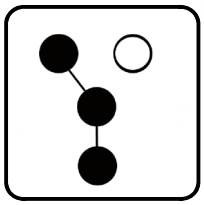
Operation and Installation

Automatic Transfer Switch



Model:

RXT

100–400 Amp Automatic Transfer Switches

For use with Kohler® Model RESA, RESAL, or RCL generator sets equipped with RDC2 or DC2 generator/transfer switch controllers

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6807 12/11

Product Identification Information

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

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Model Designation _____

Serial Number _____

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

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

DANGER

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

WARNING

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

CAUTION

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

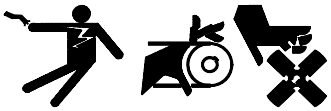
NOTICE

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

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

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

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

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

Hazardous Voltage/ Moving Parts

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

DANGER

Hazardous voltage.
Will cause severe injury or death.

This equipment must be installed and serviced by qualified electrical personnel.

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

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

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

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

Heavy Equipment

⚠ WARNING

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

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

Notice

NOTICE

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

NOTICE

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

This manual provides operation and installation instructions for Kohler® Model RXT automatic transfer switches. See Figure 1 for typical Model RXT transfer switches.

Model RXT transfer switches operate only with Kohler® Model generator sets equipped with the RDC2 or DC2 generator/transfer switch controller. See Figure 2 for controller identification. The following Kohler® model generator sets can be used with the Model RXT transfer switch:

- 14RESA
- 14RESAL
- 20RESA
- 20RESAL
- 48RCL

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

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

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

Figure 1 Typical Model RXT Transfer Switches (shown with optional status indicators)

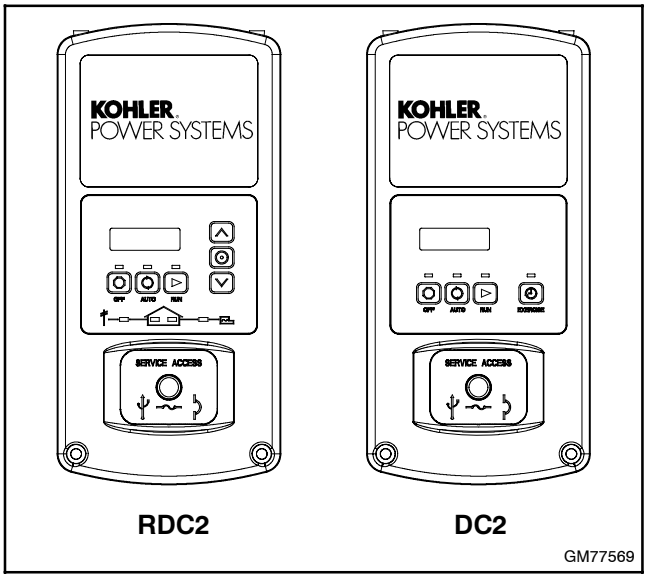


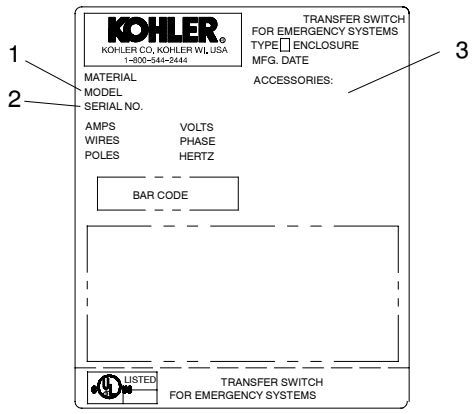
Figure 2 RDC2 and DC2 Generator/Transfer Switch Controllers (provided with and mounted on the generator set)

Nameplate

A nameplate attached to the inside of the enclosure cover or on the upper right side wall includes a model designation, a serial number, ratings, and other information about the transfer switch. See Figure 3.

Check the transfer switch model number from the transfer switch nameplate and verify that it matches the model shown on the front cover of this manual before proceeding with installation.

Copy the model designation, serial number, and accessory information from the nameplate to the spaces provided in the Product Identification Information section located inside the front cover of this manual for use when requesting service or parts.



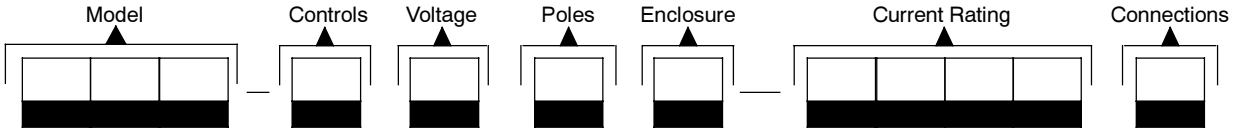
GM21291-E

1. Model designation
2. Serial number
3. Factory-installed accessory numbers

Figure 3 Typical Transfer Switch Nameplate

Model Designation

Figure 4 explains the model designation.



Record the transfer switch model designation in the boxes. The transfer switch model designation defines ratings a characteristics as explained below.

Sample Model Designation: RXT-JFNC-0200A

Model
RXT: Kohler Automatic Transfer Switch

Controls
J: Interface for RDC2/DC2 Controller

Voltage/Frequency
C: 208 Volts/60 Hz (3-phase only)
F: 240 Volts/60 Hz
M: 480 Volts/60 Hz (3-phase only)

Number of Poles/Wires
N: 2-pole, 3-wire, solid neutral (120/240 V only)
T: 3-pole, 4-wire, solid neutral
V: 4-pole, 4-wire, switched neutral

Enclosure
C: NEMA 3R

Current Rating: Numbers indicate the current rating of the switch in amperes:

0100
0200
0400

Connections
A: No load center
B: With load center (100 amp single-phase only)
ASE: Service entrance rated

Figure 4 Model Designation

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

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

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Kohler Power Systems
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93200 Saint Denis
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Phone: (33) 1 49 178300
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China
North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

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

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
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Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

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

Notes

1.1 Transfer Switch Description

An automatic transfer switch (ATS) transfers electrical loads from a normal source of electrical power to an emergency source when the normal source voltage or frequency falls below an acceptable level. The normal source is typically utility power. The emergency source is usually a generator set.

Model RXT transfer switches must be connected to a generator set equipped with the Kohler® RDC2 or DC2 generator/transfer switch controller. Applicable generator set models are listed in the Introduction.

Voltage sensing data from the ATS is continuously transmitted to the RDC2/DC2 controller mounted on the generator set. When the normal source fails, the RDC2/DC2 controller signals the emergency source generator set to start. When the emergency source reaches acceptable levels and stabilizes, the ATS transfers the electrical load to the emergency source.

The RDC2/DC2 controller signals the ATS to transfer the load back when the normal source returns and stabilizes.

Figure 1-1 shows a typical installation block diagram.

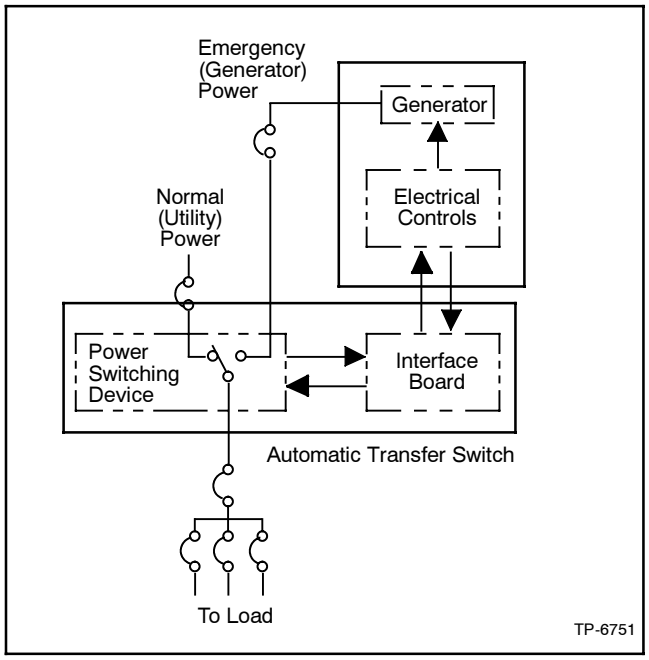


Figure 1-1 Typical ATS Block Diagram

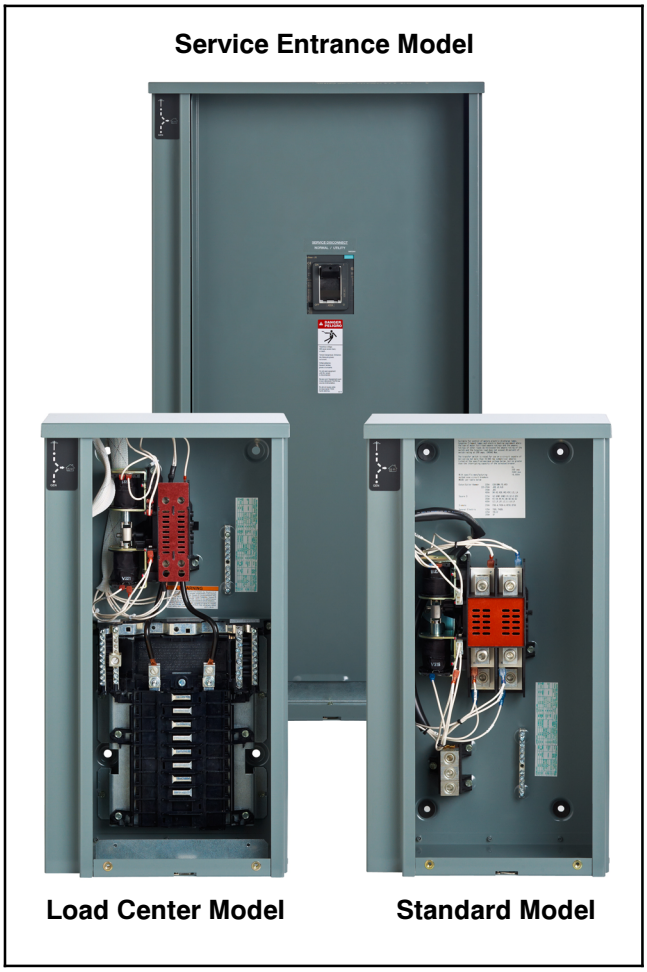


Figure 1-2 Selected Transfer Switches (covers removed)

1.2 Service Entrance Models

Service entrance models use a circuit breaker to provide the service disconnect for the utility source. A service entrance model is shown in Figure 1-2.

1.3 Load Centers

Model RXT 100 amp transfer switches are available with a built-in load center. A model with a built-in load center is shown in Figure 1-2. Models without load centers require the installation of a separate load panel.

Loads. The transfer switch can be connected to supply all of the electrical loads in the home, or only the essential loads such as the furnace, refrigerator, well pump, and selected light circuits. Identify the essential circuits that must be supplied during a power outage. Verify that the generator set and transfer switch are adequately rated to supply all of the selected loads.

Circuit breakers. Because the size and number of circuit breakers required will vary with each application, circuit breakers are not provided with the transfer switch load center.

Determine the circuits that will be connected to the transfer switch (essential loads). Identify the breakers for those circuits in the main distribution panel.

The ATS load center requires Square D type QO breakers. If the main distribution panel uses the same type of breakers, the breakers can be moved from the main panel to the load center. Otherwise, obtain new Square D type QO circuit breakers. For each circuit, the rating of the load center circuit breaker must match the rating of the existing breaker in the main panel.

Up to 8 tandem breakers can be used. Use Square D type QOT tandem breakers.

Verify that the total rating for all of the breakers used in the load center does not exceed the rating of the transfer switch.

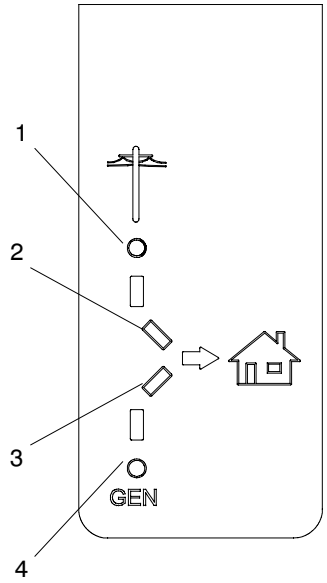
1.4 Controller Interface Board

All ATS control functions are performed by the RDC2/DC2 controller mounted on the generator set and communicated through the interface board. The controller interface board sends voltage sensing data to the RDC2/DC2 controller and receives transfer and load control signals from the RDC2/DC2 controller.

1.5 Optional LED Indicator Panel

A user interface panel that contains status-indicating LEDs is available. See Figure 1-3. Source available LEDs light to indicate that the utility and/or generator sources are available. The utility or generator source supplying load LED lights to show which source is connected to the building load (i.e. contactor position, normal or emergency).

If the status indicator is purchased as a loose kit (not factory-installed), refer to the installation instructions provided with the kit, TT-1585.



1. Utility power available
2. Utility source supplying load
3. Generator source supplying load
4. Generator power available

Figure 1-3 LED Indicators

2.1 Introduction

Kohler® transfer switches are shipped factory-wired, factory-tested, and ready for installation. Have the equipment installed only by trained and qualified personnel, and verify that the installation complies with applicable codes and standards. Protect the switch against damage before and during installation.

2.2 Receipt of Unit

2.2.1 Inspection

At the time of delivery, inspect the packaging and the transfer switch for signs of shipping damage. Unpack the transfer switch as soon as possible and inspect the exterior and interior for shipping damage. If damage and/or rough handling is evident, immediately file a damage claim with the transportation company.

2.2.2 Storage

Store the transfer switch in its protective packing until final installation. Protect the transfer switch at all times from moisture, construction grit, and metal chips. Avoid storage in cold or damp areas where moisture could condense on the unit. See Figure 2-1 for acceptable storage temperatures.

Item	Specification
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Operating Temperature	-20°C to 70°C (-4°F to 158°F)
Humidity	5% to 95% noncondensing
Altitude	0 to 3050 m (10000 ft.) without derating

Figure 2-1 Environmental Specifications

2.2.3 Unpacking

Allow the equipment to warm to room temperature for at least 24 hours before unpacking to prevent condensation on the electrical apparatus. Use care when unpacking to avoid damaging transfer switch components. Use a vacuum cleaner or a dry cloth to remove dirt and packing material that may have accumulated in the transfer switch or any of its components.

Note: Do not use compressed air to clean the switch. Cleaning with compressed air can cause debris to lodge in the components and damage the switch.

2.2.4 Lifting

⚠ WARNING

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

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

See Figure 2-2 or the dimensional drawing for the weight of the transfer switch. Use a spreader bar to lift the transfer switch. Attach the bar only to the enclosure's mounting holes or lifting brackets; do not lift the unit any other way. Close and latch the enclosure door before moving the unit.

Amps	Description	Weight, kg (lb.) †	
100	Single phase	7	(14)
	With load center	8.2	(18)
	Three phase	14	(30)
	Service Entrance	10	(22)
200	Single phase	7	(15)
	Three phase	14	(30)
	Service Entrance	12	(26)
400	Single phase	36	(80)
	3-Pole/208-240 Volts	41	(90)
	3-Pole/480 Volts	59	(130)
	4-Pole	59	(130)
	Service Entrance	46	(100)

Figure 2-2 Approximate Weights

2.3 Installation

NOTICE

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

NOTICE

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

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

Plan the installation. Use the dimensions given on the enclosure dimension (ADV) drawings in Section 6. Select a mounting site that complies 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 and service the switch.

NEMA 3R enclosures. To remove the enclosure's front panel, support the panel while removing the screws. Pull the bottom of the panel out and down until the top clears the enclosure. Remove the inner panel to access the transfer switch components.

NEMA 3R enclosures have locking tabs at the bottom of the enclosure and the door. While the enclosure is open, turn the locking tab out so that the door can be locked with a padlock after installation is complete.

Wall mounting. Mount the transfer switch to a wall or other rigid vertical supporting structure. Refer to the dimension drawings in Section 6 for hole locations. Use shims to plumb the enclosure.

Cover or remove the transfer switch's internal components to protect them from drill chips or debris during installation. Use a vacuum cleaner to remove debris from the enclosure.

Note: Do not use compressed air to clean the switch. Cleaning with compressed air can cause debris to lodge in the components and cause damage.

Tighten the mounting screws to 2.9 Nm (26 in. lb.) when reinstalling the components.

Clearance holes through the back of each enclosure are provided for mounting. The mounting holes on NEMA 3R enclosures have gaskets to seal out moisture. Use washers with the mounting screws to protect the gaskets.

2.4 Manual Operation Check

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Check the manual operation before energizing the transfer switch. Verify that the contactor operates smoothly without binding. Do not place the transfer switch into service if the contactor does not operate smoothly.

After checking the manual operation, place the contactor in the Normal (utility) position.

See Figure 2-3 to identify the manual operation procedure for your transfer switch.

ATS	Procedure	Figure
100-200 amps, 1-phase	2.4.1	Figure 2-4
100-200 amps, 3-phase	2.4.2	Figure 2-6
400 amps, 1-phase	2.4.1	Figure 2-5
400 amps, 3-phase, 3-pole, 208-240 Volts	2.4.1	Figure 2-5
400 amps, 3-phase, 3-pole/480 Volt and 4-pole	2.4.2	Figure 2-7

Figure 2-3 Manual Operation Procedure Guide

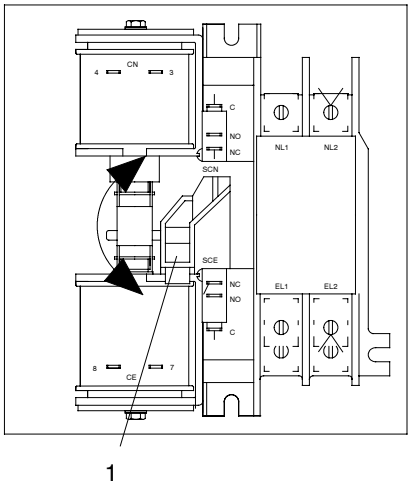
2.4.1 Manual Operation Procedure 1

Note: Never manually operate the transfer switch when the power is connected. Disconnect both power sources before manually operating the switch.

