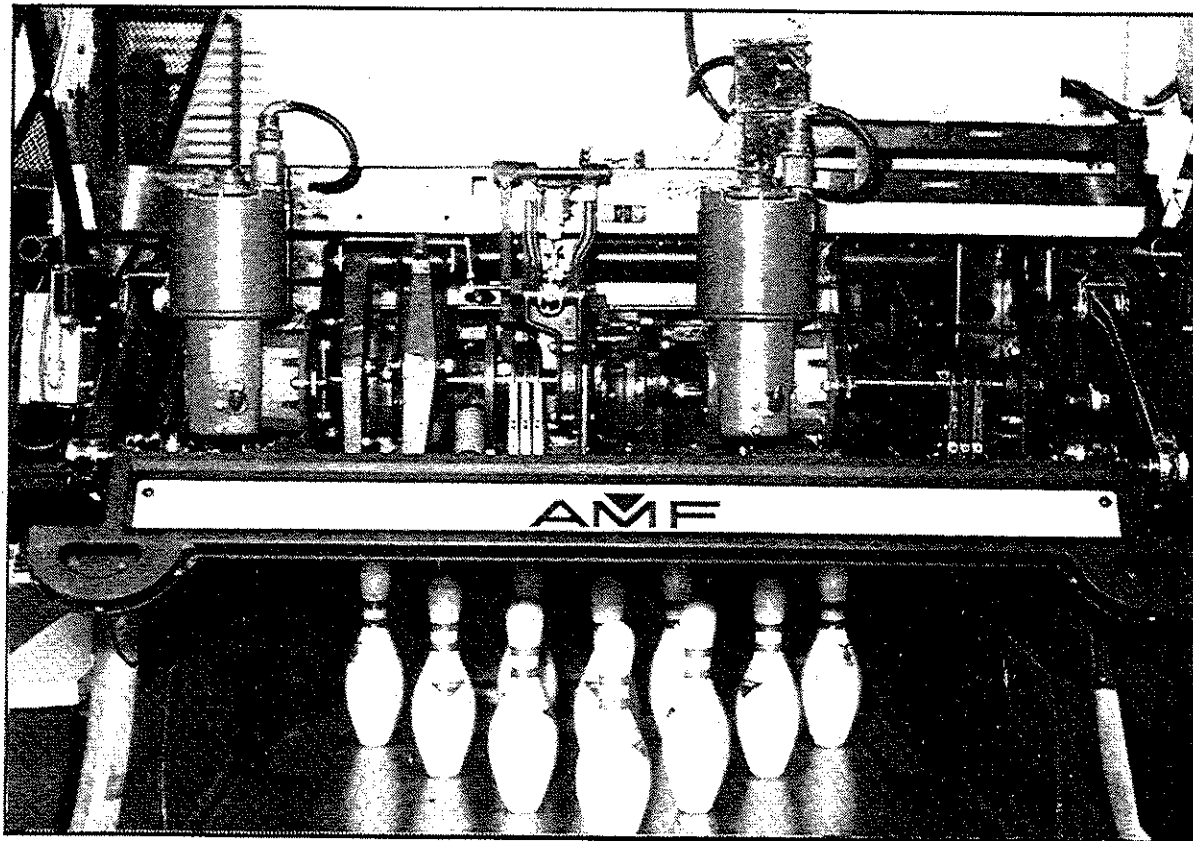


AMF 82-70 MICROPROCESSOR

PINSPOTTER



AMF BOWLING INC. PINSPOTTER TRAINING

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AMF BOWLING INC. PINSPOTTER TRAINING

INTRODUCTION

Power-line voltage has been standardized throughout the country at 115/230 volts, 60 hertz (cycle), A.C (alternating current) single phase. This figure represents nominal voltage and line voltage in a particular area may be between 110 and 125 volts. Voltage average across the country is approximately 117 volts. The domestic 82-70 pinspotter will operate satisfactorily between 104 and 127 volts, 60 cycle. The foreign version 82-70 pinspotter operates on 50 hertz (cycle) current. Either 115 or 230 volts.

Three wires are brought into the bowling centers distribution panel from the power company's transformer. In the three-wire system, the third wire is neutral which is grounded. Voltage between the other two wires is 230, while half of this voltage (115) appears between each of these wires and neutral. In this system, pinspotter load is divided between the two sides of the circuit, half the pinspotters in the center being connected between one wire and the neutral, while the other half connected between the other wire and neutral.

Each pinspotter requires its own 25 AMP circuit breaker. The circuit breaker must be in the "hot" side of the line going to the pinspotter. A 3-conductor power cord (Russell-Stoll plug) connects the 115 volts to the pinspotter. Two of the conductors in this cord carry power, one hot and one neutral or return. 115 volts can be measured between these two conductors. The third conductor is connected to the frame of the machine, while having its other end connected to an earth ground. This grounds the machine preventing the possibility of electrical shock. Power to the machine and machine ground will only be present when the 3-contact polarized plug (Russell-Stoll) is properly seated in its receptacle.

Some of the pinspotters' electrical components require 115 volts A.C. to operate and therefore use the line voltage. Components using 115 volts include the table, sweep and back-end motors, solenoids, pit light and 115 volts is applied to the primary transformer windings in the chassis.

Transformers are used to step-up (increase) line voltage or step-down (decrease) line voltage to the level needed for relays, lights and other pinspotter controlling devices. Not all chassis used on the 82-70 machine supply the same operating voltages. Voltage used to operate and control the pinspotter might include 12, 24 and 115 A.C. (alternating current) and 5, -6.8, 10, 12 and -160 volts D.C. (direct current). The increased or decreased voltage will be present at the transformer secondary winding but will always be A.C. Direct current (D.C.) is required for most solid state devices and is obtained by using a rectifier to convert A.C. to D.C. Capacitor filtering is used to remove any ripple from the rectified voltage.

Control voltage found at various machine switches will vary depending on the type of control chassis being used. There will be 24 volts A.C. at some machine switches while -160 D.C. will appear at others when a five board chassis is on the machine and that will change if a one board replacement (XOP) is used. With an "A" or "B" chassis 24 volts A.C. and 24 volts D.C. will be at the switches. 5 volts D.C. and 24 volts A.C. will be at the switches with an MP chassis. Regardless of the voltage found there, the switches are used to control relays and/or chassis logic to give the machine its sequence of operation.

AMF BOWLING INC. PINSPOTTER TRAINING

The newer 82-70 Pinspotters (after 1979) have a stop switch located to the left of the power plug on the front wireway of the machine. This safety switch, when pressed, turns off the machine circuit breaker on the rear control panel. This disables all control circuitry, however power is still in the pinspotter unless the power plug is removed.

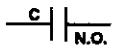



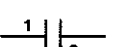
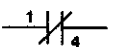
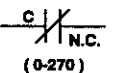
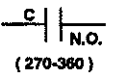




Remove Power Plug When Working On Machine.





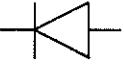

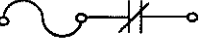

AMF BOWLING INC. PINSPOTTER TRAINING

NOTE: AN "OPEN" SWITCH WILL PASS NO CURRENT (OFF).

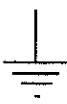

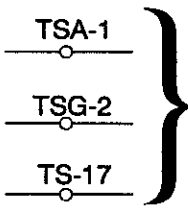
A "CLOSED" SWITCH WILL PASS CURRENT (ON).

- 1.)  SWITCH CONTACTS, OPEN WHEN SWITCH IS NOT ACTUATED.
SWITCH BUTTON IS OUT.
- 2.)  SWITCH CONTACTS, CLOSED WHEN SWITCH IS NOT ACTUATED.
SWITCH BUTTON IS OUT.
- 3.)  SWITCH CONTACTS, CLOSED WHEN SWITCH IS ACTUATED.
SWITCH BUTTON IS IN.
- 4.)  SWITCH CONTACTS, OPEN WHEN SWITCH IS ACTUATED.
SWITCH BUTTON IS IN.
- 5.)  RELAY CONTACT 1 & 3, OPEN, WHEN RELAY IS NOT
ENERGIZED. NO VOLTAGE TO RELAY COIL. CONTACT 1 & 3
WILL CLOSE WHEN VOLTAGE IS APPLIED TO RELAY COIL.
- 6.)  RELAY CONTACT 1 & 4, CLOSED, WHEN RELAY IS NOT
ENERGIZED. NO VOLTAGE TO RELAY COIL. CONTACT 1 & 4
WILL OPEN WHEN VOLTAGE IS APPLIED TO RELAY COIL.
- 7.)  SWITCH CONTACTS, CLOSED WHILE CONTROLLING CAM IS
BETWEEN 0 AND 270 DEGREES. DEGREE MARKINGS ALWAYS
INDICATE WHEN THE SWITCH WILL BE ON.
- 8.)  SWITCH CONTACTS, CLOSED WHILE CONTROLLING CAM IS
BETWEEN 270 AND 360 DEGREES. DEGREE MARKINGS ALWAYS
INDICATE WHEN THE SWITCH WILL BE ON.
- 9.)  TWO WIRES CROSSING BUT NO ELECTRICAL CONNECTION
- 10.)  TWO WIRES CROSSING AND HAVING AN ELECTRICAL
CONNECTION

AMF BOWLING INC. **PINSPOTTER TRAINING**

- | | | |
|------|--|--|
| 11.) |  T1
PRI. | TRANSFORMER PRIMARY (MAIN WINDINGS). LINE
VOLTAGE PRESENT |
| 12.) |  T1
SEC. | TRANSFORMER SECONDARY. OPERATING VOLTAGE
PRESENT |
| 13.) |  M | RELAY COIL |
| 14.) |  S | SOLENOID WINDINGS |
| 15.) |  | DIODE OR RECTIFIER |
| 16.) |  F | FUSE |
| 17.) |  | OVERLOAD OR CIRCUIT BREAKER OR KLIXON |
| 18.) |  | CAPACITOR |

AMF BOWLING INC. PINSPOTTER TRAINING

- | | | |
|------|---|--|
| 19.) |  | GROUND |
| 20.) |  | RESISTOR |
| 21.) |  | JUNCTION TERMINAL FOR TWO OR MORE WIRES.
(LOCATED IN WIREWAY UNDER CHASSIS) |
| 22.) | C-1 | UPPER PLUG ON LEFT SIDE OF CHASSIS. (AS VIEWED FROM FRONT OF MACHINE) (110 VOLT) |
| 23.) | C2A | LOWER PLUG ON LEFT SIDE OF CHASSIS. (AS VIEWED FROM FRONT OF MACHINE) |
| 24.) | PM | FRONT PLUG ON RIGHT SIDE OF CHASSIS. (AS VIEWED FROM FRONT OF MACHINE) (WIRES FOR MASK) |
| 25.) | BP | REAR PLUG ON RIGHT SIDE OF CHASSIS. (AS VIEWED FROM FRONT OF MACHINE) (SPAREMAKER 6700 OR 7750 CHASSIS) |
| 26.) | APS | REAR PLUG ON RIGHT SIDE OF CHASSIS. (AS VIEWED FROM FRONT OF MACHINE) (FOR AUTOMATIC SCORING 9800 & 9900 CHASIS) |
| 27.) | C1 - 16 Z | PIN IN C1 PLUG (ROW 1, PIN 6, LABELED Z) |
| 28.) | C2A-312 BB | PIN IN C2A PLUG (ROW 3, PIN 12, LABELED BB) |

AMF BOWLING INC. PINSPOTTER TRAINING

- 29.) TAP - 15 P PIN IN TABLE CABLE PLUG (ROW 1, PIN 5, LABELED P)
- 30.) PC1 - 15 PRINTED CIRCUIT BOARD #1, TERMINAL 15
- 31.) P-1 A-101 M. P. CIRCUIT BOARD PLUG #1, TERMINAL A-101
- 32.) TMP - X TABLE MOTOR PLUG, TERMINAL X
- 33.) SMP - Y SWEEP MOTOR PLUG, TERMINAL Y
- 34.) BEMP - 2 BACK END MOTOR PLUG, TERMINAL 2
- 35.) A & MC - 11A A & MC PLUG, (ROW 1, TERMINAL 1, LABELED A)
- 36.) T BA - 3 A & MC BOX (TERMINAL STRIP A, TERMINAL 3)
(LOCATED ON CURTAIN WALL)

AMF BOWLING INC. PINSPOッター TRAINING

82-70 WITH 9800 CHASSIS

RELAYS

M	MASTER	CONTROLS POWER TO THE TI TRANSFORMER, HALO LIGHT, AND PIT LIGHT.
M2	SWEEP REVERSE	CAUSES SWEEP TO RUN IN REVERSE WITH AUTOMATIC SCORING.
BE	BACK END	CONTROLS BACK END DRIVE MOTOR.
S	SWEEP	CONTROLS SWEEP MOTOR.
T	TABLE	CONTROLS TABLE MOTOR.
SP	SPOT	CONTROLS SPOTTING ACTION OF MACHINE BY SWITCHING SPOT SOLENOID.
MI		TURNS ON BALL RETURN.
KLIXON		DEVICE THAT PROTECTS CIRCUITS FROM OVERLOADS.

TRANSFORMERS

TI		SUPPLIES VARIOUS VOLTAGES TO THE CHASSIS FOR OPERATIONAL PURPOSES.
T2		SUPPLIES 24 VOLTS AC TO THE MANAGER'S CONTROL CIRCUIT.
T3		SUPPLIES 24 VOLTS FOR CIRCUIT BOARD.
T4		SUPPLIES 24 VOLTS FOR BE RELAY AND MI RELAY.

CAMS

TA1	TABLE	RUNS TABLE UP AND STOPS TABLE AT ZERO. (355°)
TA2	TABLE	STARTS SWEEP RUN THROUGH, AND STARTS SWEEP UP AT END OF CYCLE.
TB	TABLE	CONTROLS TABLE-SWEEP INTERLOCK.
SA	SWEEP	STOPS SWEEP AT 2ND GUARD, RUNS SWEEP UP AND STOPS SWEEP AT ZERO. (360°)
SB	SWEEP	STOPS SWEEP AT FIRST GUARD (66°) STARTS TABLE SPOTTING.
SC	SWEEP	CONTROLS TABLE-SWEEP INTERLOCK.

AMF BOWLING INC. PINSPOTTER TRAINING

82-70 WITH 6700 CHASSIS (5 BOARD)

RELAYS

M	MASTER	CONTROLS POWER TO M2, HALOLIGHT AND PITLIGHT
M2	TIME DELAY	CONTROLS POWER TO T1 AND KEEPS BACK END MOTOR AND BALL RETURN RUNNING FOR 30 SECONDS WHEN MACHINE IS TURNED OFF
SP	SPOT	CONTROLS SPOTTING ACTION OF MACHINE BY SWITCHING SPOT SOLENOID. (AND RESPOT SOLENOID)
BE	BACKEND	CONTROLS BACKEND MOTOR
S	SWEEP	CONTROLS SWEEP MOTOR
T	TABLE	CONTROLS TABLE MOTOR
KLIXON		DEVICE THAT PROTECTS CIRCUITS FROM OVERLOADS
H		THERMAL UNIT FOR TURNING OFF M2
KX		PIN PRESENCE RELAY FOR SPAREMAKER

TRANSFORMERS

T1		SUPPLIES VARIOUS VOLTAGES TO CHASSIS FOR OPERATIONAL PURPOSES
T2		SUPPLIES 24 VOLTS AC TO THE MANAGERS CONTROL CIRCUIT

CAMS

TA1	TABLE	RUNS TABLE UP AND STOPS TABLE AT ZERO (355°) STARTS SWEEP UP AT END OF CYCLE
TA2	TABLE	STARTS SWEEP RUN THROUGH
TB	TABLE	CONTROLS TABLE-SWEEP INTERLOCK
SA	SWEEP	STOPS SWEEP AT 2ND GUARD, RUNS SWEEP UP AND STOPS SWEEP AT ZERO (360°).
SB	SWEEP	STOPS SWEEP AT THE FIRST GUARD. (66°) STARTS TABLE SPOTTING
SC	SWEEP	CONTROLS TABLE-SWEEP INTERLOCK.

AMF BOWLING INC. PINSPOTTER TRAINING

SWITCHES

MGR.	CONTROL	Turns machine on (Bowl or Instructomat).
SS	START SWITCH	Cycles machine when ball hits cushion.
OS	OFF SPOT	Signals chassis when table contacts off spot pin.
GS	GRIPPER SWITCH	Signals chassis when pin or pins are present on pin deck as table picks up standing pins.
GP	GRIPPER PROTECTION SWITCH	Protects table fingers from damage. (won't let table feel for pins when off).
CB	CIRCUIT BREAKER	Protects machine from overload or short circuit.
T	TABLE SWITCH	Manual switch controlling table relay.
S	SWEEP SWITCH	Manual switch controlling sweep relay.
BS	BIN SWITCH	Signals chassis when the number nine pin is present in bin.
SWS	SWEEP RUN SWITCH	Runs sweep from rear of machine. Manual.
SWSR	SWEEP REVERSE	Runs sweep in reverse. Manual. (used with SWS)
PBZ	ZERO SWITCH	Controls machine first ball or second ball status. (used to restart MP chassis "MANUAL INTERVENTION")
PBC	CYCLE SWITCH	Cycles machine from rear.
10TH FRAME	SWITCH	Cycles machine from approach. Bowler controlled.

MOTORS

BE	DRIVES PIN ELEVATOR, BALL ELEVATOR, PITVEYOR (CARPET), DISTRIBUTOR, PADDLE ASSY.
T	DRIVES TABLE.
S	DRIVES SWEEP.

