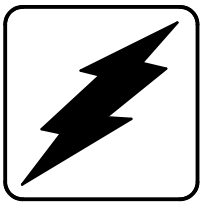
Operation and Installation

Automatic Transfer Switches



Models:

ZCS

Contactors:
40 to 3000 Amperes

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-5660 11/98

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Appendix A. Glossary of Abbreviations A-1

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

DANGER

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

WARNING

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

CAUTION

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

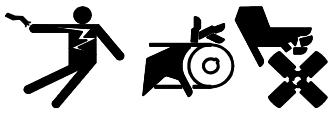
NOTICE

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

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

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

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

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

Battery

WARNING

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

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

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

⚠ WARNING

Explosion.
Can cause severe injury or death.
Relays in battery charger cause arcs or sparks.

Locate battery in a well-ventilated area. Isolate battery charger from explosive fumes.

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

Hazardous Voltage/ Electrical Shock

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

(600 Volt and above)

⚠ WARNING

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

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

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

Installing battery charger. Hazardous voltage can cause severe injury or death. Electrical shock may occur if battery charger is not electrically grounded. Connect battery charger enclosure to ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect to equipment grounding terminal or lead on battery charger. Perform battery charger installation as prescribed in equipment manual. Install battery charger in compliance with local codes and ordinances.

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

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

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

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent the possibility of electrical shock, 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 wristwatch, rings, and jewelry before servicing equipment.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open main circuit breakers of all power sources to the transfer switch 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 battery cables after servicing. Follow these precautions to prevent starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

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

Heavy Equipment

⚠ WARNING

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

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

Moving Parts

⚠ WARNING

Hazardous voltage. Moving rotor.

Can cause severe injury or death.

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

Notice

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

This manual provides operation and installation instructions for Kohler Model ZCS automatic transfer switches that use a 40- to 3000-ampere contactor as the power switching device.

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

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

Equipment service requirements are minimal but are very important to safe and efficient operation; therefore, inspect parts often and perform required service at the prescribed intervals. An authorized service distributor 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.

Three types of electrical controls are available on the Model ZCS transfer switch, and each type is covered in a separate manual. The following table lists the available electrical controls and the related operation and installation manual part numbers.

Electrical Controls	Operation/ Installation Manual
E33+ (Solid State)	TP-5662
S340+ (Solid State)	TP-5663
M340+ (Microprocessor)	TP-5664

Separate manuals cover service and parts information for transfer switch power switching devices and electrical controls. The following table lists the available manuals and the related manual part numbers.

Power Switching Device	Service/Parts Manual
ZCS/ZCB (Contactor)	TP-5668

Electrical Controls	Service/Parts Manual
E33+ (Solid State)	TP-5670
S340+ (Solid State)	TP-5671
M340+ (Microprocessor)	TP-5672

Transfer switches with microprocessor electrical controls and communication accessories can be monitored and controlled with a personal computer and software. The following table lists the available manuals and part numbers.

Communications Item	Operation/ Installation Manual
Remote Monitoring and Control Communications (Monitor) Software	TP-5823
Communications Kits	TT-847

Service Assistance

Service Information

For sales, service, or other information about a Kohler Generator Division product, contact a local authorized distributor or dealer first.

To locate a local authorized distributor or dealer

- Look on the product or the information included with the product
- Consult the Yellow Pages under the heading Generators– Electric
- Visit the Kohler Generator Division Web site at www.kohlergenerators.com
- Call 1-800-544-2444 (inside the U.S.A. and Canada) or 920-565-3381 (outside the U.S.A. and Canada)

Product Identification

To ensure the supply of correct parts and information, write the product identification numbers in the spaces below. Record the identification numbers immediately after unpacking the products so that the numbers are readily available for future reference. Record the field-installed kit numbers after installing the kit.

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Part Number _____

Serial Number _____

Accessory Number	Accessory Description

1.1 Purpose

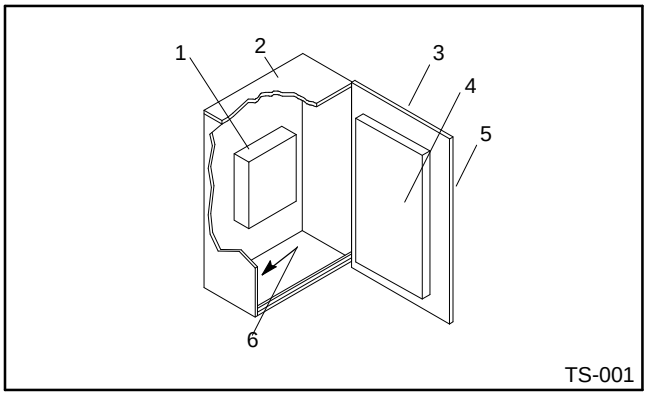
An automatic transfer switch (ATS) transfers critical electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source when the normal source fails to maintain minimum voltage and/or frequency levels.

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.

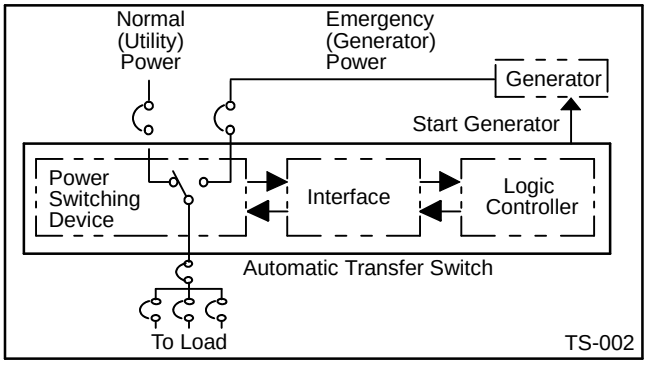


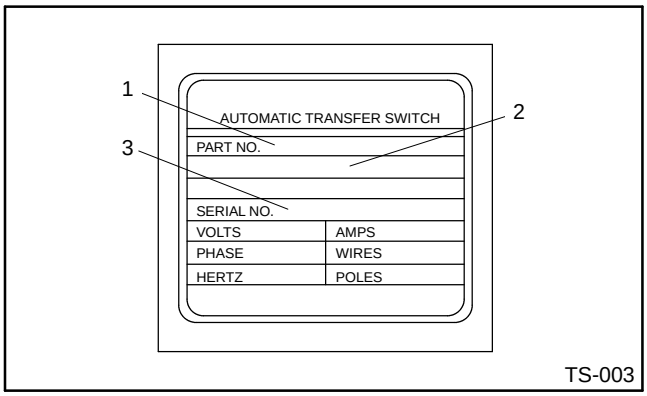
Figure 1-2. Typical Transfer Switch Block Diagram

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 1-4 and then use Figure 1-4 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.



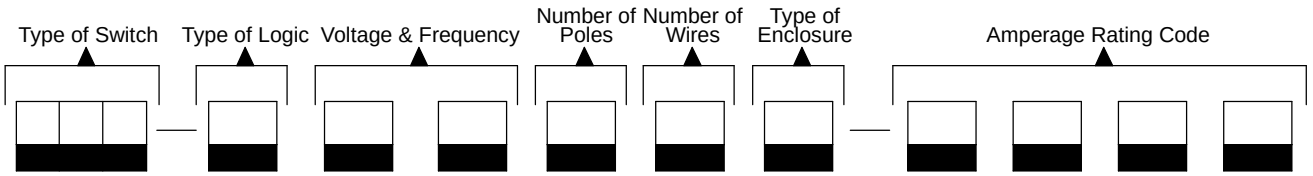
1. Location for part number used to identify type of ATS.
2. Location for factory-installed accessory numbers.
3. Location for the ATS serial number.

Figure 1-3. Typical Transfer Switch Nameplate

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)
1: S340+
2: E33+
3: S340+ with Programmed Transition
4: E33+ with Programmed Transition
5: M340+
6: M340+ with Programmed Transition

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

Figure 1-4. 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.

- Provided as a complete automatic transfer switch with E33+ (solid state logic), S340+ (solid state logic), or M340+ (microprocessor logic) controller in various enclosures
- Meets UL and CSA standards
- Voltage ratings up to 600 vac
- Amperage ratings for Programmed Transition Switches from 40 to 3000 amperes
- 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 1-5 provides WCR when used with any current-limiting fuse or any overcurrent protective device. Figure 1-6 and Figure 1-7 provides WCR when coordinated with specific manufacturer's circuit breakers or fuse types. Figure 1-6 has ratings for 480 V maximum and apply to both UL and CSA listings. Figure 1-7 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
Programmed Transition Models:					
40	50	200,000	150,000	22,000	18,000
80	100	200,000	150,000	22,000	18,000
100	125	200,000	150,000	22,000	18,000
150	200	200,000	150,000	30,000	25,000
225	300	200,000	150,000	30,000	25,000
260	350	200,000	150,000	30,000	25,000
400	600	200,000	150,000	35,000	30,000
Standard and Programmed Transition Models:					
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 1-5. 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)
40, 80, and 100	22,000	Any, 150 Amperes Maximum		150	200,000	J, RK5, RK1	200
150, 225, and 260	42,000	ABB	JHB	400	200,000	J, RK5, RK1	400
		GE	TB4, TJL, TLB4, THLC4				
		Merlin Gerin	CJ400L, CK400H				
		ITE	CJD6, SCJD6, HJD6, SHJD6				
		Square D	IL				
		Westinghouse	HKD, KDC, LCL, LA TRI-PAC				
400	50,000	GE	TB4, TLB4, THLC4	400	200,000	J, RK5, RK1	600
			TB6, TJL	600			
			TB8, TKH, TKL, TP, THP, TC, THC	800			
		Merlin Gerin	CJ400L, CK400H	400			
			CK800H	600			
		ITE	CJD6, SCJD6, HJD6, SHJD6	400			
			CLD6, SCLD6, HLD6, SHLD6, HHJD6, HHLD6	600			
			MD6, MXD6, SMD6, CMD6, SCMD6, HMD6, HMXD6, SHMD6	800			
		Square D	IL	400			
			MH, ME, SE	600			
		Westinghouse	HKD, KDC, LCL, LA TRI-PAC	400			
			HLD, LDC	600			
			HMC, NB TRI-PAC	800			
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 1-6. 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)
40, 80, and 100	18,000	Any, 150 Amperes Maximum		150	150,000	J, RK5, RK1	200
150, 225, and 260	35,000	ABB	JHB, MHB	400	150,000	J, RK5, RK1	400
		GE	TB4, SGH4, TJJ	400			
			TB6, SGH6	600			
		Merlin Gerin	CK400H, CK400L, CK400N, CK400NN	400			
		ITE	CJ, SKM				
		Westinghouse	HKD, KDC, HLD, LA TRI-PAC				
400	42,000	GE	SGL4, SGP4	400	150,000	J, RK5, RK1	600
			SGL6, SGP6	600			
		Merlin Gerin	CJ400L, SK400N, SK400H	400			
			SK800N	600			
		ITE	CJD6, SCJD6, SHP, SHK, CED6, CFD6	400			
			CLD6, SCLD6, HLD6, SHLD6	600			
		Westinghouse	HKD, KDC, LA TRI-PAC	400			
			NB TRI-PAC	800			
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 1-7. Withstand and Closing Current Ratings (WCR) With Coordinated Circuit Breakers or Fuses, 600 V Maximum, CSA Listings

1.7 Application Data

See Figure 1-8 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**		**Switch Size (amps)**	**Normal, Emergency, and Load Terminals**	
	Cables per Pole	**Range of Wire Sizes**		**Cables per Pole**	**Range of Wire Sizes**
40	1	#14 AWG to #2 AWG	800	4	#2 AWG to 600 MCM
80–100	1	#14 AWG to 1/0 AWG	1000	4	#2 AWG to 600 MCM
150	1	#8 AWG to 3/0 AWG	1200	4	#2 AWG to 600 MCM
225	1	#6 AWG to 250 MCM	1600	Bus Bar Connection	
260	1	#6 AWG to 350 MCM	2000	Bus Bar Connection	
400	1	#4 AWG to 600 MCM	2500	Bus Bar Connection	
600	2	#2 AWG to 600 MCM	3000	Bus Bar Connection	

Figure 1-8. Application Data

Notes

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

Have preventive maintenance performed on the transfer switch at regular intervals after installation. See Section 4 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 6– Installation in this manual.

Follow 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 5 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 Time Delay Engine Cooldown (TDEC), if equipped, ends.

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.

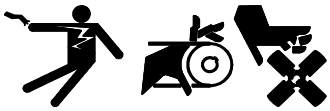
After load transfer the switch mechanically latches in the normal position and the controller starts a time delay called Time Delay Engine Cooldown (TDEC), if equipped. TDEC allows the engine and generator to run unloaded and cool down before shutdown. When TDEC expires the controller signals the generator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

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

2.3 Manual Operation

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

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

(600 Volt and above)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open main circuit breakers of all power sources to the transfer switch 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 battery cables after servicing. Follow these precautions to prevent starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

NOTICE

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

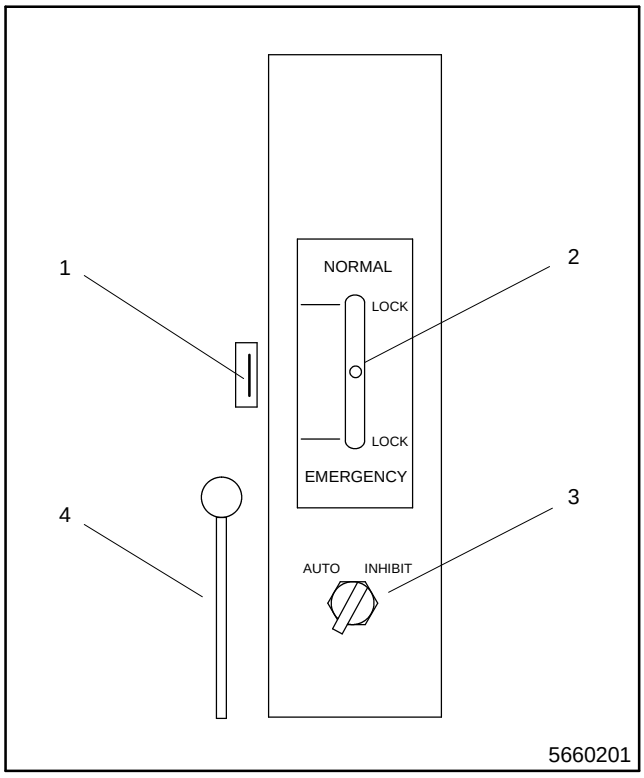
NOTE

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.

2.3.1 Programmed Transition Switch, 40–260 Amps

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. Mid-position manual release handle
2. Switch lever, middle (off) position shown
3. Disconnect switch, INHIBIT position shown
4. Manual operating handle, typical

Figure 2-1. Manual Operation, Programmed Transition Switch 40–260 Amps

5. Attach the manual operating handle to the switch lever.
6. If the handle is not in the middle (off) position, move the handle up or down to bring it into the middle (off) position. The switch should operate smoothly without binding. Both normal and emergency sources are disconnected from the load in the middle (off) position.
7. Locate the mid-position manual release handle on the left side of the switch. See Figure 2-1.
8. Pull and hold the mid-position manual release handle to the left. This releases the mechanism that allows manual switching to the normal or emergency source from the off position. Move the handle up to the normal position to manually connect the load to the normal source or down to the emergency position to manually connect the load to the emergency source. The switch should operate smoothly in both directions without binding.
9. Manually connect the load to the normal source for automatic operation.
10. Remove and return the manual operator handle to the holder provided.
11. Move the disconnect switch (DS) to the AUTO position for automatic operation.
12. Close and lock the transfer switch enclosure door.
13. Reconnect power supplies to the transfer switch.

NOTE

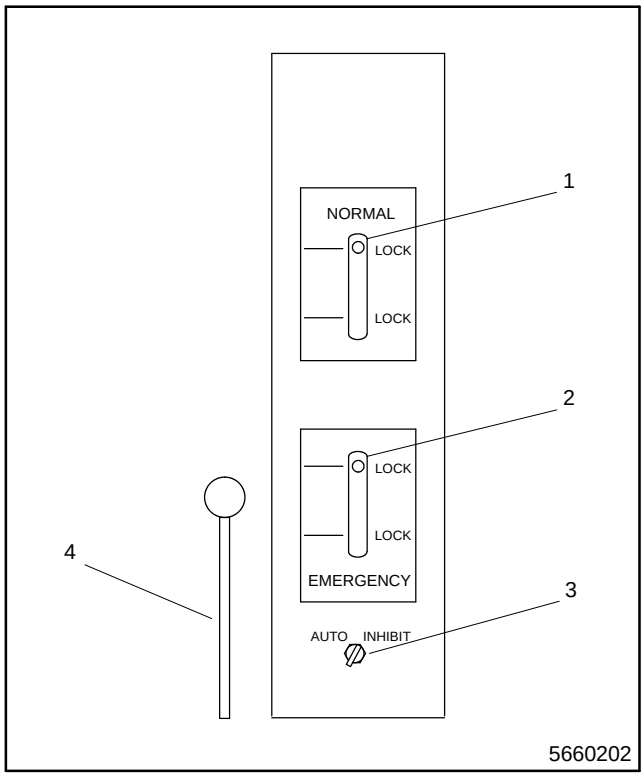
When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Time Delay Engine Cooldown (TDEC), if equipped, ends.

14. 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).

2.3.2 Programmed Transition Switch, 400–3000 Amps

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 2-2.



1. Normal switch lever, normal source shown connected to load
2. Emergency switch lever, emergency source shown disconnected from load
3. Disconnect switch, INHIBIT position shown
4. Manual operating handle, typical

Figure 2-2. Manual Operation, Programmed Transition Switch 400–3000 Amps

5. Attach the manual operator handle to the normal switch lever and move it *up* to the normal position to manually connect the load to the normal source and move it *down* to disconnect. The switch should operate smoothly in both directions without binding.
6. Attach the manual operator handle to the emergency switch lever. Move the handle *down* to the emergency position to manually connect the load to the emergency source and move it *up* to disconnect. The switch should operate smoothly in both directions without binding.

NOTE

A mechanical interlock prevents simultaneous emergency and normal source connection to the load. Both sources can be manually disconnected from the load simultaneously.

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

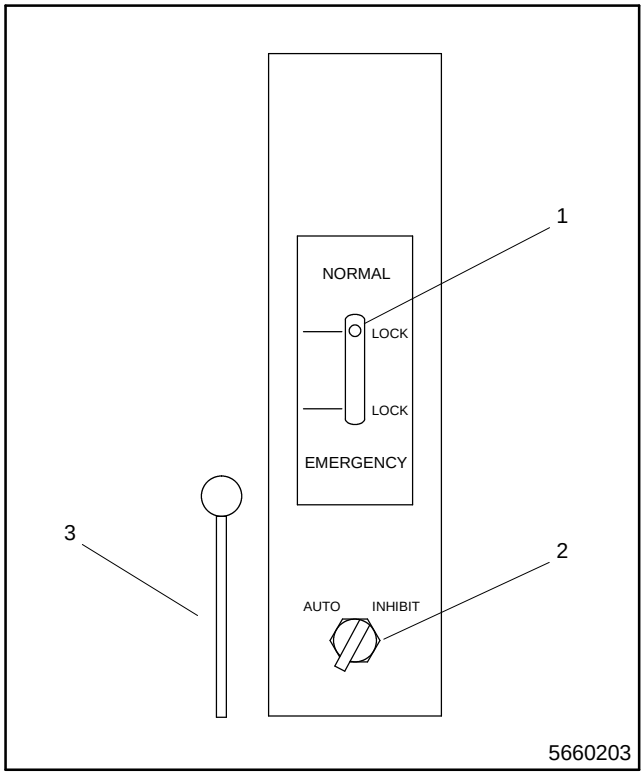
When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Time Delay Engine Cooldown (TDEC), if equipped, ends.

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).

2.3.3 Standard Switch, 800–3000 Amps

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 2-3.



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

Figure 2-3. 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 Time Delay Engine Cooldown (TDEC), if equipped, ends.

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).

3.1 Programmed Transition

NOTE

ATSs using microprocessor logic control do not use this section. The programmed transition function takes place within the microprocessor and no time relays are required. See TP-5664, operation and installation manual for the M340+ controller, for operational details. Relays K3 and K4 on the interface board are replaced with a standard form C relay.

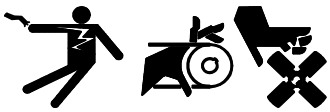
3.1.1 Description

The Programmed Transition accessory consists of two timing relays that plug into an interface circuit board. See Figure 3-1. If these relays are present, power transfers from normal to emergency or emergency to normal in three steps: (1) the switch or circuit breaker for the previously connected power source opens, (2) a delay period, adjustable from 2 to 40 seconds, allows any residual voltage in the load circuit to decay, and (3) the switch or circuit breaker for the new power source closes.

3.1.2 Adjustment

Two separate timing relays are used. One relay, K4 (TDOE), produces the time delay for the normal to emergency power transfer. The other relay, K3 (TDON), produces the time delay for the emergency to normal power transfer. Each relay has a separate adjustment. To make the adjustment, proceed as follows.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

(600 Volt and above)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open main circuit breakers of all power sources to the transfer switch 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 battery cables after servicing. Follow these precautions to prevent starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

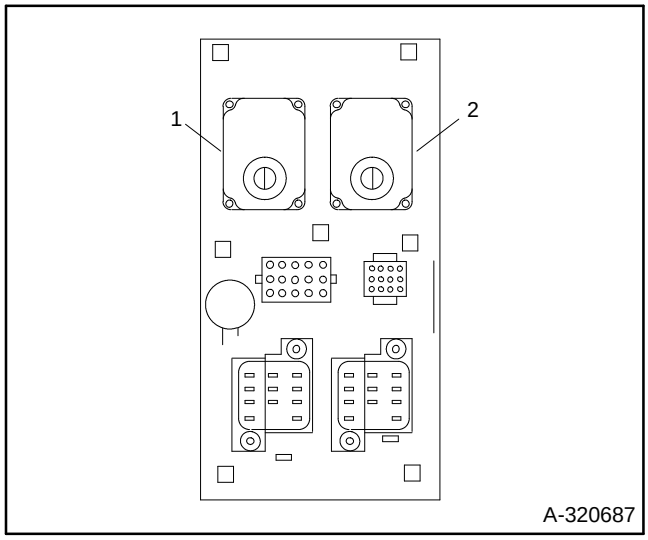
Time Delay Off Adjustment Procedure

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. Locate the appropriate relay on the interface circuit board. See Figure 3-1.
5. Insert a screwdriver into the slot of the adjustment screw, which is visible through the cover of the relay, and turn the adjustment screw to the desired time delay period. Turn clockwise to increase time, counterclockwise to decrease time.
6. Close and lock the transfer switch enclosure door.
7. 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 Time Delay Engine Cooldown (TDEC), if equipped, ends.

8. 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).
9. Perform an automatic operation test to verify time delays. See the logic controller operation and installation manual. See List of Related Materials in the Introduction section in this manual.



1. K3 (TDON)
2. K4 (TDOE)

Figure 3-1. Interface Circuit Board with Time Delay Off Relays

3.2 Other Accessories

With the exception of the Time Delay Off accessory, all other accessories for this automatic transfer switch are controller accessories. For controller accessory information and procedures, refer to the appropriate logic controller operation and installation manual. See List of Related Materials in the Introduction section in this manual.

Section 4. Scheduled Maintenance

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

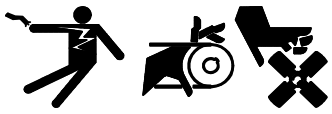
A local authorized distributor or dealer (authorized service center) can provide complete preventive maintenance and services to keep the transfer switch in top condition. Contact a local distributor or dealer for additional information. See the Service Assistance section in this manual for how to locate 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 battery cables before working on generator set. (Remove negative (–) lead first when disconnecting battery. Reconnect negative (–) lead last when reconnecting battery.)

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

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

(600 Volt and above)

⚠ WARNING

Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

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

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

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

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open main circuit breakers of all power sources to the transfer switch 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 battery cables after servicing. Follow these precautions to prevent starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

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

NOTICE

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

NOTICE

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

NOTICE

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

4.1 Inspection and Service

Contact an authorized 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.

4.1.1 General Inspection

External Inspection Keep the transfer switch clean and in good condition by performing a weekly general external inspection of the transfer switch 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.

4.1.2 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 4.3– 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.

4.2 Testing

4.2.1 Weekly Generator Set Exercise

Use a plant exerciser or manual test to start and run the generator set under a load once a week to maximize the reliability of the emergency power system. See the 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.

4.2.2 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.

4.3 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	4.1.1	X	X				M
Check the contactor's external operating mechanism for cleanliness and clean and relubricate if dirty *	4.1.1	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	4.1.1	X		D, R (wiring)			M
	4.1.2	D	D				Q
Check the transfer switch's main power switching mechanisms' mechanical operation and integrity	4.1.2	D	D			D	Y
Tighten control and power wiring connections to specifications	4.1.2, 6.4, 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	4.1.2	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	4.1.2		D	D, R	D	D	Y
Test wire and cable insulation for electrical breakdown	4.1.2					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary	4.1.2		D			D	Every 5 Years
CONTROL SYSTEM							
Exercise the generator set under load	4.2.1, L					X	W
Test the transfer switch's automatic control system	4.2.2, 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 *	4.1.1	X			X		W
Check that all external hardware is in place, tightened, and not badly worn	4.1.1	X	X	R			W
Inspect the inside of transfer switch for any condition of vibration, leakage, noise, temperature, contamination, or deterioration to keep the inside of the transfer switch clean, dry, and in good condition *	4.1.1	X	X		D		M
	4.1.2	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn	4.1.2	X	D				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.

