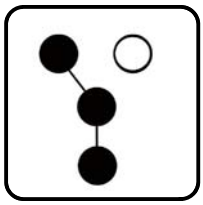
Operation and Installation

Automatic Transfer Switches



Models:

ZCS

Standard Transition

Contactors:
600 to 3000 Amperes

Controls:
Decision-Maker® MPAC 1500 (Conversion Kit)

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
Power Systems

TP-7039 3/16

Product Identification Information

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Model Designation _____

Serial Number _____

Accessory Number	Accessory Description

Table of Contents

Notes

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

DANGER

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

WARNING

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

CAUTION

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

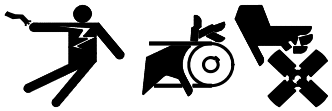
NOTICE

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

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

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect 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 equipment connected to the set, 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.

(Decision-Maker® 3+ and 550 Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 3000, 3500, and 6000 Controllers)

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 electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. 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. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. 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. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Hazardous Voltage/ Electrical Shock

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

⚠ WARNING

Hazardous voltage. Moving parts.
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. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. 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).

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.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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 all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (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 all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3000, 3500 and 6000 Controllers)

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

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.

Notice

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.

Notes

This manual provides operation and installation instructions for Kohler® Model ZCS standard-transition automatic transfer switches that use a 600-to 3000-ampere contactor as the power switching device. This manual applies to units equipped with the Decision-Maker® MPAC 1500 controller conversion kit.

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

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

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

List of Related Materials

This manual covers operation and installation information for the transfer switch's power switching device. Decode the transfer switch part number model code from the transfer switch nameplate and verify that the transfer switch's power switching device matches that what is 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 (logic controller) completes operation and installation instructions for the transfer switch.

Document	Part Number
Operation Manual, Decision-Maker® MPAC 1500	TP-6883
Installation Instructions, Decision-Maker® MPAC 1500 Conversion Kit for Model ZCS-5	TT-1682

Service Assistance

For professional advice on generator power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KOHLERPower.com.
- Look at the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

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

Latin America
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

1.1 Purpose

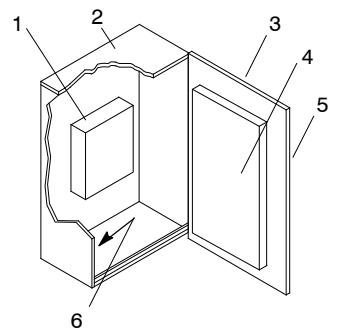
An automatic transfer switch (ATS) transfers critical electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source when the normal source fails to maintain minimum voltage and/or frequency levels.

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

1.2 Components

A typical transfer switch consists of functional units mounted in an enclosure with a hinged front door. See Figure 1-1. The power switching device connects the load to the normal or emergency sources of power. An inner panel mounted on the inside of the enclosure door contains the electrical controls (logic controller) circuitry that monitors power sources, controls the power switching device, and signals the generator to start when needed. Enclosure door-mounted controls and indicators allow the operator to control the transfer switch operation mode and obtain system status information. A wire harness with inline connectors to facilitate component replacement and door removal connects the inner panel to the power switching device.

Controls and indicators on the transfer switch are determined by the logic controller and installed accessories. For details see the operation and installation manual for the logic controller specified by the part number model code on the transfer switch nameplate. See Sections 1.3 and 1.4 to determine the logic controller on the transfer switch. See List of Related Materials in the Introduction section in this manual.



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

Figure 1-1 Typical Transfer Switch Components

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

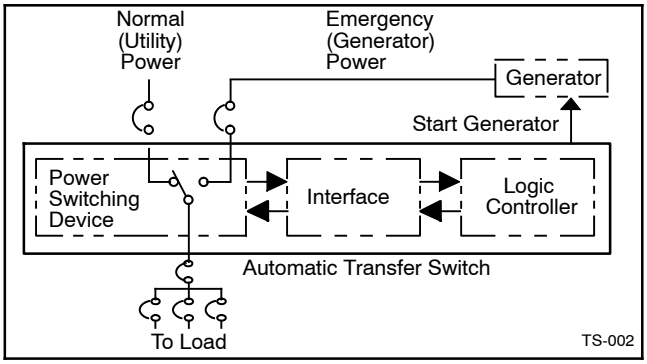


Figure 1-2 Typical Transfer Switch Block Diagram

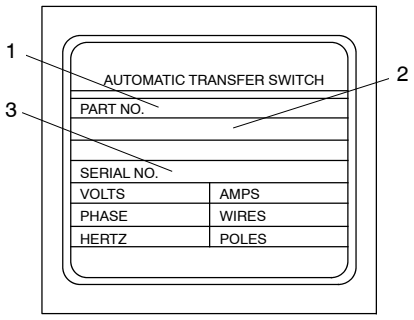
1.3 Nameplate

A nameplate providing characteristic and rating information that affects operation, installation, and servicing is attached to the inside of the transfer switch enclosure door. See Figure 1-3.

Copy the part number into the blank spaces provided in Figure 1-5 and then use Figure 1-5 to interpret the part number.

Copy the part number, factory-installed accessory numbers, and serial number from the nameplate into the spaces provided in the Service Assistance section in this manual for use when requesting service or parts.

On transfer switches equipped with the Decision-Maker® MPAC 1500 controller conversion kit, refer to the information recorded on decal GM70205 located on the door near the controller assembly. See Figure 1-4.



1. Location for part number used to identify type of ATS.
2. Location for factory-installed accessory numbers.
3. Location for the ATS serial number.

Figure 1-3 Typical Transfer Switch Nameplate

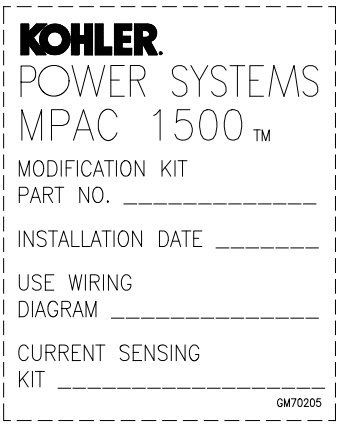
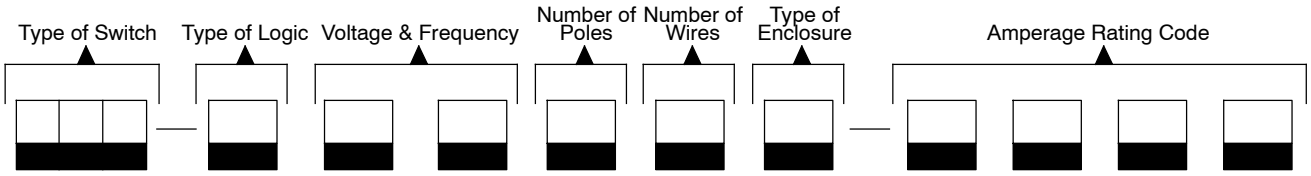


Figure 1-4 Controller Conversion Kit Decal

1.4 Part Number Model Code

Use the diagram below to record and interpret the transfer switch part number model code.

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



Kohler Part Number Key
This chart explains the Kohler transfer switch part numbering code system. The sample part number shown is for a standard contactor power switch with M340+ logic rated at 600 volts, 60 hertz, 3-phase, 3-pole, and 4 wires in a NEMA Type 1 enclosure with a contactor rating of 1000 amperes.

SAMPLE PART NUMBER

ZCS-560341-1000

Classification of Power Switch
Z: Power Switch

Type of Power Switch
C: Contactor

Type of Switch
S: Standard

Type of Electrical Controls (Logic Controller)*
5: M340+

Voltage Code

60: 600 Volt, 60 Hz	66: 480 Volt, 60 Hz
62: 120 Volt, 60 Hz	68: 208 Volt, 60 Hz
63: 220 Volt, 50 Hz	71: 380 Volt, 50/60 Hz
64: 240 Volt, 60 Hz	

Number of Poles

2: 2 Pole, 1 Phase	4: 3 Pole, 1 Phase
3: 3 Pole, 3 Phase	6: 4 Pole, Fully Rated

Number of Wires
3: 3 Wire
4: 4 Wire

Enclosure
0 = Open
1 = NEMA Type 1
2 = NEMA Type 12
3 = NEMA Type 3R

Amperes
Numbers Indicate Ampere Rating of Switch

***** This manual applies to ZCS-5 models equipped with the Decision-Maker® MPAC 1500 controller conversion kit.

Figure 1-5 Transfer Switch Model Designations

1.5 Standard Features

The standard features listed here are for the ZCS contactor power switching device. Refer to the logic controller operation and installation manual for controller specifications. See List of Related Materials in the Introduction section in this manual.

- Meets UL and CSA standards
- Voltage ratings up to 600 vac
- Amperage ratings for Standard Switches from 600 to 3000 amperes
- Switching device electrically and mechanically interlocked
- Two-pole, three-pole and four-pole
- Four-pole—fully rated
- Can be operated manually when unpowered
- Two normally open (N.O.) and two normally closed (N.C.) main shaft auxiliary contacts
- Withstand and closing current ratings as shown below.

1.6 Ratings

The following tables provide information on contactor withstand and closing current ratings (WCR). Figure 1-6 provides WCR when used with any current-limiting fuse or any overcurrent protective device. Figure 1-7 and Figure 1-8 provides WCR when coordinated with specific manufacturer's circuit breakers or fuse types. Figure 1-7 has ratings for 480 V maximum and apply to both UL and CSA listings. Figure 1-8 has ratings for 600 V maximum and apply to a CSA listing only.

UL 1008 Switch Rating (amps)	**Withstand and Closing Current Ratings per UL 1008 and CSA ***				
	When Used With Any Current-limiting Fuse			**When Used With Any Overcurrent Protective Device (3 cycles)**	
	Max. Fuse Size (amps)	Maximum Current (amps)		Maximum Current (amps)	
		@ 480 VAC	@ 600 VAC	@ 480 VAC	@ 600 VAC
600	750	200,000	150,000	50,000	42,000
800	1000	200,000	150,000	50,000	42,000
1000	1250	200,000	150,000	50,000	42,000
1200	1500	200,000	150,000	50,000	42,000
1600	2500	200,000	150,000	100,000	85,000
2000	2500	200,000	150,000	100,000	85,000
2500	4000	200,000	150,000	100,000	85,000
3000	4000	200,000	150,000	100,000	85,000

* UL 1008 listed at 480 vac and CSA listed at 600 vac.

Figure 1-6 Withstand and Closing Current Ratings

Switch Rating (amps)	Molded-case Circuit Breakers				Fuses		
	WCR, RMS Symmetrical Amperes	Manufacturer	Type or Class	Maximum Size (amps)	WCR, RMS Symmetrical Amperes	Type or Class	Maximum Size (amps)
600	65,000	GE	TB8, TKL, TP, THP, TC, THC	800	200,000	L, J, RK5, RK1	750
		ITE	CMD6, SCMD6, HMD6, HMXD6, SHMD6				
		Square D	NC, SE				
		Westinghouse	NB TRI-PAC, DSL206				
800, 1000, and 1200	85,000	GE	TP, THP, TC, THC	1600	200,000	L	3000
		Merlin Gerin	CK 1000L	1200			
			CM 1600	1600			
		ITE	CND6, SCND6	1200			
			CPD6	1600			
		Square D	NC, NE	1200			
			PH, PE, SE	1600			
		Westinghouse	PC, PCC, PB TRI-PAC	1600			
1600 and 2000	100,000	Any, 4000 Ampere Maximum		4000	200,000	L	2500
2500 and 3000	100,000	Any, 4000 Ampere Maximum		4000	200,000	L	4000

Figure 1-7 Withstand and Closing Current Ratings (WCR) With Coordinated Circuit Breakers or Fuses, 480 V Maximum, UL and CSA Listings

Switch Rating (amps)	Molded-case Circuit Breakers				Fuses		
	WCR, RMS Symmetrical Amperes	Manufacturer	Type or Class	Maximum Size (amps)	WCR, RMS Symmetrical Amperes	Type or Class	Maximum Size (amps)
600	50,000	GE	TB8, TKL, TP, THP, TC, THC, TKH, TBC8	800	150,000	L, J, RK5, RK1	750
		ITE	CP, CN				
		Square D	SE, SES, SEH, MA, MH				
		Westinghouse	NB TRI-PAC, DSL206				
800, 1000, and 1200	65,000	GE	TKMA, THKMA, TPMM, THMM, TPSS, TJS, TJSS, TKS, THKS, THKSS, THSS	1600	150,000	L	3000
		Merlin Gerin	MP16H1, MP16H2, MC16H1				
		ITE	CND6	1200			
			CPD6, HPD6, HRD6	1600			
		Square D	NC	1200			
			PHF, PCF	1600			
		Westinghouse	PC, PCC, PB TRI-PAC	1600			
1600 and 2000	85,000	Any, 4000 Ampere Maximum		4000	150,000	L	2500
2500 and 3000	85,000	Any, 4000 Ampere Maximum		4000	150,000	L	4000

Figure 1-8 Withstand and Closing Current Ratings (WCR) With Coordinated Circuit Breakers or Fuses, 600 V Maximum, CSA Listings

1.7 Application Data

See Figure 1-9 for application data including the range of wire sizes for the transfer switch's power terminals.

AL/CU UL-listed Solderless Screw-type Terminals for External Power Connections		
Switch Size (amps)	**Normal, Emergency, and Load Terminals**	
	Cables per Pole	**Range of Wire Sizes**
600	2	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM
1600	Bus Bar Connection	
2000	Bus Bar Connection	
2500	Bus Bar Connection	
3000	Bus Bar Connection	

Figure 1-9 Application Data

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Have preventive maintenance performed on the transfer switch at regular intervals after installation. See Section 3 for preventive maintenance.

Contact an authorized service center 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

Use this section when power sources have been disconnected to the transfer switch for an extended period after maintenance or service of the standby system, *NOT FOR INITIAL STARTUP.*

For initial startup, follow the instructions in the installation section of the operation and installation manual for the logic controller and Section 5—Installation in this manual.

Perform the following steps to power up the transfer switch and prepare it for automatic operation.

Powerup Procedure

1. Move the generator set master switch to the OFF position to prevent the generator set from starting.
2. Ensure that *BOTH* the normal and emergency power sources are disconnected by opening upstream circuit breakers or switches to the transfer switch.
3. Open the enclosure and check that the wire harnesses for the power switching device and the controller are plugged together at the inline disconnect plug P1. See the drawings in Section 4 to locate the disconnect plug on the contactor.
4. Follow the manual operation procedure to prepare the transfer switch for automatic operation. See Section 2.3.
5. Close and lock the transfer switch enclosure door.
6. Prepare the generator set that provides standby power for operation. Check the oil level, coolant level, fuel supply, batteries, and items specified by the generator set installation or operation checklist or manual.
7. Move the generator set master switch to the AUTO position. The generator set should start.
8. When loads can be safely energized, reapply power sources to the transfer switch by closing circuit breakers or switches.

