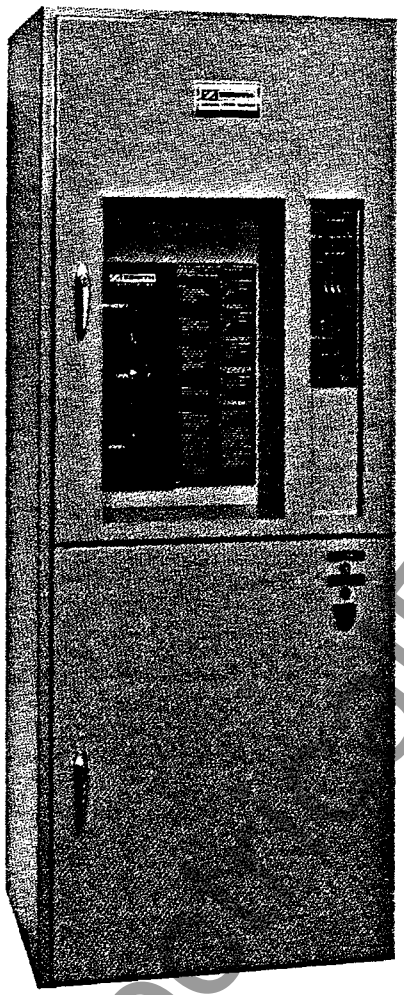
46R-1000E

Revised October, 1996

INSTRUCTION MANUAL

ZBTSH SERIES BYPASS/ISOLATION TRANSFER SWITCH
100 — 400 AMPS



MODEL NO. _____

SERIAL NO. _____

ZENITH CONTROLS, INC.

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STORAGE:

The ZBTSH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION:

1. **Lifting:**

   To lift and manuever the Bypass Switch use lifting angles. See Fig. 1 (below). CAUTION: Depending upon the model, a ZBTSH weighs between 650 — 700 lbs. Use adequate machinery and cables to handle the load.

2. **Equipment Preparation:**

   a). Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b). Lock open breakers to normal and emergency lines.

3. **Cabinet Preparation:**

   a). A small amount of cabinet work is required before the cables are connected. **Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical components.** Visually verify that metal filings are removed from top bus support. (Use vacuum if necessary).

   b). Standard cable entry is through the top or bottom of the cabinet. Fig. 2 below shows one suggested knockout order. For a guide to assist in the hole layout, refer to page 15.

4. **Cable and Wire Connections:**

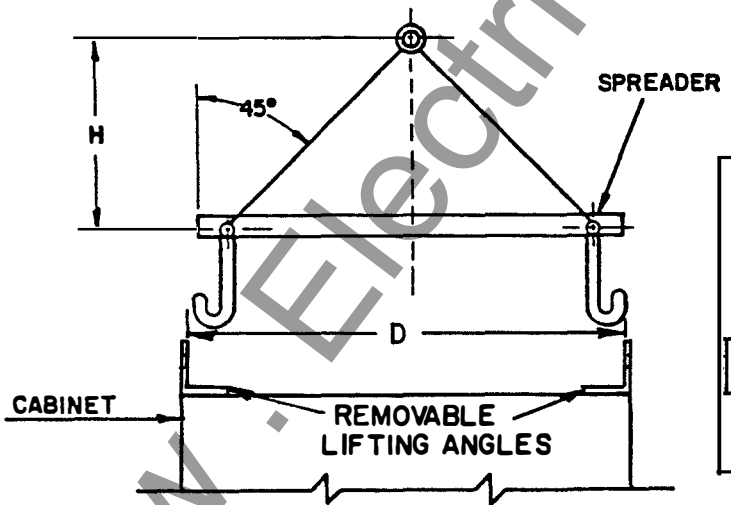
   a). To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b). Connect all auxiliary wires for external electrical operation. Example: E-start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to isolate position (approx. 1 ft.).

5. **Prior to the Unit's Energization:**

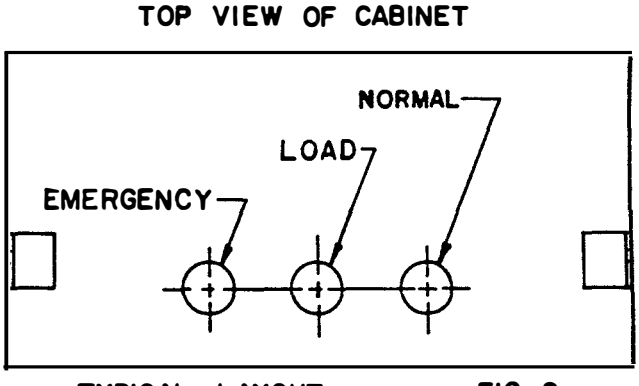
   a). Remove any debris incurred due to installation (cut cable strands, metal filings, etc.).

   b). Inspect the unit and verify torque of cable and wire connections.

