Operation/Installation/Service

DETROIT DIESEL®

mtu

Automatic Transfer Switches

Model:

DSE TS 880

Power Switching Device:
Service-Entrance Rated
100–4000 Amps

Controls:
TSC 800

MP-6380 6/05

Product Identification Information

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Product Code _____

Serial Number _____

Accessory	Accessory Description

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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***.

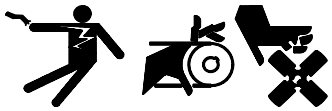
NOTICE

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/ Electrical Shock

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

⚠ 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.

Close and lock the transfer switch enclosure door before connecting power sources.

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

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

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

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

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

Transfer switch service disconnect. Hazardous voltage can cause severe injury or death. Move the service disconnect switch to the DISCONNECTED position and verify that the transfer switch mechanism is in the neutral position before servicing the transfer switch. *(100-1200 Amp service entrance models with molded-case power switching units.)*

Transfer switch service disconnect. Hazardous voltage can cause severe injury or death. Move the service disconnect switch to the DISCONNECTED position and verify that both the utility and generator set power switching devices are open before servicing the transfer switch. *(800-4000 Amp service entrance models with insulated-case power switching units.)*

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.

Moving Parts

⚠ WARNING

Airborne particles.
Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

Notice

NOTICE

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

NOTICE

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

NOTICE

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 DDC/MTU Power Generation Model MSE TS 880 service-entrance rated automatic transfer switches with TSC 800 electrical controls.

DDC/MTU Power Generation transfer switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from Source 1 power to Source 2 power in the event that Source 1 voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All DDC/MTU Power Generation service entrance rated transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL listed under Standard 1008 and CSA certified under Standard C22.2 No. 178.

Information in this publication represents data available at the time of print. The manufacturer of DDC/MTU products 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.

List of Related Materials

A separate operation/installation/service manual covers information specific to the transfer switch's electrical controls. The following table lists the the related document part numbers.

Document Description	Part Number
TSC 800 Controller Operation/Installation/Service	MP-6381
Remote Communication System Instuctions	TT-1409

Service Assistance

For professional advice on generator power requirements and conscientious service, please contact your nearest DDC/MTU Power Generation distributor.

- Consult the Yellow Pages under the heading Generators—Electric
- Visit the DDC/MTU Power Generation website at ddcmtupowergeneration.com
- Look at the labels and stickers on your DDC/MTU Power Generation product or review the appropriate literature or documents included with the product

1.1 General Description

The TS 880 automatic transfer switches employ two mechanically interlocked enclosed contact power switching units and a microprocessor-based controller to automatically transfer system load to a generator supply in the event of a utility supply failure. System load is then automatically retransferred back to the utility supply following restoration of the utility power source to within normal operating limits.

The TS 880 service-entrance rated automatic transfer switch uses integral overcurrent protection within the enclosed contact power switching units. Refer to Section 4, Overcurrent Protection, for detailed information on overcurrent protection.

The TS 880 series transfer switches employ a TSC 800 microprocessor-based controller that provides all necessary control functions for fully automatic operation. The TSC 800 controller is mounted on the door of the transfer switch enclosure and operating status is shown via LED lights and LCD display module. For further information on the TSC 800 transfer controller, refer to instruction manual MP-6381.

The 100A–1200A rated molded case power switching devices used for the utility and generator sources are operated by an electrically driven motor mechanism in the transfer switch. The 800A–4000A rated insulated case power switching devices used for the utility and generator sources are operated by internal drive motor operators.

The transfer switch mechanism utilizes the power from the source to which the electrical load is being transferred. The mechanism provides a positive mechanical interlock to prevent both power switching units from being closed at the same time, allowing an interrupted open transition break-before-make transfer sequence. The TSC 800 transfer controller provides a standard neutral position delay timer for open transition transfer sequences to allow adequate voltage decay during transfer operation to prevent out of phase transfers.

Note: For the purpose of this manual, the following standard nomenclature is utilized:

- Utility—to indicate the source of primary power.
- Generator—to indicate source of standby power.
- Power switching device—to indicate the automatic transfer switch power switching device.

1.2 Product Code

The type of TS 880 series transfer switch supplied is identified by way of a 21-digit product code that appears on the equipment rating plate (MODEL) on the door of the transfer switch and on the transfer switch drawings. The product code structure and definitions are shown in Figure 1-1.

T	S		8	8	3	A	0	6	0	0	B	1	A	E	2	D	N	N	A	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

1–3. Series
TS: Transfer Switch

4–5. Model
88: 880 switch

6. Poles
2: 2 pole
3: 3 pole
4: 4 pole

7. Configuration Type
A: ATS

8–11. Current Rating in amperes:

0100	1000
0150	1200
0200	1600
0250	2000
0400	2500
0600	3000
0800	4000

12. Application
B: Service Entrance

13. Operation Type
1: Open Transition

14. Certification
A: UL 1008

15. Voltage
1 phase 3 wire:
D: 120/240

3 phase 4 wire (grounded neutral):
E: 120/208
G: 120/240 (delta)
M: 277/480

3 phase 3 wire:
P: 208
R: 240
V: 480

16. Controller:
2: TSC 800

17. Enclosure Type
A: NEMA 1 ASA #61 Grey
C: NEMA 12 ASA #61 Grey
D: NEMA 3R SD (single door) ASA #61 Grey
E: NEMA 3R DD (double door) ASA #61 Grey
F: NEMA 4X, Stainless Steel

18. Utility Switching Device
M: Molded case switch w/ther-mag trip 100–200A
N: Molded case switch w/electronic trip 250–800A
P Molded case switch w/electronic and GF trip 250–1200A
Q Insulated case, fix mount switch (800A–4000A)
R Insulated case, fix mount switch w/electronic trip (800A–4000A)
T Insulated case, fix mount switch w/electronic and GF trip (800A–4000A)

19. Generator Switching Device
K: Molded case switch 100–800A
M: Molded case switch w/ther-mag trip 100–200A
N: Molded case switch w/electronic trip 250–800A
P: Molded case switch w/electronic and GF trip 250–1200A
Q Insulated case, fix mount switch (800A–4000A)
R Insulated case, fix mount switch w/electronic trip (800A–4000A)
T Insulated case, fix mount switch w/electronic and GF trip (800A–4000A)

20. Power Connections
A: Standard

21. Connection Configuration
A: Standard

Figure 1-1 Product Code Structure and Definitions

1.3 Environmental Conditions

Caution. Failure to store and operate equipment under the specified environmental conditions may cause equipment damage and void warranty.

1.4 Equipment Storage

Store the transfer switch in an environment with a temperature range not exceeding –20°C to 70°C (–4°F to 158°F) and a humidity range not exceeding 5%–95% non-condensing. Before storing, unpack sufficiently to check for concealed damage. If concealed damage is found, notify the ATS supplier and the carrier immediately. Repack with the original, or equivalent, packing materials. Protect from physical damage. Do not stack. Store indoors in a clean, dry, well-ventilated area free of corrosive agents including fumes, salt, and concrete/cement dust. Apply heat, as necessary, to prevent condensation.

1.5 Equipment Operation

Operate the transfer switch in an environment with a temperature range not exceeding –15°C to 50°C (–5°F to 122°F) and a humidity range not exceeding 5%–95% non-condensing.

2.1 General Information

Note: Installations should be done in accordance with all applicable electrical regulation codes as required.

The following installation guidelines are provided as general information only pertaining to typical site installations. For specific site installation information, consult the factory as required.

Note: Factory installation of supplied transfer switches that have been tested and proven may deviate from these recommendations.

2.2 Installer Notes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

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

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.

Before opening the transfer switch enclosure to perform any service task or to manually transfer the mechanism, it is imperative to *isolate the transfer switch from any possible source of power*.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Note: Qualified personnel only must perform all installation and/or service work.

2.2.1 Upstream Circuit Protective Devices/Electrical Connections

To ensure satisfactory installation of this equipment, observe Section 2.3, Cable Terminal Information, regarding power cable connection tightness and Section 2.4, Requirements for Upstream Circuit Protective Devices.

Check tightness of mechanical and electrical connections prior to placing equipment in service to ensure proper operation and to validate applicable warranty coverage.

2.2.2 Transfer Switches with Integral Overcurrent Protection

For models of transfer switch with integral overcurrent protection, the overcurrent protection *must be set prior to operation.* The equipment will be shipped from the factory with a long-time current setting of 100% (of the equipment rating) and maximum short-time/ instantaneous current and time delay settings.

Note: Do not energize this equipment until device settings have been verified to ensure proper system protection and coordination.

Refer to Section 3.2.2, Overcurrent Trip, for additional information on operation of the transfer switch following an overcurrent trip condition.

Refer to information supplied with the transfer switch documentation package for adjustment procedures on the power switching units overcurrent protection trip unit. Contact the factory if any additional information is required.

2.2.3 System Phasing, High Leg Delta Systems

For systems using high leg delta, 240V, 3-phase 4-wire systems, connection of supply conductors must have the correct phasing as shown in Figure 2-1.

Note: Failure to match correct system phasing will result in serious damage to the controller.

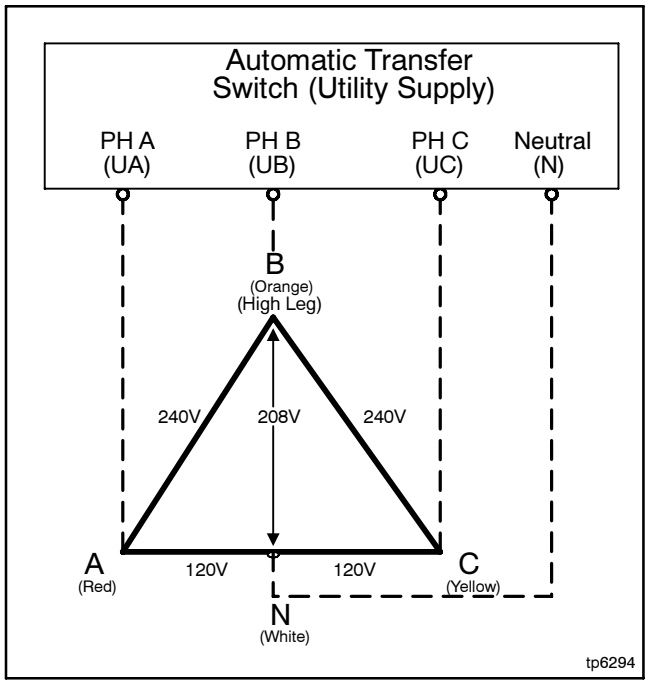
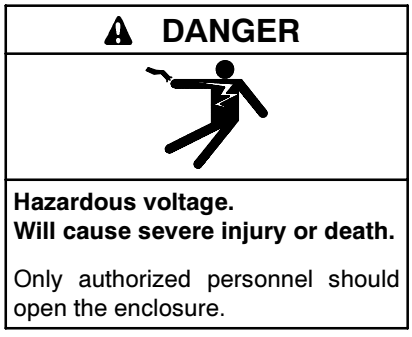


Figure 2-1 System Phasing



Note: Qualified personnel only must perform all installation and/or service work.

Where transfer switches are supplied without power isolation transformers (PT1 and PT2) for ATS control logic, it is essential that the orientation of phase conductors of the supply source be arranged such that the phase of highest potential with respect to ground is not connected to the power supply inputs to the controller (A Phase for both supplies). Failure to do so will result in equipment damage.

Per NEC Article 384-3 (f), the B phase shall be the phase having the higher voltage to ground on a 3-phase, 4-wire delta connected system.

2.2.4 Remote Start Contact Field Wiring

As a minimum, the remote engine start control field wiring shall conform to the local regulatory authority on electrical installations. Field wiring of a remote start contact from a transfer switch to a control panel should conform to the following guidelines to avoid possible controller malfunction and/or damage.

1. Minimum #14 AWG wire size shall be used for distances up to 30 m (100 ft.). For distances exceeding 30 m (100 ft.), consult the factory.
2. Remote start contact wires should be run in a separate conduit.
3. Avoid wiring near AC power cables to prevent pickup of induced voltages.
4. An interposing relay may be required if field-wiring distance is excessively long, i.e. greater than 30 m (100 ft.), and/or if a remote contact has a resistance of greater than 5.0 ohms.
5. The remote start contact must be voltage free (i.e. dry contact). The use of a powered contact will damage the transfer controller.

2.2.5 Dielectric Testing

Do not perform any high voltage dielectric testing on the transfer switch with the TSC 800 controller connected into the circuit as serious damage will occur to the controller. Remove AC control fuses or control circuit isolation plugs connected to the TSC 800 if high voltage dielectric testing is performed on the transfer switch.

2.2.6 Open Type Transfer Switch Installation

Please refer to the factory for additional information.

2.3 Cable Terminal Information

Basic Model	Terminal Rating		Connection Tightness, Nm (in. lb.)	
	Qty. Per Phase	Range	Terminal Mounting Screw	Cable Clamp
TS88xA-0100	1	#14-1/0	13.6 (120)	5.7 (50)
TS88xA-0150	1	#2–4/0	13.6 (120)	13.6 (120)
TS88xA-0200	1	#6–350MCM	16.9 (150)	31.1 (275)
TS88xA-0250	1	#6–350MCM	16.9 (150)	31.1 (275)
TS88xA-0400*	2	2/0–500MCM	8.1 (72)	31.1 (275)
TS88xA-0600*	2	2/0–500MCM	8.1 (72)	42.4 (375)
TS88xA-0800*	3	2/0–500MCM	12.4 (110)	42.4 (375)
TS88xA-1000/1200*	4	4/0–500MCM	42.4 (375)	42.4 (375)
TS88xA-0800/4000†	As Req'd	300 – 300MCM		300-450MCM: 325 500-750MCM: 375 800MCM: 500
		250 – 600MCM		250-350MCM: 300 500-600MCM: 450

* With molded case power switching units.
† With insulated case power switching units.
Note: For other model types not shown, contact the manufacturer for further information.

2.4 Requirements For Upstream Circuit Protective Devices

Basic Model	Max. Voltage	Rated Current (A)	Withstand Current Rating Amps (RMS)				
			With Upstream Circuit Breaker Protection			With Upstream Fuse Protection	
			@240V	@480V	@600V	@ Up to 600V	Fuse Type
TS88xA-0100	600	100	65000	25000	18000	100000	T, J
TS88xA-0150	600	150	65000	25000	18000	100000	T, J
TS88xA-0200	240	200	65000	N/A	N/A	N/A	T, J
TS88xA-0250	600	250	65000	35000	25000	100000	T, J
TS88xA-0400	600	400	65000	50000	35000	100000	T, J
TS88xA-0600	600	600	65000	50000	35000	100000	T, J
TS88xA-0800 *	600	800	65000	50000	35000	100000	Consult Factory
TS88xA-1000/1200*	600	1000/1200	65000	50000	42000	100000	Consult Factory
TS88xA-0800 †	600	800	100000	50000	85000	100000	Consult Factory
TS88xA-1200 †	600	1200	100000	100000	85000	100000	Consult Factory
TS88xA-1600 †	600	1600	100000	100000	85000	100000	Consult Factory
TS88xA-2000 †	600	2000	100000	100000	85000	100000	Consult Factory
TS88xA-2500 †	600	2500	100000	100000	85000	100000	Consult Factory
TS88xA-3000 †	600	3000	100000	100000	85000	100000	Consult Factory
TS88xA-4000 †	600	4000	100000	100000	85000	100000	Consult Factory

* With molded case power switching units
† With insulated case power switching units
Note: For other ratings, contact the manufacturer for further information.

Fuse ratings shown are maximum allowable to permit use of the transfer switch in application with available fault current not exceeding that shown. Consideration must be given to fuse sizing when fuses also provide overload protection. Please refer to the factory for further information on upstream protection requirements if required.

2.5 Ground Fault Site Test Requirements

Per NEC and UL1008, a ground fault protected system shall be performance tested when first installed onsite. A written record of this shall be made and be available to the authority having jurisdiction. A form is provided for this purpose. See Section 10, Performance Test Form.

Confirm and record actual trip setpoints in the form provided which is to be made available on request by the inspection authority.

2.5.1 Performance Test

Qualified field service technicians require a calibrated current injection test apparatus and must be knowledgeable in power switching unit testing to provide primary neutral CT injection up to or greater than the trip setpoint as selected by the responsible party. As indicated in the NEC, the maximum setting of the ground fault protection shall be 1200 amps, and the maximum time delay shall be 1 second for ground faults equal to or greater than 3000 amps.

Contact the inspection authority to confirm actual test requirements as these may vary by region or local code requirements.

The interconnected system shall be evaluated to ensure compliance with the appropriate schematic drawings. The proper location of sensors and power cabling shall be determined. The grounding points of the system shall be verified to determine that ground paths do not exist that would bypass the sensors. The use of high-voltage testers and resistance bridges may be required. A simulated fault current is to be generated by a coil around the sensors. The reaction of the circuit-interrupting device is to be observed for correct response. The results of the test are to be recorded on the test form provided.

