CATERPILLAR®

FORM NO. SENR2164

FOR USE IN SERVICE MANUAL:
ELECTRIC SET GENERATORS, SENR7958

Service Manual

Transfer Switches (Manual And Automatic)

⚠ WARNING

IMPORTANT SAFETY NOTICE

Proper repair is important to the safe and reliable operation of a machine. This Service Manual outlines basic recommended procedures, some of which require special tools, devices or work methods. Although not necessarily all inclusive, a list of additional skills, precautions and knowledge required to safely perform repairs is provided in the SAFETY section of this Manual.

Improper repair procedures can be dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE PERFORMING REPAIRS ON THIS MACHINE

Basic safety precautions, skills and knowledge are listed in the SAFETY section of this Manual and in the descriptions of operations where hazards exist. Warning labels have also been put on the machine to provide instructions and identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These labels identify hazards which may not be apparent to a trained mechanic. There are many potential hazards during repair for an untrained mechanic and there is no way to label the machine against all such hazards. These warnings in the Service Manual and on the machine are identified by this symbol:

⚠ WARNING

Operations that may result only in machine damage are identified by labels on the machine and in the Service Manual by the word **CAUTION**.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this Manual are therefore not all inclusive. If a procedure, tool, device or work method not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the machine will not be damaged or made unsafe by the procedures you choose.

IMPORTANT

The information, specifications and illustrations in this book are on the basis of information available at the time it was written. The specifications, torques, pressures of operation, measurements, adjustments, illustrations and other items can change at any time. These changes can effect the service given to the product. Get the complete and most current information before you start any job. Caterpillar Dealers have the most current information which is available. For a list of the most current modules and form numbers available for each Service Manual, see the SERVICE MANUAL CONTENTS MICROFICHE REG1139F.

SYSTEMS OPERATION

TESTING AND ADJUSTING

⚠ WARNING

SAFETY

⚠ WARNING

The proper and safe lubrication and maintenance procedures for this machine, recommended by Caterpillar, are outlined in the LUBRICATION & MAINTENANCE GUIDE for this machine.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the LUBRICATION & MAINTENANCE GUIDE before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and/or component is important before the removal or disassembly of any component.

Because of the size of some of the machine components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all Warning plates and decals on the machine before operating, lubricating or repairing the machine.
2. Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when pounding on any part of the machine or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Disconnect battery and discharge any capacitors before starting to work on machine. Hang "Do Not Operate" tag in the Operator's Compartment.

⚠ WARNING

Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S GUIDE. Improper machine operation is dangerous and could result in injury or death.

4. If possible, make all repairs with the machine parked on a level, hard surface. Block machine so it does not roll while working on or under machine.
5. Do not work on any machine that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the machine before performing any disassembly.
6. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
7. Lower the bucket, blade, ripper or other implements to the ground before performing any work on the machine. If this can not be done, make sure the bucket, blade, ripper or other implement is blocked correctly to prevent it from dropping unexpectedly.
8. Use steps and grab handles when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
9. To avoid back injury, use a hoist when lifting components which weigh 50 lb. (23 kg) or more. Make sure all chains, hooks, slings, etc., are in good condition and are in the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.

⚠ WARNING

10. To avoid burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.

11. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing them completely.

12. Be careful when removing filler caps, breathers and plugs on the machines. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.

13. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.

14. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary.

15. Repairs which require welding should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Make reference to "Techniques of Structural Repair Course" form number JEG03719. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.

16. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.

17. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.

18. Always use lift arm supports to keep bucket arms raised and bucket tilted down when maintenance or repair work is performed which requires the bucket in the raised position.

19. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure must be installed correctly.

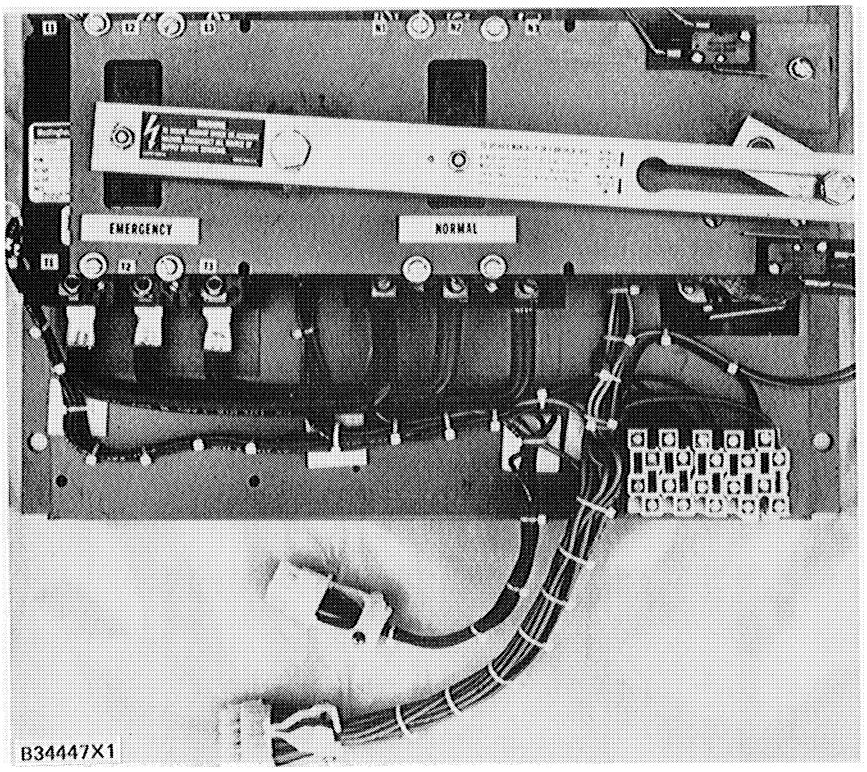
20. Do not operate a machine if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.

21. On track-type machines, be careful when servicing or separating tracks. Chips can fly when removing or installing a track pin. Wear safety glasses. Track can unroll very quickly when separated. Keep away from front and rear of machine. The machine can move unexpectedly when both tracks are disengaged from the sprockets. Block the machine to prevent it from moving.

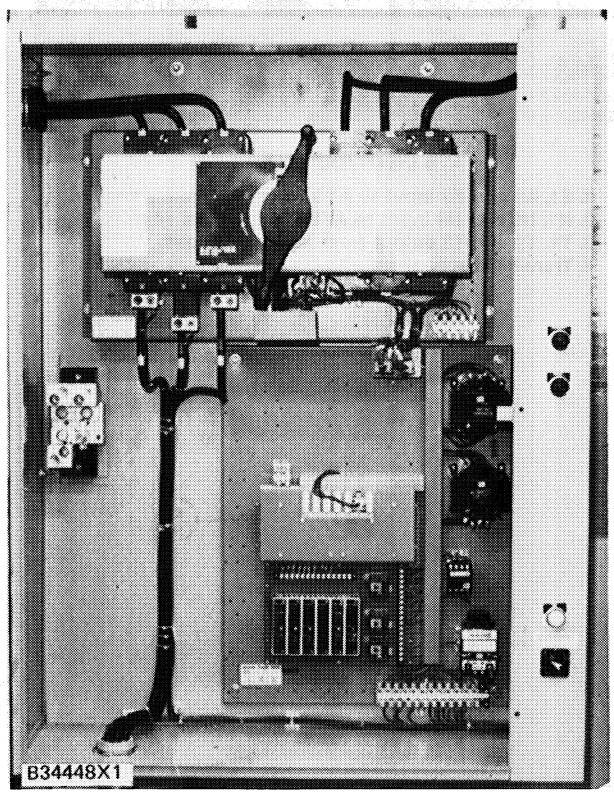
GENERAL INFORMATION

MANUAL		
Standard	**Single Generator**	**Dual Generator**
Normal circuit breaker high-instantaneous trip. Emergency circuit breaker high-instantaneous trip.	Normal source circuit breaker with high-instantaneous trip. Emergency source circuit breaker (to generator set) with thermal-magnetic trip.	Normal source circuit breaker (to generator set) with thermal magnetic trip. Emergency source circuit breaker (to generator set) with thermal-magnetic trip.
Single handle manually operated transfer mechanism		
Solid Neutral Assembly Bar		
Nema I Enclosure		

AUTOMATIC		
Standard	**Single Generator**	**Dual Generator**
Normal circuit breaker high-instantaneous trip. Emergency circuit breaker high-instantaneous trip.	Normal source circuit breaker with high-instantaneous trip. Emergency source circuit breaker (to generator set) with thermal-magnetic trip.	Normal source circuit breaker (to generator set) with thermal magnetic trip. Emergency source circuit breaker (to generator set) with thermal-magnetic trip.
Single handle automatically operated transfer mechanism		
Solid Neutral Assembly Bar		
Nema I Enclosure		
Logic		
Controls & components that provide a set of engine initiating (NO) start contacts.		
Adjustable time delay for engine start (TDES) (.2-50 sec.)		
Adjustable time delay for emergency to normal retransfer (TDEN) (.2-30 min.)		
Single-phase adjustable frequency and voltage monitoring relays for the emergency source.		
Close differential three-phase voltage sensing relay on normal source supply.		
Four-position selector switch (FPSS) with off-test-auto-engine start positions.		
Face mounted indicating lights for indicating transfer switch position.		
—	Overcurrent indication light to indicate emergency source circuit breaker tripped.	Individual overcurrent indication lights to indicate either normal or emergency source circuit breakers trip condition.



WALL-MOUNTED CATERPILLAR AUTOMATIC TRANSFER SWITCH (ATS)
(Transfer Mechanism For 100 Ampere Rated Switch)
(Transfer Mechanism Shown Only)

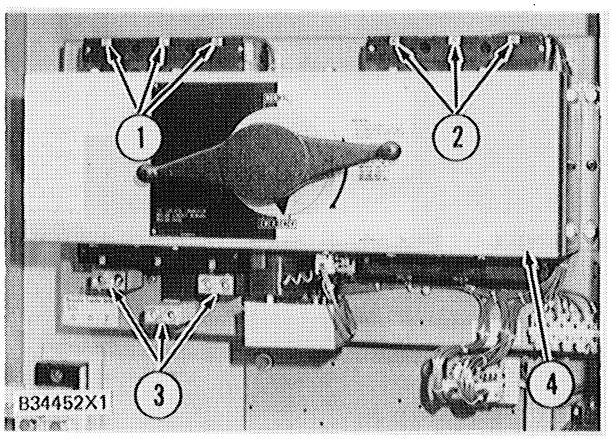


WALL-MOUNTED CATERPILLAR AUTOMATIC
TRANSFER SWITCH (ATS)
(Transfer Mechanism Used in All Ratings Except 100 Ampere)

SYSTEMS OPERATION

INTRODUCTION

Transfer switches are used to protect electrical loads against prolonged loss of power. The load (3) is connected to either the emergency (1) or the normal source (2) through the transfer mechanism (4). If power is lost from the normal source (2) the transfer mechanism transfers the load to the emergency (secondary) sources (1). Transfer is automatic (ATS) if the switching is based on intelligence circuitry and accomplished by a transfer motor. Transfer is manual (MTS) if switching is based on operator decision making and physical transferring by use of a handle. With ATS, the load is automatically returned to the normal source (2) when normal power is restored.

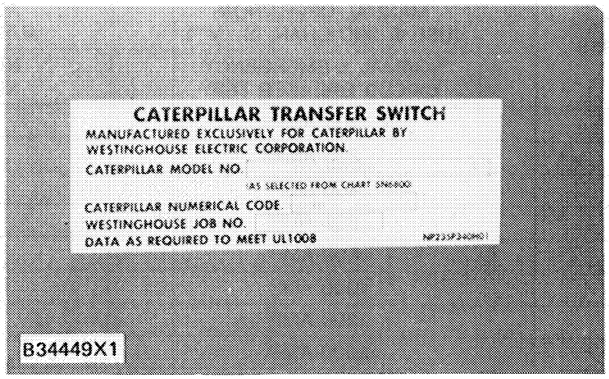


ATS INPUT/OUTPUT

1. **E1, E2 and E3 input to ATS from emergency source.**
2. **N1, N2 and N3 input to ATS from normal source.**
3. **T1, T2 and T3 output from ATS to the load.**
4. **Transfer mechanism.**

IDENTIFICATION

The transfer switch model number is located on the door.



TYPICAL ATS NAMEPLATE

The model number tells eleven things about the Automatic Transfer Switch (ATS).

1. A "T" as the first character of the model number specifies the equipment as a transfer switch.

2. The second character of the model number specifies the type of transfer switch operation and application.

SECOND CHARACTER		
	TRANSFER SWITCH OPERATION AND APPLICATION	
M	Manual Operation	No automatic controls or intelligence logic provided.
N	Single Generator Manual Operation	No automatic controls or intelligence logic provided. Normal source breaker has high instantaneous trip and emergency source circuit breaker has thermo-magnetic trip element.
P	Dual Generator Manual Operation	No automatic controls or intelligence logic provided. Both normal and emergency sources have circuit breakers with thermo-magnetic trip elements.
A	Automatic Operation	Controls and logic provided to automatically transfer from normal to emergency and from emergency to normal sources. Circuit breakers provided with high instantaneous trip elements.
S	Single Generator Automatic Operation	Controls and logic provided to automatically transfer from normal to emergency and from emergency to normal sources. Normal source breaker has high instantaneous trip and emergency source circuit breaker has thermal-magnetic trip element.
D	Dual Generator Automatic Operation	Control and logic provided to automatically transfer from normal to emergency and from emergency to normal sources. Both normal and emergency sources have circuit breakers with thermal-magnetic trip elements.

3. The third character of the model number specifies the power switching panel rating, neutral assembly bar, intelligence panel and transfer switch layout drawing.

THIRD CHARACTER - MANUAL OR AUTOMATIC OPERATION			
	TRANSFER SWITCH RATING AMPERES	POWER SWITCHING MODULE	
		MANUAL OPERATION (USE IF 2ND CHAR. IS "M")	AUTOMATIC OPERATION (USE IF 2ND CHAR. IS "A")
		NORMAL & EMERGENCY CIRCUIT BREAKER TRIP	NORMAL & EMERGENCY CIRCUIT BREAKER TRIP
1	100	100 AMP	100 AMP
2	225	225 AMP	225 AMP
3	400	400 AMP	400 AMP
4	600	600 AMP	600 AMP
5	800	800 AMP	800 AMP
6	1000	1000 AMP	1000 AMP
7	1200	1200 AMP	1200 AMP
8	2000	2000 AMP	2000 AMP

THIRD CHARACTER - SINGLE OR DUAL GENERATOR MANUAL						
	POWER SWITCHING MODULE					
	SINGLE GEN. (USE IF 2ND CHAR IS "N")				DUAL GEN (USE IF 2ND CHAR IS "P")	
	EMERGENCY BREAKER		NORMAL BREAKER		EMERGENCY & NORMAL BREAKER	
	TRIP	FRAME	TRIP	FRAME	TRIP	FRAME
A	100	100 A	100 A	100 A	100 A	100 A
B	125	225 A	225 A	225 A	125 A	225 A
C	150				150 A	
D	175				175 A	
E	200				200 A	
F	225				225 A	
G	250	400 A	400 A	400 A	250 A	400 A
H	300				300 A	
J	350				350 A	
K	400				400 A	
L	500	600 A	600 A	600 A	500 A	600 A
M	600				600 A	
N	700	800 A	800 A	800 A	700 A	800 A
P	800				800 A	
R	1000	1000 A	1000 A	1000 A	1000 A	1000 A
S	1200	2000 A	2000 A	2000 A	2000 A	2000 A
T	1400				1400 A	
U	1600				1600 A	
V	1800				1800 A	
W	2000				2000A	

THIRD CHARACTER - SINGLE OR DUAL GENERATOR MANUAL						
	POWER SWITCHING MODULE					
	SINGLE GEN. (USE IF 2ND CHAR IS "S")				DUAL GEN (USE IF 2ND CHAR IS "D")	
	EMERGENCY BREAKER		NORMAL BREAKER		EMERGENCY & NORMAL BREAKER	
	TRIP	FRAME	TRIP	FRAME	TRIP	FRAME
A	100	100 A	100 A	100 A	100 A	100 A
B	125	225 A	225 A	225 A	125 A	225 A
C	150				150 A	
D	175				175 A	
E	200				200 A	
F	225				225 A	
G	250	400 A	400 A	400 A	250 A	400 A
H	300				300 A	
J	350				350 A	
K	400				400 A	
L	500	600 A	600 A	600 A	500 A	600 A
M	600				600 A	
N	700	800 A	800 A	800 A	700 A	800 A
P	800				800 A	
R	1000	1000 A	1000 A	1000 A	1000 A	1000 A
S	1200	2000 A	2000 A	2000 A	2000 A	2000 A
T	1400				1400 A	
U	1600				1600 A	
V	1800				1800 A	
W	2000				2000A	

4. The fourth character of the model number specifies the enclosure size.

FOURTH CHARACTER		
	TRANSFER SWITCH ENCLOSURE SIZE mm (in.)	MAXIMUM 3 POLE RATING
1	686 (27)W X 1067 (42)H X 219 (8.62)D	100 AMPERES
2	965 (38)W X 1245 (49)H X 365 (14.38)D	225- 400 AMPERES
3	965 (38)W X 1499 (59)H X 416 (16.38)D	600-1000 AMPERES
4	965 (38)W X 2286 (90)H X 1067 (42)D	1200-2000 AMPERES

5. The fifth character of the model number specifies the system connected voltage.

FIFTH CHARACTER	
	SYSTEM CONNECTED VOLTAGE
A	600 Volts AC
B	480
C	400
D	240
E	208

6. The sixth character of the model number specifies the system frequency.

SIXTH CHARACTER	
	SYSTEM FREQUENCY
5	50 HERTZ
6	60 HERTZ

7. The seventh character of the model number specifies an auxiliary relay with contacts for external use, if required, to indicate transfer switch position on normal source.

SEVENTH CHARACTER		
	AUXILIARY RELAY/CONTACTS	QTY
X	Not Required	
N	Normal Source Side	1
E	Emergency Source Side	1
B	Both Normal and Emer. Sides	2

8. The eighth character of the model number specifies an automatic plant exercise timer, if required.

EIGHTH CHARACTER		PARTS INCLUDED		
		60 HZ	50 HZ	
	PLANT EXERCISE CONTROL	ALL VOLTAGES	240 & 400 VAC.	480 VAC
X	Not Required	—	—	—
G	Exercises Generator Set	X	X	X
T	Exercises Generator Set and Transfer Switch	X	X	X

9. The ninth character of the model number specifies a two-position selector switch to allow selection of either the normal or emergency power source as the preferred source, if required.

NINTH CHARACTER		PARTS INCLUDED		
	SELECTABLE SOURCE OPTION	SWITCH	RELAY	LAMP ASSEMBLY
X	Not Required	—	—	—
S	Switch Selectable	X	X	X

10. The tenth character of the model number specifies an adjustable time delay (0.2-30 min.) for engine cool-off, if required.

TENTH CHARACTER	
	ENGINE COOL-OFF TIMER
X	Not Required
T	Cool-Off Timer

11. The eleventh character of the model number specifies the change number to which the transfer switch was built.

COMPONENT DESCRIPTION

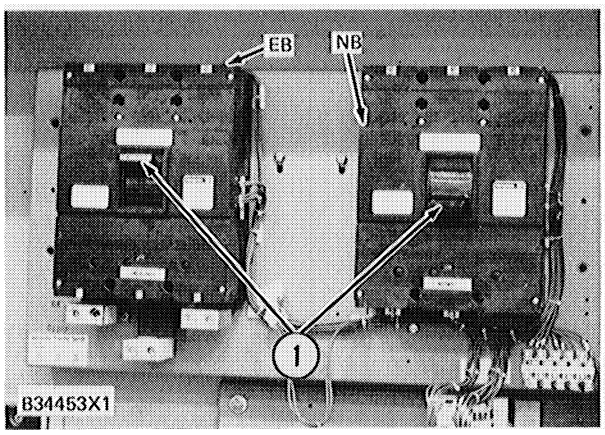
The ATS consists of a sheet steel enclosure housing five operating assemblies:

1. Breaker Assembly.
2. Transfer Mechanism.
3. Intelligence Panel.
4. Plant Exerciser (optional).
5. Controls and Monitor Panel.

