



TS 850

AUTOMATIC TRANSFER SWITCHES

INSTALLATION, OPERATING & SERVICE MANUAL



PM042 Rev 4 00/08/31

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1. CAUTION!

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. Failure to do so may result in serious personal injury or death due to electrical shock.

Service procedures must be undertaken by qualified personnel only!

NOTE: - All information contained in this manual is for reference only and is subject to change without notice.

Contact Thomson Technology Inc. for clarification of current revisions or if in doubt about any matter relating to installation, operation or maintenance.

NOTE: This manual (Revision 4) makes reference to a 600A transfer switch model TS 850-TCK-600 which was introduced in August of Year 2000. For 600A transfer switches manufactured prior to this date (e.g. Model TS 850-TCJ-600) refer to previous revision manual.

2. NOTES TO INSTALLER

To ensure satisfactory installation of this equipment be sure to observe "Recommended Connection Tightness" and "Requirements for Upstream Circuit Protective Devices" located in this manual.

All mechanical and electrical connections must be checked for tightness prior to placing this equipment in service to ensure proper operation and to validate applicable warranty coverage.

If the transfer switch has programmable multi-tap voltage capability (refer to electrical schematic), confirm the transfer switch has been configured for the system voltage prior to installation.

Warning

Failure to confirm and match transfer switch voltage with the system voltage could cause serious equipment damage.

The voltage selections and connections are shown on the electrical schematics attached to each transfer switch. The factory default settings will be indicated on the calibration label attached on the

inside of the enclosure door (supplied loose on open style models). A blank label is included to record the applicable settings if the configuration is changed from the factory default settings.

To change the transfer switch configuration the following must be accomplished:

- Change voltage taps of PT's to system voltage (refer to schematics)
- Change TSC 800 programming (refer to sections 6.2.2, 6.2.4, 6.2.5, 6.3, and 6.4 of the TSC 800 instruction manual). The following settings may require reprogramming (depending on options purchased):
 - System voltage
 - System frequency
 - System phase
 - Utility undervoltage pickup (typically 90% of system voltage)
 - Utility undervoltage dropout (typically 80% of system voltage)
 - Utility overvoltage pickup (typically 110% of system voltage)
 - Utility overvoltage dropout (typically 105% of system voltage)
 - Utility underfrequency (typically 95% of system frequency)
 - Utility overfrequency (typically 105% of system frequency)
 - Generator undervoltage pickup (typically 90% of system voltage)
 - Generator undervoltage dropout (typically 80% of system voltage)
 - Generator overvoltage pickup (typically 110% of system voltage)
 - Generator overvoltage dropout (typically 105% of system voltage)
 - Generator underfrequency (typically 95% of system frequency)
 - Generator overfrequency (typically 105% of system frequency)

Record any changed setting on the TSC 800 Programming Data Sheets for future reference.

Complete the blank calibration label and attach to the inside of the transfer switch enclosure door.

INSTALLATION OF OPEN TYPE TRANSFER SWITCHES - Please refer to the factory for additional information.

3. GENERAL DESCRIPTION

(See CAUTION! on Page #1)

The automatic transfer switch employs two moulded-case switching devices which may be:

- a) non-automatic circuit interrupters ("type A" transfer switch)
- b) automatic circuit interrupters with integral trip units; ("type B" transfer switch)

In this manual, the switching devices will be referred to as "breakers". The breakers are operated by a mechanism driven with an electric motor. The transfer switch provides automatic transfer of an electrical load to a standby power supply in the event of drop or loss of voltage of any or all phases of the primary power supply. Upon restoration of the primary supply, the electrical load is automatically retransferred to the primary power supply (after an adjustable time delay). All necessary control components for automatic transferring are located in the control compartment and on the enclosure door.