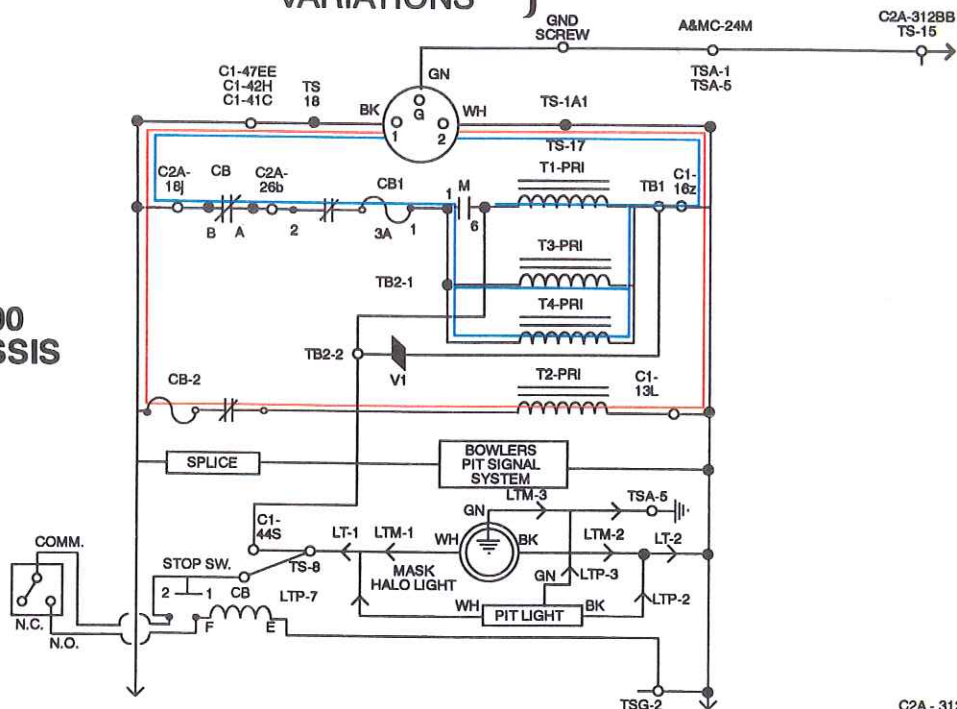
SOLENOIDS

SPOT SOLENOID	Controls table when spotting pins. (latches spot lever, removes shuttle stop, unlocks table drive)
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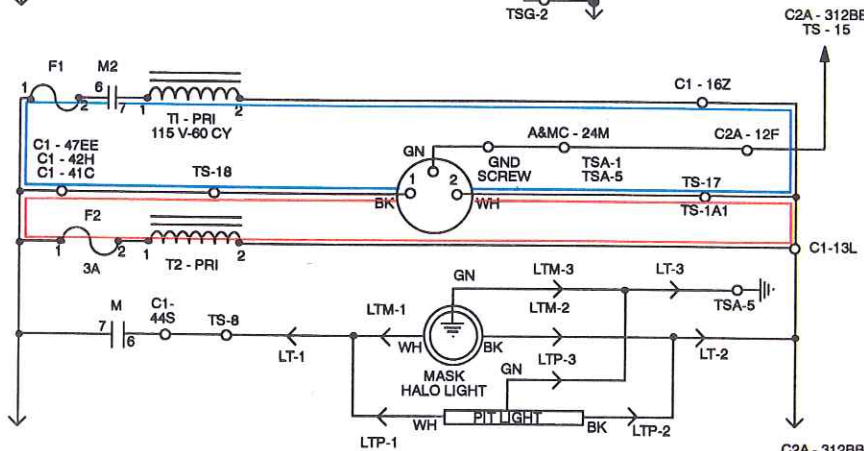
AMF BOWLING INC. PINSPOTTER TRAINING

POWER CIRCUIT } 115 VOLTS VARIATIONS

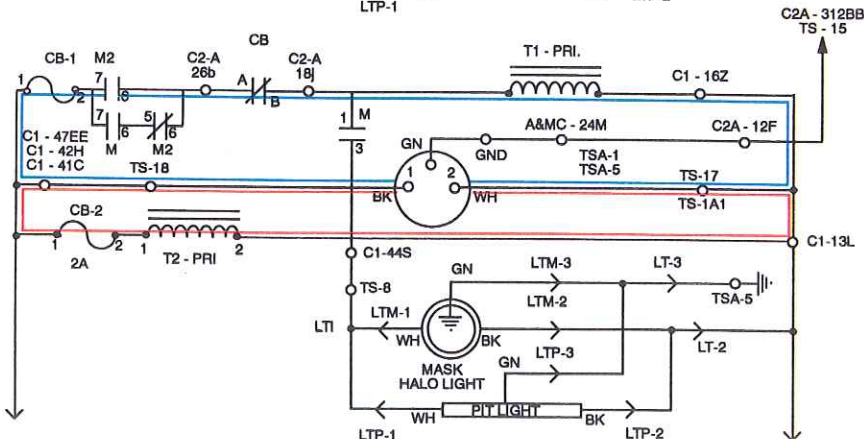
9800 CHASSIS



6700 CHASSIS



7750 CHASSIS



RED-MANAGERS CONTROL PRIMARY CIRCUIT
BLUE - CONTROL AND OPERATING VOLTAGE PRIMARY CIRCUITS

AMF BOWLING INC. PINSPOTTER TRAINING

MANAGERS CONTROL CIRCUIT

BOWL

When the managers control switch is moved into the bowl position, 24 volts A.C. are sent to one side of the M relay coil. This voltage is available at the secondary winding of the T-2 transformer. The circuit consists of the T-2 transformer secondary winding, managers control switch, masking unit switch, and with some chassis, CB contacts A and B to the coil of the M relay. The other side of the M relay coil is connected directly to the other side of the transformer winding. M now becomes energized and its normally open contacts close, completing the necessary circuits to turn the machine on.

INSTRUCT-O-MAT

When the managers control switch is moved into the Instruct-O-Mat position, the circuit is completed in the same way as it was in the bowl position. In addition, the managers control circuit is grounded. This ground prevents chassis logic from running the sweep down. The machine will not go through its cycles until the managers switch is returned to the bowl position. However, the back end motor will run normally with the managers switch in the Instruct-O-Mat (practice play) position.

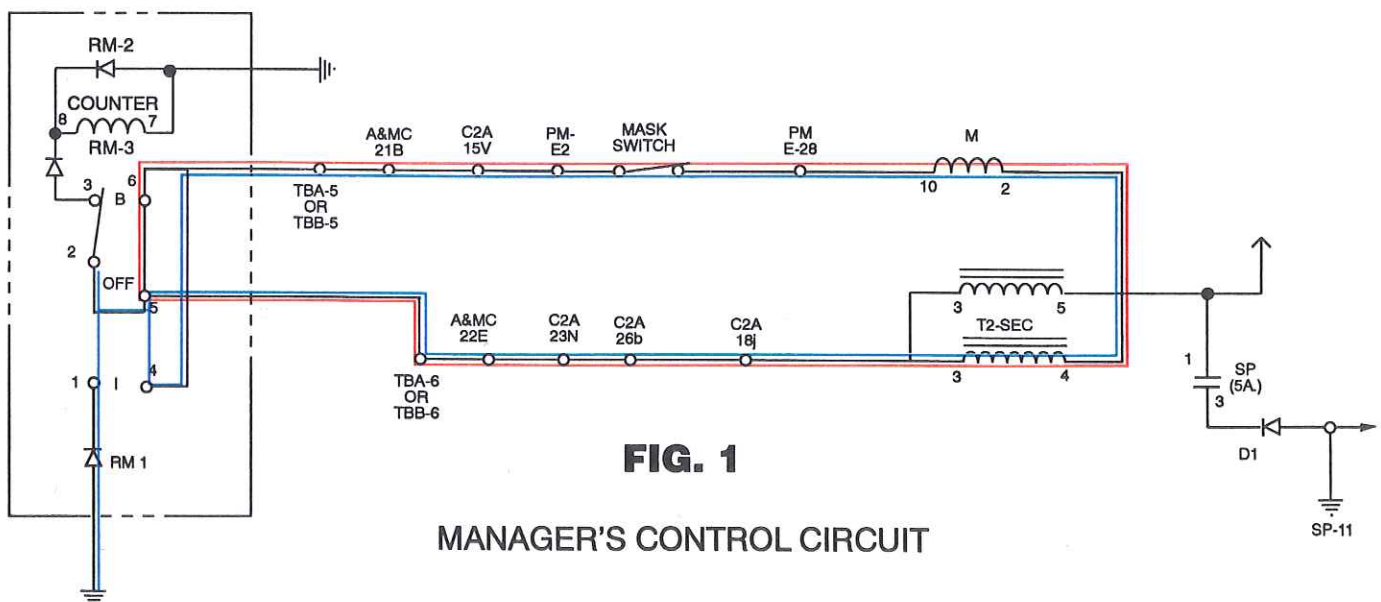


FIG. 1

MANAGER'S CONTROL CIRCUIT

RED - BOWL

BLUE - INSTRUCT-O-MAT

AMF BOWLING INC. PINSPOTTER TRAINING

INTERLOCK

In order to energize the table or sweep motor relay, the 24 volt controlling voltage must pass through the table sweep interlock circuit consisting of TB (table cam switch) and SC (sweep cam switch) contacts wired in parallel. One of these switches, either TB or SC, must be on to run the table and sweep motors. If the table and sweep are on a collision course, both TB and SC will turn off. This removes the controlling voltage from both relays, stopping the table and sweep motors. Table and sweep run switches are inoperative in an interlock condition. Cranking the table or sweep motor to clear the interference zone is the safest procedure to follow.

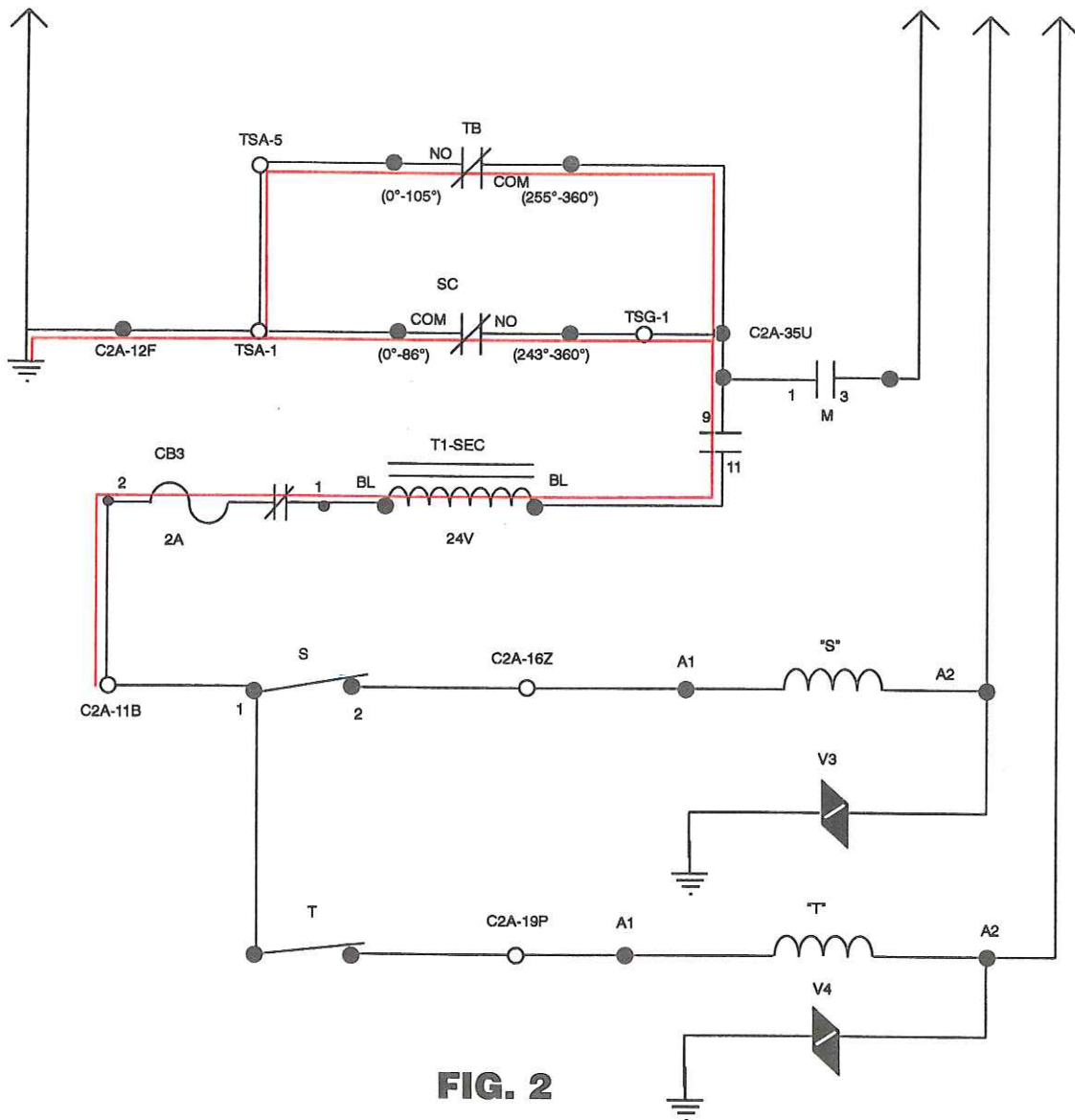


FIG. 2

INTERLOCK CIRCUIT

AMF BOWLING INC. PINSPOTTER TRAINING

TABLE AND SWEEP CONTROL RELAY OPERATION

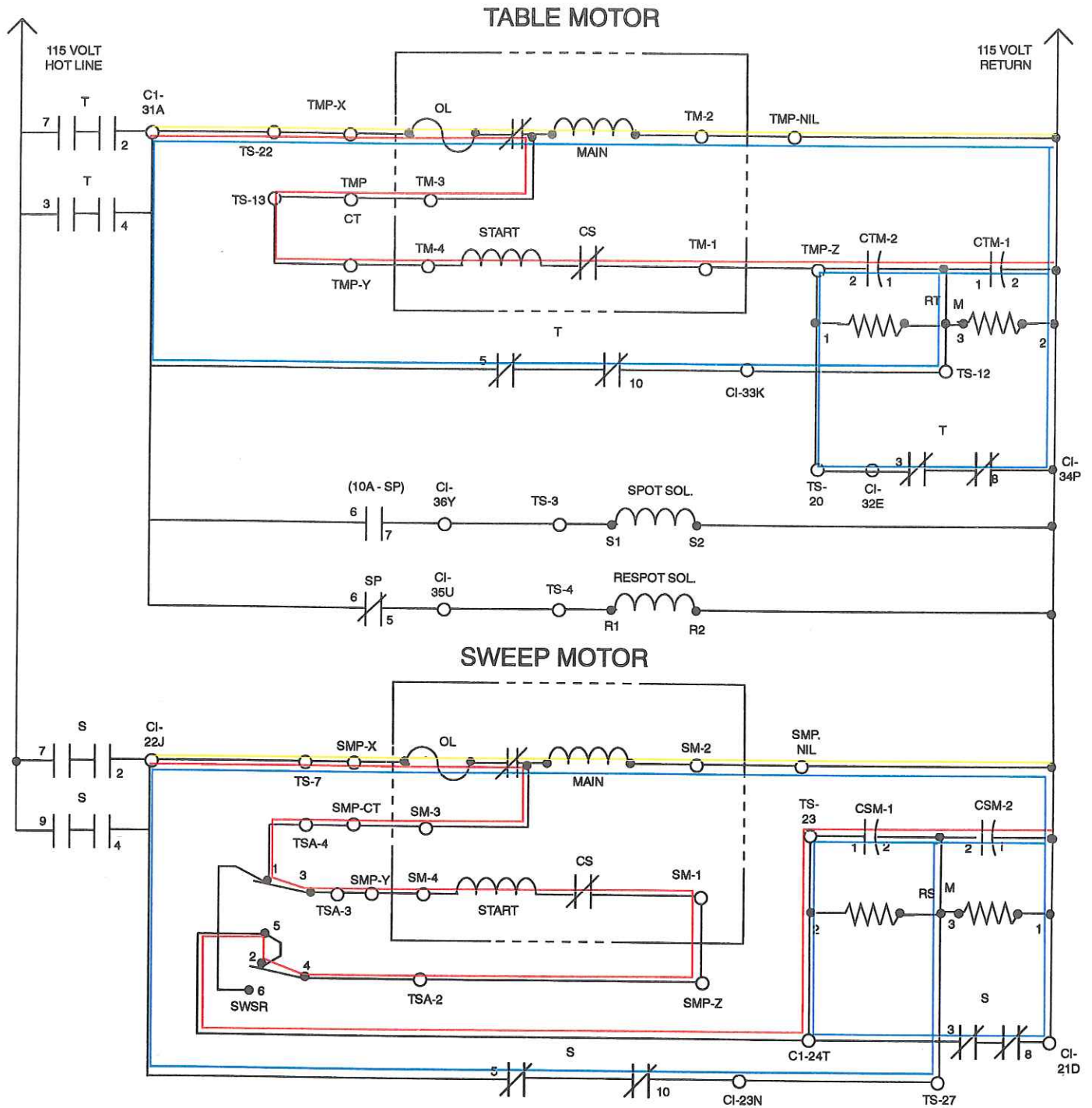
MOTOR RUNNING

On control relays T and S, two sets of contacts (normally open (N.O.) and normally closed (N.C.)) are used. For example, when S or T is energized, the normally open (N.O.) contacts close and power is sent to the main winding and to the starting winding through the capacitors and centrifugal switch starting the motor. When the motor gets up to speed, the centrifugal switch opens, removing the start winding, and the motor continues to run on the main winding. If the capacitors are in a charged state at this time, resistors connected in parallel with the capacitors will discharge them. (Fig. 3)

MOTOR BRAKING

When T or S is de-energized, the normally closed (N.C.) contacts close, connecting the capacitors across the main winding. When power is cut off to the motor, the armature still turning acts as a generator and induces a voltage in the main winding. The capacitors connected in parallel with the main winding provide a current path for the generated voltage, producing a magnetic field. This magnetic field polarity opposes the rotating armatures magnetic field which effectively slows down the motor. The motor slowing down closes the centrifugal switch connecting the start winding across the main winding, producing additional field strength and stopping the motor. When the armature has stopped turning, there is no more braking. Friction in the motor's gearcase will hold the table and sweep at their zero positions. Some motors incorporate friction braking in addition to regenerative braking to stop motors and hold them at zero.