Breaker Assembly

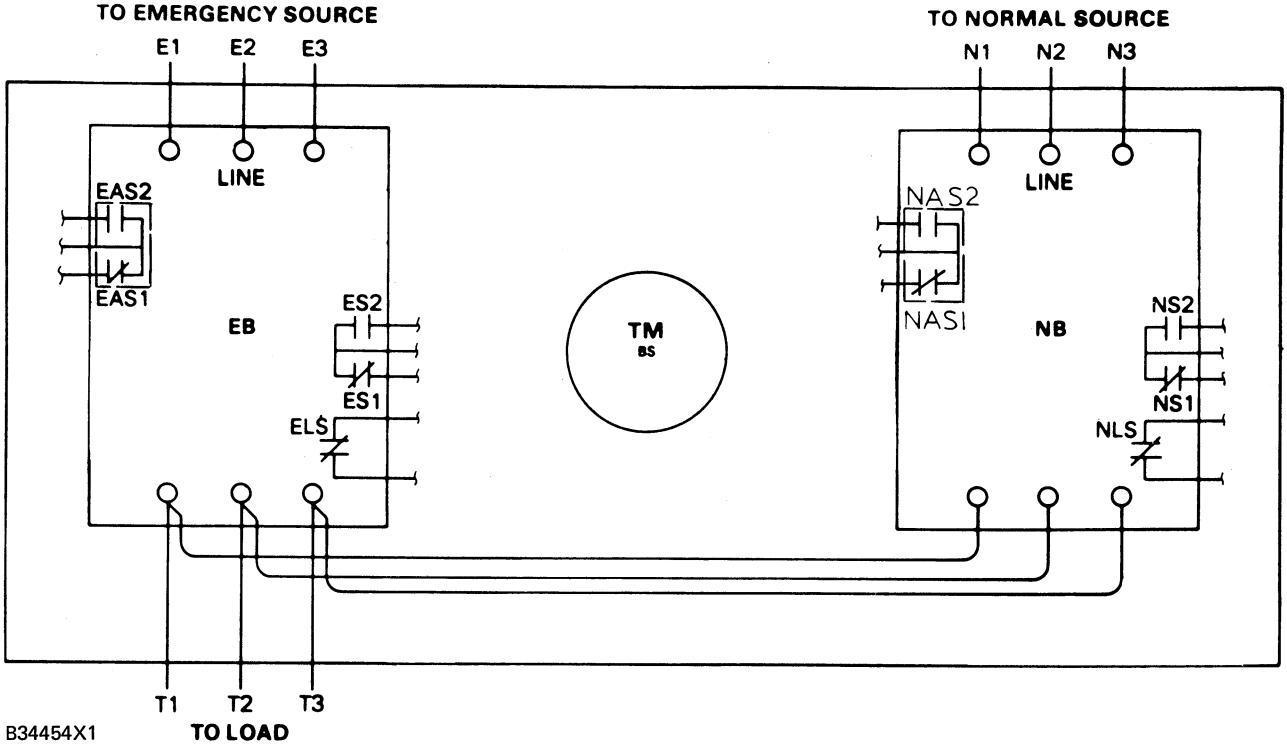
The emergency breaker (EB) and normal breaker (NB) are of three-pole, molded case construction. The Normal Source breaker (NB) is located on the right side of the enclosure. The Emergency Source breaker (EB) is located on the left side. (NB) and (EB) are interlocked mechanically through the transfer mechanism. They are interlocked electrically through relays and switches. As a result of interlocking, only one breaker can be closed at one time.

The breakers cannot be prevented from tripping by holding the manual operating handle (1). The breaker handle (1) moves to a neutral "tripped" position on a fault. After the fault is cleared, the breaker is reset by rotating the ATS manual operating handle counterclockwise to the desired source breaker position.



ATS Breakers (Transfer Mechanism Removed for Illustration)

EB Emergency ATS breaker.
NB Normal ATS breaker.
1. Trip handles.



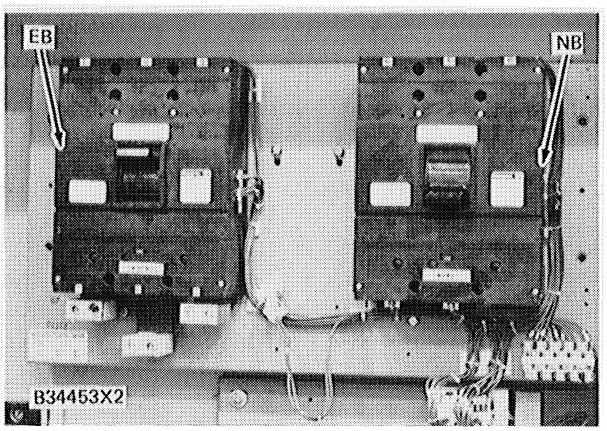
BREAKERS AND AUXILIARY SWITCHES

EAS1	**Emergency Circuit Breaker Lockout**	**NAS2**	**Normal Bell Alarm Contact (amber trip lamp)**
EAS2	**Emergency Bell Alarm Contact (amber trip lamp)**	**NB**	**Normal Circuit Breaker**
EB	**Emergency Circuit Breaker**	**NLS**	**Normal Limit Switch-Controls Transfer Motor**
ELS	**Emergency Limit Switch-Controls Transfer Motor**	**NS1**	**Normal Source Contact-Auxiliary Lamp**
ES1	**Emergency Source Contact-Auxiliary Lamps**	**NS2**	**Normal Source-Controls Green Lamp**
ES2	**Emergency Source-Controls Red Lamp**	**TM**	**Transfer Motor**
NAS1	**Normal Circuit Breaker Lockout**		

Each breaker contains two standard switches and one optional switch. Each switch is operated by breaker contact action. *The switches are:

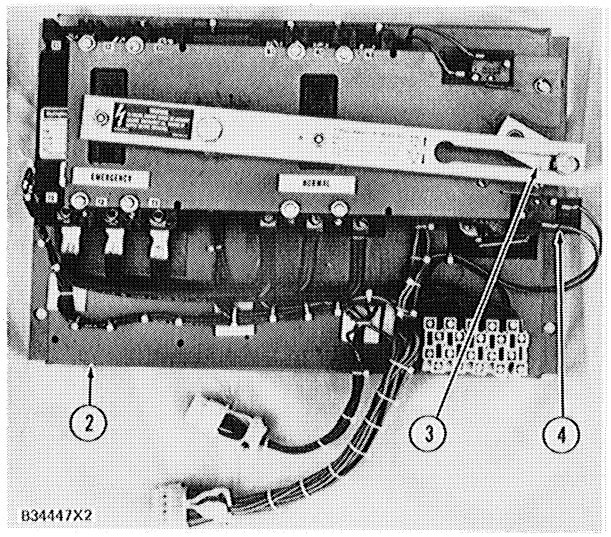
1. Normal and Emergency Limit Switches (NLS and ELS)*
2. Normal and Emergency Source Auxiliary Switch (NS and ES)
3. Normal and Emergency Auxiliary Switch (NAS and EAS)

Normal and Emergency Limit Switches (NLS and ELS)



225-2000 AMP ATS LIMIT SWITCH (INTERNAL TO BREAKER)

EB Emergency Breaker (ELS Internal).
NB Normal Breaker (NLS Internal).



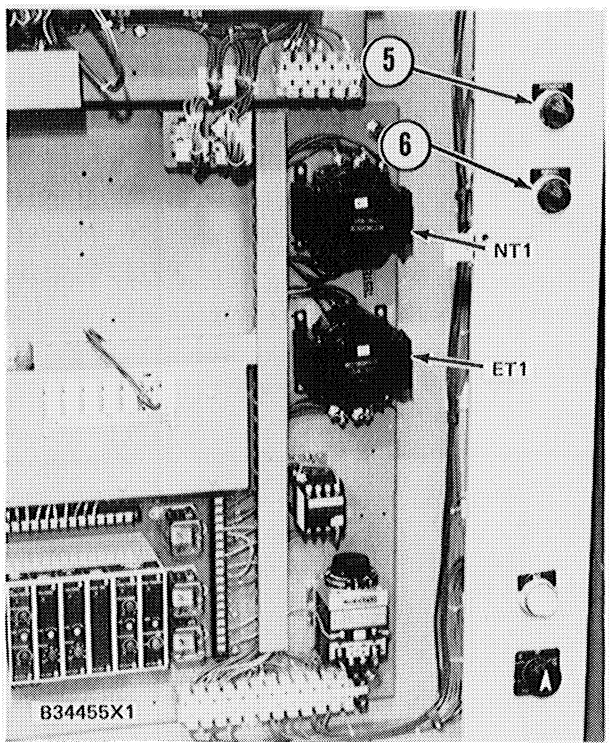
100 AMP ATS LIMIT SWITCH (EXTERNAL TO BREAKER)

2. 100 amp ATS.
3. Lever.
4. External limit switch.

These standard switches are used to start and stop the transfer motor. The NLS and ELS switches are breaker operated in the ATS units rated 225 A and above. On the 100 A unit, the limit switches (4) are mechanically sequenced by a lever (3) operated by the gear box. The transfer mechanism opens one source breaker. The breaker contact of that source closes the switch contact in preparation for return of the load. At the same time, the transfer mechanism closes the other source breaker. That source breaker in closing, opens the switch contact to stop the transfer motor.

*In the 100 amp ATS, the limit switches are operated by the transfer mechanism.

Normal Source Switch and Emergency Source Switch (NS and ES)



POWER SOURCE INDICATOR LAMPS

5. Emergency power source lamp - red.
6. Normal power source lamp - green.
NT1 Normal Transformer
ET1 Emergency Transformer

These standard switches operate power source indicator lamps. The Normal Breaker (NB) and Emergency Breaker (EB) contacts operate the NS and ES switches. The NS and ES switches are located inside the NB and EB.

The NS2 contact controls a green pilot light (6). When lit, the green light (6) indicates that the load is connected to the normal source (power is on the system from the normal system). The ES2 contacts control a red light (5). When lit, the red light (5) indicates that the load is connected to the emergency source. Power is then on the system from the emergency source.

The standard green (6) and red (5) pilot lights cannot indicate the status of the source if there is no power on the system. If the normal source fails, the green light (6) goes out momentarily until either the normal source returns or transfer is made to the emergency source. When emergency power appears on the system, the ATS will transfer to the emergency source. The red light (5) will then light.

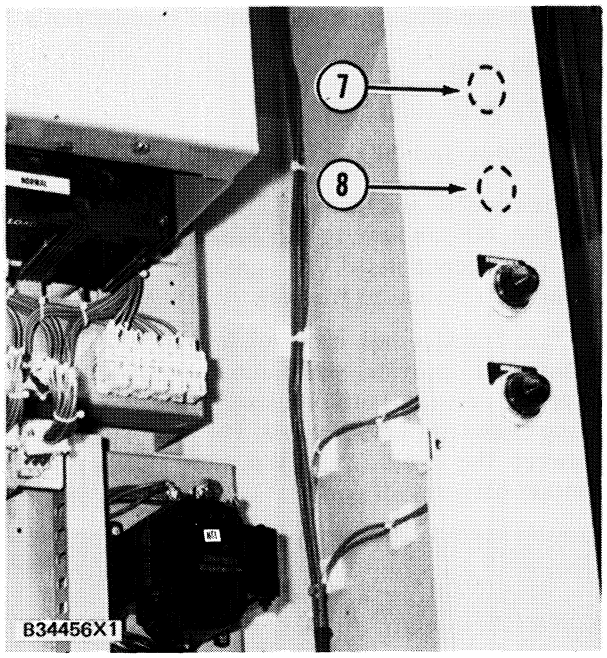
The NS switch is tied into the normal transformer (NT1). The ES switch is tied into the emergency transformer (ET1). The ES1 and NS1 contacts can be used to power other 110 volt pilot lights. However, the current draw on such lights cannot exceed .1 amp due to other demands on NT1 and ET1. These switch contacts cannot be used to control other auxiliary equipment other than pilot lights.

Normal Auxiliary Switch and Emergency Auxiliary Switch (NAS and EAS)

These optional switches operate to lockout the transfer motor in problem faults. At the same time, these switches light a lamp which shows which source breaker has tripped. The NB and EB contacts operate NAS and EAS. NAS and EAS are located inside NB and EB. NAS is used only in the dual generator application where the thermal-magnetic trip is used in both EB and NB. The optional EAS is used in both the single and dual generator application.

The NAS contact (NAS1) is also called the normal circuit breaker lockout. The EAS contact (EAS1) is called the Emergency Circuit Breaker Lockout. The term "lockout" refers to the (NAS1 and EAS1) contact opening (when NB or EB trips) and electrically isolating the transfer motor. The normally closed (NC) lockout control (NAS1) and (EAS1) prevent the transfer motor from transferring the alternate source into a problem fault.

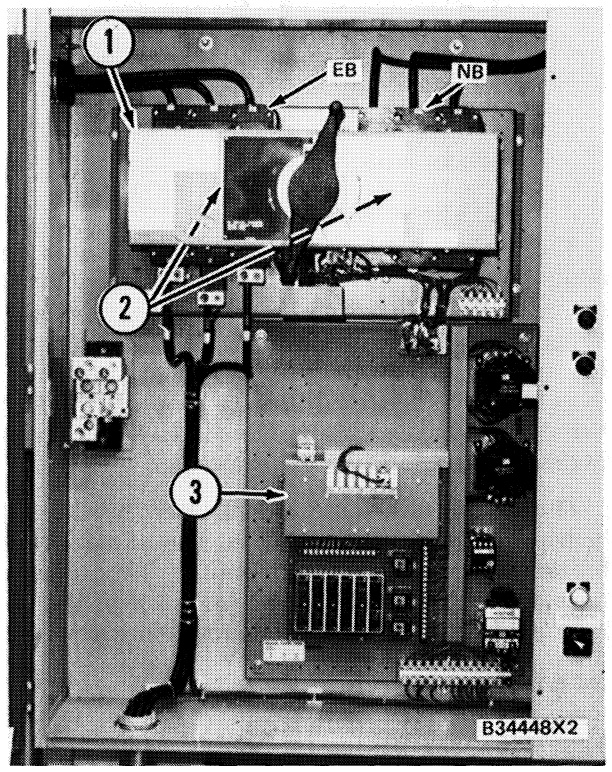
The NAS contact (NAS2) is called the normal bell alarm contact. The EAS contact (EAS2) is called the emergency bell alarm contact. When the NB trips, the normally open (NO) contact NAS2 closes. This completes circuitry to a yellow lamp (8). The yellow lamp (8) lights indicating the NB has tripped. When the EB trips, the (NO) contact (EAS2) closes. This completes circuitry to a yellow lamp (7). This yellow lamp (7) lights indicating the EB has tripped.



BREAKER TRIP INDICATOR LAMPS (OPTIONAL)

7. Emergency breaker trip lamp - amber.
8. Normal breaker trip lamp - amber.

Transfer Mechanism



AUTOMATIC TRANSFER SWITCH - TRANSFER MECHANISM

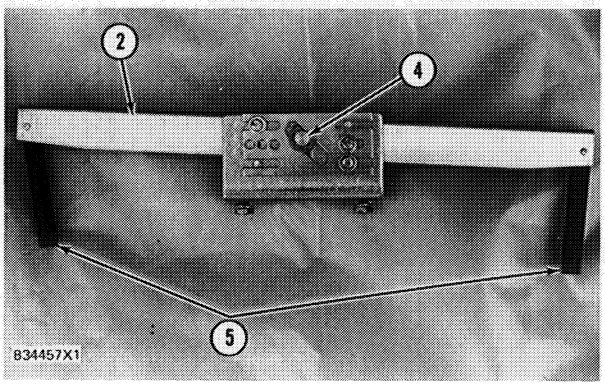
1. Transfer mechanism (225 A to 1000 A).
2. Oscillating beam (not shown - located on back of panel).
3. Intelligence panel.
EB Emergency breaker.
NB Normal breaker.

There are three types of transfer mechanisms:

1. 100 amp.
2. 225 A to 1000 A.
3. 1200 A and 2000 A.

The transfer mechanism (1) transfers the normal breaker (NB) and emergency breaker (EB) contacts. The intelligence panel (3) signals the transfer mechanism (1) when to transfer.

Once transfer has been made, the transfer mechanism (1) provides mechanical interlocking. The interlock prevents both breakers (EB and NB) from being closed at the same time. The mechanical parts between the handles and the motor keep positive contact between all parts.



OSCILLATING BEAM INTERLOCK

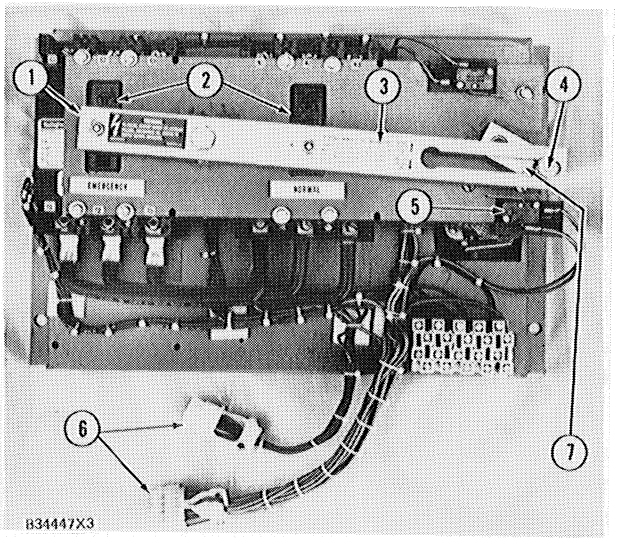
2. Oscillating beam.
4. Pivot
5. Nonconductive plungers.

The mechanical interlock is backed up with an oscillating beam (2) interlock. This interlock is mounted on the panel at the rear of the breakers. When one breaker is closed, a nonconductive plunger (5) extends into the opposite breaker to prevent it from closing. The closed breaker must open before the other breaker can be closed. However, both breakers can be open at the same time.

The transfer mechanism (1) allows the breakers to be trip-free in the closed position. This allows either breaker to trip under fault conditions. The trip-free interlock setup works on the standard high instantaneous breaker and optional thermal-magnetic trip.

100 A Transfer Mechanism

This transfer mechanism consists of a pivoting rocker arm (1) which toggles the circuit breaker handles (2). The rocker arm (1) is moved by a rotating slide pin (4). The slide pin (4) is rotated by a lever (7). The lever is rotated by a transfer motor and gear box. The slide pin (4) engaging the rocker arm (1) converts rotary motion to linear motion. A spring operated brake stops the motor when the motor is shutoff. The brake is released by a solenoid connected in parallel with the motor. The limit switches (5) which stop and start the motor are mechanically sequenced by the lever (7).



100 AMP ATS TRANSFER MECHANISM

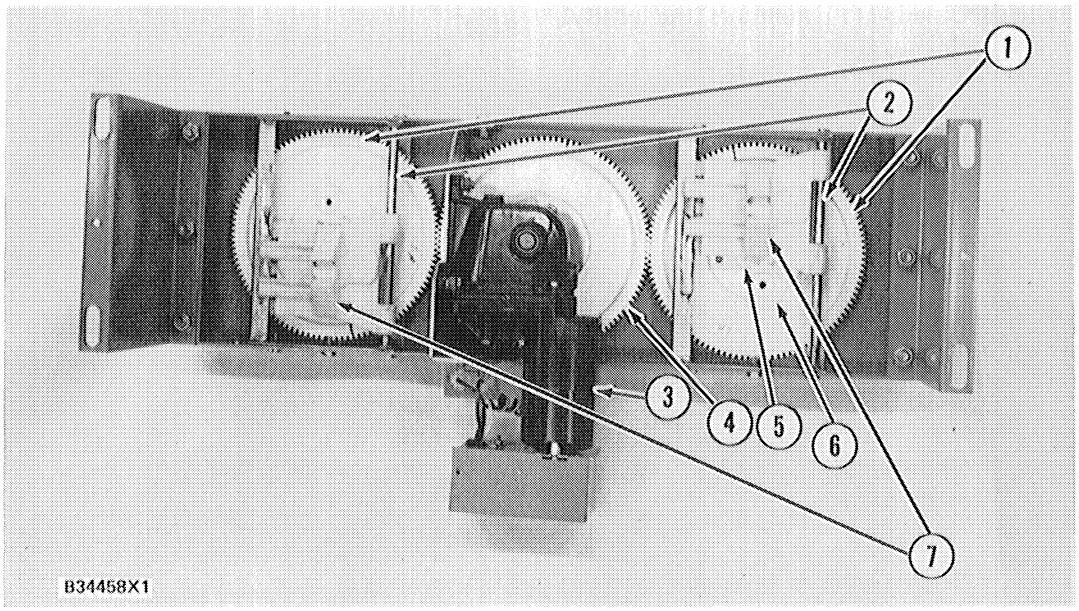
1. Rocker arm. 2. Breaker handles. 3. Operating instructions. 4. Slide pin. 5. Limit switches. 6. Interconnect plugs. 7. Lever.

To operate manually, the logic must be disconnected. It is disconnected by disconnecting the panel interconnect plugs (6). The transfer mechanism will restore itself to its previous position if the logic circuit is not disconnected. Next, disconnect the motor by unscrewing the slide pin (4) from the slot in the rocker arm (1). Remove the slide pin. The rocker arm (1) then becomes the manual handle. Instructions on manual operation and switch position are printed (3) on the rocker arm (1).

225 A to 1000 A Transfer Mechanism

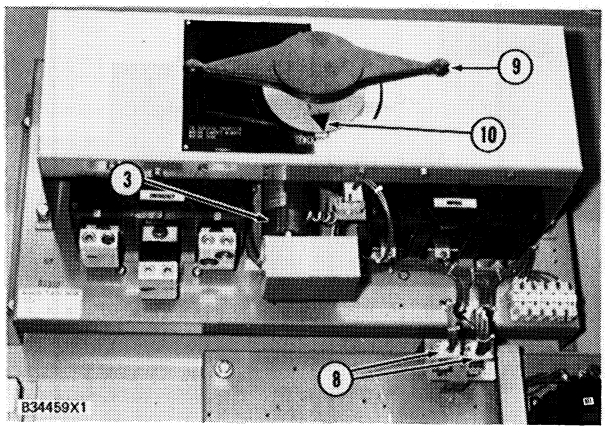
The components of this transfer mechanism are a center drive gear (4), transfer motor (3), secondary gears (1), and two cam driven toggles (7). The toggles (7) directly operate the breaker handles. The changing of rotary motion to vertical movement is accomplished by a roller pin mounted on each toggle (7). Each pin rides in a groove (5) in cam (6). The toggle (7) moves up and down on guide rods (2) attached to the metal housing.