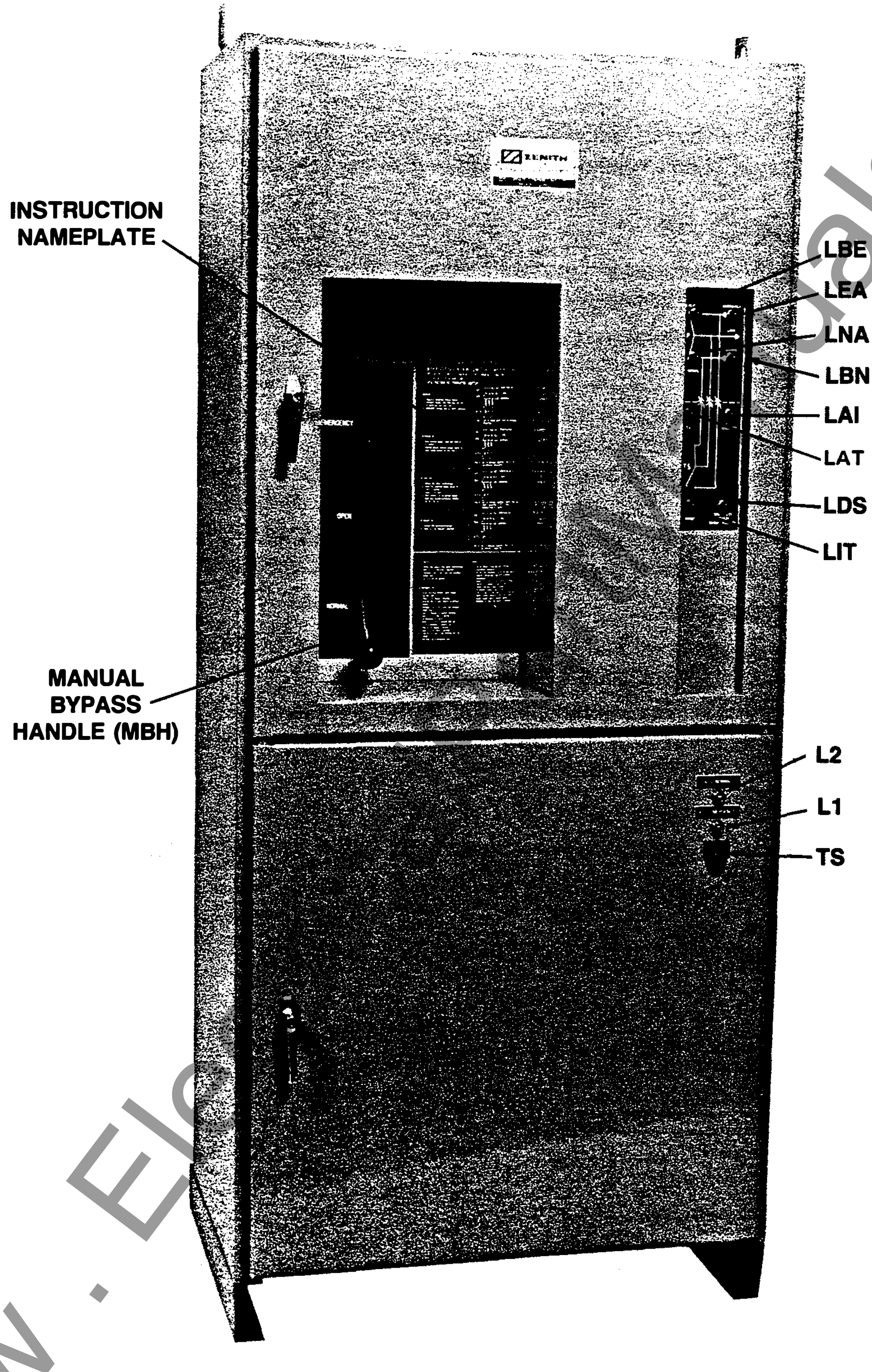


Note: When lifting the switch, a spreader must be used. The height H must be equal to D/2.

FIG. 1

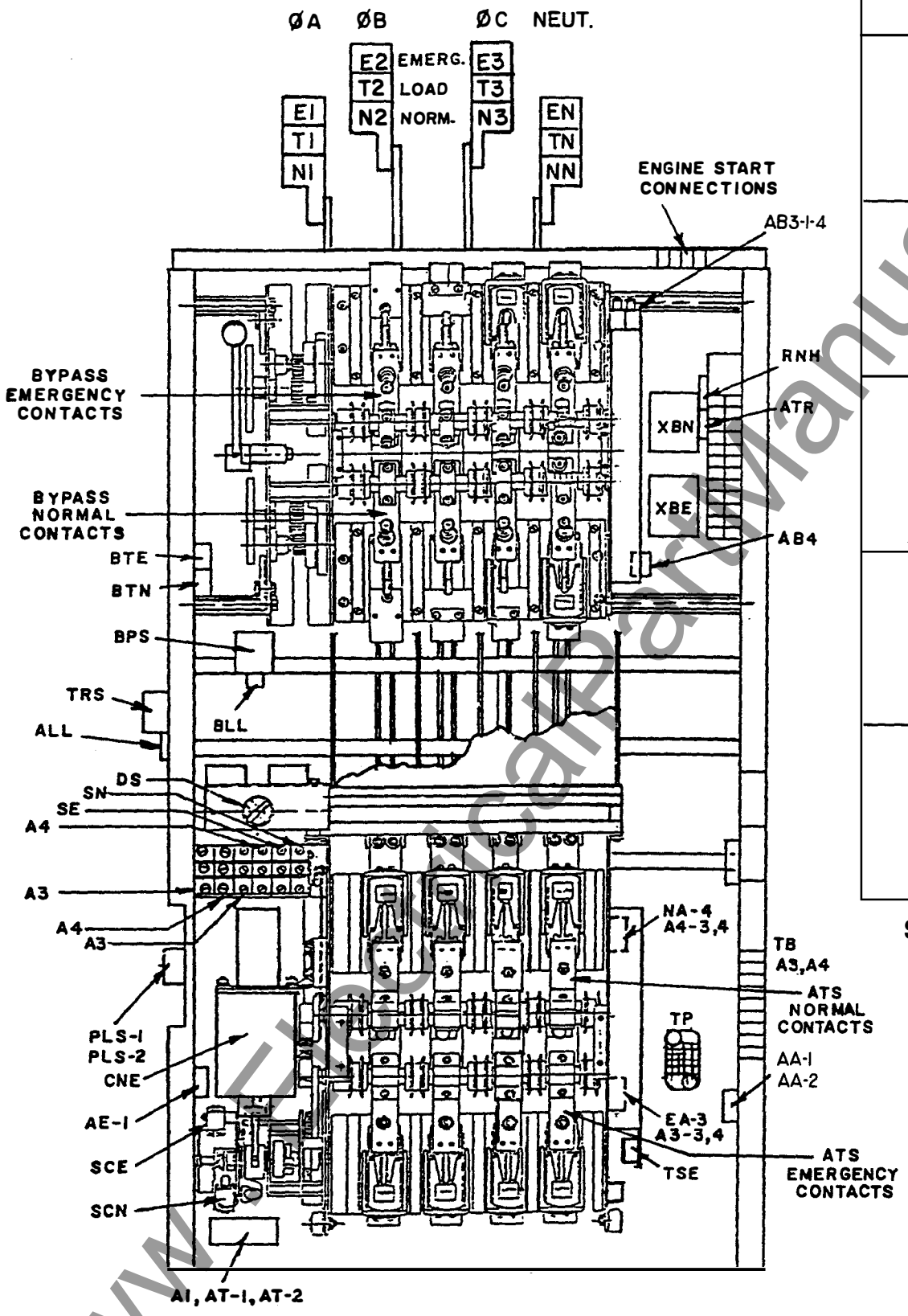


TYPICAL LAYOUT FIG. 2

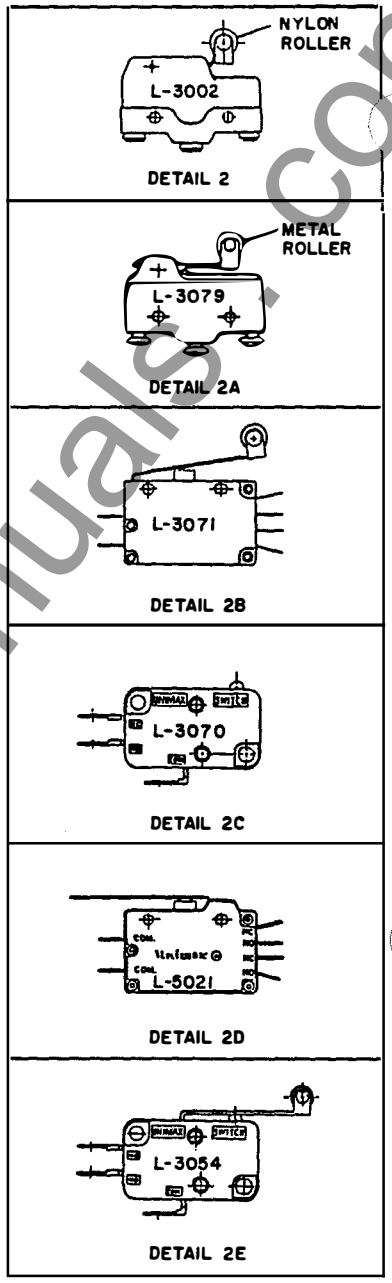


A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NO.
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Off" Indicator (R) Flashing Bulb, PS-1272	
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Bulbs (Incandescent)	PS-5105
	Bulb Socket (Incandescent)	PS-5046
	Emergency Lens (Red)	PS-5047
	Normal Lens (Green)	PS-5048
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Contact Mounting Base	PS-3473