The transfer motor utilizes the power from the source to which the electrical load is being transferred. The mechanism provides a positive mechanical interlock to prevent both breakers from being closed at the same time. The mechanism is also designed to leave both breakers "trip free" in the closed position, permitting incorporation of overload and/or short-circuit protection in either or both breakers ("type B"). After tripping, the breaker of a "type B" transfer switch must be manually reset.

Note: For the purpose of this manual, the term UTILITY indicates the primary power, and the term GENERATOR indicates the standby power.

4. GENERAL THEORY OF OPERATION

4.1. STANDARD AUTOMATIC TRANSFER SWITCH

4.1.1. NORMAL OPERATION

When utility supply voltage drops below a preset nominal value (adjustable from 70% to 100% 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 to 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 levels. Once the generator voltage and frequency rises above preset values (adjustable from 70% to 100% of nominal), the engine warmup timer will be initiated. Once the warmup timer expires (adjustable from 0 to 60 sec.), 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 driven mechanism. Note: An optional neutral delay timer circuit will delay the transfer sequence in the neutral position (i.e. both breakers open) until the selected time expires (adjustable from 0 to 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% to 100% of nominal) on all phases, a transfer return delay circuit will be initiated. Following expiry of the Transfer Return Timer (adjustable from 0 to 30 min.), the Transfer to Generator Supply signal will be removed (contact opening), 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: An optional neutral delay timer circuit will delay the transfer sequence in the neutral position (i.e. both breakers open) until the selected time expires (adjustable from 0 to 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 to 30 min.), the engine start signal will be removed (contact opening) to initiate stopping of the generator set.

4.2. SERVICE ENTRANCE AUTOMATIC TRANSFER SWITCH

(Note: This applies only to service entrance transfer switches supplied with a Padlockable Disconnect Switch. Contact TTI for other types.)

4.2.1. NORMAL OPERATION

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

In the normal operating mode, the Service Disconnect switch shall be in the "energized" position.

4.2.2. 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 as required.* In this condition, the transfer switch is in the neutral position, with both utility and transfer breakers 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 condition, nor will the transfer switch move to the generator position). *If the Light is **not** illuminated, further procedures are required (refer to the following procedure #4).*
3. Attach 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 door key.
4. If the "Service Disconnected" pilot light is **not** illuminated, the service will **not** have been successfully disconnected and it is therefore **not** safe to perform any maintenance until the following additional procedures are performed:

Warning

*Qualified personnel must undertake the following procedures **only!** Failure to do so may result in **serious personal injury or death** due to electrical shock.*

- Open the door to the transfer switch using a suitable tool and opening the door lock with the key.
- Visually inspect the actual position of the transfer switch mechanism. *If the position of the transfer switch mechanism is clearly in the "neutral position", the service has been successfully disconnected.*

Notes: 1) 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:

- a) Utility and generator supply voltages are not present (the pilot light requires AC supply voltage to be present).
- b) The pilot light may be burnt out. The bulb should be immediately replaced with a suitably rated bulb.
- c) Failure of one or more of the sensing/logic contacts. A qualified service technician is required to trouble shoot this specific condition. Unplug the control circuit isolation plug to de-energize all AC power to the control circuits. Note: The AC power conductors will still remain energized. Once the control circuit isolation plug is removed 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 for correct operation.

- The transfer switch door should then be securely closed using a suitable tool and locked in the closed position with the key. Once the transfer switch door has been positively locked closed and secured and only then is, it is safe to perform any maintenance procedures as required.
- If the position of the transfer switch mechanism is **not** in the "neutral position" further procedures are required (refer to the following procedure)

Warning

*Failure to positively lock closed and secure the transfer switch door may result in **serious personal injury or death** due to electrical shock.*

- If the position of the transfer switch mechanism is **not** in the "neutral position" the transfer switch mechanism must be manually operated as follows. To operate manually, 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.

Warning

*Failure to move the mechanism to the Neutral Position may result in **serious personal injury or death** due to electrical shock.*

The transfer switch door should then be securely closed using a suitable tool and locked in the closed position with the key. Once the Transfer switch door has been positively locked closed and secured and only then is, it is safe to perform any maintenance procedures as required.