A brake operated by a spring stops the motor when the motor is shutoff. The brake is released by a solenoid connected in parallel with the motor. Limit switches which stop and start the transfer motor are mechanically operated by the breaker contacts.



225 AMPS & ABOVE ATS - TRANSFER MECHANISM (REMOVED FROM ATS AND REAR VIEW)
1. Secondary gears (2). 2. Guide rods (2). 3. Transfer motor. 4. Center drive gear. 5. Cam grooves. 6. Cam. 7. Toggles (2).

To operate manually, the logic circuit must be disconnected. This is done by disconnecting the panel interconnect plugs (8). If the handle (9) is operated manually without disconnecting the logic circuit, the transfer mechanism will restore itself to its previous position. On the 225 A to 2000 A ATS, it is constructed to have a free-wheeling, ratchet sprocket drive. During automatic operation of the transfer mechanism, the operating handle (9) remains stationary. This handle (9) is electrically dead to eliminate the possibility of an electrical shock. To operate the ATS manually, turn the handle (9) counterclockwise one-half turn (180°) until one breaker opens and the other closes. Emergency and normal positions are shown by the arrow (10). The red or green source lamps indicate which source the switch is connected.

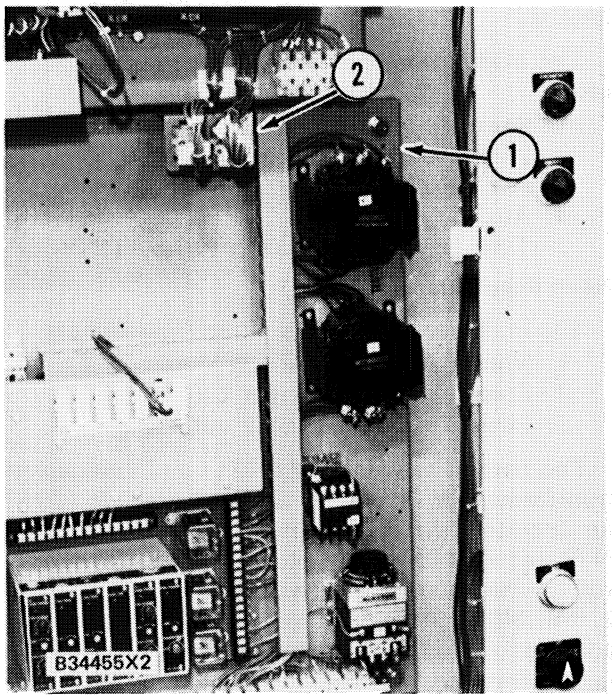


225 AMPS & ABOVE ATS - TRANSFER MECHANISM (INSTALLED AND FRONT VIEW)
3. Transfer motor. 9. Manual handle.
8. Interconnect plugs. 10. Switch position indicator.

1200 A and 2000 A Transfer Mechanism

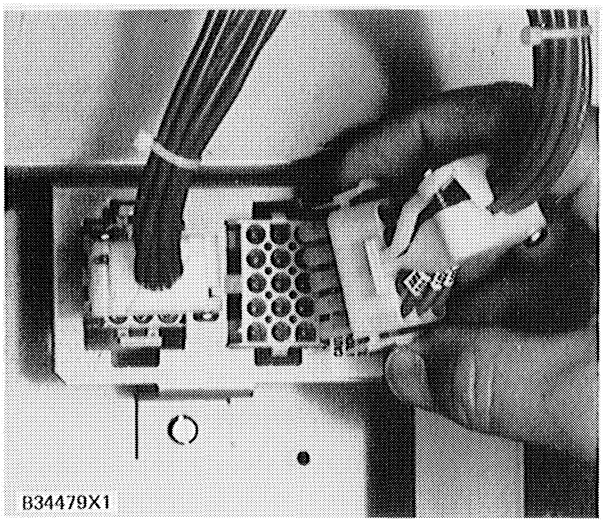
The 1200 A and 2000 A transfer mechanism is very similar to the 225 A to 1000 A mechanism. The 1200 A and 2000 A mechanism has an idler gear between each of the secondary gears and the drive gear. This provides greater torque.

Intelligence Panel



INTELLIGENCE PANEL
1. Intelligence panel.
2. Interconnect plugs (2).

The intelligence panel (1) monitors the utility power and load demand. If a loss of power or fault occurs, the intelligence panel signals the transfer mechanism to switch to the alternate source. The intelligence panel (1) is mounted on the lower part of the ATS. It is connected to the transfer mechanism above it by means of cables terminating in two interconnect plugs (2). The plugs (2) are keyed to prevent improper insertion.



INTERCONNECT PLUG

One size intelligence panel is used in all eight sizes of ATS. Each intelligence panel is drilled and tapped for the maximum number of options that can be installed.

The major components of the intelligence panel are:

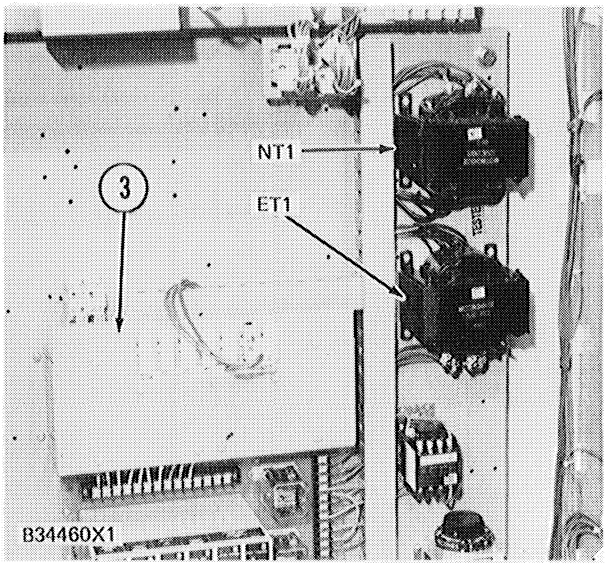
1. Power Supply Transformers.
2. Logic Package.
3. Logic Relays.
4. Auxiliary Relays.
5. Time Delay Engine Start Relay (TDES).

Power Supply Transformers

The intelligence panel has three transformers:

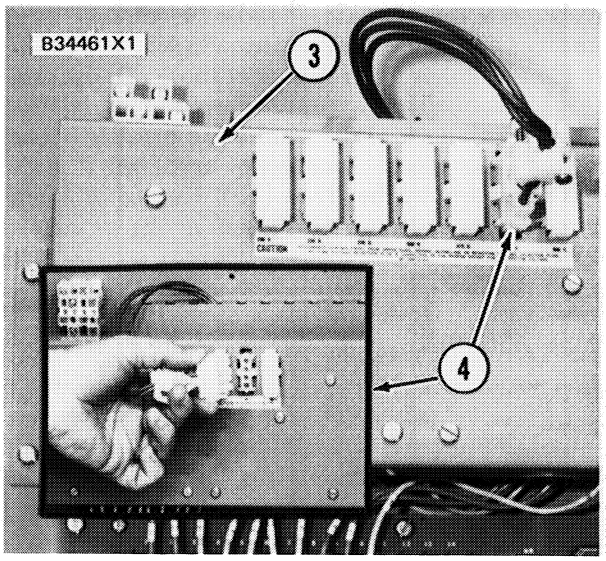
1. Normal Transformer 120 V output.
2. Emergency Transformer 120 V output.
3. Logic Transformer 24 V output.

The normal transformer (NT1) and emergency transformers (ET1) reduce the line voltage to 120 V for operating the transfer motor and pilot devices. NT1 and ET1 have multiple taps to use the supply voltage that is available. System voltages of 208 V, 220 V, 240 V, 380 V, 415 V, 480 V or 600 V can be adapted to by inserting the voltage selection plug (4) in the proper socket. Other voltages and frequencies can be used. This is done by adjusting the voltage and frequency plug-in cards of the solid-state logic package (5).



POWER SUPPLY TRANSFORMERS

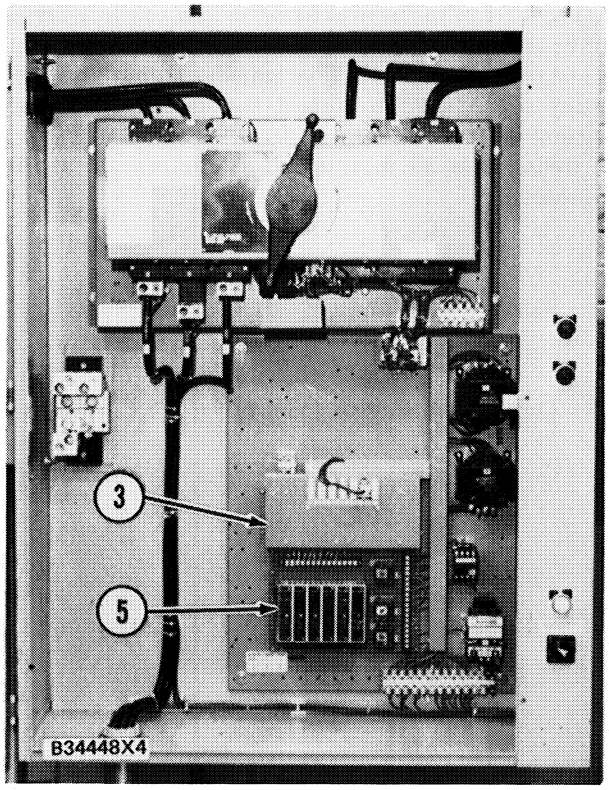
3. Logic transformer.
NT1 Normal Transformer.
ET1 Emergency Transformer.



VOLTAGE SELECTION PLUG

3. Logic transformer. 4. Voltage plug.

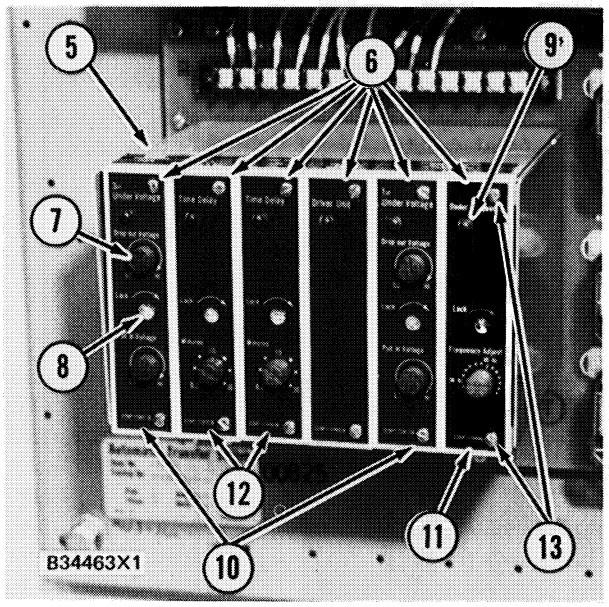
The logic package requires 24 V. This is supplied by the logic transformer (3).



LOGIC PACKAGE

3. Logic transformer. 5. Logic package.

Logic Package

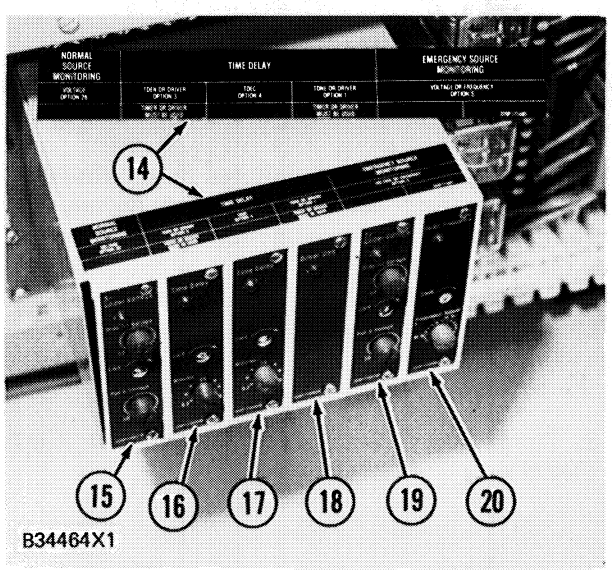


LOGIC PACKAGE - COMPONENT DESCRIPTION

5. Logic package.
6. Printed circuit (PC) cards.
7. Adjustment dial.
8. Adjustment lock.
9. Light emmitting diode (LED).
10. Under-voltage PC cards.
11. Under-frequency PC card.
12. Time delay cards.
13. Mounting screws (2).

A solid-state logic package (5) is also mounted on the intelligence panel. It contains six printed circuit (PC) cards (6) which provide the intelligence. The PC cards (6) are plug-in, modular and solid-state units. Each PC card has adjustment dials (7) to adjust both dropout and pickup values. The dials (7) can be screwdriver or finger adjusted. Each card also has an adjustment lock (8). This locks in the adjustment setting.

A light emmitting diode (LED) (9) is located on the face of each plug-in card. On the two voltage PC cards (10) and the one frequency PC card (11) the LED (9) light appears when the characteristics are within preset limits. On the two time delay PC cards (12), the LED (9) light appears after the preset time has elapsed. These LED's are useful when troubleshooting.



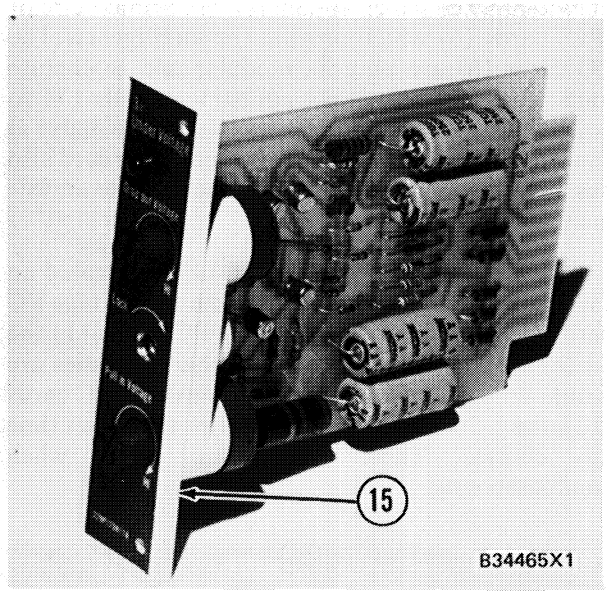
LOGIC PACKAGE - PC CARD IDENTIFICATION

14. Function identification plate.
15. Normal source voltage monitoring (standard).
16. Time delay, emergency to normal (standard) TDEN.
17. Time delay engine cooldown (optional) TDEC.
18. Driver card.
19. Emergency source voltage monitoring (standard).
20. Emergency source frequency monitoring (standard).

The two voltage cards (15) and (19) cannot be switched. Voltage card (15) monitors 3-phase and card (19) monitors 1-phase.

Either of the two timing cards (16) and (17) may be used in any of the three time delay slots of the card cage. However, each card is limited to one type of function. A timing card cannot be used in the voltage or frequency lots or vice-versa. The cards are key interlocked to prevent improper insertion. Each card is held in place by two screws (13).

1. Normal Source Voltage Monitoring Card

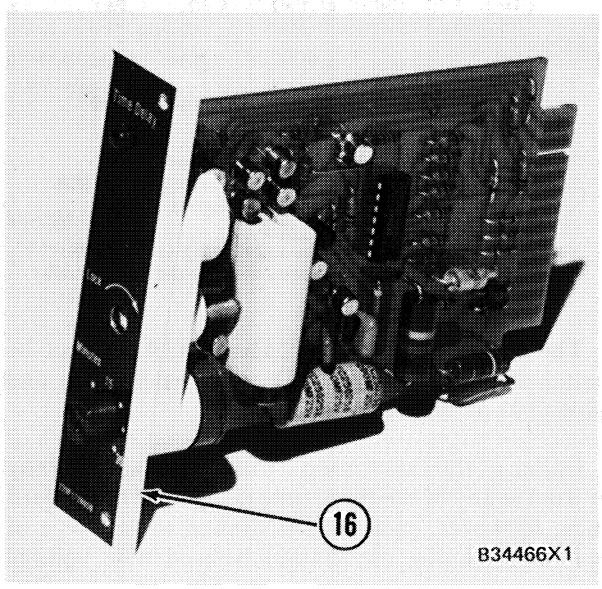


NORMAL SOURCE VOLTAGE MONITORING CARD

15. 3-Phase normal source voltage monitoring PC card.

The normal source is monitored by the first card (15). The normal source voltage monitoring card (15) is standard. It senses line voltage in each phase of the normal three-phase power supply. This removes the possibility of running the load on less than three phases. The values for switch transfer are adjustable. They are normally set at 70% dropout and 90% pickup.

2. Time Delay Emergency to Normal Card (TDEN)

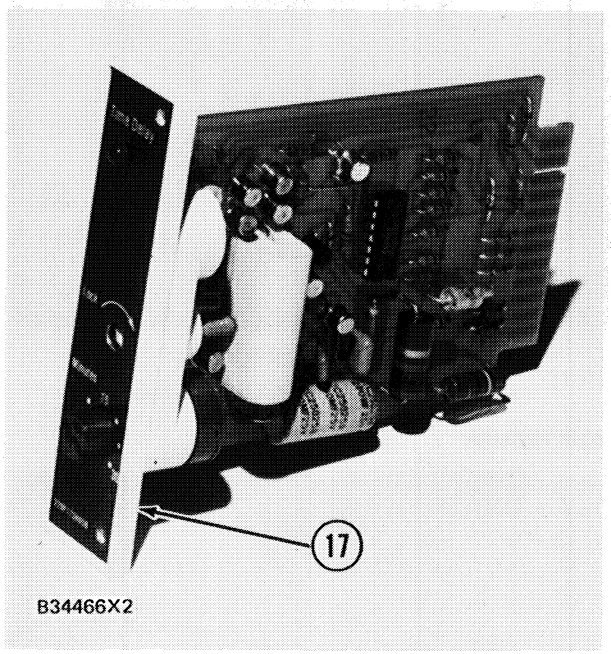


TIME DELAY EMERGENCY TO NORMAL CARD (TDEN)

16. TDEN PC card.

The TDEN PC card (16) is the first of three cards in the time delay section (14) of the logic package. It is a standard card. It delays transfer from the emergency source to the normal source to permit the normal source to become stable. It is adjustable from .2 minutes to 30 minutes. It is factory set at 10 minutes.

3. Time Delay Engine Cool-Off Card (TDEC)



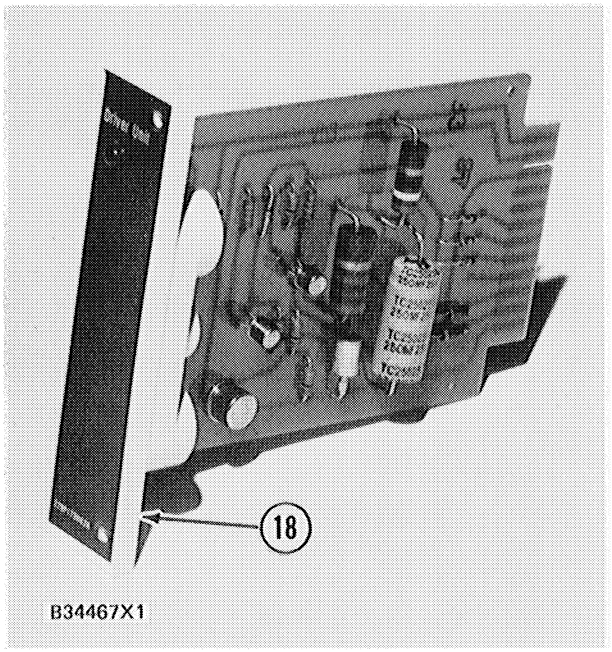
TIME DELAY ENGINE COOL-OFF CARD (TDEC)

17. TDEC (optional).

The TDEC card (17) is the second of three cards in the time delay section (14). The TDEC card (17) is optional. It can be interchanged with TDEN card (16). This card functions after the load has been switched back to normal. The TDEC card (17) permits the generator set to run in the no-load condition. This allows the engine to cool gradually, eliminating loss of coolant. It is adjustable .2 minutes to 30 minutes. It is factory set at 10 minutes.

In some applications, this function could be accomplished by the Automatic Start/Stop Control (ASSC). The ASSC is not a part of the ATS. In this situation, a blank cover is supplied as standard equipment in place of TDEC card (17).