   Note: When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Engine Cooldown Time Delay ends (if the time delay is not set to 0).
9. Perform an automatic operation test. See the logic controller operation and installation manual.

Refer to the logic controller operation and installation manual for other startup and setup procedures.

2.2 Automatic Operation

The logic controller installed in the unit provides automatic operation. Refer to the logic controller 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 logic controller 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 the voltage and/or frequency on one or more phases fall below preset limits. A power source is acceptable when the voltage and/or frequency on all monitored phases rise above preset levels. A power source is restored when it becomes acceptable after failing. Typical ATS 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 logic controller 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 signalling 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 transfer switch 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 the Time Delay Engine Cooldown (TDEC), if the time delay is not set to zero (0). 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.

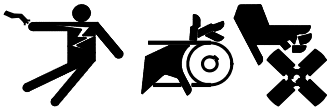
The generator set controller may allow the generator to run for an additional cooldown period after the transfer switch signals a shutdown. Consult the generator set operation manual for more information.

2.3 Manual Operation

To test or troubleshoot the transfer switch, or when the controller fails in an emergency situation, manually operate the power switching device as described in the following procedure.

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

⚠ 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 equipment connected to the set, 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.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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 all 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.

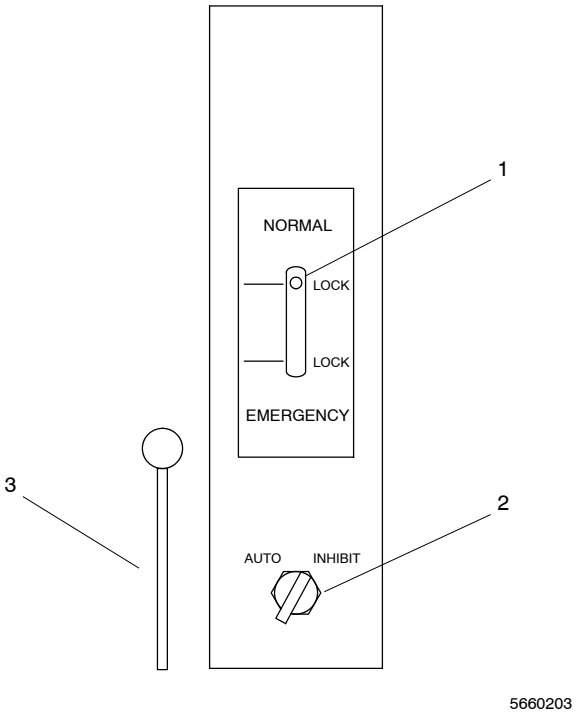
Manual Operation Procedure

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

2. Disconnect *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. Set the disconnect switch (DS) to the INHIBIT position to prevent the controller from energizing the solenoid(s). See Figure 2-1.



1. Switch lever, normal source shown connected to load
2. Disconnect switch, INHIBIT position shown
3. Manual operating handle, typical

Figure 2-1 Manual Operation, Standard Switch 600–3000 Amps

5. Attach the manual operating handle to the switch lever.

6. Move the handle up to the normal position to connect the load to the normal source or down to the emergency position to connect the load to the emergency source. Switch should operate smoothly between both positions without binding.

7. Manually connect the load to the normal source for automatic operation.

8. Remove and return the manual operator handle to the holder provided.

9. Move the disconnect switch (DS) to the AUTO position for automatic operation.

10. Close and lock the transfer switch enclosure door.

11. Reconnect power supplies to the transfer switch.

    Note: When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Engine Cooldown Time Delay ends (if the time delay is not set to 0).

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

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

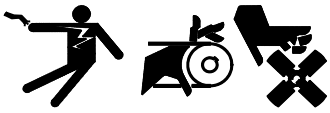
A local authorized distributor or dealer (authorized service center) can provide complete preventive maintenance and services to keep the transfer switch in top condition. Contact a local distributor or dealer for additional information. See the Service Assistance section in this manual for how to locate a local distributor or dealer.

Read this entire section carefully before attempting any maintenance or service. Unless otherwise specified, have maintenance or service performed by an authorized service center 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 after maintenance or service and 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 equipment connected to the set, 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.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

⚠ WARNING

Hazardous voltage. Moving parts.
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. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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 all 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

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.

3.1 Inspection and Service

Contact an authorized service center 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.

3.1.1 General Inspection

External Inspection Keep the transfer switch clean and in good condition by performing a weekly general external inspection of the transfer switch for any condition of vibration, leakage, 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 service center 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 monthly or when any condition noticed during an external inspection may have affected internal components.

Contact an authorized service center 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 service center.

3.1.2 Other Inspections and Service

Have an authorized service center 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 3.3—Service Schedule for the recommended maintenance items and service intervals.

Have an authorized service center repair or replace components inside the transfer switch enclosure with manufacturer-recommended replacement parts.

3.2 Testing

3.2.1 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 logic controller operation and installation manual for the procedure to exercise the generator set. See List of Related Materials in the Introduction section in this manual.

3.2.2 Monthly Automatic Control System Test

Test the transfer switch's automatic control system monthly. See the logic controller 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 (after a time delay in the off position on programmed transition units), end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the available normal source (after a time delay in the off position on programmed transition units) and signals the generator set to shut down after a cooldown period.

3.3 Service Schedule

Follow the service schedule below for the recommended service intervals. Have all service performed by an authorized service center except for activities limited to the items designated by an X.

System Component or Procedure	See Section	Visually Inspect	Check	Change	Clean	Test	Frequency
ELECTRICAL SYSTEM							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor	3.1.1	X	X				M
Check the contactor's external operating mechanism for cleanliness and clean and relubricate if dirty *	3.1.1	X		D, R (lubricant)	D		M
Check wiring insulation for deterioration, cuts, or abrasion and repair or replace wiring to regain the properties of the original wiring	3.1.1	X		D, R (wiring)			M
	3.1.2	D	D				Q
Check the transfer switch's main power switching mechanisms' mechanical operation and integrity	3.1.2	D	D			D	Y
Tighten control and power wiring connections to specifications	3.1.2, L		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	3.1.2	D		D, R	D		Y
Perform a thermal scan or 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	3.1.2		D	D, R	D	D	Y
Test wire and cable insulation for electrical breakdown	3.1.2					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary	3.1.2		D			D	Every 5 Years
CONTROL SYSTEM							
Exercise the generator set under load	3.2.1, L					X	W
Test the transfer switch's automatic control system	3.2.2, L	X				X	M
Test all indicators (incandescent lamps and LEDs) and all remote control systems for operation	L	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 *	3.1.1	X			X		W
Check that all external hardware is in place, tightened, and not badly worn	3.1.1	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 *	3.1.1	X	X		D		M
	3.1.2	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn	3.1.2	X	D				M

***** Service more frequently if operated in dusty or dirty areas.

See Section Read these sections carefully for additional information before attempting maintenance or service.

Visually Inspect Examine these items visually.

Check Requires physical contact with or movement of system components, or the use of nonvisual indications.

Change May require replacement of components depending upon the severity of the problem.

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. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.*

Test May require tools, equipment, or training available only through an authorized service center.

L See the transfer switch logic controller operation and installation manual for more information.

D Have service performed by an authorized service center.

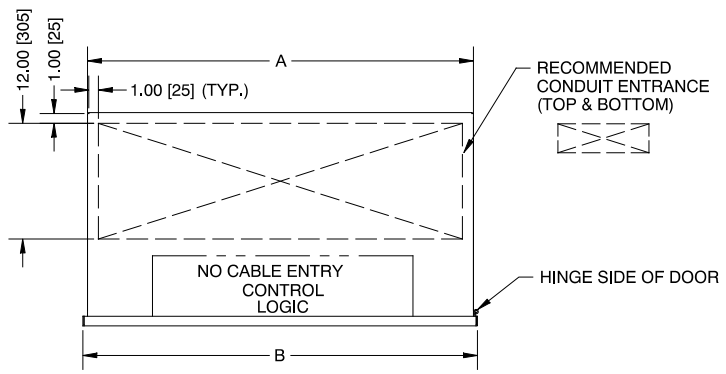
X Operator action.

R May require replacement of components.

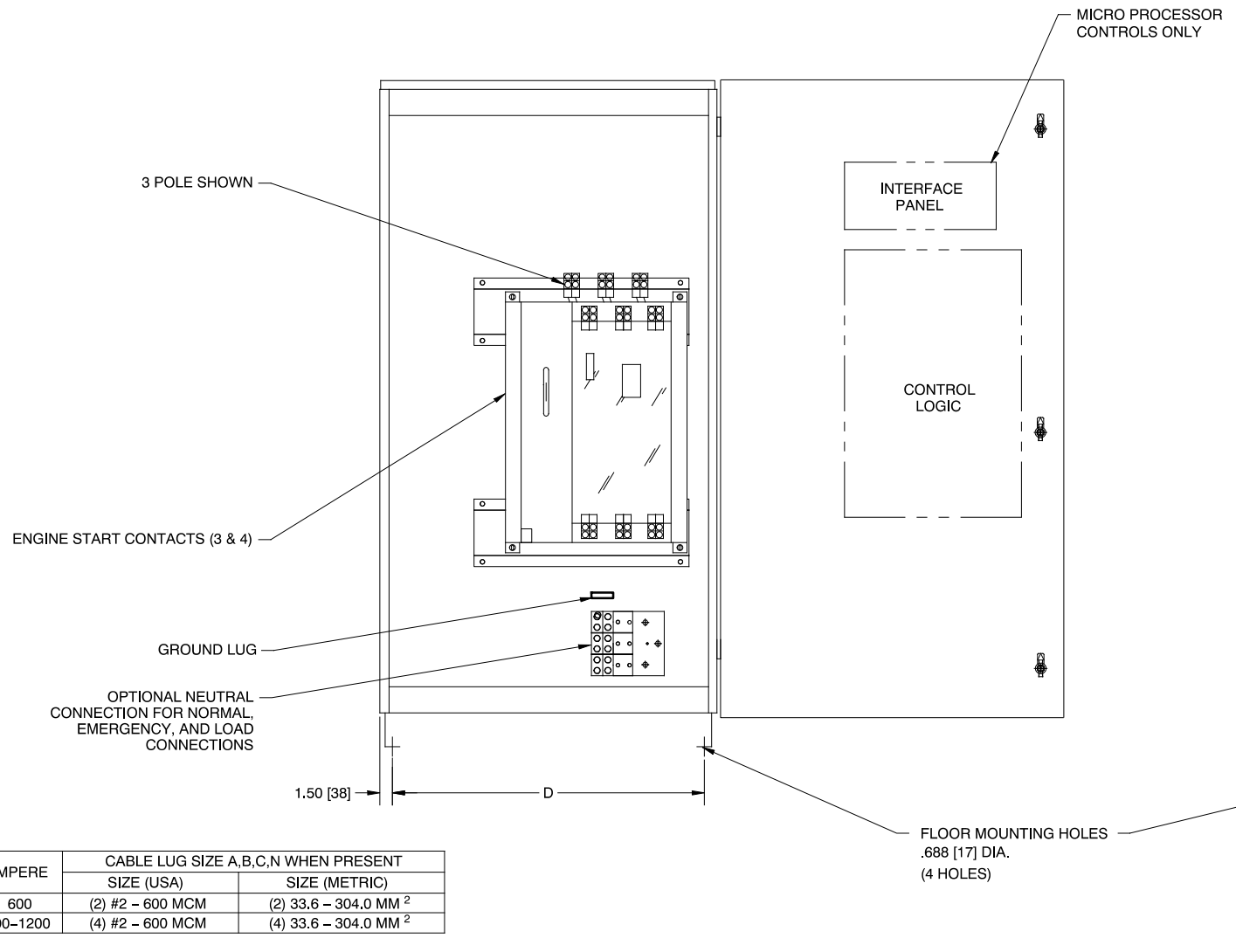
W=Weekly
M=Monthly
Q=Quarterly
S=Six Months
Y=Yearly

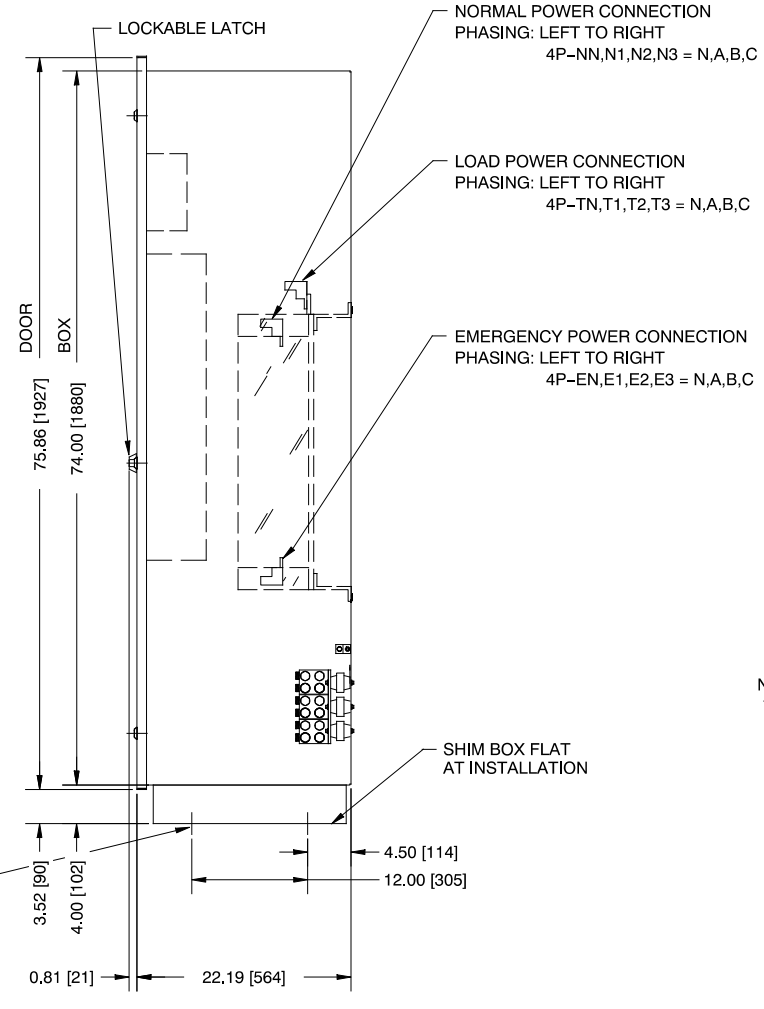
Section 4 Diagrams and Drawings

Notes



AMPERE	POLE	A	B		D
800–1200A (STD)	3	30.00 [762]	30.89 [785]		27.00 [686]
600A STANDARD AND PROGRAMMED TRANSITION	2, 3 & 4	30.00 [762]	30.89 [785]		27.00 [686]
800–1200A PROGRAMMED TRANSITION	2 & 3	30.00 [762]	30.89 [785]		27.00 [686]
800–1200A (STD) & PROGRAMMED TRANSITION	4	40.00 [1016]	40.89 [1039]		37.00 [940]