2.6 Typical Commissioning Procedures

Commissioning procedures must be performed by qualified personnel only. Ensure the Automatic Transfer Switch (ATS) Isolation Plug is disconnected prior to energizing the supply sources. Manually place the transfer switch mechanism in the neutral position prior to applying power. Failure to do so may result in equipment failure or personal injury.

The Typical Automatic Transfer Switch Commissioning Procedures, Model Series TS 880 (attached as Appendix B) is provided for general information only pertaining to typical site installations and applications. Contact the manufacturer for further information as may be required.

3.1 Normal Sequence of Operation, Open Transition Type Transfer Switches

When utility supply voltage drops below a preset nominal value (adjustable from 70%–99% of nominal) on any phase, an engine start delay circuit will be initiated and the transfer to utility supply signal will be removed (i.e. contact opening). Following expiry of the engine start delay period (adjustable from 0–60 sec.) an engine start signal (contact closure) will be given.

Once the engine starts, the transfer switch controller will monitor the generator voltage and frequency. Once the generator voltage and frequency rises above preset values (adjustable from 70%–99% of nominal), the engine warmup timer will be initiated. Once the warmup timer expires (adjustable from 0–60 min.), the transfer to generator supply signal (contact closure) will be given to the transfer switch mechanism. The load will then transfer from the utility supply to the generator supply via the motor operated mechanism.

Note: A neutral delay timer circuit will delay the transfer sequence in the neutral position (i.e. both power-switching devices open) until the selected time expires (adjustable from 0–60 sec.).

The generator will continue to supply the load until the utility supply has returned. The retransfer sequence is completed as follows: When the utility supply voltage is restored to above the preset values (adjustable from 70%–99% of nominal) on all phases, a utility return delay circuit will be initiated. Following expiry of the utility return timer (adjustable from 0–60 min.), the transfer to generator supply signal will be removed (contact opening), and then the transfer to utility supply signal (contact closure) will be given to the transfer switch mechanism. The load will then retransfer the load from the generator supply back to the utility supply.

Note: A neutral delay timer circuit will delay the transfer sequence in the neutral position (i.e. both power switching devices open) until the neutral time delay time expires (adjustable from 0–60 sec.).

An engine cooldown timer circuit will be initiated once the load is transferred from the generator supply. Following expiry of the cooldown delay period (adjustable from 0–30 min.), the engine start signal will be removed (contact opening) to initiate stopping of the generator set.

3.2 Service Entrance Automatic Transfer Switch

Note: This section applies only to service entrance transfer switches.

3.2.1 Normal Operation

Under normal conditions, the load is energized from the utility supply through the closed utility transfer power switching device. If the utility power fails, the generator will start and the load will be reenergized via the closed generator transfer power switching device.

In the normal operating mode, the service disconnect switch shall be in the energized position.

3.2.2 Overcurrent Trip

Should the utility power switching device trip open due to an overcurrent condition, the TSC 800 transfer controller will initiate an engine start signal and will permit transfer of the load to the generator supply. The utility source will be locked out and the load will remain on the generator supply until the TSC 800 alarm signal is manually reset.

Refer to the TSC 800 instruction manual for further details on transfer fail operation.

Should the generator power switching device trip open due to an overcurrent condition, the TSC 800 transfer controller will initiate transfer of the load to the utility supply. The generator source will be locked out and the load will remain on the utility supply until the TSC 800 alarm signal is manually reset.

3.3 Service Disconnect

Note: This section applies only to service entrance transfer switches.

3.3.1 Service Disconnect Procedure

To perform a service disconnect (i.e. to disconnect the utility and generator supplies), the following procedure is required:

1. Move the service disconnect control switch located on the door of the transfer switch to the Disconnected position.

2. Verify that the service disconnected pilot light is illuminated. *If the light is illuminated, the service has been successfully disconnected and it is safe to perform any maintenance procedures (i.e. external to the transfer switch) as required*. In this condition, the transfer switch is in the neutral position, with both utility and generator transfer power switching devices open. The transfer switch will remain in this condition, regardless of condition of the utility and generator supplies (i.e. if the utility power fails, the generator will not receive a start signal, nor will the transfer switch move to the generator position).

   Note: If the service disconnected light is **not** illuminated, additional procedures are required. Proceed to Section 3.3.2.

3. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed. If the door is not locked, turn and remove the door key.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Close and lock the transfer switch enclosure door before connecting power sources.

4. To reenergize the load, remove the padlock(s) from the service disconnect control switch and move the switch to the energized position. The transfer switch will immediately return to the utility or generator supply if within normal operating limits.

3.3.2 Additional Procedures

If the service disconnected pilot light is not illuminated, the service has not been successfully disconnected, and it is not safe to perform any maintenance until the following *additional* procedures are performed.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Transfer switch service disconnect. Hazardous voltage can cause severe injury or death. Move the service disconnect switch to the DISCONNECTED position and verify that the transfer switch mechanism is in the neutral position before servicing the transfer switch. *(100-1200 Amp service entrance models with molded-case power switching units.)*

Transfer switch service disconnect. Hazardous voltage can cause severe injury or death. Move the service disconnect switch to the DISCONNECTED position and verify that both the utility and generator set power switching devices are open before servicing the transfer switch. *(800-4000 Amp service entrance models with insulated-case power switching units.)*

1. On 100A-1200A molded case power switching unit type transfer switches, open the door to the transfer switch using a suitable tool and open the door lock with the key.

2. Visually inspect the actual position of the transfer switch mechanism as follows:

   For 100A-1200A molded-case power switching unit type transfer switches: If the position of the transfer switch mechanism is clearly in the neutral position, and the load bus on all phases is deenergized, the service has been successfully disconnected. Proceed to step 4.

   If the position of the transfer switch mechanism is *not* in the neutral position, proceed to step 3.

For 800A–4000A insulated-case power switching unit type transfer switches: Verify that both power switching devices are in the OPEN position. If both power switching devices clearly indicate they are in the OPEN position, the service has been successfully disconnected. Proceed to step 4.

If both power switching units are *not* in the OPEN position, proceed to step 3.

Note: If the position of the transfer switch mechanism is clearly in the neutral position, the service disconnected pilot light may not have illuminated due to the following reasons:

- Utility and generator supply voltages are not present (the pilot light requires AC supply voltage to be present).
- The pilot light may be burnt out. The bulb should be immediately replaced with a suitably rated bulb.
- Failure of one or more of the sensing/logic contacts. *A qualified service technician is required to troubleshoot this specific condition.* Switch the utility control circuit isolation switch to the deenergized position to remove utility control power. To isolate the generator supply, remove the control circuit isolation plug.

  Note: *The AC power conductors will still remain energized.* Once all the control circuits are deenergized and isolated the service disconnected pilot light will not illuminate due to loss of control power.

  Note: To return the transfer switch back to normal operation, *the control circuit isolation plug must be reconnected first and then the utility control circuit disconnect switch can be switched back to the On position.*

3. **For 100A–1200A molded-case power switching unit type transfer switches:**

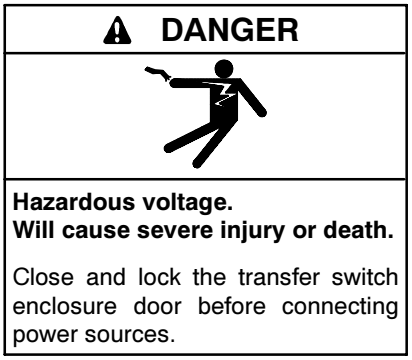
   If the position of the transfer switch mechanism is *not* in the neutral position, manually operate the transfer switch mechanism as follows. Pull the manual release plunger on the mechanism releasing the motor drive rod from motor drive arm and move the knob and yoke to the marked *Neutral* position.

   For 800A–4000A insulated-case power switching unit type transfer switches:

   If both power switching units are *not* in the OPEN position, manually operate the power switching units as follows: Push the unit's OPEN pushbutton. The unit should then open. Repeat for the other power switching unit.

4. Close the transfer switch door securely using a suitable tool. Lock the door in the closed position and remove the key.

5. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify that the transfer switch door is locked closed. Once the transfer switch door has been positively locked closed and secured it is safe to perform any maintenance procedures as required.



6. To reenergize the load, remove the padlock(s) from the service disconnect control switch and move the switch to the Energized position. The transfer switch will immediately return to the utility or generator supply if within normal operating limits.

3.4 Test Modes

The transfer switch may be tested utilizing the TSC 800 controller pushbuttons. A simulated utility power failure condition will be activated when the on load test mode is selected. The transfer switch will operate as per a normal utility power fail condition.

The transfer switch will remain on generator supply until the test mode is terminated. It will then immediately transfer back to the utility supply and then continue to operate the generator set for its cooldown period then stop.

Note: The transfer switch will automatically return to the utility supply (if within nominal limits) if the generator set fails while in the test mode.

Section 4 Overcurrent Protection

Model DSE TS 880 transfer switches will have integral overcurrent protection supplied on the utility source as standard. Integral overcurrent protection may also be supplied on the generator source. The type of overcurrent protection utilized is dependent upon ATS amperage size and optional features specified. For transfer switches rated 100A through 200A, overcurrent protection is nonadjustable thermal-magnetic type trip units. For transfer switches rated 400A through 4000A overcurrent protection is adjustable electronic type with long time and instantaneous trip unit elements with optional ground fault protection elements.

Note: Ground fault protection is supplied as standard on 1000A and 1200A transfer switches that are used on systems greater than 240V.

An upstream overcurrent protection device is required on the generator source that feeds the TS 880 transfer switch if the integral overcurrent protection option is not specified on the ATS.

Note: For models of transfer switch with *adjustable* integral overcurrent protection trip units, the overcurrent protection *must be set prior to operation.* The equipment will be shipped from the factory with a longtime current setting of 100% (of the equipment rating) and maximum instantaneous/short time/ground fault (if supplied) current and time delay settings.

Note: Do not energize this equipment until device settings have been verified to ensure proper system protection & coordination.

Refer to Section 1.2, Product Code, for types of integral overcurrent protection that are supplied with the transfer switch.

Notes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Note: Only qualified personnel must perform all installation and/or service work.

Failure to correctly maintain an automatic transfer switch may present a hazard to life and equipment. Full operational testing must be done prior to placing a transfer switch in service subsequent to any maintenance or repair. Any service work involving electrical components requires high-potential testing to ensure that required insulation levels have been maintained.

5.1 Power Switching, 100–250 Amp

5.1.1 General Description

The transfer mechanism consists of the transfer motor and drive assembly, which operates a common yoke which in turn operates both utility and generator power switching devices. Since the power switching devices are oriented opposite to each other, the action of turning one power switching device off will result in turning the other power switching device on. The geometry of the mechanism ensures that one power switching device always opens before the other closes, thus maintaining the required mechanical interlocking.

The motor operates the motor drive arm and rod assembly. The motor drive arm is normally held captive to the yoke via the manual release plunger assembly. A common yoke assembly operates both power-switching device toggles. There are two limit switches that are contacted by the yoke at its extremes of travel, which disconnects the motor circuit at the point of full power switching device toggle travel in the intended direction. Should adjustment be required, consult the manufacturer for further information.

The transfer switch mechanism has three possible positions:

1. Utility power switching device closed and generator power switching device open;
2. Generator power switching device closed and utility power switching device open;
3. Both utility and generator power switching devices open, but NEVER both utility and generator power switching devices closed at the same time.

5.1.2 Equipment Inspection

To maintain mechanical integrity, ensure that;

- Both limit switches are correctly adjusted to provide full travel of the power switching device toggles *without* exerting unnecessary forces associated with excessive travel. Ensure the power switching device travels far enough to reset any internal trip unit.

  Note: It is more important for the toggle to go fully in the off direction, than in the on direction.

- Mechanical interlocking is correct (i.e. one power switching device must be well open before the other should close).
- All fasteners are adequately tightened.
- The operating linkages are not damaged or bent, and that all bearing points operate freely.
- To maintain electrical integrity, ensure that:
  - All electrical connections are clean and adequately tightened. Corroded or loose power connections will cause destructive heating, and may cause premature tripping.
  - All insulating devices are in place and in good condition.
  - No moisture or other contamination is present.
  - Electrical conductors are adequately secured away from moving parts.
- To maintain operational integrity, ensure that:
  - All control devices are in good condition and correctly calibrated.
  - All control devices are adequately secured in their plug-in fixtures.

Failure to correctly maintain an automatic transfer switch may present a hazard to life and equipment. Full operational testing must be done prior to placing a transfer switch in service subsequent to any maintenance or repair. Any service work involving electrical components requires high-potential testing to ensure that required insulation levels have been maintained.

5.1.3 Manual Operation

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Note: Only qualified personnel must perform all installation and/or service work.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

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

Isolate the transfer switch from all sources of supply before opening the enclosure for manual operation. With all sources of power deenergized to the transfer switch, the control circuit isolation plug can be unplugged to prevent subsequent operation.

To operate manually, pull the manual release plunger, releasing the motor drive rod from the motor drive arm, and push the yoke in the desired direction.

Automatic operation may be regained by replacing the isolation plug. With all sources of power deenergized to the transfer switch, the control circuit isolation plug can be reconnected. The drive system is self-engaging and will move the transfer switch mechanism to the required position. Refer to the manual operation instruction on front of the transfer switch mechanism for further details.

5.1.4 Recommended Maintenance

- DO NOT perform dielectric tests on the equipment with the control components in the circuit.
- Check that control components are tight in sockets.
- Periodically inspect all terminals (load, line, and control) for tightness. Retorque all bolts, nuts, and other hardware. Clean or replace any contact surfaces that are dirty, corroded, or pitted.
- Transfer switches should be in a clean, dry, and moderately warm location. If signs of moisture are present, dry and clean the transfer switch. If there is corrosion, try to clean it off. If cleaning is unsuitable, replace the corroded parts. Should dust and/or debris gather on the transfer switch, brush, vacuum, or wipe clean. *Do not* blow dirt into power switching devices.
- Test the transfer switch operation. While the unit is exercising, check for freedom of movement, hidden dirt, corrosion, or any excessive wear on the mechanical operating parts. Ensure that the power switching device travel is correct.
- Verify all program settings on the TSC 800 controller are as per the programming sheet supplied with the transfer switch.
- Confirm that the yoke operates freely on the yoke pivot bushings. Should lubrication be required, apply medium weight (SAE 20) oil sparingly at these points.
- The motor and gearbox are permanently lubricated and should not require attention under normal operating circumstances.

5.2 400–1200 Amp, Molded Case Type

5.2.1 General Description

The transfer mechanism consists primarily of the transfer motor, a hub assembly, two operating rods, and two power switching device operating yokes.

The reversible transfer motor drives the hub assembly, which in turn moves the operating rods that are connected to the power switching device operating yokes. The power switching device toggles are set inside the yokes and are operated by the yoke. There are two limit switches, which are contacted by the operating yokes (one for each direction of travel), that disconnect the transfer motor power supply when the power switching devices have attained full travel. The adjuster screws located on the yokes determines the operating point of these limit switches. Should adjustment be required, consult the manufacturer for further information.

The transfer switch mechanism has three possible positions:

1. Utility power switching device closed and generator power switching device open.
2. Generator power switching device closed and utility power switching device open.
3. Both utility and generator power switching devices open, but *never* both utility and generator power switching devices closed at the same time.

5.2.2 Equipment Inspection

To maintain mechanical integrity, ensure that:

- All limit switch linkages are correctly adjusted to provide full travel of the power switching device toggles *without* exerting unnecessary forces associated with excessive travel. Ensure that power switching devices travel far enough to reset any internal trip unit.

  Note: It is more important for the toggle to go fully in the off direction than in the on direction.

- Mechanical interlocking is correct (i.e. one power switching device must be well open before the other should close).
- All fasteners are adequately tightened.
- The operating linkages are not damaged or bent, and that all bearing points operate freely.

To maintain electrical integrity, ensure that:

- All electrical connections are clean and adequately tightened. Corroded or loose power connections will cause destructive heating and may cause premature tripping.
- All insulating devices are in place and in good condition.
- No moisture or other contamination is present.
- Electrical conductors are adequately secured away from moving parts.

To maintain operational integrity, ensure that:

- All control devices are in good condition and correctly calibrated.
- All control devices are adequately secured in their plug-in fixtures.
- Failure to correctly maintain an automatic transfer switch may present a hazard to life and equipment. Full operational testing must be done prior to placing a transfer switch in service subsequent to any maintenance or repair. Any service work involving electrical components requires high-potential testing to ensure that required insulation levels have been maintained.