ZBTSH 4 POLE



SWITCH DETAILS

B. BP-BYPASS AND ATS AUTOMATIC TRANSFER SWITCH POWER PANEL

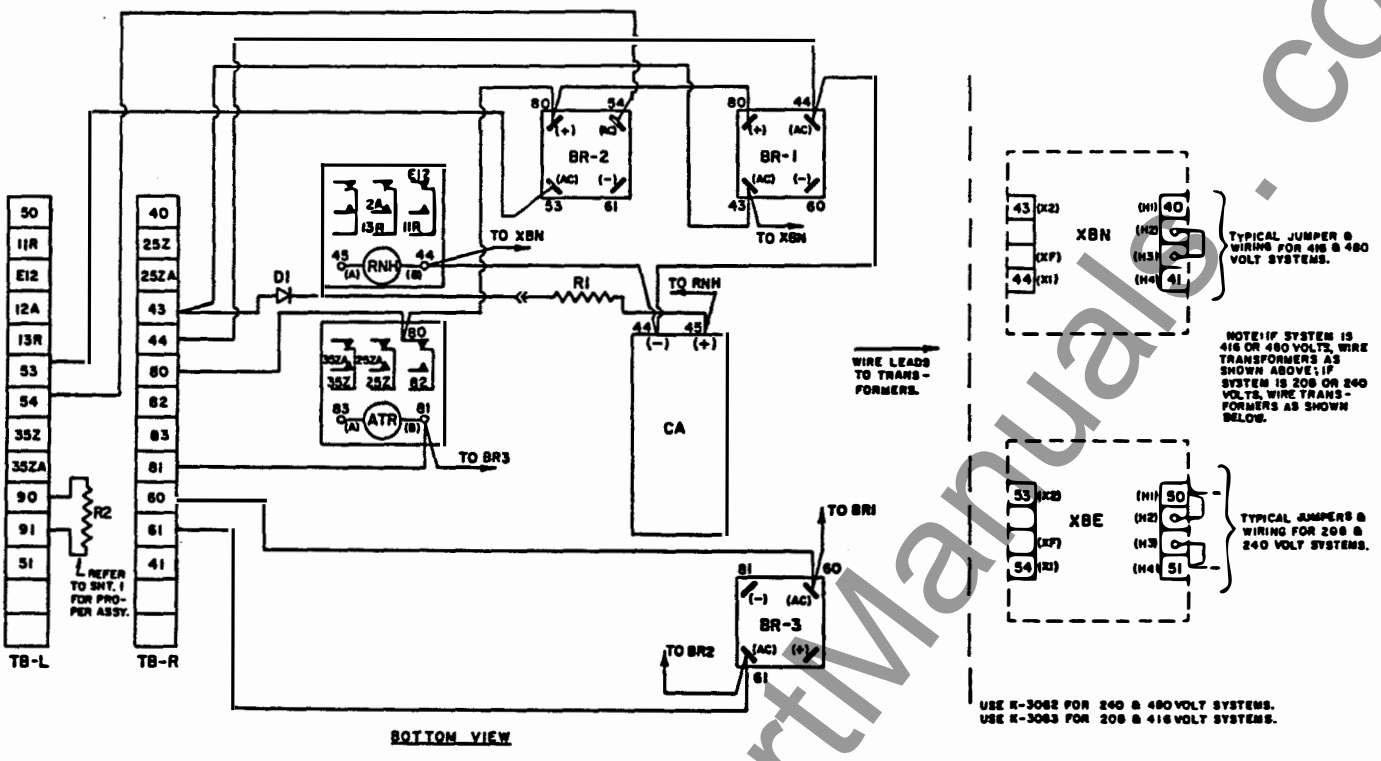
TAG	DESCRIPTION	PART NUMBER BY AMPERAGE				
Bypass		100	150	225	260	400
N1, 2, 3, N E1, 2, 3, N T1, 2, 3, N	Normal Emergency Load } LUGS	PS-4418	PS-4418	PS-4418	S-1422	S-1422
BYPASS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
N1, 2, 3	Normal	46P-1104A	46P-1104B	46P-1104C	46P-1104D	46P-1104E
N	(Sw. Neut. Norm.)	46P-1105A	46P-1105B	46P-1105C	46P-1105D	46P-1105E
E1, 2, 3	Emergency	46P-1106A	46P-1106B	46P-1106C	46P-1106D	46P-1106E
N	(Sw. Neut. Emerg.)	46P-1107A	46P-1107B	46P-1107C	46P-1107D	46P-1107E
ATS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
NL1, 2, 3	Normal	46P-1100A	46P-1100B	46P-1100C	46P-1100D	46P-1100E
N	(Sw. Neut. Norm)	46P-1101A	46P-1101B	46P-1101C	46P-1101D	46P-1101E
EL1, 2, 3	Emergency	46P-1102A	46P-1102B	46P-1102C	46P-1102D	46P-1102E
N	(Sw. Neut. Emerg.)	46P-1103A	46P-1103B	46P-1103C	46P-1103D	46P-1103E
Arc Grid Assy.		46P-1099				

XBN, XBE	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NO.
		120/240	K-3061
		208/416	K-3063
		220/440	K-3064
		240/480	K-3062
		380	K-3067
		575	K-3065
		600	K-3066

CNE	Main ATS Operating Coils Voltage Systems						
	No.	Volts	Ph	Wire	Coil Volts	Poles	PART NO.
	-1	120	1	2	120	2	K-2178
	-2	120/240	1	3	240	2,3	K-2189
	-3	240	3	3	240	3	K-2189
	-38	120/240	3	4	240	3,4	K-2189
	-4	120/208	3	4	208	3,4	K-2177
	-5	480	3	3	480	3	K-2176
	-6	575/600	3	3	575/600	3	K-2196
	-7	277/480	3	4	480	3,4	K-2176
	-9	240/416	3	4	416	3,4	K-2188
	-91	220/380	3	4	380	3,4	K-2188