AMF BOWLING INC. PINSPOTTER TRAINING



MOTOR CIRCUITS

FIG. 3

YELLOW RUN
RED START
BLUE BREAKING

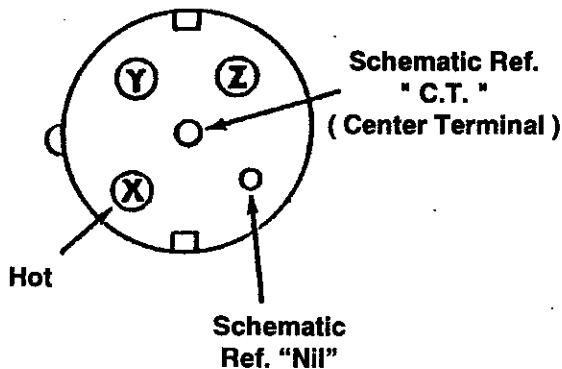
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TESTING MOTOR PLUGS

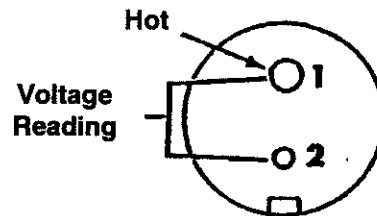
A voltmeter or neon voltage tester can be used to check for voltage at the motor plugs. Voltage will only be present at the plugs when the machine is on and the appropriate motor relay in the chassis is energized. With the motor cable disconnected from the motor, look at the mating surface of the plug. Table and sweep motor plugs are viewed with the index pin at nine o'clock (Fig. 4.) Plug terminals can now be identified. The back end motor plug only has two terminals. Voltage must be present between these two terminals when the back end relay is energized. Voltage must be present between terminals X and NIL and between terminals X and Z of the table and sweep motor plugs. In addition, there must be continuity between terminals Y and C.T. Power must be removed from the pinspotter before making continuity tests. If voltage or continuity is not present at the proper test points the motor cable plug can be disassembled and connections inspected. Wires in the motor cable can be checked for continuity from the motor plug to the terminal strip in the wireway. The C-I plug is another likely component to suspect when motors fail to run or drift. Look for pins pushed in, burned or corroded. Terminal strip and C-I plug numbers can be found on the 6730, 9807 or 5500 drawings. If voltage and continuity are present at all the proper test points, but the motor fails to run, the motor itself may be at fault or a motor capacitor may have failed. (See section on capacitor testing.)

TESTING MOTOR PLUGS (Plug Viewed From Mating Surface)

**Sweep-Table
Cable Plug**



B.E. Plug



**Voltage Tests
With Power On**

Between			
X	and	Nil	} Sweep & Table)
X	and	Z	
X	and	Y	(Sweep Reverse)
1	and	2	(BE Plug)

Fig. 4

**Continuity Tests
With Power Off**

Between			
(Breaking) X	and	Z	(300 OHMS)
(Run) Y	and	C.T.	
(Breaking) Z	and	NIL	

AMF BOWLING INC. PINSPOTTER TRAINING

USING A VOLTAGE TESTER

NOTE:

All power to the machine must be turned on. Do not touch exposed metal on test leads.

CAUTION Should be used when testing live circuits.

To check for voltage at the motor plug, the machine must be on and the motor relay must also be on. Insert one test lead into each hole of the plug. (Fig. 5) If the neon lamp glows the circuit is "hot"/ If the neon lamp does not glow the circuit is open. The tester test leads do not have polarity — either lead can be inserted into either hole.

TESTING MOTOR PLUGS WITH A VOLTAGE TESTER

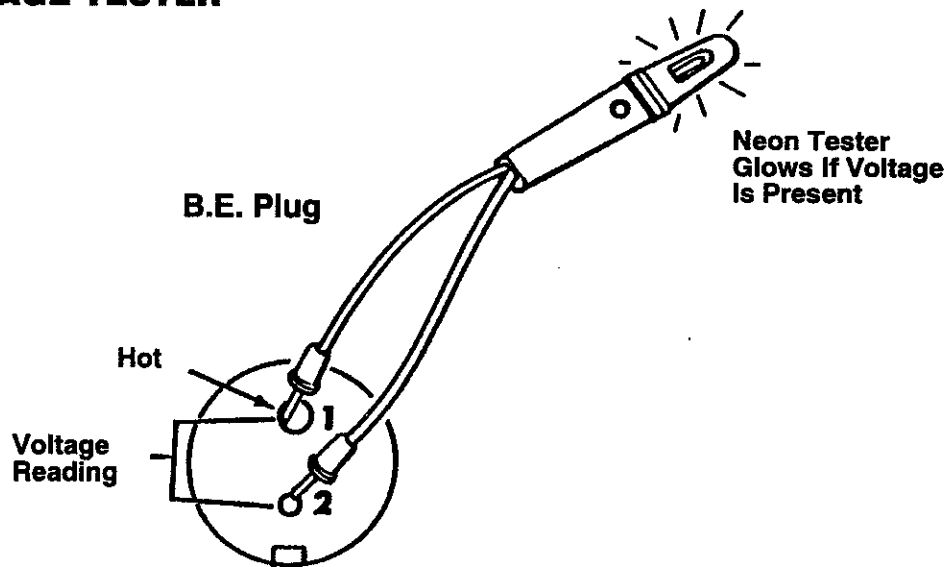


Fig. 5

AMF BOWLING INC. PINSPOTTER TRAINING

MOTOR CAPACITORS

Two capacitors are used in the starting and electrical breaking circuits of the table and sweep motors. Only one capacitor is used in the starting circuit of the back end motor. The back end motor does not have a breaking circuit. Occasionally a capacitor may fail, resulting in an inoperative motor. If a capacitor opens internally, the motor will not start. The motor will hum, get hot and the klixon will trip. If a capacitor shorts internally, the motor will run but may start with a strange sound. With a shorted capacitor, electrical braking will not work and the motor will coast (drift) to a stop.

Burnt or loose connections may cause coasting or failure to run and the trouble could be intermittent. Trouble areas include relay contacts, CI plug, motor plug and the centrifugal switch in the motor. If the centrifugal switch is open, the motor will not start. The motor just hums, gets hot and trips the klixon. If the centrifugal switch fails to open when the motor runs, once again the motor gets hot. Also one or both capacitors may explode.

An ohmmeter can be used to determine if a capacitor is good, open or shorted. Capacitors store an electrical charge and could be in a charged state in the machine. Before handling a capacitor, remove the power plug (Russell Stoll), lift the cover from the wireway behind the table motor (Fig. 6) and short across the terminals of the capacitors. An insulated screwdriver can be used to do this. If a capacitor is charged, this will discharge it. However, it is unlikely you will find a charged capacitor in the pinspotter. The capacitors are identified as CTM for capacitor table motor and CSM for capacitor sweep motor. The back end motor capacitor is mounted on the BE motor stator.

To test a capacitor, after making certain it is discharged, remove the connections from one capacitor terminal (Fig. 7). Using the highest resistance scale of an ohmmeter, connect the meter leads to the two capacitor terminals and leave them connected of approximately one minute. The battery in the meter will charge the capacitor. A resistance reading of 50,000 ohms or more indicates a good capacitor. If the meter reads zero ohms, a shorted capacitor is indicated. No reading at all (infinite) indicates an open capacitor. After testing a capacitor it should be discharged by shorting across its terminals. When replacing a capacitor, it should be installed with the vent plug at the top (12 o'clock position). Capacitor terminal screws must be tight. The resistors to the right of the capacitors in the wireway are used to discharge the capacitors.

AMF BOWLING INC. PINSPOTTER TRAINING

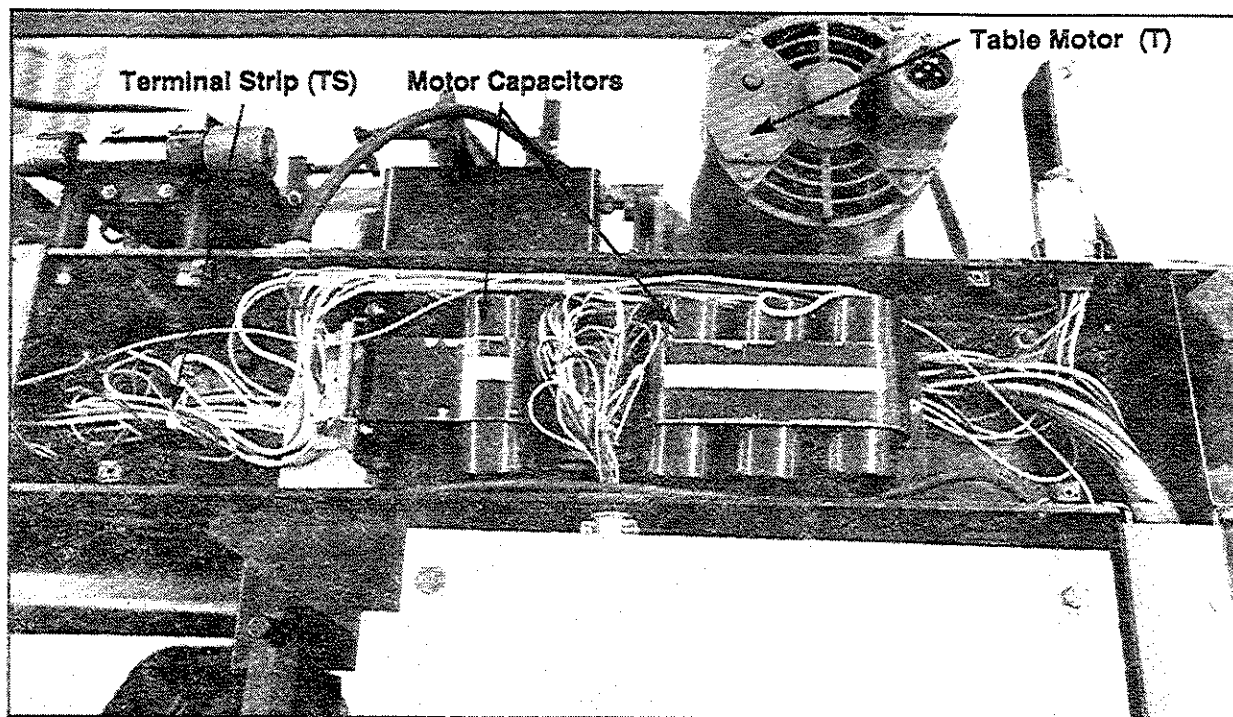


Fig. 6

MOTOR CAPACITORS

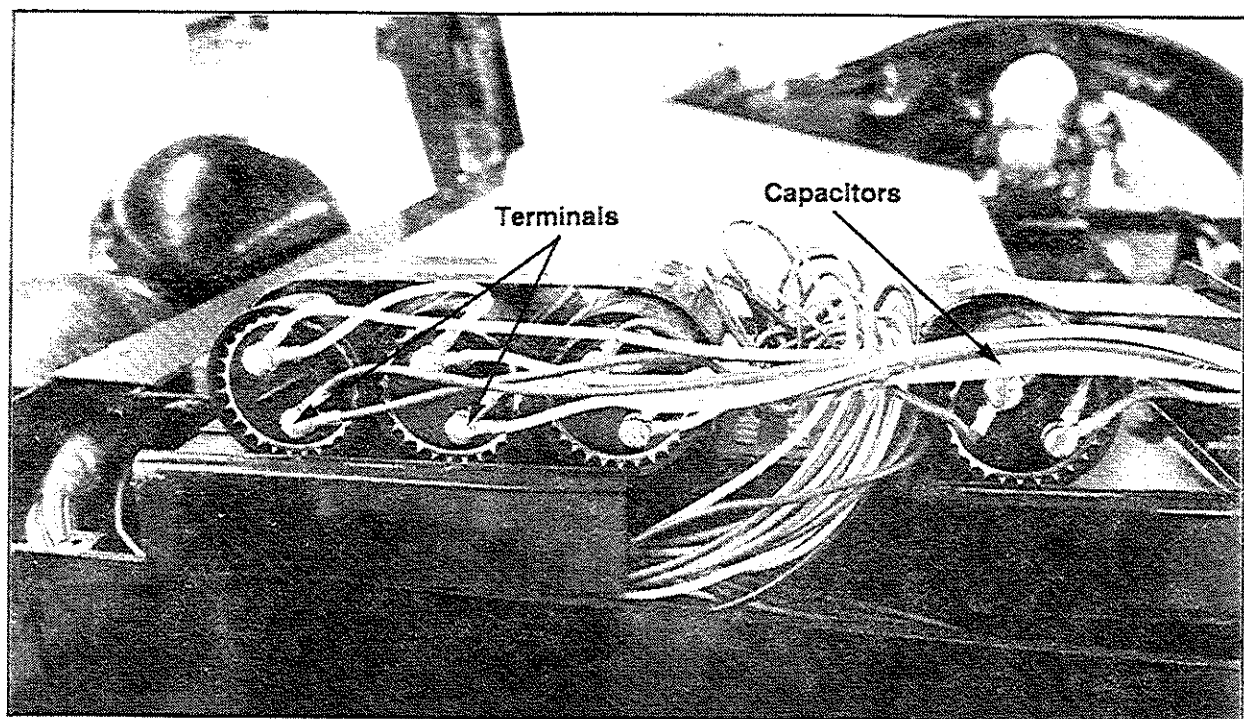


Fig. 7

AMF BOWLING INC. PINSPOTTER TRAINING

TROUBLE SHOOTING PROCEDURES FOR WIRING AND SWITCHES

Wires are used to connect individual circuit components, such as switches, lights, motors, and control chassis. Wire used in the Pinspotter is called stranded wire. It is made up of individual strands of wire, twisted together in a bundle and wrapped in insulation. Wires sometimes break at stress points where they are twisted, subjected to continual bending, or just have normal use over a long period of time. Normally, wire has very low resistance. When wires break or "open", their resistance is very high or "infinite", and no current will flow. An open circuit test would indicate a broken wire. In addition to an "open" wire causing trouble, wires "shorted" to other wires or a wire "grounded" to the machine frame will cause trouble. Each condition, "open", "shorted", or "grounded" requires a different test procedure in order to isolate the problem. Testing for continuity, ("open" circuit test) is probably the most common test made. This test can be used to check wires, switches, fuses, bulbs, relay contacts and many other electrical devices. Any of the various types of continuity testers available can be used to make these tests. However, continuity testers supply their own voltage to the circuit or device being tested. **Make certain that the device or wire being tested is unplugged so that no voltage exists in the circuit. Electricity can kill.**

When a machine malfunctions and the cause is not obvious, the machine control chassis can be replaced with a chassis known to be good, thus eliminating the chassis as a possible cause of the problem. If changing the chassis cures the problem, we would then repair the chassis. However, if the problem remains, we would trouble shoot the machine wiring and switches. What the machine does or does not do dictates what circuit a problem is in and what type of test should be used.

EXAMPLE:

If a pindication light never comes on, we would look for an open wire.

If a pindication light always comes on, we would look for a ground or short.

USING A CONTINUITY TESTER

A simple flashlight type continuity tester is easy to use. It consists of a flashlight with plug in test leads. The test leads must be shorted together to make the light come on. To use the continuity tester, turn it on and touch the leads together. The light should come on. Always perform this preliminary step before using any continuity tester. It verifies that the tester is working.

AMF BOWLING INC. PINSPOTTER TRAINING

Open Circuit Test

To check continuity of a wire, switch, fuse or relay contact, remove it from the circuit by disconnecting one end of the wire or one wire from the switch. Connect one test lead to one end of the suspected wire, and the remaining test lead to the other end of the disconnected wire. If the wire is good, the tester will light. With an open wire, the tester will not light. When testing a switch, it should be turned on and off several times to detect intermittent closings. (See Fig.8)

Short Circuit Test

To check for a short between two wires, disconnect both ends of the suspected wires. Connect one test lead to each wire. If the tester lights, the wires are shorted to one another. If the tester does not light, the wires are okay.

Ground Test

If a grounded wire is suspected, disconnect both ends of the wire, connect one test lead to the frame of the machine. This connection should be made to unpainted metal. The other test lead connects to the wire being tested. If the wire is grounded, the tester will light.

TESTING MICRO SWITCHES USING CONTINUITY TESTER

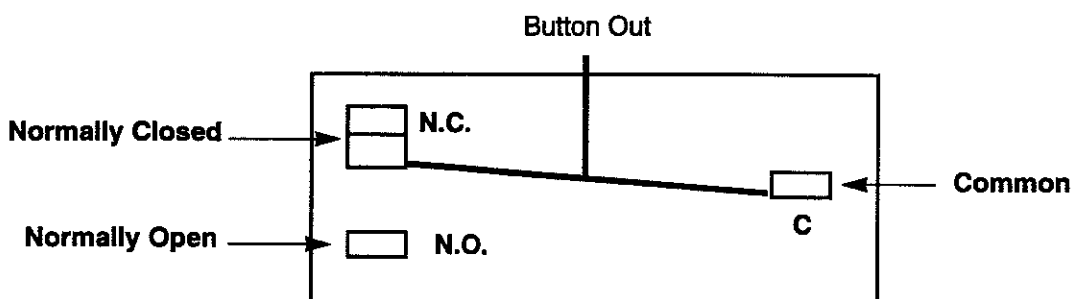


Fig. 8

NOTE: To make this test on machine remove wire connected to common terminal of switch.

1. Connect continuity tester across common (C) and normally closed (N.C.) contacts of switch. Tester should light. Depress button on switch several times to check mechanical action. Tester light should go on and off.
2. Connect continuity tester across common (C) and normally open (N.O.) contacts of switch. Tester should not light. Depress button on switch several times. Tester light should go on and off.