5.2.3 Manual Operation

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Note: Only qualified personnel must perform all installation and/or service work.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

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

Isolate the transfer switch from all sources of supply before opening the enclosure for manual operation. With all sources of power deenergized to the transfer switch, the control circuit isolation plug can be unplugged to prevent subsequent operation.

To operate manually, pull the release plunger and operate the handle in the desired direction.

Automatic operation may be regained by replacing the isolation plug. With all sources of power deenergized to the transfer switch, the control circuit isolation plug can be reconnected. The drive system is self-engaging and will operate the transfer switch to the required position.

Refer to the manual operation instruction on front of the transfer switch mechanism for further details.

5.2.4 Recommended Maintenance

- *Do not* perform dielectric tests on the equipment with the control components in the circuit.
- Check if control components are tight in sockets.
- Periodically inspect all terminals (load, line, and control) for tightness. Retorque all bolts, nuts, and other hardware. Clean or replace any contact surfaces that are dirty, corroded, or pitted.
- Transfer switches should be in a clean, dry, and moderately warm location. If signs of moisture are present, dry and clean the transfer switch. If there is corrosion, try to clean it off. If cleaning is unsuitable, replace the corroded parts. Should dust and/or debris gather on the transfer switch, brush, vacuum, or wipe clean. *Do not* blow dirt into power switching devices.
- Test the transfer switch operation. While the unit is exercising, check for freedom of movement, hidden dirt, corrosion, or any excessive wear on the mechanical operating parts. Ensure that the power switching device travel is correct.
- Verify all program settings on the TSC 800 controller as per the programming sheet as supplied with the transfer switch.
- Ensure that the manual handle moves freely on the hub when the lock pin is disengaged. If lubrication is necessary, apply medium weight (SAE 20) oil sparingly.
- Yoke pivot bearings and rod ends are permanently lubricated and do not require maintenance.
- The motor and gearbox are permanently lubricated and should not require attention under normal operating circumstances.

5.3 800-4000 Amp, Insulated Case Type

5.3.1 General Description

800A-4000A transfer switches consist of two insulated case power switching units mounted in a vertical stack configuration. Standard transfer switches have insulated case power switching devices that are fix-mounted. The power switching devices are electrically and mechanically interlocked using a cable interlock mechanism.

Should adjustment be required on the mechanical interlock, it is advisable to consult the manufacturer for further information.

5.3.2 Equipment Inspection

To maintain mechanical integrity, ensure that:

- All linkages are correctly adjusted.
- Mechanical interlocking is correct. It should not be possible to close a power switching unit without first opening the other power switching unit.
- All fasteners are adequately tightened.
- The operating linkages are not damaged or bent, and that all bearing points operate freely.

To maintain electrical integrity, ensure that:

- All electrical connections are clean and adequately tightened. Corroded or loose power connections will cause destructive heating and may cause premature tripping of the power switching devices that incorporate integral overcurrent protection units.
- All insulating devices are in place and in good condition.
- No moisture or other contamination is present.
- Electrical conductors are adequately secured away from moving parts.

To maintain operational integrity, ensure that:

- All control devices are in good condition and correctly calibrated.
- All control devices are adequately secured in their plug-in fixtures

5.3.3 Manual Operation

A 2-position system operation mode selector switch is provided to operate the transfer switch manually as follows:

AUTO: This selects automatic operation of the transfer switch. The power switching device will automatically open/close as detailed in the sequence of operation.

MAN: This position inhibits automatic operation and automatic engine starting. The power switching device must be manually operated via pushbuttons located on the face of the power switching devices to open/close them as required.

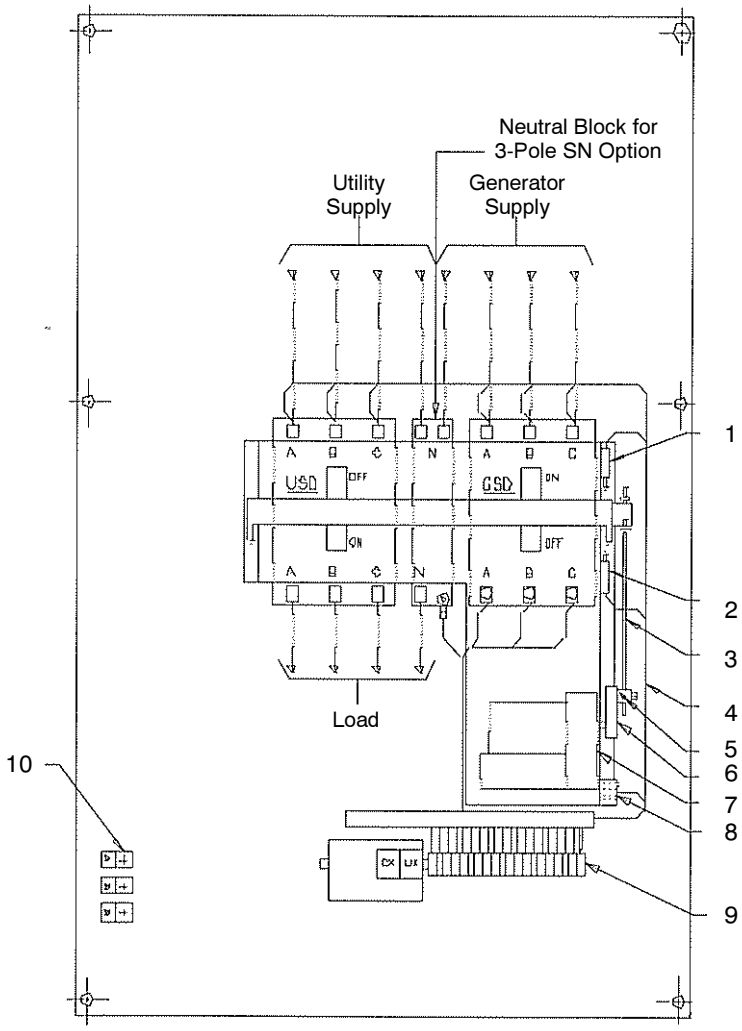
Note: When the MANUAL Mode is selected the engine start output logic is disabled. Where generator voltage is required during manual operation the local generator controls must be set for manual operation.

To transfer manually to generator, turn the system operation mode selector to MANUAL, manually start the generator, open the utility power switching device, close the generator power switching device, using open/close pushbuttons.

To transfer manually to utility, place the local generator controls in manual/run to ensure continued operation, turn the system operation mode selector to MANUAL, open the generator power switching device, close the utility power switching device, using open/close pushbuttons.

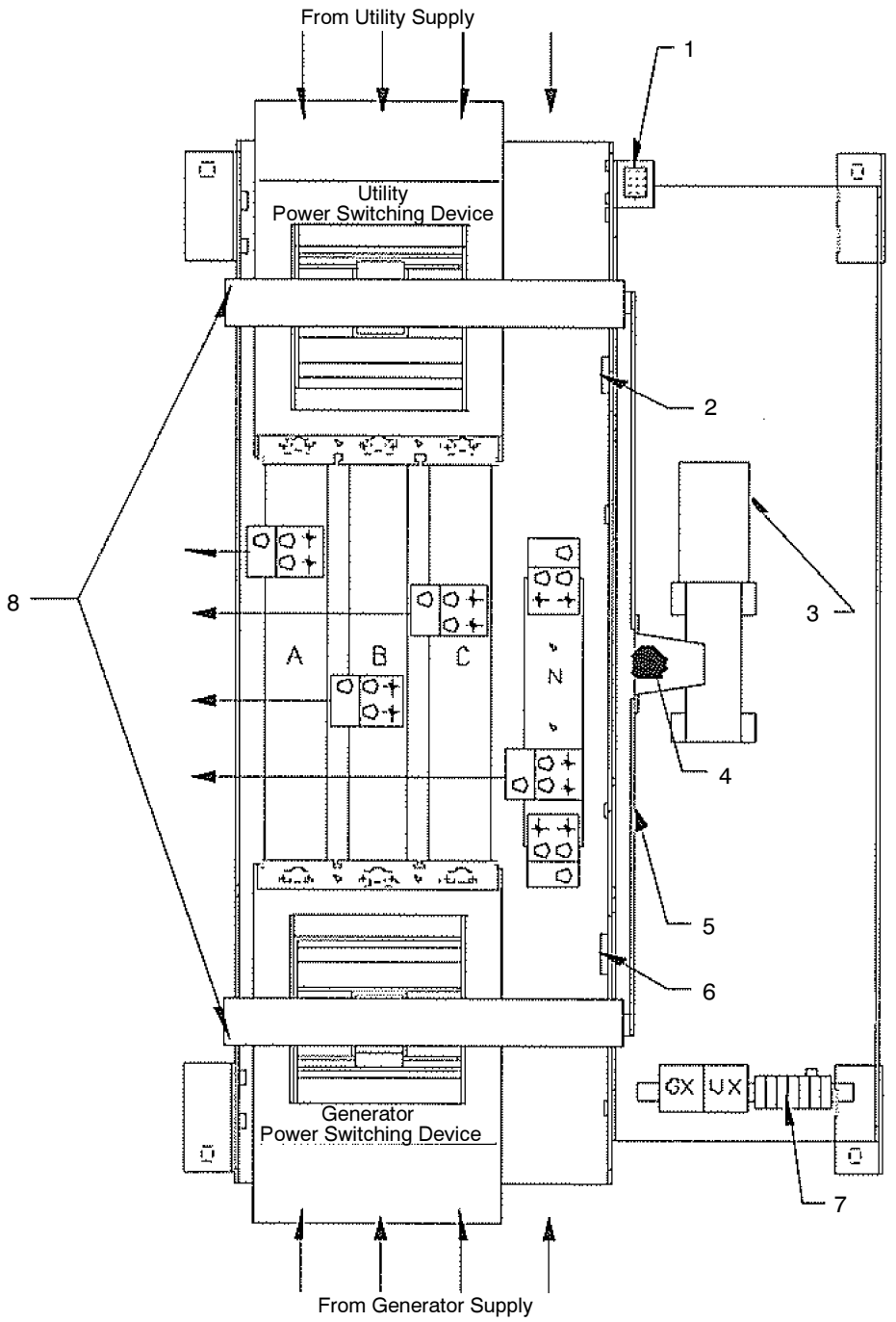
5.3.4 Recommended Maintenance

- Do not perform dielectric tests on the equipment with the control components in the circuit.
- Check if control components are tight in sockets.
- Periodically inspect all terminals (load, line, and control) for tightness. Retorque all bolts, nuts, and other hardware. Clean or replace any contact surfaces which are dirty, corroded, or pitted.
- Transfer switches should be in a clean, dry, and moderately warm location. If signs of moisture are present, dry and clean the transfer switch. If there is corrosion, try to clean it off. If cleaning is unsuitable, replace the corroded parts. Should dust and/or debris gather on the transfer switch, brush, vacuum, or wipe clean. Do not blow dirt into power switching devices.
- Test the transfer switch operation. While the unit is exercising, check for freedom of movement, hidden dirt, corrosion, or any excessive wear on the mechanical operating parts. Ensure that the power switching device travel is correct.
- Verify all program settings on the TSC 800 controller are as per the programming sheet supplied with the transfer switch.



1. GLS
2. ULS
3. Drive rod
4. Wiring harness
5. Manual release plunger
6. Motor drive arm
7. Gear motor
8. PL12 isolation plug
9. Control terminal block
10. Ground lugs

Figure 5-1 Front View, Typical, 3-Pole, 100A–250A Transfer Mechanism



Note: 3-phase connection shown. For single-phase, connect to A and B only.

Configuration "SL" shown. Refer to Drawing M-007450-051 for variations per job requirements.

1. Control isolation plug
2. Utility limit switch
3. Drive motor
4. Manual operation handle
5. Link rod
6. Generator set limit switch
7. Control terminal block
8. Yoke

Figure 5-2 Front View, Typical, 3-Pole Style, 400A–1200A Transfer Mechanism

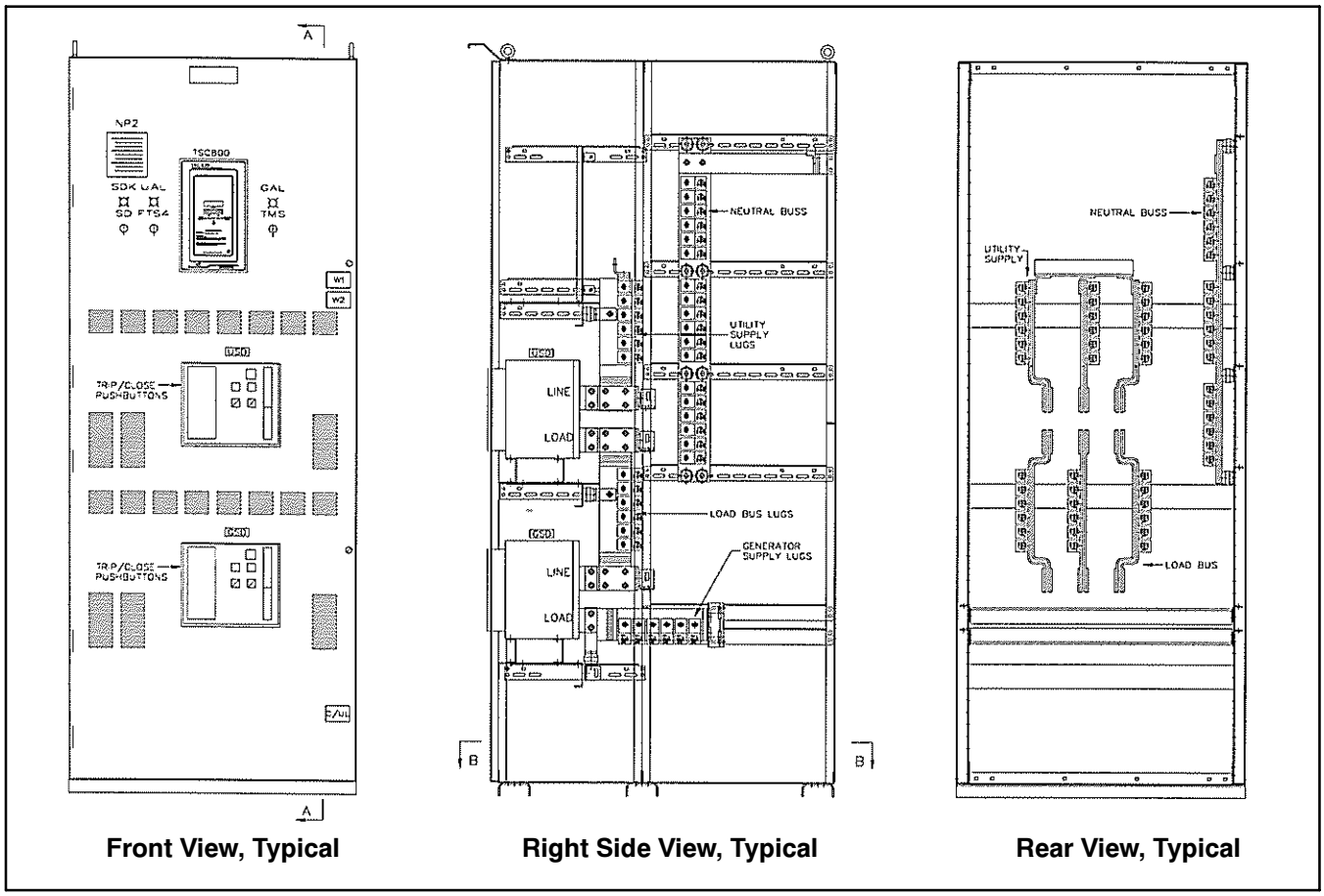


Figure 5-3 3-Pole, 800A–4000A Insulated Case Type Transfer Mechanism, Typical

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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

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

Note: Only qualified personnel must perform all installation and/or service work.

6.1 100A–1200A Molded-Case Switch Type ATS

Symptom	Possible Causes
Will not retransfer to utility source upon restoration	Isolation plug out.
	Utility disconnect switch is in the deenergized position (Service Entrance Rated ATS). Switch to the energized position.
	A test mode has been activated (check controller).
	Utility voltage is below the preprogrammed limits (check utility source for adequate voltage).
	A loose control connection.
	Faulty motor limit switch.
	Defective motor.
	Controller has incorrect voltage programmed for correct system voltage.
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Controller has transfer fail alarm activated. Determine cause of alarm and rectify before controller is reset.
Will not transfer to generator source upon failure of utility source	Isolation plug out.
	Generator set not producing enough voltage/frequency or output circuit breaker is open.
	Controller has incorrect voltage programmed for system voltage.
	Warmup time delay function has not timed out yet (verify controller timer setting).
	A loose control connection.
	Faulty motor limit switch.
	Defective motor.
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Controller has transfer fail alarm activated Determine cause of alarm and rectify before controller is reset.
Transfer to generator source without a power failure in the utility source	A test mode has been activated (check controller). Utility supply voltage is slightly below voltage sensing setpoints.
	Verify controller has incorrect voltage program setting for system voltage.
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Utility power switching device has tripped due to an over current condition and controller transfer fail alarm activated. Determine cause of alarm and rectify before controller is reset.
Generator does not start up or stop when it should	Verify remote engine control panel is set for automatic mode.
No time delay when there should be	Verify time delay function in the controller program setting as per programming sheets as supplied with the transfer switch.
Power is not available at the load terminals but the utility or generator power switching device appears to be closed to a live source	The power switching device's overcurrent protection unit has opened due to a fault on the system. Correct the fault, and manually reset the power switching device in the transfer switch by moving it off and then on again with the manual operating handle.
	Limit switch incorrectly adjusted.
The transfer switch has completed a transfer, but the motor has overheated and the internal thermal protector has opened	Limit switch failure or improper adjustment has failed to disconnect motor. Binding or jamming of the transfer mechanism.

