFT SIDE

Generator Interconnection Drawing, 4 Pole; ADV-6495B-

ADV-6495B-

Section 6. Installation

Kohler® automatic transfer switches are shipped factory wired and tested, ready for installation. Follow this installation section first when installing the transfer switch. Installation of the switch consists of the following.

- Unpacking and inspecting the transfer switch upon receipt.
- Protecting the switch against damage before and during installation.
- Wiring of normal source (utility), emergency source (generator), and load circuits.
- Wiring of control connections such as generator start signals and accessories.
- Checking voltages and functions.
- Connecting and initializing the electrical controls.

Refer to the electrical controls operation and installation manual packed with the transfer switch for details on electrical controls and accessories. See Sections 1.3 and 1.4 for nameplate and model number information to identify the type of electrical controls. See List of Related Materials in the Introduction section in this manual.

6.1 Upon Receipt of Unit

6.1.1 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.

6.1.2 Lifting

⚠ WARNING

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

See Figure 6-1 for the approximate weight of each transfer switch covered in this manual. Use a spreader bar to lift. Attach the bar only to the enclosure's mounting holes or lifting brackets; do not lift the unit at any other points. Replace, close, and latch the enclosure door before moving or mounting the unit.

Specifications		Nominal Weight lbs. (kg) NEMA Type 1 Enclosed
Amps	Poles	
40-200	2	129 (58.5)
	3	132 (59.9)
	4	135 (61.2)
225-400	2	213 (96.6)
	3	218 (98.9)
	4	225 (102)

Figure 6-1. Approximate Transfer Switch Weight

6.1.3 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.

6.1.4 Storage

Store the transfer switch in its protective packing until ready for final installation. Protect the automatic 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.

6.2 Mechanical Installation

Check the system voltage and frequency. Do not install the transfer switch if the system voltage and frequency shown on the transfer switch nameplate are different from the nominal normal (utility) source voltage and frequency and the nominal emergency source voltage and frequency shown on the generator set nameplate.

To plan the installation, use the dimensions given on the enclosure dimension drawings in Section 5. Select the mounting site to comply with local electrical code restrictions for the enclosure type. Mount the transfer switch as close to the load and power sources as possible. Allow adequate space to open the enclosure door fully and to service the switch.

Vertically mount the 40- through 400-ampere transfer switches covered by this manual to a wall or other rigid vertical supporting structure. Keyhole slots for mounting purposes are provided in the mounting brackets on the top and bottom of each unit. When mounting these units, plumb the enclosure to avoid any distortion of the enclosure or door. Place washers behind the mounting bracket key holes to shim the enclosure to a plumb condition.

6.3 Check Manual Operation

Manually operate the contactor to verify that it operates smoothly without binding and prepare it for automatic operation. See Section 2.3. If the contactor does not operate smoothly without binding, *stop!* Call an authorized distributor/dealer to service the contactor before proceeding.

6.4 Electrical Wiring

The factory prewires all internal electrical connections. The only wiring necessary to install the transfer switch is to connect the unit to external devices.

Observe all applicable national, state, and local electrical codes during installation.

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

See Section 5 for schematic diagrams and enclosure drawings.

⚠ WARNING



**Accidental starting.
Can cause severe injury or death.**

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

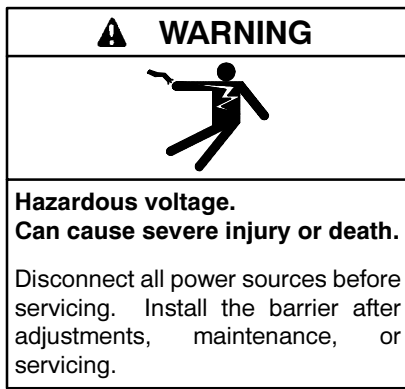
⚠ WARNING



**Hazardous voltage.
Can cause severe injury or death.**

Disconnect all power sources before opening the enclosure.

(600 volts and under)



(600 volts and under)

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, 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 because these conditions increase the risk of electrocution.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage. (*Models with E33+, S340, S340+, 340, R340, and R33 controls only*)

Installing accessories to the transformer assembly. Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to the 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 electrical shock deenergize the normal power source before making any line or auxiliary connections.

