



46R-5003A

Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

**BYPASS/
ISOLATION
DELAYED
TRANSITION
TRANSFER SWITCH**

**ZBTSDH SERIES
600 THRU 1200 AMPS**

CONTROLLED

MODEL NUMBER

SERIAL NUMBER

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

STORAGE:

The ZBTSDH 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 maneuver the Bypass Switch use eyebolts. See Fig. 1 (below). CAUTION: Depending upon the model, a ZBTSDH weighs between 1500 – 2500 lbs. Use adequate machinery and cables to handle the load.

2. Equipment Preparation:

- Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.
- Lock open breakers to normal and emergency lines.

3. Cabinet Preparation:

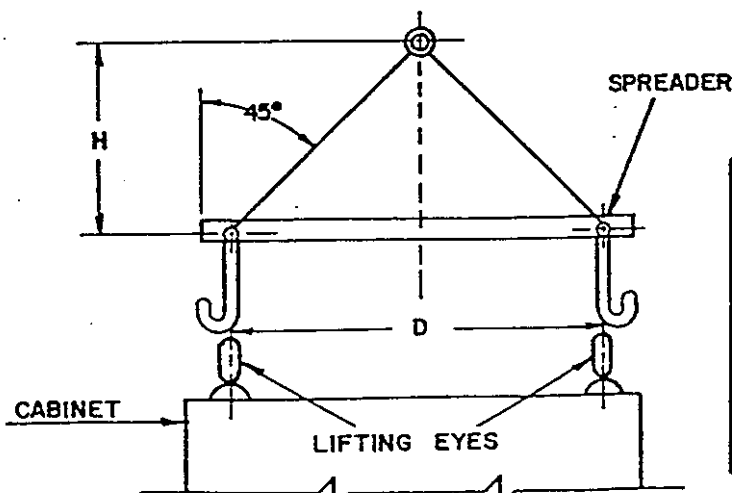
- A small amount of cabinet work is required before the cables are connected. Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical components.
- Standard cable entry is through the top or side of the cabinet. Fig. 2 below shows one suggested knockout order. For a guide to assist in the hole layout, refer to Appendix A, page 17.

4. Cable and Wire Connections:

- To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. (On aluminum cables use a stainless steel wire brush). Insert cables into appropriate lugs.
- 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 (approx. 1 ft.).

5. Prior to the unit's energization:

- Remove any debris incurred due to shipment or installation.
- Inspect the unit, especially the 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

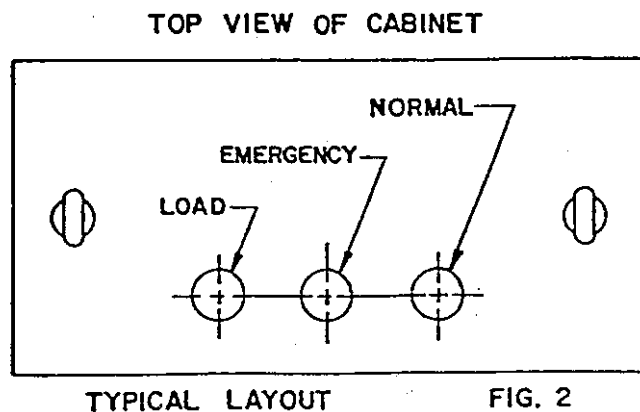
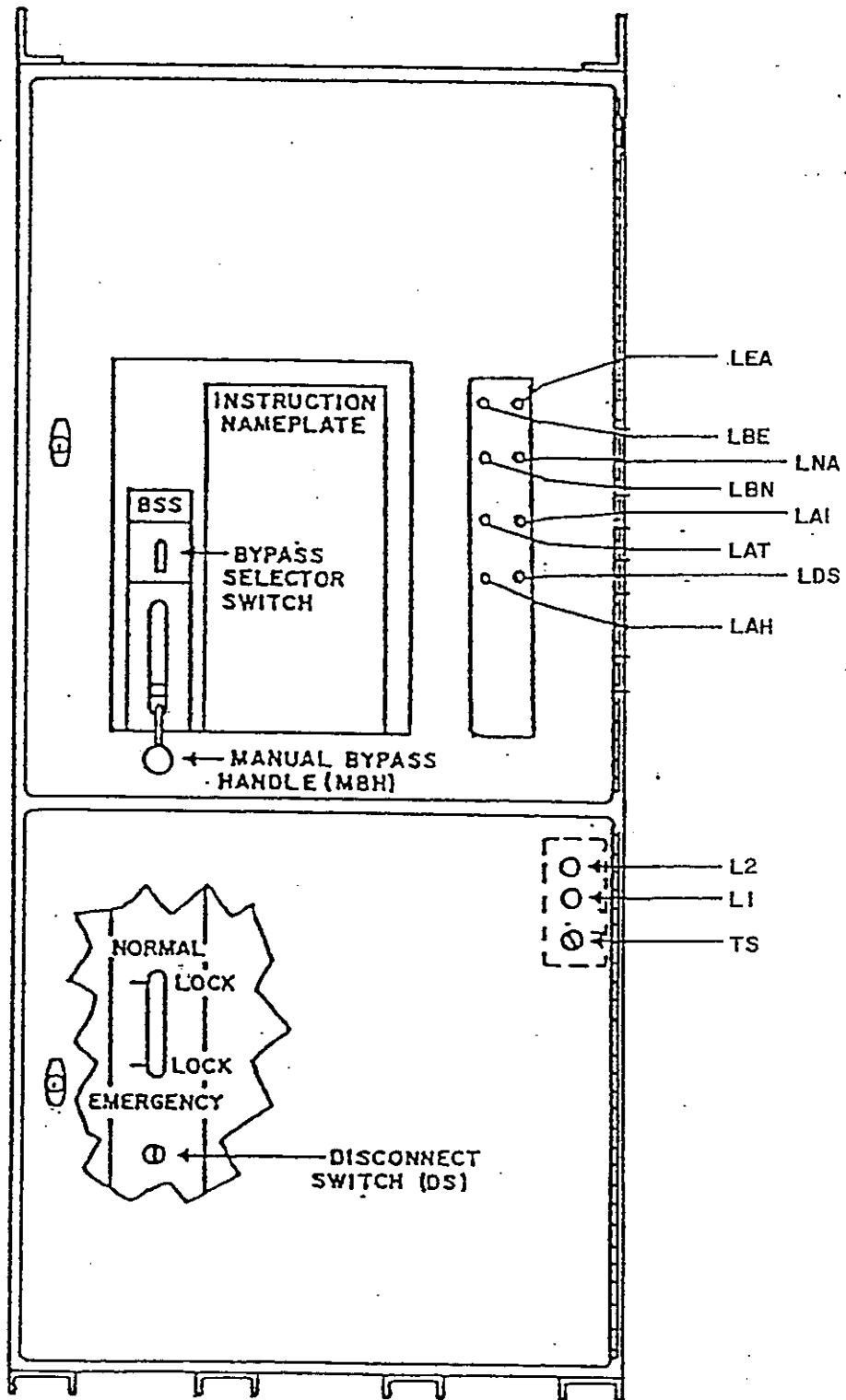
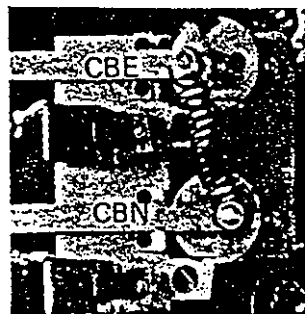
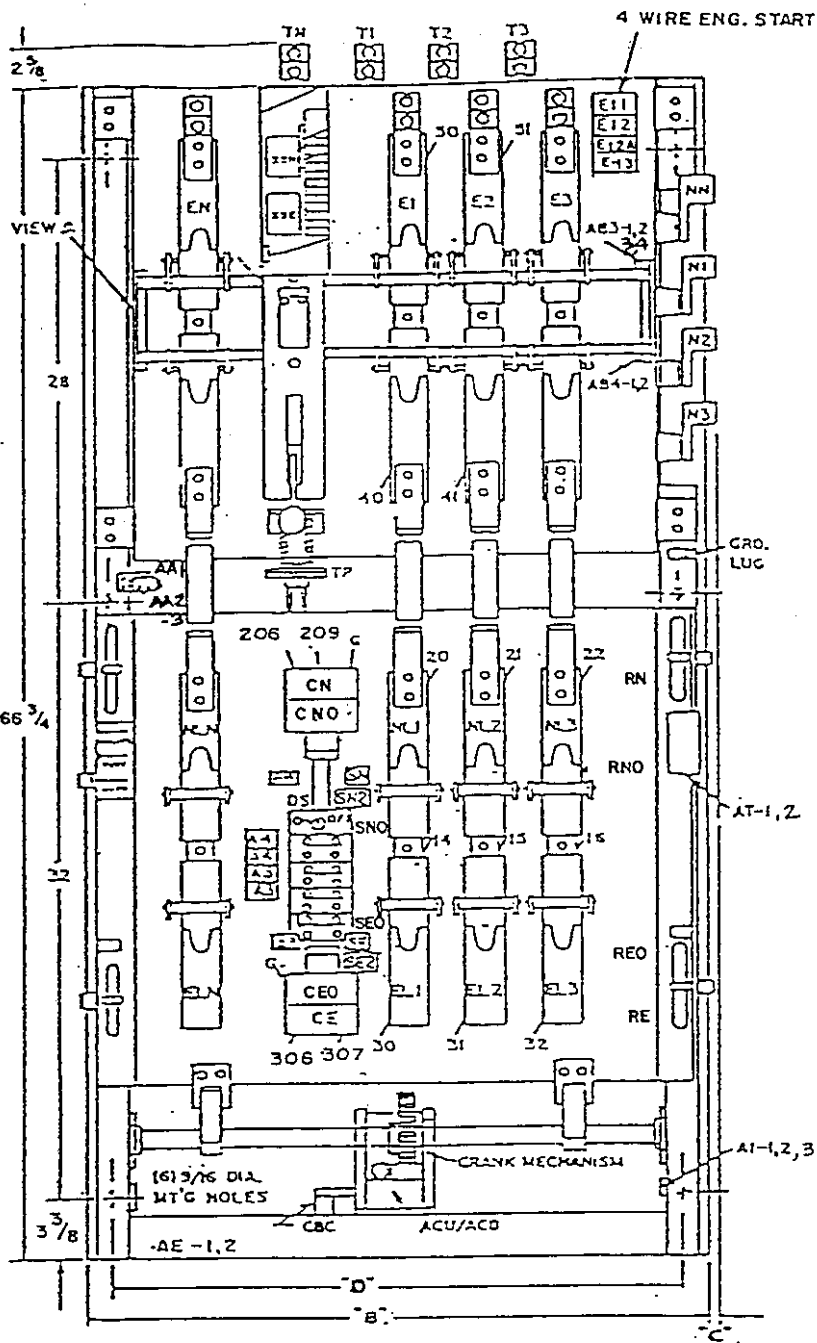