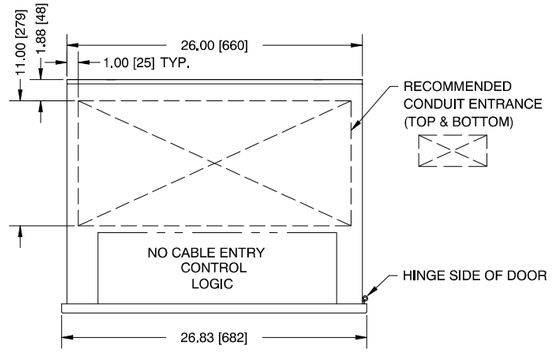
W=Weekly
M=Monthly
Q=Quarterly
S=Six Months
Y=Yearly

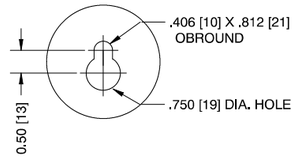
Section 5. Diagrams and Drawings

Diagram or Drawing	Drawing Number	Page
Enclosure Dimensions Drawings		
40–260 Amp, NEMA Type 1 and Type 3R	ADV-6180-	23
400 Amp, NEMA Type 1 and Type 3R	ADV-5934-C	24
600–1200 Amp, NEMA Type 1 and 3R	ADV-5936A-F	25
600–1200 Amp, NEMA Type 12	ADV-5936B-B	26
1600–2000 Amp, NEMA Type 1	ADV-5941-E	27
1600–2000 Amp, NEMA Type 3R, E33+ and S340+ Logic	ADV-5990-A	28
1600–2000 Amp, NEMA Type 3R, M340+ Logic	ADV-5989-A	29
2500–3000 Amp, NEMA Type 1	ADV-6242-B	30
2500–3000 Amp, NEMA Type 3R, E33+ and S340+ Logic	ADV-6241-A	31
2500–3000 Amp, NEMA Type 3R, M340+ Logic	ADV-6240-A	32
Open Units Dimensions Drawings*		
600–3000 Amp, M340+ Logic and Inner Panel Mounting	ADV-5975A-B	*
600–3000 Amp, E33+ and S340+ Logic and Inner Panel Mounting	ADV-5975B-B	*
600 Amp	ADV-5975C-A	*
800–1200 Amp	ADV-5975D-A	*
1600–2000 Amp	ADV-5975E-B	*
2500–3000 Amp	ADV-5975F-B	*
40–3000 Amp, M340+ Logic and Inner Panel Mtg., Prog. Transition	ADV-5976A-C	*
40–3000 Amp, E33+ and S340+ Logic and Inner Panel Mtg., Prog. Transition	ADV-5976B-C	*
40–260 Amp, Programmed Transition	ADV-5976C-A	*
400 Amp, Programmed Transition	ADV-5976D-B	*
600 Amp, Programmed Transition	ADV-5976E-A	*
600–1200 Amp, Programmed Transition	ADV-5976F-B	*
1600–2000 Amp, Programmed Transition	ADV-5976G-B	*
2500–3000 Amp, Programmed Transition	ADV-5976H-B	*
Schematic Diagrams, E33+ Logic		
600–1200 Amp	321283-C	33
1600–3000 Amp	321296-B	34
400 Amp with Programmed Transition	321295-C	35
600–3000 Amp with Programmed Transition	321285-B	36
Schematic Diagrams, S340+ Logic		
600–1200 Amp	321096-C	37
1600–3000 Amp	321097-A	38
40–260 Amp with Programmed Transition		
120 VAC	346311-	39
208 VAC	353185-	40
240 and 480 VAC	353184-	41
380 and 416 VAC	353183-	42
600 VAC	353182-	43
400 Amp with Programmed Transition	321098-B	44
600–3000 Amp with Programmed Transition	321099-B	45
Schematic Diagrams, M340+ Logic		
600–1200 Amp	321287-C	46
1600–3000 Amp	321301-B	47
40–260 Amp with Programmed Transition		
120 VAC	346312-	48
208 VAC	353174-	49
240 and 480 VAC	353175-	50
380 and 416 VAC	353176-	51
600 VAC	353177-	52
400 Amp with Programmed Transition	321300-B	53
600–3000 Amp with Programmed Transition	321286-A	54

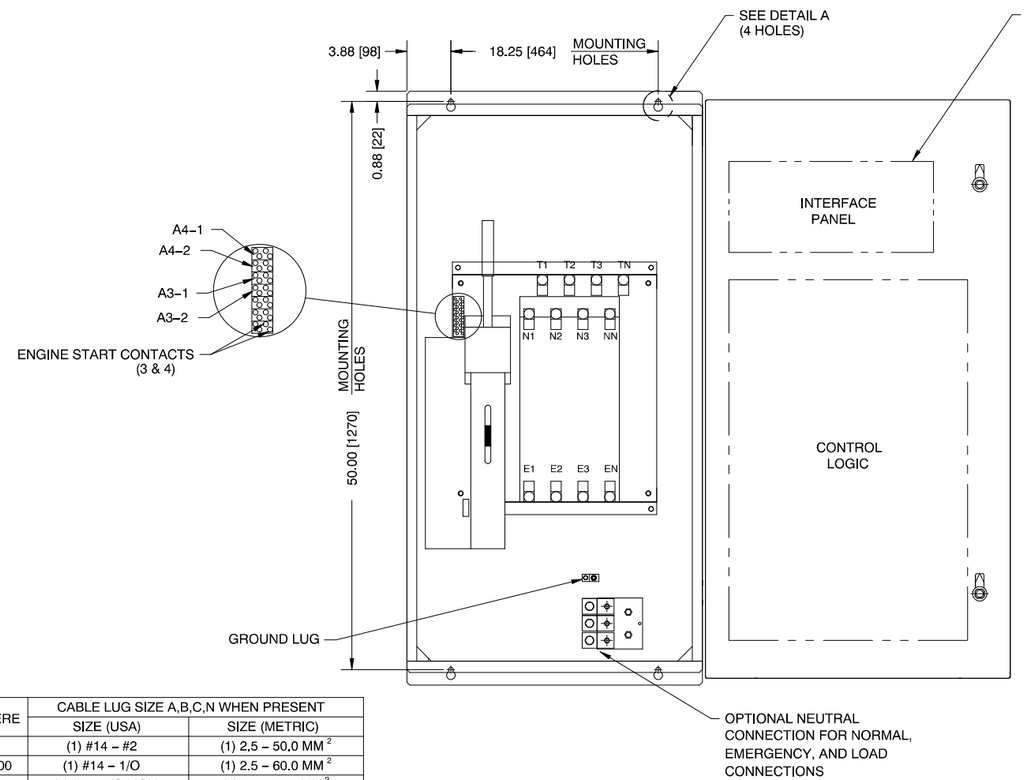
* Contact your local distributor or dealer for a copy of these drawings. They are not included in this manual.

Notes

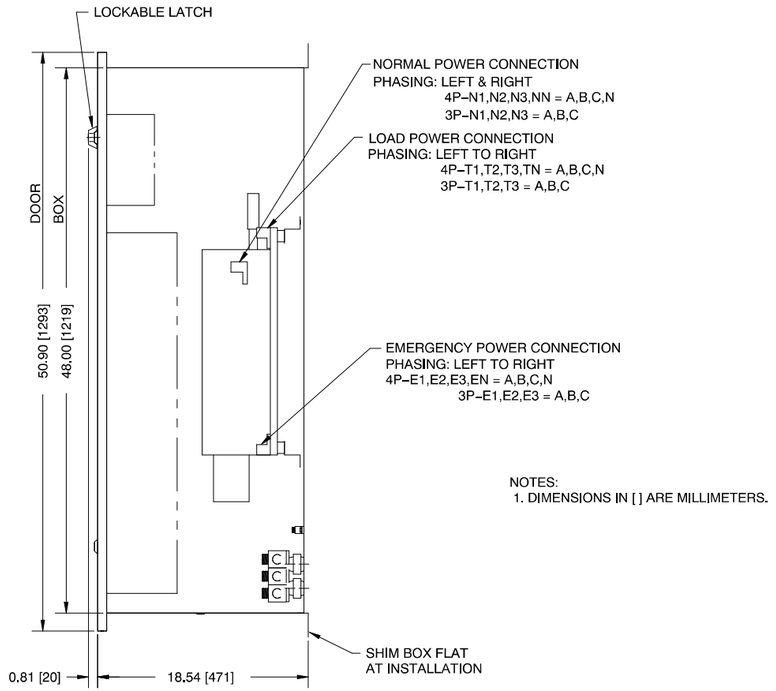




DETAIL A
(FULL SCALE)



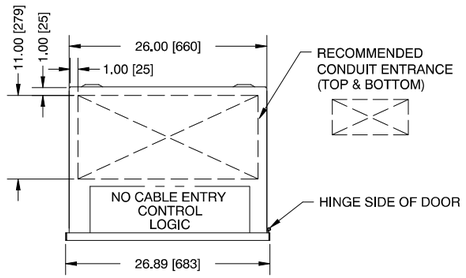
AMPERE	CABLE LUG SIZE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC)
40	(1) #14 – #2	(1) 2.5 – 50.0 MM ^{2}
80–100	(1) #14 – 1/O	(1) 2.5 – 60.0 MM ^{2}
150	(1) #8 – 3/O MCM	(1) 10 – 95.0 MM ^{2}
225	(1) #6 – 250 MCM	(1) 10 – 150.0 MM ^{2}
260	(1) #6 – 350 MCM	(1) 10 – 185.0 MM ^{2}

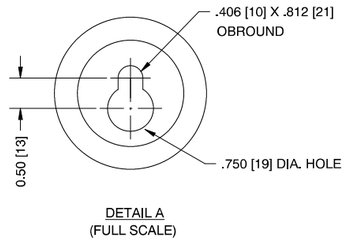


NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

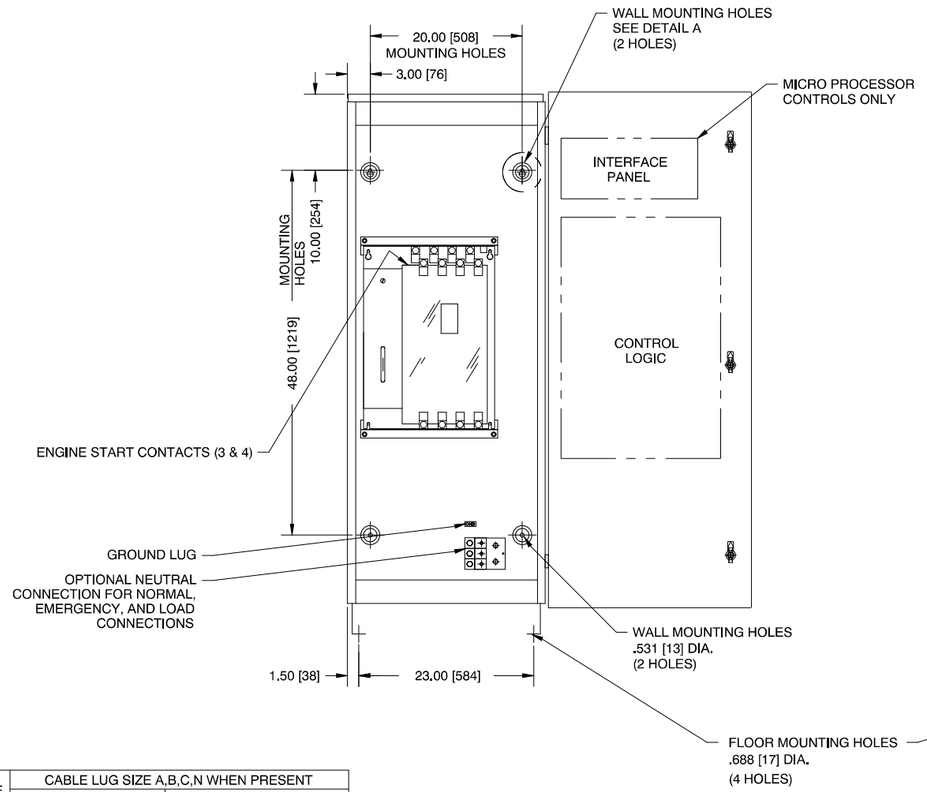
ADV-6180-

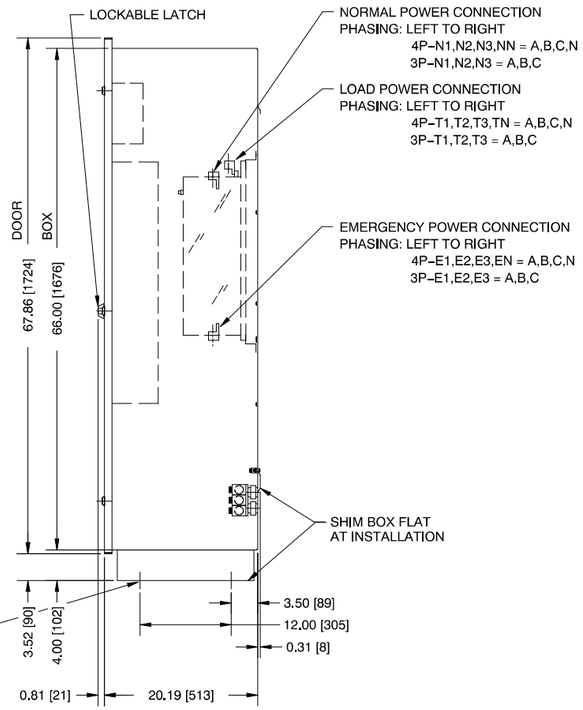
Enclosure Dimensions Drawing, 40–260 Amp, NEMA Type 1 and Type 3R





DETAIL A
(FULL SCALE)



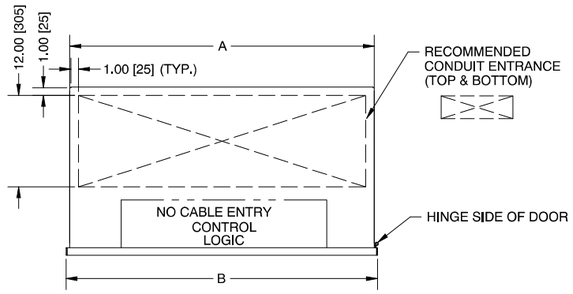


AMPERE	CABLE LUG SIZE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC)
400	(1) #4 – 600 MCM	(1) 21.2 – 304.0 MM ^{2}

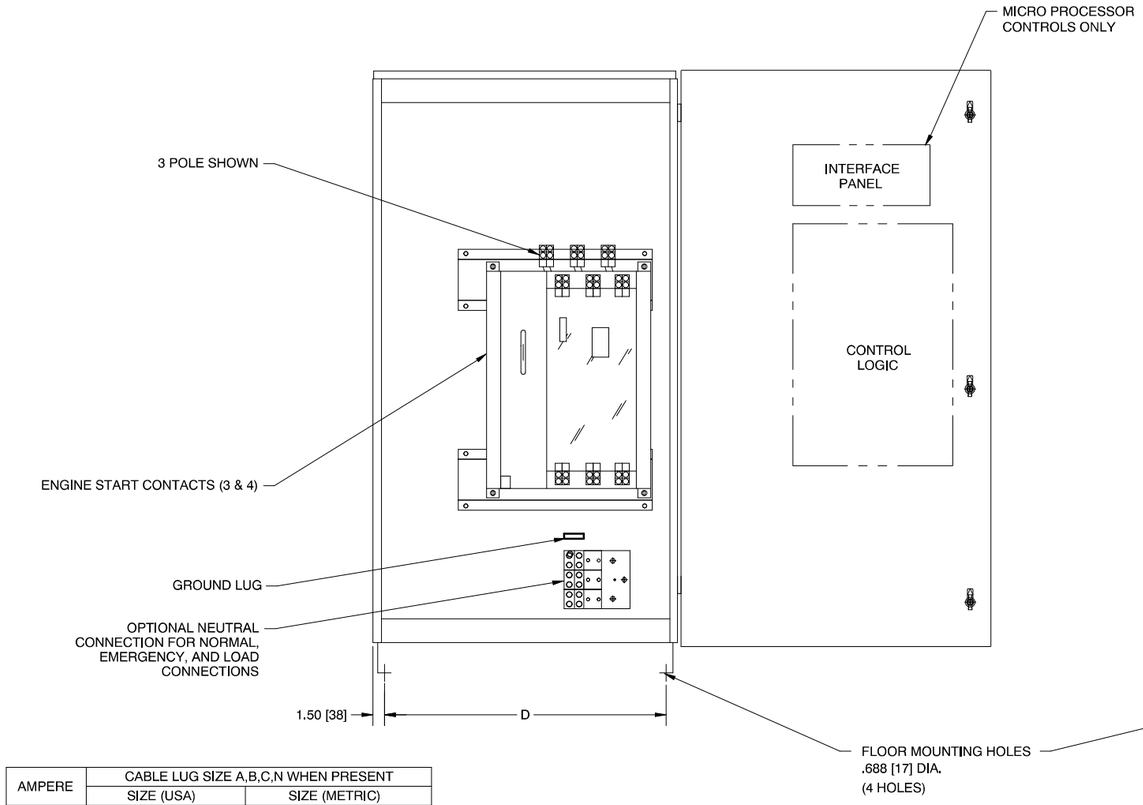
NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

ADV-5934-C

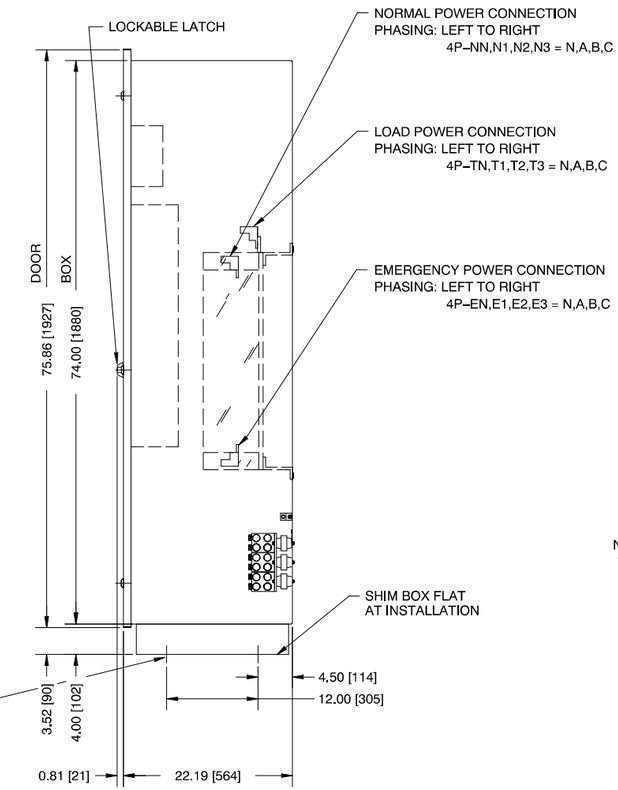
Enclosure Dimensions Drawing, 400 Amp, NEMA Type 1 and Type 3R



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}

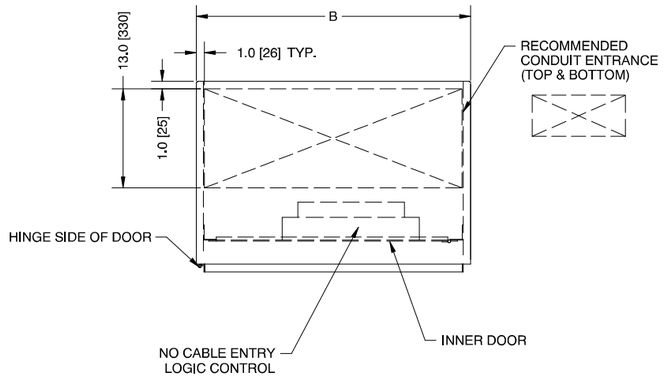


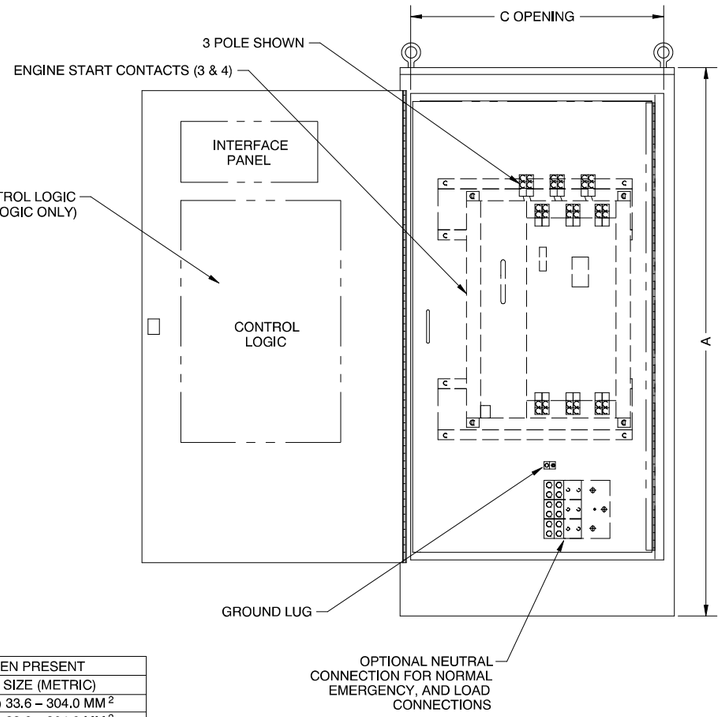
NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

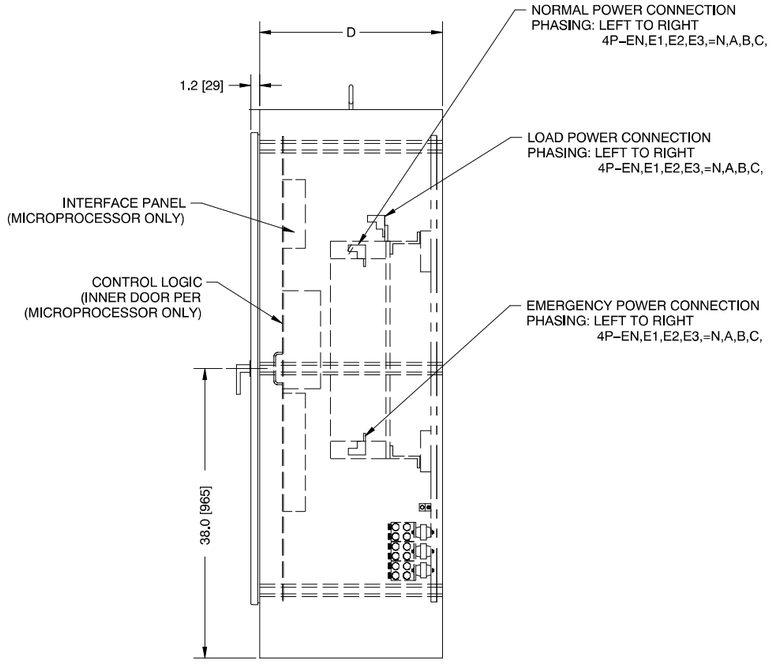
ADV-5936A-F

Enclosure Dimensions Drawing, 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]





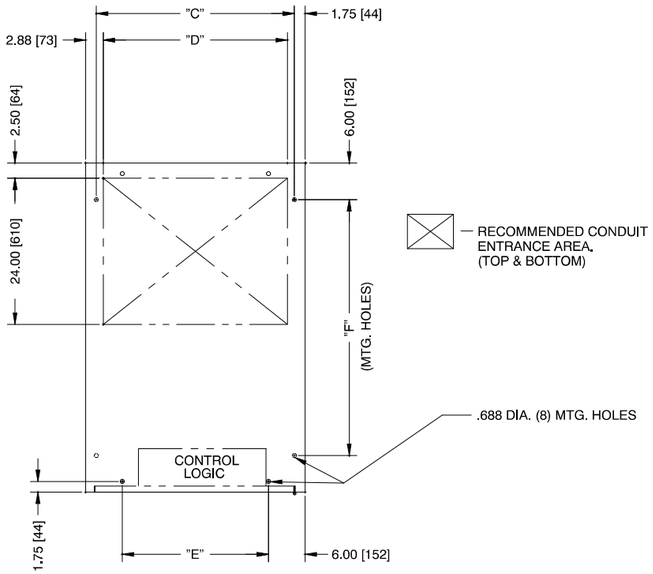


AMPERE	CABLE LUG SIZE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC)
600	(2) #2 – 600 MCM	(2) 33.6 – 304.0 MM ^{2}
800–1200	(4) #2 – 600 MCM	(4) 33.6 – 304.0 MM ^{2}

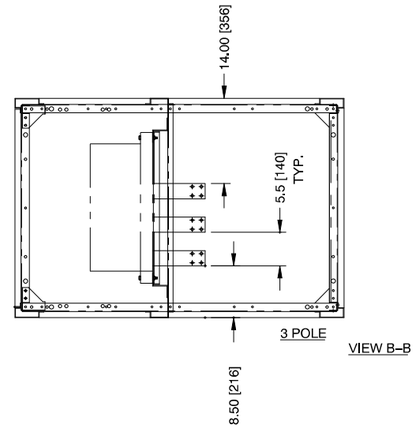
ADV-5936B-B

Enclosure Dimensions Drawing, 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]	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]