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

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.

NOTE

For easy access during installation wiring, remove the front door of the enclosure. Disconnect the cable plug that connects the front door components to the internal components and then lift the door off its hinge pins.

6.4.1 AC Power 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 accumulations of dirt, dust, and other contaminants from the transfer switch's external components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush. *Do not use compressed air to clean the switch because it can cause debris to lodge in the 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 them with a wire brush. If using aluminum conductors, apply a joint compound to cables. After tightening terminal lugs, carefully wipe off the excess joint compound.

Connection points for the normal power, emergency power, and load are clearly marked on the contactor assembly and drawings. See Section 5. Be sure to follow the phase markings (A, B, C, and N).

NOTE

Connect the source and load phases as indicated by the markings and drawings to prevent short circuits and to prevent phase-sensitive load devices from malfunctioning or operating 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 on the power switching device.

NOTE

The power source leads must be phased A-B-C for phase sequence and loss monitoring (accessory KD-34-Z) to function correctly on microprocessor-based controls. If the power source phase sequence is not A-B-C and accessory KD-34-Z is enabled the controller considers the source to have failed.

Connect the normal, emergency, and load conductors to the clearly marked terminals on the transfer switch. Verify that all connections are consistent with drawings before tightening the lugs. Tighten all cable lug connections to the torque values shown in Figure 6-2.

Socket Size Across Flat	Torque		
	in. lbs.	ft. lbs.	Nm
1/8	45	4	5.1
5/32	100	8	11.3
3/16	120	10	13.6
7/32	150	12	17.0
1/4	200	17	22.6
5/16	275	23	31.1
3/8	375	31	42.3
1/2	500	42	56.5
9/16	600	50	67.8

Figure 6-2. Tightening Torque for Lugs

6.4.2 Generator Start Connection

⚠ WARNING



**Accidental starting.
Can cause severe injury or death.**

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

Disabling the 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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

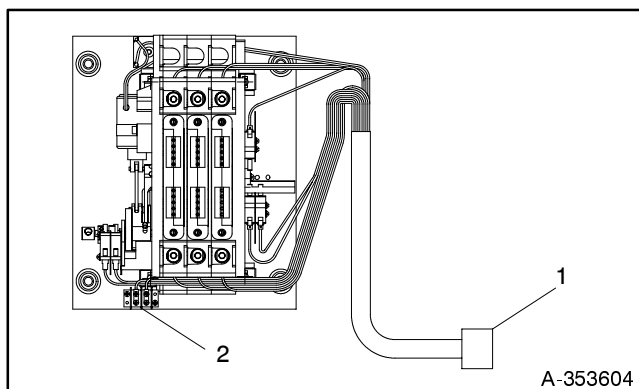
Prevent the generator set from starting by moving the generator set master switch to the OFF position, disconnecting power to the generator engine start battery charger, if installed, and disconnecting all generator engine start battery cables, negative (-) leads first.

NOTE

If accessory KA-10—Preferred Source Switch is installed on the transfer switch, the generator set engine start connections are made to a terminal strip on the inner panel, not to the engine start terminals on the power switching device assembly. See the electrical controls operation and installation manual for details.

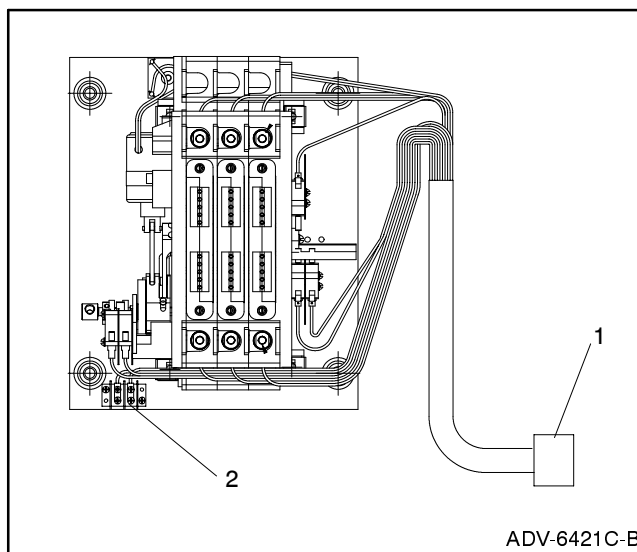
Connect the generator set remote starting circuit to the generator engine start signal connections located on terminals 3 and 4 of the transfer switch contactor assembly. A red decal identifies the location of the terminal block on the contactor assembly.