Warning

*Failure to positively lock closed and secure the transfer switch door may result in **serious personal injury or death** due to electrical shock.*

To re-energize the load, the padlock(s) should be removed 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.

4.3. TEST CONDITION

The transfer switch may be tested utilizing the TSC 800 controller push-buttons or optional four position test switch. A simulated utility power failure condition will be activated when the test mode is selected. The transfer switch will operate as per a normal utility power fail condition. Note the test mode is operator selectable for "On-Load" or "Off-Load" testing scenarios.

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.

5. TYPE A AND TYPE B DEFINITIONS

"Type A" transfer switch means an automatic transfer switch that does not employ integral overcurrent devices.

"Type B" transfer switch means an automatic transfer switch that does employ integral overcurrent protection in at least one of its two breakers.

"Type A" transfer switches are not equipped with trip units, and require properly coordinated upstream protection. Information on closing and withstand ratings, and recommendations for maximum upstream protective devices for "type A" units are in this manual. (Note: Some "Type A" models employ "high-magnetic" trips in the breakers, however these are set to trip at a higher than normal current for that amperage circuit, therefore the possibility of tripping is very remote. Since these trips are not intended to provide overcurrent protection, but are rather employed to ensure the integrity of the transfer switch under all circumstances, they are still classed as "Type A").

"Type B" transfer switches are typically equipped with standard thermal-magnetic trips which will provide the required overload and short circuit protection. "Type B" can also be built using solid state trip breakers, which can include ground fault tripping as well as overload and short circuit protection.

It should be noted that a "Type B" transfer switch with overcurrent protection in only one breaker will require the same consideration for upstream protection in the feeder of the breaker with no trip (as applies to a "Type A" transfer switch).

6. GENERAL NOTES ON SERVICING MECHANISM

(See CAUTION! on Page #1)

When performing any service work on the transfer mechanism, it is imperative that the following be observed:

6.1. To maintain mechanical integrity, ensure that:

- All limit switches linkages are correctly adjusted to provide full travel of the breaker toggles *without* exerting unnecessary forces associated with excessive travel. Ensure that breakers travel far enough to reset any internal trip unit (it is more important for the toggle to go fully in the "off" direction, than in the "on" direction).
- Mechanical interlocking is correct one breaker 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.

6.2. To maintain electrical integrity, ensure that:

- All electrical connections, especially power connections, are clean and adequately tightened. Corroded or loose power connections will cause destructive heating, and may cause premature tripping in "type B" 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.

6.3. 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.

Service work should be undertaken only by qualified personnel. 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.

7. STYLE "T" TRANSFER SWITCH MECHANISM - 400 - 1200 Amp

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

The reversible transfer motor drives the hub assembly, which in turn moves the operating rods which are connected to the breaker operating yokes. The breaker toggles are set inside the yokes and are moved by them. There are two limit switches which are contacted by the operating yokes (one for each direction of travel) which disconnect the transfer motor power supply when the breakers have attained full travel. The operating point of these limit switches is determined by the adjuster screws located on the yokes. Should adjustment be required, it is advisable to consult TTI for further information.

The transfer switch mechanism has three possible positions:

- a) Utility breaker closed and generator breaker open;
- b) Generator breaker closed and utility breaker open;
- c) Both utility and generator breakers open, but NEVER both utility and generator breakers closed at the same time.

7.1. MANUAL OPERATION (or to reset a typical breaker) (See CAUTION on Page 1)

Isolate the transfer switch from all sources of supply before opening the enclosure for manual operation. The control circuit isolation plug (PL12) should 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. The drive system is self engaging and will operate the transfer switch to the required position. (See manual operation instruction on front of transfer switch mechanism.)