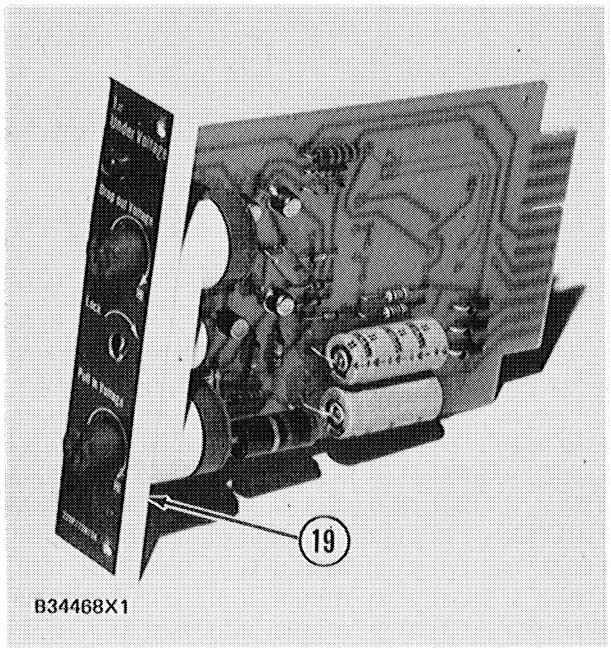
4. Driver Card



DRIVER CARD
18. Driver card.

The third card in the time delay section is a driver card (18). It completes the circuitry but does not add time.

5. Emergency Source Voltage Monitoring Card

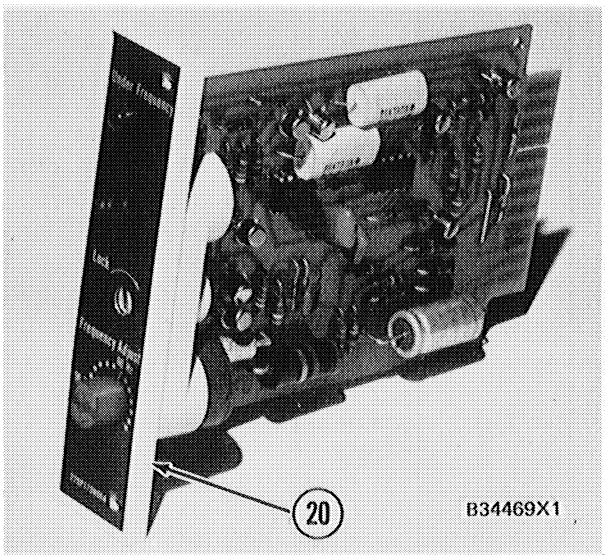


EMERGENCY SOURCE VOLTAGE MONITORING CARD
19. 1-Phase emergency source voltage monitoring card.

This PC card (19) is one of two standard cards in the emergency source monitoring section. Its job is to prevent transfer from normal to emergency source until proper voltage appears. Transfer occurs when the generator set voltage is at least 90% of normal. This voltage is field adjustable between 70% and 100%. The dropout voltage is set at 70% at the factory.

When operating under the emergency source and the generator voltage drops below the dropout voltage, the PC card (19) starts to initiate action. If the utility is out, the ATS remains in the emergency position. However, if the utility has returned and the TDEN card (16) is timing out, the ATS will override the delay. It will transfer immediately to the utility (normal source).

6. Emergency Source Frequency Monitoring Card



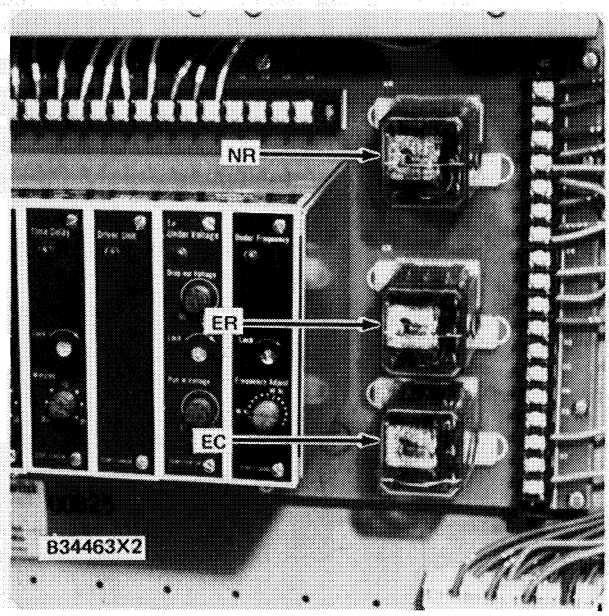
EMERGENCY SOURCE FREQUENCY MONITORING CARD
20. Emergency source frequency monitoring card.

The last PC card (20) prevents transfer from the normal source to the emergency source until the proper frequency appears. The emergency frequency is preset between 40 Hertz (Hz) and 65 Hz. On the 60 Hz system, this frequency pickup value is factory set at 57 Hz. On a 50 Hz system, it is factory set at 47 Hz.

When operating under emergency conditions, if the frequency of the generator decreases to the dropout value, the emergency frequency monitoring card will prepare to initiate action. If the utility is out, the ATS stays in the emergency position. If the utility has returned and the TDEN is being timed out, the ATS will override the delay and go to utility immediately. The factory dropout setting of the frequency card is 55 Hz on the 60 Hz ATS. On the 50 Hz ATS, the dropout value is factory set at 45 Hz. The lower end of the adjustment range is 40 Hz.

Logic Relays

The three plug-in relays to the right of the logic package are made to work by the logic package. They make sure that electrically the breakers will not close on each other. These relays are the cleanable, electromechanical, plug-in type with see through dust covers. The relay contacts are rated at 10 amps.



LOGIC RELAYS

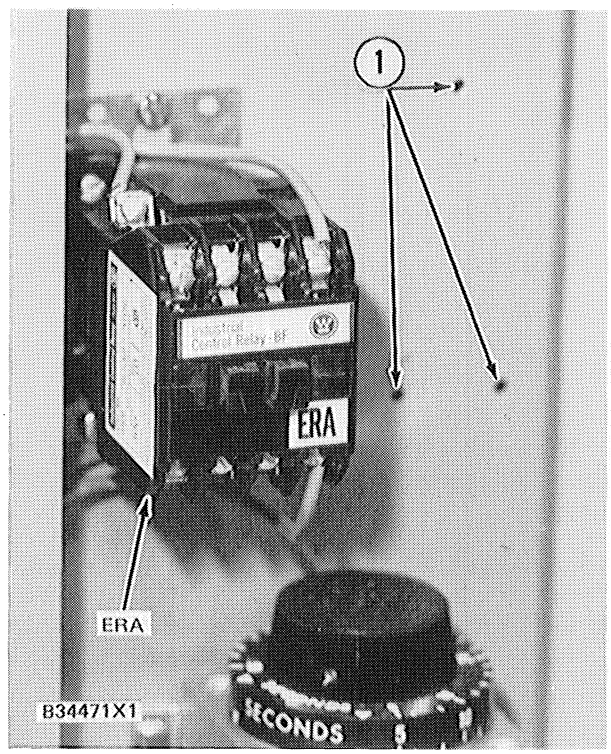
NR Normal source relay.
ER Emergency source relay.
EC Engine start-stop relay.

The logic relays and their functions are as follows:

1. Normal Source Relay (NR)* - A standard relay that controls the various contacts (NR1, NR2, NR3 and NR4) in the ATS circuitry which contribute to operation of the transfer motor and in turn, the opening and closing of the breakers. It also contributes to the engine start contact circuitry with one contact (NR5).
2. Emergency Source Relay (ER)* - A standard relay that is the final relay to close its contact (ER2) when transferring to emergency from normal. It is made to operate by the logic package only when the generator set is up to proper voltage and frequency.
3. Engine Cool-Off Relay (EC)* - An optional relay that is included only when the optional engine cool-off timer (TDEC) is provided. This relay (EC) controls a contact (EC1) which is part of the engine start contact circuitry. This allows the engine to cool down under no load conditions before being shutoff.

*See the ATS Operation section, Page 26, for sequencial operation.

Auxiliary Relays



AUXILIARY RELAYS

1. Mounting holes for normal relay auxiliary (NRA).
ERA Emergency relay auxiliary (optional).

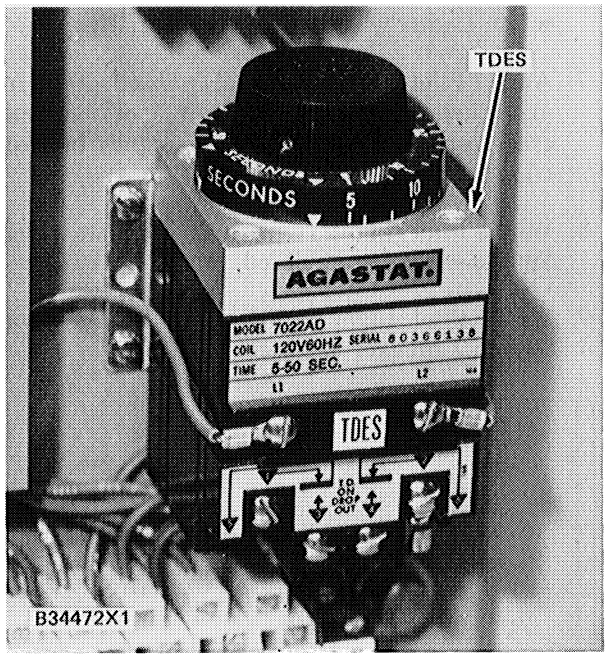
The emergency relay auxiliary (ERA) and normal relay auxiliary (NRA) are optional. These two relays are added when current demand will be in excess of that used by pilot lamps (0.1 A). The ratings of each set of contacts is 6 A inductive or 10 A resistive and 120 VAC. The relays are heavy duty industrial relays. They can handle solenoids and motor starter coils. Each relay provides two (NO) and two (NC) contacts. These relay contacts transfer when the normal or emergency source is energized or de-energized.

Location and prime usage is as follows:

1. Normal Relay Auxiliary (NRA) - This optional relay is located above the TDES option and to the right of the ERA on the intelligence panel.

2. Emergency Relay Auxiliary (ERA) - This optional relay is located above the TDES option and to the left of the (NRA) on the intelligence panel. One set of contacts is used with the TDEC option in the "Engine Start Contact" circuitry. The NO contact is closed while the emergency source is present. See section, "Operation of the ATS" for further details.

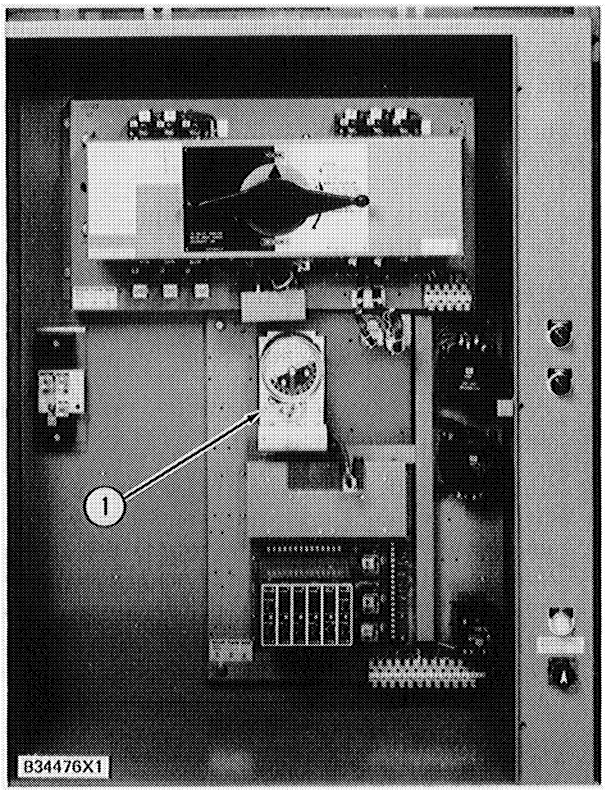
Time Delay Engine Start Relay (TDES)



TIME DELAY ENGINE START RELAY (TDES)

This relay is also a part of the intelligence panel. So that the generator set is not started on momentary outages, this relay is used for a time delay on start of the engine. The relay is adjustable between 0 and 50 seconds. It is factory set at three seconds. The relay is of the pneumatic bellows-type which is field adjustable.

Plant Exerciser



PLANT EXERCISER LOCATION

1. Plant exerciser (typical unit).

The plant exerciser (1) is a 168 hour clock timer. It provides automatic test operation of the ATS. The exerciser is adjustable 0 to 168 hours in 15 minute stages for at least one time a week. A 60 or 50 Hz exerciser is used depending upon frequency. The plant exerciser can be used to:

Check starting circuit without interrupting the normal supply; or

Simulate power failure and change to the emergency source.

CAUTION

When changing the line voltage selection plug, be sure to reconnect the plant exerciser to conform to new voltage.

Panel Controls and Monitoring Lights

The monitoring lights and the switches are located on the face of the Nema I enclosure. The wall mounted enclosure covers 100 thru 1000 amps. The floor-standing enclosure covers 1200 thru 2000 amps.

The functions of the exterior switches and lamps are as follows:

1. Four-position selector switch permits four types of switch operation:

   Test - The test position simulates power failure. Engine starting is initiated and the switch will transfer when emergency voltage appears.

   Auto - The auto position returns the transfer switch to normal operation.

   Off - The off position is used during maintenance or manual operation. This position de-energizes the control relays, opens the engine start circuit, and opens the transfer motor circuit. The switch will not operate nor will the engine start on power failure. A white light is also furnished that lights only when the switch is in the off position.

   Engine Start - The engine start position keeps the transfer switch on the normal source and initiates the engine start circuit. The switch will transfer if normal source fails during test.

2. White Pilot Light - Lights only when the above switch is in the off position.

3. A Two-Position Selector Switch (Optional) - For use mainly when the normal and emergency source are both generator sets. This option permits selection of either generator set as the preferred source to which the ATS will always transfer if that source is available. The switch is marked Source 1/Source 2.

4. Green Pilot Light - Lights when normal supply is connected to load.

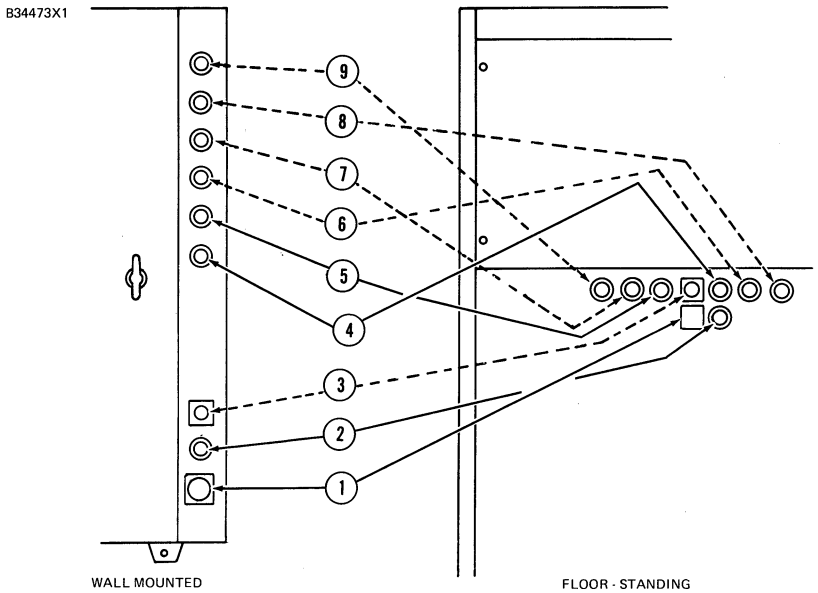
5. Red Pilot Light - Lights when emergency supply is connected to load.

6. Amber Pilot Light (Optional) - Used with the thermal-magnetic breaker in the dual generator setup. Lights when normal breaker trips.

7. Amber Pilot Light (Optional) - Used with thermal-magnetic breaker in the single or dual generator setups. Lights when emergency breaker trips.

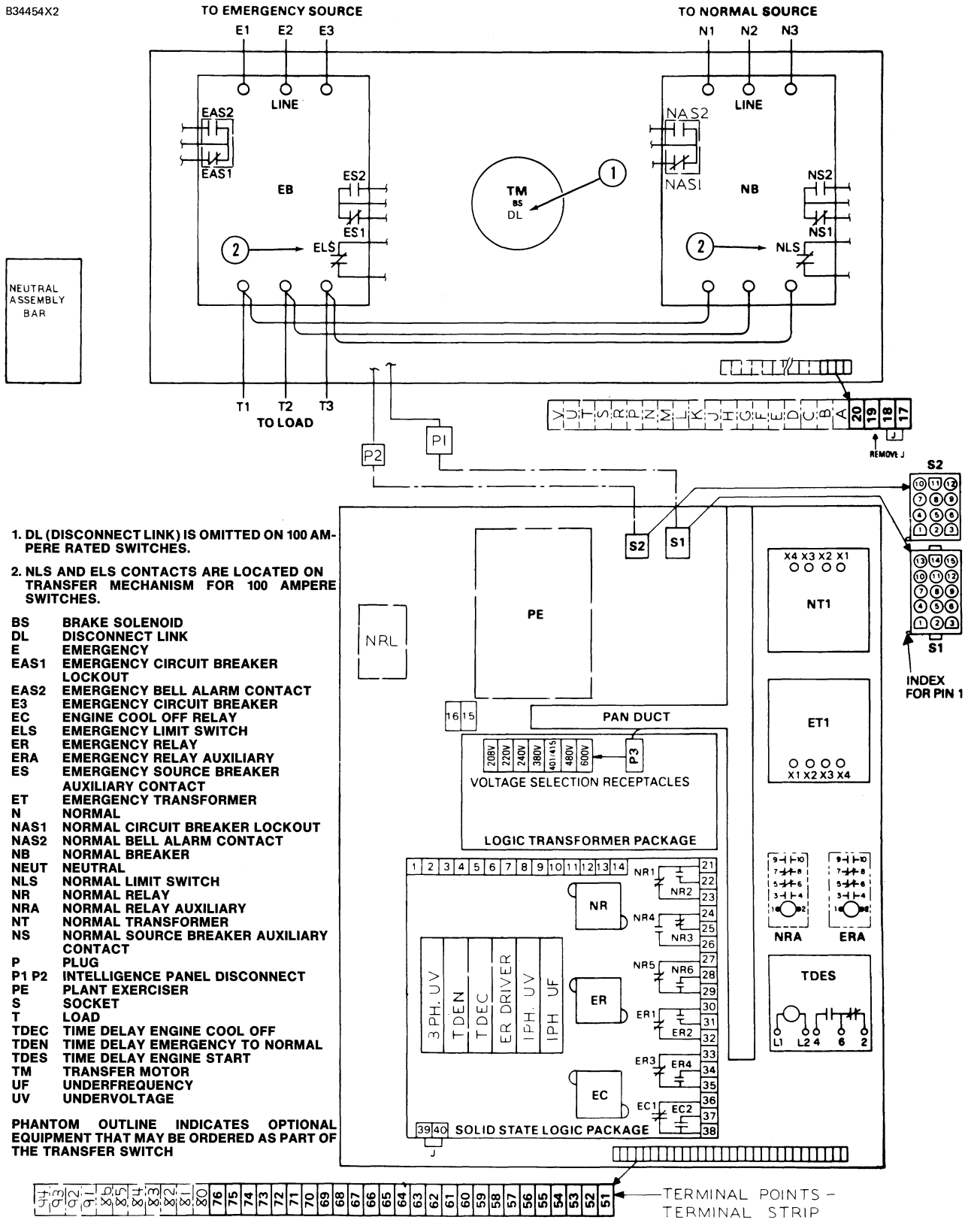
8. White Pilot Light (Optional) - Lights when Source 1 breaker is closed.

9. White Pilot Light (Optional) - Lights when Source 2 breaker is closed.



CONTROLS AND MONITORING LAMPS

1.	FPSS	Four position selector switch.
2.	OFF	White pilot light - FPSS is "off" position.
3.	TPSS	Two position selector switch.
4.	NL	Green pilot light - normal breaker closed.
5.	EL	Red pilot light - emergency breaker closed.
6.	TN	Amber pilot light - trip, normal breaker.
7.	TE	Amber pilot light - trip, emergency breaker.
8.	S1	White pilot light - source 1 breaker closed.
9.	S2	White pilot light - source 2 breaker closed.



1. DL (DISCONNECT LINK) IS OMITTED ON 100 AMPERE RATED SWITCHES.
2. NLS AND ELS CONTACTS ARE LOCATED ON TRANSFER MECHANISM FOR 100 AMPERE SWITCHES.

BS	BRAKE SOLENOID
DL	DISCONNECT LINK
E	EMERGENCY
EAS1	EMERGENCY CIRCUIT BREAKER LOCKOUT
EAS2	EMERGENCY BELL ALARM CONTACT
E3	EMERGENCY CIRCUIT BREAKER
EC	ENGINE COOL OFF RELAY
ELS	EMERGENCY LIMIT SWITCH
ER	EMERGENCY RELAY
ERA	EMERGENCY RELAY AUXILIARY
ES	EMERGENCY SOURCE BREAKER AUXILIARY CONTACT
ET	EMERGENCY TRANSFORMER
N	NORMAL
NAS1	NORMAL CIRCUIT BREAKER LOCKOUT
NAS2	NORMAL BELL ALARM CONTACT
NB	NORMAL BREAKER
NEUT	NEUTRAL
NLS	NORMAL LIMIT SWITCH
NR	NORMAL RELAY
NRA	NORMAL RELAY AUXILIARY
NT	NORMAL TRANSFORMER
NS	NORMAL SOURCE BREAKER AUXILIARY CONTACT
P	PLUG
P1 P2	INTELLIGENCE PANEL DISCONNECT
PE	PLANT EXERCISER
S	SOCKET
T	LOAD
TDEC	TIME DELAY ENGINE COOL OFF
TDEN	TIME DELAY EMERGENCY TO NORMAL
TDES	TIME DELAY ENGINE START
TM	TRANSFER MOTOR
UF	UNDERFREQUENCY
UV	UNDERVOLTAGE

PHANTOM OUTLINE INDICATES OPTIONAL EQUIPMENT THAT MAY BE ORDERED AS PART OF THE TRANSFER SWITCH

POWER SWITCHING MODULE & INTELLIGENCE PANEL

ATS OPERATION

Switch De-Energized (Four Position Selector Switch (FPSS) in "OFF" Position)

All contacts are shown with no power applied to the switch or the load (nonenergized state).