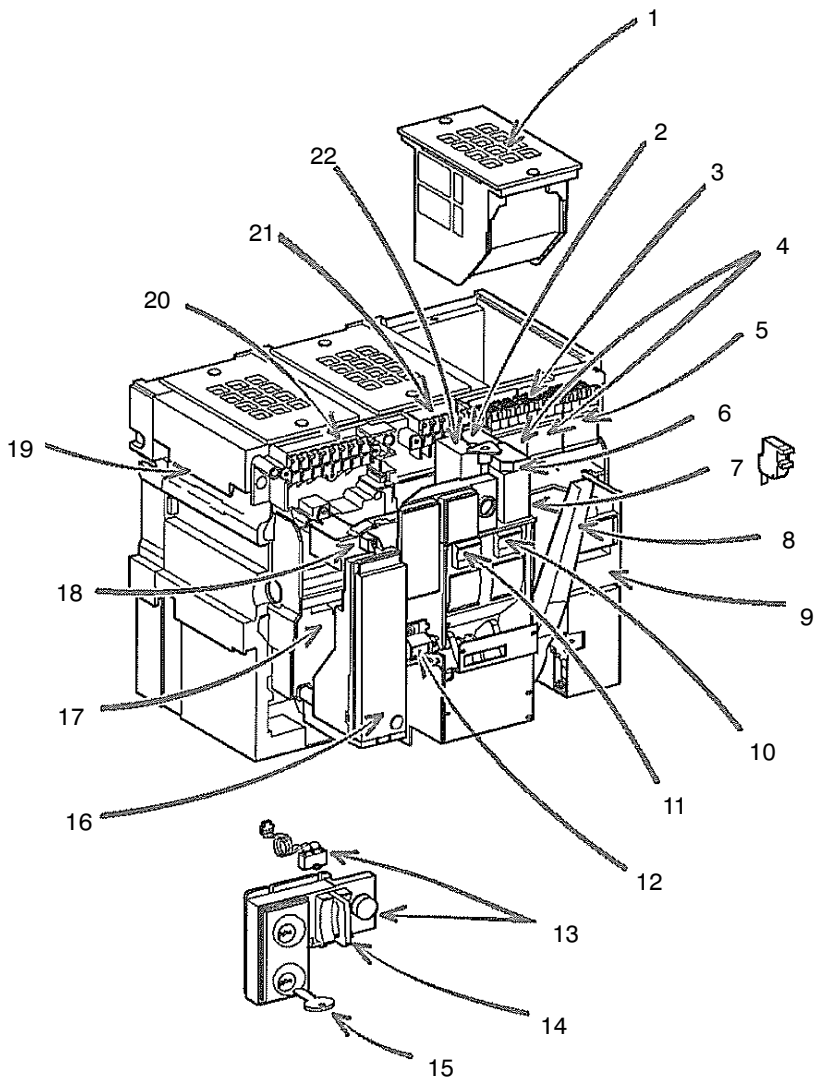
6.2 800A–4000A Insulated-Case Switch Type ATS

There are no user-serviceable components located on the controller printed circuit board. If the controller is defective, return it to the manufacturer for repair or replacement. Contact the factory for instructions.

Symptom	Possible Causes
Will not retransfer to utility source upon restoration	Control wiring isolation plug is removed.
	A test mode has been activated (check controller status LCD display).
	Utility disconnect switch is in the deenergized position (Service Entrance Rated ATS). Switch to the energized position.
	Transfer mode selector is not in auto position.
	Utility voltage or frequency is outside the pre-programmed limits (check utility source for adequate voltage & frequency).
	Loose control connection.
	Faulty Power Switching Device (refer to Power Switching Device Troubleshooting Section 6.3).
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Controller has Transfer Fail alarm activated (if programmed as Force Transfer). Determine cause of alarm and rectify before controller is reset.
Will not transfer to generator source upon failure of utility source	Control wiring isolation plug is removed
	Generator set not producing enough voltage/frequency or output circuit breaker open.
	Warmup time delay function has not timed out yet (verify controller timer setting).
	Transfer mode selector is not in auto position.
	A loose control connection.
	Faulty Power Switching Device (refer to Power Switching Device Troubleshooting Section 6.3).
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Controller has Transfer Fail alarm activated (if programmed as Force Transfer). Determine cause of alarm and rectify before controller is reset.
Transfer to generator source without a power failure in the utility source	A test mode has been activated (check controller status LCD display).
	Utility supply voltage is slightly above or below voltage sensing setpoints. Compare controller program voltage setpoints with actual utility voltage displayed on the controller.
	Defective controller (verify output signals with circuit board mounted diagnostic LEDs).
	Utility Power Switching Device has opened due to an over current condition (Service Entrance type ATS) and controller Transfer Fail alarm activated. (**Note:** Controller must be programmed as Force Transfer for this to occur). Determine cause of alarm and rectify before controller is reset.
Generator does not start up or stop when it should	Verify remote engine control panel is set for automatic mode.
No time delay when there should be	Verify time delay function in the controller program setting as per programming sheets as supplied with the transfer switch.
Power is not available at the load terminals but the utility or generator power switching unit appears to be closed to a live source	The power switching device (service entrance type ATS) has opened due to a fault on the system and controller Transfer Fail is programmed as Disabled or Halt Transfer. Correct the fault, and manually reset the power switching unit.

6.3 Power Switching Device (800A–4000A Insulated-Case Switch Type ATS)

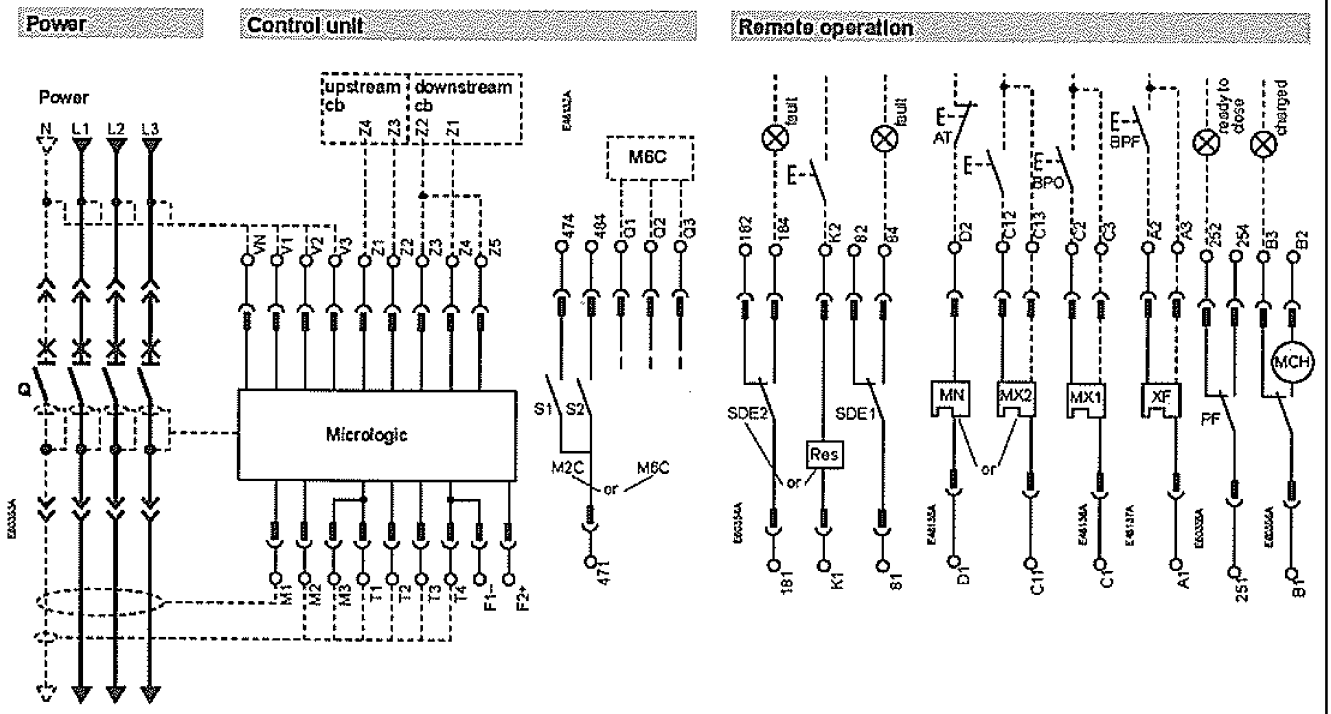
Malfunctions	Probable Causes	Corrective Actions
The power switching device cannot be opened locally.	Open pushbutton locked.	Remove the locking.
	Faulty mechanism or main circuits bonded.	Contact service department.
The power switching device cannot be manually closed.	Power switching device closing on short-circuit.	Clear the fault. Check power switching device condition before putting back into operation.
	Fault trip indicator on power switching device button not reset (service entrance type ATS).	Reset fault trip indicator-button.
	Power switching device not fully connected (drawout type only).	Connect power switching device fully.
	Antipumping function.	Move transfer mode switch to the manual position, then back to the auto position to cycle the control signal.
	Power switching device not charged.	Check the geared motor power supply is greater than 85% nominal voltage. Check the power supply circuit. Attempt a manual recharging. Replace the geared motor if necessary. (Contact service department).
	Closing coil is continuously supplied.	Move transfer mode switch to the manual position, then back to the auto position to cycle the control signal.
	Power switching device locked in *open* position.	Remove the locking.
	Power switching device interlocked.	Check whether this refusal to close is not normal.
The power switching device does not recharge electrically.	Charge motor supply voltage too low (less than 85% nominal voltage).	Apply a voltage greater than 85% nominal voltage. Check the charge motor electrical circuit. Attempt to recharge manually. If problem continues, mechanism is faulty. Contact service department. If okay, motor is faulty. Replace it.
It is impossible to insert the racking handle to connect or to disconnect the power switching device.	There is a padlock or a key lock for connected or disconnected position. There is a racking interlock.	Remove disabling.
	The extraction rails or the power switching device is not completely pushed in.	Push the rails or the power switching device completely in.
It is impossible to extract the right side rail (on chassis alone) or the power switching device.	The racking handle is inserted.	Remove the racking handle and put it in its storage.
	The power switching device is not completely disconnected.	Disconnect the power switching device.
	There is a padlock or a key lock for connected or disconnected position. There is a racking interlock.	Remove disabling.
It is impossible to extract the power switching device whenever it is charged.	There is an extraction locking when power switching device is charged.	Discharge the power switching device (open, close then open again the power switching device).
It is impossible to rack in the power switching device	The chassis does not correspond with the power switching device.	Fit fouling plate on your chassis and power switching device to avoid new problems.
	The plastic ties which hold clusters during transport are not removed.	Remove the plastic ties.
	The cluster positions are not correct.	Put them in order again.
	There is a safety shutter locking.	Remove this locking.



1. Arc chute
2. MX1 opening release
3. Terminal block for the On/Off indication contacts
4. Blocks (2) of four additional OF On/Off contacts or EF combined connected/closed contacts
5. Block of four OF On/Off indication contacts
6. XF closing release
7. PF ready to close contact
8. Operating mechanism charging handle
9. MCH gear motor for electrical charging of operating mechanism
10. Closing pushbutton
11. Opening pushbutton
12. Operation counter
13. BPFE electrical closing pushbutton
14. Locking by padlocks
15. Keylocking kit
16. Control unit
17. SDE1 fault-trip indication contact
18. SDE2 fault-trip indication contact or Res electrical remote reset
19. Carrying grip
20. Terminal block for control unit and SDE contact(s)
21. Terminal block for control auxiliaries
22. MX2 opening release or MN undervoltage release

Figure 7-1 Power Switching Device

The diagram is shown with circuits de-energised, all devices open, connected and charged and relays in normal position.



Control unit

Com		UC1		UC2		UC3	UC4	M2C / M6C
E5	E6	Z5	M1	M2	M3	F2+	V3	484 / Q3
E3	E4	Z3	Z4	T3	T4	VN	V2	474 / Q2
E1	E2	Z1	Z2	T1	T2	F1–	V1	471 / Q1

Remote operation

SDE2 / Res			MN / MX2		MX1	XF	PF	MCH
184	/	K2	84	D2	/ C12	C2	A2	254	B2
182			82			C3	A3	252	B3
181	/	K1	81	D1	/ C11	C1	A1	251	B1

A	P	H	Control unit	Remote operation
■	■	■	**Com:** E1-E6 communication	**SDE2:** Fault-trip indication contact or **Res:** Remote reset
■	■	■	**UC1:** Z1-Z5 zone selective interlocking: Z1 = ZSI OUT SOURCE Z2 = ZSI OUT; Z3 = ZSI IN SOURCE Z4 = ZSI IN ST (short time) Z5 = ZSI IN GF (earth fault) M1 = Vigi module input (Micrologic 7)	**SDE1:** Fault-trip indication contact (supplied as standard)
■	■	■		**MN:** Undervoltage release or **MX2:** Shunt release
■	■	■	**UC2:** T1, T2, T3, T4 = external neutral; M2, M3 = Vigi module input (Micrologic 7)	**MX1:** Shunt release (standard or communicating)
■	■	■	**UC3:** F2+, F1– external 24 V DC power supply VN external voltage connector	**XF:** Closing release (standard or communicating)
	■	■		**PF:** "Ready to close" contact
	■	■	**UC4:** V1, V2, V3 optional external voltage protector	**MCH:** Gear motor.
	■	■	**M2C:** 2 programmable contacts (internal relay); ext. 24 V DC power supply required or	*Note:* *When communicating MX or XF releases are used, the third wire (C3, A3) must be connected even if the communications module is not installed.*
	■	■	**M6C:** 6 programmable contacts (external relay); 24 V DC power supply required	

A : Digital ammeter
P : A + power meter + programmable protection
H : P + harmonics