8. STYLE "M" TRANSFER SWITCH MECHANISM - Maximum 250 Amp

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

The unidirectional motor, operating through the motor drive arm and rod assembly, which is normally held captive to the yoke via the manual release plunger assembly, acts upon the yoke drive arm. Both breaker toggles are set inside the common yoke and are moved by it. There are two limit switches which are contacted by the yoke at its extremes of travel, disconnecting the motor circuit at the point of full breaker toggle travel in the intended direction. Adjustment of the limit switches is accomplished by loosening the two mounting screws securing each switch and sliding them in the desired direction. Should adjustment be required it is advisable to consult TTI for further information.

The transfer switch mechanism has three possible positions:

- a) Utility breaker closed and generator breaker open;
- b) Generator breaker closed and utility breaker open;
- c) Both utility and generator breakers open, but NEVER both utility and generator breakers closed at the same time.

8.1. MANUAL OPERATION (or to reset a typical breaker) **(See CAUTION! on Page #1)**

Isolate the transfer switch from all sources of supply before opening the enclosure for manual operation. The control circuit isolation plug (PL12) should 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 turning the release plunger until locked and replacing the isolation plug. The mechanism drive will operate until the motor drive rod is engaged and the transfer switch yoke is moved into the required position. (See manual operation instruction on door of transfer switch mechanism).

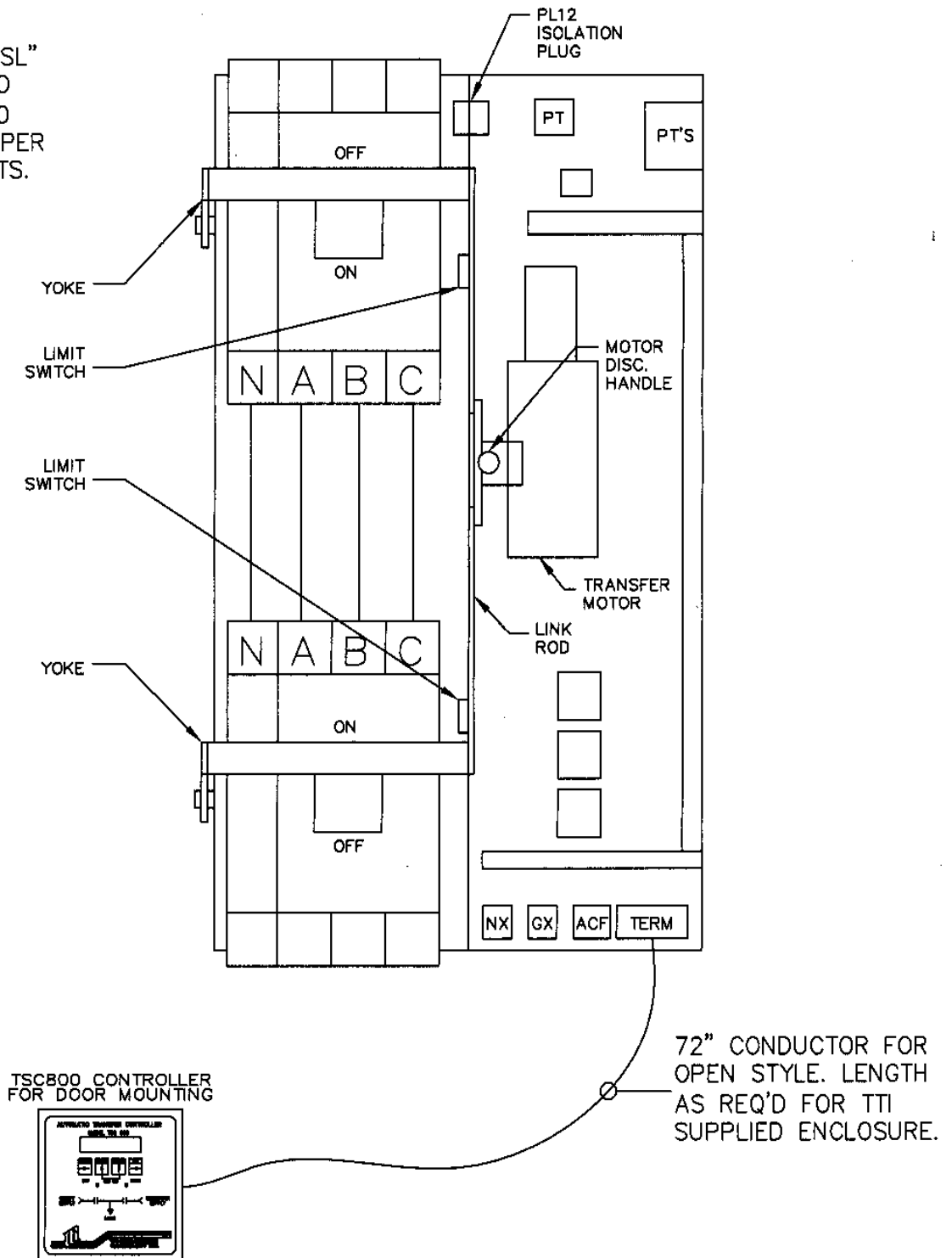
9. RECOMMENDED MAINTENANCE (STYLE "T" & STYLE "M" MECHANISMS)