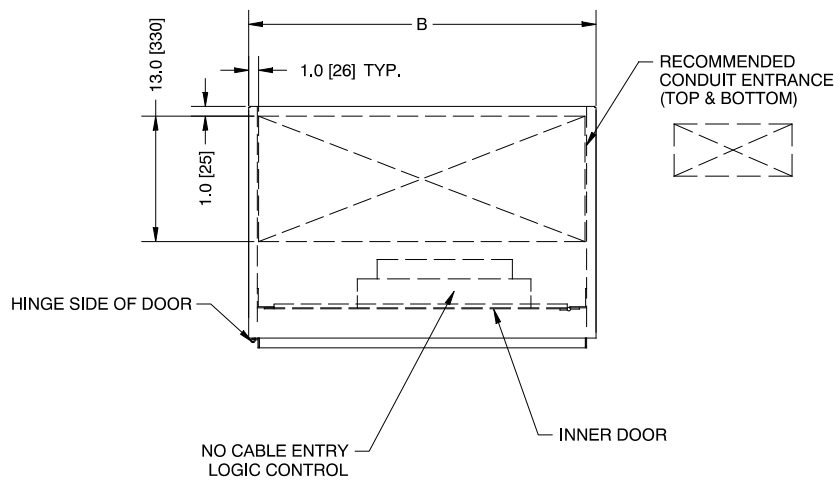
AMPERE	CABLE LUG SIZE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC)
600	(2) #2 – 600 MCM	(2) 33.6 – 304.0 MM ^{2}
800–1200	(4) #2 – 600 MCM	(4) 33.6 – 304.0 MM ^{2}

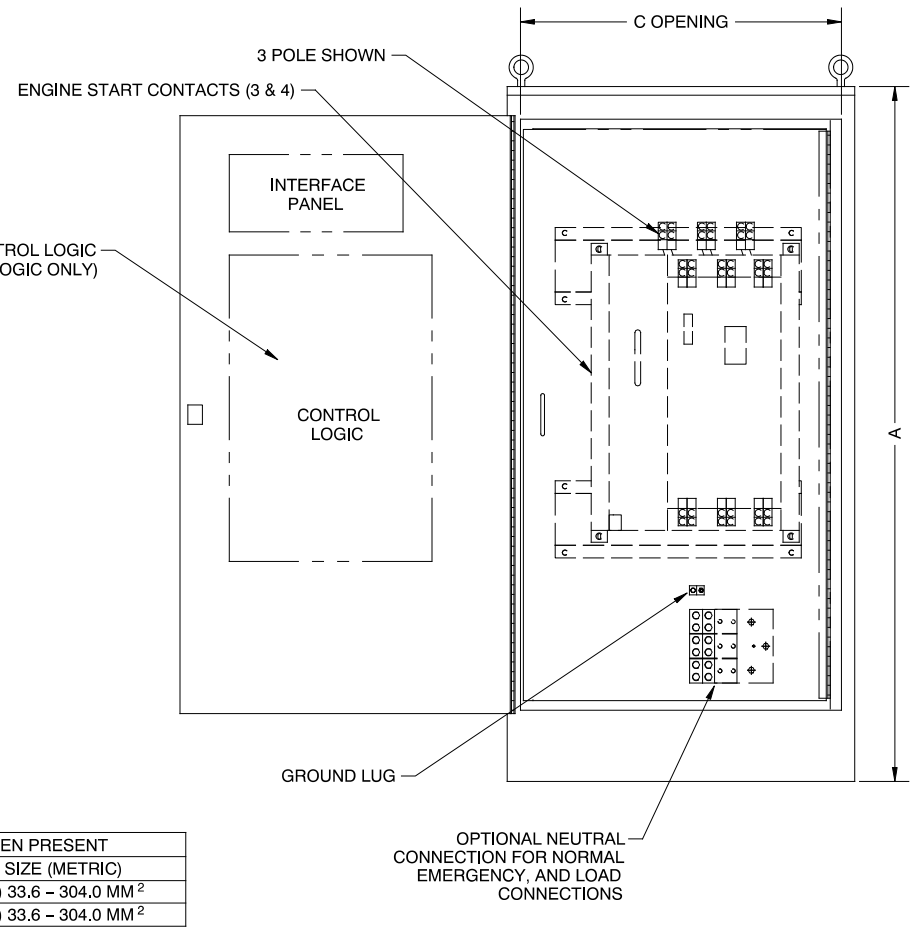
NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

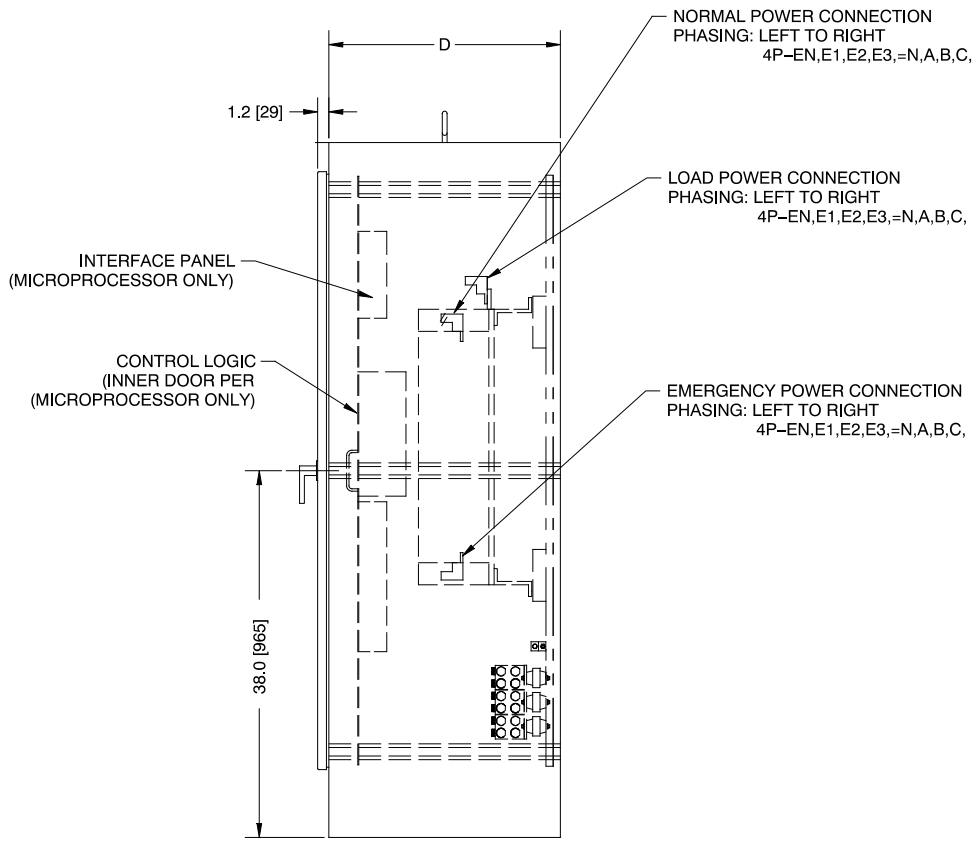
ADV-5936A-F

Enclosure Dimension Drawing, ADV-5936A, 600–1200 Amp, NEMA Type 1 and Type 3R

AMPERE	POLE	A	B	C	D
800–1200A (STD)	3	72.00 [1829]	36.00 [914]	33.30 [846]	24.00 [610]
600A STANDARD AND PROGRAMMED TRANSITION	2, 3 & 4	72.00 [1829]	36.00 [914]	33.30 [846]	24.00 [610]
800–1200A PROGRAMMED TRANSITION	2 & 3	72.00 [1829]	36.00 [914]	33.30 [846]	24.00 [610]
800–1200A (STD) & PROGRAMMED TRANSITION	4	72.00 [1829]	40.00 [1016]	37.30 [947]	24.00 [610]







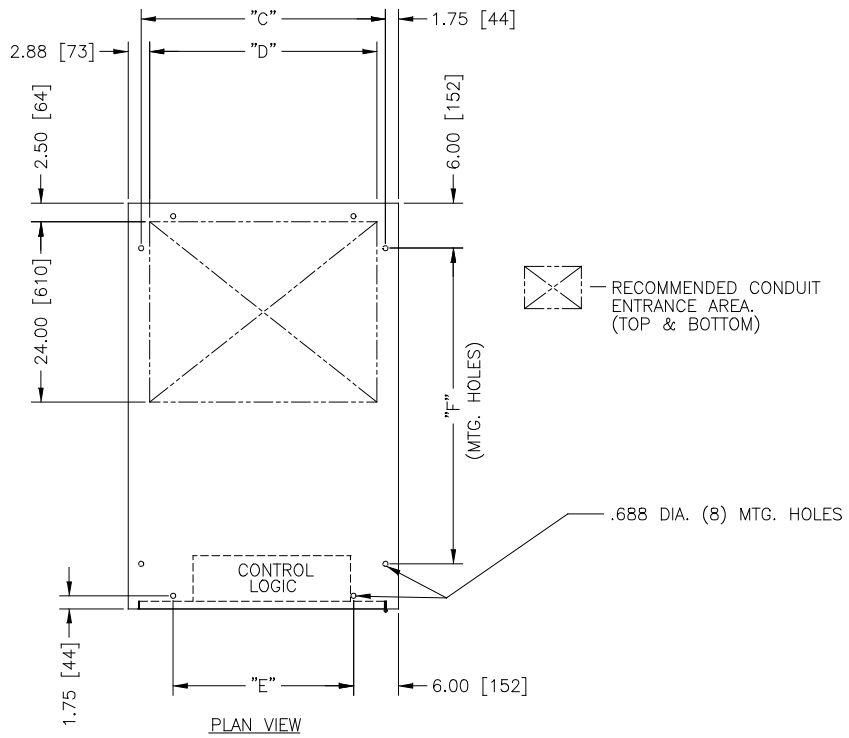
AMPERE	CABLE LUG SIZE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC)
600	(2) #2 – 600 MCM	(2) 33.6 – 304.0 MM ^{2}
800–1200	(4) #2 – 600 MCM	(4) 33.6 – 304.0 MM ^{2}

ADV-5936B-B

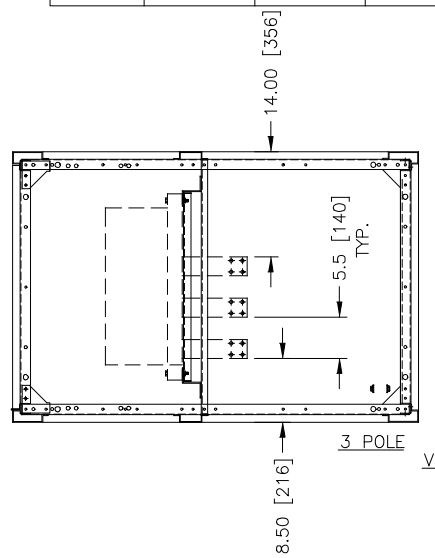
Enclosure Dimension Drawing, ADV-5936B, 600–1200 Amp, NEMA Type 12

POLES	"A" DIM	"B" DIM	"C" DIM	"D" DIM	"E" DIM	"F" DIM
2 & 3	36.00[914]	54.00[1372]	32.50[825]	30.25[768]	18.00[457]	42.00[1067]
4	42.00[1067]	54.00[1372]	38.50[978]	36.25[921]	24.00[610]	42.00[1067]

REV	DATE	REVISION	BY	M F
D	11-14-96	1600-2000A BUS LAYOUT REVISED, 3000A BUS LAYOUT REMOVED		
		[48751]	KAR	
E	09-13-97	(C-1) LUG NOTE REMOVED [51723]	JMG	
F	10-15-98	(D-4) "D" DIM: 30.25[768] WAS 24.25[616], 36.25[921] WAS		
		30.25[768] [56411]	LDS	