AMF BOWLING INC. PINSPOTTER TRAINING

HOW TO LOCATE BREAKS IN WIRES

If you have a wire that is broken (no continuity) a continuity tester will tell you the wire is broken, but not where the break is. Here is one method that can be used to locate the break. The first test would be over the entire length of the wire indicating a break (no continuity). An extension wire can be used if the test leads are not long enough. Next, test from one end of the wire to a point somewhere near the center. A pin can be used to pierce the insulation so contact is made with the wire. If there is continuity perform the same test on the remaining length of the wire. If there is no continuity, take half the length of the wire and repeat the test. Continue to use this half the length of previous test approach until the break is found (see Fig. 9)

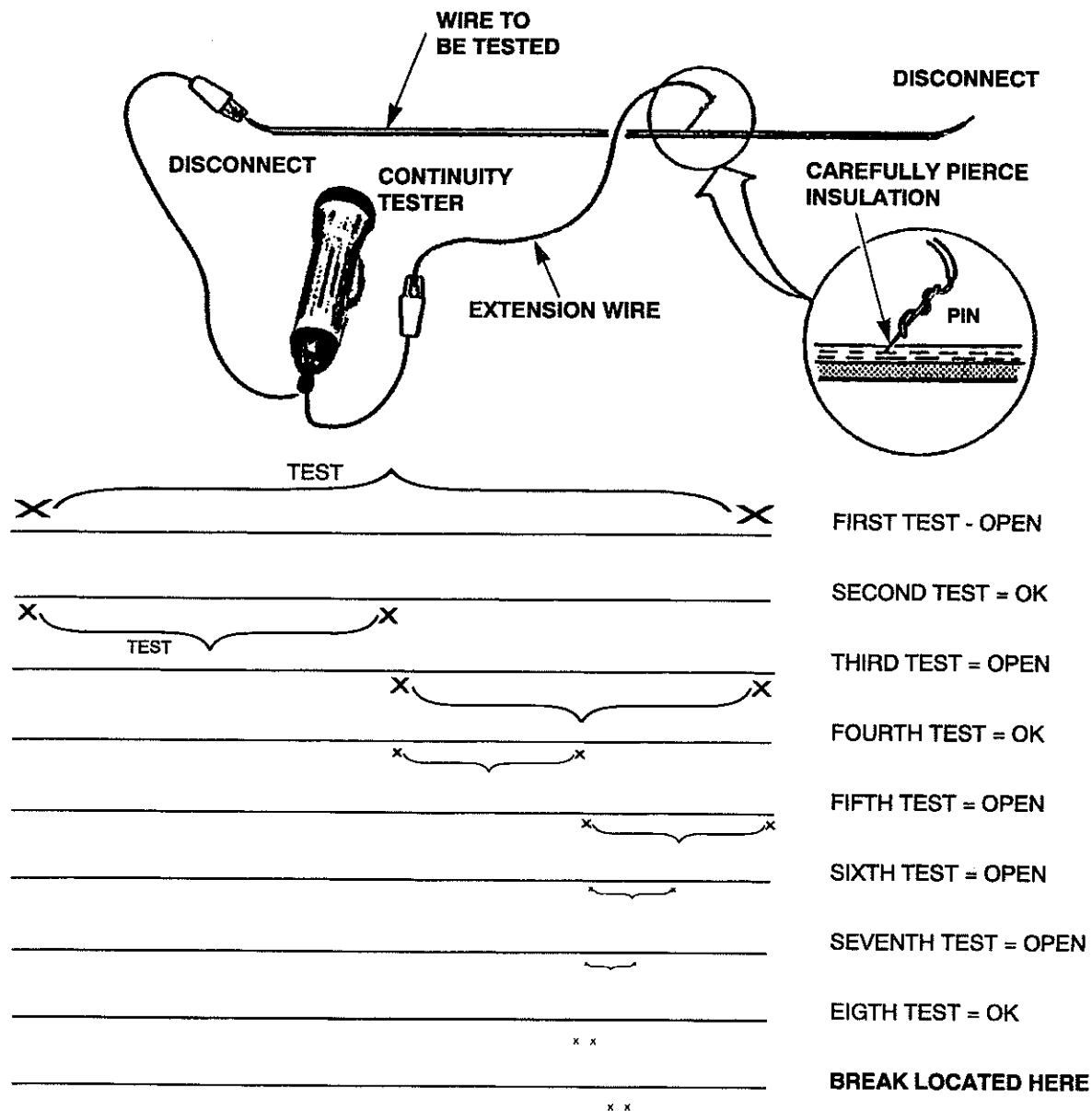


FIG. 9

AMF BOWLING INC. PINSPOTTER TRAINING

PLUG TERMINAL IDENTIFICATION

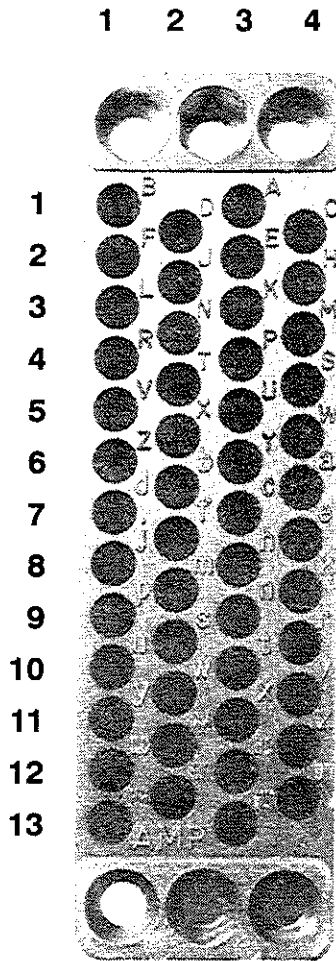


Fig. 11

Plug Terminal Numbers

Plug viewed from mating surface with the 13 terminal row to your left.

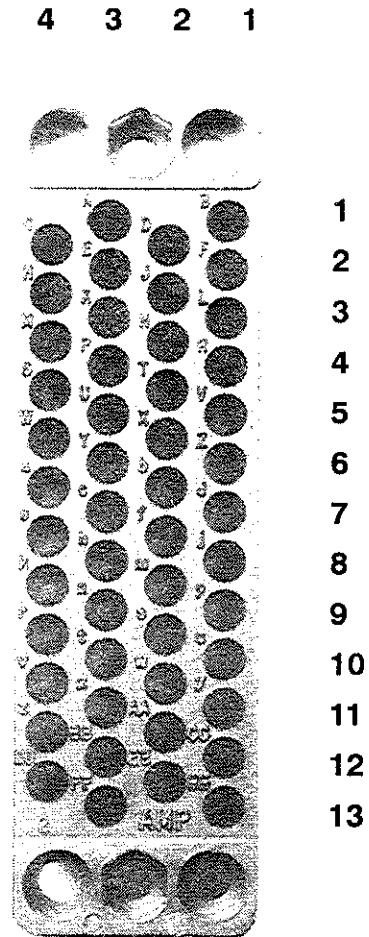


Fig. 12

Receptacle Terminal Numbers

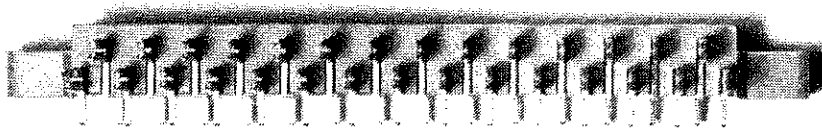
Plug viewed from mating surface with the 13 terminal row to your right.

With the mating surface of the plug held vertically and facing you, and with the outside row of 13 terminals to your left, the left column of 13 terminals is column 1 (Fig. 11). The next column to the right, having 12 terminals, is column 2, the next is column 3 and the right-hand column, having 12 terminals, is column 4. Starting at the top of the plug, the first pin in a column is pin 1. The next one below it is pin 2, the next is pin 3, etc. The last pin in column 1 is pin 13. The last pin in column 2 is pin 12. The drawings are marked to indicate what plug is being used, e.g., C1, C2A, table or A&MC. Numbers are used to indicate the column and pin. The first digit of the number indicates the column, the second digit(s) indicates the pin. Example: C2A 3 5 - this is the C2A plug, column 3, 5th pin down. C2A 311 would mean the C2A plug, column 3 11th pin down. Letters of the alphabet are also used at each terminal for their identification. Example: C2A 11 B. The exact same method of numbering is incorporated for the receptacle, except the receptacle columns are numbered from right to left (Fig. 12). All AMP type "M" plugs and receptacles used on the pinspotter are read in a similar fashion.

AMF BOWLING INC. PINSPOTTER TRAINING

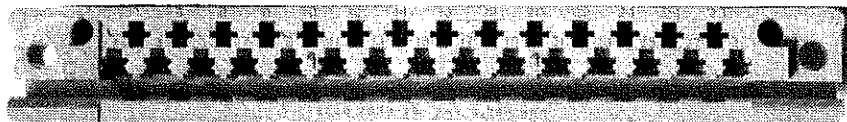
MASK PLUG TERMINAL IDENTIFICATION

RECEPTACLE USED ON 6700 ELCO CHASSIS



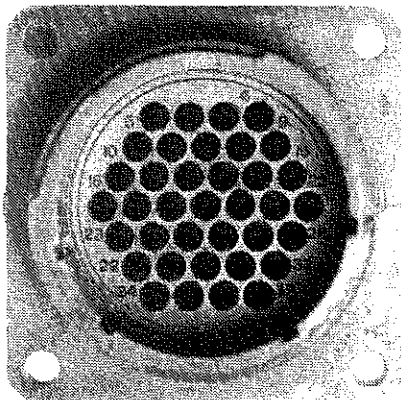
PM (plug Mask) and BPP (Ball Path Plug) Receptacle viewed from mating surface with the row of odd numbered terminals toward the bottom of the chassis.

PLUG USED ON 6700 ELCO CHASSIS (EARLY 5 BOARD)



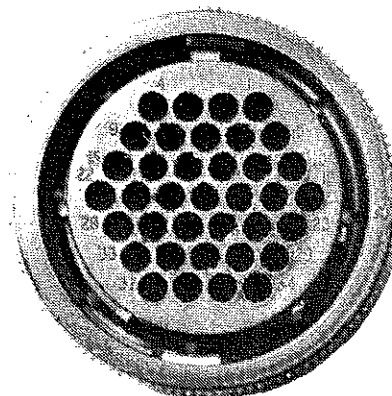
PM (plug Mask) and BPP (Ball Path Plug) Receptacle viewed from mating surface with plug held horizontally with the guide slot down. Mask plug numbers on the drawings are called out as PM E-1. Meaning Plug Mask-Elco-Pin Number 1.

RECEPTACLE USED ON C-23,(7750) 9800 AND 9900 CHASSIS

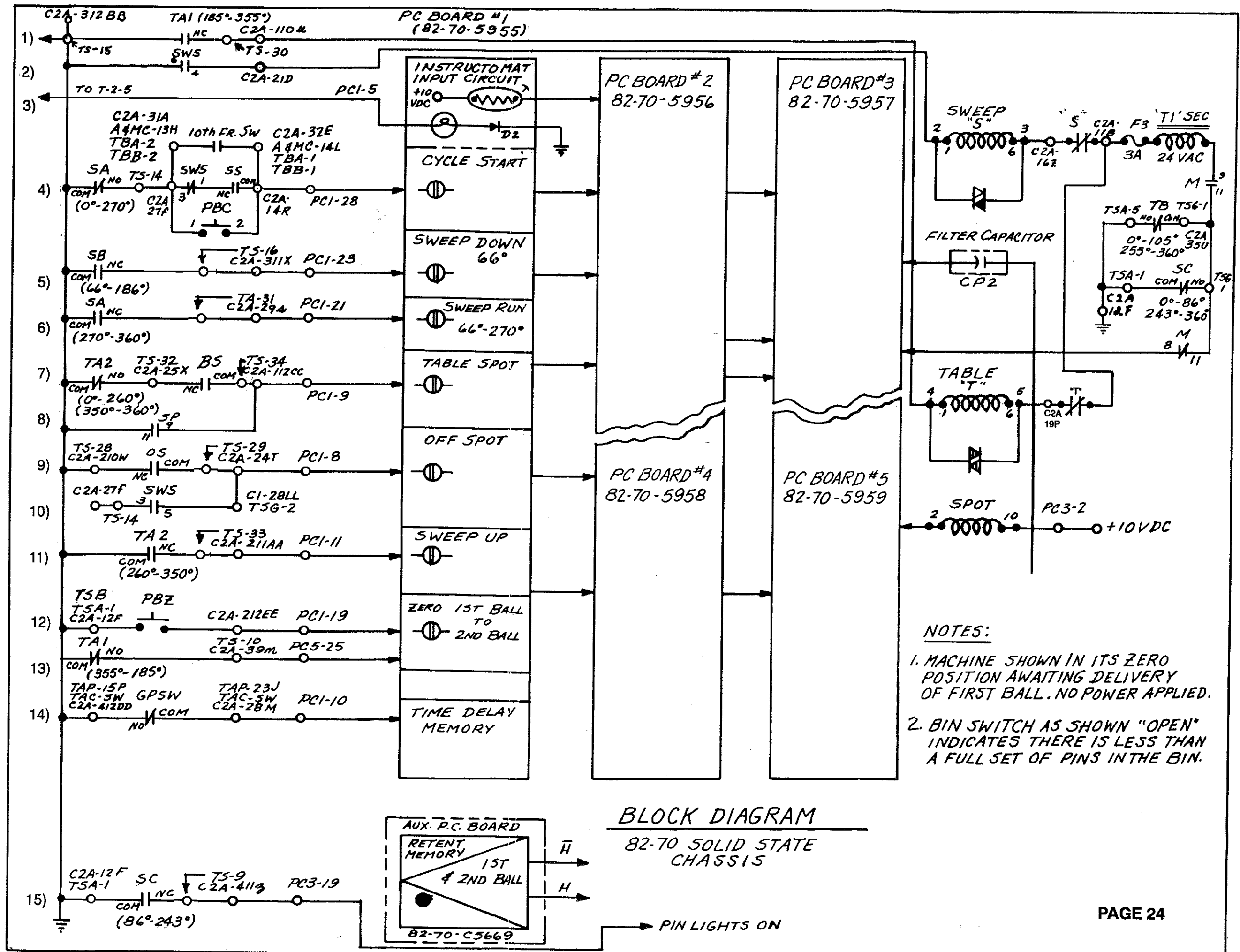


PM and BPP AMP Receptacle viewed from mating surface. The guide pins are in the bottom row. The numbers in the schematic indicated as E1 through E29 correspond to the same number on the AMP connectors and on the Elco connectors.

RECEPTACLE USED WITH 7750 (C-23) 9800 AND 9900 CHASSIS



PM and BPP AMP Receptacle viewed from mating surface with plug held so that the guide pins are in the bottom row.



AMF BOWLING INC. PINSPOTTER TRAINING

82-70 SWITCH AND WIRE TESTING ON THE MACHINE

1. USE DRAWING 82-70 E 5500, 6730 OR 9807.
2. **REMOVE MACHINE POWER PLUG
3. USE CONTINUITY TESTER
4. FILL IN WHAT TERMINALS USED TO CHECK EACH SWITCH

EXAMPLE: TO TEST: SW BE USE - C2A TERMINALS 13L AND 313FE

<u>TO TEST:</u>	<u>USE - C2A TERMINALS:</u>	<u>TO TEST:</u>	<u>USE - C2A TERMINALS:</u>
T SWITCH	_____	SA N.O.	_____
S SWITCH	_____	SA N.C.	_____
PBZ	_____	SB N.O.	_____
SWS 4/6	_____	SB N.C.	_____
SS	_____	SC N.O.	_____
PBC	_____	SC N.C.	_____
10TH FRAME	_____	GS-1	_____
BS	_____	GS-2	_____
OFF SPOT	_____	GS-3	_____
GP	_____	GS-4	_____
TA1 N.O.	_____	GS-5	_____
TA1 N.C.	_____	GS-6	_____
TA2 N.O.	_____	GS-7	_____
TA2 2 N.C.	_____	GS-8	_____
TB N.O.	_____	GS-9	_____
TB N.C	_____	GS-10	_____

AMF BOWLING INC. PINSPOTTER TRAINING

GRIPPER PROTECTION (G.P.) CIRCUIT TEST PROCEDURES

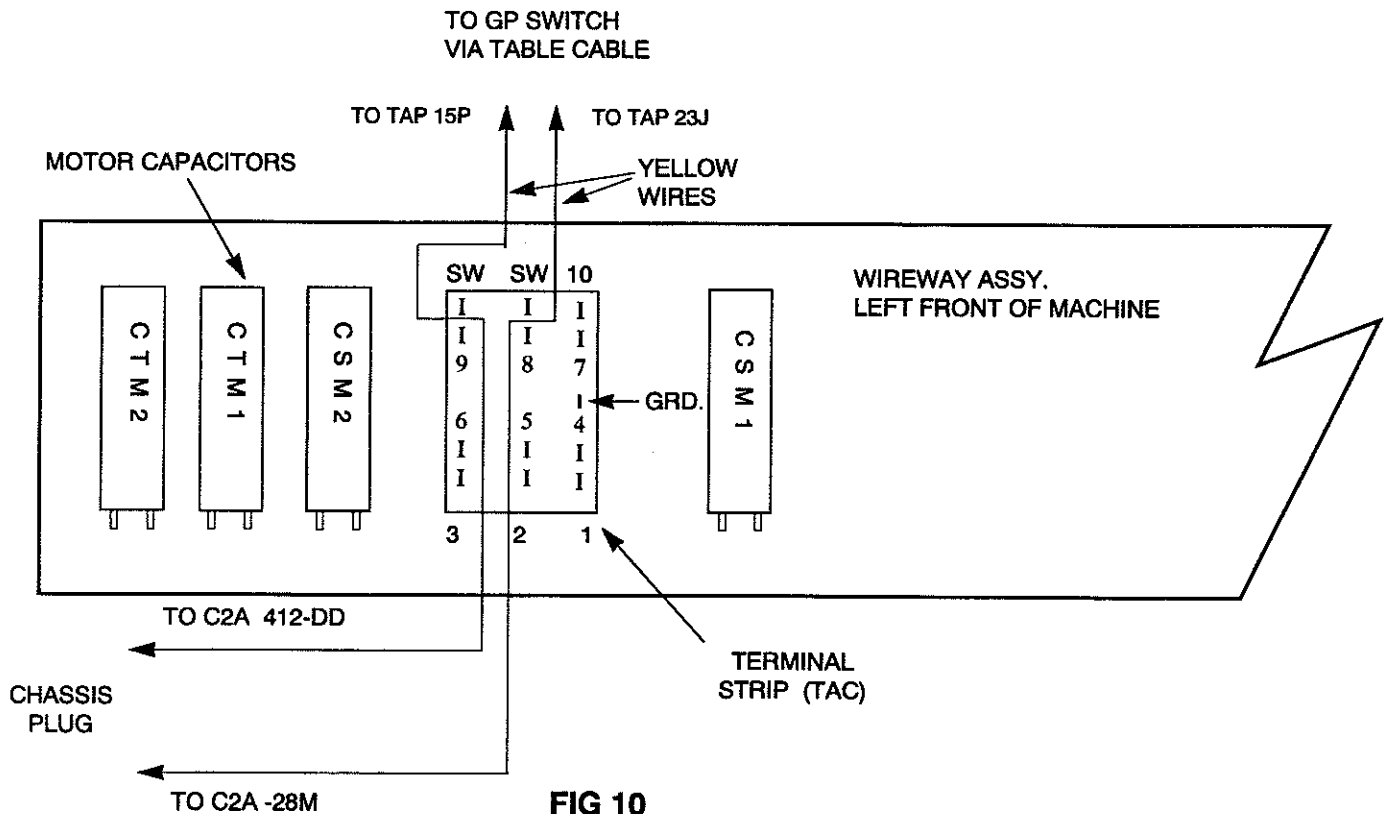


FIG 10

1. If an open occurs in the GP switch, wire assy. or table cable, the table will not feel for pins during the first ball cycle.
2. Test - make sure respot cells are open, then connect jumper between (SW) contacts on terminal strip. If table feels for pins, there is an open in this circuit. Visually check all plugs, and connections, then test for continuity in the GP circuit and table cable.
3. If the table does not feel for pins with the jumper in place, the open is between the chassis (C) plugs and the terminal strip, or the problem is in the chassis, replace chassis and try again.