Figure 7-2 Electrical Diagram

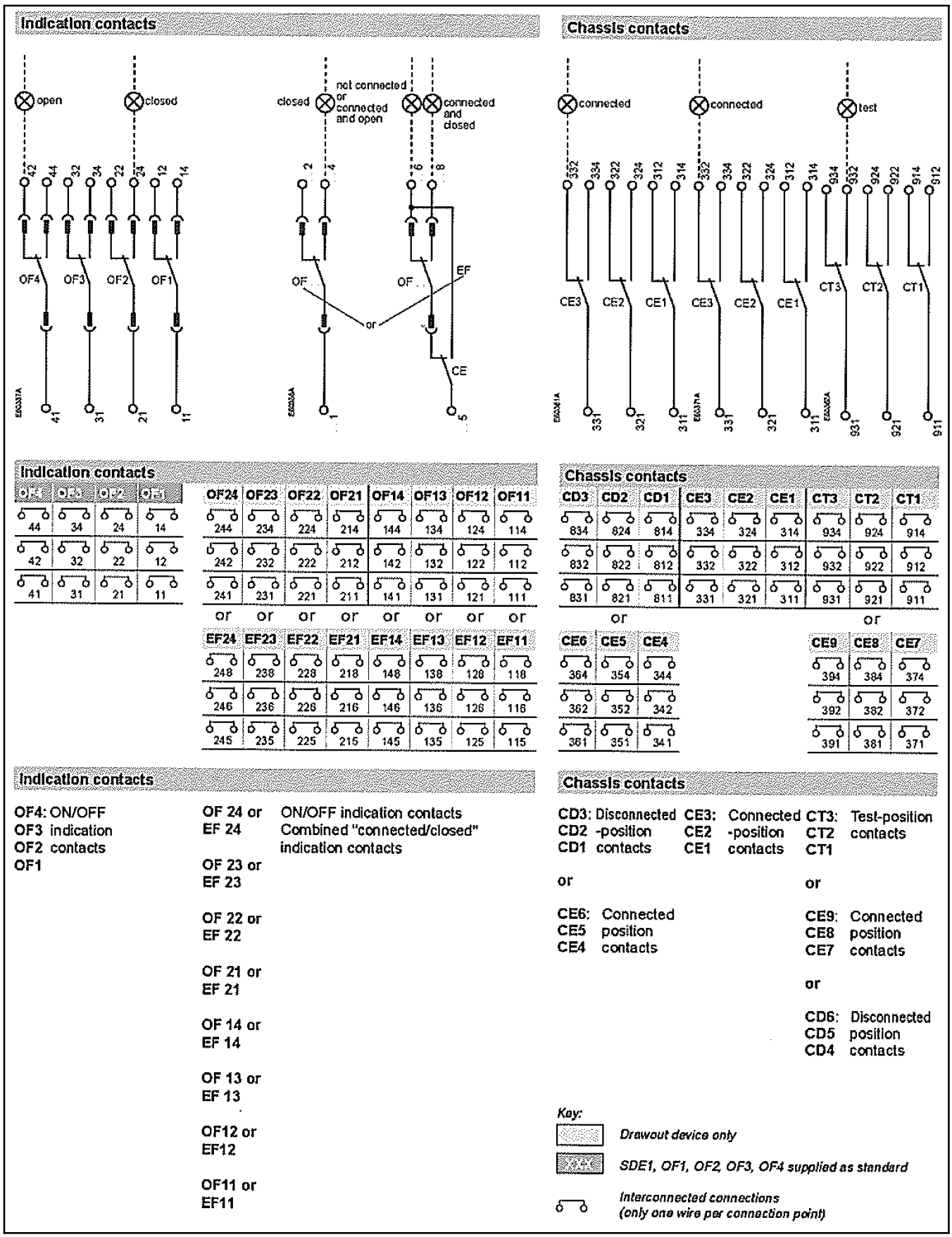


Figure 7-3 Electrical Diagram, Identifying the Electrical Auxiliaries

Notes

8.1 Weights and Dimensions

Basic Model	Dimensions, mm (in.) ‡ Height	Width	Depth	Shipping Weight, kg (lbs)
TS 88xA-0100/0150*	787.4 (31)	558.8 (22)	330.3 (13)	72.6 (160)
TS 88xA-0200*	787.4 (31)	558.8 (22)	330.3 (13)	72.6 (160)
TS 88xA-0250*	889.0 (35)	685.8 (27)	330.3 (13)	74.8 (165)
TS 88xA-0400*	1625.6 (64)	762.0 (30)	330.3 (13)	175.5 (387)
TS 88xA-0600*	1778.0 (70)	863.3 (34)	330.3 (13)	187.8 (414)
TS 88xA-0800*	1778.0 (70)	863.3 (34)	330.3 (13)	187.8 (414)
TS 88xA-1000/1200*	1930.4 (76)	863.3 (34)	330.3 (13)	249.6 (550)
TS 88xA-0800†	2324 (91.5)	915 (36)	1067 (42)	680 (1500)
TS 88xA-1200†	2324 (91.5)	915 (36)	1067 (42)	680 (1500)
TS 88xA-1600†	2324 (91.5)	915 (36)	1067 (42)	680 (1500)
TS 88xA-2000†	2324 (91.5)	915 (36)	1219 (48)	680 (1500)
TS 88xA-2500†	2324 (91.5)	915 (36)	1524 (60)	817 (1800)
TS 88xA-3000†	2324 (91.5)	915 (36)	1524 (60)	817 (1800)
TS 88xA-4000†	2324 (91.5)	1219 (48)	1829 (72)	1089 (2400)

* With molded-case power switching devices

† With insulated-case power switching devices

‡ Enclosure dimensions are for reference only. Do not use for installation.