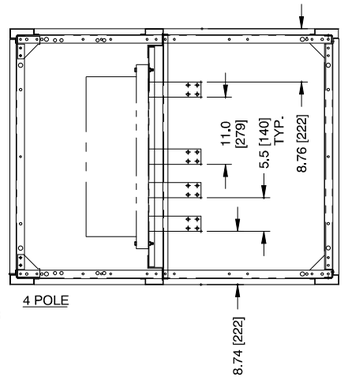


PLAN VIEW

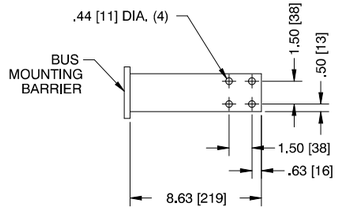


3 POLE

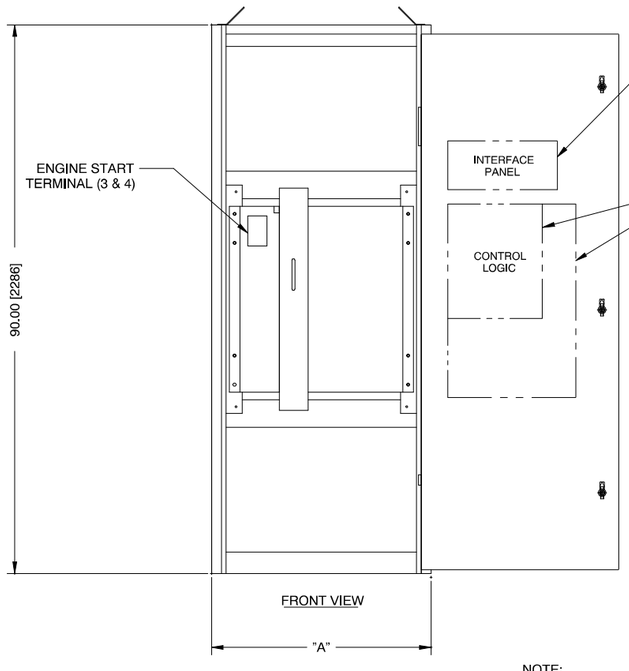
VIEW B–B



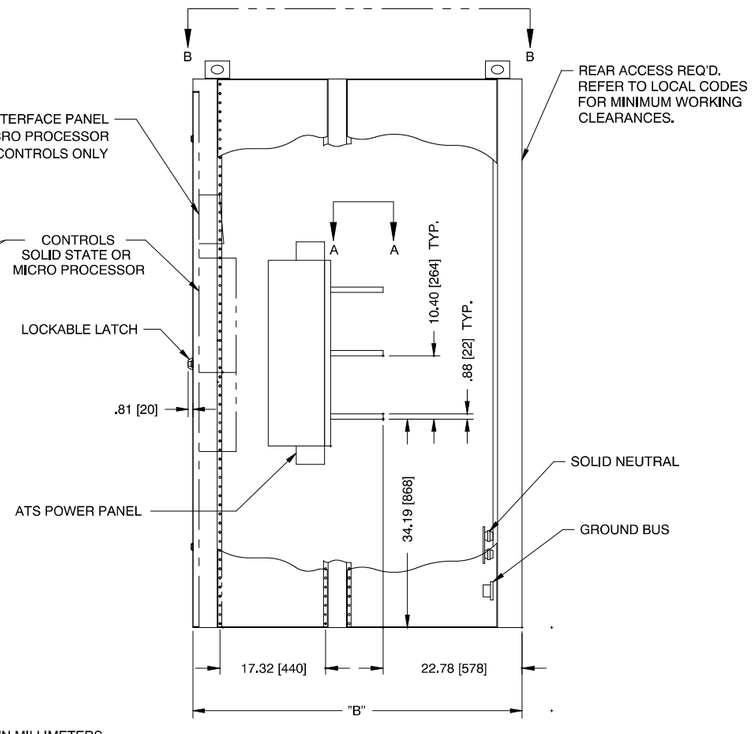
4 POLE



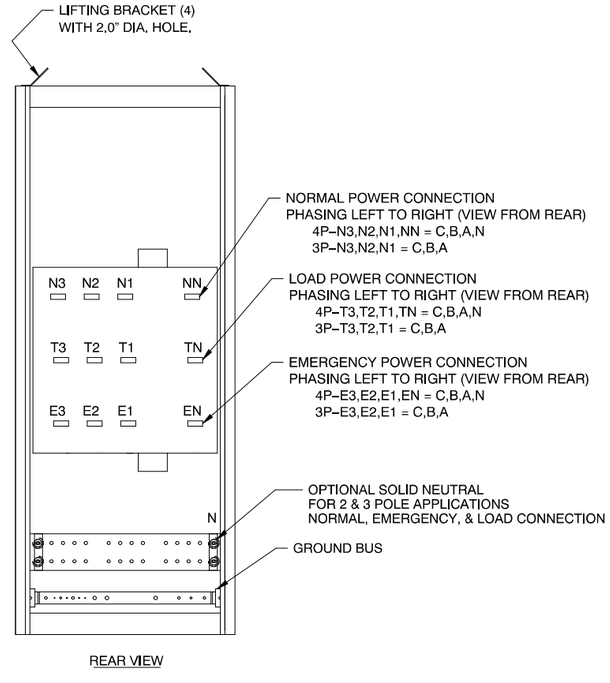
BUS DRILLING DETAIL
(1600–2000 AMP)
VIEW A–A (TYP.)
SCALE: 1/5



FRONT VIEW



RIGHT SIDE VIEW

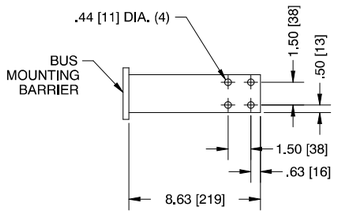


REAR VIEW

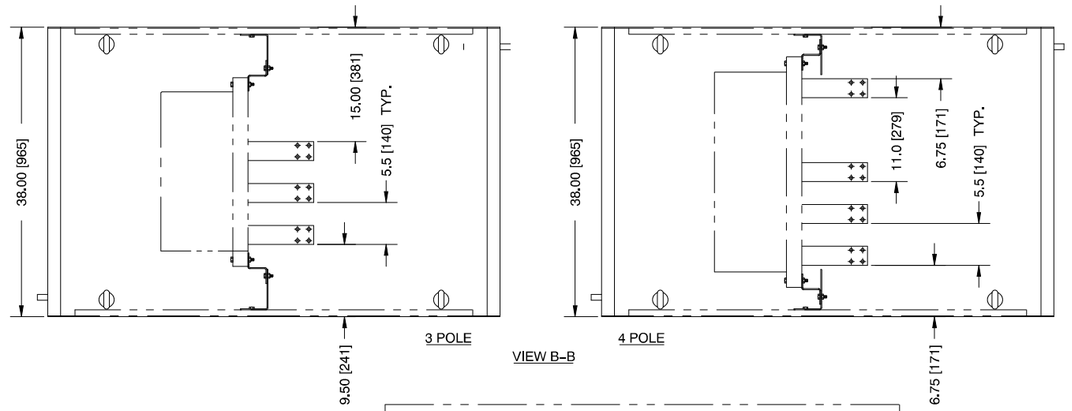
NOTE:
DIMENSIONS IN [ ] ARE IN MILLIMETERS.
FINISH – ANSI 61 GREY

ADV-5941-E

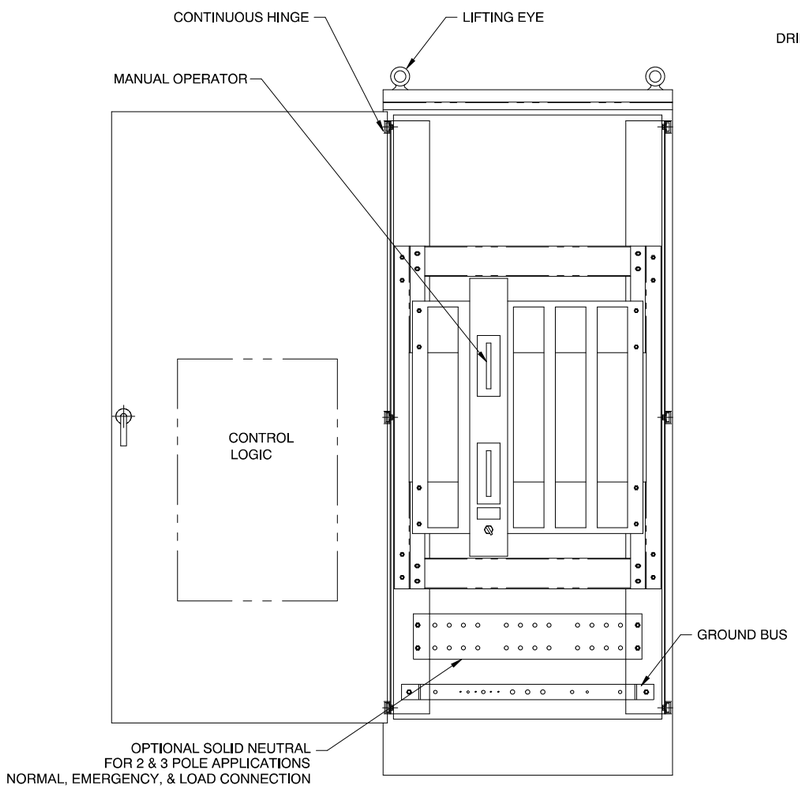
Enclosure Dimensions Drawing, 1600–2000 Amp, NEMA Type 1

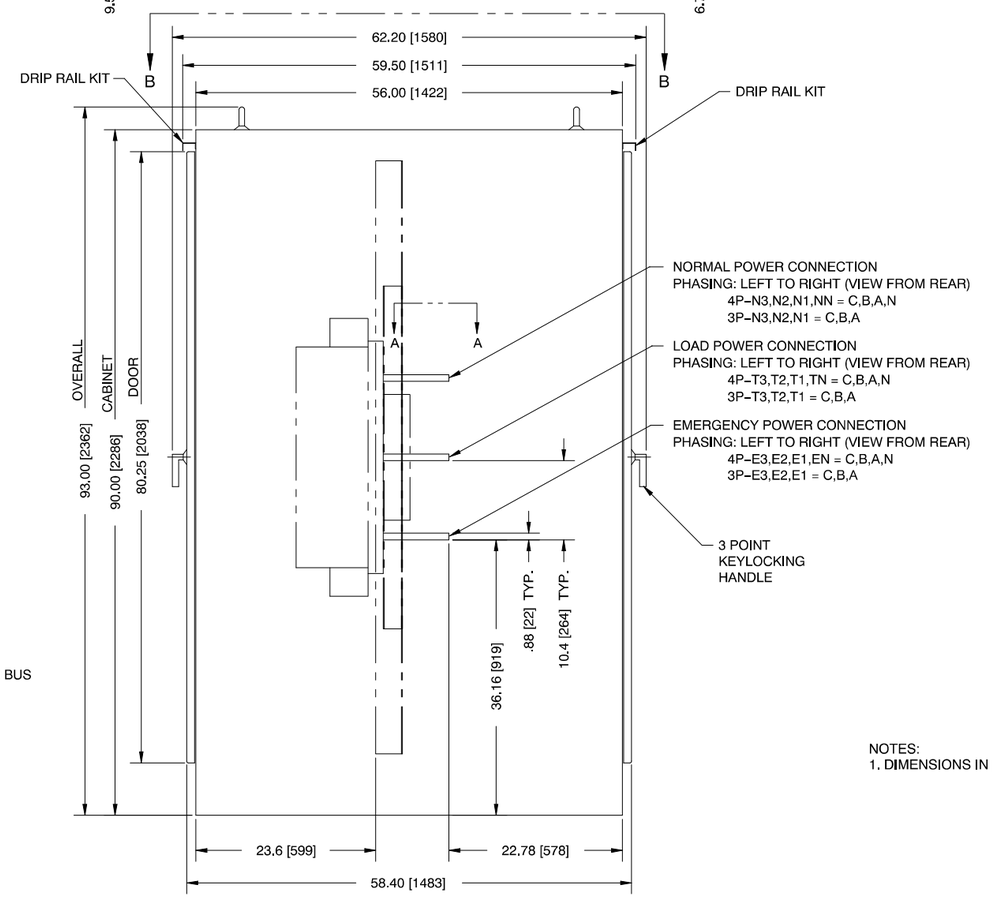


BUS DRILLING DETAIL
(1600–2000 AMP)
VIEW A–A (TYP.)
SCALE: 1/4



VIEW B–B

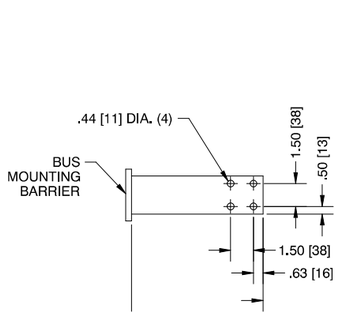




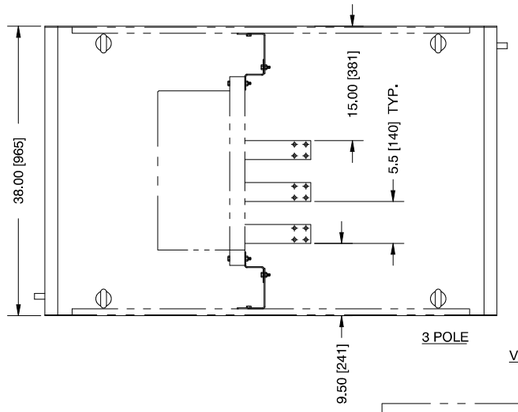
NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

ADV-5990-A

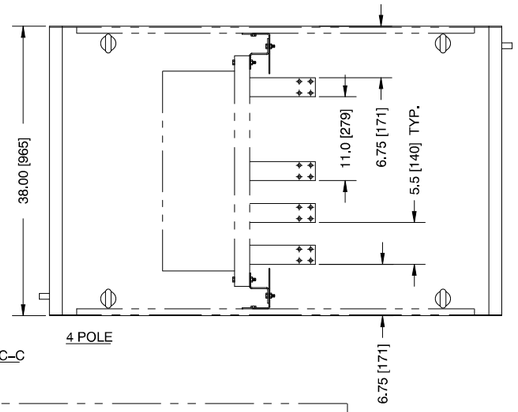
Enclosure Dimensions Drawing, 1600–2000 Amp, NEMA Type 3R, E33+ and S340+ Logic



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

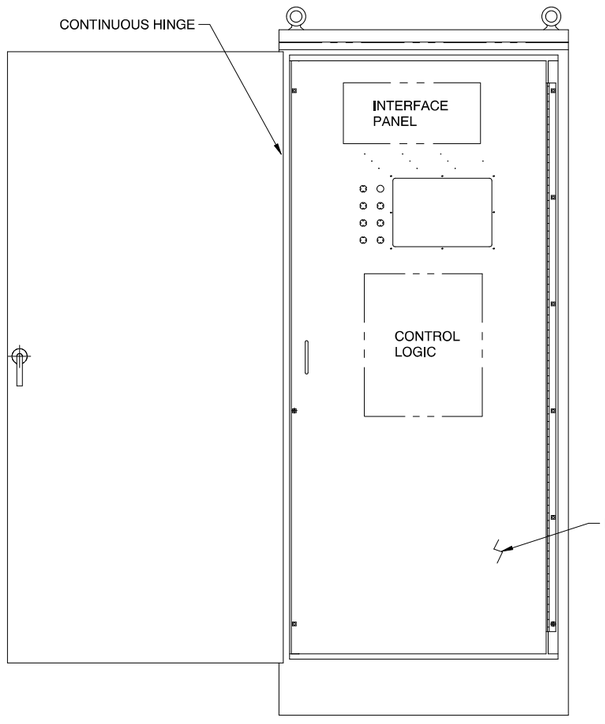


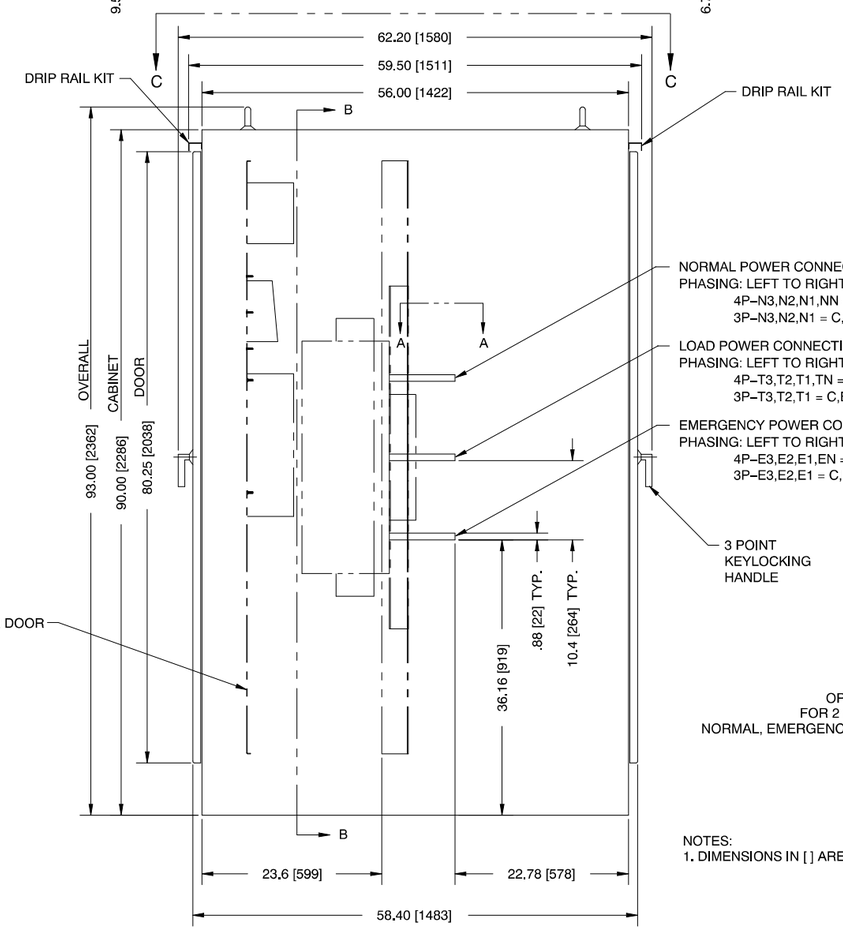
3 POLE

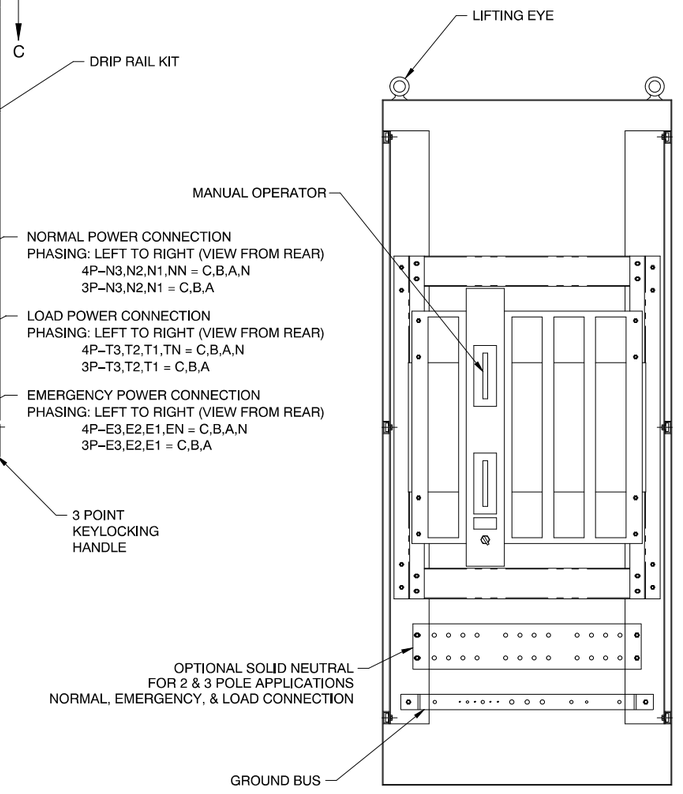


4 POLE

VIEW C–C







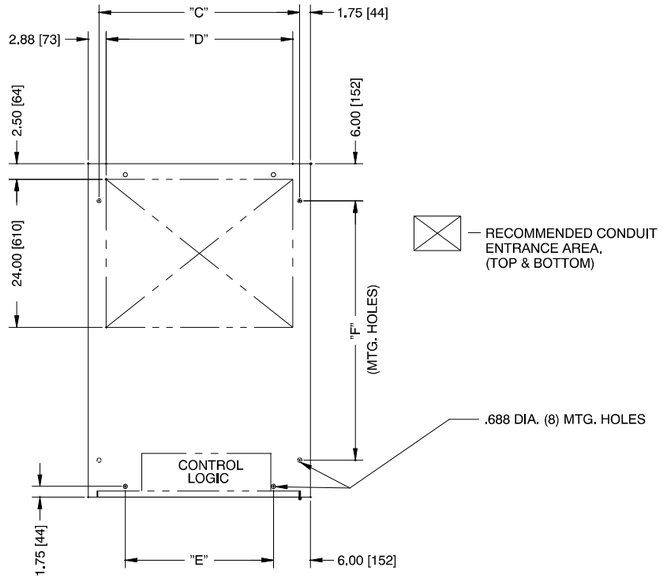
VIEW B–B

NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

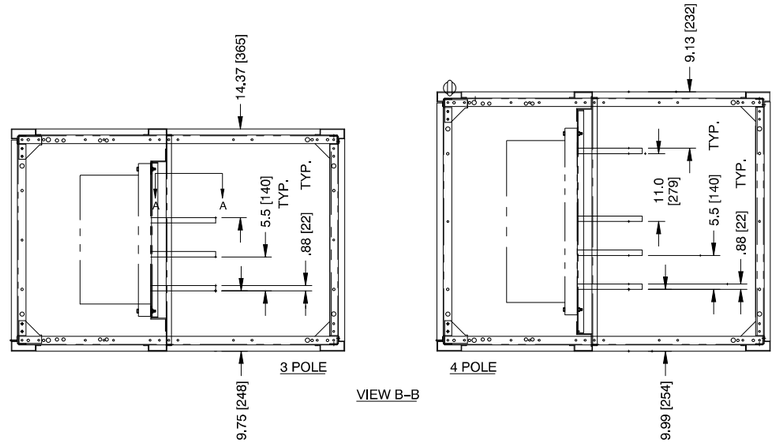
ADV-5989-A

Enclosure Dimensions Drawing, 1600–2000 Amp, NEMA Type 3R, M340+ Logic

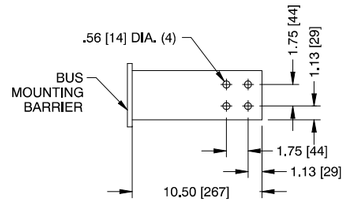
POLES	"A" DIM	"B" DIM	"C" DIM	"D" DIM	"E" DIM	"F" DIM
2 & 3	36.00[914]	54.00[1372]	32.50[825]	24.25[616]	18.00[457]	42.00[1067]
4	42.00[1067]	54.00[1372]	38.50[978]	30.25[768]	24.00[610]	42.00[1067]



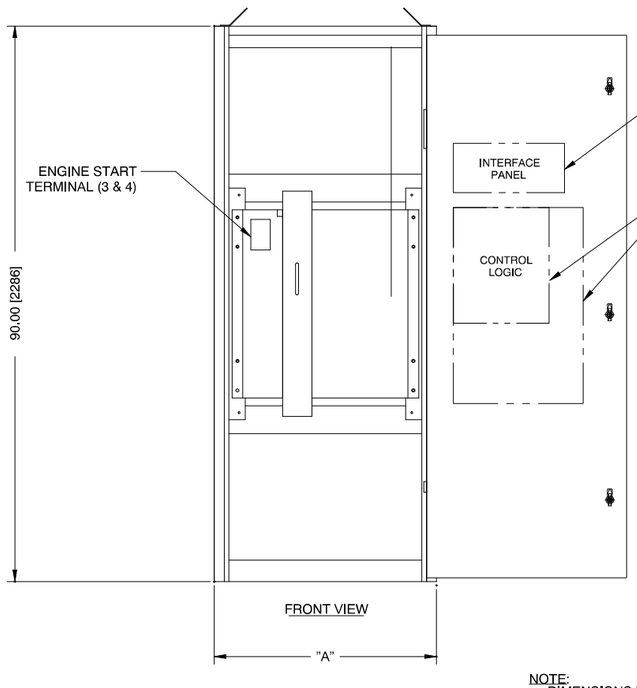
PLAN VIEW



VIEW B–B

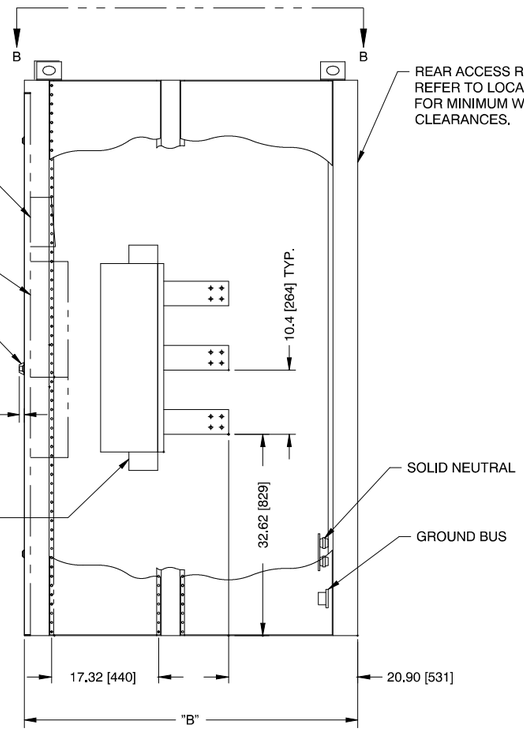


BUS DRILLING DETAIL
(3000 AMP)
VIEW A–A (TYP.)
SCALE: 1/5



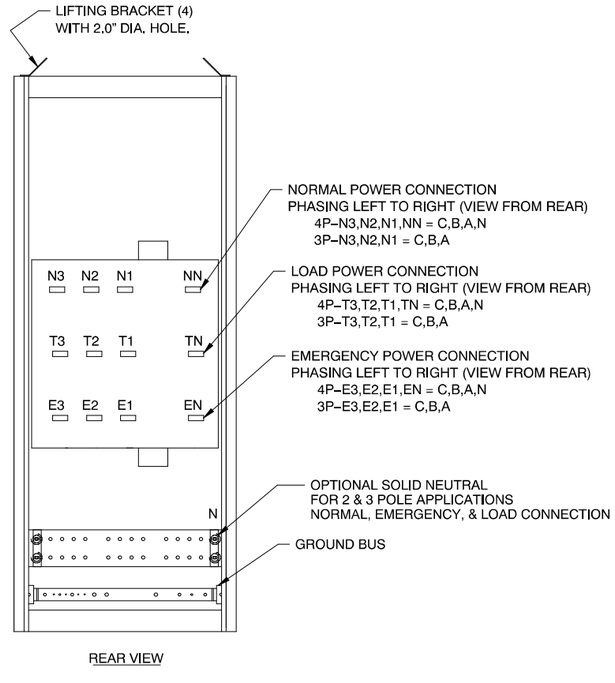
FRONT VIEW

"A"



"B"

RIGHT SIDE VIEW

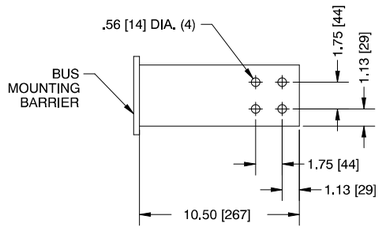


REAR VIEW

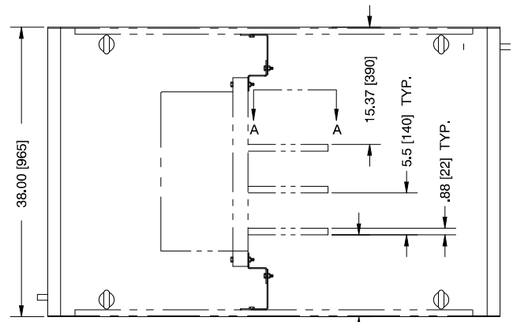
NOTE:
DIMENSIONS IN [ ] ARE IN MILLIMETERS.
FINISH – ANSI 61 GREY

ADV-6242-B

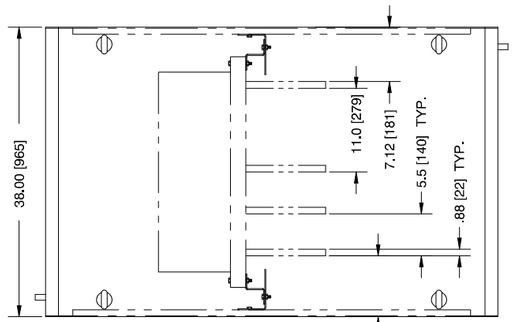
Enclosure Dimensions Drawing, 2500–3000 Amp, NEMA Type 1