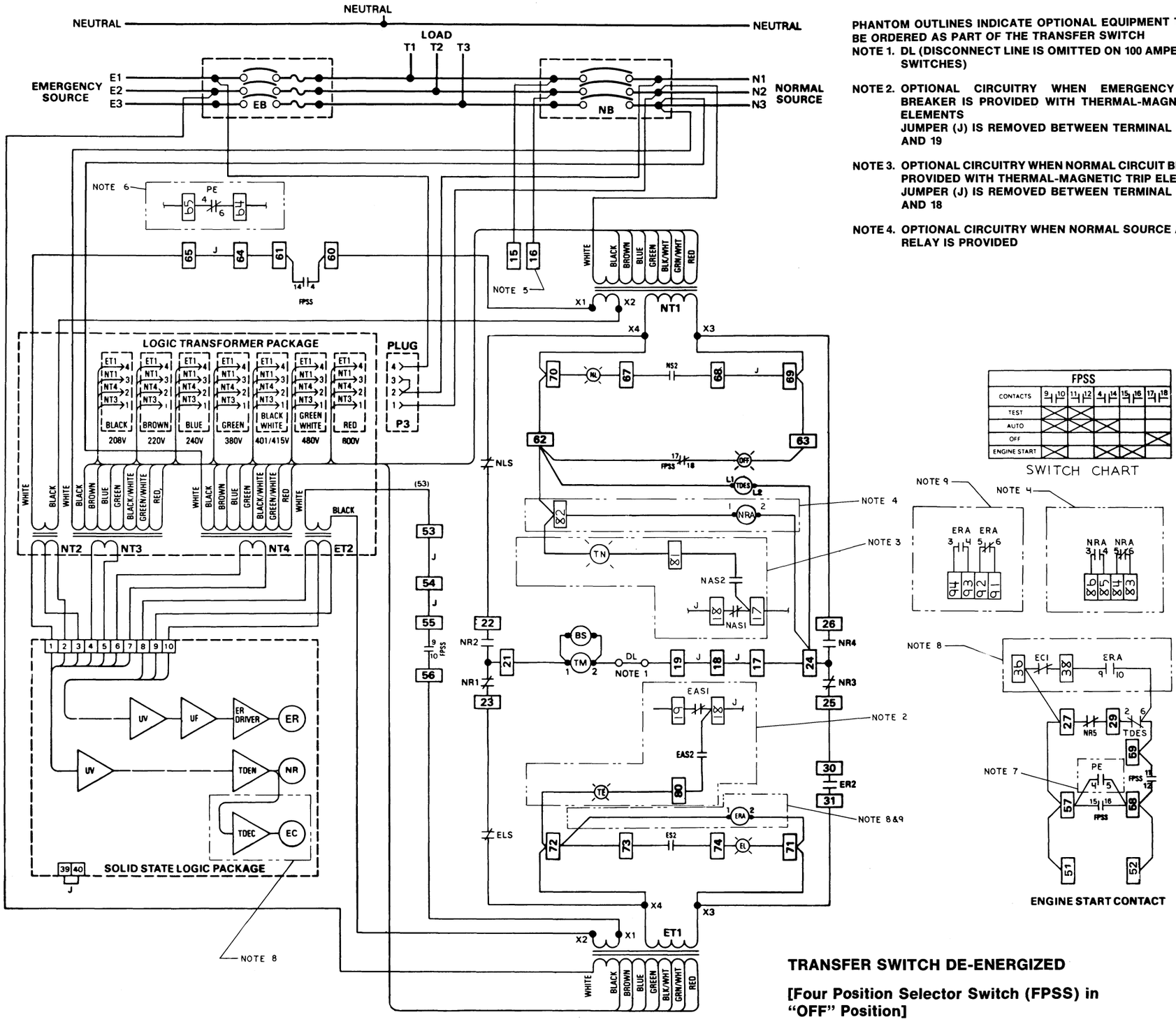
Circuit conditions are as follows:

Normally open contacts are open.

Normally closed contacts are closed.

Normal and emergency limit switches (NLS and ELS) are closed.

FPSS contact (17-18) is in the closed position. (When power is available and the FPSS is in the "OFF" position, the white "OFF" lamp is lit.)



FPSS

CONTACTS	9 10	11 12	4 14	15 16	17 18
TEST	X	X			
AUTO	X	X			
OFF			X	X	X
ENGINE START	X	X	X		

SWITCH CHART

PHANTOM OUTLINES INDICATE OPTIONAL EQUIPMENT THAT MAY BE ORDERED AS PART OF THE TRANSFER SWITCH

NOTE 1. DL (DISCONNECT LINE IS OMITTED ON 100 AMPERE RATED SWITCHES)

NOTE 2. OPTIONAL CIRCUITRY WHEN EMERGENCY CIRCUIT BREAKER IS PROVIDED WITH THERMAL-MAGNETIC TRIP ELEMENTS
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 18 AND 19

NOTE 3. OPTIONAL CIRCUITRY WHEN NORMAL CIRCUIT BREAKER IS PROVIDED WITH THERMAL-MAGNETIC TRIP ELEMENTS
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 17 AND 18

NOTE 4. OPTIONAL CIRCUITRY WHEN NORMAL SOURCE AUXILIARY RELAY IS PROVIDED

NOTE 5. POWER SUPPLY SOURCE FOR PLANT EXERCISER (PE)

NOTE 6. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET AND TRANSFER SWITCH)
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 64 AND 65

NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

NOTE 9. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN AUXILIARY RELAY EMERGENCY SOURCE SIDE OPTION IS PROVIDED.

ABBREVIATIONS

SYMBOL	DESCRIPTION
BS	BRAKE SOLENOID
DL	DISCONNECT LINK
E	EMERGENCY
EAS1	EMERGENCY CIRCUIT BREAKER LOCKOUT
EAS2	EMERGENCY BELL ALARM CONTACT
E3	EMERGENCY CIRCUIT BREAKER
EC	ENGINE COOL OFF RELAY
EL	SWITCH POSITION EMERGENCY SOURCE PILOT LIGHT
ELS	EMERGENCY LIMIT SWITCH
ER	EMERGENCY RELAY
ERA	EMERGENCY RELAY AUXILIARY
ESC	ENGINE START CONTACT
ES	EMERGENCY SOURCE BREAKER AUXILIARY CONTACT
ET	EMERGENCY TRANSFORMER
FPSS	FOUR-POSITION SELECTOR SWITCH
J	JUMPER WIRE (UNNUMBERED)
N	NORMAL
NAS1	NORMAL CIRCUIT BREAKER LOCKOUT
NAS2	NORMAL BELL ALARM CONTACT
NB	NORMAL BREAKER
NEUT	NEUTRAL
NL	NORMAL SOURCE PILOT LIGHT SWITCH POSITION
NLS	NORMAL LIMIT SWITCH
NR	NORMAL RELAY
NRA	NORMAL RELAY AUXILIARY
NT	NORMAL TRANSFORMER
NS	NORMAL SOURCE BREAKER AUXILIARY CONTACT
OFF	OFF POSITION WHITE PILOT LIGHT
P	PLUG
P1, P2	INTELLIGENCE PANEL DISCONNECT
PE	PLANT EXERCISER
RD	RELAY DRIVER
S	SOCKET
T	LOAD
TDEC	TIME DELAY ENGINE COOL OFF
TDEN	TIME DELAY EMERGENCY TO NORMAL
TDES	TIME DELAY ENGINE START
TE	TRIPPED CONDITION EMERGENCY SOURCE PILOT LIGHT
TM	TRANSFER MOTOR
TN	TRIPPED CONDITION NORMAL SOURCE PILOT LIGHT
UF	UNDERFREQUENCY
UV	UNDERVOLTAGE
☐	TERMINAL

TRANSFER SWITCH DE-ENERGIZED

[Four Position Selector Switch (FPSS) in "OFF" Position]

B34495X1

Normal Energized/Emergency De-Energized (FPSS In "Auto" Position)

The following FPSS contacts are closed:

Contact (9-10) - located in the emergency sensing circuit

Contact (11-12) - located in the engine start contact circuit

Contact (4-14) - located in the normal sensing circuit

The following circuit conditions exist:

Normally open normal relay (NR) contacts are closed - NR2 and NR4.

Normally closed NR contacts are open - NR1, NR3 and NR5.

Normally closed time delay engine start (TDES) relay contact (2-6) is open. Contact (2-6) is located in the engine start contact circuit.

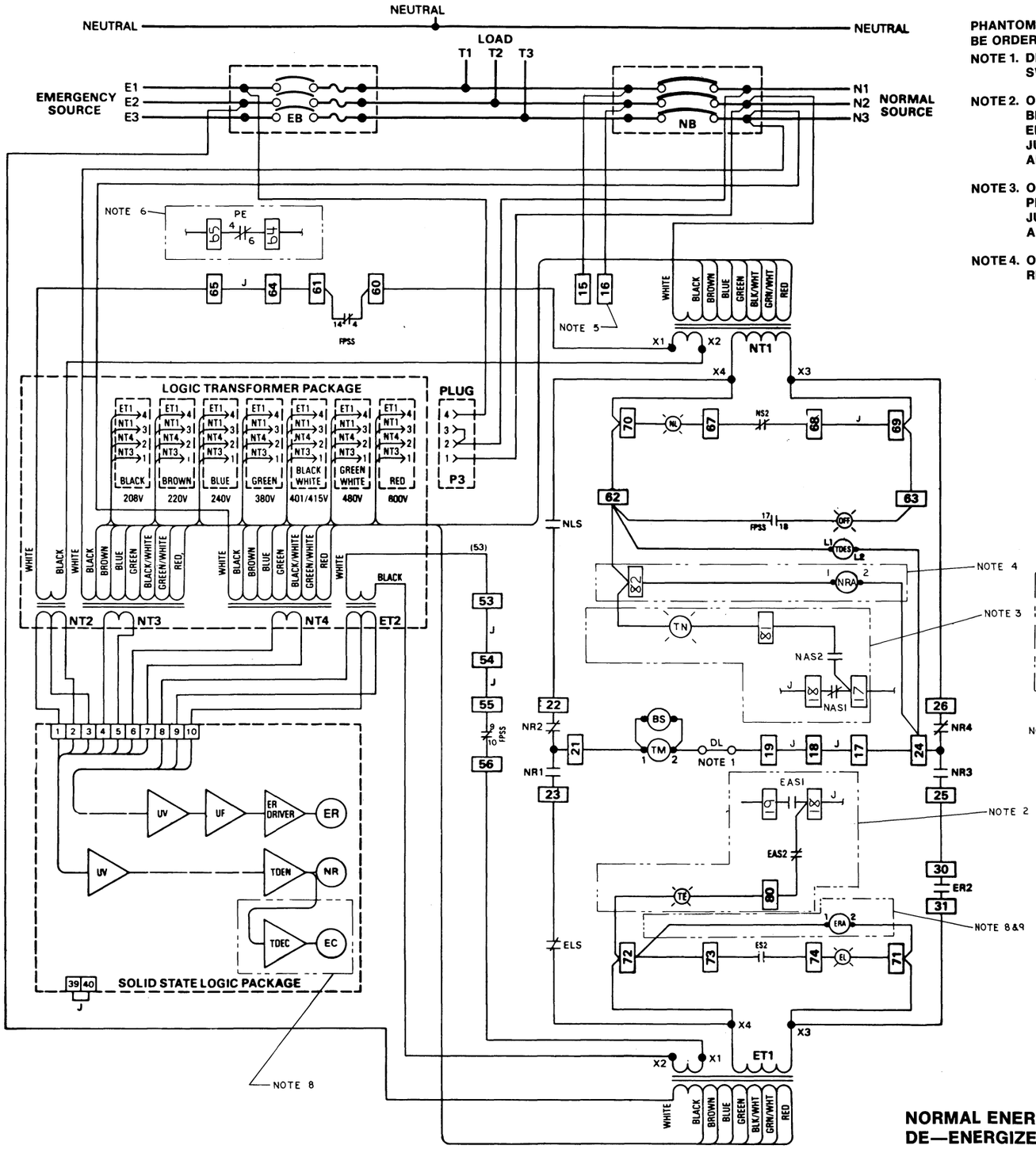
Normal limit switch (NLS) contact is open. This occurred when the normal breaker was closed. When the NLS contact opens due to breaker action, the transfer motor is shutoff.

Normal source (NS) breaker auxiliary pilot light switch contact (NS2) closes. This lights the normal source green pilot light (NL).

Normally closed time delay engine cooldown relay (EC) contact (EC1) is open. (Only if this option is part of the ATS.)

Normally open emergency relay (ER) contact (ER2) remains open.

This is the condition with the normal source providing power and no problems.



FPSS							
CONTACTS	9	10	11	12	14	15	16	17	18
TEST	X		X						
AUTO	X		X						
OFF								X	
ENGINE START	X				X			X	

SWITCH CHART

PHANTOM OUTLINES INDICATE OPTIONAL EQUIPMENT THAT MAY BE ORDERED AS PART OF THE TRANSFER SWITCH

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NOTE 4. OPTIONAL CIRCUITRY WHEN NORMAL SOURCE AUXILIARY RELAY IS PROVIDED

NOTE 5. POWER SUPPLY SOURCE FOR PLANT EXERCISER (PE)

NOTE 6. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET AND TRANSFER SWITCH)
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 64 AND 65

NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

NOTE 9. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN AUXILIARY RELAY EMERGENCY SOURCE SIDE OPTION IS PROVIDED.

ABBREVIATIONS

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E3	EMERGENCY CIRCUIT BREAKER
EC	ENGINE COOL OFF RELAY
EL	SWITCH POSITION EMERGENCY SOURCE PILOT LIGHT
ELS	EMERGENCY LIMIT SWITCH
ER	EMERGENCY RELAY
ERA	EMERGENCY RELAY AUXILIARY
ESC	ENGINE START CONTACT
ES	EMERGENCY SOURCE BREAKER AUXILIARY CONTACT
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FPSS	FOUR-POSITION SELECTOR SWITCH
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NEUT	NEUTRAL
NL	NORMAL SOURCE PILOT LIGHT SWITCH POSITION
NLS	NORMAL LIMIT SWITCH
NR	NORMAL RELAY
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OFF	OFF POSITION WHITE PILOT LIGHT
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P1, P2	INTELLIGENCE PANEL DISCONNECT
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S	SOCKET
T	LOAD
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TDEN	TIME DELAY EMERGENCY TO NORMAL
TDES	TIME DELAY ENGINE START
TE	TRIPPED CONDITION EMERGENCY SOURCE PILOT LIGHT
TM	TRANSFER MOTOR
TN	TRIPPED CONDITION NORMAL SOURCE PILOT LIGHT
UF	UNDERFREQUENCY
UV	UNDERVOLTAGE
▭	TERMINAL

NORMAL ENERGIZED/EMERGENCY DE—ENERGIZED

(Four Position Selector Switch (FPSS) in "Auto" Position)

B34494X1

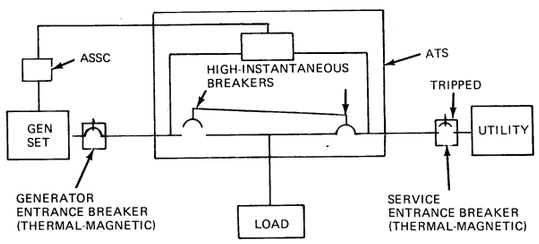
Normal Energized/Loss Of Normal Source (FPSS In "Auto" Position)

This condition could come about by:

a. A load fault tripping the service entrance breaker, or

b. A voltage or frequency drop.

B34450X2



LOSS OF NORMAL SOURCE (Service Entrance Breaker Tripped)

ATS Automatic transfer switch.
ASSC Automatic start-stop control.

The logic package senses the loss of power and initiates the following thru the (NR):

Normally open (NR) contacts open - NR2 and NR4.

Normally closed (NR) contacts close - NR1, NR3 and NR5.

The engine cooldown relay (EC) is de-energized.

Engine cooldown relay contact (EC1) closes

When contact NR4 opens, this opens the TDES circuit. TDES starts timing out. After timing out, TDES contact (2-6) closes. Contact (2-6) closing, completes the engine start contact circuit. The emergency source (generator set) is started and brought up to speed (frequency) and voltage.

Emergency relay auxiliary (ERA) energizes. ERA contact (9-10) closes. (Only if engine cooldown option is part of the ATS.)

When the emergency source is at specified voltage and frequency, the logic package closes ER contact ER2. The transfer motor (TM) then transfers the load to the emergency source through opening of the normal breaker and closing of the emergency breaker.

When the normal breaker opens, it in turn:

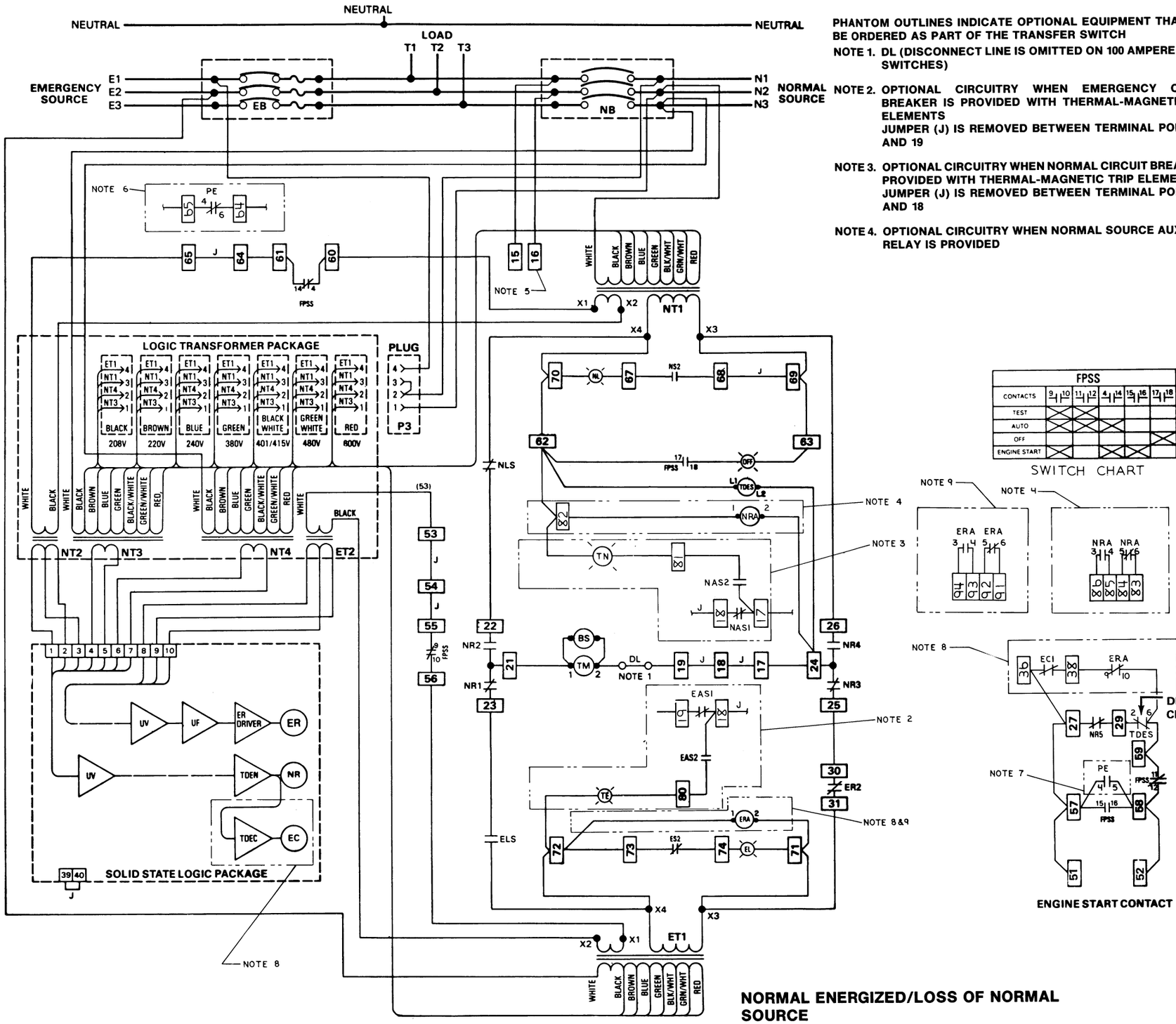
a. Opens the breaker switch NS2. This shuts "OFF" the green normal source light (NL).

b. Closes NLS so transfer can come about fast back to the normal source when the normal source returns.