NOTE:

The contacts on TAC terminal strip 1 thru 10 are wire connections coming from (GS) gripper switch in respot cells 1 thru 10.

AMF BOWLING INC. PINSPOTTER TRAINING

REAR CONTROL PANEL WIRING

MASTER CB

R or L 66 Pink to term A
 R or L 57 Blue to term B
 R or L 64 Green to term C
 (jumper) 151 Green to term D from Gnd 1
 (jumper) 173 Black to term E from term 2 in Rear of Box
 R or L 172 Red to term F

Plt

R or L 74 Yellow to term 1

R or L 53 Yellow to term 2

Sweep

R or L 51 Yellow to term 1 w/piggyback

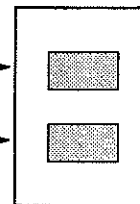
(jumper) 165 Yellow to term 1 to table term 1

R or L 55 Orange to term 2

Table R or L 58 Gray to term 2

term 2# →

term 1# →



1st Ball Zero

R or L 102 Orange to term 2

(jumper) 161 Green to term 1 from Gnd 1

term 2# ↔



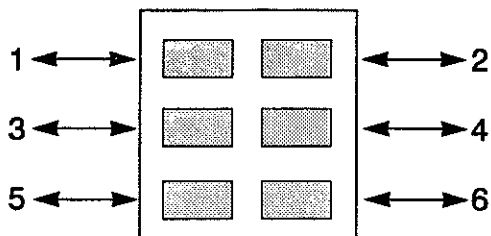
↔ term 1#

Cycle

R or L 129 Blue to term 1 w/piggy back

R or L 54 Black to term 2

Sweep Run and Sweep Rev.



Sweep Run

Hot Black from start switch to term 1

Term 2 Empty

Jumper from cycle term 1 to term 3

R or L 63 Purple to term 4

128 white to term 5

R or L 132 Black to term 6

AMF BOWLING INC. PINSPOTTER TRAINING

REAR CONTROL PANEL (cont.)

Sweep Rev.

from Term 1 jumper gray to term 6 w/piggy back
from Term 2 w/piggy back jumper gray to term 5
R or L 1 33 Blue to term 2
R or L 135 Black to term 3
R or L 138 Red to term 4
Term 5 jumper from term 2
R or L 136 Yellow to term 6 w/piggy back
Term 6 jumper from term 1

Ground term strip
151 Green from Master CB
161 Green from PBZ
R or L 130 Green from Harness

Term. strip in left rear of Control Box

term 1 #



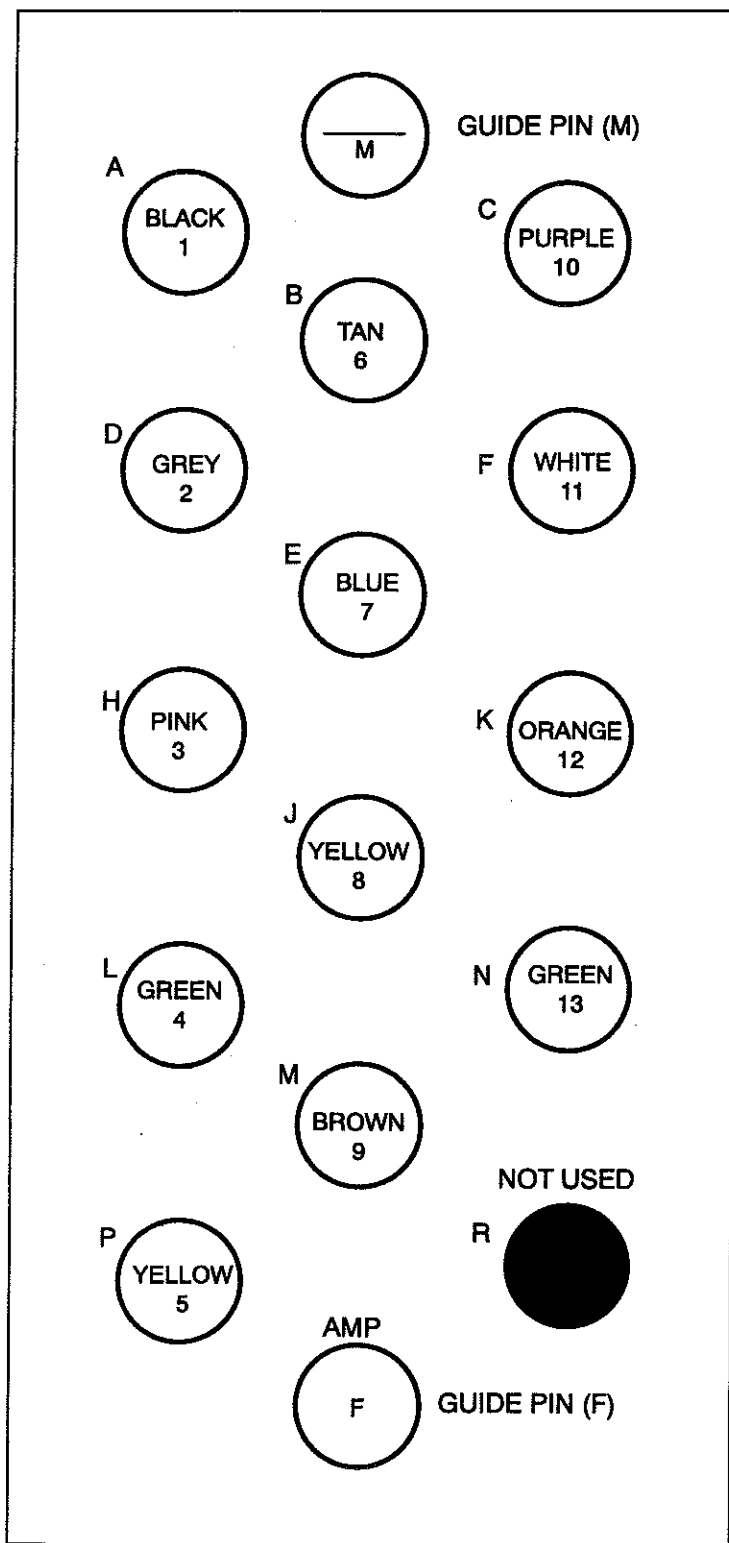
term 2#

R or L 167 Black to term 1
R or L 170 Black to term 1
Back end motor plug Hot Black to term 1
Back end motor plug com. White to term 2
173 Black from Master CB term E to term 2
R or L 166 white to term 2

Splice 157 Black from term 19
tape & stow away wires 112 Yellow and 111 Brown (Extra)

AMF BOWLING INC. PINSPOTTER TRAINING

TABLE CABLE WIRING



(TAC) Located On Capacitor Terminal Board In Wireway

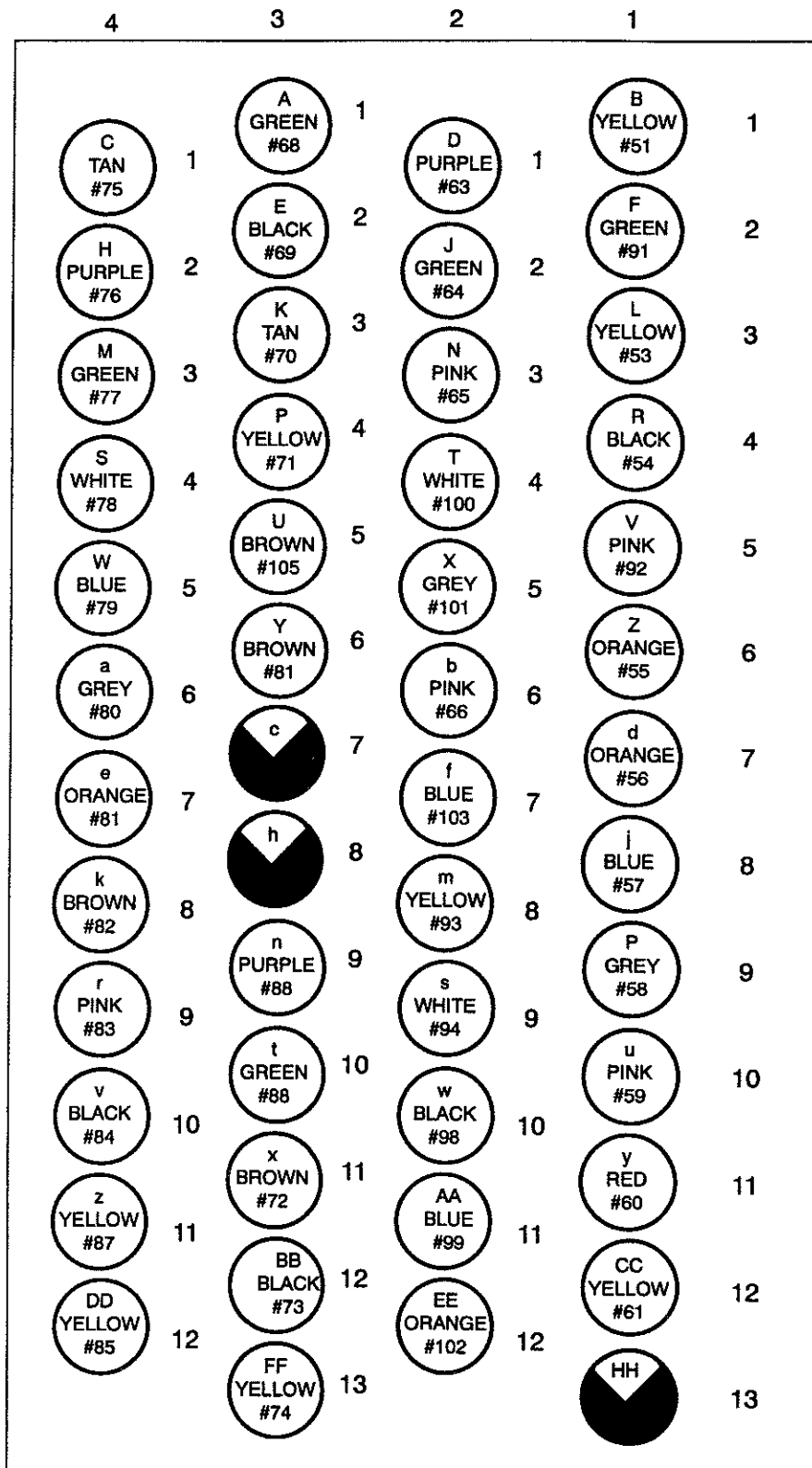
5	yellow on	(sw)
8	yellow on	(sw)
1	black on	(10)
12	orange on	(7)
9	brown on	(8)
3	pink on	(9)
13	green on	(gnd)
11	white on	(4)
7	blue on	(5)
2	grey on	(6)
6	tan on	(1)
10	purple on	(2)
4	green on	(3)

TABLE PLUG (TAP)

AMF BOWLING INC. PINSPOTTER TRAINING

C2A
47 WIRES

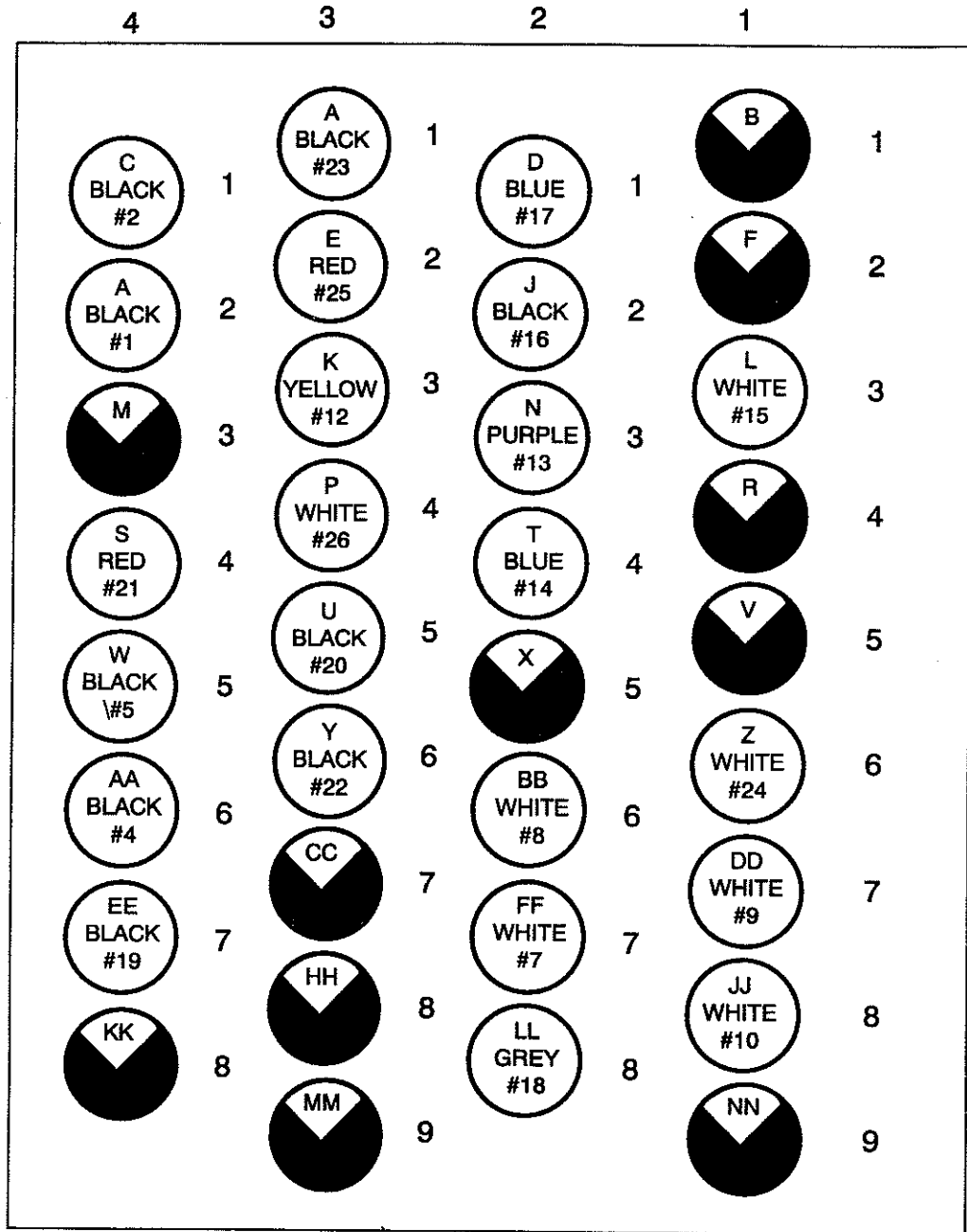
VIEW FROM BACK OF PLUG OR
FRONT OF RECEPTACLE