1. 100-200 amp switches: These switches have an attached handle as shown in Figure 2-4.
   400 amp switches: Slide the detachable handle or a wrench over the shaft. See Figure 2-5.

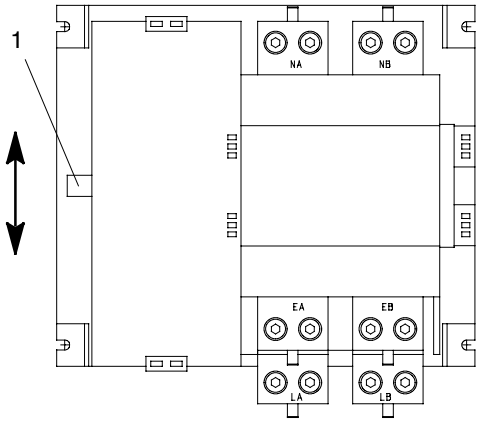
2. Move the handle up to place the transfer switch in the Normal Source position or down to place the contactor in the Emergency Source position. See Figure 2-4 or Figure 2-5.

3. 400 amp switches: Remove the detachable handle or wrench.



1. Handle (not detachable)

Figure 2-4 Manual Operation, 100 and 200 Amp Single-Phase Switches



1. Shaft (attach handle or wrench here)

Figure 2-5 Manual Operation, 400 Amp Single-Phase and 208-240 Volt Switches

2.4.2 Manual Operation Procedure 2

Note: Never use the maintenance handle to transfer the load with the power connected. Disconnect both power sources before manually operating the switch.

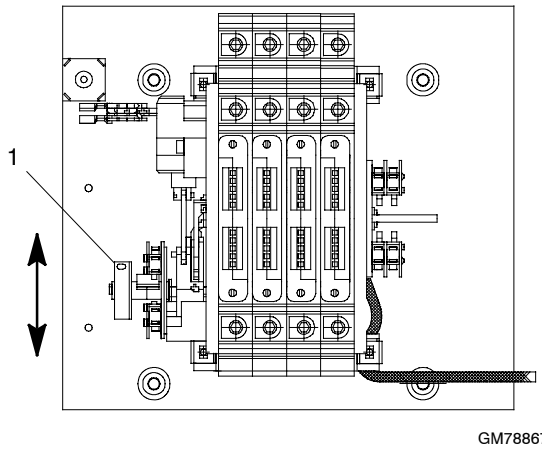
1. If the transfer switch is equipped with a maintenance handle, remove the handle from its storage location inside the enclosure. See Figure 2-7.

2. Insert the maintenance handle or a tool (such as a screwdriver) into the hole in the shaft on the left side of the operator as shown in Figure 2-6 or Figure 2-7.

3. Move the maintenance handle (or tool) up or down as shown to manually operate the transfer switch. It should operate smoothly without any binding. If it does not, check for shipping damage or construction debris.

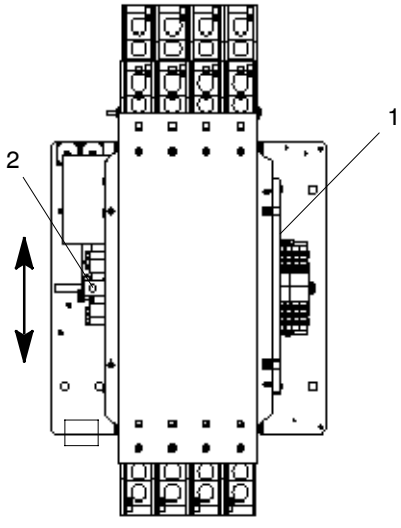
4. Return the transfer switch to the Normal position.

5. Remove the maintenance handle and return it to the storage location.



1. Insert handle or tool here for manual operation

Figure 2-6 Manual Operation, 100–200 Amp 3-Phase Switches



1. Handle storage location
2. Insert handle here for manual operation

Figure 2-7 Manual Operation, 400 Amp 3-Phase Switches

2.5 Electrical Wiring

Refer to the connection diagrams on the transfer switch enclosure door and the wiring diagrams in Section 6 during installation.

All wiring must comply with applicable national, state, and local electrical codes. Use separate conduit for AC power wiring and low-voltage DC, control, and communication system wiring.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

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

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

2.5.1 Load Center Circuit Breakers

The 100 amp Model RXT transfer switch is available with a built-in load center with room for up to 16 single-pole circuit breakers. Up to 8 tandem breakers can be used for a maximum of 24 circuits.

The load center uses Square D type QO or QOT tandem breakers. In an essential load application, the breakers can be moved from the main panel to the load center if the main distribution panel uses the same type of breakers. Otherwise, obtain and install new Square D type QO circuit breakers. The rating of the load center circuit breaker must match the rating of the existing breaker in the main panel for each circuit. If circuit breakers are removed from the load panel, install cover plates over the vacant positions. Cover plates can be obtained from a local Square D supplier.

Verify that the total rating for all breakers used in the load center does not exceed the rating of the transfer switch.

2.5.2 AC Power Connections

Determine the cable size. Refer to Figure 2-8 or the ADV drawings in Section 6 to determine the cable size required for the transfer switch. Make sure the lugs provided are suitable for use with the cables being installed.

Conduit. Use separate conduit for AC power wiring and low-voltage DC, control, and communication system wiring. Watertight conduit hubs may be required for outdoor use.

Select the proper cable clamp or use other approved methods for securing the cable or conduit to the enclosure.

Source and load connections. Clean cables with a wire brush to remove surface oxides before connecting them to the terminals. Apply joint compound to the connections of any aluminum conductors.

Refer to the connection diagrams on the transfer switch enclosure door and the wiring diagrams in Section 6. The connection points on the transfer switch contactor are labelled Normal, Emergency, and Load. Connect the utility power to Normal. Connect the generator set to Emergency.

Single phase. For single-phase models, connect to A and C.

Three phase. For three-phase models, be sure to follow the phase markings (A, B, C, and N).

Note: Connect the source and load phases as indicated by the markings and drawings to prevent short circuits and to prevent phase-sensitive devices from malfunctioning or operating in reverse.

Service entrance models. Connect the utility source to the lugs on the normal source disconnect circuit breakers as shown in the service entrance switch wiring diagram in Section 6.

Verify that all connections are consistent with drawings before tightening the lugs. Tighten all cable lug connections to the torque values shown on the label on the switch. Carefully wipe off any excess joint compound after tightening the terminal lugs.

On models with built-in load centers, the load lugs are factory-wired to the load center. Connect the load leads to the circuits in the load center and tighten the connections. Check the labels on the breakers for the tightening torques.

2.5.3 Neutral Connection

Connect the neutral from the main panel to the neutral lug in the ATS enclosure.

Ground the system according to NEC and local codes.

2.5.4 Neutral Bonding Jumper, Service Entrance Models

The transfer switch is shipped with the neutral-to-ground jumper installed. For non-service entrance applications, disconnect the neutral-to-ground bonding jumper. See the transfer switch dimension drawing.

2.5.5 Engine Start Function

The engine start function is controlled by the RDC2/DC2 controller on the generator set. There are no engine start terminals on the Model RXT ATS.

Cable Sizes						
AL/CU UL-Listed Solderless Screw-Type Terminals for External Power Connections						
Switch Size, Amps			Range of Wire Sizes, Cu/Al			
	Switch	Phases	Normal and Emergency	Load	Neutral	Ground
100	Standard	1	(1) #14 - 1/0 AWG	(1) #14 – 1/0 AWG	(3) #12 – 1/0 AWG	(9) #4 – 14 AWG
	With load center	1	(1) #14 – 1/0 AWG	per customer-supplied circuit breaker	(1) #2 – 2/0 AWG	(9) #4 – 14 AWG
	Service Entrance	1	Normal: (1) #12 – 2/0 AWG Emerg: (1) #6 – 250 MCM	(1) #6 – 250 MCM	(3) #6 – 250 MCM	(3) #14 – 1/0 AWG
	3-Phase	3	(1) #8 – 3/0 AWG	(1) #8 – 3/0 AWG	(3) #6 AWG – 3/0 AWG	(3) #6 – 3/0 AWG
200	Standard	1	(1) #6 AWG – 250 MCM	(1) #6 AWG – 250 MCM	(3) #6 AWG – 250 MCM	(9) #4 – 14 AWG
	Service Entrance	1	Normal: (1) #4 – 300 MCM Emerg: (1) #6 - 250 MCM	(1) #6 AWG – 250 MCM	(3) #6 AWG – 250 MCM	(3) #14 – 1/0 AWG
	3-Phase	3	(1) #6 AWG – 250 MCM	(1) #6 AWG – 250 MCM	(3) #4 AWG – 600 MCM (6) 1/0 – 250 MCM	(3) #6 – 3/0 AWG
400	Standard	1	(2) #6 – 250 MCM	(2) #6 – 250 MCM	(1) #4 – 600 MCM (2) 1/0 – 250 MCM	(3) #14 – 1/0 AWG
	Service Entrance	1	Normal: (2) 3/0 – 250 MCM Emerg: (2) #6 - 250 MCM	(2) #6 – 250 MCM	(3) #4 – 600 MCM (6) 1/0 – 250 MCM	
	3-pole 208-240 V	3	(2) #6 – 250 MCM	(2) #6 – 250 MCM	(1) #4 – 600 MCM (2) 1/0 – 250 MCM	
	3 or 4 pole 480 V	3	(1) #4 – 600 MCM (2) #6 – 250 MCM	(1) #4 – 600 MCM (2) #6 – 250 MCM	(1) #4 – 600 MCM (2) 1/0 – 250 MCM	

Figure 2-8 Cable Sizes

2.5.6 Interface Module Connection

The interface module must be connected to a Kohler® generator set equipped with the RDC2 or DC2 controller. The generator set is typically equipped with a field-connection terminal block. See the generator set Installation Manual for the location of the terminal block.

Note: This document gives connection information for one Model RXT transfer switch connected to a generator set equipped with an RDC2 or DC2 controller. If additional accessory modules such as a programmable interface module (PIM) or a load control module (LCM) are connected, refer to the generator set installation manual for cable requirements and connection instructions.

See Figure 2-9 and Figure 2-10. Use 20 AWG Belden #9402, 8723, or equivalent shielded, twisted-pair cable to connect P10-1 through P10-4 on the controller interface module to the generator set terminal block connections A, B, PWR, and COM. The maximum cable length is 61 meters (200 ft.).

Alternatively, 12–14 AWG wire can be used for the PWR and COM connections *only.* If 12–14 AWG wire is used for the PWR and COM connections, the maximum cable length is 152 m (500 ft.) if one Model RXT transfer switch and no accessory modules are connected to the generator set.

Note: Connections 3 and 4 on the generator set are not used with the Model RXT transfer switch.

Terminal Block	Connection	Designation	Description	Wire Size
P10	P10-1	A	Communication Line	20 AWG shielded twisted-pair, Belden 9402, 8723, or equivalent
	P10-2	B	Communication Line	
	P10-3	PWR	12 VDC	20 AWG shielded twisted-pair Belden 9402 or 12–14 AWG wire
	P10-4	COM	12 VDC	

Figure 2-9 Controller Interface Connections

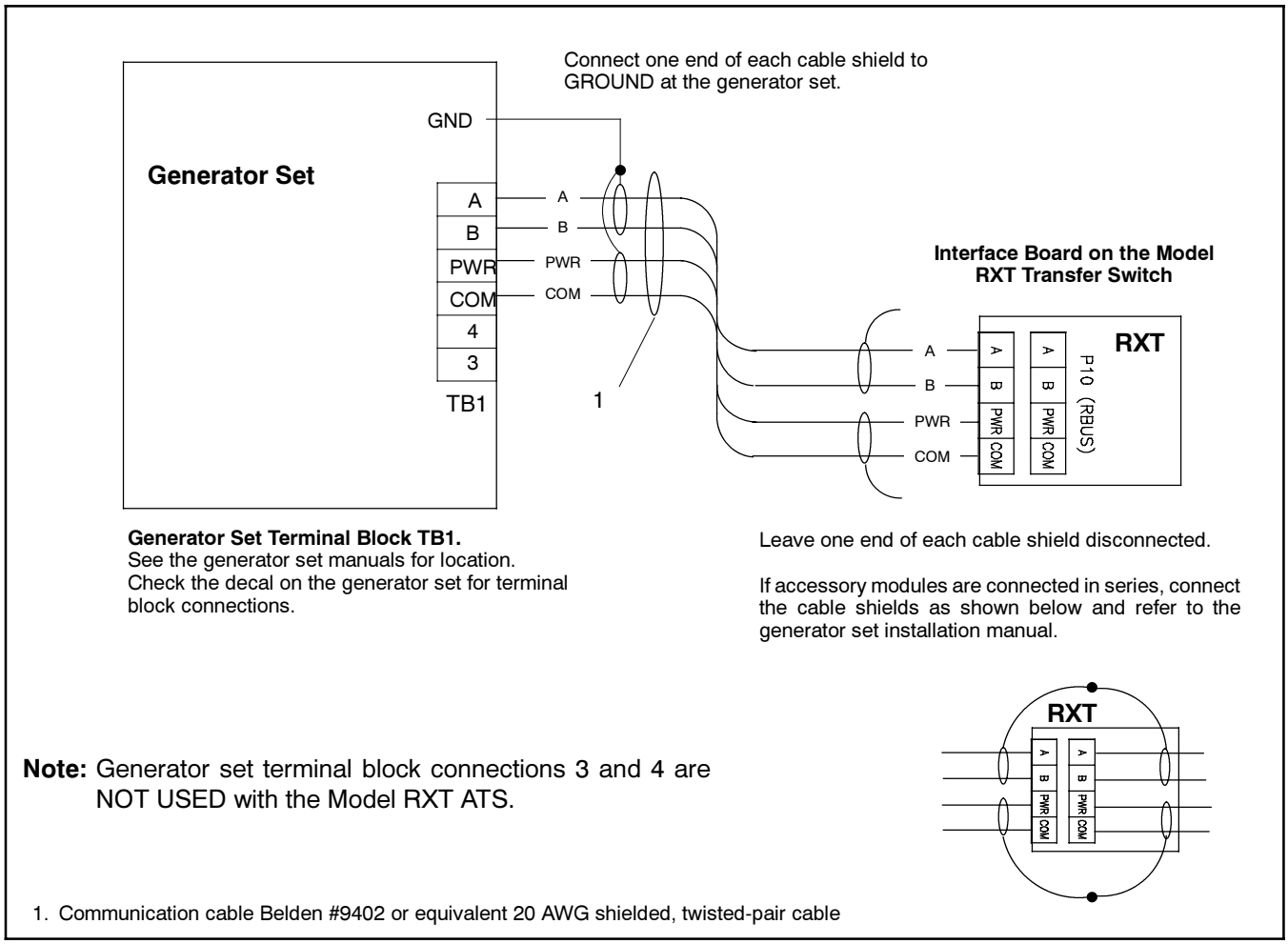


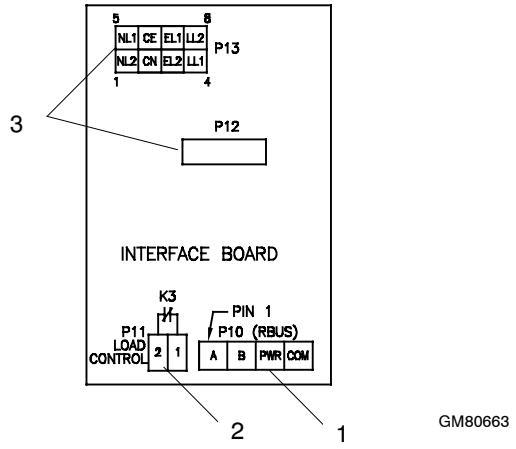
Figure 2-10 Interface Module Connection to Generator Set Field-Connection Terminal Block

2.5.7 Optional Load Control Connection

Connector P11 on the interface module provides a connection point for optional load control circuits. The load control contact provides a delayed contact closure to allow startup of selected loads 5 minutes after transfer to the emergency power source (generator set). Use this contact to delay startup of equipment with large motor-starting loads such as air conditioners.

See Figure 2-11 for the location of load control connector P11. See Figure 2-12 for contact ratings, connection, and wire size information.

Note: An optional load control module is available for generator sets equipped with the RDC2 or DC2 controller. The load control module allows management of up to six separate loads (two HVAC thermostat connections and four other non-essential loads). See TT-1574, Load Control Module Instructions.



1. ATS/generator set interface connection P10
2. Load control connection P11
3. Factory connections

Figure 2-11 Interface Module Connections

2.5.8 Accessory Module Connections

For connection of the optional load control module (LCM) or programmable interface module (PIM), refer to the instructions provided with the modules and to the generator set installation manual.

2.6 Test and Exercise

Refer to the generator set Operation Manual for instructions to test the power system operation and to set the RDC2 or DC2 controller for weekly exercise runs to keep the power system in good operating condition.