8.2 Dimension Drawings

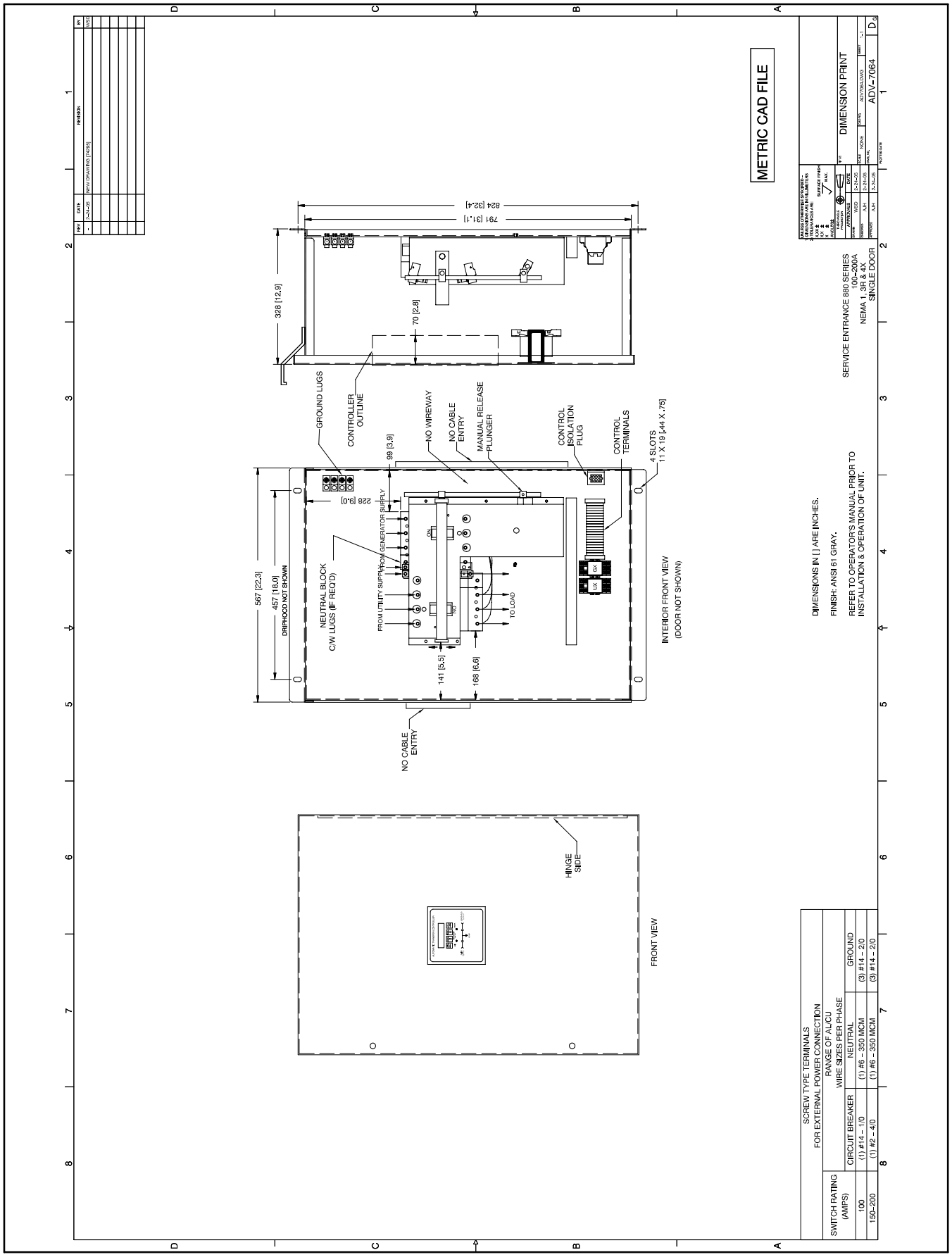


Figure 8-1 ADV-7064-S-

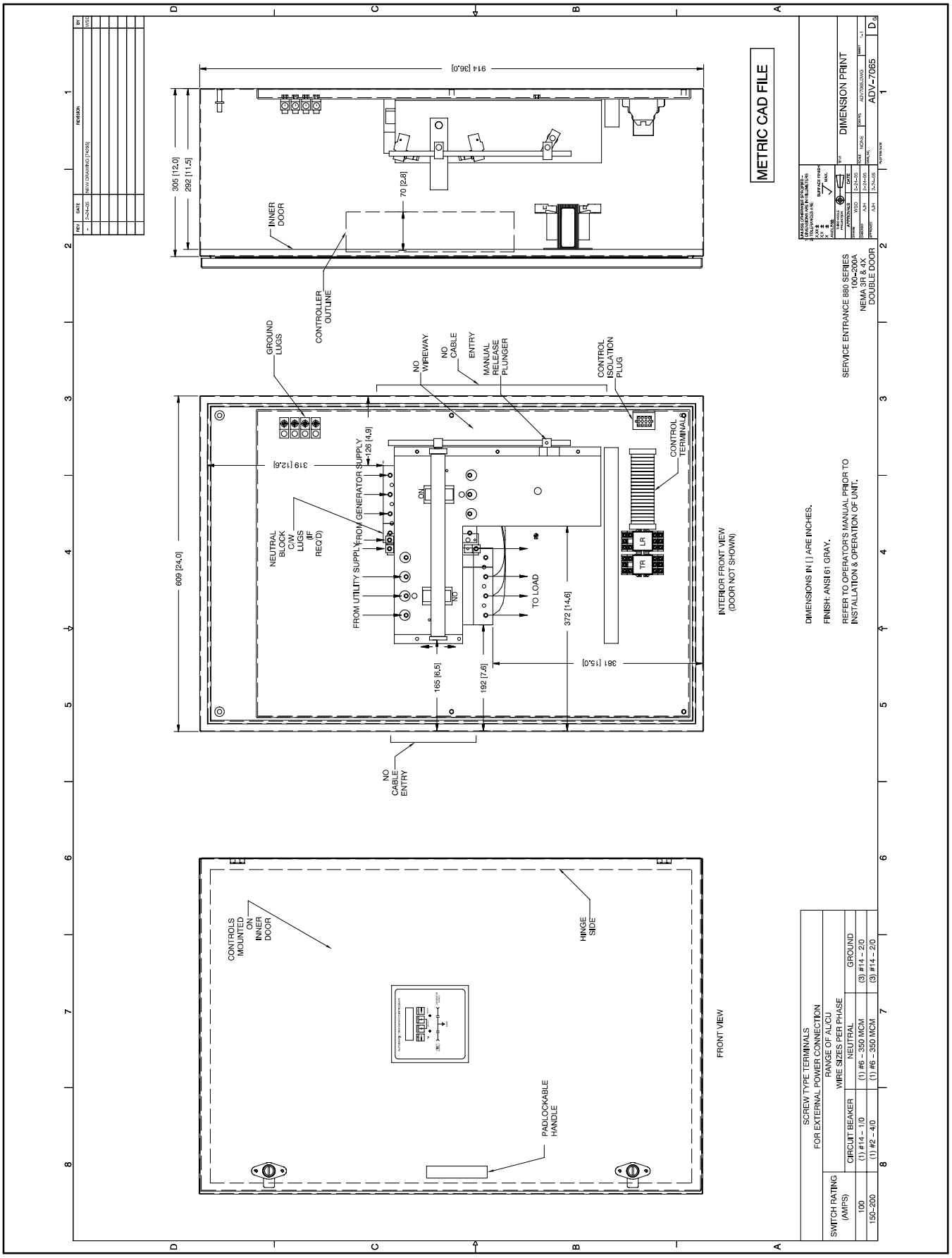


Figure 8-2 ADV-7065-S-

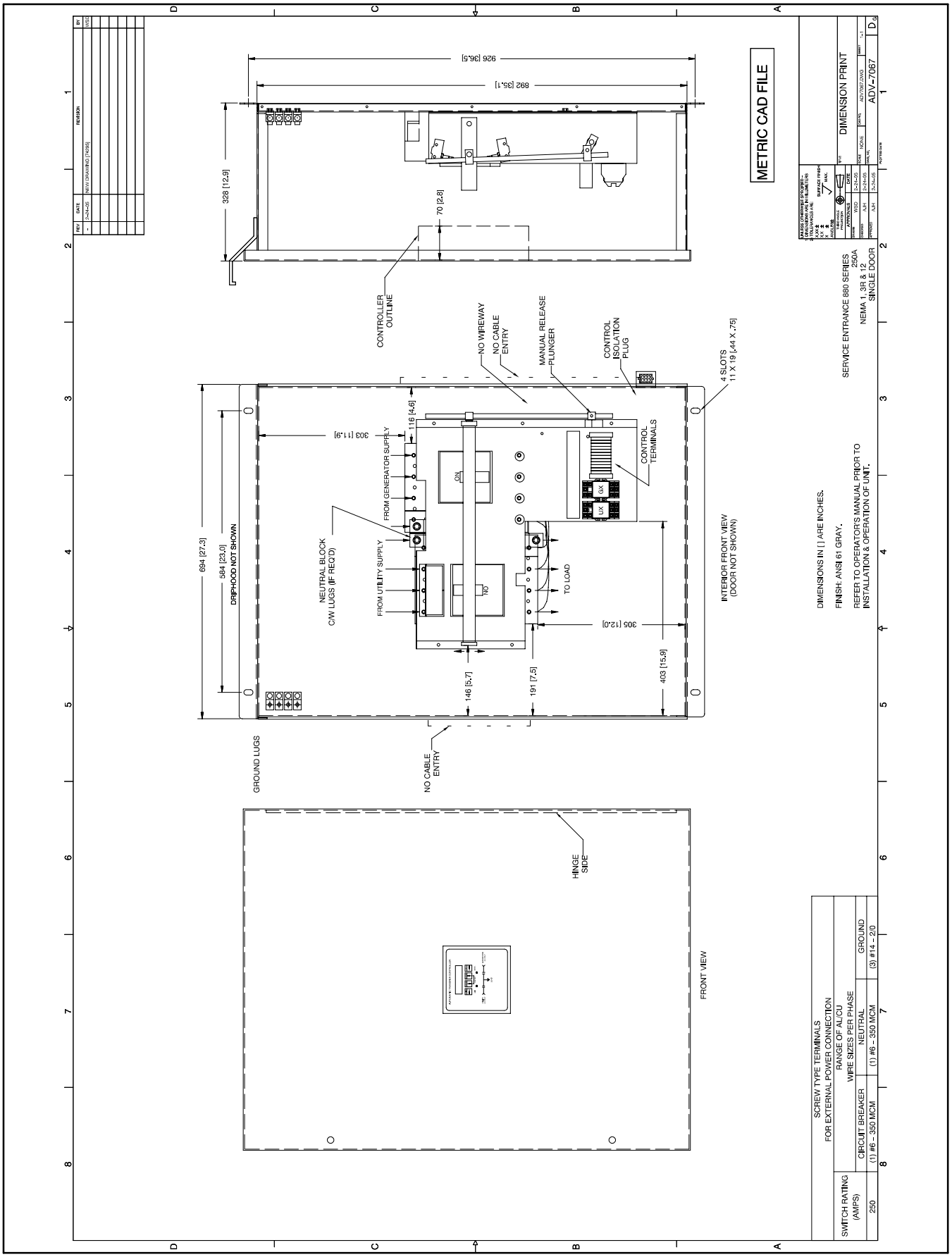


Figure 8-3 ADV-7067-S-

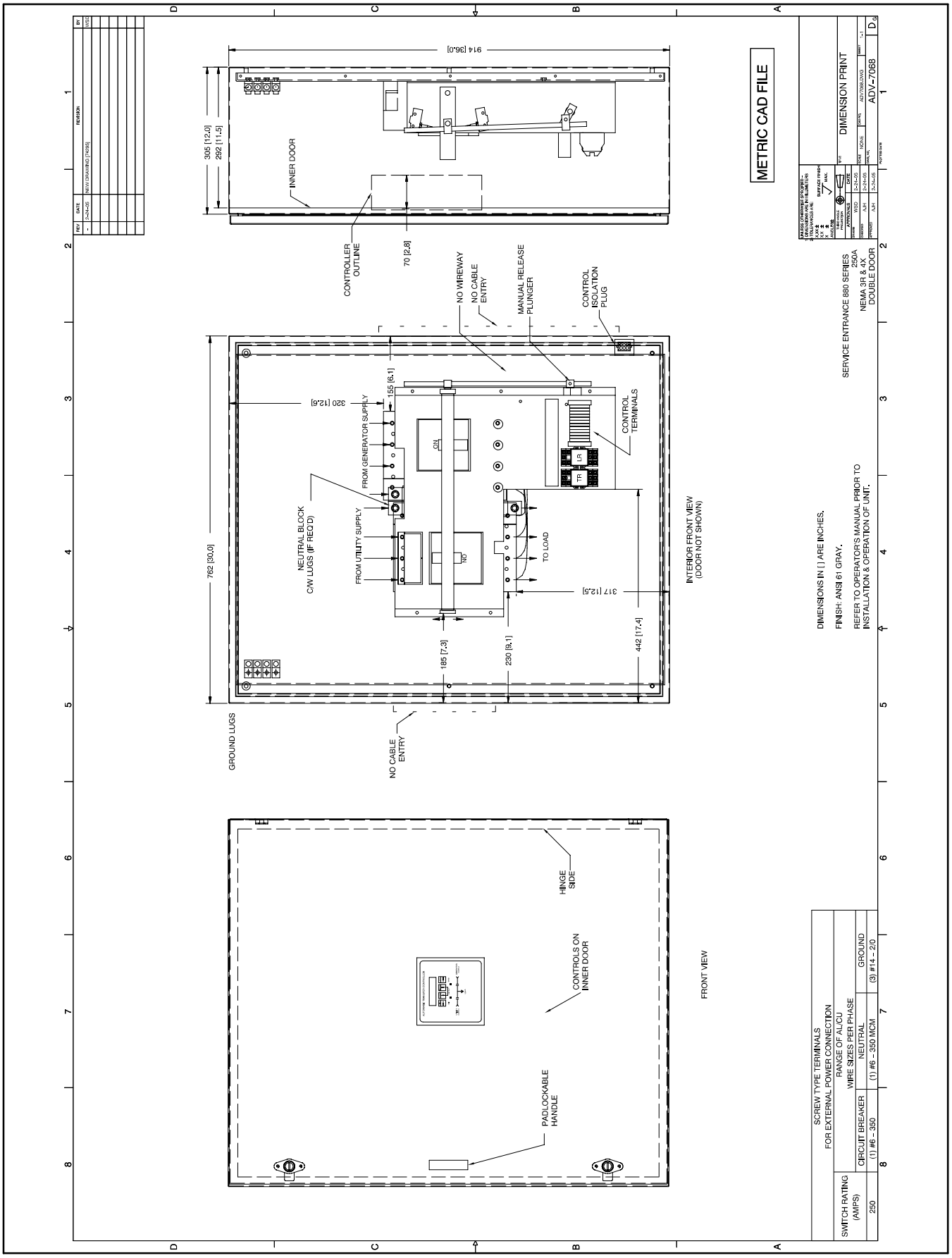


Figure 8-4 ADV-7068-S-

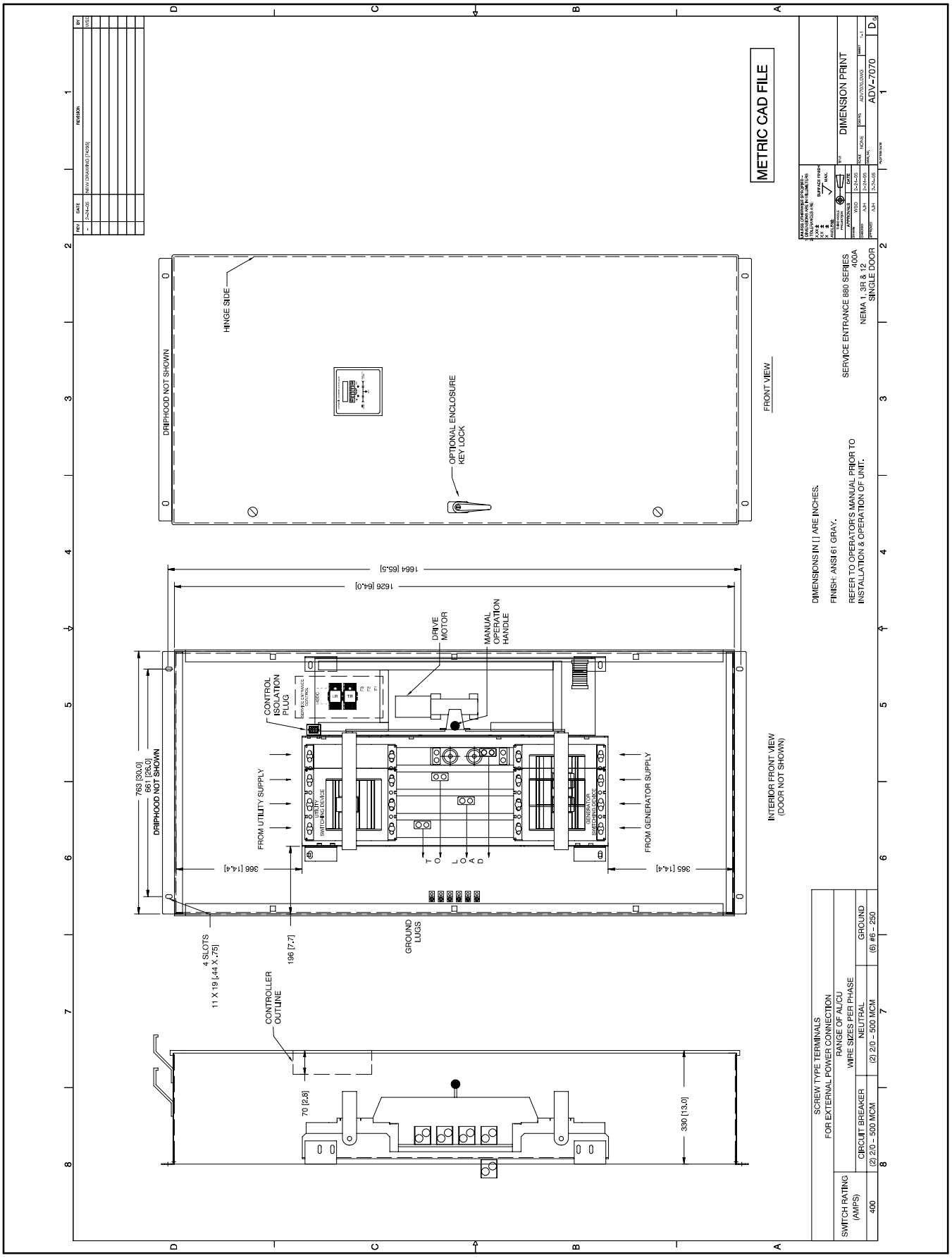


Figure 8-5 ADV-7070-S-

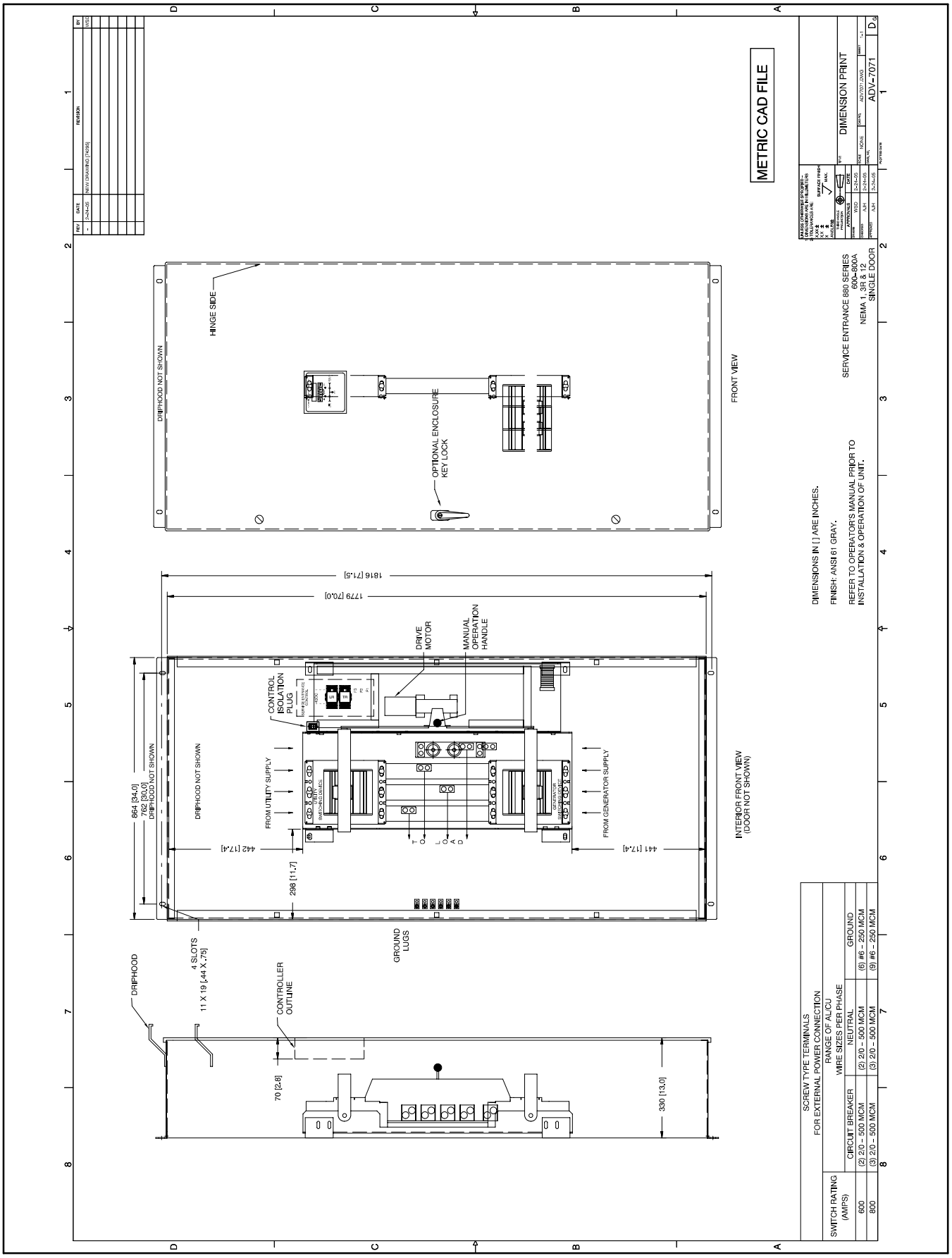


Figure 8-6 ADV-7071-S-

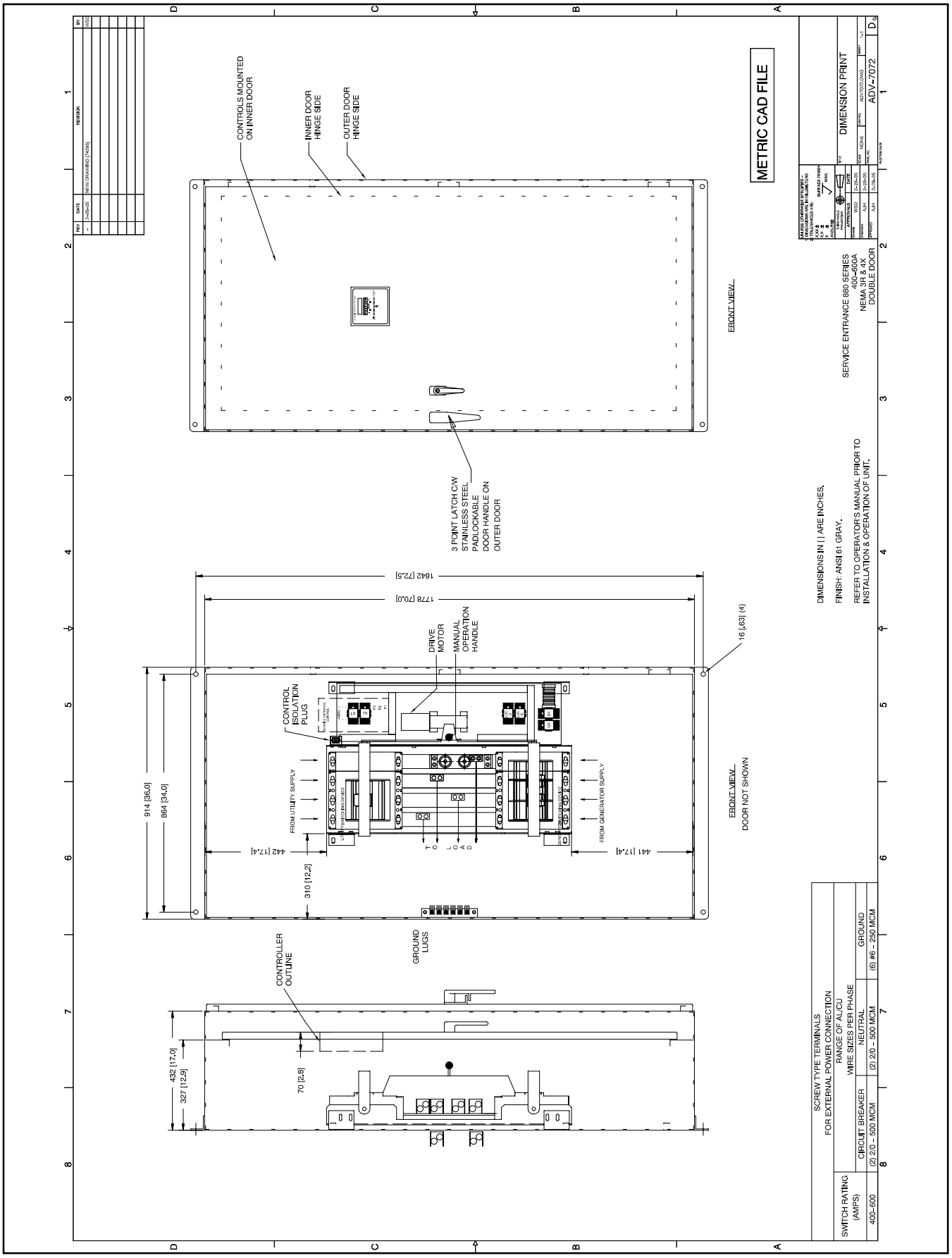


Figure 8-7 ADV-7072-S-

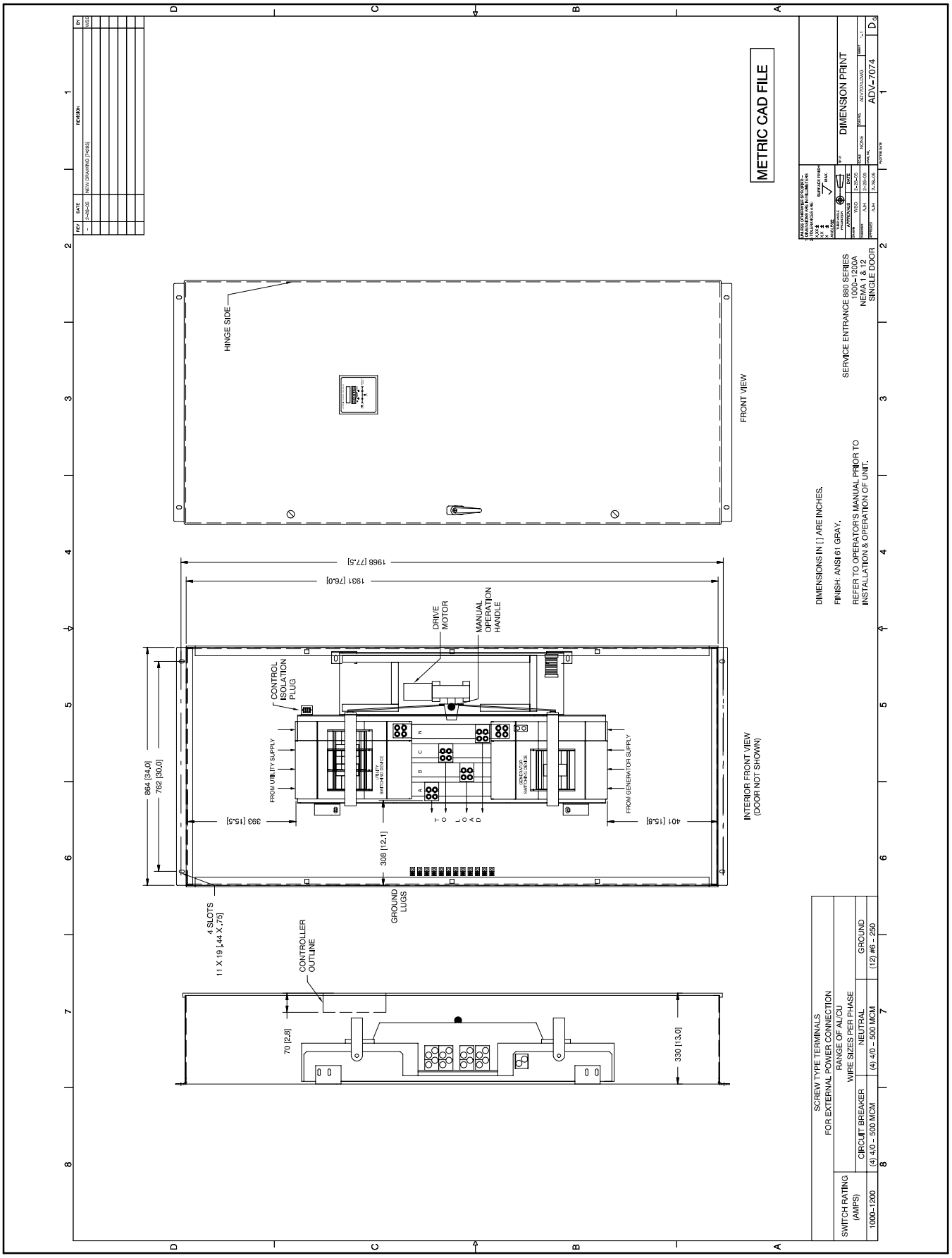


Figure 8-8 ADV-7074-S-

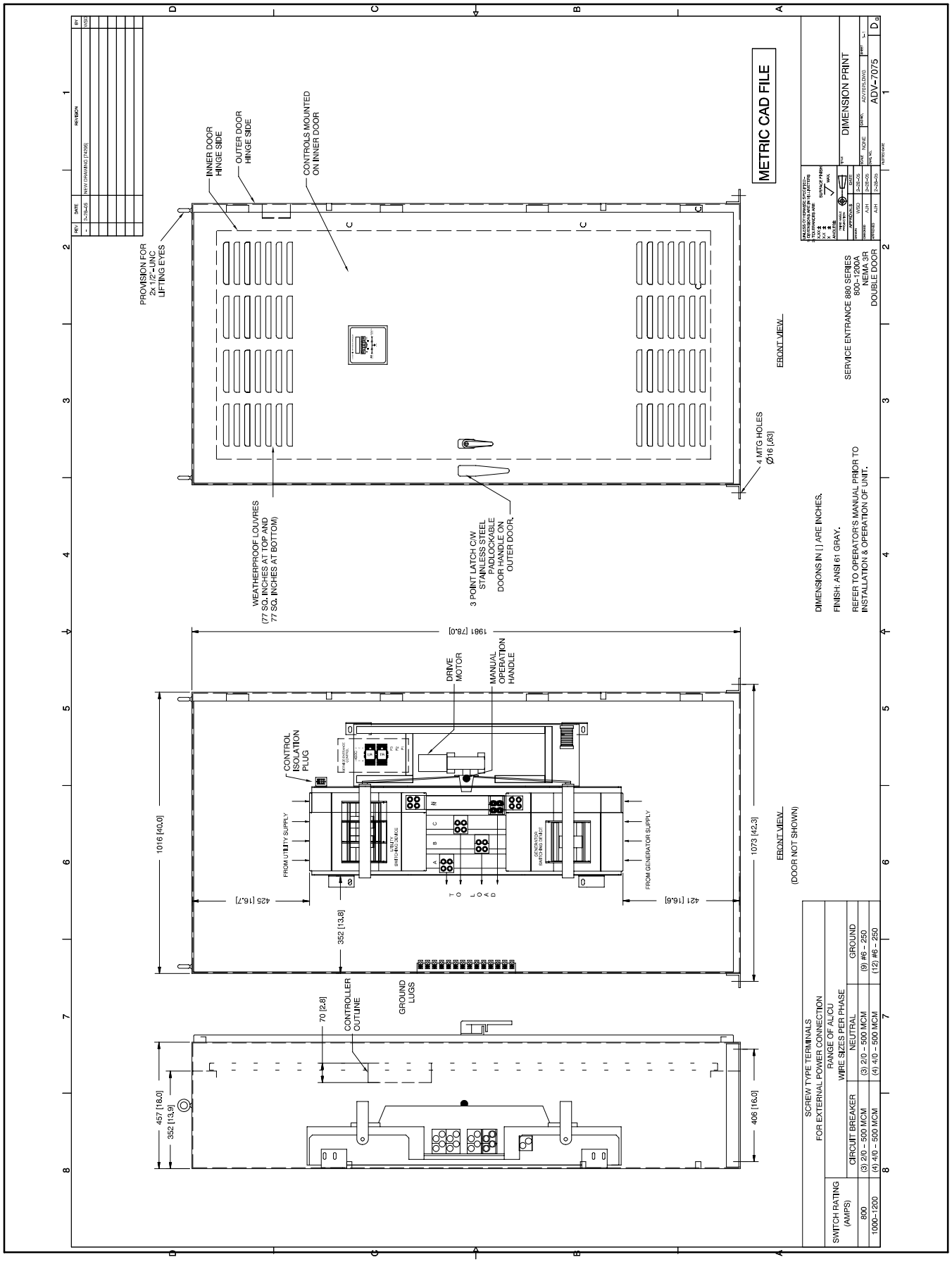


Figure 8-9 ADV-7075-S-

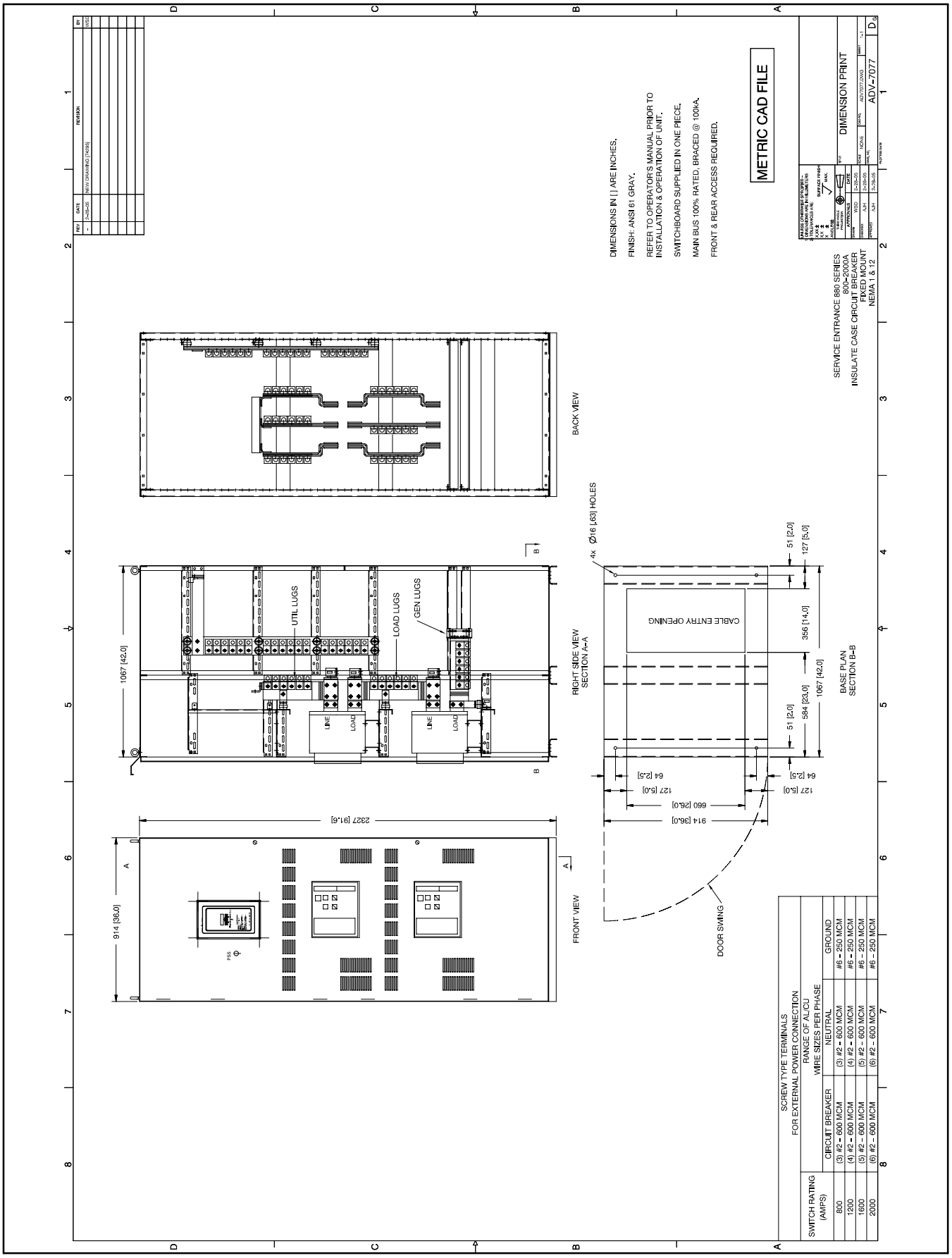


Figure 8-10 ADV-7077-S-

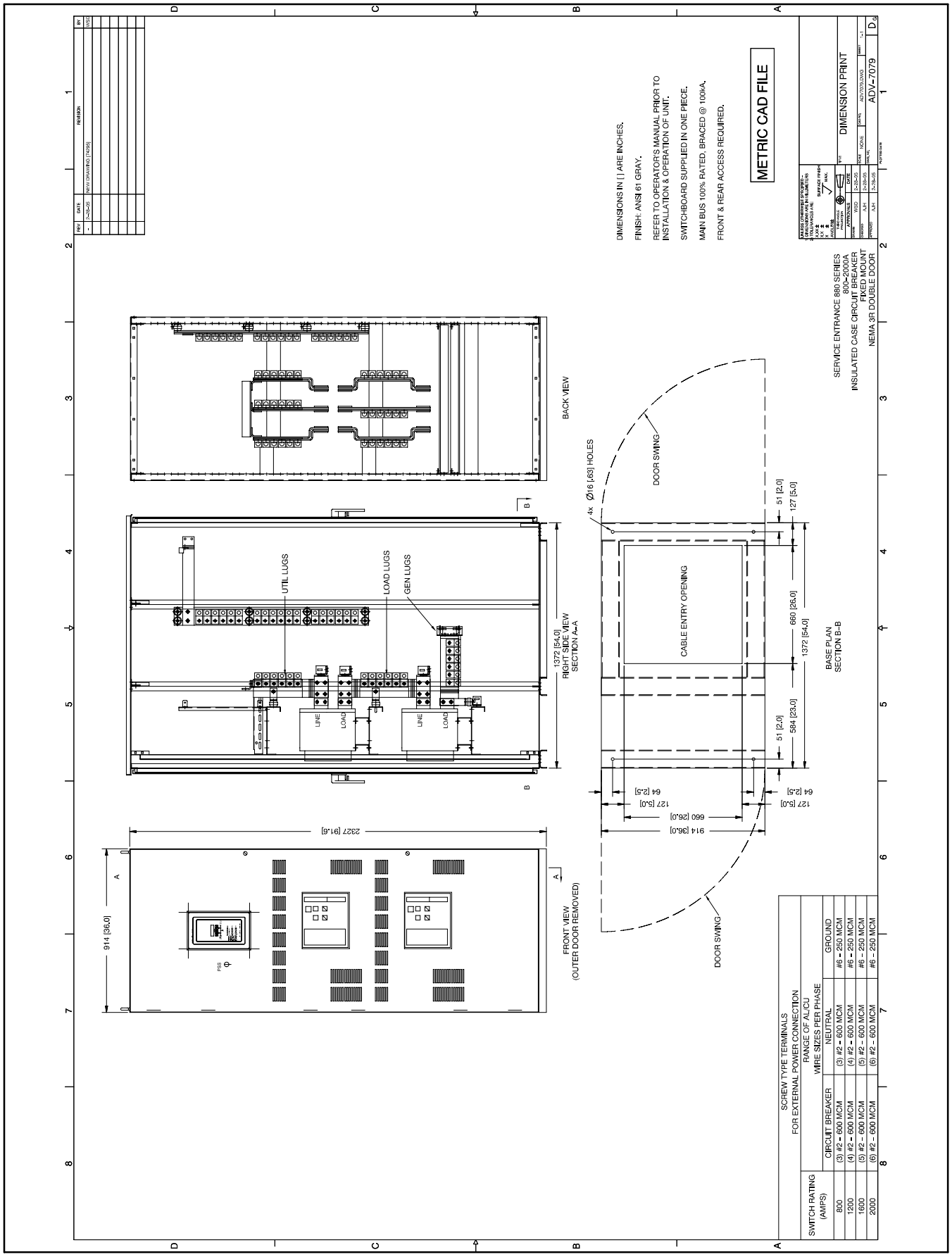


Figure 8-11 ADV-7079-S-

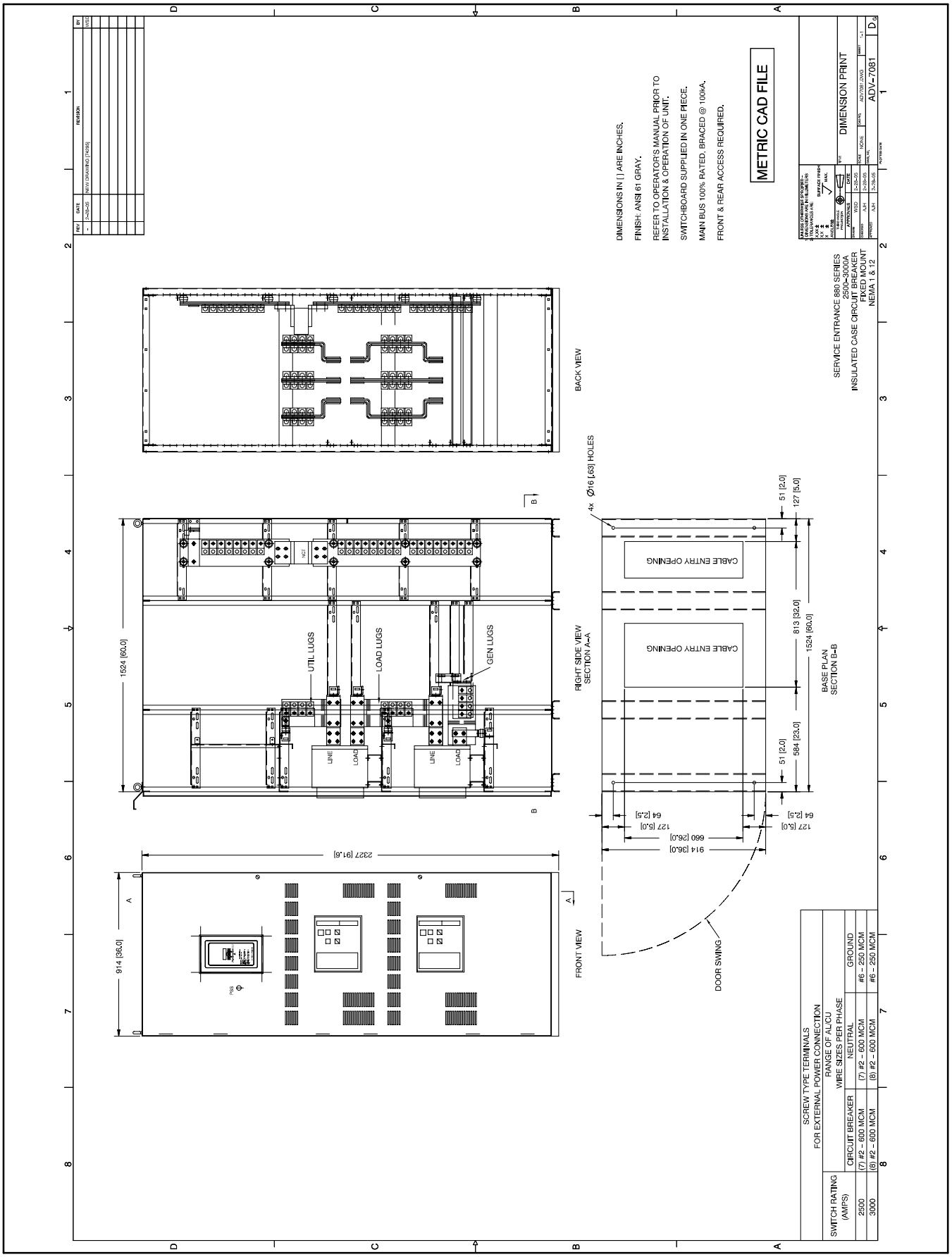


Figure 8-12 ADV-7081-S-

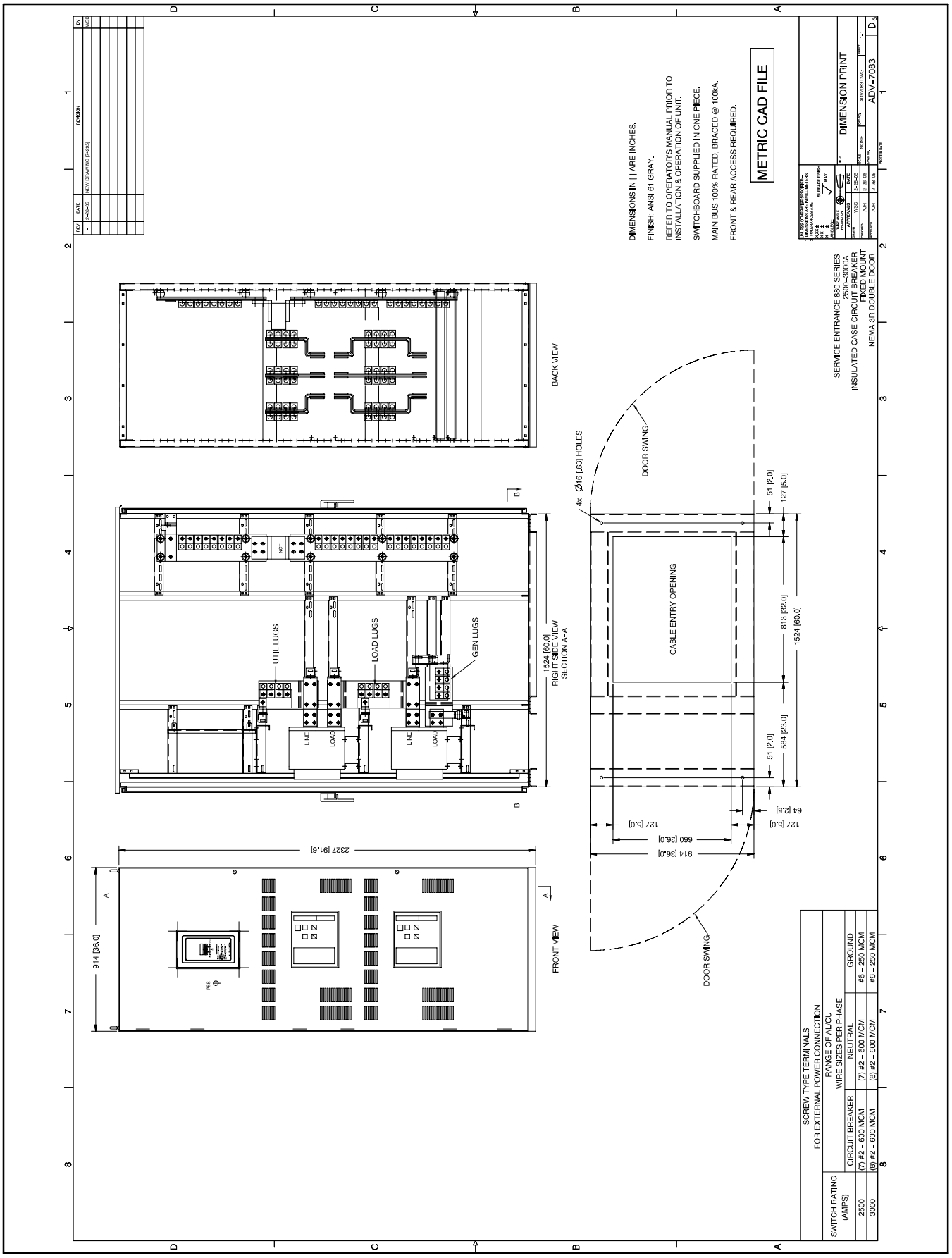


Figure 8-13 ADV-7083-S-

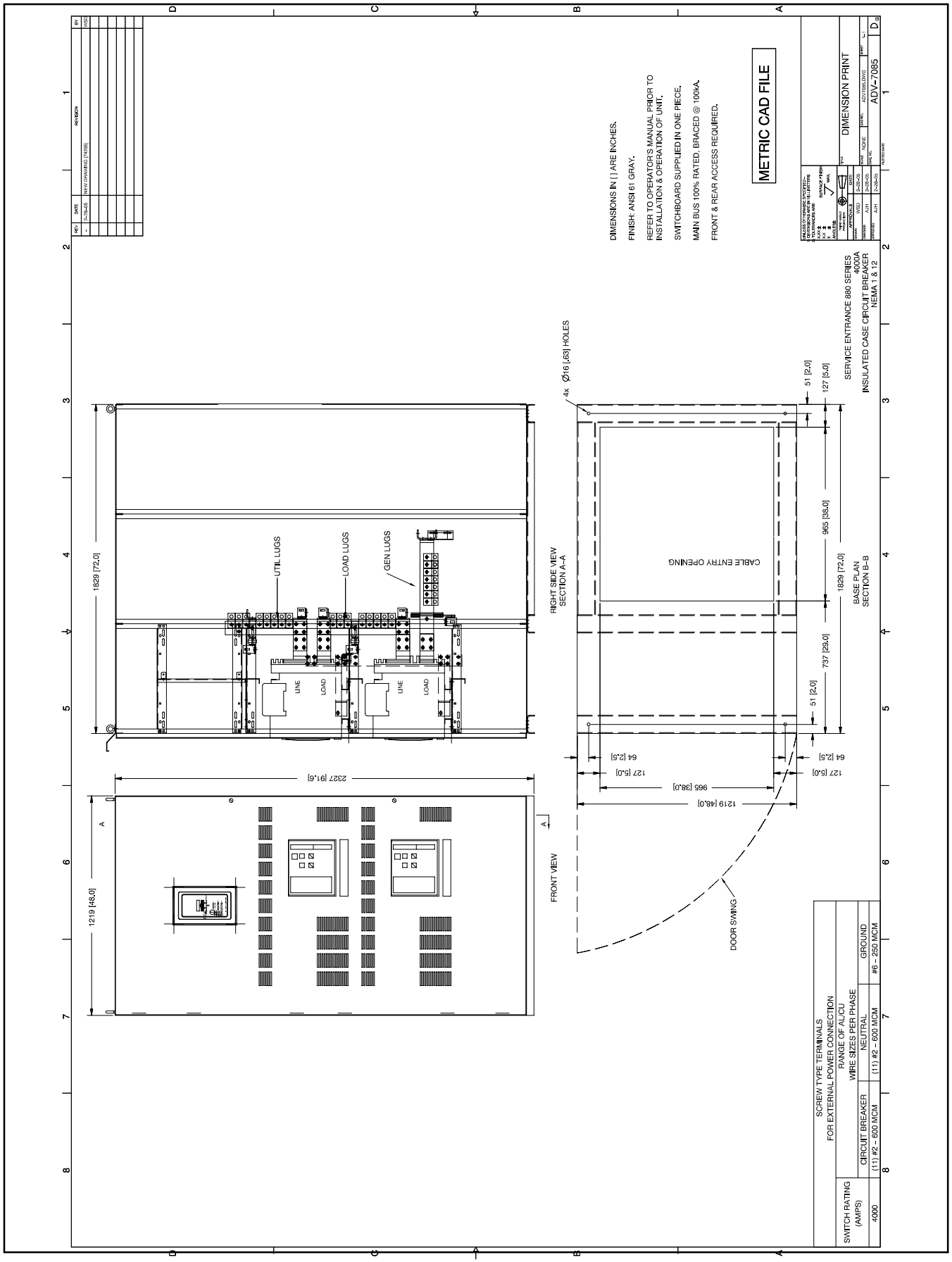


Figure 8-14 ADV-7085-S-

Notes

Available replacement parts for the transfer switch are listed in Figure 9-1.

When ordering replacement parts, please provide the following information:

- Transfer switch product (model) code (e.g. TS 883AA0200AS).
- Transfer switch serial number (e.g. W-022345).

Note: The above information can be found on the transfer switch equipment rating plate located on the outside of the ATS door.

For parts not listed, please contact the supplier.

Motor Types

Motor types used on 100A–250A transfer switches were changed during the first quarter of 2005 from unidirectional to reversing style motors.

A reversing type motor cannot be used as a direct replacement for a unidirectional motor due to mechanical and electrical wiring differences. Therefore, when ordering replacement motors, the same motor type must be specified to ensure it matches the original mechanism design. To distinguish between the two different motor types, refer to the following product descriptions:

- Unidirectional Transfer Switch Motor: 2 wire leads extend from the motor. The ATS Terminal block has number “M1” terminal, which connects to this type of motor.
- Reversing Transfer Switch Motor: 3 wire leads extend from the motor. ATS Terminal block does not contain terminal number “M1”. The reversing motor also uses a starting capacitor, which is mounted above the motor under the ATS mechanism.

Part No.	Description	Comments
GM42047	Controller, TSC 800	Must verify program prior to use. Refer to MP-6381, Operation/Installation/Service Manual.
GM42050	Switch, limit 1 NO, 1 NC, 100–1200 amp molded-case type	Must install and adjust for proper operation before use. Contact the supplier for installation/ adjustment procedures.
GM	Faceplate	Contact the supplier for installation procedures.
GM	Service replacement LCD display	Contact the supplier for installation procedures.
GM42051 *	Motor, unidirectional, 100–250 amp, 1-phase, 120 volt	Motor is supplied with gear box assembly. Contact the supplier for installation procedures. See Motor Types, above.
GM42052 *	Motor, reversing, 100–250 1-phase, 120-volt	See Motor Types, above.
GM42053	Motor, transfer switch, 400–1200 amp molded-case type, 120 volt, 1/10 HP, 1-phase	Motor is supplied with gear box assembly. Contact the supplier for installation procedures.
GM42054	Relay, auxiliary plug-in, 120 VAC, 11-pin square (UX/GX)	Must ensure coil voltage is correct.
GM42055	Timer, auxiliary plug-in, 120 VAC	Must ensure coil voltage is correct.
GM42056	Transformer, control, 100 VA	
GM42057	Transformer, control, 200 VA	
* See Motor Types, above, to determine whether a unidirectional or a reversing motor is required.		

Figure 9-1 Service Parts

Notes

Section 10 Performance Test Form

This form should be retained by those in charge of the building electrical installation in order to be available to the authority having jurisdiction.

Date	Personnel	Tests Performed	Comments
		Interconnection evaluation	
		Grounding point evaluation	
		Fault current test:	
		Ground fault settings – _____	
		Simulated current – _____	
		Results – _____	

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	analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
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
API	American Petroleum Institute
approx.	approximate, approximately
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
A/V	audiovisual
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
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
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dBA	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
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
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 temperature, high engine temperature
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)
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
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/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
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