AMF BOWLING INC. PINSPOTTER TRAINING

C1
23 WIRES

VIEW FROM BACK OF PLUG OR
FRONT OF RECEPTACLE



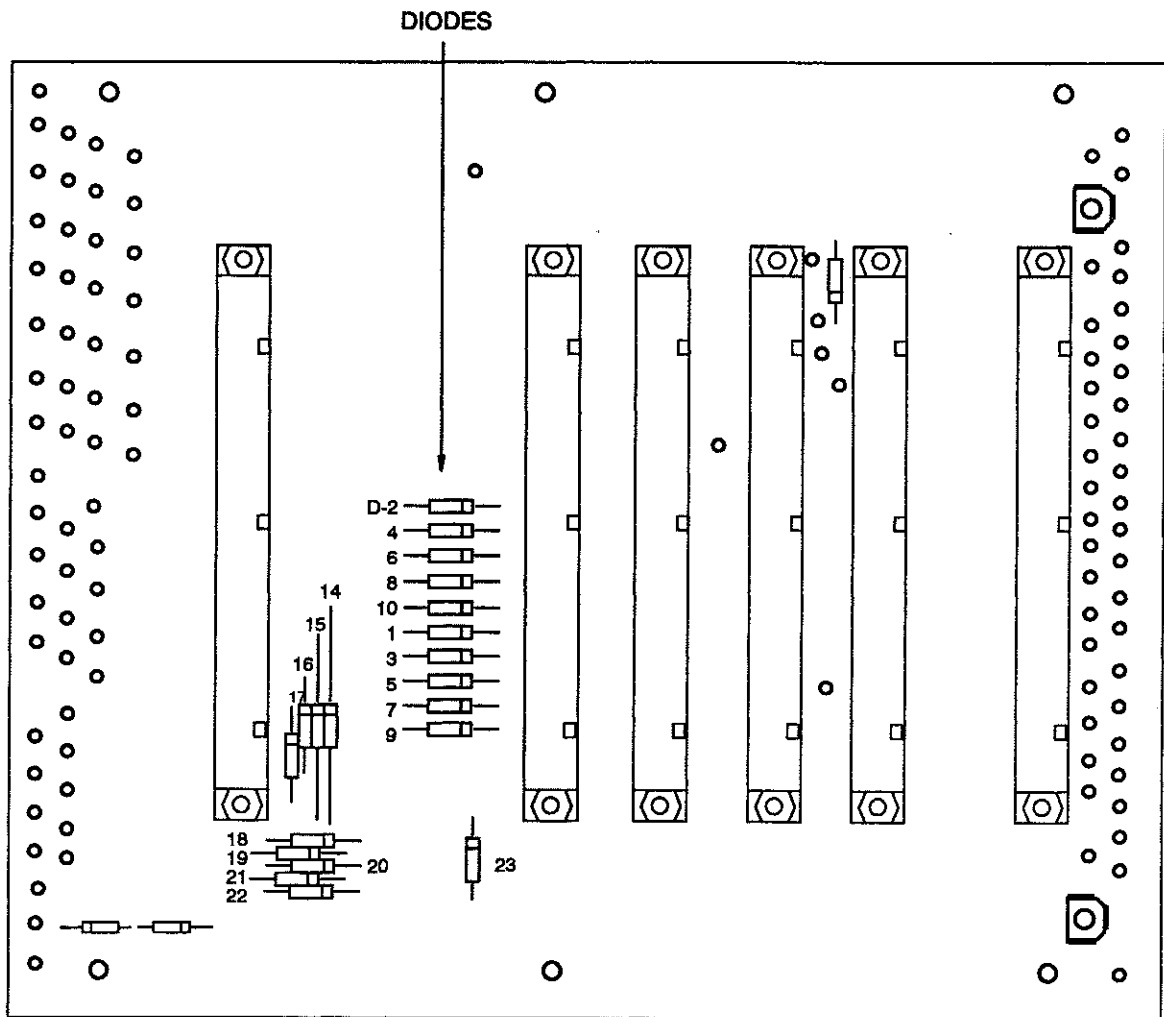
AMF BOWLING INC. PINSPOTTER TRAINING

CIRCUIT BOARD HANDLING PRECAUTIONS

1. DO NOT remove the circuit board while power is on.
2. ALLOW one minute capacitor discharge period after removing power before removing circuit board.
3. USE a board removal tool if circuit board does not have card ejectors.
4. WEAR a grounding strap when working with microprocessor boards.
5. DO NOT handle boards with dirty hands.
6. DO NOT flex the circuit board, this could damage the foil.
7. DO NOT write on the boards, this could cause a short.
8. IF you need to indicate a defective part or solder joint, use a piece of masking tape.
9. Examine a suspected bad board for broken or loose components.
10. USE A pencil eraser to clean circuit board contacts where they mate with the terminal strip.
11. RECHECK a suspected bad board in another chassis before returning.
12. KEEP circuit boards in their protective container until they are to be installed in the chassis.
13. STORE spare boards in the box they are shipped in.

AMF BOWLING INC. PINSPOTTER TRAINING

MOTHER BOARD (5 BOARD CHASSIS) 070 007 659



Diodes D-1 thru D-10 are in series with pindication lights 1 thru 10 on the mask. An open diode would prevent the corresponding light from lighting. Diodes can be checked with an ohmmeter for being open or shorted. Forward resistance should be low (10-50 OHMS) while reverse-resistance should be very high. (Infinity)

AMF BOWLING INC.

PINSPOTTER TRAINING

ELECTRO- MECHANICAL DICTIONARY

A.C.	- ALTERNATING CURRENT
ACTUATED	- PUT INTO MOTION
BALL PATH	- THE LINE OF MOVEMENT OR COURSE TAKEN BY A BOWLING BALL AS IT CROSSES THE PIN DECK.
BLUE PRINT	- A DETAILED PLAN OR OUTLINE OF A PIECE OF EQUIPMENT.
BRIDGE RECTIFIER	- A FULL WAVE RECTIFIER WITH FOUR ELEMENTS CONNECTED IN THE FORM OF A BRIDGE. CHANGES A.C. TO D.C.
CAM	- A MOVING PART, IRREGULARLY SHAPED, OPERATES LEVERS OR CONTROL MECHANISMS.
CAPACITOR	- AN ELECTRONIC COMPONENT WHICH HAS THE ABILITY TO PASS A.C. AND BLOCK D.C. ALSO HAS THE ABILITY TO HOLD AN ELECTRICAL CHARGE.
CHASSIS	- A METAL ENCLOSURE WHERE ELECTRICAL OR MECHANICAL PARTS ARE CONTAINED WITHIN ITSELF.
CIRCUIT	- AN ELECTRONIC PATH BETWEEN TWO OR MORE POINTS CAPABLE OF CARRYING CURRENT.
CIRCUIT BREAKER	- A PROTECTION DEVICE FOR ELECTRICAL CIRCUITS. WHEN AN OVERLOAD OCCURS, THE CIRCUIT BREAKER OPENS, PROTECTING THE CIRCUIT. SOME MUST BE RESET MANUALLY WHILE OTHERS RESET AUTOMATICALLY.
CIRCUIT BOARD	- SEE PRINTED CIRCUIT.
CLOSED CIRCUIT	- SAME AS CIRCUIT.
COIL	- MANY TURNS OF WIRE WOUND ON AN INSULATED FORM.
COMPONENT	- ANY OF THE BASIC PARTS USED IN BUILDING ELECTRONIC EQUIPMENT.
COMPUTER	- A DEVICE CAPABLE OF PERFORMING SEQUENCES OF ARITHMETIC AND LOGICAL OPERATIONS FROM A STORED PROGRAM.
CONDENSER	- SAME AS CAPACITOR.
CONDUCTOR	- A MATERIAL THAT OFFERS LOW RESISTANCE TO CURRENT.
CONNECTION	- WIRES FASTENED TOGETHER.
CONNECTOR	- A COUPLING DEVICE, PLUG OR RECEPTACLE WHICH CAN BE EASILY JOINED TO OR SEPARATED FROM ITS MATE.

AMF BOWLING INC.

PINSPOTTER TRAINING

ELECTRO- MECHANICAL DICTIONARY

CONTACT	- ONE OF THE CURRENT CARRYING PARTS OF A SWITCH OR RELAY.
CONTACTOR	- SAME AS RELAY.
CONTINUITY	- A CONTINUOUS PATH FOR THE FLOW OF CURRENT IN AN ELECTRIC CIRCUIT.
CONTINUITY TESTER	- A TEST LIGHT OR DEVICE THAT WOULD INDICATE CONTINUITY IN A CIRCUIT.
CURRENT	- THE MOVEMENT OF ELECTRONS THROUGH A CONDUCTOR.
DIAGRAM	- A LAYOUT OR PLAN OF A PIECE OF EQUIPMENT.
DIODE	- A DEVICE WHICH WILL ALLOW CURRENT TO PASS IN ONE DIRECTION ONLY.
D.C.	- DIRECT CURRENT.
D.P.D.T.	- DOUBLE POLE, DOUBLE THROW SWITCH.
D.P.S.T.	- DOUBLE POLE, SINGLE THROW SWITCH.
EDGE CONNECTOR	- A MULTIPLE CONTACT RECEPTACLE WHICH CAN BE EASILY JOINED TO OR SEPARATED FROM ITS MATE.
ELEMENT	- ANY ELECTRICAL DEVICE WITH TERMINALS AT WHICH IT MAY BE CONNECTED TO OTHER ELECTRICAL DEVICES.
ENERGIZE	- APPLY VOLTAGE IN ORDER TO ACTIVATE A DEVICE.
FASTON TERMINAL	- SEE TERMINAL.
FLEXIBLE CONDUIT	- METAL PIPE ABLE TO BEND WITHOUT BREAKING. USED TO PROTECT ELECTRICAL WIRING.
FULL WAVE RECTIFIER	- A CIRCUIT THAT USES BOTH THE POSITIVE AND NEGATIVE ALTERNATIONS OF AC CURRENT TO PRODUCE DC
FUSE	- A PROTECTION DEVICE FOR ELECTRIC EQUIPMENT.
GRIPPER	- A THING THAT GRIPS (RESPOT CELL).
GROUND	- WHEN A WIRE IN A CIRCUIT MAKES CONTACT WITH A METAL RETURN TO GROUND. SUCH AS THE MACHINE FRAME.
INSULATOR	- A MATERIAL WHICH CANNOT PASS ELECTRICITY.
JUNCTION BOX	- A POINT WHERE ELECTRICAL CONNECTIONS ARE MADE.
KLIXON	- SAME AS OVERLOAD OR CIRCUIT BREAKER.
LOGIC	- THE SCIENCE DEALING WITH THE BASIC PRINCIPLES AND APPLICATIONS OF TRUTH TABLES.

AMF BOWLING INC.

PINSPOTTER TRAINING

ELECTRO- MECHANICAL DICTIONARY

LOW VOLTAGE	- A CIRCUIT IN WHICH VOLTAGE BELOW 110 VOLTS ARE USED.
MAGNETISM	- THE ABILITY OF A MATERIAL TO ATTRACT IRON.
MICRO SWITCH	- A SNAP ACTION SWITCH WHICH IS SENSITIVE TO ACTUATION.
MINUS (-)	- INDICATES THE NEGATIVE SIDE OF A POWER SUPPLY.
MOTHER BOARD	- A PIECE OF INSULATING MATERIAL ON WHICH COMPONENTS, MODULES OR CIRCUIT BOARDS CAN BE MOUNTED.
MP (MICRO-PROCESSOR)	- A COMPUTER WHICH FUNCTIONS AS A CENTRAL PROCESSOR FOR EXECUTING INSTRUCTIONS. A VOLATILE MEMORY FOR STORING DATA AND AN INTERFACE UNIT THROUGH WHICH INSTRUCTIONS ARE TRANSMITTED.
NATIONAL ELECTRIC CODE	- RULES AND REGULATIONS REGARDING INSTALLATION AND CONSTRUCTION OF ELECTRICAL EQUIPMENT.
NOMINAL VOLTAGE	- SPECIFIED VALUE AS OPPOSED TO ACTUAL VALUE.
OHM	- THE UNIT OF ELECTRICAL RESISTANCE.
OPEN CIRCUIT	- A CIRCUIT WHICH DOES NOT PROVIDE A COMPLETE PATH FOR THE FLOW OF CURRENT.
OVERLOAD	- SEE CIRCUIT BREAKER
PARALLEL CIRCUIT	- A CIRCUIT IN WHICH THE CURRENT IS DIVIDED INTO TWO OR MORE PATHS.
PHOTO ELECTRIC CELL	- A LIGHT SENSITIVE DEVICE WHICH PRODUCES CHANGES IN VOLTAGE WITH CORRESPONDING CHANGES IN LIGHT.
PINDICATION	- LIGHTS ON THE MASK OR MONITOR USED TO INDICATE PINS LEFT STANDING AFTER FIRST BALL.
PLUG	- SEE CONNECTOR.
PLUS (+)	- INDICATES THE POSITIVE SIDE OF A POWER SUPPLY.
POWER	- MEASURED IN WATTS - A PRODUCT OF VOLTAGE AND CURRENT.
POWER CIRCUITS	- A CIRCUIT IN WHICH 110 VOLTS OR MORE ARE USED.
POWER CORD	- A CABLE OR SET OF WIRES THAT CARRIES POWER TO AN ELECTRICAL LOAD.
POWER SUPPLY	- A DEVICE WHICH CONVERTS THE POWER AVAILABLE INTO VOLTAGES REQUIRED FOR A PARTICULAR CIRCUIT.
PRIMARY	- THE INPUT SIDE OF A TRANSFORMER.
PRINTED CIRCUIT	- A CIRCUIT IN WHICH THE INTER-CONNECTING WIRES HAVE BEEN REPLACED BY CONDUCTIVE STRIPS PRINTED OR ETCHED ONTO AN INSULATING BOARD.

AMF BOWLING INC.

PINSPOTTER TRAINING

ELECTRO- MECHANICAL DICTIONARY

PUSH BUTTON	- A SWITCH MOMENTARILY OPERATED
RECTIFIER	- A DEVICE WHICH CHANGES A.C. TO D.C.
RESISTOR	- AN ELECTRONIC COMPONENT WHICH OFFERS RESISTANCE TO CURRENT FLOW.
RELAY	- AN ELECTROMAGNETIC DEVICE WHICH CONTROLS A FLOW OF CURRENT IN ONE CIRCUIT BY MEANS OF A LESSER CURRENT IN ANOTHER CIRCUIT. AN ELECTRONICALLY OPERATED SWITCH.
RESIDUAL MAGNETISM	- MAGNETISM WHICH REMAINS IN AN ELECTRO MAGNET AFTER THE POWER IS DISCONNECTED.
RPM	- REVOLUTIONS PER MINUTE.
SCHEMATIC DIAGRAM	- A DRAWING WHICH SHOWS THE ELECTRICAL CONNECTIONS IN A CIRCUIT.
SECONDARY	- THE OUTPUT SIDE OF A TRANSFORMER.
SERIES CIRCUIT	- A CIRCUIT IN WHICH THE SAME CURRENT MUST FLOW THROUGH ALL PARTS.
SHORT CIRCUIT	- WHEN TWO WIRES BETWEEN TWO SIDES OF A CIRCUIT TOUCH EACH OTHER.
S.P.S.T.	- SINGLE POLE, SINGLE THROW SWITCH.
SOLDER	- A METAL COMPOSED OF 60% TIN AND 40% LEAD USED TO MAKE ELECTRICAL CONNECTIONS.
SOLDERING IRON	- AN INSTRUMENT WHICH APPLIES HEAT TO MATERIAL TO BE SOLDERED.
SOLENOID	- AN ELECTRO-MAGNET HAVING A MOVABLE IRON CORE.
SPAREMAKER	- AN ELECTRONIC DEVICE USED TO HELP A BOWLER DIRECT HIS SECOND BALL TO HAVE THE MAXIMUM CHANCE OF EFFECTING A SPARE. BALL PLACEMENT IS INDICATED BY A LIGHTED ARROW ON THE MASKING UNIT OR MONITOR.
STEP-DOWN TRANSFORMER	- A TRANSFORMER THAT DELIVERS LESS VOLTAGE THAN IS SUPPLIED TO IT.
STEP-UP TRANSFORMER	- A TRANSFORMER THAT DELIVERS MORE VOLTAGE THAN IS SUPPLIED TO IT.
SWITCH	- A MECHANICAL OR ELECTRICAL DEVICE THAT COMPLETES OR BREAKS THE PATH OF CURRENT.
SYMBOL	- A DESIGN WHICH INDICATES AN ELECTRONIC OR ELECTRICAL PART.

AMF BOWLING INC. PINSPOTTER TRAINING

ELECTRO- MECHANICAL DICTIONARY

TERMINAL	- A SPRING TYPE METAL CLIP WHICH IS CLAMPED ON THE END OF A WIRE. PERMITS ELECTRICAL CONNECTION TO BE MADE WITHOUT THE USE OF SOLDER.
TEST LEADS	- A PAIR OF WIRES USED TO CONNECT A METER OR INSTRUMENT TO AN ELECTRICAL CIRCUIT.
THERMAL	- HAVING TO DO WITH HEAT.
TIME DELAY	- THE ELAPSED TIME REQUIRED FOR RESULTS TO BE SEEN AFTER A COMMAND IS GIVEN.
TRANSFORMER	- A DEVICE WHICH STEPS UP OR REDUCES THE AVAILABLE LINE VOLTAGE.
TRANSISTOR	- A SEMI-CONDUCTOR DEVICE SIMILAR IN OPERATION TO A VACUUM TUBE.
TRUTH TABLE	- A TABULATION SHOWING OUTPUT LOGIC LEVEL IN RELATION TO ALL POSSIBLE INPUT COMBINATIONS.
VOLT	- UNIT OF MEASUREMENT OF ELECTRICITY.
VOLTAGE TESTER	- A NEON TYPE TESTER USED TO INDICATE THE PRESENCE OF VOLTAGE.
VOLT METER	- AN INSTRUMENT USED TO MEASURE VOLTAGE.
WATT	- A UNIT OF MEASUREMENT OF ELECTRICAL POWER.
WIRE STRIPPER	- A TOOL USED TO REMOVE INSULATION FROM WIRE.