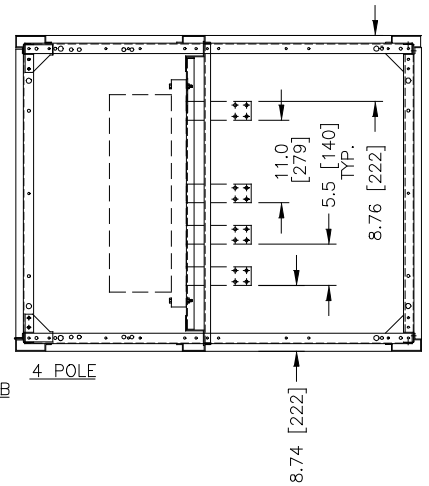


PLAN VIEW

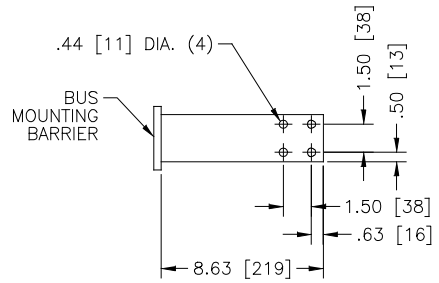


3 POLE

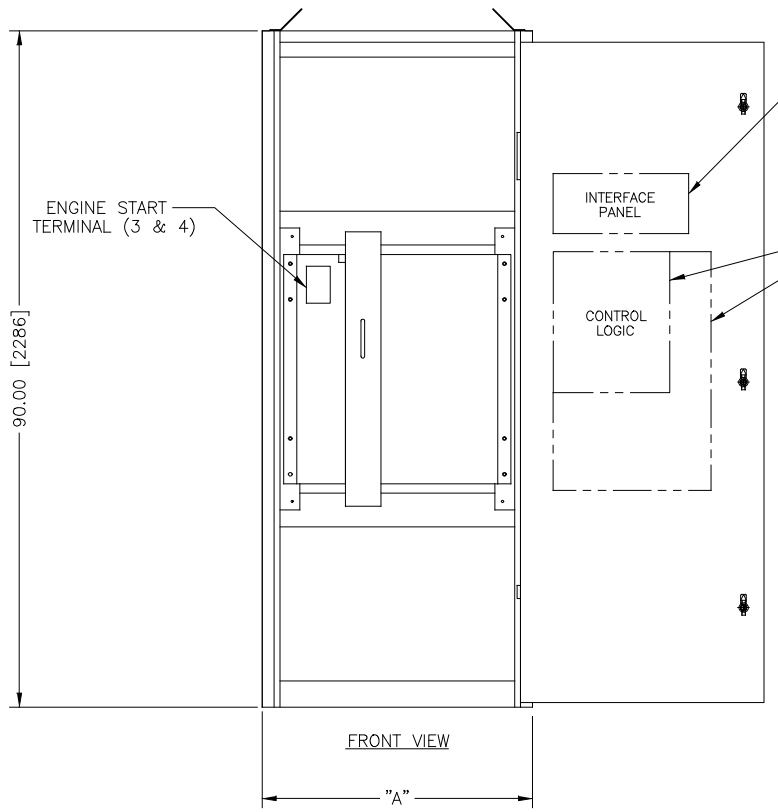
VIEW B–B



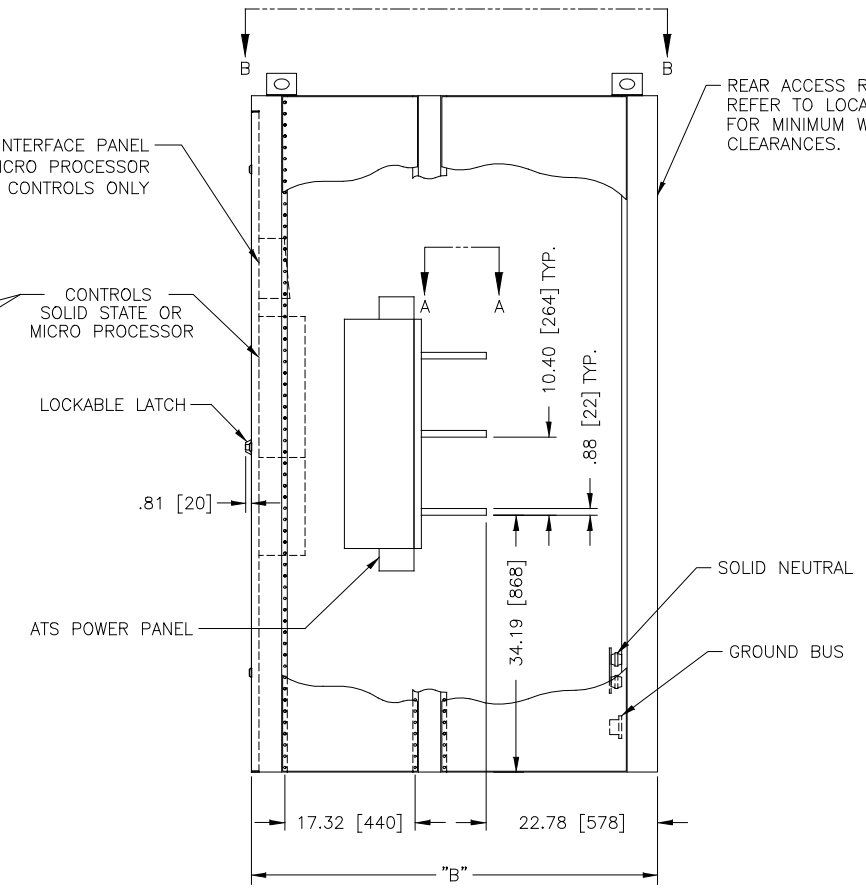
4 POLE



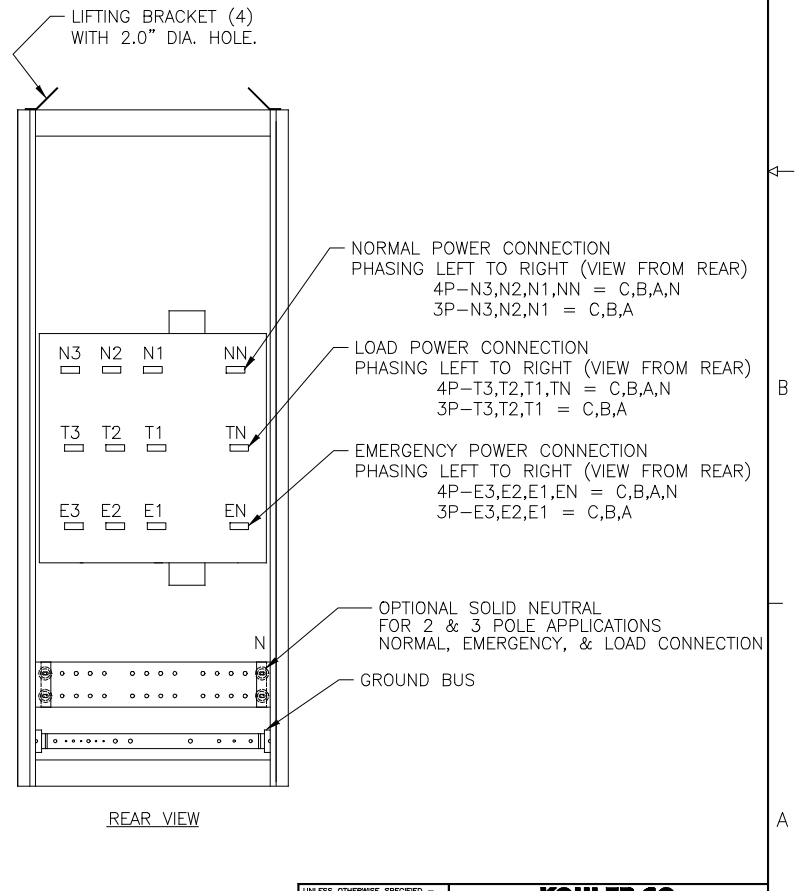
BUS DRILLING DETAIL
(1600–2000 AMP)
VIEW A–A (TYP.)
SCALE: 1/5



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

NOTE: DIMENSIONS IN [ ] ARE IN MILLIMETERS.
FINISH – ANSI 61 GREY

MODEL ZCS
1600–2000 AMP
3 & 4 POLE STANDARD & PROGRAMMED TRANSITION
NEMA 1 ENCLOSURE

UNLESS OTHERWISE SPECIFIED – 1) DIMENSIONS ARE IN INCHES 2) TOLERANCES ARE: .XXX ± .010 ANGLES ± 1/2° .XX ± .030 SURFACE FINISH .X ± .060 FRACTIONS ± MAX.

APPROVALS	DATE
DRAWN DLK	7-23-93
CHECKED EB	8-16-93
APPROVED BS	6-16-93

KOHLER CO.
POWER SYSTEMS, KOHLER, WI 53044 U.S.A.

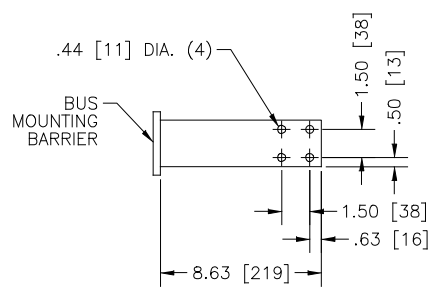
TITLE: DIMENSION PRINT

SCALE 1/10 | CAD NO. ADV5941.DWG | SHEET 1–1
PLOTTED | DWG. NO. ADV–5941 | D

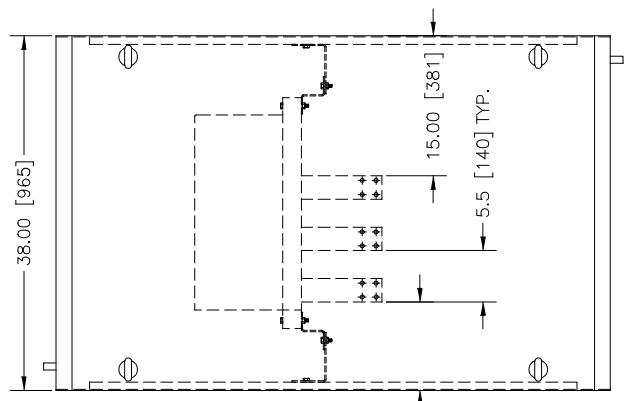
ADV-5941-F

Enclosure Dimension Drawing, ADV-5941, 1600-2000 Amp, NEMA Type 1

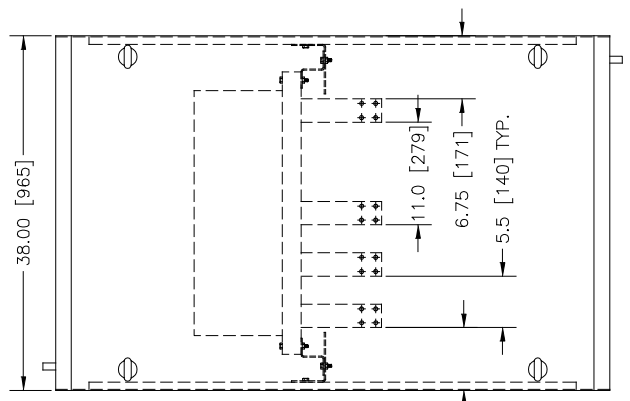
REV	DATE	REVISION	BY	ECN
A	11-4-96	(A-3) 1600-2000 AMP WAS 1600-3000 AMP; (D-4,-6) VIEW		
		C-C ADDED [48646]	KAR	
B	4-23-98	(C-6) AND (C-3) DRIP RAIL KIT (NEMA 3R ONLY) CLARIFIED.		
		(A-2) NEMA 12 ADDED. (A-3) NOTE 2 ADDED. [54037]	GFR	