SN	CN1 Limit Switch	L-3002 (Detail 2)
SE	CE1 Limit Switch	
A3	ATS Emergency Position Switch	
A4	ATS Normal Position Switch	
SCN/SCE	CNE Limit Switches	L-3079 (Detail 2a)
AA AE1, 2 PLS1, 2	ATS Auto Location Switch ATS Isolate/Remove Location Switch Position Lever Switch	L-3071 (Detail 2b)
AI AT1, 2	ATS Isolate Location Switch ATS Test Location Switch	L-3070 (Detail 2c)
AB3/ABE AB4/ABN NA4 EA3	Bypass Emergency Position Switch Bypass Normal Position Switch Normal TRS Limit Switch Emergency TRS Limit Switch	L-5021 (Detail 2d)
BTE BTN TSE BLL ALL	Bypass Emergency Position Switch Bypass Normal Positiion Switch ATS Engaged Switch Bypass Lock Location Switch ATS Lock Location Switch	L-3054 (Detail 2e)
DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C. (1) Contact Block N.O. (2) Contact Block Mounting Plate	L-4018 L-1029 L-1028 PS-3473
BPS TRS	Bypass Interlock Solenoid Transfer Release Solenoid	K-2180 K-2180

C. BYPASS CONTROL PANEL



D. ATS CONTROL PANEL (SSRCP)

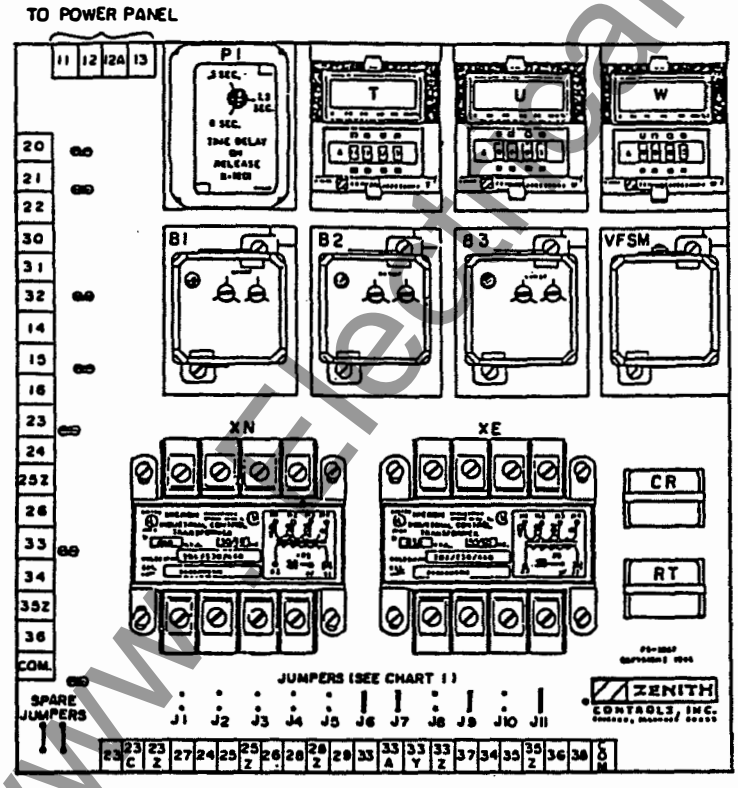


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR1, 2, 3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	Y260000
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxilary Test Relay	Y260000

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers (See Note 1)	120V	K-3076
		208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays Solid State (See Note 1)	120V	K-1185
		208 or 240V	K-1186
		480V	K-1188
VFSM	Voltage Frequency Sensor	120V	K-1192R
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
CN1/CE1	CNE Transfer Relays (not shown)	120V	K-1120
J1-J11	Jumpers		PS-5067

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
PI	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575;600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/ISOLATION SWITCH OPERATION

BP — Bypass Switch, Indicated by Contacts BN/BE, is a 3 Position Switch
ATS — Automatic Transfer Switch

1. Automatic

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the load. (Fig. 1).
2. Disconnect Switch (DS) is in "Auto" position.

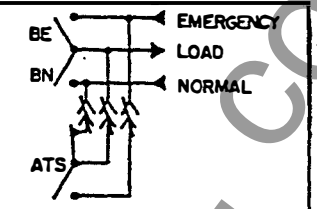


FIG. 1 BP IS OPEN WITH ATS IN NORMAL POSITION.

2. To Bypass ATS

1. Open bottom cabinet door and turn DS to "Inhibit".
2. Position Manual Bypass Handle (MBH) to same power source as ATS (Fig. 2).

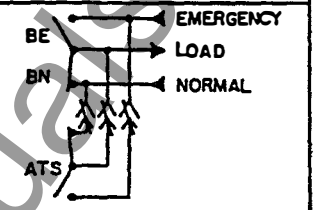


FIG.2 BP IS BYPASS NORMAL WITH ATS IN NORMAL POSITION.

3. To Test ATS

1. Bypass per above instructions.
2. Move ATS Location Handle (ALH) to "Test" location.
3. Turn DS to "Auto".
4. Test Switch (TS) on bottom cabinet door will allow electrical testing of ATS. (Fig. 3).

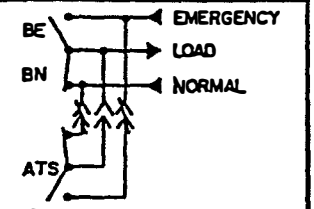


FIG.3 BP IS BYPASS NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTION IS OPEN)

4. To Isolate ATS

1. Bypass per above instructions.
2. Move ALH to "Isolate" location.

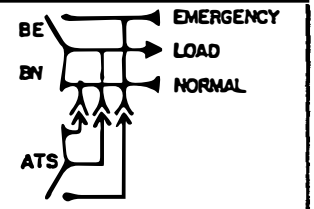


FIG.4 BP IS BYPASS NORMAL WITH ATS IN ISOLATE LOCATION.

5. To Remove ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "Release" location.
3. Disconnect multi-pin plugs and external connections.
4. Lift ATS out of drawer.

6. To Reconnect ATS

1. Place ATS into drawer slots, (front rollers first).
2. Turn DS to "Inhibit" position.
3. Position ATS to same source as Bypass Switch.
4. Reconnect Multi-pin plugs and external connections.
5. Push ATS inward to engage carriage.
6. Move ALH to "Test" location (as indicated by light).
7. Turn DS to "Auto" position and use TS to electrically operate ATS.
8. Turn DS to "Inhibit" position.
9. Move ALH to "Auto" location.
10. Turn DS to "Auto" and position MBH to "Open".
11. ATS now fully automatic (Fig. 1).

7. Notes

1. DS in "Inhibit" position will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles (interlocks prevent incorrect sequencing).
3. When ATS is in Test or Isolate, Bypass Switch is a manual transfer switch to either **available** power source.
4. To operate Bypass Switch when ATS is in Test or Isolate, position MBH to available power source (indicated on light panel).
5. Above figures depict Bypass Normal; sequence is same for Bypass Emergency.