(See CAUTION! on Page #1)

- 9.1.DO NOT perform dielectric tests on the equipment with the control components in the circuit.
- 9.2.Check if control components are tight in sockets.
- 9.3.Periodically inspect all terminals (load, line and control) for tightness. Re-torque all bolts, nuts and other hardware. Clean or replace any contact surfaces which are dirty, corroded or pitted.
- 9.4.Transfer switches should be in a clean, dry and moderately warm location. If signs of moisture are present, dry and clean 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 breakers.
- 9.5.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 breaker travel is correct.
- 9.6.Verify all program settings on the TSC 800 controller as per the programming sheet as supplied with the transfer switch.
- 9.7.Style "M": 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.
- 9.8.Style "T": 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.
- 9.9.Style "T": yoke pivot bearings and rod ends are permanently lubricated and do not require maintenance.
- 9.10.The motor and gearbox are permanently lubricated, and should not require attention under normal operating circumstances.

10. FRONT VIEW (TYPICAL) 3 / 4 POLE STYLE "T" TRANSFER MECHANISM

CONFIGURATION "SL"
SHOWN. REFER TO
DWG. EPA5015/30
FOR VARIATIONS PER
JOB REQUIREMENTS.



11. STYLE "T" CONFIGURATION OPTIONS

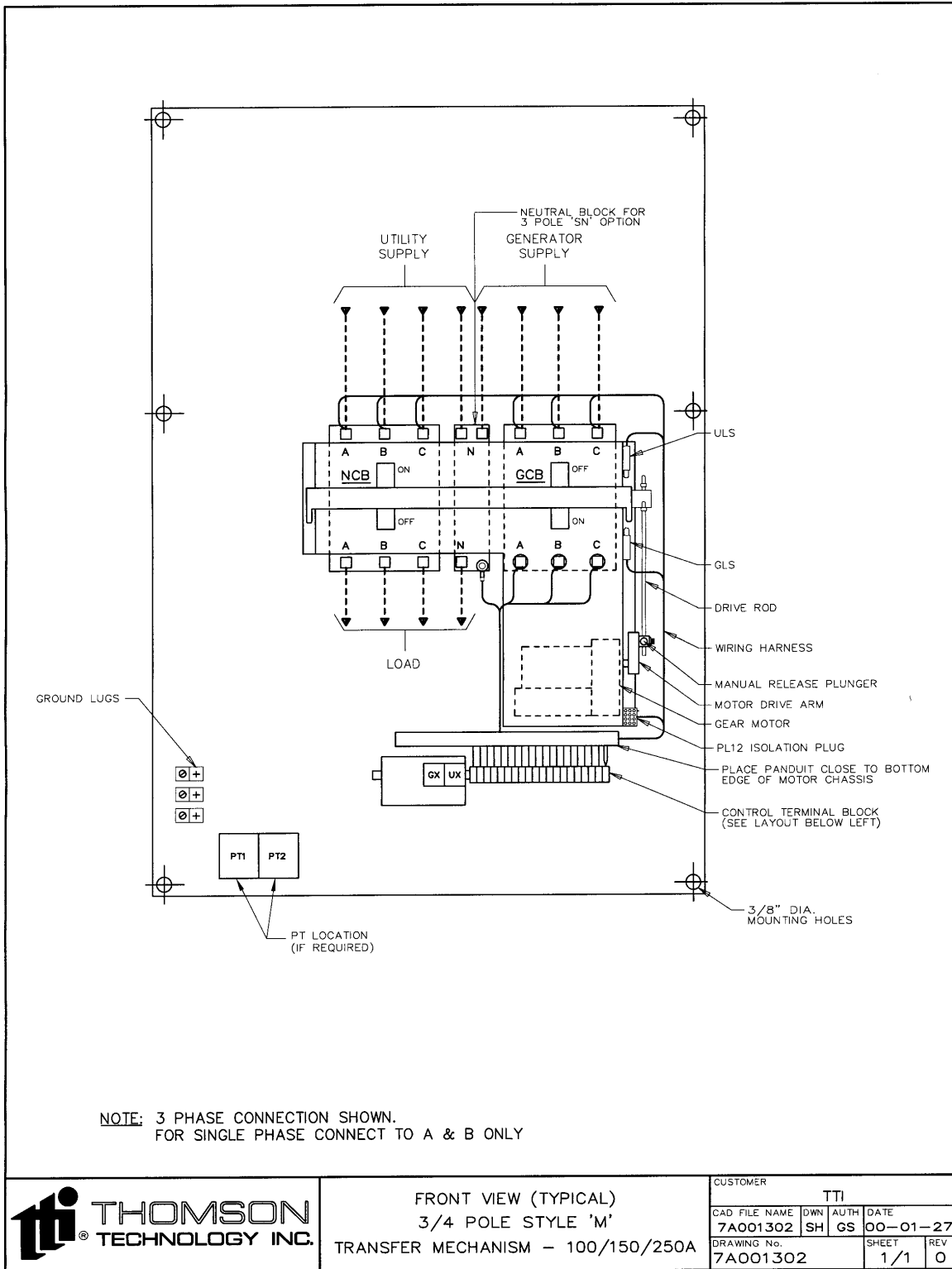
SL CONFIGURATION	XR CONFIGURATION	CHASSIS CONFIGURATION OPTION ☐ SL ☐ SR ☐ XL ☐ XR																
NOTE: FOR GENERAL LAYOUT ONLY, PHASING ORDER MAY CHANGE. 3 PHASE CONNECTION SHOWN. FOR SINGLE PHASE CONNECT TO A & B ONLY.																		
XL CONFIGURATION	SR CONFIGURATION	NOTE: TYPICAL LOAD CONNECTIONS ONLY. FOR EXACT LOCATIONS CONSULT FACTORY.																
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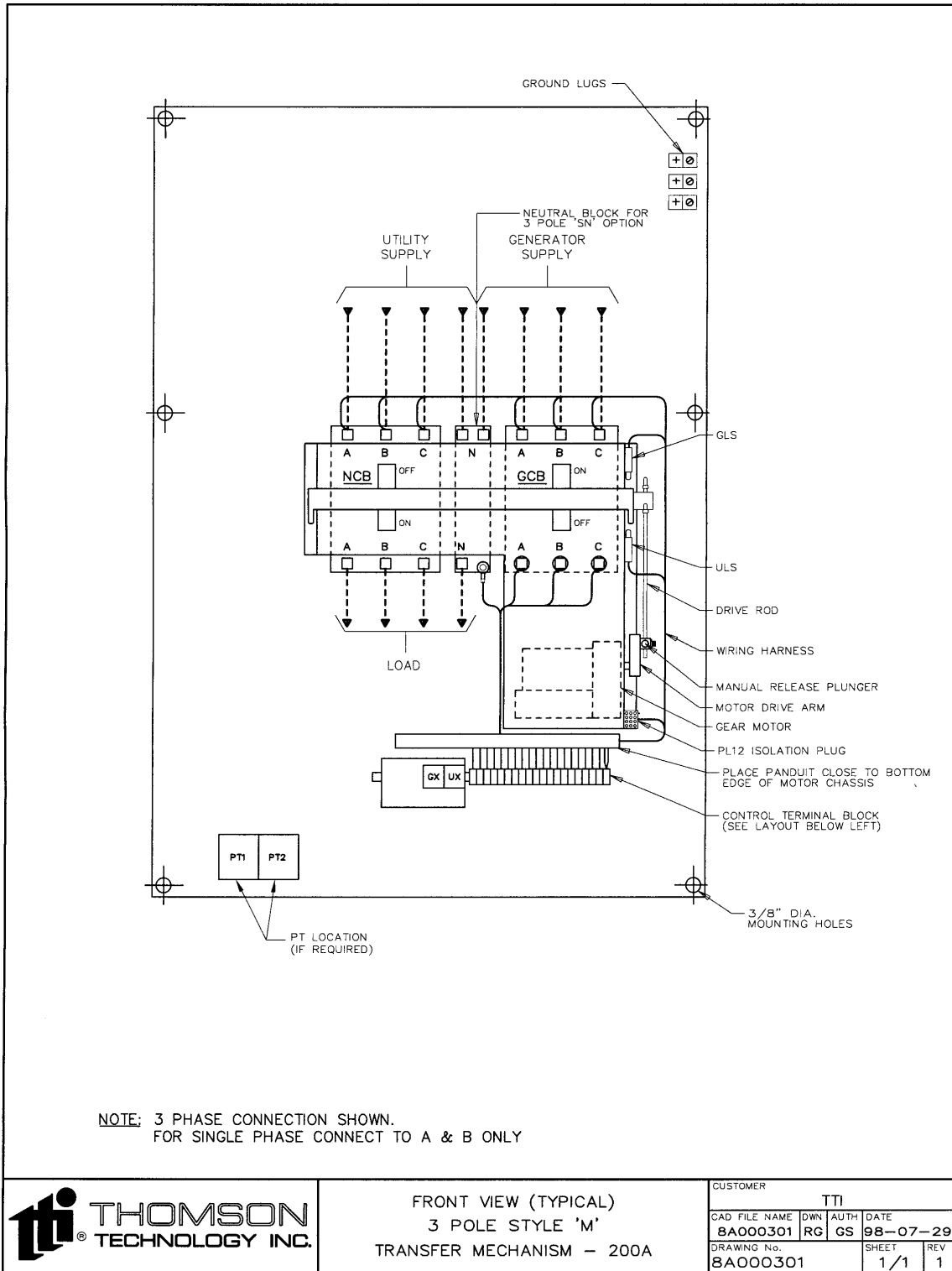
12. FRONT VIEW (TYPICAL) 3 / 4 POLE STYLE "M" - 100/150/250A TRANSFER MECHANISM