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
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
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
RTV	room temperature vulcanization
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
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, 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
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

Typical Automatic Transfer Switch Commissioning Procedures

Note: The following commissioning procedures are provided for general information only pertaining to typical site installations and applications. Contact the factory for further information as may be required.

CAUTION
Commissioning procedures must be performed by qualified personnel only. Ensure the Automatic Transfer Switch (ATS) Isolation Plug is pulled prior to energizing the supply sources. Manually place the transfer switch mechanism in the neutral position by opening both Utility and Generator Power Switching devices prior to applying power. Failure to do so may result in equipment failure or personal injury.

Precommissioning Checks Prior to Commissioning Agent Onsite (to allow loads to be supplied prior to final commissioning)

1. Verify supply source voltage to be applied to the transfer switch is of the correct nominal value. Confirm voltage is the same as listed on the ATS drawings and the ATS equipment label. For other system voltages, refer to the ATS instruction manual for reconfiguring procedures prior to energization. *Failure to reconfigure ATS voltage to match system voltage will result in equipment malfunction and damage.* If ATS voltage is changed, record the new voltage on the TSC 800 component calibration label.

2. For 240V high leg delta systems, refer to the ATS instruction manual for correct phasing required and reconfiguring procedures. *Failure to obtain the correct ATS phasing will result in equipment malfunction and damage.*

3. Confirm cable size is correct for the lugs supplied in the transfer switch (line and load). Confirm the cables were meggered by the electrical contractor to ensure no cross phase connections or conduction to ground.

4. Confirm cable lugs are properly torqued. Confirm cable installation; ensure the cables do not interfere with normal equipment operation or which may cause component damage.

5. Manually operate the transfer mechanism by opening or closing the utility or generator set power switching device to the appropriate source of supply. Leave the isolation plug disconnected until final transfer switch commissioning is to be completed.

Final Commissioning

1. Verify installation of the automatic transfer switch as per installation manual and verify wiring (also see the Precommissioning Checks). Confirm phase, neutral, and grounding conductors are installed as per electrical code requirements.

   Note: Confirm neutral conductors of both sources are correctly installed and are solidly grounded for 3-phase 4-wire configurations.

2. Check for mechanical damage (shipping or installer).

3. Check for cable interference with mechanical moving parts or the motor brake on 100A–250A ATS mechanism.

4. Verify correct control wire interconnects to the engine/generator set auto start/stop circuitry. Ensure the engine controller automatic start circuit does not draw more than 5.0 amps (resistive) across the TSC 800 engine start contact. The TSC 800 engine start contact is voltage free and the only voltage measured should result from the engine controllers internal control logic.

   Note: The ATS engine start contact CLOSES to start the engine and OPENS to stop the engine.

5. Place the generator set engine controller in the OFF position and open the generator set local circuit breaker.

6. Ensure the ATS isolation plug is disconnected prior to application of voltage of the supply sources.

7. Energize the utility supply and the generator set supply sources and verify these meet the correct voltage, phasing, and phase rotation for the ATS and system. Once these have been confirmed to be correct, deenergize both sources before installing the isolation plug.

8. Once the isolation plug is connected, the ATS and system load may be energized with utility power once the site electrical contractor and or owner (as required) give authorization to proceed.

9. If utility power is within nominal limits, the ATS should transfer to the utility source. To determine correct operation, observe the following on the TSC 800 display:

   a. UTIL NORMAL

   b. GEN AUTO

   c. Green LED above mimic bus for the Utility source is ON

10. To verify all LED's are operational, perform a LAMP TEST operation (lamp test is initiated by pressing and holding the INCREMENT and DECREMENT pushbuttons on the TSC 800 faceplate simultaneously On until all the LED's illuminate. Review TSC 800 program settings by entering the program menu. Select Program Menu on the display by scrolling with the forward arrow button (right button). Select Yes by using the up or down arrow, then enter. Password will be displayed. Enter password *1* for read only access or password *2* for read/write access (select password *3* only if passwords are to be changed).