2.7 Warranty Registration

Startup Notification Form. The Startup Notification Form covers all equipment in the standby system. Complete the Startup Notification Form and register the equipment in the Kohler online warranty system within 60 days of the initial startup date. Standby systems not registered within 60 days of startup are automatically registered using the manufacturer's ship date as the startup date.

Terminal Block	Connection	Designation	Description	Contact Rating	Wire Size
P11	P11-1	LC1	Load Control Output	10 A @ 250 VAC 1 A @ 30 VDC	#12–18 AWG
	P11-2	LC2			

Figure 2-12 Load Control Contact P11 Connections

3.1 Model RXT Transfer Switch Operation

The Model RXT transfer switch must be connected to a generator set equipped with the RDC2 or DC2 controller. The RDC2/DC2 generator set/transfer switch controller manages automatic transfer switch (ATS) functions when connected to a Kohler® Model RXT transfer switch through the ATS interface board. The controller receives voltage sensing data from the Model RXT ATS and operates the generator set and transfer switch to provide standby power when utility power is lost.

See the generator set operation manual for:

- ATS status screens and configuration menus.
- Information about loaded exercise.

3.2 Source Availability

The Model RXT transfer switch supplies voltage sensing data to the RDC2 or DC2 controller through the ATS interface board. If the source voltage falls below the undervoltage dropout setting, the source is considered to have failed. See Figure 3-1.

Voltage Sensing Parameter	Setting
Accuracy	±5%
Undervoltage Dropout	90% of Pickup
Undervoltage Pickup	90% of Nominal

Figure 3-1 Voltage Sensing Parameters

3.3 ATS Control Sequence of Operation

See Figure 3-2 for time delay settings.

Preferred Source Fails:

1. The load control contact opens.
2. The engine start time delay times out.
3. The generator set is signaled to start.
4. The generator starts and the emergency source becomes available.
5. The normal-to-emergency time delay times out.
6. The transfer switch transfers to the emergency source.
7. The load control contact time delay times out.
8. The load control contact closes.

Normal Source Returns:

1. The emergency-to-normal time delay times out.
2. The contactor transfers to the normal source.
3. The engine cooldown time delay times out.
4. The generator is signaled to stop.

3.4 Time Delays

Time delays are factory-set to the values shown in Figure 3-2. An authorized distributor/dealer can adjust time delays using a personal computer and Kohler® SiteTech™ software.

Time delays described in this section operate only when the RDC2 or DC2 generator set controller is connected to a Kohler® Model RXT transfer switch.

The engine start and load transfer time delays prevent engine start and load transfer caused by brief variations in the utility power source.

3.5 Load Control Time Delay

The load control time delay allows delayed starting of large motor loads (such as air conditioners), preventing simultaneous starting of large motors after transfer to the generator set. The load control time delay is fixed at 5 minutes. It is not adjustable.

The load must be connected to the load control output on the interface board of the Model RXT transfer switch. See the transfer switch operation and installation manual for connection instructions.

Note: A separate load control module (LCM) that provides four power relays and two HVAC relays is available for generator sets equipped with the RDC2 or DC2 controller. See LCM Specification Sheet G6-120 for more information.

Time Delay	Setting	Description
Engine Start	3 seconds	Time delay after utility source is lost until the engine start cycle begins. Guards against starting the generator set because of a brief change in the utility source.
Transfer, Normal to Emergency	3 seconds	Time delay after emergency source becomes available until transfer to emergency source.
Transfer, Emergency to Normal	2 minutes	Time delay after the utility source returns until transfer back to normal. Ensures that the the utility source is stable before transferring from the emergency source.
Load Control	5 minutes	Allows delayed connection of selected loads to the generator set. Prevents simultaneous starting of large motors after transfer to the emergency source. Recommended for delayed starting of air conditioners.

Figure 3-2 Time Delays

Note: This section applies only to service entrance model transfer switches, which are identified with the letters ASE at the end of the model designation.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

This equipment must be installed and serviced by qualified electrical personnel.

4.1 Service Disconnect Procedure

Use the following procedure to disconnect the utility source on service entrance model transfer switches.

Note: Power is still present on the input side of the utility source circuit breaker after this procedure.

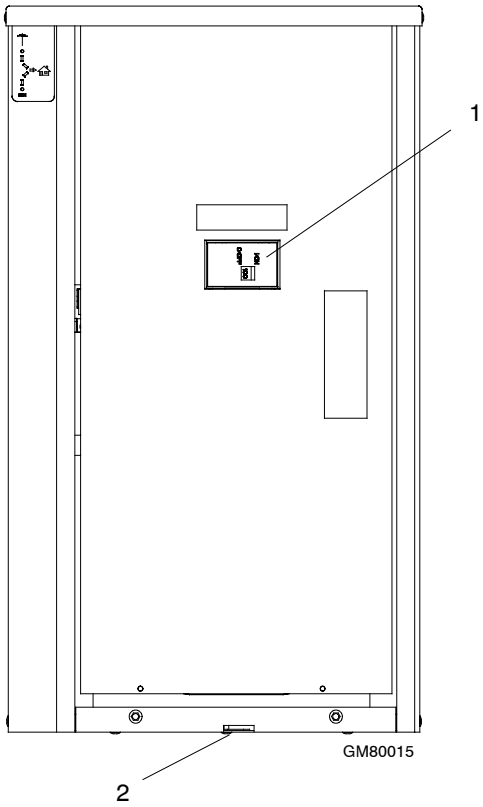
1. Prevent the emergency generator set from starting:
   a. Press the OFF button on the generator set controller.
   b. Disconnect power to the generator set battery charger.
   c. Disconnect the generator set engine starting battery, negative (–) lead first.
2. On the transfer switch, remove the outer enclosure door only.
3. Move the utility source circuit breaker to the OFF position.

   Note: Power is still present on the input side of the utility source circuit breaker. Do not remove the protective barrier around the utility source connection lugs.
4. To lock out the transfer switch, replace the outer door and attach a padlock to the hasp.

4.2 Source Circuit Breaker Reset

The utility source circuit breaker can trip due to an overcurrent condition. Identify and correct the cause of the overcurrent condition before resetting the circuit breaker. Contact a local distributor/dealer for service if necessary.

When the circuit breaker trips, the handle moves to an intermediate position. To reset a tripped circuit breaker, move the handle to the extreme OFF position and then to the ON position.



1. Normal/utility circuit breaker
2. Padlock hasp

Figure 4-1 Service Entrance Model, Door Removed

Notes

5.1 Introduction

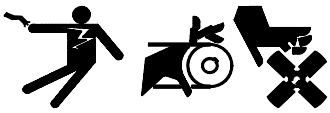
Regular preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspection, and replacement of worn or missing components. Section 5.4 contains a service schedule for recommended maintenance tasks.

A local authorized distributor/dealer can provide complete preventive maintenance and service to keep the transfer switch in top condition. Unless otherwise specified, have maintenance or service performed by an authorized distributor/dealer in accordance with all applicable codes and standards. See the Service Assistance section in this manual for how to locate a local distributor/dealer.

Keep records of all maintenance or service.

Replace all barriers and close and lock the enclosure door after maintenance or service and before reapplying power.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ WARNING

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

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

Grounding 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.

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

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

NOTICE

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

NOTICE

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

Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

5.2 Testing

5.2.1 Weekly Generator Set Exercise

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

5.2.2 Monthly Automatic Control System Test

Test the transfer switch's automatic control system monthly. Refer to the RDC2/DC2 controller operation 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 preferred source failure occurs or is simulated.
- Watch and listen for signs of excessive noise or vibration during operation.
- After the switch transfers the load to the standby source, end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the preferred source.

5.3 Inspection and Service

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

5.3.1 General Inspection

External Inspection. Keep the transfer switch clean and in good condition by performing a weekly general external inspection of the transfer switch. Check for any condition of vibration, leakage, excessive 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.

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

Tighten loose external hardware. Replace worn, missing, or broken external components with manufacturer-recommended replacement parts. Contact an authorized distributor/dealer for specific part information and ordering.

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

- Accumulations of dirt, dust, moisture, or other contaminants.
- Signs of corrosion.
- Worn, missing, or broken components.
- Loose hardware.
- Wire or cable insulation deterioration, cuts, or abrasion.

- Signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor.

- Other evidence of wear, damage, deterioration, or malfunction of the transfer switch or its components.

If the application does not allow a power interruption for the time required for the internal inspection, have an authorized distributor/dealer perform the internal inspection.

5.3.2 Other Inspections and Service

Have an authorized distributor/dealer perform scheduled maintenance, service, and other maintenance that ensures the safe and reliable operation of the transfer switch. See Section 5.4, Service Schedule, for the recommended maintenance items and service intervals.

Have an authorized distributor/dealer repair or replace damaged or worn internal components with manufacturer-recommended replacement parts.

5.4 Service Schedule

Follow the service schedule in Figure 5-1 for the recommended service intervals. Have all service performed by an authorized distributor/dealer except for activities designated by an X, which may be performed by the switch operator.

System Component or Procedure	See Section	Visually Inspect	Check	Adjust, Repair, Replace	Clean	Test	Frequency
Electrical System							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor	5.3.1	X	X				Y
Check the contactor's external operating mechanism for cleanliness; clean and relubricate if dirty *	5.3.1	X			D (clean and lube)		Y
Inspect wiring insulation for deterioration, cuts, or abrasion. Repair or replace deteriorated or damaged wiring	5.3.1	X	D	D			Y
Tighten control and power wiring connections to specifications	2.5		D			D	Y
Check the transfer switch's main power switching contacts' condition; clean or replace the main contacts or replace the contactor assembly as necessary	S/M	D		D	D		Y
General Equipment Condition							
Inspect the outside of the transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration *	5.3	X			X		M
Check that all external hardware is in place, tightened, and not badly worn	5.3	X	X	X			M
Inspect the inside of transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration *	5.3	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn	5.3	X	D	D			Y

* Service more frequently if the transfer switch is 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.

Adjust, Repair, Replace: Includes tightening hardware and lubricating the mechanism. 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 distributor/dealer.

Symbols used in the chart:

X=The transfer switch operator can perform these tasks.
D=Authorized distributor/dealer must perform these tasks.
W=Weekly
M=Monthly
Q=Quarterly
S=Semiannually (every six months)
Y=Yearly (annually)
W/D=Wiring diagram

Figure 5-1 Service Schedule

Notes

Diagram or Drawing	Drawing Number	Page
Single-Phase		
Enclosure Dimension Drawings		
100–200 Amp Single-Phase		
Sheet 1	ADV-8190 1 of 2	30
Sheet 2	ADV-8190 2 of 2	31
100 Amp Single-Phase with Load Center	ADV-8197	41
400 Amp Single-Phase	ADV-8193	36
Wiring Diagrams		
100–400 Amp Single-Phase	GM80663	42
100 Amp Single-Phase with Load Center	GM80675	52
Schematic Diagrams		
100–400 Amp Single-Phase	GM80664	43
100 Amp Single-Phase with Load Center	GM80676	53
Service Entrance		
Enclosure Dimension Drawings		
100–200 Amp Single-Phase Service Entrance		
Sheet 1	ADV-8192 1 of 3	33
Sheet 2	ADV-8192 2 of 3	34
Sheet 3	ADV-8192 3 of 3	35
400 Amp Single-Phase Service Entrance Switch		
Sheet 1	ADV-8196 1 of 2	39
Sheet 2	ADV-8196 2 of 2	40
Wiring Diagrams		
100–400 Amp Service Entrance	GM80665	44
Schematic Diagrams		
100–400 Amp Service Entrance	GM80666	45
Three-Phase		
Enclosure Dimension Drawings		
100–200 Amp Standard, Three-Phase, 3- and 4-Pole	ADV-8191	32
400 Amp Standard, Three-Phase, 3-pole 208–240 V	ADV-8194	37
400 Amp Standard, Three-Phase, 4-pole and 3-Pole/480 V	ADV-8195	38
Wiring Diagrams		
100–200 Amp Standard, Three-Phase, 3- and 4-Pole	GM80667	46
400 Amp Standard, Three-Phase, 3-pole 208–240 V	GM80669	48
400 Amp Standard, Three-Phase, 4-pole and 3-Pole/480 V	GM80671	50
Schematic Diagrams		
100–200 Amp Standard, Three-Phase, 3- and 4-Pole	GM80668	47
400 Amp Standard, Three-Phase, 3-pole 208–240 V	GM80670	49
400 Amp Standard, Three-Phase, 4-pole and 3-Pole/480 V	GM80672	51

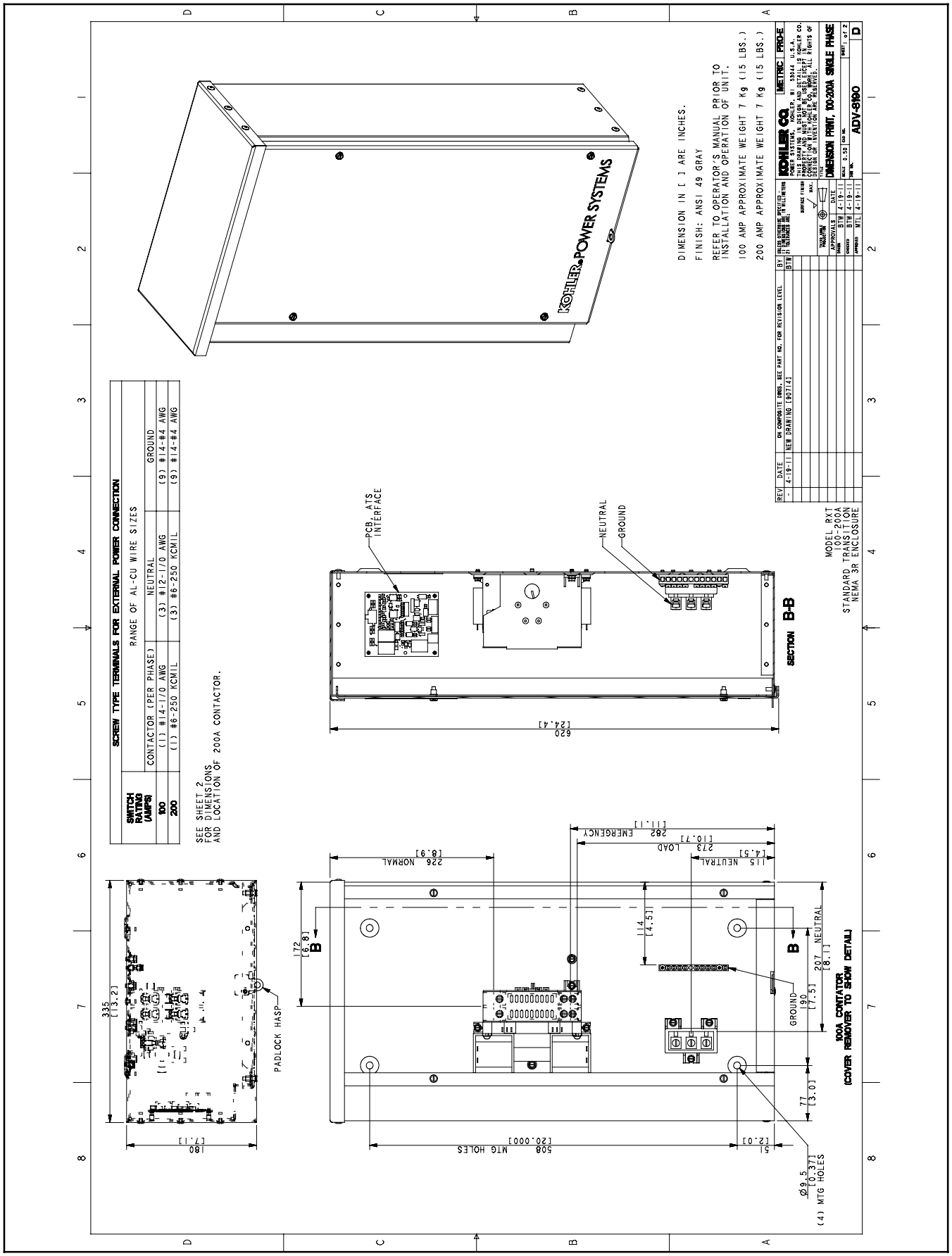


Figure 6-1 Enclosure Dimensions, 100–200 Amp Single-Phase, ADV-8190, Sheet 1 of 2