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13. FRONT VIEW (TYPICAL) 3 POLE STYLE "M" - 200A TRANSFER MECHANISM



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14. TROUBLESHOOTING (See CAUTION! on Page #1)

Symptom

- will not re-transfer to utility source upon restoration
- will not transfer to generator source upon failure of utility source
- transfer to generator source without a power failure in the utility source
- generator does not start up or stop when it should
- no time delay when there should be
- power is not available at the load terminals but the utility or generator breaker appears to be closed to a live source
- the transfer switch has completed a transfer, but the motor has overheated and the internal thermal protector has opened

Possible Causes

- isolation plug out
- a test mode has been activated (check TSC 800 status LCD display)
- utility voltage or frequency is outside the pre-programmed limits (check utility source for adequate voltage & frequency)
- a loose control connection
- faulty motor limit switch
- defective motor
- defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's)
- isolation plug out
- generator set not producing enough voltage/frequency or output circuit breaker open
- warmup time delay function has not timed out yet (verify TSC 800 timer setting)
- a loose control connection
- faulty motor limit switch
- defective motor
- defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's)
- a test mode has been activated (check TSC 800 status LCD display)
- defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's)
- verify remote engine control panel is set for automatic mode
- verify time delay function in the TSC 800 program setting as per programming sheets as supplied with the transfer switch
- the breaker's trip unit (Type B style only) has tripped on a fault on the system. Correct the fault, and manually reset the breaker in the transfer switch by moving it off and then on again with the manual operating handle
- limit switch incorrectly adjusted
- limit switch failure or improper adjustment has failed to disconnect motor
- binding or jamming of the transfer mechanism

DEFECTIVE COMPONENTS

Return defective components to Thomson Technology Inc. for repair. Be sure to advise model and serial number of the transfer switch.

15. CABLE TERMINAL INFORMATION

CABLE TERMINAL INFORMATION AND RECOMMENDED TIGHTNESS							
		Terminal Rating				Connection Tightness (In-Lbs)	
Basic Transfer Switch Style	Transfer Switch Rating (Amps)	Utility & Generator Supply		Load & Neutral Supply		Terminal Mounting Screw	Cable Clamp
		Qty Per Phase	Range	Qty Per Phase	Range		
MCE	100 150	1 1	#4-4/0 #4-4/0	1 1	#4-4/0 #4-4/0	-- 20	100 (Socket) 50 (Slot)
MS3	200	1	#6-350MCM	1	#6-350MCM	72	275
MCE	250	1	#1-350MCM	1	#1-350MCM	90	275
TCJ	400	1	2/0-600MCM	1	2/0-600MCM	275	375
TCK	600 800	4 3	3/0-500MCM 2/0-400MCM	2 3	2/0-500MCM 2/0-400MCM	275	375
TCK	1000/1200	4	3/0-500MCM	4	3/0-500MCM	275	375

16. REQUIREMENTS FOR UPSTREAM CIRCUIT PROTECTIVE DEVICES

Closing and Withstand Rating (Amps RMS Sym) With Upstream Fuse Protection

Basic Model	Max. Voltage	Rated Current (A)	SHORT CIRCUIT CURRENT RATING (AVAILABLE SYMMETRICAL AMPS (RMS)) ₁				
			With Upstream Circuit Breaker Protection			With Upstream Fuse Protection	
			@240V	@480V	@600V	@ Up to 600V	Fuse Type
TS 850 - MCE- 100	600	100	65,000	25,000	18,000	100,000	T, J
TS 850 - MCE- 150	600	150	65,000	25,000	18,000	100,000	T, J
TS 850 - MS3- 200	240	200	100,000	N/A	N/A	N/A	T, J
TS 850 - MCJL-250	600	250	65,000	35,000	25,000	100,000	T, J
TS 850 - TCJ- 400	600	400	65,000	35,000	25,000	100,000	T, J
TS 850 - TCK- 600	600	600	65,000	35,000	25,000	100,000	T, J
TS 850 - TCK- 800	600	800	65,000	50,000	35,000	100,000	Consult Factory
TS 850 - TCK-1000	600	1000	65,000	50,000	35,000	100,000	"
TS 850 - TCK-1200	600	1200	65,000	50,000	35,000	100,000	"

1. Standard ratings only are shown. Consult TTI for versions with higher short circuit current ratings.

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.

17. NOTES