Tighten the terminal screws to 9 in. lbs. (1.0 Nm) of torque. See Figure 6-3 and the enclosure dimension drawings in Section 5. The transfer switch controller provides a contact closure through the wire harness to these terminals to signal the generator set to start.



1. Inline disconnect plug P1
2. Engine start terminals 3 and 4

Figure 6-3. Typical Contactor, 40-200 Amps



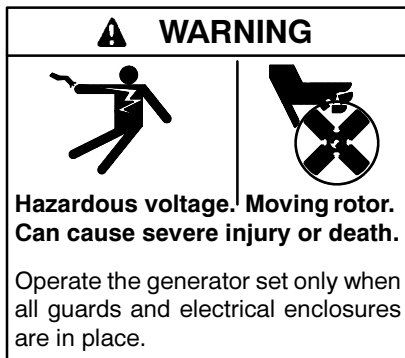
1. Inline disconnect plug P1
2. Engine start terminals 3 and 4

Figure 6-4. Typical Contactor, 225-400 Amps

6.4.3 Accessory and Control Connections

Complete external connections for accessories. See Section 3—Accessories and the transfer switch electrical controls operation and installation manual. See Sections 1.3 and 1.4 for nameplate and model number information to identify type of electrical controls. Do not connect the power switching device and controller wire harnesses together at the inline disconnect plug until after the voltage check procedure described later in this section. See the electrical controls operation and installation manual for additional control connection information. See List of Related Materials in the Introduction section in this manual.

6.5 Prepare the Generator Set for Operation



Disconnect all power sources to the transfer switch by opening upstream circuit breakers or switches to the transfer switch.

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.

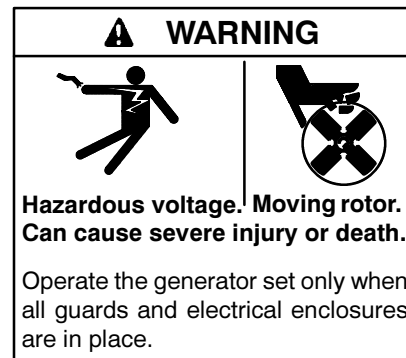
Move the generator set master switch to the OFF position, reconnect the generator engine start battery cables, negative (-) leads last, and reconnect power to the generator engine start battery chargers, if installed.

6.6 Functional Tests

6.6.1 Voltage Check

Perform a voltage check to verify that the voltages and phasing of all power sources are compatible with the transfer switch before energizing the load or connecting the power switching device to the controls.

The nominal voltage and frequency of the normal (utility) source, transfer switch nameplate, and generator set output and nameplate should all be the same to avoid damage to loads and the transfer switch.



Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove rings, wristwatch, and jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. *(600 volts and under)*

Read and understand all instructions on installation drawings and labels affixed to the switch. Note any accessories installed on the switch and review their operation.

Voltage Check Procedure

NOTE

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

1. Disconnect all power sources before opening the transfer switch enclosure by opening upstream circuit breakers or switches to the transfer switch.
2. Disconnect the power switching device from the electrical controls at the inline disconnect plug (P1) if they are connected. See Figure 6-3.

3. Move the generator set master switch to the OFF position to inhibit generator set starting.
4. Manually transfer the load to the emergency source. See Section 2.3.
5. Reapply the normal source by closing circuit breakers or switches.
6. Use an accurate voltmeter to check the normal source phase-to-phase and phase-to-neutral terminal voltages. Use accurate test equipment to check the phase rotation at the normal source terminals. If the nominal normal source voltage or frequency is not what is shown on the transfer switch nameplate, **STOP!** Do not continue installation because the transfer switch is not designed for the application. Call a local service center to order the correct transfer switch. Rewire the transfer switch normal source terminals to obtain a phase sequence of A-B-C if required on transfer switches with microprocessor controls.