FIG. 2

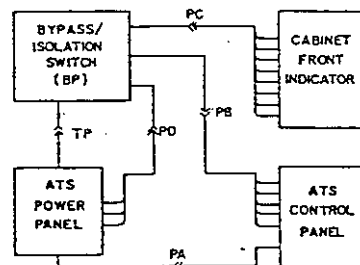


A. CABINET ELECTRICAL PARTS

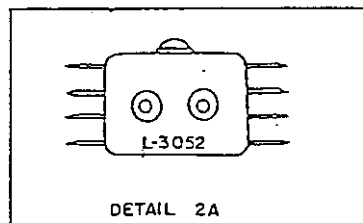
TAG	DESCRIPTION	PART NUMBER
LNA LEA LBN LBE LAT LAI LAH LDS	Normal Available Indicator (G) Emergency Available Indicator (R) Bypass Normal Indicator (G) Bypass Emergency Indicator (R) ATS Test Location Indicator (A) ATS Isolate Location Indicator (G) ATS Inhibit Indicator (R) ATS Disconnect Switch "Off" Indicator (R) Flashing Bulb COMMON PARTS BYPASS INDICATORS Bulb Socket Red Lens (R) Green Lens (G) Amber Lens (A)	PS-1272 Y500005 PS-5046 PS-5047 PS-5048 PS-5049
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Green Lens (Normal) Red Lens (Emergency) Bulb Socket Normal/ Emergency Nameplate Emergency Bulb Normal Bulb	PS-5048 PS-5047 PS-5046 V-1502 PS-5105 PS-5105
TS	Test Switch Operator, Momentary Contact Block N.C. Name Plate	L-1025 L-1029 V-1503



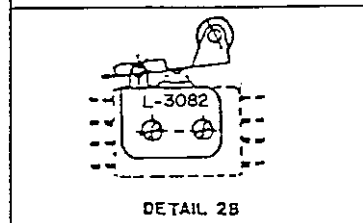
INTERLOCK SOLENOIDS VIEW A



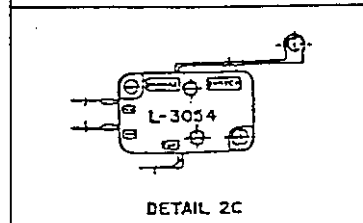
INTERCONNECTION DIAGRAM



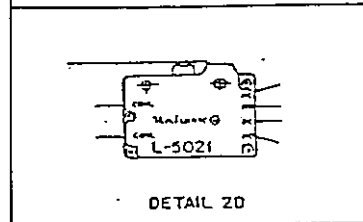
DETAIL 2A



DETAIL 2B

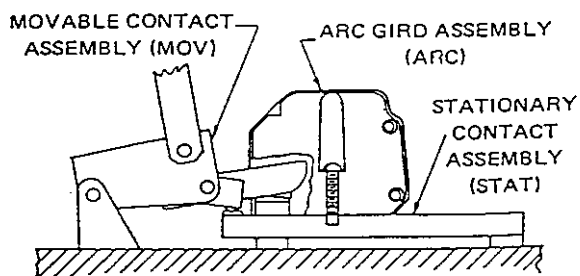


DETAIL 2C



DETAIL 2D

SWITCH AMP & POLES	DEPTH	"B"	"C"	"D"
600	3	19	27	23-3/4
600	4	19	31 1/2	29-1/4
00-1200	3	19	30-3/8	28-1/8
00-1200	4	19	36	33-3/4

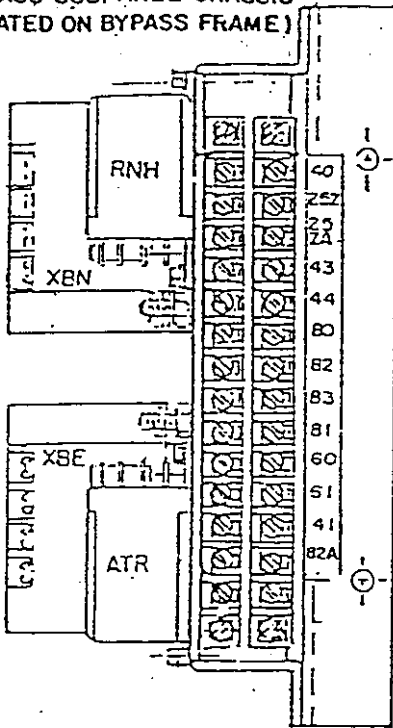


DETAIL 1

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

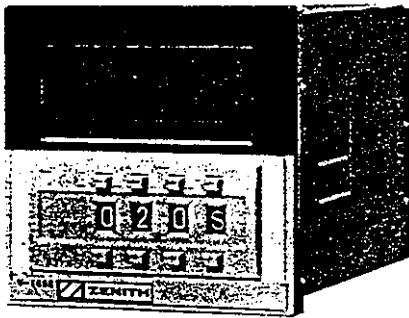
TAG	DESCRIPTION	PART NUMBER				
		PART NUMBERS BY AMPERAGE				
N-1,2,3,N	Normal Connections CU/AL Cable Lugs	400/600	800	1000	1200	
		S-2119 (2)600MCM-2	S-2131 (3)600MCM-2	S-2132 (4)600MCM-2	S-2132 (4)600MCM-2	
E-1,2,3,N	Emergency Connections CU/AL Cable Lugs	S-1393F (2)600MCM-2	S-1391F (3)600MCM-2	S-1392F (4)600MCM-2	S-1392F (4)600MCM-2	
T-1,2,3,N	Load Connections CU/AL Cable Lugs	S-1393F (2)600MCM-2	S-1391F (3)600MCM-2	S-1392F (4)600MCM-2	S-1392F (4)600MCM-2	
STAT (BP)	Stationary Contact Assembly Bypass (See Detail 1)	26P-1144	26P-1126	26P-1126	26P-1126	
STAT (ATS)	Stationary Contact Assembly ATS (See Detail 1)	26P-1144	26P-1126	26P-1126	26P-1126	
ARC	Arc Grd Assembly Kit	23P-1366	23P-1366	23P-1366	23P-1366	
MOV	Moveable Contact Assembly	23P-1157	26P-1125	26P-1125	26P-1125	
	Moveable Contact (Sw. Neut.)	23P-1157	26P-1231	26P-1231	26P-1231	
XBN, XBE	Bypass Step Down Transformer 24 Volt Secondary	Voltage*	Rating	*Part Number		
		120/240	25VA	K-3061		
		208/416	25VA	K-3063		
		220/440	25VA	K-3064		
		240/480	25VA	K-3062		
		380	25VA	K-3067		
		575	25VA	K-3065		
600	25VA	K-3066				
CN/CNO CE/CEO	ATS Main Operating Coils					
	PART NUMBERS BY AMPERAGE					
	VOLTAGE SYSTEM					
	No.	Volts	Ph	Wire	Coil Volts	Pole
	-1	120	1	2	120	2
	-2	120/240	1	3	240	2
	-3	240	3	4	240	3
	-4	120/208	3	4	208	3,4
	-5	480	3	3	480	3
	-7	277/480	3	4	480	3,4
-9	240/416	3	4	416	3	
AB3 AB4	Bypass Emergency Position Switch Bypass Normal Position Switch					
	Limit Switch DPDT, Lever Actuator					
AA AT ACU/ACD AI AE	L-5021 (Detail 2B, Page 4)					
	ATS Auto Location Switch					
	ATS Test Location Switch					
	Crank Limit Switches					
	ATS Isolate Location Switch					
A3	Limit Switch DPDT, Roller Actuator					
	L-3052 (Detail 2A) L-3052 WITH L-3082 (Detail 2A and 2B) L-3054 (Detail 2C) L-3052 L-3052 WITH L-3082					
A3	ATS Emergency Position Switch (Aux. Contact)			SPDT (Std.) 23P-1333		DPDT (OPT.) 23P-1334
A4	ATS Normal Position Switch (Aux. Contact)			23P-1327		23P-1328
SN/SN2, SNO	ATS Normal Position Coil Cutout Switch DPDT			23P-1334		
SE/SE2, SEO	ATS Emergency Position Coil Cutout Switch DPDT			26P-1304		
BPB	Bypass Permissive Pushbutton Momentary Pushbutton Operator N.O. Contact Block			L-1025 L-1028		
DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C. Contact Block N.O.			L-4009 L-1020 L-1024		
CBE CBN	Emergency Interlock Solenoid Normal Interlock Solenoid			K-2159 K-2159		
CBC	Crank Mechanism Coil			K-2159		
RN/RNO RE/REO	Coil Rectifiers			23P-1473		