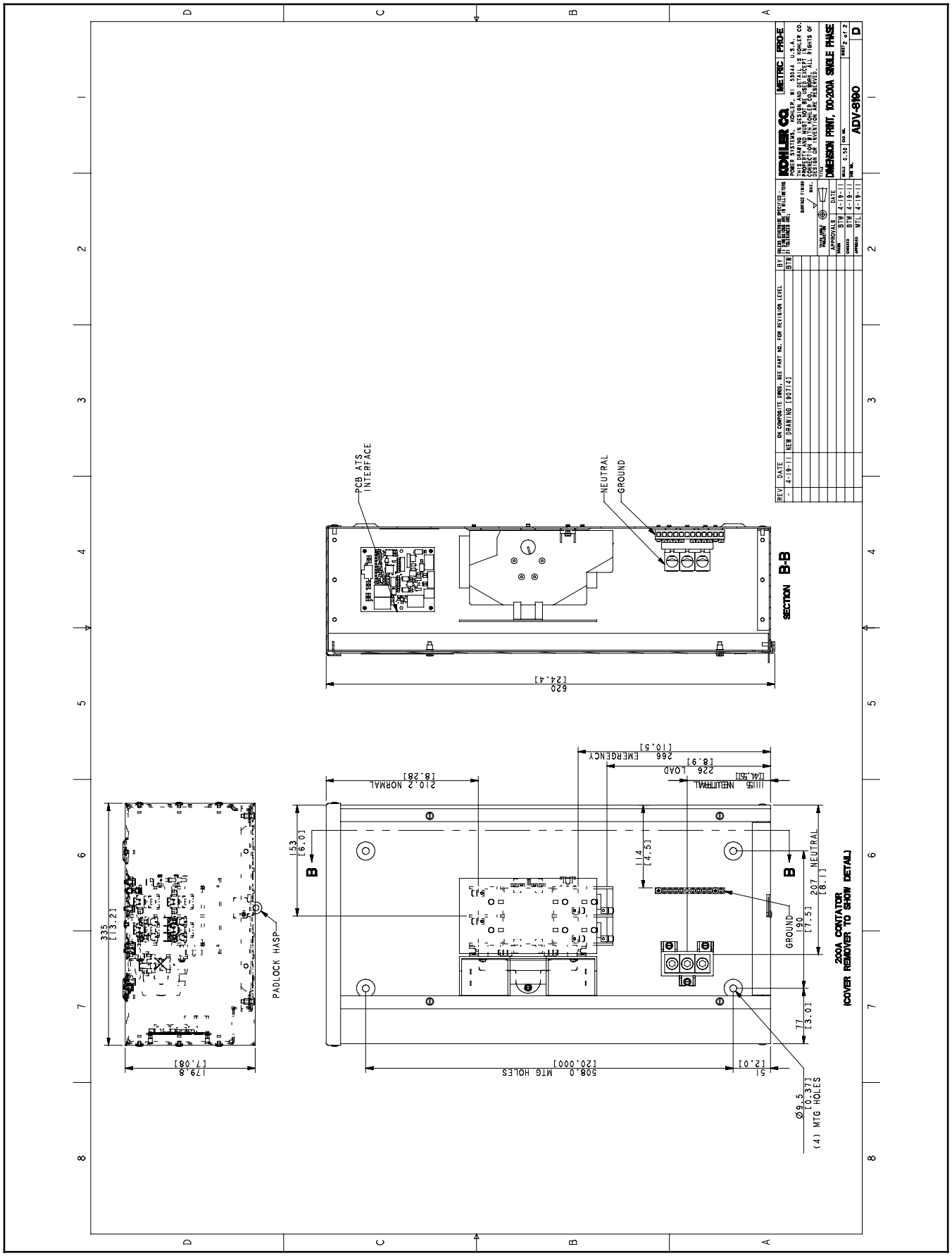


Figure 6-2 Enclosure Dimensions, 100–200 Amp Single-Phase, ADV-8190, Sheet 2 of 2

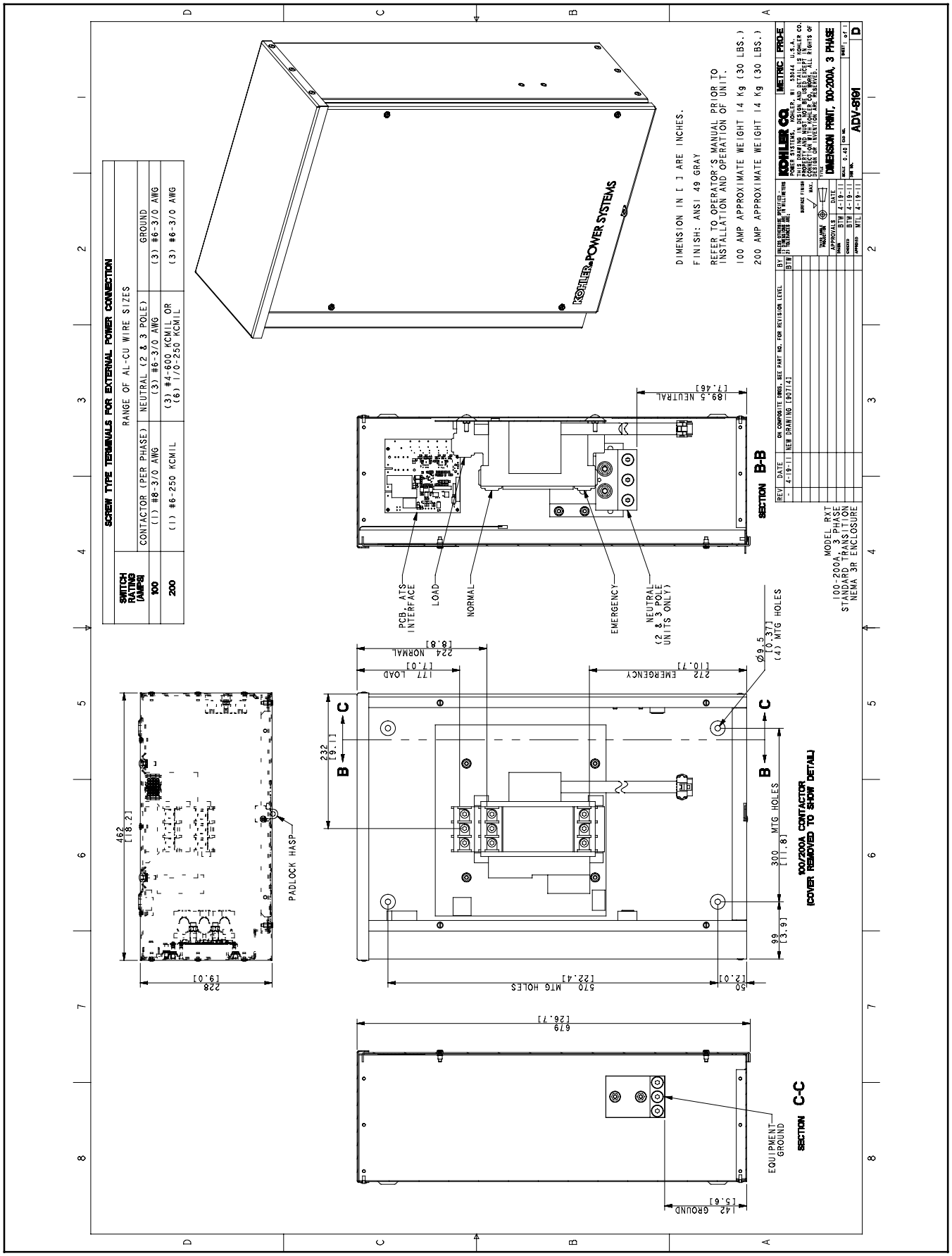


Figure 6-3 Enclosure Dimensions, 100–200 Amp Three-Phase, 3- and 4-Pole, ADV-8191

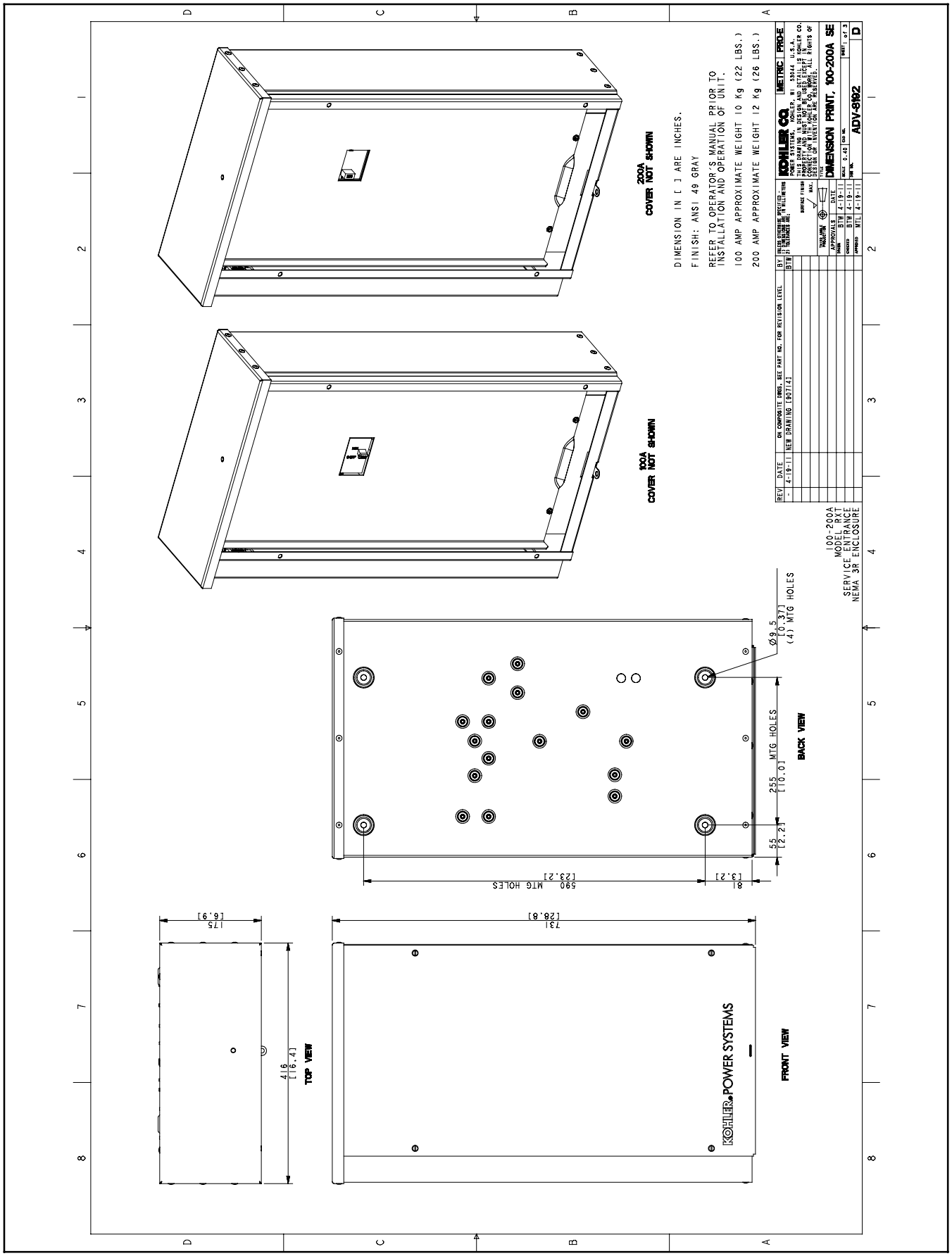


Figure 6-4 Enclosure Dimensions, 100–200 Amp Single-Phase, Service Entrance, ADV-8192, Sheet 1 of 3

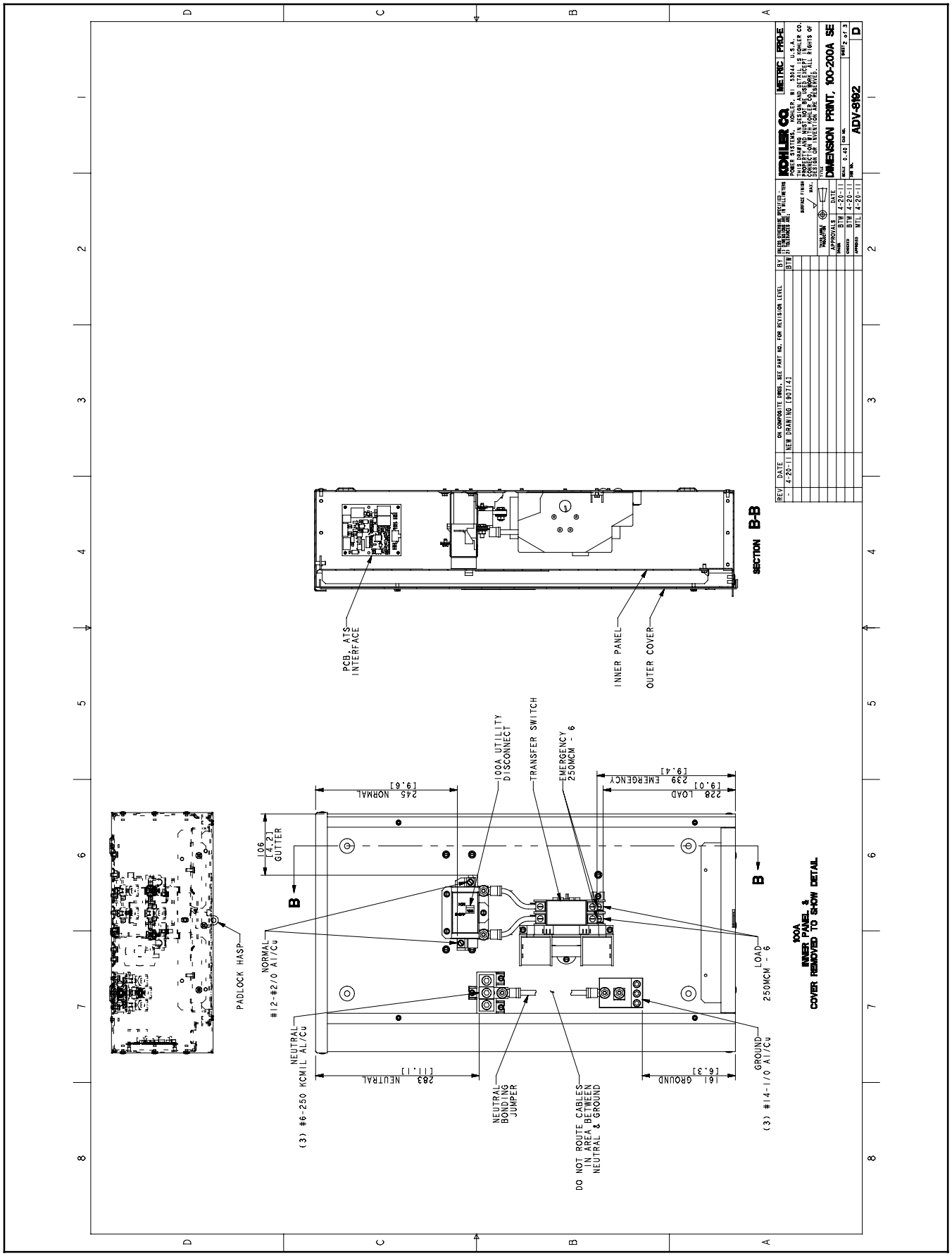


Figure 6-5 Enclosure Dimensions, 100–200 Amp Single-Phase, Service Entrance, ADV-8192, Sheet 2 of 3

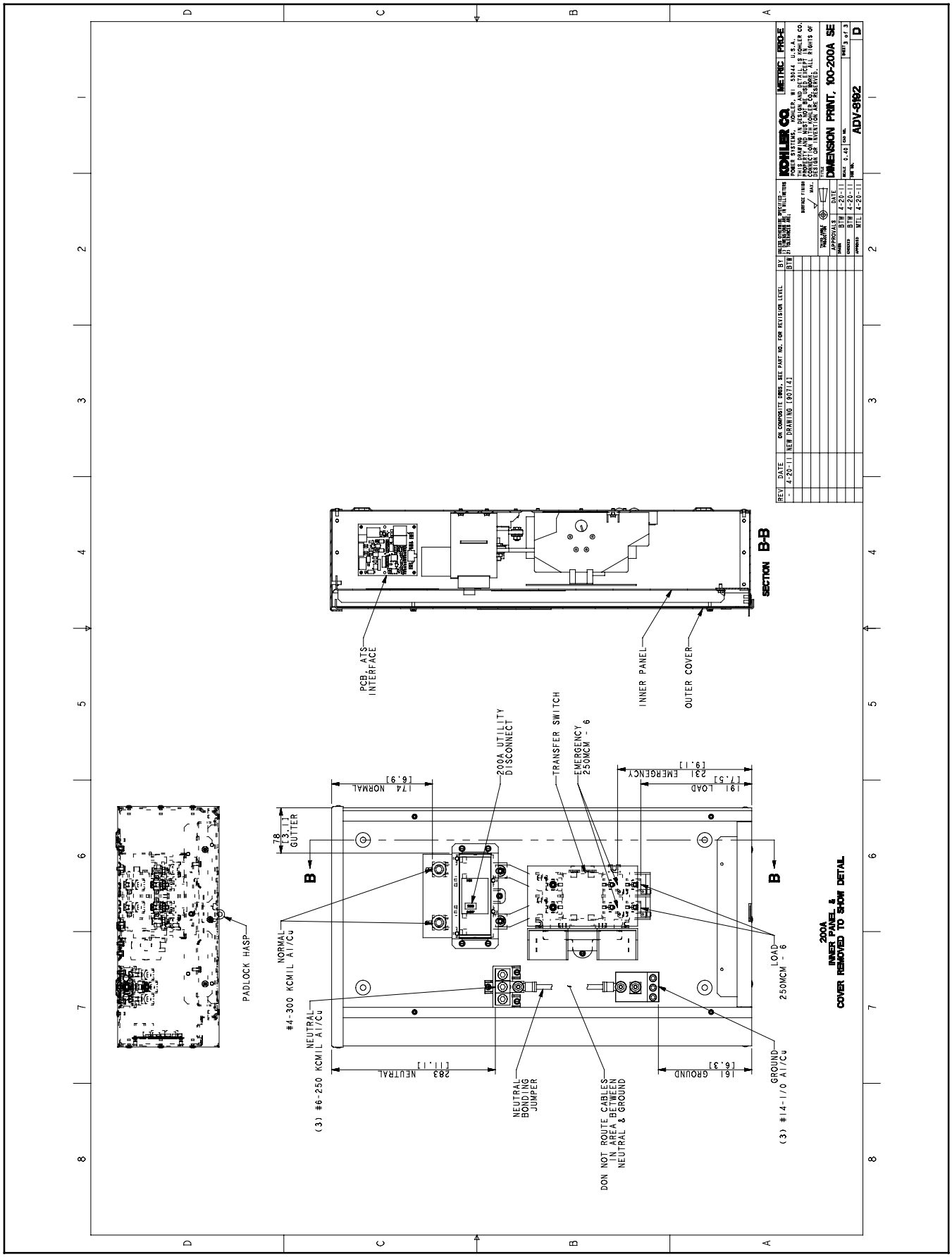


Figure 6-6 Enclosure Dimensions, 100–200 Amp Single-Phase, Service Entrance, ADV-8192, Sheet 3 of 3