When the emergency breaker closes, it in turn:

a. Closes the breaker switch ES2. This turns on the red emergency source light (EL).

b. Opens ELS which shuts "OFF" the transfer motor [brake solenoid (BS) gives positive stop of the motor].



B34493X1

NORMAL ENERGIZED/LOSS OF NORMAL SOURCE

(Four Position Selector Switch (FPSS) in "Auto" Position)

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NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

NOTE 9. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN AUXILIARY RELAY EMERGENCY SOURCE SIDE OPTION IS PROVIDED.

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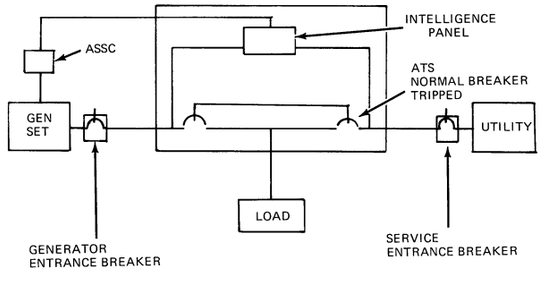
UF	UNDERFREQUENCY
UV	UNDERVOLTAGE
▭	TERMINAL

Normal (Or Emergency) Energized and Normal (Or Emergency) Source Breaker Trips (FPSS In "Auto" Position)

The ATS normal and emergency breakers in a normally recommended installation should not trip before the service entrance (thermal-magnetic) breakers. In cases where the normal breaker trips before the service entrance breaker, the logic package will sense voltage as still being at leads N1, N2 and N3. As a result, the emergency source generator is not started and transfer is not initiated. The same is applicable where the ATS emergency breaker trips.



B34478X1

LOSS OF NORMAL SOURCE (ATS NORMAL SOURCE BREAKER TRIPPED)

ATS Automatic transfer switch.
ASSC Automatic start-stop control.

In applications where legal codes allow the service breaker to be replaced by ATS thermal-magnetic trip breaker, the same results would come about as described above.

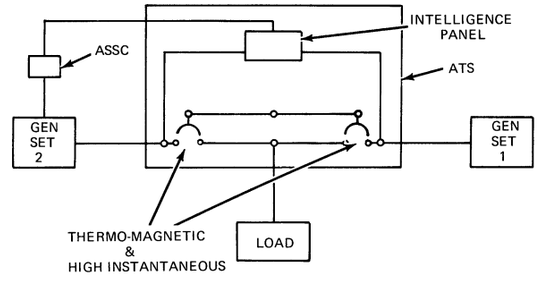
Normal Energized - Thermal Magnetic Breaker Trips (FPSS In "Auto" Position)

Trip Switch Lockout And Alarm Option Operation

This option is part of the thermal-magnetic trip setup. It is used in the following ATS arrangements:

a. Emergency Source Breaker - Single or dual generator automatic operation.

b. Normal Source Breaker - Dual generator automatic operation.



B34451X1

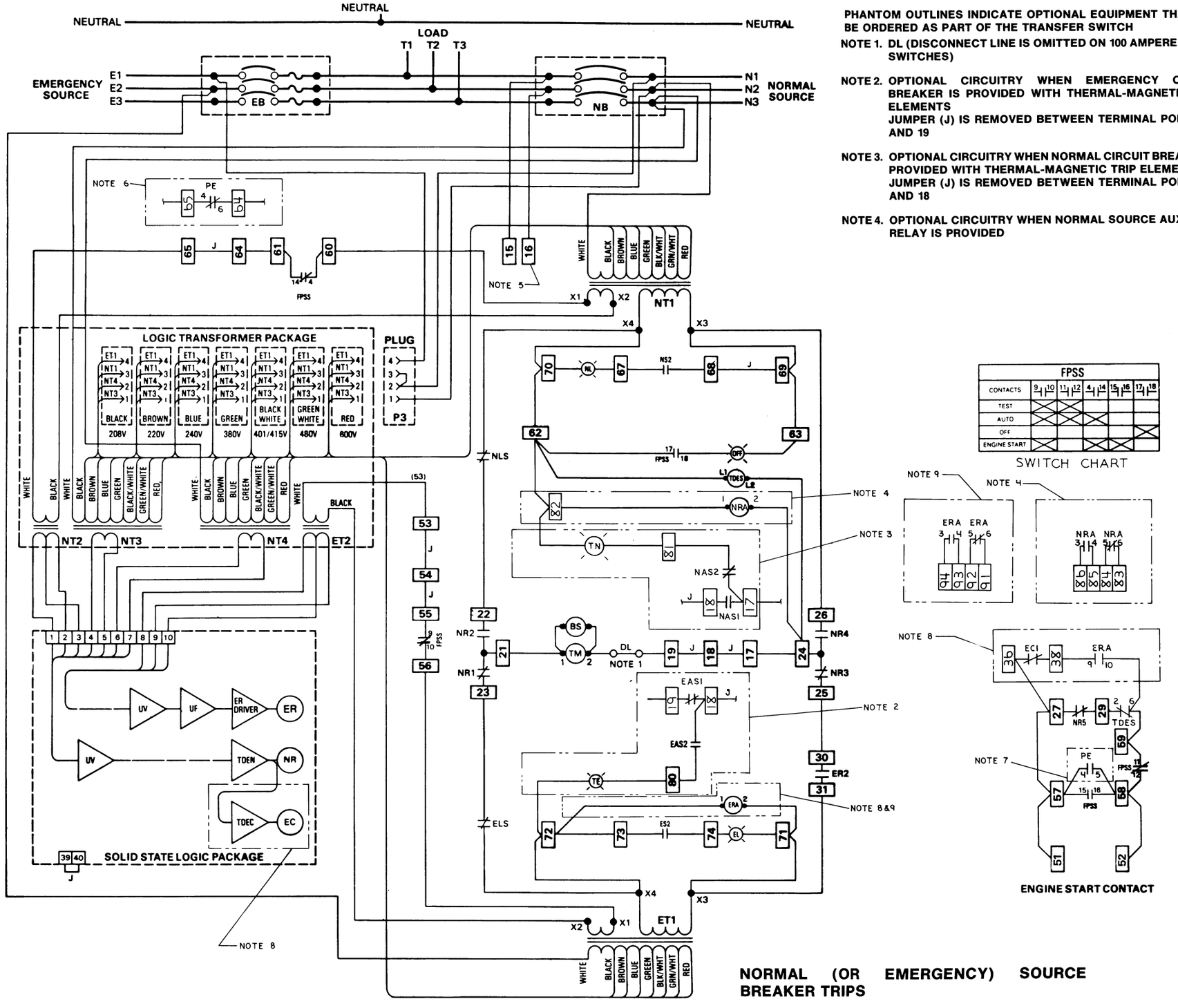
DUAL GENERATOR AUTOMATIC OPERATION

ASSC Automatic start-stop control.
ATS Automatic transfer switch.

This switch option is operated by the TM in the 100 ampere ATS or by the breaker in the 225 amp and above. In the case of the normal breaker tripping (thermal-magnetic trip - dual generator application), the breaker opens switch contact NAS1 (Normal Circuit Breaker Lockout). This locks the TM out until the normal breaker is reset. This prevents emergency source startup.

At the same time that NAS1 contact opens, switch contact NAS2 (Normal Bell Alarm Contact) closes. When NAS2 closes, the circuit for the normal source trip alarm lamp (TN) is complete. The amber lamp (TN) lights.

The emergency source breaker switch EAS1 and 2 operate the same. Upon resetting the breaker, the transfer motor can operate and the amber trip lamp (TN or EN) is turned off.



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NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

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NORMAL (OR EMERGENCY) SOURCE BREAKER TRIPS

[Four Position Selector Switch (FPSS) In "Auto" Position]

B34492X1

Emergency Energized - Normal Source Returns (FPSS In "Auto" Position)

Logic package senses through leads (N1, N2 and N3) when the normal source has returned. The logic package initiates a time delay through the time delay emergency to normal (TDEN) card. This allows for utility stabilization. At the end of the delay, the following occurs:

Normally open NR contacts are closed - NR2 and NR4.

Normally closed NR contacts are opened - NR1, NR3 and NR5.

Normally closed ER contact ER2 is opened.

Normally closed TDES contact (2-6) is opened.

The TM operates when NR2 and NR4 close. The TM transfers the load to the normal source through the opening of the emergency breaker and closing of the normal breaker.

When the emergency breaker opens, it in turn:

a. Opens the breaker switch ES2. This shuts "off" the red emergency source light EL.

b. Closes the emergency limit switch ELS. Transfer can then occur to emergency source if the normal source should again fail.

When the normal breaker closes, it in turn:

a. Closes the breaker switch NS2. This turns "ON" the green normal source light (NL).

b. Opens NLS which shuts "OFF" the transfer motor (brake solenoid (BS) gives positive stop of motor).

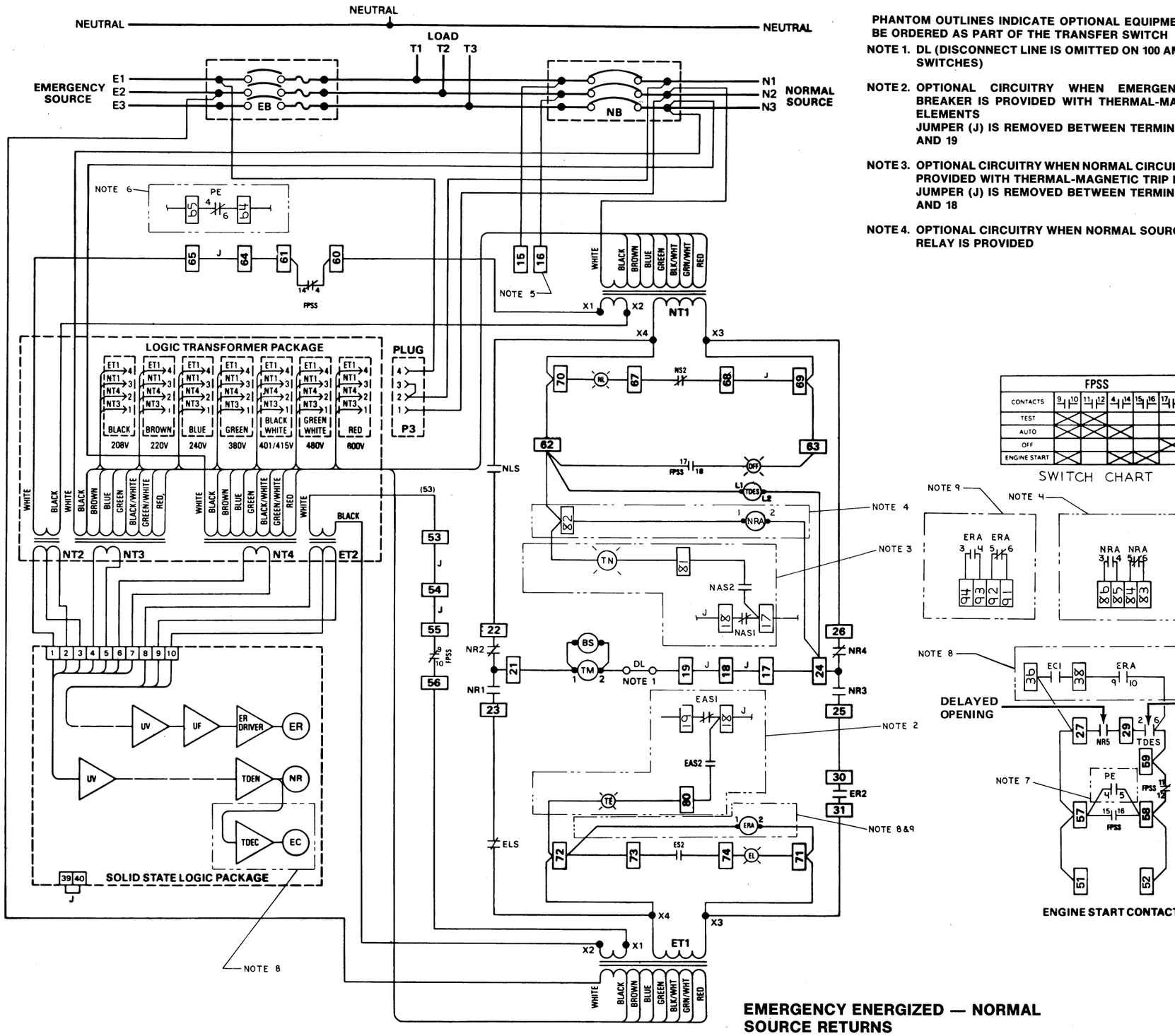
If the engine cooldown option is included in the ATS logic package, the following relays are used:

a. Time Delay Engine Cooldown (TDEC) Relay EC.

b. Emergency Relay Auxiliary (ERA).

After transfer has been made back to the normal source, the engine cooldown relay (EC) remains closed because of the time delay engine cooldown logic card (TDEC). The TDEC keeps the EC relay contact EC1 in the nonenergized condition for a certain amount of time. When the time delay is complete, EC is energized and EC1 opens. With EC1 open, the engine start contact circuit is open, which shuts down the engine.

While the generator is in operation, the emergency relay auxiliary (ERA) remains energized. After EC1 opens, the engine shuts down. This de-energizes ERA. With ERA de-energized, ERA contact (9-10) opens.



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NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

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EMERGENCY ENERGIZED — NORMAL SOURCE RETURNS

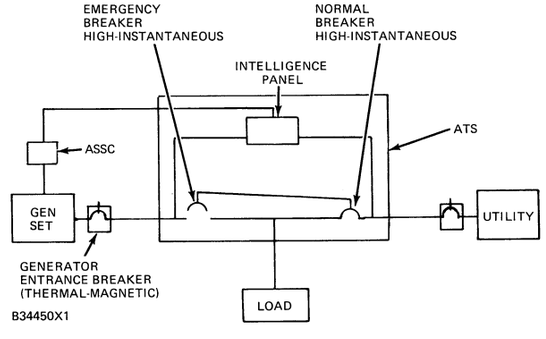
[Four Position Selector Switch (FPSS) in "Auto" Position]

B34491X1

ATS RATINGS

The ATS is offered in eight basic ratings (100A, 225A, 400A, 600A, 800A, 1000A, 1200A, and 2000A) for use on three-phase systems of 600V or less. The ATS can be applied to either a three-wire or four-wire system. In the four-wire system, the fourth wire is a solid neutral that is not switched. Application depends on installation and use.

Continuous Rating - High Instantaneous Trip



AUTOMATIC TRANSFER SWITCH (HIGH-INSTANTANEOUS BREAKERS)

The ATS can be applied to any inductive and/or resistive load. When properly installed, the ATS can handle the maximum demand of the load continuously. The continuous ampere rating of the standard ATS (both ATS breakers high instantaneous) at a power factor of .8 and 100% use of capacity is as follows:

	*kW Range by Voltage and .8 Pf				
ATS Rating (amps)	220 200 208 Volts	380 230 240 Volts	400 415 Volts	460 480 Volts	600 Volts
100	to 28	to 30	to 50	to 60	to 80
225	29-70	31-75	51-130	61-150	81-180
400	71-115	76-130	131-220	151-270	181-300
600	116-170	101-190	221-330	271-390	301-450
800	171-225	191-260	331-450	391-520	451-610
1000	226-280	261-310	451-560	521-650	611-760
1200	281-340	311-390	561-680	651-785	759-910
2000	341-560	391-650	681-1130	786-1310	911-1500

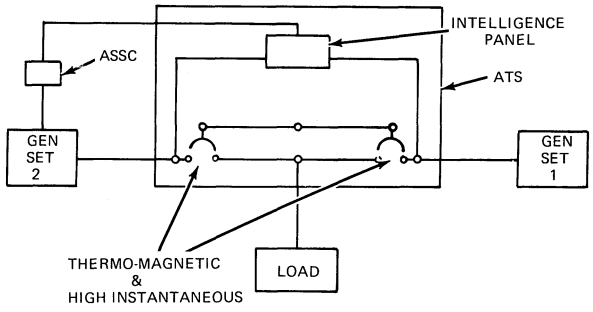
SELECTION TABLE FOR ATS WITH STANDARD EQUIPMENT
(Manual and Automatic With High Instantaneous Trips)

***Continuous ampere rating of standard ATS is calculated as follows:**

$$\text{Rating} = \frac{\text{kW Demand X 1,000}}{\text{1.732 X Voltage X Power Factor}}$$

Continuous Rating - Thermal-Magnetic Trips

When the ATS serves as both isolation/protective device and automatic transfer switch, the ATS should be derated 10%. This allows for temperature rise (inside the ATS) above the rating of the thermal overload trip. The breaker can then carry system load without nuisance trips. The following table is used to select an ATS with optional thermal-magnetic trips in either or both sources. These thermal-magnetic trips operate along with the standard high instantaneous breakers. The eight basic ratings has been increased to twenty ratings by using different trip ratings in the basic ATS sizes. Trip ratings are matched to KW ranges.



B34451X1

DUAL GENERATOR ATS
(ONE OR TWO THERMAL-MAGNETIC TRIPS)

*kW Range by Voltage					Rating	
200 208 Volts	220 230 240 Volts	380 400 415 Volts	460 480 Volts	600 Volts	Basic ATS Amps	Trips Amps
0-30	0-30	0-50	0-60	0-75	100	100
31-33	31-37	51-63	61-75	76-94	225	125
34-39	38-45	64-75	76-90	94-112	225	150
40-45	46-52	76-87	91-105	113-131	225	175
46-52	53-60	88-100	106-120	132-150	225	200
53-58	61-67	101-112	121-135	151-168	225	225
59-65	68-75	113-125	136-150	169-187	400	250
66-78	76-90	126-149	151-180	188-224	400	300
79-91	91-105	150-174	181-210	225-261	400	350
92-104	106-120	175-199	211-240	262-299	400	400
105-130	121-150	200-249	241-298	300-374	500	500
131-155	151-180	250-299	299-359	375-448	600	600
156-181	181-210	300-349	360-419	449-523	800	700
182-207	211-240	350-399	420-478	524-598	800	800
208-260	241-300	400-498	479-598	599-747	1000	1000
261-311	301-359	499-598	599-717	748-897	1200	1200
312-363	360-420	599-697	718-837	898-1046	2000	1400
364-415	421-480	698-797	838-957	1047-1194	2000	1600
416-466	481-538	798-897	958-1075	1195-1345	2000	1800
467-520	539-600	898-1000	1076-1200	1346-1500	2000	2000

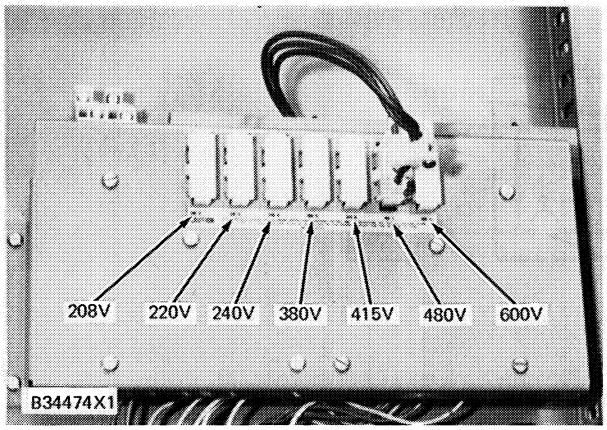
SELECTION TABLE FOR ATS IN DUAL SERVICE,
I.E., WITH OPTIONAL THERMAL-MAGNETIC TRIPS

*ATS is rated down minimum of 10% for temperature compensation and system coordination.

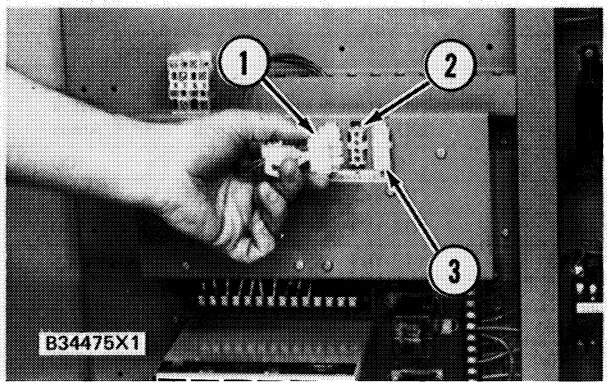
TESTING AND ADJUSTING

VOLTAGE SELECTION

The ATS is equipped with a line voltage plug (1) and seven sockets for 208 V, 220 V, 240 V, 380 V, 415 V, 480 V or 600 V. This adapts the transfer equipment to the supply voltage in use.



ATS VOLTAGE SELECTIONS



VOLTAGE SELECTION PLUG REMOVAL

1. Voltage plug.
2. Voltage socket.
3. Micarta cover.

To change line voltage, remove the micarta cover (3) and fit the plug (1) in the socket (2). Install the micarta cover (3) in the unused socket (2).