**BYPASS SUBPANEL CHASSIS
(LOCATED ON BYPASS FRAME)**



C. BYPASS CONTROL PANEL, INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	Y260000
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1,2,3,4	Diodes	PS-4812
C1	Capacitor RNH	PS-4058
ATR	Aux. Test Relay	Y260002



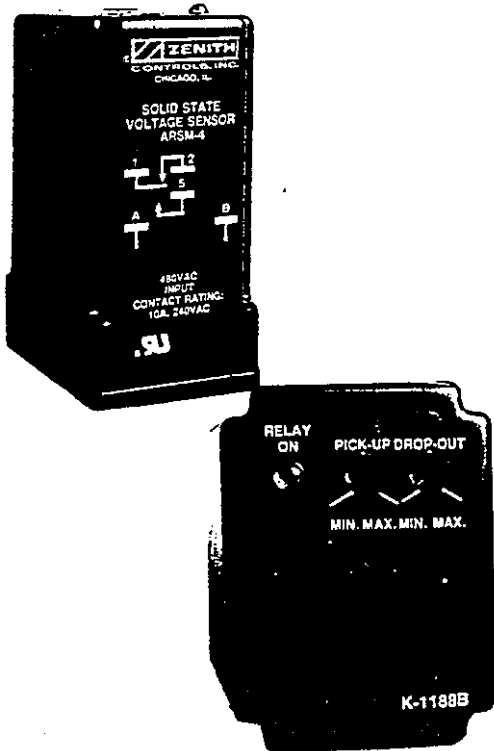
New Solid State Time Delay

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.
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Close Differential (ARSM) Relay Adjustment

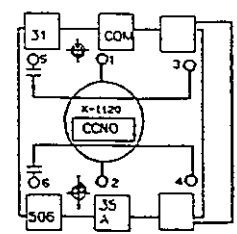
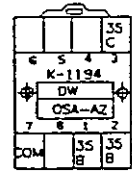
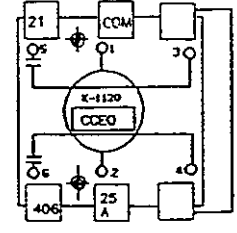
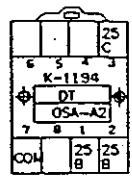
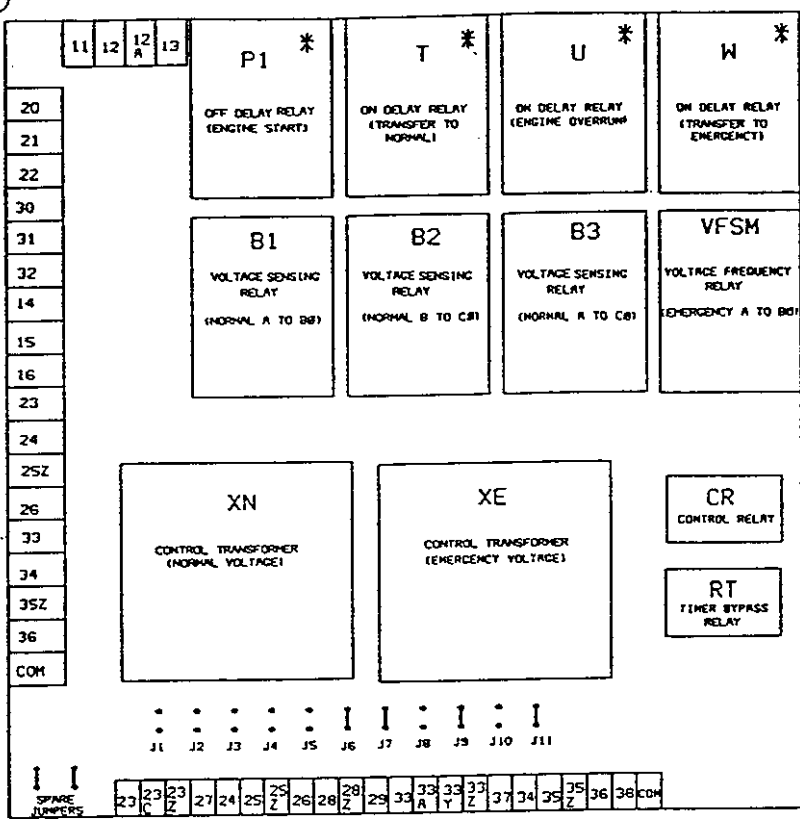
The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

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

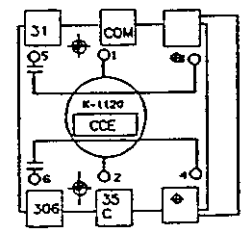
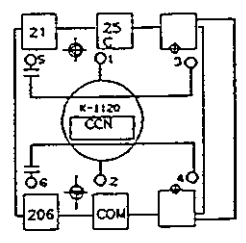
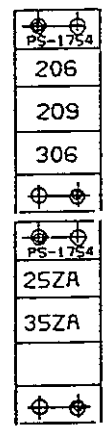
1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very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