NOTE

The power source leads must be phased A-B-C for phase sequence and loss monitoring (accessory KD-34-Z) to function correctly on microprocessor-based controls. If the power source phase sequence is not A-B-C and accessory KD-34-Z is enabled, the controller considers the source to have failed.

7. Disconnect the normal power source by opening upstream circuit breakers or switches to the transfer switch.
8. Manually transfer the load to the normal source. See Section 2.3.
9. Reapply the emergency source by closing circuit breakers or switches.
10. Move the generator set master switch to the RUN position. The generator set should start.
11. Use an accurate voltmeter to check the emergency source phase-to-phase and phase-to-neutral terminal voltages. Use accurate test equipment to check the phase rotation at the emergency-source terminals. Rewire the transfer switch emergency source terminals if the emergency source phase rotation is not the same as the normal source.
12. Follow the generator set manufacturer's instructions to adjust the generator output voltage and frequency to match the nominal system

voltage and frequency shown on the transfer switch nameplate if they are different. The automatic transfer switch will operate correctly only to the rated system voltage and frequency specified on the nameplate.

13. Move the generator set master switch to the AUTO position.
14. Disconnect the emergency power source by opening upstream circuit breakers or switches to the transfer switch.
15. Connect the power switching device and controller wire harnesses together at the inline disconnect plug. See Figure 6-3.
16. Close and lock the transfer switch enclosure door.
17. Reconnect power sources by closing circuit breakers or switches.

NOTE

When initially applying power to a transfer switch whose electrical controls have lost power, the engine start contacts remain closed, signaling the generator to run until the ATS's time delay engine cooldown (TDEC), if equipped, ends.

Installation of the transfer switch's power switching device is complete. Close and lock the enclosure door.

6.6.2 Automatic Operation Test

Test the transfer switch's automatic control system. See the electrical controls operation and installation manual for the test procedure.

6.7 Controller Setup

See the electrical controls operation and installation manual for controller startup and setup procedures.

6.8 Ensure Warranty Registration

The transfer switch seller must complete a Startup Notification Form and submit it to the manufacturer within 60 days of the initial startup date. A Startup 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 date are automatically registered using the manufacturer's ship date as the startup date.