DEFINITIONS:

BP — Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer Switch in the event of a power failure while the ATS is in the TEST, ISOLATE, or RELEASE positions.

ATS — Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS — Disconnect Switch

Inhibits operation of ATS Main Coil (CNE). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coil (CNE) cannot be energized, and automatic transfer in either direction cannot take place.

MBH — Manual Bypass Handle

Actuates the Bypass Operator.
Center for Bypass Open.
Down for Normal Bypass.
Up for Emergency Bypass.

TS — Test Switch

Simulates Normal line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a). Harness plugs are not connected.
   b). DS is in the 'INHIBIT' position.
   c). ATS is not in 'AUTO' or 'TEST' location.
   d). ATS is in 'AUTO' location and BYPASS SWITCH is not open.

2. The MBH will not operate if:
   a). ALH is not engaged in one of the following: AUTO — TEST — ISOLATE.
   b). If source selected is opposite of the ATS position while in the AUTO location.
   c). ATS is in 'TEST' or 'ISOLATE' location and source selected is not available.

3. The ALH (ATS Location Handle) will not operate if:
   a). BP and ATS are not positioned to same source.
   b). Power is not available.
   c). Harness Plugs are not connected.
   d). ATS has reached limit of travel to 'AUTO' or 'ISOLATE'.

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T — Restoration to Normal . . . . . 30 minutes (Factory set)
U — Engine Cooldown/Stop . . . . . 5 minutes (Factory set)
W — Engine Warmup . . . . . 1 second (Factory set)
P1 — Engine Start . . . . . 3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1). "AUTO LOCATION":

Full Transfer Test — This test checks the complete operation of the ATS by transferring and interrupting the load's power source from 'Normal' to 'Emergency'.

Depress TS (Test Switch) until Generator starts and the 'W' timer times out (timer will indicate ON). ATS will transfer to Emergency.

Release TS (this resets TS to AUTO). Normal restoration timer 'T' will time out (will indicate ON) which will energize the CR relay causing ATS to retransfer back to Normal.

Engine/Generator will shut down after timer U times out. Full Transfer Test is now complete.

2). "TEST LOCATION":

This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH. Refer to Page 8 (Step 3).

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH

Operation:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) will drop out disconnecting the CR relay.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CE1 relay thru the SE cutout switch causing the main transfer coil CNE to operate thru the SCE limit switch. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CNE transfer coil. The transfer switch is now locked mechanically only. Limit switches SN and SCN operate to complete the circuit for the next closing operation to normal.

When the normal line voltage restores to the preset value, the phase relay(s), (B1, 2, 3) operate to energize the normal restoration timer T. After the set time delay, the timer contact closes to energize CR relay. The CN1 relay is now energized thru the SN cutout switch causing the main transfer coil CNE to operate thru the SCN limit switch. The load is now re-transferred back to the normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CNE transfer coil. The transfer is now locked mechanically only. Limit switches SE and SCE operate for the next emergency operation.

MAINTENANCE

Electrical Test:

The ATS may be electrically tested for preventive maintenance (refer to page 10 "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode. If the ATS malfunctions, troubleshoot the switch, referring to page 12, and replace any faulty part(s) immediately.

Inspection:

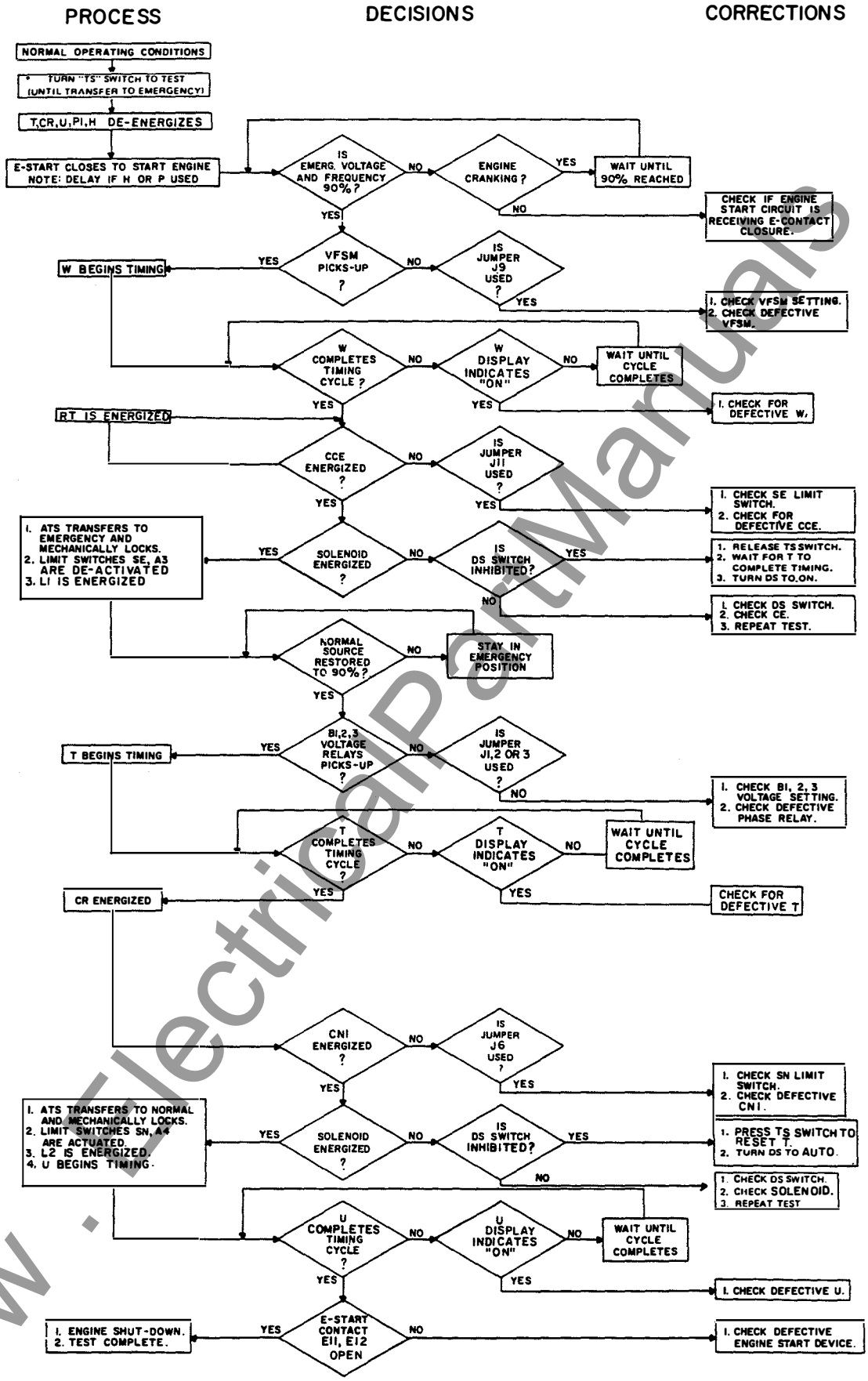
CONTACTS — The movable and stationary contacts are a vital part of the ZBTSH and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

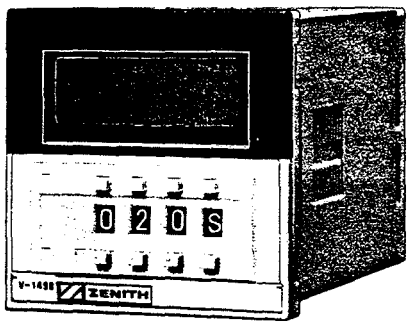
Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), return the ZBTSH to Auto Mode.