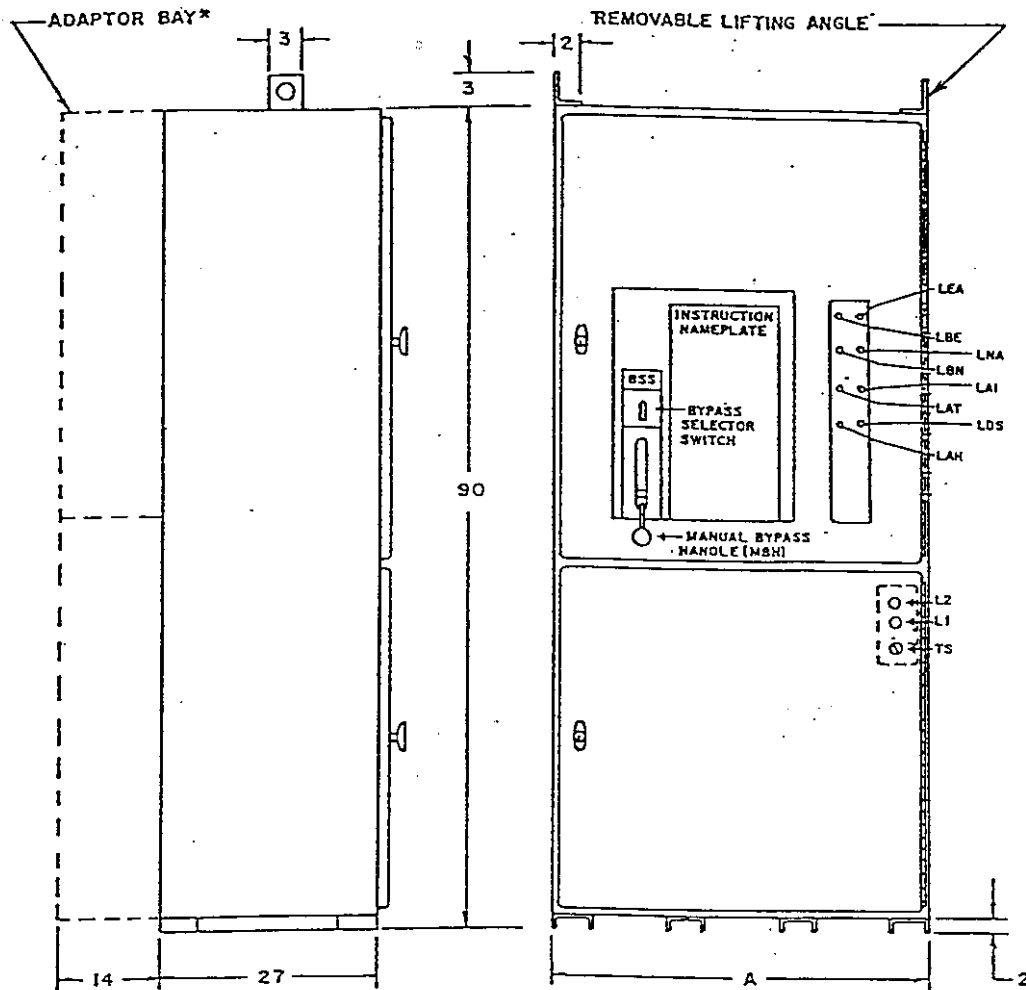


CONTROL PANEL BASIC CONTROLS

AUTOMATIC TRANSFER SWITCH



- XN.....Control Transformer, Normal
- XE.....Control Transformer, Emergency
- B-1,2,3....Normal Line Phase Relays Undervoltage
Pick-up _____
Dropout _____
- VFSM.....Emergency Volt-Frequency Relay (k-1192)
Pick-up 90% of Voltage-Frequency
- CR..... Control Relay (K-1204)
- CCN.....CN Coil Control Relay, Normal (K-1120)
- CCE.....CE Coil control Relay, Emergency (K-1120)
- CCNO.....CNO Coil Control Relay, Normal to Open (K-1120)
- CCEQ.....CEO Coil Control Relay, Emergency to Open (K-1120)
- RT.....Control Relay Emergency (K-1204)
(Bypass Relay on Emergency Failure)
- P1.....Delay Engine Start Timer (K-1201)
Adjustable 5 to 6 seconds
- T.....Normal Restoration Timer, OSA-A-T
- U.....Engine Cool-down Timer, OSA-A-U
- W.....Time Delay to Emergency Timer, OSA-A-W



SWITCH, AMP & POLE	CAB. No.	DIM. "A"	ADAPT. BAY*
ZBTS DH 60 3-POLE	F-1252	36"	26H-1332
ZBTS DH 80-120 3-POLE	F-1253	40"	26H-1333
ZBTS DH 60 4-POLE	F-1253	40"	26H-1333
ZBTS DH 80-120 4-POLE	F-1254	46"	26H-1334

* ADAPTOR BAY REQUIRED WHEN CUSTOMER CONNECTIONS ARE REAR, SIDE OR BOTTOM ENTRY (SEE 36C-1000). OPTIONAL.

OPERATION OF CABINET LIGHTS

BOTTOM DOOR

- L1..... On when the ATS is mechanically locked in the Emergency position.
- L2..... On when the ATS is mechanically locked in the Normal position.

TOP DOOR

- LNA On when Normal power is available, Off otherwise.
- LEA On when Emergency is available, Off otherwise.

Note: The following will illuminate only when the DS is in the Inhibit position, the BSS is in the Normal or Emergency position, or the ATS is not in the Auto location.

- LBN On when the Normal Bypass (lower) contacts are closed.
- LBE..... On when the Emergency Bypass (upper) contacts are closed.
- LAT On when the ATS is in the Test location as indicated by the ATS location pointer.
- LAI On when the ATS is isolated from the switch.
- LAH On when the ATS is not in the Automatic mode.
- LDS..... Flashing when the ATS coils are prevented from operating by the DS.

DESCRIPTION OF MECHANICAL AND ELECTRICAL OPERATORS

BO (Bypass Operator) - The bypass operator opens and closes the bypass contacts BN (Bypass Normal Contacts).

MBH(Manual Bypass Handle) - The manual bypass handle actuates the bypass operator. In the lower (open) position, the bypass contacts BN and BE are open. In the upper (bypass) position, the bypass contacts BN or BE are closed.

BSS (Bypass Selector Switch) - The bypass selector switch determines which contacts the MBH actuates: turn the BSS right for BN to close, center to open BN and BE, and left for the BE to close.

CM (Crank Mechanism) - The crank mechanism controls the location of the ATS: turn the CM clockwise to raise and counterclockwise to lower the transfer switch. CM Operation can only be performed when the bypass is in the BN or BE position.

DS (Disconnect Switch) - The DS controls ATS main coil operation. In the Auto position, the ATS operates normally. In the Inhibit position, the main coils (CN and CE) cannot be energized, and the ATS remains connected to the present source.

TS (Test Switch) - The test switch, when opened, will simulate a normal line failure.

*For location of the preceding operators, see figure 3, page 8.

LABELS

ATS Nameplate - The ATS nameplate indicates which ATS contacts are closed.

Normal Plate - The upper position has closed Normal contacts; the lower position has opened Normal contacts.

Emergency Plate - The upper position has opened Emergency contacts; the lower position has closed Emergency contacts.

ATS Location Pointer and Label - The red Location Pointer to the left of the Label indicates the position of the ATS. Auto: the ATS is connected to normal, emergency and load buses. Test: The ATS is disconnected from the load, but connected to the Normal and Emergency buses. Isolate: the ATS is disconnected from the Normal, Emergency and load buses.

ZBTSDH PURPOSE

ZBTSDH: Bypass/Isolation Switch (BP) and Automatic Transfer Switch (ATS) combination provides means to maintain continuity of source lines to critical loads in either of two modes:

- i. **Automatic:** Auto Operation Mode allows the ATS to determine the load's power source.
- ii. **Manual:** Manual Operation Mode allows the operator to manually connect the load to either available power source. This mode is allowed only in the "Isolate" and "Test" positions.

OPERATION

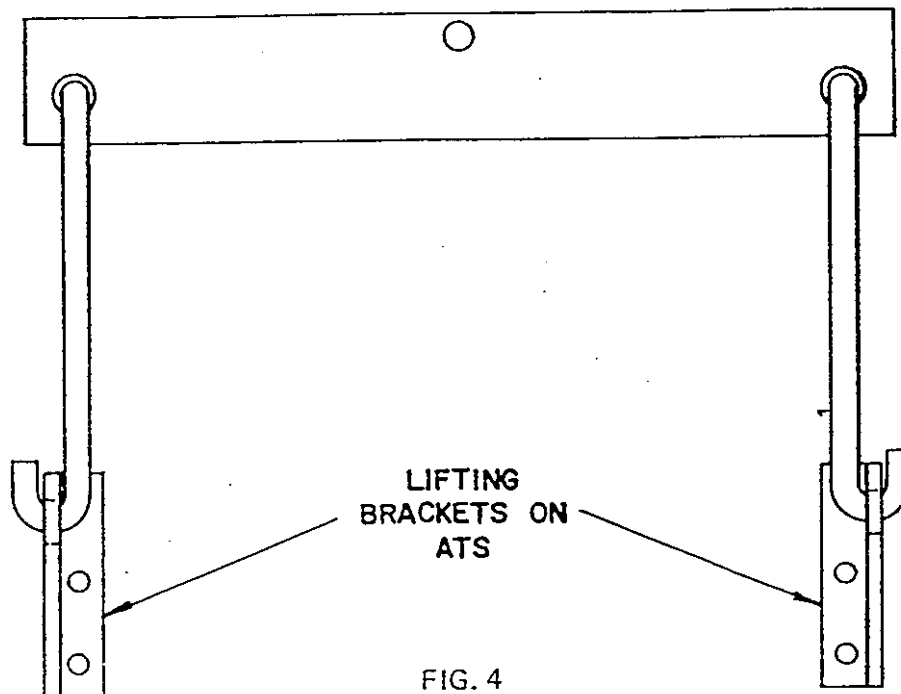
The Auto Operation Mode occurs when "AUTO" is indicated by the ATS Location Pointer, the DS is "AUTO" the BSS is "OFF" and BP is "OPEN."

Auto to Test — To change the ATS location from Auto to Test, turn the DS to the "INHIBIT" position. Switch the BSS to the same source that powers the ATS. Note: The BP will not allow cross phasing; any such operation is prevented by safety interlocks. Move the MBH up. The ATS is bypassed.

Rotate the CM counterclockwise until the ATS Location Pointer is aligned with "TEST." (Note: The BP can act as a manual transfer switch only when the ATS is located in "TEST" or "ISOLATE.") The "TEST" location permits the user to verify the ATS operation. To sequence the ATS, review the drawing supplied with the unit and refer to the "TEST PROCEDURE," page 12, and "TROUBLESHOOTING GUIDE," page 14.

Test or Isolate — To change the ATS location from Test to Isolate, turn the DS to "INHIBIT." Rotate CM counterclockwise until the ATS Location Pointer is aligned with "Isolate."

ATS Removal — DO NOT REMOVE THE ATS UNTIL THE HARNESS MULTIPIN PLUGS HAVE BEEN DISCONNECTED (connections to A3 and A4 and any other customer options should be disconnected). To remove the ATS, rotate the four panel latches to the vertical position (Fig. 3, page 8). Pull the ATS outward until the slide brackets are fully extended. Engage slide locks to prevent movement of the brackets. (See Fig. 5). Connect a lift bar (similar to Fig. 4) to the ATS lifting brackets.