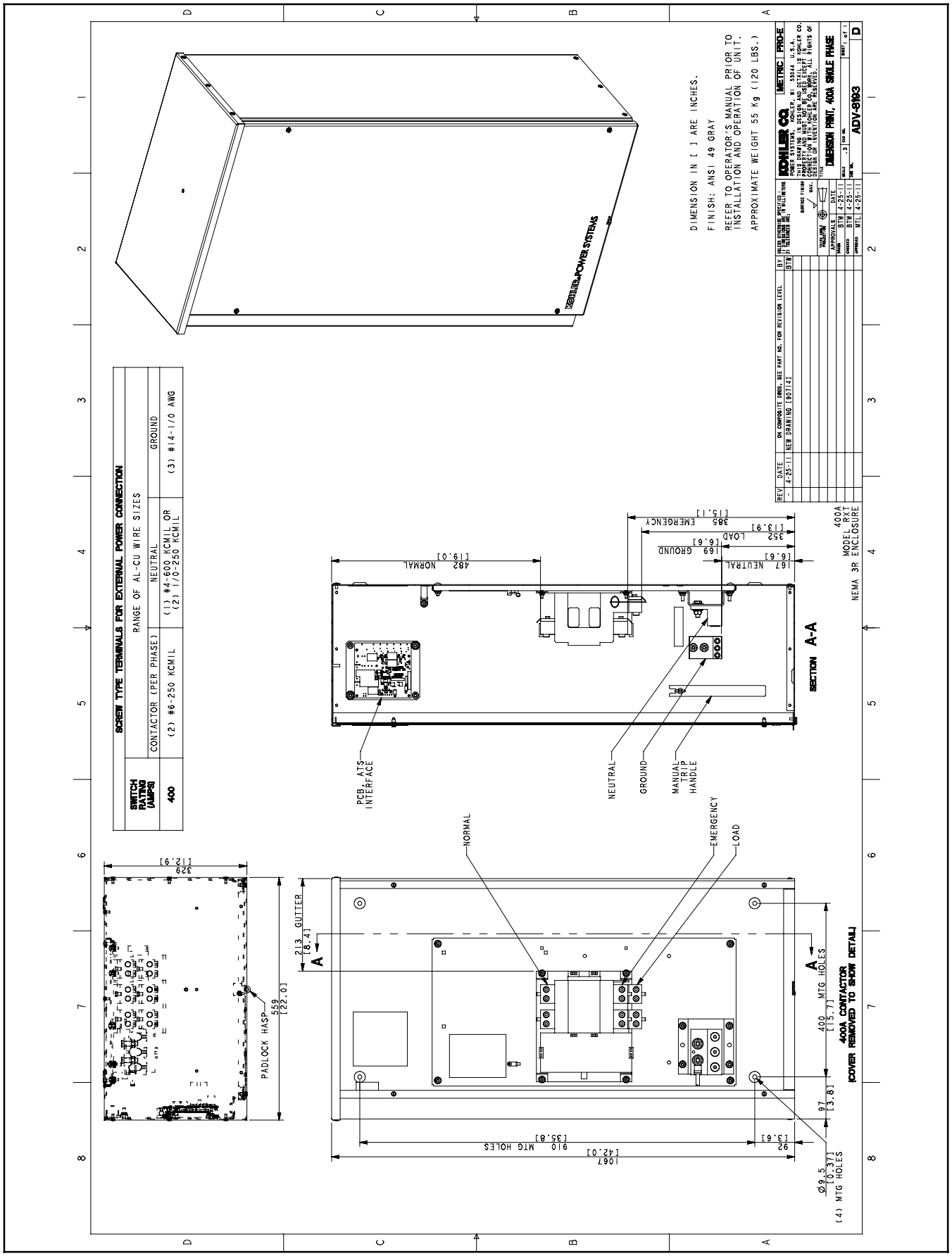


Figure 6-7 Enclosure Dimensions, 400 Amp Single-Phase, ADV-8193

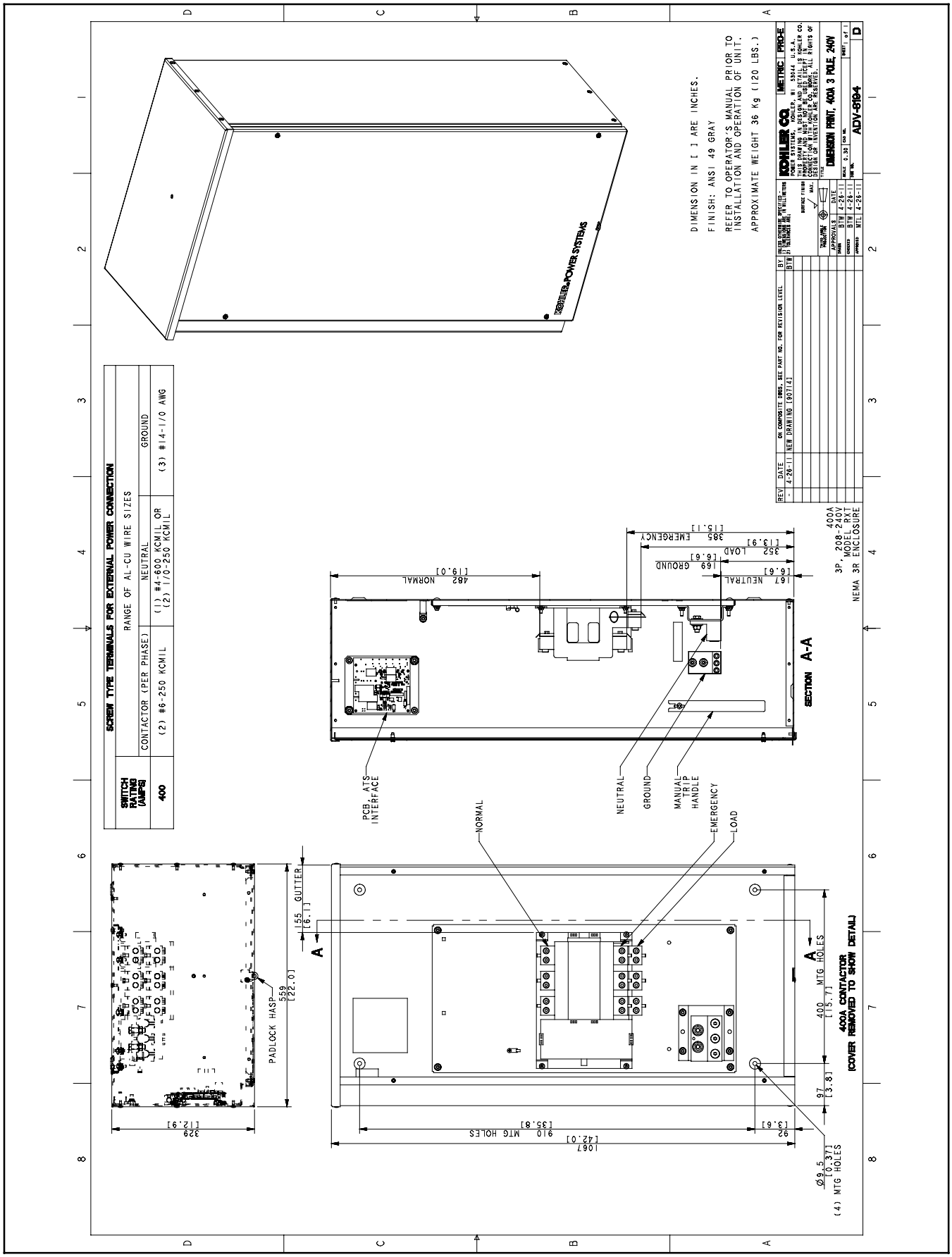


Figure 6-8 Enclosure Dimensions, 400 Amp Three-Phase, 3-Pole/208–240 Volts, ADV-8194

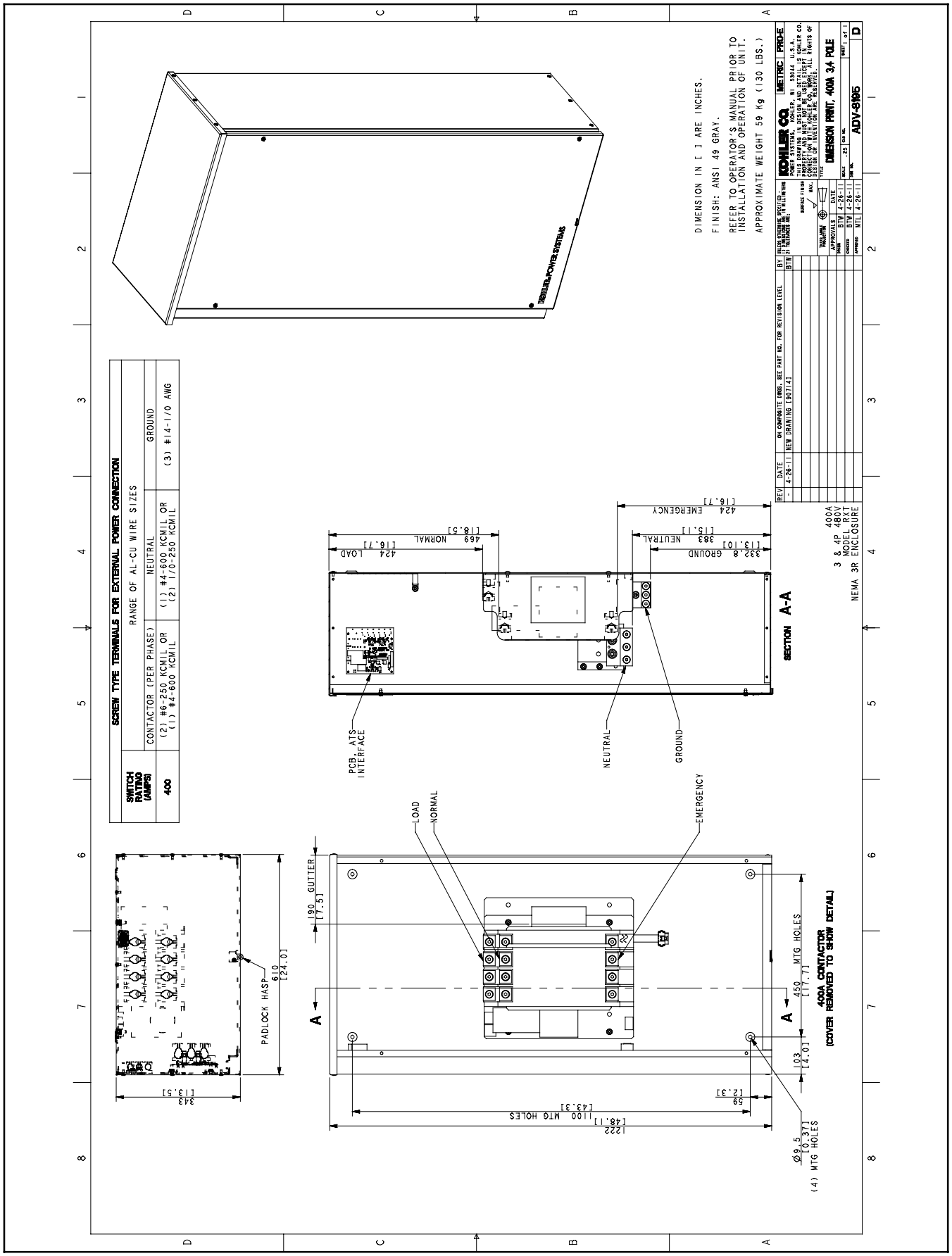


Figure 6-9 Enclosure Dimensions, 400 Amp Three-Phase, 3-Pole/480 Volt and 4-Pole, ADV-8195

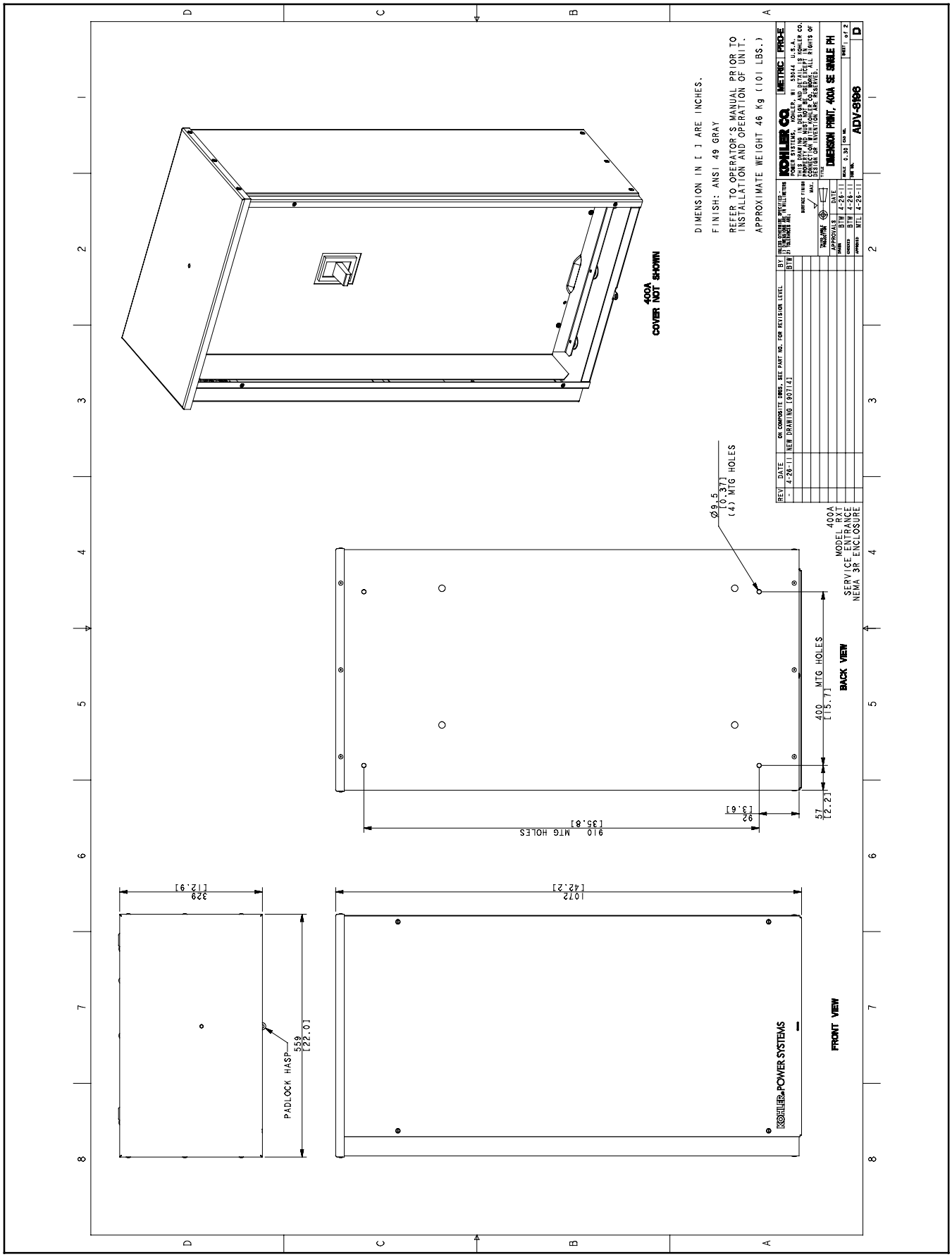


Figure 6-10 Enclosure Dimensions, 400 Amp Single-Phase, Service Entrance, ADV-8196, Sheet 1 of 2