BUS DRILLING DETAIL
(1600-2000 AMP)
VIEW A-A (TYP.)
SCALE: 1/4

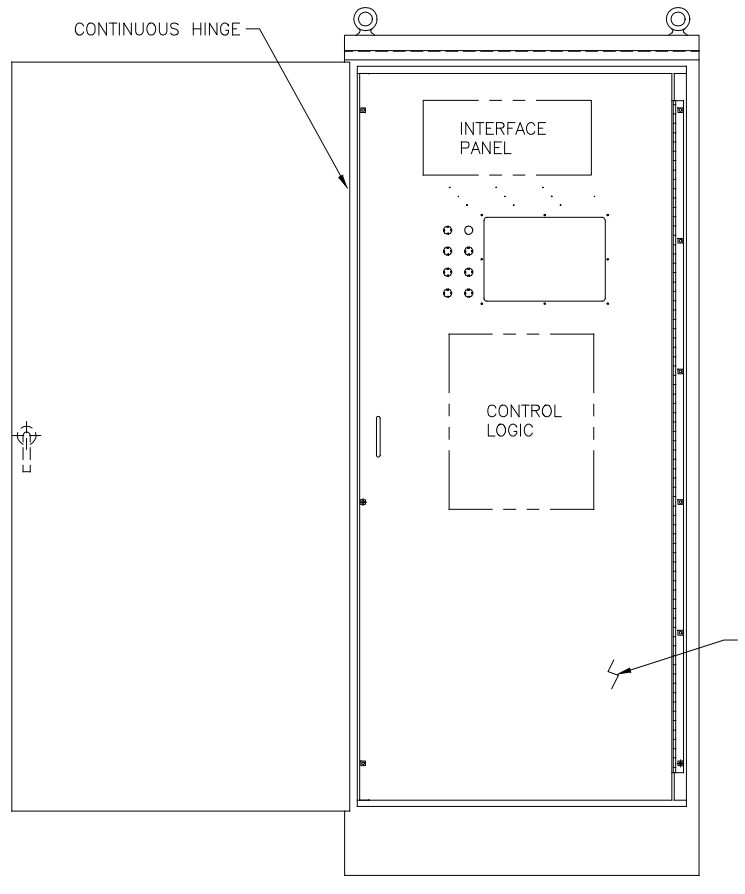


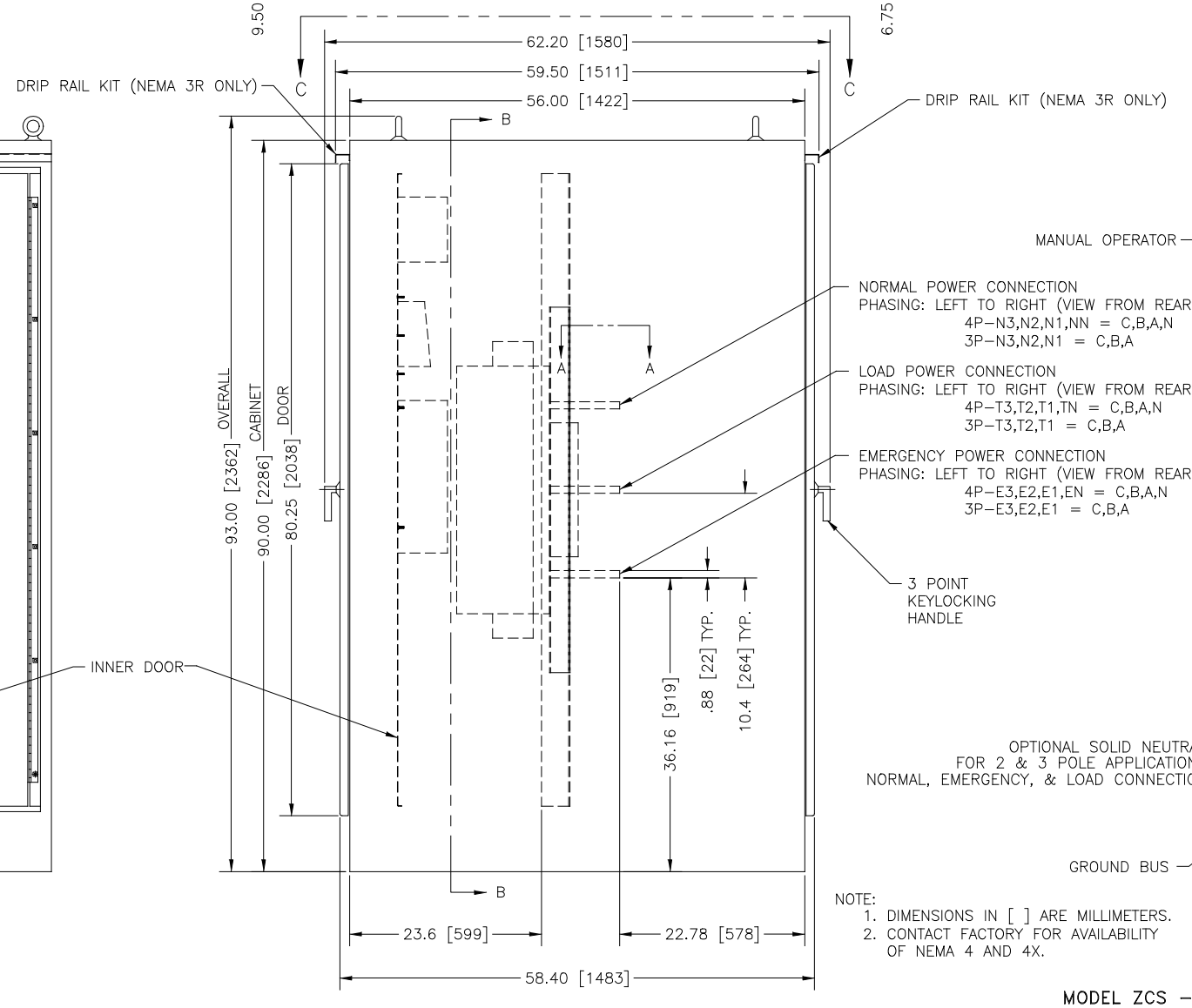
3 POLE

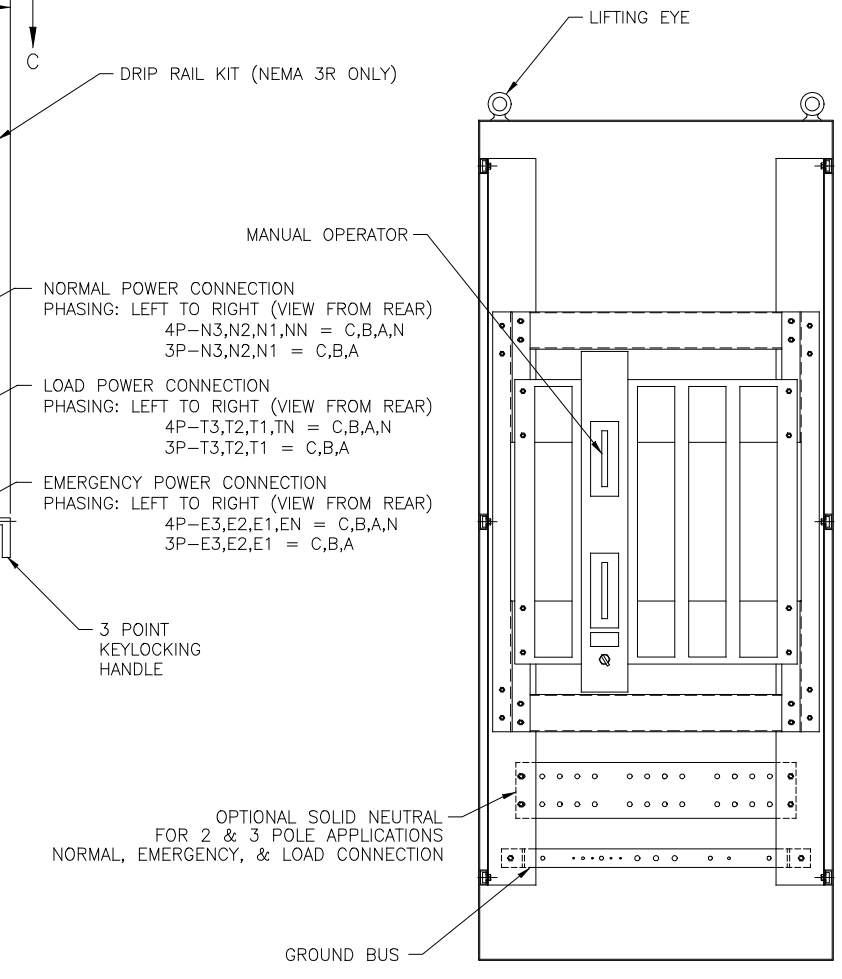


4 POLE

VIEW C-C







VIEW B-B

NORMAL POWER CONNECTION
PHASING: LEFT TO RIGHT (VIEW FROM REAR)
4P-N3,N2,N1,NN = C,B,A,N
3P-N3,N2,N1 = C,B,A

LOAD POWER CONNECTION
PHASING: LEFT TO RIGHT (VIEW FROM REAR)
4P-T3,T2,T1,TN = C,B,A,N
3P-T3,T2,T1 = C,B,A

EMERGENCY POWER CONNECTION
PHASING: LEFT TO RIGHT (VIEW FROM REAR)
4P-E3,E2,E1,EN = C,B,A,N
3P-E3,E2,E1 = C,B,A

3 POINT KEYLOCKING HANDLE

NOTE:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.
2. CONTACT FACTORY FOR AVAILABILITY OF NEMA 4 AND 4X.

MODEL ZCS - 5,6
1600-2000 AMP ATS 3 & 4 POLE
STANDARD AND PROGRAMMED TRANSITION
NEMA 3R, 12

UNLESS OTHERWISE SPECIFIED -
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± .010 ANGLES ± 1/2°
.XX ± .030 SURFACE FINISH
.X ± .060 √ MAX.
FRACTIONS ±

APPROVALS	DATE
DRAWN BTW	12-16-94
CHECKED AH	11-5-96
APPROVED AH	11-5-96

KOHLER CO.
POWER SYSTEMS, KOHLER, WI 53044 U.S.A.

TITLE: DIMENSION PRINT

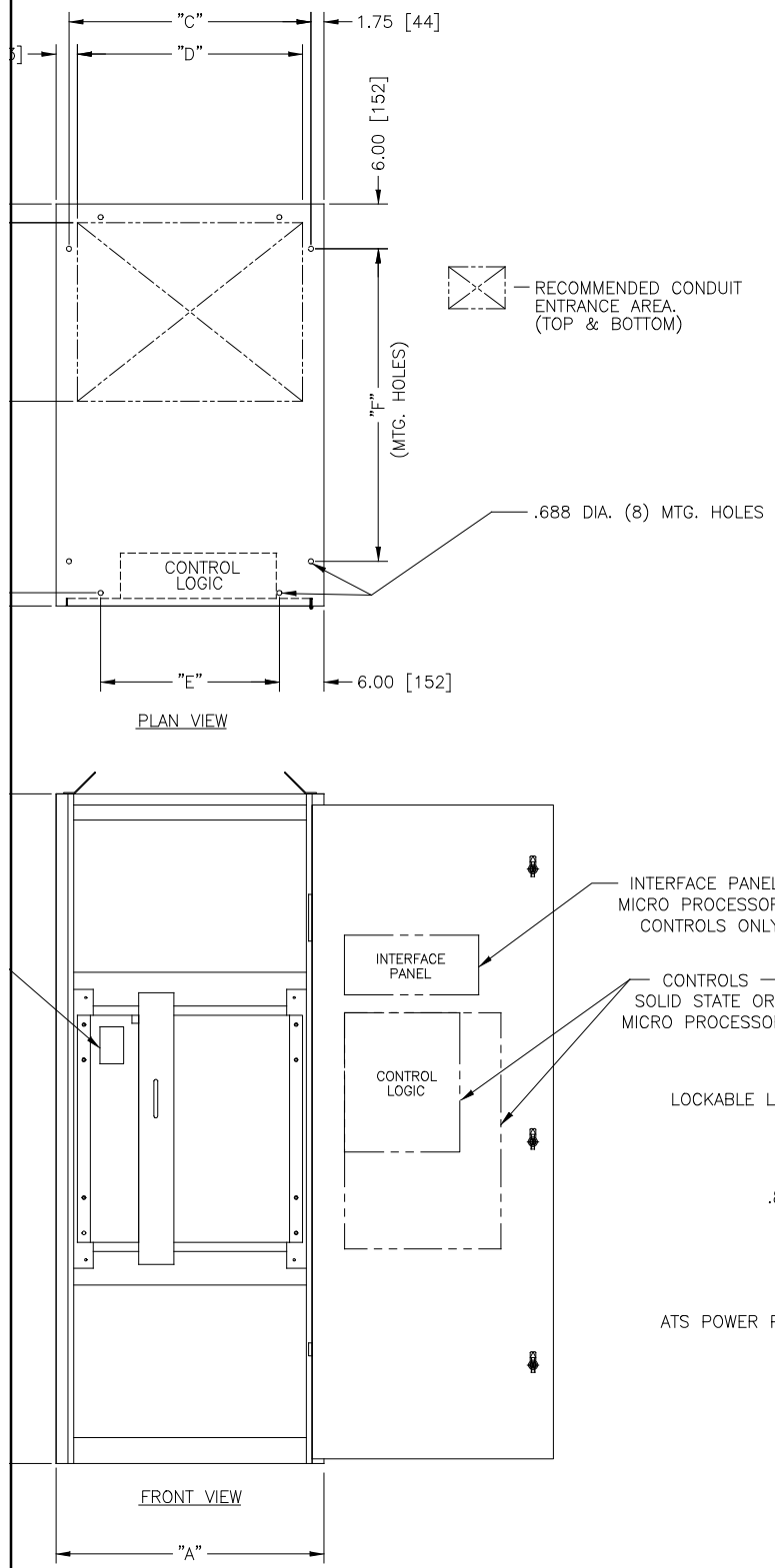
SCALE 1/8 | CAD NO. ADV5989.DWG | SHEET 1-1
PLOTTED | DWG. NO. ADV-5989 | D

ADV-5989-B

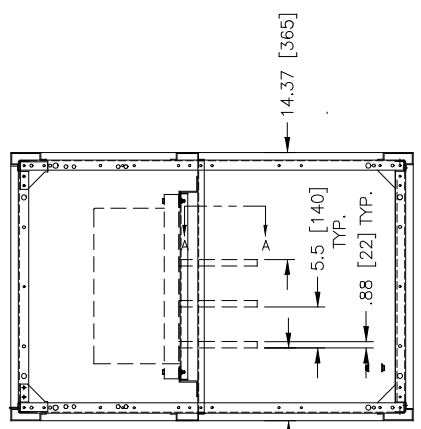
Enclosure Dimension Drawing, ADV-5989, 1600-2000 Amp, NEMA Type 3R and 12

POLES	"A" DIM	"B" DIM	"C" DIM	"D" DIM	"E" DIM	"F" DIM
2 & 3	36.00[914]	54.00[1372]	32.50[825]	24.25[616]	18.00[457]	42.00[1067]
4	42.00[1067]	54.00[1372]	38.50[978]	30.25[768]	24.00[610]	42.00[1067]

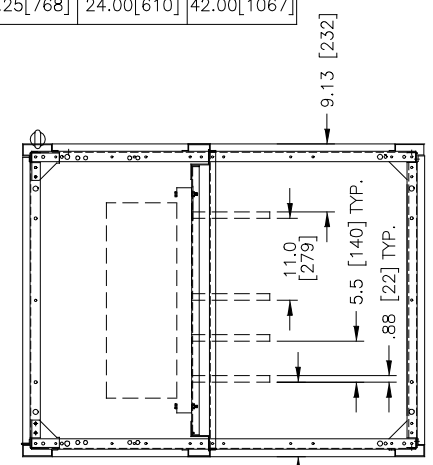
REV	DATE	REVISION	BY	M F
–	11-14-96	NEW DRAWING [48751]	KAR	
A	8-6-97	(A-2) 2500-3000 AMP WAS 3000 AMP [51516]	WSD	
B	09-13-97	(C-1) LUG NOTE REMOVED [51723]	JMG	



PLAN VIEW

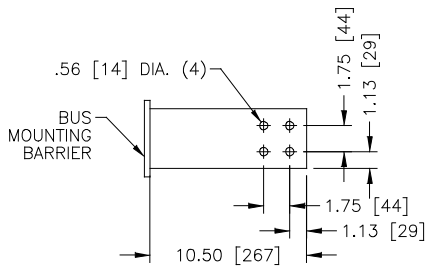


3 POLE



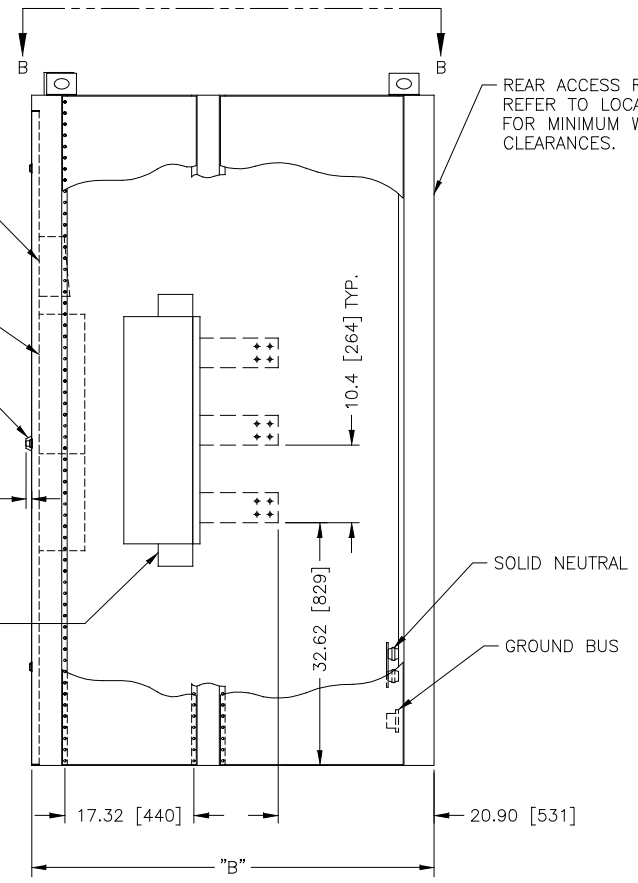
4 POLE

VIEW B–B

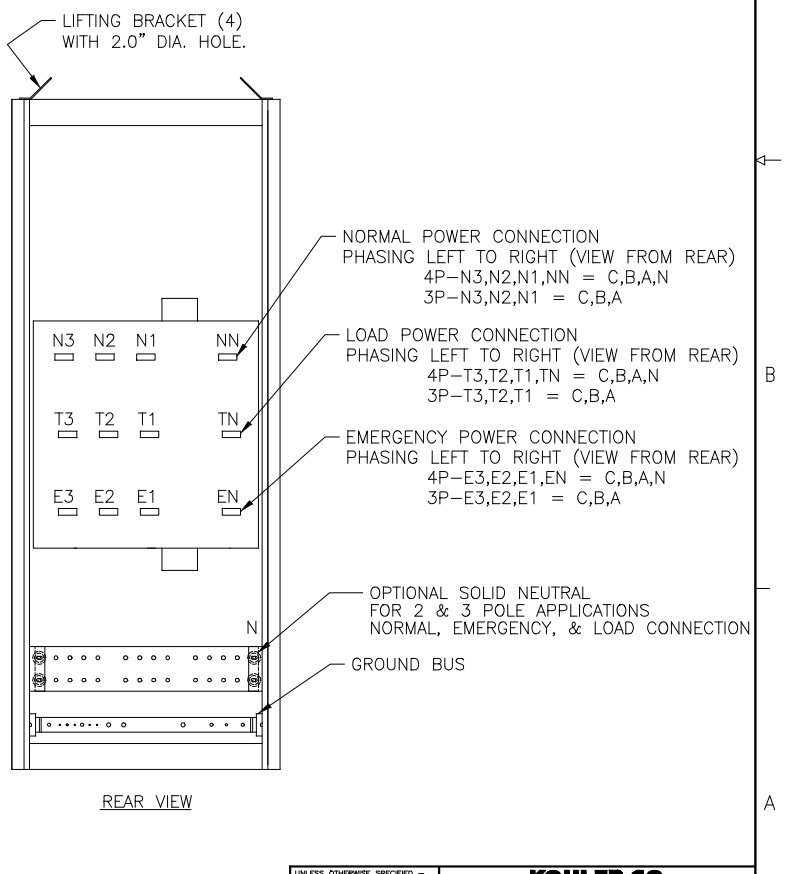


BUS DRILLING DETAIL
(3000 AMP)
VIEW A–A (TYP.)
SCALE: 1/5

FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

NOTE: DIMENSIONS IN [ ] ARE IN MILLIMETERS.
FINISH – ANSI 61 GREY

MODEL ZCS
2500–3000 AMP
3 & 4 POLE STANDARD & PROGRAMMED TRANSITION
NEMA 1 ENCLOSURE

UNLESS OTHERWISE SPECIFIED –
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± .010 ANGLES ± 1/2°
.XX ± .030 SURFACE FINISH
.X ± .060 √ MAX.
FRACTIONS ±