ZBTS DH

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. P1 drops out after .5 to 6 seconds (adjustable) and signals generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFMS relay is energized. The RT relay is now energized to operate the CNO relay thru the SE cutout switch causing the main transfer coil CN/O to operate thru the SCNO limit switch. The load is now transferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O transfer coil. The transfer switch is now locked mechanically open. SNO now is deactivated. This energizes the DW timer. After time setting has lapsed, DW will energize CE1, which will energize main transfer coil through the SCE and CE1. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O main transfer coil. The transfer switch is now locked mechanically in Emergency position.

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 time setting has lapsed, the timer contact closes to energize CR relay. The CEO relay is now energized thru the SN and SEO limit switches, causing the main transfer coil CEO to operate thru the SCEO limit switch. The load is now transferred back to Open position. The SEO and SCEO limit switches operate to disconnect the CEO relay and CE/O transfer coil. The transfer is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CN1 which will energize main transfer coil through the CN1 and SCN. The load is now transferred to the Normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O main transfer coil. The transfer switch is now locked into Normal position.

OPERATION (continued)

Test Procedure - The ATS can be tested in either of two locations:

- 1). **"Auto Location"**: To run a test in the auto location, two methods are possible. (The Normal source must be available for each):
 - a). **Control Panel Test** - A control panel test checks the operation of the ATS without breaking the load connections. To use this procedure, turn the DS to "INHIBIT" (See Fig. 3, page 8). Turn the TS to "TEST." Hold the TS until the CCNO picks up (see page 6; ATS control panel). (Note: if the CCNO does not energize after the W time delay, release the TS and refer to Table 3 Page 14). Release the Test Switch; the spring-loaded TS will move back to "AUTO". The CR picks up after the T time delay has elapsed. (If the CR does not energize, refer to Table 3). The control panel test method is complete.
 - b). **Full Transfer Test** - A full transfer test checks the complete operation of the ATS by transferring the load's power source from "Normal" to "Emergency." To use this method, turn the DS "ON." (See Fig. 3, p. 8). Hold the TS until the ATS transfers to Emergency. (Note: If the ATS does not transfer after the W time delay, release the TS and refer to Appendix B). Release the Test Switch; the spring-loaded TS will move back to "Auto." The ATS will transfer back to Normal after the T time delay has elapsed. (If the ATS does not re-transfer, refer to Table 3). The full transfer test is complete.
- 2). **"Test Location"**: The "TEST" procedure is used after maintenance or repair of the ATS. To use this method, the BN contacts should be closed and the Normal source must be available. In the "TEST" location, the ATS is disconnected from the load bus. The same two options, as described in the "AUTO" location, are present. Refer to 1-a, b for the procedure.

CAUTION: 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 the engine to safely cool down.

RECOMMENDATIONS: The suggested range on the T timer is 0-30 minutes. A test is recommended at least once a month. Hospitals test the ATS once a week.

NOTES ON OPERATION

CAUTION: When the ATS is located in "TEST" or "ISOLATE" the BP acts as a Manual Transfer Switch. The user should be aware that the manual bypass has two cautionary states:

- 1). The BP cannot be transferred without at least one source (Normal or Emergency) available.
- 2). The transfer from BE to BN results in a momentary loss of power to the load while BP is open.

In the event of a failure and the ZBTSDH is not in the Auto Operation Mode, a manual transfer of the BP is required. When the BN contacts are closed, the emergency generator starts after a six second delay. (Note. Transfer only after the generator is verified to operate properly). To manually transfer the BP, depress the BPB, pull the MBH down and then, switch the BSS from Normal to Emergency. The BSS movement through the open position, Normal to Emergency, temporarily opens the engine start contacts. Once the BSS is in Emergency, the engine start contacts remain closed. Move the MBH upward to complete the manual transfer to the BP to the Emergency position. The Emergency generator presently powers the load through the BP, BE contacts.

To obtain the BN position (Note: Verify Normal Source is Available) when the BE contacts are closed, Move the MBH down. Switch the BSS from EMERGENCY to NORMAL. Move the MBH up; the BN contacts are closed, and the normal source powers the load. (For a summary of the ZBTSDH operations and permitted BP/ATS movements, see Table 1,2).

TABLE 1 ZBTSDH STATES

X DENOTES PERMISSIVE COMBINATION

ATS LOCATION	ATS POSITION	BYPASS SWITCH MODES		
		EMERG.	OPEN	NORMAL
IN TRAVEL (NON-ALIGNED POINTER)	NORMAL	NOT ALLOWED	NOT ALLOWED	X
	EMERG.	X	NOT ALLOWED	NOT ALLOWED
AUTO POINTER ALIGNED	NORMAL	NOT ALLOWED	X	X
	EMERG.	X	X	NOT ALLOWED
TEST POINTER ALIGNED	NORMAL	X	X	X *
	EMERG.	X	X	X *
ISOLATE POINTER ALIGNED	NORMAL	X	X	X *
	EMERG.	X	X	X *

TABLE 2 ZBTSDH 2 WIRE
ENGINE CONTROL CONTACT

ATS LOCATION	BSS SELECTOR SWITCH POS.		
	EMERG.	OFF	NORMAL
IN TRAVEL (NON-ALIGNED POINTER)	CLOSED	NOT ALLOWED	OPEN *
AUTO POINTER POSITION	CLOSED	ATS CONTROL	OPEN *
TEST POINTER POSITION	CLOSED	ATS CONTROL	ATS * CONTROL
ISOLATE POINTER POSITION	CLOSED	ATS CONTROL	OPEN *

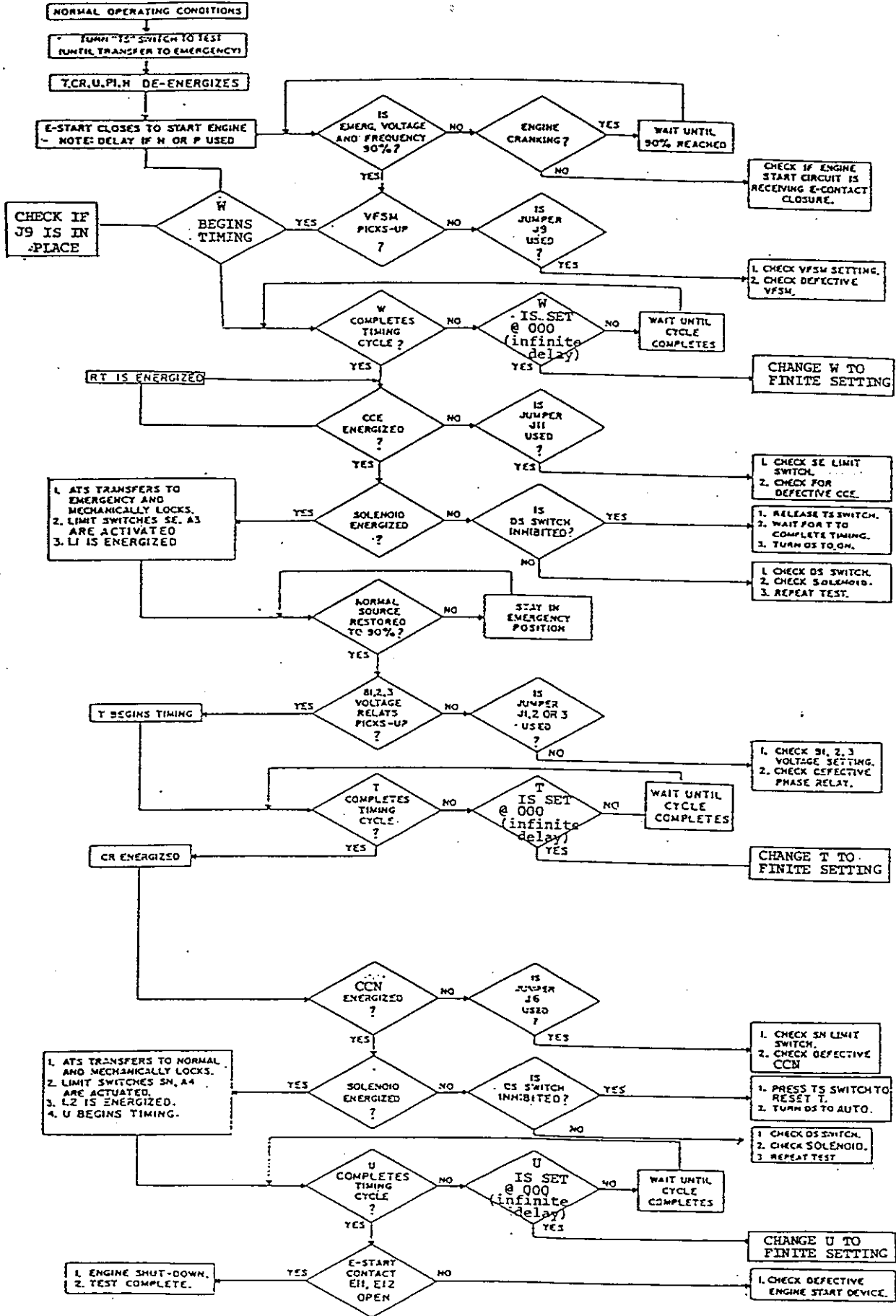
*IF NORMAL IS BYPASSED AND NORMAL SOURCE FAILS THEN AFTER 6 SECOND DELAY RNH RELAY WILL DE-ENERGIZE CLOSING ENGINE START CIRCUIT.