CURRENT CARRYING PARTS — An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. **WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF!** If the discoloration persists, contact the factory.

TABLE 3 "TROUBLE SHOOTING"





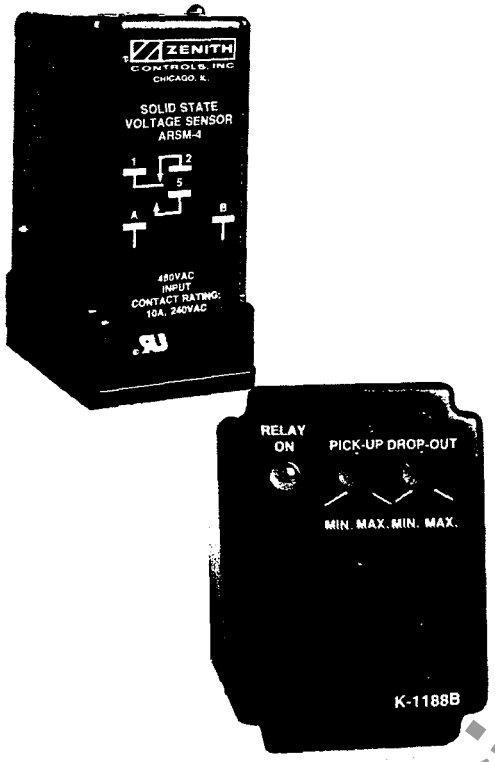
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is $\frac{1}{10}$ of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams of the ZBTSH are lubricated with Super Lube PTFE grease, and gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below.
Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

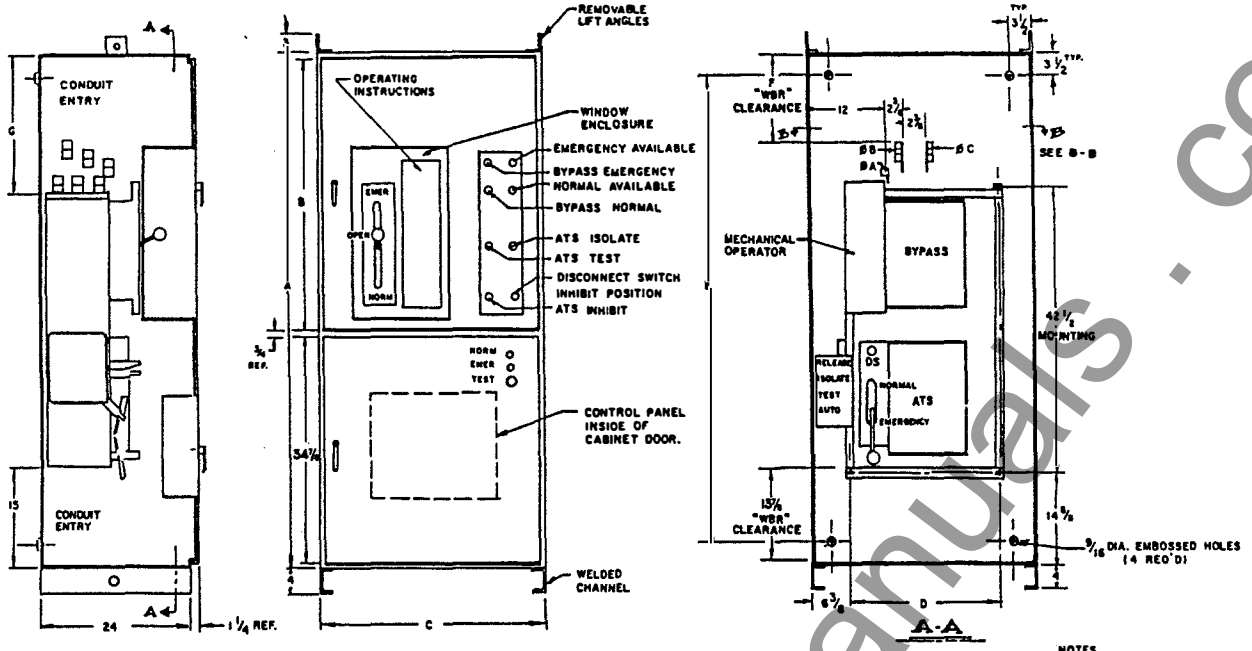
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

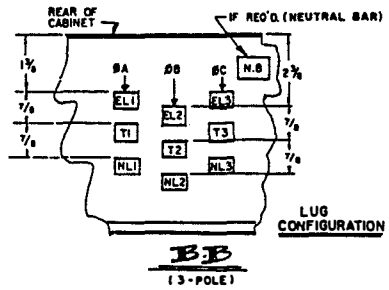
WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55