11. Set the TSC 800 timeclock as there is no battery installed on the circuit board. The timeclock is a 7-day, 4-week, 24-hour clock. Refer to the TSC 800 manual for timeclock programming instructions. The TSC 800 timeclock is used for automatic exercise load testing.

12. TSC 800 Automatic Plant Exercise Programming (optional). If an automatic plant exercise feature is desired, program the TSC 800 automatic plant exercise settings. Refer to the TSC 800 manual for detailed automatic exercise programming instructions.

13. Review the remainder of the TSC 800 program by using the enter key to navigate through the program. Verify each program value is the same as the value that is entered on the program data sheets. If any of these values are modified to suit the site conditions or requirements, these should be noted on the data sheets for future reference.

14. Utility/Load Voltage Calibration: Near the end of the TSC 800 program loop are calibration menus for utility, generator set, and load voltages. If the TSC 800 voltage display accuracy needs to be verified, measure actual voltages on the ATS power connections with an accurately calibrated meter. Verify that each phase-to-phase reading at the TSC 800 is within 0.5% accuracy. Refer to the TSC 800 instruction manual for complete details on voltage calibration, if required. Document any changes on the program data sheets. To exit the program, press and hold the exit key for a minimum of 2–3 seconds.

15. Prior to operating the generator set, ensure it is ready to be energized and the site electrical contractor and/or owner (as required) give authorization to proceed. In preparation for operation, turn the generator set's engine control switch to the automatic start position.

16. To transfer the generator set on load, perform a load test by entering the ATS MODE MENU, selecting YES on the TSC 800 display, then selecting ON LOAD test, then enter. The engine should start following the 3-second engine start delay period and the transfer switch will begin transferring to the generator set supply once the 2-second engine warmup timer expires.

    Note: The engine warmup timer will only begin timing once the generator set's output rises above 90% nominal voltage and 90% nominal frequency. Once the utility power switching device opens, the transfer switch mechanism will pause in the neutral position for the 3-second neutral delay period, then the mechanism will complete the transfer and close the generator set power switching device.

    To determine correct operation, observe the following on the TSC 800 controller:

    a. DISPLAY—GEN NORMAL

    b. Red LED above mimic bus for the generator source is ON

    c. Green LED above mimic bus for the Utility source is OFF

17. With the generator set operating, view the TSC 800 display and verify correct voltage is displayed. If the TSC 800 generator voltage display accuracy needs to be verified, refer to step 15.

18. To terminate the test, enter the ATS MODE MENU, select Yes on the TSC 800 display, then select NONE, then enter. Once initiated, the transfer switch will begin transferring to the utility supply following the 2-minute utility return delay period.

Note: The utility return delay timer will only begin timing if the utility voltage is above 90% nominal on all phases. Once the generator set power switching device opens, the transfer switch mechanism will pause in the neutral position for the 3-second neutral delay period, then the mechanism will complete the transfer and close the utility power switching device to return the load to the utility source. Once the load has transferred to the utility source, the engine will continue to run for the 2-minute cooldown time delay period and automatically stop.

19. Perform a power outage test by opening the upstream utility feeder breaker. The TSC 800 controller display will go blank; the generator set will start after the 3-second engine start delay has expired. The generator set should transfer on load as described in step 17.
20. Return the transfer switch to utility power by reclosing the upstream utility breaker. The load should retransfer back to the utility supply and the engine should stop as described in step 19.
21. Repeat steps 17 through 20 two (or more) times to ensure correct operation.
22. On completion of commissioning, ensure all controls are left in automatic.
23. If required, forward document or drawing updates to the manufacturer if revisions are required, and provide the end user with a set of markups to be retained onsite.
24. Ensure copies of manuals for the equipment are onsite.
25. Record and forward list of deficiencies to the appropriate parties where applicable.

Notes

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