Notes

Appendix A. Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere	CG	center of gravity	F	Fahrenheit, female
ABDC	after bottom dead center	CID	cubic inch displacement	fglass.	fiberglass
AC	alternating current	CL	centerline	FHM	flat head machine (screw)
A/D	analog to digital	cm	centimeter	fl. oz.	fluid ounce
ADC	analog to digital converter	cmm	cubic meters per minute	flex.	flexible
adj.	adjust, adjustment	CMOS	complementary metal oxide substrate (semiconductor)	freq.	frequency
ADV	advertising dimensional drawing			FS	full scale
AHWT	anticipatory high water temperature	cogen.	cogeneration	ft.	foot, feet
AI/ISI	American Iron and Steel Institute	COM	communications (port)	ft. lbs.	foot pounds (torque)
ALOP	anticipatory low oil pressure	conn.	connection	ft./min.	feet per minute
alt.	alternator	cont.	continued	g	gram
Al	aluminum	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	crit.	critical	gal.	gallon
		CRT	cathode ray tube	gen.	generator
		CSA	Canadian Standards Association	genset	generator set
		CT	current transformer	GFI	ground fault interrupter
AO	anticipatory only	Cu	copper	gnd.	ground
API	American Petroleum Institute	cu. in.	cubic inch	gov.	governor
approx.	approximate, approximately	cw.	clockwise	gph	gallons per hour
AR	as required, as requested	CWC	city water-cooled	gpm	gallons per minute
AS	as supplied, as stated, as suggested	cyl.	cylinder	gr.	grade, gross
ASE	American Society of Engineers	D/A	digital to analog	gr. wt.	gross weight
ASME	American Society of Mechanical Engineers	DAC	digital to analog converter	H x W x D	height by width by depth
assy.	assembly	dB	decibel	HC	hex cap
ASTM	American Society for Testing Materials	dBA	decibel (A weighted)	HCHT	high cylinder head temperature
		DC	direct current	HD	heavy duty
ATDC	after top dead center	DCR	direct current resistance	HET	high exhaust temperature
ATS	automatic transfer switch	deg., °	degree	hex	hexagon
auto.	automatic	dept.	department	Hg	mercury (element)
aux.	auxiliary	dia.	diameter	HH	hex head
A/V	audio/visual	DI/EO	dual inlet/end outlet	HHC	hex head cap
avg.	average	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HP	horsepower
AVR	automatic voltage regulator			hr.	hour
AWG	American Wire Gauge	DIP	dual inline package	HS	heat shrink
AWM	appliance wiring material	DPDT	double-pole, double-throw	hsg.	housing
bat.	battery	DPST	double-pole, single-throw	HVAC	heating, ventilation, and air conditioning
BBDC	before bottom dead center	DS	disconnect switch	HWT	high water temperature
BC	battery charger, battery charging	DVR	digital voltage regulator	Hz	hertz (cycles per second)
		E, emer.	emergency (power source)	IC	integrated circuit
BCA	battery charging alternator	EDI	electronic data interchange	ID	inside diameter, identification
BCI	Battery Council International	EFR	emergency frequency relay	IEC	International Electrotechnical Commission
BDC	before dead center	e.g.	for example (<i>exempli gratia</i>)	IEEE	Institute of Electrical and Electronics Engineers
BHP	brake horsepower	EG	electronic governor	IMS	improved motor starting
blk.	black (paint color), block (engine)	EGSA	Electrical Generating Systems Association	in.	inch
		EIA	Electronic Industries Association	in. H ₂ O	inches of water
blk. htr.	block heater	EI/EO	end inlet/end outlet	in. Hg	inches of mercury
BMEP	brake mean effective pressure	EMI	electromagnetic interference	in. lbs.	inch pounds
bps	bits per second	emiss.	emission	inc.	incorporated
br.	brass	eng.	engine	ind.	industrial
BTDC	before top dead center	EPA	Environmental Protection Agency	int.	internal
Btu	British thermal unit			int./ext.	internal/external
Btu/min.	British thermal units per minute	EPS	emergency power system	I/O	input/output
C	Celsius, centigrade	ER	emergency relay	IP	iron pipe
cal.	calorie	ES	engineering special, engineered special	ISO	International Organization for Standardization
CARB	California Air Resources Board	ESD	electrostatic discharge	J	joule
CB	circuit breaker	est.	estimated	JIS	Japanese Industry Standard
cc	cubic centimeter	E-Stop	emergency stop	k	kilo (1000)
CCA	cold cranking amps	etc.	et cetera (and so forth)	K	kelvin
ccw.	counterclockwise	exh.	exhaust	kA	kiloampere
CEC	Canadian Electrical Code	ext.	external	KB	kilobyte (2 ¹⁰ bytes)
cfh	cubic feet per hour			kg	kilogram
cfm	cubic feet per minute				