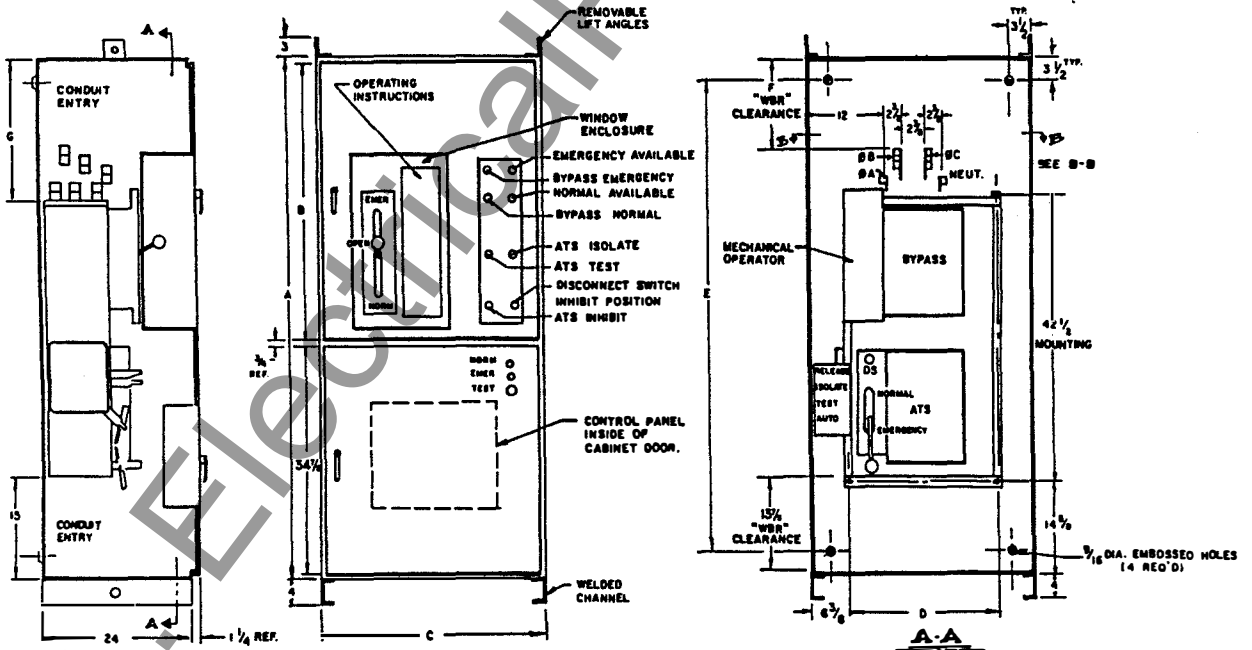


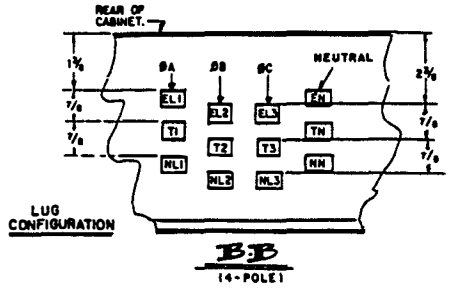


NOTES
1) TYPE 1 ENCLOSURE
2) ALL DIM ± 1/8
3) "WBR" WIRE BENDING RADIUS.

3 POLE

ZBTBH	CABINET NO.	A	B	C	D	E	F	G
10-22 (3P)	F-1310	79	42⅝	30	23½	72	15¼	2⅝
26-40 (3P)	F-1310	79	42⅝	30	23½	72	15¼	2⅝



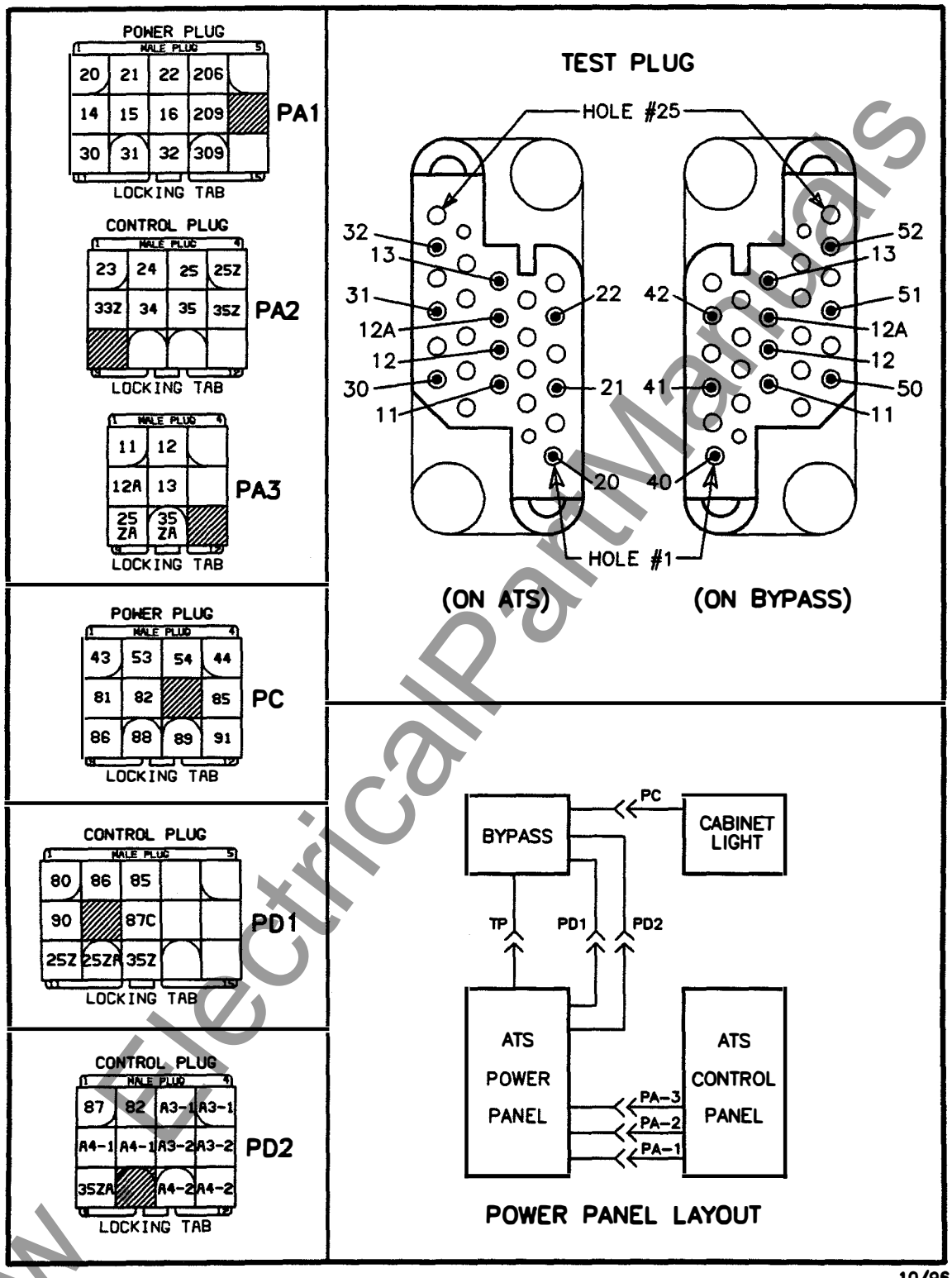


NOTES
1) TYPE 1 ENCLOSURE
2) ALL DIM ± 1/8
3) "WBR" WIRE BENDING RADIUS.