APPROVALS	DATE
DRAWN KAR	11-14-96
CHECKED EB	11-18-96
APPROVED AH	11-18-96

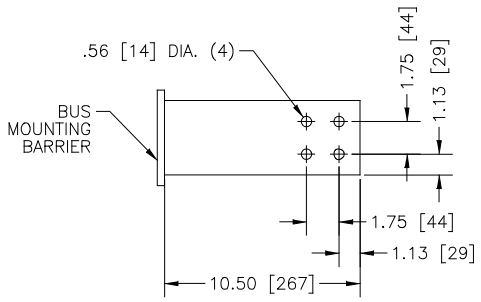
TITLE: DIMENSION PRINT

SCALE 1/10 | CAD NO. ADV6242.DWG | SHEET 1–1
PLOTTED | DWG. NO. ADV–6242 | D

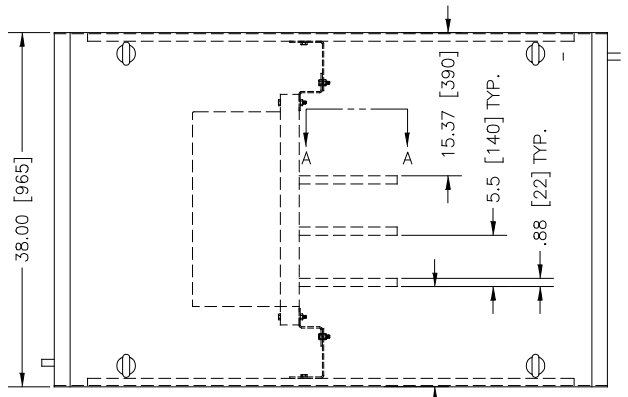
ADV-6242-B

Enclosure Dimension Drawing, ADV- 6242, 2500-3000 Amp, NEMA Type 1

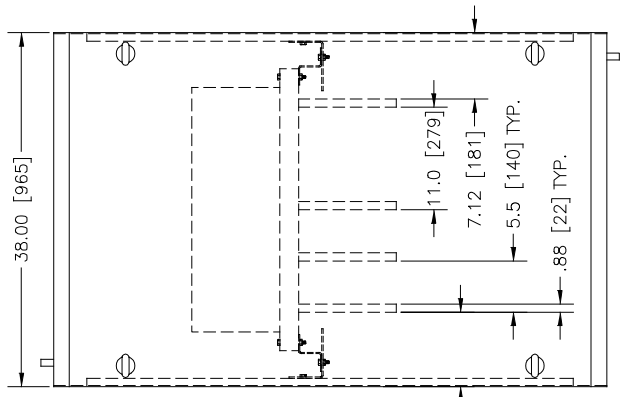
REV	DATE	REVISION	BY	VT
–	11–5–96	NEW DRAWING [48646]	KAR	
A	09–13–97	(A–3) 2500–3000 AMP WAS 3000 [51723]	JMG	
B	4–23–98	(C–6) AND (C–3) DRIP RAIL KIT (NEMA 3R ONLY) CLARIFIED.		
		(A–2) NEMA 12 ADDED. (A–3) NOTE 2 ADDED. [54037]	GFR	



BUS DRILLING DETAIL
(3000 AMP)
VIEW A–A (TYP.)
SCALE: 1/4

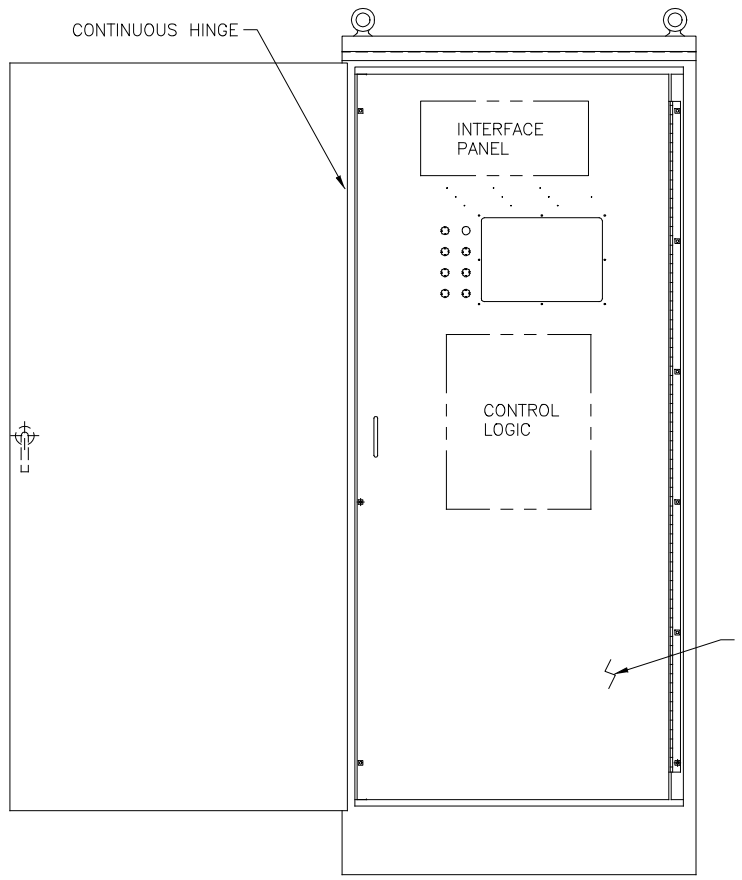


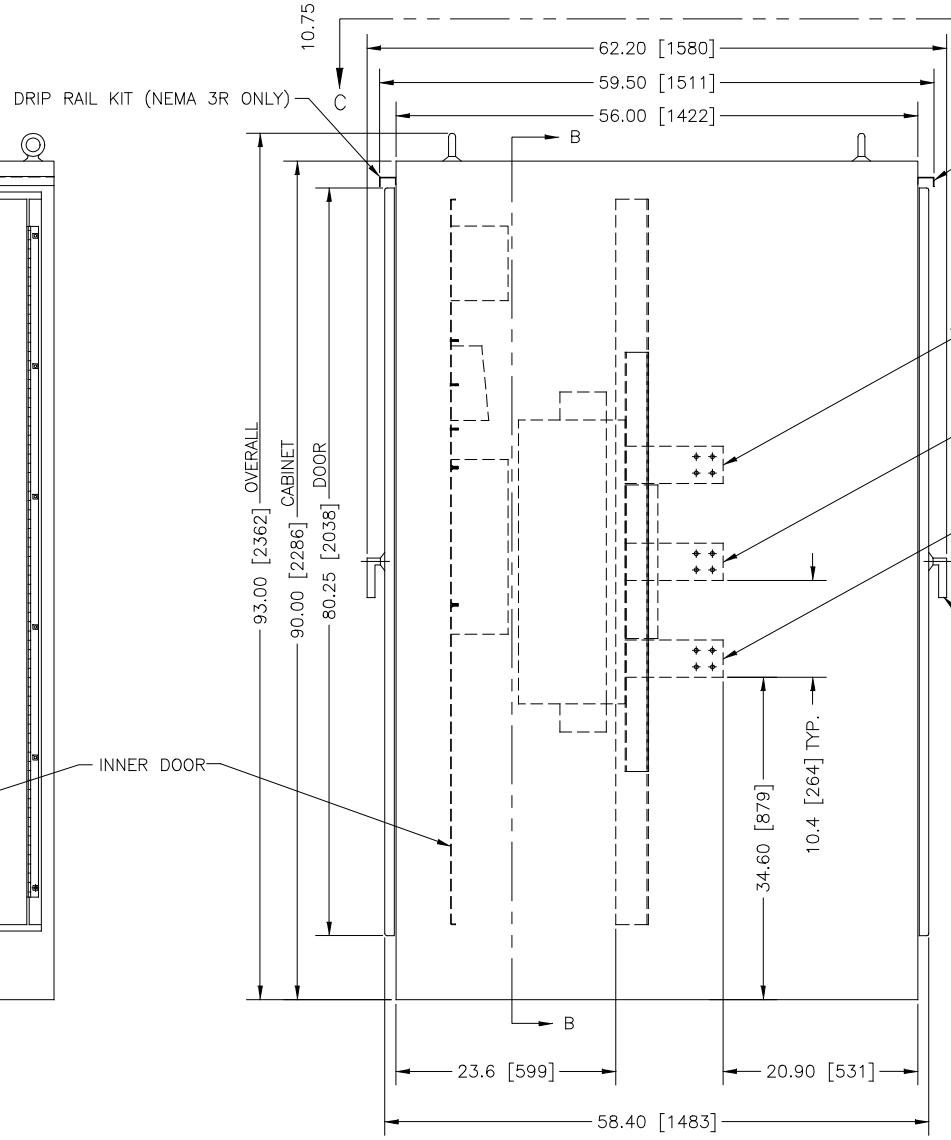
3 POLE

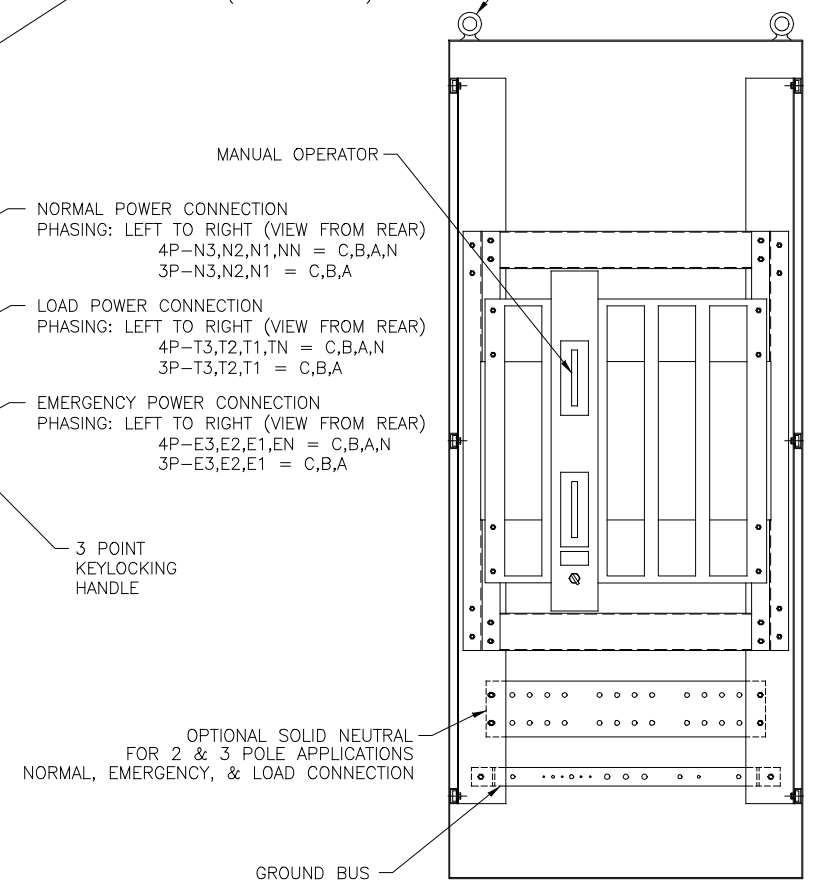


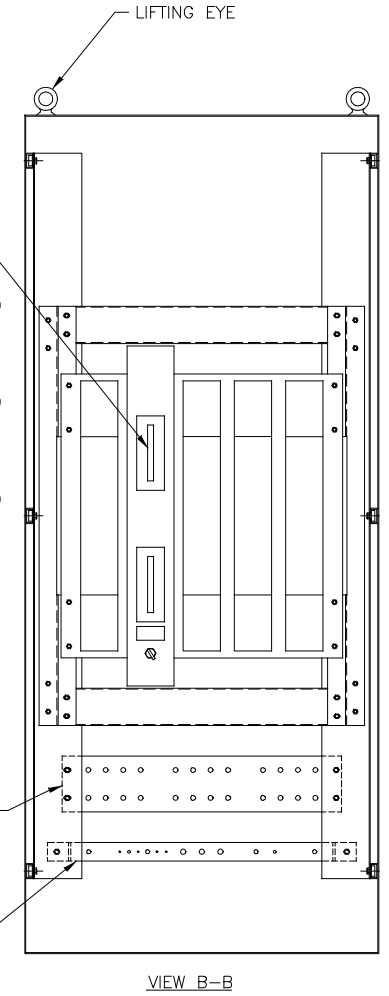
4 POLE

VIEW C–C









VIEW B–B

NOTE:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.
2. CONTACT FACTORY FOR AVAILABILITY OF NEMA 4 AND 4X.