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

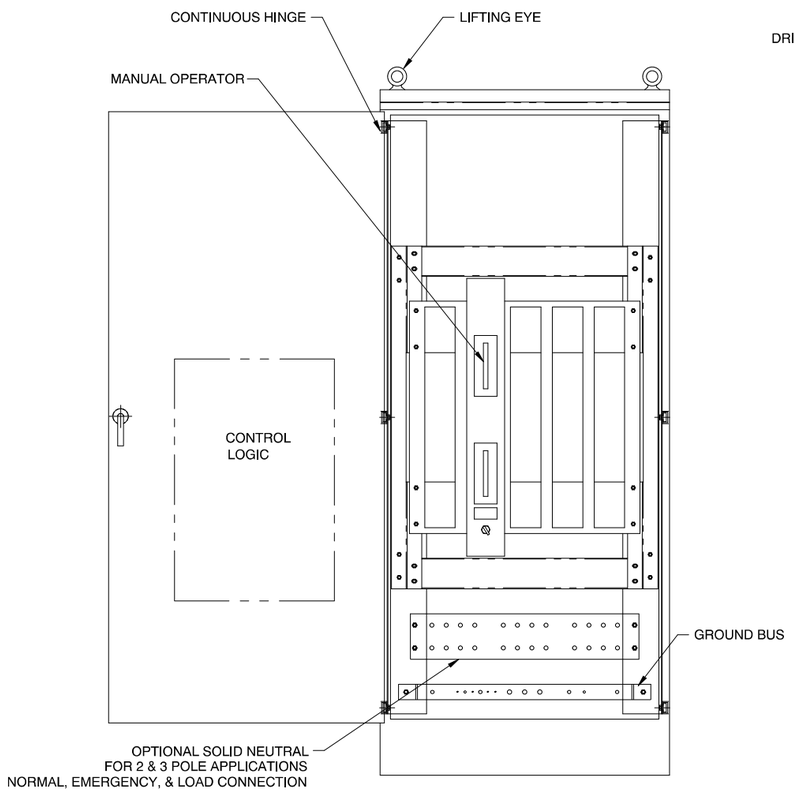


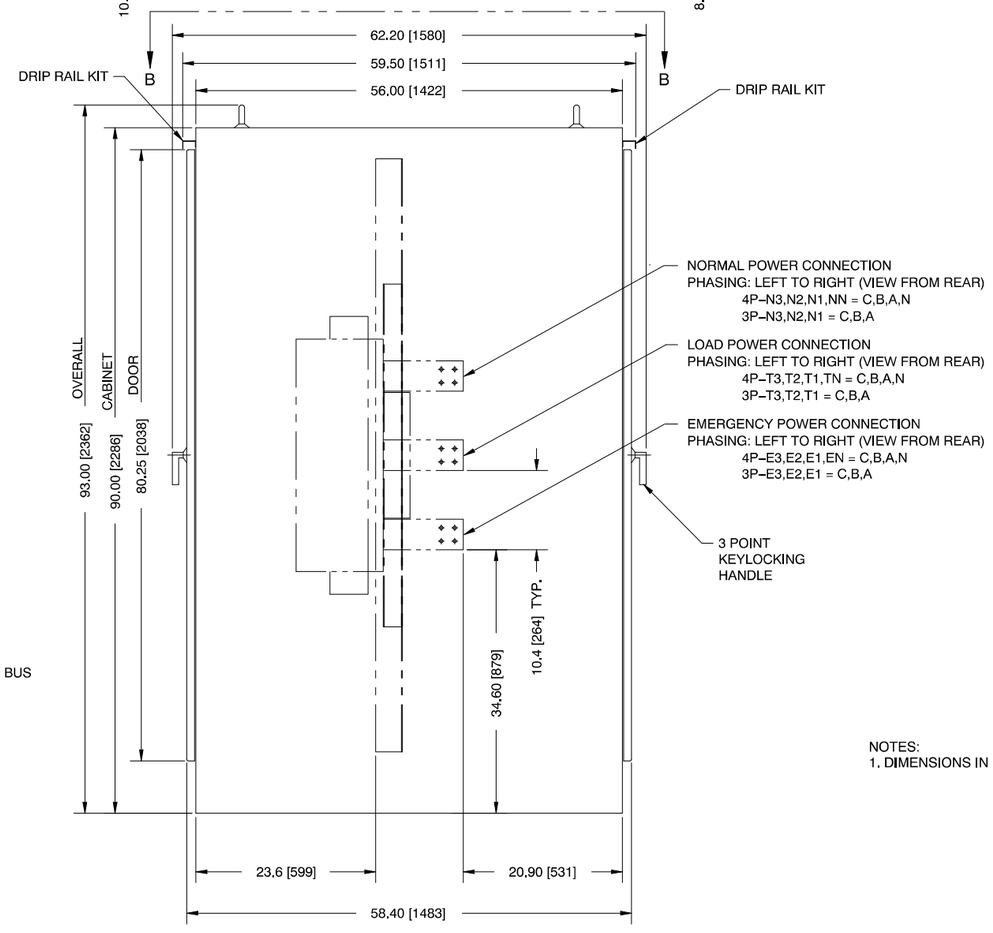
3 POLE



4 POLE

VIEW B–B

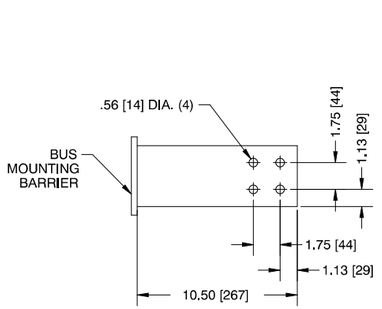




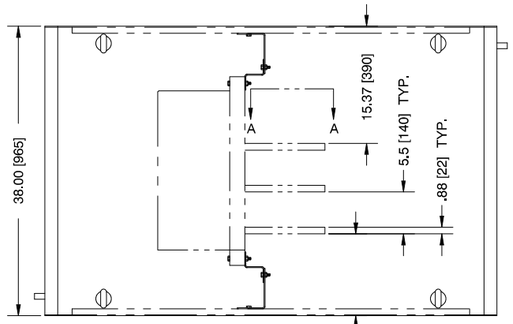
NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

ADV-6241-A

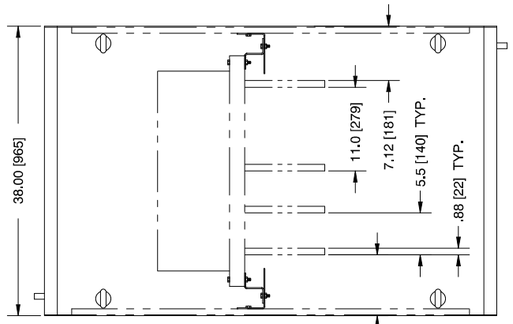
Enclosure Dimensions Drawing, 2500–3000 Amp, NEMA Type 3R, E33+ and S340+ Logic



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

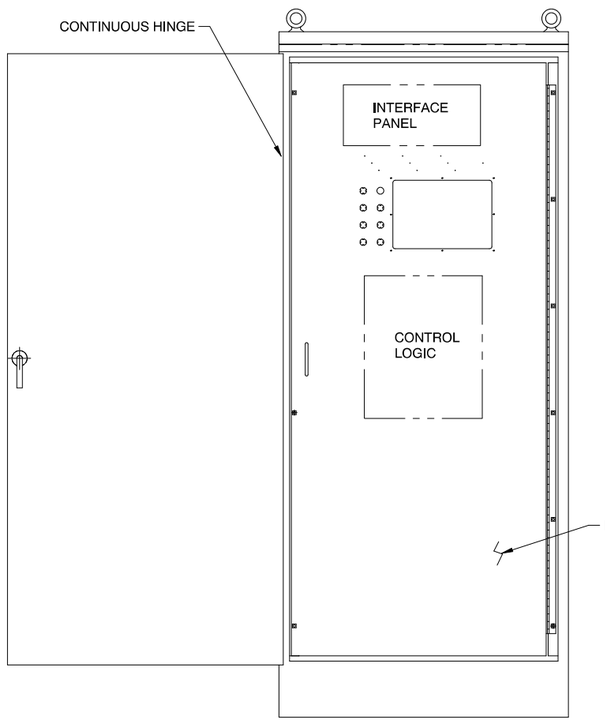


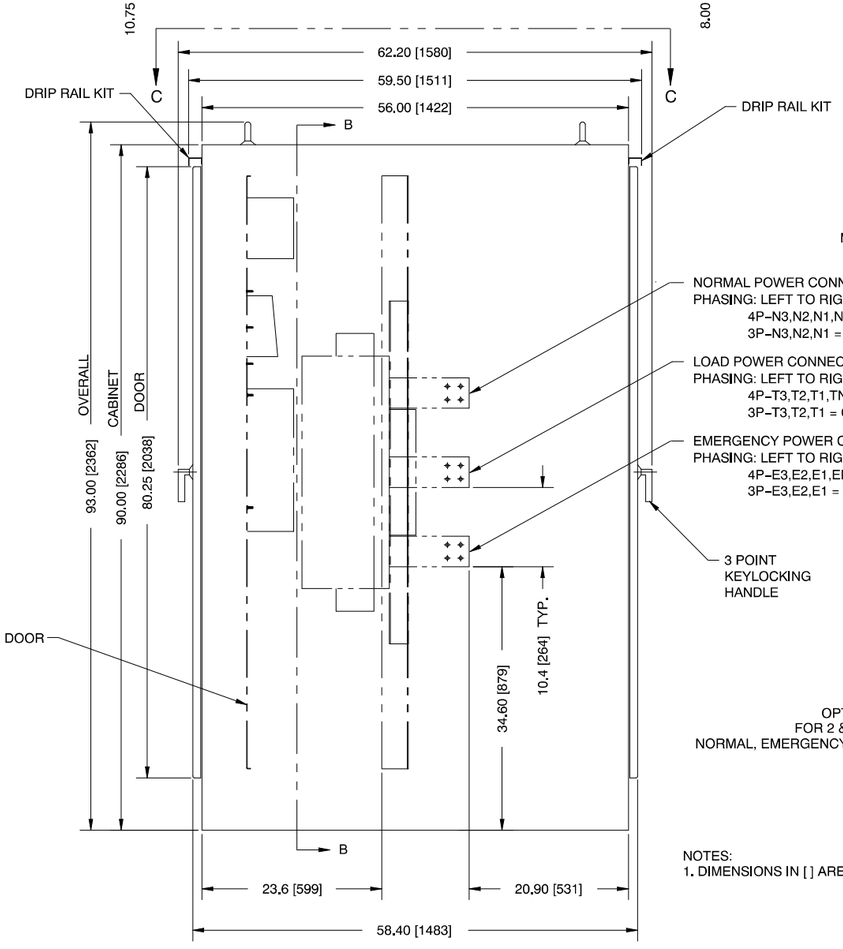
3 POLE

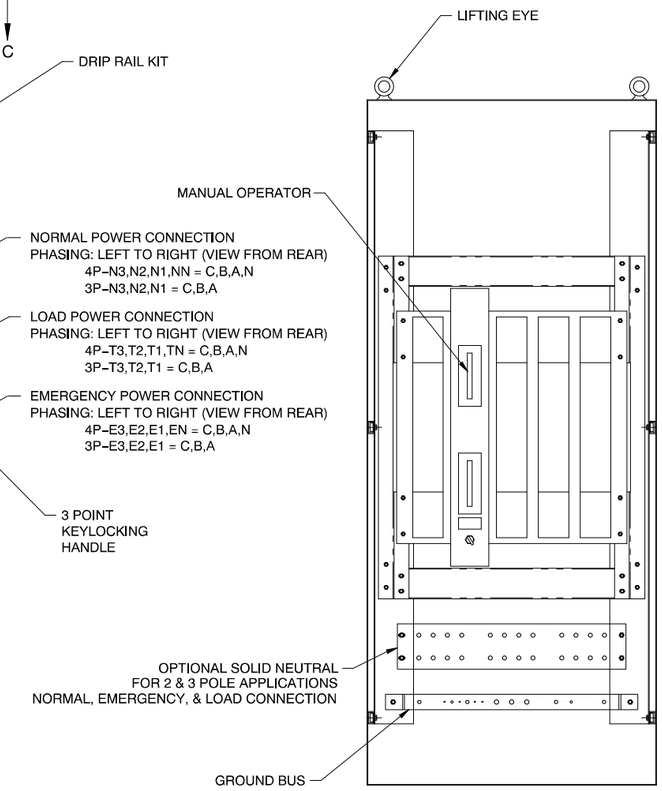


4 POLE

VIEW C–C





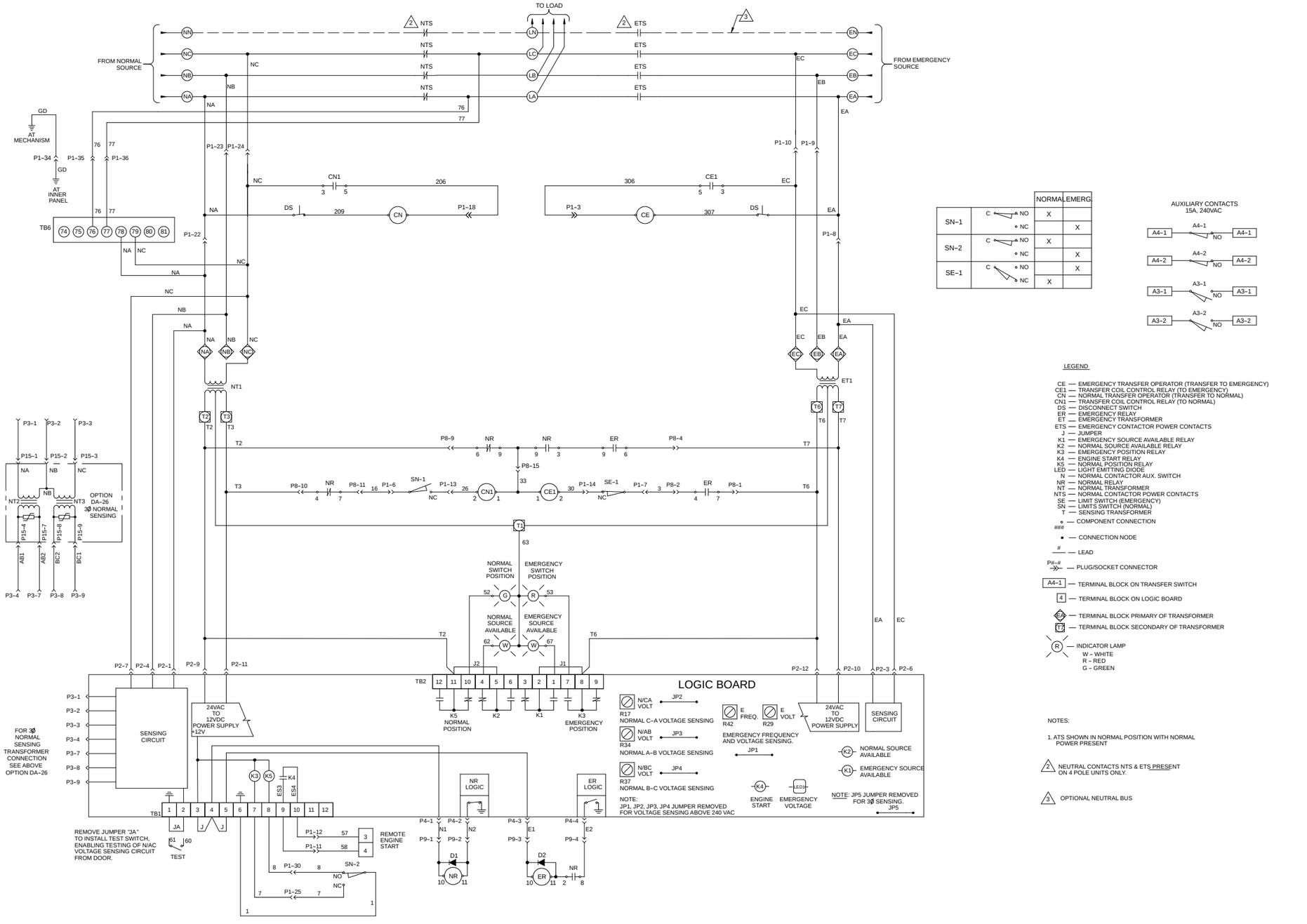


VIEW B–B

NOTES:
1. DIMENSIONS IN [ ] ARE MILLIMETERS.

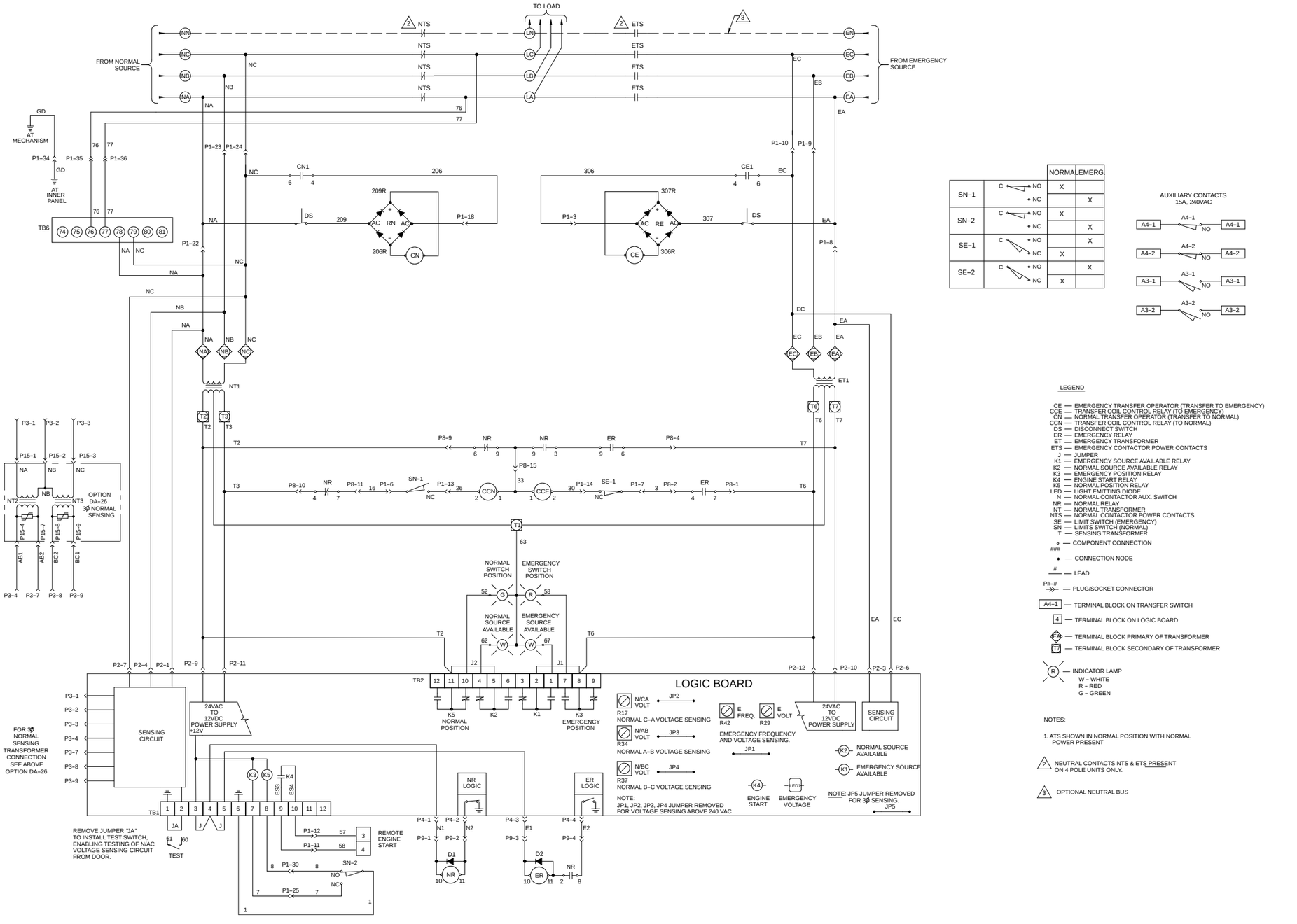
ADV-6240-A

Enclosure Dimensions Drawing, 2500–3000 Amp, NEMA Type 3R, M340+ Logic



321283-C

Schematic Diagram, E33+ Logic, 600–1200 Amp



		NORMAL	EMERG.
SN–1	C – NO	X	
	NC		X
SN–2	C – NO	X	
	NC		X
SE–1	C – NO		X
	NC	X	
SE–2	C – NO		X
	NC	X	

AUXILIARY CONTACTS
15A, 240VAC

LEGEND

CE — EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)
CCE — TRANSFER COIL CONTROL RELAY (TO EMERGENCY)
CN — NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)
CCN — TRANSFER COIL CONTROL RELAY (TO NORMAL)
DS — DISCONNECT SWITCH
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
ETS — EMERGENCY CONTACTOR POWER CONTACTS
J — JUMPER
K1 — EMERGENCY SOURCE AVAILABLE RELAY
K2 — NORMAL SOURCE AVAILABLE RELAY
K3 — EMERGENCY POSITION RELAY
K4 — ENGINE START RELAY
K5 — NORMAL POSITION RELAY
LED — LIGHT EMITTING DIODE
N — NORMAL CONTACTOR AUX. SWITCH
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
NTS — NORMAL CONTACTOR POWER CONTACTS
SE — LIMIT SWITCH (EMERGENCY)
SN — LIMITS SWITCH (NORMAL)
T — SENSING TRANSFORMER
— COMPONENT CONNECTION
• — CONNECTION NODE
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
A4–1 — TERMINAL BLOCK ON TRANSFER SWITCH
4 — TERMINAL BLOCK ON LOGIC BOARD
E2 — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T2 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
R — INDICATOR LAMP
W – WHITE
R – RED
G – GREEN

NOTES:

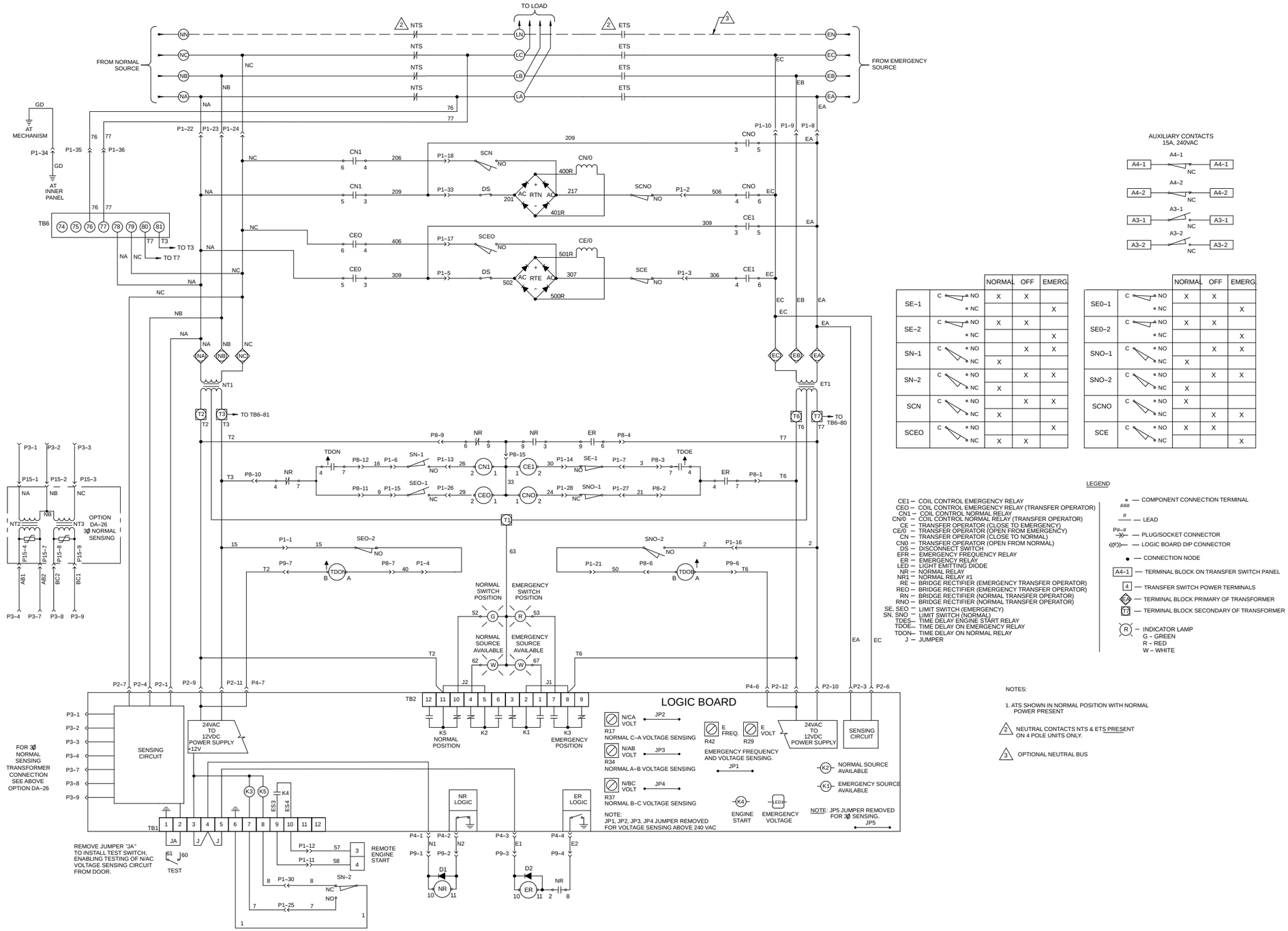
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

3 OPTIONAL NEUTRAL BUS

321296-B

Schematic Diagram, E33+ Logic, 1600–3000 Amp



		NORMAL	OFF	EMERG.
SE-1	NO	X	X	
	NC			X
SE-2	NO	X	X	
	NC			X
SN-1	NO		X	X
	NC	X		
SN-2	NO		X	X
	NC	X		
SCN	NO		X	X
	NC	X		
SCEO	NO			X
	NC	X	X	

		NORMAL	OFF	EMERG.
SE0-1	NO	X	X	
	NC			X
SE0-2	NO	X	X	
	NC			X
SNO-1	NO		X	X
	NC	X		
SNO-2	NO		X	X
	NC	X		
SCNO	NO	X		
	NC		X	X
SCE	NO	X	X	
	NC			X

LEGEND

CE1 – COIL CONTROL EMERGENCY RELAY
CEO – COIL CONTROL EMERGENCY RELAY (TRANSFER OPERATOR)
CN1 – COIL CONTROL NORMAL RELAY
CN/0 – COIL CONTROL NORMAL RELAY (TRANSFER OPERATOR)
CE – TRANSFER OPERATOR (CLOSE TO EMERGENCY)
CE/0 – TRANSFER OPERATOR (OPEN FROM EMERGENCY)
CN – TRANSFER OPERATOR (CLOSE TO NORMAL)
CN0 – TRANSFER OPERATOR (OPEN FROM NORMAL)
DS – DISCONNECT SWITCH
EFR – EMERGENCY FREQUENCY RELAY
ER – EMERGENCY RELAY
LED – LIGHT EMITTING DIODE
NR – NORMAL RELAY
NR1 – NORMAL RELAY #1
RE – BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
REO – BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
RN – BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
RNO – BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
SE, SEO – LIMIT SWITCH (EMERGENCY)
SN, SNO – LIMIT SWITCH (NORMAL)
TDES – TIME DELAY ENGINE START RELAY
TDOE – TIME DELAY ON EMERGENCY RELAY
TDON – TIME DELAY ON NORMAL RELAY
J – JUMPER