4 POLE

ZBTBH	CABINET NO.	A	B	C	D	E	F	G
10-22 (4P)	F-1311	79	42⅝	36	23½	72	15¼	2⅝
26-40 (4P)	F-1311	79	42⅝	36	23½	72	15¼	2⅝

DISCONNECT PLUGS
ZBTSH 100-400 AMPS



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FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

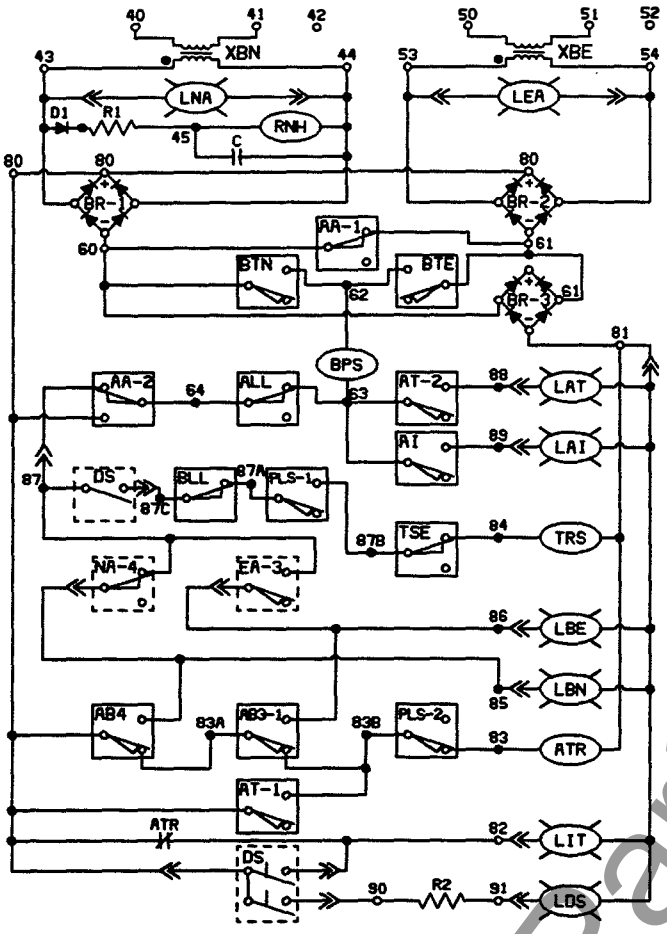
DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	PROBLEMS	NOTES

BYPASS CONTROL SCHEMATIC



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

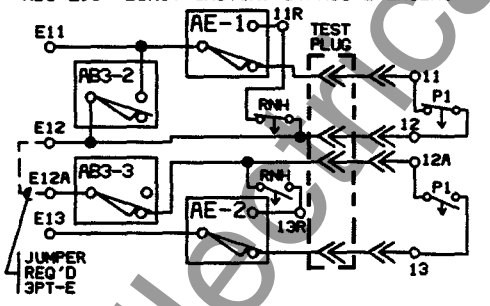
AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE

ENGINE START CIRCUIT

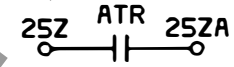
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



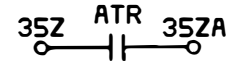
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA-1,2	X								
AT-1,2		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE-1,2			X	X					
NA-4					X				
EA-3						X			
AB4							X		
AB3-1,2,3								X	
BLL							X	X	X
PLS-1,2	ACTIVATED WHEN ALH IS OPERATED								

PERMIT CIRCUITS

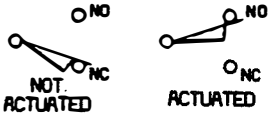


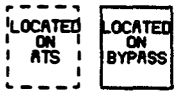
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

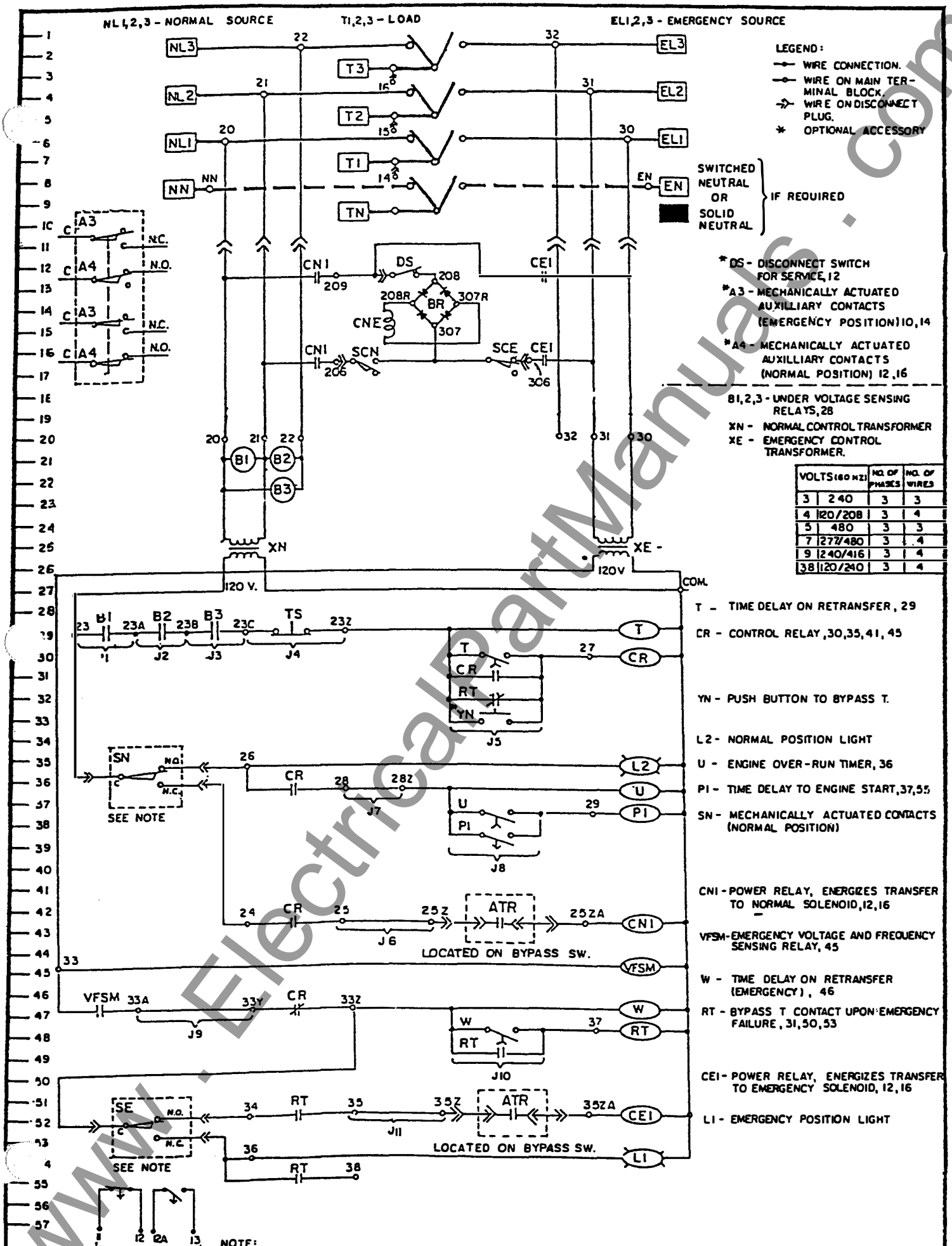


EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

LIMIT SWITCHES







	VOLTS (60 HZ)	NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	4

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