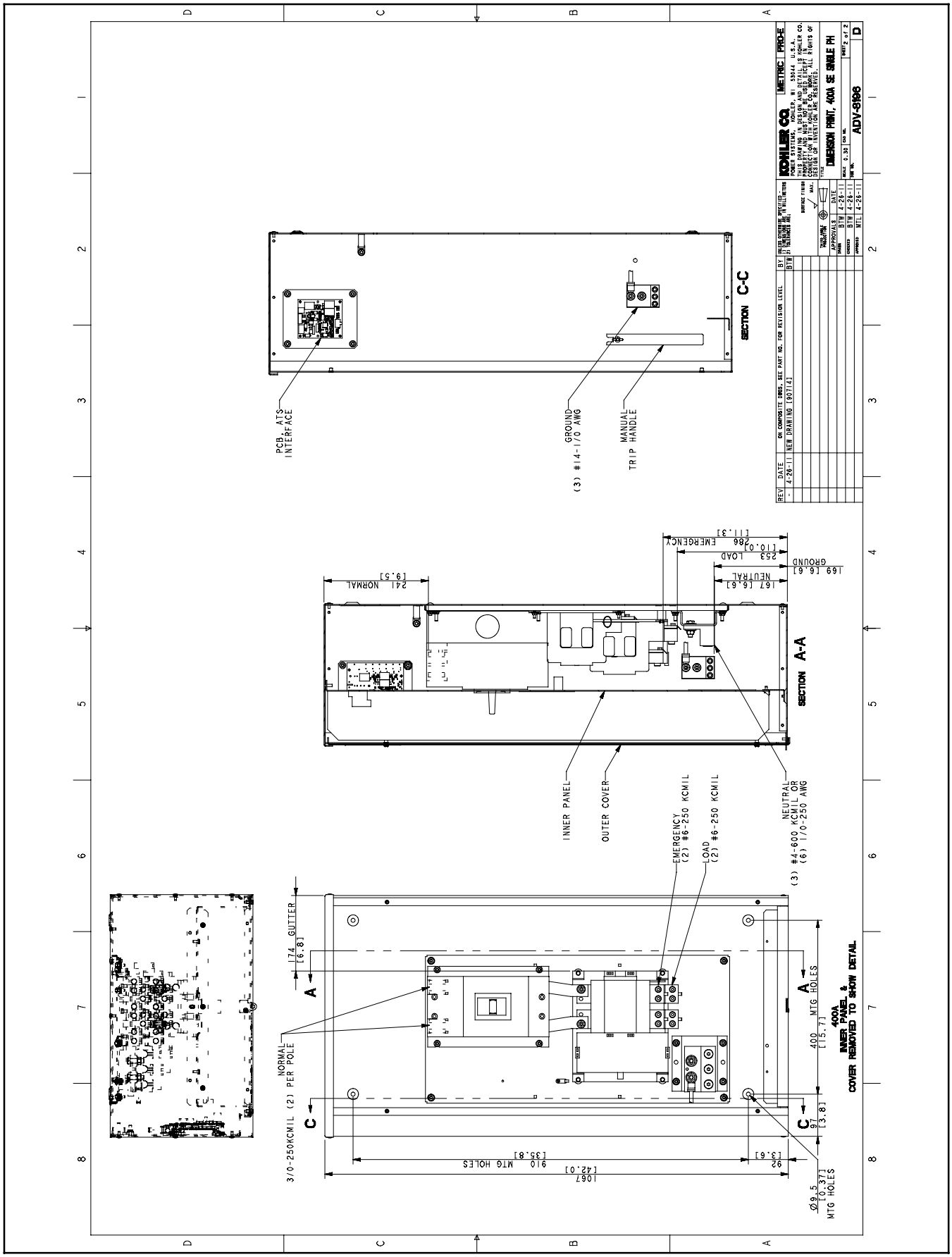


Figure 6-11 Enclosure Dimensions, 400 Amp Single-Phase, Service Entrance, ADV-8196, Sheet 2 of 2

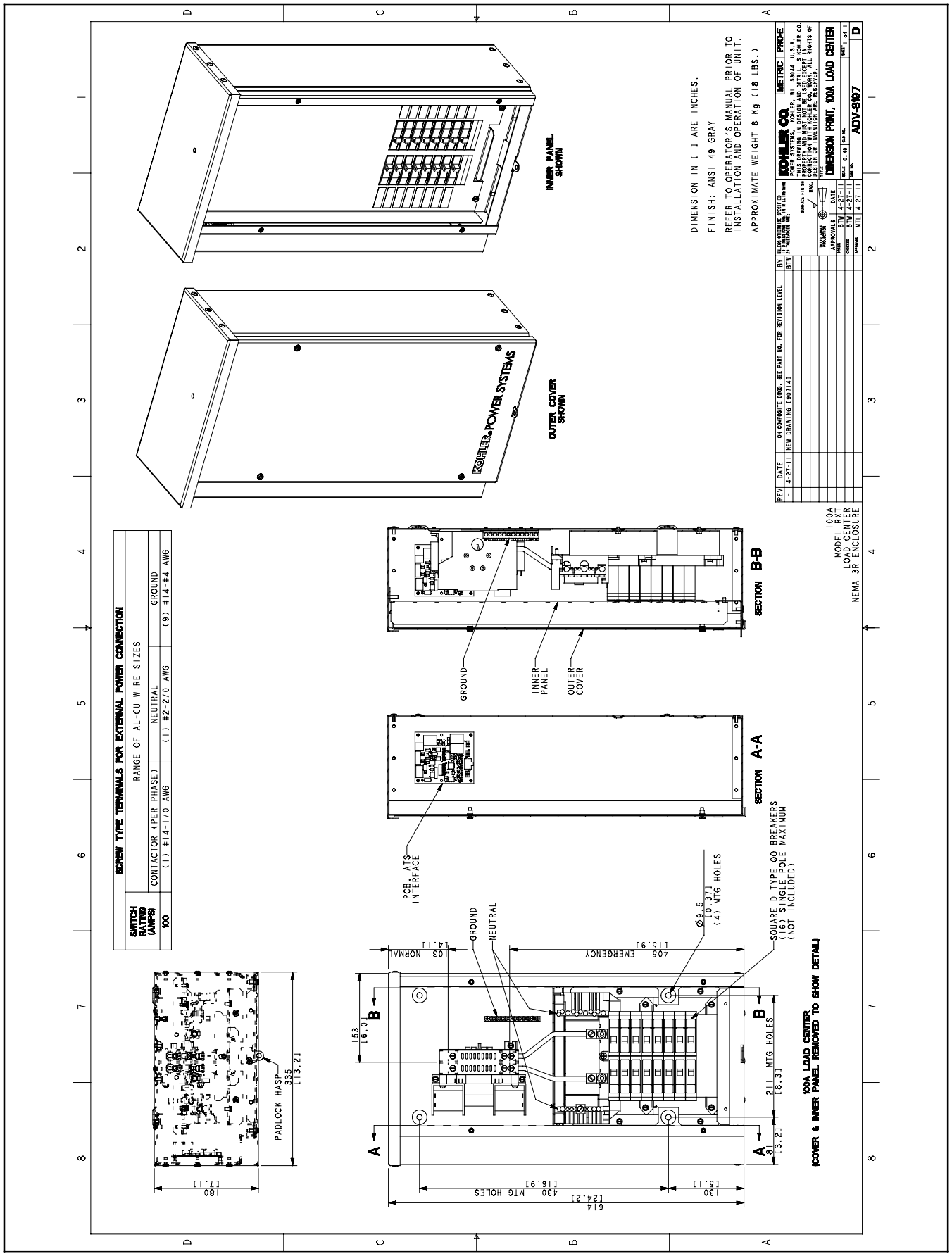


Figure 6-12 Enclosure Dimensions, 100 Amp Single-Phase with Load Center, ADV-8197