NOTES:

1. MACHINE SHOWN IN ITS ZERO POSITION AWAITING DELIVERY OF A FIRST BALL, NO POWER APPLIED.
2. BIN SWITCH AS SHOWN "OPEN" INDICATES THERE IS LESS THAN A FULL SET OF PINS IN THE BIN.
3. LEGEND -

CONTROL BOX

CB - MASTER CIRCUIT BREAKER
SWS - SWEEP RUN SWITCH
SWE - SWITCH-BACK END MOTOR
PBC - PUSH BUTTON CYCLE SWITCH
PBZ - PUSH BUTTON 1ST. BALL ZERO
T - SWITCH, TABLE
S - SWITCH, SWEEP
SWR - SWITCH, SWEEP REVERSE

CONNECTORS

CI - CIRCUIT POWER PLUG
CEA - CIRCUIT CONTROL PLUG-LOW VOLTAGE
TAC - TABLE TERM. BLOCK
A/MC - APPROACH, MGR. CONTROL
LTP-1 - 2 - LIGHT PLUG, PIT
LTM-1 - 2 - LIGHT PLUG, MASK
LT - MASK (PIT LIGHT SOCKET)
TM - TABLE MOTOR
SM - SWEEP MOTOR
TAP - TABLE PLUG
MP - M.A.P. PLUG
APS - A.P.S. PLUG

CONTROL

BS - BIN SWITCH
SS - START SWITCH
OS - OFF SPOT CAM SWITCH
GP - GRIPPER PROTECTION SW.
CIS - CIRCUIT INTERRUPT SWITCH
C.S.W. - CYCLE SWITCH
PZ - PROGRAM ZERO SWITCH
S.S.W. - SWEEP RUN SWITCH
T.S.W. - TABLE RUN SWITCH

CONTROL COMPONENTS

SP - SPOT RELAY
BE - BACK END MOTOR RELAY
A - MASTER ON-OFF RELAY
S - SWEEP REVERSE RELAY
S - SWEEP RELAY
T - TABLE CONTACTOR
M1 - BALL RETURN RELAY

TABLE CAMS

TA1
TA2
TB

SWEEP CAMS

SA
SB
SC

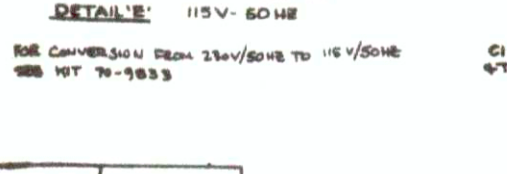
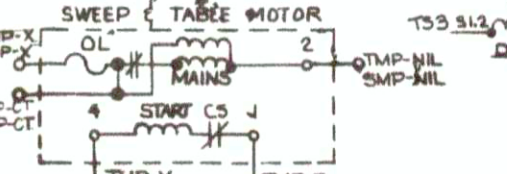
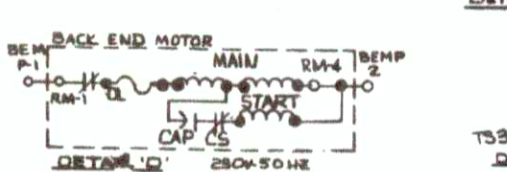
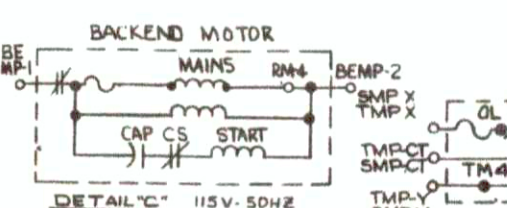
M.P. BOARD CONNECTORS

P-1 - PLUG #1
P-2 - PLUG #2

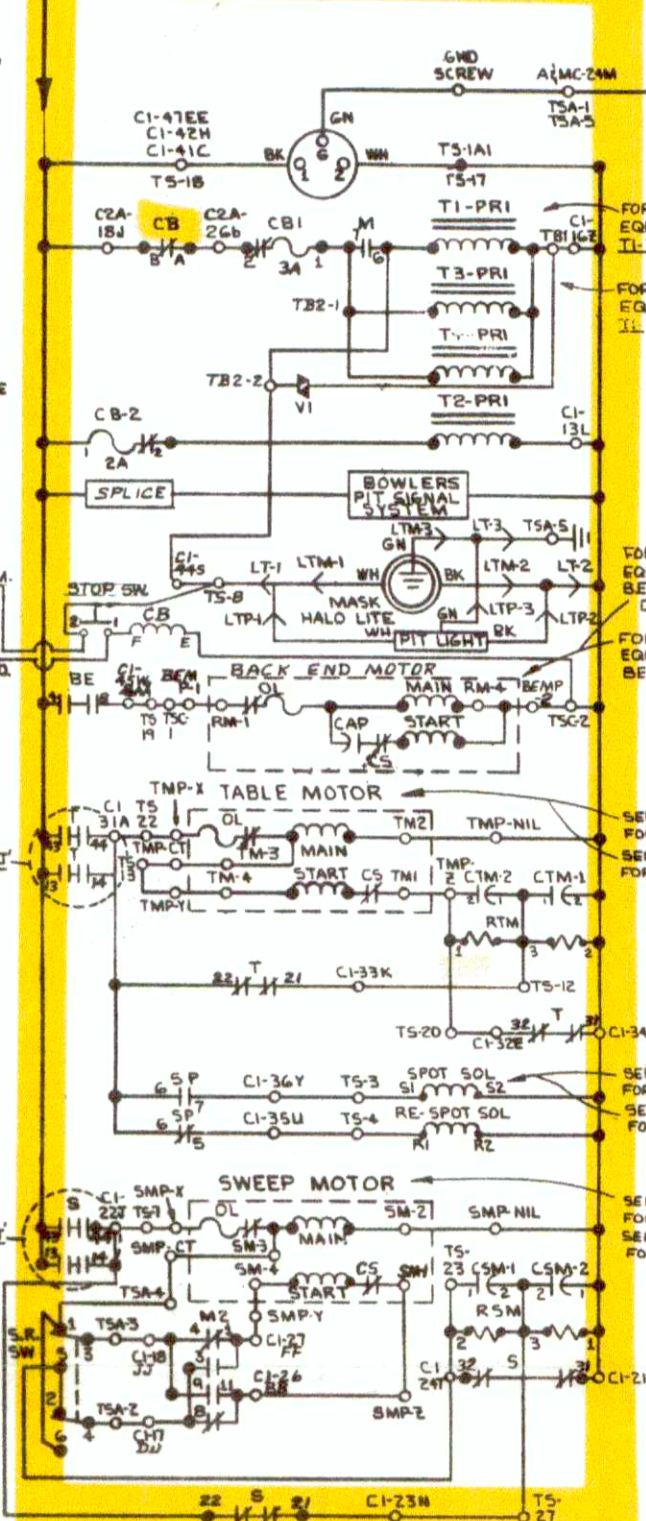
A.P.S. CHASSIS CONNECTORS

PI/P4 IDENTICAL PLUGS FOR LEFT (RIGHT) MACHINES
070-009-BIG ASSY. (REF)
070-009-SMALL ASSY. (REF)
(DIFFER IN LENGTH ONLY)

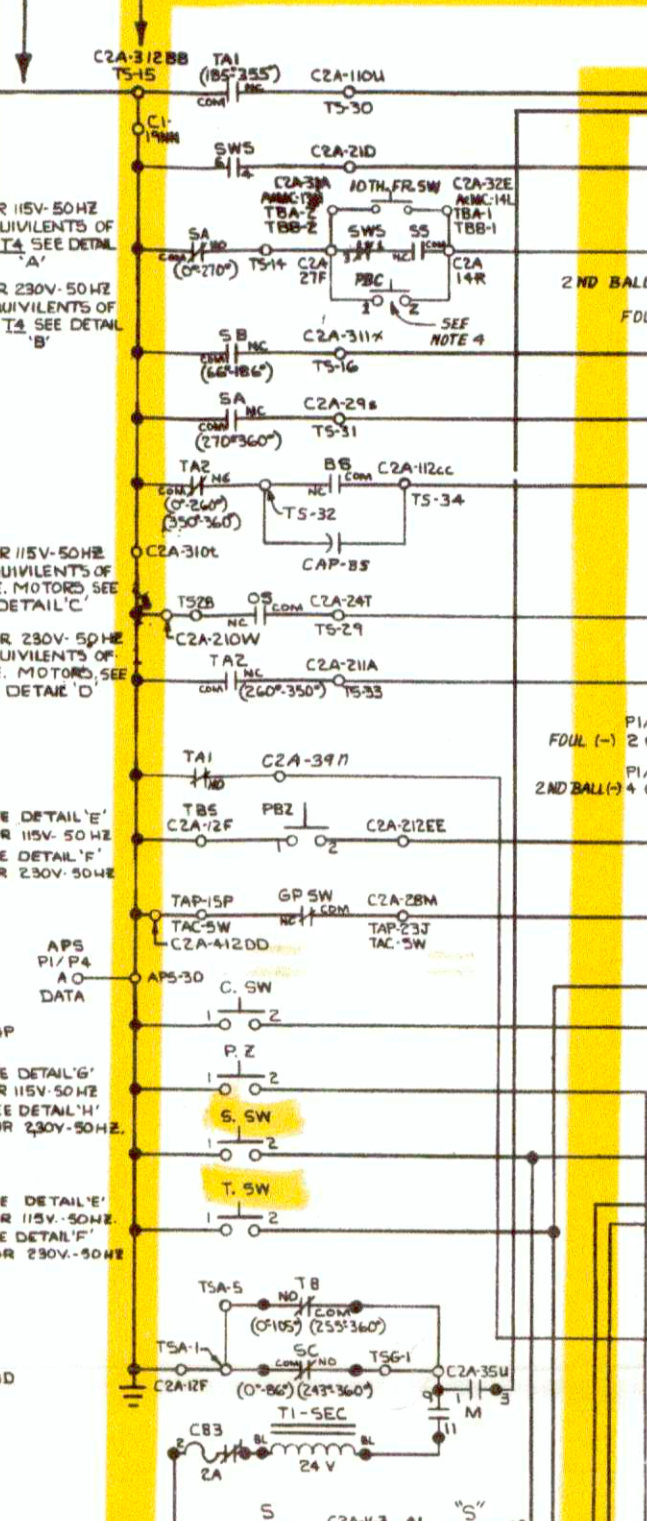
4. WHEN UNIT INCLUDES MAGIC SCORL WITH ACUSTICAL AUTOMATIC PHOSPHORING, OMIT PBC SWITCH BETWEEN POINTS CZA-27F AND CZA-14R. TAPE EXISTING WIRE CONNECTIONS TO PBC. USE ALTERNATE CONNECTION SHOWN FOR REFERENCE ONLY SEE 070-009-466 AND 070-009-467.
5. SP SWITCH AS SHOWN "CLOSED" INDICATES RESPOT CELLS ARE IN OPEN POSITION.
6. HALO LIGHT USED ONLY ON MODEL 59 MASK
7. 50 HZ SCHEMATIC CHANGES PER DETAIL BELOW:



POWER CIRCUITS

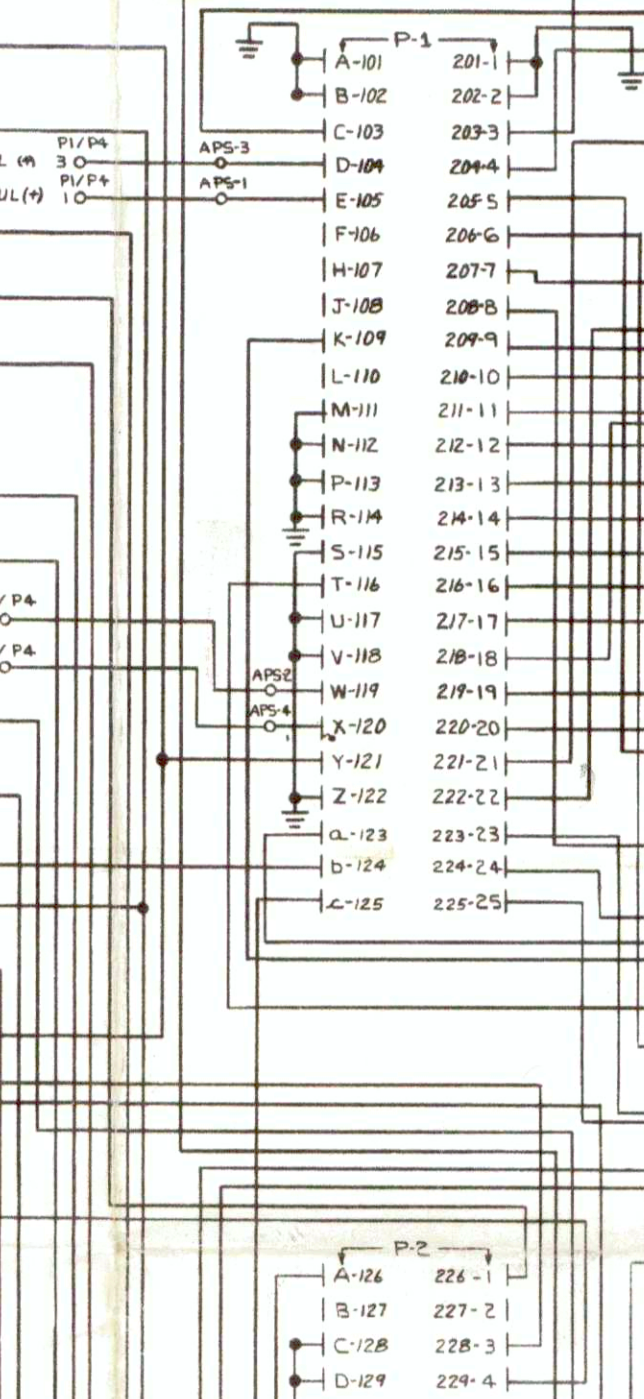


CONTROL CIRCUITS

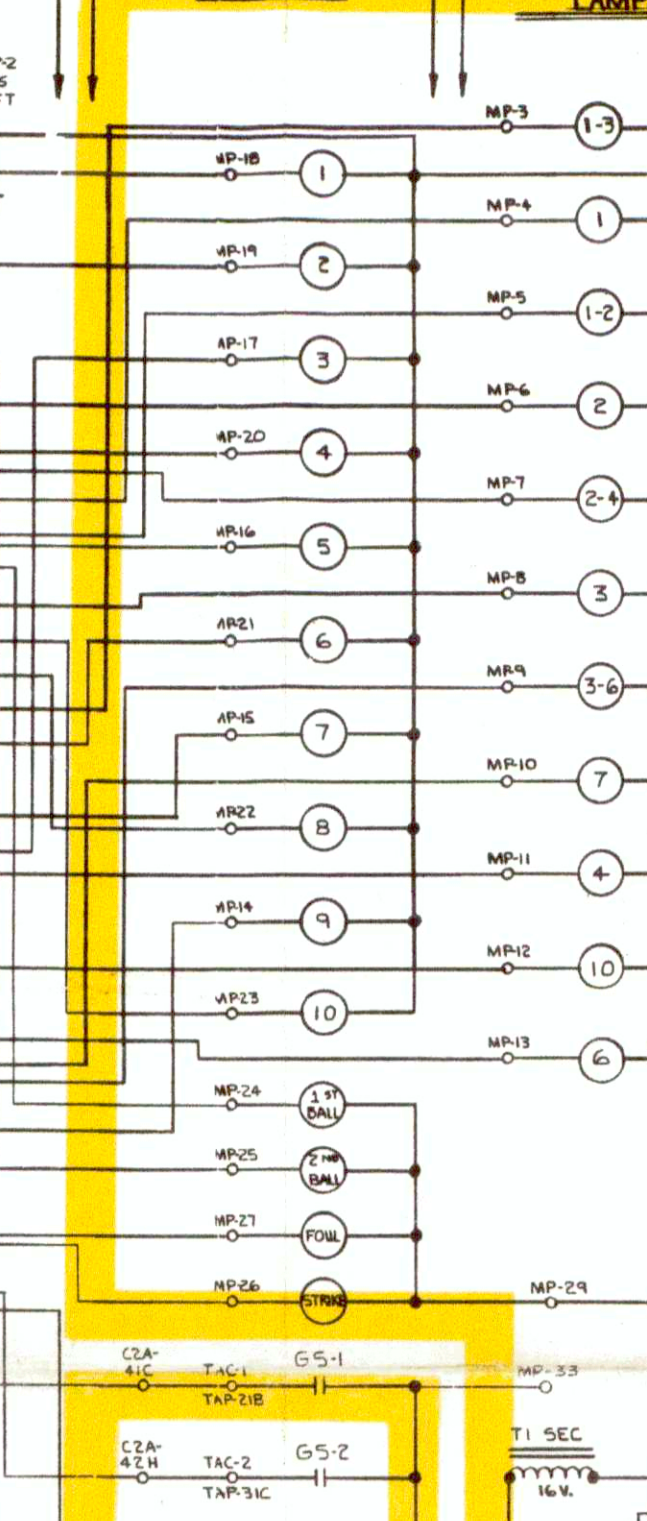


M.P. BOARD

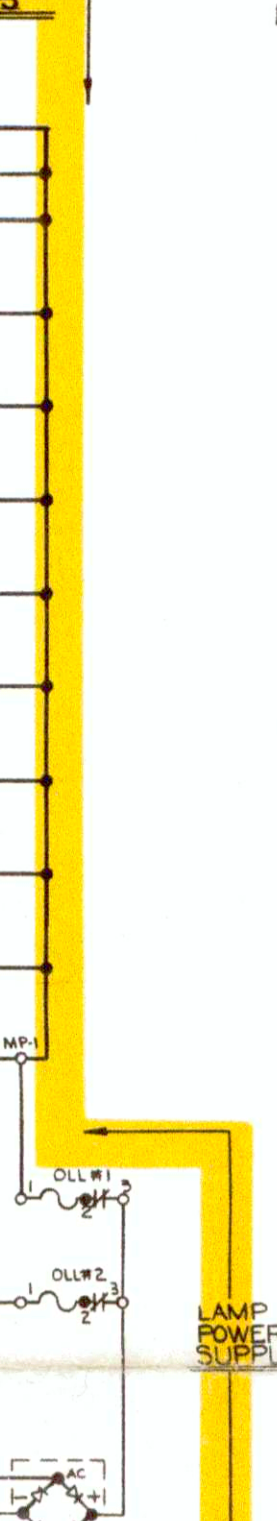
P.C. BOARD CONNECTORS P-1 & P-2 VIEWED FROM UNDER SIDE OF CHASSIS AND P.C. BOARD COMPONENTS TO THE LEFT