MODEL ZCS – 5,6
2500–3000 AMP ATS 3 & 4 POLE
STANDARD AND PROGRAMMED TRANSITION
NEMA 3R, 12

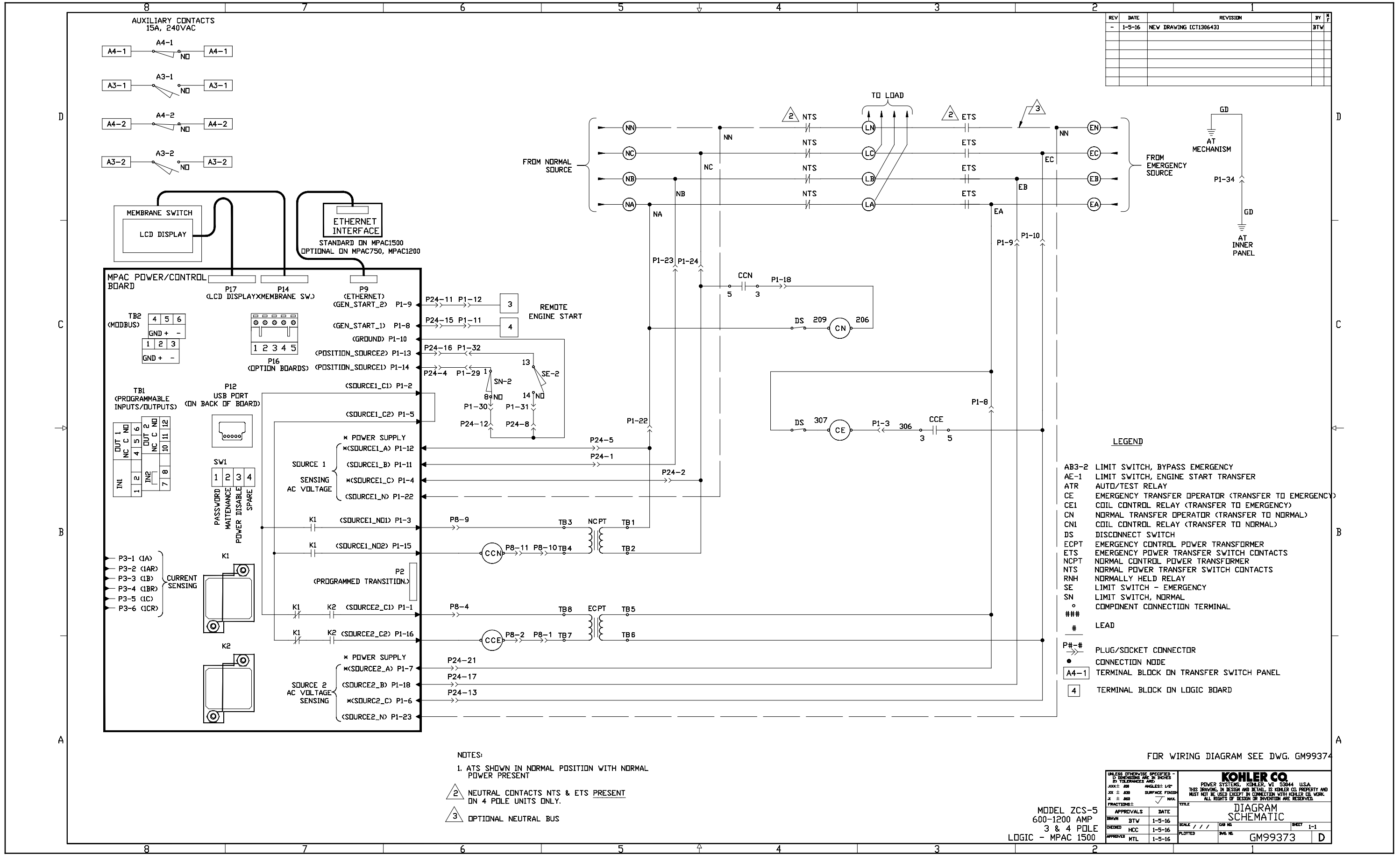
UNLESS OTHERWISE SPECIFIED –
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± .010 ANGLES ± 1/2°
.XX ± .030 SURFACE FINISH
.X ± .060 √ MAX.
FRACTIONS ±

APPROVALS	DATE
DRAWN KAR	11–5–96
CHECKED AH	11–5–96
APPROVED AH	11–5–96

TITLE: DIMENSION PRINT
SCALE: 1/8 CAD NO. ADV6240.DWG SHEET 1–1
PLOTTED DWG. NO. ADV–6240 D

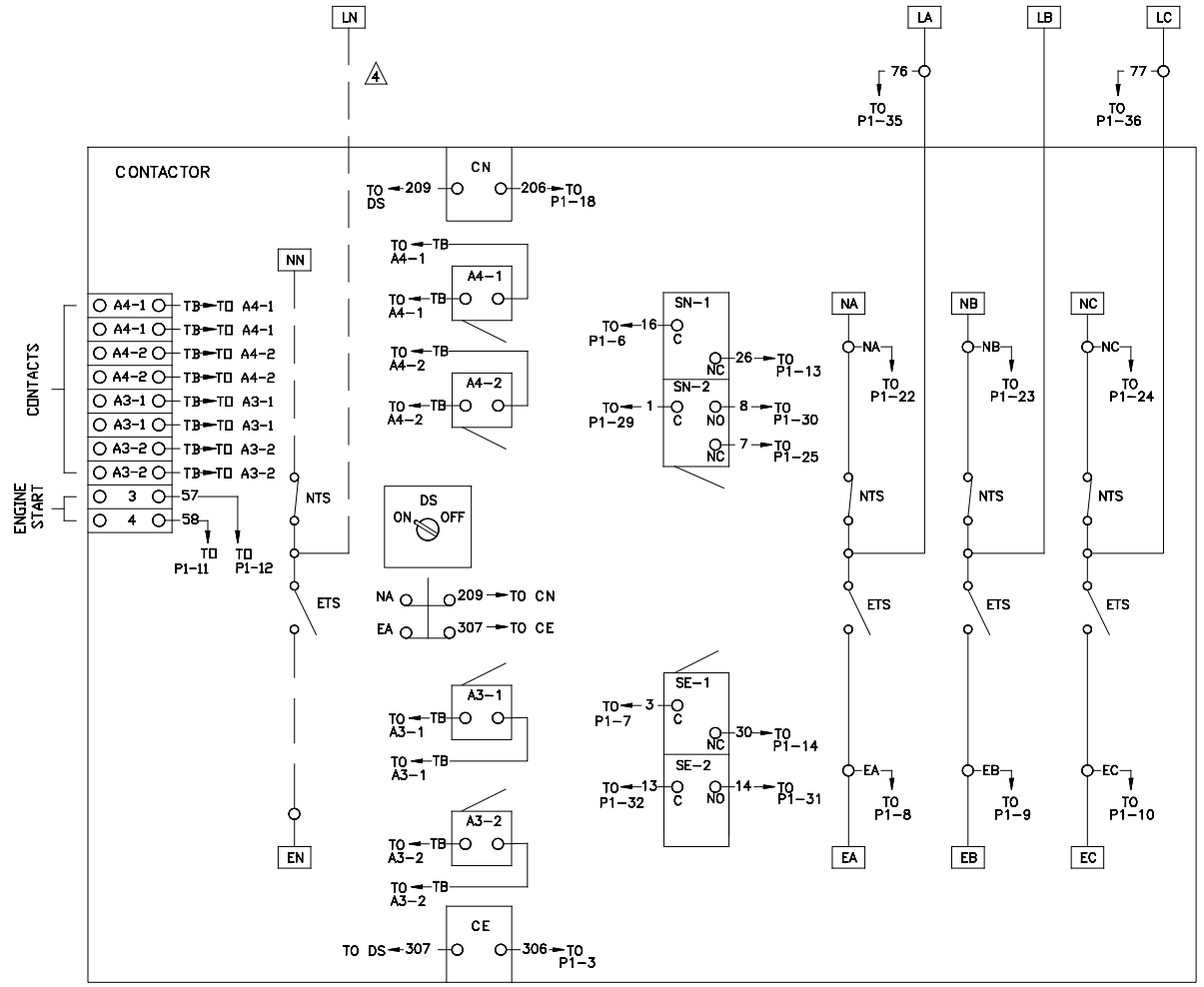
ADV-6240-B

Enclosure Dimension Drawing, ADV-6240, 2500-3000 Amp, NEMA Type 3R and 12



Schematic Diagram, ZCS Standard Transition with Decision-Maker® MPAC 1500 Controls, 600-1200 Amps, GM99373

REV	DATE	REVISION	BY	N F
–	12-21-15	NEW DRAWING [CT130643]	BTW	

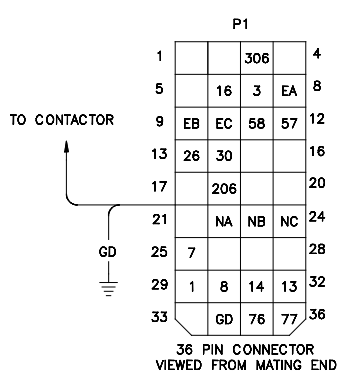


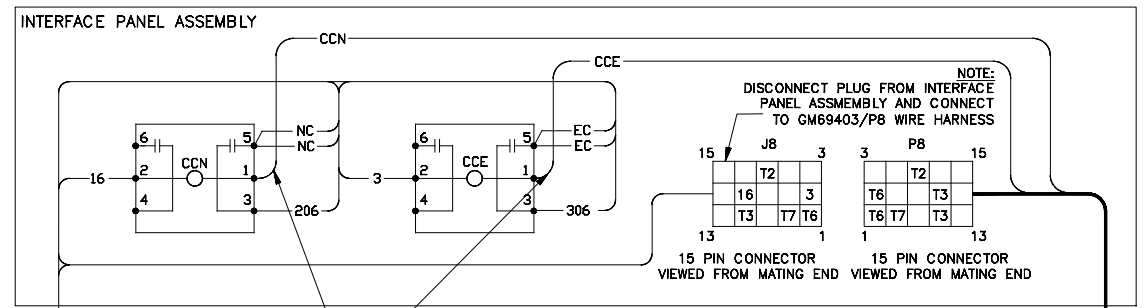
NOTES

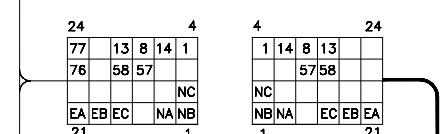
1. SWITCH SHOWN DE-ENERGIZED CONNECTED TO NORMAL SOURCE.
2. OPERATORS MANUAL IS FURNISHED WITH EACH AUTOMATIC TRANSFER SWITCH REFER TO THIS PUBLICATION PRIOR TO INSTALLATION AND OPERATION OF THE SWITCH.
3. ALL PLUGS & SOCKETS VIEWED FROM MATING SIDE.
4. NEUTRAL NOT USED ON 3 WIRE SYSTEMS.

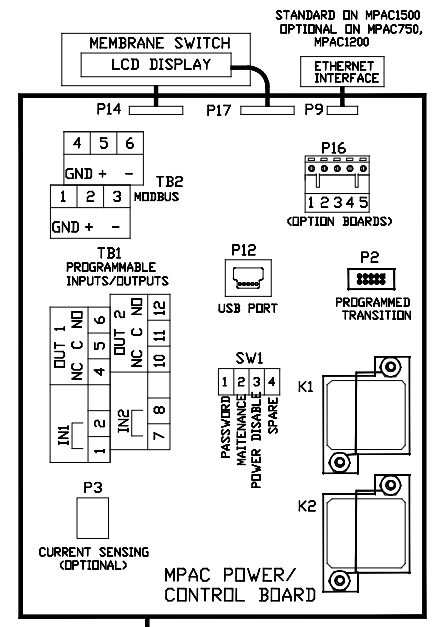
LEGEND

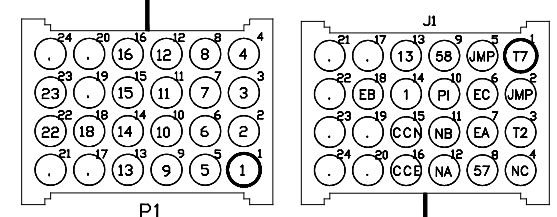
CE	EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)
CCE	COIL CONTROL RELAY (TRANSFER TO EMERGENCY)
CN	NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)
CCN	COIL CONTROL RELAY (TRANSFER TO NORMAL)
DS	DISCONNECT SWITCH
ECPT	EMERGENCY CONTROL POWER TRANSFORMER
ETS	EMERGENCY POWER TRANSFER SWITCH CONTACTS
NCPT	NORMAL CONTROL POWER TRANSFORMER
NTS	NORMAL POWER TRANSFER SWITCH CONTACTS
UIF	CONTROLLER USER INTERFACE
SE	LIMIT SWITCH – EMERGENCY
SN	LIMIT SWITCH – NORMAL
TB	TERMINAL BLOCK
P	PLUG

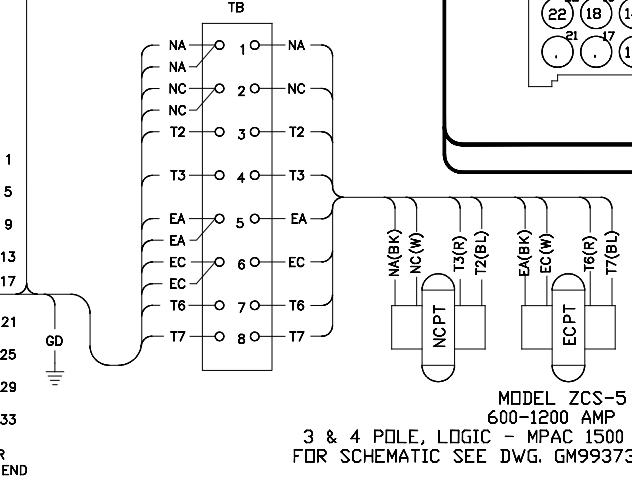












MODEL ZCS-5
600-1200 AMP
3 & 4 POLE, LOGIC – MPAC 1500
FOR SCHEMATIC SEE DWG. GM99373

UNLESS OTHERWISE SPECIFIED – DIMENSIONS ARE IN INCHES – TOLERANCES ARE: .XXX ± .010, .XX ± .020, .X ± .040, FRACTIONS ± , ANGLES ± 1/2°, SURFACE FINISH 125 MAX.