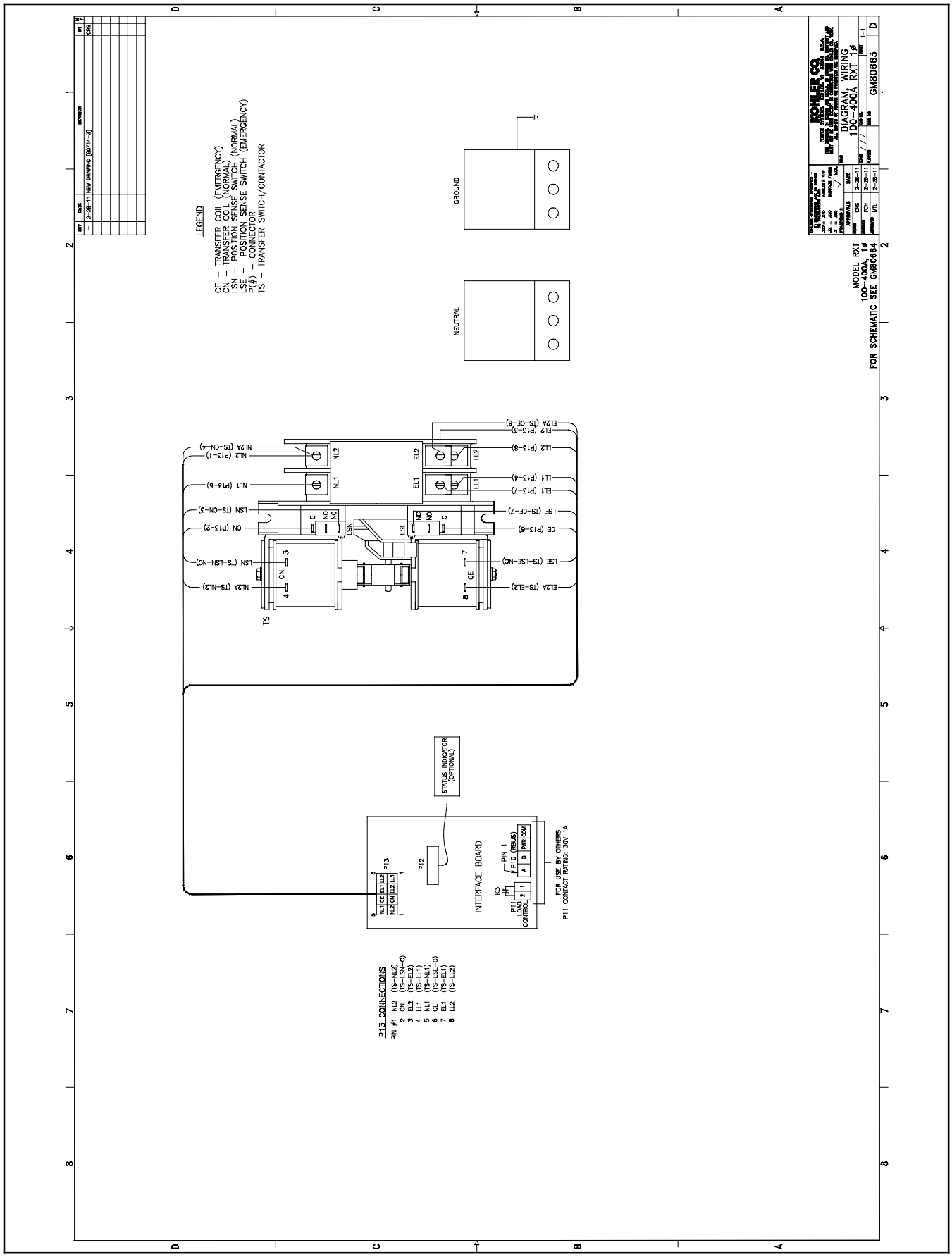


Figure 6-13 Wiring Diagram, 100–400 Amp Single-Phase, GM80663

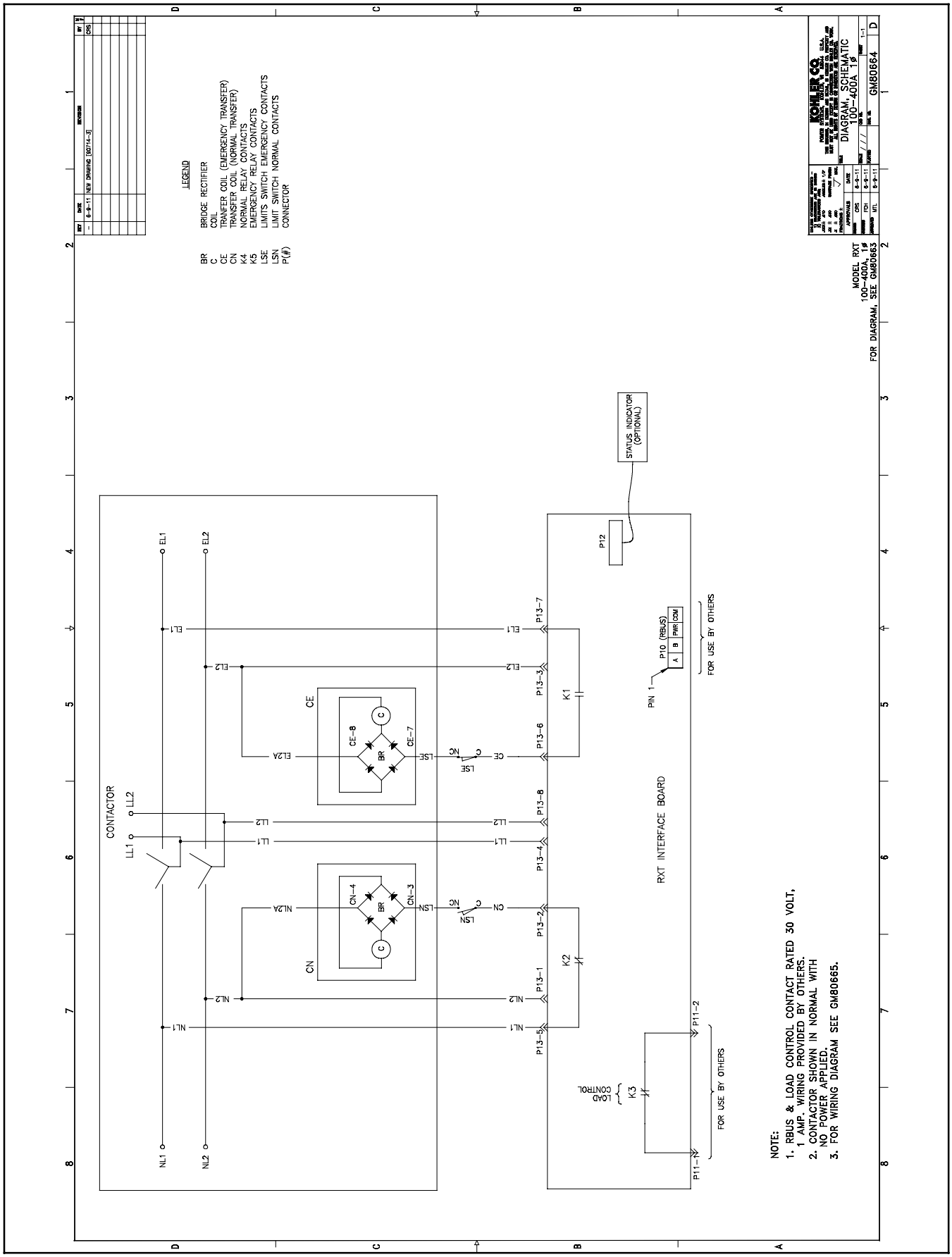


Figure 6-14 Schematic Diagram, 100-400 Amp Single-Phase, GM80664

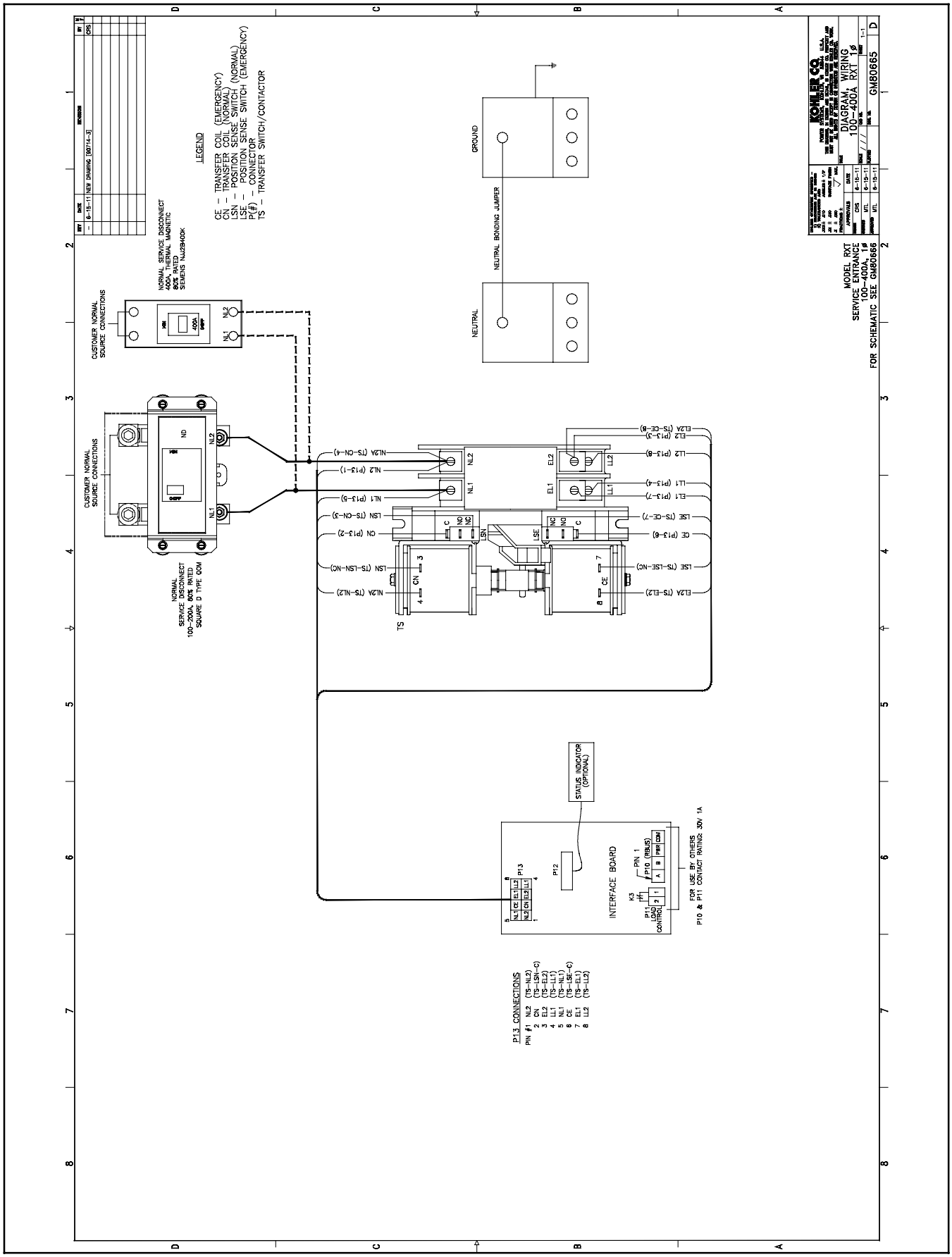


Figure 6-15 Wiring Diagram, 100–400 Amp Service Entrance, GM80665

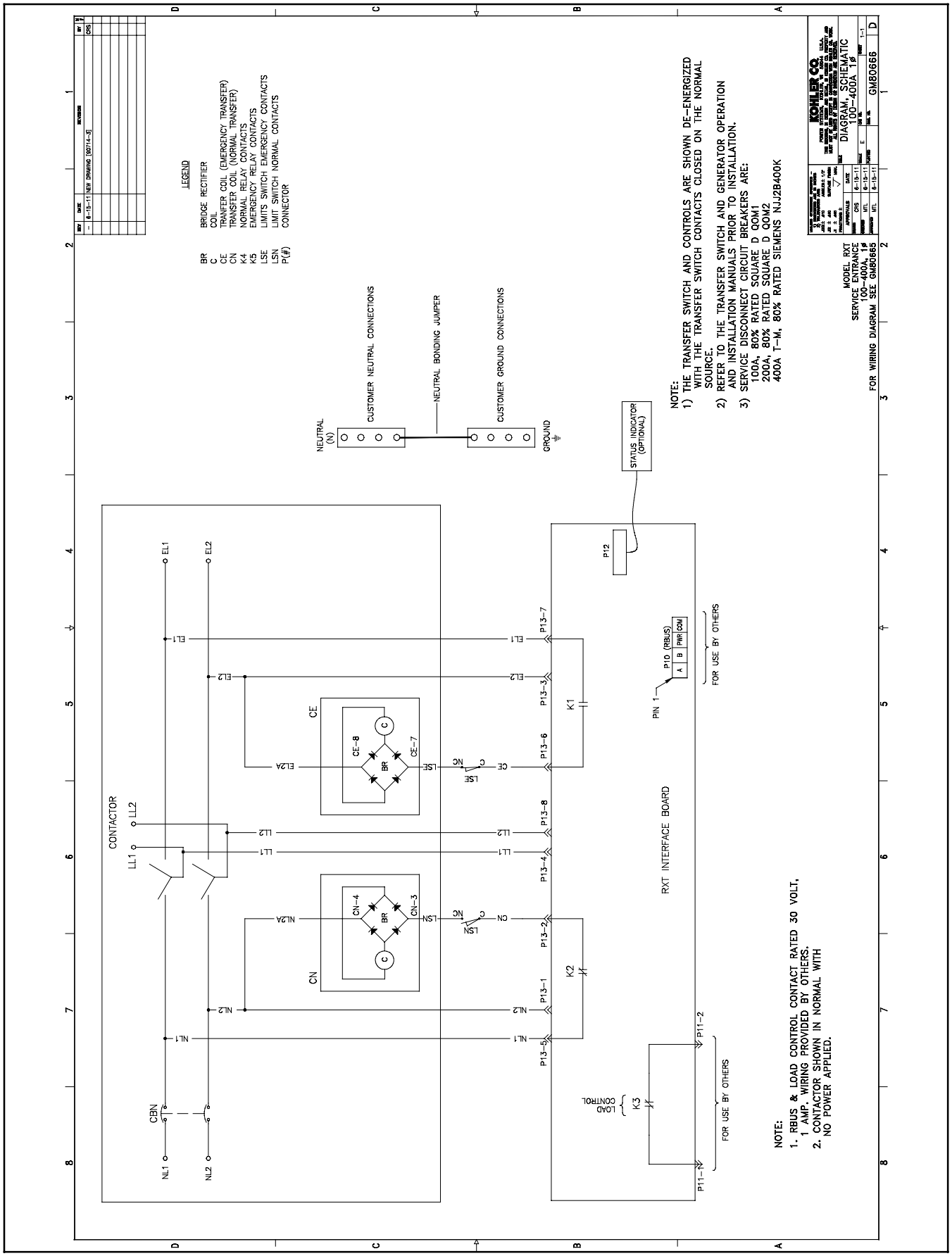


Figure 6-16 Schematic Diagram, 100-400 Amp Service Entrance, GM80666

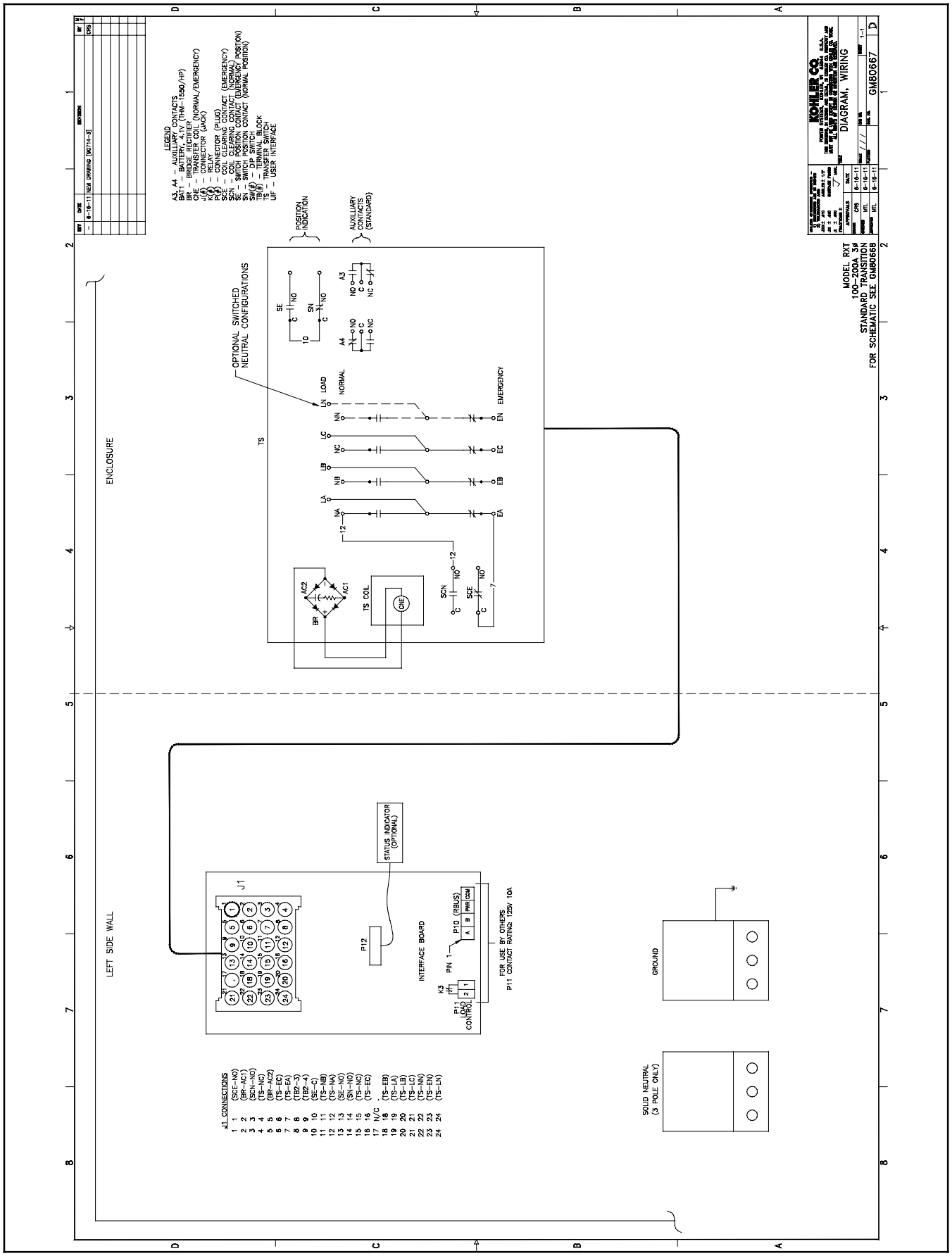


Figure 6-17 Wiring Diagram, 100–200 Amp Three-Phase, 3- and 4-Pole, GM80667

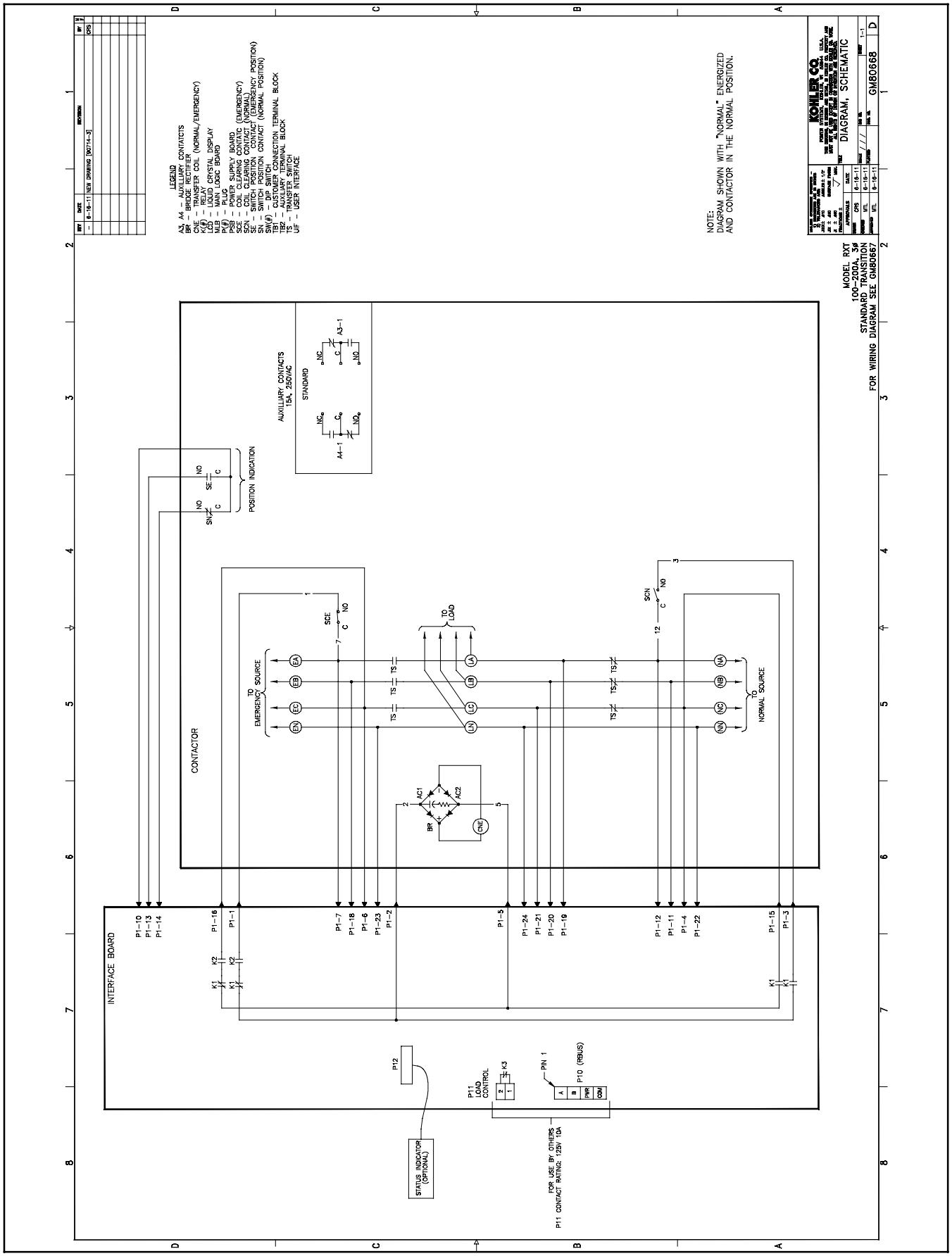


Figure 6-18 Schematic Diagram, 100–200 Amp Three-Phase, 3- and 4-Pole, GM80668

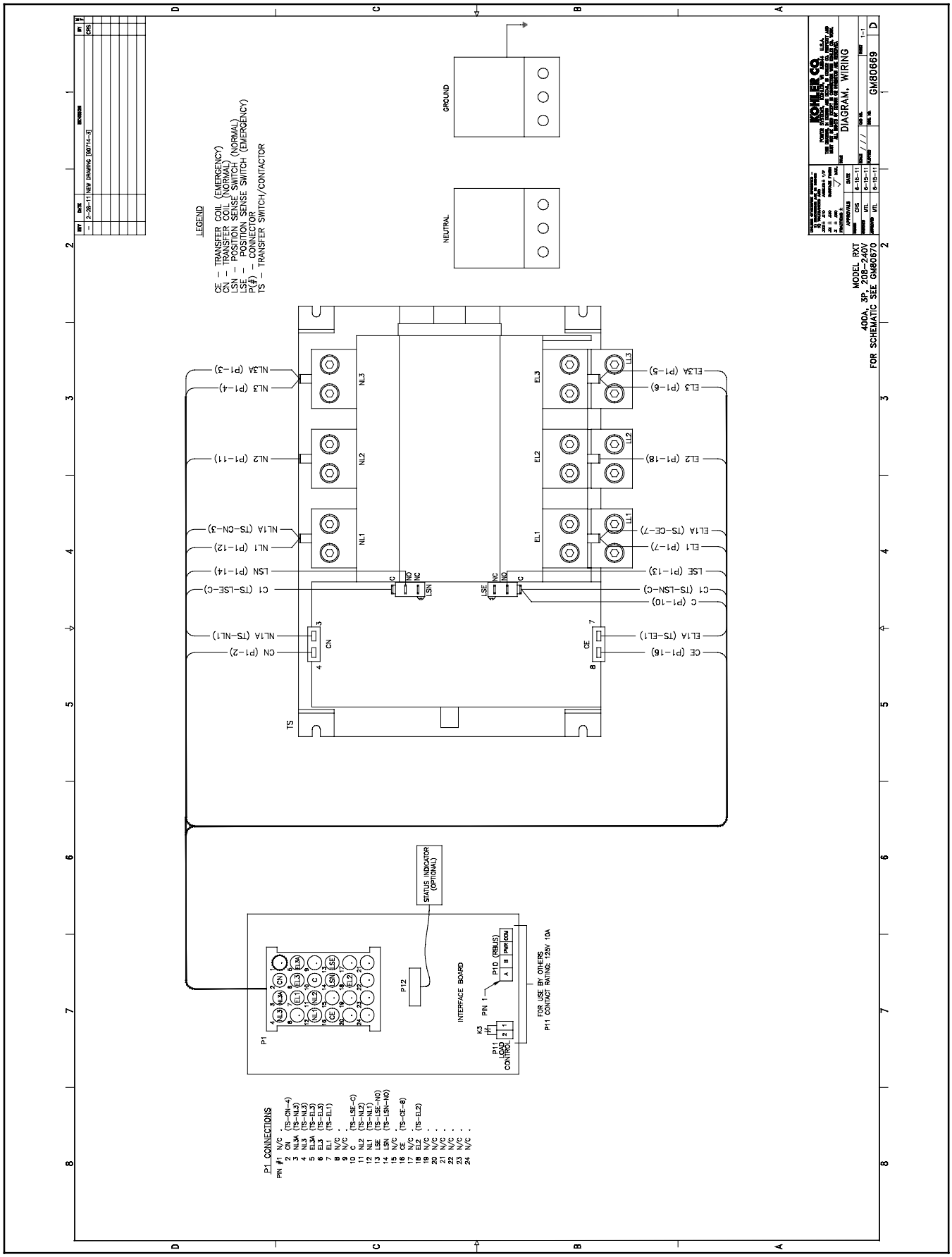


Figure 6-19 Wiring Diagram, 400 Amp Three-Phase, 3-Pole/208–240 Volts, GM80669

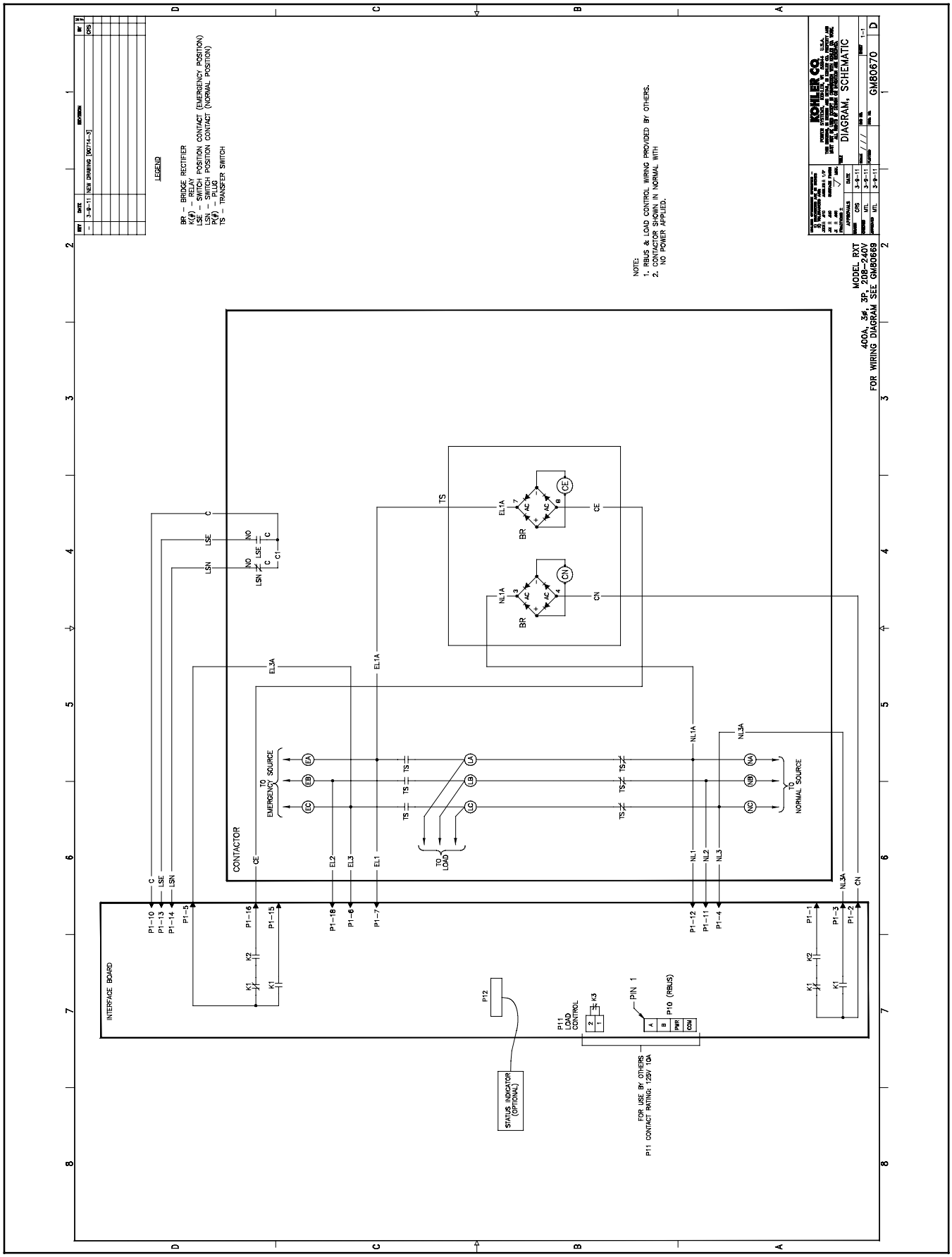


Figure 6-20 Schematic Diagram, 400 Amp Three-Phase, 3-Pole/208–240 Volts, GM80670