○ — COMPONENT CONNECTION TERMINAL
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
— LOGIC BOARD DIP CONNECTOR
● — CONNECTION NODE
A4–1 — TERMINAL BLOCK ON TRANSFER SWITCH PANEL
4 — TRANSFER SWITCH POWER TERMINALS
E1 E2 — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T1 T2 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
R — INDICATOR LAMP
G – GREEN
R – RED
W – WHITE

NOTES:

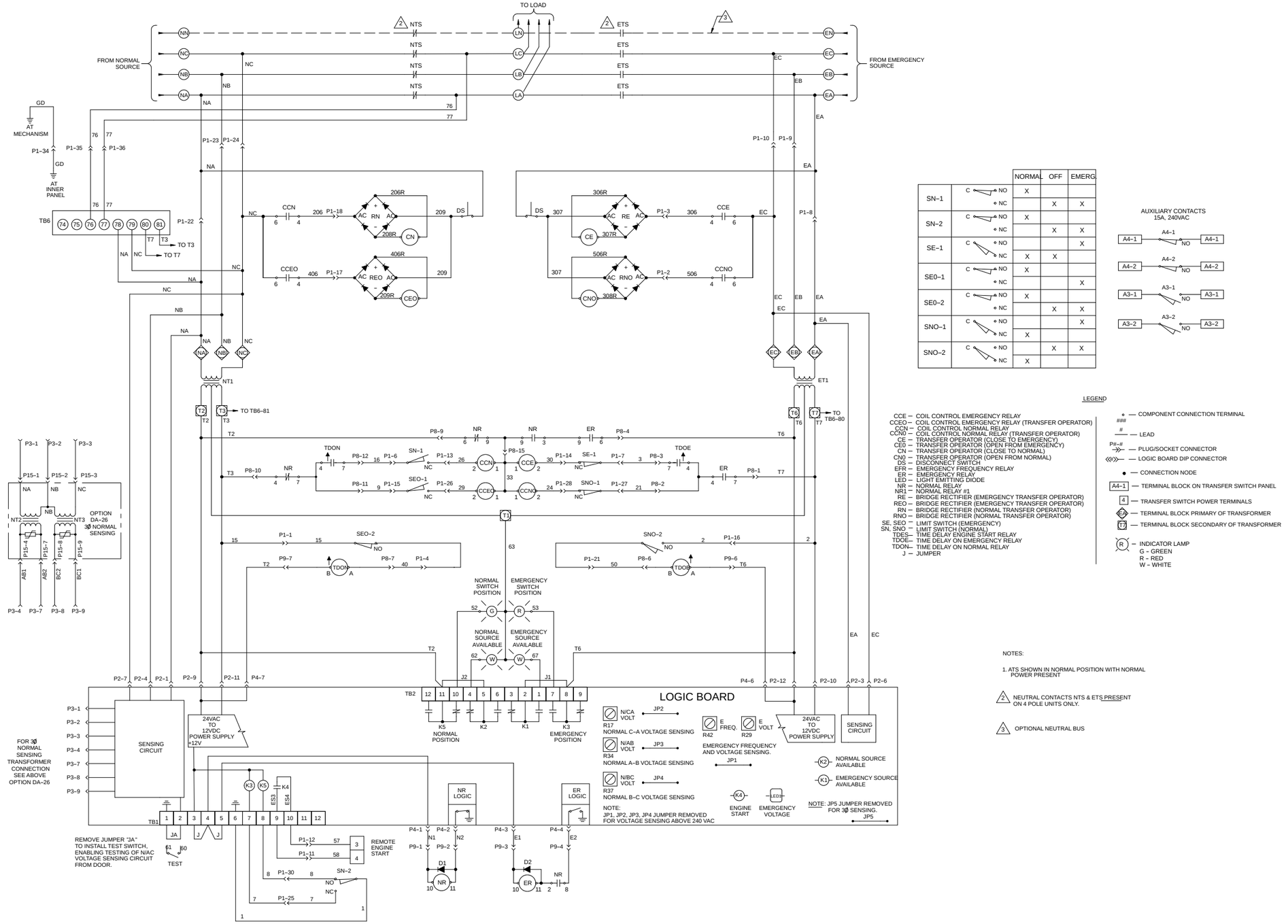
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

3 OPTIONAL NEUTRAL BUS

321295-C

Schematic Diagram, E33+ Logic, 400 Amp with Programmed Transition



		NORMAL	OFF	EMERG
SN–1	C NO	X		
	NC		X	X
SN–2	C NO	X		
	NC		X	X
SE–1	C NO			X
	NC	X	X	
SE0–1	C NO	X		
	NC			X
SE0–2	C NO	X		
	NC		X	X
SNO–1	C NO			X
	NC	X		
SNO–2	C NO		X	X
	NC	X		

AUXILIARY CONTACTS
15A, 240VAC

A4–1 A4–1 NO
A4–2 A4–2 NO
A3–1 A3–1 NO
A3–2 A3–2 NO

LEGEND

CCE – COIL CONTROL EMERGENCY RELAY
CCEO – COIL CONTROL EMERGENCY RELAY (TRANSFER OPERATOR)
CCN – COIL CONTROL NORMAL RELAY
CCN0 – COIL CONTROL NORMAL RELAY (TRANSFER OPERATOR)
CE – TRANSFER OPERATOR (CLOSE TO EMERGENCY)
CEO – TRANSFER OPERATOR (OPEN FROM EMERGENCY)
CN – TRANSFER OPERATOR (CLOSE TO NORMAL)
CN0 – TRANSFER OPERATOR (OPEN FROM NORMAL)
DS – DISCONNECT SWITCH
EFR – EMERGENCY FREQUENCY RELAY
ER – EMERGENCY RELAY
LED – LIGHT EMITTING DIODE
NR – NORMAL RELAY
NR1 – NORMAL RELAY #1
RE – BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
REO – BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
RN – BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
RNO – BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
SE, SEO – LIMIT SWITCH (EMERGENCY)
SN, SNO – LIMIT SWITCH (NORMAL)
TDES – TIME DELAY ENGINE START RELAY
TDOE – TIME DELAY ON EMERGENCY RELAY
TDON – TIME DELAY ON NORMAL RELAY
J – JUMPER

◦ ### — COMPONENT CONNECTION TERMINAL
— LEAD
P##–# — PLUG/SOCKET CONNECTOR
— LOGIC BOARD DIP CONNECTOR
● — CONNECTION NODE
A4–1 — TERMINAL BLOCK ON TRANSFER SWITCH PANEL
4 — TRANSFER SWITCH POWER TERMINALS
E2 — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T7 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
R – INDICATOR LAMP
G – GREEN
R – RED
W – WHITE

NOTES:

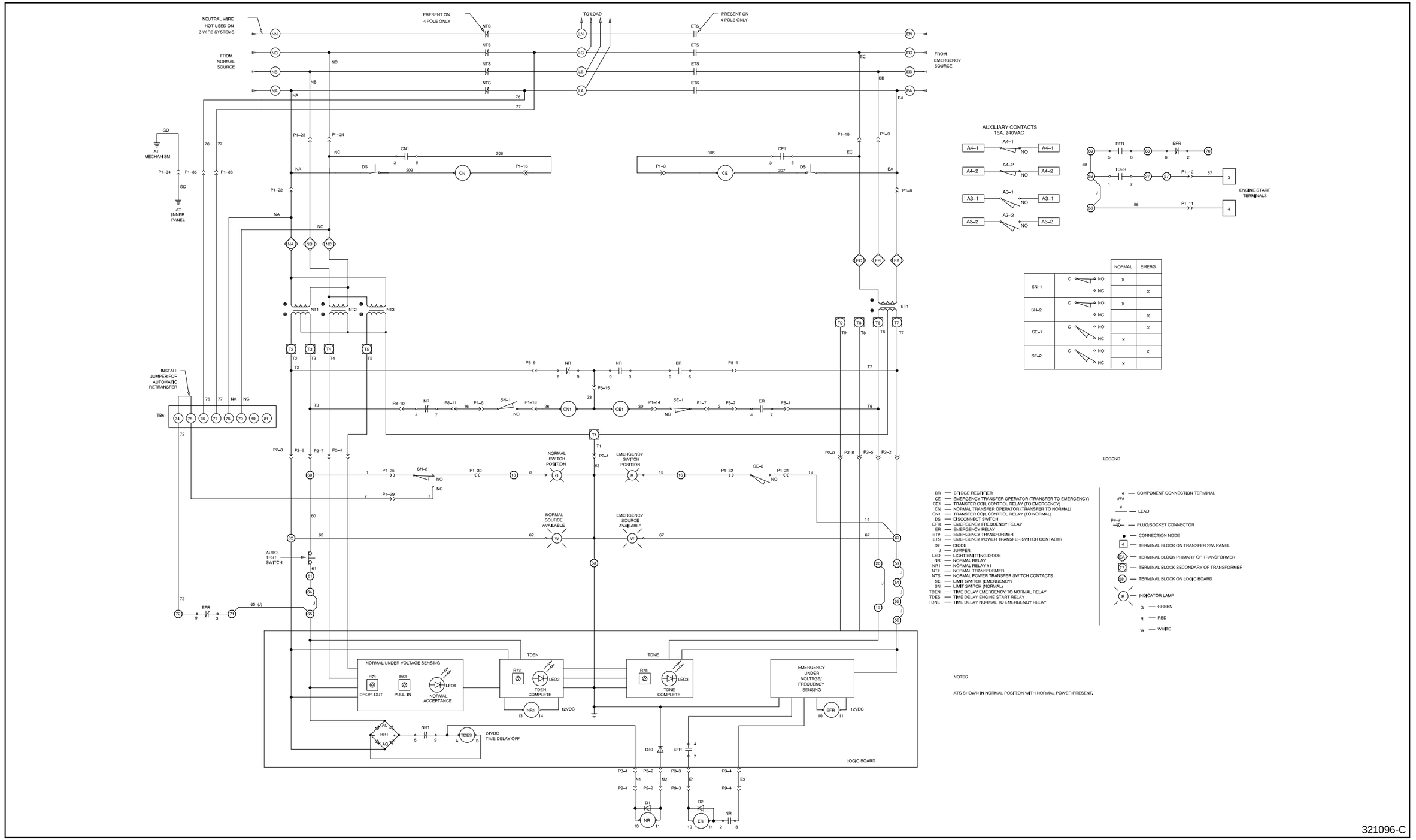
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

△2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

△3 OPTIONAL NEUTRAL BUS

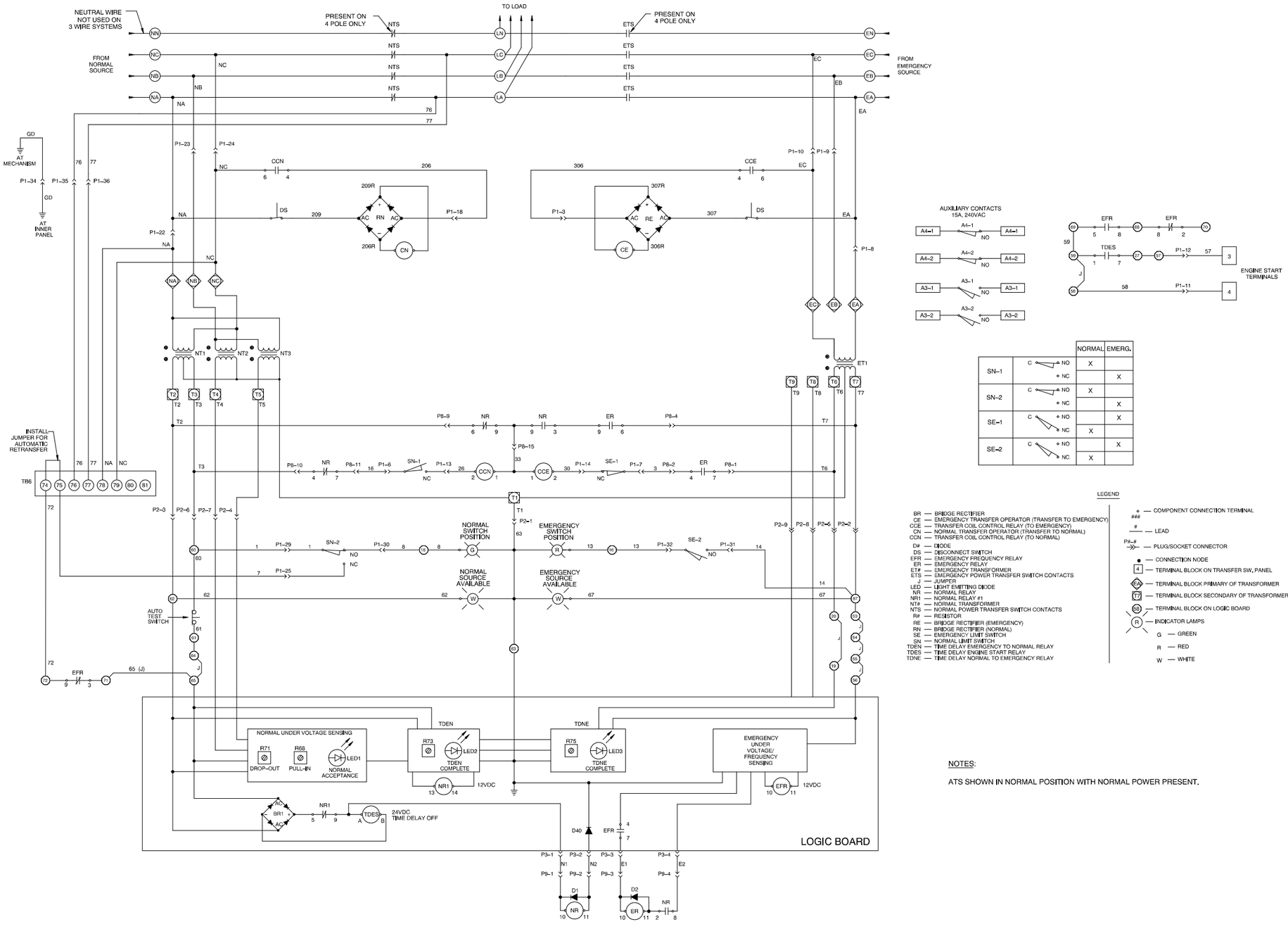
321285-B

Schematic Diagram, E33+ Logic, 600–3000 Amp with Programmed Transition



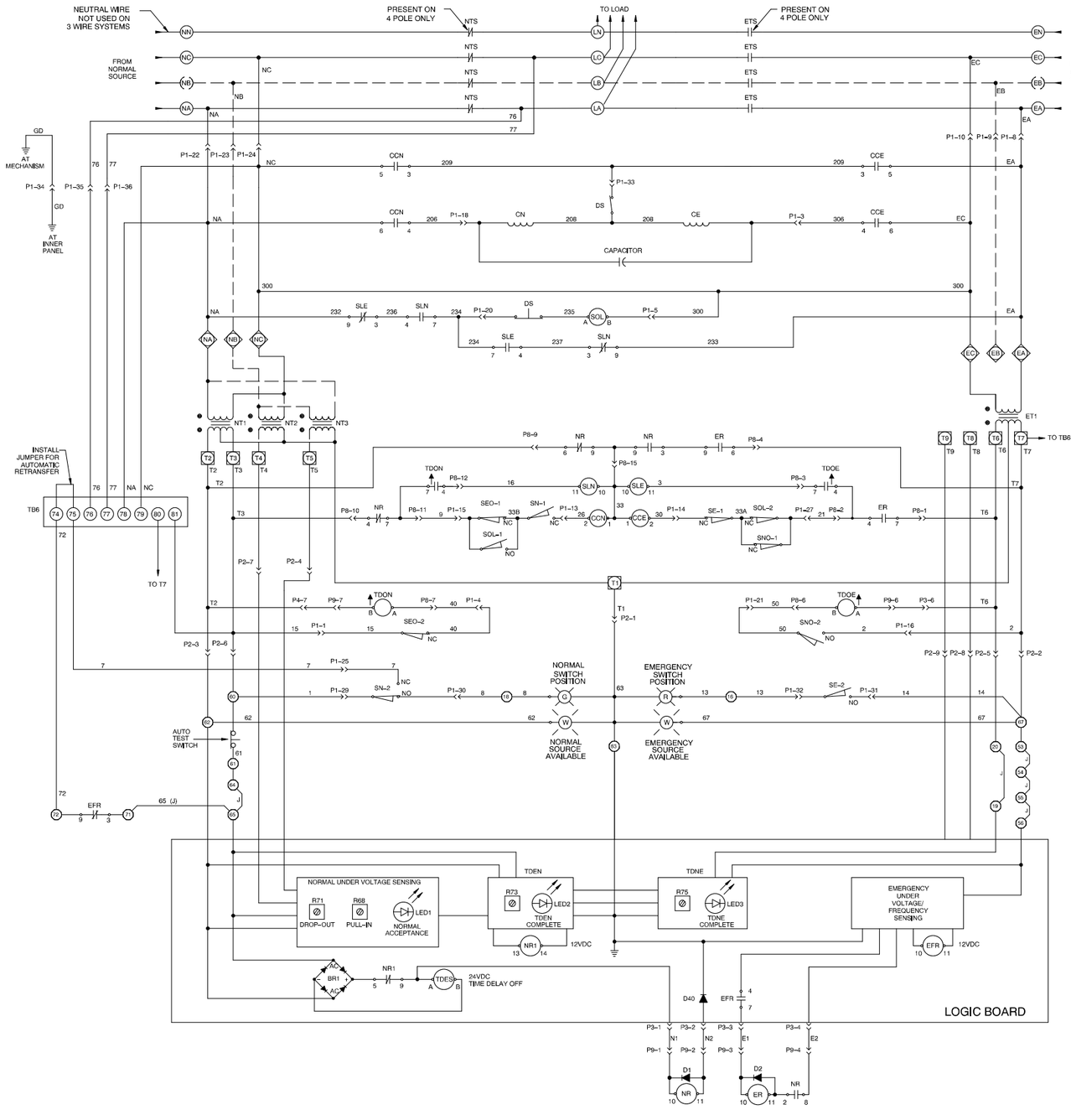
321096-C

Schematic Diagram, S340+ Logic, 600–1200 Amp

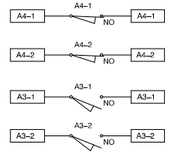


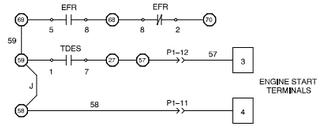
321097-A

Schematic Diagram, S340+ Logic, 1600–3000 Amp



AUXILIARY CONTACTS
15A, 240VAC





		NORMAL	OFF	EMERG.
SN-1	C NO	X		
	C NC		X	X
SN-2	C NO	X		
	C NC		X	X
SE-1	C NO			X
	C NC	X	X	
SE-2	C NO			X
	C NC	X	X	

		NORMAL	OFF	EMERG.
SEO-1	C NO		X ①	
	C NC	X		X
SEO-2	C NO		X ①	
	C NC	X		X
SNO-1	C NO		X ②	
	C NC	X		X
SNO-2	C NO		X ②	
	C NC	X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL-1	C NO / C NC	X	
SOL-2	C NO / C NC	X	

LEGEND

BR1 — BRIDGE RECTIFIER
CCE — CLOSE EMERGENCY RELAY
CCN — CLOSE NORMAL RELAY
CN/CE — COIL, MAIN TRANSFER OPERATOR
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
DS — SWITCH, SERVICE DISCONNECT
— JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
SOL — MOTOR, LINEAR
TDEN — TIME DELAY, EMERGENCY TO NORMAL
TDES — TIME DELAY, ENGINE START
TDNE — TIME DELAY, NORMAL TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
TDOE — TIME DELAY, OFF TO EMERGENCY
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

○ — COMPONENT CONNECTION TERMINAL ###
\# — LEAD
P#-# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
(EA) — TERMINAL BLOCK PRIMARY OF TRANSFORMER
17 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
58 — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
G — GREEN
R — RED
W — WHITE

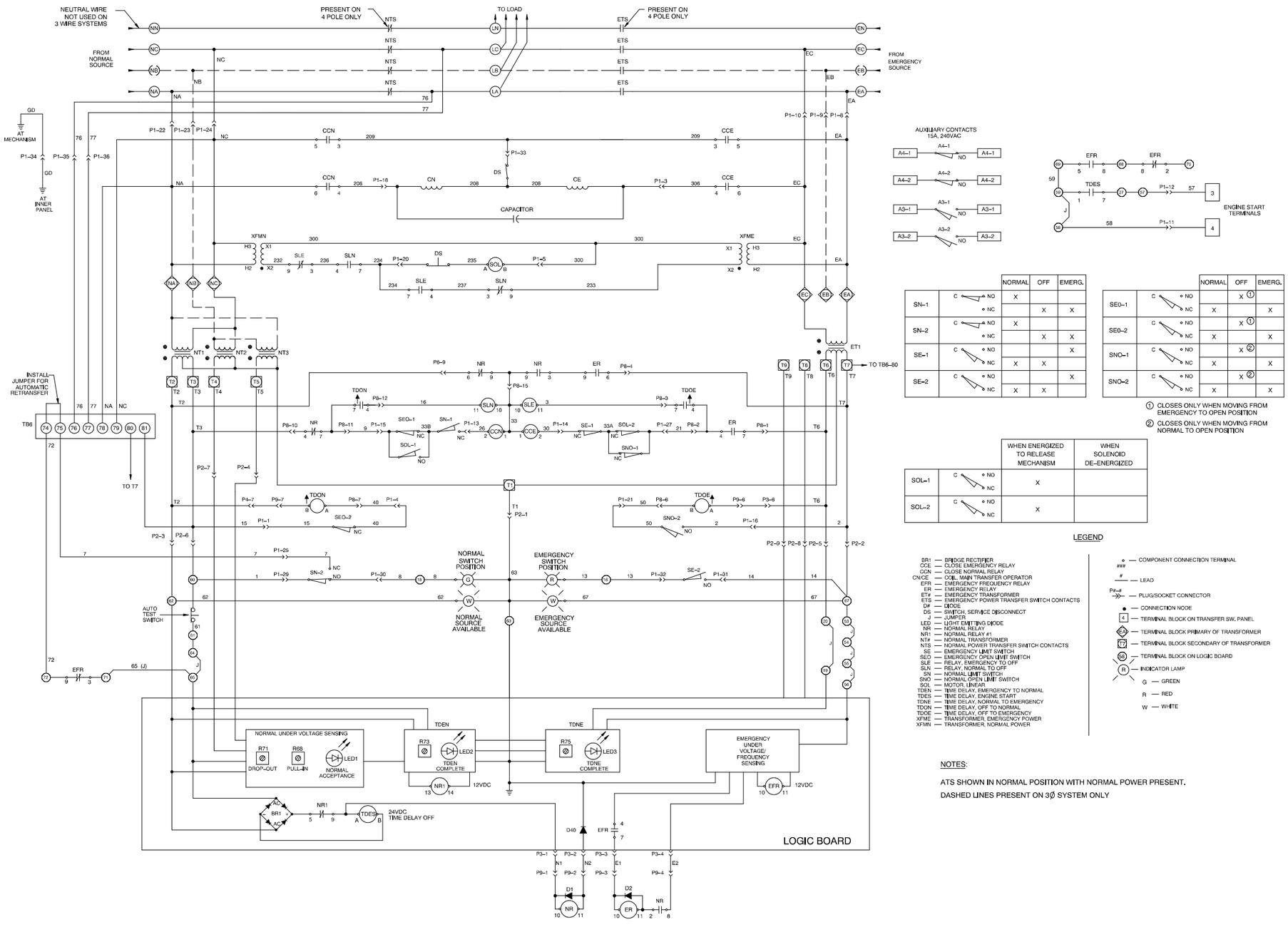
NOTES:

ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT.

DASHED LINES PRESENT ON 3Ø SYSTEM ONLY

346311-

Schematic Diagram, S340+ Logic, 120 VAC, 40–260 Amp with Programmed Transition



① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

LEGEND

BR1 — BRIDGE RECTIFIER
CCE — CLOSE EMERGENCY RELAY
CCN — CLOSE NORMAL RELAY
CN/CE — COIL, MAIN TRANSFER OPERATOR
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
DS — SWITCH, SERVICE DISCONNECT
J — JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
SOL — MOTOR, LINEAR
TDEN — TIME DELAY, EMERGENCY TO NORMAL
TDES — TIME DELAY, ENGINE START
TDNE — TIME DELAY, NORMAL TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
TDOE — TIME DELAY, OFF TO EMERGENCY
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

◦ — COMPONENT CONNECTION TERMINAL
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
T# — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T# — TERMINAL BLOCK SECONDARY OF TRANSFORMER
S6 — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
G — GREEN
R — RED
W — WHITE

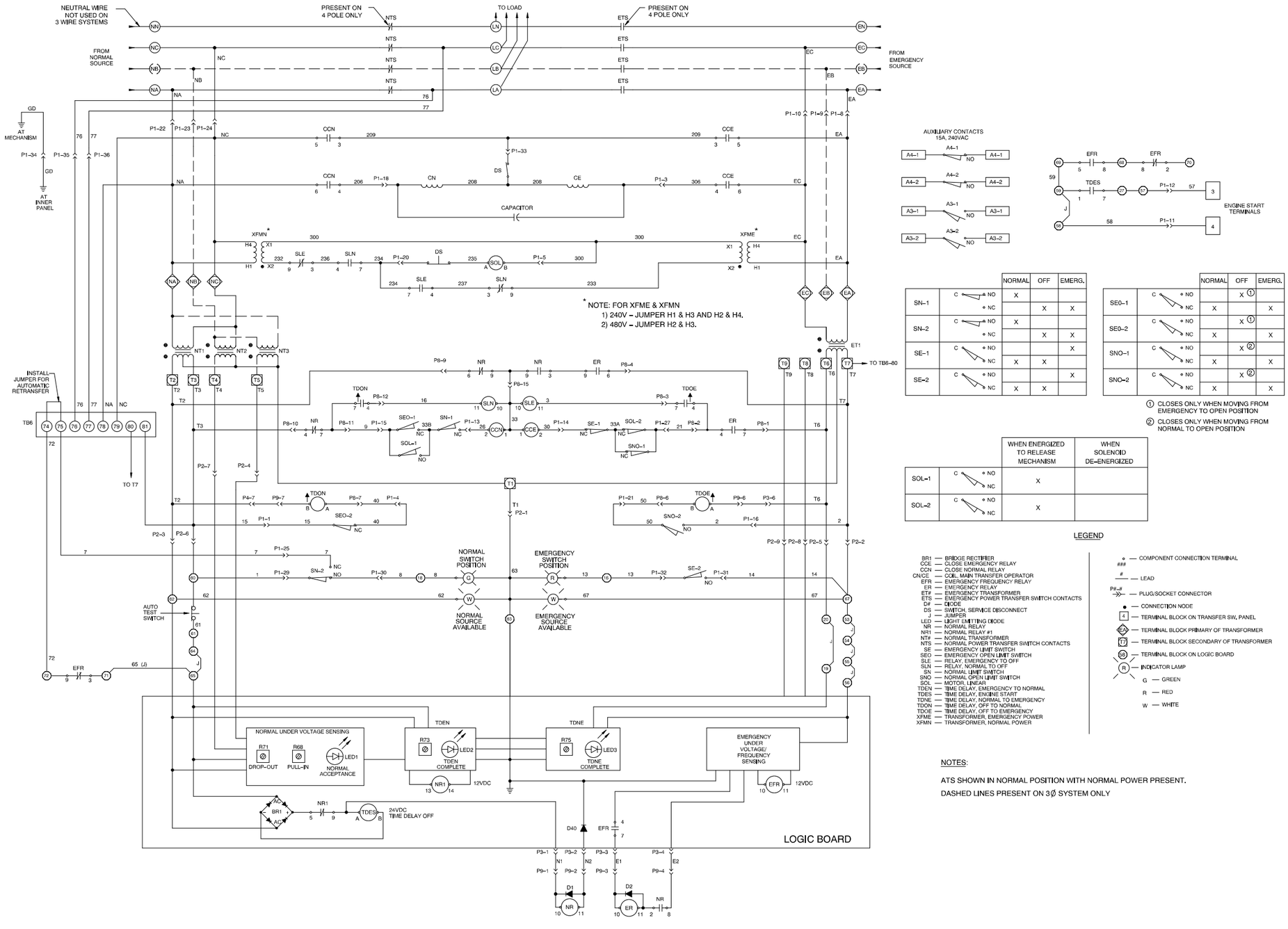
NOTES:

ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT.