TABLE 3 "TROUBLE SHOOTING"

PROCESS

DECISIONS

CORRECTIONS



MAINTENANCE

ELECTRICAL TEST

The ATS may be electrically tested (refer to operation: "Test Procedure"). After completion of an electrical test, the ATS may be returned to the Auto Operation Mode (follow the instructions in the Operation section). If the ATS malfunctions, troubleshoot the switch and replace any faulty part(s) immediately. (A PROBLEM/REMEDY CHART is located in Table 3, page 14).

INSPECTION

Contacts - The movable and stationary contacts are a vital part of the ZBTSDH and must be kept clean. To inspect the ATS contacts remove switch (see Operation section). Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). A thin black film can be wiped clean with a cloth dipped in solvent. After the movable contacts and stationary contacts are clean (no discoloration or deposits) return the ATS to the Auto Operation Mode.

Multilams - To inspect the multilams, remove the ATS (see Operation instructions). The multilams are the vaned connectors and lower buses (see Fig. 6). Examine the multilams. Verify that all the vanes are present, unbent and uncorroded. Any defective parts should be replaced before the ATS resumes normal operation.

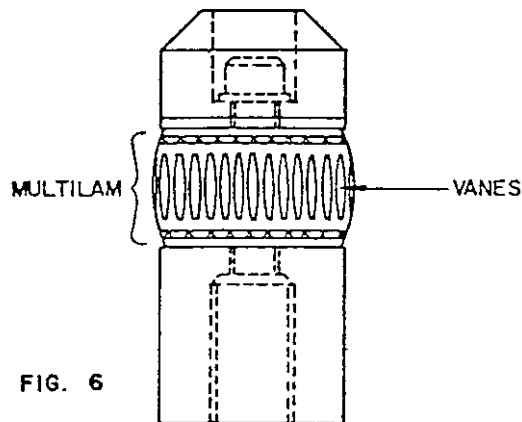


FIG. 6

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.

LUBRICATION

The cams of the ZBTSDH are lubricated with "Dow Chemical's Molykote" (321R or GN paste), and the gears are lubricated with Lubriplate 105. These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants (321R, GN paste or Lubriplate).

LUBRICATION MAINTENANCE CHART

DATE INSPECTED	DATE LUBRICATED	LUBRICANT USED (CAMS) (GEARS)	NOTES

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

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

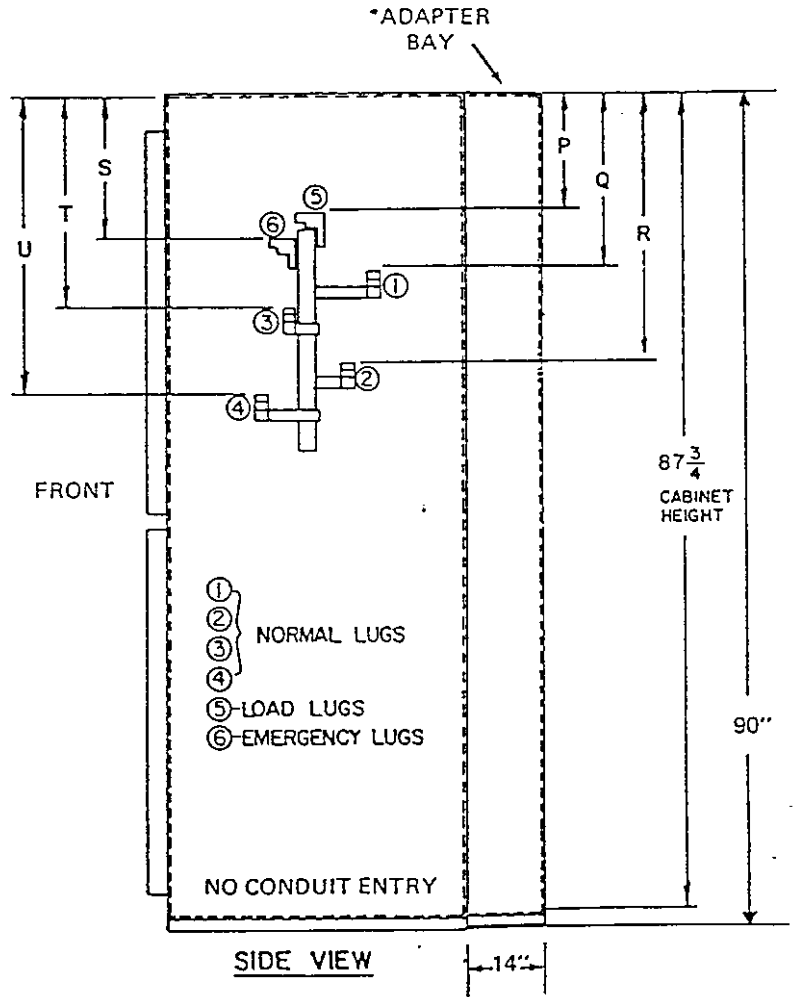
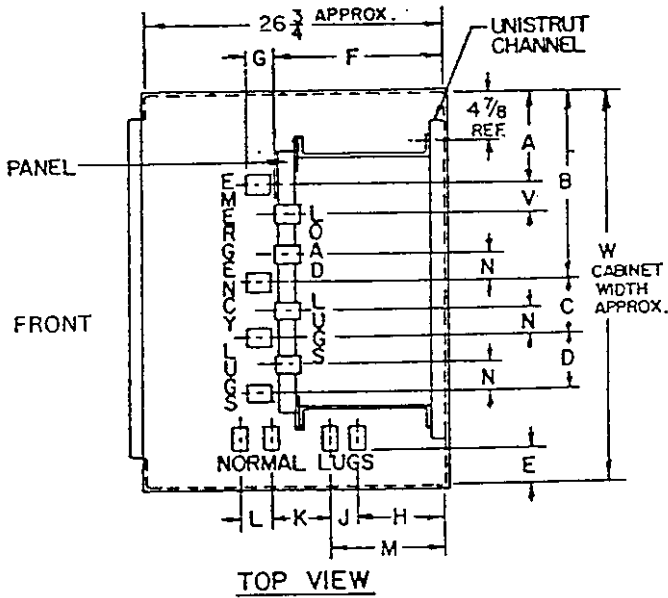
**WIRE CONNECTION
TIGHTENING TORQUE**