APPROVALS		DATE
DRAWN	BTW	12-21-15
CHECKED	HCC	12-21-15
APPROVED	MTL	12-21-15

TITLE: DIAGRAM, WIRING
SCALE: NONE | CAD NO. | SHEET 1-1
PLOTTED | DWG NO. GM99374 | D

Wiring Diagram, ZCS Standard Transition with Decision-Maker® MPAC 1500 Controls, 600-1200 Amps, GM99374

REV	DATE	REVISION	BY	N F
-	1-5-16	NEW DRAWING (CT1306643)	BTW	

AUXILIARY CONTACTS
15A, 240VAC

A4-1 NO A4-1
A3-1 NO A3-1
A4-2 NO A4-2
A3-2 NO A3-2

MEMBRANE SWITCH
LCD DISPLAY

ETHERNET INTERFACE
STANDARD ON MPAC1500
OPTIONAL ON MPAC750, MPAC1200

MPAC POWER/CONTROL BOARD

P17 (LCD DISPLAY)×(MEMBRANE SW.)
P14
P9 (ETHERNET)
(GEN_START_1) P1-8
(GEN_START_2) P1-9
(GROUND) P1-10
(POSITION_SOURCE2) P1-13
(POSITION_SOURCE1) P1-14
P16 (OPTION BOARDS)

TB2 (MODBUS): GND + -
P24-11 P1-12 — 3
P24-15 P1-11 — 4
REMOTE ENGINE START
P24-16 P1-32
P24-4 P1-29 SN-2 SE-2 P1-30 P1-31 P24-12 P24-8

TB1 (PROGRAMMABLE INPUTS/OUTPUTS)
OUT 1 NC C NO 4 5 6
OUT 2 NC C NO 10 11 12
IN1 1 2
IN2 7 8

P12 USB PORT (ON BACK OF BOARD)

SW1: 1 2 3 4
PASSWORD
MAITENANCE
POWER DISABLE
SPARE

(SOURCE1_C1) P1-2
(SOURCE1_C2) P1-5
× POWER SUPPLY
SOURCE 1 SENSING AC VOLTAGE
×(SOURCE1_A) P1-12
(SOURCE1_B) P1-11
×(SOURCE1_C) P1-4
(SOURCE1_N) P1-22
P24-5
P24-1
P24-2

K1 (SOURCE1_NO1) P1-3 — P8-9 — TB3 NCPT TB1
K1 (SOURCE1_NO2) P1-15 — CCN — P8-11 P8-10 — TB4 TB2

P2 (PROGRAMMED TRANSITION)

P3-1 (1A)
P3-2 (1AR)
P3-3 (1B)
P3-4 (1BR)
P3-5 (1C)
P3-6 (1CR)
CURRENT SENSING

K1 K2 (SOURCE2_C1) P1-1 — P8-4 — TB8 ECPT TB5
K1 K2 (SOURCE2_C2) P1-16 — CCE — P8-2 P8-1 — TB7 TB6

K2
× POWER SUPPLY
SOURCE 2 AC VOLTAGE SENSING
×(SOURCE2_A) P1-7
(SOURCE2_B) P1-18
×(SOURCE2_C) P1-6
(SOURCE2_N) P1-23
P24-21
P24-17
P24-13

TO LOAD
FROM NORMAL SOURCE
NN NC NB NA
2 NTS
LN LC LB LA
2 ETS
3
EN EC EB EA
FROM EMERGENCY SOURCE

GD
AT MECHANISM
P1-34
GD
AT INNER PANEL

P1-23 P1-24
P1-9 P1-10
P1-22
P1-8

CCN 6 4 P1-18
209R + AC RN AC − 206
DS
206R CN

307R + AC RE AC − 306R CE
DS 307
P1-3 306 CCE 4 6

LEGEND

AB3-3	LIMIT SWITCH, BYPASS EMERGENCY
AE-1	LIMIT SWITCH, ENGINE START TRANSFER
ATR	AUTO/TEST RELAY
CE	EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)
CCE	COIL CONTROL RELAY (TRANSFER TO EMERGENCY)
RE	EMERGENCY OPERATOR BRIDGE RECTIFIER
CN	NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)
CCN	COIL CONTROL RELAY (TRANSFER TO NORMAL)
RN	NORMAL OPERATOR BRIDGE RECTIFIER
DS	DISCONNECT SWITCH
ECPT	EMERGENCY CONTROL POWER TRANSFORMER
ETS	EMERGENCY POWER TRANSFER SWITCH CONTACTS
NCPT	NORMAL CONTROL POWER TRANSFORMER
NTS	NORMAL POWER TRANSFER SWITCH CONTACTS
RNH	NORMALLY HELD RELAY
SE	LIMIT SWITCH - EMERGENCY
SN	LIMIT SWITCH, NORMAL
° ###	COMPONENT CONNECTION TERMINAL
#	LEAD
P#-#	PLUG/SOCKET CONNECTOR
•	CONNECTION NODE
A4-1	TERMINAL BLOCK ON TRANSFER SWITCH PANEL
4	TERMINAL BLOCK ON LOGIC BOARD

NOTES:
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT
2. NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.
3. OPTIONAL NEUTRAL BUS

FOR WIRING DIAGRAM SEE DWG. GM99376

MODEL ZCS-5
1600-3000 AMP
3 & 4 POLE
LOGIC - MPAC 1500

UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN INCHES. TOLERANCES ARE: .XXX ± .010 ANGLES ± 1/2° .XX ± .030 SURFACE FINISH 125 MAX. FRACTIONS ±

KOHLER CO.
KOHLER, WI 53044 U.S.A.
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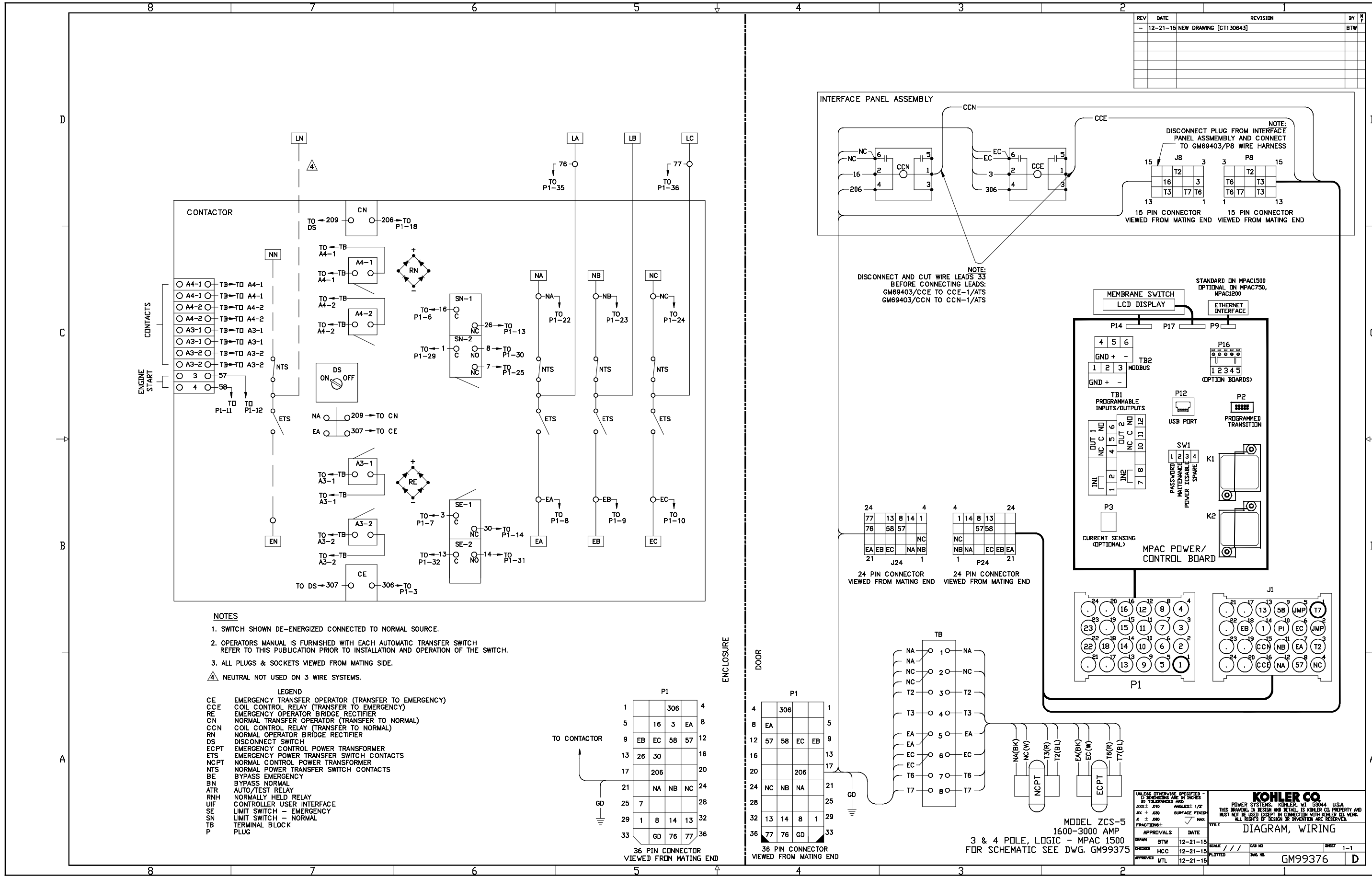
APPROVALS	DATE
DRAWN BTW	1-5-16
CHECKED HCC	1-5-16
APPROVED MTL	1-5-16

TITLE: DIAGRAM SCHEMATIC
SCALE: / / / CAD NO. SHEET 1-1
PLOTTED DWG. NO. GM99375 D

Schematic Diagram, Model ZCS Standard Transition with Decision-Maker® MPAC 1500 Controls, 1600-3000 Amps, GM99375



Wiring Diagram, Model ZCS Standard Transition with Decision-Maker® MPAC 1500 Controls, 1600-3000 Amps, GM99376

Automatic transfer switches are shipped factory wired and tested, ready for installation. 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 controller.

Follow this installation section first when installing the transfer switch. Refer to the logic controller 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 type of logic controller. See List of Related Materials in Introduction section in this manual.

5.1 Upon Receipt of Unit

5.1.1 Inspection

At time of delivery, inspect the automatic 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 or dealer.

5.1.2 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 5-1 for the approximate weight of each transfer switch covered in this manual. Use a spreader bar for lifting. 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 lock the enclosure door before moving or mounting the unit.

Transfer Switch Rating (amps)	Number of Poles	Approximate Weight lb. (kg)
600	2,3 4	638 (290) 658 (298)
800	2, 3 4	678 (308) 761 (345)
1000	3 4	678 (308) 761 (345)
1200	3 4	678 (308) 761 (345)
1600	3 4	975 (442) 1100 (499)
2000	3 4	975 (442) 1100 (499)
2500	3 4	1155 (524) 1295 (587)
3000	3 4	1155 (524) 1295 (587)

Figure 5-1 Approximate Transfer Switch Weight

5.1.3 Unpacking

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

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

5.1.4 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.

5.2 Mechanical Installation

Check the System Voltage and Frequency Do not install a 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 4. 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.

Bolt the 600- through 3000-ampere automatic transfer switches directly to floor mounting pads. When mounting one of these units, level the mounting pads so that the door hinges are plumb when the unit is installed to avoid distorting the enclosure or door.

5.3 Check Manual Operation

Follow the procedure in Section 2.3 to manually operate the contactor but stop before reapplying power sources. Verify that the contactor operates smoothly without binding and prepare it for automatic operation. If the contactor does not operate smoothly without binding, *STOP!* Call an authorized service center to service the contactor before proceeding!

5.4 Electrical Wiring

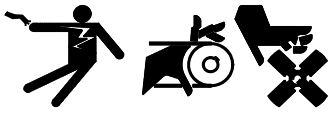
All internal electrical connections are prewired. The only wiring necessary when installing the transfer switch is to connect the unit to external devices.

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 4 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 equipment connected to the set, 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.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. 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).

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

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.

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.

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.

5.4.1 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 any debris from the enclosure with a vacuum cleaner. *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 with a wire brush. If using aluminum conductors, apply a joint compound to cables. After tightening terminal lugs, carefully wipe off excess joint compound.

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

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

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

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 5-2.

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 5-2 Tightening Torque for Lugs

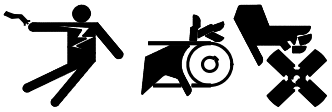
In cases where the normal, emergency, and load connections are made to a rear connected bus bar, use a compression washer, flat washer, and a minimum grade 5 bolt and torque to the values in Figure 5-3.

Bolt Size	Torque Bolt (Grade 5)		
	in. lbs.	ft. lbs.	Nm
1/4-20	72	6	8.1
5/16-18	132	11	14.9
3/8-16	300	25	33.9
1/2-13	720	60	81.4

Figure 5-3 Tightening Torque for Bus Bars

5.4.2 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 equipment connected to the set, 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 that provides the emergency power source to the transfer switch from starting by moving the generator set master switch to the OFF position; disconnecting power to the generator engine start battery charger, if installed; and disconnecting all generator engine start battery cables, negative (-) leads first.

Connect the generator set remote starting circuit to the generator 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. See the enclosure dimension drawings in Section 4. The transfer switch controller provides a contact closure through the wiring harness to these terminals to signal the generator set to start.

5.4.3 Accessory and Controller Connections

Complete any external connections for accessories. See the transfer switch logic controller operation and installation manual. See List of Related Materials in the Introduction section in this manual for document part numbers.

Connect the power switching device and controller wiring harnesses together at the inline disconnect plug after performing the voltage check procedure to complete installation.

5.5 Prepare the Generator Set for Operation

⚠ WARNING

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

Operate the generator set only when all guards and electrical enclosures are in place.

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 generator engine start battery cables, negative (–) leads last; and reconnect power to the generator engine start battery chargers, if installed.

5.6 Functional Tests

5.6.1 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 and controller wire harnesses together.

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.

⚠ WARNING

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

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Read and understand all instructions on installation drawings and labels affixed to the switch. Note any optional accessories that have been furnished with the switch and review their operation. Refer to the controller operation manual for more information. See List of Related Materials in the Introduction for the manual part number.

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 and the logic controller wire harnesses at the inline disconnect plug if they are connected.
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 proceed further in 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 necessary.
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 wiring harnesses together at the inline disconnect plug.

16. Close and lock the transfer switch enclosure door.

17. Reconnect power sources by closing circuit breakers or switches. The transfer switch may signal the generator set to run for the engine cooldown time delay, if it is not set to zero.

Note: When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Engine Cooldown Time Delay (TDEC) ends (if the time delay is not set to zero).

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

5.6.2 Automatic Operation Test

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

5.7 Controller Setup

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

5.8 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.

Appendix A Abbreviations

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

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
APU	Auxiliary Power Unit
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CAT5	Category 5 (network cable)
CB	circuit breaker
CC	crank cycle
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E^2PROM, EEPROM	electrically-erasable programmable read-only memory
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IBC	International Building Code
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	internet protocol
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram

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

Notes

Notes

KOHLER.
Power Systems

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