CAUTION

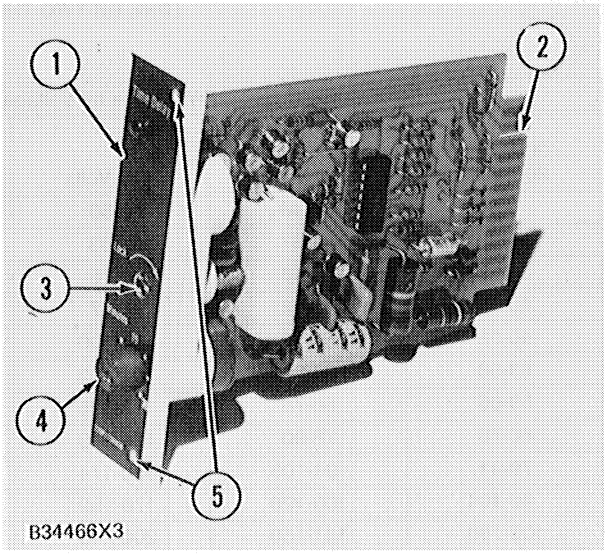
Disconnect control panel from upper panel before installing or removing voltage selection plug. Be sure voltage selection plug is connected to the proper socket for the system voltage.

CAUTION

If ATS is equipped with optional plant exerciser, it must be reconnected to the system voltage to avoid damage.

LOGIC CARD ADJUSTMENTS

The printed circuit (PC) logic card (1) has an interlocking slot (2) to prevent placing in the wrong slot.



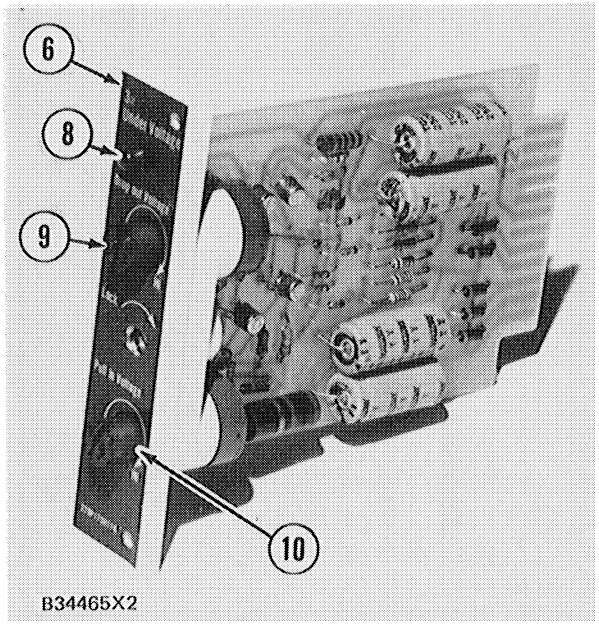
INTERLOCKING SLOT AND ADJUSTMENT DIAL (TYPICAL PC CARD)

1. PC card.
2. Interlocking slot.
3. Adjustment dial.
4. Locking screw.
5. Mounting screws (2 screws).

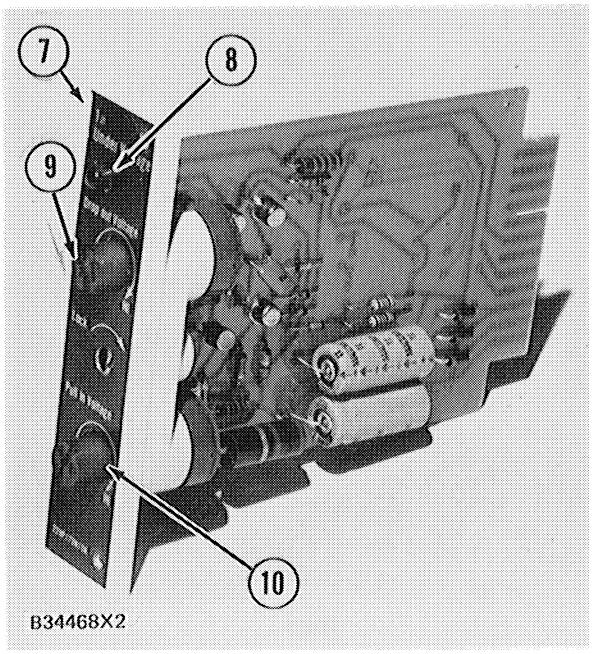
Dial (3) settings are ± 10% of the amount shown. After making adjustments, tighten locking screw (4) to secure setting. Mounting screws (5) must be tight.

Undervoltage Card

The normal source undervoltage PC card (6) monitors all three phases. The emergency source undervoltage PC card (7) monitors only one phase of the voltage.



UNDERVOLTAGE PC CARD (3-PHASE)
6. Normal source voltage PC card.
8. LED.
9. Dropout voltage adjust dial.
10. Pull-in voltage adjust dial.

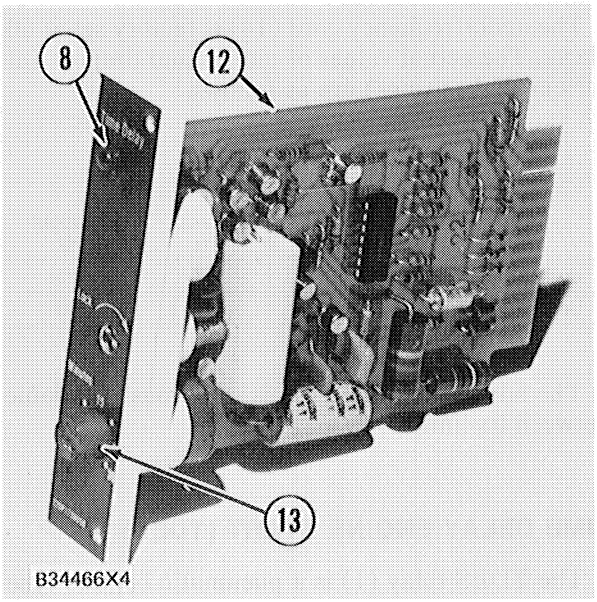


UNDERVOLTAGE PC CARD (1-PHASE)
7. Emergency source voltage PC card.
8. LED.
9. Dropout voltage adjust dial.
10. Pull-in voltage adjust dial.

1. Set dropout dial (9) maximum counterclockwise.
2. Set pull-in dial (10) maximum counterclockwise.
3. Increase line volts to desired dropout value (normally 70%). The LED (8) should be "ON".
4. Rotate dropout dial (9) clockwise until the LED (8) goes "OFF".
5. Rotate pull-in dial (10) maximum clockwise. The LED (8) is "OFF".
6. Increase line volts to desired pull-in value (normally 90%). The LED (8) should be "OFF".
7. Rotate the pull-in dial (10) counterclockwise until the LED (8) comes "ON".
8. Recheck pull-in and dropout values by running voltage up and down. Check the LED (8) for proper indication.
9. Tighten locking screw (4).

On startup, the LED (8) will light at the 90% pull-in voltage level. The LED (8) will then stay lit until voltage drops below the 70% dropout voltage level.

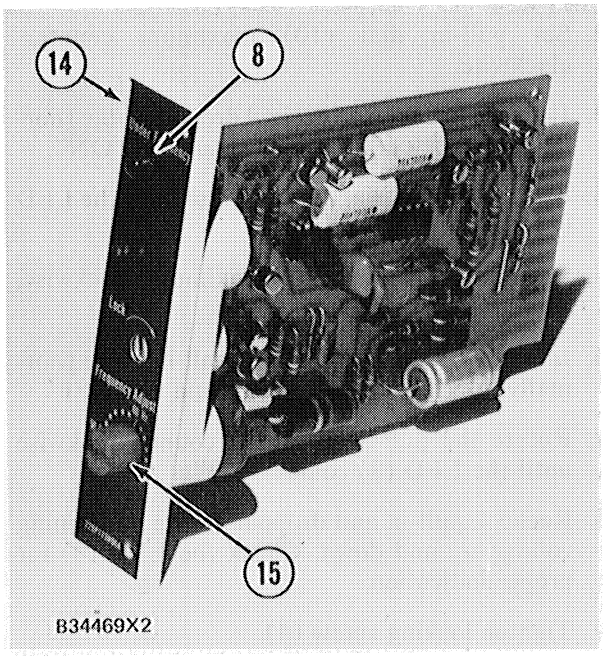
Time Delay Card



TIME DELAY PC CARD
8. LED.
12. Time delay card.
13. Delay time adjust dial.

The time delay card (12) is adjustable .2 to 30 minutes. It is adjusted by rotating the dial (13). It is factory set at 10 minutes. The light appears on the LED (8) after the preset time has passed.

Underfrequency Card



UNDERFREQUENCY PC CARD

8. LED.
14. Underfrequency card.
15. Frequency adjust dial.

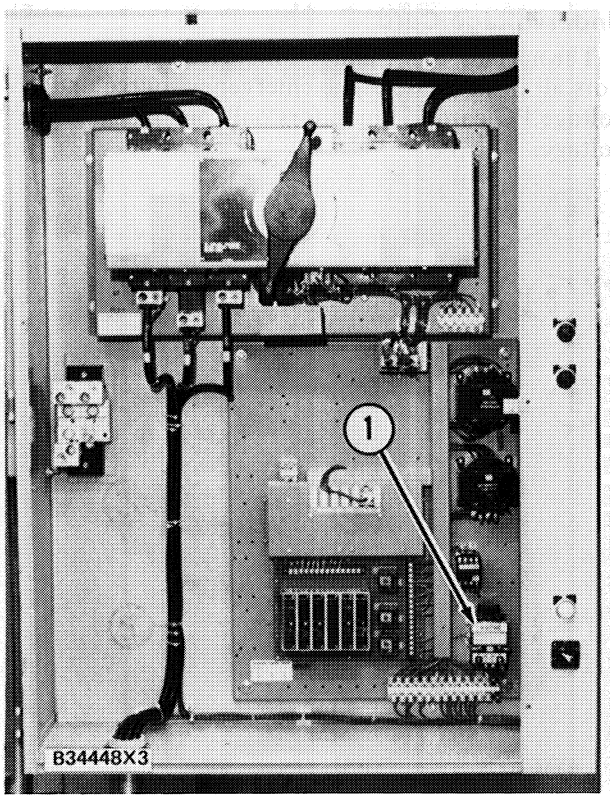
The underfrequency card (14) is factory set at 60 Hertz. The actual values of pickup and dropout (at various dial settings) are as follows:

Type	Dial Setting Hz	Pickup Hz	Dropout Hz
Underfrequency	60	57	55
Underfrequency	50	47	45

The adjustment dial (15) is continously variable between its limits.

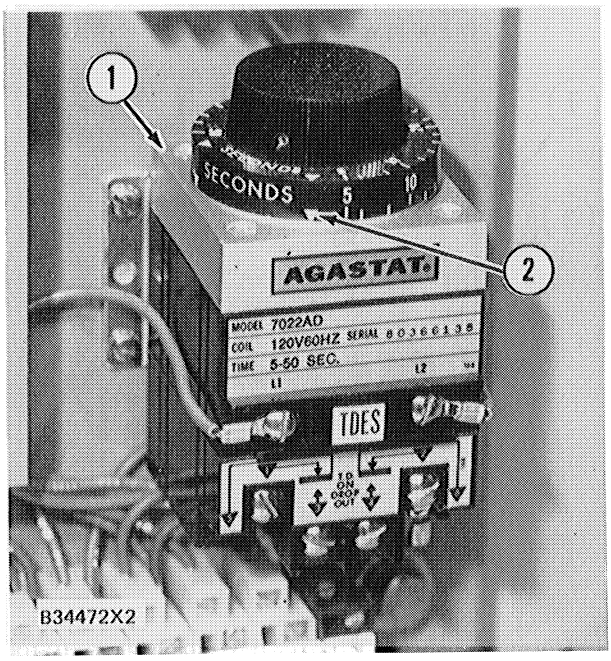
TIME DELAY ENGINE START (TDES)

The TDES relay (1) is a pneumatic bellows type relay. It is adjustable from 5 to 50 seconds.



TDES LOCATION

1. Time delay engine start (TDES).

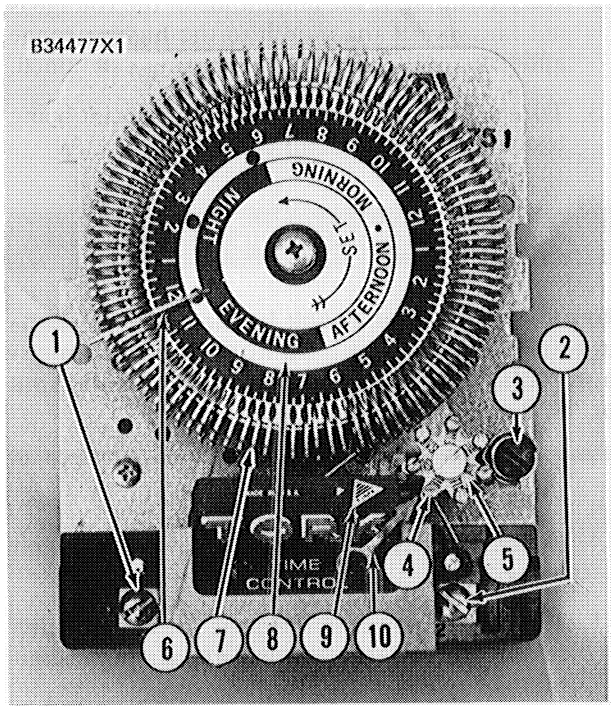


TDES

1. Time delay engine start (TDES)
2. Dial pointer.

Move the dial pointer (2) to the time desired and tighten locknut.

PLANT EXERCISER



PLANT EXERCISER

1. Terminal #1 (load #1).
2. Terminal #2 (load #2).
3. Terminal common.
4. Screw.
5. 7 day dial.
6. Tab (tilted inward).
7. Tab (tilted outward).
8. 24 hour dial.
9. Time indicator.
10. Day arrow.

1. Connect plant exerciser to ATS as follows:

   a. ATS terminals 64 and 65 to plant exerciser terminals #1 (1) and common (3) for power failure simulation.

   b. ATS terminals 57 and 58 to plant exerciser terminals #2 (2) and common (3) for engine-generator test only.

2. Tilt all tabs (7) on 24 hour dial (8) inward. For test times desired, tilt those tabs outward. Each tab controls about 15 minutes in time.

3. For correct time, turn 24 hour dial (8) counter-clockwise until the correct time of day is indicated by the arrow (9) on the nameplate. Be sure the A.M. or P.M. is correct. A seven spoked omitting dial (5) controls days on which tests are omitted.

4. To omit a testing day, insert brass screw (4) in the spoke of that day. The day omitting dial (5) moves ahead once each day at about 2:00 A.M.

CAUTION

Do not attempt to insert screw in spoke while it is pointing to the copper colored arrow (10). If necessary, turn seven spoke wheel (5), then insert screw (4).

To set the omitting wheel to the correct day, turn the omitting wheel (5) clockwise until present day of week is indicated by the copper arrow (10). Between midnight and 2:00 A.M., the setting must be made to day just ended at midnight.

CAUTION

When changing the line voltage selection plug, be sure to reconnect the plant exerciser to conform to new voltage.

Plant Exerciser Set-Up				
Test	Plant Excerciser Terminal Used	Timer Contact Normal Position	24 Hour Tab Position	To Omit Day of Test
Power failure simulation with generator brought on line	#1	Normally Closed (N.C.)	Tilt tab outward (7) for time of test (opens N.C. contact)	Screw brass screw down on day not desired.
Engine-generator start-up test without normal source interruption	#2	Normally Open (N.O.)	Tilt tab outward for time of test (closes N.O. contact)	

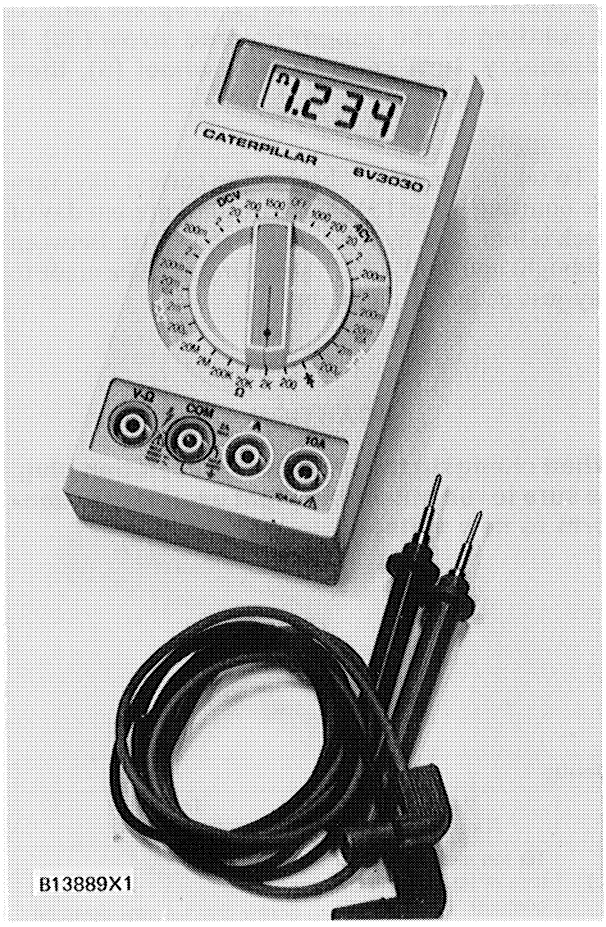
TROUBLESHOOTING

⚠ WARNING

When working inside the transfer switch, line voltage is present. Safety procedures must be followed.

TEST INSTRUMENT

The checks made on the transfer switch can be made with the 6V3030 Digital Multimeter.



6V3030 DIGITAL MULTIMETER

AC Voltage Checks

1. Connect the red test lead to the V - Input Connector and the black test lead to COM Input Connector.
2. Set the Function/Range Switch to the desired ACV position. If the magnitude of the voltage is not known, set the switch to the highest range and reduce until satisfactory reading is obtained.
3. Turn off the power to the device or circuit being tested and discharge all capacitors.

⚠ WARNING

To avoid electrical shock hazard and/or damage to the instrument, do not attempt to measure voltage that might exceed 1000 volts rms or 1500 volts peak ac.

4. Connect the test leads to the device or circuit being tested.
5. Turn on the power to the device or circuit being tested. The voltage value will appear on the digital display.
6. Turn off the power to the device or circuit, and discharge all capacitors before disconnecting the test leads.

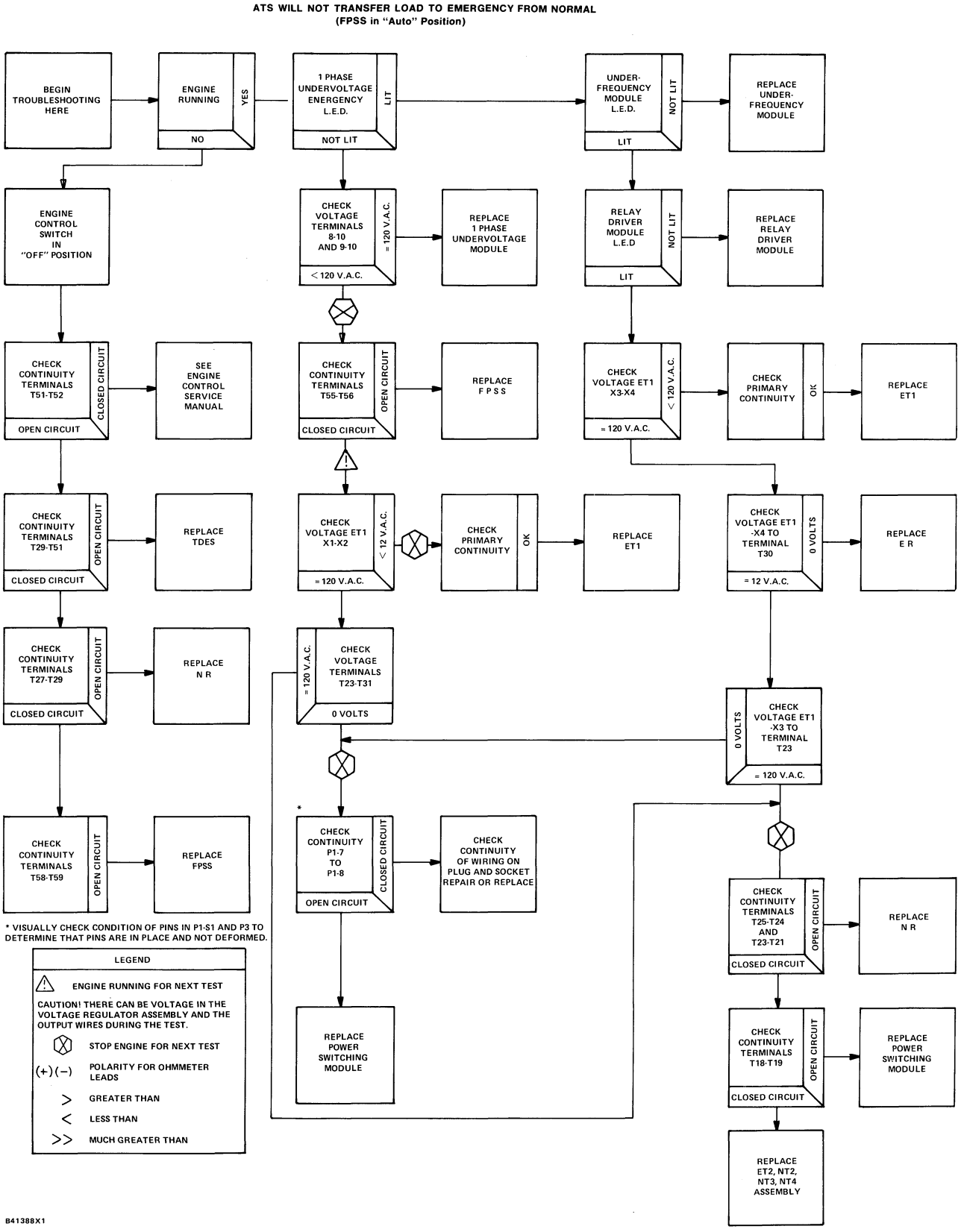
Continuity Checks

1. Place the Function/Range Switch in any range.
2. Connect the red test lead to the V - connector and the black test lead to the COM connector. With the test leads separated or measuring an out-of-range resistance, the digital display will indicate OL (overload).
3. Put one test lead probe at one end of the cable or circuit to be tested. Use the other test lead to trace the circuit or cable until the circuit is complete. When continuity is established, an ohm (Ω) symbol will appear in the upper left corner of the digital display. If contact in the cable or circuit is maintained long enough (about 1/4 of a second), the OL will disappear and the resistance value of the cable or circuit will appear next to the symbol.