DASHED LINES PRESENT ON 3Ø SYSTEM ONLY

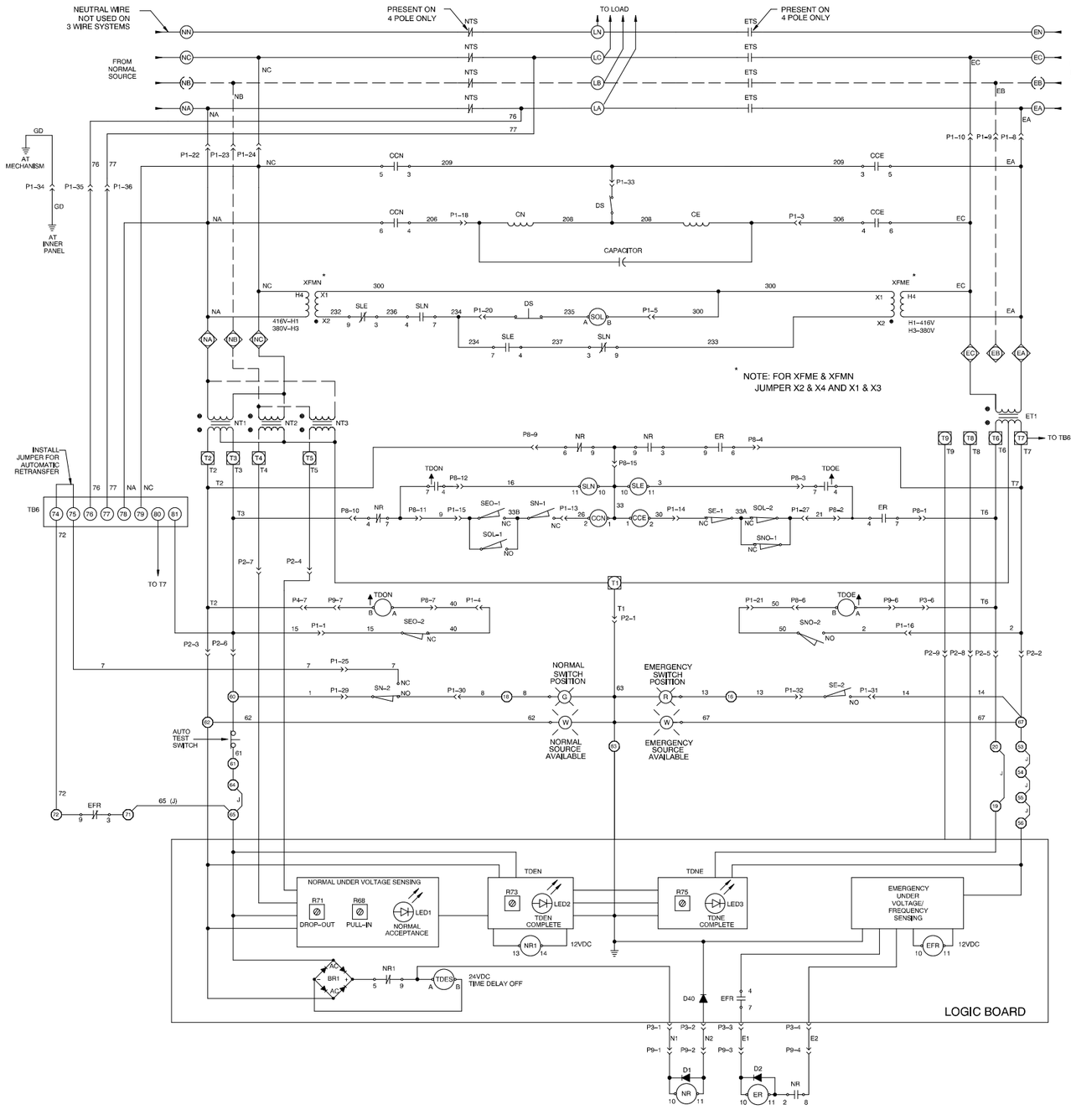
353185-

Schematic Diagram, S340+ Logic, 208 VAC, 40–260 Amp with Programmed Transition

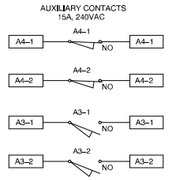


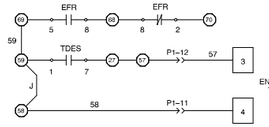
353184-

Schematic Diagram, S340+ Logic, 240 and 480 VAC, 40–260 Amp with Programmed Transition



AUXILIARY CONTACTS
15A, 240VAC





		NORMAL	OFF	EMERG.
SN-1	C NO	X		
	NC		X	X
SN-2	C NO	X		
	NC		X	X
SE-1	C NO			X
	NC	X	X	
SE-2	C NO			X
	NC	X	X	

		NORMAL	OFF	EMERG.
SEO-1	C NO		X ①	
	NC	X		X
SEO-2	C NO		X ①	
	NC	X		X
SNO-1	C NO		X ②	
	NC	X		X
SNO-2	C NO		X ②	
	NC	X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL-1	C NO	X	
	NC		
SOL-2	C NO	X	
	NC		

LEGEND

BR1 — BRIDGE RECTIFIER
CCE — CLOSE EMERGENCY RELAY
CCN — CLOSE NORMAL RELAY
CN/CE — COIL, MAIN TRANSFER OPERATOR
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
DS — SWITCH, SERVICE DISCONNECT
J — JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
SOL — MOTOR, LINEAR
TDEN — TIME DELAY, EMERGENCY TO NORMAL
TDES — TIME DELAY, ENGINE START
TDNE — TIME DELAY, NORMAL TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
TDOE — TIME DELAY, OFF TO EMERGENCY
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

○ — COMPONENT CONNECTION TERMINAL
— LEAD
P#-# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
(EA) — TERMINAL BLOCK PRIMARY OF TRANSFORMER
17 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
58 — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
G — GREEN
R — RED
W — WHITE

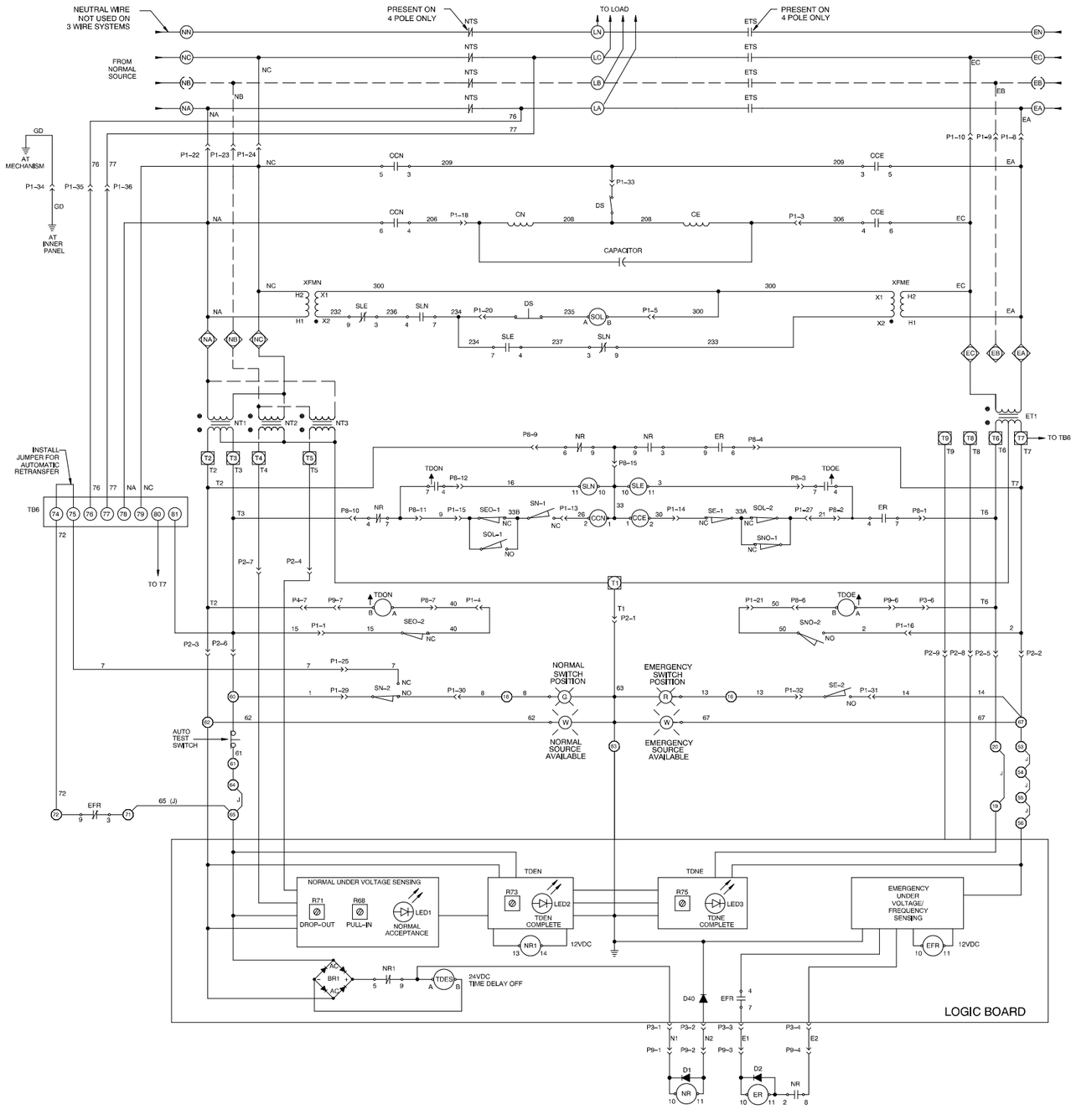
NOTES:

ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT.

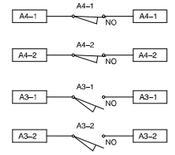
DASHED LINES PRESENT ON 3Ø SYSTEM ONLY

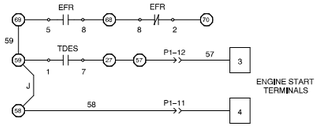
353183-

Schematic Diagram, S340+ Logic, 380 and 416 VAC, 40–260, Amp with Programmed Transition



AUXILIARY CONTACTS
15A, 240VAC





		NORMAL	OFF	EMERG.
SN-1	C NO	X		
	C NC		X	X
SN-2	C NO	X		
	C NC		X	X
SE-1	C NO			X
	C NC	X	X	
SE-2	C NO			X
	C NC	X	X	

		NORMAL	OFF	EMERG.
SEO-1	C NO		X ①	
	C NC	X		X
SEO-2	C NO		X ①	
	C NC	X		X
SNO-1	C NO		X ②	
	C NC	X		X
SNO-2	C NO		X ②	
	C NC	X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL-1	C NO	X	
	C NC		
SOL-2	C NO	X	
	C NC		

LEGEND

BR1 — BRIDGE RECTIFIER
CCE — CLOSE EMERGENCY RELAY
CCN — CLOSE NORMAL RELAY
CN/CE — COIL, MAIN TRANSFER OPERATOR
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
DS — SWITCH, SERVICE DISCONNECT
J — JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
SOL — MOTOR, LINEAR
TDEN — TIME DELAY, EMERGENCY TO NORMAL
TDES — TIME DELAY, ENGINE START
TDNE — TIME DELAY, NORMAL TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
TDOE — TIME DELAY, OFF TO EMERGENCY
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

◦ — COMPONENT CONNECTION TERMINAL
— LEAD
P#-# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
EA — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T7 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
56 — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
G — GREEN
R — RED
W — WHITE

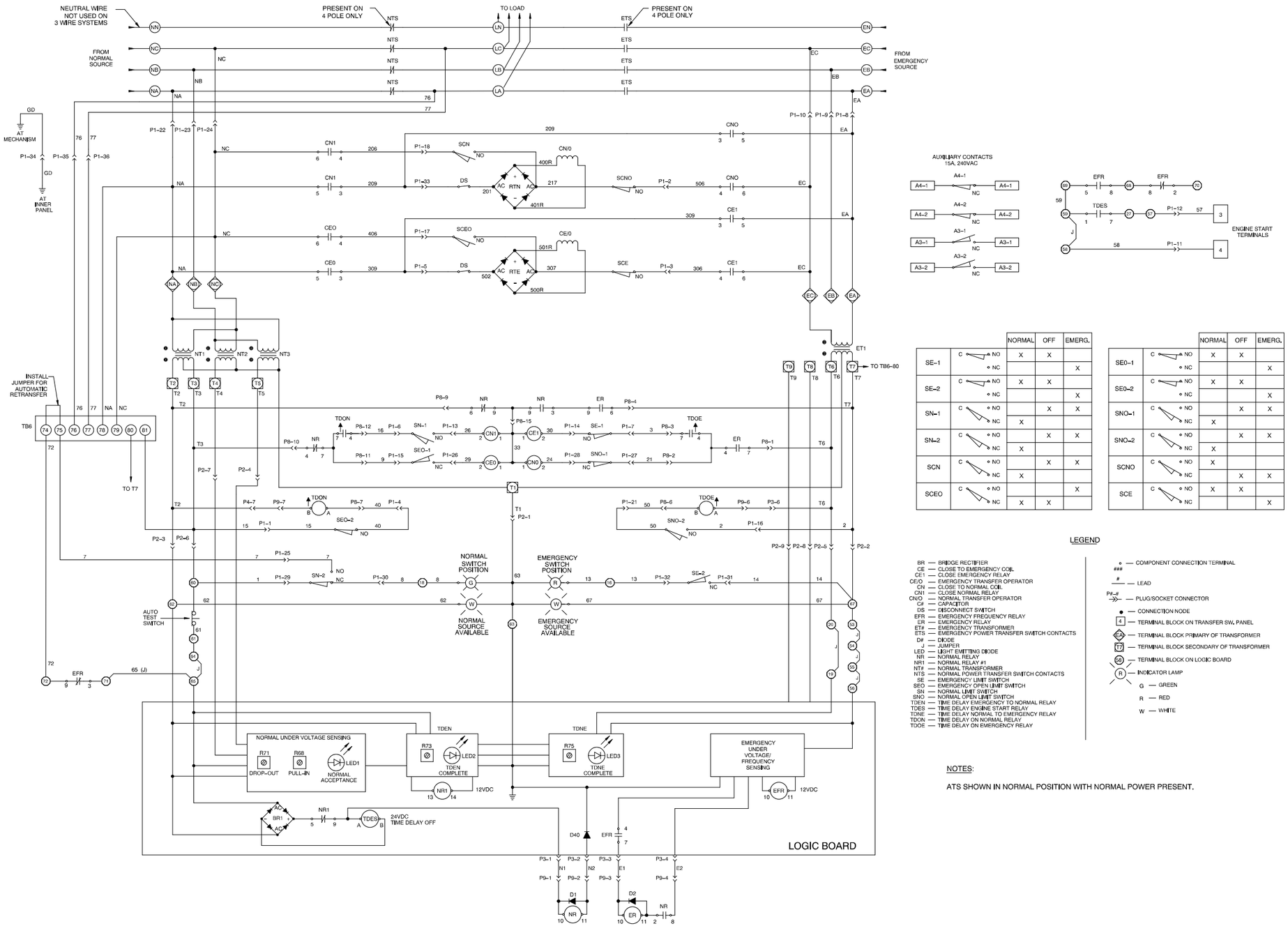
NOTES:

ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT.

DASHED LINES PRESENT ON 3 Ø SYSTEM ONLY

353182-

Schematic Diagram, S340+ Logic, 600 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SE–1	C NO	X	X	
	NC			X
SE–2	C NO	X	X	
	NC			X
SN–1	C NO		X	X
	NC	X		
SN–2	C NO		X	X
	NC	X		
SCN	C NO		X	X
	NC	X		
SCEO	C NO			X
	NC	X	X	

		NORMAL	OFF	EMERG.
SE0–1	C NO	X	X	
	NC			X
SE0–2	C NO	X	X	
	NC			X
SN0–1	C NO		X	X
	NC	X		
SN0–2	C NO		X	X
	NC	X		
SCNO	C NO	X		
	NC		X	X
SCE	C NO	X	X	
	NC			X

LEGEND

BR — BRIDGE RECTIFIER
CE — CLOSE TO EMERGENCY COIL
CE1 — CLOSE EMERGENCY RELAY
CEO — EMERGENCY TRANSFER OPERATOR
CN — CLOSE TO NORMAL COIL
CN1 — CLOSE NORMAL RELAY
CNO — NORMAL TRANSFER OPERATOR
C# — CAPACITOR
DS — DISCONNECT SWITCH
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
J — JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
TDEN — TIME DELAY EMERGENCY TO NORMAL RELAY
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY RELAY
TDON — TIME DELAY ON NORMAL RELAY
TDOE — TIME DELAY ON EMERGENCY RELAY

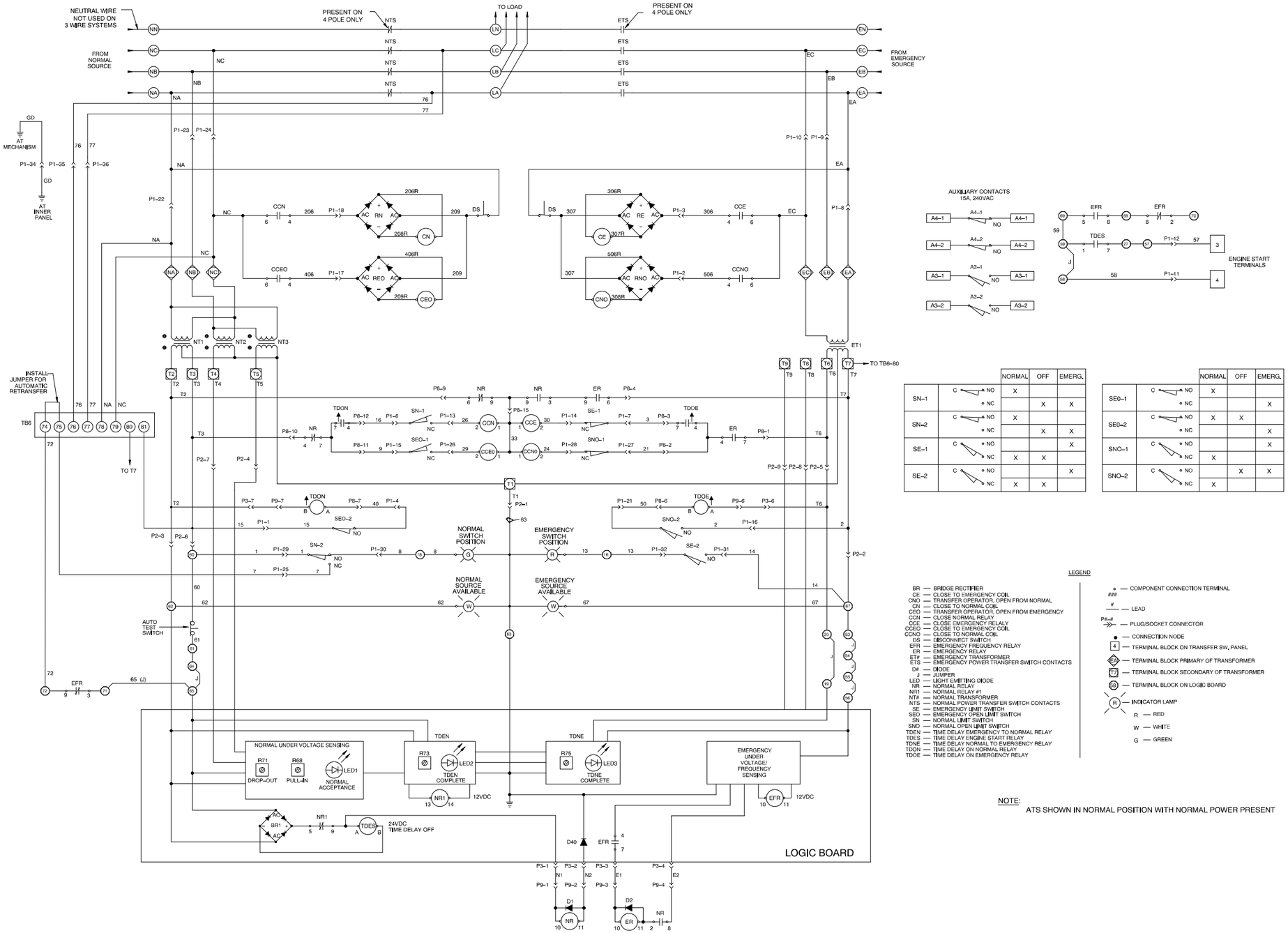
* — COMPONENT CONNECTION TERMINAL
— LEAD
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
T2 — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T2 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
80 — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
G — GREEN
R — RED
W — WHITE

NOTES:

ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT.