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

APPENDIX A



- ①
 - ②
 - ③
 - ④
 - ⑤
 - ⑥
- NORMAL LUGS
LOAD LUGS
EMERGENCY LUGS

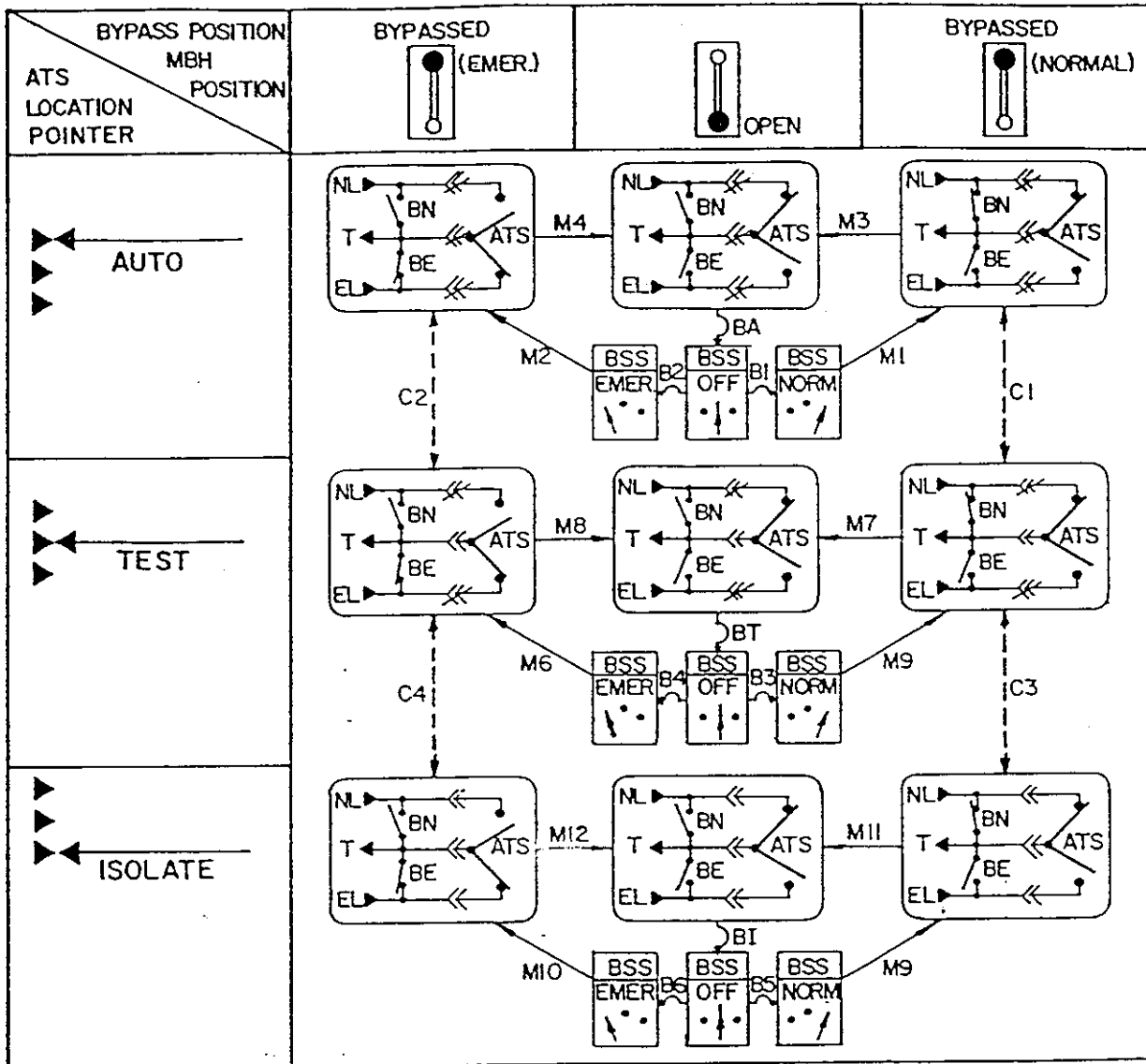
NOTE: Dimensions are subject to change. If critical dimensioning is required, contact factory.

*ADAPTOR BAY REQUIRED WHEN CUSTOMERS CONNECTIONS ARE REAR, SIDE OR BOTTOM ENTRY: (OPTIONAL).

UNIT	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W
BTSDH 60 3P	—	14 5/8	4 1/4	4 1/4	1 13/16	12 1/2	3 1/8	—	—	3 3/8	2 1/2	8 1/8	2 1/8	18 1/8	—	33 1/4	22 5/8	31	39 1/2	—	35 3/4
BTSDH 60 4P	9 3/4	18 3/4	4 1/4	4 1/4	1 5/16	12 1/2	3 1/8	5 5/8	2 1/2	3 3/8	2 1/2	—	2 1/8	18 1/8	26 3/4	33 1/4	22 5/8	31	39 1/2	2 5/8	39 3/4
BTSDH 80-120 3P	—	15	5	5	1 1/8	12 3/8	3 1/4	—	—	4 1/4	3	7 3/8	2 1/2	18 1/8	—	33 7/8	22 5/8	29 3/8	38 3/8	—	39 3/4
BTSDH 80-120 4P	10 5/8	20 5/8	5	5	1 1/2	12 3/8	3 1/4	5 1/8	2 1/2	4 1/4	3	—	2 1/2	18 1/8	24 7/8	33 7/8	22 5/8	29 3/8	38 3/8	2 1/2	45 3/4

NOTE: ALL DIMENSIONS ARE FROM THE INSIDE OF CABINET.

OPERATIONAL FLOW



DIRECTIONAL PATH KEY

- M# → Manual Bypass Handle (MBH) Operation (See Note 3, 4)
- C# - - - Manual Crank Mechanism (CM) Operation (See Note 4)
- B# ~ Manual Bypass Selector Switch (BSS) Operation

NOTES

1. When operating CM between - "Auto" and "Test" location, BP and ATS switch must parallel same source.
2. One source - Normal or Emergency - must be available to operate ZBTSDH.
3. Always depress BPB prior to and while operating MBH.
4. Always verify "DS" switch is in "INHIBIT" position, prior to operation of MBH, CM or BSS.
5. When ATS is in the "Test" or "Isolate" locations, opening a Bypass switch will disconnect the load from the Power Source.

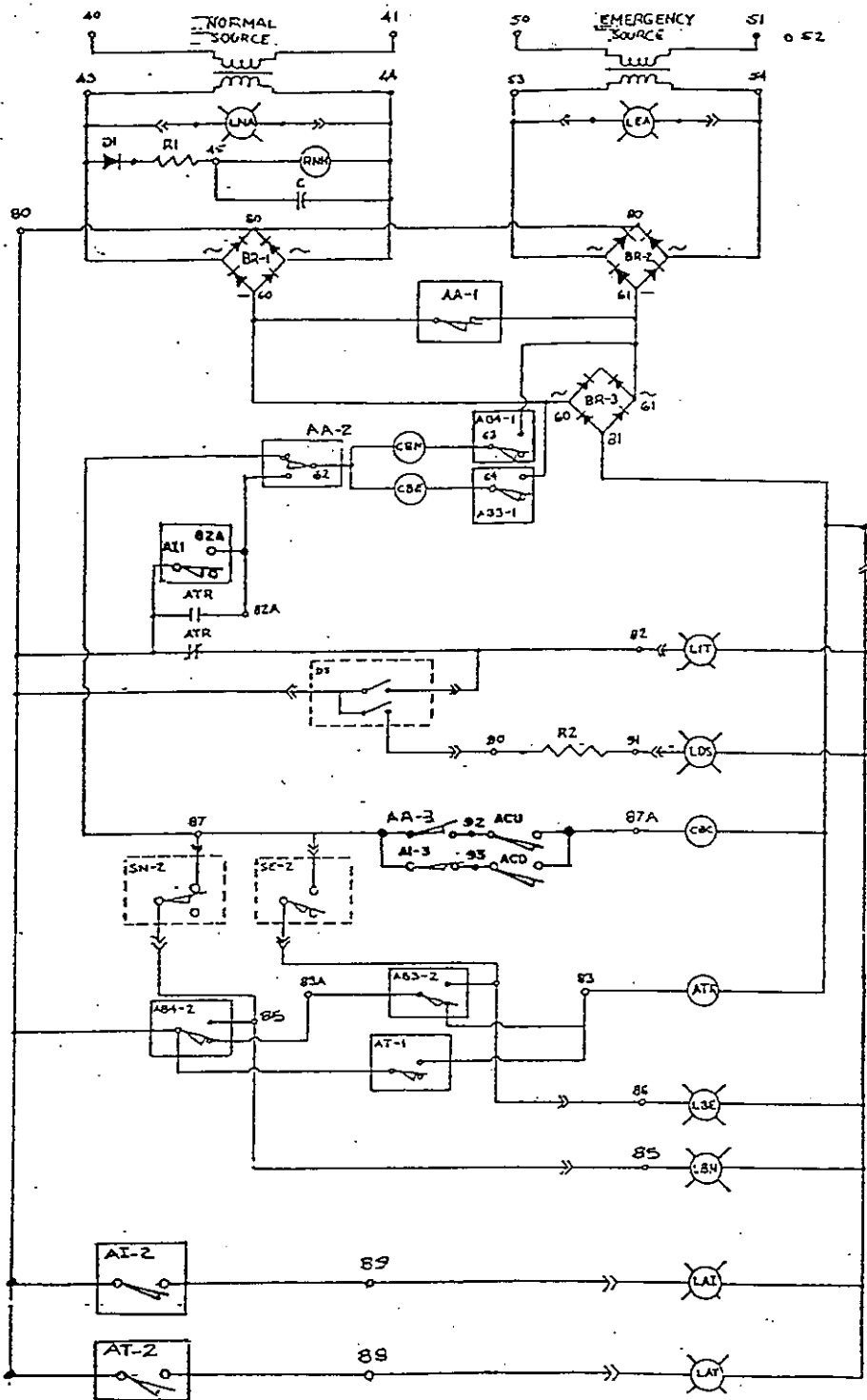
CHART OVERVIEW

The left index of chart represents location of ATS controlled by the operation of CM. The top index of chart

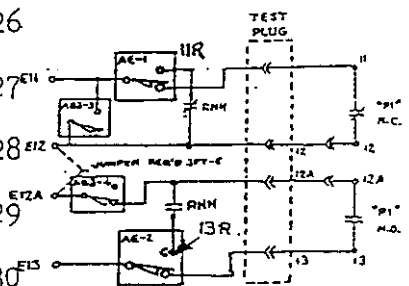
represents position of MBH handle and within the chart are positional representation of BSS. The arrowed paths M#, C#, B# give directional flow of operation of MBH, CM and BSS respectively.