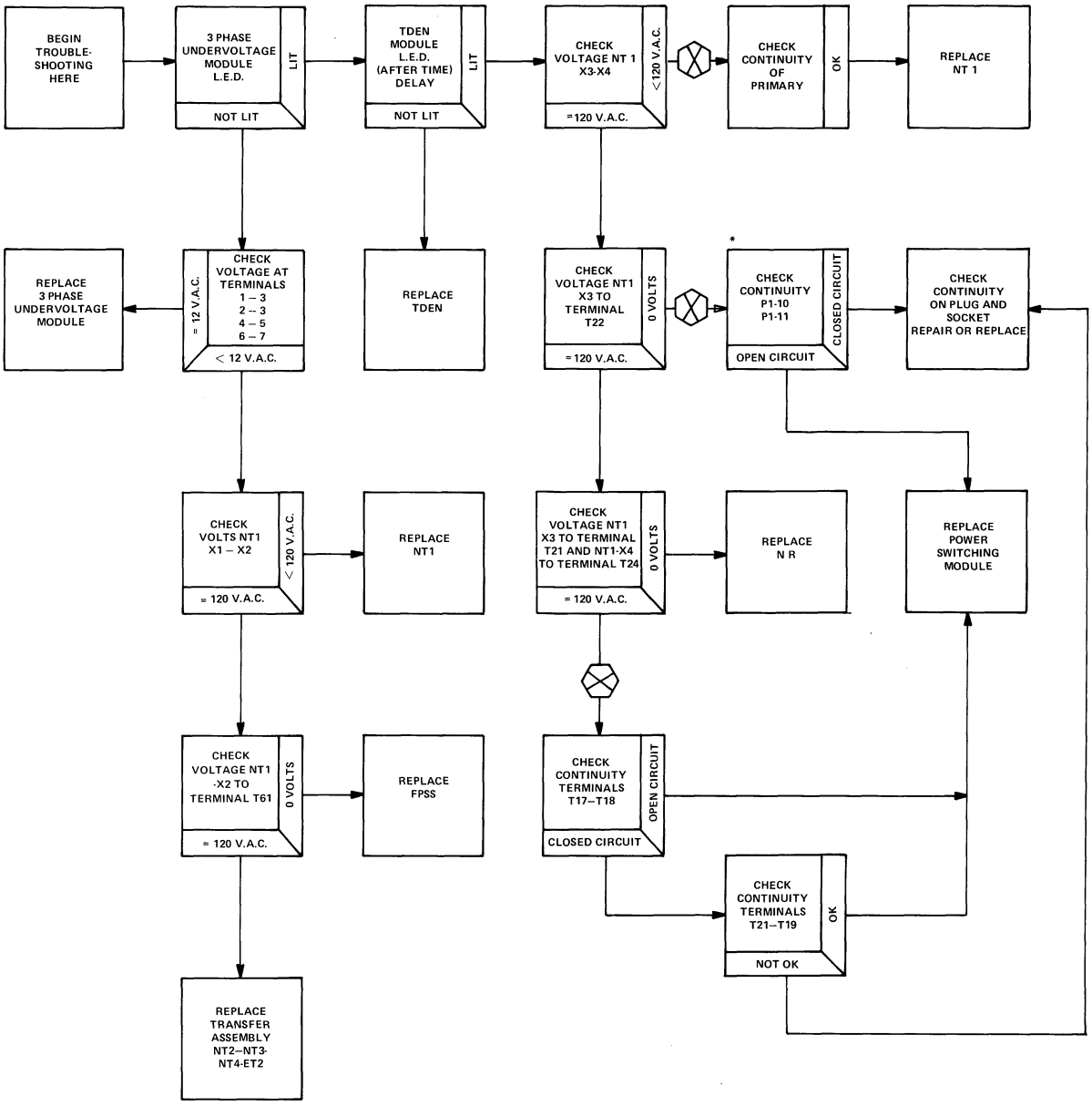
NOTE: The continuity indicator is triggered by any resistance less than double the maximum resistance measurable on the selected range. For example, on the 200 range, the symbol will appear when less than 400 is detected by the instrument.

For additional information on how to use the Digital Multimeter, see Special Instructions, Form SEHS7734.

Troubleshooting Charts


ATS WILL NOT TRANSFER LOAD TO EMERGENCY FROM NORMAL
(FPSS in "Auto" Position)
BEGIN TROUBLESHOOTING HERE
ENGINE RUNNING
YES
NO
1 PHASE UNDERVOLTAGE ENERGENCY L.E.D.
LIT
NOT LIT
UNDER-FREQUENCY MODULE L.E.D.
NOT LIT
LIT
REPLACE UNDER-FREQUENCY MODULE
ENGINE CONTROL SWITCH IN "OFF" POSITION
CHECK VOLTAGE TERMINALS 8-10 AND 9-10
= 120 V.A.C.
< 120 V.A.C.
REPLACE 1 PHASE UNDERVOLTAGE MODULE
RELAY DRIVER MODULE L.E.D
NOT LIT
LIT
REPLACE RELAY DRIVER MODULE
CHECK CONTINUITY TERMINALS T51-T52
CLOSED CIRCUIT
OPEN CIRCUIT
SEE ENGINE CONTROL SERVICE MANUAL
CHECK CONTINUITY TERMINALS T55-T56
OPEN CIRCUIT
CLOSED CIRCUIT
REPLACE F P S S
CHECK VOLTAGE ET1 X3-X4
< 120 V.A.C.
= 120 V.A.C.
CHECK PRIMARY CONTINUITY
OK
REPLACE ET1
CHECK CONTINUITY TERMINALS T29-T51
OPEN CIRCUIT
CLOSED CIRCUIT
REPLACE TDES
CHECK VOLTAGE ET1 X1-X2
< 12 V.A.C.
= 120 V.A.C.
CHECK PRIMARY CONTINUITY
OK
REPLACE ET1
CHECK VOLTAGE ET1 -X4 TO TERMINAL T30
0 VOLTS
= 12 V.A.C.
REPLACE E R
CHECK CONTINUITY TERMINALS T27-T29
OPEN CIRCUIT
CLOSED CIRCUIT
REPLACE N R
= 120 V.A.C.
CHECK VOLTAGE TERMINALS T23-T31
0 VOLTS
0 VOLTS
CHECK VOLTAGE ET1 -X3 TO TERMINAL T23
= 120 V.A.C.
CHECK CONTINUITY TERMINALS T58-T59
OPEN CIRCUIT
REPLACE FPSS
*
CHECK CONTINUITY P1-7 TO P1-8
CLOSED CIRCUIT
OPEN CIRCUIT
CHECK CONTINUITY OF WIRING ON PLUG AND SOCKET REPAIR OR REPLACE
CHECK CONTINUITY TERMINALS T25-T24 AND T23-T21
OPEN CIRCUIT
CLOSED CIRCUIT
REPLACE N R
CHECK CONTINUITY TERMINALS T18-T19
OPEN CIRCUIT
CLOSED CIRCUIT
REPLACE POWER SWITCHING MODULE
REPLACE POWER SWITCHING MODULE
REPLACE ET2, NT2, NT3, NT4 ASSEMBLY
* VISUALLY CHECK CONDITION OF PINS IN P1-S1 AND P3 TO DETERMINE THAT PINS ARE IN PLACE AND NOT DEFORMED.
LEGEND
ENGINE RUNNING FOR NEXT TEST
CAUTION! THERE CAN BE VOLTAGE IN THE VOLTAGE REGULATOR ASSEMBLY AND THE OUTPUT WIRES DURING THE TEST.
STOP ENGINE FOR NEXT TEST
(+)(−) POLARITY FOR OHMMETER LEADS
> GREATER THAN
< LESS THAN
>> MUCH GREATER THAN
B41388X1

ATS WILL NOT TRANSFER LOAD WHEN NORMAL RETURNS
(FPSS in "Auto" Position)

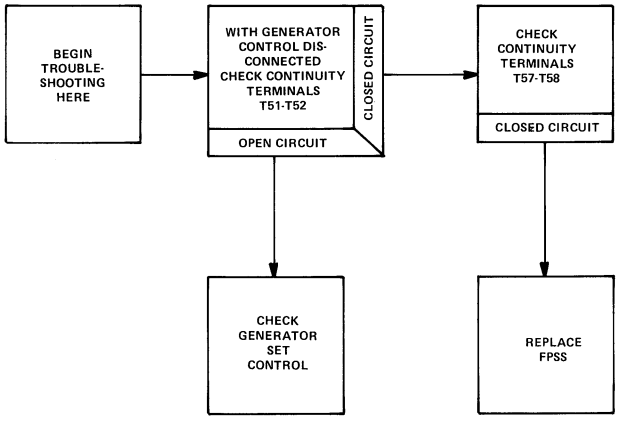


* VISUALLY CHECK CONDITION OF P1–S1 AND P3 TO SEE THAT PINS ARE NOT DEFORMED AND IN PLACE.

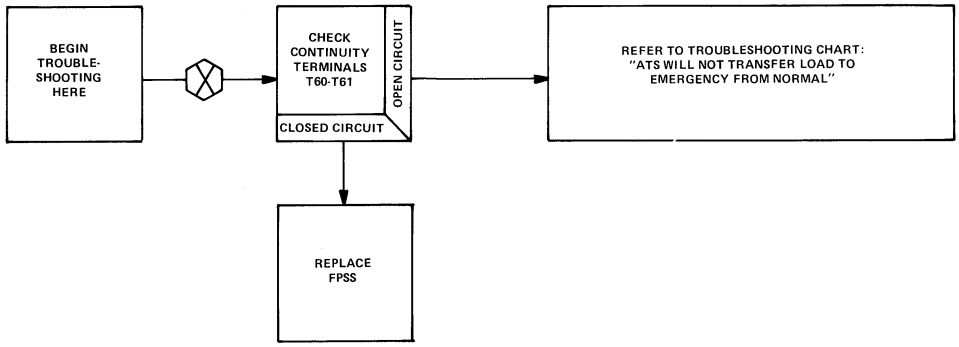
LEGEND	
⚠	ENGINE RUNNING FOR NEXT TEST
CAUTION! THERE CAN BE VOLTAGE IN THE VOLTAGE REGULATOR ASSEMBLY AND THE OUTPUT WIRES DURING THE TEST.	
⊗	STOP ENGINE FOR NEXT TEST
(+)(−)	POLARITY FOR OHMMETER LEADS
>	GREATER THAN
<	LESS THAN
>>	MUCH GREATER THAN

B41387X1

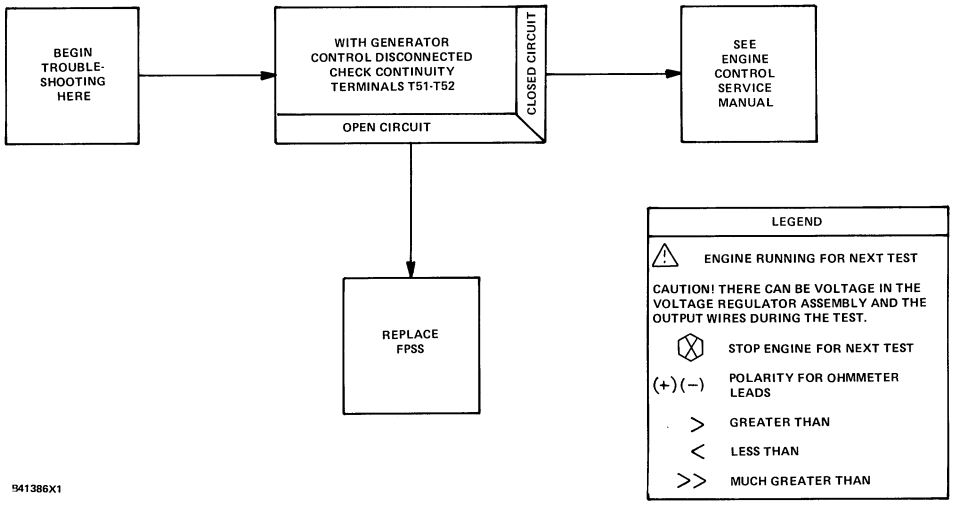
ATS RETRANSFERS LOAD BUT GENERATOR SET CONTINUES TO RUN
(FPSS in "Auto" Position)



ATS WILL NOT TRANSFER TO EMERGENCY
(FPSS in "Test" Position)



ENGINE DOES NOT START
(FPSS in "Engine Start" Position)



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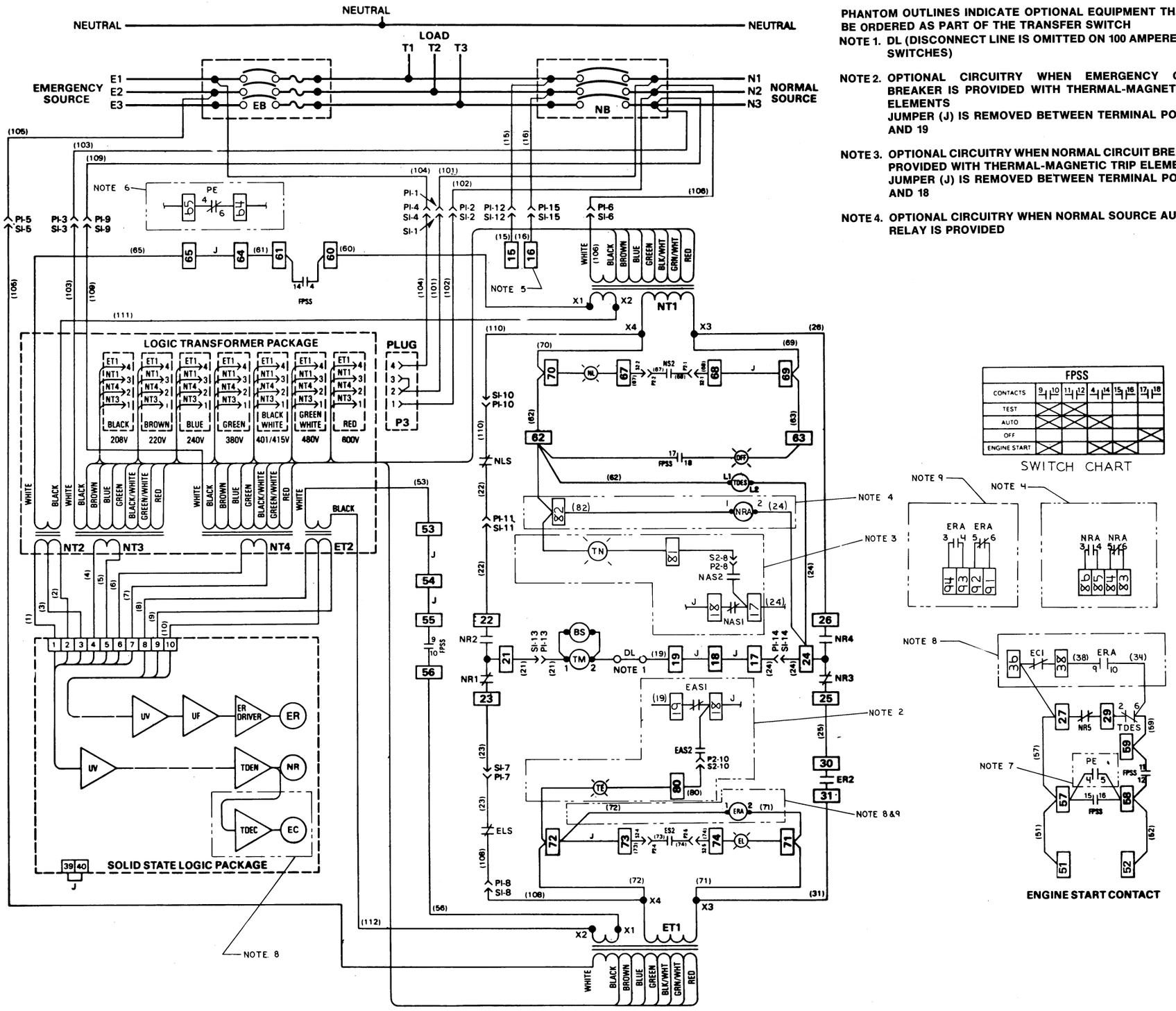

PHANTOM OUTLINES INDICATE OPTIONAL EQUIPMENT THAT MAY BE ORDERED AS PART OF THE TRANSFER SWITCH

NOTE 1. DL (DISCONNECT LINE IS OMITTED ON 100 AMPERE RATED SWITCHES)

NOTE 2. OPTIONAL CIRCUITRY WHEN EMERGENCY CIRCUIT BREAKER IS PROVIDED WITH THERMAL-MAGNETIC TRIP ELEMENTS
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 18 AND 19

NOTE 3. OPTIONAL CIRCUITRY WHEN NORMAL CIRCUIT BREAKER IS PROVIDED WITH THERMAL-MAGNETIC TRIP ELEMENTS
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 17 AND 18

NOTE 4. OPTIONAL CIRCUITRY WHEN NORMAL SOURCE AUXILIARY RELAY IS PROVIDED

NOTE 5. POWER SUPPLY SOURCE FOR PLANT EXERCISER (PE)

NOTE 6. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET AND TRANSFER SWITCH)
JUMPER (J) IS REMOVED BETWEEN TERMINAL POINTS 64 AND 65

NOTE 7. PART OF CIRCUITRY FOR PLANT EXERCISER OPTION (EXERCISES GENERATOR SET ONLY)

NOTE 8. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN ENGINE COOL-OFF TIMER OPTION IS PROVIDED

NOTE 9. COMPONENTS AND CIRCUITRY THAT IS PROVIDED WHEN AUXILIARY RELAY EMERGENCY SOURCE SIDE OPTION IS PROVIDED.

ABBREVIATIONS

SYMBOL	DESCRIPTION
BS	BRAKE SOLENOID
DL	DISCONNECT LINK
E	EMERGENCY
EAS1	EMERGENCY CIRCUIT BREAKER LOCKOUT
EAS2	EMERGENCY BELL ALARM CONTACT
E3	EMERGENCY CIRCUIT BREAKER
EC	ENGINE COOL OFF RELAY
EL	SWITCH POSITION EMERGENCY SOURCE PILOT LIGHT
ELS	EMERGENCY LIMIT SWITCH
ER	EMERGENCY RELAY
ERA	EMERGENCY RELAY AUXILIARY
ESC	ENGINE START CONTACT
ES	EMERGENCY SOURCE BREAKER AUXILIARY CONTACT
ET	EMERGENCY TRANSFORMER
FPSS	FOUR-POSITION SELECTOR SWITCH
J	JUMPER WIRE (UNNUMBERED)
N	NORMAL
NAS1	NORMAL CIRCUIT BREAKER LOCKOUT
NAS2	NORMAL BELL ALARM CONTACT
NB	NORMAL BREAKER
NEUT	NEUTRAL
NL	NORMAL SOURCE PILOT LIGHT SWITCH POSITION
NLS	NORMAL LIMIT SWITCH
NR	NORMAL RELAY
NRA	NORMAL RELAY AUXILIARY
NT	NORMAL TRANSFORMER
NS	NORMAL SOURCE BREAKER AUXILIARY CONTACT
OFF	OFF POSITION WHITE PILOT LIGHT
P	PLUG
P1, P2	INTELLIGENCE PANEL DISCONNECT
PE	PLANT EXERCISER
RD	RELAY DRIVER
S	SOCKET
T	LOAD
TDEC	TIME DELAY ENGINE COOL OFF
TDEN	TIME DELAY EMERGENCY TO NORMAL
TDES	TIME DELAY ENGINE START
TE	TRIPPED CONDITION EMERGENCY SOURCE PILOT LIGHT
TM	TRANSFER MOTOR
TN	TRIPPED CONDITION NORMAL SOURCE PILOT LIGHT
UF	UNDERFREQUENCY
UV	UNDERVOLTAGE
▭	TERMINAL

PIN AND SOCKET IDENTIFICATION
P1-13 (PLUG 1 - PIN 13)
S1-13 (SOCKET 1 - HOLE 13)

TROUBLESHOOTING REFERENCE SCHEMATIC TRANSFER SWITCH DE-ENERGIZED

B34490X1

CATERPILLAR®

SENR2164

Printed in U.S.A. (6/81)