321098-B

Schematic Diagram, S340+ Logic, 400 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SN–1	NO	X		
	NC		X	X
SN–2	NO	X		
	NC		X	X
SE–1	NO			X
	NC	X	X	
SE–2	NO			X
	NC	X	X	

		NORMAL	OFF	EMERG.
SE0–1	NO	X		
	NC			X
SE0–2	NO	X	X	
	NC			X
SNO–1	NO			X
	NC	X		
SNO–2	NO		X	X
	NC	X		

LEGEND

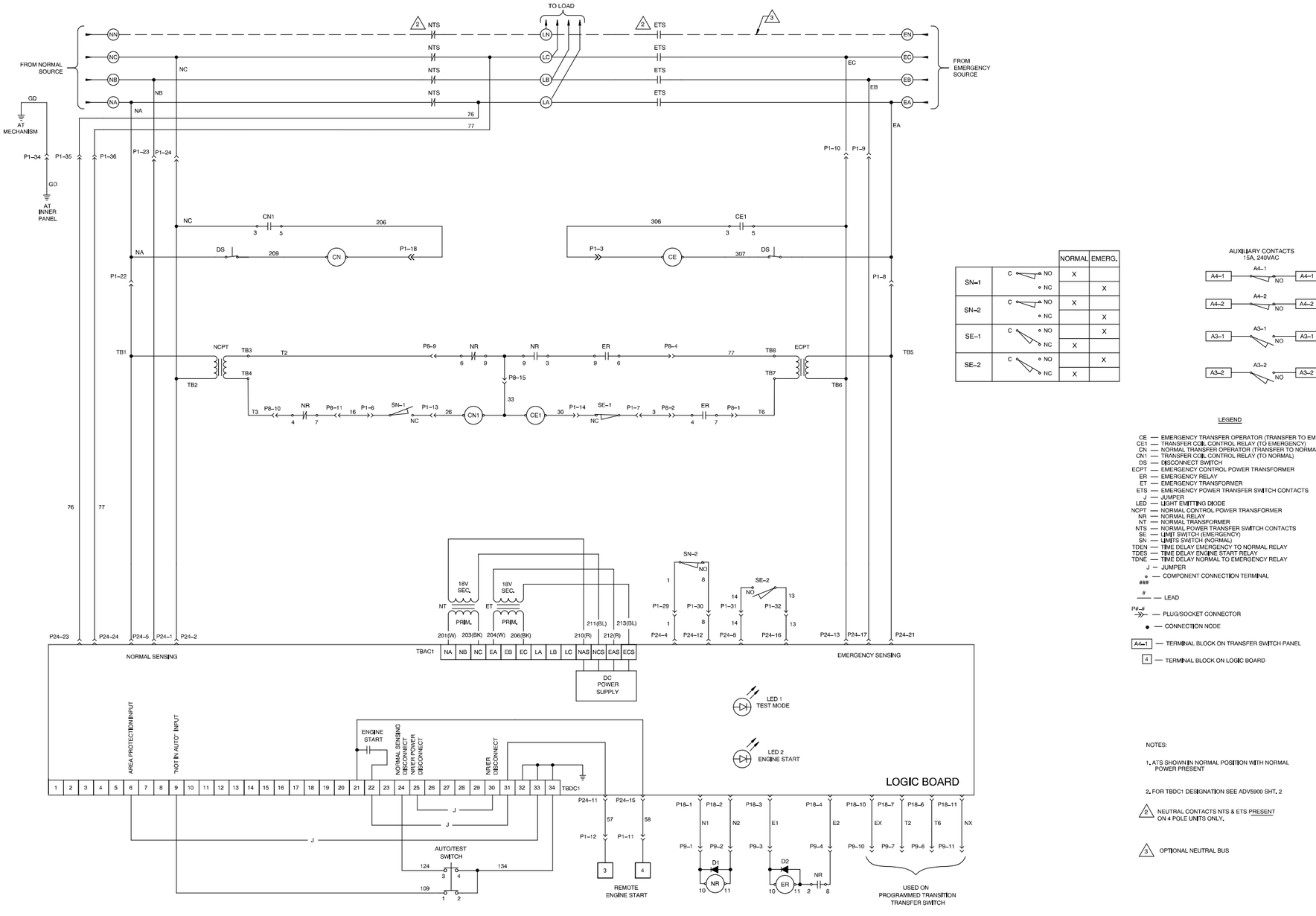
BR — BRIDGE RECTIFIER
CE — CLOSE TO EMERGENCY COIL
CNO — TRANSFER OPERATOR, OPEN FROM NORMAL
CN — CLOSE TO NORMAL COIL
CEO — TRANSFER OPERATOR, OPEN FROM EMERGENCY
CCN — CLOSE NORMAL RELAY
CCE — CLOSE EMERGENCY RELAYLY
CCEO — CLOSE TO EMERGENCY COIL
CCNO — CLOSE TO NORMAL COIL
DS — DISCONNECT SWITCH
EFR — EMERGENCY FREQUENCY RELAY
ER — EMERGENCY RELAY
ET# — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
D# — DIODE
J — JUMPER
LED — LIGHT EMITTING DIODE
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT# — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — EMERGENCY LIMIT SWITCH
SEO — EMERGENCY OPEN LIMIT SWITCH
SN — NORMAL LIMIT SWITCH
SNO — NORMAL OPEN LIMIT SWITCH
TDEN — TIME DELAY EMERGENCY TO NORMAL RELAY
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY RELAY
TDON — TIME DELAY ON NORMAL RELAY
TDOE — TIME DELAY ON EMERGENCY RELAY

— COMPONENT CONNECTION TERMINAL
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
• — CONNECTION NODE
4 — TERMINAL BLOCK ON TRANSFER SW. PANEL
T# — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T# — TERMINAL BLOCK SECONDARY OF TRANSFORMER
J# — TERMINAL BLOCK ON LOGIC BOARD
R — INDICATOR LAMP
R — RED
W — WHITE
G — GREEN

NOTE:
ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

321099-B

Schematic Diagram, S340+ Logic, 600–3000 Amp with Programmed Transition



		NORMAL	EMERG.
SN–1	C NO	X	
	NC		X
SN–2	C NO	X	
	NC		X
SE–1	C NO		X
	NC	X	
SE–2	C NO		X
	NC	X	

LEGEND

CE — EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)
CE1 — TRANSFER COIL CONTROL RELAY (TO EMERGENCY)
CN — NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)
CN1 — TRANSFER COIL CONTROL RELAY (TO NORMAL)
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
J — JUMPER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — LIMIT SWITCH (EMERGENCY)
SN — LIMITS SWITCH (NORMAL)
TDEN — TIME DELAY EMERGENCY TO NORMAL RELAY
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY RELAY
J — JUMPER
— COMPONENT CONNECTION TERMINAL
— LEAD
PJ–# — 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

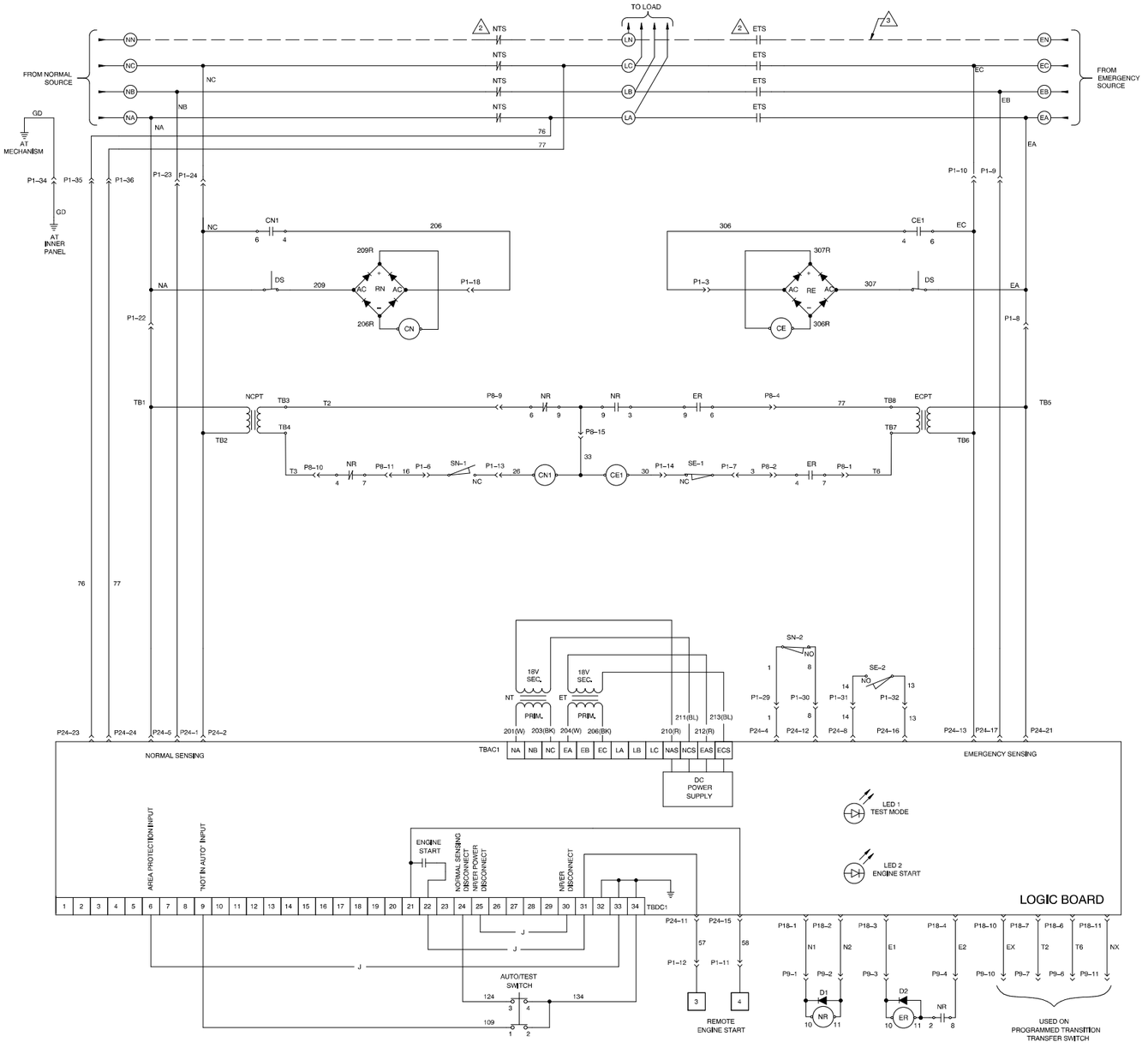
2. FOR TBDC1 DESIGNATION SEE ADV5900 SHT. 2

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

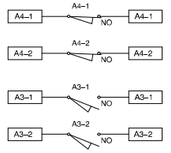
3 OPTIONAL NEUTRAL BUS

321287-C

Schematic Diagram, M340+ Logic 600–1200 Amp



AUXILIARY CONTACTS
15A, 240VAC



		NORMAL	EMERG.
SN–1	C NO	X	
	NC		X
SN–2	C NO	X	
	NC		X
SE–1	C NO		X
	NC	X	
SE–2	C NO		X
	NC	X	

LEGEND

CE — EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)
CE1 — TRANSFER COIL CONTROL RELAY (TO EMERGENCY)
CN — NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)
CN1 — TRANSFER COIL CONTROL RELAY (TO NORMAL)
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
ETS — EMERGENCY POWER TRANSFER SWITCH CONTACTS
J — JUMPER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
NTS — NORMAL POWER TRANSFER SWITCH CONTACTS
SE — LIMIT SWITCH (EMERGENCY)
SN — LIMITS SWITCH (NORMAL)
TDEN — TIME DELAY EMERGENCY TO NORMAL RELAY
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY RELAY
J — JUMPER
* — COMPONENT CONNECTION TERMINAL
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
● — CONNECTION NODE
A#–# — TERMINAL BLOCK ON TRANSFER SWITCH PANEL
— TERMINAL BLOCK ON LOGIC BOARD

NOTES:

1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

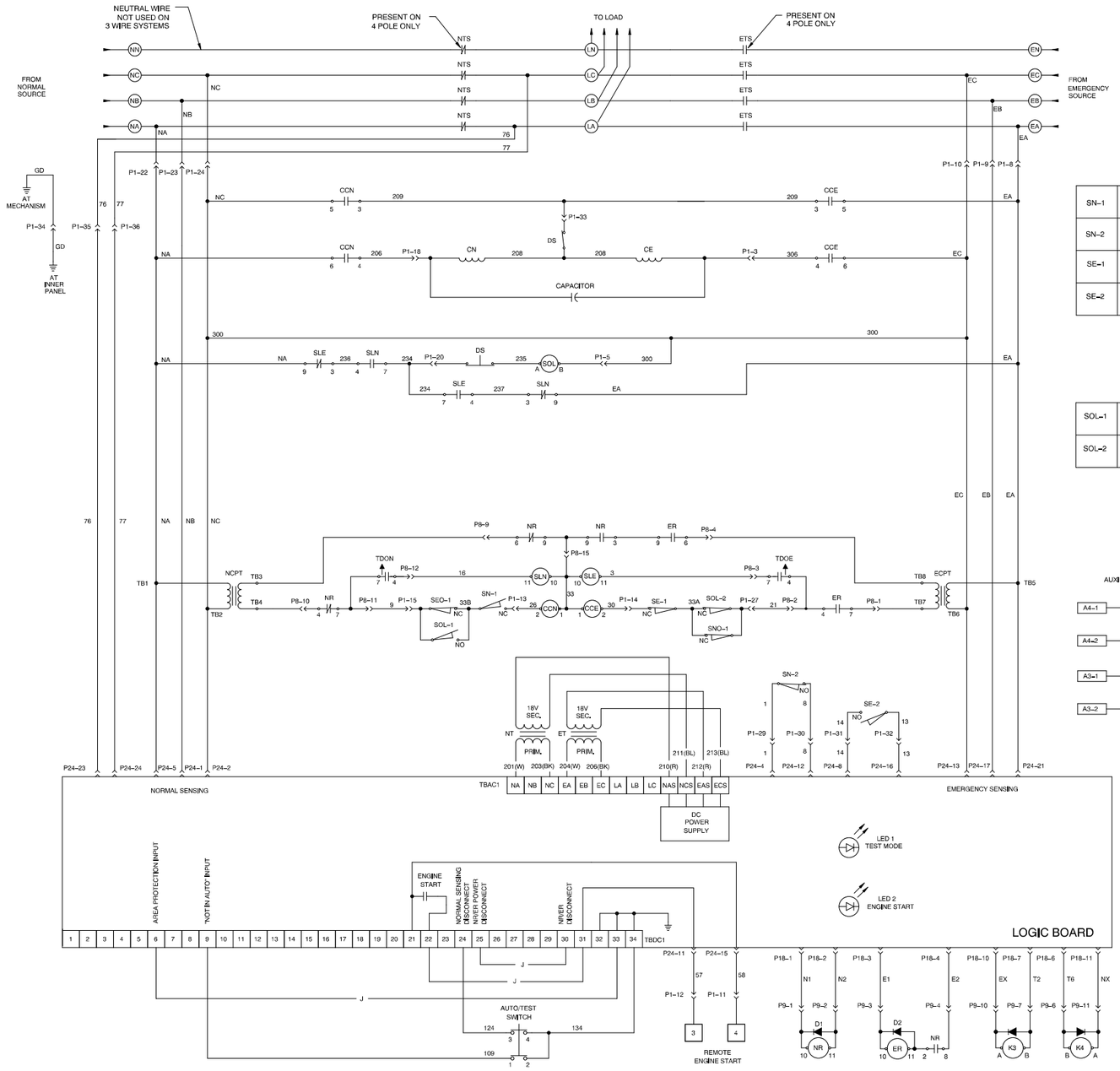
2. FOR TBDC1 DESIGNATION SEE ADV5900 SHT. 2

△2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

△3 OPTIONAL NEUTRAL BUS

321301-B

Schematic Diagram, M340+ Logic, 1600–3000 Amp



		NORMAL	OFF	EMERG.
SN–1	C NO / NC	X		
			X	X
SN–2	C NO / NC	X		
			X	X
SE–1	C NO / NC			X
		X	X	
SE–2	C NO / NC			X
		X	X	

		NORMAL	OFF	EMERG.
SE0–1	C NO / NC		X ①	
		X		X
SE0–2	C NO / NC		X ①	
		X		X
SNO–1	C NO / NC		X ②	
		X		X
SNO–2	C NO / NC		X ②	
		X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL–1	C NO / NC	X	
SOL–2	C NO / NC	X	

LEGEND

CA — CAPACITOR, MAIN TRANSFER OPERATOR
CCE — RELAY, COIL CONTROL, CLOSE TO EMERGENCY
CCN — RELAY, COIL CONTROL, CLOSE TO NORMAL
CN/CE — COIL, MAIN TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SOL — MOTOR, LINEAR
TDOE — TIME DELAY, OFF TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
K4 — TIME DELAY, ON EMERGENCY RELAY
K3 — TIME DELAY, ON NORMAL RELAY
J — JUMPER

* / ### — 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

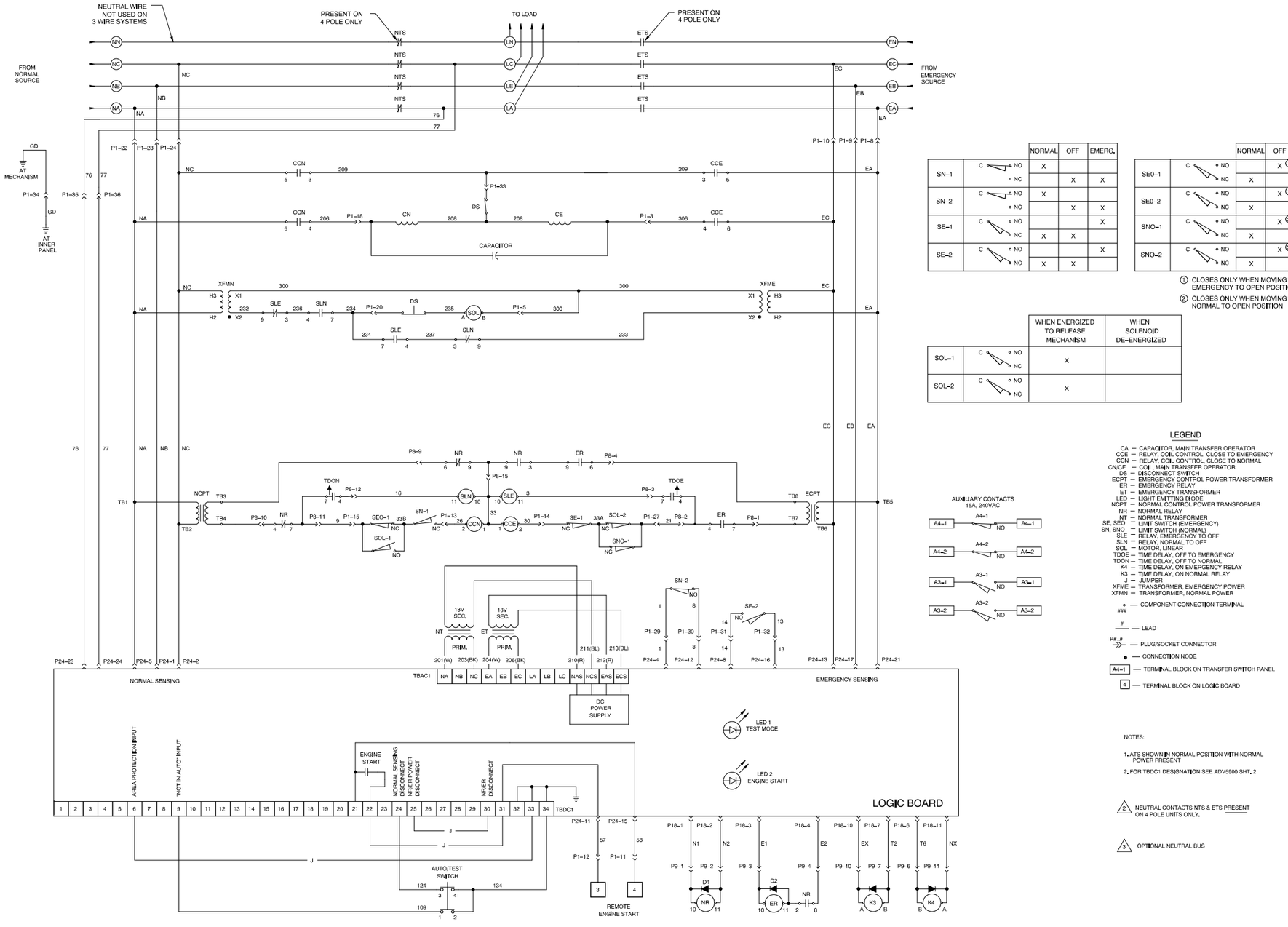
2. FOR TBDC1 DESIGNATION SEE ADV–5900 SHT. 2

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

3 OPTIONAL NEUTRAL BUS

346312-

Schematic Diagram, M340+ Logic, 120 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SN-1	C NO NC	X		
			X	X
SN-2	C NO NC	X		
			X	X
SE-1	C NO NC			X
		X	X	
SE-2	C NO NC			X
		X	X	

		NORMAL	OFF	EMERG.
SE0-1	C NO NC		X ①	
		X		X
SE0-2	C NO NC		X ①	
		X		X
SNO-1	C NO NC		X ②	
		X		X
SNO-2	C NO NC		X ②	
		X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL-1	C NO NC	X	
SOL-2	C NO NC	X	

LEGEND

CA — CAPACITOR, MAIN TRANSFER OPERATOR
CCE — RELAY, COIL CONTROL, CLOSE TO EMERGENCY
CCN — RELAY, COIL CONTROL, CLOSE TO NORMAL
CN/CE — COIL, MAIN TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SOL — MOTOR, LINEAR
TDOE — TIME DELAY, OFF TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
K4 — TIME DELAY, ON EMERGENCY RELAY
K3 — TIME DELAY, ON NORMAL RELAY
J — JUMPER
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

○ ### — 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:

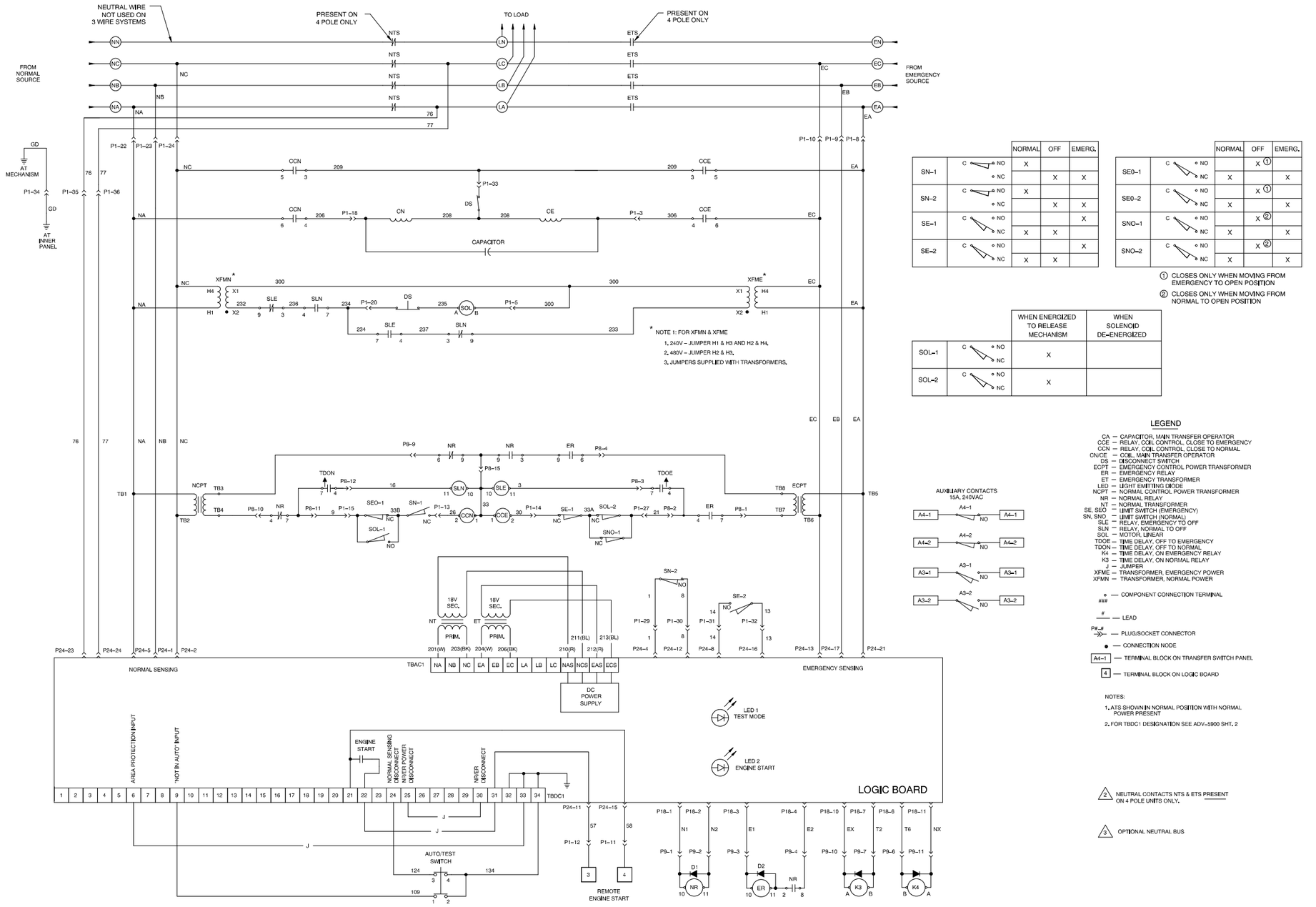
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT
2. FOR TBDC1 DESIGNATION SEE ADV5900 SHT. 2

② NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

③ OPTIONAL NEUTRAL BUS

353174-

Schematic Diagram, M340+ Logic, 208 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SN–1	C NO / NC	X		
			X	X
SN–2	C NO / NC	X		
			X	X
SE–1	C NO / NC			X
		X	X	
SE–2	C NO / NC			X
		X	X	

		NORMAL	OFF	EMERG.
SE0–1	C NO / NC		X ①	
		X		X
SE0–2	C NO / NC		X ①	
		X		X
SNO–1	C NO / NC		X ②	
		X		X
SNO–2	C NO / NC		X ②	
		X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL–1	C NO / NC	X	
SOL–2	C NO / NC	X	

LEGEND

CA — CAPACITOR, MAIN TRANSFER OPERATOR
CCE — RELAY, COIL CONTROL, CLOSE TO EMERGENCY
CCN — RELAY, COIL CONTROL, CLOSE TO NORMAL
CN/CE — COIL, MAIN TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SOL — MOTOR, LINEAR
TDOE — TIME DELAY, OFF TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
K4 — TIME DELAY, ON EMERGENCY RELAY
K3 — TIME DELAY, ON NORMAL RELAY
J — JUMPER
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

* ### — 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:

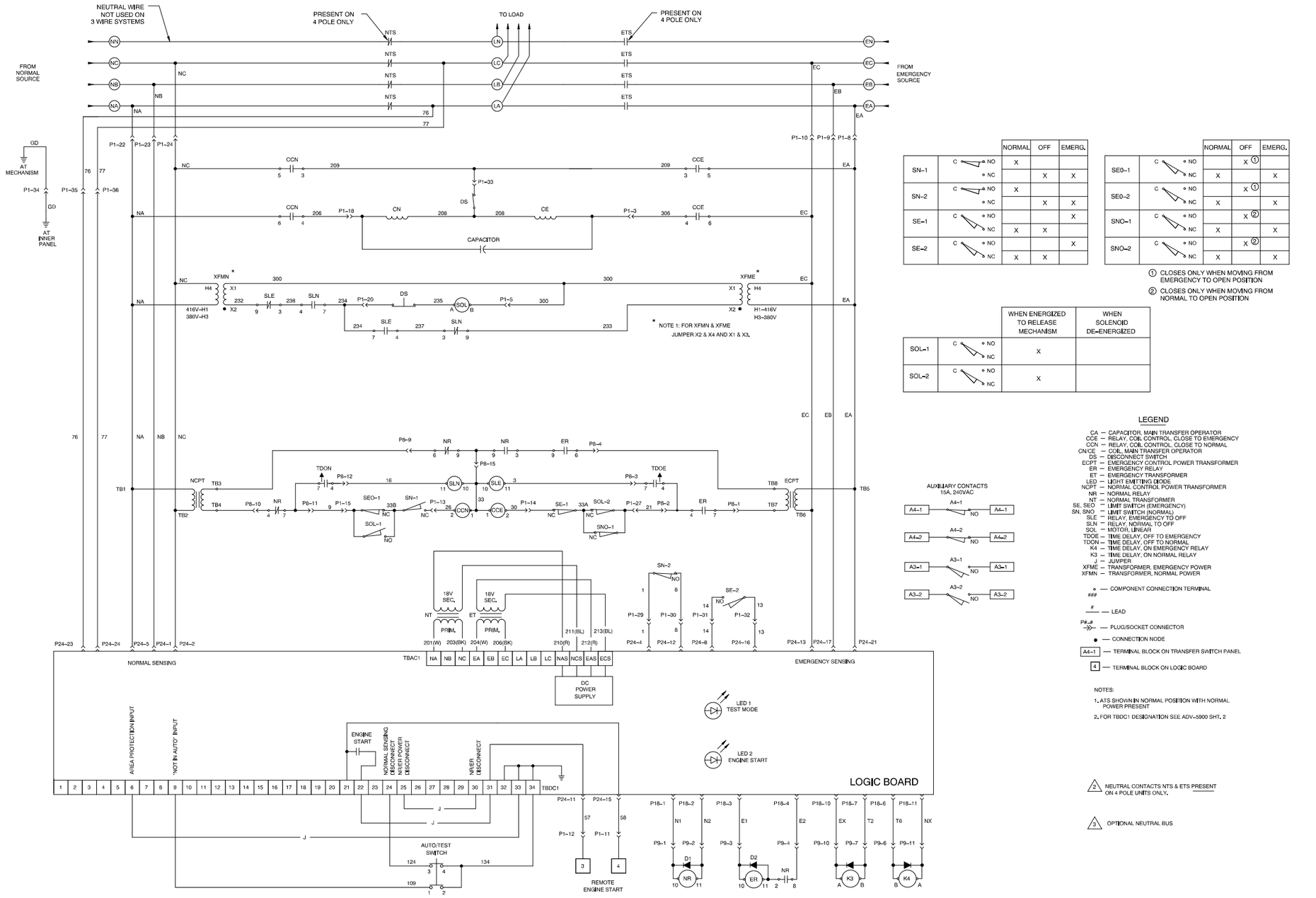
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT
2. FOR TBDC1 DESIGNATION SEE ADV-5900 SHT. 2

② NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

③ OPTIONAL NEUTRAL BUS

353175-

Schematic Diagram, M340+ Logic, 240 and 480 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SN–1	C NO	X		
	C NC		X	X
SN–2	C NO	X		
	C NC		X	X
SE–1	C NO			X
	C NC	X	X	
SE–2	C NO			X
	C NC	X	X	

		NORMAL	OFF	EMERG.
SE0–1	C NO		X ①	
	C NC	X		X
SE0–2	C NO		X ①	
	C NC	X		X
SNO–1	C NO		X ②	
	C NC	X		X
SNO–2	C NO		X ②	
	C NC	X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL–1	C NO NC	X	
SOL–2	C NO NC	X	

LEGEND

CA — CAPACITOR, MAIN TRANSFER OPERATOR
CCE — RELAY, COIL CONTROL, CLOSE TO EMERGENCY
CCN — RELAY, COIL CONTROL, CLOSE TO NORMAL
CN/CE — COIL, MAIN TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SOL — MOTOR, LINEAR
TDOE — TIME DELAY, OFF TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
K4 — TIME DELAY, ON EMERGENCY RELAY
K3 — TIME DELAY, ON NORMAL RELAY
J — JUMPER
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

* ### — 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:

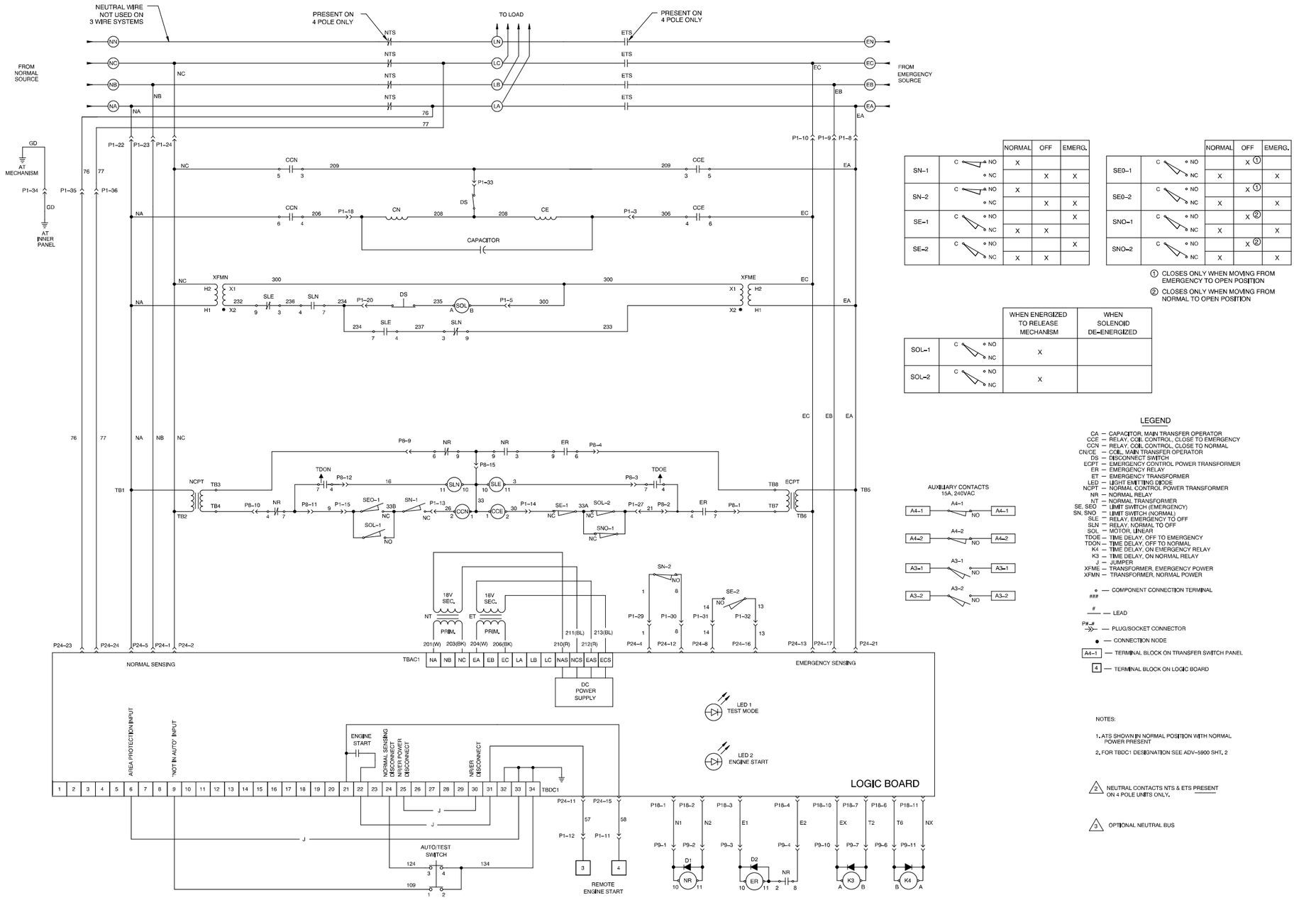
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT
2. FOR TBDC1 DESIGNATION SEE ADV–5900 SHT. 2

② NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

③ OPTIONAL NEUTRAL BUS

353176-

Schematic Diagram, M340+ Logic, 380 and 416 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SN–1	C NO NC	X		
			X	X
SN–2	C NO NC	X		
			X	X
SE–1	C NO NC			X
		X	X	
SE–2	C NO NC			X
		X	X	

		NORMAL	OFF	EMERG.
SE0–1	C NO NC		X ①	
		X		X
SE0–2	C NO NC		X ①	
		X		X
SNO–1	C NO NC		X ②	
		X		X
SNO–2	C NO NC		X ②	
		X		X

① CLOSES ONLY WHEN MOVING FROM EMERGENCY TO OPEN POSITION

② CLOSES ONLY WHEN MOVING FROM NORMAL TO OPEN POSITION

		WHEN ENERGIZED TO RELEASE MECHANISM	WHEN SOLENOID DE-ENERGIZED
SOL–1	C NO NC	X	
SOL–2	C NO NC	X	

LEGEND

CA — CAPACITOR, MAIN TRANSFER OPERATOR
CCE — RELAY, COIL CONTROL, CLOSE TO EMERGENCY
CCN — RELAY, COIL CONTROL, CLOSE TO NORMAL
CN/CE — COIL, MAIN TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
SLE — RELAY, EMERGENCY TO OFF
SLN — RELAY, NORMAL TO OFF
SOL — MOTOR, LINEAR
TDOE — TIME DELAY, OFF TO EMERGENCY
TDON — TIME DELAY, OFF TO NORMAL
K4 — TIME DELAY, ON EMERGENCY RELAY
K3 — TIME DELAY, ON NORMAL RELAY
J — JUMPER
XFME — TRANSFORMER, EMERGENCY POWER
XFMN — TRANSFORMER, NORMAL POWER

* ### — 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:

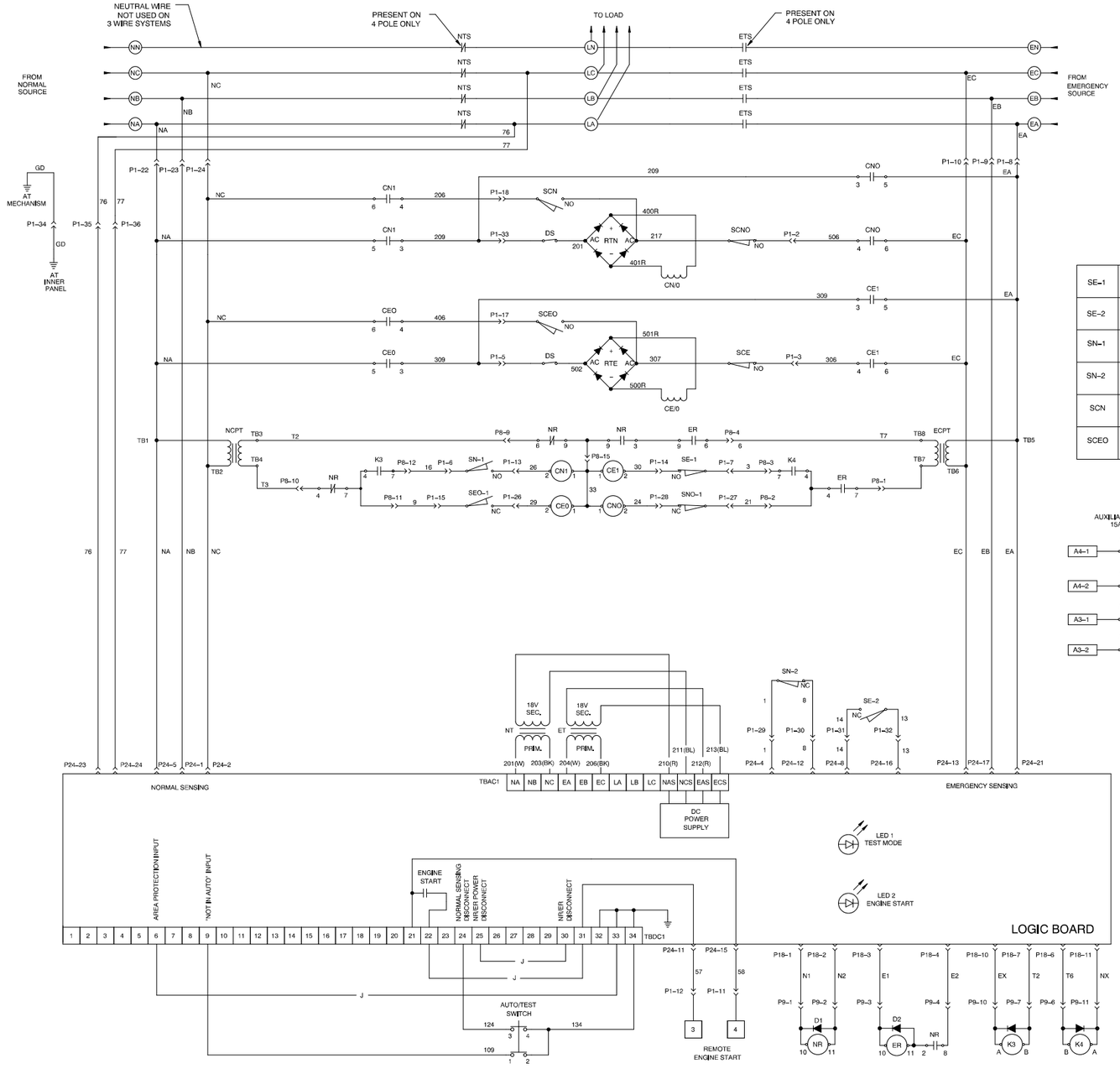
1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT
2. FOR TBDC1 DESIGNATION SEE ADV–5900 SHT. 2

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

3 OPTIONAL NEUTRAL BUS

353177-

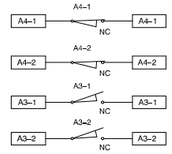
Schematic Diagram, M340+ Logic, 600 VAC, 40–260 Amp with Programmed Transition



		NORMAL	OFF	EMERG.
SE-1	C NO	X	X	
	NC			X
SE-2	C NO	X	X	
	NC			X
SN-1	C NO		X	X
	NC	X		
SN-2	C NO		X	X
	NC	X		
SCN	C NO		X	X
	NC	X		
SCEO	C NO			X
	NC	X	X	

		NORMAL	OFF	EMERG.
SE0-1	C NO	X	X	
	NC			X
SE0-2	C NO	X	X	
	NC			X
SNO-1	C NO		X	X
	NC	X		
SNO-2	C NO		X	X
	NC	X		
SCNO	C NO	X		
	NC		X	X
SCE	C NO	X	X	
	NC			X

AUXILIARY CONTACTS
15A, 240VAC



LEGEND

CE1 — COIL CONTROL EMERGENCY RELAY
CEO — COIL CONTROL EMERGENCY OPEN RELAY (TRANSFER OPERATOR)
CC1 — COIL CONTROL NORMAL RELAY
CN0 — COIL CONTROL NORMAL OPEN RELAY (TRANSFER OPERATOR)
CE — TRANSFER OPERATOR (CLOSE TO EMERGENCY)
CE0 — TRANSFER OPERATOR (OPEN FROM EMERGENCY)
CE/O — EMERGENCY TRANSFER OPERATOR
CN — TRANSFER OPERATOR (CLOSE TO NORMAL)
CN/0 — NORMAL TRANSFER OPERATOR
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
RE — BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
REO — BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
RN — BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
RNO — BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
TDES — TIME DELAY ENGINE START RELAY
K4 — TIME DELAY ON EMERGENCY RELAY
K3 — TIME DELAY ON NORMAL RELAY
J — JUMPER
• — 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

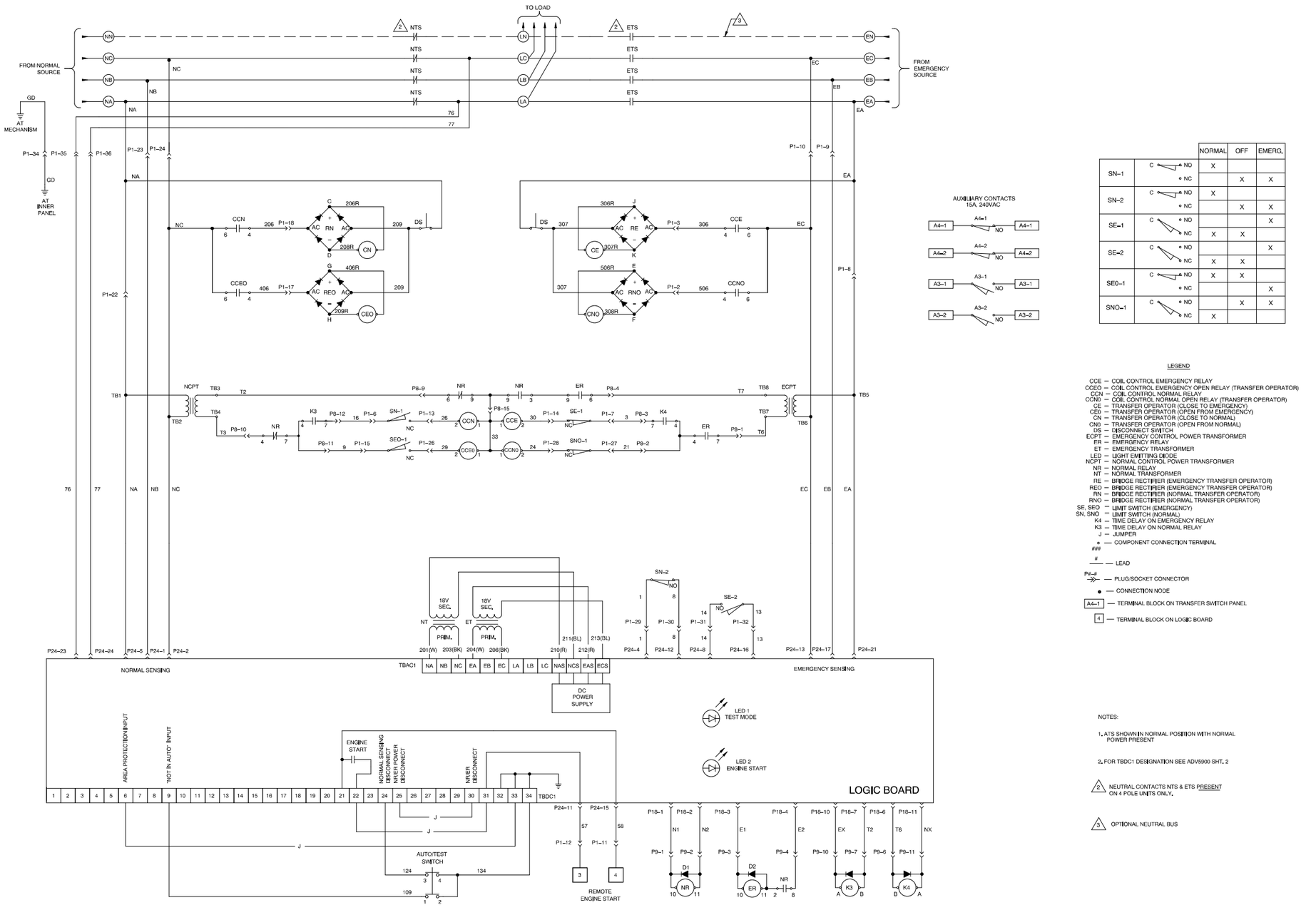
2. FOR TBDC1 DESIGNATION SEE ADV5900 SHT. 2

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.

3 OPTIONAL NEUTRAL BUS

321300-B

Schematic Diagram, M340+ Logic, 400 Amp with Programmed Transition



AUXILIARY CONTACTS
15A, 240VAC

		NORMAL	OFF	EMERG.
SN-1	C — NO	X		
	C — NC		X	X
SN-2	C — NO	X		
	C — NC		X	X
SE-1	C — NO			X
	C — NC	X	X	
SE-2	C — NO			X
	C — NC	X	X	
SEO-1	C — NO	X	X	
	C — NC			X
SNO-1	C — NO		X	X
	C — NC	X		

LEGEND

CCE — COIL CONTROL EMERGENCY RELAY
CCEO — COIL CONTROL EMERGENCY OPEN RELAY (TRANSFER OPERATOR)
CCN — COIL CONTROL NORMAL RELAY
CCNO — COIL CONTROL NORMAL OPEN RELAY (TRANSFER OPERATOR)
CE — TRANSFER OPERATOR (CLOSE TO EMERGENCY)
CEO — TRANSFER OPERATOR (OPEN FROM EMERGENCY)
CN — TRANSFER OPERATOR (CLOSE TO NORMAL)
CNO — TRANSFER OPERATOR (OPEN FROM NORMAL)
DS — DISCONNECT SWITCH
ECPT — EMERGENCY CONTROL POWER TRANSFORMER
ER — EMERGENCY RELAY
ET — EMERGENCY TRANSFORMER
LED — LIGHT EMITTING DIODE
NCPT — NORMAL CONTROL POWER TRANSFORMER
NR — NORMAL RELAY
NT — NORMAL TRANSFORMER
RE — BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
REO — BRIDGE RECTIFIER (EMERGENCY TRANSFER OPERATOR)
RN — BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
RNO — BRIDGE RECTIFIER (NORMAL TRANSFER OPERATOR)
SE, SEO — LIMIT SWITCH (EMERGENCY)
SN, SNO — LIMIT SWITCH (NORMAL)
K4 — TIME DELAY ON EMERGENCY RELAY
K3 — TIME DELAY ON NORMAL RELAY
J — JUMPER
○ — 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. FOR TBDC1 DESIGNATION SEE ADV5900 SHT. 2
2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY.
3 OPTIONAL NEUTRAL BUS

321286-A

Schematic Diagram, M340+ Logic, 600–3000 Amp with Programmed Transition

Kohler 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 the Introduction section in this manual.

6.1 Upon Receipt of Unit

6.1.1 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.

6.1.2 Lifting

⚠ WARNING

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

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

See Figure 6-1 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)
40	2, 3 4	237 (108) 242 (110)
80	2, 3 4	237 (108) 242 (110)
100	2, 3 4	237 (108) 242 (110)
150	2, 3 4	242 (110) 247 (112)
225	2, 3 4	242 (110) 247 (112)
260	2, 3 4	242 (110) 247 (112)
400	Any	524 (238)
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 6-1. Approximate Transfer Switch Weight

6.1.3 Unpacking

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

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

6.1.4 Storage

Store the transfer switch in its protective packing until ready for final installation. Protect the automatic transfer switch at all times from excessive moisture, construction grit, and metal chips. Avoid storage in low temperature and high humidity areas where condensation could occur on the unit.

6.2 Mechanical Installation

Check the System Voltage and Frequency Do not install 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 5. Select the mounting site to comply with local electrical code restrictions for the enclosure type. Mount the transfer switch as close to the load and power sources as possible. Allow adequate space to open the enclosure door fully and to service the switch.

Vertically mount the 40- through 260-ampere transfer switches covered in this manual to a wall or other rigid vertical supporting structure. Keyhole slots for mounting purposes are provided in the mounting brackets on the top and bottom of each unit. When mounting these units, plumb the enclosure to ensure that the door hinges are vertical to avoid any distortion of the enclosure or door. Place washers behind the mounting bracket key holes to shim the enclosure to a plumb condition.

Floor mount or attach the 400-ampere transfer switch covered in this manual to a rigid supporting structure such as a wall. When mounting these units either way, plumb the enclosure to ensure that the door hinges are vertical to avoid any distortion of the enclosure or door. For floor mounting, bolt the mounting feet to the floor and shim the mounting feet as needed to plumb the enclosure. Keyhole slots for wall mounting are provided in the rear panel of the enclosure. Place washers behind the mounting bracket key holes to shim the enclosure to a plumb condition.

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.

6.3 Check Manual Operation

Follow a 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!

6.4 Electrical Wiring

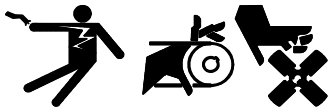
All internal electrical connections are prewired. The only wiring necessary when installing the transfer switch is to connect the unit to external devices.

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 5 for schematic diagrams and enclosure drawings.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Disconnect all power sources before opening enclosure.

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening enclosure.

(600 Volt and above)

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

(under 600 Volt)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

(600 Volt and above)

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

Installing battery charger. Hazardous voltage can cause severe injury or death. Electrical shock may occur if battery charger is not electrically grounded. Connect battery charger enclosure to ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect to equipment grounding terminal or lead on battery charger. Perform battery charger installation as prescribed in equipment manual. Install battery charger in compliance with local codes and ordinances.

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

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

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

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

NOTICE

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

NOTICE

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

NOTE

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

6.4.1 AC Power Connections

All conductors should enter the enclosure at the locations shown on the drawings. When drilling entry holes for any conductors, cover the transfer switch components for protection from metal chips and construction grit. Remove 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.

NOTE

The power source leads must be phased A-B-C for option DD-34-Z (phase sequence and loss monitoring) to function correctly. If the power source phase sequence is not A-B-C and option DD-34-Z is enabled the controller consider the source to have failed.

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

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

Figure 6-2. Tightening Torque for Lugs

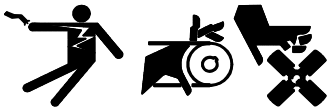
In cases where the normal, emergency, and load connections are made to a rear connected bus bar, use a compression washer, flat washer, and a minimum grade 5 bolt and torque to the values in Figure 6-3.

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 6-3. Tightening Torque for Bus Bars

6.4.2 Generator Start Connection

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

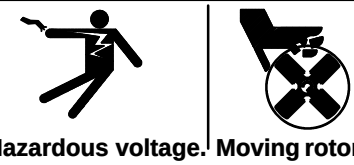
Connect the generator set remote starting circuit to the generator start signal connections located on terminals 3 and 4 of the transfer switch contactor assembly. A red decal identifies the location of the terminal block. See the enclosure dimension drawings in Section 5. The transfer switch controller provides a contact closure through the wiring harness to these terminals to signal the generator set to start.

6.4.3 Accessory and Controller Connections

Complete any external connections for accessories. See Section the transfer switch logic controller operation and installation manual. 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 the Introduction section in this manual. See the logic controller operation and installation manual for additional control connection information. Connect the power switching device and controller wiring harnesses together at the inline disconnect plug after performing the voltage check procedure to complete installation.

6.5 Prepare the Generator Set for Operation

⚠ WARNING



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

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

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.

6.6 Functional Tests

6.6.1 Voltage Check

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

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures 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 wristwatch, rings, and jewelry before servicing 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.

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 required on transfer switches with microprocessor controls (see NOTE.)

NOTE

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

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

12. Follow the generator set manufacturer's instructions to adjust the generator output voltage and frequency to match the nominal system voltage and frequency shown on the transfer switch nameplate if they are different. The automatic transfer switch will operate correctly only to the rated system voltage and frequency specified on the nameplate.
13. Move the generator set master switch to the AUTO position.
14. Disconnect the emergency power source by opening upstream circuit breakers or switches to the transfer switch.
15. Connect the power switching device and controller 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 TDEC, if equipped.

NOTE

When initially applying power to the transfer switch, the engine start contacts remain closed signalling the generator to run until the ATS's Time Delay Engine Cooldown (TDEC), if equipped, ends.

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

6.6.2 Automatic Operation Test

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

6.7 Controller Setup

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

6.8 Ensure Warranty Registration

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

Notes

Appendix A. Glossary of Abbreviations

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

AC	alternating current
AISI	American Iron and Steel Institute
Amp	ampere
Amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
aux.	auxiliary
AWG	American Wire Gauge
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective pressure
Btu	British thermal unit
℃	Celsius degree
cc	cubic centimeter
CCA	cold cranking Amps.
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch, cubic inches
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	et cetera (and so forth)
ext.	external
℉	Fahrenheit degree
fl. oz.	fluid ounce, fluid ounces
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound, foot pounds
ga.	gauge (meters, wire size)
gal./ gals.	gallon, gallons
gph	gallons per hour
gpm	gallons per minute
gr.	grade
gnd.	ground
HCHT	high cylinder head temperature
HET	high exhaust (or engine) temperature
Hg	mercury (element)
H_2O	water
HP	horsepower
hr, hrs	hour
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch(es)
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
kJ	kilojoules (btu cal)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED(s)	light emitting diode
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minutes
LOP	low oil pressure
LP	liquefied petroleum
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
meggar	megohmmeter
MHz	megahertz
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m^3/min	cubic meters per minute
MPa	megaPascal
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available or not applicable
NBS	National Bureau of Standards
N.C.	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter, Newton meters
no., nos	number, numbers
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
O/S	oversize
OSHA	Occupational Safety and Health Act
OV	overvoltage
oz.	ounce, ounces
PF	power factor
PMG	permanent magnet generator
pot.	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
PVC	polyvinyl chloride
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
r.h.m.	round-head machine (screw)
rms	root mean square
RPM	revolutions per minute
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
SCR	silicon-controlled rectifier
sec.	second, seconds
spec.	specs, specification
sq.	square
sq. cm	square centimeters
sq. in.	square inch, square inches
tach	tachometer
TDC	top dead center
tech. pub.	technical publications
temp.	temperature
TIF	telephone influence factor
TP, TPs	technical publications
turbo	turbocharger
UHF	ultrahigh frequency
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter's Laboratories, Inc.
U/S	undersize
U.S.A.	United States of America
V	volt, volts
vac	volts alternating current
vdc	volts direct current
VHF	very high frequency
W	watt, watts

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