EXAMPLES

- I: ATS Auto-operation:
 - A. To Bypass Normal and Isolate ATS.
 1. Follow path B1, M1, C1 and C3.
 2. To return to the original position follow path; C3, C1, M3 and BA.
 - B. To Bypass Emergency and Isolate ATS:
 1. Follow path B2, M2, C2 and C4.
 2. To return to original position follow path; C4, C2, M4 and BA.
- II. Normal Bypass/Isolate to Emergency Bypass/Isolation:
 1. If Normal Source fails follow path; M11, BI, B6 and M10.
 2. To return to original position follow path; M12, BI, B5 and M9.



- LNA- Normal Lamp Available
- LEA- Emergency Lamp Available
- RNH- Relay Normal Hold
3,27,29
- AA-1,2,3- Auto Limit Switch
6,8,14
- BR-1,2,3- Bridge Rectifier
- CBN- Normal Solenoid
8
- CBE- Emergency Solenoid
9
- AI-1,2,3, Isolate Limit Switch
10,22,14
- ATR- Auto/Test Relay
11,17
- LIT- Lamp Inhibit Transfer
11
- LDS- Lamp Disconnect Switch
"INHIBIT" position. 13
- CBC- Crank Solenoid. 14
- AT-1,2- Test Limit Switch
18,23
- LBE- Lamp Bypass Emergency.19
- LBN- Lamp Bypass Normal. 20
- LAI- - - - Lamp ATS Isolate. 22
- LAT/TEST- Lamp Ats Test pos.23
- AUTO- Lamp ATS Auto pos. 25
- AB4-1,2- Bypass Normal
8,18
- AB3-1,2,3,4- Bypass Emergency
9,17,27,29



NOTE:
WIRE NUMBER E12 BECOMES WIRE NUMBER 12 AFTER.
THE TEST PLUG (TP).

600 - 1200 AMP (ATS) BYPASS W/ SSRCP

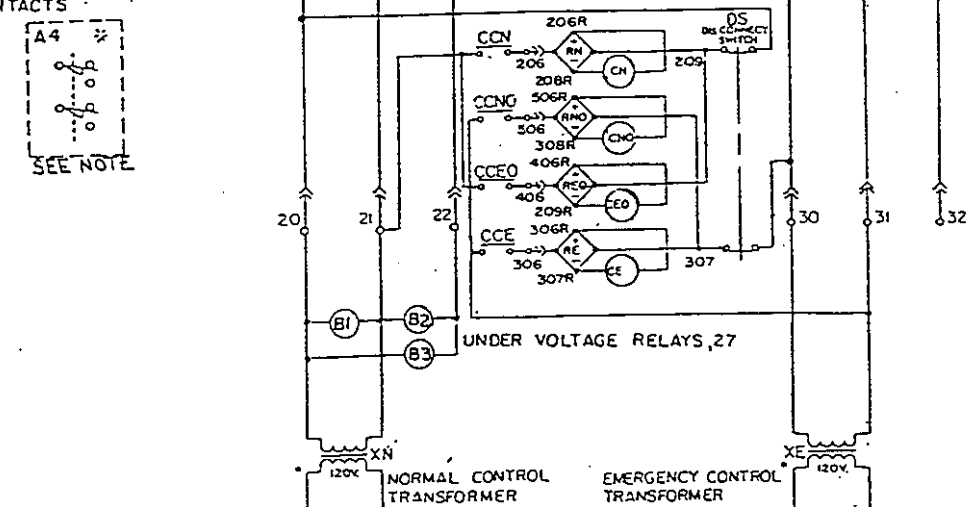
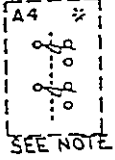
NL1,2,3,NN NORMAL SOURCE

T1,2,3,TN LOAD

EL1,2,3,EN EMERGENCY SOURCE

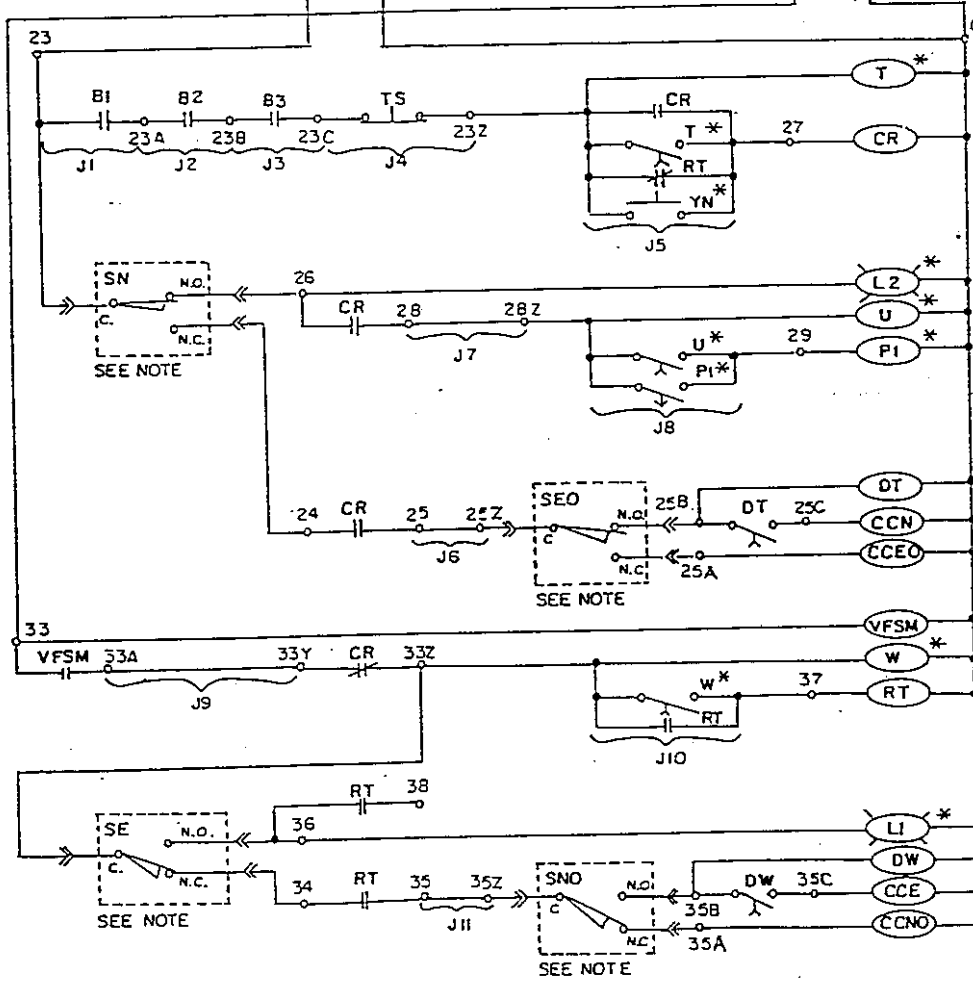
LEGEND:
 — WIRE CONNECTION
 — WIRE ON MAIN TERMINAL BLOCK
 — WIRE CN DISCONNECT PLUG.
 * OPTIONAL ACCESSORIES
 SWITCHED NEUTRAL OR SOLID NEUTRAL } IF REQUIRED
 MECHANICALLY ACTUATED EMERGENCY POSITION CONTACTS.

MECHANICALLY ACTUATED NORMAL POSITION CONTACTS

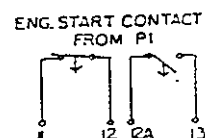


CN - SOLENOID COIL, TRANSFERS ATS FROM NEUTRAL TO NORM. POSITION.
 CE - SOLENOID COIL, TRANSFERS ATS FROM NEUTRAL TO EMER. POSITION.
 CNO - SOLENOID COIL, TRANSFERS ATS FROM NORMAL TO NEUTRAL POSITION.
 CEO - SOLENOID COIL, TRANSFERS ATS FROM EMERG. TO NEUTRAL POSITION.
 RN - CN RECTIFIER
 RE - CE RECTIFIER
 RNO - CNO RECTIFIER
 REO - CEO RECTIFIER

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



T - TIME DELAY ON RETRANSFER, 28
 CR - CONTROL RELAY, 27, 33, 39, 43
 YN - PUSH BUTTON TO BYPASS T.
 L2 - NORMAL POSITION LIGHT
 U - ENGINE OVER-RUN TIMER, 34
 PI - ADJUSTABLE TIME DELAY TO ENGINE START, 35, 55
 DT - TIME DELAY IN NEUT. TO NORMAL, 39
 CCN - POWER RELAY, ENERGIZES SOLENOID CN, 11
 CCEO - POWER RELAY, ENERGIZES SOLENOID CEO, 15
 VFSM - EMER. VOLTAGE FREQUENCY SENSITIVE RELAY, 43
 W - TIME DELAY TO EMER. TRANSFER, 44
 RT - BYPASS T CONTACT IF EMERGENCY FAILS, 29, 45, 47, 50
 LI - EMER. POSITION LIGHT
 DW - TIME DELAY IN NEUT. TO EMER., 50
 CCE - POWER RELAY, ENERGIZES SOLENOID CE, 16
 CCNO - POWER RELAY, ENERGIZES SOLENOID CNO, 13



NOTE:
 LOCATED ON POWER PANEL.



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