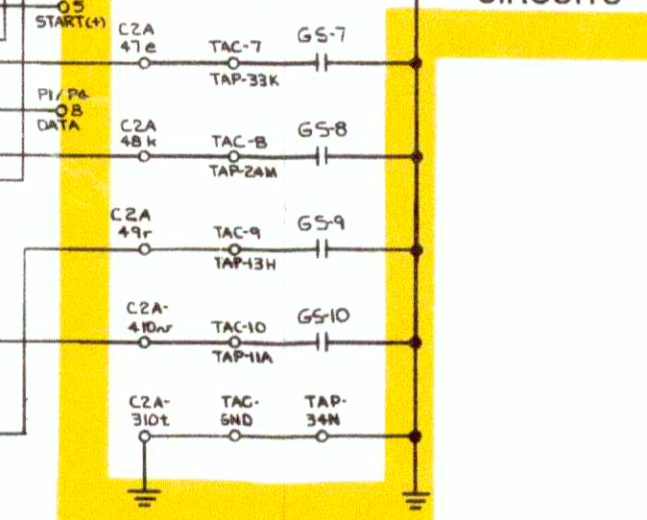
BIN LAMPS



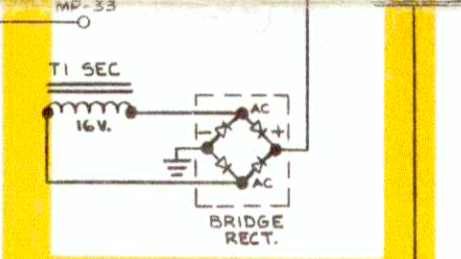
SPARE MAKER LAMPS



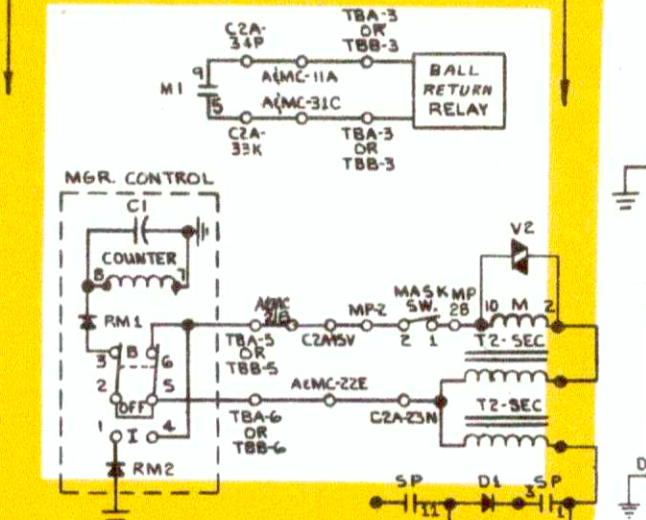
RESPOT CELL CIRCUITS



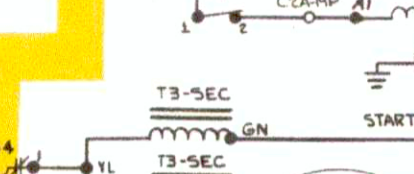
LAMP POWER SUPPLY



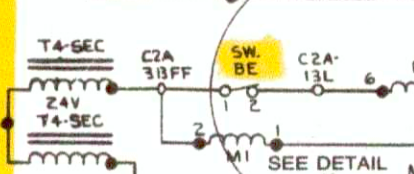
MANAGER'S CONTROL CIRCUIT



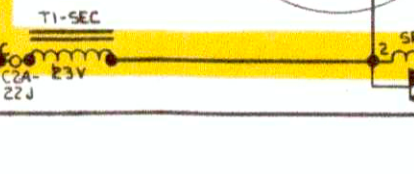
DETAIL A' 115V-50HZ



DETAIL B' 230V-50HZ



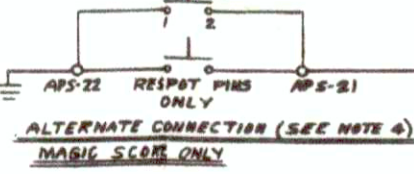
DETAIL C' 115V-50HZ



DETAIL D' 230V-50HZ



DETAIL E' 115V-50HZ



DETAIL F' 230V-50HZ



DETAIL G' 115V-50HZ



DETAIL H' 230V-50HZ



SWEEP CAMS

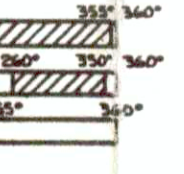


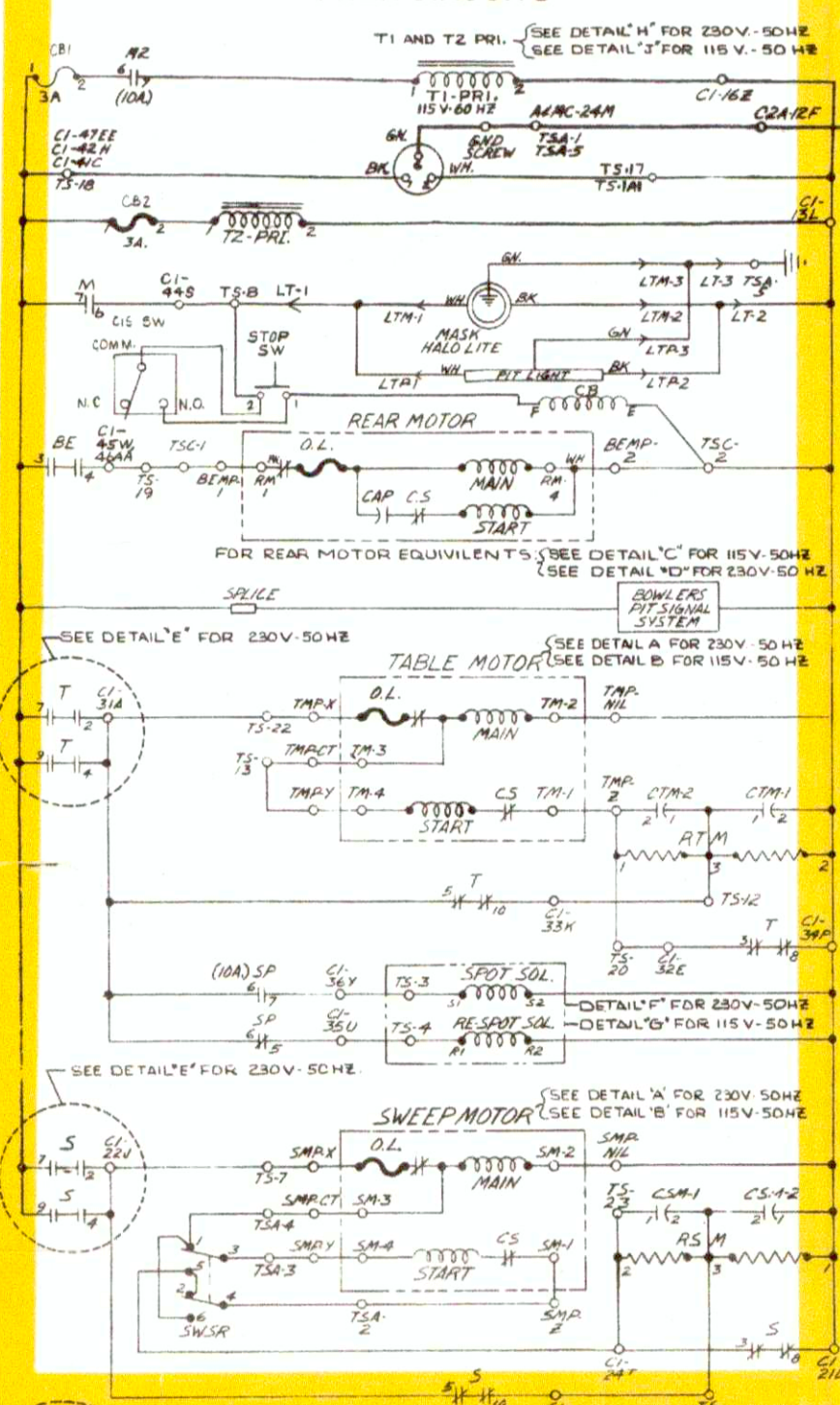
TABLE CAMS



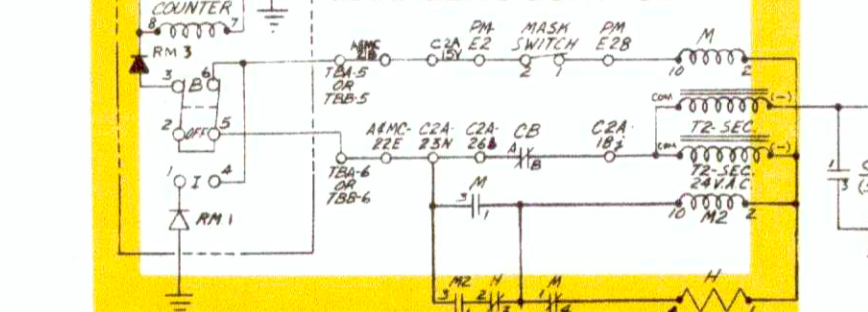
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4	11/10/54	JES	WJS	REVISION
5	11/10/54	JES	WJS	REVISION
6	11/10/54	JES	WJS	REVISION
7	11/10/54	JES	WJS	REVISION
8	11/10/54	JES	WJS	REVISION
9	11/10/54	JES	WJS	REVISION
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48	11/10/54	JES	WJS	REVISION
49	11/10/54	JES	WJS	REVISION
50	11/10/54	JES	WJS	REVISION

- NOTES:
1. MACHINE SHOWN IN ITS REAR POSITION AWAITING DELIVERY OF A FIRST BALL, NO POWER APPLIED.
 2. BIN SWITCH AS SHOWN OPEN INDICATES THERE IS LESS THAN A FULL SET OF PINS IN THE BIN.
 3. HALO LIGHT USED ONLY ON MODEL 59 MASK.

POWER CIRCUITS



MANAGER'S CONTROL



SWEEP CAMS

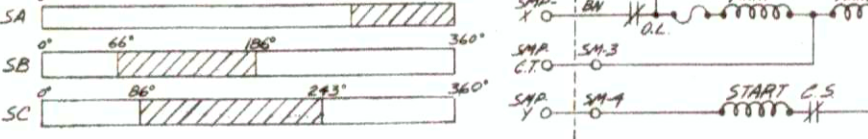
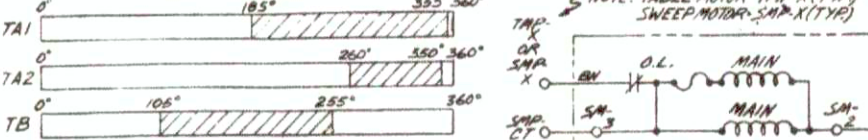
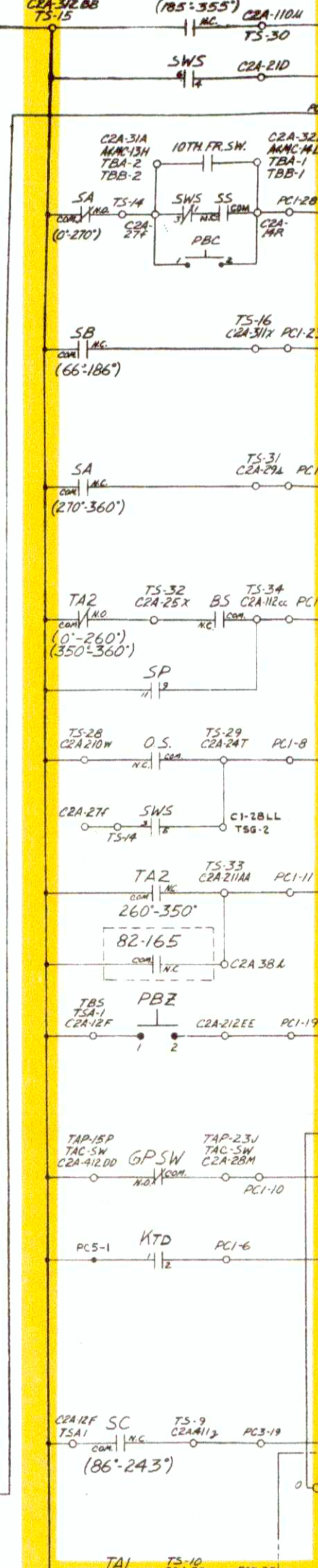


TABLE CAMS



CONTROL CIRCUIT

SWITCHES



LEGEND

CONTROL BOX

- CB - MASTER CIRCUIT BREAKER
- SWS - SWEEP RUN SWITCH
- SMB - SWITCH BACK END MOTOR
- PBC - PUSH BUTTON STOP SWITCH
- PBZ - PUSH BUTTON 1ST BALL
- T - STEPPER REVERSE SWITCH
- S - SWITCH, SWEEP
- SNRS - SWITCH, SWEEP REVERSE
- CIS - COMBINATION INTERLOCK SWITCH (POWER)

CONNECTORS

- C1 - CIRCUIT POWER PLUG
- C2A - CIRCUIT CONTROL PLUG-LOW VOLT
- PM - PLUG MASH
- BPP - BALL PATH PLUG
- TAC - TABLE TERM. BLOCK
- AMC - APPROACH, MGR. CONTROL
- LT - LIGHT PLUG, PIT
- LTM - LIGHT PLUG, MASK
- LT - MGR. PIT LIGHT SOCKET
- LT - TABLE MOTOR
- SM - SWEEP MOTOR
- TAP - TABLE PLUG

CONTROL CHANNEL

- BS - BIN SWITCH
- OS - OFF SPOT CAM SWITCH
- GP - GRIPPER PROTECT SW.
- SP - SPOT RELAY
- BE - BACK END MOTOR RELAY
- M - MASTER ON-OFF RELAY
- ME - TIME DELAY RELAY
- H - THERMAL TIME RELAY UNIT
- S - SWEEP MOTOR
- TABLE CONTROL
- XX - PIN FALL DATA FOR SPT

TABLE CAMS

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SWEEP CAMS

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LAMP SUPPLY

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NEON LAMP SUPPLY

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HEAT SINK

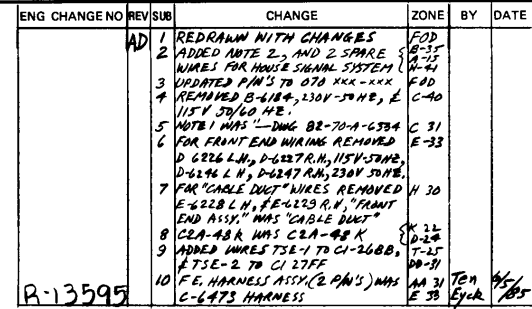
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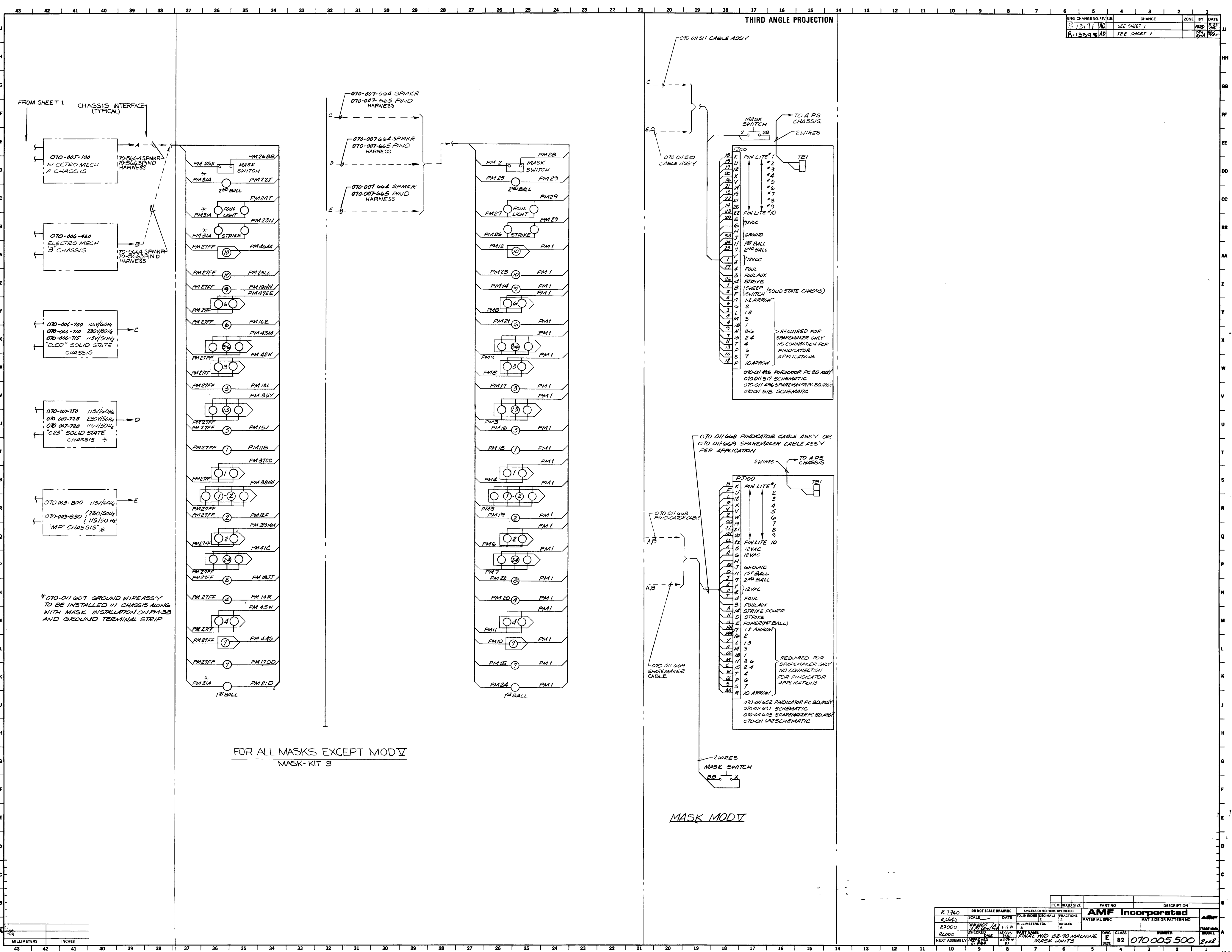
INTERLOCK CIRCUIT

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SPAREMAKER LAMPS

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ENG	CHANGE NO	REV	DATE
R-1271	AC	1	12/1/71
R-1259	AD	1	12/1/71

ITEM	REQD SIZE	PART NO	DESCRIPTION
R 7740	DO NOT SCALE DRAWING	UNLESS OTHERWISE SPECIFIED	AMF Incorporated
R 6640	SCALE	DATE	MATERIAL SPEC
R 7000	DRYING	DATE	MAT SIZE OR PATTERN NO
R 6000	DRYING	DATE	NUMBER
NEXT ASSEMBLY	APPROVED	DATE	CLASS
	J. B. K.	12/1/71	E 82
			070 005 500