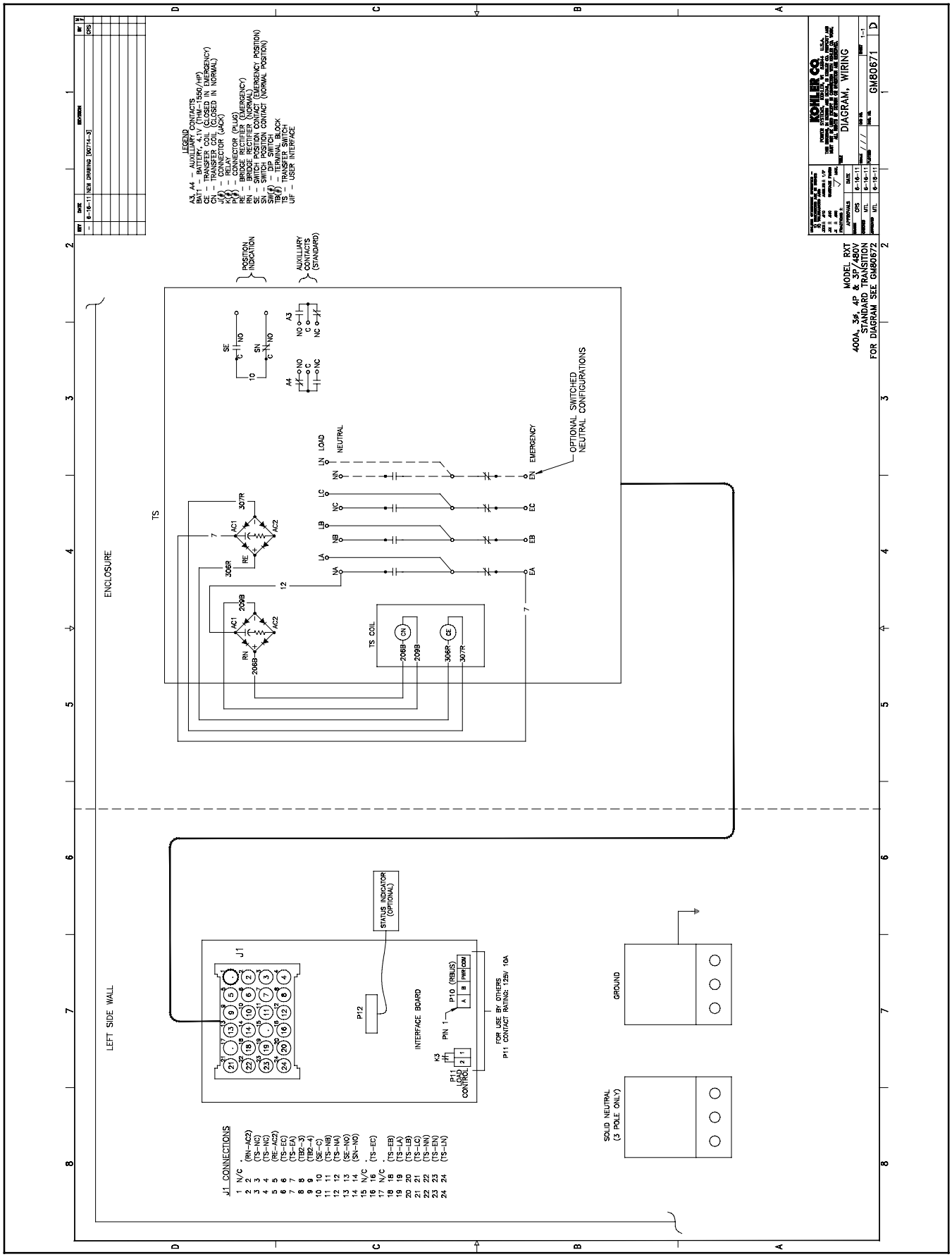


Figure 6-21 Wiring Diagram, 400 Amp Three-Phase, 3-Pole/480 Volts and 4-Pole, GM80671

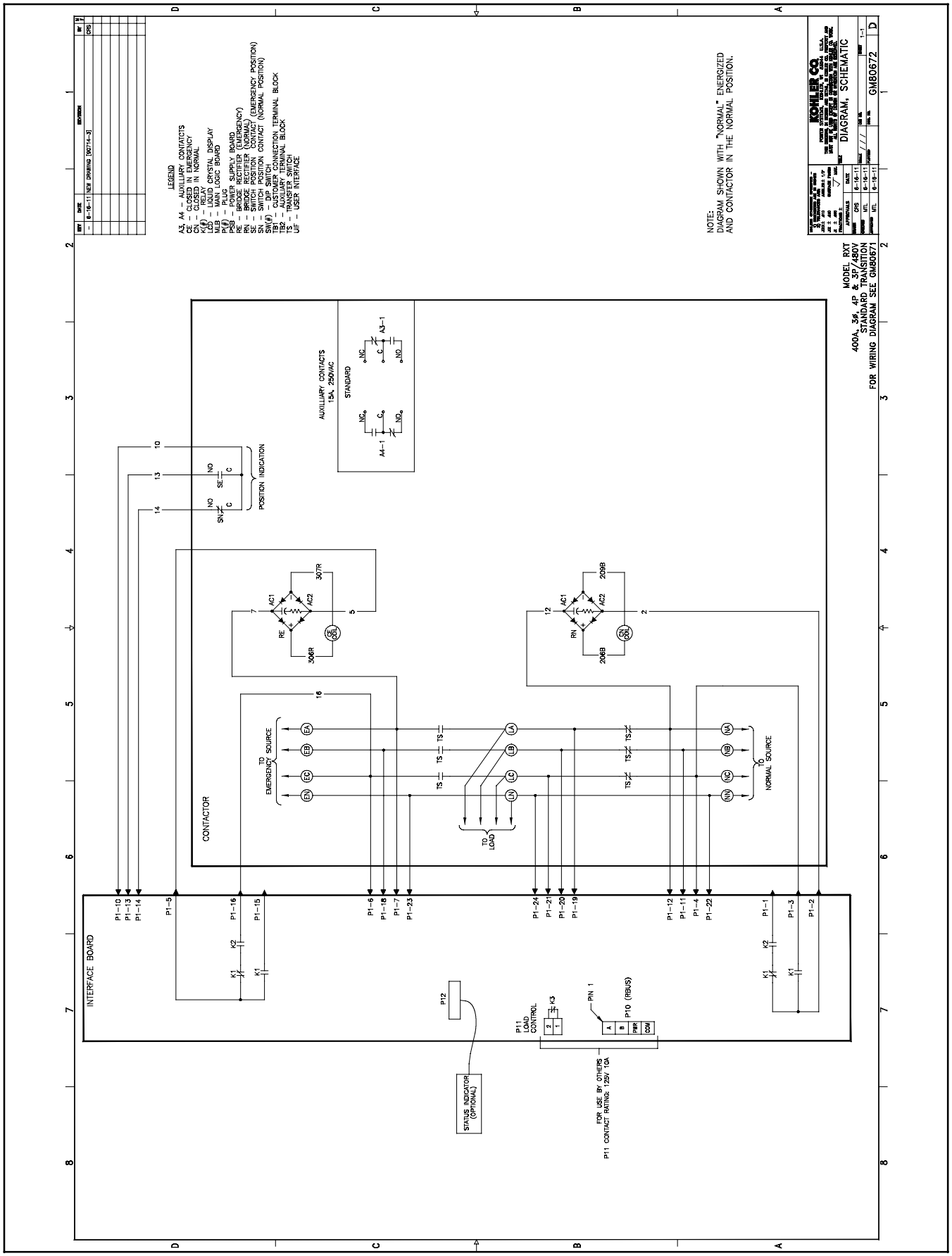


Figure 6-22 Schematic Diagram, 400 Amp Three-Phase, 3-Pole/480 Volts and 4-Pole, GM80672

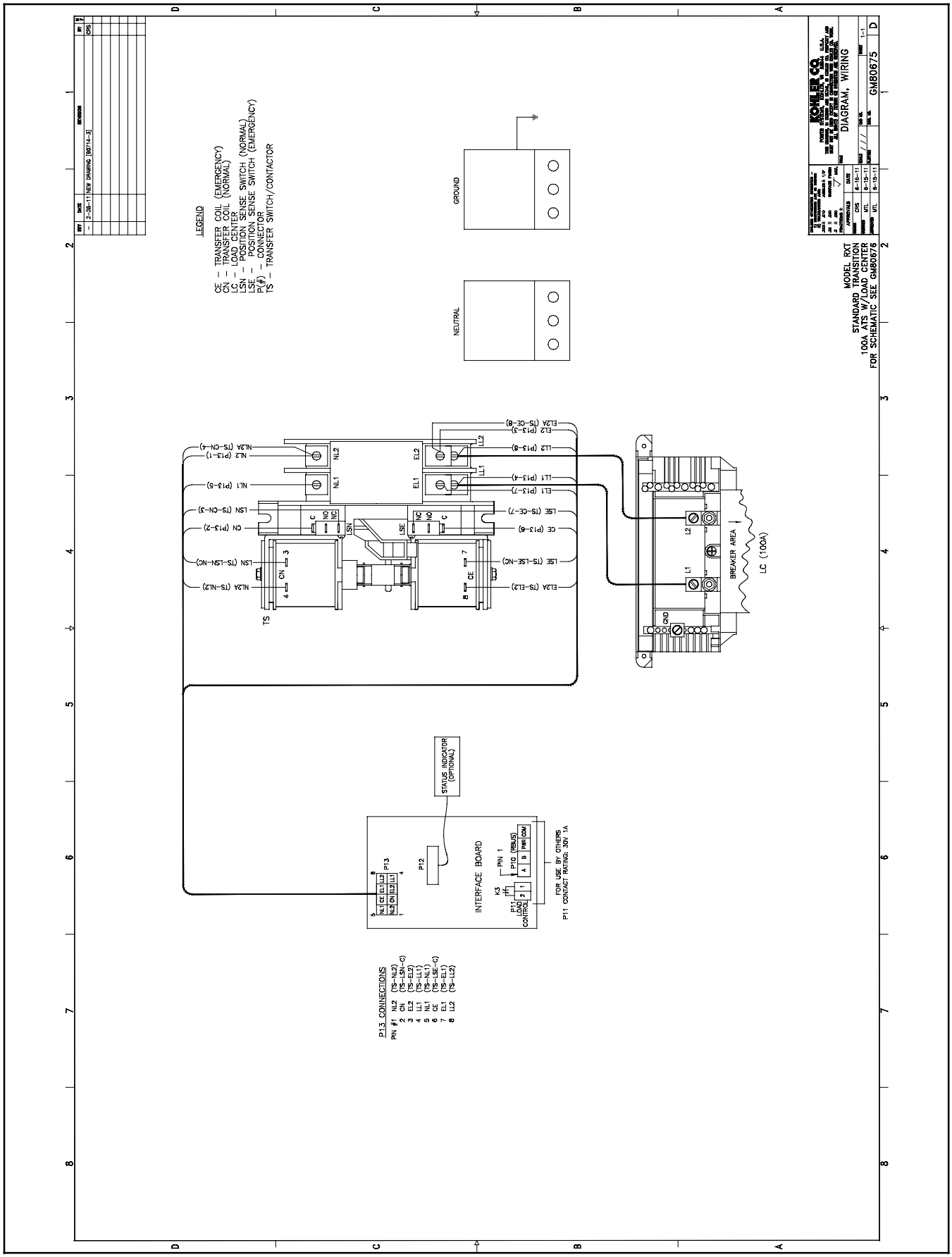


Figure 6-23 Wiring Diagram, 100 Amp Single-Phase with Load Center, GM80675

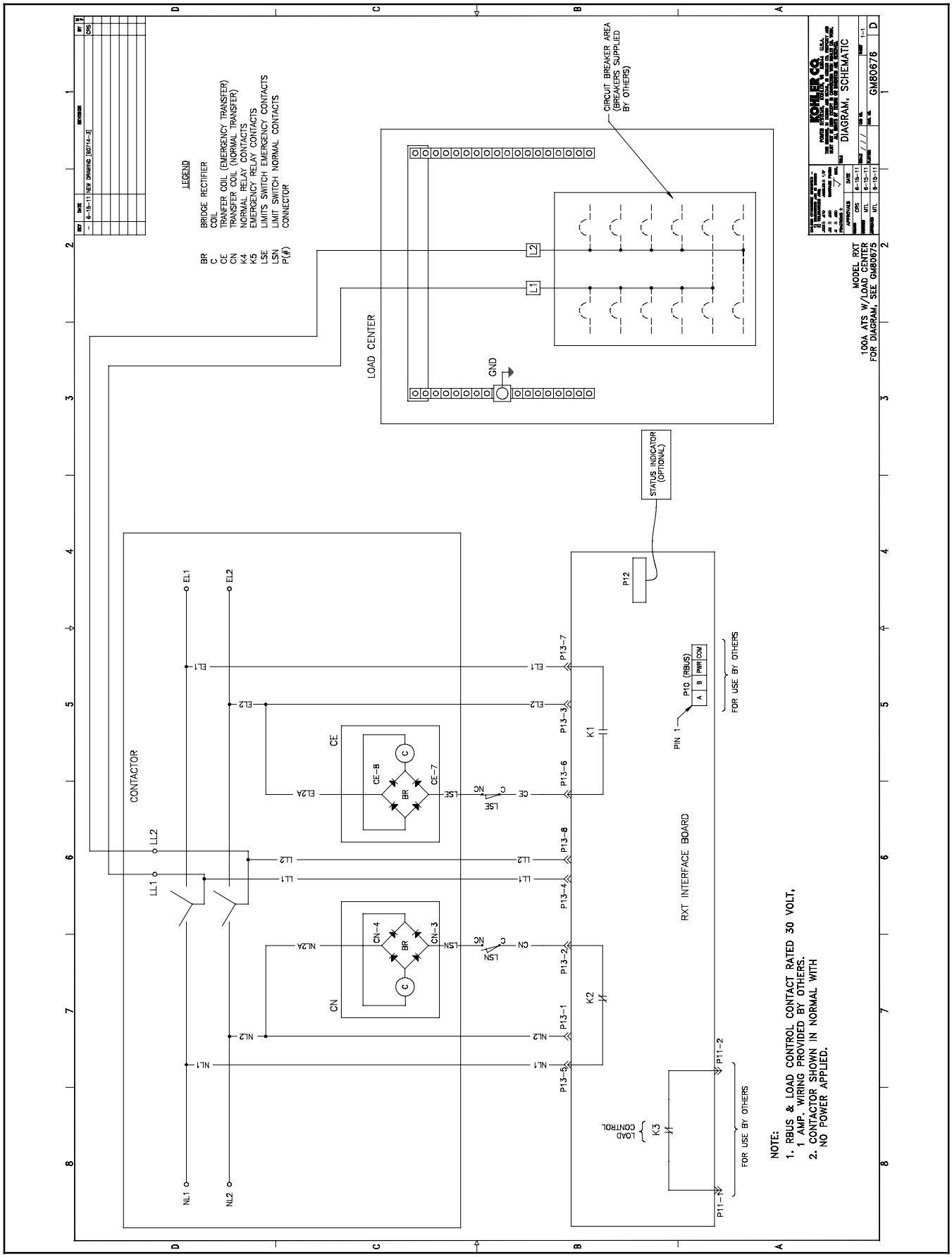


Figure 6-24 Schematic Diagram, 100 Amp Single-Phase with Load Center, GM80676

Notes

Appendix A Abbreviations

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

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

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

Notes

Notes

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