kg/cm ²	kilograms per square centimeter	mW	milliwatt	rnd.	round
kgm	kilogram-meter	μF	microfarad	ROM	read only memory
kg/m ³	kilograms per cubic meter	N, norm.	normal (power source)	rot.	rotate, rotating
kHz	kilohertz	NA	not available, not applicable	rpm	revolutions per minute
kJ	kilojoule	nat. gas	natural gas	RS	right side
km	kilometer	NBS	National Bureau of Standards	RTV	room temperature vulcanization
kOhm, kΩ	kilo-ohm	NC	normally closed	SAE	Society of Automotive Engineers
kPa	kilopascal	NEC	National Electrical Code	scfm	standard cubic feet per minute
kph	kilometers per hour	NEMA	National Electrical Manufacturers Association	SCR	silicon controlled rectifier
kV	kilovolt	NFPA	National Fire Protection Association	s, sec.	second
kVA	kilovolt ampere	Nm	newton meter	SI	<i>Système international d'unités</i> , International System of Units
kVAR	kilovolt ampere reactive	NO	normally open	SI/EO	side in/end out
kW	kilowatt	no., nos.	number, numbers	sil.	silencer
kWh	kilowatt-hour	NPS	National Pipe, Straight	SN	serial number
kWm	kilowatt mechanical	NPSC	National Pipe, Straight-coupling	SPDT	single-pole, double-throw
L	liter	NPT	National Standard taper pipe thread per general use	SPST	single-pole, single-throw
LAN	local area network	NPTF	National Pipe, Taper-Fine	spec, specs	specification(s)
L x W x H	length by width by height	NR	not required, normal relay	sq.	square
lb.	pound	ns	nanosecond	sq. cm	square centimeter
lbm/ft ³	pounds mass per cubic feet	O/C	overcrank	sq. in.	square inch
LCB	line circuit breaker	OD	outside diameter	SS	stainless steel
LCD	liquid crystal display	OEM	original equipment manufacturer	std.	standard
ld. shd.	load shed	O/F	overfrequency	stl.	steel
LED	light emitting diode	opt.	option, optional	tach.	tachometer
Lph	liters per hour	O/S	oversize, overspeed	TD	time delay
Lpm	liters per minute	OSHA	Occupational Safety and Health Administration	TDC	top dead center
LOP	low oil pressure	O/V	overvoltage	TDEC	time delay engine cooldown
LP	liquefied petroleum	oz.	ounce	TDEN	time delay emergency to normal
LPG	liquefied petroleum gas	p., pp.	page, pages	TDES	time delay engine start
LS	left side	PA	packed accessory	TDNE	time delay normal to emergency
L _{wa}	sound power level, A weighted	PC	personal computer	TDOE	time delay off to emergency
LWL	low water level	PCB	printed circuit board	TDON	time delay off to normal
LWT	low water temperature	pF	picofarad	temp.	temperature
m	meter, milli (1/1000)	PF	power factor	term.	terminal
M	mega (10 ⁶ when used with SI units), male	ph.	phase	TIF	telephone influence factor
m ³	cubic meter	PHC	Phillips head crimp (screw)	TIR	total indicator reading
m ³ /min.	cubic meters per minute	PHH	Phillips hex head (screw)	tol.	tolerance
mA	milliampere	PHM	pan head machine (screw)	turbo.	turbocharger
man.	manual	PLC	programmable logic control	typ.	typical (same in multiple locations)
max.	maximum	PMG	permanent magnet generator	U/F	underfrequency
MB	megabyte (2 ²⁰ bytes)	pot	potentiometer, potential	UHF	ultrahigh frequency
MCM	one thousand circular mils	ppm	parts per million	UL	Underwriter's Laboratories, Inc.
meggar	megohmmeter	PROM	programmable read only memory	UNC	unified coarse thread (was NC)
MHz	megahertz	psi	pounds per square inch	UNF	unified fine thread (was NF)
mi.	mile	pt.	pint	univ.	universal
mil	one one-thousandth of an inch	PTC	positive temperature coefficient	U/S	undersize, underspeed
min.	minimum, minute	PTO	power takeoff	UV	ultraviolet
misc.	miscellaneous	PVC	polyvinyl chloride	U/V	undervoltage
MJ	megajoule	qt.	quart	V	volt
mJ	millijoule	qty.	quantity	VAC	volts alternating current
mm	millimeter	R	replacement (emergency) power source	VAR	voltampere reactive
mOhm, mΩ	milliohm	rad.	radiator, radius	VDC	volts direct current
MOhm, MΩ	megohm	RAM	random access memory	VFD	vacuum fluorescent display
MOV	metal oxide varistor	RDO	relay driver output	VGA	video graphics adapter
MPa	megapascal	ref.	reference	VHF	very high frequency
mpg	miles per gallon	rem.	remote	W	watt
mph	miles per hour	RFI	radio frequency interference	WCR	withstand and closing rating
MS	military standard	RH	round head	w/	with
m/sec.	meters per second	RHM	round head machine (screw)	w/o	without
MTBF	mean time between failure	rly.	relay	wt.	weight
MTBO	mean time between overhauls	rms	root mean square	xfrm	transformer
mtg.	mounting				
MW	megawatt				

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